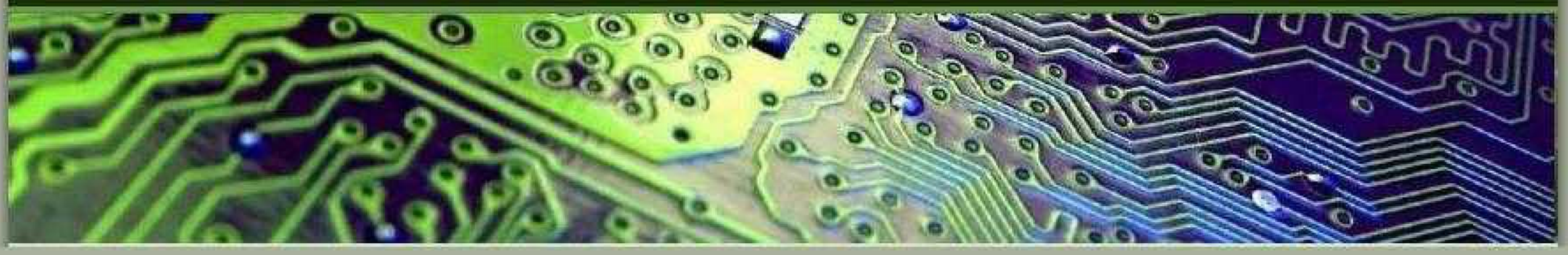
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RADIO SERVICE MANUAL

and

Complete Directory of all Commercial Wiring Diagrams of Receivers

PREPARED ESPECIALLY
FOR THE
RADIO SERVICE MAN

HUGO GERNSBACK
Editor

CLYDE FITCH
Managing Editor



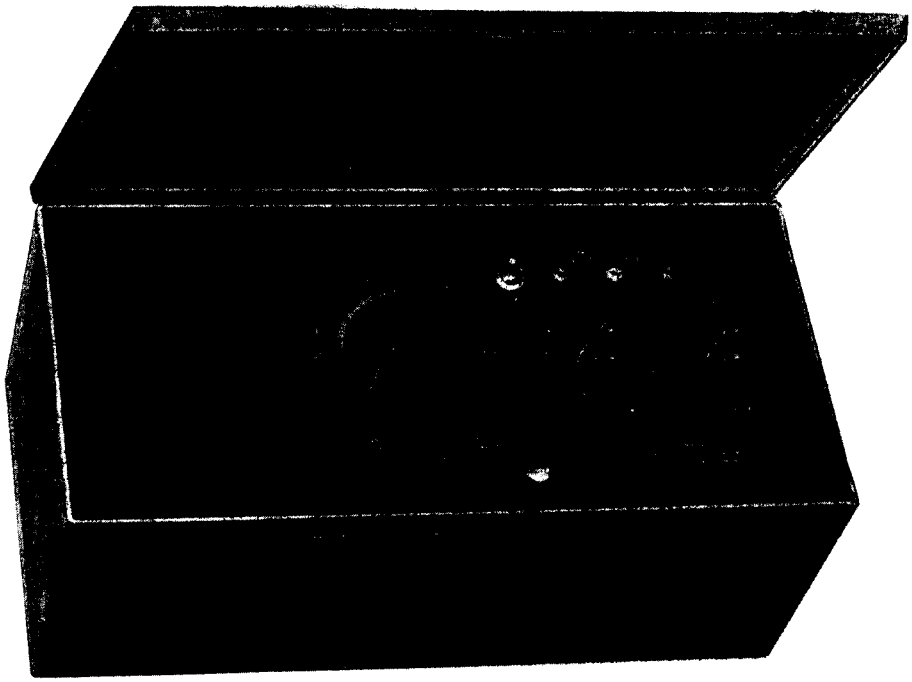
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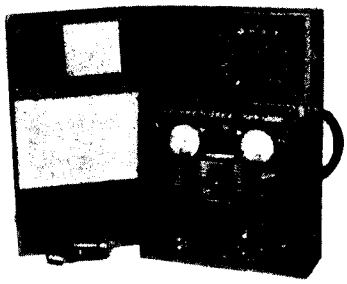
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In the supplements are included diagrams for which we have received requests. Wherever the diagrams that have been requested are not included in one set of supplements, they will appear in the first set published after we receive them. Many diagrams of obsolete sets are difficult to obtain, but we are using every possible effort to procure them.

We wish to express our thanks to the many subscribers who have taken such extreme interest in the MANUAL, and especially to those who have voluntarily submitted diagrams for publication in the supplements.—THE PUBLISHERS.

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Zenith—Zenith Radio Corp.

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Potter Condenser service provides immediate shipment of condenser units for standard sets.

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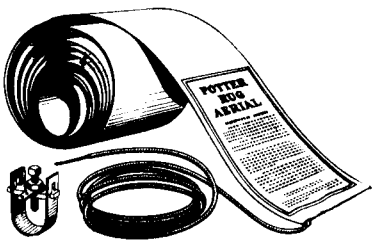
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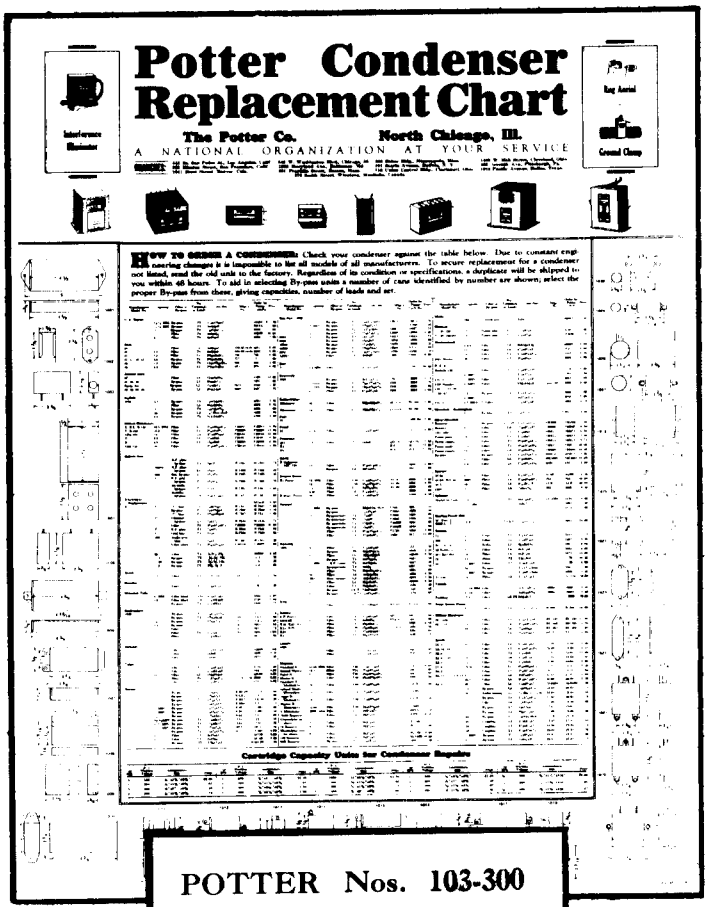
Order from your jobber, any Potter sales office, or from the factory in North Chicago, Ill.

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Potter Rug Aerial

The convenient and sensitive aerial for all sets. Makes the outside antenna unnecessary. No installation; just connect to receiver.







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Potter cartridge condenser units and No. 1 wax should be carried by every serviceman. Invaluable for quick repairs.

POTTER Nos. 103-300 *eliminator stops interference from entering set through the power supply.*

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A National Organization *At Your Service*

INDEX TO COMMERCIAL WIRING DIAGRAMS

WITH the issuance of each set of supplements, a completely revised and up-to-date index is furnished. To use this first remove all of the pages from the cover; throw away the old index pages and replace them with the new ones; and then insert the supplement pages in their numerical and alphabetical order. Then replace the cover and the book is complete.

Often, the trade name of a set is known by the user of this book but the name of the manufacturer not known.

In searching for diagrams, if the particular diagram you desire cannot be found, be sure to look through the Miscellaneous section at the end of this index. If it is not listed there look through the **Trade Name Index**; this gives the name of the manufacturer for each trade name. Since all diagrams are listed in the index in alphabetical order in accordance with the manufacturers' names, it is absolutely necessary to know the name of the manufacturer before a particular diagram can be found.

In the supplements are included diagrams for which we have received requests. Wherever the diagrams that have been requested are not included in one set of supplements, they will appear in the first set published after we receive them. Many diagrams of obsolete sets are difficult to obtain, but we are using every possible effort to procure them.

We wish to express our thanks to the many subscribers who have taken such extreme interest in the MANUAL, and especially to those who have voluntarily submitted diagrams for publication in the supplements.—THE PUBLISHERS.

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INTRODUCTION

THIS book has been compiled in an attempt to give the radio Service Man as complete and concise a compendium of practical data and instruction concerning radio installation, maintenance and repair as could be selected from the hosts of material already written on the subject. It is evident that a book of this type, to be entirely complete, would cover virtually all phases of radio and include complete diagrams and specifications of every radio set that has ever been built -- an enormous undertaking which would give the book a stupendous size. While such a volume would be of value for reference, it would be too clumsy to be handled by the busy radio Service Man who wants practical information, suggestions, and data in few words at his finger tips, with diagrams and specifications of the more popular types of sets in active service that daily require his attention. Therefore, only the salient features of radio servicing are given, and information on the servicing of battery sets, which are daily becoming obsolete, is covered more in general than in detail. In all instances where possible, specifications are given in connection with the diagrams, which were obtained through the kind assistance of the various manufacturers. More up-to-date information on later sets can be supplied from time to time as the material becomes available, for which purpose the loose-leaf form of this book has been adopted. In connection with RADIO-CRAFT Magazine (which supplies the latest important news on the subject in proper page size to fit in this book) the book can be kept alive and up-to-date and be of inestimable value to the active Service Man.

No attempt is made to delve into the theory of radio, since this is not within the scope of a book of this type. There are many technical books covering the theory and practice of radio, from which the would-be Service Man can get a good elementary grounding on the subject. Therefore, it is here assumed that the reader has an adequate technical knowledge of the subject, although technicalities are avoided as much as possible and simple language is used throughout, covering mainly the practical rather than the theoretical aspect of the subject. For, after all, the Service Man is practical. He must go out in the field, diagnose the troubles in radio sets from the symptoms, and in a few minutes' time correct the defects. A man of theoretical knowledge only is at sea when up against a set, apparently in perfect order, but which does not work; and all his theory is of no avail without some background of practice. All the books in the world cannot give as much knowledge in this line of work as can be obtained by installing, servicing, and repairing a hundred sets of different types. Highly-trained engineers have been known to labor for hours on a set that would not work, only to find out later that the antenna was disconnected; a condition which would be instantly noticed by a less-technical but practically-trained Service Man. He who can give the quickest and best service will have the greatest number of satisfied customers and will build up the greatest reputation and monetary income. He who bluffs his way through and makes only temporary repairs in hopes of obtaining future work on the same sets, will soon find that his best customers have left him. A thorough knowledge of the work, backed by a few months' practice, together with a data book of this type containing information one cannot reliably carry in his head, should be the foundation of a successful servicing business, provided it is conducted in an honest manner. We hope that the readers will find this book as valuable as we are trying to make it.

Aside from his theoretical and practical knowledge of radio, the Service Man, like a practicing doctor, should be somewhat of a psychologist. Not that his psychology will have any effect upon the subject on which he is working, as in the case of the doctor, but he will come in contact with all kinds of people, the vast army of radio set owners, some of whom will look upon him with suspicion and presume that they are being swindled, no matter how fairly he treats them. He will be called upon to explain in detail everything connected with the work, and must not only repair the set, but give the highly-

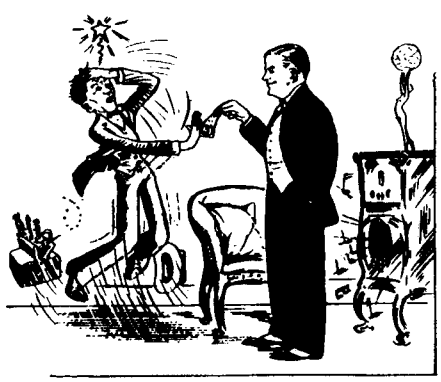
opinionated set owner a still higher opinion of his knowledge of radio. Of course, such cases should be handled tactfully, but just how is beyond the scope of this book, which makes no attempt to teach psychology. This can be learned better out in the field than from books. "Trouble-Shooting" in radio has many interesting and peculiar aspects.

The first section of this book is devoted to pointing out the weak spots in all kinds of radio sets and showing where trouble is likely to occur, how it can be located, isolated and repaired. Of course, the first and greatest symptom of a faulty radio set manifests itself in the loud speaker, which does not speak very pleasantly, or refuses to talk at all. This symptom is noticed by the set owner, who immediately telephones for the Service Man. From the owner's report of the set's behavior, the experienced Service Man can usually point his finger to the cause, since there is a cause for every effect. From this, he can select the necessary tools for making repairs, if any are required, and also any tubes, batteries, etc., which may be needed, and the job is shortly completed. The inexperienced Service Man, however, not being so keen at diagnosing from the meagre symptoms, must necessarily carry all his tools, testing apparatus, and spare parts, and make a longer job of it at greater expense to the owner. By making the tests systematically, the beginner can effect repairs quicker and soon acquire that apparently psychic insight into radio sets that the expert enjoys. The more proficient he becomes, the fewer tools he requires and the fewer tests he has to make. Therefore, we have endeavored to present, in a concise manner, a description of the various testing devices and tools that are indispensable to the beginner, as well as of great aid to the expert, and show how they are used in diagnosing set troubles. While many writings on trouble shooting trace cause to effect, we have attempted to trace effect to cause, which is the necessary procedure of the Service Man out on the job. As a concrete example, it is a simple matter to tell someone through the medium of a book that an open audio-transformer winding will stop the set from functioning, but it is an entirely different matter to trace the cause of a defective set back to the open transformer winding, when there are many other reasons why a set might stop functioning.

We believe that the vast collection of diagrams, forming the main bulk of the book, will be of help to all radio Service Men, and consequently we have made it as complete as possible without including diagrams known to be of little value. In modern manufactured radio receivers of somewhat inaccessible nature, an authentic diagram is almost indispensable in making tests, such as voltage and current readings and resistance measurements, for the difference in internal connections of various receivers is not apparent from the outside, and without the diagram mistakes are likely to be made.

We shall be pleased to receive suggestions and criticisms from those who are out in the field, and at the same time we wish to extend our thanks for the many suggestions submitted to RADIO-CRAFT by so many practical Service Men, which have been of great aid in preparing this book, and also to the manufacturers who have generously submitted data and diagrams concerning their products.

THE EDITORS



Sometimes the Service Man's money comes easy

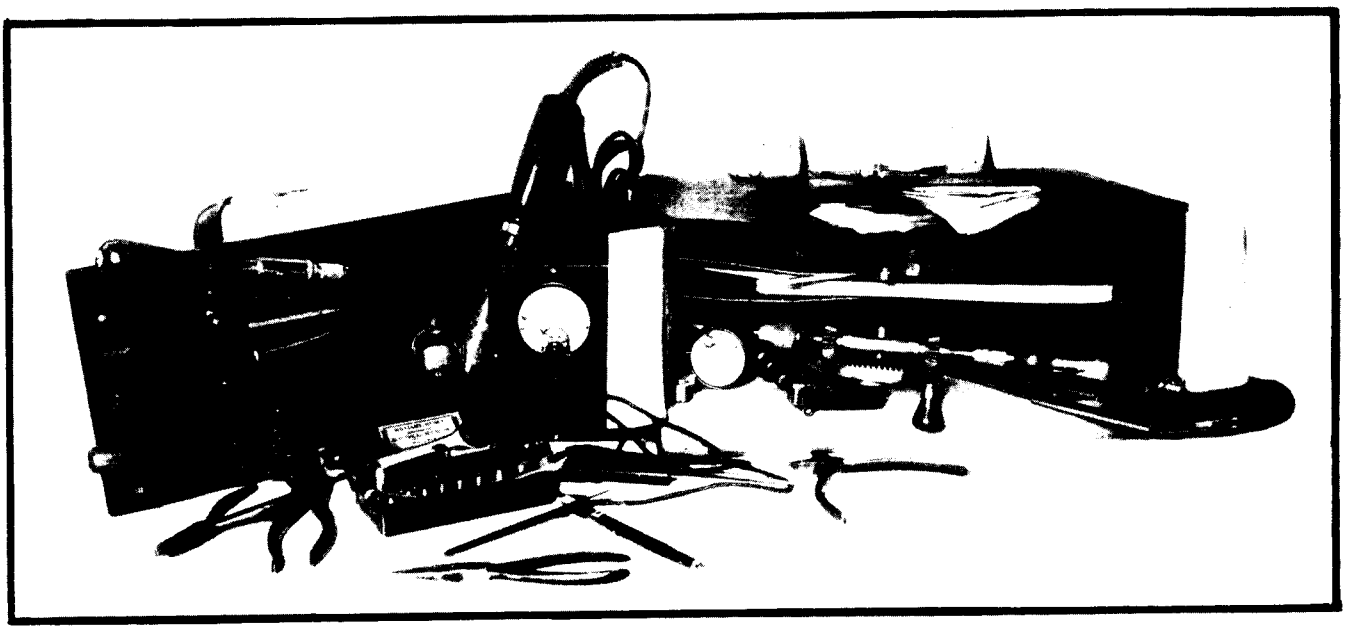
CHAPTER I

SERVICE EQUIPMENT

SPEED and accuracy in set installation and servicing depend upon the skill of the Service Man and the tools and testing equipment at his command; the greater the skill, the less equipment required, and vice versa. Practice will strike for each his own balance between skill and equipment, and he can be judged accordingly. Good testing equipment will instil confidence into the customer and help largely to alleviate dissatisfaction. The nature of the work and type of set also dictates to some extent the equipment required. If a car is used, one can naturally carry a well-nigh complete set of tools and testing apparatus, but without the car, only the most necessary paraphernalia should be carried, the rest remaining at the shop for work too complex to be done at the customer's home. The list below gives the tools, supplies and instruments that every Service Man should have available:

(2) Tools:

One pair diagonal pliers
" pair long-nose pliers
" pair side-cutting wire nippers or pliers
" jackknife
" socket-wrench set
" pair test prods
" combination neutralizing and aligning tool
" automatic blow torch
" soldering iron
" can flux
" short, heavy screwdriver
" long thin screwdriver
" roll friction tape
" hand drill with assorted drills
" reamer
" coarse file
" sheet emery cloth
" fine file
" flashlight
" large piece of cloth



This illustration shows the radio Service Man's ideal tool and testing equipment. Note the convenience of the carrying case. Photo courtesy The Grenpark Co.

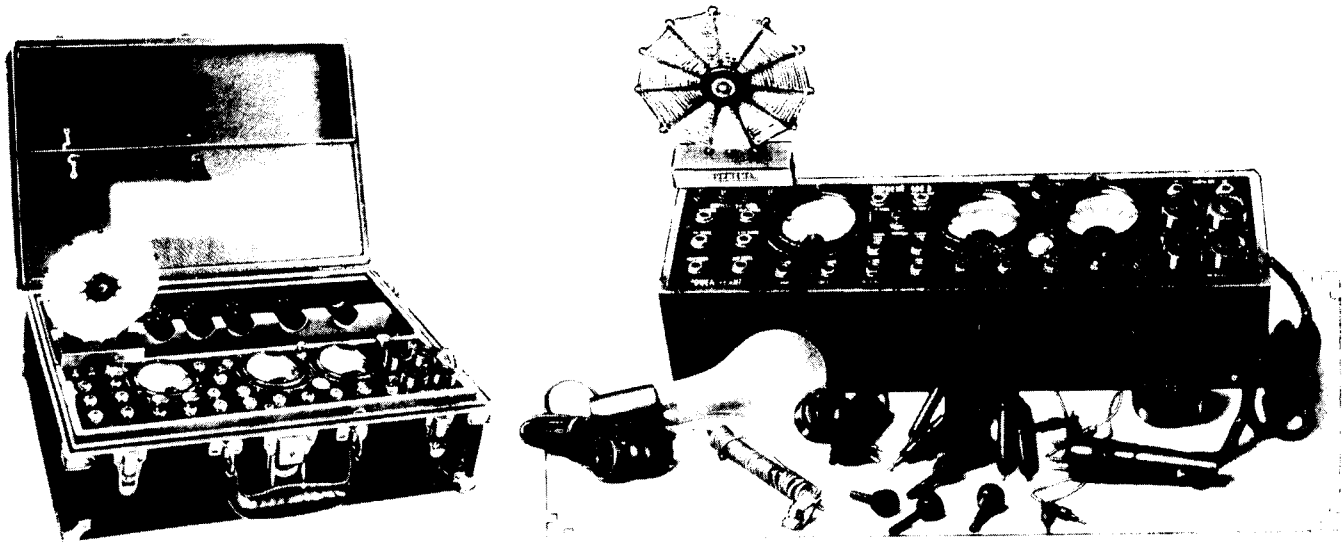


Fig. 1. - The Supreme Diagnometer is one of the most completely equipped testing apparatus available to the Service Man.

(3) Miscellaneous Parts: Assorted grid suppressors; center-tapped filament resistors; by-pass and filter condensers; variable high resistors; grid leaks; replacement A.F. transformer; phonograph pick-up adapter; rheostats; hook-up wire; a roll of bell wire; milenite tacks; insulated staples; replacement sockets; tube shield; trimming condensers; neutralizing condensers; tube adapters; R.F. choke; R.F. transformer; open and closed circuit jacks; filament switches; S.P.D.T. switches; phone plug; binding posts; soldering lugs; lock washers; assorted screws; aerial insulators; lead-in screweyes, hooks and insulators; lead anchors; filament ballasts; pilot lights; ground clamps; lead-in strips; lightning arrester; phone cord; 6 or 7-wire battery cable; battery clips, large and small; small knobs; cone apexes; complete set of various tubes; dummy neutralizing tubes; 45-volt "B" batteries; "C" battery.

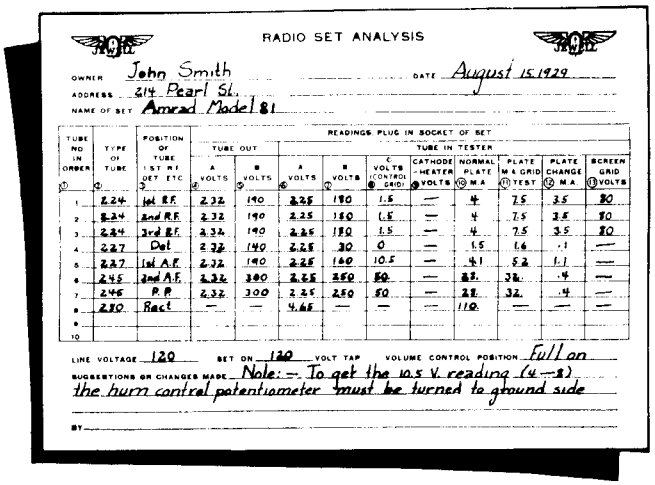
(4) Instruments: One radio set analyzer, one hydrometer, one speaker unit, one headset or single receiver, one audio-modulated R.F. oscillator, one resonance indicator.

(5) The Radio Set Analyzer. This is one instrument that every Service Man should have, as it will permit the complete analysis of any type of radio set. There are several set analyzers or testers on the market, among which we find the Jewell, Hickok and Weston, and the Supreme Radio Diagnometer. Complete instructions on the operation and use of these instruments are furnished by the manufacturers and therefore we will describe their use here briefly.

(6) Each of these analyzers is in the form of a portable carrying case, as illustrated in Fig. 1, with a small compartment for carrying tools and miscellaneous parts for making minor repairs. They are more or less complete, having measuring instruments with multiple scales whereby, through switching arrangements, a rapid diagnosis of a radio set can be made. The analyzer can be used for measuring plate current of each individual tube, plate voltage, grid voltage, filament voltage, screen-grid voltage, power supply voltage, approximate resistance values, approximate capacity values, continuity tests.

(7) These measurements can be made with the tube in or out of the circuit. For example, by removing a particular tube from the set and placing it in the socket of the analyzer, and placing the plug connection of the analyzer in the empty socket of the set, measurements of actual operation conditions can be made while the set is in operation. Such a test on each tube of the set will soon reveal any defect.

(8) The Supreme Diagnometer. In addition to the above, this instrument contains a modulated radio-frequency oscillator for use in balancing R.F. amplifier circuits and also a resonance indicator. In effect, it is virtually a complete portable radio laboratory. This instrument was fully described in the February, 1930, issue of RADIO-CRAFT.



RADIO SET ANALYSIS

OWNER John Smith DATE August 15 1929

ADDRESS 214 Pearl St.

NAME OF SET Amrad Model 81

TUBE NO IN ORDER ①	TYPE OF TUBE ②	POSITION OF TUBE 1ST R.F. DET ETC ③	TUBE OUT A VOLTS ④	TUBE OUT B VOLTS ⑤	READINGS PLUG IN SOCKET OF SET TUBE IN TESTER A VOLTS ⑥	B VOLTS ⑦	C VOLTS CONTROL GRID ⑧	CATHODE HEATER VOLTS ⑨	NORMAL PLATE M.A. ⑩	PLATE M.A. GRID TEST ⑪	PLATE CHANGE M.A. ⑫	SCREEN GRID VOLTS ⑬
1	224	1st R.F.	232	190	225	180	1.5	—	4	7.5	3.5	80
2	224	2nd R.F.	232	190	225	180	1.5	—	4	7.5	3.5	80
3	224	3rd R.F.	232	190	225	180	1.5	—	4	7.5	3.5	80
4	227	Det	232	140	225	30	0	—	1.5	1.6	.1	—
5	227	1st A.F.	232	190	225	160	10.5	—	41	52	1.1	—
6	245	2nd A.F.	232	300	225	250	50	—	85	36	.4	—
7	245	P.P.	232	300	225	250	50	—	85	32	.4	—
8	280	Rect	—	—	465	—	—	—	110	—	—	—
9												
10												

LINE VOLTAGE 120 SET ON 120 VOLT TAP VOLUME CONTROL POSITION Full on

SUGGESTIONS OR CHANGES MADE Note:- To get the 10.5 V. reading (4—8) the hum control potentiometer must be turned to ground side

BY

Fig. 2 - Typical Service Man's Chart.

(9) Charts. Charts are furnished by the makers of the various instruments on which complete readings can be recorded and analyzed as a whole, after which corrective measures can be made if necessary. A copy of the chart should be left with the customer and the original filed for future reference. Fig. 2 shows a typical chart, giving readings taken on an Amrad Model 81 Receiver with a Jewell No. 199 analyzer.

(10) Continuity Tests. One of the most common tests is the continuity test, for determining the condition of circuits or instruments. This test is usually made with a 4½-volt "C" battery connected in series with one of the voltmeters of the analyzer, with long flexible leads for connecting to the instrument or circuit under test. If the circuit is open, the meter reading will be zero; if closed, the reading will be full scale, or partially full, depending upon the resistance of the circuit - the scale reading giving a measure of the resistance of the circuit. Thus open circuits or short circuits can be easily located and values of resistances measured. This test will instantly show you if a by-pass condenser is shorted, or a resistance or coil is open. With the aid of the wiring diagram of the set being analyzed, trouble can quickly be located and the defective part repaired or replaced. We will have occasion to refer to continuity tests quite often in subsequent chapters. Fig. 3 shows a simple circuit for a continuity test.

(11) Capacity Tests. Large condensers having capacities from 0.1 mf. up are measured by connecting them in series with the 110-volt 60-cycle line and measuring the current. The current flow through the condenser is proportional to its capacity. Charts giving the capacity values for different current readings are usually furnished with the analyzers. This test is very useful for testing "B" eliminator, filter and by-pass condensers.

(12) Modulated Oscillator. A modulated oscillator (which is simply a miniature radio transmitting station) is useful in balancing or neutralizing sets. While a strong local broadcast station may serve the purpose of balancing, when no oscillator is available, the oscillator is more reliable and should be part of every Service Man's equipment. A simple modulated oscillator can be constructed by following the diagram. Fig. 4. This is a Hartley oscillator, which is self-modulated by the grid condenser and grid leak; the condenser building up a charge and discharging through the leak at audio frequency. The parts can be mounted in a suitable case with the coil so placed that it can be closely coupled to the first grid circuit coil of the set being adjusted.

Meter—Jewell 0-3 voltmeter D-C. Type 54.

Battery—3 Volt C Battery.

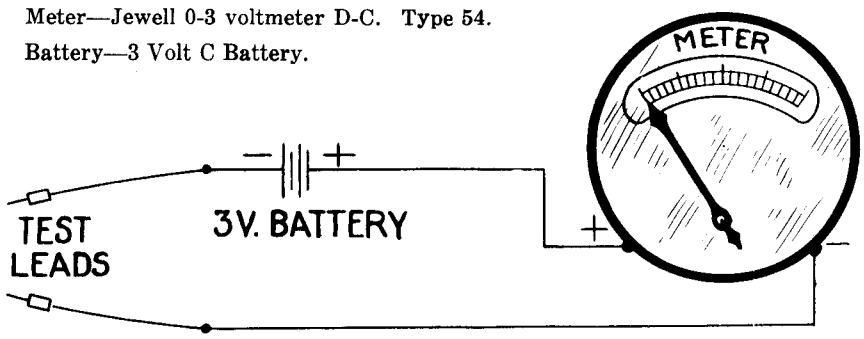
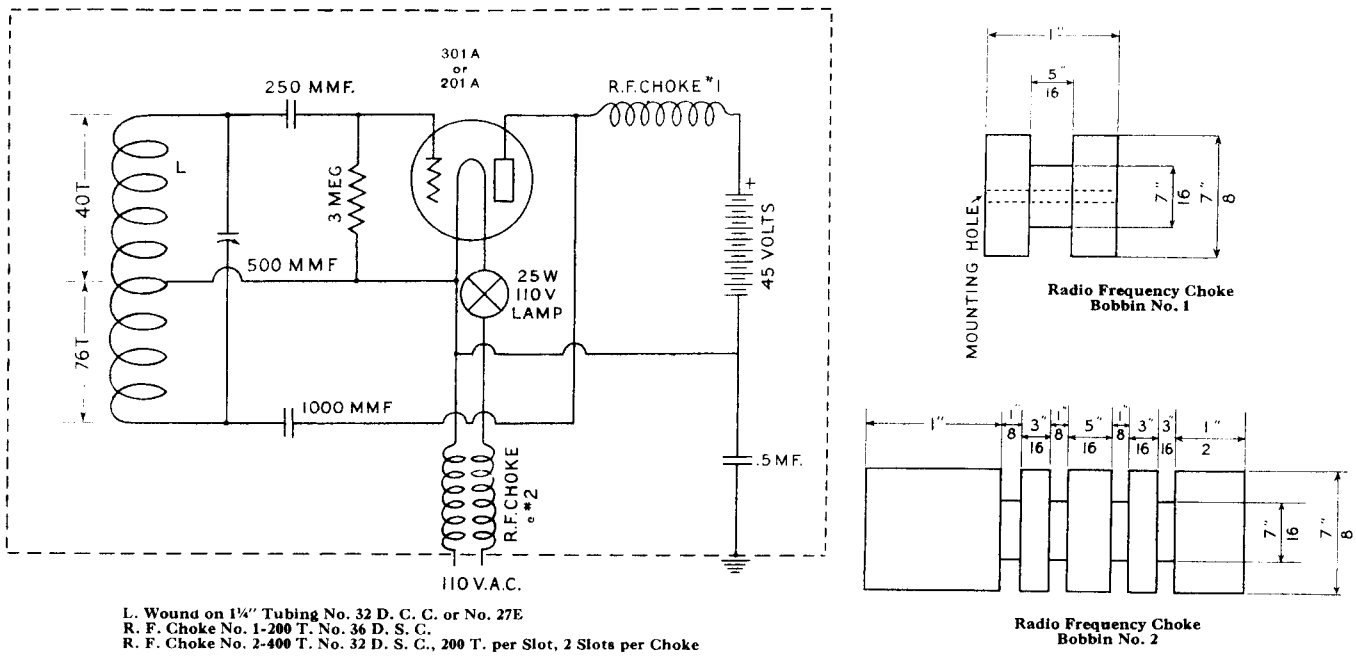


Fig. 3 - Circuit for Continuity Test.

(13) Resonance Indicator. While the fineness of tuning and balancing can be fairly well determined by ear, a more accurate method is to employ a resonance indicator. Such a device is indicated diagrammatically in Fig. 5. It consists of a low-range D.C. milliammeter for measuring the rectified output of the radio set. The output of the set is rectified by means of a type '99 tube with the grid and plate tied together, as shown. A variable resistor is shunted across the input to protect the meter from excessive currents, likely to be encountered when testing receivers that do not employ a dynamic speaker. The input should be equipped with a two-conductor telephone cord with clips for connecting to the set output.

(14) Dummy Tubes. Balancing a set requires the use of a dummy tube or balancing tube, which should be of the same type as those used in the set, in good condition and perfectly normal, except that one of the filament prongs is cut off and the internal filament wire resoldered to the shortened prong. This allows the tube to be inserted into the set without lighting its filament. An assortment of dummies for all types of tubes should be part of the Service Man's equipment, the most common being types '01A, '26, and '27. It is important that the elements inside are not jarred out of their normal



L. Wound on 1¼" Tubing No. 32 D. C. C. or No. 27E
R. F. Choke No. 1-200 T. No. 36 D. S. C.
R. F. Choke No. 2-400 T. No. 32 D. S. C., 200 T. per Slot, 2 Slots per Choke

Fig. 4 - Socket-Powered Audio-Modulated Oscillator.

position, or the internal capacity of the tube will change and its usefulness in balancing will be impaired. The tubes should be distinctly marked, to avoid mistakes.

(15) Balancing a Set. The receiver to be balanced should be connected up in normal operating condition, and either headphones or a resonance indicator used; either of which can be connected to the set output at the speaker or set chassis. The receiver should then be tuned to about 300 meters, or in between interfering stations if they are on the air. The oscillator is now put in operation, and its tuning condenser varied until it is in resonance with the set, as indicated by a reading of the resonance indicator or by sound in the headphones. The oscillator should be placed a distance from the receiver, so that the intensity is about equal to that of normal reception, and the set tunes sharply. The filament rheostat of the resonance indicator should be adjusted, together with changes in the distance between the receiver and the oscillator, so that the meter reads about two-thirds scale deflection. Maximum deflection, while tuning the oscillator, indicates maximum resonance between oscillator and receiver.

(16) The dummy tube is now placed in the last R.F. stage of the set, near the detector, in place of the tube formerly in that socket, and the neutralizing condensers are adjusted until there is no deflection on the resonance indicator, or no sound in the phones. This operation is then repeated with each R.F. stage, and when it is completed, the set is balanced. Note that the trimming condensers should be adjusted for maximum response and the neutralizing condensers for minimum response.

(17) It is well to balance the set at three or more points on the tuning dial, to insure a fine degree of balancing. To test the degree of balancing, replace the regular tube in the set and tune to a very low wavelength, then try forcing the set to oscillate by rocking the antenna trimming condenser or the volume control. If the set is well balanced, it will not oscillate.

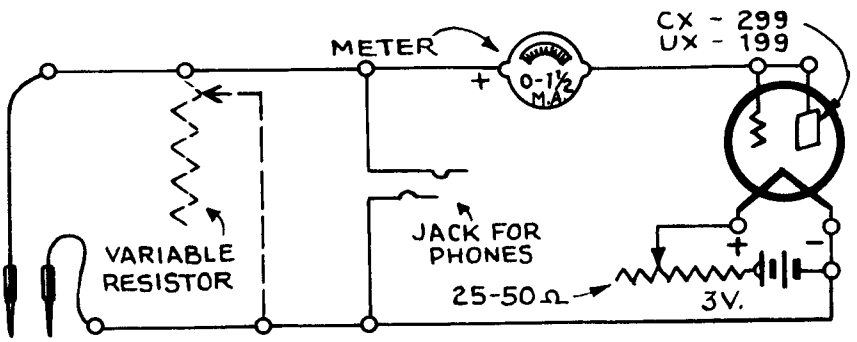
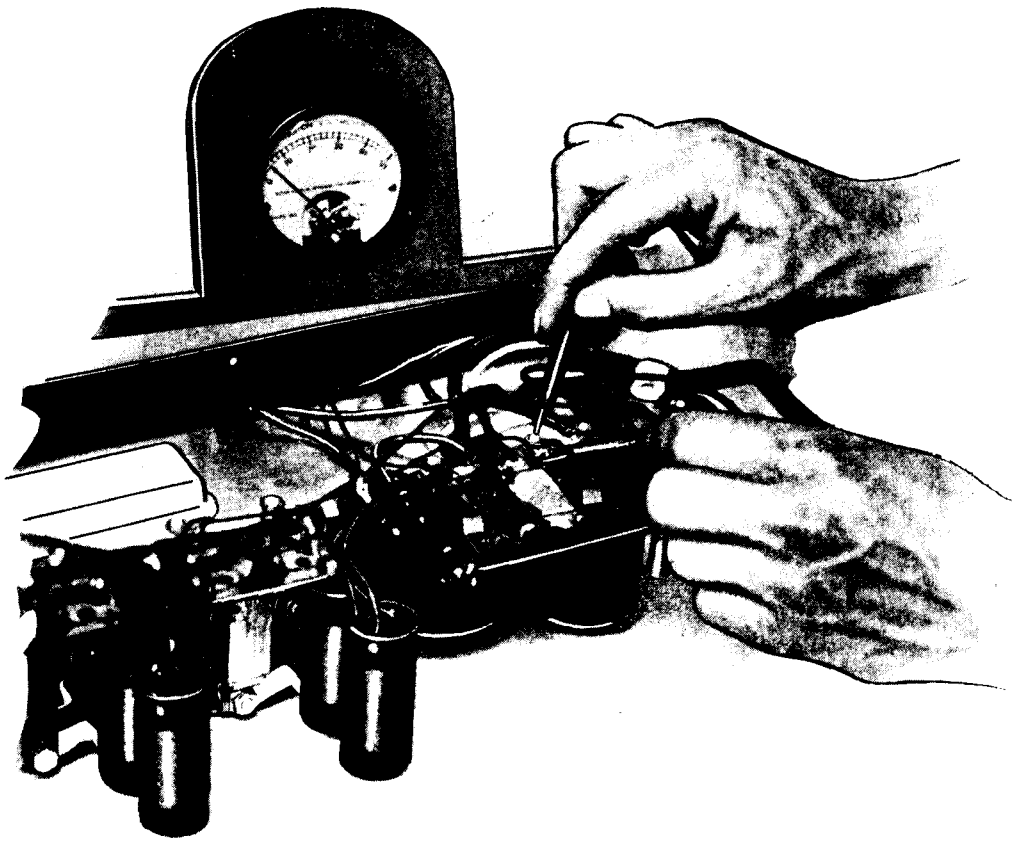


Fig. 5 - Resonance Indicator, Fleming Valve Type.

(18) Condition of Set. The condition of the radio set should always be taken into account when looking for trouble, as many commercial sets have been tampered with by the set owner or by Service Men who have worked on it previously. We cannot always assume that the set is exactly in accordance with the specifications and circuit diagram given. Defective parts may have been replaced with others of incorrect values. A visual examination will usually reveal any discrepancies and they should be compared with the diagram and corrected before relying on test measurements. This is another important reason why an accurate history of service calls should be kept.



Testing a Circuit for Continuity. Note the use of the Test Prods. The Set shown is an Atwater Kent Model.

CHAPTER II

GENERAL SERVICE PROCEDURE

WHETHER installing or servicing, it is of utmost importance to please the customer, and all complaints should be attended to immediately. At the first complaint of trouble, inquiry should be made of the customer as to the type of set, the nature of the trouble, the behavior of the set before and after the trouble started, the age of the tubes, batteries and set, the condition and type of aerial used, and any further questions that the answers to these questions might involve. This information, together with the shop records of other service calls if any have been made on the same set, may reveal the cause of the trouble and enable a quick and immediate repair. The importance of this phase of the work cannot be too strongly stressed, since it may save much time and many unnecessary trips.

(2) Type of Set. Tracing trouble is always performed, consciously or unconsciously, by a classifying process, and the most general classification is in the type of set, there being four general types, namely:

Battery sets,
Battery sets with eliminators,
D.C. Electric sets,
A.C. Electric sets.

(3) Contrary to general opinion, electric sets are usually much simpler to service than battery sets, because they are inherently more compact and consequently of sturdier construction, and less vulnerable to mechanical injury. Battery sets, on the other hand, because of corrosion of battery connections, discharged "A" batteries, old "B" batteries, and frequent alterations and replacing of batteries by the inexperienced owner, are a source of many service calls. However, the battery type of set will first

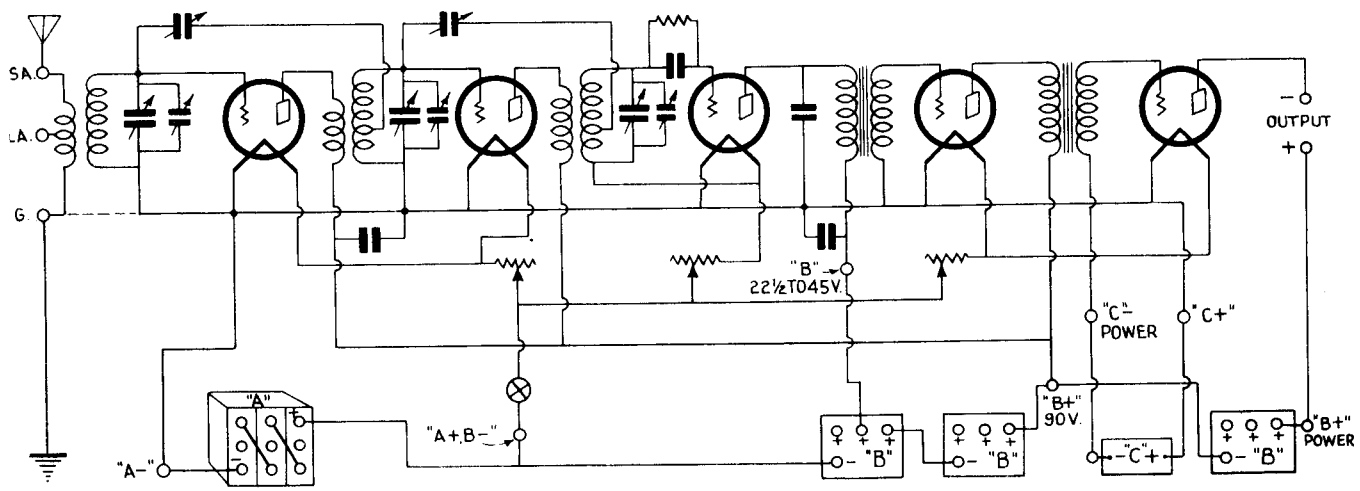


Fig. 6 - Typical 5-Tube Tuned R.F. Battery Receiver.

be described, in a general way, and we will take for our example a standard 5-tube tuned R.F. set. The circuit of Fig. 6 is typical of this type of set. Let us assume that the owner of this set claims that it will not work, and that is all the information that we have; we will proceed systematically to trace the source of the trouble.

(4) General Survey. The experienced man can often tell, by the nature of the sounds emanating from the speaker, the cause of the trouble and make repairs immediately; but we will assume that there is no sound in the speaker. The first thing to do is make a general survey of the layout, and look for simple things first. Things so simple that they are overlooked have caused much trouble and unnecessary labor on the

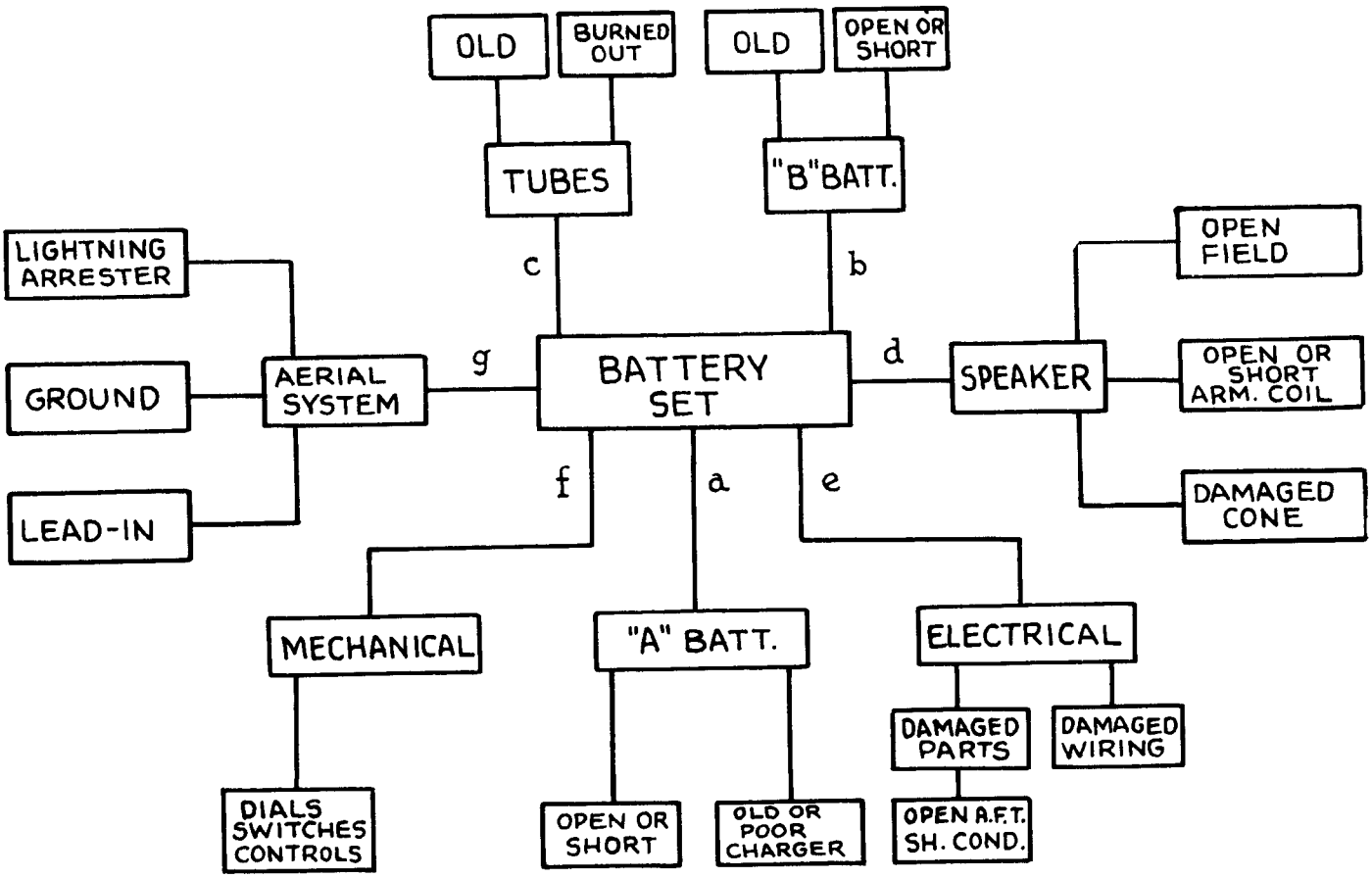


Fig. 7 - Trouble Chart for Battery Type Sets.

more complex parts of the set. For example, in one case a man worked nearly an hour on a set that failed to receive any stations, only to find later than an "S.O.S." call was on the air. Sometimes a tube loose in a socket, or in a dirty corroded socket, will cause trouble. The most common simple fault encountered is a disconnected or loose wire in some part of the battery, aerial, or speaker circuits, which may produce a dead, noisy, or weak set.

(5) Main Sources of Trouble. Further classification reveals that there are seven main sources where trouble may exist in the battery set. These are represented graphically in the chart of Fig. 7. Listing them in order of their importance, they are:

(a) "A" battery or circuit,
(b) "B" battery or circuit,
(c) Tubes,
(d) Speaker or circuit.
(e) Electrical system,
(f) Mechanical system,
(g) Aerial system.

Further classification of each of these seven sources are indicated in the illustration, but the first procedure is to localize the trouble in one, or possibly more, of these main branches, after which it may be traced down to one or more of the sub-branches. This is usually done by a process of elimination.

(6) "A" Battery or Circuit. A glance at the tubes will show whether they light up brightly, or not, after the set is turned on. If they light brightly, the "A" battery connections should be examined to see that they are not reversed, for a reversed "A" battery will produce a very weak set. If the connections are correct, and the tubes light, we can eliminate branch (a) of our chart. If the tubes fail to light or are very

dim, we must examine this branch and test the "A" battery with a hydrometer or quickly short the "A" battery and note if a powerful spark is produced. If the battery tests fully charged, examine the battery clips, which may be corroded; also the filament switch, rheostats, and ballast resistors (if any are in the circuit.) If the battery is discharged, examine the battery charger. See that it is not reversed and that it is charging properly and well connected to the lighting line. Note the amount of electrolyte and add distilled water if necessary. If the charger is in good condition, examine the "A" battery circuit for shorts, or failure to turn completely "off" by the filament switch or rheostats. The age and care of the battery will also give some indication of its condition. If beyond salvation, replace it. If branch (a) is found in good condition, examine branch (b).

(7) The "B" Battery or Circuit. A quick check of the "B" battery is to disconnect the high-voltage lead and listen for a loud click in the speaker when it is re-connected with the set turned on. A strong click indicates a good "B" battery, and vice versa - assuming the speaker is in good condition. The age of the "B" battery will indicate if it needs replacing or not, but if it is fairly new, measure the voltage with the set turned on. If the voltage is low, examine the set before installing a new set of batteries, for a shorted by-pass condenser in the set has ruined many a new set of "B" batteries.

Usually the battery nearest the negative or filament side of the circuit runs down first, because of the greater drain placed on it by the detector tube. Temporary operation can sometimes be obtained by exchanging it with the last one. A large by-pass condenser, about 2 mf, connected across the "B" battery, also helps.

With the "B" batteries in good condition and all the connections examined and tested to make sure that the voltage is applied to the tubes, we can pass on to branch (c).

(8) Tubes. Tubes often cause trouble, but the trouble is easy to rectify. If they are burned out from old age or damaged by mechanical jar, they must be replaced with new ones. Otherwise, the circuit should be examined before inserting new tubes, as the fault may be in the connections. The sockets should be cleaned by forcing the tubes in and out. Sometimes the tubes light normally but the filaments have lost their ability to emit sufficient electrons, or are "deactivated." A couple of good spare tubes should be used for comparing them by trying them in one socket after another, as it is seldom that all tubes in a set become weak at the same time, and the one or more weak tubes can be found. Of course, a set analyzer will instantly indicate the condition of a tube; if the plate current is low with the proper plate, grid, and filament voltages applied, the tube should be discarded, or reactivated, if possible, in a tube reactivator. Study Chapter IV for further information on tube analysis and tests.

(9) Speaker or Circuit. Disconnecting and connecting the "B" battery lead (as described in connection with the "B" battery or circuit) should give a click in the speaker if the speaker is in good condition. Otherwise, disconnect the speaker and test it for continuity, or quickly touch its terminals across a portion of the "B" battery and listen for a click. If the speaker is found impaired in any way, test it in accordance with the directions given in Chapter V. Otherwise, eliminate this branch of the system and examine the next one. Tapping the detector tube with the finger should give a clear ringing sound in the speaker, if the audio amplifier and speaker are in good condition. Comparing the speaker with one known to be good will also reveal its condition.

(10) The Electrical System. The electrical system of the set comprises the radio-frequency amplifier, the detector, and the audio-frequency amplifier; the most common source of trouble being an open winding in one of the audio-frequency transformers (usually caused by soldering flux employed in their manufacture, which eats away the

fine wire) a burnt-out resistor, or a short-circuited by-pass condenser. The last-named may ruin the "B" batteries, as mentioned before under the "B" battery heading. Continuity tests across all the transformer windings, chokes and condensers, will instantly reveal any trouble from these sources. Defective parts should be replaced with new ones. A headset connected in the plate circuit of the detector, will show that the radio-frequency amplifier and detector are in good condition if stations are heard, and thereby localize the trouble in the audio amplifier.

If stations are not heard in the phones, and tapping the detector tube produces a ringing sound, in the speaker, the trouble will probably be found in the radio-frequency amplifier or aerial system. Continuity tests should then be made on the R.F. transformers for opens, and the tuning condensers examined and cleaned if necessary. If trouble is found in this branch, a detailed analysis can be made in accordance with the instructions given in Chapters VI and VII.

(11) The Mechanical System. This part of the set receives all the mechanical wear and sometimes gets out of order. The trouble being of a mechanical nature, rather than an electrical one, is easily corrected. Under this heading we have the tuning condensers, dials, volume control, rheostats, filament switch, loud-speaker cord, and any other part that undergoes mechanical wear. A visual examination will usually reveal trouble from these sources. Electrical continuity tests of the manually-operated instruments will also reveal defects. It is better practice to replace defective instruments of this nature than to try to repair them.

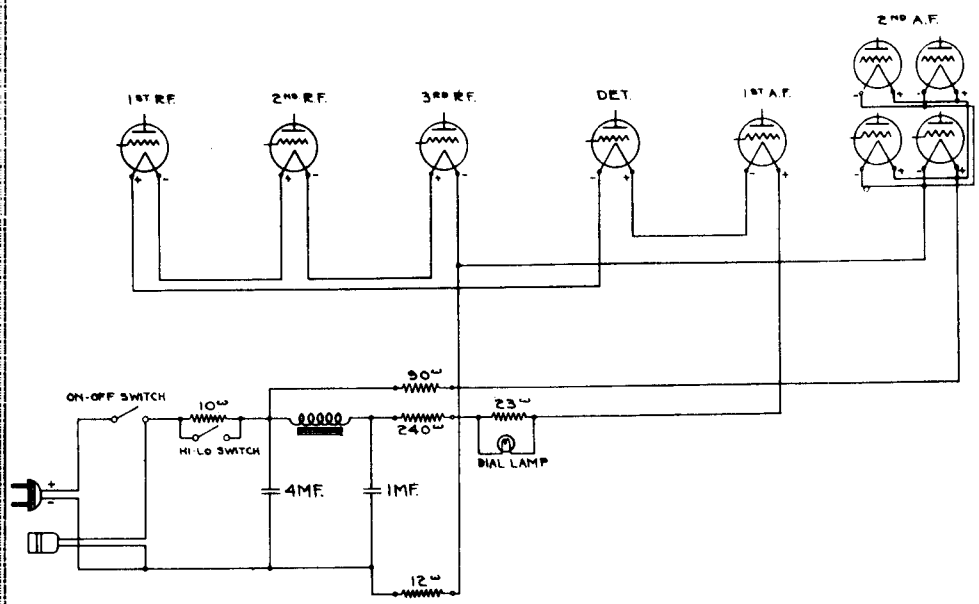


Fig.8 - Filament Circuits of a 110V. D.C. Set.

(12) The Aerial System. While we analyze this branch of the system last, a hasty examination of the aerial and its associated components should be made before thoroughly going over the entire set. At least one can tell whether the aerial is down or not, without making elaborate tests. Having eliminated the other branches of the system, and traced the trouble to the input or aerial and ground connections, we can make a detailed analysis of this branch by following the instructions given in Chapter VI under aerials.

(12) Battery Sets with Eliminators. The same general procedure for testing battery sets employing "A" or "B" battery eliminators, or both, should be followed as just described in connection with battery sets. In fact, the same chart of Fig. 7 may be used. If trouble is located in branch (a) comprising the "A" battery or circuit, testing methods described in Chapter III should be followed. Likewise, if trouble is located in branch (b), covering the "B" battery system, instructions on "B" battery eliminators should be studied. Since this information is fully covered in separate chapters, we will not go into it in detail here.

(13) D.C. Electric Receivers. These receivers differ from the battery type mainly in the manner by which the plate and filament supply voltages are obtained, and consequently the same testing procedure can be followed as with the battery type. In these receivers, the filaments are connected in series and supplied directly from the D.C. lighting line through a suitable resistor. Since the maximum voltage obtained from the

line is from 115 to 125 volts, a number of output tubes connected in push-pull or parallel are usually employed in the amplifier to get sufficient undistorted output.

(14) Filament Wiring. As an illustrative example, Fig. 8 shows the filament wiring of the Stromberg-Carlson "No. 638" Art Console receiver for D.C. operation. In this receiver the first, second, and third R.F. amplifier tubes, the detector and first audio amplifier tubes, are of the '01A type and connected in series with the pilot light and resistance; the whole being connected to the line through a filter system. The output stage consists of four type '71A tubes with filaments connected in parallel and connected across the line through a 90-ohm resistor, as shown.

(15) Testing Filament Wiring. In testing the filament circuit of the D.C. receiver, it is obvious that if one of the series filament tubes of the '01A type in the diagram, Fig. 8, burns out, the circuit will be open and the others will go out; replacing the burnt-out tube will cause all the others to light. It is well to test the line voltage at the filament terminals to make sure that the series resistors, choke and pilot lamp are in good condition. Voltages at the set sockets can be measured with a set analyzer, but only while the set is in operating condition with all tubes lit. If the tube is burnt-out, from excessive line voltage, the "Hi-Lo" switch, shown in the diagram, should be opened, thus placing an additional 10-ohms in series with the set with consequent voltage reduction.

(16) Power Tube Filaments. The four '71A power tube filaments in this set are connected in parallel and, since they are all fed through one series resistor, if one of these tubes burns out or is removed from the socket, the voltage across the others will rise to a dangerous value and burn out all the others unless the set is immediately turned off. Therefore, it is very important to turn the set off before removing any of these tubes; furthermore, do not turn the set on again until good tubes have been placed back in the empty sockets. Chapter III gives further information of value in this connection.

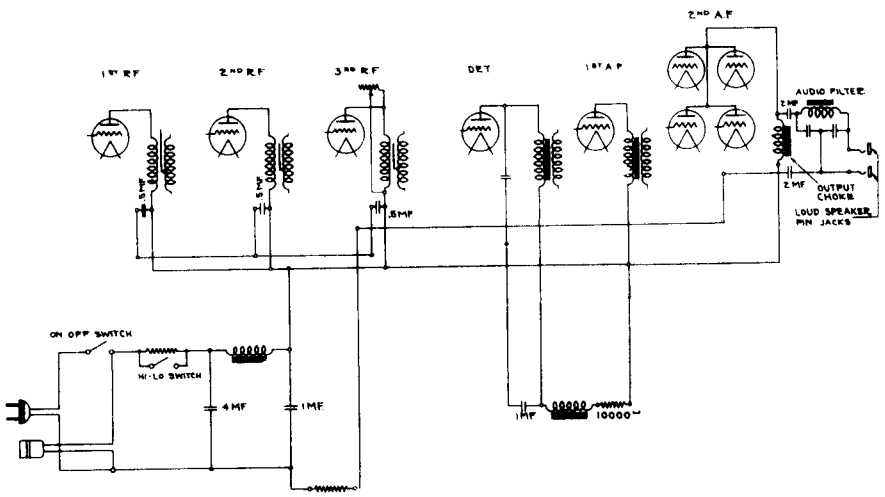


Fig. 9 - Plate Circuits of a 110V. D.C. Set.

(17) Plate Supply. Fig. 9 shows a schematic diagram of the plate circuits of this set. Note that all tubes are fed by the maximum line voltage (neglecting the slight voltage reduction caused by the filter choke.) A simple voltage test at the socket will indicate whether there is failure in the plate supply. If so, continuity tests across the choke, series resistor and switch, with the line-plug out, will probably locate the cause. A shorted filter condenser may cause a fuse to blow. The condensers should be tested and replaced if necessary before replacing the fuse. Further information may be found in Chapter III under D.C. "B" eliminators.

(18) A.C. Electric Sets. These sets differ from those previously described mainly in the type of tubes employed and the method of heating their filaments. The filaments in these sets are heated by means of a step-down transformer connected to the A.C. line, and it is consequently a simple matter to trace failure of any part of the filament circuits. Two methods are employed; in one, the filaments are heated by the alternating current and the grid returns find their way back to the electrical center of the filament, by means of a center-tapped resistor placed across the filament, or

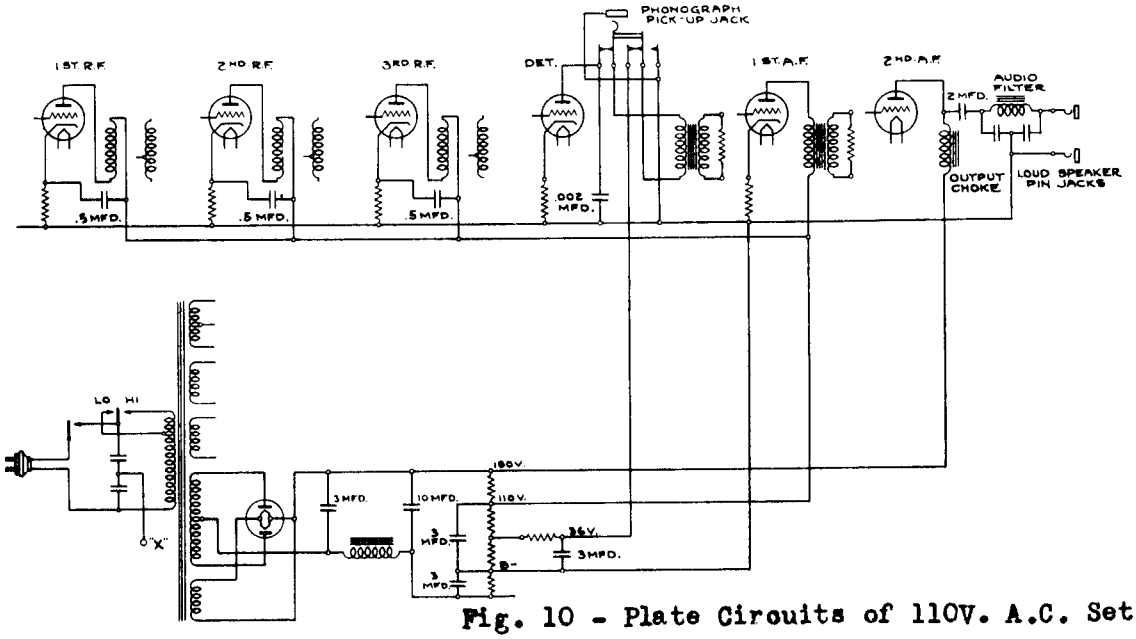


Fig. 10 - Plate Circuits of 110V. A.C. Set.

by a center tap on the filament transformer winding. If the tap is not at the exact electrical center, hum will be introduced. The type '26 A.C. tube is used in this manner for both radio- and audio-frequency amplifiers. The various power tubes for the output stages in the radio amplifier are also connected in this way.

In the other method, a heating element is used to heat a cathode which is not in electrical contact with the heater, but is brought by the heater to a sufficient temperature to cause electrons to be emitted from it; the cathode serves as a filament and is considered as such in the various circuit diagrams. This type of tube, the '27, is used for the detector in virtually all A.C. sets, and in many cases also used for the radio- and audio-frequency amplifiers. The reader is referred to the special Chapter IV on tubes for more detailed information.

(19) Plate Supply. The plate supply of A.C. sets is obtained by the same basic method as in battery sets employing "B" eliminators; the main difference being that, in the A.C. set, the "eliminator" is usually an integral part of the set and cannot as easily be isolated, removed and repaired.

(20) A.C. Power Supply. A typical example of the power supply system for an A.C. set is illustrated in the schematic diagram of Fig. 10, which shows the power supply of the Stromberg-Carlson "Nos. 635 and 636" receivers. If the initial tests reveal a failure in the power supply, as indicated by absence of plate voltage, the trouble may be caused by a defective rectifier tube, burnt-out filter choke, punctured filter condensers, or open voltage divider. This latter device, indicated as a group of resistances at the extreme lower right of the diagram (Fig. 10) may cause excessive plate voltage on some of the tubes, should the lower or negative end of it be open. This is a frequent occurrence and, if the resistance values and current carrying capacities of the voltage divider are known (as indicated on the diagram of the specific set) a new resistor of the same value should be inserted. Further reference to power supply equipment will be found in Chapter III.

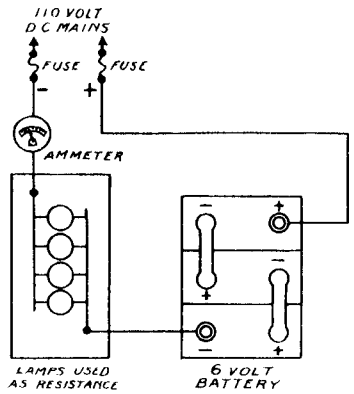
(21) 25- and 60-Cycle Sets. It is well to check the frequency of the power supply, especially when making installations, and make sure that the set is designed to operate on the frequency available. While 60-cycle supply is the most common, in some localities (especially near Buffalo, N.Y., and in many parts of Canada) 25-cycle and sometimes 40-cycle current is in general use. It is ruinous to attempt to operate a 60-cycle set on a 25- or 40-cycle line, but a 25- or 40-cycle set may be safely operated on a 60-cycle line. The 25-cycle set may be operated on a 40-cycle line, but not vice versa.

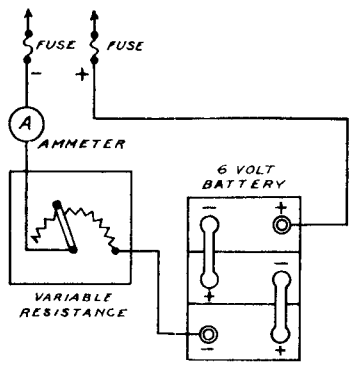
CHAPTER III

POWER-SUPPLY SYSTEMS

IN the course of time the service man will encounter a wide variety of socket-power-supply systems - both filament "A" supply, plate "B" supply and "C" supply units - as indicated by the various diagrams in this book. While the circuits differ widely, and the apparatus employed and combinations also differ, trouble shooting in each system is essentially the same, and can be boiled down to a few simple tests of the various parts. Sets employing batteries for the "A", "B" and "C" supply were sufficiently covered in the second chapter of this book, and will not be included in this chapter; only power-supply systems in connection with the house-lighting line, both A.C. and D.C., will be included. These may be divided into :

(a) Eliminators for battery sets,
(b) Power-Supply Systems for A.C. Electric Sets.





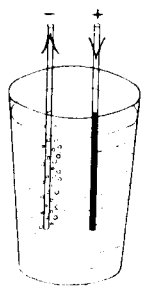


Fig. 12 - (left) Charging a 6-volt battery from a 110V. D.C. line using a variable resistance.
Fig. 13 - (center) Charging a 6-volt battery using a lamp bank resistance.
Fig. 14 - (right) Testing the polarity of the D.C. line with salt water.

The first group will include battery chargers as well as eliminators, both A.C. and D.C. types, for use with battery sets. The second group will include power packs and power supply systems for A.C. electric sets. Both groups will be subdivided as we proceed with the discussion. A voltage measurement on any of these devices will reveal an abnormal condition. Current output measurement will show whether the fault is in the set or in the power-supply device. In this chapter we will assume the defect, if any, to be in the power-supply device.

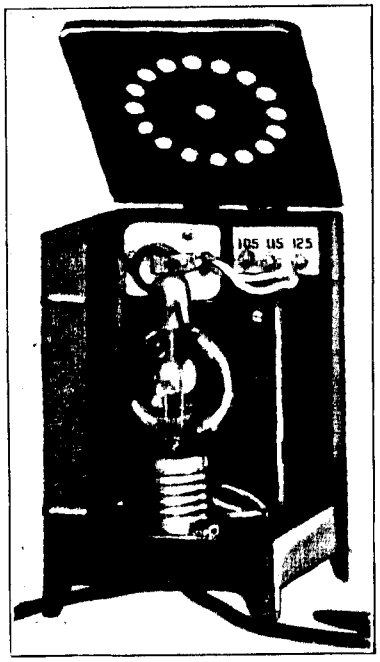
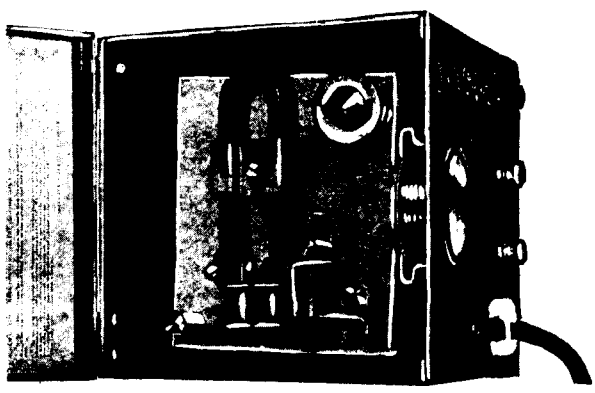
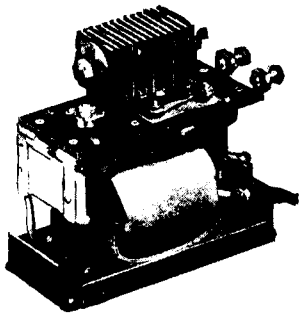
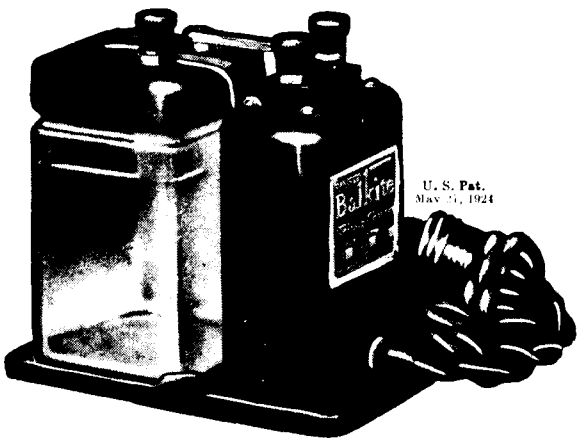
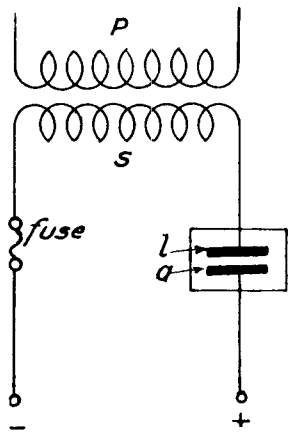


Fig. 15 - (left) Tungar charger.
Fig. 16 - (center) Vibrating reed charger.
Fig. 18 - (right) Dry disc charger.









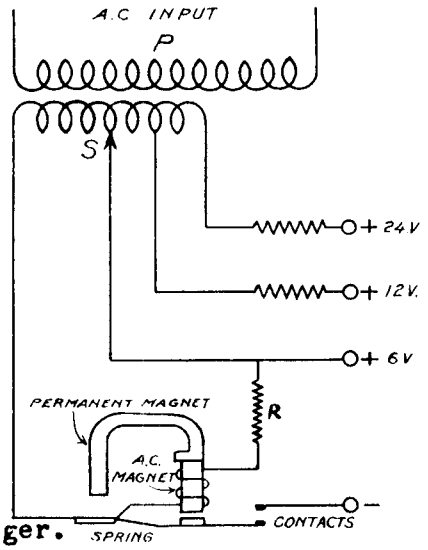


Fig. 17 - (left) Electrolytic charger.
Fig. 21 - (center) Diagram of electrolytic and dry-disc charger.
Fig. 20 - (right) Diagram of half-wave vibrating reed charger.

(2) 110V. D.C. Battery Chargers. This type of charger consists merely of a resistance in series with the battery under charge; the wole being connected to the 110-volt D.C. line. See Figs. 12 and 13. Tracing trouble, therefore, consists merely of checking the continuity of the circuit and its polarity. Trickle chargers usually have an ammeter which indicates the polarity and amount of charge. Trouble is usually found in the connections to the battery, which become corroded in time, and introduce resistance into the circuit. In some sets, automatic relays are employed to disconnect the charger from the line when the set is turned on. Through wear and sparking, the contacts in the relays fail to close and the charger circuit remains open. In lieu of a polarized meter, the line polarity can be determined by dipping the two terminals in water containing a few grains of salt; violent bubbling will take place around the negative wire. See Fig. 14.

(3) 110V. A.C. Battery Chargers. These chargers may be of the tungar-tube type, the vibrating-reed type, the electrolytic rectifier type or the dry-disc rectifier type; the latter two being used mainly for trickle chargers. The illustrations of Figs. 15, 16, 17 and 18 show these types of chargers. Figs. 19, 20 and 21 show the connections, respectively, In addition to the causes of troubles mentioned in connection with D.C. battery chargers, we have a likely source of trouble in the rectifying device. In the tungar type, the filament may burn out, or a defective tube may be encountered. The life of this type of tube is uncertain, even though its filament may be intact. This is true also of dry-disc rectifiers and vibrating rectifiers, which in time require new contact points. Failure in charging may also be due to an open transformer winding, or a dirty or loose tube socket. Some chargers have connections for charging storage "B" batteries, with consequent troubles from corroded connections to the battery.

(4) 110V. D.C. "A" Eliminators. These consist merely of a network of resistors designed to give the required voltage drop, together with a choke coil and condensers for filtering purposes, as indicated in Fig. 22. In some cases the tubes are wired in series, as was illustrated in Fig. 8. In this case, the current drain from the line is much less than when lighting the tubes in parallel. In the latter case (Fig. 22) an output voltage of 6-volts is usually desired; but the voltage remains at this value only when the set is turned on and all tubes lit; because the least change

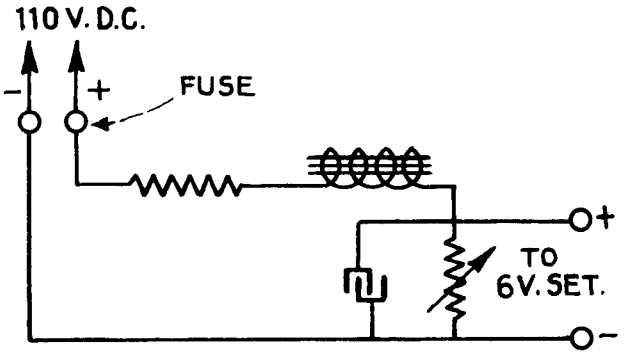


Fig. 22 - Circuit of 110V. D.C. "A" battery eliminator.

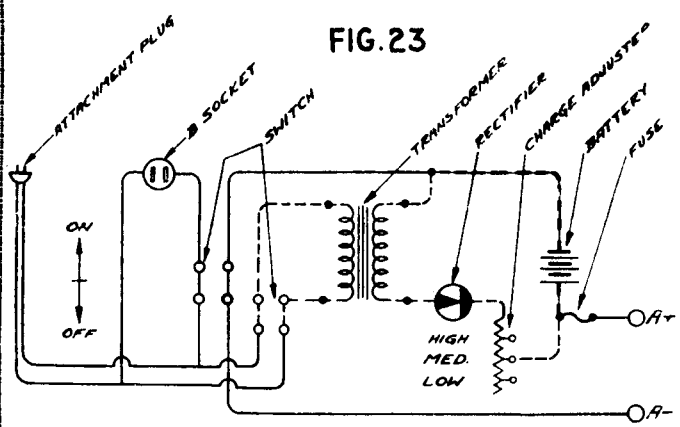


FIG. 23

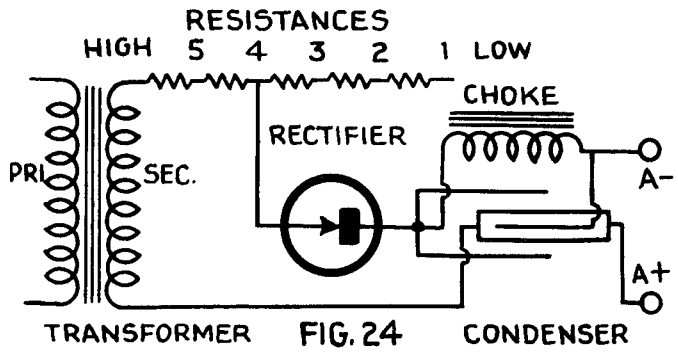


FIG. 24

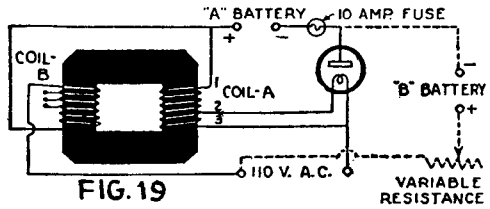


FIG. 19

Fig. 19 - Diagram of Tungar Charger.
Fig. 23 - Diagram of Philco Socket Power "A" supply.
Fig. 24 - Diagram of Balkite socket Power "A" supply.

in current drain charges the resultant voltage drop, causing the output terminal voltage to fluctuate widely, and endanger the tubes. For this reason, no tubes should be removed from the set without first turning off the switch, and the switch should not be turned on again until all good tubes are in the set. However, the variable resistors give a wide range of voltage control, and should be carefully adjusted. Simple continuity tests will indicate the condition of this device. If a fuse blows, because of a short in the eliminator, test the filter condensers for continuity before connecting the outfit in service again.

(5) 110V. A.C. "A" Eliminators. Such a device is naturally more complex than the D.C. type, since it comprises a power transformer, a rectifier, a filter system and, in some cases, a storage battery. The last arrangement cannot be considered a real battery eliminator, but is merely a combined storage battery and trickle charger. Fig. 23 shows the diagram of the Philco Socket Power "A", which is representative of this type in which no filter system is employed, the storage battery serving for this purpose. In the other types, no battery is used. Fig. 24 shows the diagram of the Balkite "A" Socket Power Unit, which is typical of this. Both of these employ electrolytic rectifiers. We shall describe each in detail.

(6) "A" Power Units With Battery. Troubles in this unit are similar to those occurring in regular batteries and chargers. In these, a comparatively smaller battery is used (about 40-ampere-hour) , and it is continually being charged while the set is in operation. Hum may be produced if the battery is operated near or in a discharged condition; in which case the condition of the battery and rectifier should be examined. If the rectifier electrolytic has evaporated, more should be added. Loose binding posts and connecting cables are also a source of trouble. The control resistor also may become loose, dirty, or worn, and require cleaning or replacing. Electrolytic or dry-disc rectifiers are usually employed in these units. These need replacing in time, depending upon the length of time they have been in service.

(7) "A" Power Units Without Battery. As shown in Fig. 24, these units comprise a step-down transformer, control resistance, rectifier, choke coil and filter condenser. Since the output voltage is low (about 6 volts) and the current high, the condenser may be designed for low voltage, but it should have an enormous capacity to produce any appreciable filtering effect. The output voltage in these units may vary because of a defective rectifier or leaky filter condenser. The resistance-control allows for adjustment over wide limits, however, and a slight readjustment is usually sufficient.

(8) Series-Filament "A" Supply. If type '99 tubes are used and connected in series, a current of 60 milliamperes is sufficient to light them, and this may be obtained from the "B" supply. If '01A tubes are used in series, a current of $\frac{1}{4}$ ampere is

required, which is too great to be taken from the usual "B" supply, so a separate rectifier is necessary. These systems are not in general use (except for 110V D.C. systems) and need not be described in detail. Trouble shooting resolves itself merely into testing the rectifier and continuity of the circuits, remembering that "C" voltages are obtained by returning the grid-circuit leads to different points of the filament circuit; each point, of course, being at a different potential.

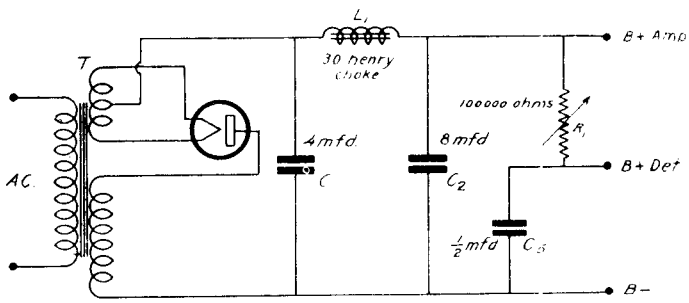
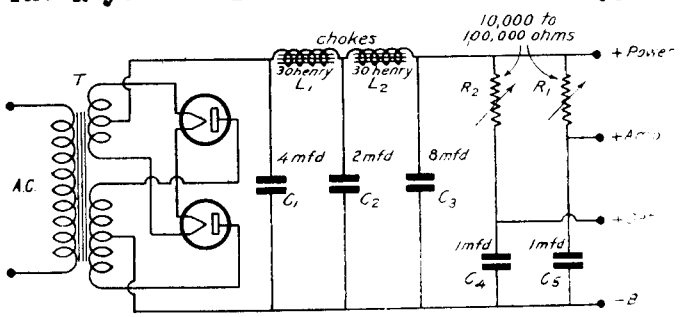


Fig. 25 - "B" Power Supply using half-wave filament type rectifier.

(9) "B" Battery Eliminators. We shall limit this discussion to "B" battery eliminators operating from the A.C. line, as the D.C. type were covered sufficiently in Chapter II. So far we have talked about rectifiers, but made no distinction between half-wave and full-wave ones. In the former, every other half-cycle of the alternating current wave is used, resulting in a D.C. output with a 60-cycle pulsation, which is smoothed out by the filter. In the latter (which is in effect two half-wave rectifiers operating alternately or "out of phase") each half-cycle is used; every other one being in effect reversed, giving a 120-cycle pulsation in the D.C. output. The 120-cycle pulsation is easier to filter than the 60-cycle pulsation and a smaller filter system may be used; however, the sound reproducer is more sensitive to the 120-cycle tone than to the 60-cycle one, and the amount of hum produced is about the same in each case. Filament-type, gas-type, and dry-disc type rectifiers are most generally used.

(10) Filament-Type Rectifiers. Figs. 25 and 26 show typical circuits of half-wave and full-wave filament rectifiers, the latter consisting of two half-wave rectifiers so connected as to obtain full-wave rectification. The type '81 tube is a typical half-wave rectifier. Fig. 27 shows a full-wave rectifier circuit employing a full-wave rectifier, such as the type-'80 tube. A comparison of these three circuits will give a fundamental idea of the basic principles involved, as they are all fundamentally the same and subject to the same defects. Like defects or troubles produce like symptoms in all.

(11) Gas Rectifiers. These are more generally used for commercial "B" eliminators. The Raytheon "B" and "BH" tubes are typical examples. Fig. 28 shows circuits of the



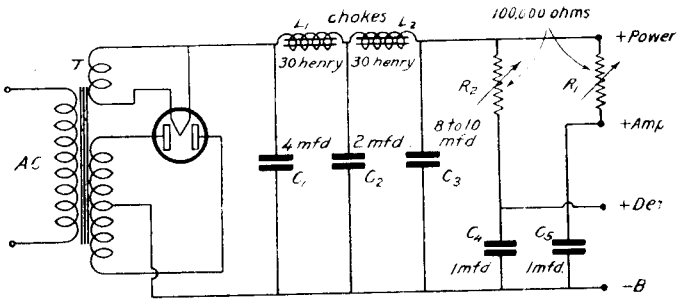


Fig. 26 - "B" Power Supply using two Half-Wave Filament Type Rectifiers for Full-Wave Rectification.

Fig. 27 - (right) Full-Wave Rectifier Circuit for "B" Supply using Filament Type of Tube.

Majestic "B" eliminators employing a full-wave gas-type rectifier. Analysing these, we find them composed of input transformer, buffer condensers, rectifier, filter condensers and chokes, and voltage-control resistors. A condenser, connected between one side of the 110-volt line and ground, is also indicated. The two buffer condensers, connected across each half of the transformer secondary, have a capacity of

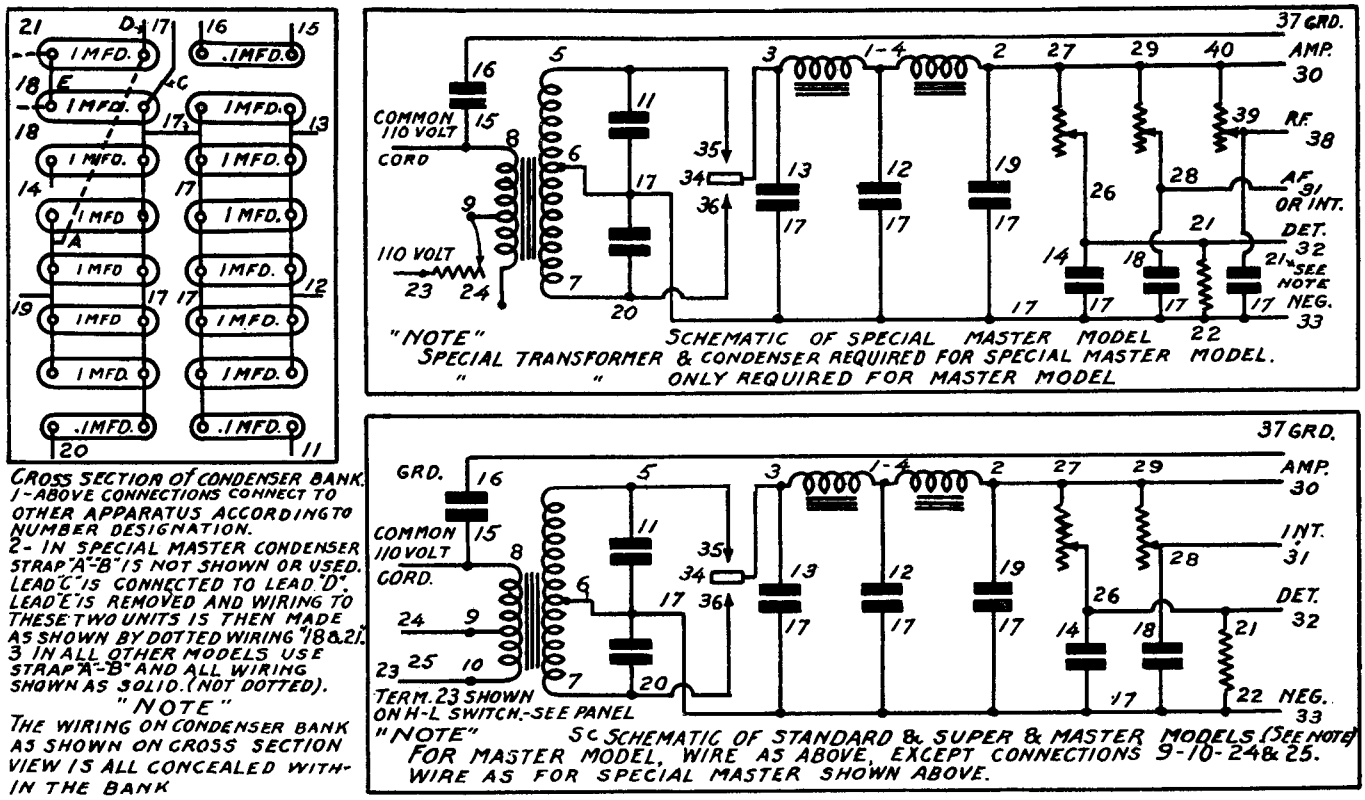


Fig. 28 - Diagram of Majestic "B" Eliminators.

o.1-mf each. They are used to absorb or prevent any high-frequency parasitic oscillations across the rectifier tube and are used only with gas-type rectifiers.

(12) Dry-Disc Rectifiers. These can be obtained to plug into the regular socket of the commercial "B" eliminator, without any changes in the internal wiring. Therefore, special circuits will not be given showing their use.

(13) "B" Eliminator Troubles. The most common cause of trouble in a "B" eliminator that fails to work is a shorted filter condenser. Therefore the first thing to do is to turn off the current, open the case, and test each condenser for shorts. The shorted condenser can be clipped out of the circuit and the eliminator put back in service again for temporary use, with only a possible slight increase in hum. It is important, however, to replace the condenser with a new one as soon as possible. The next source of trouble is usually found in the control resistors. If the detector voltage is high, the resistor connecting the detector tap to the negative side of the circuit is open. By measuring the output voltages with a high-resistance voltmeter, a defective resistor can easily be located. Continuity tests will indicate the condition of the choke coils and transformer windings. Slow starting, irregular operation or low voltage output, indicates a defective rectifier tube. The Raytheon should give about 4000 hours service, after which the voltage output will gradually drop off. By readjustment of the resistors, the voltage can be brought back and the tube used a considerable length of time before discarding it. "Hum" indicates a shorted filter coil or buffer condenser.

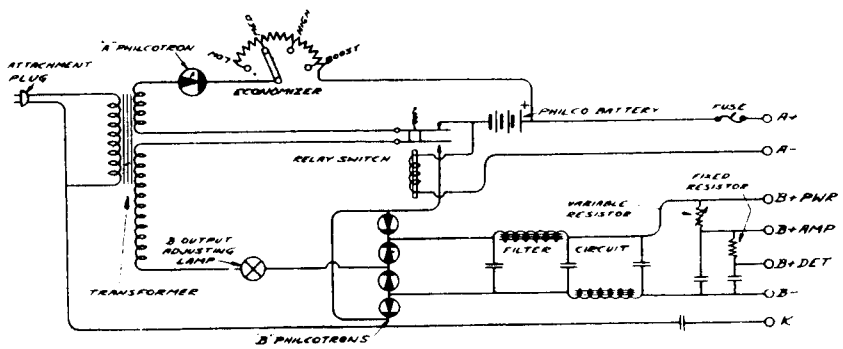


Fig. 29 - Philco AB Socket Power Types AB-656 and AB-652.

(14) Motorboating. Motorboating is a common occurrence when using "B" eliminators,

and is important enough to be considered separately. It produces a "put-put-put" sound in the speaker, similar to that of a small gas engine, from which it gets its title. It is in reality a low-frequency oscillation caused by the combined circuits of the eliminator and set. A different type of eliminator may prevent it, or the use of a separate 45-volt battery for the detector, connected between the negative side of the eliminator and the detector terminal of the set; in which case the "Detector" terminal of the eliminator is not used. Sometimes it may be stopped by reversing one of the transformer windings in the audio-frequency amplifier. In resistance-coupled amplifiers, it is best to remove the first stage and insert in its stead an audio transformer. Sometimes a large by-pass condenser added to the eliminator output (especially the detector output) will prevent it.

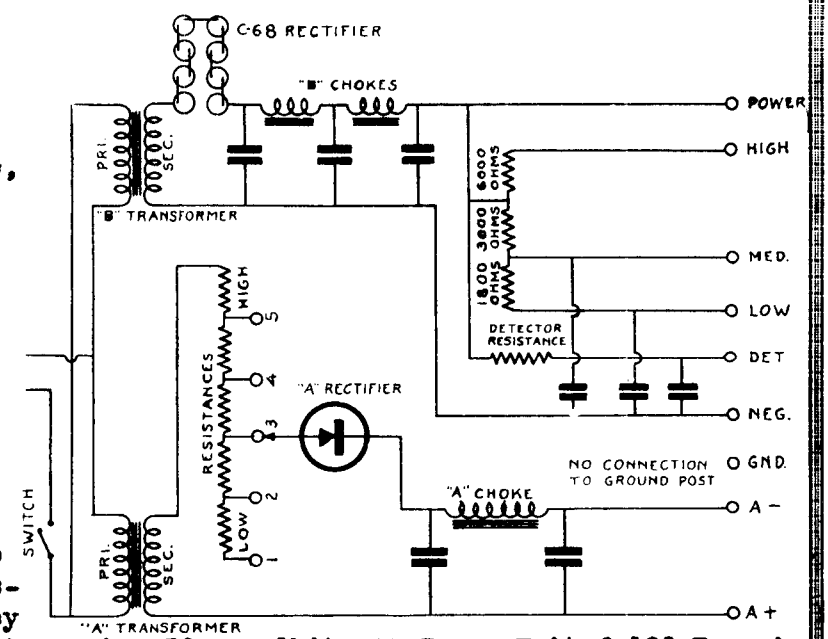


Fig. 30 - Balkite AB Power Unit 6-180 Form A.

(15) Combined "A" and "B" Eliminators. A combined "A" and "B" eliminator is merely the combination of the subjects we have just discussed, and a detailed analysis need not be given. Circuit diagrams, Figs. 29 and 30, showing the Philco and Balkite "AB" socket-power units, are given, however; the illustrations being self-explanatory.

(16) Power Packs. Power packs are made in many forms to suit different set conditions, but they are all fundamentally the same and have the same inherent characteristics. The power pack is a combination of parts designed to furnish the set with plate, grid, and filament voltages for A.C. tubes and is built in a unit separate from the set. It is thus distinguished from electric sets in which the power-supply system is an integral part of the set. We might appropriately call them heavy-duty "B" eliminators. In addition to furnishing plate, grid and filament voltages for A.C. tubes, some power packs also contain a stage of audio-frequency amplification - the output stage - of

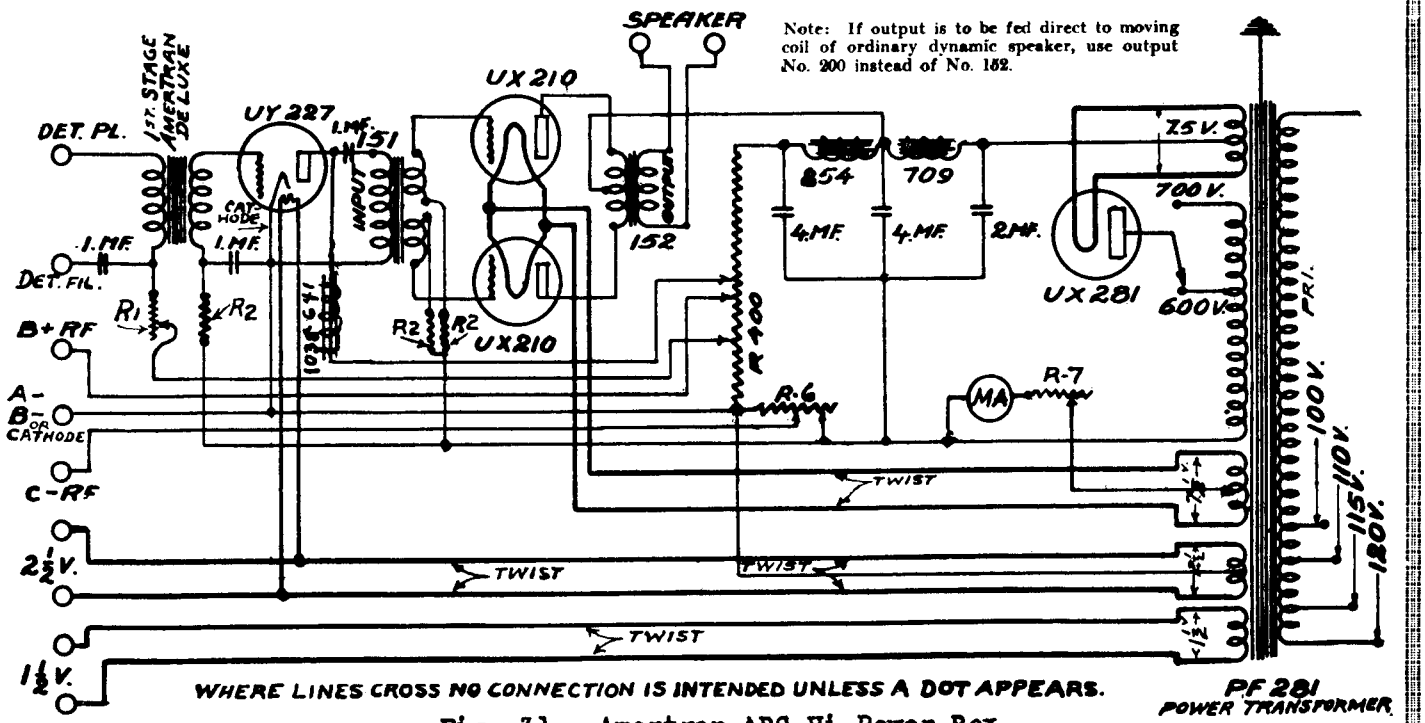


Fig. 31 - Amertran ABC Hi Power Box.

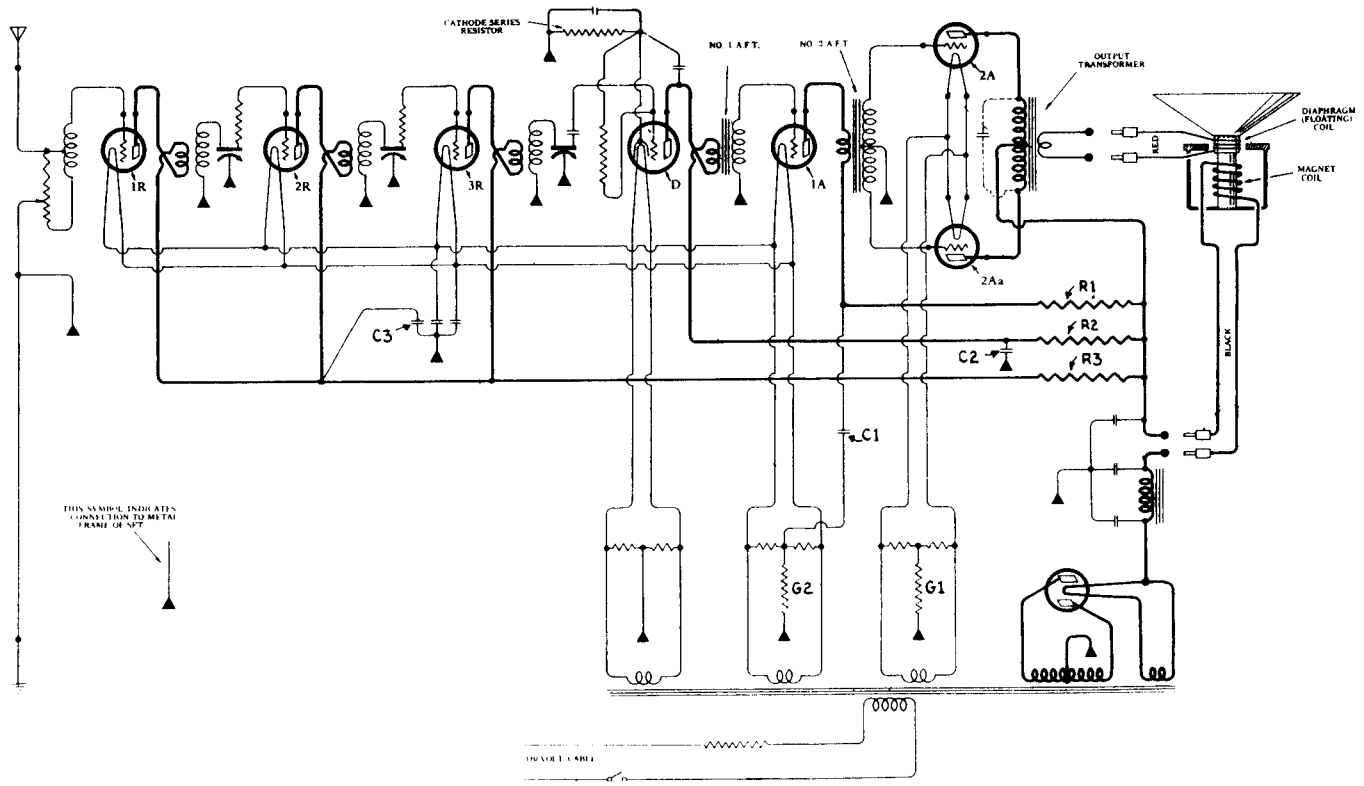


Fig. 32 - Atwater Kent Model 43 Set and Power Unit.

type '71, '10, '45 or '50, singly or in push-pull. A power pack of this type may be connected to the output from the first audio stage of any broadcast receiver and deliver a high-quality output of sufficient power to operate a dynamic speaker. Since servicing of power packs is identical with servicing power-supply systems in A.C. sets, we will describe this phase of the subject collectively at the end of this chapter. Fig. 31 shows the connections of the Amertran "ABC Hi-Power Box." Note that two audio stages are included, allowing the pack to be connected to the detector output of the receiver. A half-wave, type '81 rectifier tube is used. Note the connection between the two filter chokes to obtain the high-voltage plate supply for the two type '10 push-pull tubes.

(17) "Glow" Tube. It seems fitting to briefly describe the type '74 glow tube employed in many power packs to maintain a constant voltage output of 90 volts for the tubes of the set requiring this voltage. This tube will remedy much trouble from unstable A.C. supply. It is connected between the "B" negative and intermediate (90-volt) terminals, usually in series with a ballast resistor to maintain a constant current flow of 60 milliamperes through it. Characteristics of this tube are given in the tube chart, elsewhere in this book.

(18) Power Supply Systems. There are slight differences in the methods of obtaining plate and grid-bias voltages in the sets whose diagrams are included in this book. These differences, or rather methods, should be understood when making measurements, especially voltmeter readings, in order to be sure that the desired voltage supply leads will be found. Fundamentally, these power-supply systems are the same as those employed in "B" eliminators and power packs described previously. However, we shall point out a few of the variations in them, as designed by different set manufacturers.

(19) Plate-Supply Power. The main differences in plate supply appear in the voltage divider, or resistance network system. For example, Fig. 32 shows the diagram of the Atwater Kent "Model 43" set and power unit. Note that separate resistors (R1, R2 and R3) are used to obtain plate voltages for the first audio, detector, and R.F.amplifier tubes respectively. The resistances are by-passed by the condensers C1, C2 and C3.

With this arrangement, the only drain on the plate supply system is that due to the current consumption of the tubes. This method has certain advantages; if one resistor burns out it will not greatly affect the others. In this set, the field coil of the dynamic speaker serves as a filter choke; this is clearly indicated in the diagram. Series-resistance voltage dividers are more generally used, as indicated in the various diagrams of "B" eliminators and power packs; Fig. 33 shows the Steinite "Model 40" power pack which is representative of this method. In this case the voltage divider may be considered as one resistance, with taps taken off at the required voltage points. In this case the dynamic speaker's field winding is also used as a filter choke. The arrangement of chokes and condensers in the filter also varies in different sets - another reason why the diagram of the set should be studied before making measurements.

(20) Grid-Bias Voltage. The method of obtaining grid-bias voltage for the various tubes is fundamentally the same in all electric sets. Use is made of the voltage drop caused by the plate current of the tube flowing through a resistance. Knowing the plate current of the particular tube, the resistance can be calculated to give the desired drop. The "C" bias resistor is connected between the tube filament (or the center-tapped resistance connected across the filament, in the case of the '26 tube or power tubes; or the cathode in heater-type tubes) and the extreme negative end of the power-supply system. This is shown in the simplified diagram of Fig. 34. In the diagram of Fig. 32 the bias voltage for the power tubes is obtained by the drop across the grid resistance G1: that for the first audio and the R.F. stages is obtained by means of the resistance G2. In the diagram of Fig. 33 the 1190-ohm resistance furnishes the grid bias for the '71A power stage. These bias resistorsare sometimes in the power pack and sometimes in the set (or in both) and they should be located before taking grid voltage measurements; although the bias voltage may be obtained by connecting the voltmeter between the grid terminal of the set and the center-tap in the filament circuit of the same tube, or the cathode in heater-type tubes. An

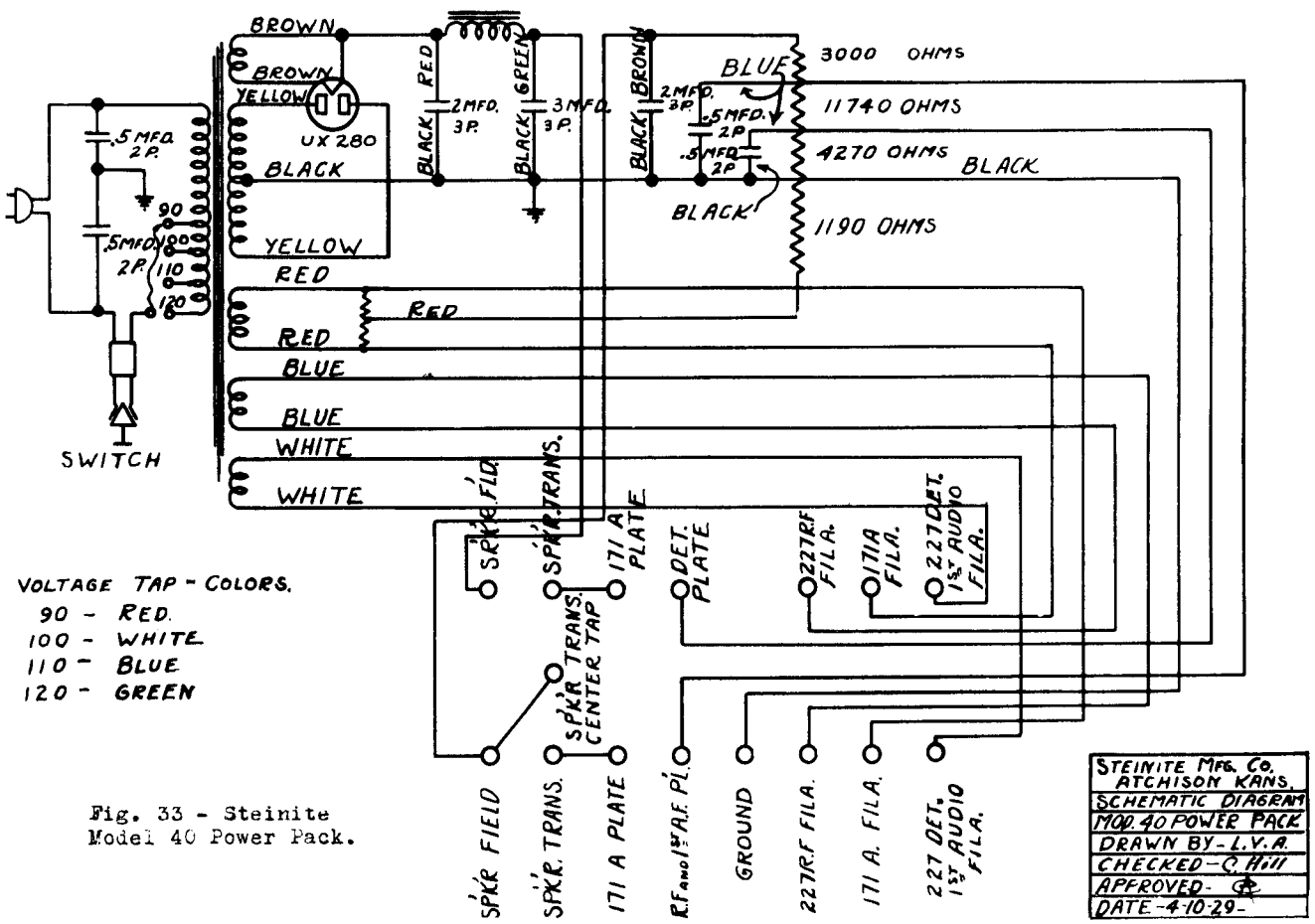


Fig. 33 - Steinite Model 40 Power Pack.

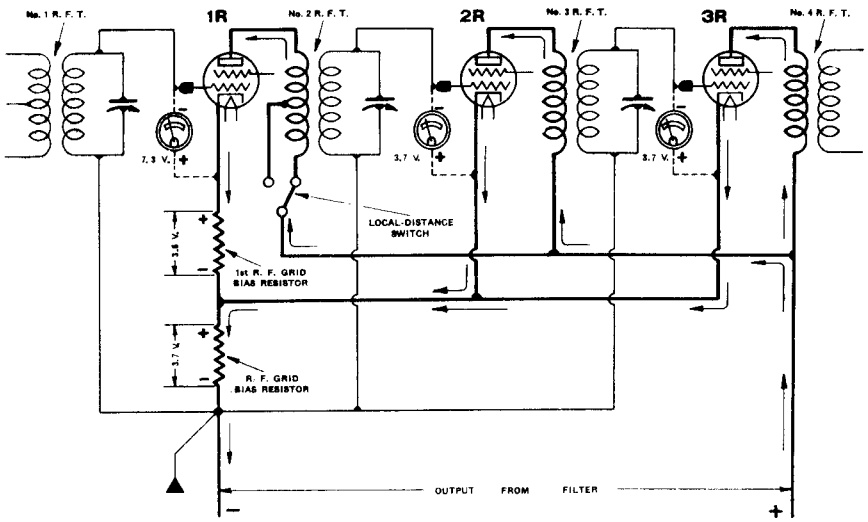


Fig. 34 - Circuit showing how Grid Bias Voltages are obtained in the Atwater Kent Model 60.

interesting departure is illustrated in Fig. 35; this simplified circuit shows how the second A.F. bias voltage in the Atwater Kent "Model 66" is obtained from the drop across the speaker's field coil, in the negative side of the filter circuit. It is imperative that the grid-bias resistance is by-passed by a suitable condenser to prevent feed-back, howling and hum.

(21) Filament Voltage. Regardless of the type of tubes used, the filament supply system is very simple; raw alternating current being used on all filaments. The correct voltage and current outputs are taken from secondary windings on the main power transformer or, in some cases, from a separate filament transformer. Connections are made to the electrical centers of the filament windings by means of center taps on the windings or center-tapped resistors connected across the windings. In many cases, hum is caused by not having the correct center tap; this center-tapped resistor or potentiometer should be carefully adjusted until minimum hum is heard in the loud speaker.

(22) Power-Supply Troubles. Troubles in power-supply systems are not very difficult to locate if we proceed in a systematic manner. Knowing the main sources of troubles and their corresponding symptoms, we can trace back and find the detailed faults probably in less time than it takes to read this paragraph. Therefore a complete detailed analysis is deemed unnecessary and we limit ourselves to generalizations only. Faults in power-supply systems manifest themselves in producing either:

(a) A.C. Hum,
(b) Wrong Supply Voltage,

or both; one usually accompanying the other. Many things can happen to the system that will produce the above effects. By testing each part of the apparatus in turn, the fault is soon located.

(23) A.C.Hum It is taken for granted that previous tests on the set show that the trouble exists somewhere in the eliminator. If the hum is slight, it may be caused by poor shielding, or proximity of the power transformer to the set, or induction from some part of the A.C. line into the set. Sometimes reversing the A.C. line plug will reduce hum slightly. A general cause of hum is found in wrong "C" bias voltages, poor adjustment of the center-tapped filament potentiometers, or open or shorted by-pass condensers across these resistors. In the

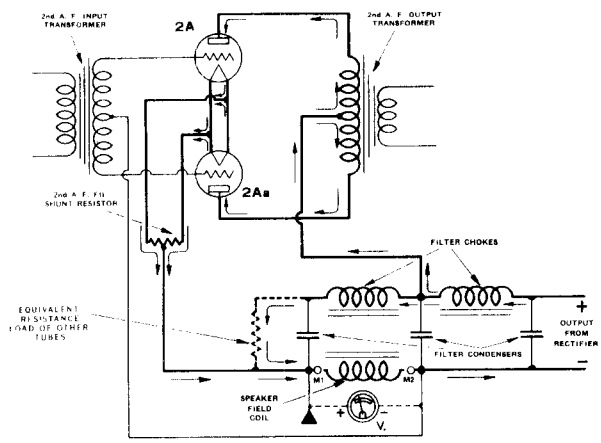


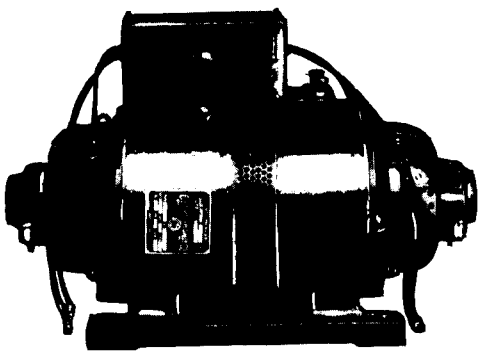
Fig. 35 - In the Atwater Kent 66 the drop across the speakor field coil gives the grid bias voltage of the 2nd A.F. tube.

type '26 tube used for radio and audio amplifiers, an accurate center tap on the filament circuit is important. An open filter condenser or a shorted choke coil will also cause poor filtering with a resultant hum. A poor rectifier tube will produce hum. Mechanical hum may be produced by vibration of the transformer core. Continuity tests on the coils and condensers, and voltmeter readings of the different output voltages, will locate the trouble.

(24) Wrong Supply Voltage. In this case, the line-voltage should be checked, adjusted if necessary by the line ballast resistance or taps on the transformer primary. After this is ascertained, the trouble may be found in an open resistor in the voltage divider. This is a common occurrence. The next most likely place is in the filter condensers; the one connected directly across the rectifier output usually punctures first, as it is under the influence of the hightest voltage. Of course a wrong load on the system will upset the various voltages; since we are assuming that the set is all right, this may be caused by a short circuit. In making voltage readings, it is important to use a high-resistance meter, otherwise the load placed on the system by the current consumed by the meter will upset the system and give erroneous values. A shorted filter coil, or an open coil, will cause too much voltage or give no output at all. Continuity tests will indicate the condition of the various parts. It is always well to compare the rectifier tube with a new one; as these tubes have a limited life. The resistance, condenser, and choke values should be compared with those specified by the manufacturer, to make certain that someone hasn't inserted wrong parts.

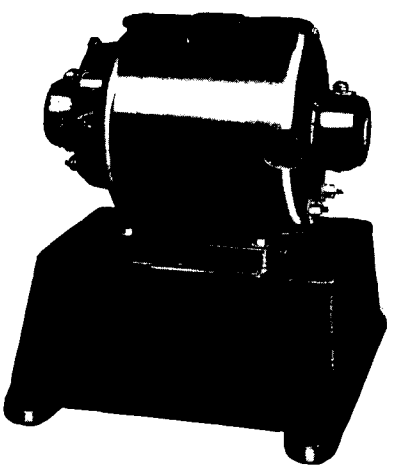
(25) Motor Generators. A.C. electric sets are sometimes operated on D.C. lines by means of motor generators or rotary converters, which change the 110-volt direct current to 110-volt, 60-cycle A.C. form. Aside from the additional cost and noise incurred by the use of the machine, the results obtained are superior to those obtained from D.C. sets. The rotary converter type, although very quiet in operation, should be installed in a closet or some distant place where it cannot be heard. These machines are furnished with a filter for eliminating commutator or line noises, the final result being quieter operation than is usually obtained on the normal 110-volt A.C. line. Both input and output sides of the motor generator or converter should be filtered, as shown in the illustration, Fig. 36. Troubles in these machines are those inherent to any motor or generator. Barring abuse, they should last a long time with only an occasional oiling of the bearings.

The brushes also need repair and replacing occasionally. In one instance, a Service Man reported trouble from brushes which were completely worn down to the brush holders - and these caused excessive grooves in the commutator. The commutator had to be removed and turned down on a lathe before the machine could be placed in service again.



MOTOR GENERATOR WITH FILTER FOR RADIO RECEIVERS

Fig. 36 - At the left is shown the "ESCO" motor generator. The illustration at the right is that of the "JANETTE" rotary converter. Note the size of the filters used in connection with these machines. These instruments supply 110 volts A.C. from the 110 volt D.C. line.



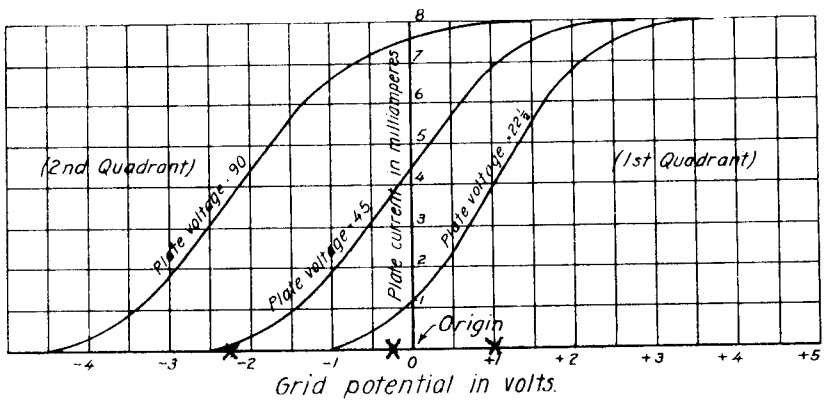
Type C-13-F

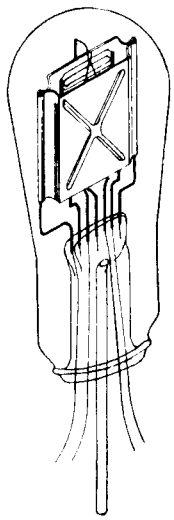
CHAPTER IV

VACUUM TUBES

THE vacuum tube is the heart of the radio set, and one must understand vacuum tubes to understand radio. Since the beginning of radio broadcasting, improvements in sets have followed improvements in tubes. The theoretical analysis of vacuum tubes is beyond the scope of this book, which aims mainly to give the practical side only; one can measure tube voltages and characteristics without a profound understanding of the theory. A deeper insight into vacuum-tube action should be sought, however; but this should be obtained from a book devoted to the subject. Not only is the vacuum tube a source of many set failures, as well as successes, but it offers a means of diagnosing virtually all set troubles. The first procedure of the experienced Service Man is to measure quickly the currents and voltages of the different tubes in the set with a set analyzer and record the values. Any great discrepancy from normal values, as given by the manufacturer of the set, is instantly detected and in almost all cases as easily cured: whether it is caused by the tube or some other part of the set.

(2) Types of Vacuum Tubes. We are giving herewith a chart, Fig. 38, showing the average characteristics of the various types of vacuum tubes used in receiving sets, the ratings given being those recommended by the tube manufacturer. Tubes of different makes may vary slightly from these, but this list is representative of the majority. This chart is very helpful as a guide, but it should not be adhered to too closely, for many set manufacturers operate tubes at voltages differing widely from those specified in this list. For example, the Majestic "Model 90" receiver, employing power detection, operates the type '27 detector on a plate voltage of 270 volts, with a grid bias of 30 volts - values much higher than those given for this type of tube in the chart. In the following paragraphs, only the more popular types of tubes of widely different characteristics will be described in detail, which should sufficiently cover the entire field for all practical purposes.





STEM AND BULB
After Sealing

Fig. 39 - Static Characteristic curves of 3-element vacuum tube.
Fig. 40 (right) The type '01A vacuum tube.

(3) Basic Principles. The basic principles of vacuum-tube action should be understood, at least in an elementary way, in order to facilitate set diagnosis. For example, in the three-element tube comprising filament, grid and plate, an understanding of the interdependence of one on the other should be known while taking measurements. Although the plate current will give much information regarding the set's condition, we must not forget that the plate current in a normal tube depends upon the plate voltage, the grid voltage and the filament current - the latter in turn depending upon the filament voltage. The graph of Fig. 39 shows the dependence of plate current on grid voltage, using a fixed plate voltages of 22½, 45 and 90 volts. With different

AVERAGE CHARACTERISTICS OF RECEIVING RADIOTRONS

	MODEL	USE	CIRCUIT REQUIREMENTS	BASE	GENERAL: MAXIMUM OVERALL HEIGHT	GENERAL: MAXIMUM OVERALL DIAMETER	DETECTION: "A" SUPPLY	DETECTION: FILAMENT TERMINAL VOLTAGE (AMPERES)	DETECTION: FILAMENT CURRENT (AMPERES)	DETECTION: GRID RETURN LEAD TO	DETECTION: GRID LEAK (MEGOHMS)	DETECTION: "B" BATTERY VOLTAGE	DETECTION: DETECTOR PLATE CURRENT (MILLIAMPERES)	AMPLIFICATION: AMPLIFIER "B" BATTERY VOLTAGE	AMPLIFICATION: AMPLIFIER "C" BATTERY VOLTAGE	AMPLIFICATION: AMPLIFIER PLATE CURRENT (MILLIAMPERES)	AMPLIFICATION: A.C. PLATE RESISTANCE (OHMS)	AMPLIFICATION: MUTUAL CONDUCTANCE (MICROMHOS)	AMPLIFICATION: VOLTAGE AMPLIFICATION FACTOR	MAXIMUM UNDISTORTED OUTPUT (MILLIWATTS)
DETECTORS AND AMPLIFIERS	RADIOTRON WD-11	Detector or Amplifier	Transformer Coupling	WD-11 Base	4 1/8"	1 3/16"	Dry Cell 1½ V Storage 2 V	1.1	.25	+F	3 to 5	22½ to 45	1.5	90 135	4½ 10½	2.5 3.5	15,500 15,000	425 440	6.6 6.6	
	RADIOTRON WX-12	Detector or Amplifier	Transformer Coupling	Large Standard UX Base	4 11/16"	1 7/16"	Dry Cell 1½ V Storage 2 V	1.1	.25	+F	3 to 5	22½ to 45	1.5	90 135	4½ 10½	2.5 3.5	15,500 15,000	425 440	6.6 6.6	35
	RADIOTRON UX-112-A ‡	Detector or Amplifier	Transformer Coupling	Large Standard UX Base	4 11/16"	1 13/16"	Storage 6 V	5.0	.25	+F	3 to 5	45	1.5	90 135	4½ 9	5.5 7	5,300 5,000	1,500 1,600	8 8	30 120
	RADIOTRON UV-199	Detector or Amplifier	Transformer Coupling	UV-199 Base	3½"	1 1/16"	Dry Cell 4½ V Storage 4 V	3.0 3.3	.060 .063	+F	2 to 9	45	1	90	4½	2.5	15,500	425	6.6	7
	RADIOTRON UX-199	Detector or Amplifier	Transformer Coupling	Small Standard UX Base	4 1/8"	1 3/16"	Dry Cell 4½ V Storage 4 V	3.0 3.3	.060 .063	+F	2 to 9	45	1	90	4½	2.5	15,500	425	6.6	7
	RADIOTRON UX-200-A	Detector	Tuned or React. Coupling	Large Standard UX Base	4 11/16"	1 13/16"	Storage 6 V	5.0	.25	-F	2 to 3	45	1.5	Following UX-200A Characteristics apply only for Detector Connection			30,000	666	20	—
	RADIOTRON UX-201-A	Detector or Amplifier	Transformer Coupling	Large Standard UX Base	4 11/16"	1 13/16"	Storage 6 V	5.0	.25	+F	2 to 9	45	1.5	90 135	4½ 9	2.5 3	11,000 10,000	725 800	9 8	15 55
	RADIOTRON UX-222	Radio Frq. Amplifier	Special	Large Standard UX Base	5 3/8"	1 13/16"	Dry Cell 4½ V Storage 4.5 V	3.3	.132	—	—	—	—	135	1½ **	1.5	850,000	350	300	—
	RADIOTRON UX-222	Radio Frq. Amplifier	Special	Large Standard UX Base	5 3/8"	1 13/16"	Dry Cell 4½ V Storage 4.5 V	3.3	.132	—	—	—	—	180	1½ □	.3	150,000	400	60	—
	RADIOTRON UY-224	Radio Frq. Amplifier	Special	5 Prong Standard UY Base	5 1/4"	1 13/16"	Transformer 2.5 V.	2.5	1.75	—	—	—	—	180	1½ ¶	4	400,000	1050	420	—
	RADIOTRON UX-226	Amplifier A.C. Filament Type	Transformer Coupling	Large Standard UX Base	4 11/16"	1 13/16"	Transformer 1.5 V	1.5	1.05	—	—	—	—	90 135 180	6 △ 9 △ 13½ △	3.7 6 7.5	9,400 7,400 7,000	875 1,100 1,170	8.2 8.2 8.2	20 70 160
	RADIOTRON UY-227	Detector or Amplifier A.C. Heater Type	Transformer Coupling	5 Prong Standard UY Base	4 11/16"	1 13/16"	Transformer 2.5 V	2.5	1.75	C	2.9	45	2	90 135 180	6 9 13½	3 5 6	10,000 9,000 9,000	900 1,000 1,000	9 9 9	30 78 164
	RADIOTRON UX-240	Detector or Amplifier	Resistance Coupling	Large Standard UX Base	4 11/16"	1 13/16"	Storage 6 V	5.0	.25	+F	2 to 5	135 180	.3 .4	135 180	11 3	.2 .2	150,000 150,000	200 200	30 30	—
POWER AMPLIFIERS	RADIOTRON UX-112-A ‡	Power Amplifier	No L.S.C. Required	Large Standard UX Base	4 11/16"	1 13/16"	Storage 6 V	5.0	.25	—	—	—	—	135 157½ 180	9 10½ 13½	7 9.5 9.5	5,000 4,700 4,700	1,600 1,700 1,700	8 8 8	120 195 275
	RADIOTRON UX-120	Power Amplifier	No L.S.C. Required	Small Standard UX Base	4 1/8"	1 3/16"	Dry Cell 4½ V Storage 4 V	3.0 3.3	.125 .132	—	—	—	—	135	22½	6.5	6,600	500	3.3	110
	RADIOTRON UX-171-A	Power Amplifier	L.S.C. Except at 90 V.	Large Standard UX Base	4 11/16"	1 13/16"	Storage 6 V Transformer 5 V	5.0	.25	—	—	—	—	90 135 180	16½ 20 22½	10 18 20	2,500 2,200 2,000	1,200 1,350 1,500	3.0 3.0 3.0	130 330 780
	RADIOTRON UX-210	Power Amplifier	L.S.C.	Large Standard UX Base	5 5/8"	2 3/16"	Transformer 7.5 V	7.5	1.25	—	—	—	—	250 300 350 400 475	18 22½ 27½ 35	10 11 16 18 18	6,000 5,600 5,150 5,000 5,000	1,350 1,450 1,550 1,600 1,600	8 8 8 8 8	340 600 925 1325 1940
	RADIOTRON UX-245	Power Amplifier	L.C.S.	Large Standard UX Base	5 5/8"	2 5/16"	Transformer 2.5 V	2.5	1.5	—	—	—	—	180 250	33△ 50△	26 32	1950 1900	1800 1850	3.5 3.5	780 1600
	RADIOTRON UX-250	Power Amplifier	L.S.C.	Large Standard UX Base	6 1/4"	2 11/16"	Transformer 7.5 V	7.5	1.25	—	—	—	—	250 300 350 400 450	45△ 54△ 63△ 72△ 84△	28 35 45 55 55	2,100 2,000 1,900 1,800 1,800	1,800 1,900 2,000 2,100 2,100	3.8 3.8 3.8 3.8 3.8	900 1590 2350 3250 4050
RECTIFIERS	RADIOTRON UX-280	Full-Wave Rectifier	Full-Wave Circuit	Large Standard UX Base	5 5/8"	2 3/16"	Rectification in Eliminators Designed for this Radiotron or Radiotron UX-213	Filament Terminal Voltage ... 5 Volts Filament Current ... 2 Amperes } RMS A. C. Plate Voltage ... 350 Volts (Max. per plate)						Max. D. C. Output Current (both plates) ... 125 Milliamperes D. C. Output Voltage at max. current as applied to filter of typical rectifier circuit ... 300 Volts						
	RADIOTRON UX-281	Half-Wave Rectifier	Half or Full Wave Circuit	Large Standard UX Base	6 1/4"	2 7/16"	Rectification in Eliminators Designed for this Radiotron or Radiotron UX-216 B	Filament Terminal Voltage ... 2.5 Volts Filament Current ... 1.25 Amperes } RMS A. C. Plate Voltage ... 700 Volts (Maximum)						A. C. Plate Voltage ... Recommended 650 ... Maximum 700 Volts D. C. Output Current ... 85 ... 85 Milliamperes D. C. Output Voltage as applied to filter of typical rectifier circuit ... 620 ... 620 Volts						
MISCELLANEOUS	RADIOTRON UX-874	Voltage Regulator	Series Resistance	Large Standard UX Base	5 5/8"	2 3/16"	Constant Voltage Device	Designed to keep output voltage of B eliminators constant when different values of "B" current are supplied						Operating Voltage ... 90 Volts D.C. Starting Voltage ... 125 Volts D.C. Operating Current ... 10 50 Milliamperes						
	RADIOTRON UV-876	Current Regulator (Ballast Tube)	Transformer Primary of 65 Volts for use on 115 Volt Line	Standard Mogul Type Screw Base	8"	2 1/16"	Constant Current Device	Designed to insure constant input to power operated radio receivers despite fluctuations in line voltage						Operating Current ... 1.7 Amperes Mean Voltage Drop ... 50 Volts Permissible Variation ... ±10 Volts						
	RADIOTRON UV-886	Current Regulator (Ballast Tube)	Transformer Primary of 65 Volts for use on 115 Volt Line	Standard Mogul Type Screw Base	8"	2 1/16"	Constant Current Device	Designed to insure constant input to power operated radio receivers despite fluctuations in line voltage						Operating Current ... 2.05 Amperes Mean Voltage Drop ... 50 Volts Permissible Variation ... ±10 Volts						

† (+) Note other use of this Radiotron above (below)
* Inner Grid - 1½ Volts; Outer Grid +45 Volts, 15 Milliamperes
□ Outer Grid - 1½ Volts; Inner Grid + 22½ Volts, 6 Milliamperes
‡ Applied thru plate coupling resistance of 250,000 Ohms
△ Grid voltage is given with respect to mid point of filament
¶ Inner Grid - 1½ Volts; Outer Grid +75 Volts

Note: All grid voltages are given with respect to cathode or negative filament terminal unless otherwise noted

Max. Values not to be exceeded

A ..... Except for half ampere filament UX-112 and UX-171 characteristics are identical respectively to UX-112-A and UX-171-A
C ..... Cathode
H ..... Heater Voltage
L S C ..... Load Sensitive Coupling consisting of either Choke Coil and By-Pass Condenser or Output Transformer in plate circuit. Data for recommended values of plate current, D.C. resistance and A.C. impedance of these units are given in tables.
M ..... With a screen grid tube, on account of circuit limitations the actual voltage amplification ratio may not be in exact relation to the voltage amplification factor as in the case of three electrode tubes.

Fig. 38 - The characteristics given in this chart may be considered typical of all makes of receiving tubes. Characteristics of the types of tubes used in the majority of radio sets are given. Average characteristics of additional tubes not included in this chart will be found on page 37. These tubes made their appearance after publication of the above chart. Characteristics of special tubes such as the pentode shown on page 35, are not given in this chart.

fixed plate voltages, different curves result, as shown. For undistorted reception in audio amplifiers the tube can be operated only on the straight portion of the curve, which portion is longer with higher plate voltages, thereby affording greater undistorted output. The grid voltage should be held normally at a definite average value indicated by the center of the straight portion of the curve. This allows the plate current to swing equally above and below this point, and cover the entire straight portion. Since the curve is different with different plate voltages, the normal grid voltage or bias will likewise be different; the higher the plate voltage, the greater the negative grid bias voltage required. In other words, within practical limits, a tube may be operated at any plate voltage, provided the corresponding proper grid voltage is employed. For example, the correct grid bias voltages for use with the plate voltages shown in Fig. 39 are indicated at the bottom of the graph; they are, approximately, plus 1, minus $\frac{1}{4}$, and minus $2\frac{1}{4}$, for the $22\frac{1}{2}$, 45 and 90 volt curves, respectively.

(4) Battery-Operated Tubes. The type '01A tube is widely used in battery and D.C. electric sets and may be considered in this elementary discussion as typical of all three-element battery operated tubes, the difference being mainly in the ratings. This tube is used for detector, radio, and audio-frequency amplifiers. From our chart we find that this particular tube operates from a 6-volt storage battery and has a terminal voltage of 5; one volt being lost in the filament-control rheostat and connecting leads. At this voltage the filament current is 0.25-ampere. Plate voltages of 45, 90 or 135 may be employed depending upon the circuit in which it is used; corresponding grid-bias voltages are given in the chart. Fig. 40 shows the internal construction of this type of tube. Defects are usually traced to the filament which, through age or abuse becomes impotent and loses its power to emit electrons. Such a defect is accompanied by general weakness of the set and lack of sensitivity. It has almost human qualities. Very low plate current, with proper applied voltages, is another symptom of low electronic emission. It is best to replace such tubes with new ones. In any event, it is advisable to check the filament voltage, especially in D.C. electric sets, as this is one value which should remain normal and constant. Excessive filament voltage will shorten the life of the tube; less than normal filament voltage will give the tube longer life, as a general rule; but for over-all efficiency the rated filament voltages should be adhered to.

(5) Battery-Operated Power Tubes. The types '12A and '71A tubes are commonly used in the output stages of battery sets, and differ mainly from the '01A type in that they allow a much greater undistorted output; the same general information given in regard to the '01A tube may be applied to them.

(6) A.C. Tubes. The type '26 tube is extensively employed in A.C. sets for both radio- and audio-frequency amplifiers; it is not suited for detection purposes, on account of the excessive A.C. hum produced. This tube is similar to the '01A type, except that its filament is designed for a much lower voltage and higher current; namely, 1.5 volts and 1.05 amperes. The reason for this is to give the filament sufficient mass to hold the heat longer and not rise and fall in temperature with the rise and fall in each half-cycle of alternating current; thereby reducing hum. It has a four-prong base and connections similar to those of the '01A type. In an amplifier stage employing this tube, the grid return leads connect to a center-tapped resistor connected across the filament. If excessive hum is produced in the set, these resistors should be examined and adjusted for minimum hum. This tube is not suited for the output stage on account of its limited output; for this purpose, the type '71, '10, '45, or '50 power tubes are employed, connected singly, in parallel or push-pull, with filaments lit by A.C. and having center-tapped resistors for the grid returns. Sometimes center-tapped resistances are eliminated by connecting the grid returns to a center tap on the secondary winding of the filament transformer.

(7) The A.C.Heater Tube. The type '27 A.C. heater tube is used as a detector in

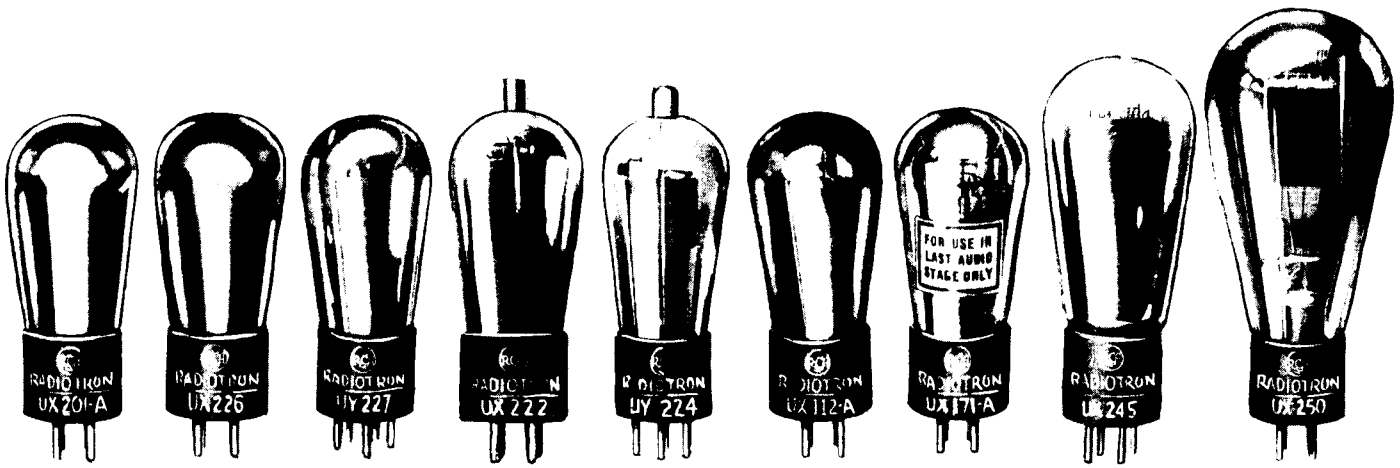


Fig. 41 - Vacuum tubes most generally used in modern receivers.

all A.C. electric sets; and also as radio-frequency and first-stage audio-frequency amplifiers in many sets. The filament of this tube draws 1.75 amperes at 2.5 volts; it consists of a fine tungsten wire threaded through two holes in a porcelain-like tube. Around this tube is an oxide-coated metal cylinder, the cathode, which emits electrons when heated to redness. Its heat is obtained by its proximity to the white-hot tungsten filament. Since the cathode is electrically insulated from the A.C.filament, no A.C. hum is introduced into the radio circuits. It takes an appreciable time for the heater filament to heat the cathode to redness, from 15 to 45 seconds elapse before the set gets into action. Some of the early makes of these tubes are known as "blinkers;" a poor weld at the heater causes the circuit to open after the heater becomes hot, and close again after it cools down, making the reception rise and fall in volume. In the circuits in which heater type tubes are used, the tungsten filament is maintained at a positive potential with respect to the cathode, thereby preventing any emission of electrons from the A.C. filament into the cathode with a consequent introduction of hum. These tubes employ a five-prong or "UY" base; having two prongs for the filament or heater, one for the cathode, one for the grid and one for the plate.

(8) Screen-Grid Tubes. In addition to the regular filament, grid, and plate elements of the ordinary tube, the screen-grid tube employs a fourth element, which is a metallic network interposed between the grid and plate, and used mainly as an electrostatic shield for shielding the plate from the grid and preventing electrostatic feed-back. This allows much greater amplification in radio-frequency amplifiers without oscillation. Neutralization is therefore unnecessary. A positive potential of from 70 to 90 volts is applied to the screen. Although this type of tube is used mainly in radio-frequency amplifiers, it may be employed as a detector or a resistance- or impedance-coupled audio amplifier; or as a "space-charge" tube in an audio amplifier. In this case the inner grid is connected to a positive potential of about 22½ volts, to neutralize the space charge within the tube. The screen is employed as the control-grid. In radio-frequency amplifiers, the value of the positive voltage applied to the screen, determines the amplification, and this effect is made use of as a volume control. The screen-grid tube is made in the heater type, the type '24, in which a standard 5-prong base is used and the control grid is connected to a terminal at the top of the tube, as illustrated in Fig. 41. The type '22 is also a screen-grid tube, but is not the heater type.

(9) Gas Rectifier Tubes. The gas-rectifier tube is largely employed in "B" eliminators, of which the Raytheon type "BH", illustrated in Fig. 42, is a typical example. These rectifiers depend upon ionization of gas for their action and take advantage of the difference in size of their electrodes for "unilateral" (one-way) conductivity. In the one illustrated, the two small electrodes connect to the 350-volt output termin-

als of a transformer secondary having a center tap. A direct-current output of 125 milliamperes may be drawn from the hat-shaped electrode and the center tap. Failure in these rectifiers is usually due to age or internal breakdown, in which case sparking can be observed. Chapter III gives further information in connection with this tube, as used in a "B" eliminator.

(10) The Pentode. A new tube to make its appearance on the market is known as the five-element pentode. While not in general use, it is fast becoming popular, and a brief description may not be amiss. It is somewhat similar to the four-element screen-grid tube described above, but with the addition of a "space-charge" grid surrounding the cathode; the connection to this extra grid being brought out to a terminal on the side of the tube base. The remaining terminals are similar to those of the '24 type screen-grid tube. A very high amplification factor is claimed, one stage being sufficient in the audio amplifier. An amplification factor as high as 750 may be obtained with a plate voltage of 250, screen-grid voltage of 135 (positive) and space-charger-grid voltage of 20 (positive). The heater filament is similar to that of the '24 type. An illustration of this tube is also shown in Fig. 42.

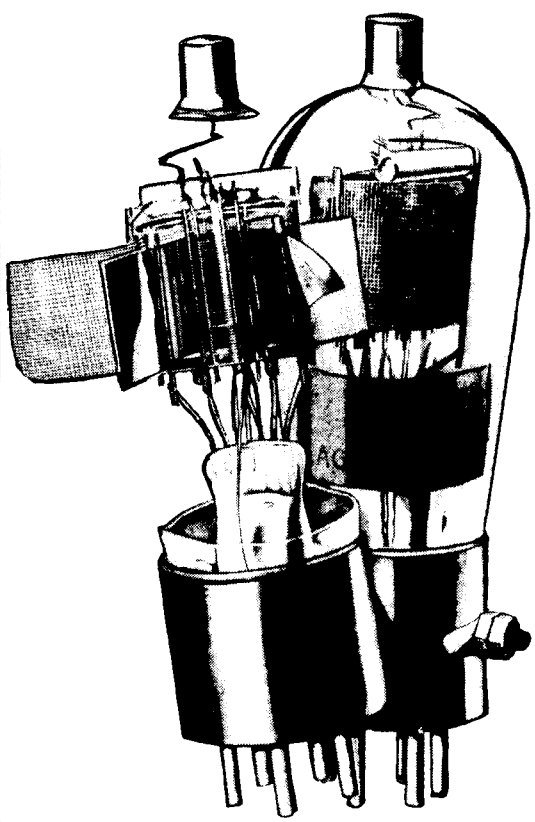
(11) Filament Rectifier Tubes. The half-wave '81 and full-wave '80 rectifiers are largely employed in A.C. receivers, and in some cases to supplying field current for dynamic speaker. Characteristics of these tubes are given in the chart. Failure is usually due to internal breakdown, manifesting itself in the form of a blue glow within the tube. When this takes place, the tube may be operated successfully at a lower voltage, but it is usually best to replace it. Circuit connections are shown in Chapter III as well as in many of the diagrams of this book.

(12) Vacuum-Tube Tests. Vacuum-tube tests on any radio set should be conducted systematically. Suppose we arrange our tests in the following order:

(a) Plate-current tests,
(b) Plate-voltage tests,
(c) Grid-voltage tests,
(d) Filament-voltage tests.

A knowledge of these four functions will give a fairly complete indication of the condition of the tubes and associated circuits.

(13) Plate-Current Tests. The milliampere reading of the plate current of each tube in the set tells us a very complete story, but we cannot rely on it



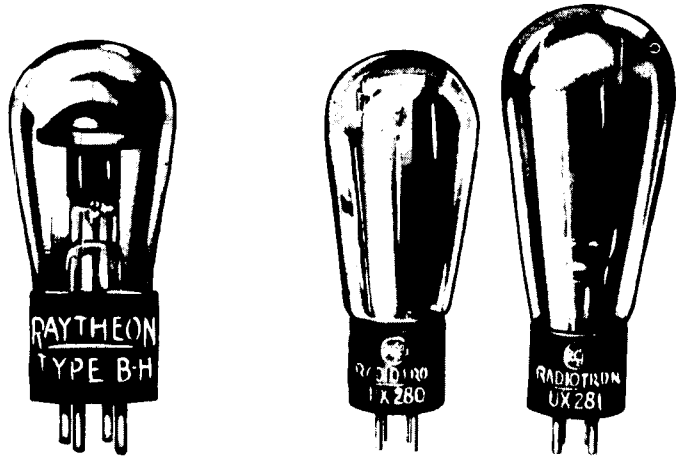


Fig. 42 - The Pentode, Raytheon Type "BH," and the types '80 and '81 rectifiers are shown in this illustration.

too much, since the plate current of different tubes in the different sets varies widely and the figures given in the tube chart cannot be rigidly adhered to. Only where the readings deviate very far from those given should we look for real trouble. It is best to follow the ratings given by the set manufacturer, wherever possible. Causes of excessive plate current and of insufficient plate current are given below, which causes should be further checked to find the guilty ones, after which they can be corrected.

(14) Excessive Plate Current may be due to :

(a) Excessive plate voltage,
(b) Insufficient or incorrect grid voltage,
(c) Excessive filament voltage,
(d) Defective tubes,
(e) Leaky condenser, or poor insulation of circuit.

(15) Insufficient Plate Current may be due to :

(a) Insufficient plate voltage,
(b) Excessive negative grid bias,
(c) Low filament voltage,
(d) Defective tube.

(16) Plate Voltage Tests. If the foregoing measurements indicate that the trouble lies in excessive or insufficient plate voltage, the causes of an erratic plate voltage may be traced to the following:

(17) Excessive plate voltage may be due to:

(a) Open in the negative end of voltage divider in the power-supply system,
(b) Excessive negative grid bias,
(c) Low filament voltage,
(d) Defective tube.

(18) Insufficient plate voltage may be due to:

(a) Failure in power-supply system,
(b) Low negative or even a positive grid bias,
(c) Excessive filament voltage,
(d) Defective tube.

(19) Grid-Voltage tests. Should the erratic plate voltage or plate current readings be traced to high, low or reversed grid bias, we may look for the following defects:

(a) Shorted by-pass condenser across "C" battery or grid-bias resistor,
(b) Open "C" battery or grid-bias resistor,
(c) Leakage in insulation or blocking condenser between grid and plate-supply circuit,
(d) Open transformer winding in grid circuit,
(e) Defective tube socket.

(20) Filament-Voltage Tests. If our erratic plate current and voltage readings are traced to wrong filament-supply voltage, we have but to trace the filament-supply circuit and find the cause. In battery sets the filament voltage may be too low, because of poor connections or a weak battery. If an "A" eliminator is used, its adjustment should be checked. In A.C. electric sets, the filament transformer may be

overloaded by a partial short across the filament circuit. The line-voltage should be checked also.

(21) Defective Tube. A defective tube may cause erratic readings due to a deactivated filament, loss of vacuum (causing the tube to emit a blue glow); or a short circuit between the elements within the tube. In this latter case, the grid may touch the plate or filament, thereby upsetting its bias potential and killing the normal tube action. Some tubes have a very detrimental microphonic effect producing a loud howl in the speaker; the detector tube is the worst offender. It should be replaced or exchanged with one of the other tubes.



RCA 232

RCA Radiotron 230 - - - - -

. . . may be used either as detector or amplifier. Its characteristics are :

Filament Voltage	2.0 Volts
Filament Current	0.06 Amperes
Plate Voltage, Max.	90 Volts
Grid Voltage (C-Bias)	4.5 Volts
Plate Current	2.0 Ma.
Plate Resistance	12,500 Ohms
Amplification Factor	8.8
Mutual Conductance	700 Micromhos
Effective Grid-Plate Capacitance	6 Mmf.

RCA Radiotron 231 - - - - -

. . . has been designed for volume output from battery operated receivers where economy of plate current is important. It is for use in last audio stage. Its characteristics are :

Filament Voltage	2.0 Volts
Filament Current	0.150 Amperes
Plate Voltage, Max.	135 Volts
Grid Voltage (C-Bias)	22.5 Volts
Plate Current	8 Ma.
Plate Resistance	4000 Ohms
Amplification Factor	3.5
Mutual Conductance	875 Micromhos
Undistorted Power Output	170 Milliwatts
Effective Grid-Plate Capacitance	6 Mmf.



RCA 230

RCA Radiotron 232 - - - - -

. . . is particularly recommended for use as a radio frequency amplifier in circuits designed especially for it. Its characteristics are :

Filament Voltage	2.0 Volts
Filament Current	0.06 Amperes
Plate Voltage, Max.	135 Volts
Grid Voltage (C-Bias)	-3 Volts
Screen Voltage, Max.	67.5 Volts
Plate Current	1.5 Ma.
Screen Current	Not over 1/3 of plate current
Plate Resistance	800,000 Ohms
Amplification Factor	440
Mutual Conductance	550 Micromhos
Effective Grid-Plate Capacitance	0.02 Mmf. Max.

Fig. 43 - Average characteristics of three types of 2-volt tubes are given in this illustration.



RCA 231

(22) Tube Reactivation. When a tube has lost its electron-emitting ability and passes a very small plate current, it can often be restored by reactivation. This is true of thoriated filaments such as are in nearly all tubes now in use. The coating of thorium on the surface gradually gives out and the tube loses its sensitivity. By reactivating the thorium inside of the filament is brought to the surface, thus permitting the tube to function normally again. One simple method to restore tubes that are only slightly weak is to burn them for $\frac{1}{2}$ to $1\frac{1}{2}$ hours with the plate supply disconnected. This "boils" out the thorium from the inside of the filament and provides a new layer on the surface. Tubes that are very weak can often be restored by "flashing" the filaments from 10 to 20 seconds at a filament voltage of approximately three times the normal filament voltage. After this process, the filament must be burned for about 30 minutes at a filament voltage about 25% above normal. The plate supply should be disconnected while this is being done. While reactivation is not always possible, and there is also danger of burning out the tube filament, the process may come in handy to the Service Man in cases of emergency or for temporary set operation to please a dissatisfied customer. Of course, reactivation of heater type A.C. tubes is impractical, especially "flash" method. Holding a tube over a gas flame will sometimes reactivate it.

CHAPTER V

THE LOUD SPEAKER

THE loud speaker or sound reproducer forms a very important part of every radio set; for, with a poor reproducer, good results cannot be expected, no matter how good the set may be. Since the reproducer is partly mechanical and it is in continuous use during reception, it is subject to wear and disintegration due to the excessive continuous vibration. Furthermore, it receives the greatest electrical strains of any part of the set, being connected to the extreme output and subjected to the total amplified output of the set. The importance of good speaker operation, as regards satisfied customers, cannot be too strongly urged.

(2) Speaker Tests. The nature of the sound coming from the speaker usually tells exactly the condition of the speaker; but we are not endowed with ears subtle enough to completely diagnose the trouble by sound alone. Only by much experience can we approach this skill. A dead, weak, noisy, or distorted set may be the effect of trouble either in the set or in the speaker system; and it can easily be localized in either by connecting a speaker known to be in good condition to the set output terminals in place of the questionable speaker, and comparing the two. We will assume, in the following paragraphs of this section, that the set output is of excellent quality and that trouble lurks in the speaker or its associated circuits. There are a variety of speakers in operation, each with its own group of inherent weaknesses, if we may use this term, where trouble may brew. We will describe them in the order of the following classification:

(a) Electrodynamic cone speakers,
(b) Magnetic cone speakers,
(c) Horn-type speakers,
(d) Electrostatic speakers.

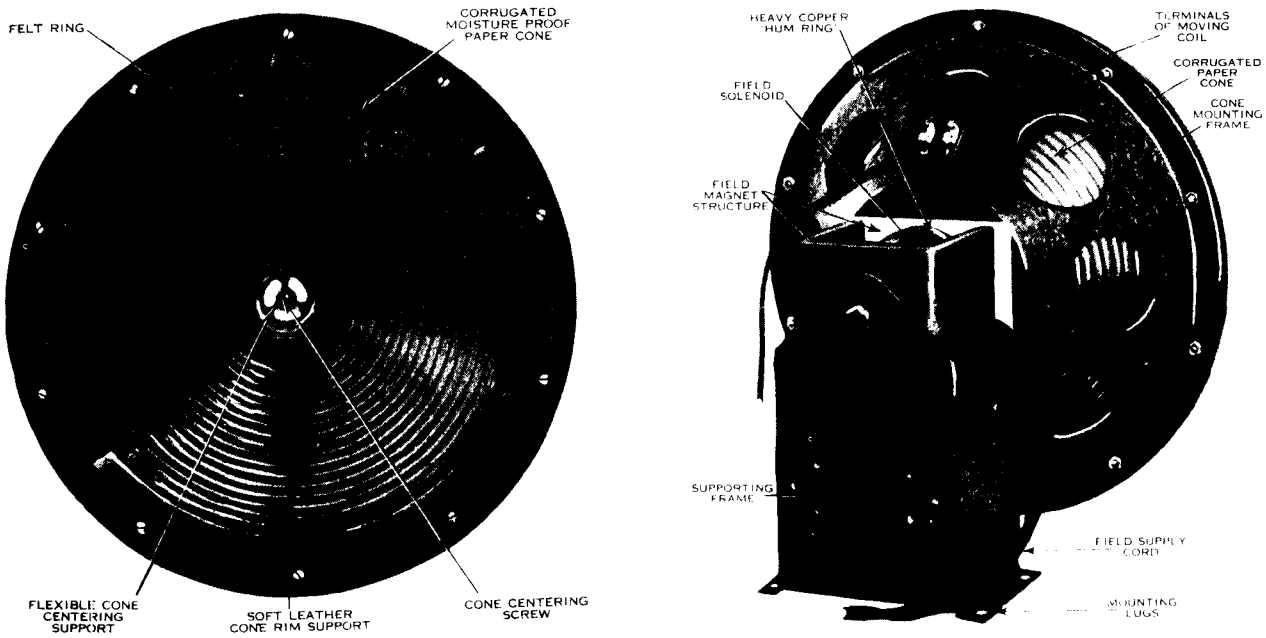


Fig. 44 - Front and rear views of the Stromberg Carlson P-1887C dynamic speaker.

(3) Electrodynamic cone speakers. Nearly all the more recent sets employ this form of reproducer. A typical example is shown in Fig. 44. The diagrammatic illustration, Fig. 45, shows that it is composed of a powerful electromagnet and a moving coil or "voice coil," which is attached to the apex of a cone and arranged for free movement within the magnetic gap of the electromagnet. In addition to these, the speaker system comprises the source of direct-current supply for energizing the electromagnetic field coil, and the output choke, filter or transformer adapting the voice

coil to the set output. Trouble may arise in any of these places, but we will first consider the main elements of the speaker shown in the illustration of Fig. 45.

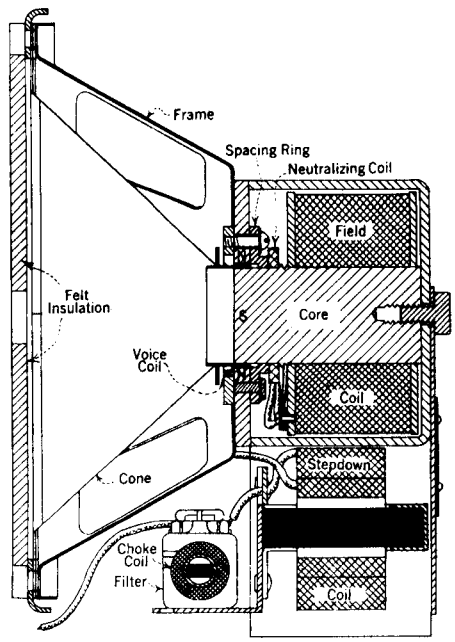


Fig. 45 - Dynamic speaker diagram.

(4) The Field Coil. Very weak, raspy, reproduction with almost complete absence of bass notes indicates failure of the field supply. It is best to remove the speaker from the cabinet before making tests; after which a clean knife blade or other iron tool, held near the center magnetic pole of the voice coil, should be strongly attracted when the field current is turned on. If no magnetism exists there is an open somewhere in the line, and a continuity test across the field winding should be made, after disconnecting it from the set. In many sets, the field coil serves as a filter choke in the power supply, in which case it is merely plugged into a jack in the rear of the set chassis. In such installations, the field coil has a resistance of several thousand ohms, which should be indicated by the continuity tester. The voltage supply to the coil should be measured at the field-coil jack, with the speaker in circuit and the set turned on, to make sure that there is no failure from that source. In some speakers, supplied with low-voltage direct-current obtained from the A.C. line by the use of dry rectifiers, a low-resistance field winding is employed, and this should be noted when making continuity tests in the field.

(5) The Voice Coil. The voice coils of different makes of dynamic speakers vary widely in number of turns and, consequently, in resistance. The resistances are too low to be accurately indicated on a continuity tester, making it difficult to detect a shorted turn. Often a loss of bass in the reproduction is caused by a shorted portion of the voice coil, due to rubbing on the iron field. This is best determined by removing the cone and coil and examining it. While an open circuit will kill reception, sometimes a high-resistance connection to the voice-coil terminals will cause much trouble. In one particular instance, a customer was well pleased with the radio reception, but the results from the phonograph pickup were not much to brag about, and the customer threatened to return the set after several attempts to rectify the trouble failed. It was later found, however, that this particular speaker employed a single-turn voice coil of heavy copper ribbon connected to a similar copper strip forming the secondary of the output transformer. The coil was obviously of very low ohmic resistance, and it was found that the resistance of one of the connections to the coil, although low, was appreciable when compared with the coil's resistance. This connection was thoroughly cleaned with steel wool and soldered. This not only brought the quality of the phonograph reproduction up to normal, but also improved the radio reception, and the customer was well pleased. The radio reception previously had been sufficiently powerful to give fairly good quality.

(6) The Magnetic Gap. This part of the speaker is more important than it appears, as it has a very bad habit of picking up bits of iron filings and holding them in the path of the moving coil, causing a raspy sound. In bad cases it will be necessary to disconnect the field, dismantle the speaker and wipe the gap with a piece of clean cloth. Sometimes bits of iron may be removed with a sharp-pointed iron tool; the magnetized iron particles will cling to the iron tool and are easily removed.

(7) Cone. The paper or composition cone sometimes becomes damaged by ill treatment, and sometimes it is shattered or broken near the apex by excessive volume. In either

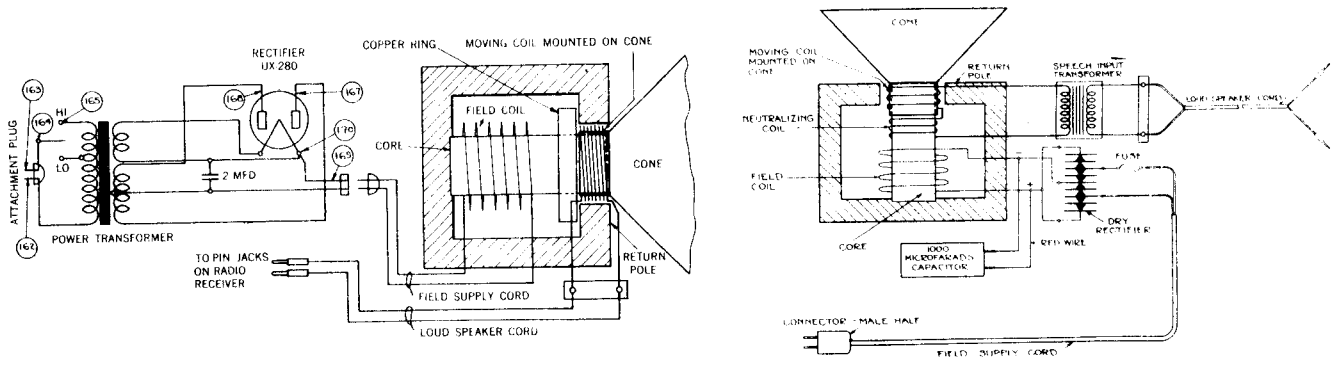
case, it is best to replace it with a new one. It is important to center the cone accurately so that the coil does not touch the iron field and cause chattering. Loose parts on any part of the speaker or cabinet in which it is mounted are likely to cause rattling or extraneous vibration, and should be corrected.

(8) Field Supply. Field current for dynamics, in addition to the method previously described, in which the field coil forms part of the filter system of the set, is sometimes contained separately by rectified alternating-current or from the 110-volt D.C. line in D.C. installations, or from a storage battery. It is obvious that the rectifier-A.C. method is likely to cause the most trouble. In some cases the current is rectified by means of a vacuum tube such as the '80, giving a comparatively high voltage, and sometimes by means of dry-disc rectifiers, giving a low voltage. These two methods are shown in Figs. 46 and 47. Of the two methods, the vacuum-tube type of rectifier usually causes the least trouble. Sometimes the field is connected across the voltage divider of the set's power supply, as in the Atwater Kent "Model 55" set, as shown in Fig. 48. A filter is required in either case to reduce A.C. hum. Fig. 49 shows a typical speaker installation.

(9) Vacuum-Tube Rectifier. Failure in field supply on speakers using this type of rectifier may be due to a poor rectifier tube, a punctured filter condenser, an open transformer winding or line connection. Continuity tests will soon locate the trouble. As shown in the illustration, Fig. 46, a 2-mfd. condenser is sufficient for filtering purposes.

(10) Dry Rectifiers. A dynamic speaker with a 6-volt field connected to the rectified output of a trickle charger forms the basis of this type of A.C. dynamic speaker, except that the whole is assembled as one unit. The schematic diagram, Fig. 47, shows the usual connections. Fig. 50 shows the Radiola 41 A.C. speaker. Failure of field current is usually caused by the dry-disc rectifiers reaching the end of their useful life, especially if A.C. voltage is found across the secondary of the step-down transformer. Should this be the case, the rectifiers must be replaced. Excessive hum, caused by the pulsating direct current delivered to the field, may be reduced by connecting a low-voltage high-capacity condenser across the field. A condenser of 1000 to 2500 mf. rating is usually employed for this purpose. Short circuits often occur in this type of condenser, making it another source of trouble for the service man.

(11) Hum. Hum in dynamic speakers is sometimes reduced by means of a short-circuited ring around the center pole, which produces a bucking effect on any magnetic changes in the field and holds the flux steady. (see Fig. 44). In some speakers, part of the pulsating field current is fed into the voice-coil circuit through a variable resistance in order to balance out any hum. In these speakers the hum is under control and



Figs. 46 and 47, showing filament rectifier field current supply and dry-disc rectifier field supply. Illustrations courtesy of Stromberg Carlson.

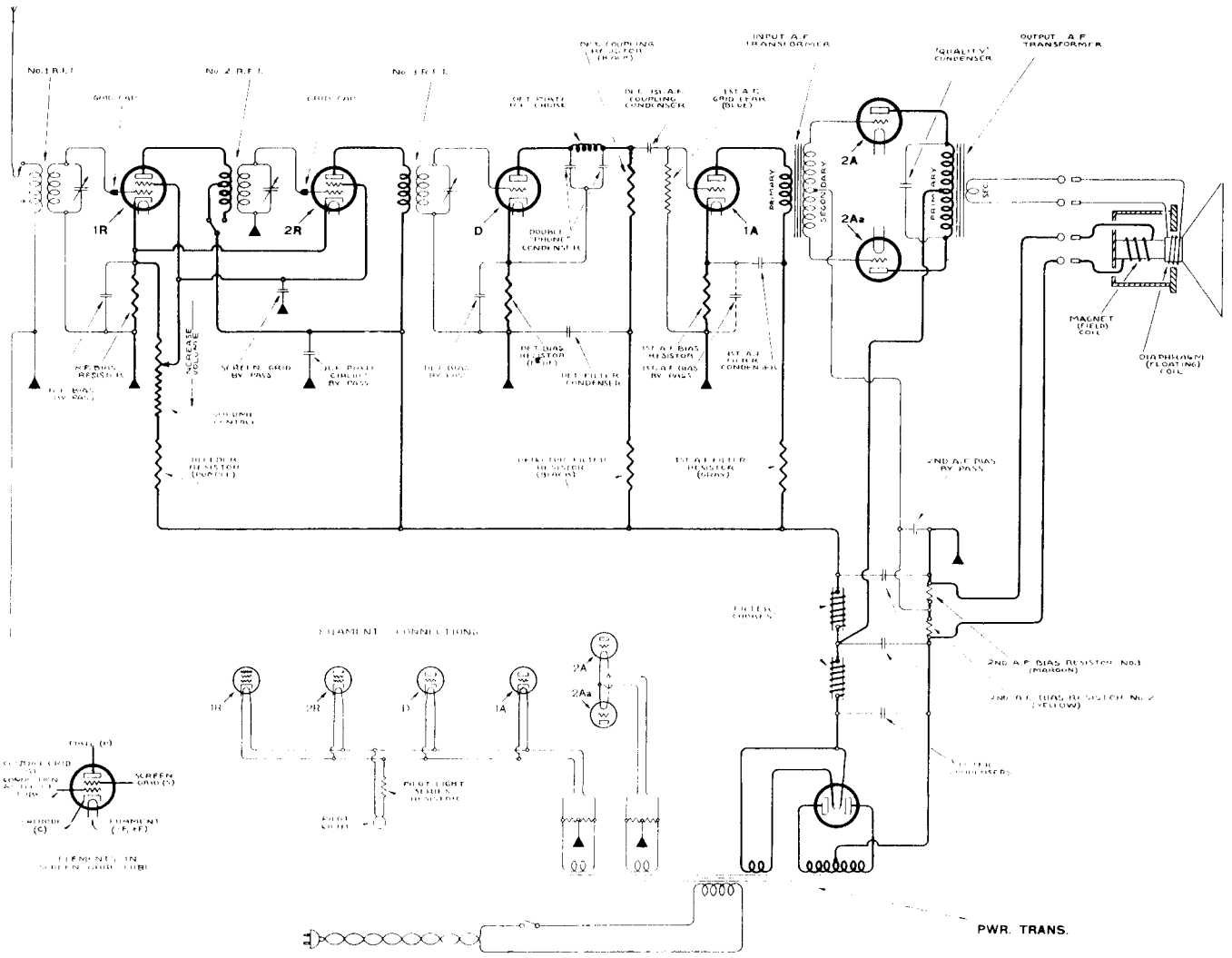


Fig. 48 - The Atwater Kent Early-Type Model 55 Set.

the control resistor should be carefully adjusted. A stationary bucking coil on the center field pole, connected in series with the voice coil and shunted by a variable resistance, is also employed in some speakers, as in Fig. 47.

(12) Speech-Input Transformer. This transformer may be part of the set or part of the speaker, but in any case its purpose is to match the output impedance of the power tube or tubes to the impedance of the voice coil of the speaker. The secondary of this transformer connects directly to the voice coil, as shown in Fig. 47 and its primary to the set output; sometimes through an output choke and by-pass condenser. In push-pull amplifiers, the primary may have a center connection to the high-voltage plate supply, the two ends connecting to the tube plates. An open speech-transformer winding will cause failure in the speaker. The connections to the transformer should be removed and continuity tests made on all the windings. Also, test between the windings and core to see that they are not grounded.

(13) Audio Filters. Some sets employ a combination of chokes and condensers to filter the audio output by making a definite predetermined frequency cut-off and an improved quality of reproduction. Fig. 51 shows the type of filter used in the Federal "Model K" receiver. It is obvious that an open choke or shorted condenser will interrupt reception, and the components of the filter should be tested separately.

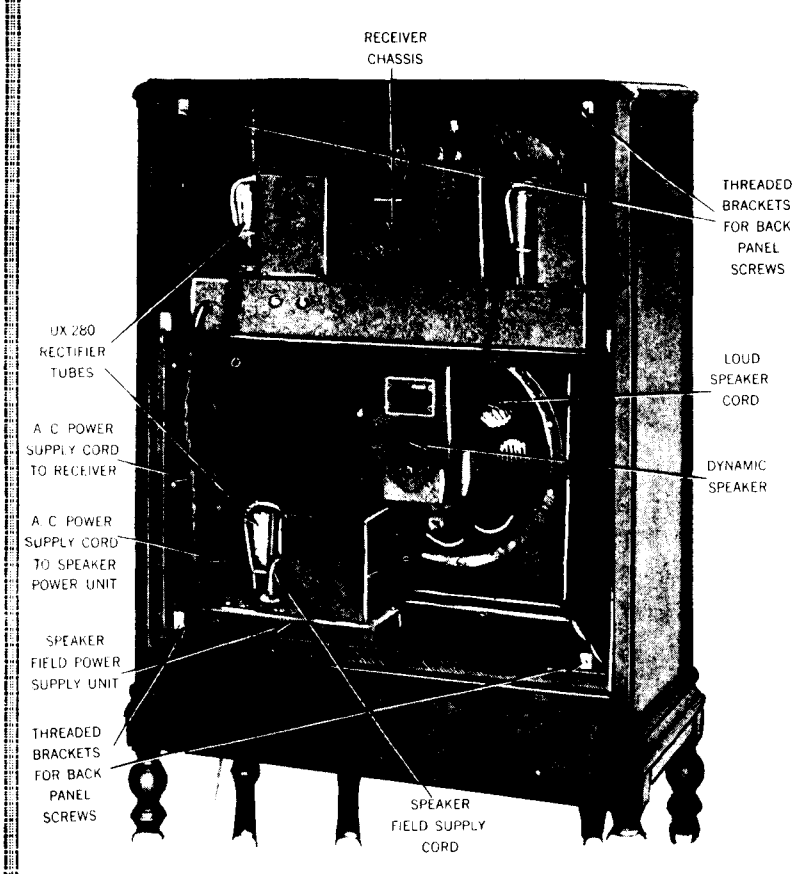


Fig. 49 - Rear view of #846 Stromberg Carlson Receiver.

(14) Magnetic Cone Speakers. The testing of magnetic cone speakers is similar to that of dynamic speakers, the main difference being that the magnetic instruments employ permanent magnets and have no field supply, making the localizing of trouble easier. Since these speakers employ a high-impedance coil wound in a small space with many turns of fine wire, open coils are a frequent occurrence. A continuity test at the coil terminals will reveal the condition of the coil. It is best to disconnect the flexible connecting cord, as this may be shorted from dampness or open circuited. The cord should then be tested separately. Speech-input transformers are sometimes employed with these speakers, but usually there are an output choke and condenser, arranged to prevent the D.C. component of the plate current from flowing through the speaker unit winding and destroying it or unbalancing the unit or weakening the permanent magnet. Tests on this apparatus are described in connection with dynamic speakers. Fig. 52 shows the coils, armature and driving mechanism of the R.C.A. Model 100 A speaker.

(15) Troubles in Magnetic Speakers. Weak, tinny sounds may be caused by a damaged or crushed cone near the apex. The cone paper can be strengthened with collodion, which should be allowed to soak in and dry, but it is better to replace the cone. Loud chattering sounds are the result of the armature striking the pole tips, and the unit then requires adjustment. See Figs. 53, 54 and 55. Raspy sounds may be due to iron filings or dirt in the narrow magnetic gaps; these may be removed with pieces of stiff paper forced between the armature and pole tips. Rattling sounds denote looseness in some part of the driving system; either a loose drive pin or a loose cone attachment. Lack of volume may be due to a weak magnet, or poor insulation in the connecting cord, or open coil winding.

(16) Types of Magnetic Speakers. The illustrations, Figs. 56 and 57, show two magnetic units of different

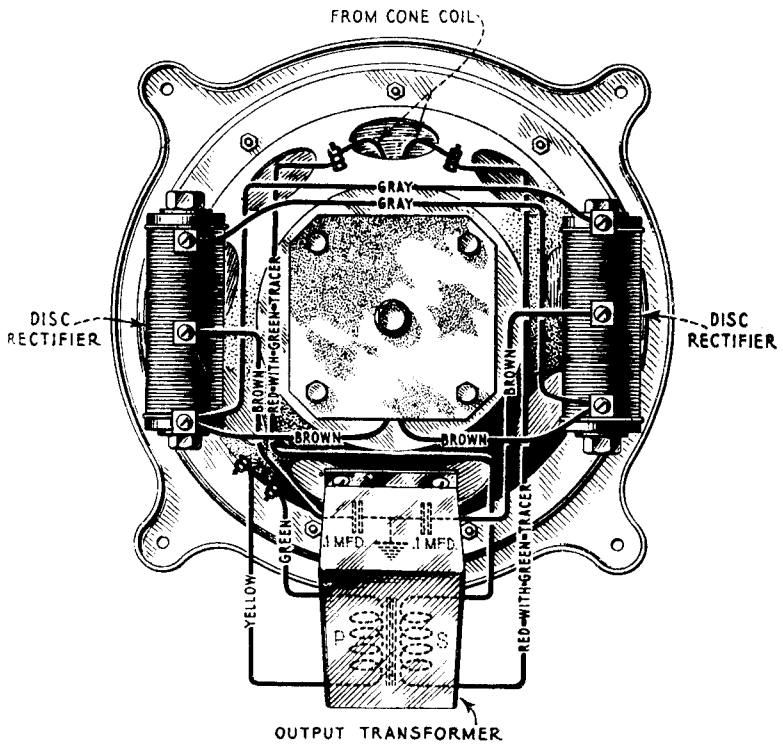


Fig. 50 - Dynamic Speaker used in the Radiola 41 A.C.

types; the latter called the Inductor Dynamic, in action and sound resembles the dynamic speaker. The armature and cone are free to move a comparatively great distance without hitting the pole tips.

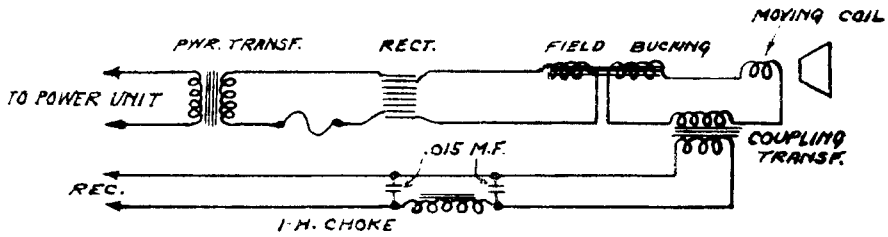


Fig. 51 - An Audio Filter for improved quality.

(17) Horn-Type Speakers. These speakers exist with both dynamic and magnetic units, the former being used largely in talking-picture houses in which a large exponential horn is employed. The latter type was used extensively in radio reception a few years ago but is fast becoming obsolete. Diagnosing trouble in these speakers is similar to that just described and need not be repeated here.

(18) Electrostatic Speakers. These speakers are not in general use as yet, although the Peerless Kylectron employs one. They consist essentially of a condenser, one plate of which is free to vibrate under the influence of electrostatic attraction and repulsion. A high positive biasing potential is employed across them, being taken from the power supply of the set or from a separate rectifier tube. Since only the current leakage need be supplied by the biasing potential, little current is used; thereby eliminating any trouble from hum. The main trouble may arise due to excessive vibration, together with the high voltage accompanying it, causing a short circuit, or intermittent sparking across plate. This either kills reception or produces annoying rattling sounds.

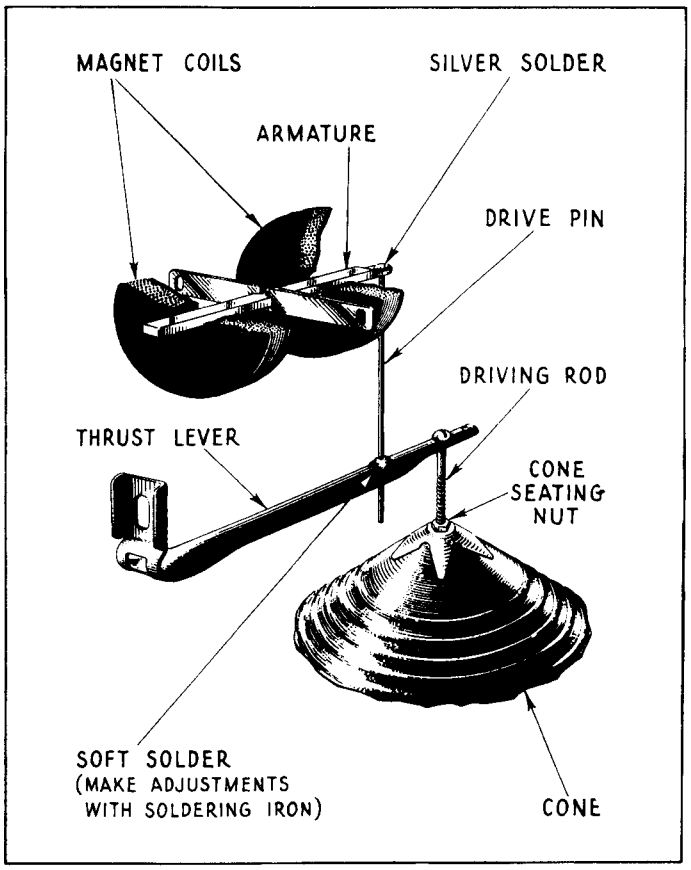


Fig. 52 - Speaker- driving mechanism.

(19) Microphonic Hum. When a microphonic detector tube is in the set, a hum or ringing sound will be produced in the speaker whenever the tube is jarred. It is evident, therefore, that if the sound from the speaker causes the set and microphonic tube to vibrate, a continuous hum will be produced, which will reinforce itself as soon as it sets up its own vibrations in the speaker. The result will be a continuous howl. It is entirely an acoustical effect. Holding the detector

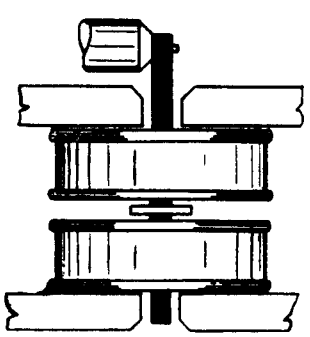


Fig. 53—Correct

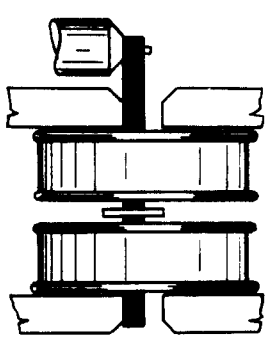


Fig. 54—Incorrect

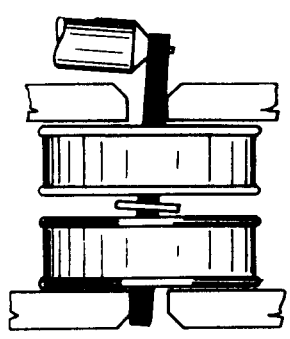


Fig. 55—Incorrect

tube tightly in most cases will prevent it. A "howl arrester" placed over the detector tube also may be used. In bad cases, it may be necessary to change the location of the speaker, or insulate it from the cabinet with felt. Resonance within the cabinet may set up an excessive vibration, which will reinforce this effect and mar the tonal quality. Moving the cabinet away from the wall, or cutting openings in the cabinet, or padding it with felt, may remedy the trouble.

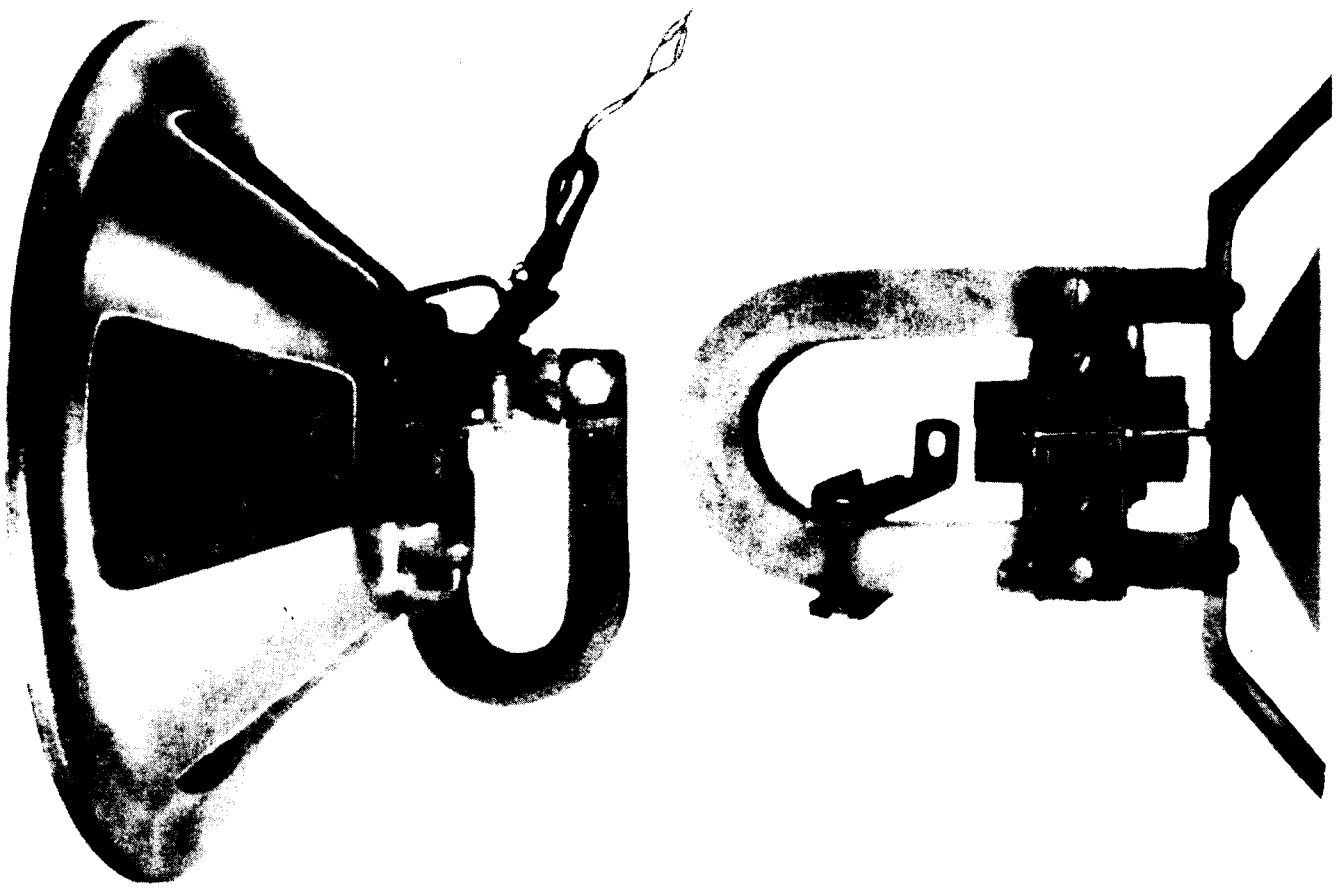


Fig. 56, at the left, shows the Wright-DeCoster Hy-Flux magnetic cone speaker. Note the audio filter mounted near the unit for improved tone quality.
Fig.57, at the right, shows a cross-sectional view of the Farrand Inductor Dynamic speaker. In this unit the armature is attracted in between the pole tips, thus allowing a large movement without chattering.

CHAPTER VI

THE ANTENNA SYSTEM

THE antenna system comprises the aerial and lead-in, with its lightning arrester, and the ground connection. While a good sensitive modern receiver will operate after a fashion on any kind of a haphazard aerial system if the location is fair, remember that a well-constructed antenna system is imperative for permanent set operation and satisfied customers.

(2) Types of Aerials. The busy Service Man will encounter various types of aerials, but the general form comprises a single stranded wire, bare or enameled, about 100 feet long, suspended between insulators from 20 to 50 feet above ground or higher when installed on the roof of a tall building. Attached to this is the lead-in connecting it to the set, with an attachment to a lightning arrester which is connected to ground. There are special types of aerials, such as lamp-socket aerials, indoor

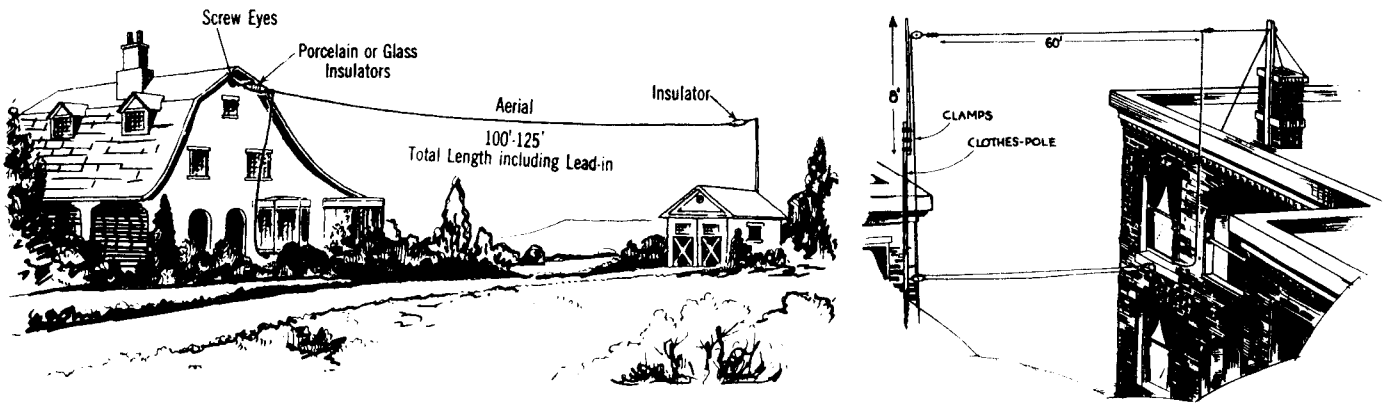


Fig. 60 - Typical Aerial Installations.

aerials, underground aerials, multiple aerials and loop aerials, but these will be discussed subsequently under their proper headings. Trouble shooting in the various types is basically the same procedure. We will concern ourselves mainly with the general type of single-wire aerial first mentioned.

(3) Aerial Installation. The subject of aerials comes more under set installation than servicing; but, in either case, care should be taken to see that the aerial is well constructed to insure permanent operation. See the illustrations of Fig. 60. It should be erected as far from other aerials or wires as possible, strung as nearly at right angles as possible to other wires, and placed neither under or over high-voltage lines, which is not only dangerous in case of breakage of a wire but is likely to produce a 60-cycle hum in the set. With a good soldered connection between the lead-in and the aerial (scraping each strand of the aerial wire separately if it is enamelled) little trouble should be experienced with it from thereafter. Many installers don't take the trouble to solder the lead-in connection to the aerial, and in time corrosion takes place, causing an imperfect connection which is swayed by the wind and produces "static" in the set. In cases when it is temporarily impossible to form a good soldered connection, the joint should be tightly bound with tape to protect it from the weather.

(4) Aerial Location. The location of the aerial depends largely upon environment, and one phase of environment usually overlooked and likely to cause trouble is that of the so-called "dead spots," more noticeable in the vicinity of large steel buildings than elsewhere. In such installations, when the set fails to function properly and stations are very weak, changing the direction of the aerial (say 90 degrees or at right angles to its former position) will rectify the trouble. Sometimes it will be

necessary to shift the aerial considerably, and if possible support its free end on some near-by building. Sometimes better results are obtained by eliminating the aerial entirely and making connection to the steel window framework of the building instead. Troubles of this nature are encountered mainly in large cities.

The inverted "L" type of aerial, as this type is called, is slightly directional, and will receive better from a direction nearest the lead-in. This effect may be taken advantage of, especially when long aerials are used, either to improve reception from a certain direction, or to reduce reception from certain near-by powerful interfering stations.

(5) Aerial Tests. A reliable aerial test can be made by disconnecting the aerial from the set and connecting, in place of it, a wire 30 or 40 feet long strung along the room or outside of the window. A comparison of the two will usually indicate if the regular aerial is defective. This test is not always possible, but the efficiency of an aerial can usually be detected by simply disconnecting it from the set. If the set is noisy when it is known that there is no excessive natural static, and the noise ceases with the aerial disconnected, the trouble will probably be found in a loose connection in the aerial or in a near-by aerial in inductive relation with it. Possibly some wire has fallen in contact with the aerial and is rubbing against it; the aerial system should be thoroughly examined. A continuity test between aerial and ground terminals will indicate whether the aerial is grounded or not. A grounded aerial will sometimes work, especially if the ground is at the further end of the wire; in which case it may act as a large closed-loop antenna. If no defects can be observed in the aerial, yet it appears to be noisy, examine the lightning arrester.

(6) Lightning Arrester. The lightning arrester, Fig. 61, may be grounded or partially grounded, by internal defects, and cause a noisy set or kill reception entirely. Try disconnecting the arrester. If the trouble ceases, replace the arrester with a new one.

(7) Length of Aerial. The selectivity of many sets depends largely upon the aerial length, and in many cases where complaints of poor selectivity are received it will be found necessary to shorten the aerial and thereby reduce its fundamental period of electrical vibration to a point below the broadcast band. This shortening also reduces the input to the set and gives the effect of greater selectivity. Usually the same results can be obtained by connecting a condenser of about .00025 mf. in series with the aerial.

Some unstable sets may oscillate furiously with a short aerial and cease to oscillate on a long one, by reason of the greater radiation resistance of the long one, which absorbes more energy from the set. Aerial resistance likewise causes broadness of tuning and poor selectivity. Bare copper wire, which has been exposed to the weather and is corroded, has a greater high-frequency resistance than enamelled wire.

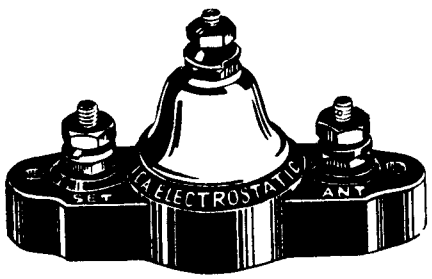
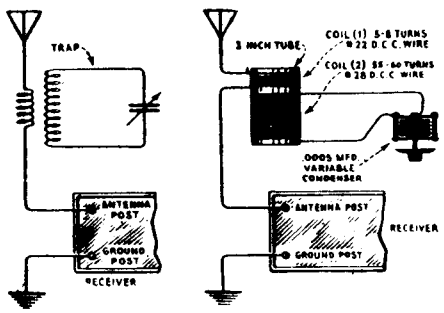
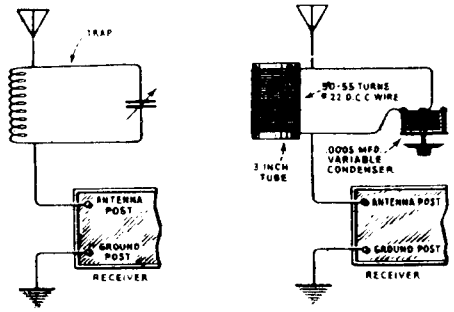


Fig. 61 - Lightning Arrester



The "absorption" type of wavetrap; to eliminate powerful local interference it may be necessary to increase, to 15 or 18, the number of turns in coil 1.

Fig. 62



The "rejector" wavetrap is extremely effective in reducing signal interference; but it also causes a reduction in the strength of desired signals.

Fig. 63

Broadness of tuning on a near-by local station may be reduced by the use of a wave-trap, tuned to the interfering station, and connected as shown in the illustrations Figs. 62 and 63.

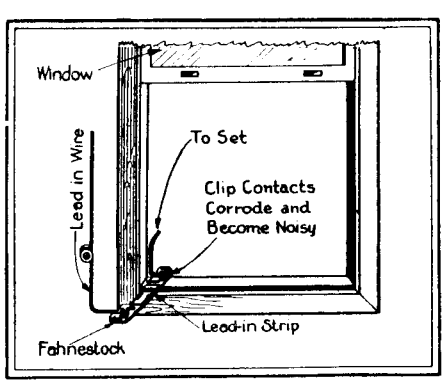
(8) Lead-In Strip. The lead-in from the aerial is usually connected outside the window to a lead-in strip. This is a flexible-copper, insulated strip with spring-clip connections on each end. The window is jammed down against this strip, forming a convenient entry to the inside where connection is made to the set. The connections to the strip should be soldered or thoroughly taped to prevent corrosion. See Figs. 64 and 65. If the set loses sensitivity during rainy weather, this strip should be examined, as well as other outside aerial or lead-in supports, such as the lightning arrester and aerial insulators. Leakage through wet insulation may cause a grounded aerial, especially if the wet lead-in-strip enters through a steel window casement. This is a frequent trouble in many set installations.

(9) Aerial Length. The length of the aerial to be installed depends largely upon the location. As a general rule, the shorter the aerial employed, if it gets the desired stations, the better the results obtained from the set. Many sets have two or more aerial connections, for short aerial, medium aerial, or long aerial. A 30-foot wire may be considered a short aerial; a 60-foot one a medium aerial, and a 100- to 200-foot one a long aerial. In congested districts, a short aerial is recommended.

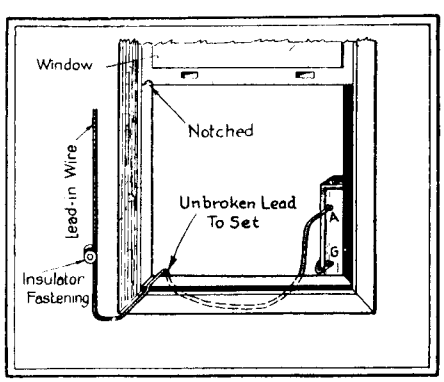
(10) Counterpoise. Where it is impossible to obtain a good ground connection, a counterpoise may be used. This consists of a wire similar to the aerial and suspended beneath the aerial or in its vicinity, and insulated from the ground. It proves very effective in many installations. In some cases it reduces hum.

(11) The Ground Connection. In many installations the ground connection is made to the radiator pipe. This is usually the most convenient, and often serves very well. But an additional connection to a cold-water pipe is recommended, especially when the installation is made in one of the upper floors of an apartment house or hotel containing noisy elevators and ice machines. This will not only improve signal strength but reduce interference from noisy motors as well;for these motors are also grounded and the long path to earth from both radio and motor ground connections causes induction between the two. It is important that the pipe be thoroughly cleaned with a file before attaching the ground clamp.

(12) Testing The Ground Connection. A continuity test between the ground wire and a metal pipe in the building will indicate the condition of the ground connection. In some D.C. installations, an insulating condenser is placed in the ground lead, and care should be taken to make the test from the ground side of the condenser to the pipe, otherwise a short circuit is likely to occur, as in Fig. 66. If set noises cease after



A common form of lead-in installation, which is very good until the exposed connections corrode.



If the insulated lead-in wire is brought inside and a good connection made, it will last.



Direct-current house supplies are a source of much grief in these days of alternating-current standards. Particularly when the tyro starts experimenting is there apt to be trouble—even the simple one of polarity.

Fig. 64- left; Fig. 65- center; Fig. 66- right.

disconnecting the ground wire, examine the ground connection thoroughly, or run an extra temporary ground wire to some other pipe in the building.

(13) Lamp-Socket Aerial. In some congested districts permission for the erection of an outdoor aerial cannot be obtained and some alternative method must be employed. The electric-light lines are sometimes used, by means of a lamp-socket aerial plug. This contains isolating condensers to prevent the lighting current from entering the set. Good results are sometimes obtained, but sometimes noises are introduced, which are difficult to filter out without reducing the signal intensity. It is dangerous to employ this aerial on some electric sets, as a dangerous short circuit is likely to occur.

(14) Indoor Aerials. A wire strung around the room behind the picture molding, or in some other concealed place, serves as an efficient aerial in many locations, but in steel buildings poor results may be expected. It may be used in combination with a lamp-socket aerial.

(15) Underground Aerials. In outlying districts, where space permits, underground aerials may be employed for the reduction of various kinds of interference. While no exact data as to the efficiency of this type of aerial can be given at this time, we have received many satisfactory reports from various experimenters.

(16) Multiple Aerials. The tangled maze of unsightly copper wires, strung in all directions on the roofs of some apartment houses, should inspire all Service Men to recommend some form of multiple aerial to the owner of the building. The illustration, Fig. 67, shows how neat this arrangement can be made(Amy, Aceves and King, Inc.) One well-erected aerial feeds all sets in the building through special coupling devices, thereby simplifying set installation and insuring satisfactory set operation with virtually no trouble from this source. A defective coupling unit will seldom occur, and in this case, it can easily be replaced.

(17) Centralized Radio System. This apparatus, made by R.C.A., will be found in many hotels and apartment buildings. Fig. 68 shows the circuit diagram. It couples a single aerial to as many as 80 receiving sets, without mutual interference, and comprises an RFC unit shown at the left in Figs. 68 and 69, which is mounted on the roof or near the aerial. This unit feeds as many as 8 RFX units (shown at the right of the above illustrations) by means of a twisted three-wire radio-frequency transmission line. Each RFX unit will feed up to 10 radio sets. The amplification gained in these units compensates for any transmission losses.

In other systems one aerial feeds one master radio set usually located in the basement of the building. This set feeds audio power to the various room outlets. Each room, therefore, has only a loud speaker and volume control, with a switch that will select any one of about four stations.

(18) Loop Aerials. The superheterodyne receiver is the most common type that employs a loop aerial. Lack of sensitivity in the set may be traced to poor location in the room; in

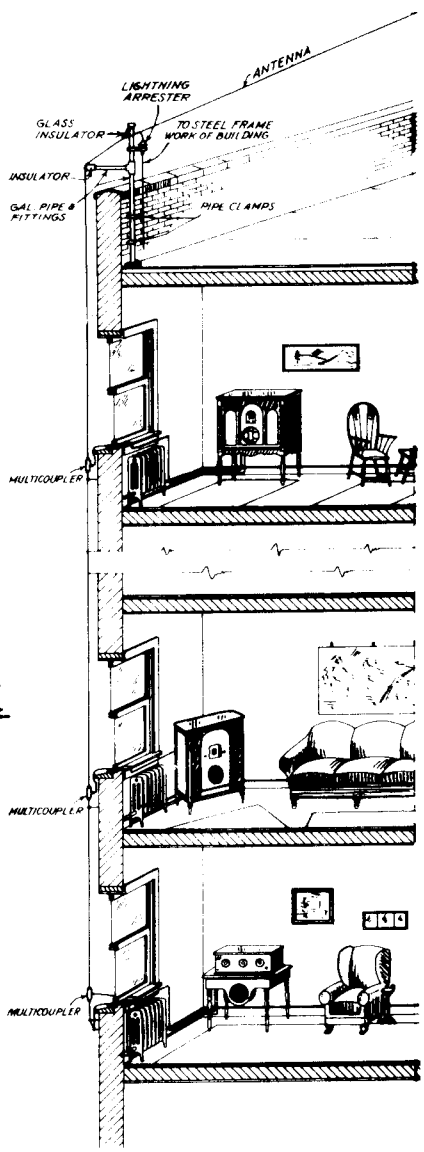


Fig. 67 - One aerial supplies many sets.

a steel building, moving the set a few feet sometimes makes considerable difference. If it is located near a steel column, the directional effect of the loop is usually impaired , the loop receiving its energy directly from the column by induction effect.

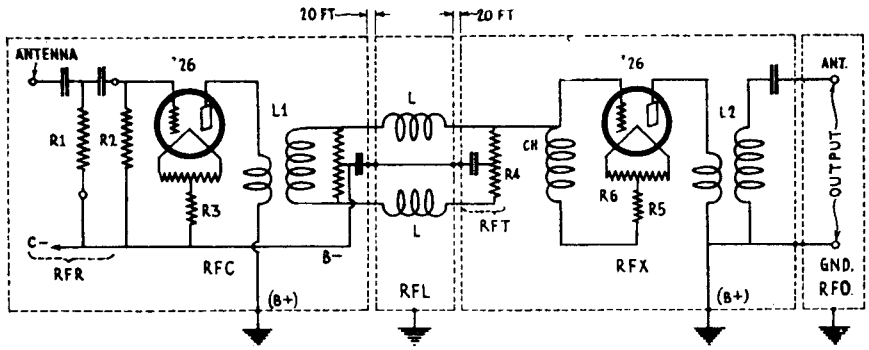
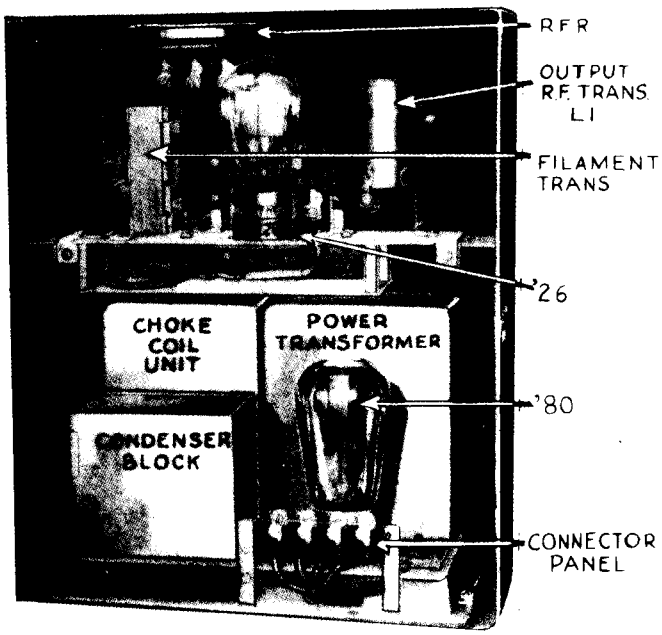


Fig. 68 - Diagram of the R.C.A. centralized radio system.

In home-made receivers employing an external loop one sometimes finds a neat-looking flexible telephone cord connecting the loop to the set. The electrostatic capacity of this cord is so great that it is virtually impossible to tune the loop and tuning appears broad. To remedy, connect the loop to the set with two short separate wires.

Often the simplest things cause the most trouble, and one should first make sure that the aerial and ground are connected to the set before making elaborate tests on the latter.



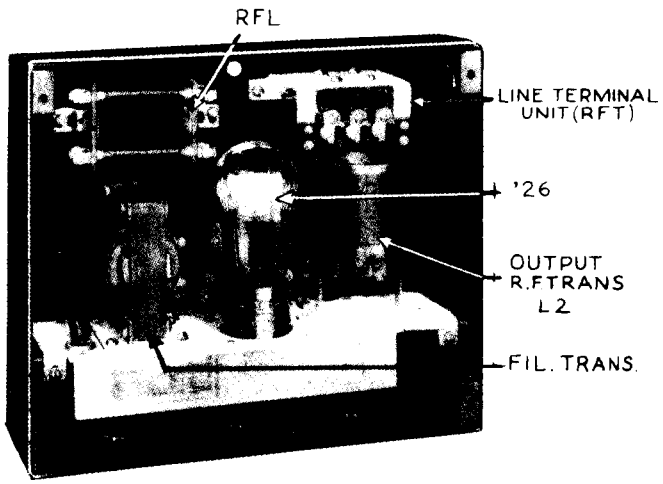


Fig. 69 - at the left is shown the "RFC," or first unit of the system which supplies plate current also for the coupling units.
- at the right is shown the "RFX" or outlet unit which feeds the individual receivers. The "RFT" unit shown in the diagram of Fig. 68, appears only in the last "RFX" on the line.

CHAPTER VII

RADIO-FREQUENCY AMPLIFIERS

FROM the viewpoint of the set owner, the radio-frequency amplifier may be considered as consisting of the tuning dial and the volume control and he will detect the least fault in either. The Service Man, however, must know the insides of the particular set in order to localize the trouble and make repairs. The various commercial set diagrams in this book display the almost unlimited forms in which the above two constituents may exist. Each manufacturer, testing the methods of the others, changes or adds to them in attempted improvements, and a new breed of sets finds its way into the homes of the lay public. Otherwise all sets would be alike. Basically they are alike, but vary in details. These details are important, however, and to point out some of the more salient ones, we shall classify the different types of sets and, in turn, the different elements of which the radio-frequency amplifiers in them are composed. We can first classify sets into those -

(a) without screen-grid tubes,
(b) with screen-grid tubes,

and make a further classification of those using -

(c) conventional tuned circuits,
(d) band selector circuits.

In addition we have superheterodyne circuits. The different methods of volume control, both manually-operated and automatic, will also be included in this chapter.

(2) Conventional Tuned Circuits. In the ordinary tuned-R.F. amplifier illustrated in Fig. 6 of Chapter II, three tuned circuits are employed; the first couples the aerial circuit to the first tube, the second couples the first and second tubes, and the third couples the second tube to the detector. When all three circuits are in resonance, amplification takes place; this means that the three tuning condensers must be accurately adjusted. In modern sets the three condensers are all mounted on one shaft and tuned collectively. For maximum efficiency, the circuits and condensers must be identical; otherwise one circuit will be out of resonance and the over-all amplification will be reduced. Slight mechanical variations in manufactured condensers do exist, however, so "trimmer" condensers (or aligning condensers, as they are sometimes called) are connected in parallel with the main tuning condensers, as illustrated in the diagram mentioned above. These condensers are of small size and small capacity. They are adjusted for resonance at two or three points on the dial and left in the best average position. This adjustment can be done by ear through tuning in stations and adjusting the trimmer condensers for maximum volume; but the method described in Chapter I, Paragraph 15, for balancing , in which a resonance indicator is employed, is more accurate.

(3) Neutralizing. It is evident that, in a radio-frequency amplifier, the output circuits contain radio-frequency currents identical with those in the input circuits, but of a much greater value; therefore, if the slightest degree of coupling exists between the output and input circuits, the amplifier will be thrown into violent oscillation, resulting in decreased amplification and whistling, squealing, and howling everytime a station is tuned in. To reduce this disastrous coupling, the coils and condensers are enclosed in metal shield-cans. But even then coupling exists within the tube itself in the form of electrostatic coupling between the grid, which is part of the input circuit, and the plate, which is part of the output circuit. Various circuit arrangements have been devised to "neutralize" this capacity coupling within the tube. All these circuits depend upon some form of "Wheatstone bridge" arrangement, whereby an equal amount of capacitative coupling of opposite sign is

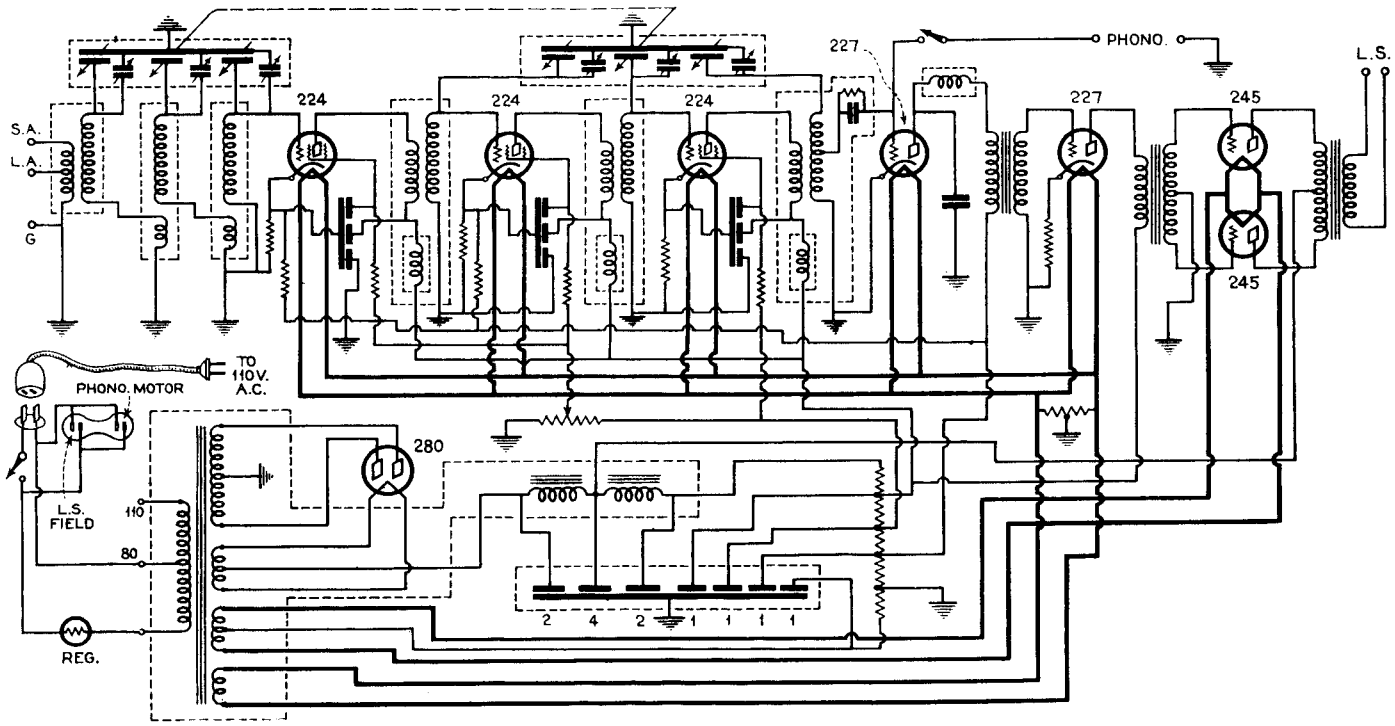


Fig. 70 - Hammarlund "Hi-Q 30"A.C. Receiver.

introduced between the input and output circuits, thus nullifying the effect of the tube-capacity coupling. These various arrangements will not be described in detail here, as the diagrams of the various sets show them. The Service Man is interested only in the neutralizing condenser employed to obtain this balancing effect and how it should be adjusted. These condensers are clearly indicated in the diagram of Fig.6, and the method of adjusting them is described in Chapter I, Paragraph 15. Without instruments, a fair degree of adjustment can be obtained by tuning in a station, inserting a dummy tube in one socket after the other, and adjusting the neutralizing condenser in each case for minimum or zero sound; at the same time adjusting the trimmer condensers for maximum sound. When correctly adjusted, it should be impossible to make the set oscillate at any point on the dial, with any volume-control adjustment.

(4) The Screen-Grid Tube. Having just described the cause and cure of oscillation in the ordinary tuned R.F. circuits employing three-electrode tubes, it seems fitting at this place to point out the effect which the advent of the four-electrode or screen-grid tube has had on circuit design. The use of metal shields to prevent coupling between the output and input circuits has been described; in screen-grid circuits, the shielding is extended until it exists within the tube itself, in the form of a metal network, entirely encompassing the plate, which is called the screen-grid. This fourth electrode is grounded but maintained at a proper positive-bias voltage, so that it does not interfere with normal tube action. It is evident, therefore, that the input and output circuits are entirely shielded, and feed-back coupling cannot exist. The circuit will not oscillate, and neutralizing is not necessary. In practice, the entire tube or the most vulnerable part of it, is enclosed in a metal shield. A very high degree of amplification is obtained, but the characteristics of the tube are different. It has a much higher impedance, requiring special design of the R.F. transformers. These tubes are made in the ordinary battery type ('22) and A.C. heater type ('24.) See Fig. 41 in Chapter IV.

(5) Band-Selector Circuits. Band-selector circuits are becoming more and more popular, especially since the advent of the screen-grid tube with which they are mainly used.

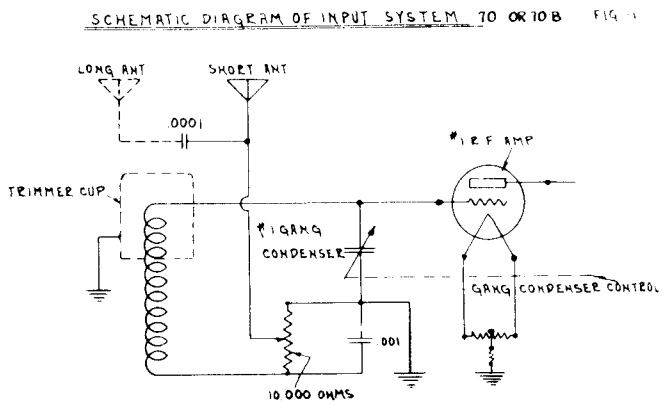


Fig. 71 - The 10,000-ohm resistance is the volume control.

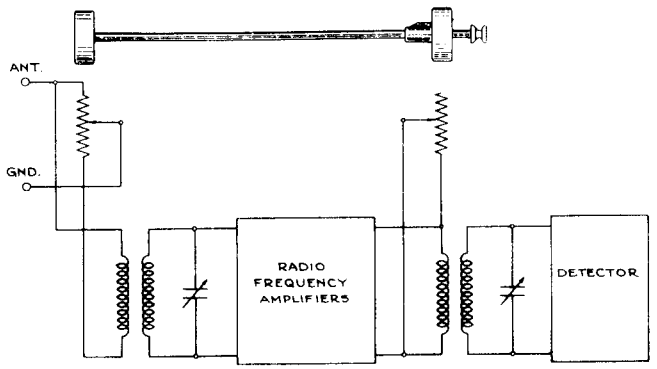


Fig. 72 - Two resistances control the volume simultaneously in this set.

The band selector, or band-pass filter as it is also called, consists essentially of two or more tuned circuits loosely coupled together. This gives a flat-topped resonance curve which, by proper design, can be made to have a flat top 10-kilocycles wide, thereby accepting the entire program, sidebands and all, giving a high degree of selectivity without distortion. The band-selector circuits may be found ahead of the R.F. amplifier, at the input side; they may be part of the amplifier circuit, or may be placed between the amplifier and the detector. Various combinations are possible. In many sets, as in the Sparton "Model 49," (a diagram of which will be found in the back of this book) the band selector will be found between the aerial and the R. F. amplifier, and an untuned or aperiodic R.F. amplifier is employed. That is, the R. F. transformers are of special design to cover the entire broadcast band without tuning. Incidentally, three-electrode tubes are employed in this set. In the Hammarlund "Hi-Q 30 A.C." receiver, a diagram of which is reproduced in Fig. 70, band-selector tuning is employed between the aerial and the amplifier, as well as tuned stages in the amplifier, giving six tuned circuits in all. The six tuning condensers, illustrated in the upper left side of the diagram, are controlled simultaneously by one dial. The six trimmer condensers are also shown. Note the R.F. chokes in the plate-supply leads of the screen-grid tubes; these leads, as well as the grid return leads and screen-grids, are by-passed to the filament through large condensers.

(6) Grid-Bias Volume Control. Various methods of controlling the volume in different circuits are employed. In the old tuned-R.F. sets, it was customary to control the volume by changing the bias voltage on the grids of the tubes. This was effected by the use of a potentiometer connected across the filament circuit; the variable tap connecting to the grid return leads. Thus a bias voltage from zero (at the negative side of the filament) to plus 6 volts (at the positive side) could be obtained. This positive bias on the grids caused excessive plate current, resulting in short-lived tubes and batteries. Also, tuning was broadened because of the R.F. circuit drain from the tuned circuits.

(7) Filament-Current Volume Control. Another simple method of controlling volume was by means of the filament rheostats of the R.F. amplifier tubes. While this is effective, it is not very satisfactory.

(8) Plate-Current Volume Control. A high variable resistor in the R.F. plate leads is commonly employed to control the volume, by controlling the plate current. These resistors are, of course, by-passed by large condensers. This method lengthens the tube and battery life and is quite satisfactory; it is used in the Sparton No. 49 above mentioned.

(9) Absorption Methods of Volume Control. Variable resistors are sometimes inserted in the R.F. circuits to control volume. Grid-suppressor resistors, connected in series with the grids, are also used to prevent oscillation in unstable sets; about 800 ohms

is sufficient. A variable resistor in the input circuit is also common. An example is illustrated in the diagram of Fig. 71, showing the method employed in the Majestic "70" or "70B" sets. Sometimes two variable resistors are employed; Fig. 72 shows how this is done in the Stromberg Carlson No. 638 D.C. receiver. Here two 10,000-ohm resistors, mounted on one shaft, are used; one to control the input to the R.F. amplifier, and the other to control the input to the detector.

(10) Screen-Grid Control. Controlling the positive bias voltage on screen-grid tubes makes a very efficient volume control in sets employing these tubes. This is the method employed in the Hammarlund receiver shown in Fig. 70. It is indicated at V.

(11) Automatic Volume Control. Modern sets are so sensitive, and capable of giving such great volume, that it is annoying to tune for a weak station and suddenly have a powerful local roar in. To avoid this, some sets employ automatic volume controls, which limit the volume automatically. Fig. 73 shows the circuit used in the Stromberg Carlson "No. 846" receiver, which employs a type '27 tube, the grid circuit of which is coupled through a .00025-mf. condenser to the output of the R.F. amplifier. A 2-megohm grid leak is used to prevent blocking of the tube and to hold the grid bias at the proper value. The plate is connected to ground through two 100,000-ohm resistors; but, since the cathode is at a lower potential than ground, plate current will pass through these resistors. The drop across both of them serves to bias the grid of the first R.F. stage, and the drop across one to bias the second R.F. stage. Thus, when the received R.F. signal reaches a certain intensity, current through the resistors decreases; resulting in less negative bias on the amplifier tubes and reducing the amplification. An equilibrium is soon established, in which the volume is maintained at a constant limited value. It seems needless to add that all resistors are thoroughly by-passed to prevent any radio-frequency feed-back; only the voltage drop across the two 100,000-ohm resistors, resulting from the average signal-intensity value, is instantaneously and automatically fed back to the R.F. amplifier grids. Many other sets use similar controls, such as the Kellogg 523 and 526 shown in the diagram section of this book.

(12) Radio-Frequency Amplifier Trouble. Trouble in R.F. amplifiers resolves itself into:

(a) lack of sensitivity,
(b) broad tuning,
(c) oscillation,
(d) noise,
(e) lack of control.

All of these symptoms may be due to poor tubes or wrong supply voltages; but, since we have described voltage tests and tube tests in chapters III and IV, we will limit this chapter to searching for trouble within the remaining parts of the system.

(13) Lack of Sensitivity. This may be attributed to: poor alignment of the tuning condensers, an open circuit in the input or some part of the system, shorted coils, an open or shorted by-pass condenser. In fact, any default in the circuit may contribute to decrease sensitivity or kill reception entirely. It is probably simpler to test the coils and condensers than to read about all the things that might happen. Even damp weather

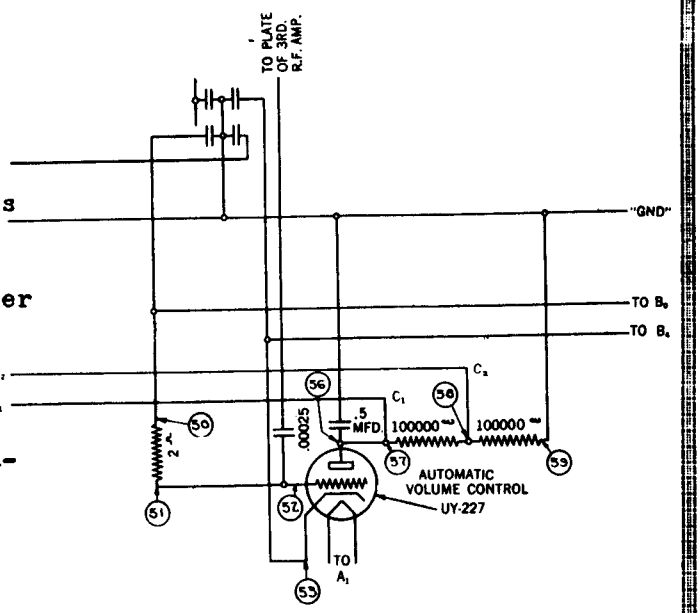


Fig. 73 - Automatic volume control circuit.

is detrimental, as shown in Fig. 74. This shows the results of an actual test. A usual fault in R.F. amplifiers is an open coil winding. The windings should be tested for continuity; a full reading indicates either good coil or a shorted coil. The latter is difficult to detect but, fortunately, is not a common occurrence. A visual examination will usually reveal any damaged condition. Lack of plate voltage at the tube sockets may indicate an open primary winding, or an open choke-coil winding in some sets in which the plate current does not pass through the R.F.T. primary (such as the Stewart Warner "Series 900" receivers.) It may be difficult to solder an open-circuited winding together; the best method is to rewind the coil, making note of the number of turns, size of wire, directions of winding, and external connections. So far as the tuning condensers are concerned, a visual examination is usually sufficient; they should be thoroughly cleaned and the pig-tail connections examined. The method of aligning them for maximum resonance has already been explained in Chapter I.

(14) Broad Tuning. Lack of sensitivity and broad tuning usually go hand in hand. The troubles just described in the preceding paragraph apply here also. Unless some previous Service Man has left a soldering iron or screwdriver inside of one of the shield cans, we may find the cause of broad tuning in the aerial system, to which a separate chapter has been devoted; or in an incorrect "C" voltage on the tubes, or in some defect in the circuit or volume control. The usual complaint from this trouble is found to be due to the closeness to some broadcast station; the fault is not in the set then, and the Service Man is not expected to improve the set far beyond its original abilities. Extreme sensitivity, like a powerful telescope, has the effect of bringing the stations nearer, and also results in complaints of broad tuning. In these cases a shorter aerial is recommended or a wavetrap may be required, as described in Chapter VI. Damp weather causes broad tuning in many sets, due to moisture impregnating the insulation of the coils. If complaints spring up during the damp season, it is well to bear this in mind. See Fig. 74.

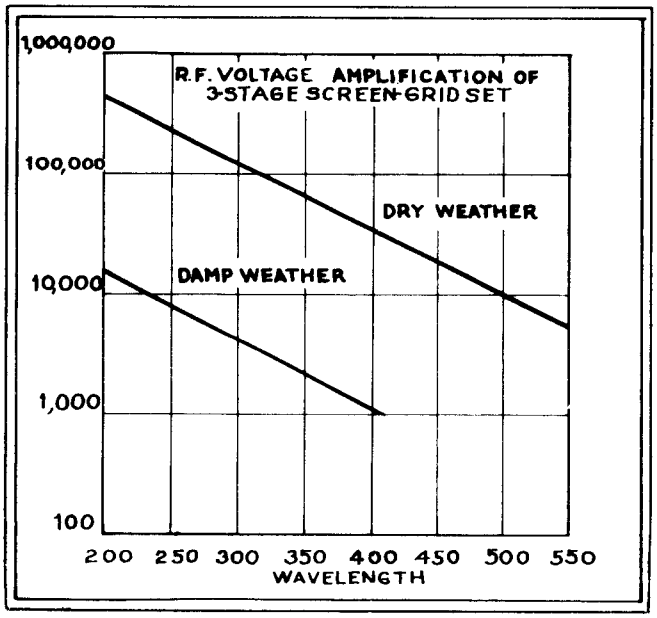


Fig. 74 - The effect of damp weather on R.F. amplifiers.

(15) Oscillation. Either the shielding is poor, the connecting leads are lying in the wrong positions, or the set is not neutralized. In some sets a defective volume control may cause oscillation. This trouble manifests itself by penetrating squealing, howling and whistling sounds while tuning in a station. There is feed-back coupling somewhere in the set to cause oscillation. Perhaps the antenna lead is too near the detector output region. Check the tubes, tube shields and supply voltages.

(16) Noise. Noise is invariably caused by loose connections, either within the circuit or near to it; as in the case of loose shield-can joints that reflect noises into the circuit, due to their absorbing of energy from it. Loose socket contacts are a common occurrence; also, loose soldered connections to the coils and loose pigtail connections to the condensers. Rubbing contacts on the condensers are also noisy. Condenser plates which touch cause noise, as well as fine metal burrs on the plates, or dirt between them. The volume control is a frequent source of noise; it should be cleaned with alcohol and oiled with Nujol. (This applies to filament rheostats also.) Sometimes a soft lead pencil rubbed on the resistance wire will give sufficient lubrication, due to the graphite, without interfering with the contact.

(17) Lack of Control. Lack of control of the set indicates a defective volume control. In virtually all cases the volume control is a variable resistor of some sort, and it is apt to be worn out from mechanical usage rather than electrically destroyed. Knowing its approximate resistance from the circuit diagram, it may be intelligently tested with a continuity tester, and preferably replaced rather than repaired, if defective. If the set has an automatic volume control, the tube may be at fault and should be tested. By-pass condensers may be shorted, or resistors open; with a continuity tester, almost all faults can be found. Hum may be introduced into the R.F. amplifier, due to electrostatic induction from some nearby high-voltage A.C. line.

(18) Superheterodyne Receivers. A whole volume could be written on the servicing of superheterodynes; but we only have space for the high spots, and let the reader's imagination dip into the valleys wherever it is indicated that he should do this. Owing to the comparative complexity of the superheterodyne, many things can happen to interrupt its service; but, if we segregate it into its main components and test each separately, we may find that the servicing of one superheterodyne is like servicing two ordinary sets. In the superheterodyne we have:

(a) oscillator,
(b) radio-frequency amplifier (in some sets),
(c) first detector,
(d) intermediate-frequency amplifier,
(e) second detector,
(f) audio-frequency amplifier.

Parts e and f are considered in chapters VIII and IX. Various superheterodyne circuits appear in the diagram section of this book. No matter how complicated the set, if we test one thing at a time we can't help but find the fault if it exists. With all parts of the proper values and properly connected, the set will work, because it did work before the trouble started. Knowing the circuit diagram and the values of the parts, it won't take long to make the tests and make repairs or substitute new parts.

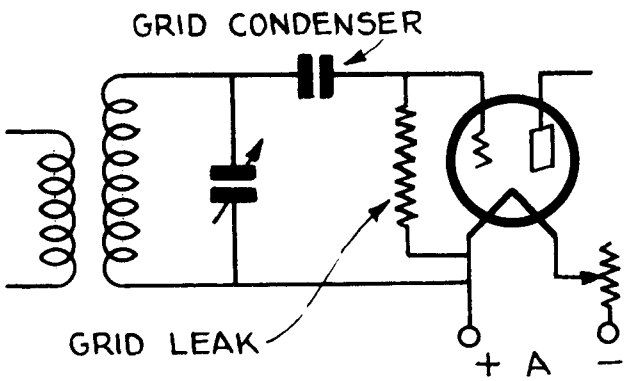
(19) Servicing Supers. Since there are a variety of superheterodyne circuits in use - the greatest variety being the home-built ones assembled from "kits" - it is virtually impossible to list all the causes and cures of troubles that may occur in them. Of the commercial supers, the Radiola is probably the most numerous, and a detailed analysis of the "Radiola 25" Superheterodyne appears in the Radio Data Service Sheet in the diagram section of this book.

CHAPTER VIII

DETECTORS

THE detector plays a very important part in every radio receiver - it is the pivot on which the radio-frequency amplifier and the audio-frequency amplifier hinge. Linking the two amplifiers, it could well be described in connection with either, but, since it plays such an important part in radio reception, we will devote a separate chapter to it.

(2) Function of Detector. The function of the detector in the ordinary broadcast receiver is to convert the form of the energy delivered to it by the radio-frequency amplifier to a form suitable for amplification by the audio-frequency amplifier and for sound reproduction by the loud speaker. In other words, in the input or grid-circuit side of the detector we have modulated radio-frequency currents and in the output or plate side, audio-frequency currents. Both forms of current may exist in both input and output circuits, in which case trouble results in some sets, while in others, employing regeneration, this phenomenon is utilized to advantage. In the superheterodyne receiver, two detectors are used, but their basic action is the same. One links the radio with the intermediate-frequency amplifier and the other links the intermediate with the audio-frequency amplifier. In the first case, the highest frequency is wiped out, leaving the intermediate frequency; in the second case the intermediate frequency is wiped out, leaving the audio frequency. Since the detector converts the radio energy into audio energy, it should do this work without distorting the audio-frequency wave shape or discriminating between high and low audio frequencies; it should effect this conversion without great loss of energy, and should introduce no extraneous noises in the set.



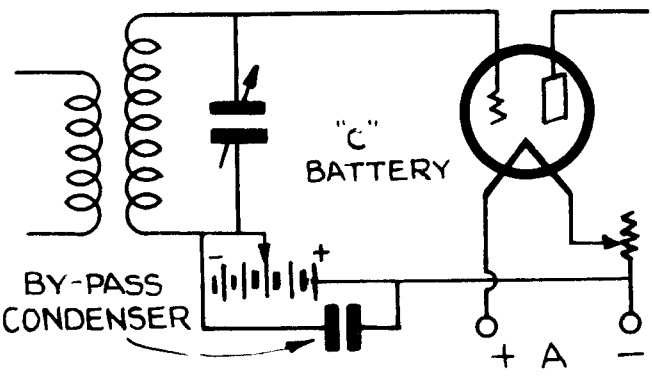


Fig. 77 - (left) Grid Leak and Condenser Method of Detection.
Fig. 78 - Power Detection using a "C" Battery.

(3) Simple Detector Circuit. A simple detector circuit employing a three-element tube (such as the '01A) is shown in Fig. 77. In this circuit, the modulated R.F. current is impressed on the grid of the tube through a grid condenser. The rectifying action of the grid and filament portions of the tube will allow the positive half cycles to pass through to the filament or return side of the input circuit; but the negative halves will be trapped and will accumulate on the grid. The intensity of this accumulation varies in accordance with the intensity of the input, which, we know, varies at audio frequencies; resulting in a similar audio plate-current variation. The grid leak resistance of several megohms allows the accumulating negative charge to leak off slowly. This holds the mean grid potential at a constant value and prevents an excessive accumulation which would block the tube action. It is evident, therefore, that the values of the grid condenser, grid leak and the plate voltage are important factors in determining detector efficiency.

(4) Grid-Bias Detector. This method is called "plate detection" and makes use of the "bend" in the lower portion of the "characteristic curve" of the tube for its effect.

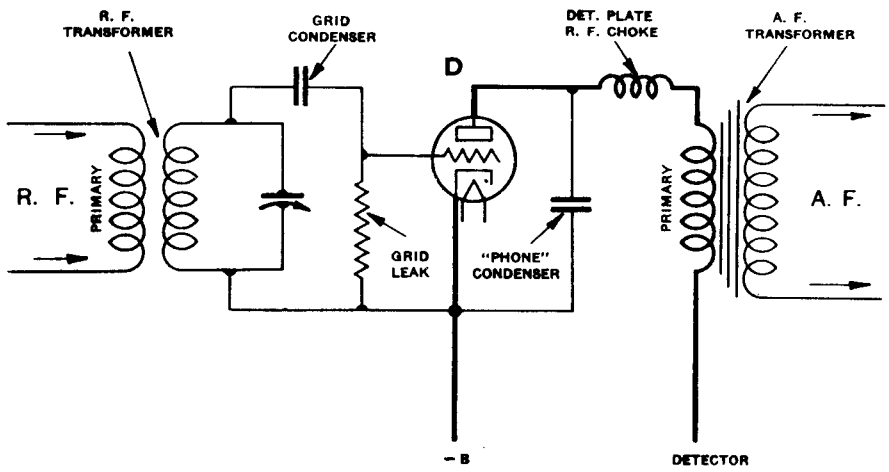


Fig. 79 - The '27 type tube detector using a condenser and leak.

See Fig. 39 on page 31. To operate the tube on this bend, a negative grid-bias voltage is necessary. This may be obtained from a "C" battery or from the voltage drop across a resistance. No grid condenser or leak is used , as shown in Fig. 78. Such a detector works by virtue of the fact that one side of the R.F. alternations is suppressed, allowing the A.F. modulations of the other side only to produce A.F. current variations in the plate circuit. As a rule, this method is not as sensitive as grid-leak detection, but the audio quality output is considered better. It is important that a very accurate adjustment of the grid-bias voltage and plate voltage be maintained. The grid-bias resistance or "C" battery must be by-passed by a condenser of at least 0.5-mf. capacity.

(5) The A.C.Detector. Both the detector methods just described were used in battery sets, but the same methods are used with the heater-type tubes in A.C. sets. Fig. 79 shows the grid condenser-and-leak method used with the type '27 tube, and Fig. 80 the grid-bias method, or plate detection. A "C" battery is seldom used in an A.C. set, as grid voltages are easily obtained from drops across resistors through which the plate current flows. Note the by-pass condenser across the bias resistor in Fig. 80.

(6) Power Detection. The sensitivity of a detector to weak signals depends upon the values of the plate voltage, the grid condenser and the leak, or grid-bias, voltage. Usually 22½ to 45 volts is sufficient for the plate. A detector designed for weak signals would be unsatisfactory for operation where comparatively large amounts of radio-frequency energy is encountered - as in some of the modern high-powered sets. In these, power detection is used. The basic action is the same, as shown in the schematic circuit of the power detector used in the Stromberg-Carlson "No. 846" receiver illustrated in Fig. 81. The main difference is that a plate voltage of 250 volts is employed with a grid-bias voltage of about 28 volts. Where these detectors are used it is seldom that more than one stage of audio-frequency amplification is required; the detector feeds directly into the push-pull power stage, resulting in very quiet operation with excellent quality. The values of the parts are given in the illustration.

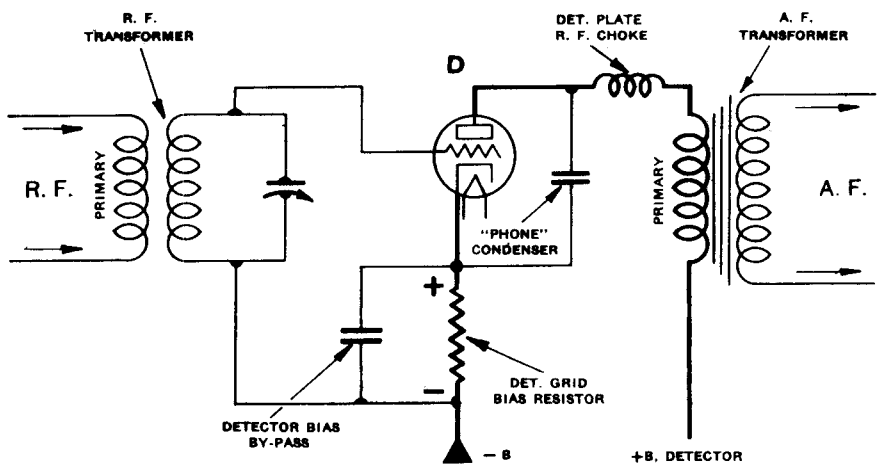


Fig. 80 - The '27 type tube using power detection and grid-bias resistor.

(7) Regenerative Detectors. Regenerative detectors are seldom used in modern multi-tube radio sets, and we will not describe them in detail. It is sufficient to state that the circuits are similar to those given, except that

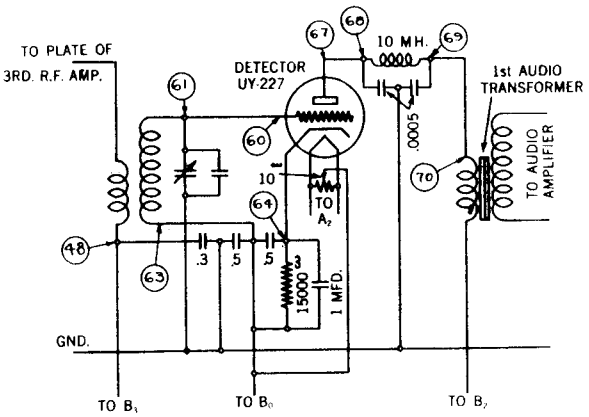


Fig. 81 - Linear Power Detector.

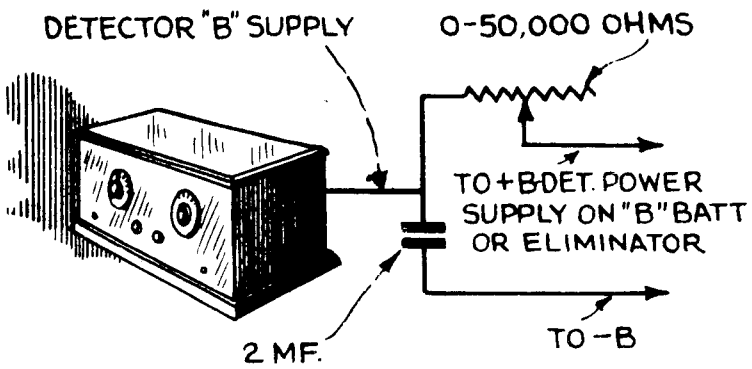


Fig. 83 - A resistor and condenser eliminates audio regeneration.

part of the audio-frequency energy existing in the plate circuit is transferred back to the grid circuit by means of a "tickler" coil connected directly in the plate lead. This reinforces the grid current and builds up the signal strength.

(8) Microphonic Howl. Microphonic howl is one common source of trouble in detectors, especially those employing battery-type tubes. The heater-type A.C. tubes give practically no trouble from this source. In extreme cases, it is necessary to exchange the tube in order to eliminate the howl, or use a cushioned socket or "howl arrestor." See Fig. 82. Since the detector is connected to the input side of the audio-frequency amplifier, it is extremely susceptible to audio vibrations or current variations, which explains the excessive tendency to microphonic howl in this particular tube. The grid-bias or plate-detection type is less susceptible; as far as audio-frequency currents are concerned, the grid may be considered as connected directly to the filament or cathode, thereby preventing the detector from acting as an audio-frequency amplifier, which it is when a grid condenser and leak are used.

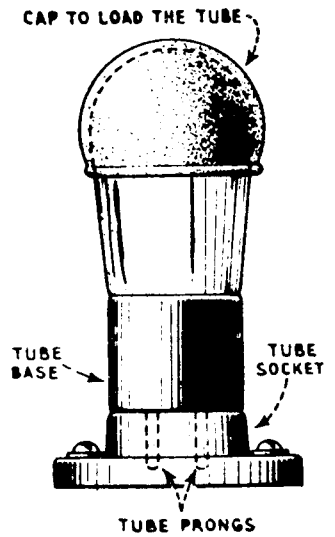


Fig. 82 - Howl Arrestor.

(9) Audio-Frequency Oscillation. This is partially due to the audio-frequency amplifier, but may be eliminated in many cases by correcting the detector. Audio oscillation manifests itself usually in a high-pitched squeal, caused by feed-back coupling in the "B" battery or supply circuit, from the output of the audio amplifier to the detector input. A 2-mf. by-pass condenser connected between the detector "B plus" lead and the filament will usually prevent it. An audio choke or high variable resistor connected between the power-supply lead and the condenser also helps and proves very beneficial in many cases. See Fig. 83. Changing from grid condenser - leak detection to grid-bias detection also helps in extreme cases.

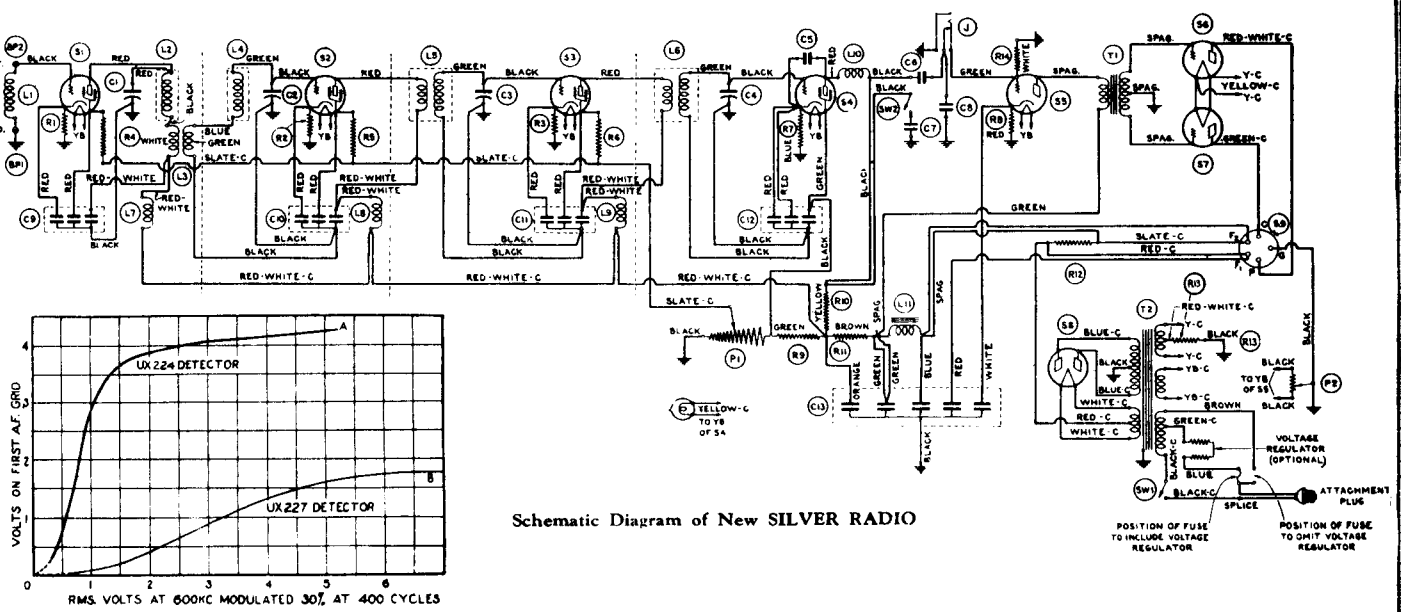
(10) Sensitivity. Lack of sensitivity in the detector is usually due to a poor tube, or to wrong plate or filament voltages. An open grid leak or condenser is a contributing cause.

(11) Noise. In addition to microphonic howl, noise is caused by a poor or loose grid-leak resistor or dirty socket connections.

(12) Hum. Hum is usually caused by induction from near-by A.C. circuits, due to poor shielding or lack of proper by-pass condensers in the grid and plate circuits.

(13) Overloading. In modern powerful sets using power detection, the detector is sometimes overloaded, causing distortion or "dead spots" on the tuning dial. The latter produces the effect of double resonance. The station may be slowly tuned in, approaching a maximum of volume as the set approaches resonance, until the detector is overloaded, causing a decrease in volume with the set tuned to resonance. Tuning beyond resonance removes the overload from the detector and the volume increases again. One may be deceived by this and think that the tuning system is out of order, when in fact the detector is at fault. In this case, the plate voltage should be adjusted to suit the particular location of the set, depending upon its proximity to broadcast stations and the particular stations that the customer desires. The grid leak or "C" bias voltage should be correspondingly changed.

(14). Filter Circuits. The radio-frequency energy that passes through the detector would cause havoc in the audio-frequency amplifier if it were not filtered; noisy, choked, distorting sounds would result. Usually a single .0005-mf. by-pass condenser, connected between the plate and filament of the detector, or across the primary of the first stage audio transformer (or the plate resistor in a resistance coupled amplifier) will suffice. A better filter is illustrated in the circuit of Fig. 81. Here two condensers of .0005-mf. each and a 10-mh. choke, connected as shown, are used. A filter of this kind could with advantage be easily added to a set having the above trouble. It will not interfere with the normal audio quality.



Schematic Diagram of New SILVER RADIO

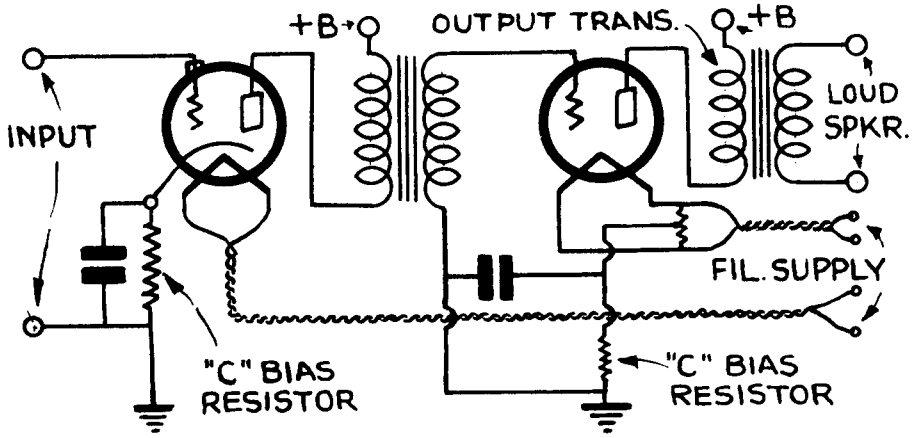
Fig. 84 - Diagram of the Silver-Marshall 720 A.C. screen grid receiver is shown above. This set employs a screen grid power detector, S4, with a 60,000 ohm grid bias resistor, a "B" voltage of 170 volts, and a plate resistor of 300,000 ohms; the first audio stage being resistance coupled. The curves at the left show the comparison of the screen grid power detector with the type '27 tube detector circuit. Excellent audio quality at high volume is reported by users of this set.

CHAPTER IX

AUDIO-FREQUENCY AMPLIFIERS

SINCE the audio-frequency amplifier determines the tone quality of the set, other things being normal, it is important that this part of the set be kept in the utmost of condition and that the tubes, transformers or other coupling devices and parts, as well as the supply voltages, be maintained in accordance with the specifications supplied by the manufacturer of the set. Good tone quality pleases the set owner. Poor tone quality pains him and breeds trouble for the Service Man - or may we call it pleasure, if he enjoys his work?

(2) Types of Audio Amplifiers. Audio amplifiers vary in the forms of interstage coupling and the types of tubes employed. There are many varieties in the thousands of sets in everyday use. The most common employs transformer coupling between stages. Others employ impedance coupling. Then there are the troublesome resistance-coupled ones, quite popular a few years ago and now not so common, yet again coming to the foreground in the form of direct-coupled amplifiers; to wit, the Loftin-White amplifier. With these three main groups, and from one to three stages in each amplifier, together with a wide variety of tubes, it is evident that many combinations can be produced, and such is the case. Yet trouble shooting is comparatively easy if we centralize our efforts on the coupling devices, tubes, connections and the supply voltages; the latter are assumed to be correct since we have already attended to them in Chapter III; and tubes we have tested and corrected in Chapter IV, leaving our present work limited to the coupling device and connections. Therefore, with the connections and coupling device correct, the amplifier will work. Of course, improvements may be made in the general tone quality and volume of many sets by changing the form of the audio amplifier, but the Service Man is not usually called upon to do this work.



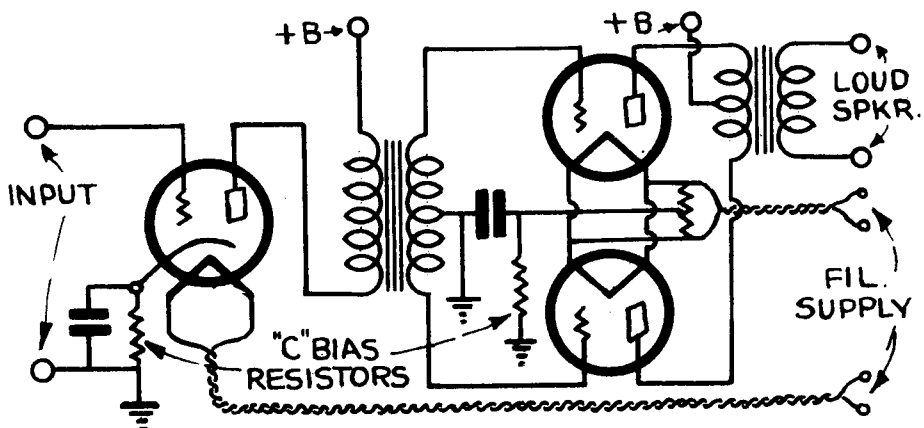


Fig. 85 - above. Standard 2-stage audio amplifier.
Fig. 86 - below. A push-pull audio amplifier circuit.
Both circuits are for use on A.C. electric sets.

(3) Transformer-Coupled Amplifier. A two-stage transformer coupled amplifier is most generally used and, in many cases, the second stage is of the push-pull type (illustrated in Fig. 86, as compared with the ordinary type of Fig. 85.) Push-pull arrangement gives greater output - which is demanded by electrodynamic speakers. Parallel tubes connected in the last stage give greater output than a single tube, but two tubes in parallel are not equal to two in push-pull. In almost all cases, an output transformer or output choke coil-and-condenser is employed as shown, to couple the amplifier to the speaker; matching their electrical characteristics and eliminating the D.C. plate current from

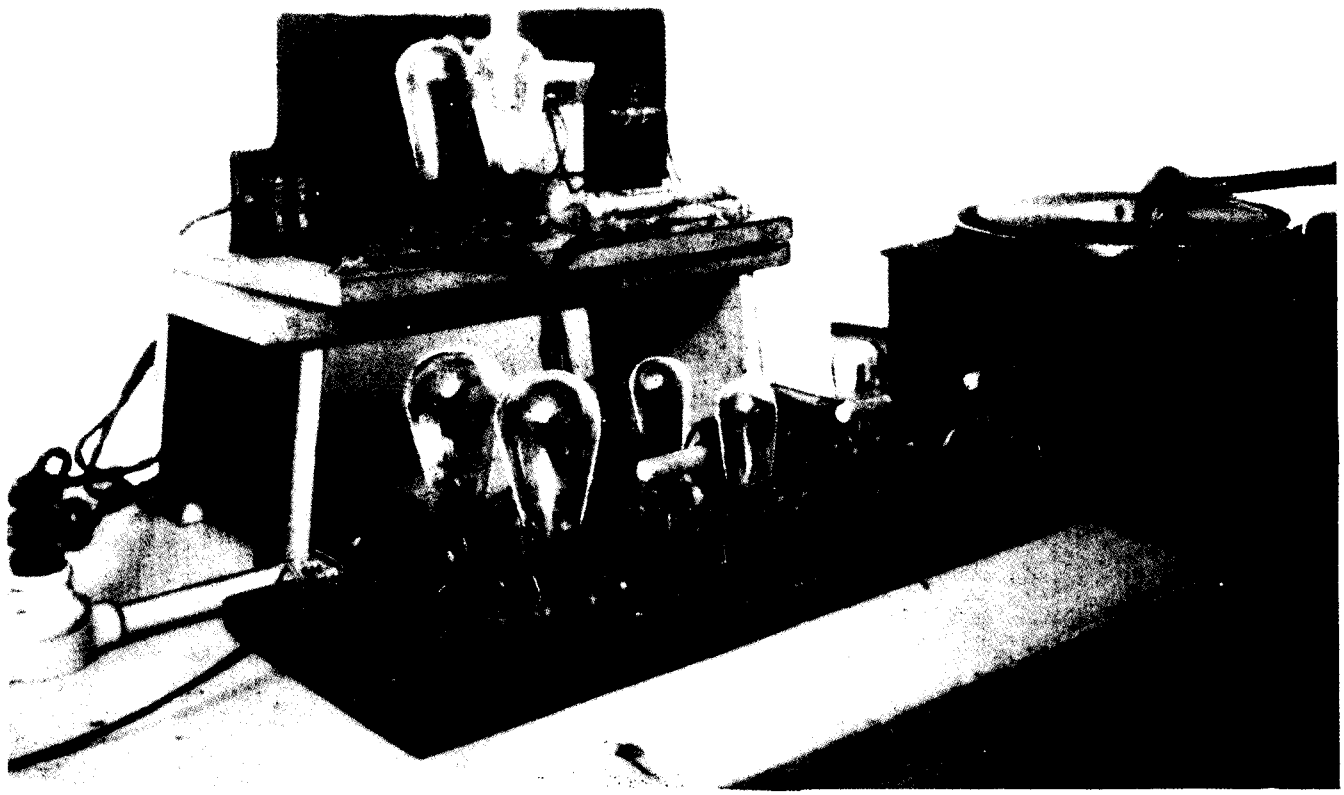


Fig. 88 - Thordarson '50 push-pull amplifier. A single and two push-pull stages are employed. The power supply is at the top. Note the output transformer in the lower left.

the speaker windings. In sets not employing power tubes, the speaker may be connected directly in the plate circuit without the use of an output coupling device, but in all push-pull amplifiers the coupling device is necessary, because of the circuit arrangement, unless the speaker winding has a center tap (which few have) or two speakers are used. Further reference to speaker coupling devices will be found in Chapter V. Some modern sets employ only one stage of audio amplification; the output from the power detector feeding directly into the push-pull audio power stage. See Chapter VIII. Tone quality with a minimum of hum is thereby obtained, at the expense of sensitivity, which must be compensated for in the radio-frequency amplifier.

(4) Transformer Tests. Lack of plate voltage at the tube socket indicates an open transformer primary winding, or a plate circuit open somewhere in the connections. Lack of grid-bias voltage indicates an open transformer secondary winding, or a grid circuit open somewhere in the connections. A continuity test on the transformer windings will reveal their condition. If the meter of the continuity tester reads full, the winding is short circuited; if the reading is zero, the winding is open or burnt out. The latter is a common occurrence in transformer primaries, which carry the plate current. If only a partial reading is obtained, the winding is intact. These windings have a rather high resistance which is indicated by the partial reading of the continuity meter. When a damaged transformer is located in a set, it should be replaced with one of the same type. Tests should also be made between the primary and secondary windings and between the windings and the core; in these tests the readings should be zero. A full reading indicates a short, and the transformer should be replaced. After the transformer has been disconnected from the set, the wiring in the set should be tested as the short may be in the external wiring to the transformer. Noise in transformers is common, and is due to a poor or loose connection within the instrument. To test, connect a 4½-volt "C" battery, in series with a headset, to the winding under test and listen for noise. No sound except the initial click will be heard if the

transformer is in good condition.

(5) Special Circuits. Some transformers employ a core of special alloy which is more susceptible to magnetic influences than iron. When continually subjected to the magnetizing effect of the plate current of the tube, the core loses its qualities and the resultant tone quality of the set is impaired; bass notes are lacking. When other faults cannot be found in the amplifier, it is well to replace the transformers. Special circuits have been developed to prevent this trouble. In the circuit of Fig.31 (shown on page 26), methods known as "series plate feed" and "parallel plate feed" are employed. The former is shown in the connections of the first-stage transformer. A series resistor, R1, by-passed by the 1-mf. condenser, limits the plate current to a safe value. The parallel plate feed method is represented in the second or push-pull stage connections; here the D.C. plate current passes through a choke coil, the audio-frequency component of the current passing through the 1-mf. coupling condenser to the primary of the input transformer. Note the 50,000-ohm resistors R2 in the grid return circuit of the input push-pull transformer. These are to suppress any cross-current "parasitic" oscillations that might develop in the push-pull tube circuit and introduce distortion and noise.

(6) Resistance-Coupled Amplifiers. Ordinary resistance coupling does not give as much amplification per stage as can be obtained from transformer-coupled amplifiers, consequently when it was first introduced, three stages were used. With present receivers, having more efficient radio-frequency amplifiers, more than two stages are seldom employed, with a consequent reduction in sources of troubles. Usually a combination of transformer and resistance coupling is encountered, as in the Atwater Kent "Model 55" and "55C" receivers; here the first stage is resistance coupled and the second stage push-pull transformer coupled. Fig. 48, page 41, shows the first (resistance) stage in this set. The detector and first audio tubes are indicated, together with the "C"-bias resistors and detector-plate filter system. The coupling unit comprises a plate resistor, a blocking condenser and a grid-leak resistor. The audio-frequency current passing through the plate resistor causes voltage variations across it, which are applied to the grid of the following tube by means of the condenser. The purpose of the blocking condenser is to prevent the positive potential of the plate circuit from direct contact with the following grid, which would place a positive bias on it and kill the tube action. Resistor and condenser values vary, in accordance with the requirements of the tubes used.

(7) Troubles in Resistance-Coupled Amplifiers. Many things can happen to a resistance-coupled amplifier to throw it out of kilter; the most common faults are wrong plate voltages and wrong resistance values. Some resistors change with age. Power supply leads to the plate circuits should be thoroughly by-passed, to prevent motorboating, as indicated by the "detector filter condenser" of Fig. 48. A leaky blocking condenser is disastrous, resulting in excessive plate current in the following tube. On the other hand, an open or disconnected blocking condenser will prevent the transfer of voltage variations (signals) from one tube to the next, but will not effect voltage and current readings at the tube sockets. Since the condensers are seldom over 0.1-mf. in capacity, a continuity test or crude capacity measurement will not reveal the open. A quick check is to connect another condenser in parallel with the questionable one and note the results. Aside from checking the resistors and all condensers in the circuit, as well as the supply voltages, there is little to do in the resistance-coupled amplifier. It is well to remember that special "High-Mu" tubes (such as the type '40) have been developed especially for resistance- and impedance-coupled amplifiers and should not be used in transformer-coupled stages. Therefore, check all tubes.

(8) Impedance-Coupled Amplifiers. The circuit arrangements of these are identical to those of resistance-coupled amplifiers, choke coils being used instead of resistors. This makes possible the use of lower plate voltages, as we do not have the excessive voltage drop inevitable with resistors. Combinations of chokes and resistors are also

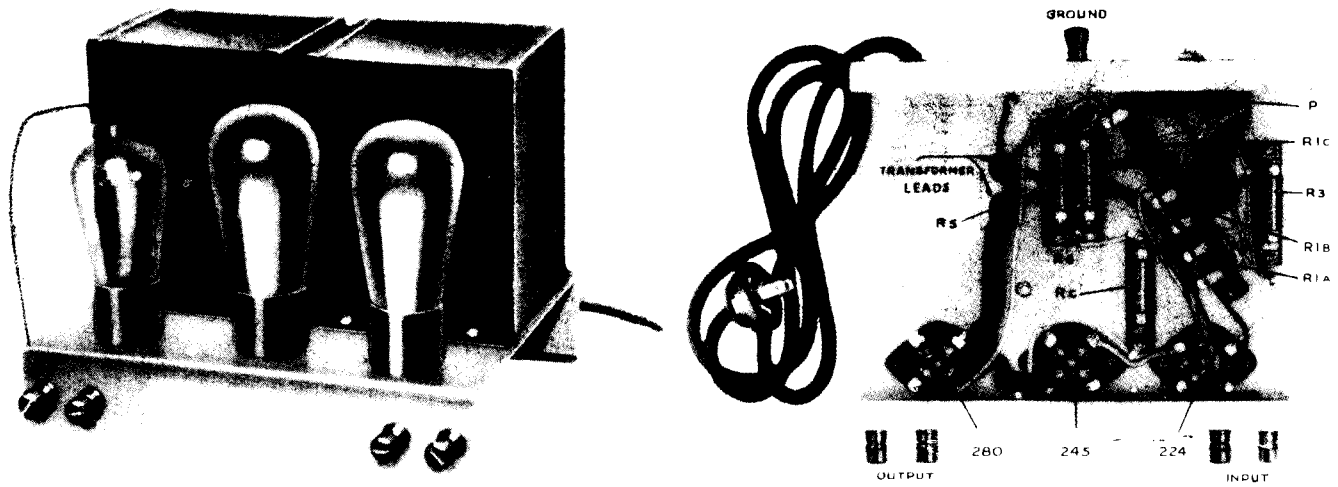


Fig. 89 - The Electrad-Loftin White direct-coupled amplifier.
Fig. 90 - (right) Shows the wiring on the bottom of the instrument.

possible, such as a plate resistor and grid-leak choke, or vice-versa. In either case, a coupling or blocking condenser is required. Tapped chokes or impedances are sometimes used, giving the device an auto-transformer action. Testing impedance-coupled amplifiers will not be considered separately, as it involves only testing the coils and condensers in a manner similar to that described in connection with transformers.

(9) Direct-Coupled Amplifiers. The elimination of the coupling or blocking condenser in a resistance-coupled amplifier gives us what is called a direct-coupled amplifier, but certain precautions must be taken before this can be effected. Some means must be employed to maintain the grid-bias voltages at the proper values. This has been well accomplished in a practical manner in the Loftin-White amplifier, the circuit of which is given in Fig. 91.

This circuit was designed specifically for use as a phone amplifier, the phonograph pick-up being connected directly to the input terminals. However, with the addition of a suitable coupling device many interesting combinations of this system with various R.F. tuners can be obtained. A simple receiver can be constructed by coupling the input terminals to an antenna and ground through a conventional tuning coil and condenser. In the diagram of Fig. 91, P is a 200 ohm potentiometer; R1 a tapped divider resistance; R5, 25000 ohm metallic resistor; R3, 50,000 ohm metallic resistor; R6, 100,000 ohm metallic resistor; RC, 500,000 ohm resistor; the tubes used are a type '80 rectifier, a '45 amplifier, and a '24 screen grid tube for the first stage. The resistances and connections are such that the correct bias voltages are obtained only when using the correct tubes.

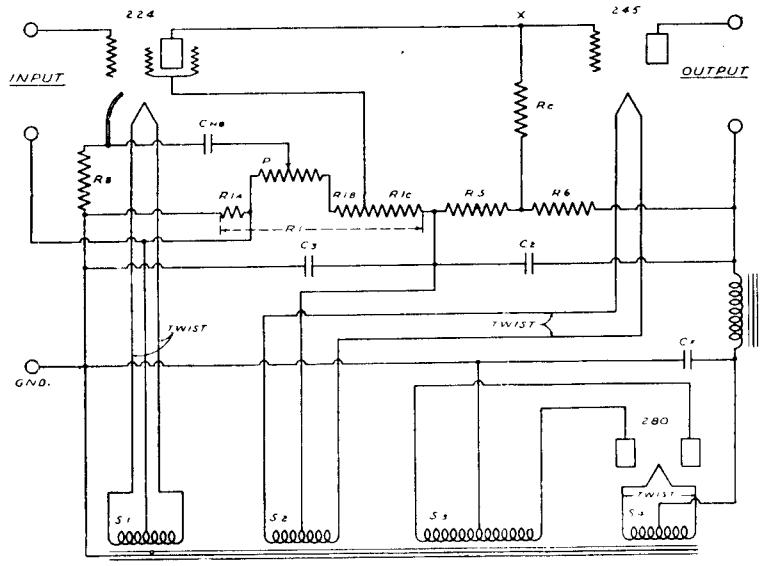
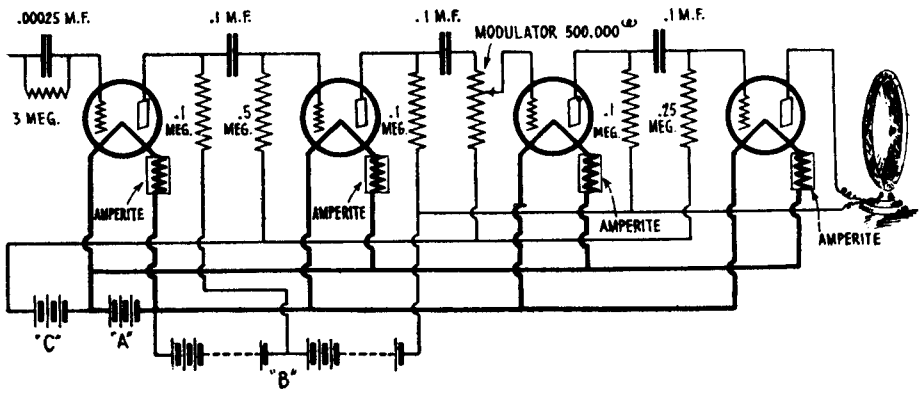


Fig.91 - Diagram of direct-coupled amplifier.

(10) General Audio Troubles. Oscillation, resulting in a high-pitched squeal, is

prevalent in many poor audio amplifiers, especially transformer-coupled ones. Sometimes placing the fingers across the secondary terminals of the first- or second-stage transformer will eliminate this, showing that a high resistor of from 10,000 to 50,000 ohms will do the same thing. This reduces volume, however, and should not be resorted to unless absolutely necessary. A condenser of about .0005-mf. capacity will also be a relief; but this method is likely to absorb high notes and produce distortion and a muffled tone. By-passing the plate-supply power leads or "B" batteries will also help. A condenser across the first primary, or an equivalent filter system in the detector plate circuit, is essential. For resistance-coupled amplifiers, a supply of resistors should be on hand, so that these can be interchanged.

(11) Audio Amplifier Comparisons. Transformer-coupled amplifiers have limited frequency characteristics; that is, they do not respond equally to all musical frequencies, especially at the extreme high and low ends of the scale, where they are less efficient than in the middle. Also, the magnetic qualities of the core distort the wave shape, introducing foreign frequencies into the tone. But modern transformers are good enough for all ordinary requirements, and are very reliable and practical. Resistance-coupled amplifiers have possibilities of giving extremely wide undistorted frequency-characteristics, resulting in better quality; but, generally speaking, they are less reliable and practical than transformer-coupled amplifiers. Impedance coupling may be placed somewhere between the two in merit. Therefore, in sets employing two or more resistance stages, it is sometimes advisable to substitute a transformer of modern make for one of the resistance stages. This will give more constant, reliable, dependable, practical, operation; with ultimate satisfaction on the part of the set owner. In making the change, it is usually necessary to change to the proper tube, and plate voltage, for transformer operation.



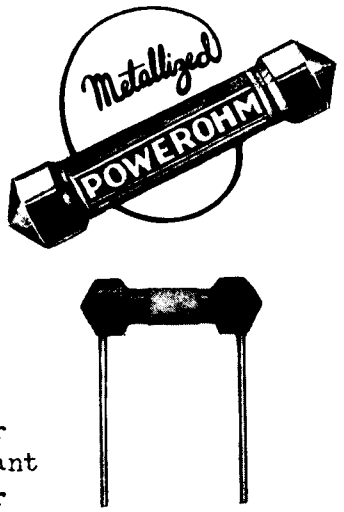
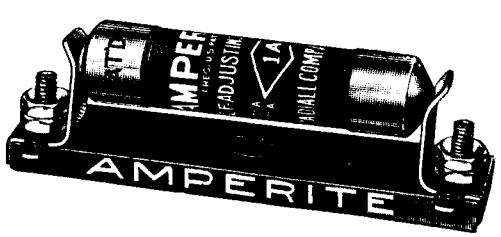


Fig. 92. - A typical resistance-capacity coupled amplifier is shown above. In amplifiers of this type absolute constant operating conditions are necessary. Changes in voltages or resistance values impair the quality and destroy the amplification factor. At the right are shown resistors of small size and high capacity suitable for circuits of this type. The illustrations are full size. The upper one has a rating of two watts and the lower one $\frac{1}{2}$ watt. They are furnished in various resistance values. Illustrations courtesy International Resistance Co. As regards constancy in voltage control, Amperites, (automatic voltage controls) are indicated in the filament circuits of the various tubes. The illustration at the lower left shows a full size amperite. As the current which passes through it increases, the resistance wire in it becomes heated and its resistance increases -- thus tending to reduce the current or hold it at a constant value. Devices of this kind are also furnished to maintain a constant input voltage for electric sets.



CHAPTER X

EXTRANEOUS NOISES AND THEIR ORIGIN

COMMONLY known as "interference," we may classify everything that comes under the above heading as sounds coming from the speaker that interfere with the program we desire to hear. This covers a broad field. However, we can group these pests into those originating outside the receiver, and those originating within the receiver. When the customer says, "My set is noisy; come and fix it," only the experienced Service Man knows the full significance of that simple sentence. His first procedure is to turn on the set and listen to the noise; if his ears have been trained by long experience, he knows exactly where to find the origin of the noise. Knowing the source, however, does not solve the problem. The difficulty lies in eliminating the noise; and this difficulty has prevented the sale of many electric sets.

(2) External sounds. Suppose we let this cover all sounds originating from electrical disturbances external to the set. We can tell whether the set or lighting line is noisy by disconnecting the aerial; if everything is quiet, we know that the interference comes through the aerial. If the aerial is examined and tested and found to be in good shape, we know that the interference is received in the form of radio waves originating at some external place. We can classify this form of interference into:

(a) Interference caused by broadcast stations,
(b) Interference from some oscillating receiving set,
(c) "Man made" static,
(d) Natural static.

Of the four types, "d" is probably the most annoying from the Service Man's viewpoint.

(3) Interference from Broadcast Stations. This form of interference in one case manifests itself in actual reception of the program of the interfering station, in which case the trouble is in the receiving set. It tunes too broadly and should be corrected, as described in Chapters VI and VII. In the other case, this interference manifests itself in a continuous squeal, due to the heterodyne effect of the interfering waves. Sometimes the squeal, is "scrambled" by the audio program, giving rise to a very peculiar mess of squealing sounds; in this case the trouble is caused by the transmitting station, which is not using its allocated wave. This is more noticeable among the low wave length stations. Since the Service Man's field of action is limited to the receiving set, he can't correct troubles in the broadcast stations and the set owner will have to be content with what he gets until other corrective measures are taken.

(4) Interference from Oscillating Receiving Sets. A regenerative set in the state of oscillation will radiate waves, just like a broadcast station, though not so powerful. These waves heterodyne with those of the broadcast station being tuned in, setting up whistling and squealing sounds which run up beyond and down below the audible musical scale, creating disturbance in all other sets within a half-mile radius. One has a desire to

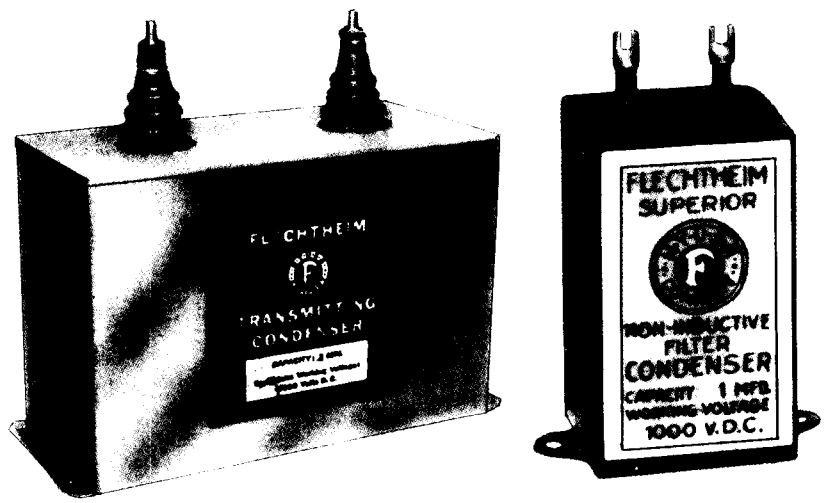
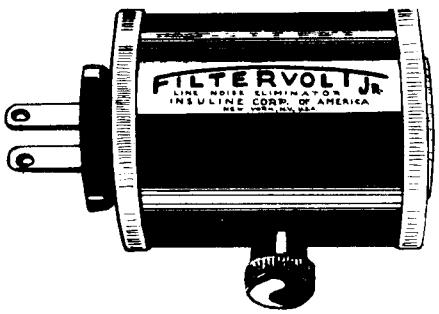


Fig. 96 - The Flechtheim condensers are ideal for filtering line noises.



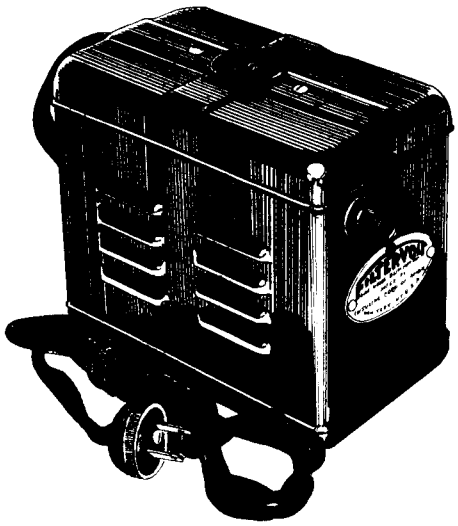


Fig. - 98. These line-noise eliminators connect between the set and the power supply Illustrations courtesy of The Insuline Corporation.

clip the offender's aerial, if it can be located. Fortunately, this form of interference is not as common as it used to be, as few modern sets oscillate.

(5) "Man-Made" Static. This form of interference can usually be distinguished from natural static, in that it has a more orderly arrangment of disordered, cacophonous, annoying, noises. To tabulate the various forms of man-made static seems unnecessary. Just keep in mind that every electrical device, from the simple electric light up to electric railways and down to door bells - in fact, the whole gamut of electrical appliances - gives birth to disturbances that affect the sensitive receiving set. These disturbances travel over three routes, and we can explain all of them by describing the origin of the simple click heard in a radio set when a light is turned off.

(a) We have the low-frequency surge, or impulse, due to interrupting the current when the light is turned off. This upsets the equilibrium of the line voltage, giving rise to an impulse that finds its way into all sets connected to the line.

(b) There is the radio-frequency wave, generated by virtue of the electrostatic capacity and inductance of the line in the immediate vicinity of the circuit interruption where sparking occurs. This exists, though the sparking is ever so slight. This wave travels over the line in the form of "wired wireless"; finding its way into the input or radio-frequency amplifier side of all sets connected to the line.

(c) The radio-frequency wave, generated as described above, radiates from the light-circuit wires, as waves radiate from a broadcast aerial. These waves find their way into all sets in the vicinity, whether connected or disconnected from the line.

It is evident that any electrical device that interrupts the current causes interference, In addition, we have devices, such as arc lights and mercury-arc battery chargers, that give what we may call "continuous interruption" and produce very annoying noises. The nature of the noise may indicate the source. Low sputtering sounds like

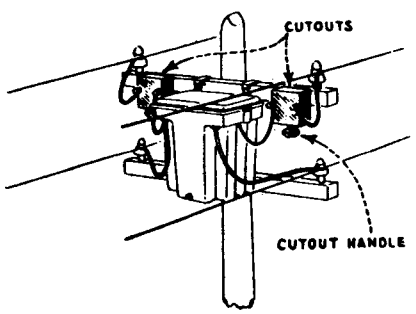


Fig. 93 - A common source of "static."

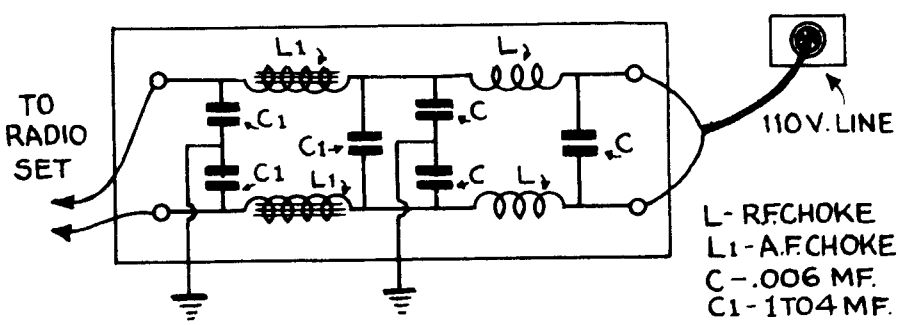
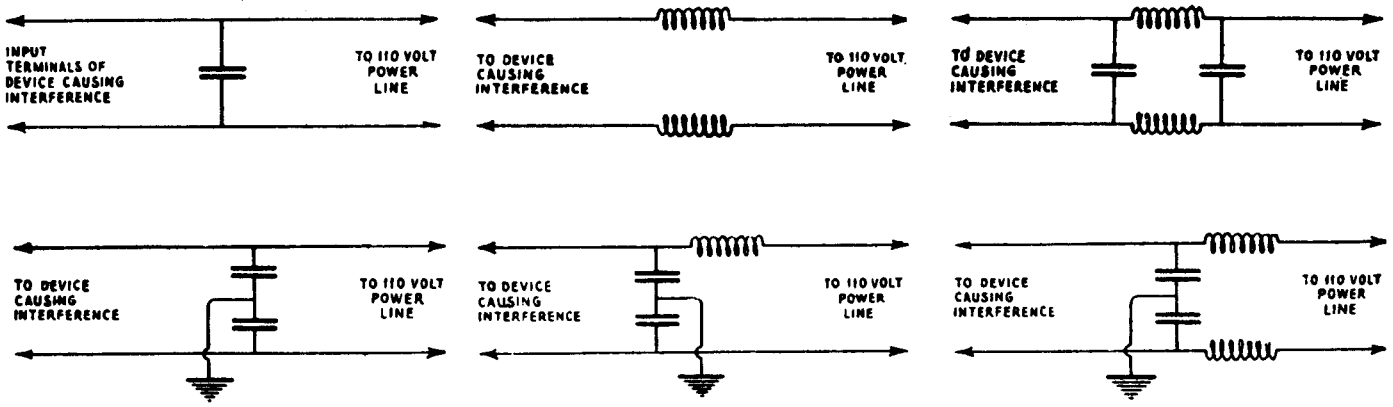


Fig. 94 - To completely filter line noises both audio and radio-frequency filters should be used.



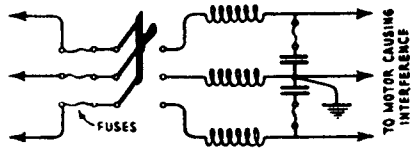


Fig. 95 - Various forms of filter arrangements. Both audio- and radio-frequency coils should be tried.

a rush order of bacon and eggs, indicate 60-cycle sparking, which may be due to a loose street lamp, or leakage in wet power lines, or loose transformer cutouts. See Fig. 93. Continuous clicking or buzzing may be due to ringing door bells or electric vibrators, or a radio station sending out code signals. Continuous semi-musical noises, that rise and fall in pitch, are caused by commutator-type motors that speed up and slow down, as in a trolley car. Short-wave sets seem to enjoy picking up the spark-plug noises from motor cars. "Super-Hets" have this habit also, as those who have operated them in motor boats know.

(6) Eliminating Man-Made Static. Various methods have been devised to eliminate man-made static; all use some form of filter system. For example, we can connect radio-frequency chokes in the line circuit supplying our set. As the name implies, these will choke out the radio-frequency currents existing in the line in the form of "wired-wireless." Then we can connect condensers across the line or between each side of the line and ground, to absorb radio-frequency currents. In addition, we must connect large iron-core chokes and large condensers in a similar fashion to the line to filter out all audio- or low-frequency impulses or surges. A complete filter of this type is illustrated in Fig. 94. Fig. 95 shows various types of filters. If the origin of the noise is definitely located, a filter should be connected there also, as indicated by the various illustrations of Fig. 97. This will block all three routes over which interference travels. Just a single 1-mf. condenser will help a lot.

A good grade of condenser should be used - one that will stand the terminal voltages of the machines being filtered. Fig. 96 shows two types, mainly employed in "B" supply systems, but suitable for filter systems also. Note that the larger one shown has a 2-mf. 5000 V. D.C. rating. The smaller one, measuring 1 1/8" square by 2" high, has a capacity of 1-mf. and will stand a working voltage of 1000 D.C. The unusually small size of this instrument explains why it is favored by many Service Men.

Various filter devices now on the market are available to the Service Man and will facilitate his work in this line. The "Filtervolt" line noise eliminators, two forms of which are shown in Fig. 98, can quickly be applied to any set.

(7) Locating Disturbances. A noisy street light, or other outside interference, may be located by the use of a simple portable regenerative set and a loop aerial. A good way is to ride around in a car with the set until the disturbance is found. The loop is directional, and will point to the direction of the disturbance. This is clearly illustrated in Fig. 99. The neighbors may think that you are looking for a lost radio program, but you will find that the search will be well worth the trouble.

(8) Natural Static. Natural static cannot as yet be eliminated or effectively reduced in any way, but the Service Man should recognize it, not to waste time trying to find trouble elsewhere when static exists. The most common source of static is the lightning discharge, and since there are some two hundred lightning discharges per minute taking place within the receiving area of a sensitive radio set, and more in the tropical regions, we hear a continuous grinding roar when we adjust our set to extreme sensitivity while tuning in a distant station. This is called "the noise level". If we could eliminate it, our receiving range would encircle the globe. Static, or "atmospherics," as it is also called, is more prevalent in the summer months, especially during local thunderstorms.

(9) Noises Originating Within the Set. The most likely sources of noise within the set are loose or poor connections in the circuit; such noise sounds for all the world like static. In addition, there are noises from microphonic tubes, weak batteries, oscillating circuits and mechanical vibration caused by the speaker or loose parts adjoining it or within its acoustical range. In the latter case there are instances when a picture on the opposite side of the room was set into vibration and chattered against the wall. Perhaps the best way to diagnose troubles from the resultant sound would be to list all the various sounds and give all the possible sources of trouble that could produce such sounds. The futility of doing this completely makes one hesitate to start. In the first place, we cannot spell all the various discordant sounds with the 26 letters available, and even if we could we couldn't pronounce them. In the second place, after investigating all the reasons given, the practical Service Man may find that the real trouble is due to a drop of solder spilled into the set by some previous Service Man - a condition that we could not possibly predict in advance. If one understands the function of each part in the set, as well as the electrical coordination of the whole ensemble, he can make a complete test of the set in the time it takes to read a printed diagnosis. Therefore, we will limit the following to the most outstanding symptoms.

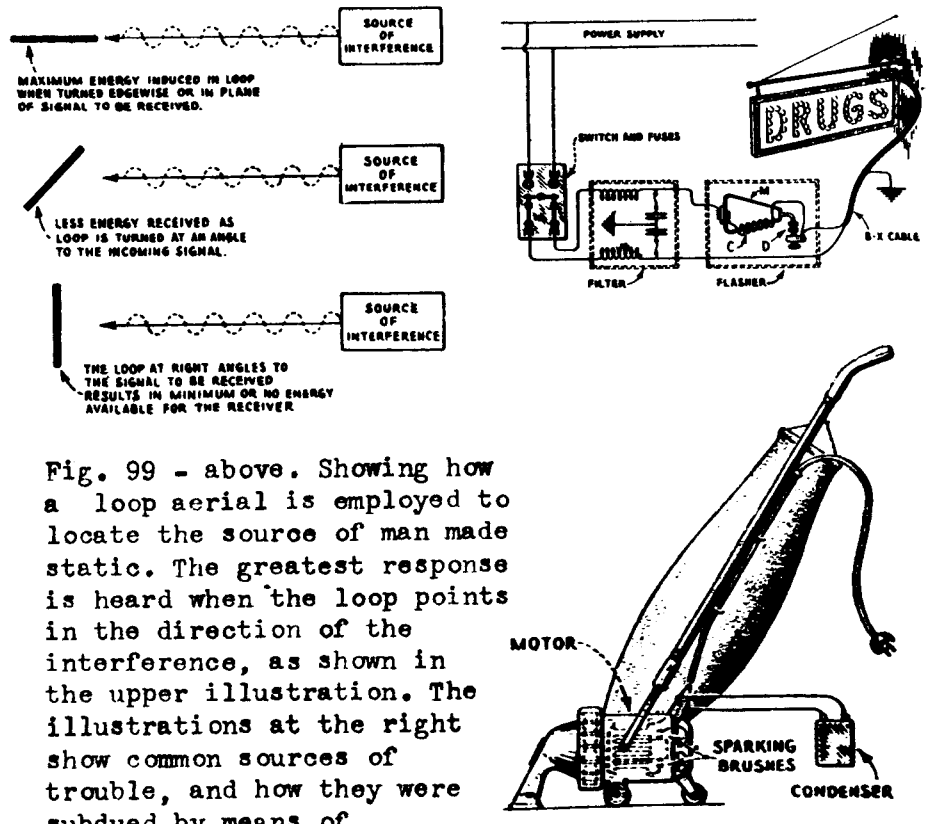


Fig. 99 - above. Showing how a loop aerial is employed to locate the source of man made static. The greatest response is heard when the loop points in the direction of the interference, as shown in the upper illustration. The illustrations at the right show common sources of trouble, and how they were subdued by means of condenser type of filter circuits. Sign flashers, as shown above, always produce noises. Worn out or old commutator type motors, are also noisy.

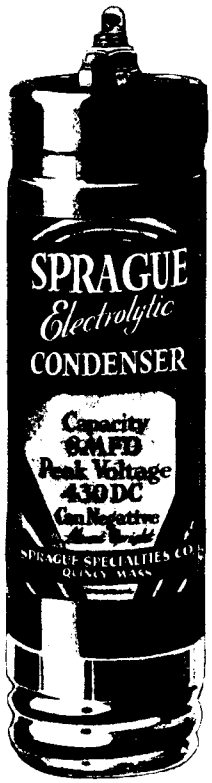


Fig. 100 - above. This illustration shows an electrolytic condenser. Its small size and large capacity make it ideal for all kinds of filters.

(10)	Dead set, no sound at all. No tube noise when jarring set, or background static hiss.	Probably due to a broken circuit or poor tubes. Examine the aerial circuit, battery or power connections and loud speaker.
(11)	Low volume.	If the volume gradually decreases when the set is turned on, examine the batteries and tubes. If the volume is unsteady, test the line-voltage . Examine the aerial for swaying and "leaks" in wet weather.
(12)	Poor selectivity.	Note the set's location with respect to local stations. Try shorter aerial, wavetrap or rebalance set in the shop.
(13)	Poor tone quality.	- Check supply voltages. Look for trouble in the speaker, or wrong "C" - bias voltages on the tubes. Examine grid leak on detector.
(14)	Sharp cracking sounds.	- Probably static, or outside line interference. If followed by set going dead, look for loose connection. Examine all soldered joints.
(15)	Squeals and howls.	- If not very loud, probably due to neighboring set. If very loud and varying in pitch while tuning, due to oscillations in set. Test by-pass condensers and adjust trimming and neutralizing condensers. Examine by-pass condensers on audio transformers.
(16)	Gradually increasing ringing sounds.	- Due to microphonic tube - probably in detector socket. Try new tube or howl arrester.
(17)	Intermittent squeaks, like sound of wagon wheel or cold, squeaky snow.	- In battery set, look for run-down storage battery or corroded connections.
(18)	A.C. Hum.	- On A.C. sets, try reversing line plug. Try connecting one side of line to set chassis through a 2- to 4-mf. condenser. Examine rectifier supplying dynamic field current. Examine filter system and A.C. wiring or leads near set. Test "C" bias resistors and voltage divider. On D.C. sets, look for open grid circuit.
(19)	Fading.	- This may be due to a natural atmospheric condition or poor aerial installation, or nearness to some other receiving set. Check line voltage for variations.
(20)	Rattling sounds.	- Probably mechanical vibrations. Tighten all parts near speaker and cabinet. Examine speaker and re-center voice coil if necessary.

(21) Fuses "blow" when turning on set. - Examine filter condensers on A.C. input and in power supply. Test rectifiers supplying dynamic field current.

(22) In describing sounds indicating radio interference, we cannot improve on those given in "Filterette," a booklet published by the Tobe Deutschmann Corporation.

(23) Whirring, crackling, buzzing, humming, droning, whining. - Indicate interference caused by electric motor; sometimes, when the motor starts and stops, the sound will start low and rise in pitch until the motor reaches full speed; when the whine will remain at a steady pitch, usually rather high. Especially true of commutator motors.

(24) Rattles, Buzzes, Machine-gun fire. - Sounds of this sort generally indicate interference caused by telephone dialing, buzzers, or door bells. It is not generally steady, but stops and starts.

(25) Violent heavy buzzing or rushing sound. - Sounds of this sort generally indicate interference caused by high-frequency apparatus. Such noises will usually be heard over a large area, a whole town, even; and often are so loud that they drown out the radio program completely.

(26) Crackling, sputtering, snapping, short buzzes or scraping. - Sounds of this sort generally indicate interference which is being caused by one or more loose connections in the set, or electrical wiring in the vicinity. Sometimes the sounds are especially noticeable when the room is jarred or shaken by footsteps, street cars or traffic.

(27) Clicking. - Sounds of this sort generally indicate interference which is being caused by some sort of make-and-break connection, such as a thermostat; especially if it comes at fairly steady intervals.

(28) Heavy violent, buzzing, usually short. - Sounds of this sort generally indicate radio interference which is being caused by arcing of a spark across a gap. This may occur as a short noise or a steady one.

(29) Steady humming. - Sounds of this sort generally indicate interference which is being caused by improperly filtered alternating current. Such humming is often a fault of your set or eliminator. Look for dynamic speakers improperly filtered; faulty construction of set or eliminator; filter condensers blown or shorted; ground on set poor; improper wiring;poor tubes; wiring parallel with power line.

CHAPTER XI

RADIO-PHONOGRAPH COMBINATIONS, SHORT-WAVE SETS, AUTOMOTIVE INSTALLATIONS.

RADIO-Phonograph Combinations. Many radio sets have phonograph combinations, and the Service Man is often called to make repairs on them. These phonograph combinations employ some kind of electromagnetic pickup device, consisting of parts similar to those in a magnetic speaker unit, except that the armature has an attachment for a phonograph needle. This rides in the groove of the record, causing the armature to vibrate, thereby inducing corresponding electrical vibrations in a coil surrounding the armature. The armature, of course, is mounted between the poles of a small permanent magnet. All that remains to do is to amplify these currents induced in the armature coil; various methods are employed. Part or all of the audio-frequency amplifier of the radio set is used to amplify these currents, the sound being reproduced by the regular loud speaker. The phonograph attachment is usually connected to the set by a plug connection; a switch on the set connects either radio or phonograph to the amplifier.

(2) Phono-Pickup Circuits. Connections of the phono-pickup circuits are included in the regular diagrams in the back of this book on the sets employing phonograph combinations. But a few words describing some of the circuits may not be amiss here. Fig. 102 shows a typical method as employed in the Stromberg Carlson "No. 654" A.C. receiver. In this set the phonograph motor is operated by the A.C. line and drives the turntable at a rate of 78 revolutions per minute; the output of the magnetic pickup is connected to a potentiometer volume control which, in turn, connects to the input transformer as shown. The secondary of the input transformer is led by means of a plug connection to the set, to the grid and filament of the detector tube, thus employing the detector as a stage of audio-frequency amplification. Arrangement for obtaining the proper "C" bias on the detector is included. In many other sets, the pickup connects to the primary winding of the first audio-frequency transformer, as shown in the diagrams of the Brunswick-Balke-Collender sets.

(3) Phonograph Motors. Special electric motors are employed for driving the turntable. In the Sonora sets a slow-speed series-wound commutator type is used; the motor armature revolves at the same speed as the turntable. A centrifugal-ball governor and brake disc maintain constant speed. It is operated by the 110V. 60-cycle line. Noises which the motor might produce in the radio set are filtered out as shown in the diagram of Fig. 103. Other types of motors run at high speed and have gear-reducing devices.

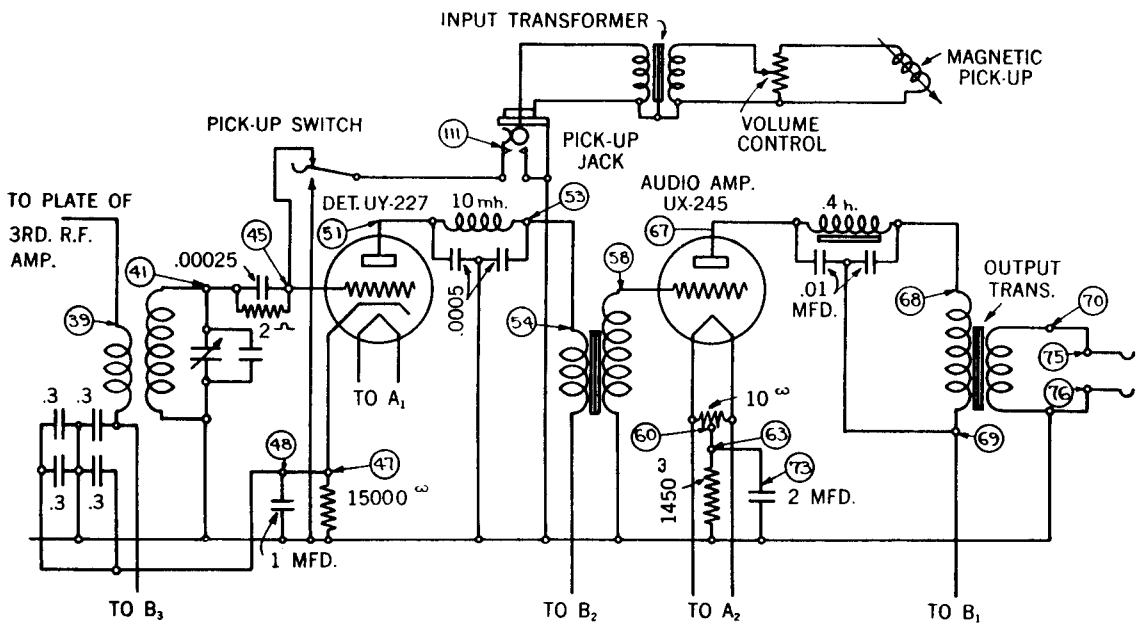


Fig. 102 - Typical circuit of a phonograph pick-up. The pick-up is shown at the upper part of the drawing. It feeds into the detector grid circuit.

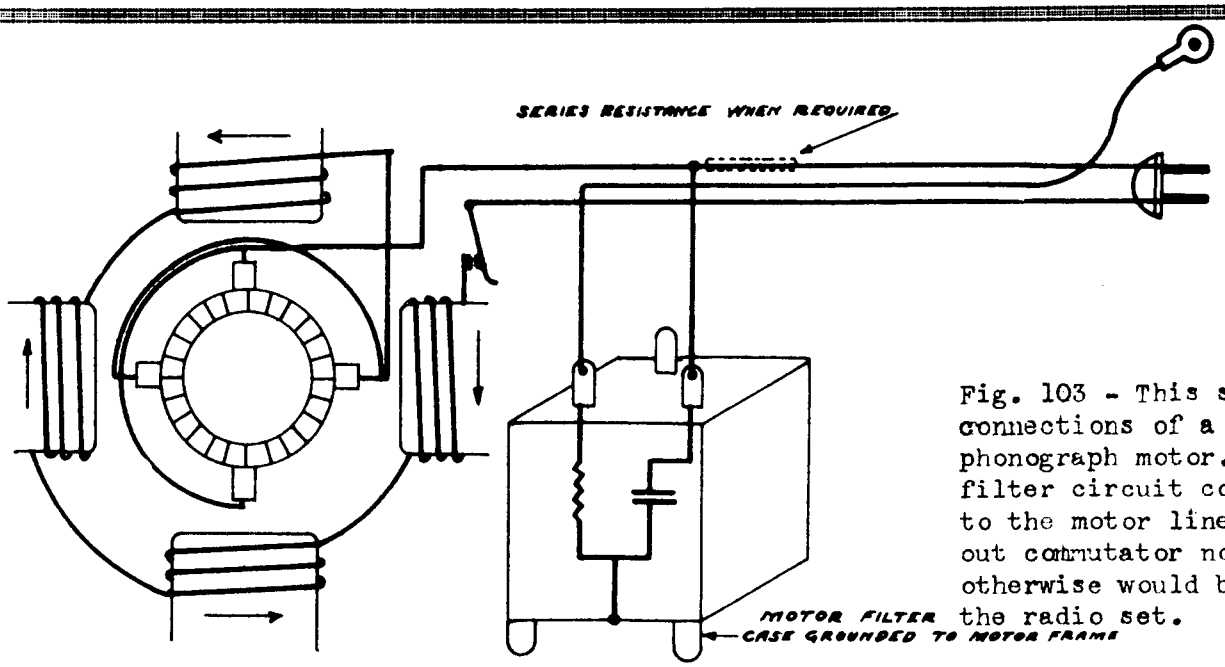


Fig. 103 - This shows the connections of a slow speed phonograph motor. Note the filter circuit connected to the motor line to filter out commutator noises which otherwise would be heard in the radio set.

TYPE 2M MOTOR

(4) Automatic Stops. Arrangements are provided to automatically stop the phonograph motors at the end of the record, by an arm projecting underneath the motor board carried by the pickup arm. This arm opens the motor circuit, at the same time applying a brake, so that the motor stops within 8 to 10 revolutions.

(5) Troubles in Radio Phonograph Combinations. One of the simplest tests of a "dead" radio is to try the phonograph combination. If this works, it shows that the audio-frequency amplifier and speaker are in good condition, and that the trouble is in the radio-frequency amplifier or aerial system. So far as electrical trouble is concerned, in the pickup device, this can easily be tested by a continuity test, as well as all the associated parts. Mechanically, the pickup should be examined and the armature adjusted and cleaned if necessary. Loose parts and dirt will cause rattles. If it is "dead," examine the plug connections to the set. Test the volume control for opens and noise, and clean if necessary. Use new steel needles only for each rendition, or Tungstone needles.

(6) Motor Troubles. The speed should be measured and adjusted by timing with a watch. The turntable should turn 39 times in 30 seconds. In case of a stalled motor, test all the electrical circuits for continuity, and also remove the turntable and try turning the shaft with the fingers to see if it binds; this test is applicable to slow speed motors that run at the same speed as the turntable. Low torque may be due to a shorted portion of some of the motor windings, or binding in the mechanical system. Examine the governor. Shorted windings also cause a loud A.C. hum and commutator sparking. Open windings also cause excessive commutator sparking. Clean the commutator with fine carborundum paper. Fluctuations in speed are probably due to the governor, or to an open or loose connection, which should be corrected. Oil all parts indicated, with a good grade of sewing-machine oil. In cases of real difficulty, it is best to take the complete phonograph equipment to the shop for a thorough overhauling, taking care to follow the explicit instructions given by the manufacturer of the apparatus.

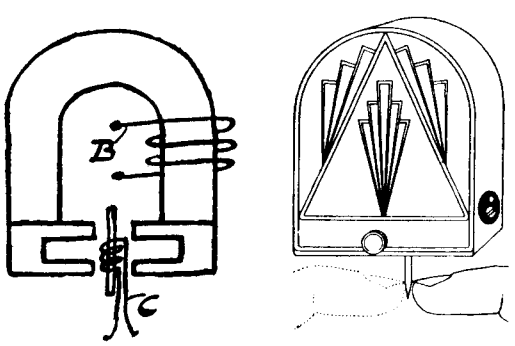


Fig. 101 - At the left is shown the magnetic and electric circuits of the Audak "tuned" phonograph pick-up. The right illustration shows the pick-up being tested for magnetic balance by tapping the needle with the finger. It can be balanced centrally by means of the thumb screw adjustment. An unbalanced condition means distorted reproduction.

SHORT-WAVE RECEIVERS.

The same general methods of testing broadcast receivers apply to short-wave receivers. There are outstanding differences in design, however, which we will briefly point out. In the first place, the short-wave receiver employs plug-in coils, so that the entire range may be covered; secondly, regeneration is used, the station usually being tuned in by the heterodyne whistle, after which the set is left on the verge of oscillating, for phone reception. Regeneration is controlled by a rotating tickler coil, a variable condenser, or a variable high resistor. A typical short-wave circuit of wide popularity is that of the Pilot "Super Wasp," illustrated in Fig. 104. This is an A.C. receiver, which required special design, as will be pointed out later. The battery-type short-wave set is more common and of simpler design. The Service Man cannot account for or explain all the vagaries of short-wave reception, but he can test the set and see that it is in working order, and trust to the elements whether Holland, Australia, or the next-door neighbor is tuned in.

(2) Troubles in Short-Wave Sets. In addition to many of the troubles encountered in broadcast sets, the short-wave set has troubles all its own. Perhaps the most common complaint is due to fading of the signals; this, however, is due to external agencies beyond the control of the Service Man. The reflection and refraction of waves by the Heaviside layer some 60 to 200 miles above the earth (depending upon the time of day) influences short waves of different frequencies differently. The waves "skip" around the earth and are apt to be heard at any place on the globe. Foreign stations roar in at certain times and locals fade away. All we can suggest is the use of three or four aerials of different lengths and locations, and switching arrangements whereby any one, or any combination, can quickly be connected for operation.

The receiver circuit shows plainly the precautions taken, to make possible high-quality reproduction of short-wave broadcasts—the newest idea in radio.

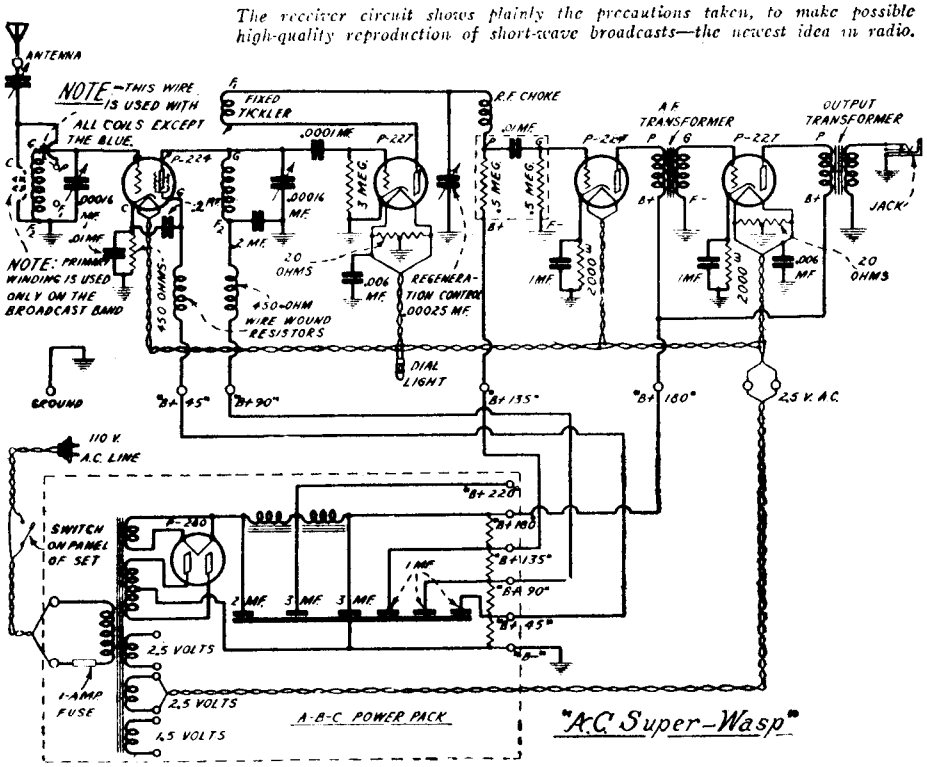
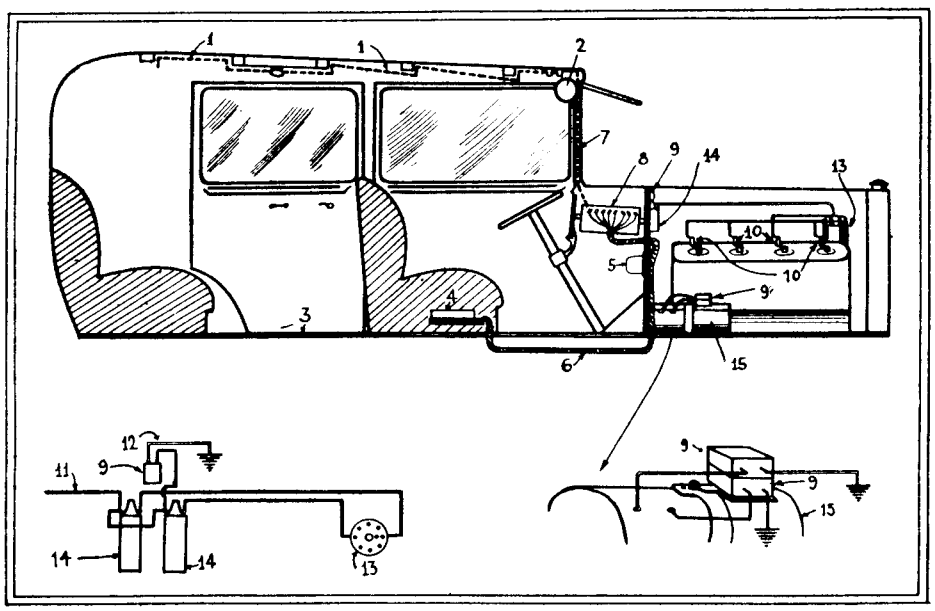


Fig. 104 - The Pilot A.C. Super Wasp.

(3) A.C.Hum. In the short-wave A.C. set shown in Fig. 104, hum was successfully eliminated by special methods. Two classes of hum were encountered; one existed with the tuning dials at any position; the other seemed to be "tuned in," like a radio station. The former was found to be due to the tube construction; the A.C. magnetic field about the filament reacted on the electron flow and hence the plate current, causing it to vibrate in unison. A special Pilot type '27 tube was subsequently developed, in which the heater filament doubled back on itself, like a hairpin, thus neutralizing its own magnetic field and eliminating this source of hum. The second type of hum was very prominent in regions between 14 and 50 meters and was found to be caused by parasitic oscillations existing in the heater-cathode combination and center-tapped resistor across the filament of the detector. These were modulated by the 60-cycle filament current, producing the hum. A .006-mf. condenser, connected across one side of this resistor, as shown, wiped them out and eliminated the hum. Other forms of troubles are similar to those in broadcast sets and need not be repeated again.

SERVICING AUTOMOTIVE RADIO

The popularity of this type of radio set makes a few words describing it necessary. While the set proper is similar to that of hundreds of other broadcast sets, certain precautions had to be taken in the design of it, to make it adaptable to the car. For example, the size of aerial and "counterpoise" (ground) is limited. The aerial must be small enough to be contained within the car; the ground is a counterpoise consisting of the metal framework of the car. With this small pick-up system, an extremely sensitive set is required. And a sensitive set of this nature is difficult to operate properly within a few feet of a noisy, sparky, high-tension, ignition system. Add to this the excessive mechanical vibrations acting on the tubes and connections and loosening them, and we have a vague idea of the troubles that had to be overcome to make automotive radio successful.



The "Transitone" installation: 1, aerial; 2, reproducer; 3, car floor; 5, output filter; 7, aerial lead; 9, interference filter condensers; 12, "ground"; 13, distributor; 14 ignition coil; 15, generator. See illustrations below.

Fig. 105 - A typical auto installation.

(2) Auto Installations. The various illustrations show typical examples of car installations. Fig.105 shows the general layout of the "Transitone" system; the set is installed under the instrument panel, the tubes being inverted. Flexible control shafts extend from the set to the control dials on the instrument board. The aerial consists of wire netting in the top of the car. The regular 6-volt car storage battery supplies the filaments, and the "B" batteries installed under the front seat supply the plate current. In limousines the magnetic reproducer is mounted above the windshield, and in open cars, below the instrument panel. The layout of the "Bosch" equipment is illustrated in Fig. 106. But the Service Man is more interested in the electrical problems than the mechanical layout.

(3) Interference Problems. A 25,000-ohm resistor is placed in series with each spark-plug lead to suppress high-frequency oscillations. See Fig. 107. A similar resistor is placed in the high-tension lead between the coil and the distributor. These have negligible effect on the action of the ignition system. In all types of ignition coils a certain amount of "kick-back" voltage is impressed on the primary winding by the high-tension side. This finds

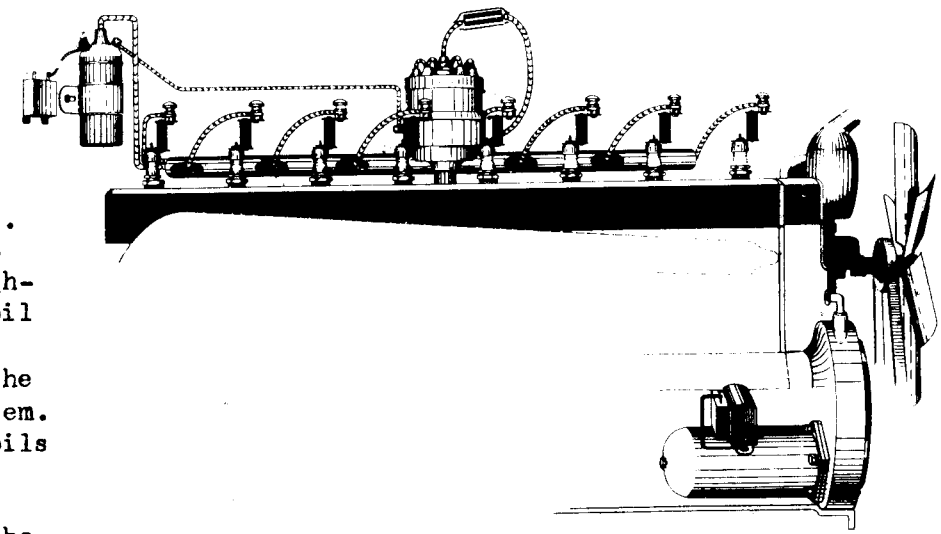


Fig. 107 - Resistors on spark plugs to reduce noise.

its way back to the storage battery and thence to the receiver, and is therefore filtered out by means of a 1-mf. condenser connected between the battery terminal of the coil and ground. If the ignition coil is mounted on the instrument board, it is necessary to shield the high-tension, and the leads going to the breaker points, at the point where they pass through the engine partition. Remember, in some cars the positive terminal of the storage battery is grounded, and in others, the negative side is grounded.

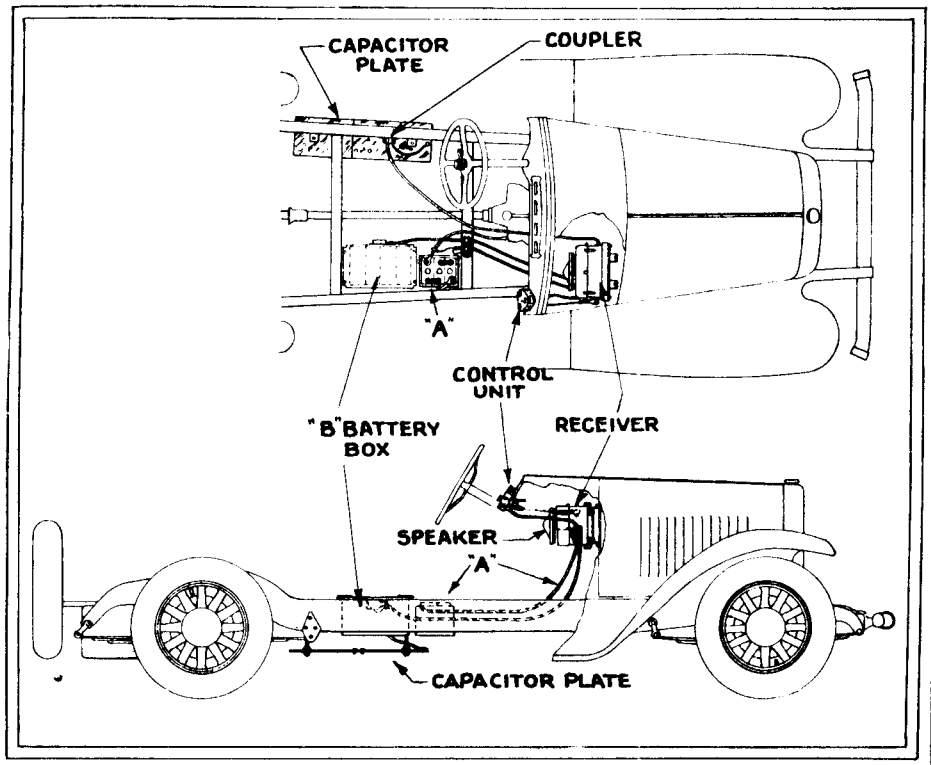
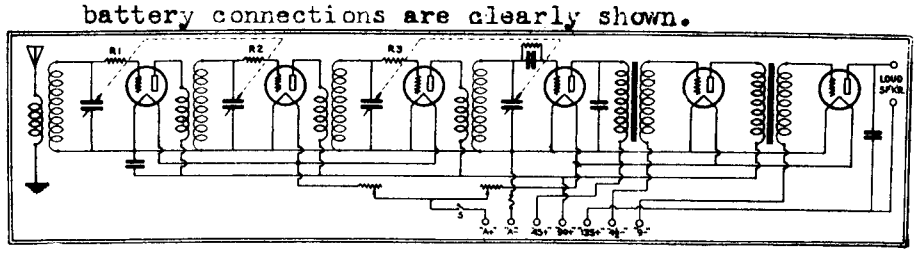


Fig. 106 - above. A typical auto installation. The battery connections are clearly shown.

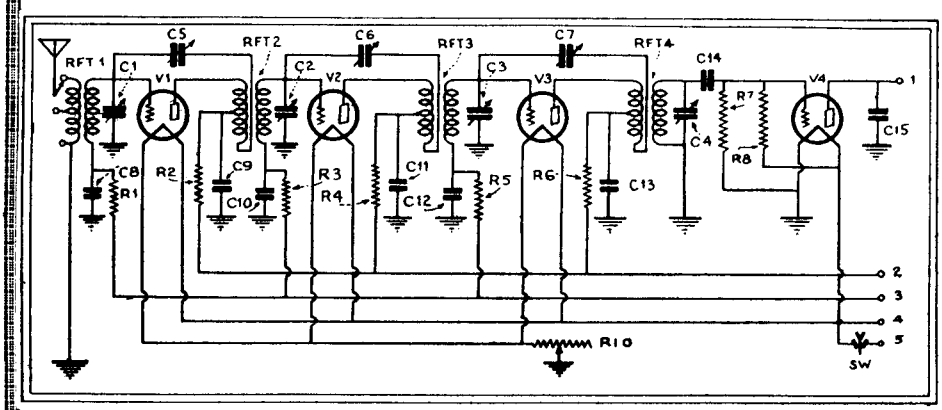
(4) Type of Circuit. In the Transitone "Model TR106 set," a schematic diagram of which is shown in Fig. 108, three stages of tuned R.F. amplification are employed, using type '01A tubes, with grid-suppressor resistances to stabilize the circuit. Two tuning-control dials are used. A "soft" (type '00) detector tube is employed, and a two-stage audio-frequency amplifier; the last or output tube being a type '12A. Trouble shooting in the set, therefore, can be in accordance with the instructions outlined elsewhere in this book.

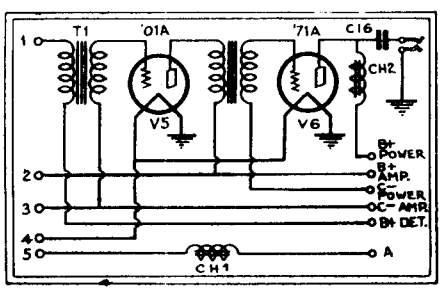


The schematic circuit of the receiver illustrated above. The switch is S, the R.F. rheostat is a panel control for volume. The grid suppressors, R1-2-3, are 500, 3,000 and 100 ohms, respectively.

Fig. 108 - Diagram of the set shown in Fig. 106.

(5) Fig. 109 shows the schematic circuit of the "NR109" set developed by the Automobile Radio Corp. The receiver and detector is in one unit (NR107) and the audio amplifier in another unit (NR108). A single-control dial is used, and the volume-control knob is mounted on the center of the dial. The output tube is a type '71A. This set is used on all Chrysler cars which are radio equipped at the factory.



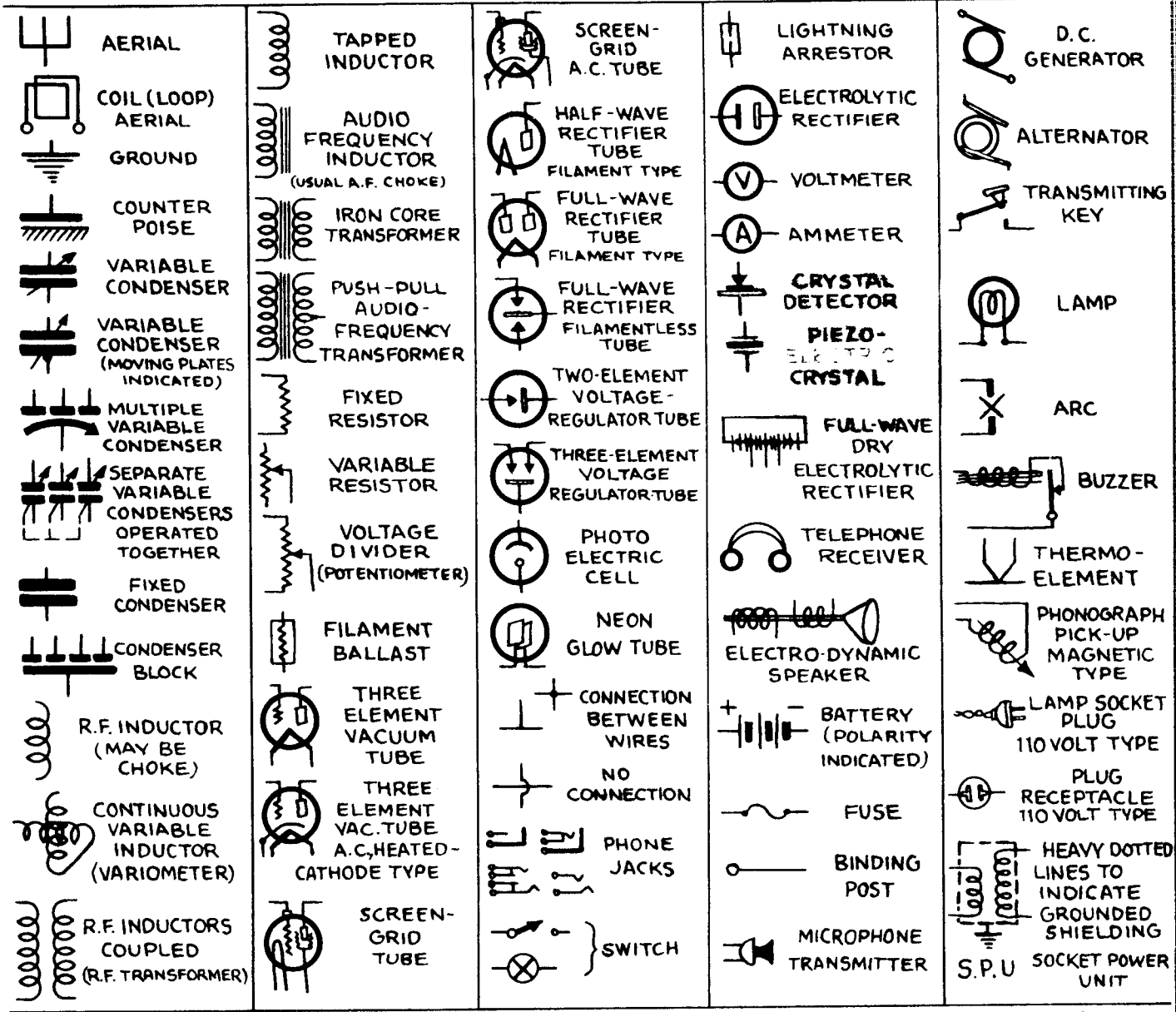


"Model NR. 107" tuning unit, left; "Model NR. 108" amplifier above. Either R7 or R8, or both, may be used. Observe resistance-capacity filters in grid and plate leads. Part values are not given.

Fig. 109 - This is a later type of circuit used in the auto installation. The circuit is neutralized and is thereby made more sensitive.

* STANDARD RADIO SYMBOLS *

In the various diagrams the parts of the sets which they represent are shown by means of symbols. While there is no standardized set of symbols in rigid use, they are



somewhat similar. Therefore, in this list are given only the ones more in general use. Since the diagrams in nearly all cases are reproduced exactly as they appear in the service manuals furnished by the manufacturers, the publishers cannot be held responsible for any damage resulting from the use of the information contained in them.

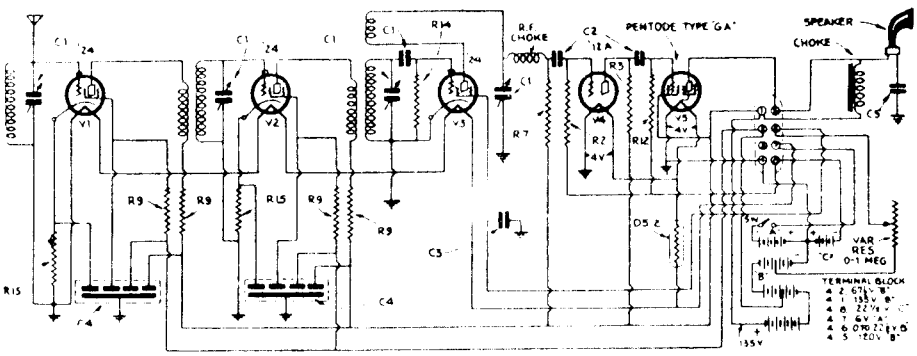
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FORMULAS FOR DETERMINING RESISTANCE VALUES AND TYPES

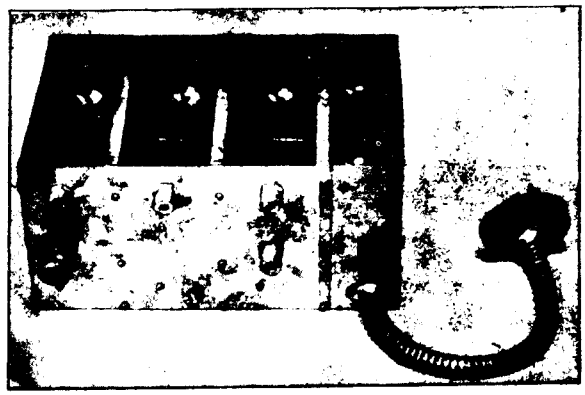
Voltage in Volts	Current in MA	Resistance in Ohms	Power in Watts
KNOWN	KNOWN	$\frac{1000 \times \text{Volts}}{\text{MA}}$	$\frac{\text{Volts} \times \text{MA}}{1000}$
KNOWN	$\frac{1000 \times \text{Volts}}{\text{Ohms}}$	KNOWN	$\frac{\text{Volts} \times \text{Volts}}{\text{Ohms}}$
KNOWN	$\frac{1000 \times \text{Watts}}{\text{Volts}}$	$\frac{\text{Volts} \times \text{Volts}}{\text{Watts}}$	KNOWN
$\frac{\text{MA} \times \text{Ohms}}{1000}$	KNOWN	KNOWN	$\frac{\text{MA} \times \text{MA} \times \text{Ohms}}{1{,}000{,}000}$
$\frac{1000 \times \text{Watts}}{\text{MA}}$	KNOWN	$\frac{1{,}000{,}000 \times \text{Watts}}{\text{MA} \times \text{MA}}$	KNOWN
$\sqrt{\text{Ohms} \times \text{Watts}}$	$1000\sqrt{\frac{\text{Watts}}{\text{Ohms}}}$	KNOWN	KNOWN

These formulas are furnished by the INTERNATIONAL RESISTANCE CO. To use, find the horizontal line in which the two known values appear and the formula for either of the two remaining values will be found in the proper column. These equasions include correction factors where necessary so that the current values may be substituted in milliamperes

A "POLICE" SHORT-WAVE SET FOR AUTOMOTIVE USE



Above the schematic circuit of the Delco "Police" short-wave receiver, showing battery and speaker connections. It will be observed that a screen-grid tube is used as a regenerative detector, the variable condensers shown here are set with a screwdriver and locked (their shafts are seen protruding through the chassis in the view at the left). R2, 1 meg. R3, 250,000 ohms; R7, 500,000; R9, 10,000; R12, 2 meg; R14, 5 meg; R15, 400 ohms.



The circuit, which is shown herewith, incorporates three '24 screen-grid tubes, which are connected in series to the car's storage battery; a first audio stage, with a '12A tube, resistance-coupled between detector and a pentode; and the latter, which serves as the output stage. This tube, which follows the description given in May RADIO-CRAFT (page 578) is here first used for the first time in a commercial receiver in America. With a filament voltage of 5, and consumption of ¼ ampere current, it has an amplification factor of 70, and a rating of 500 milliwatts undistorted output, on 135-volt plate supply. It is a product of the Arcturus Radio Tube Co.

The *minimum* operating conditions, which permit a considerable reduction of battery voltages, are given as follows (a special analyzer being used):

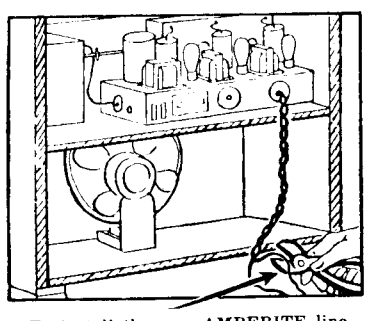
	F	P	CG	SG	PC	GT
1 R.F.	2.0	100	1.1	55	2.0	2.8
2 R.F.	1.9	100	1.1	53	2.0	2.7
Det.	1.9	18	0.0	22.5	0.23	0.24
1 A.F.	4.0	80	0.1	....	0.13	0.5
2 A.F.	4.0	135	9.0	135	7.5	6.0

(F, filament voltage; P, plate voltage; CG, control-grid voltage; SG, screen-grid voltage; PC, normal plate current in analyzer; GT, grid test reading.)

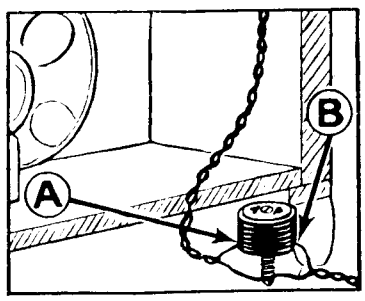
LINE VOLTAGE CONTROLS

The Service Man will encounter a wide variety of line-voltages in different localities -- ranging anywhere between 105 and 130 volts. Under such conditions it is logical to expect erratic operation of the various sets. To avoid such troubles various forms of line-voltage regulators have been produced. An automatic voltage regulator requires a certain amount of current for its operation, and for this reason many sets are designed to operate on a lower than line-voltage. The difference between this voltage and the line voltage is used up by the regulator. Directions for installing the AMPERITE line-voltage regulator are given below. To make the installation, first disconnect the set power cord from the house lighting line outlet. If the set chassis is provided with a voltage control switch or variable voltage fuse, place on the "low" voltage position. When installed the voltage supplied to the set will remain practically constant and reliable operation is assured.

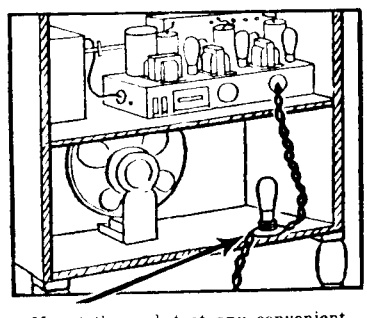
Method of Installing AMPERITE Line Voltage Control



To install the new AMPERITE line voltage control cut one lead of the power supply line or cable at any place between the set and the house socket plug.



Connect these two cut ends to the terminals of an AMPERITE socket as shown by lines "A & B" or to any standard UX tube socket. If a tube socket is used, make connections to either two opposite terminals.



Mount the socket at any convenient place inside the cabinet. Insert the proper AMPERITE Line Voltage Control tube and the receiver is ready for operation.

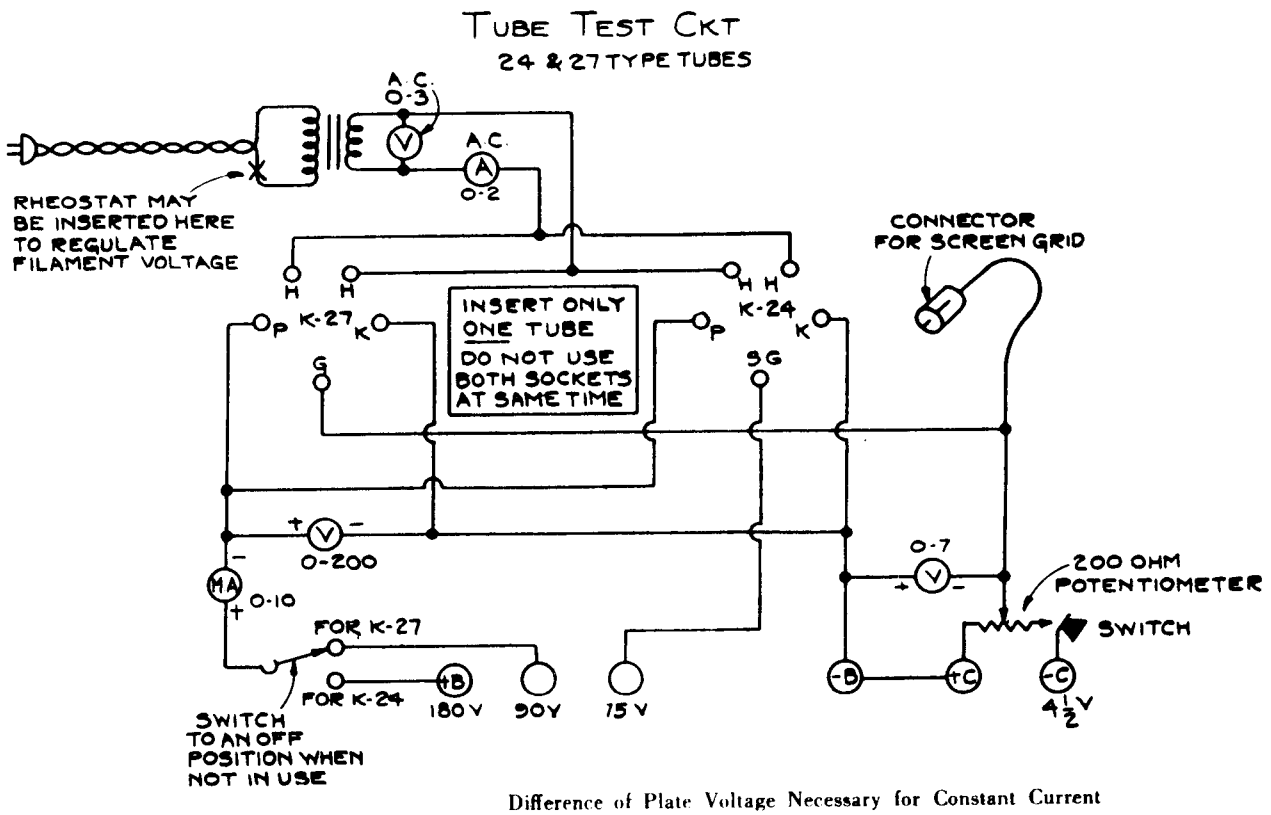
TUBE TESTING CIRCUIT

(Courtesy Kellogg Swd. & Supply Co.)

For the convenience of the service man who has no elaborate tube tester, a circuit is furnished on this page using equipment which every service man should have. A tester of this type will facilitate tube tests and may often save time in correcting trouble caused by defective or worn out tubes.

With this equipment resistors and capacitors may be tested. Resistances may be calculated from the Ohms Law formula $I = \frac{E}{R}$ or $E = IR$ or $R = \frac{E}{I}$ wherein I = current in amperes, E = voltage, R = resistance in ohms.

All measurements of D.C. voltages as indicated on charts, are to be made with a high resistance meter, 800 to 1000 ohms per volt. Lower resistance meters will not indicate as accurately and allowance should be made for slightly lower readings than specified in the tables.



$$\text{Amplification Constant or Mu} = \frac{\text{Difference of Plate Voltage Necessary for Constant Current}}{\text{Difference of Grid Voltage}}$$

$$\text{Plate Impedance or Rp} = \frac{\text{Difference of Plate Voltage}}{\text{Difference of Plate Current}}$$

$$\text{Mutual Conductance or Gm} = \frac{\text{Difference of Plate Current}}{\text{Difference of Grid Voltage}}$$

K-27 TUBES

Gm { With 4½ Volts on Grid and 90 Volts on Plate Note Plate Current
{ With 0 Volts on Grid and 90 Volts on Plate Note Plate Current

Rp { With 4½ Volts on Grid and 90 Volts on Plate Note Plate Current
{ With 4½ Volts on Grid and 75 Volts on Plate Note Plate Current

Mu With 4½ Volts on Grid and 90 Volts on Plate—Note Plate Current—Change Grid to 3 Volts—Change Plate Voltage until Plate Current Is Same as Noted Above—Note Plate Voltage

K-24 TUBES

Gm { With 1½ Volts on Grid—75 Volts on Screen Grid and 180 Volts on Plate—Note Plate Current
{ With 0 Volts on Grid—75 Volts on Screen Grid and 180 Volts on Plate—Note Plate Current

Rp { With 1½ Volts on Grid—75 Volts on Screen Grid and 180 Volts on Plate—Note Plate Current
{ With 1½ Volts on Grid—75 Volts on Screen Grid and 150 Volts on Plate—Note Plate Current

CHARACTERISTICS OF KELLOGG A.C. TUBES

	Fil. A.C. Volts	Fil. A.C. Amp.	Grid Volts	Plate Volts	Plate Current Min.	Gm	Rp	Mu
K-24	2.5	1¾	1½	180	2. M.A.	800 to 1600	400,000 W to 1½ Meg.	75 Volts on Screen Grid
K-27	2.5	1¾	4½	90		800 to 1200		8 to 10

Courtesy Weston Electrical Inst. Corp.

AIRLINE "8"—MODEL A.E.-11

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.25	100	6.0	...	...	6.0	3.5	7.5
'27	2 R.F.	2.25	100	6.0	...	...	6.0	...	...
'27	3 R.F.	2.25	100	6.0	...	...	6.0	...	...
'27	Det.	2.25	45	...	...	...	...	2.4	4.3
'27	1 A.F.	2.3	95	5.2	...	...	5.2	3.0	4.3
'71A / '45	2 A.F. / P.P.	4.7	170	43	...	...	...	15	18.5
'71A / '45	2 A.F. / P.P.	4.7	170	43	...	...	...	...	...
'80	Rect.	4.8	...	...	...	...	...	37.5 per anode	

LV—115. No Voltage Adj. Vol. Con. Max.

AIRLINE "9"—MODEL A.E.-10

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'26	1 R.F.	1.35	116	8.5	...	...	...	4.7	8.7
'26	2 R.F.	1.35	116	8.5	...	...	...	...	...
'26	3 R.F.	1.35	116	8.5	...	...	...	...	...
'26	4 R.F.	1.35	116	8.5	...	...	...	...	...
'24	Det.	2.2	80	1.3	15	...	...	...	...
'26	1 A.F.	1.4	110	1.0	...	...	...	4.0	5.0
'45	2 A.F. / P.P.	2.2	232	42	...	...	...	27	32
'45	2 A.F. / P.P.	2.2	232	42	...	...	...	...	...
'80	Rect.	4.6	...	...	...	...	...	42 per anode	

LV—117. No Voltage Adj. Vol. Con. not Critical.

AMRAD—MODEL 81

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.3	180	1.5	75	...	+2	3.4	4.7
'24	2 R.F.	2.3	180	1.5	75	...	+2	3.4	4.7
'24	3 R.F.	2.3	180	1.5	75	...	+2	3.4	4.7
'27	Det.	2.3	30	...	...	...	...	1.4	1.4
'27	1 A.F.	2.3	165	10	...	...	+2	5.5	6.8
'45	2 A.F. / P.P.	2.3	225	40	...	...	...	30	37
'45	2 A.F. / P.P.	2.3	225	40	...	...	...	30	37
'80	Rect.	4.7	...	...	...	...	...	54 Per Anode	

LV—118. LVS—120. Vol. Con. Max.

NOTE—Cathode Volts variable according to setting of Hum Control

APEX 47 & 47A

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.36	173	2.7	86	0.8	2.7	3.0	4.1
'24	2 R.F.	2.31	173	2.7	86	0.2	2.7	3.0	4.1
'27	Det.	2.28	38	0.0	...	...	0.0	2.8	3.0
'27	1 A.F.	2.28	100	6.1	...	...	6.1	3.2	3.8
'45	2 A.F. / P.P.	2.29	169	38.0	...	...	...	11.3	13.8
'45	2 A.F. / P.P.	2.29	169	38.0	...	...	...	11.3	13.8
'80	Rect.	4.61	...	...	...	...	...	34.5 per anode	

LV—115. Vol. Con. Max.

APEX 48 & 48A

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.4	181	3.4	90	0.2	3.4	4.0	5.4
'24	2 R.F.	2.4	181	3.4	90	0.2	3.4	4.0	5.4
'24	3 R.F.	2.4	181	3.4	90	0.2	3.4	4.0	5.3
'27	Det.	2.3	75	9.0	...	...	9.0	0.2	0.6
'27	1 A.F.	2.4	105	6.0	...	...	6.0	4.3	5.9
'45	2 A.F. / P.P.	2.4	187	41.0	...	...	...	12.0	15.0
'45	2 A.F. / P.P.	2.4	187	41.0	...	...	...	12.0	15.0
'80	Rect.	5.0	...	...	...	...	...	38.0 per anode	

LV—115. Vol. Con. Max.

ARCO—MODEL A

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.45	146	9.4	...	...	29	6.6	11
'27	2 R.F.	2.45	146	9.4	...	...	29	6.6	11
'27	3 R.F.	2.45	146	9.4	...	...	29	6.6	11
'27	Det.	2.45	55	2	...	...	40	3.2	4
'27	1 A.F.	2.5	140	9	...	...	29	5	6.2
'45	2 A.F. / P.P.	2.5	215	38	...	...	...	45	50
'45	2 A.F. / P.P.	2.5	215	38	...	...	...	45	50
'80	Rect.	5.5	...	...	...	...	...	55	...

LV—114. Volume Control Max.

ATWATER KENT—MODEL 55

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.25	155	3.6	84	...	+3.8	1.8	4.6
'24	2 R.F.	2.25	155	3.5	80	...	+3.8	3.1	4.5
'27	Det.	2.25	85	...	12	...	+12	4	7
'27	1 A.F.	2.25	64	1.0	1	...	+3	3.5	3.5
'45	2 A.F. / P.P.	2.35	223	42.5	...	...	...	28	30
'45	2 A.F. / P.P.	2.35	223	42.5	...	...	...	28	30
'80	Rect.	4.5	...	...	...	...	...	37	...

LV—114. Vol. Con. Max.

ATWATER KENT—MODEL 60

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.4	170	8	130	.7	+8	2.2	8.5
'24	2 R.F.	2.4	175	4	130	.8	+4	2.5	7.5
'24	3 R.F.	2.35	175	4	130	.8	+4	2.5	7.5
'27	Det.	2.35	105	12	...	...	+12	...	...
'27	1 A.F.	2.35	75	2	...	...	2	3.5	4.5
'45	2 A.F. / P.P.	2.35	250	48	...	...	...	25	37
'45	2 A.F. / P.P.	2.35	250	48	...	...	...	25	37
'80	Rect.	4.9	...	...	...	...	...	45	...

LV—120. Vol. Con. Max.

ATWATER KENT—MODEL 56

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.1	165	5.2	110	.6	+6	2.6	5.4
'24	2 R.F.	2.1	175	2.5	80	.3	+3	2.8	5.0
'24	3 R.F.	2.2	165	2.5	74	.8	+3	3.6	5.4
'27	Det.	2.2	225	23.0	...	...	+23	.6	.7
'27	1 A.F.	2.2	165	5.0	...	...	+12	5.8	6.5
'50	2 A.F. / P.P.	7.0	440	78.0*	...	...	...	35	40
'50	2 A.F. / P.P.	7.0	440	78.0*	...	...	...	35	40
'81	Rect.	7.1	...	...	...	...	...	58	...
'81	Rect.	7.1	...	...	...	...	...	58	...

LV—118. Vol. Con. Max.

* Resistors in series with grid.

ATWATER KENT—MODEL 70

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.4	170	8	130	.7	+8	2.2	8.5
'24	2 R.F.	2.4	175	4	130	.8	+4	2.5	7.5
'24	3 R.F.	2.4	175	4	130	.8	+4	2.5	7.5
'27	Det.	2.4	105	12	...	...	+12	...	...
'27	1 A.F.	2.4	75	2	...	...	+2	3.5	4.5
'45	2 A.F. / P.P.	2.4	250	48	...	...	...	3.5	37
'45	2 A.F. / P.P.	2.4	250	48	...	...	...	2.5	37
'80	Rect.	4.9	...	...	...	...	...	4.5 per anode	

LV—120. Vol. Con. Max.

BOSCH—MODEL 48

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.4	175	2.5	70	.5	3	3.0	6.0
'24	2 R.F.	2.4	175	2.5	70	.5	3	3.0	6.0
'24	3 R.F.	2.4	175	2.5	70	.5	3	3.0	6.0
'27	Det.	2.4	280	27	...	...	...	2.0	...
'45	1 A.F. / P.P.	2.4	250	45	...	...	...	30	50
'45	1 A.F. / P.P.	2.4	250	45	...	...	...	30	50
'80	Rect.	4.8	...	...	...	...	...	55	...

LV—115. LVS—115.

BOSCH—MODEL 49

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.3	170	2.4	68	.5	+3	2.8	6.0
'24	2 R.F.	2.3	170	2.4	68	6	+3	2.7	5.8
'24	3 R.F.	2.3	170	2.4	68	.6	+3	2.8	5.4
'27	Det.	2.2	285	26	...	...	...	2.1	2.2
'45	1 A.F. / P.P.	2.3	245	43	...	...	...	30	42
'45	1 A.F. / P.P.	2.3	245	43	...	...	...	30	42
'80	Rect.	...	...	...	...	...	...	...	...

LV—120. LVS—115. Vol. Con. Max.

BOSCH 54 (DIRECT CURRENT)

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.5	100	Var.	25	.5	...	1.0	2.0
'24	2 R.F.	2.5	100	1.0	25	4	...	1.0	2.0
'24	3 R.F.	2.5	100	1.0	25	4	...	1.0	2.0
'27	Det.	2.5	100	1.0	...	...	...	1.5	2.5
'27	1 A.F.	2.5	95	4.0	...	...	...	3.5	5.0
'71A / '12	2 A.F. / P.P.	5.0	110	22.5	...	...	...	12.0	24.0
'71A / '12	2 A.F. / P.P.	5.0	110	22.5	...	...	...	12.0	24.0

LV—110 DC. Vol. Con. Max.

BOSCH MOTOR CAR RADIO

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2	180	3.5	90	7	...	2.0	5.0
'24	2 R.F.	2	180	3.5	90	7	...	2.0	5.0
'24	3 R.F.	2	180	3.5	90	7	...	2.0	5.0
'27	Det.	2	50	1.0	15	1	...	...	...
'12	A.F.	4.8	165	10.5	...	...	...	6.5	9.0

Vol. Con. Max.

BRANDES—MODEL B-16

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2	80	2	...	...	+2	2.5	4
'27	2 R.F.	2	82	2	...	...	+2	2.5	3.5
'27	3 R.F.	2	83	2	...	...	+2	1.7	2
'27	Det.	2	34	...	...	...	...	.8	1
'27	1 A.F.	2	80	2	...	...	+2	1.8	2.5
'45	2 A.F. / P.P.	2.35	185	33	...	...	...	20	22.5
'45	2 A.F. / P.P.	2.35	185	33	...	...	...	20	22.5
'80	Rect.	4.7	...	...	...	...	...	48 / 48	... / ...

LV—115. Vol. Con. Max.

BREMER TULLY—MODEL 81

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.4	160	12.5	...	...	12.5	3.7	7.5
'27	2 R.F.	2.4	162	12.5	...	...	12.5	3.5	7.2
'27	3 R.F.	2.4	162	13	...	...	13	3.8	7.2
'27	Det.	2.4	45	...	...	...	...	3.8	4
'27	1 A.F.	2.5	157	7	...	...	12	6.7	8.5
'45	2 A.F. / P.P.	2.5	245	*20	...	...	...	42	50
'45	2 A.F. / P.P.	2.5	245	*20	...	...	...	42	50
'80	Rect.	5	...	...	...	...	...	35	...

LV—112. Vol. Con. Max.

NOTE—Test across speaker terminals gives actual bias, approx 50 volts

BRUNSWICK—MODEL S-14

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.6	145	3	55	65	+2	1.5	3.5
'24	2 R.F.	2.6	140	2	55	12	+2	1.5	3.5
'24	3 R.F.	2.6	138	2	55	45	+2	1.5	3.5
'24	Det.	2.65	80	2	18	.05	+2	0	.75
'27	1 A.F.	2.7	125	8	...	...	8	4	5
'45	2 A.F. / P.P.	2.5	240	...	...	...	...	33	38
'45	2 A.F. / P.P.	2.5	240	...	...	...	...	28	32
'80	Rect.	5	...	...	...	...	...	40 per anode	

LV—120. Vol. Con. Max.

BRUNSWICK—MODEL 31 COMB.

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.4	160	13	...	...	+13	3.5	6.6
'27	2 R.F.	2.4	160	14	...	...	+13	3.5	6.6
'27	3 R.F.	2.4	160	15	...	...	+14	3.5	6.7
'27	Det.	2.4	45	...	...	...	...	3.2	3.3
'27	1 A.F.	2.5	150	8	...	...	+12	3.4	4.2
'45	2 A.F. / P.P.	2.3	250	25*	...	...	...	31	35
'45	2 A.F. / P.P.	2.3	250	25*	...	...	...	31	35
'80	Rect.	5	...	...	...	...	...	42	...
105	Ballast	*							

LV—120. Vol. Con. Max.

* Resistor in series with grid.

BUCKINGHAM—MODEL 80

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'26	1 R.F.	1.25	135	8	...	...	...	6.6	11
'26	2 R.F.	1.25	135	8	...	...	...	6.6	11
'26	3 R.F.	1.25	135	8	...	...	...	6.6	11
'27	Det.	2.25	46	...	...	...	...	2.6	3.3
'26	1 A.F.	1.25	125	7.5	...	...	...	5	8.5
'71A	P.P.	4.9	205	42	...	...	...	18.2	22.5
'80	Rect.	5	...	...	...	...	...	38	...

LV—115. Vol. Con. Max.

COLIN B. KENNEDY—MODEL 10

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.1	118	7	...	...	7	4.9	9
'27	2 R.F.	2.1	118	7	...	...	7	4.9	9
'27	3 R.F.	2.1	118	7	...	...	7	4.9	9
'27	Det.	2.1	37	...	...	...	...	2.8	3.2
'27	1 A.F.	2.1	113	6.2	...	...	...	4.9	6.5
'45	2 A.F. / P.P.	2.2	210	37	...	...	...	28	32.5
'45	2 A.F. / P.P.	2.2	210	37	...	...	...	28	32.5
80	Rect.	4.6	...	...	...	...	...	55	32

LV—115. Vol. Con. Max.

Courtesy Weston Electrical Inst. Corp.

COLONIAL—MODEL 28 AC

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'26	1 R.F.	1.5	105	—3	....	....	....	7.5	....
'26	2 R.F.	1.5	105	—3	....	....	....	7.5	....
'99	Det.	3.3	30-50	+ 6	....	....	....	1.5	....
'26	1 A.F.	1.5	90	—6	....	....	....	3.8	....
'71A	2 A.F.	5.	165	37	....	....	....	17	....
B.H.	Rect.	....	....	....	....	....	....	32	....

COLONIAL—MODEL 28 DC

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'01A	1 R.F.	5	100	1.5	....	....	....	5-7	....
'01A	2 R.F.	5	100	1.5	....	....	....	5-7	....
'01A	Det.	5	60	3.0	....	....	....	.25	....
'01A	1 A.F.	5	90	3.0	....	....	....	1.5-2.5	....
'71A	2 A.F.	5	95	15	....	....	....	10	....

LV—115 D.C.

COLONIAL—MODEL 31 AC

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'26	1 R.F.	1.35	95	4.5				6	
'26	2 R.F.	1.35	95	4.5				6	
'27	Det.	2.15	30					2	
'27	1 A.F.	2.15	80	4.5				3	
'71A	{2 A.F.}	4.5	160	38				15	
71A	{P.P. }	4.5	160	38				15	
'80	Rect.	4.5						42	per anode

COLONIAL—MODEL 31 DC

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'26	1 R.F.	1.4	50	2	....	....	....	2	....
'26	2 R.F.	1.4	75	2	....	....	....	5	....
'26	3 R.F.	1.4	75	2	....	....	....	5	....
'26	Det.	1.3	40	2	....	....	....	1	....
'26	1 A.F.	1.3	70	1.5	....	....	....	2.5	....
'71A	{2 A.F.}	4.4	75	12	....	....	....	10	....
'71A	{P.P. }	4.4	75	12	....	....	....	10	....

COLONIAL—MODEL 32 AC

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.2	155	*	56	.5	+1.0	2.5	3.5
'24	2 R.F.	2.2	155	1.2	56	.5	+1.0	2.5	3.0
'24	3 R.F.	2.2	160	1.1	52	.4	+1.0	2.5	3.0
'24	Det.	2.2	88	*	9	.05	+4	....	.5
27	1 A.F.	2.2	68				+5	2.5	3
'45	{2 A.F.}	2.3	230	26				25	27
45	{P.P. }	2.3	230	36				25	27
'80	Rect.	....	....	....	....	....	....	R53	....
								L53	....

LV—117. Vol. Con. Max.

* No reading due to a resistor in series with the grid.

CROSLEY—MODEL 33-S

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.5	160	1.6	62	0.5	+2.0	2.4	3.1
'24	2 R.F.	2.5	160	1.6	62	0.5	+2.0	2.4	3.1
'27	Det.	2.5	110	17.0*	....	....	+14.0	0.2	0.4
'27	1 A.F.	2.5	105	8.0*	....	....	+11.0	3.5	4.8
'45	{2 A.F.}	2.5	240	45.0	....	....	....	33.0	37.0
'45	{P.P. }	2.5	240	45.0	....	....	....	33.0	37.0
'80	Rect.	5.0	....	....	....	....	....	55.0	per anode

LV—119. Vol. Con. Max.

* First A.F. resistance coupled.

CROSLEY—MODELS 40-S, 41-S, 42-S, 82-S

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.1	145	2.3	68	.3	+2.5	2.0	4.0
'24	2 R.F.	2.1	140	2.3	68	.3	+2.5	2.0	4.0
'24	3 R.F.	2.1	140	2.3	68	.3	+2.5	1.8	4.0
'27	Det.	2.2	90	11.0	....	....	+11.0	2	.3
'27	1 A.F.	2.1	145	4.0	....	....	+11.0	3.6	4.5
'45	{2 A.F.}	2.2	240	40	....	....	....	28	33
'45	{P.P. }	2.2	240	40	....	....	....	28	33
'80	Rect.	4.5	....	....	....	....	....	55	....

LV—117. Vol. Con. Max.

CROSLEY—MODEL 705

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.2	195	2.8	90	0.8	+4	0.8	1.2
'24	2 R.F.	2.2	195	2.8	92	0.9	+4	0.8	1.3
'27	Det.	2.3	155	23.0	....	....	+23	0.0	0.1
'71	{1 A.F.}	5.0	180	40.0				19.0	22.0
'71	{P.P. }	5.0	180	40.0				19.0	22.0
'80	Rect.	5.0						33.0	per anode

LV—119. Vol. Con. Max.

CROSLEY SHOWBOX 706

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'26	1 R.F.	1.5	160	10				6.5	10.0
'26	2 R.F.	1.5	160	10				6.5	10.0
'26	3 R.F.	1.5	160	10				6.5	10.0
'27	Det.	2.2	35	0			0	2.5	2.5
'26	1 A.F.	1.5	160	9				4.5	5.5
'71	{2 A.F.}	5.0	185	38				20.0	24.0
'71	{P.P. }	5.0	185	39				18.0	22.0
'80	Rect.	5.0						38.0	per anode

LV—119. Vol. Con. Max.

DAY FAN—PECK & HILL 5090

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'26	1 R.F.	1.4	108	5	....	....	....	5.0	11
'26	2 R.F.	1.4	108	5	....	....	....	5.0	11
'26	3 R.F.	1.4	108	5	....	....	....	5.0	11
'26	4 R.F.	1.4	108	5	....	....	....	5.0	11
'27	Det.	2.05	20	....	....	....	44	7	....
'26	1 A.F.	1.35	98	5.5	....	....	....	3.2	6.5
'71A	{2 A.F.}	4.8	165	29	....	....	....	16	19.5
'71A	{P.P. }	4.8	165	29	....	....	....	16	19.5
'80	Rect.	4.2	....	....	....	....	....	40	per anode

LV—110. LVS—115. Vol. Con. Max.

DAY FAN—66-68- 69-77
MODEL—PECK & HILL 5096

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'26	1 R.F.	1.3	150	9	....	....	....	4.5	8
'26	2 R.F.	1.3	150	9	....	....	....	4.5	8
'26	3 R.F.	1.3	150	9	....	....	....	4.5	8
'26	4 R.F.	1.3	150	9	....	....	....	4.5	8
'27	Det.	2.2	30	....	....	....	—9	1.7	....
'26	1 A.F.	1.3	130	5	....	....	....	4.5	7.5
'45	{2 A.F.}	2.25	235	*7	....	....	....	27.5	32.0
'45	{P.P. }	2.25	235	*7	....	....	....	27.5	32.0
'80	Rect.	4.5	....	....	....	....	....	40	per anode

LV—110. LVS—None Vol. Con. Max.

* Resistor in series with grid on '45 tubes.

EDISON LIGHT-O-MATIC
MODELS R-4, R-5 AND C-4

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.4	114	6	....	....	+6	5.6	8.2
'27	2 R.F.	2.4	114	6	....	....	+6	5.6	10.0
'27	3 R.F.	2.4	114	6	....	....	+6	6.2	10.5
'27	Det.	2.15	28	....	....	....	....	2.0	....
'27	1 A.F.	2.4	112	6.5	....	....	+7	3.7	5.0
'45	{2 A.F.}	2.35	250	46	....	....	....	27.5	32.0
'45	{P.P. }	2.35	250	46	....	....	....	27.5	32.0
'80	Rect.	4.9	....	....	....	....	....	{50 / 50	....

LV—105. LVS—105. Vol. Con. Max.

ERLA MODELS 30, 31, 32, AR-3
CABLE AND SKY ROVER—MODEL 224

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.25	170	1.75	85	2	2	3.0	4.4
'24	2 R.F.	2.25	170	1.75	85	2	2	3.0	4.5
'24	3 R.F.	2.25	170	1.75	85	2	2	3.0	4.5
'27	Det.	2.25	90	12.0	....	....	+12	0.5	0.5
'27	1 A.F.	2.25	105	7.0	....	....	+5.5	5.0	6.5
'45	{2 A.F.}	2.4	250	22.5	....	....	....	30.0	35.0
'45	{P.P. }	2.4	250	22.5	....	....	....	30.0	35.0
'80	Rect.	4.8	....	....	....	....	....	37.0	per anode

LV—110. LVS—95-115. Vol. Con. Max.

EVER READY SERIES 30

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.4	110	7	....	....	+7	5	10
'27	2 R.F.	2.4	110	7	....	....	+7	5	10
'27	3 R.F.	2.4	110	7	....	....	+7	5	10
'27	Det.	2.4	45	....	....	....	....	4	4.1
'27	1 A.F.	2.4	105	6	....	....	+6	3.5	5
'71	{2 A.F.}	5.2	172	40	....	....	....	19	22.5
'71	{P.P. }	5.2	172	40	....	....	....	20	22.5
80	Rect.	5.0	....	....	....	....	....	45	per anode

LV—117. LVS—115.

EVER READY SERIES 40—MODEL 42-43-44

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.18	95	6	....	....	+6	3.2	8.1
'27	2 R.F.	2.18	94	6	....	....	+6	3.2	8
'27	3 R.F.	2.15	92	6	....	....	+6	3.2	8
'27	Det.	2.15	40	....	....	....	....	2.8	3.0
'27	1 A.F.	2.15	89	5.5	....	....	+5.5	3.5	5
'45	{2 A.F.}	2.35	245	49	....	....	....	32	35
'45	{P.P. }	2.35	245	49	....	....	....	32	35
'80	Rect.	4.9	....	....	....	....	....	90	per anode

LV—117. LVS—115.

EVER READY SERIES 50—MODEL 52-53-54

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.1	145	2.8	60	.4	+1	1	1.6
'24	2 R.F.	2.1	144	2.6	60	.4	+1	1	1.5
'24	3 R.F.	2.1	144	2.6	60	.4	+1	1	1.5
'27	Det.	2.1	70	*	....	....	+5	.5	.7
'27	Res. Amp.	2.1	130	*1	....	....	+11	3.8	4.9
'45	{2 A.F.}	2.15	205	40	....	....	....	22	26
'45	{P.P. }	2.15	205	40	....	....	....	22	26
'80	Rect.	4.4	....	....	....	....	....	45	per anode

LV—109. LVS—105.

* Resistance Coupling.

Resistance in series with grid.

FADA—MODEL 15-M

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.2	112	.9	40	.4	—27	.2	.5
'27	2 R.F.	2.1	110	4.0	....	....	—25	1.1	2.0
'27	3 R.F.	2.2	110	4.0	....	....	—24	1.1	2.0
'27	Det.	2.2	75	....	—	....	....	4	.5
'27	1 A.F.	2.1	95	5.0	....	....	—24	6	1.0
'45	{2 A.F.}	2.1	150	25.0	....	....	....	20.0	25.0
'45	{P.P. }	2.1	150	25.0	....	....	....	20.0	25.0
'80	Rect. *	4.6	....	....	....	....	....	32.0	....

LV—117. LVS—High Vol. Con. Max.

FADA 25 (7 MA CHASSIS)

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.2	160	1.7	55	4	+2	0.5	0.7
'27	2 R.F.	2.2	140	5.0	....	....	+15	1.4	2.1
'27	3 R.F.	2.2	145	5.0	....	....	+16	1.1	2.0
'27	Det.	2.3	50	1.0	....	....	....	0.7	0.8
'27	1 A.F.	2.2	135	8.0	....	....	+9	1.4	1.8
45	{2 A.F.}	2.3	215	40.0	....	....	....	25.0	30.0
45	{P.P. }	2.3	215	40.0	....	....	....	25.0	30.0
'80	Rect.	4.8	....	....	....	....	....	37.0	per anode

LV—117. LVS—Hi Vol. Con. Max.

FADA—MODEL 35 OR 35Z

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.1	161	1.7	79	5	—46	3	4.6
'24	2 R.F.	2.1	160	1.7	78	5	—45	1.9	3
'27	Det.	2.1	75	9.0	....	....	+ 9	1	1.0
'27	1 A.F.	2.1	145	6.0	....	....	—36	4.0	9.5
45	{2 A.F.}	2.1	210	41	....	....	....	24.5	30
45	{P.P. }	2.1	210	41	....	....	....	25.0	32
'80	Rect.	7	....	....	....	....	....	95	....

LV—116. High Tap Vol. Con. Max.

FADA 40

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.1	162	3.3	65	0.3	—45	1.8	2.0
'24	2 R.F.	2.1	170	3.3	70	0.3	—45	2.0	2.4
'24	3 R.F.	2.1	165	5.0	97	0.4	—40	2.0	2.4
'27	Det.	2.2	75	12.0	....	....	+12	0.5	0.5
'27	1 A.F.	2.1	160	2.0*	....	....	—36	3.5	4.5
'45	P.P.	2.2	225	46.0	....	....	....	25.0	27.0
'45	P.P.	2.2	225	46.0	....	....	....	27.0	29.0
80	Rect.	4.8	....	....	....	....	....	67.0	per anode

LV—110. LVS—High Vol. Con. Max.

First A.F. resistance coupled.

Courtesy Weston Electrical Inst. Corp.

FADA—MODELS 41, 42, 44, 46 and 47. (KA CHASSIS)

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
24	1 R F	2.2	140	2	80	8		2.5	4.8
24	2 R F	2.2	140	2	80	8		2.5	4.8
24	3 R F	2.2	140	2	80	8		2.6	4.6
27	Det.	2.2	24				F2	4	5
27	1 A F	2.2	130	*5				4.6	7.7
45	{2 A F	2.2	225	42				30	35
45	{P P	2.2	225	42				30	35
80	Rect	4.5						40 per anode	
27	Vol. Con	2.2	0	2.5			−1.0		

LV—115 Vol. Con. Max.

Resistance in grid circuit

FADA—MODELS 75-77

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
24	1 R F.	2.3	160	1.4	25	1.2	+1.5	.6	1.5
24	2 R F.	2.3	160	1.4	25	.1	+1.5	.4	1.0
24	3 R F	2.2	160	1.4	25	.1	+1.5	.4	1.1
27	Det.	2.2	70	8.0	....	....	+8.0	.1	1.1
27	1 A F	2.2	145	8.0	....	....	+11	3.6	4.5
10	{2 A F	6.6	400	29.0	....	....	....	24.8	28
10	{P P	6.6	400	29.0	....	....	....	24.8	28
81	Rect	6.7	....	....	....	....	....	63	....

LV—117. LVS—High. Vol. Con. Max.

FREED—MODEL 55 EARL—MODEL 22

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
26	1 R F	1.4	82	5.5	....	....	....	4.2	8.7
26	2 R F	1.4	82	5.5	....	....	....	4.2	8.7
26	3 R F	1.4	82	5.5	....	....	....	4.2	8.7
27	Det.	1.9	18	.....	....	....	....	1.3	2.5
27	1 A F	1.9	78	4.8	....	....	+4.8	2.8	4.0
71	{2 A F	4.8	130	27.0	....	....	....	13.8	18.0
71	{P P	4.8	130	27.0	....	....	....	13.8	18.0
80	Rect	4.9	.....	....	....	....	....	22.5	

LV—115 Vol. Con. Max.

FREED—MODEL 78-79 DC EARL—MODEL 31-32 DC

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
01A	1 R F	4.6	75	4.5				4.3	7.9
01A	2 R F	4.4	70	4.3				4.9	7.3
02A	3 R F	4.15	70					5.7	7.0
01A	Det.	4.6	39	5.0				1.9	3.9
01A	1 A F	4.45	78	4.0				1.9	3.5
71A	{2 A F	4.3	78	13.0				8.9	13.0
71A	{P P	4.3	73	17.0				2.5	6.0
71A	{2 A F	4.6	85	13.0				10.5	15.6
71A	{P P	4.5	80	17.0				4.2	8.0

LV—105—DC

FREED—MODEL 78-79 EARL—MODEL 31-32

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
27	1 R.F.	2.35	89	5.8	....	....	+5.8	3.5	7.2
27	2 R.F.	2.35	84	5.0	....	....	+5	3.2	7.0
27	3 R.F.	2.35	84	5.0	....	....	+5	3.2	7.0
27	Det.	2.28	22	....	....	....	....	1.0	1.2
27	1 A.F.	2.28	85	5.5	....	....	+5.5	3.5	4.8
45	{2 A.F.	2.3	190	35.0	....	....	....	25.0	28.0
45	{P.P.	2.3	190	35.0	....	....	....	25.0	28.0
80	Rect.	4.7	.....	....	....	....	....	34.0	

LV—114.0. High Tap. Vol. Con Max

FREED—MODEL 95 EARL—MODEL 41

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
27	1 R F	2.25	80	5.0	....	....	+5.0	3.5	7.5
27	2 R F	2.25	80	5.0	....	....	+5.0	3.5	7.5
27	3 R F	2.25	80	5.0	....	....	+5.0	3.5	7.5
27	4 R F	2.25	80	5.0	....	....	+5.0	3.5	7.5
27	Det.	2.25	20	....	....	....	....	1.0	1.0
27	1 A F	2.28	75	5.0	....	....	+5.0	2.7	4.0
45	{2 A F	2.3	197	37.0	....	....	....	26.0	32.0
45	{P P	2.3	197	37.0	....	....	....	26.0	32.0
80	Rect.	4.7	....	....	....	....	....	35.0	

LV—114 High Tap Vol Con Max

GENERAL ELECTRIC—MODEL H-31

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
24	R F	2.2	240	2.2	80	5	34	3.2	
27	Osc.	2.2	60				22	6.5	
27	1 Det.	2.2	250	9.5	75	5	25	0.25	
24	1 I F	2.2	240	2.2	78	5	34	4.0	
24	2 I F	2.2	240	4.2	78		31.5	1.6	
27	2 Det	2.2	212	22			12	0.25	
45	{A F	2.2	200	*19				25	
45	{P P	2.2	200	*19				25	

Vol. Con Max

*Resistance in Grid Circuit.

GENERAL MOTORS RADIO CORP. MODEL "A"

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
24	1 R F.	2.2	140	3.0	64	0.3	+3	2.0	4.0
24	2 R F.	2.2	140	3.0	64	0.3	+3	2.0	4.0
24	3 R F.	2.2	140	3.0	64	0.3	+3	2.0	4.0
27	Det.	2.2	100	15.0	....	....	+15	0.2	0.5
27	1 A F.	2.3	145	2.0	....	....	+8	4.0	6.0
45	{2 A F	2.3	235	20.0*	....	....	....	30.0	35.0
45	{P P	2.3	235	20.0*	....	....	....	30.0	35.0
80	Rect.	4.5	....	....	....	....	....	55.0 per anode	

LV—118 LVS—120. Vol. Con. Max.

* Resistance in grid circuit.

GRAYBAR—MODEL 311

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
26	1 R.F.	1.4	127	8	....	....	....	5.5	14
26	2 R.F.	1.45	126	8.5	....	....	....	5	15
26	3 R.F.	1.45	126	8.5	....	....	....	5	15
27	Det.	2.1	26	....	....	....	....	1.5	1.5
26	1 A F	1.4	121	8	....	....	....	4.5	11.5
71A	2 A F	4.7	135	29	....	....	....	17.5	22
80	Rect.	4.7	....	....	....	....	....	....	....

LV—117. Vol. Con. Max

GRAYBAR—MODEL 500

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
24	1 R.F.	2.15	155	1.2	40	.2	+1	1	2
24	2 R.F.	2.15	155	1.2	40	.1	+1	1	2
24	Det.	2.15	155	4.5	59	4	+8	.5	2.5
45	A.F.	2.25	220	5*	....	....	....	30	32
80	Rect.	4.6	....	....	....	....	....	{28 / 28	

LV—114. High Tap. Vol. Con Max.

*NOTE—This is not the true bias voltage, but the reading obtained at the socket due to series resistance

GREBE SUPER SYNCHROPHASE SK4

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
24	1 R F	2.4	155	2	38	5	....	2.8	3.2
24	2 R F	2.4	150	2	38	5	....	2.8	3.0
24	3 R F	2.4	150	2	38	5	....	2.8	3.5
27	Det.	2.4	180	....	....	....	....	.5	1.4
45	{1 A F	2.4	225	*	....	....	....	37	42
45	{P P	2.4	225	*	....	....	....	37	42
80	Rect.	4.9	....	....	....	....	....	50 per anode	

LV—116.

* No bias reading at socket due to resistance in series with grid. Bias can be read with voltmeter lead connected between filament and chassis

GULBRANSEN MODEL C

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
26	1 R F	1.3	115	8	....	....	....	3.5	7.0
26	2 R F	1.3	120	8	....	....	....	4.0	8.0
26	3 R F	1.4	125	8	....	....	....	4.5	8.5
26	4 R F	1.25	125	8	....	....	....	4.5	8.5
24	Det.	2.2	85	....	17.5	....	....	0.2	0.5
26	1 A F	1.4	80	8	....	....	....	2.5	3.5
45	{2 A F	2.25	220	40	....	....	....	30.0	34.0
45	{P P	2.25	220	40	....	....	....	30.0	34.0
80	Rect.	4.5	....	....	....	....	....	40.0 per anode	

LV—114 Vol. Con. Max.

KELLOGG—MODEL 523

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
24	1 R F	2.5	160	4	43	5	+3	1.5	3.0
24	2 R F	2.5	150	3	43	5	+3	1.4	3.0
24	3 R F	2.5	150	3	43	5	+2	1.5	3.0
27	Det.	2.5	135	13.0			+13	1.2	1.4
27	1 A F	2.5	135	8.0			+8	4.4	5.7
45	{2 A F	2.5	230	45				33	38
45	{P P	2.5	230	45				33	38
80	Rect.	4.8						53	

LV—118. Vol. Con. Max

KELLOGG—MODELS 524, 525

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
24	1 R F.	2.4	155	.2	47	.7	+2	1.6	3.5
24	2 R F.	2.4	155	.2	47	.7	+2	1.6	3.5
24	3 R F.	2.4	155	.2	45	6	+2	1.6	3.2
27	Det.	2.4	180	17.0	....	....	+17	1.6	2.0
27	1 A F	2.4	175	11.0	....	....	+11	5.7	7.0
50	{2 A F	7.5	450	94.0	....	....	....	24	27
50	{P P	7.5	450	94.0	....	....	....	24	27
81	Rect	7.4	.....	....	....	....	....	65	....
81	Rect	7.4	.....	....	....	....	....	65	....

LV—118. Vol. Con. Max.

KELLOGG—MODELS 528 (25 CYCLES)

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
24	1 R.F.	2.4	155	.2	47	.7	+2	1.6	3.5
24	2 R.F.	2.4	155	.2	47	.7	+2	1.6	3.5
24	3 R.F.	2.4	155	.2	45	6	+2	1.6	3.2
27	Det.	2.4	180	17.0	....	....	+17	1.6	2.0
27	1 A.F.	2.4	175	11.0	....	....	+11	5.7	7.0
50	{2 A.F.	7.5	450	94.0	....	....	....	24.0	27.0
50	{P.P.	7.5	450	94.0	....	....	....	24.0	27.0
81	Rect.	7.4	.....	....	....	....	....	65	....
81	Rect.	7.4	.....	....	....	....	....	65	....

LV—118 Vol. Con. Max.

KENNEDY—MODEL 20

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
24	1 R F	2.3	170	3	60	2	3	8	1.5
24	2 R F	2.3	170	3	60	4	3	1.4	1.5
24	3 R F	2.3	170	3	60	5	3	2.2	2.5
27	Det.	2.3	80	10			10	1.0	1.1
27	1 A F	2.3	145	10			10	7.2	10
45	{2 A F	2.3	240	45				34	38
45	{P P	2.3	240	45				34	38
80	Rect.	4.8						54 per anode	

LV—115.

KOLSTER—MODELS K-20, K-22

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
26	1 R.F.	1.4	90	6	....	....	....	4.3	6.1
26	2 R.F.	1.4	88	6	....	....	....	4.2	5.8
26	3 R.F.	1.4	90	6	....	....	....	4.4	6.0
27	Det.	2.1	45	....	....	....	−9	1.2	1.8
26	1 A.F.	1.3	90	5.8	....	....	....	4.1	6.2
71	2 A.F.	4.8	185	43	....	....	....	18.3	22.8
80	Rect.	4.9	....	....	....	....	....	42 per anode	

LV—117. LVS—120 Vol. Con. Max.

KOLSTER—MODELS K-21 and K-23

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
26	1 R F	1.4	90	2.5	....	....	....	4.2	6.1
26	2 R F	1.4	90	2.6	....	....	....	4.1	6.2
26	3 R F	1.3	91	2.6	....	....	....	4.3	6.1
26	4 R F	1.4	90	2.5	....	....	....	4.2	6.1
27	Det.	2.1	35	....	....	....	−6	1.0	1.2
26	1 A F	1.4	95	2.5	....	....	....	4.5	6.0
71	2 A F	4.8	185	43	....	....	....	21	26
80	Rect.	4.8	....	....	....	....	....	48 per anode	

LV—117 LVS—120 Vol. Con. Max.

KOLSTER—MODEL K-43

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
24	1 R F	2.2	108	1.7	42	.3	+2	.7	2
24	2 R F	2.2	118	1.7	42	.3	+2	.7	2
24	3 R F	2.2	120	1.7	42	.3	+2	.7	2
27	Det.	2.2	35	....	....	....	....	1.5	....
27	1 A F	2.2	108	3	....	....	+8	2.5	3.5
45	{2 A F	2.25	188	33	....	....	....	17	20
45	{P P	2.25	188	33	....	....	....	17	20
80	Rect.	4.7	.....	....	....	....	....	{48 / 48	....

LV—115. Vol. Con. Max.

KOLSTER—MODEL K-44

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
24	1 R.F.	2.2	138	1.5	48	.2	+2	1.5	2.5
24	2 R.F.	2.2	138	1.5	48	.2	+2	1.5	2.5
24	3 R.F.	2.2	135	1.5	48	.2	+2	1.5	2.5
27	Det.	2.2	125	11	....	....	+11	.5	3
27	1 A.F.	2.35	120	3	....	....	+9.5	3.5	4.5
45	{2 A.F.	2.49	260	47	....	....	....	30	35
45	{P.P.	2.49	260	47	....	....	....	30	35
81	Rect.	7.2	.....	....	....	....	....	{70 / 70	....

LV—115 LVS—110-120 Vol. Con. Max.

Courtesy Weston Electrical Inst. Corp.

KOLSTER—MODEL 45

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	1.9	110	1.1	35	.3	+1.0	.8	1.6
'24	2 R.F.	2.0	110	1.1	36	.4	+1.0	.6	1.3
'24	3 R.F.	2.1	112	1.1	36	.2	+1.0	.6	1.2
'27	Det.	2.1	100	9.0	...	...	+9.0	8	2.9
'27	1 A.F.	2.2	100	2.5	...	...	+7.5	2.6	3.5
'27	{2 A.F.}	2.2	100	7.5	....	....	+8.0	2.5	4.4
'27	{P.P. }	2.2	100	7.5	....	....	+8.0	2.5	4.4
'30	{3 A.F.}	7.1	375	64.0	...	...	....	56.0	62.0
'30	{P.P. }	7.1	375	64.0	...	...	....	56.0	62.0
'81	Rect.	7.0	....	....	....	....	....	85.0	....
'81	Rect.	7.0	....	....	....	....	....	85.0	....

LAUTER A—DAY FAN 5096

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'26	1 R.F.	1.3	150	9	...	...	...	4.5	8
'26	2 R.F.	1.3	150	9	...	...	...	4.5	8
'26	3 R.F.	1.3	150	9	...	...	...	4.5	8
'26	4 R.F.	1.3	150	9	...	...	...	4.5	8
'27	Det.	2.2	30	...	....	...	—9	1.7	1.7
'26	1 A.F.	1.3	130	9	....	....	...	4.5	7.5
45	{2 A.F.}	2.2	235	7*	....	....	...	27.5	32.0
45	{P.P. }	2.2	235	7*	....	....	...	27.5	32.0
80	Rect.	4.5	...	...	...	...	...	40	per anode

LV—115 Vol. Con. Max

*Resistor in series with grid

LYRIC—D-11, D-19, D-29, D-39, D-69

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.2	110	1.4	64	.8	+1.2	2.5	3.5
'24	2 R.F.	2.2	110	1.4	64	.8	+1.2	2.5	3.5
'24	Det.	2.2	50	2	8	1	+2.0	0.1	0.3
'27	1 A.F.	2.2	95	31			+6.0	3.0	5.6
45	{2 A.F.}	2.2	220	40				25	30
45	{P.P. }	2.2	220	40				25	30
80	Rect.	4.5						40	per anode

LV—118 LVS—110 Vol. Con. Max

Resistance in Grid Circuit

LYRIC—MODEL 90

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.3	100	7			7	4.0	7.5
'27	2 R.F.	2.3	100	7			7	1	7.5
'27	3 R.F.	2.3	100	6			6	4.5	8
'27	4 R.F.	2.3	100	6			6	4.3	8
'27	Det.	2.3	95					1.5	1.7
'27	{1 A.F.}	2.3	100	6			6	3.6	6.4
'27	{P.P. }	2.3	100	6			6	3.6	6.4
45	{2 A.F.}	2.4	225	44				30	35
45	{P.P. }	2.4	225	44				30	35
80	Rect.	4.9						42.5	

LV—114 Vol. Con. Max

LYRIC, MODEL 94, 96, 175

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.4	150	4.0	92	0.6	4.5	3	6.0
'24	2 R.F.	2.4	150	4.0	92	0.6	5.0	3	6.0
'24	3 R.F.	2.4	150	4.0	92	0.6	4.5	3	6.0
'27	Det.	2.4	75	7.0	....	....	7.0	.7	1.0
'27	1 A.F.	2.4	135	2.0	....	....	10.0	4.4	5.5
45	{2 A.F.}	2.4	240	50.0	...	...	....	22.5	27.0
45	{P.P. }	2.4	240	50.0	...	...	....	22.5	27.0
'80	Rect.	4.7	...	...	...	...	...	38.2	per anode

LV—115. LVS—95-115. Vol. Con. Max.

MAJESTIC—MODEL 90-91-92

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.3	150	14	....	....	19	3.4	6
'27	2 R.F.	2.3	150	13	....	....	17	3.5	6
'27	3 R.F.	2.3	150	13	....	....	18	3.6	6
'27	4 R.F.	2.3	158	12	....	....	12	6.6	8
'27	Det.	2.3	290	29	....	....	28	.8	1
'45	{1 A.F.}	2.4	285	50	....	....	....	35	40
'45	{P.P. }	2.4	285	50	....	....	....	35	40
'80	Rect.	4.8	.....	.....	.....	.....	.....	60	....

LV—114. Vol. Con. Max.

NOTE—Volume control controls bias on first three R.F. tubes

MAJESTIC 90A

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.3	137	7.5	....	....	7.5	5.3	9.2
'27	2 R.F.	2.3	137	7.5	....	....	7.5	5.7	9.7
'27	3 R.F.	2.3	135	7.5	....	....	7.5	6.4	10.3
'27	4 R.F.	2.3	135	9.0	...	...	9.0	5.0	6.4
'27	Det.	2.3	280	31.0	...	...	31.0	0.7	0.85
'45	{1 A.F.}	2.4	255	48.0	....	....	....	33	37.0
'45	{P.P. }	2.4	255	48.0	....	....	....	34	36.0
'80	Rect.	5.0	...	...	...	...	...	63	per anode

LV—116 Vol. Con. Max.—dial 550 KC.

MAJESTIC 90B

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.3	134	7.5	....	....	7.5	5.3	9.0
'27	2 R.F.	2.3	135	7.5	....	....	7.5	5.8	9.8
'27	3 R.F.	2.3	136	7.5	....	....	7.5	6.5	10.5
'27	4 R.F.	2.3	134	8.7	....	....	8.7	5.0	6.5
'27	Det.	2.3	240	28.0	....	....	28.0	1.0	1.2
'45	{1 A.F.}	2.3	260	48.5	....	....	....	33.0	37.5
'45	{P.P. }	2.3	260	48.5	....	....	....	28.0	31.5
80	Rect.	4.8	...	...	...	...	...	63.0	per anode

LV—118 LVS—115. Vol. Con. Max.—dial 550 KC.

MAJESTIC 93

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.3	145	10	...	...	+10	3.5	5.9
'27	2 R.F.	2.3	145	10	...	...	+10	4.0	7.5
'27	3 R.F.	2.3	145	10	...	...	+10	3.5	7.5
'27	Det.	2.3	240	24	...	...	+23	0.7	0.9
'27	1 A.F.	2.4	145	9	...	...	+9	5.0	6.5
'45	{2 A.F.}	2.4	260	48	...	...	...	32.0	37.0
45	{P.P. }	2.4	260	48	...	...	...	32.0	37.0
'80	Rect.	5.0						61.0	per anode

LV—118 Vol. Con. Max

MAJESTIC—MODEL 180

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.25	143	8.5			+1	5.5	16.5
'27	2 R.F.	2.2	143	8.5			+1	5	16
'27	3 R.F.	2.2	143	8.5			+1	4	15.5
'27	Det.	2.2	38				8	3.3	3
'27	1 A.F.	2.2	135	7.5				4.5	10.5
'80	{2 A.F.}	7.3	355	64				49	60
'80	{P.P. }	7.3	355	64				49	60
'81	Rect.	7.3						80	
'81	Rect.	7.3						80	

LV—117 Vol. Con. Max

MAJESTIC MODEL 90, 91, 92 and 181 comb.

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.2	130	7.5	....	....	+7.5	5.0	8.7
'27	2 R.F.	2.2	130	7.5	....	....	+7.5	6.0	10.3
'27	3 R.F.	2.2	130	7.5	....	....	+7.5	5.4	9.5
'27	4 R.F.	2.2	130	8.2	....	....	+8.2	4.6	6.0
'27	Det.	2.3	280	26.0	....	....	+26.0	1.0	1.2
'45	{1 A.F.}	2.37	250	47.0	....	....	....	30.0	34.0
'45	{P.P. }	2.37	250	47.0	....	....	....	32.5	36.0
'80	Rect.	4.8	.....	.....	.....	.....	.....	63	per anode

LV—116 Vol. Con. Max.

Equalizer resistor at 550 KC approx. 600 ohms.

NORDEN HAUCK ADMIRALTY SUPER—10-30-AC

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 Det.	2.2	125	0.15	55	0.3	0	1.0	1.6
'24	1 I.F.	2.2	125	0.15	55	0.3	0	1.0	1.6
'27	Osc.	2.2	55	11.00	....	....	11.5	3.0	4.1
'24	2 I.F.	2.2	125	0.15	55	0.3	0	1.0	1.6
'24	3 I.F.	2.2	125	0.15	55	0.3	0	1.0	1.6
'24	4 I.F.	2.2	125	0.15	55	0.3	0	1.0	1.6
'24	2 Det.	2.2	130	1.40	85	0.2	1.0	1.0	1.7
'27	1 A.F.	2.2	35	7.50			1.5	2.0	3.0
'50	{2 A.F.}	7.2	425	76.00				55.0	59.5
'50	{P.P. }	7.2	425	76.00				55.0	59.5
'81	Rect.	7.2	...	...	...	...	...	62.0	...
'81	Rect.	7.2	...	...	...	...	...	62.0	...

LV—115. Vol. Con. Max.

OZARKA 91 AC

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.1	165	-9.5	+44	.5	2	2	2.75
'24	2 R.F.	2.1	165	-9.5	+44	.5	2	2	2.75
'24	3 R.F.	2.1	165	-9.5	+44	.5	2	2	2.75
'24	Det.	2.1	42	-4.6	+24.5	.07	8	1	.2
'27	1 A.F.	2.1	143	-1			10	4.5	10
'45	{2 A.F.}	2.2	243	-46.5				32	80
'45	{P.P. }	2.2	240	-46				32	80
'80	Rect.	4.8	...	...				42	per anode

LV—113. Vol. Con. Max

PEERLESS COURIER WITH KYLECTRON

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.5	190	2.2	88	.6	+2	3.5	5.4
'24	2 R.F.	2.5	190	2.2	90	.6	+2	3.5	5.5
'24	3 R.F.	2.5	185	2.2	90	1.1	+2	5.0	8.5
'27	Det.	2.5	55	7.5	90	....	+8	.1	.2
'27	1 A.F.	2.6	85	2	....	....	+5	4.5	5.6
'45	{2 A.F.}	2.6	280	33*	....	....	....	25	30
'45	{P.P. }	2.6	280	33*	....	....	....	25	30
'80	Rect.	5.0	.....	.....	.....	.....	.....	50	per anode
'99	Spkr. Volumer	3.3	Burned 38		....	....	....	....	....

LV—120. LVS—Low. Vol. Con. Max.

NOTE—Voltage across speaker—340 V. (D.C.).

*Resistor in series with grid.

PHILCO 20, 20A

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.2	225	2.8	82		10	3.0	
'24	2 R.F.	2.2	130	2.8	82		10	3.0	
'24	Det.	2.2	30	1	2		8	0	
'27	1 A.F.	2.3	115				7	3.0	
71A	{2 A.F.}	4.8	190	43				18.0	
71A	{P.P. }	4.8	190	43				18.0	
'80	Rect.	4.8						36	per anode

LV—115 Vol. Con. Max

PHILCO 30

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'32	1 R.F.	2	150	..	60	....	....	1.5	....
'32	2 R.F.	2	150	..	58	....	....	1.5	....
'32	3 R.F.	2	150	..	58	....	....	1.5	....
'30	Det. Rect	2	....	....	....	....	....	....	....
'30	Det. Amp.	2	15	..	....	....	....	....	....
'30	1 A.F.	2	90	*	....	....	..	2	..
'31	{2 A.F.}	2	150	24	....	....	....	8	..
'31	{P.P. }	2	150	24	....	....	....	8	..

*Volume control off 4 volts

Volume control on less than 1 volt

PHILCO 40, 41

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.1	100	0.4	75	.4	....	2.7	3.4
'24	2 R.F.	2.1	100	0.4	75	.4	....	2.7	3.3
'24	Det.	2.1	45	1.8	15	0	...	....	....
'27	1 A.F.	2.4	87	0.2	....	....	....	2.7	3.3
71A	{2 A.F.}	5	85	13	....	....	....	15	19
71A	{P.P. }	5	85	13	....	....	....	15	19

LV—115. Vol. Con. Max.

PHILCO—MODEL 65

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.1	120	1.4	54	...	1.4	1.6	2.5
'24	2 R.F.	2.1	120	1.4	54	....	1.4	2.0	2.8
'27	Det.	2.1	215	24	....	....	+24	1.3	1.5
'45	{1 A.F.}	2.2	215	37	....	....	....	30	34
'45	{P.P. }	2.2	215	37	....	....	....	30	34
'80	Rect.	4.4						47	

LV—115 Vol. Con. Max

PHILCO 76

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.3	145	3.0	90	0.4	13	3.5	4.2
'24	2 R.F.	2.3	145	3.0	90	0.4	13	3.5	4.2
'24	Det.	2.3	36	1.4	30	0.0	12	0.0	0.2
'27	1 A.F.	2.3	140	1.0	....	....	10	3.0	4.0
'45	{2 A.F.}	2.3	230	46.0	....	....	....	30.0	33.5
'45	{P.P. }	2.3	230	46.0	....	....	....	30.0	33.5
'80	Rect.	4.5	...	...	...	...	...	50.0	per anode

LV—115. Vol. Con. Max.

PHILCO 77, 77A

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.3	145	3	....	....	13	3.5	....
'24	2 R.F.	2.3	145	3	90	....	13	3.5	....
'24	Det.	2.3	36	1.4	30	....	12	....	....
'27	1 A.F.	2.3	140	1	....	....	10	3.0	....
'45	{2 A.F.}	2.2	230	46	....	....	....	30	....
'45	{P.P. }	2.2	230	46	....	....	....	30	....
'80	Rect.	4.5	....	....	....	....	....	90	per plate

LV—115. Vol. Con. Max.

Courtesy Weston Electrical Inst. Corp.

PHILCO—MODEL 87

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'26	1 R.F.	1.3	78	5.5	....	....	....	3.4	6.9
'26	2 R.F.	1.3	78	5.5	....	....	....	3.4	6.9
'26	3 R.F.	1.3	78	5.5	....	....	....	3.4	6.9
'27	Det.	2.1	25	....	....	....	....	....	....
'26	A.F.	1.3	75	4.5	....	....	....	3.2	6.2
'45	{2 A.F.}	2.25	205	35.5	....	....	....	25	30
'45	{P.P. }	2.25	205	35.5	....	....	....	25	30
'80	Rect.	4.4	.....	....	....	....	....	45	....

LV—115. Vol. Con. Max.

PHILCO 95

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.15	155	0.0	95	0.8	5.3	4.0	5.1
'24	2 R.F.	2.15	155	0.0	95	0.8	5.3	4.0	5.1
'24	3 R.F.	2.15	155	0.0	95	0.8	5.3	4.0	5.1
'27	Det.	2.15	0	0.5	....	....	0.7	0.0	0.0
'27	Det. Amp.	2.15	27	0.5	....	....	5.5	0.0	0.1
'27	1 A.F.	2.15	85	0.2	....	....	5.5	2.5	3.1
'45	{2 A.F.}	2.2	250	41.0	....	....	....	28.0	30.0
'45	{P.P. }	2.2	250	41.0	....	....	....	28.0	30.0
'80	Rect.	4.5	.....	....	....	....	....	43.0	per anode

LV—115. Vol. Con. Max.

PHILCO 96, 296, 96A, 296A

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.15	155	0	95	.8	5.3	4	5.6
'24	2 R.F.	2.15	155	0	95	.8	5.3	4	5.7
'24	3 R.F.	2.15	155	0	95	.8	5.3	4	5.6
'27	Det.	2.15	0	.5	....	....	.7	0	0
'27	Det. Amp.	2.15	27	.5	....	....	5.5	0	0
'27	1 A.F.	2.15	85	2.0†	....	....	5.5	2.5	4.0
'45	{2 A.F.}	2.2	250	41	....	....	....	28	33
'45	{P.P. }	2.2	250	41	....	....	....	28	33
'80	Rect.	4.5	.....	....	....	....	....	43	per anode

LV—115. Vol. Con. Max.

†Volume control off.

RADIOLA—MODEL 33

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'26	1 R.F.	1.4	127	8	....	....	....	5.5	14
'26	2 R.F.	1.45	126	8.5	....	....	....	5	15
'26	3 R.F.	1.45	126	8.5	....	....	....	5	15
'27	Det.	2.1	26	....	....	....	....	1.5	1.5
'26	1 A.F.	1.4	121	8	....	....	....	4.5	11.5
'71A	2 A.F.	4.7	135	29	....	....	....	17.5	22
'80	Rect.	4.7	.....	....	....	....	....	20	....

LV—117 Vol. Con. Max

RADIOLA—MODEL 44

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.4	162	1.4	38	....	+1.5	1	1.75
'24	2 R.F.	2.3	155	1.3	39	....	+1.5	1.1	2
'24	Det.	2.2	150	4.5	55	....	+6.5	.2	2.2
'45	A.F.	2.4	215	6	....	....	....	29	32
'80	Rect.	4.8	.....	....	....	....	....	30	....

LV—117. Vol. Con. Max

RADIOLA—MODEL 44
WITH INCREASED SCREEN BIAS VOLTAGE

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.15	155	1.2	40	.2	+1	1	2
'24	2 R.F.	2.15	155	1.2	40	.1	+1	1	2
'24	Det.	2.15	155	4.5	59	.4	+8	.5	2.5
'45	A.F.	2.25	220	5*	....	....	....	30	32
'80	Rect.	4.6	.....	....	....	....	....	{28	....
								{28	....

LV—114 High Tap. Vol. Con. Max.

*NOTE—This is not the true bias voltage, but the reading obtained at the socket due to series resistance.

RADIOLA—MODEL 45

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.5	160	1.4	37	....	+1.5	1	1.75
'24	2 R.F.	2.2	150	1.3	39	....	+1.5	1.1	2
'24	Det.	2.2	150	4.6	56	....	+6.2	.2	2.2
'45	A.F.	2.4	217	6	....	....	....	27	30
'80	Rect.	4.7	.....	....	....	....	....	47.5	....

LV—117 Vol. Con. Max.

RADIOLA—MODEL 46
WITH INCREASED SCREEN BIAS VOLTAGE

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.1	145	1.6	54	.2	+2	1.5	2.5
'24	2 R.F.	2.1	145	1.6	54	.4	+2	1.6	2.8
'24	Det.	2.1	90	3	32	.2	+4	.4	1.6
'45	A.F.	2.1	190	*8	....	....	....	25	27.5
'80	Rect.	4.2	.....	....	....	....	....	40	....

LV—109. Vol. Con. Max.

*Resistor in series with grid.

RADIOLA—MODEL 64

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	Coupler	2.4	124	2.5	....	....	—15	3.8	11.8
'27	R.F.	2.35	124	2.5	....	....	—15	3.8	7.2
'27	1 Det.	2.4	75	9	....	....	+15	.2	2.2
'27	Osc.	2.4	140	7.5	....	....	—17	6.2	11
'27	1 I.F.	2.4	140	7.5	....	....	—17	6.2	7
'27	2 I.F.	2.4	70	...	....	....	—15	8.2	7.2
'27	2 Det.	2.4	170	24	....	....	—14	....	9
'27	Vol. Con.	2.5	70	2	....	....	....	....	.8
'50	A.F.	7	356	65	....	....	....	53	65
'81	Rect.	7.1	.....	....	....	....	....	60	....
'81	Rect.	7.1	.....	....	....	....	....	60	....

LV—117. LVS—120. Vol. Con. Max.

No Station tuned in

RADIOLA—MODEL 66

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	R.F.	2.3	70	1.5	....	....	—21	4	8.5
'27	Det.	2.3	65	—7	....	....	14	.4	2.5
'27	1 I.F.	2.3	70	3	....	....	—21	3.8	7.2
'27	2 I.F.	2.3	70	—3	....	....	—21	4	8
'27	Osc.	2.3	61	....	....	....	....	6	11
27	2 Det.	2.25	210	27	....	....	—15	1	2
'45	A.F.	2.3	200	12*	....	....	....	27	30
'80	Rect.	4.6	.....	....	....	....	....	{50	....
								{50	....

LV—114. High Tap. Vol. Con. Max.

*NOTE—This is not the true bias voltage, but the reading obtained at the socket due to series resistance.

R. C. A.—MODELS 47, 67

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.4	125	3	....	....	—15	4.3	9.4
'27	1 Det.	2.3	70	8	....	....	—14	.6	3.1
'27	1 I.F.	2.4	135	6	....	....	—16	6.0	6.8
'27	2 I.F.	2.4	140	8	....	....	—17	6.0	6.8
'27	Osc.	2.3	68	....	....	....	—13	6.4	7.0
'27	2 Det.	2.3	230	27	....	....	—14	.1	.8
'27	Vol.Cont.	2.3	65	2	....	....	....	....	....
'50	A.F.	7.0	420	76	....	....	....	55	58
'81	Rect.	7.0	.....	....	....	....	....	63	....
'81	Rect.	7.0	.....	....	....	....	....	63	....

LV—116. Vol. Con. Max.

R. C. A.—VICTOR THEREMIN

Tube Position	Type Tube	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.
1	'27	1.95	60.	11.5	...	...	0	7.1
2	'24	1.95	135.	11.5	10.2	0.1	0	0
3	'27	1.95	60.	11.0	....	..	0	5.5
4*	'27	1.95—2 to 40		0	....	.	0	0 to 3.5
5*	'20	0	180 to 44	0	....	....	....	0.5 to 4.1
6*	'71-A	4.6	95.	26 to 31	....	....	....	12 to 17
7*	'71-A	4.6	140 to 145	25 to 30	....	....	....	25 to 30
Rect.*	'80	4.6	....	....	....	....	....	26 to 31 per anode

* The range of variation of the readings taken on Radiotrons Nos. 4, 5, 6 and 7 is caused by a change in the resonance point of the volume control loop circuit. Any object (such as the measuring instrument cable, body of the operator, etc.) coming in proximity to this circuit will give the variations noted above.

LV—120. LVS—120.

SILVER 30 (Serial number above 12907)

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.2	142	1.0	60	0.6	1.0	2.6	3.2
'24	2 R.F.	2.2	140	1.4	58	0.6	1.4	2.3	3.1
'24	3 R.F.	2.2	140	1.2	58	0.6	1.2	3.2	4.2
'24	Det.	2.2	55	5.4	40	0.1	10.0	0.2	0.4
'27	1 A.F.	2.3	176	0.0	....	....	12.0	6.5	8.6
'45	{2 A.F.}	2.3	205	40.0	....	....	....	28.0	32.0
'45	{P.P. }	2.3	205	40.0	....	....	....	28.0	32.0
'80	Rect.	4.3	.....	....	....	....	....	41.0	per anode

LV—114. Vol. Con. Max.

SILVER 43

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.4	152	1.5	64	0.8	1.7	4.5	5.5
'24	2 R.F.	2.4	145	2.0	64	0.8	2.0	3.6	5.1
'24	3 R.F.	2.4	148	2.0	64	0.7	2.0	3.3	5.0
'24	Det.	2.5	68	6.0	72	0.2	5.0	0.1	0.3
'27	1 A.F.	2.5	184	1.0	....	....	13.0	7.0	9.3
'45	{2 A.F.}	2.4	223	44.0	....	....	....	28.0	33.0
'45	{P.P. }	2.4	223	44.0	....	....	....	28.0	33.0
'80	Rect.	4.4	.....	....	....	....	....	43.0	per anod

LV—117. Vol. Con. Max.

SILVER—60, 95

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.3	140	1.2	60	.6	+2	2.5	3.5
'24	2 R.F.	2.3	135	1.2	60	.6	+2	2.4	3.4
'24	3 R.F.	2.3	135	1.2	60	.6	+2	2.5	3.4
'24	Det.	2.3	60	3.8	40	.0	+6	0.1	0.2
'27	1 A.F.	2.3	180	1.*	....	....	+11	5.6	7.0
'45	{2 A.F.}	2.3	210	40.0	....	....	....	29.0	33.0
'45	{P.P. }	2.3	210	40.0	....	....	....	29.0	33.0
'80	Rect.	4.8	.....	....	....	....	....	38.0	per anode

LV—117. Vol. Con. Max

*Res. in grid.

SILVER 63

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.4	170	1.0	71	0.9	1.0	2.8	4.1
'24	2 R.F.	2.4	161	2.0	71	0.8	1.7	3.1	4.0
'24	3 R.F.	2.5	164	2.0	70	0.7	2.0	3.0	3.8
'24	Det.	2.5	76	7.0	69	0.2	7.0	0.1	0.5
'27	1 A.F.	2.4	196	1.0	....	....	14.0	7.8	9.2
'45	{2 A.F.}	2.5	225	44.0	....	....	....	30.0	33.0
'45	{P.P. }	2.4	225	44.0	....	....	....	30.0	33.0
'80	Rect.	4.5	.....	....	....	....	....	42.0	per anode

LV—117 Vol. Con. Max.

SILVER MARSHALL—MODEL 30

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.25	142	—1	+60	....	+1	2.6	3.5
'24	2 R.F.	2.25	140	—1.4	+58	....	+1.	2.3	3.3
'24	3 R.F.	2.25	140	—1.2	+58	....	+1.2	3.2	4.2
'24	Det.	2.25	55	—5.4	+40	....	+10	.2	.5
'27	1 A.F.	2.3	176	.....	....	....	+12	6.5	8.7
'45	{2 A.F.}	2.3	205	—40	....	....	....	28	37
'45	{P.P. }	2.3	205	—40	....	....	....	28	37
'80	Rect.	4.7	.....	....	....	....	....	....	40

LV—114. Vol. Con. Max.

NOTE—These are lowest allowable values

SILVERTONE MODEL 51—58 comb.

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.0	110	9	....	....	+9	2.6	4.0
'26	2 R.F.	1.5	110	8	....	....	....	4.4	8.0
'26	3 R.F.	1.5	110	8	....	....	....	5.0	8.5
'27	Det.	2.0	45	....	....	....	0	3.0	3.1
'26	1 A.F.	1.5	110	7	....	....	....	5.0	7.8
'71A	{2 A.F.}	4.5	175	38	....	....	....	15.0	17.0
'71A	{P.P. }	4.5	175	38	....	....	....	15.0	17.0
'80	Rect.	4.5	.....	....	....	....	....	35.0	per anode

LV—118. Vol. Con. Max.

SILVERTONE 53—54—60

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2	105	7	....	....	+7	3.5	6.5
'27	2 R.F.	2	105	7	....	....	+7	3.5	6.6
'27	3 R.F.	2	105	7	....	....	+7	3.6	6.4
'27	4 R.F.	2	105	7	....	....	+7	3.0	6.0
'27	Det.	2	40	0	....	....	0	2.0	2.1
'27	1 A.F.	2	100	6	....	....	+6	3.0	4.5
'45	{2 A.F.}	2.1	180	30	....	....	....	22.0	25.0
'45	{P.P. }	2.1	180	30	....	....	....	22.0	25.0
'80	Rect.	4.5	.....	....	....	....	....	42.0	per anode

LV—118. Vol. Con. Max.

SILVERTONE 56

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	Det.	2.1	65	6.0	....	....	+6	0.5	1.0
'24	1 R.F.	2.1	150	2.6	70	.4	+3	1.0	1.5
'24	2 R.F.	2.1	150	2.6	70	.7	+3	1.0	1.5
'27	1 A.F.	2.1	135	9.0	....	....	+9	5.0	7.5
'45	{2 A.F.}	2.1	190	35.0	....	....	....	25.0	29.0
'45	{P.P. }	2.1	190	35.0	....	....	....	25.0	29.0
'80	Rect.	4.5	.....	....	....	....	....	37.0	....

LV—118. Vol. Con. Max.

Courtesy Weston Electrical Inst. Corp.

SLAGLE "STAR RAIDER"—MODEL 20—25—30—R. P. 40

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
484	1 R.F.	2.85	110	5			5	5	9.4
484	2 R.F.	2.85	126	5			5	5.4	10.3
484	3 R.F.	2.85	112	5			5	5	9.6
484	4 R.F.	2.85	126	5.5			5.5	4.9	8.8
484	5 R.F.	2.85	117	5.5			5.8	4.0	8.4
484	6 R.F.	2.85	120	5.5			5.5	4.1	6
484	Det.	2.85	250	20			20	1.5	1.7
250 or 585	1 A.F. / P.P.	7.2	360	66				38	45
		7.2	360	66				38	45
2-'81	Rect.	7.2						55	
2-'81	Rect.	7.2						57	

LVS—115. Vol. Con. Max.

SPARTON—MODEL 110

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA
484	1 R.F.	2.6	145	4.5			+4.5	4	8
484	2 R.F.	2.6	150	4.5			+4.5	4.6	9
484	3 R.F.	2.6	145	4.5			+4.5	4	8
484	4 R.F.	2.6	148	4.5			+4.5	3.5	7
484	5 R.F.	2.6	140	4.5			+4.5	4	8
484	Det.	2.6	125	10			+10	.5	.7
2226	1 A.F.	1.25	20					8.5	11.5
2585	2 A.F.	7.2	415					60	72
2281	Rect.	7.2						80	

LV—110 Vol. Con. Max.

SPARTON—MODEL 301

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
484	1 R.F.	2.75	130	4			+4	3.5	6
484	2 R.F.	2.75	130	4			+4	4	7.5
484	3 R.F.	2.75	128	4			+4	3.5	6
484	4 R.F.	2.75	130	4			+4	4.5	8
484	5 R.F.	2.75	125	4			+4	4	7.5
484	Det.	2.75	100	20			+20	.1	1.5
585	1 A.F. / P.P.	7.0	380					40	45
585		7.0	380					40	45
281	Rect.	7.0						72.5	
281	Rect.	7.0						72.5	

LV—117. Vol. Con. Max.

SPARTON—MODEL 930

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
C-48	1 R.F.	2.8	100	3.5			+3.5	5	8.5
C-48	2 R.F.	2.8	115	3.5			+3.5	8.7	13.7
C-48	3 R.F.	2.8	115	3.5			+3.5	3.2	6.5
C-48	4 R.F.	2.8	113	3.5			+3.5	6.7	14.3
C-48	5 R.F.	2.8	115	3.5			+3.5	5.8	9.2
C-48	Det.	2.85	160	16			+16	1.2	3
182-P-89 / 182-P-89	A.F. / P.P.	4.6	180	36				14	37
		4.6	180	36				14	37
'80	Rect.	4.6						39	

LV—114. LVS—110-120. Vol. Con. Max.

SPARTON—MODEL 931

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
484	1 R.F.	2.6	155	5			+5	8.5	15.5
484	2 R.F.	2.6	155	5			+5	8.5	15.5
484	3 R.F.	2.6	155	5			+5	7	12
484	4 R.F.	2.6	155	5			+5	10	18.5
484	5 R.F.	2.6	150	5			+5	7.5	14
484	Det.	2.6	150	11			+11	.2	.5
182	1 A.F.	4.5	255					25	27.5
182	P.P.	4.5	255					25	27.5
280	Rect.	4.8						47	

LV—117. Vol. Con. Max.

P. A. STARK PIANO CO.

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.05	164		60		1.3	2.4	3.6
'27	2 R.F.	2.05	150	12.5			12.5	6.5	9.0
'27	3 R.F.	2.05	150	12.5			12.5	6.5	9.0
'27	Det.	2.05	53					6.8	7.0
'27	1 A.F.	2.05	144	12.3			12.3	5.7	7.8
'27	P.P.	2.05	144	12.3			12.3	5.7	7.8
'45	2 A.F.	2.3	245	40.0				27.5	32
'45	P.P.	2.3	245	40.0				27.5	32
'80	Rect.	4.4						54	per anode

LV—110. Vol. Con. Max.

Dial Set at 535 K.C.

STEINITE—MODELS 70-80

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.4	226	.75	100	.4	+3.0	2.5	5.5
'24	2 R.F.	2.4	210	3.1	98	.5	+3.1	3.4	6.0
'24	3 R.F.	2.4	205	3.9	98	.65	+4.5	3.0	6.3
'27	Det.	2.4	235	24.0			+44.0	1.3	1.6
'45	1 A.F.	2.5	230	45.0				32.5	37.0
'45	P.P.	2.5	230	45.0				32.5	37.0
'80	Rect.	4.8						42.0	per anode

LV—120. LVS—High. Vol. Con. Max.

STEWART WARNER—MODEL 900

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.2	145	10			+10	3.7	6.7
'27	2 R.F.	2.3	147	10			+10	4.7	8.0
'27	3 R.F.	2.2	147	10			+10	3.9	7.1
'27	Det.	2.2	30					1.8	2.0
'27	1 A.F.	2.2	140	8			+8	4.5	5.7
'45	2 A.F.	2.2	235	44				27.5	30.0
'45	P.P.	2.2	235	44				32	35.0
'80	Rect.	4.6						47.5	

LV—109 Vol. Con Max

STEWART-WARNER—MODEL 950 (60 CY.)

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.2	172	—1.6	72	.7	+1.5	2.5	4.0
'24	2 R.F.	2.2	170	—1.6	72	1.2	+1.5	4.25	5.7
'24	3 R.F.	2.15	170	—1.3	71	.6	+1.5	3.0	4.0
'27	Det.	2.15	157	—13.0			+16	0.6	0.7
'27	1 A.F.	2.2	170	—1.5			+11	4.7	5.7
'45	2 A.F.	2.2	233	—40.0				26.0	29.0
'45	P.P.	2.2	235	—40.0				27.0	30.0
'80	Rect.	4.6						52.5	per anode

LV—107. Vol. Con. Max.

STEWART WARNER SERIES 950

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.3	166	1.5	78	0.8	—1.3	3.9	7.2
'24	2 R.F.	2.3	168	2.0	75	0.8	—2.0	5.9	9.6
'24	3 R.F.	2.3	167	2.0	75	0.8	—2.0	6.2	9.8
'27	Det.	2.3	180	18.5			—20.0	0.6	0.6
'27	1 A.F.	2.3	182	2.5			—13.5	5.8	6.8
'45	2 A.F.	2.3	260	46.0				24.0	28.0
'45	P.P.	2.3	260	46.0				27.0	31.0
'80	Rect.	4.6							

LV—115. Vol. Con. Max.

STROMBERG CARLSON—MODEL 638-A

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.1	90	4			+4	2.5	3
'27	2 R.F.	2.1	90	4			+4	2.8	4.3
'27	3 R.F.	2.1	90	4			+5	3.5	5.4
'27	Det.	2	35					2	1.5
'27	1 A.F.	2	80	4			+4	3.5	4.5
'71A	2 A.F.	4.4	155	30				22	40
'71A	P.P.	4.4	155	30				22	40
'80	Rect.	4.4						37	

LV—117. LVS—HI. Vol. Con. Max.

STROMBERG-CARLSON—MODEL 641 & 642

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.25	125	2.5	54	.1	+2.5	75	2.2
'24	2 R.F.	2.25	125	2.8	54	.1	+2.5	1	3
'24	3 R.F.	2.25	130	2	58	.4	+1	2	3
'27	Det.	2.2	230	—2*			+27	1.8	2
'45	A.F.	2.2	230	40				32.5	32
'80	Rect.	4.4						27 / 27	

LV—115. High Tap. Vol. Con. Max.

*NOTE—This is not the true bias voltage, but the reading obtained at the socket due to series resistance.

STROMBERG-CARLSON 652

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.2	130	2.4	57	0.2	+3	0.7	2.0
'24	2 R.F.	2.2	130	2.4	57	0.2	+3	0.6	2.0
'24	3 R.F.	2.2	135	2.3	60	0.2	+3	0.6	1.8
'27	Det.	2.3	250	9.0*			+25	1.6	1.8
'45	A.F.	2.3	240	41.0				32.0	35.0
'80	Rect.	4.4						45.0	per anode

LV—118. LVS—High. Vol. Con. Max.

* Resistor in grid circuit.

STROMBERG CARLSON—MODEL 846

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.4	150	.2	58	.8	+3	2.4	3.6
'24	2 R.F.	2.4	150	.3	58	.8	+3	2.5	3.7
'24	3 R.F.	2.4	155	.7	60	.6	+3	1.7	4.0
'27	Det.	2.1	220	22			+22	.1	.2
'27	1 A.F.	2.1	110	6			+7	4.4	6.3
'27	Vol. Contr.	2.5	25	2			—50		
'45	2 A.F.	2.5	270	50				35	40
'45	P.P.	2.5	270	50				35	40
'80	Rect. Nat	5.0						50	
'80	Rect. Sphr.	5.0						17	

LV—120. LVS—High. Vol. Con. Max.

TEMPLE—MODEL 860, 880, 890

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'27	1 R.F.	2.05	100	5			+5	3.8	5.5
'27	2 R.F.	2.05	100	5			+5	4	6
'27	3 R.F.	2.05	100	5			+5	4.2	6
'27	4 R.F.	2.05	100	5			+5	4	5.7
'27	Det.	2.05	35					2.4	2.5
'27	1 A.F.	2.1	115	7			+7	4.2	5.7
'45	2 A.F.	2.4	190	38				27.5	30
'45	P.P.	2.4	190	38				27.5	30
'80	Rect.	4.8						40	

LV—109 Vol. Con. Max.

VICTOR—MODEL R. E.-45, R-32

Type Tube	Position of Tube	"A" Volts	"B" Volts	"C" Volts	Normal MA.	Grid Test	Screen Grid	Cathode Volts
'26	1 R.F.	1.3	105	9	3.9	7.3		
'26	2 R.F.	1.3	105	9	3.9	7.3		
'26	3 R.F.	1.3	105	9	3.9	7.3		
'26	4 R.F.	1.3	105	9	3.9	7.3		
'26	5 R.F.	1.3	105	9	3.9	7.3		
'27	Det.	2.1	40		3	3.4		
'26	1 A.F.	1.3	100	6	4.5	7.4		
'45	2 A.F.	2.1	230	40	37	41		
'45	P.P.							
80	Rect.	4.4			57			

LV—110. Volume Control Max.

ZENITH—MODEL 41

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	1.95	200	2	98		+2	3	4
'27	2 R.F.	2	95	4.5			+4.5	4	7.1
'27	3 R.F.	2	95	4.5			+4.5	4	7.1
'27	Det.	1.95	38					2.1	2.3
'27	1 A.F.	2	89	4.5			-4.5	3	4.3
'71A	2 A.F.	4.2	145	29				14.5	15.5
'80	Rect.	4.1						7.8	

LV—110. Vol. Con. Max.

ZENITH—MODEL 42

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	1.90	214	3	94		+2.2	3.4	5.7
'27	2 R.F.	1.90	80	4			+4	3.5	6.5
'27	3 R.F.	1.90	85	4			+4	3.5	6.5
'27	Det.	1.90	35					2.2	2.7
'27	1 A.F.	1.90	78	4			+4	2.5	3.8
'10	2 A.F.	6.9	420	31				20	22.5
'81	Rect.	6.9						31	
'81									

LV—115. Vol. Con. Max.

ZENITH—MODEL 52-53-54-55

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.3	173	1	54	.3	2	2	3.9
'24	2 R.F.	2.3	173	2	54	.3	2	2.2	3.9
'24	Det.	2.3	85	4	36		5		.5
'27	1 A.F.	2.3	55	1.5			4	1.2	1.5
'27	2 A.F.	2.3	153	13			13.5	3.4	5
'27	P.P.	2.3	153	13			13.5	3.4	5
'45	3 A.F.	2.1	250	49				23	27.5
'4'	P.P.	2.1	250	49				23	27.5

LV—116. LVS—120. Vol. Con. Max.

ZENITH 71, 72, 73, 77—60 CYCLES 712, 722, 732, 772—25 CYCLES

Type Tube	Tube Position	"A" Vts.	"B" Vts.	"C" Vts.	Screen Vts.	Screen Current	Cath. Vts.	Nor'l MA.	Grid Test MA.
'24	1 R.F.	2.5	175	2	55		2	2.0	3.1
'24	2 R.F.	2.5	175	3	55		2	2.0	3.1
'24	Det.	2.5	85	4	*		2.5	0.2	.4
'27	1 A.F.	2.5	60	2			5	1.5	3.4
'27	2 A.F.	2.5	150	12			13	3.5	5.2
'27	P.P.	2.5	150	12			13	3.5	5.2
'45	3 A.F.	2.4	250	52				40.0	44
'45	P.P.	2.4	250	52				40.0	44

LV—120. LVS—120. Vol. Con. Max.

Actual voltage same as on R.F. plates, but cannot be measured unless Electrostatic voltmeter is used.

AMPERITE LINE VOLTAGE CONTROLS FOR STANDARD RECEIVERS

SET	USE AMPERITE
ACME	
Models—	Amperite
77	8-A-5
88	9-A-5
AC-7	6-A-5
AMRAD	
Models—	Amperite
84B; 84C; 84D	9-A-5
81	10-A-5
70	8-A-5
APEX	
Models—	Amperite
10; 11; R-1; R-2	8-A-5
115; 140; 240	8-A-5
28; 31; 37	8-A-5
46; 47; 48; 49	8-A-5
ATWATER-KENT	
Models—	Amperite
70; 74; 75; 76	9-A-5
55; 1055	7-A-5
60; 1060	8-A-5
46; 53	6-A-5
56; 57; 40; 37	5-A-5
AUDIOLA	
Models—	Amperite
60; 70; 80	9-A-5
733C; 8430	9-A-5
829; 929	8-A-5
BALDWIN	
Models—	Amperite
50; 70	5-A-5
80	6-A-5
BALKEIT	
Models—	Amperite
C	9-A-5
F	8-A-5
BALKITE	
Models—	Amperite
S. G. &	12-A-5
A-3; A-7	7-A-5
B-7; B-9	12-A-5
BOSCH	
Models—	Amperite
58-A; 58-B	9-A-5
60-D; 60-E; 62-C	10-A-5
48 Series; all models	9-A-5
49	9-A-5
38 Series	5-A-5
29 Series	6-A-5
28 Series	4-A-5
66; 96; 116	5-A-5
136; 146	5-A-5
126; 166; 176; 107	5-A-5
BREMER TULLY	
Models—	Amperite
S-81; S-82	9-20*
81; 82	9-A-5
8-20; 8-21	9-A-5
6-40; 6-41; 7-70; 7-71	5-A-5
BR.—DRAKE	
Models—	Amperite
60 Series	8-A-5
70; 70-R; 71; 71-R	9-A-5
53; 54; 56; 57	11-A-5
34; 36; 46	8-A-5
BRUNSWICK	
Models—	Amperite
15; 22; 32	7-A-5
S-14; S-21; S-31	9-20*
14; 21; 31	9-20*
BUCKINGHAM	
Models—	Amperite
1; 2; 3; 4; 80	8-A-5
80-SG	10-A-5
BUSH & LANE	
Models—	Amperite
55; 75; New	9-10*
20; 21; 30; 32; 34	8-A-5
40; 50; 60; 70; 90	8-A-5
9-K; 10-K; 11-K	8-A-5
12-K; 172	8-A-5
CLARION	
Models—	Amperite
AC-51; AC-53; AC-55	10-10*
CLEARTONE	
Models—	Amperite
112 All Models	8-A-5
COLONIAL	
Models—	Amperite
31-AC; 32-AC	8-A-5
33-AC; 34-AC	8-A-5
COLUMBIA	
Models—	Amperite
SG-8; 940	8-A-5
C-1; C-3	5-A-5
C-2; C-4	10-A-5
C-20; C-21	11-A-5
COURIER	
Models—	Amperite
65; 65-1; 65-2; 65-3	7-A-5
CROSLEY	
Models—	Amperite
53; 54	6-A-5
77	10-A-5
84	11-A-5
70-S	5-A-5
30-S; 31-S; 32-S; 34-S	9-A-5
30; 31; 32; 40; 41	5-A-5
40-S; 41-S; 42-S; 82-S	9-A-5
41-A; 42; 82	7-A-5
609; 610; 704	5-A-5
706; 708	5-A-5
804	6-A-5
DAYFAN	
Models—	Amperite
90; 91; 93; 94	9-A-5
66; 68; 69; 72	6-A-5
80; 81; 82; 83	6-A-5
25; 26; 27; 28	6-A-5
43; 48; 54; 56	6-A-5
EARL	
Models—	Amperite
21; 22	5-A-5
31-S; 32-S; 33-S	10-A-5
31; 24	6-A-5
32; 41	10-A-5
EDISON	
Models—	Amperite
R-6; R-7	13-A-5
R-1; R-2	10-A-5
R-4; R-5	9-A-5
EMERSON	
Models—	Amperite
E-3; F-3; G-3	7-A-5
ERLA	
Models—	Amperite
34; 36; 38; 37	9-A-5
30; 31; 32	9-A-5
S-52 R	9-A-5
S-61 R	10-A-5
71; 72; 73	8-A-5
EVEREADY	
Models—	Amperite
52; 53; 54	8-A-5
42; 43; 44	8-A-5
31; 32; 33; 34	7-A-5
FADA	
Models—	Amperite
40; 41; 42	9-A-5
44; 46	9-A-5
20; 20-Z	7-A-5
75; 77	10-A-5
25; 25-Z	9-A-5
16; 17; 32	6-A-5
10; 11; 31	5-A-5
71; 72; 50-E-420	11-A-5
70-E-420	11-A-5
50-E-180; 70-E-180	10-A-5
FALCK	
Models—	Amperite
23; 26; 27	6-A-5
FEDERAL	
Models—	Amperite
Type "M"	8-A-5
Type "K"	5-A-5
Type "L"	8-A-5
FREED-EISEMAN	
Models—	Amperite
NR-55; NR-56	5-A-5
NR-78-AC	6-A-5
NR-79-AC	8-A-5
NR-95; NR-85	9-A-5
NR-80; NR-80W	5-A-5
FRENCH, JESSE	
Models—	Amperite
All Models	9-A-5
FRESHMAN	
Models—	Amperite
N-14; N-17; N-12	9-A-5
G-2; G-3; G-4; G-5	6-A-5
G-6; 3-Q; 3-QD	6-A-5
"K"; "M"; M-11	6-A-5
Q-16; QD-16	6-A-5
GENERAL ELEC.	
Models—	Amperite
31; 51	9-V-10 or 8-A-5
Combination 7 Tube T.R.F.	9-V-10 or 8-A-5
GEN. MOTORS	
Models—	Amperite
120; 130; 140	10-A-5
150; 160	10-A-5
GILBERT	
Models—	Amperite
69	6-A-5
GILFILLAN	
Models—	Amperite
105; 106	7-A-5
100; 101; 102; 103	9-A-5
33; 44; 66; 77	9-A-5
GRAYBAR	
Models—	Amperite
700; 770	9-V-10 or 8-A-5
900	9-V-10 or 8-A-5
330; 340	9-A-5
500; 550; 520-L	5-A-5
GREBE	
Models—	Amperite
160; 18950; 225; 265	9-A-5
285	9-A-5
21950-A; 270-A	10-20*
270-C	10-20*
285-A; 450-A	10-20*
6; 7	5-A-5
GULBRANSEN	
Models—	Amperite
291; 292; 200; 9950	7-A-5
290; 295; 296; 297	7-A-5
161	8-A-5
HAMM.-ROBERTS	
Models—	Amperite
Hi Q-31	10-10*
Hi Q-30	11-20*
Hi Q-29	6-A-5
H F L	
Models—	Amperite
Mastertone	14-20*
Isotone	8-A-5
HOWARD	
Models—	Amperite
Nutro-Models	8-A-5
S. G. A.-Models	8-A-5
KELLOG	
Models—	Amperite
523; 526; 533; 534	10-A-5
524; 527	8-A-5 (use 2)
514; 516; 517; 518	5-A-5
515; 519; 520; 521	5-A-5
510; 511; 512	5-A-5
KEMPER	
Models—	Amperite
S. G. 7; S. G. 71	6-A-5
KENNEDY	
Models—	Amperite
426; 526; 626	9-10*
726; 826	9-10*
632; 1030	9-10*
210; 310; 220; 320	9-A-5
60; 70; 80	7-A-5
KING	
Models—	Amperite
100; 101; 109	5-A-5
218 Chassis	8-A-5
Royal; Monarch	7-A-5
H. K.; J. K.	6-A-5
KNIGHT	
Models—	Amperite
8 Tube Sc. Grid	8-A-5
9 Tube Sc. Grid	9-A-5
6-7	5-A-5
8-9 all Models	7-A-5
KOLSTER	
Models—	Amperite
K-43; K-23	9-A-5
K-20; K-21; K-22	6-A-5
K-25	6-A-5
K-24	10-A-5
6-K; 6-J; 6-R	7-A-5
6-H; K-44	13-A-5
KYLECTRON	
Models—	Amperite
K-71; K-72	11-20*
LAFAYETTE	
Models—	Amperite
Duo-Symphonic	8-A-5
Pre-Selector	7-A-5
Challenger	7-A-5
LEUTZ, C. R.	
Models—	Amperite
Seven Seas	10-A-5 (use 2)
Silver Ghost	11-A-5 (use 2)
LINCOLN	
Models—	Amperite
De Luxe 10-all Models	9-A-5
LYRIC	
Models—	Amperite
D-11; D-19; D-29; D-39	8-A-5
H-19; H-29; H-69	9-A-5
93; 95	10-A-5
60; 61; 62; 65; 66	6-A-5
80; 83; 84; 85	7-A-5
86; 88	7-A-5
MAJESTIC	
Models—	Amperite
130; 131; 132	11-A-5
91; 92; 93	7-A-5 (use 2)
90	12-A-5
71; 72	12-A-5
MASTER	
Models—	Amperite
70; 50; Console	7-A-5
Mc MILLAN	
Models—	Amperite
995-S; 969-S; 959-S	9-A-5
959; 965; 975; 999	8-A-5
925; 935; 937	8-A-5
8; 8-Y; 185; 186	7-A-5
MIDWEST RADIO	
Models—	Amperite
A; B; H; J; K; L; M; AC-9	8-A-5
MINUET	
Models—	Amperite
30; 31; 32 33; 34	8-A-5
35; 38	8-A-5
NATIONAL TRAN.	
Models—	Amperite
Air Knight; Admiral	10-20*
Asonian; Crown; Electra	10-20*
La Peer; Melotrope	10-20*
National; Windsor	10-20*
NAVIGATOR	
Models—	Amperite
AC-98; AC-9960	8-A-5
AC-9970	8-A-5
AC-9980; AC-9990	8-A-5
AC-99100	8-A-5
AC-66	7-A-5
50; 60	6-A-5
NORDEN-HAUCK	
Models—	Amperite
Short Wave DX-5	7-A-5
Admiralty	11-20 (use 2)
ORPHEUS	
Models—	Amperite
82	9-A-5
52; 62	8-A-5
PATTERSON	
Models—	Amperite
6-59; 6-69	7-A-5
7-69; 7-79	8-A-5
PEERLESS	
Models—	Amperite
23; 25	11-20*
21; 22; 24	11-20*
PHILCO	
Models—	Amperite
77; 77-A; 296	8-A-5
76; 65; 87	8-A-5
92; 95; 96	8-A-5
62; 82; 83; 86	7-A-5
511; 512; 513; 514	5-A-5
515	5-A-5
521; 522; 523; 524	5-A-5
525; 531; 551; 561	5-A-5
PIERCE-AIRO	
Model—	Amperite
S.G.-724; AC-725	8-A-5
524	5-A-5
RADIETTE	
Models—	Amperite
F	6-A-5
PIONEER	
Models—	Amperite
All Models	11-20*
RADIOLA	
Models—	Amperite
80; 82	9-V-10 or 8-A-5
86	9-V-10 or 8-A-5
42; 46 A. C.	8-A-5
60; 62; 66	8-A-5
RANGER	
Models—	Amperite
44; 45; 48	8-A-5
REPUBLIC	
Models—	Amperite
31; 1 P. C.	5-A-5
SARGENT	
Models—	Amperite
7-10	10-A-5
SCOTT	
Models—	Amperite
AC-10 All Models	12-20*
SENTINEL	
Models—	Amperite
11; 12; 15; 16	10-10*
104 Chassis	10-10*
444; 445; 555	8-A-5
666; 8; 9	9-A-5
666-C	10-A-5
SILVER-MARSH.	
Models—	Amperite
Type 34 Chassis	7-A-5
Type 35 Chassis	8-A-5
60-B; 75-B; B-Highboy	10-25*
60; 75; 95	10-25*
30; 30-B	10-25*
722; 735	7-A-5
SIMPLEX	
Models—	Amperite
All Models except H	8-A-5
H	6-A-5
SONORA	
Models—	Amperite
A-31; A-33; A-35	10-A-5
A-30; A-32; A-36	12-A-5
A-40	12-A-5
SPARTON	
Models—	Amperite
589; 600; 610; 620	11-A-5
591; 593; 930; 931	10-A-5
740; 750	8-A-5 (use 2)
109; 301	9-A-5 (use 2)
110; 111	10-A-5 (use 2)
SPLITDORF	
Models—	Amperite
Warwick; Avon	8-A-5
Lorenzo; Winthrop	8-A-5
Salem; Como; Devon	9-A-5
STAR-RAIDER	
Models—	Amperite
R-20; R-30	18-10 (use 2)*
RP-40	18-10 (use 2)*
Tuner	6H-20*
STEINITE	
Models—	Amperite
80; 95; 70; 105; 100	7-A-5
45; 40; 60	10-A-5
50; 102	8-A-5 (use 2)
261; 262; 263	6-A-5
264; 265; 266	6-A-5
STERLING	
Models—	Amperite
A-260; A-360; B-260	9-A-5
C; E	7-A-5
F	5-A-5
STEWART WARN.	
Models—	Amperite
Series 100	10-A-5
Series 950	10-A-5
900; 901; 902; 903	12-A-5
911; 912; 913	12-A-5
951; 952; 953	12-A-5
801-B; 802-B; 811-B	5-A-5
812-B	5-A-5
STORY & CLARK	
Models—	Amperite
36; 43; 50; 51	10-A-5
STROMBERG CA.	
Models—	Amperite
10; 11; 10-A; 11-A	10-A-5
12; 14; 846	12-A-5
641; 652	6-A-5
642; 654	8-A-5
TEMPLE	
Models—	Amperite
8-60; 8-80; 8-90	8-A-5
8-61; 8-81; 8-91	8-A-5
6-60	9-A-5
TYRMAN	
Models—	Amperite
80	10-A-5
72-AC	9-A-5
VICTOR	
Models—	Amperite
R-35; R-39	9-V-10 or 8-A-5
RE-57	9-V-10 or 8-A-5
R-32; R-52	10-V-10 or 9-A-5
RE-45	10-V-10 or 9-A-5
RE-75; RE-154	10-A-5
RE-156	10-A-5
WESTINGHOUSE	
Models—	Amperite
WR-5	9-V-10 or 8-A-5
WR-6; WR-7	9-V-10 or 8-A-5
WR-4	
WORK-RITE	
Models—	Amperite
33; 35; 37; 39; 40	6-A-5
18; 28; 38; 58	5-A-5
ZENITH	
Models—	Amperite
70 Series	10-A-5
60; 61; 62; 64; 67	12-A-5
602; 612; 622	12-A-5
642; 672	12-A-5
34-P; 342-P	10-A-5
35-P; 352-P	10-A-5
35-PX; 352-PX	11-A-5
35-APX; 352-APX	11-A-5
35; 35-A; 352	7-A-5
352-A; 33-X	7-A-5
52; 53; 54; 57; 522	10-A-5
34; 33; 342; 362	7-A-5

Note: Models indicated by * mark following the Amperite do not require the mounting socket. Their chassis provide a socket for Amperite.

RADIO SERVICE OSCILLATOR No. H2:3618

(Courtesy Canadian Westinghouse)

ELECTRICAL CONSTRUCTION.

The filament heating transformer used is a standard push-pull output, choke coil with two additional windings wound on top of the standard coil to secure 1.8 volts, .06 amperes, for the filament of the oscillator radiotron, and 3.2 volts, .06 amperes to light the filaments of the two rectifier radiotrons which are connected in series for convenience. The details of the filament heating transformer are as follows:

The primary consists of 8000 turns of No. 40 enamelled copper wire. The 3.2 volt secondary consists of 335 turns of No. 29 enamelled copper wire. The 1.8 volt secondary consists of 180 turns of No. 29 enamelled copper wire. Standard silicon steel audio transformer punchings are used to give a core area of about 2/10th of 1 square inch cross section.

The radiotrons used are all of the UX-230 type. This tube is used on account of its extreme ruggedness, its low filament consumption and its ability to operate on widely varying voltages. The radiotron UX-230 in the oscillator circuit used will operate with a filament voltage anywhere from 1.5 to 2.2A and still give satisfactory service and life. One radiotron is used as an oscillator, the other two are used as rectifiers by connecting the grid and plate of each tube together.

The value of the condenser C1, when the oscillator is going to be used most of the time on 60 cycle, is .1 MFD. When the oscillator is going to be used mostly on 25 cycle it is marked 25 cycle and the value of the .2 MFD is used for the condenser C1. The value of the condenser C1 is not critical as either the 25 cycle oscillator or the 60 cycle oscillator may be used on either 25 or 60 cycle supply line, the only difference being that the percentage modulation will change if the oscillator is used on the different frequencies.

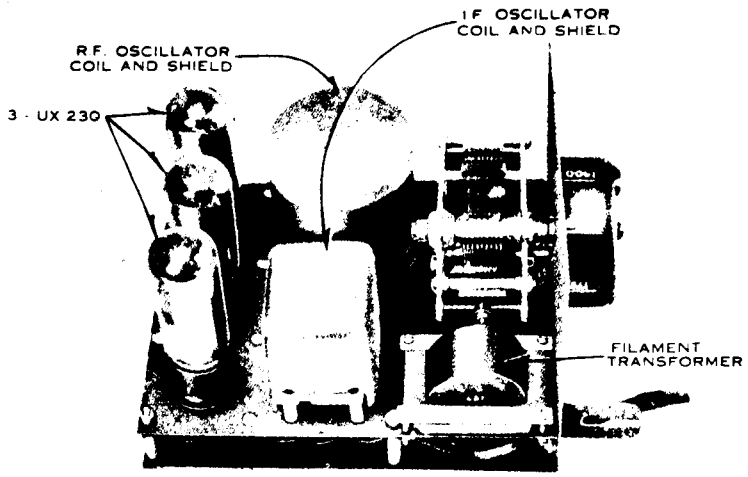


Fig. 4. Interior View.

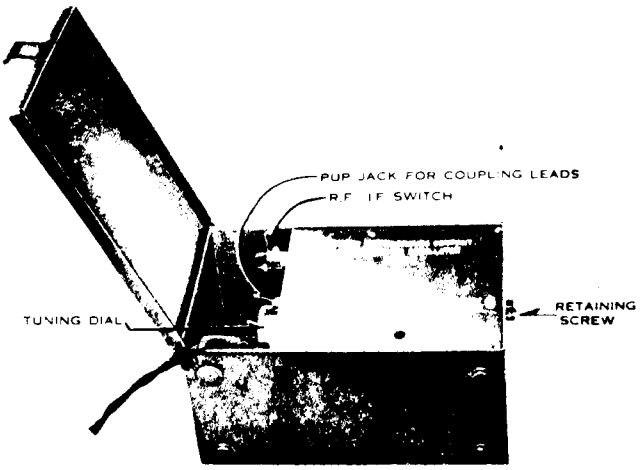


Fig. 5. Oscillator Ready For Use.

Referring to the circuit diagram, Fig. 3 of the oscillator S No. H-23618 it will be seen that two oscillating circuits may be used by throwing a 3 pole double throw switch from one side to the other. With the switch thrown to one side, the intermediate frequency oscillator coil is connected to the condensers C2 and C3, in series to form an oscillating circuit. With the switch thrown in the opposite position a radio frequency oscillator coil is connected to the condenser C2, also an auxiliary contact on the switch short circuits the condenser C3 so that the condenser C2 only, tunes the RF-oscillator coil.

It will be noted that the condenser C2 which is a .00035 MFD condenser has neither the rotor nor the stator grounded as this is not desirable in this type of circuit. The condenser is therefore mounted with insulating washers and a bakelite shaft is used to minimize hand capacity effect. On the RF side the frequency range is from 550 kilocycles to 1400 kilocycles. Calibration points are marked approximately at 1400 and 550 kilocycles. On the IF side the range is approximately from 150 to 200 kilocycles, calibration points at 180 kilocycles and 175 kilocycles.

The RF oscillator coil consists of 87½ turns of .0089 enamelled copper wire wound with a centre tap o n a micarta tube $1\frac{13}{16}$" long and $1\frac{1}{2}$ inches outside diameter. The pick-up winding is a coil about 1" diameter consisting of 275 turns .005 insulated wire. This complete RF coil is mounted in a copper shield

The IF oscillator coil consists of a standard intermediate frequency transformer as used on Model No. 110 set except that only one of the adjustable condensers is used, the primary tuning condenser is removed and the primary winding is used as the pick-up winding. This is mounted in a standard metal container in the usual way.

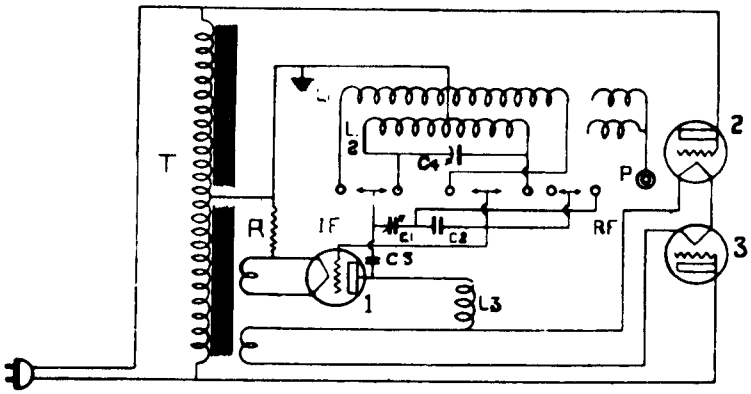


Fig. 3. Schematic Circuit Diagram R.S. Oscillator H23618

Key To Circuit Diagram

R Grid Bias Resistor 3,000 ohms.
L1 I.F. Oscillator Coil and Pick-up Winding.
L2 R.F. Oscillator Coil and Pick-up Winding.
L3 R.F. Choke Coil.
C1 Tuning Condenser .00035 MFD
C2 I.F. Series Condenser 100 MMF
C3 Filter Condenser (25 cycle .2 Mfd) (60 cycle .1 Mfd).
C4 I.F. Calibrating Condenser.
P Pup Jack for coupling leads.
I.F.-R.F. 3 pole double throw switch.
T Filament transformer (approx. .5 Watt).
Radiotron No. 1—Oscillator UX-230.
Radiotron No. 3 and No. 2—Rectifiers UX-230.

MECHANICAL CONSTRUCTION

Figure No. 4 shows the general mechanical details of the oscillator. All of the parts are assembled on a sheet metal frame with all wiring and small parts on the upper side of this frame. This frame is secured to a metal panel. This complete assembly is supported in the metal container by two pivot screws and one retaining screw. To remove the assembly in order to replace a radiotron, it is merely necessary to unscrew the retaining screw shown in Figure No. 5, lift up on the thumb nut on top of the panel just above the retaining screw and the whole assembly will pivot from the rear around the two pivot screws and when in an upright position the assembly may be removed entirely from the metal container.

ADDITIONAL EQUIPMENT REQUIRED:

For performing the various adjustments described hereafter, the following additional pieces of equipment will be required.

(a) **Dummy Antenna.** The purpose of the dummy antenna is to simulate the electrical characteristics of the average broadcast receiver antenna. That is, the dummy antenna should possess inductance, capacity and resistance, the same as an ordinary antenna but should have no pickup ability. By means of this dummy antenna the desired signal from the local oscillator may be fed into the radio receiver and extraneous signals from local broadcasting stations or electrical interference eliminated during the period of the test. The electrical characteristics of such a dummy antenna should be 25 microhenries inductance, 25 ohms resistance and 200 micro-microfarads capacity.

A simple dummy antenna of convenient design is illustrated in Figure No. 6. The dummy antenna shown is wound with resistance wire on a micarta tube, the winding serving both as a resistance and an inductance. If resistance wire is not available to wind the coil, it may be wound with the same size copper wire and a resistor added in series. This resistor should be non-inductive, and may be mounted inside the micarta tube. One-half of a standard 60 ohm filament centre tapped resistor is quite satisfactory.

(b) **Coupling Lead.** When it is desired to feed a signal of varying strength from the oscillator into the radio set, a coupling lead should be used. This coupling lead should consist of approximately 4 ft. of flexible insulated wire with a phone tip on one end and a blind coil of three or four turns on the other end. This blind coil should be formed by making a loop of three or four turns of the same insulated wire, leaving the actual end of the wire unconnected. This loop should be about 2½" in diameter and should be held in shape by means of tape or string and covered with shellac.

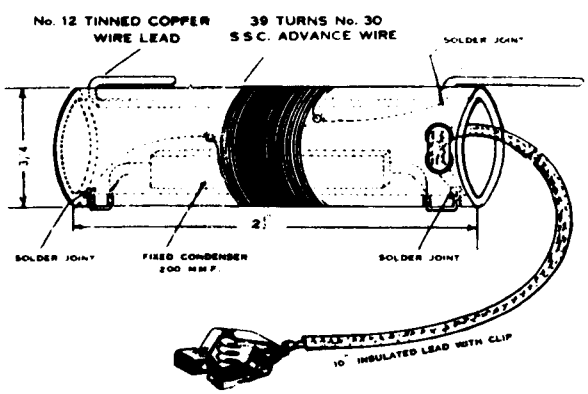


Fig. 6. Dummy Antenna.

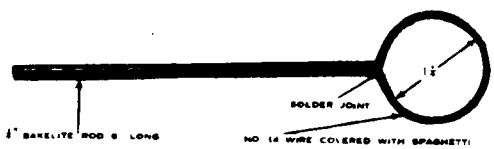


Fig. 7. Balancing Ring.

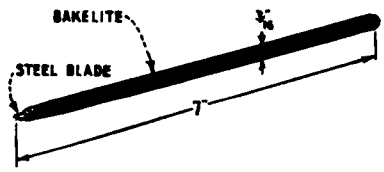


Fig. 8. Dimensions of Non-metallic Screw Driver.

(c) **Clip Lead.** When it is desired to feed a very strong signal from the oscillator into some portion of the radio set under test a clip lead should be used. This lead consists of approximately thirty inches of flexible insulated wire, having a phone tip on one end and a Pee Wee clip on the other.

(d) **Neutralizing Screw Driver.** Except where the screws of the adjustable trimming, neutralizing, compensating condensers, etc., are at ground potential, (these screws are at ground potential when they make a metallic contact to the metal frame of the radio set), a special neutralizing screw driver is required. On most Westinghouse sets standard slot-headed screws are used in the adjustable condensers. The screw driver illustrated in Figure No. 8 is therefore the type that is required. In a few Westinghouse sets a special hexagon head unslotted screw is used in the adjustable condensers. In this case a special bakelite or fibre hexagon socket wrench should be used.

(e) **Output Meters.** Any of the standard forms of output meters may be used with radio service oscillator S No. H-23618. It is more convenient however as a rule for the service man to use the ordinary A.C. voltmeter that is included in most set testers. In receiving sets using dynamic speakers having output transformers with a step down ratio of approximately 20 to 1, the 4 volt scale of the meter in common use serves excellently as an output meter when connected across the terminals of the loud speaker cone coil. The lead from the cone coil terminals to the cone coil may be left connected or disconnected, as desired. In other radio sets not having step down transformers of ratio approximately 20 to 1, the ten or fifteen volt scale of the A.C. voltmeter in common use may be used. In this case the connection should be made across the loud speaker input terminals or across the primary of the output transformer of the radio set under test and a very weak signal used.

(f) **Balancing Ring.** In lining up the gang condensers of most radio frequency sets, it is useful to have a balancing ring of the type illustrated in Figure No. 7. The purpose of the balancing ring is as follows:

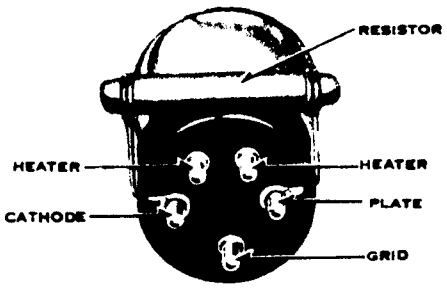


Fig. 9. Dummy Automatic Volume Control Radiotron.

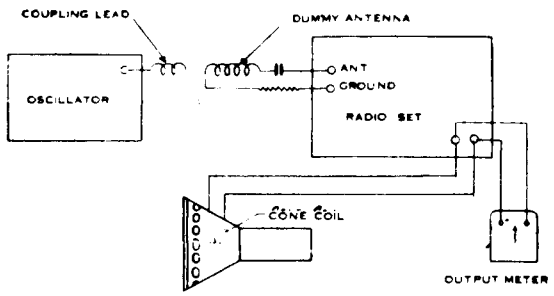


Fig. 10. Hook-up of Oscillator, Radio Set, Dummy Set, Dummy Antenna and Output Meter.

If the balancing ring is placed so that the ring is around one of the radio frequency coils, or the ring is flat against the end of the coil, it will act as a short circuited turn and decrease the inductance of the coil. By using the ring in this way, as described further on, a check may be made to see whether one of the gang condenser sections needs to be decreased in capacity.

(g) **Dummy Radiotron.** For neutralizing purposes a dummy radiotron will be required. This consists of a standard radiotron of the type normally used in the radio set being neutralized, but having one filament or heater prong cut off. A burnt-out or shorted radiotron should not be used for this purpose.

(h) **Dummy Automatic Volume Control Radiotron.** In radio sets similar to the Westinghouse Model No. 110 having an automatic volume control radiotron which is coupled to the power detector radiotron through a coupling condenser, difficulty is sometimes experienced in securing a sufficiently weak signal for balancing purposes. In most sets when the signal used for test purposes is so great that the output meter goes off scale it is merely necessary to decrease the sensitivity of the receiver by turning back the volume control. The best way of course to reduce the signal to a convenient value is to move the test oscillator and coupling lead farther away from the dummy antenna, but sometimes with a sensitive receiver, this method does not decrease the signal strength sufficiently.

In sets having an automatic volume control it is not satisfactory to reduce the sensitivity of receiver during adjustment by turning back the volume control as then the automatic volume control radiotron tends to keep the output of the radio receiver constant in spite of the various adjustments that are being made.

To reduce the sensitivity of a receiver having an automatic volume control radiotron without throwing any of the tuned circuits out of resonance, a dummy automatic volume control radiotron may be used.

PHONO-RADIO INSTALLATION

When phonograph equipment is to be placed in a phono-radio console, the installation should be of a permanent nature. For this purpose, the circuit shown in Fig. 1 is recommended as the best possible method of permanently connecting phonograph equipment to our chassis.

The circuit consists of a pickup connected in the grid circuit of the first audio tube through a transformer. The transformer is necessary so that sufficient volume may be obtained on phonograph reproduction. Two single pole single throw toggle switches are connected together so that they form a single pole double throw switch, and are used to change from phonograph reproduction to radio reception. A special adapter is used to connect the equipment in the grid circuit of the first audio tube.

If the pickup used has a self-contained volume control, no other control is necessary. If the pickup used has no control, it will be necessary to use a separate variable resistor as a volume control.

The volume control system shown in Fig. 1 is recommended. For a medium impedance pickup (see below) the resistor may have a value of 25,000 to 35,000 ohms. This resistor should be of the potentiometer type, and is connected as shown in the diagram so that the resistance across the pickup will remain constant and the characteristics of the pickup will not be changed as the volume is varied.

Phonograph pickups may be either of the low, medium or high impedance type. Both the low and medium impedance types may be used with a coupling transformer, as shown in Fig. 1, but the high impedance type is usually directly connected to the grid of the amplifier.

A medium impedance pickup will have an impedance of approximately 2,000 ohms at 400 cycles. A low impedance pickup will have an impedance of approximately 200 ohms at 400 cycles, and a high impedance pickup will have an impedance of 5,000 ohms or higher at the same frequency. We recommend the use of a medium impedance pickup.

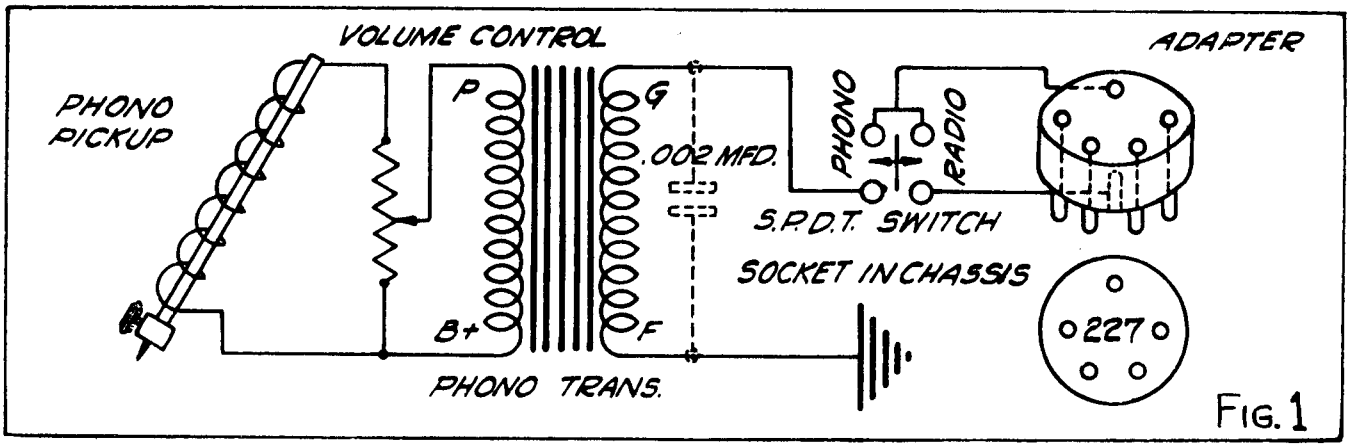


FIG. 1

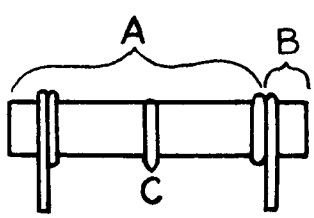
For use with any low or medium impedance pickup, a 4 to 1 ratio transformer will prove satisfactory. The pickup is connected to the primary of this transformer, and the secondary is connected to the grid circuit of the 1st audio tube. The impedance of the primary of the transformer should be at least 4 times the impedance of the pickup at 400 cycles. The .002 mfd. condenser, shown connected across the secondary of the transformer, may be used to permanently lower the pitch of the reproduction.

The adapter shown in Fig. 1 is of the "split-grid" type. This type of adapter is necessary because of the shunting action of the grid to ground resistor on the first audio tube. The adapter removes this resistor from the circuit, and allows ample volume to be obtained on phonograph reproduction.

The R.M.A. COLOR CODE

"A"—Base color.
"B"—(1) end color.
"C"—Band color or dot.
In this system,
"A" represents the first numeral of the resistance value;
"B" represents the second numeral; and
"C" represents the number of ciphers after the second numeral.
The colors are numbered as follows:
1—brown
2—red
3—pink or orange
4—yellow
5—green
6—blue
7—violet
8—gray
9—white
0—black

The numbers in front of the colors in this table also represent the number of ciphers. For example, yellow



equals No. 4 in "A," No. 4 in "B," and 0000 in "C." A resistor entirely of yellow would therefore have a value of 440,000 ohms.

To illustrate further, suppose a certain resistor has a base color "A" of violet; an end color "B" of orange; and a band color or dot "C" of red. From the tables we find that its resistance would be:
"A" = Violet = 7
"B" = Orange = 3
"C" = Red = 00, giving a value of 7,300 ohms.

If the band or dot color C were black, it would have a resistance of 73 ohms.

Fada Resistances

All fixed resistances used in Fada sets are identified by color.

Our Part No.	Resistance Ohms ± 10%	Identification	Diameter in Inches
1408-Ms	2-Megs	Red	1/4"
2-1299-Ms	250	Light Brown	1/4"
2-1300-Ms	750	Green	3/8"
2-1207-Ms	2000	Black	1/4"
1265-Ms	3000	White	1/4"
2-1308-Ms	5000	Orange	1/4"
1341-Ms	20,000	Green	1/4"
1417-Ms	50,000	Blue	1/4"
2-1315-Ms	70,000	Violet	1/4"
1375-Ms	125,000	Gray	1/4"
1311-Ms	250,000	Yellow	1/4"
1394-Ms	500,000	Brown	1/4"
1467-Ms	2000	None	3/8"
2-1330-Ms	3000	White	3/8"
2-1334-Ms	1200	Dark Green	1/4"
2-1344-Ms	1000	Green with yellow end	3/8"
2-1345-Ms	2500	Red with yellow end	3/8"
2-1346-Ms	125	Gray with yellow end	1/4"
2-1347-Ms	10,000	Blue with yellow end	1/4"
2-1358-Ms	500	Brown with blue end	1/4"
2-1364-Ms	7500	Yellow with blue end.	1/4"

Wire wound resistances used in Fada receivers are identified by spots of color in accordance with the listing below.

Our Part No.	Resistance in Ohms	Identification
1458-Ms	75	Red & White
1414-Ms	250	Yellow & White
1459-Ms	500	Blue & Green
1460-Ms	600	Red & Blue
1461-Ms	750	Red & Green
1328 Ms	1,000	Yellow
2-1219-Ms	1,200	Green & Yellow
1415-Ms	2,000	Green & White
2-1218-Ms	2,500	Blue & White
1416-Ms	3,000	White & White
1462-Ms	6,000	Red & Yellow
1463-Ms	10,000	Blue & Yellow
2-1249-Ms	65	Red
2-1250-Ms	65 Tap at 40	Blue
2-1251-Ms	10	Yellow
2-1311-Ms	20	White
2-1312-Ms	200 taps at 10 & 160	Green
2-1379-Ms	1500	Red & Red
2-1390-Ms	5000	Blue & Blue

Fada Condensers

These condensers are all labeled with our part number, capacity and voltage.

Our Part No.	Capacity	Operating D. C. Voltage	Type
1238-Ms	1.0 Mfd.	200-V	I
1239-Ms	2.0 "	200-V	I
1240-Ms	1.0 "	400-V	I
1241-Ms	0.5 "	200-V	I
1242-Ms	0.5 "	200-V	I
1418-Ms	.25 - .25	200 & 400-V	II
1419-Ms	.5 Mfd.	400-V	I
1490-Ms	.15 "	400-V	I
1225-Ms	.25 "	400-V	I
2-1307-Ms	.07 "	400-V	I
2-1340-Ms	.25 "	200-V	I
2-1341-Ms	.25/.25	400 - 400	III
2-1353-Ms	. .25 - .25	200 - 200	II
2-1360-Ms	.25/25	200 - 200	III

On the above, type I has two lugs. Type II has three leads and a red lead connects to a 400 volt section, a brown lead to a 200 volt section and the black lead is common.

Type III condensers have four leads. A red lead connects to 400 volt sections and a brown lead to 200 volt sections. Thus a 400-400 condenser has two red leads and two black leads a 200-200 condenser has two brown leads and two ack leads. The black leads are not common in type III.

WATTAGE OF RADIO RECEIVERS

The wattage of a radio receiver is the amount of electric energy it consumes. In a direct-current "electric" receiver, it is equal to the total current in amperes multiplied by the pressure in volts. In a battery receiver, it is equal to the sum of the wattages used from the various batteries, each one delivering a wattage equal to its current in amperes multiplied by the pressure in volts.

In alternating-current receivers, the wattage may be calculated in the same manner, there being a slight difference on account of the *power factor*. However, the wattage of a receiver may be computed once the number and types of tubes are known.

The first thing to determine is the wattage consumed by the various tube filaments. In a single tube, the wattage equals the voltage multiplied by the current (neglecting "power factor," which is not of sufficient importance in dealing with low-power apparatus). For example, the wattage of a type 171A tube filament is equal to 5 (volts) times 0.25 (ampere), or 1.25 watts. Making similar calculations for all the tubes (most likely to be used), we have the following table:

Type of Tube	*Filament Watts*
224	4.375
226	1.575
227	4.375
112A	1.25
171A	1.25
210	9.375
245	3.75
250	9.375

To find the total watts used by the tube filaments in the set, add up the watts used by each filament. Thus, if the set has three 226's, one 227, and one 245, the total wattage will be:

3 times 1.575 or 4.725
plus 4.735
plus 3.75

total: 12.85 watts

This gives a total of 12.85 watts for the filaments. To determine the remaining power used by the set, simply add the wattage consumed by the rectifier (both plate or plates and filament); for the rectifier supplies all the plate current for the set, as well as that lost in the voltage divider, voltage regulator, etc. The following table gives the rectifier ratings:

Tube	*Filament and Plate watts (maximum rating)*
280	50
281	65

Knowing these figures, if the set above described used a type 280 rectifier, the total wattage used by the entire set would be the filament wattage (14.21) plus the rectifier wattage (50) or:

12.85
50.00

62.85 watts

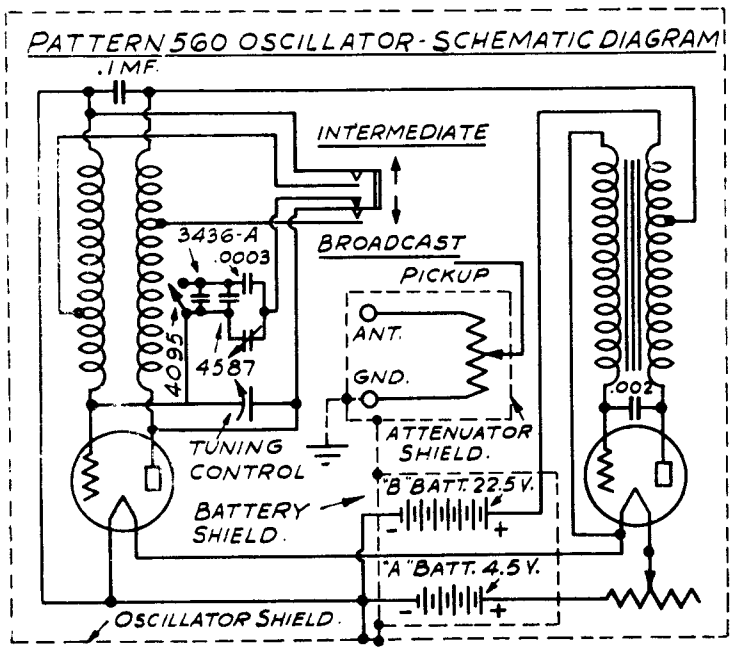
This is the maximum rating. The receiver would probably consume about 60 watts.

Condenser Data

The following Color Code will be used to determine the capacity of the small fixed condensers used in all models of Philco Receivers.

PART NO.	CAPACITY MF.	COLOR
3082	.00025	Yellow
3774	.00005	White
3910	.0005	Green
4059	.002	Light Blue
4519	.00011	Blue and Golden Yellow
4520	.0007	White and Golden Yellow
4587*	.00005	Light Blue and White
5120	.00041	Yellow and Orange

*Note: Part No. 4587 is held to closer tolerance limits than Part No. 3774. Do not substitute either of these Condensers. Use the part listed in the Service Manual.



CIRCUIT DESIGNED FOR EITHER 175 OR 260 K. C PHILCO.

PHILCO

Resistor Data

Starting with the Model 46 and continuing in all future models, standard R. M. A. colors are being used to indicate the value of the various resistors in Philco Receivers. The code is as follows:

0 — Black
1 — Brown
2 — Red
3 — Orange
4 — Yellow
5 — Green
6 — Blue
7 — Violet
8 — Gray
9 — White

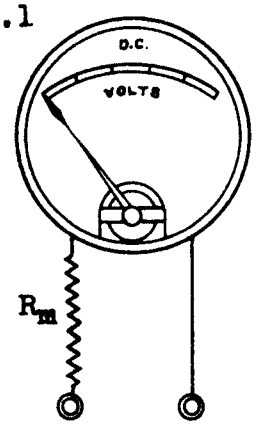
The body color represents the first digit in the resistance. The tip color represents the second digit. The dot color represents the number of zeros after the second digit: If the dot color is not present consider it to have the same color as the body. For instance, Resistor No. 3524 in the table below has a brown body—this means that the first digit is one, it has a black tip meaning that the second digit is zero, it has an orange dot meaning that there are three ciphers after the second digit or a resistance value of 10,000 Ohms.

Philco Resistors are made in two sizes—one to carry .5 watt and a larger resistor to carry 1 watt. Below is a table giving the part number and color code used in present Philco Resistors.

PART NO.	POWER (Watts)	RESISTANCE (Ohms)	— COLOR —		
			BODY	TIP	DOT
3524	1	10,000	Brown	Black	Orange
3525	1	32,000	Orange	Red	Orange
3526	1	5,000	Green	Black	Red
3542	1	70,000	Violet	Black	Orange
3655	1.6	1,000	Brown	Black	Red
3656	1	25,000	Red	Green	Orange
3766	1	13,000	Brown	Orange	Orange
3767	1	99,000	White	White	Orange
3768	1	240,000	Red	Yellow	Yellow
3769	1	490,000	Yellow	White	Yellow
4237	1	51,000	Green	Brown	Orange
4409	.5	1,000,000	Brown	Black	Green
4410	.5	240,000	Red	Yellow	Yellow
4411	.5	99,000	White	White	Orange
4412	.5	10,000	Brown	Black	Orange
4414	1	1,000,000	Brown	Black	Green
4515	1	2,000	Red	Black	Red
4516	.5	25,000	Red	Green	Orange
4517	.5	490,000	Yellow	White	Yellow
4518	.5	51,000	Green	Brown	Orange
4590	1	1,000	Brown	Black	Red
5023	1	190,000	Brown	White	Yellow

INTERNATIONAL RESISTANCE COMPANY

Fig.1

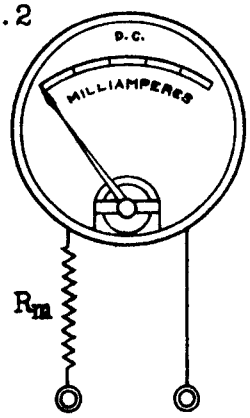


TO MAKE a D.C. VOLTMETER a MULTI-RANGE VOLTMETER.

R_v = resistance of voltmeter in ohms, or, if ohms per volt is given, then
R_v = ohms per volt x maximum reading, in volts.
V_1 = original maximum reading, in volts.
V_2 = desired new maximum reading, in volts.
$\frac{V_2}{V_1} = N$ = multiplying factor.
R_m = resistance of multiplier needed, in ohms.

Then $R_m = (N-1) \times R_v$

Fig.2



TO MAKE a D.C. MILLIAMETER a D.C. VOLTMETER.

I = original maximum reading, in milliamperes.
V = desired maximum reading, in volts.
R_m = resistance of multiplier required, in ohms.

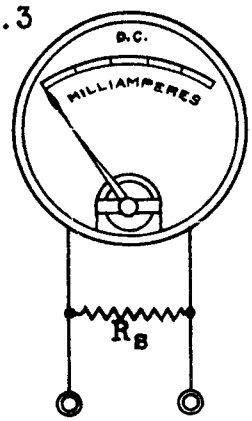
Then $R_m = \frac{1,000 \times V}{I}$

TO FIND THE SHUNT REQUIRED TO MAKE ANY D.C. MILLIAMETER A HIGHER RANGE MILLIAMETER.

R_m = resistance of meter, in ohms.
I_m = original maximum reading, in milliamperes.
I = desired new maximum reading, in milliamperes.
$\frac{I}{I_m} = N$ = multiplying factor.
R_s = resistance of shunt required, in ohms.

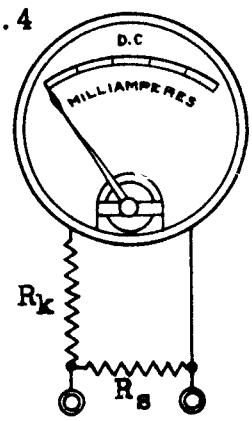
Then $R_s = \frac{R_m}{N-1}$

Fig.3



If the meter resistance is not accurately known, greater accuracy in scale conversion may be had by the use of two Precision Wire Wound Resistors, as shown in Fig. 4.

Fig.4



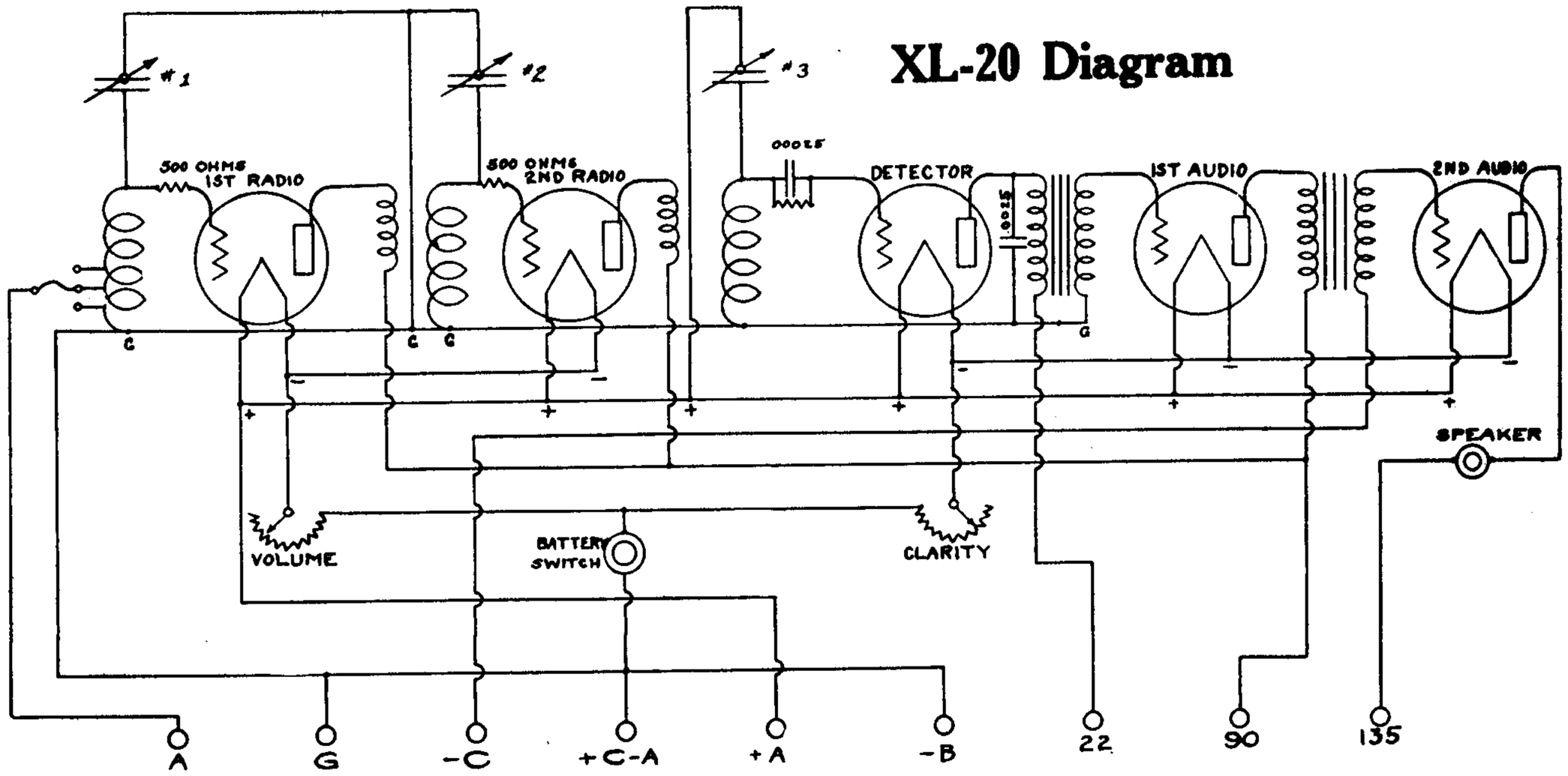
R_m = approximate meter resistance, as from manufacturer's catalog.
R_k = a resistor, equal, in ohms, to 9 times R_m.

Then $R_s = \frac{R_k + R_m}{N-1} = \frac{10\ R_m}{N-1}$

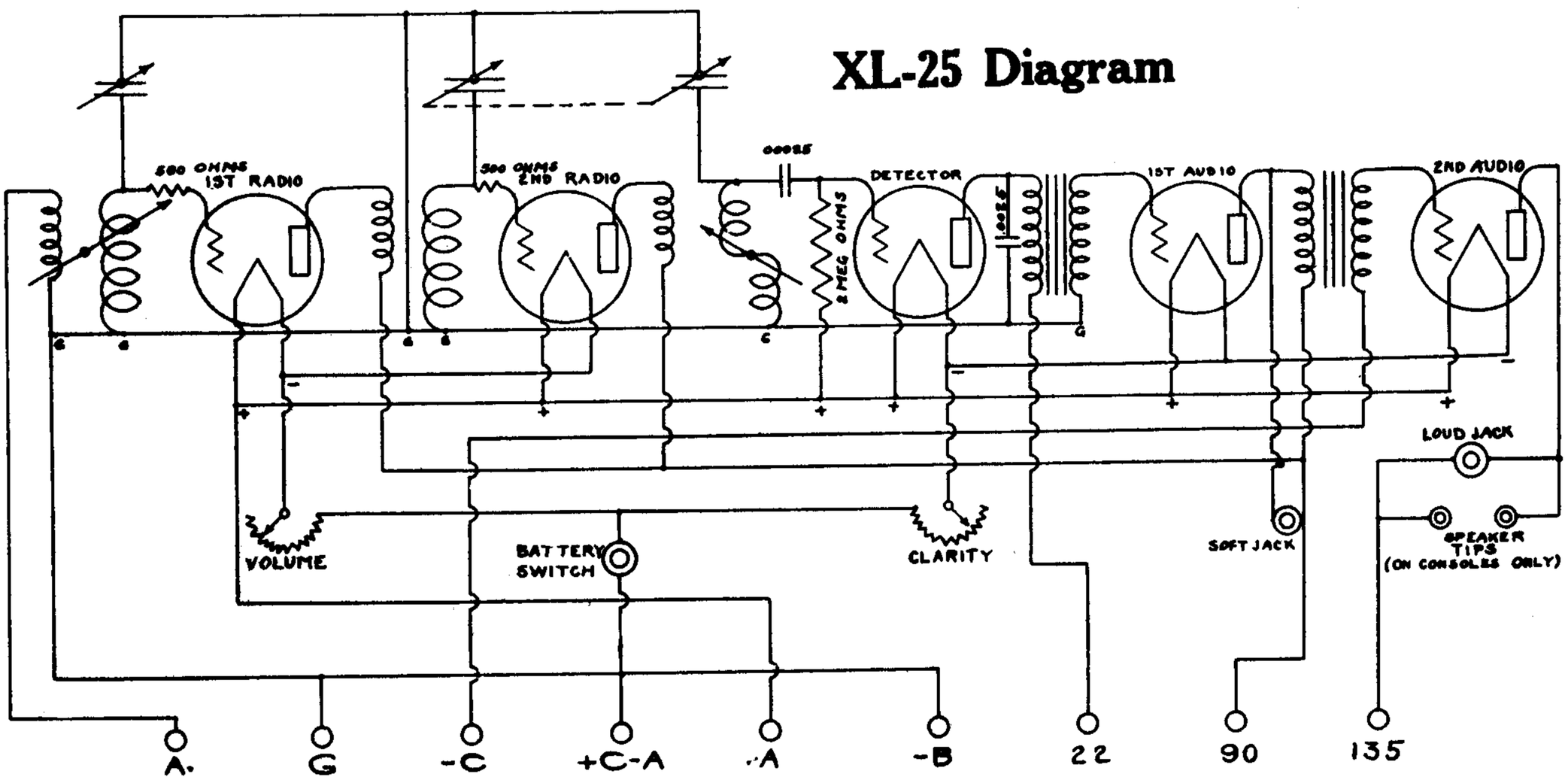
Note: For intermittent use, it is recommended that the load on any Precision Wire Wound Resistor should not exceed 2 watts.

A. C. DAYTON CO.

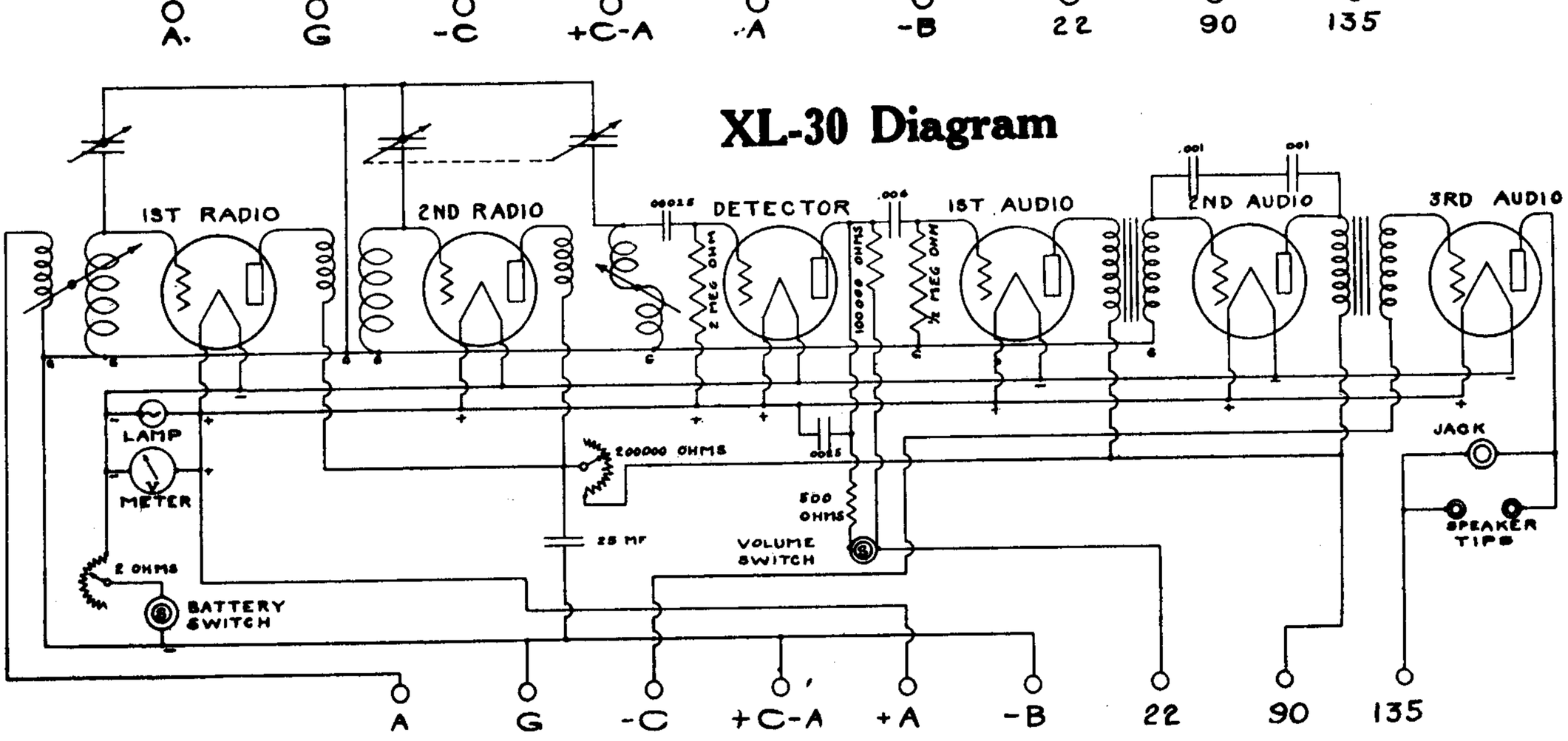
XL-20 Diagram



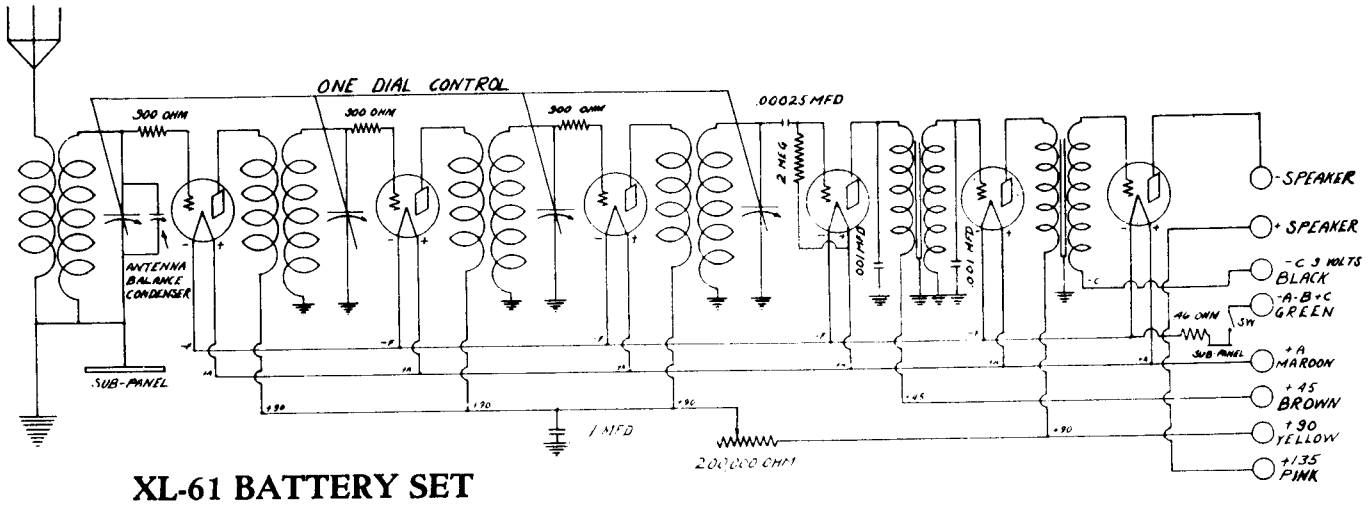
XL-25 Diagram



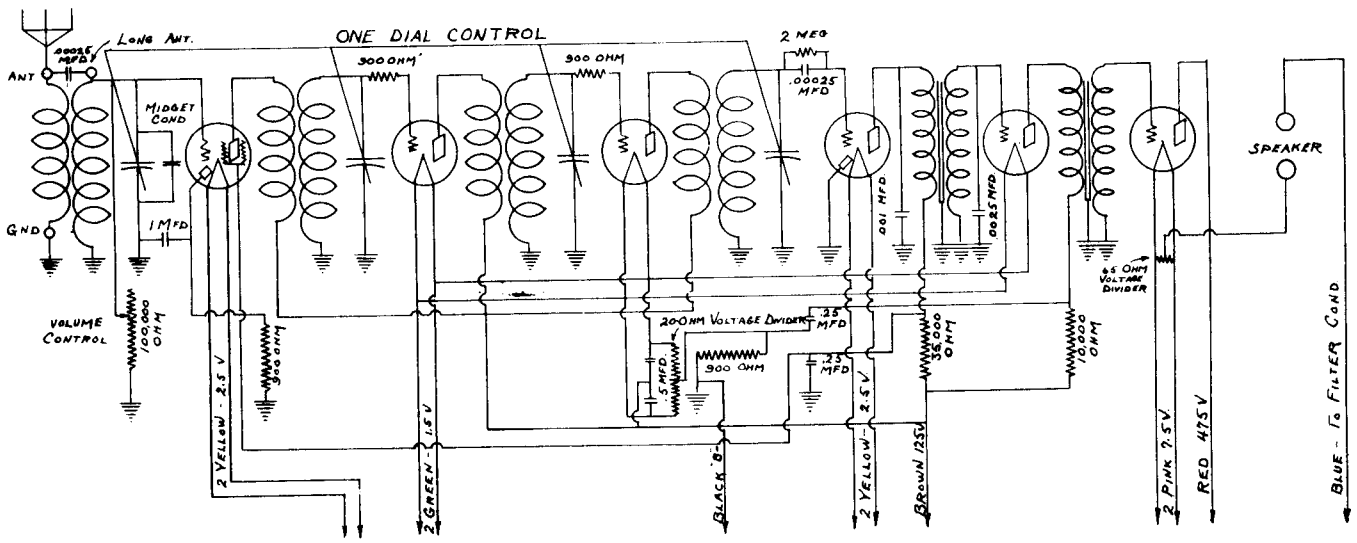
XL-30 Diagram



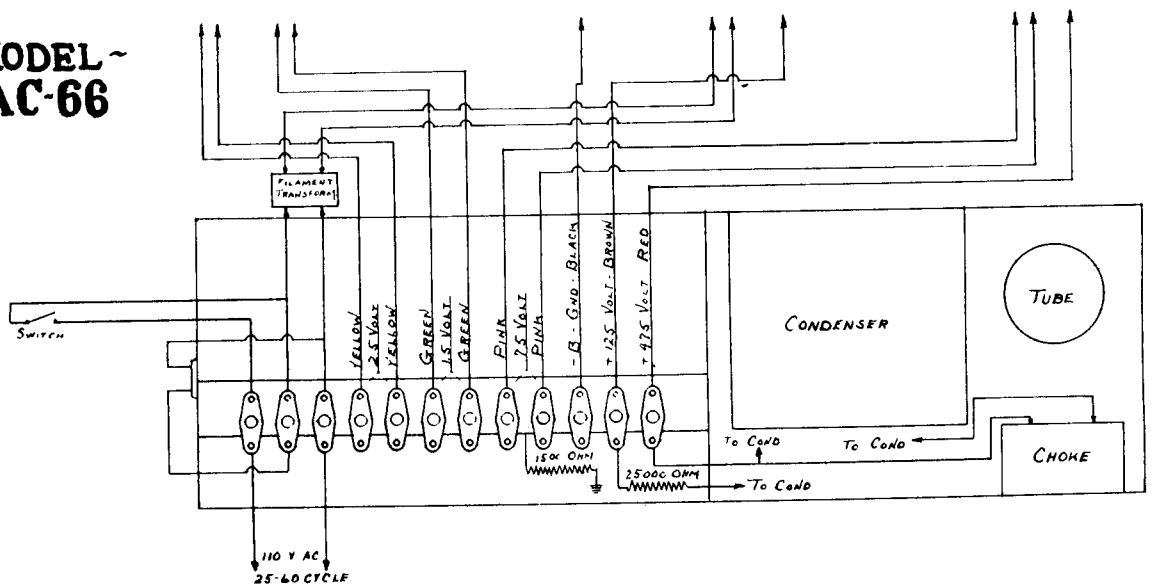
A.C. DAYTON CO.



XL-61 BATTERY SET

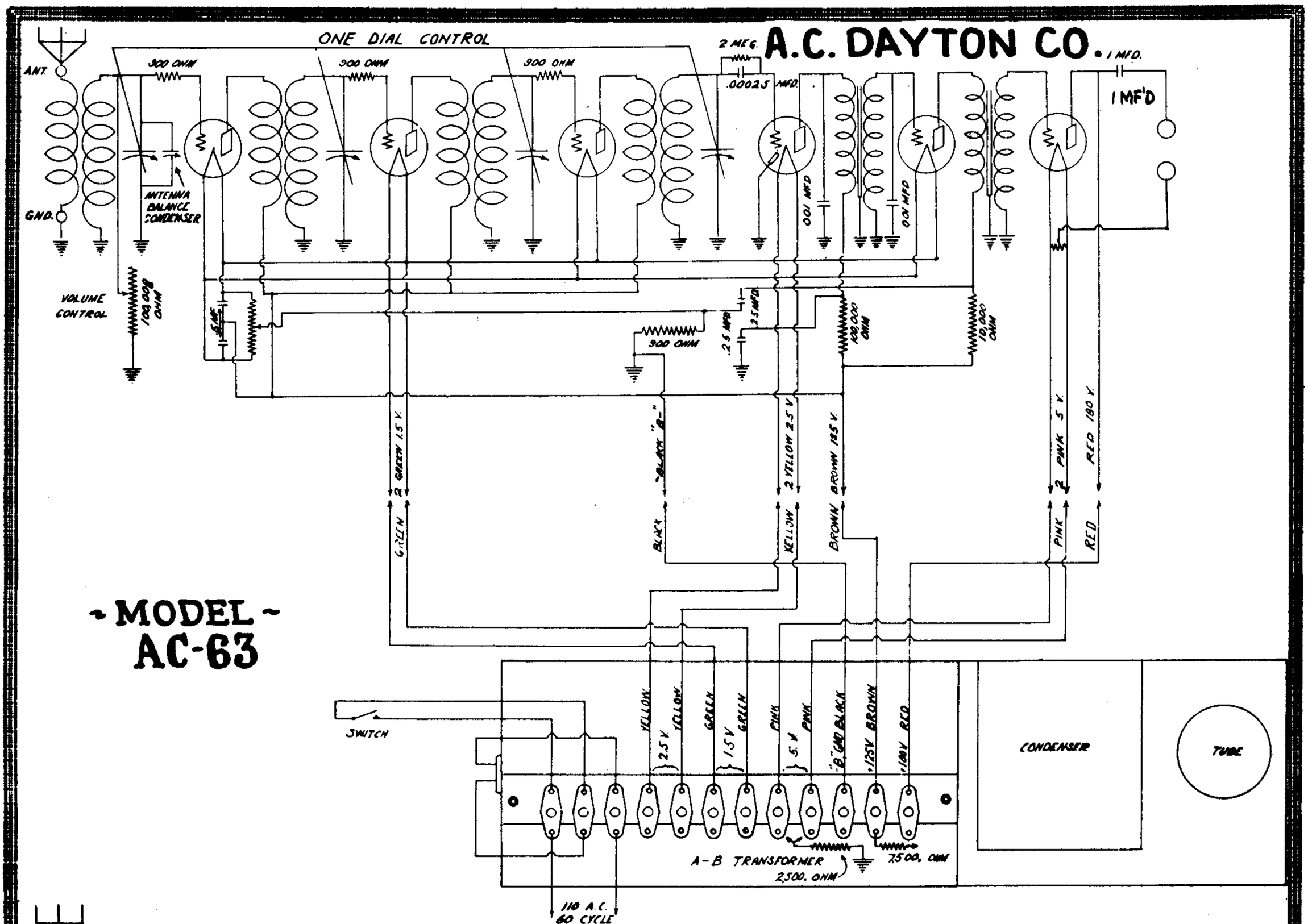


~MODEL~ AC-66

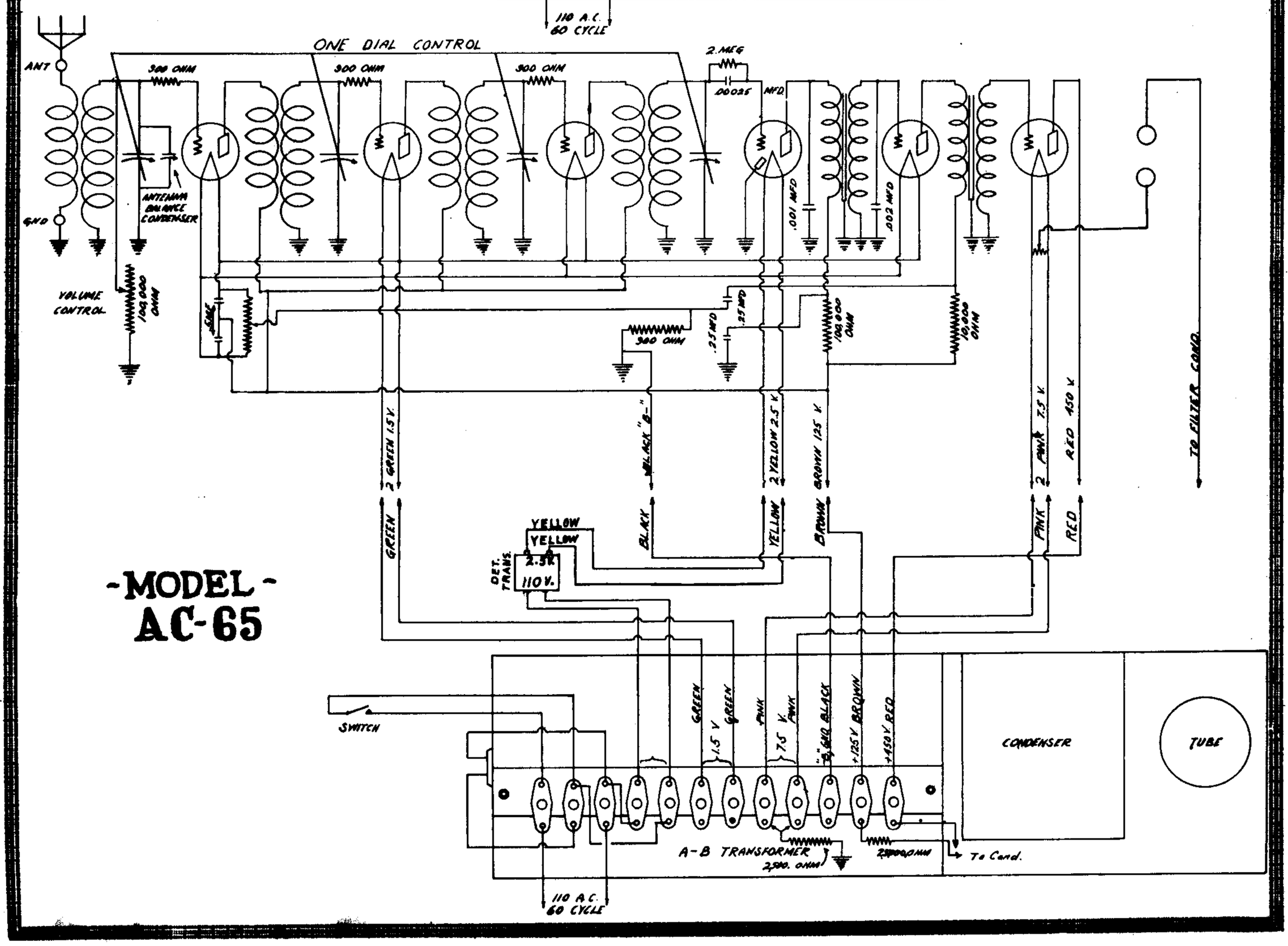


A.C. DAYTON CO.

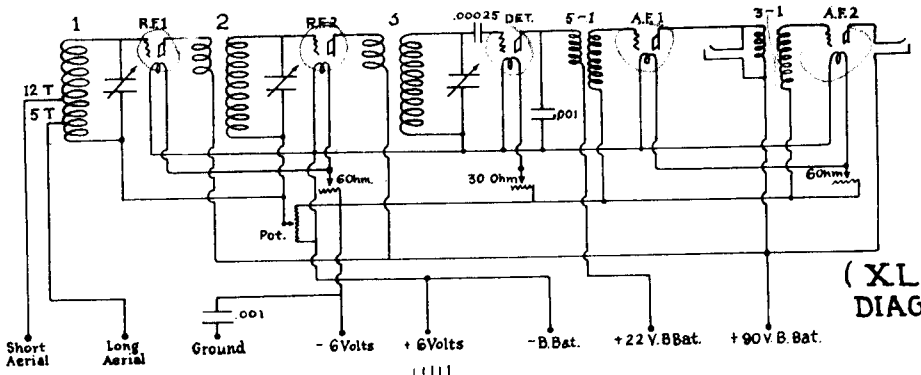
-MODEL- AC-63



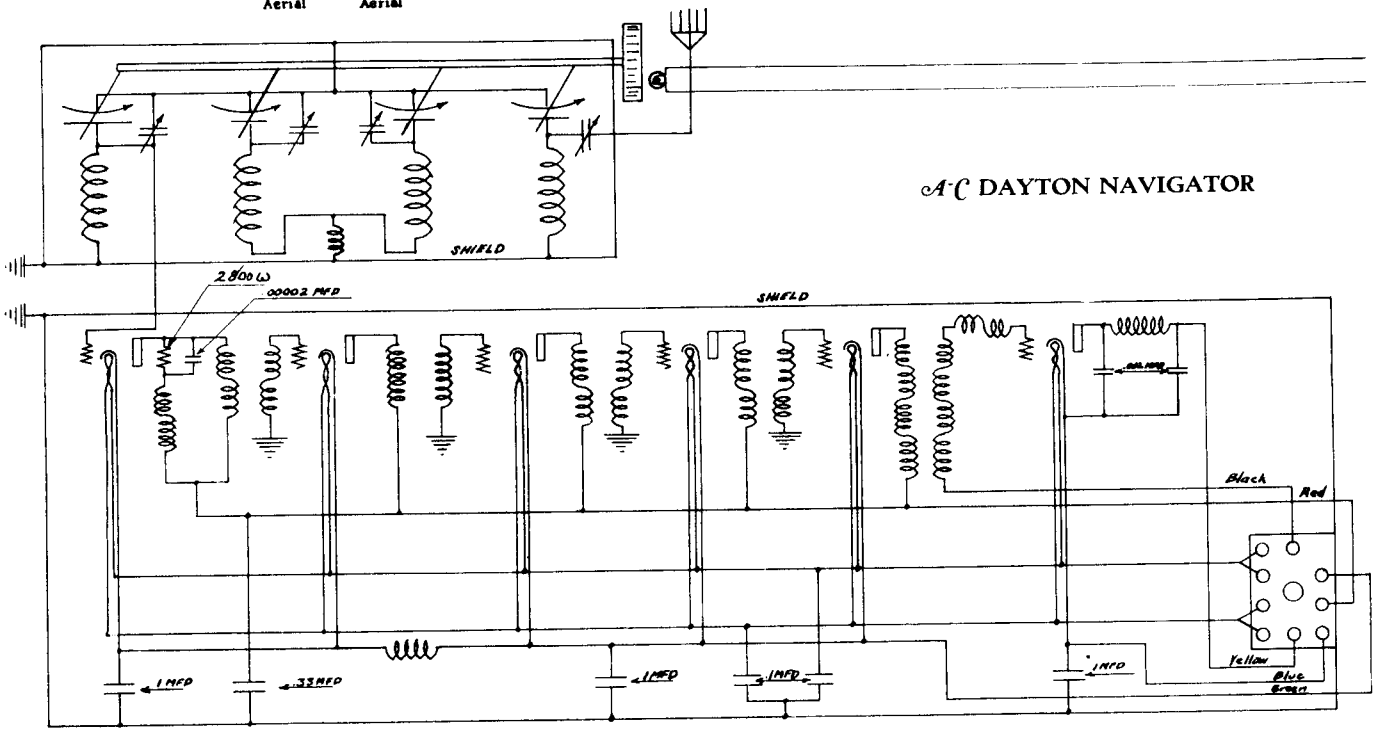
-MODEL- AC-65



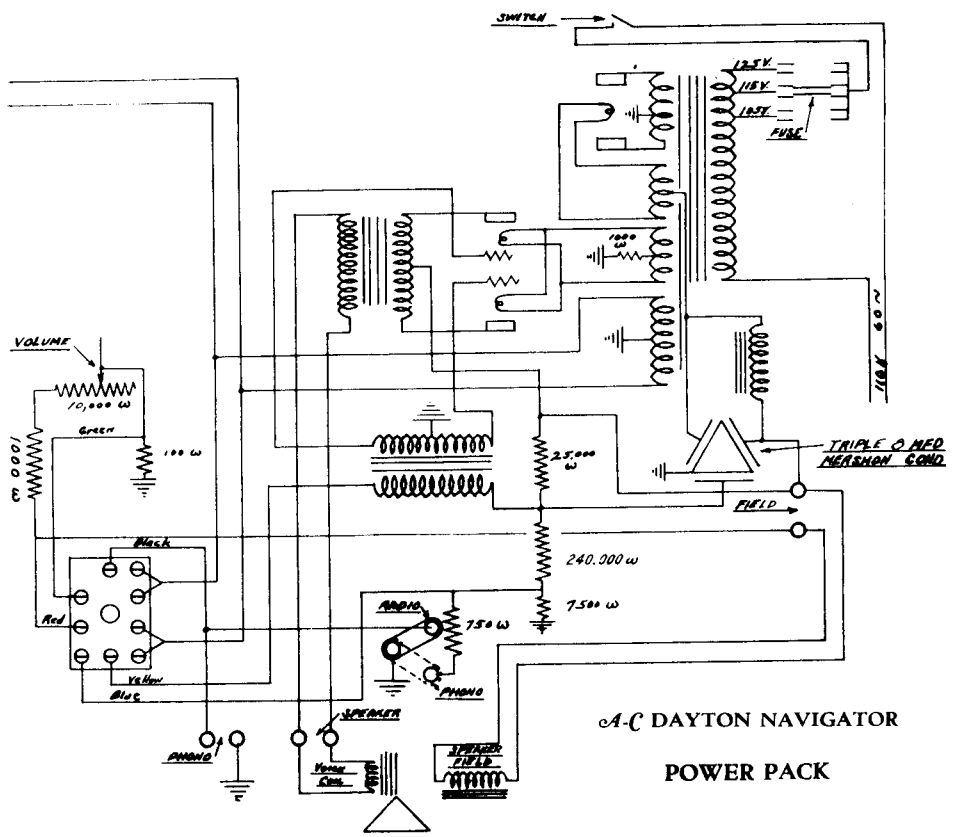
A.C. DAYTON CO.



(XL-5 DIAGRAM)



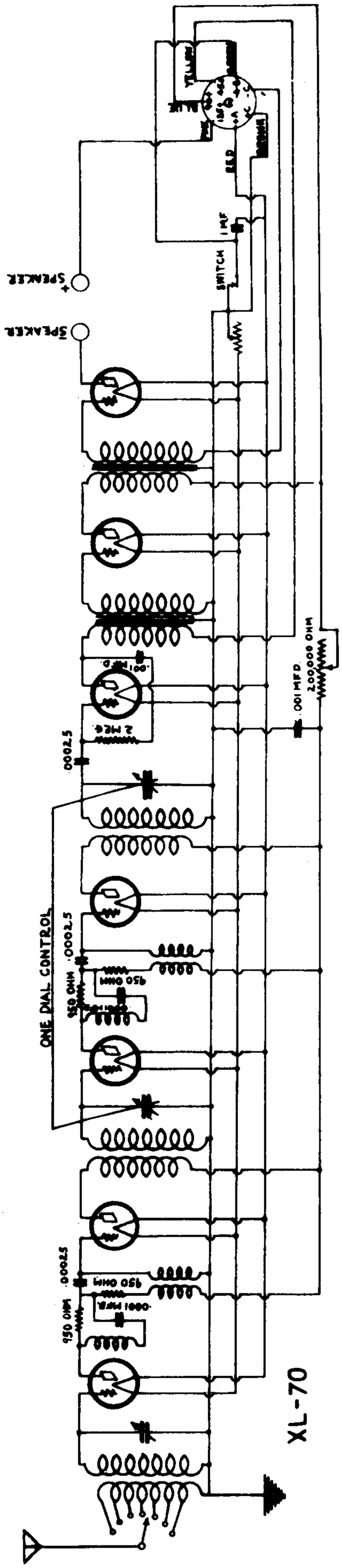
A-C DAYTON NAVIGATOR

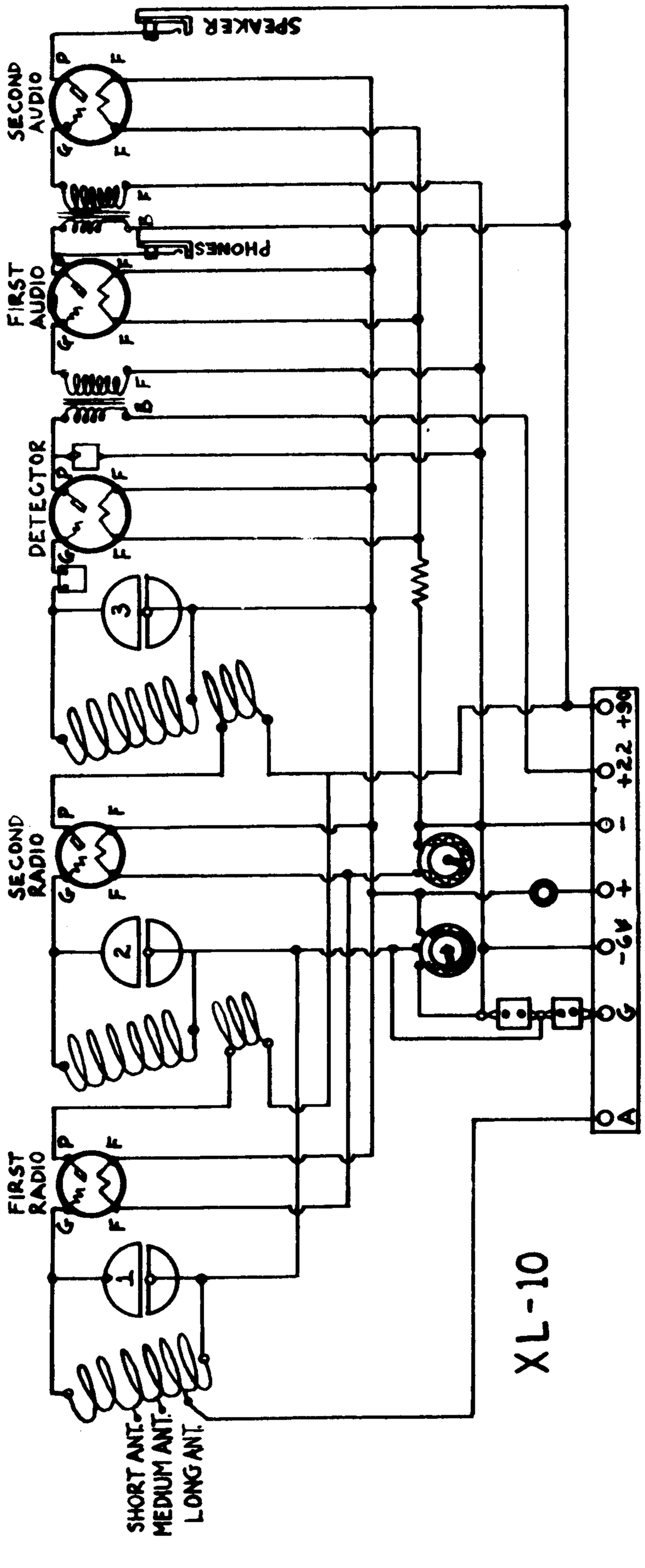


A-C DAYTON NAVIGATOR

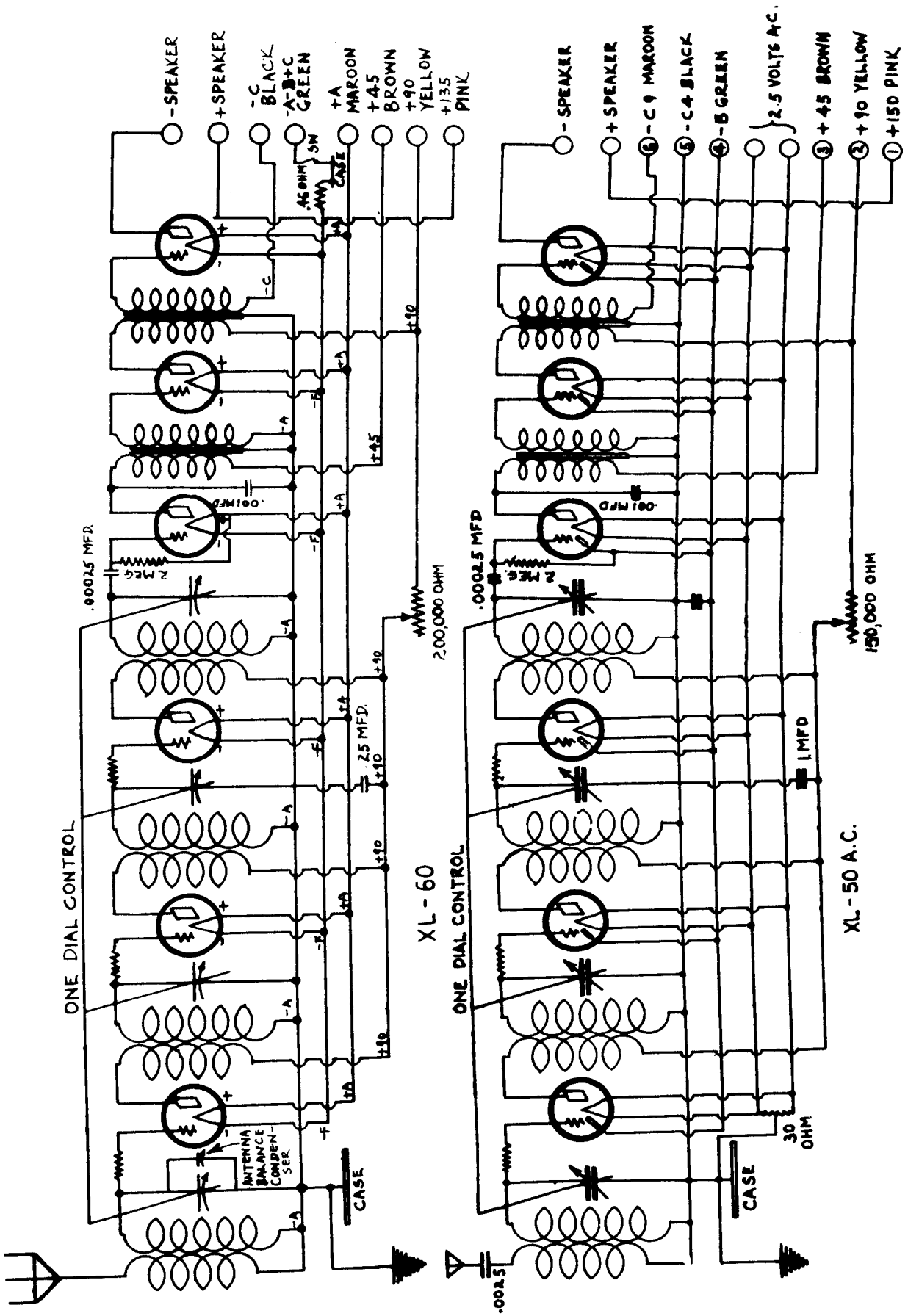
POWER PACK

A. C. DAYTON CO.

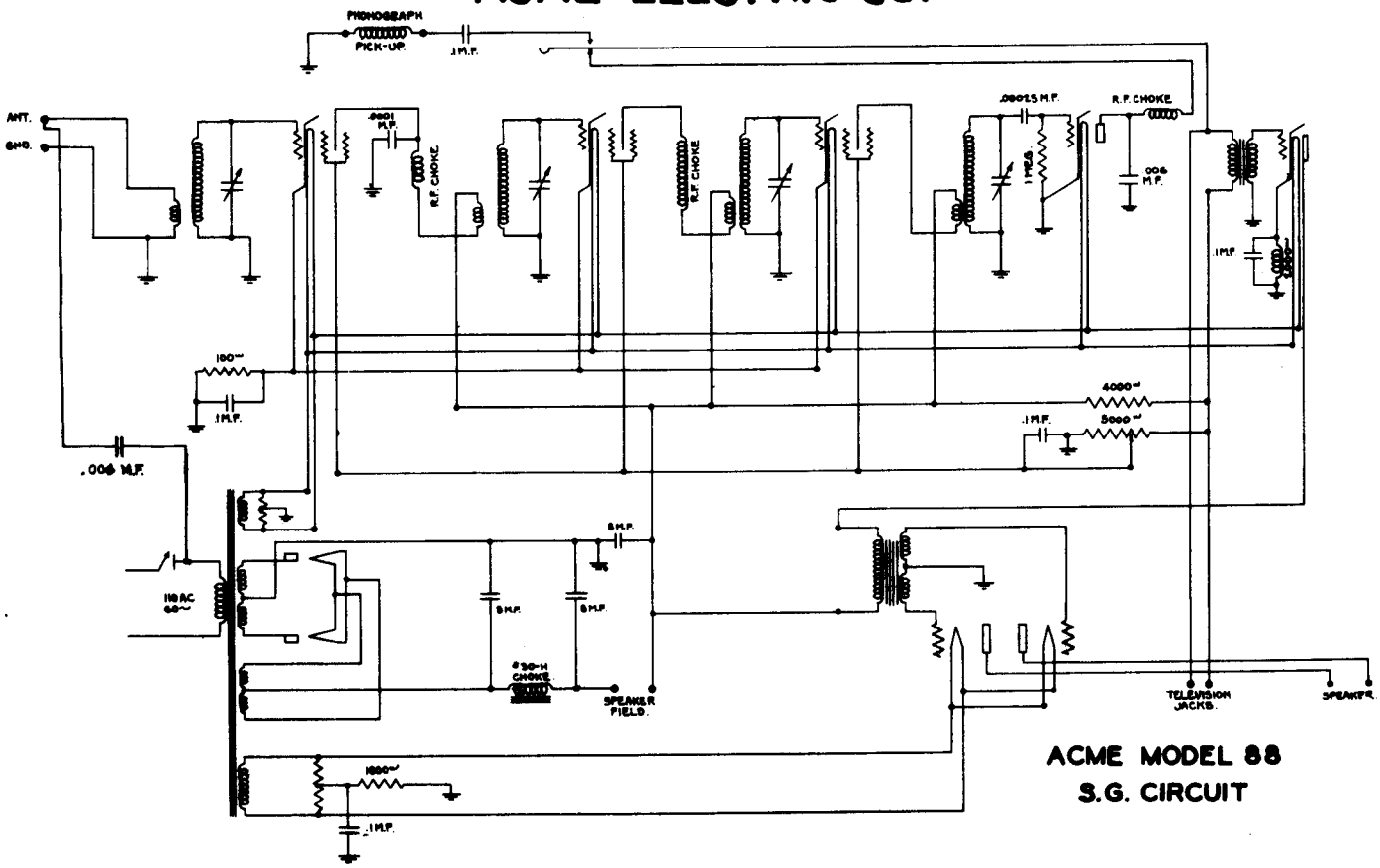

SPEAKER
SPEAKER
SWITCH
IMF
RED
YELLOW
.001 MFD
2,000,000 OHM
2 MEG
.00025
ONE DIAL CONTROL
150 OHM
.00025
150 OHM
.0001 MFD
150 OHM
.00025
XL-70


SPEAKER
SECOND AUDIO
PHONES
FIRST AUDIO
DETECTOR
SECOND RADIO
FIRST RADIO
+90
-
+
-6V
A
SHORT ANT.
MEDIUM ANT.
LONG ANT.
XL-10

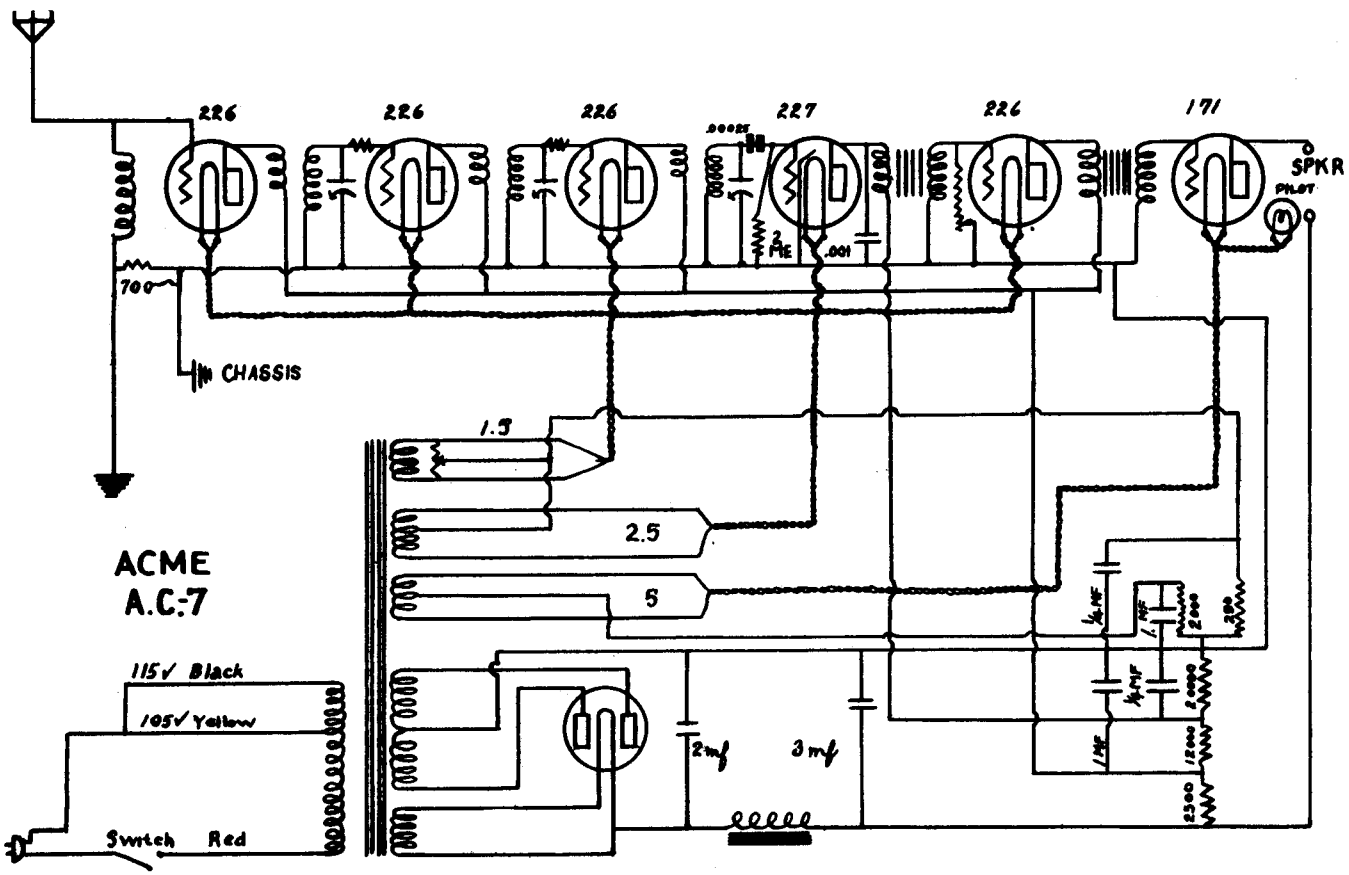
A.C. DAYTON CO.


- SPEAKER
+ SPEAKER
-C BLACK
-A-B+C GREEN
+A MAROON
+45 BROWN
+90 YELLOW
+135 PINK
.46 OHM SW
CASE
.001 MFD
2 MEG
.00025 MFD.
ONE DIAL CONTROL
200,000 OHM
.25 MFD.
ANTENNA BALANCE CONDENSER
XL - 60
- SPEAKER
+ SPEAKER
-C 1 MAROON
-C 4 BLACK
-B GREEN
2.5 VOLTS A.C.
+45 BROWN
+90 YELLOW
+150 PINK
.001 MFD
2 MEG
.00025 MFD
ONE DIAL CONTROL
150,000 OHM
1 MFD
30 OHM
CASE
.0025
XL - 50 A.C.

ACME ELECTRIC CO.



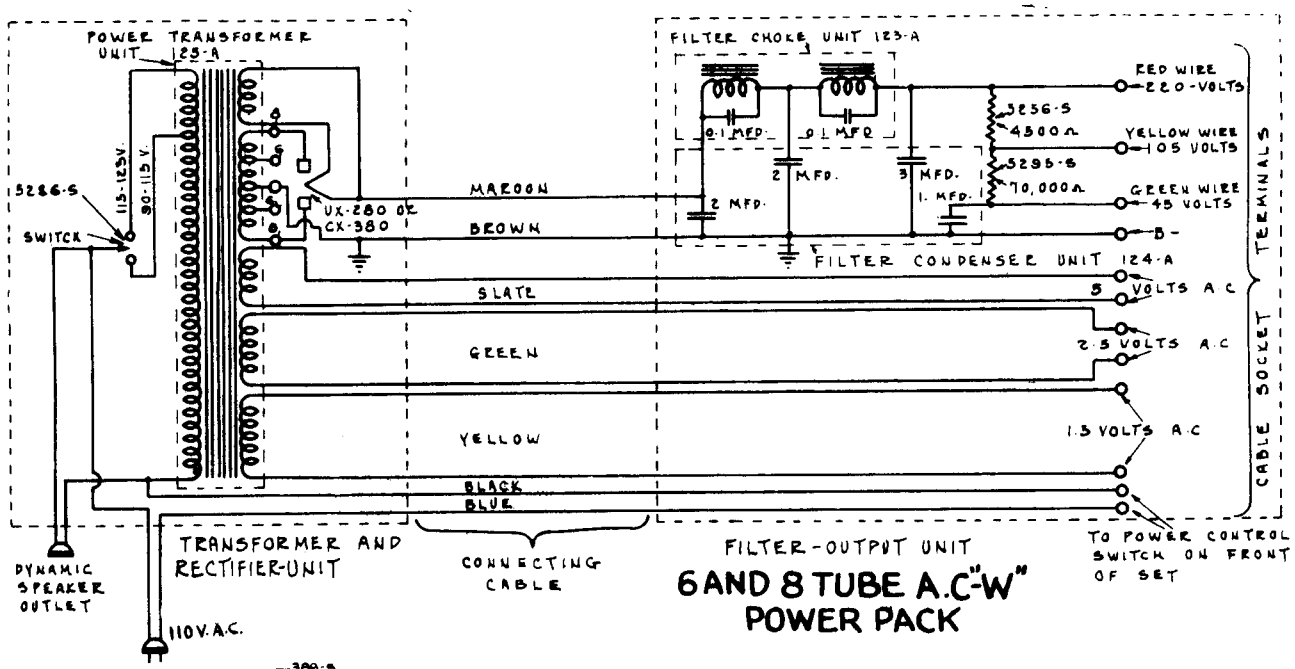
ACME MODEL 88
S.G. CIRCUIT



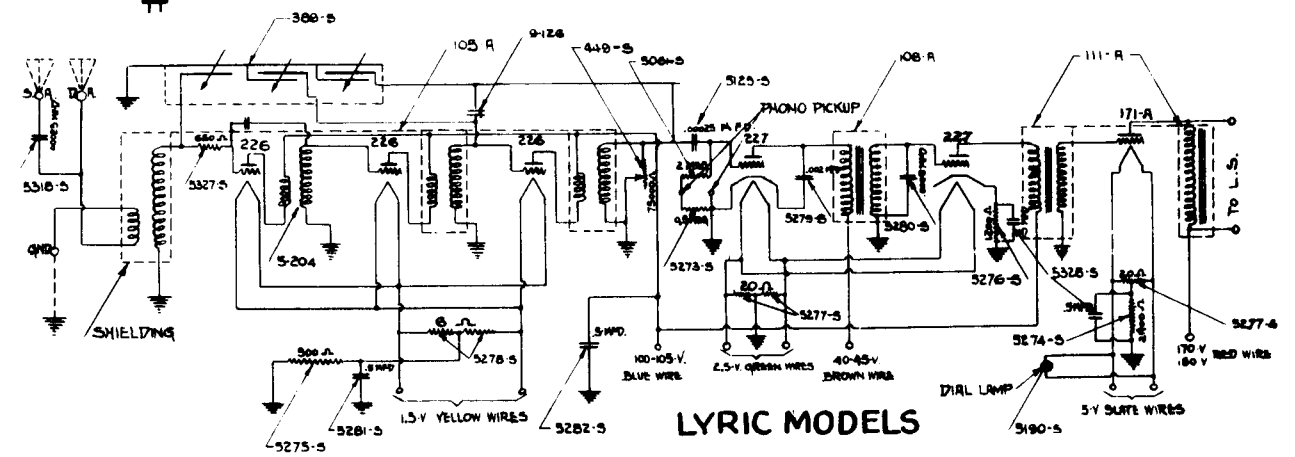
ACME
A.C.-7

ALL AMERICAN MOHAWK CORP.

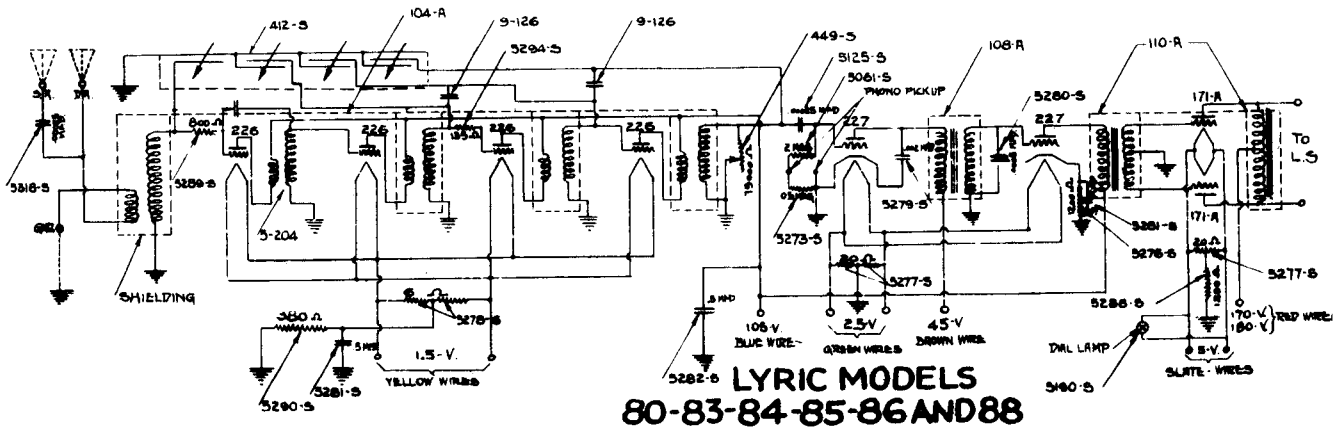
The diagrams on this page are taken from the Wurlitzer Service Manual in which the circuit diagrams are identically the same with the exception that the power pack is split into two parts instead of one complete unit as used in the Lyric Models.



6 AND 8 TUBE A.C."W" POWER PACK



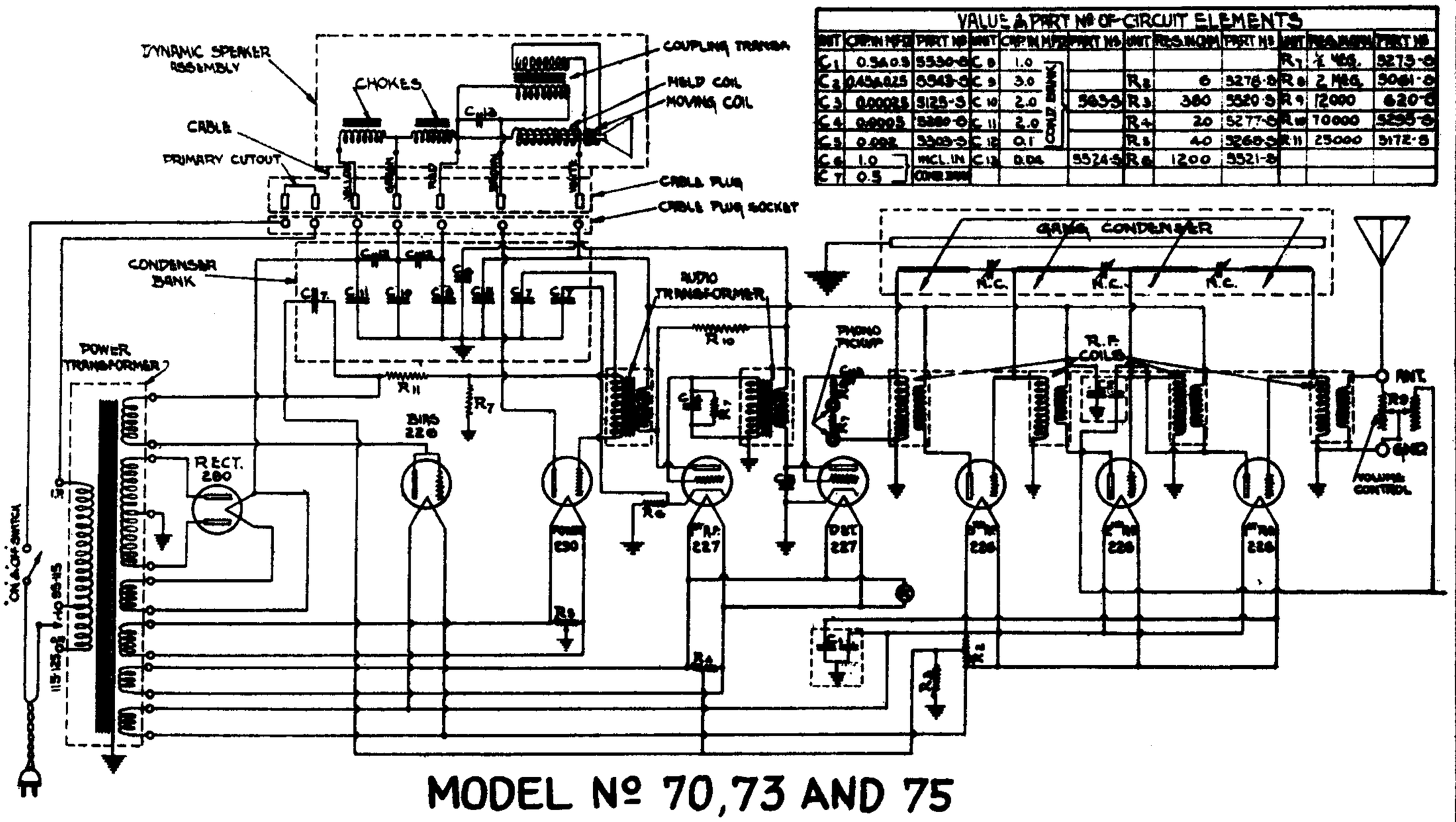
LYRIC MODELS 60-61-62-65 AND 66



LYRIC MODELS 80-83-84-85-86 AND 88

NOTE: ABOVE INDICATED PART NUMBERS ARE THE ELECTRICAL PART AND ASSEMBLY NUMBERS OF ITEMS USED IN CIRCUIT. WHEN ORDERING PARTS OR ASSEMBLIES SPECIFY THIS NUMBER AS WELL AS NAME OF ITEM.

ALL AMERICAN MOHAWK CORP.



VALUE & PART Nº OF CIRCUIT ELEMENTS

UNIT	CAP IN MFD.	PART Nº	UNIT	CAP IN MFD.	PART Nº	UNIT	RES. IN OHMS	PART Nº	UNIT	RES. IN OHMS	PART Nº
C 1	0.56 0.5	5530-S	C 9	1.0					R 1	1 Meg.	5275-S
C 2	0.45 & 0.25	5543-S	C 9	3.0		R 2	6	5276-S	R 8	2 Meg.	5081-S
C 3	0.00025	5125-S	C 10	2.0	5639-S	R 3	380	5520-S	R 9	12000	620-S
C 4	0.0005	5289-S	C 11	2.0		R 4	20	5277-S	R 10	70000	5295-S
C 5	0.002	5309-S	C 12	0.1		R 5	40	5268-S	R 11	25000	5172-S
C 6	1.0	INCL. IN	C 13	0.04	5524-S	R 6	1200	5521-S			
C 7	0.5	COND. BANK									

GANG CONDENSER

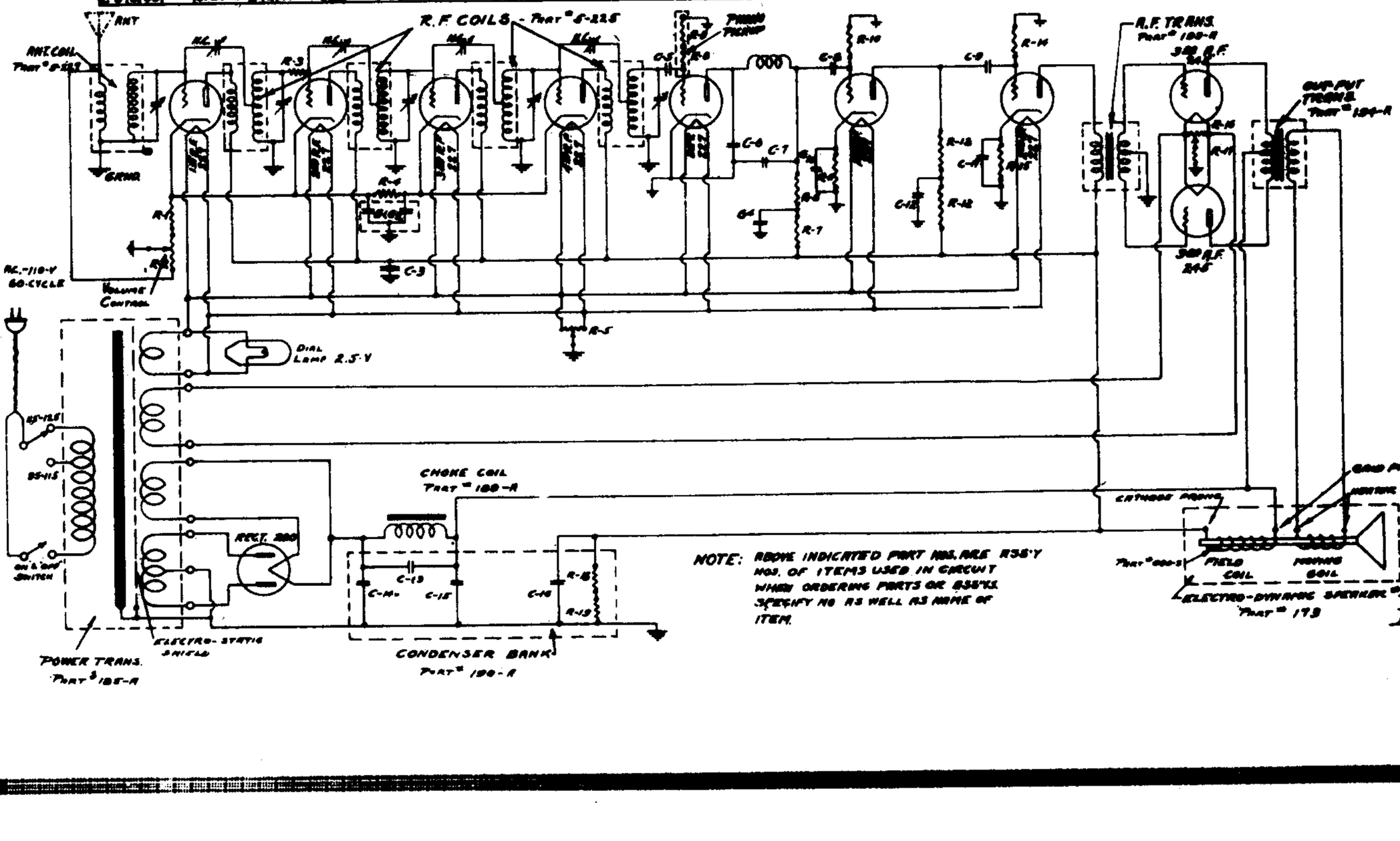
MODEL Nº 70, 73 AND 75

NO. 90 CHASSIS 60 CYCLE

180-W

VALUE AND PART NUMBER OF CIRCUIT ELEMENTS

UNIT	CAP IN MFD.	PART Nº	UNIT	CAP IN MFD.	PART Nº	UNIT	CAP IN MFD.	PART Nº	UNIT	RES. IN OHMS	PART Nº	UNIT	RES. IN OHMS	PART Nº	UNIT	RES. IN OHMS	PART Nº
C-1	0.1	5139-S	C-7	0.001	5134-S	C-13	0.1		R-1	380	5520-S	R-7	70,000	5295-S	R-13	35,000	5172-S
C-2	0.1	5139-S	C-8	0.01	5003-S	C-14	2.0		R-2	10,000	731-S	R-8	2 Megohms	5081-S	R-14	0.5 Megohm	5281-S
C-3	0.5	5518-S	C-9	0.01	5003-S	C-15	2.0		R-3	1500	6004-S	R-9	0.5 "	5281-S	R-15	2,400	5279-S
C-4	0.5	5139-S	C-10	0.5		C-16	2.0		R-4	100	5534-S	R-10	0.5 "	5281-S	R-16	20	5277-S
C-5	0.00025	5125-S	C-11	0.5					R-5	20	5277-S	R-11	2,400	5279-S	R-17	1,400	5280-S
C-6	0.001	5134-S	C-12	1.0					R-6	70,000	5295-S	R-12	76,000	5282-S	R-18	6,000	5101-S



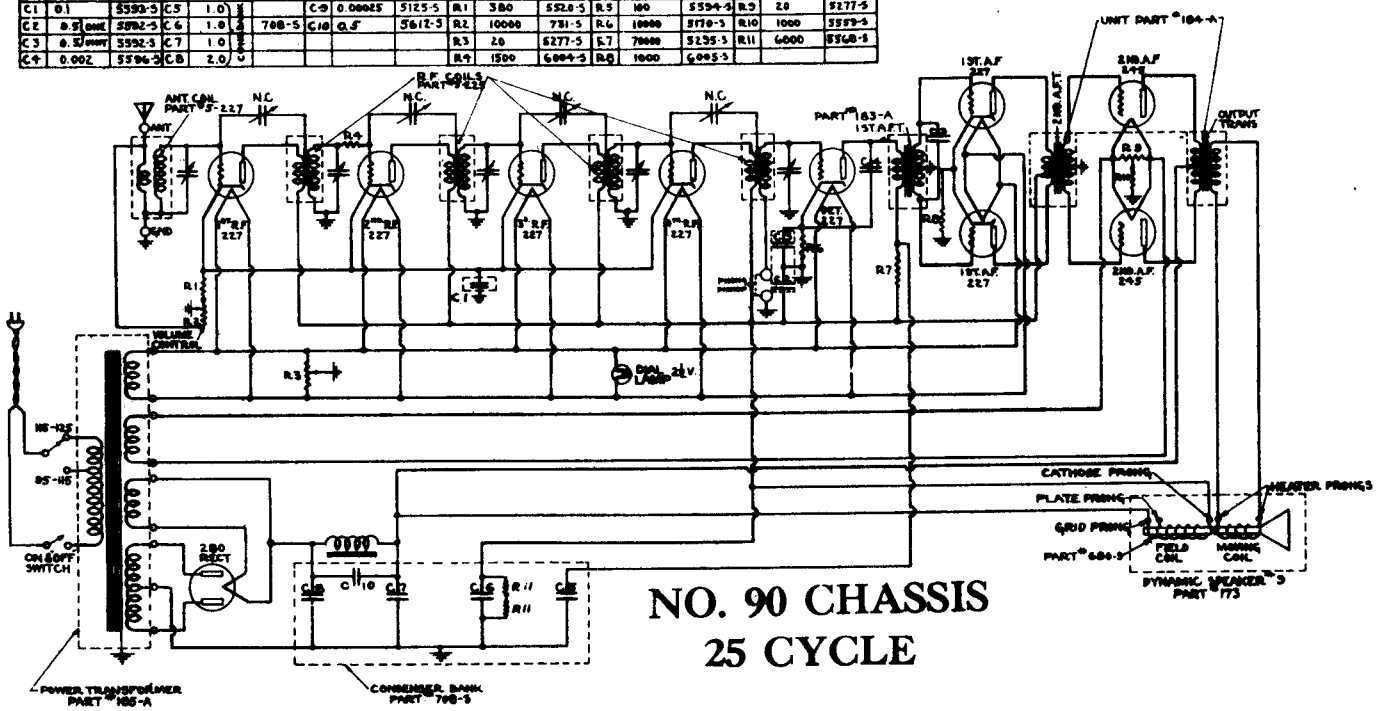
NOTE: ABOVE INDICATED PART NOS. ARE NOT THE NOS. OF ITEMS USED IN CIRCUIT WHEN ORDERING PARTS OR ASSEMBLIES SPECIFY NO AS WELL AS NAME OF ITEM.

ALL AMERICAN MOHAWK CORP.

182-W

VALUE AND PART Nº OF CIRCUIT ELEMENTS

UNIT	CAP IN MFD.	PART Nº	UNIT	CAP. IN MFD.	PART Nº	UNIT	CAP. IN MFD.	PART Nº	UNIT	RES. IN OHMS	PART Nº	UNIT	RES. IN OHMS	PART Nº	UNIT	RES. IN OHMS	PART Nº
C1	.01	5593-S	C5	1.0					C9	0.00025	5125-S	R1	380	5520-S	R5	100	5594-S
C2	.01 SAME	5592-S	C6	1.0	708-S				C10	0.5	5612-S	R2	10000	7511-S	R6	10000	8170-S
C3	.01 SAME	5592-S	C7	1.0								R3	20	5277-S	R7	70000	5235-S
C4	0.002	5596-S	C8	2.0								R9	1500	6004-S	R8	1000	6005-S

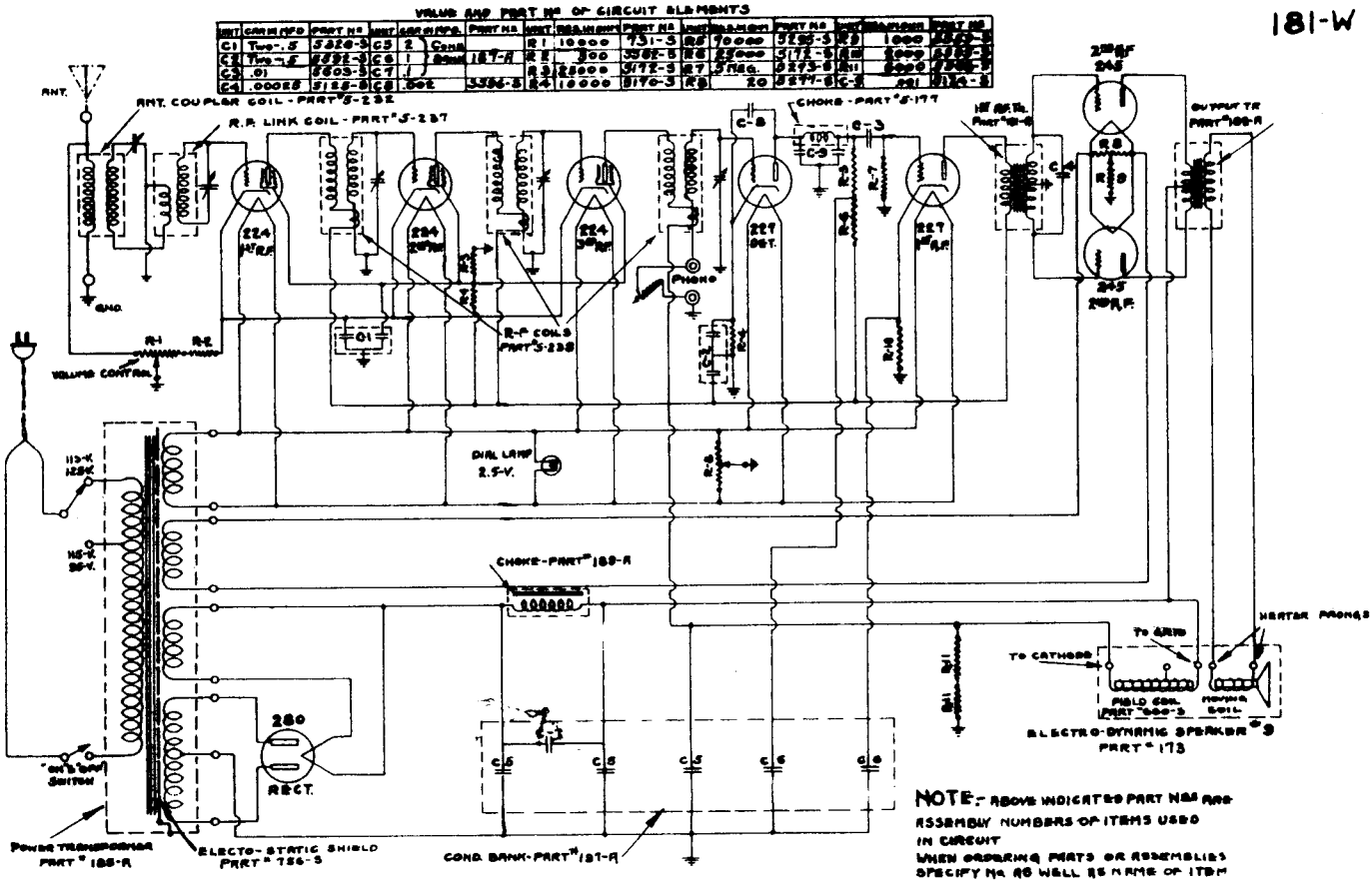


NO. 90 CHASSIS
25 CYCLE

181-W

VALUE AND PART Nº OF CIRCUIT ELEMENTS

UNIT	CAPACITY MFD	PART Nº	UNIT	CAP. IN MFD.	PART Nº	UNIT	RES. IN OHMS	PART Nº	UNIT	RES. IN OHMS	PART Nº	UNIT	RES. IN OHMS	PART Nº
C1	Two-.5	5326-S	C5	2	Cond.		R1	10000	R5	70000	5235-S	R9	1000	
C2	Two-.5	5591-S	C6	1	Block	187-A	R2	3000	R6	25000	5172-S	R10	5000	
C3	.01	5603-S	C7	1			R3	25000	R7	5 Meg.	5273-S	R11	5000	
C4	.00025	5125-S	C8	.005	5586-S	R4	10000	8170-S	R8	20	5277-S	C-2	.001	



NOTE:- ABOVE INDICATED PART NOS ARE ASSEMBLY NUMBERS OF ITEMS USED IN CIRCUIT WHEN ORDERING PARTS OR ASSEMBLIES SPECIFY NO AS WELL AS NAME OF ITEM

NO. 96 CHASSIS 60 CYCLE

Radio Service Data Sheet

ALL AMERICAN-MOHAWK "MODEL D" LYRIC RECEIVERS

This radio set, manufactured by All-American Mohawk Corp., North Tonawanda, N. Y., is made into a number of different cabinet jobs.

Following are the values of the units in the assembly. Resistors: R1, 10,000 ohms; R2, 7,500 ohms; R3, 200 ohms; R4, R5, 30,000 ohms; R6, 300,000 ohms; R7, 70,000 ohms; R8, 1.0 megohm; R9, 900 ohms; R10, 300 ohms; R11, 1,000 ohms; R12, 2,000 ohms; R13, 2,000 ohms. The ganged tuning condensers are of .00034-mf. capacity; the others measure: C1, C2, 35 mmf.; C3, C4, .05-mf.; C5, C14, 0.5-mf.; C6, .00025-mf.; C7, .0001-mf.; C8, .02-mf.; C10, C11, 1.0 mf.; C13, 1.5 mf.; C12, .073-mf. and C9, 0.5-mf.

The following figures are given as the average D.C. potentials for the tubes in this set when measured, on a high-resistance meter, with the leads on chassis and tube prong. The volume control R1-R2 must be on full-volume position; and the line potential should not exceed 115 volts.

Cathode voltages; V1, V2, 1.6; V3, 5.0; V4, 10.0: plate voltages; V1, V2, 140; V3, 50; V4, 130; V5, V6, 300; screen-grid voltages; V1, V2; 90; V3, 35; control-grid voltages; V5, V6, 50. Filament voltages are: V1, V2, V3, V4, V5, V6, 2.45.

The color code of the resistors in this set is given: R8, black with red end; R6, orange with green end; R7, orange; R4, R5, white; R3, red with black ends.

In this receiver a 24-henry choke coil is used as Ch. 1; it is tuned by C12. In the 25-cycle set, the inductance has a value of 50 henries, and the tuning condenser C12 required (to form a 120-cycle rejector) has a value of 0.2-mf. This circuit arrangement for reducing hum to a minimum should be carefully noted.

The color code for the by-pass condenser block is as follows: 0.05-mf., red leads; 0.5 mf., blue lead. The filter condensers, contained in their metal cases, have a black lead, indicating ground; green lead, 1.0 mf.; soldering lug next to green lead, .073-mf.; lug next to red lead, 1.0 mf.; red lead, 1.5 mf.

The tone control switch Sw.1 is located at the rear of the chassis, next to the antenna and ground binding posts.

The tandem volume control R1, R2, is of the tapered-resistance type, with a hop-off resistance value of 0.15-ohm; and replacements should be of the same design. This low resistance value is necessary to obtain complete control of the volume of the receiver.

The cable tension spring on the tuning control's fabric cable should be stretched to an overall length of 1⅝ in., or more. Should this length be less, it may be corrected by shortening the cable. This is most conveniently done by unhooking the spring, tying a knot in the cable, and then again connecting the spring.

Tip jacks J1 are for a phonograph pick-up, which must be connected manually by removing the jumper and inserting the tips. The volume control is turned off.

The R.F. transformers are of special design, and each has a two-section primary. One section is resonated by means of a condenser (C1 or C2) to a wavelength above the broadcast band; the other is effective at the shorter wavelengths. When the shorter wave stations are being tuned in, condensers C1 and C2 act as by-passes; at the longer wavelength both coil sections are effective. The purpose of this "staggered" design is to obtain more even amplification throughout the tuning band.

The screen-grid detector V3 is wired for plate-rectification, and is resistance-capacity-coupled to the first stage of A.F.

Connected to the reproducer is a 4-conductor cable terminating in a plug which is to be inserted in a socket (on the chassis) marked "speaker;" it is A in the diagram. The two primary plate leads from T2 are brown and yellow, the two speaker field leads are red and white; the red one being connected also to the center tap of T2.

Power transformer PT has a 5-volt winding S2, two 2½-volt windings S3, S4, and the usual high-voltage secondary S1.

Filter tuning condenser C12 is within the filter condenser can.

As a matter of record it may be of interest, to some of our readers, to list the equipment suggested by the makers as necessary for outside service, namely; a high-resistance voltmeter reading 0-50-250; a battery and high-resistance meter for continuity testing; a kit of radio service tools; a set of tested tubes for purposes of comparison or replacement with those in the receiver. Where shop service is necessary the following items are recommended: an audio-modulated oscillator for balancing; an output meter (thermo-galvanometer, preferably. The design and use of such units has been given in past issues of RADIO-CRAFT); and a tested dynamic reproducer for this model chassis.

In this receiver model, the procedure in balancing is as follows: connect the output test meter in series with voice coil of reproducer, tune set to approximately 1,500 kc. and tune oscillator to set; of course, placing oscillator sufficiently near set to be heard.

To protect output meter against burn-out, shunt it with a 6-ohm rheostat, which will serve also to control the deflection. Also, during the first part of balancing the set this resistor may be set to short the meter, and the tests conducted by ear. Greater precision is obtained later by cutting in about one-half the resistance of this shunt.

Now, adjust the trimmers for maximum deflection of the meter, starting from the antenna circuit.

Further balancing should take place at about 1,100, 750, and 570 kc. However, the adjustment is to be made by bending the slotted sections of the rotor plate, slightly, instead of adjusting the trimmer condensers. (For this adjustment a fiber strip will be handy.) To do a real job, the set should be checked again at 1500 kc.

Slightly distorted reception and reduced volume may be due to an open in one-half the secondary of T2; which is conveniently checked by removing one tube and noting reception. It is pointed out that a quick and convenient test of the entire audio system and power supply may be made by checking the performance of a phonograph pick-up connected to tip-jacks J1.

Abnormal hum usually can be traced to troubles which have been described in past issues of RADIO-CRAFT; but, for the sake of completeness these possible causes are given here: filament or heater wires grounded to chassis; socket prongs grounded to chassis by solder; defective by-pass or filter condensers; grounded biasing resistors; unbalanced or defective type '45 tube; defective '80, perhaps with only one plate functioning; open C12; reversed field coil leads; defective detector tube. In the latter instance, a convenient check is to interchange the detector and one of the R.F. tubes. If this clears the trouble, it is not necessarily an indication that the tube need be replaced by a new one, if it functions satisfactorily in the R.F. position.

When checking the receiver for antenna or light-line interference pickup, do not forget, after removing the aerial lead, to short the antenna and ground leads; as the pick-up from the binding posts only may be considerable in some localities.

The recommended antenna length for this set is 85 feet, including lead-in.

If it becomes necessary to replace resistors R1, R2, or condensers C1, C2, C7, or C12, exceptional care should be taken to obtain the correct types and values in the replacement units. In particular, condenser C12 must be exactly right to resonate the circuit Ch1-C12 at the second harmonic (120 cycles) ripple of the 60-cycle A.C. line-frequency.

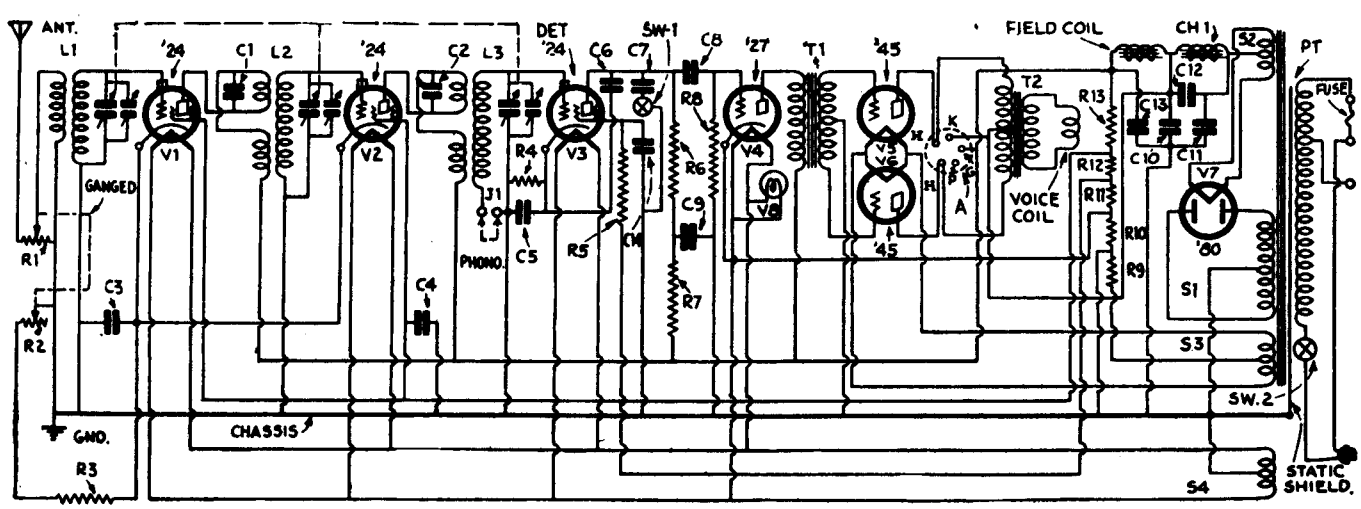
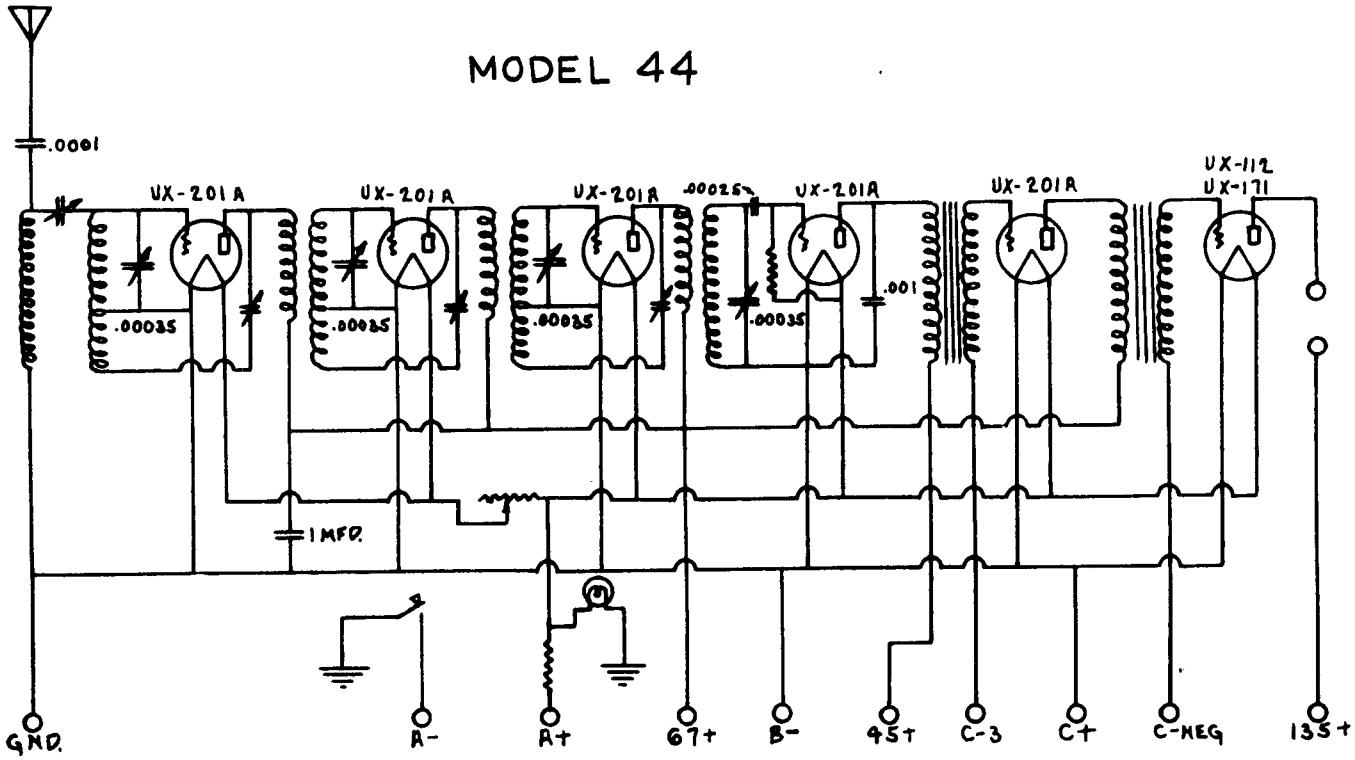


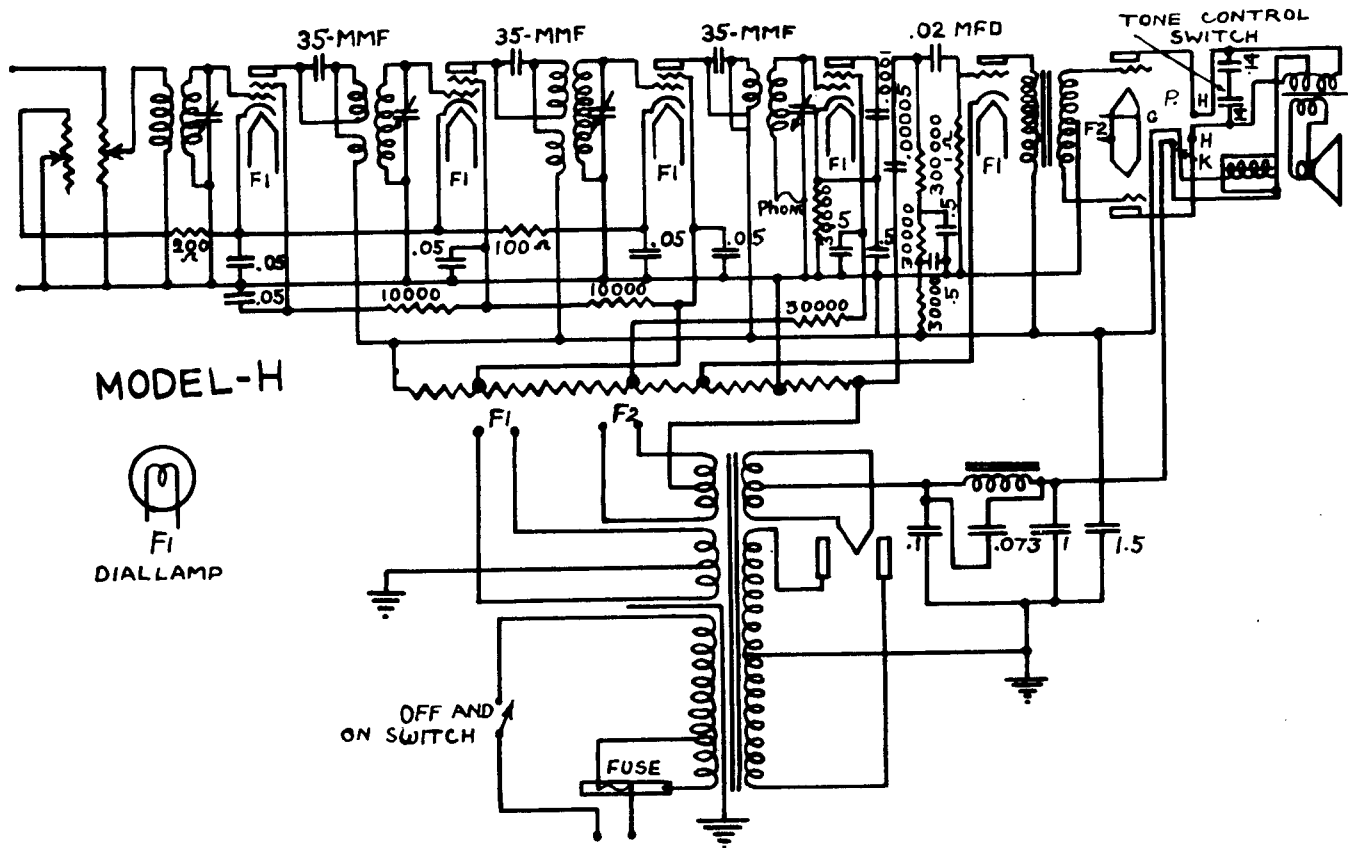
Diagram of connections of the All American-Mohawk "Model D" Lyric screen-grid receiver; a jumper closes the circuit at J1 when a phonograph pick-up is not in use. Tone control is obtained with switch SW.1.

ALL AMERICAN MOHAWK CORP.

MODEL 44

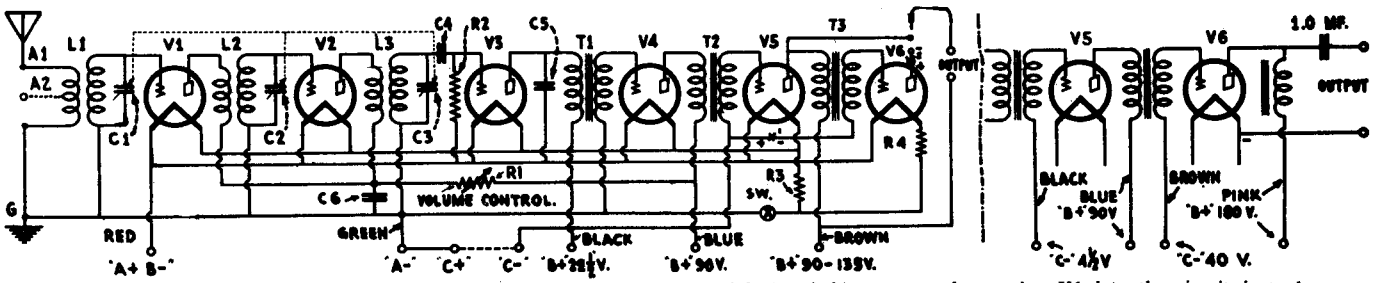


MODEL-H



Radio Service Data Sheet

ALL-AMERICAN "MOHAWK" ONE-DIAL RECEIVERS BATTERY AND A.C. 226-227



Above. Battery model of the "Mohawk" One-Dial receiver. If the original switching system for cutting V6 into the circuit is to be retained, special connections must be employed, as described in the text. At right: Modifications in later models; this standard arrangement of the output stage provides for the use of a power tube at V6.

There are two principal variations in the battery-model Mohawk receiver. The first circuit, shown above does not make provisions for a power tube at V6; six type '01A tubes are required. A 5-wire cable is used. An odd arrangement of the A.F. output circuit, to select two or three stages of A.F., by means of tip-jacks and a plug, necessitates placing the additional battery required for power-tube operation on the plate side of the A.F. output, at the point marked X2 (otherwise, this supplementary potential would be added to the plate supply of V5). The corresponding "C" potential is added at X1.

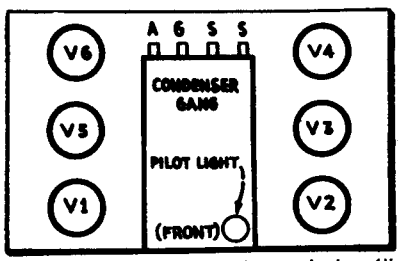
In later models, provisions were made for a power tube; and the usual connections are shown at the right of the main diagram. The color code of the (7-wire) cable is then as follows: Green, "A—"; red, "A+"; white (connected to red), "B—"; slate, "B+" 22½ or 45 volts; blue, "B+" 67½ or 90 volts; pink, "B+" 90, 135 or 180 volts; black, "C—" 4½ volts; brown, "C—" 4½, 9, 22½ or 45 volts; yellow (connected to green), "C+".

The available constants for this receiver are as follows: L1, L2, L3, shielded R.F. transformers; volume control R1 is a 500,000-ohm variable resistor which turns off the set by operating switch SW when R1 is turned to extreme left; R2, 2 megs.; R3, 1¼-amp. filament ballast; R4, 1-ohm resistor; C4, .00025-mf.; C5, .002-mf.; C6, 0.5-mf. In some sets, R3 is a 10-ohm rheostat.

In later production a selectivity control was incorporated. This was in effect a single-pole, single-throw switch arranged to select either all, or half, the primary of L1.

The circuit of this receiver will oscillate; but is controlled by R1. Trimming plates are provided on the condenser gang.

The tube layout shown is the same for A.C. and battery models.



Layout of parts in receivers of the All-American "Mohawk" line.

The A.C. model requires four '26s for V1, V2, V4, V5; a '27 for V3; and a '71A for V6.

The constants of the A.C. model are as follows: C4, .00025-mf.; C5, .002-mf.; C6, C7, C8, C15, 0.5-mf.; C9, .003-mf.; C10, C11, 1.0-mf.; C12, 6-mf.; C13, 3-mf.; C14, 2-mf.; R1, 650 ohms; R2, 850 ohms; R3, 2 to 3 megs.; R4, R7, R8, 20 ohms; R5, R9, 1,000 to 1,200 ohms; R6, 0.5-ohm; R10, 2,000 ohms.

The heater of V3 is held at 45 volts positive. If this positive tap open-circuits, there will be a noticeable increase in hum.

Resistor R6 varies the heater current to V1 and V2. It has a value from 0.5- to 0.75-ohm. Lack of volume control may be due to a short in this unit; while a ground will result in hum.

Transformers T1, T2, T3 have a ratio of 3¼ to 1; T4, 1 to 1.

Uncontrollable circuit oscillation will result if R1 or R2 becomes shorted, and may be the result if R1 and R2 are interchanged. If the set cannot be made to oscillate on medium to high wavelengths, try changing the R.F. tubes; though this may be due to C15 being open. A particularly high noise level may be an indication of C9 being open.

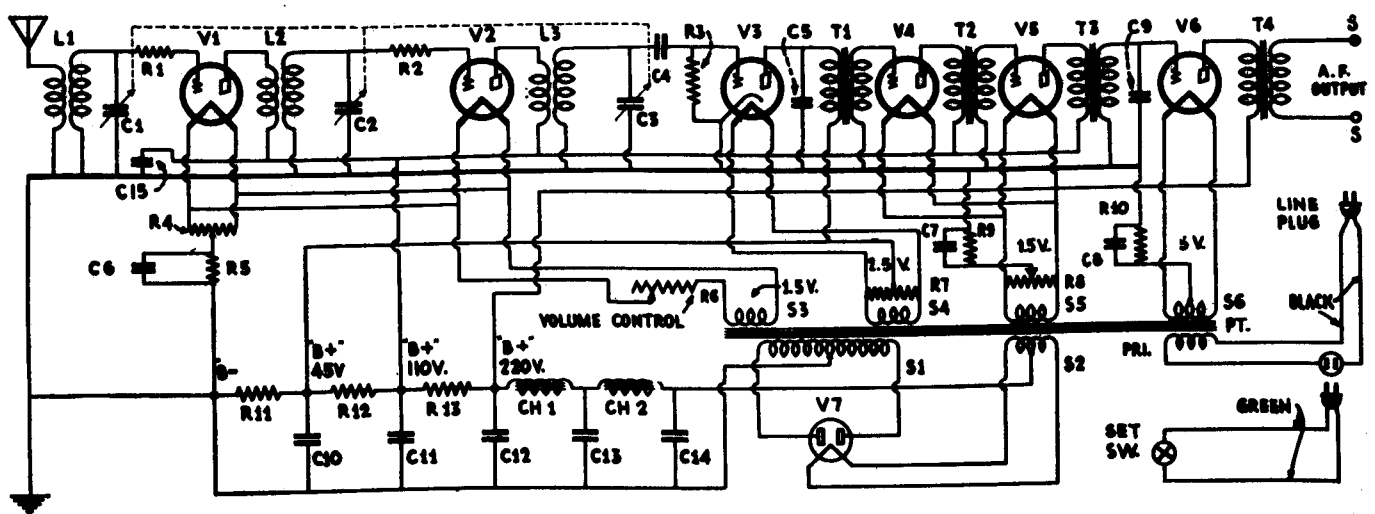
The "Mohawk" receivers carry further designating names, such as "Navajo," "Iroquois," "Cortes," "Hiawatha," "Seminole." Some of these are table models, others consoles with or without speakers. One of the early models was designed to use Kellogg tubes, with their side connections for the heater leads.

The voltage divider of the current-supply unit used in the electric model calls for these resistor values: R11 ("B—" to "B+" 45) 6,500 ohms; R12 ("B+"45 to "B+"110) 6,000 ohms; R13 ("B+"110 to "B+"220) 1,600 ohms.

Attention is called to the fact that, although some of the circuit sheets which have been issued do not show a ground, there is a return circuit to ground for the power unit, as shown in the diagram at the bottom of this page.

The color-code of the Jones cable used in this receiver to couple the receiver to the power pack is as follows: Pink (2), 1½-volt filament supply for R.F. tubes V1 and V2 (the output of secondary S3); yellow (2), 1½-volt filament supply for A.F. tubes V4 and V5 (the output of secondary S5); black (2), 5-volt filament winding for power tube V6 (the output of secondary S6); purple and gray leads, the 2½-volt supply leads (from secondary S4) for the filament of detector tube V4; green, "B+" 45 volts; white, "B+" 110 to 150 volts; red, "B+" 220 to 250 volts; brown, the "B—" lead, is to be grounded.

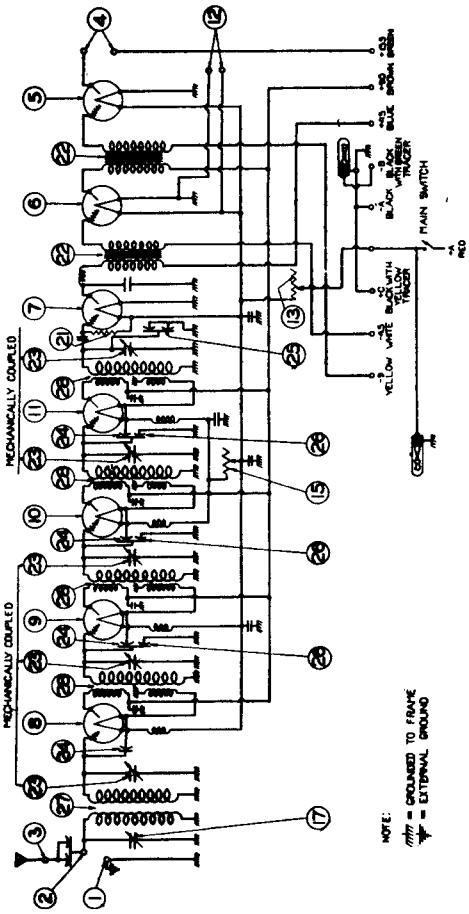
Most receivers require a good ground connection; but this is particularly true of the "Mohawks," if hum is to be held at a minimum level.



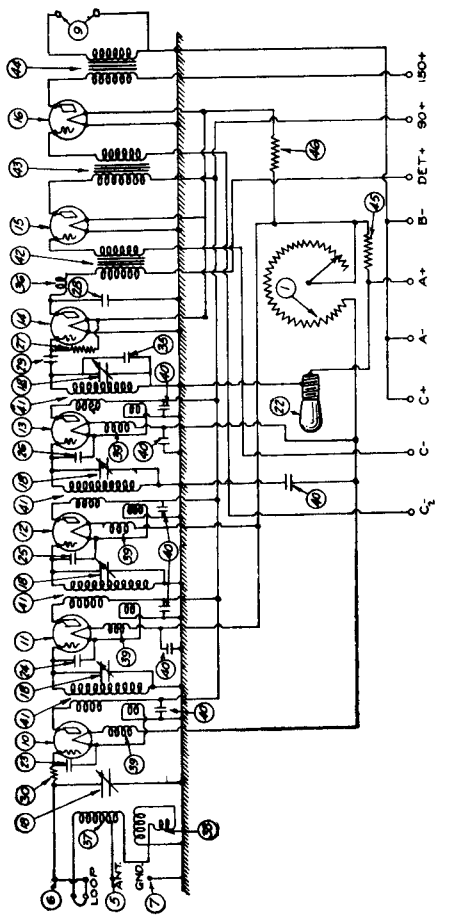
Schematic circuit of the A.C. design of the All-American "Mohawk" radio set. The color codes of its Jones cable and the voltage divider do not appear in the regular manual, but are given in the text of this sheet.

AMERICAN BOSCH MAGNETO CORP.

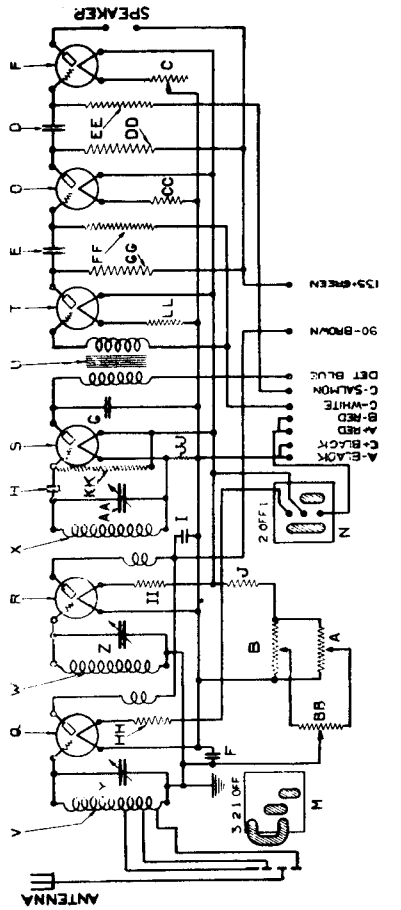
BATTERY OPERATED RECEIVERS



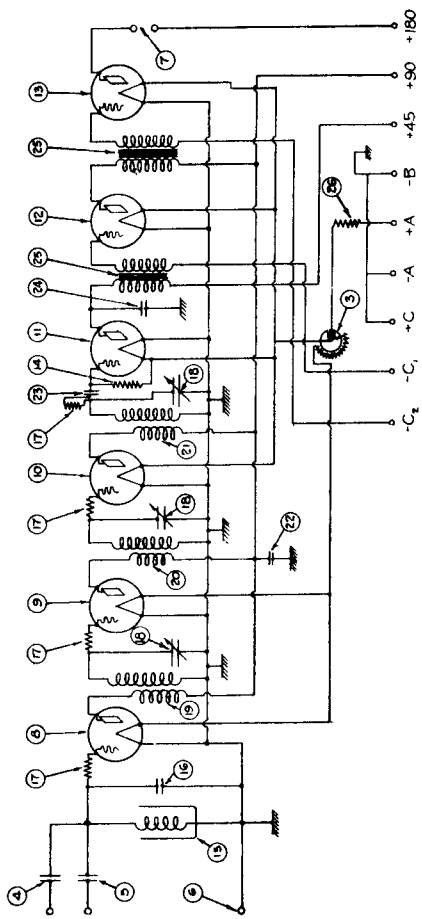
Model 27 Receiver—The "Amborada"



Models 57 and 87 Receivers



Model 16 Receiver—The "Amborola"



Model 46—The "Little Six"

Radio Service Data Sheet

BOSCH "CRUISER," "ROYAL CRUISER," AND "IMPERIAL CRUISER" MODEL 35 BATTERY SETS

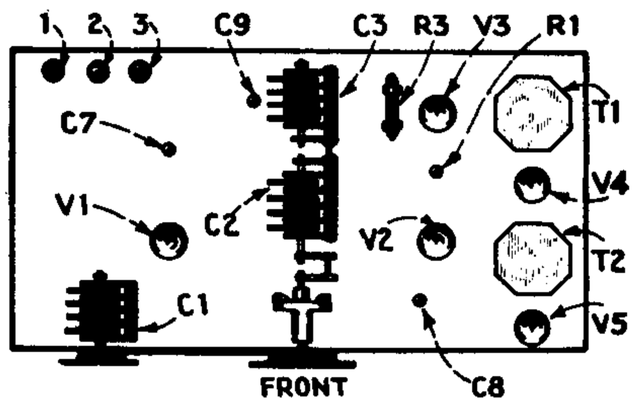
An unusual method of obtaining neutralization is observed in these popular "Cruisers." Windings (A) in coils L2 and L3 are in the negative filament leads of V1 and V2, for this purpose, and function in conjunction with condensers C7 and C8.

Resistor R1 is a master control to maintain the filament potential at five volts. Volume is further controlled through R2 (marked "Amplifier") which, at its position of highest resistance, operates switch SW1. Selectivity is governed by SW2 (marked "Clarifier") and C10. A nine-wire cable connects the current supply to the set.

As this model of the Bosch receiver is not provided with an output transformer, or choke coil and condenser, trouble may be experienced from de-polarized magnets in magnetic-type reproducers, if the leads of the reproducer have been accidentally reversed.

The location of the main rheostat, R1, is indicated in the top and bottom views of this receiver. The slot in the top of the control will be parallel with the front of the set for the five-volt setting.

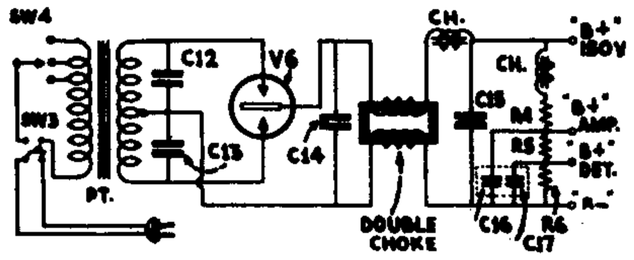
Four '01A tubes and a '12A or '71A tube are recommended for this set.



Top view of parts layout of Bosch "Cruisers." The coupling devices for C2, C3 are clearly shown.

Nearest to the panel is the knob that controls C2 and C3, the settings of which are indicated on the upper or "Main Tuning Scale." The other knob controls the antenna for tuning condenser C1, with its position indicated on the lower or "Antenna Tuning Scale." The reading on the lower scale depends, in part, on the length of the antenna.

This receiver is balanced like a regular neutrodyne receiver, a "dummy" or open-filament tube (or similar expedient) being used in place of the regular tube; first, in place of V2, and then as a substitute for V1. Adjustments of C7 and C8 are made for minimum signal. Condenser C9 resonates the detector circuit for maximum signal.



Schematic circuit of "Type BAN (Edition 3) Nobattry" eliminator.

If either of the above adjustments cannot be made, check the R.F. circuit for faults. Remove the shields from C1, C2 and C3, and note whether, at the zero setting of the dial, all the condenser rotors align perfectly straight at the tapered ends of the stators. Adjustment of the stators is accomplished through the bolts which join two end plates (if it is desired to change the spacing between interleaved rotor and stator plates); and the proper spacing here, for minimum setting, is easily obtained by adjustment of the screws on the condenser-shaft couplings.

If the condenser shafts lose their alignment, the condensers may be loosened and reset to the correct positions. Condenser C2 may be shifted for proper alignment after removing the coil assemblies.

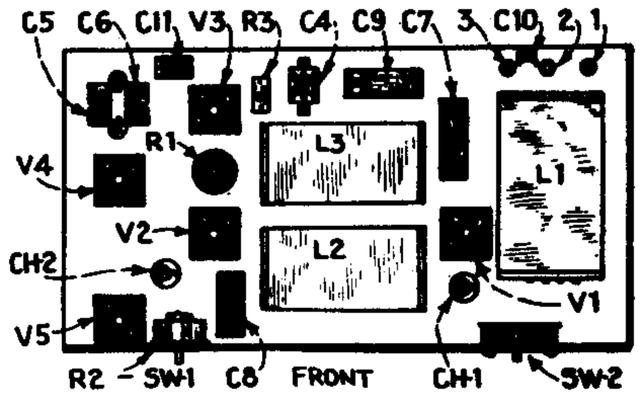
With all condensers set at maximum capacity, the dial should indicate 100. If this reading is not obtained, compensation may be secured by adjustment of two stop screws provided for this purpose.

A six-ohm rheostat may be used as replacement for R1; R2 has a resistance of about 30 ohms; R3 is the usual 2-meg. leak; C1, C2, C3 are the tuning condensers; C4 is .00025 mf.; C5, C6, 1.0 mf. each; C7, C8, C9, 100 mmf., maximum (approx.); C10 125 mmf. (approx.); C11 .006 mf.

The "Type BAN" (Edition 3) "Nobattry" eliminator is usually used with this model of the "Cruiser" line. (Other models of the "Cruiser" embodying somewhat the same general features but varying in details are the "Model 96DC, 110 volts"; "Model 156," (for direct current); "Models 66, 76, 76L" (battery-operated); "Models 66AC. 96, 116, 136" (for A.C. operation).

Constants for the above "Nobattry" unit are as follows: C12, C13 0.1-mf.; C14, 3 mf.; C15. 2 mf.; C16, C17, 2 mf.; R4, 4,000 ohms (or a variable 5,000-ohm unit); R5, 15,000 ohms; R6, 25,000 ohms. V6 is a gaseous rectifier; SW3 the power switch. The principal choke unit in the filter system is a "double" choke.

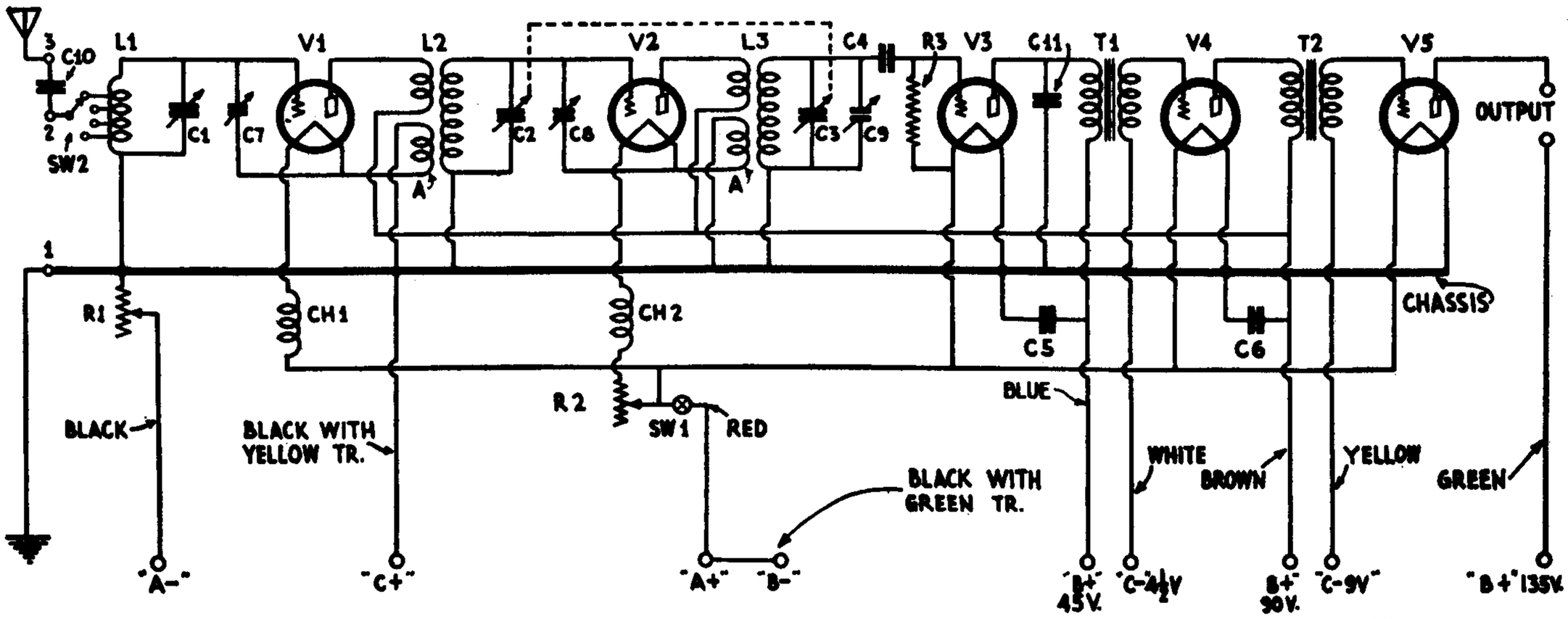
Although the circuit diagram does not indicate that there is a mechanical connection between C2, C3, and antenna condenser C1, there is a slip coupling which permits C1 to turn readily when the other two tuning condensers



Underside appearance of "Model 35" receivers. Units R1, C7, C8, C9, shown here, adjust from above.

are adjusted or to be operated independently of these two. More complete control of the dial reading designated "Antenna Tuning Scale" will be secured by making C10 one of the compact adjustable units now available. Then, by varying C10 and SW2, it will be possible to obtain nearly identical readings on both scales for any average antenna conditions.

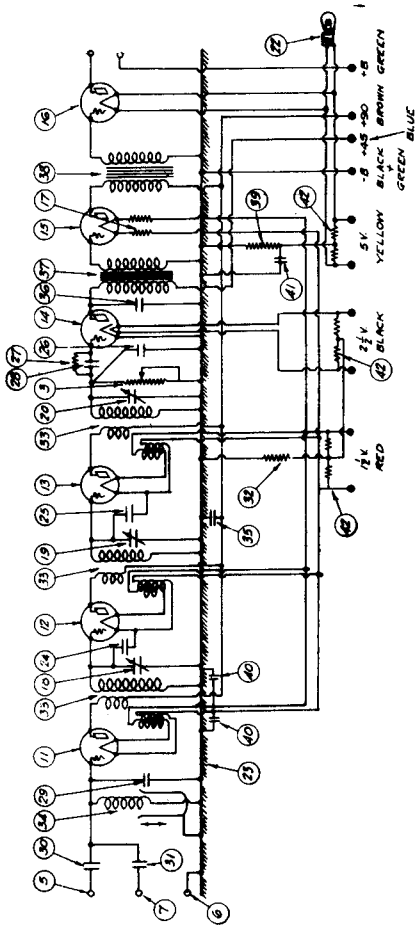
If it is found that circuit oscillation cannot be stopped, test windings A for reversed connections; checking L3 first and L2 last.



Schematic circuit of the "Cruiser," "Royal Cruiser," and "Imperial Cruiser," designs of the Bosch "Model 35" battery sets. The arrangement of the neutralizing circuit is such that the respective grids are connected to the grounded "A—" lead if the neutralizing condensers short, without affecting any of the batteries in the set.

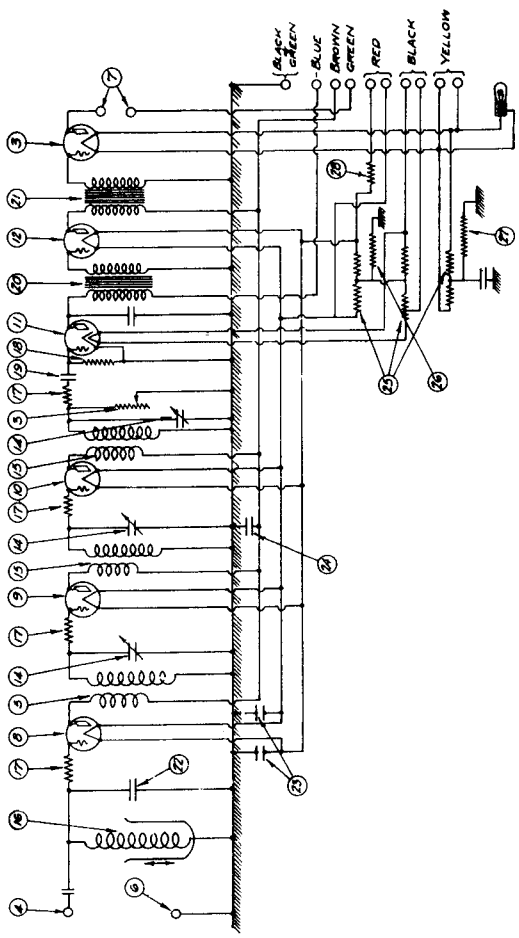
AMERICAN BOSCH MAGNETO CORP.

A.C. RECEIVER



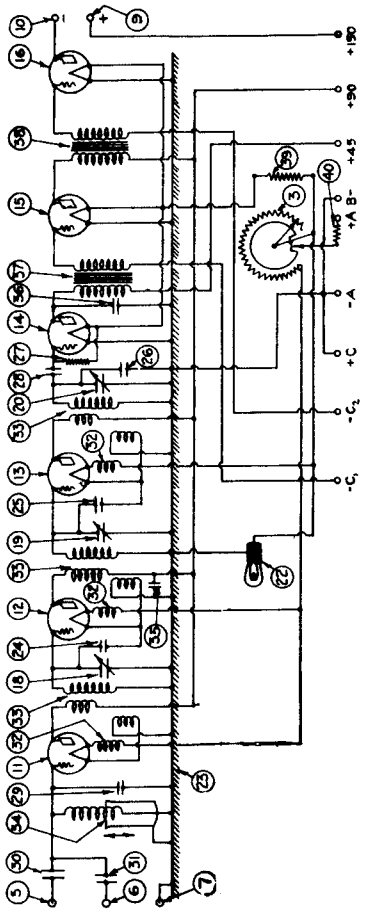
Models 66AC, 96, 116, 136 Receivers (for AC operation)

A.C. RECEIVER



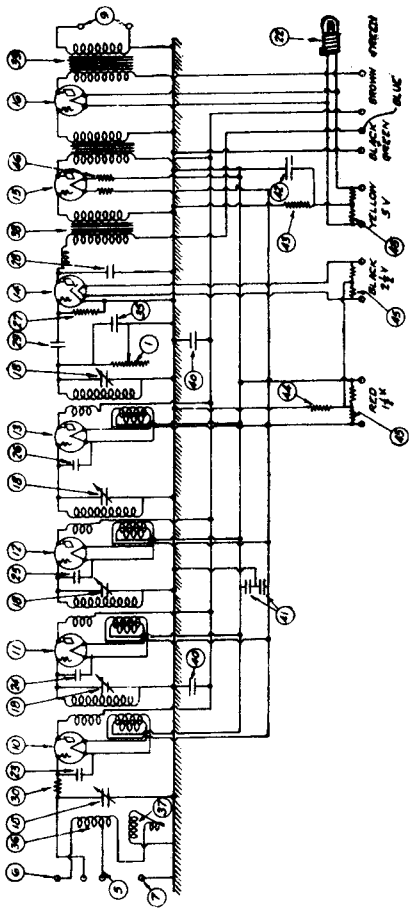
Models 126, 146, 166, 176, 46AC (AC operation)

BATTERY RECEIVER



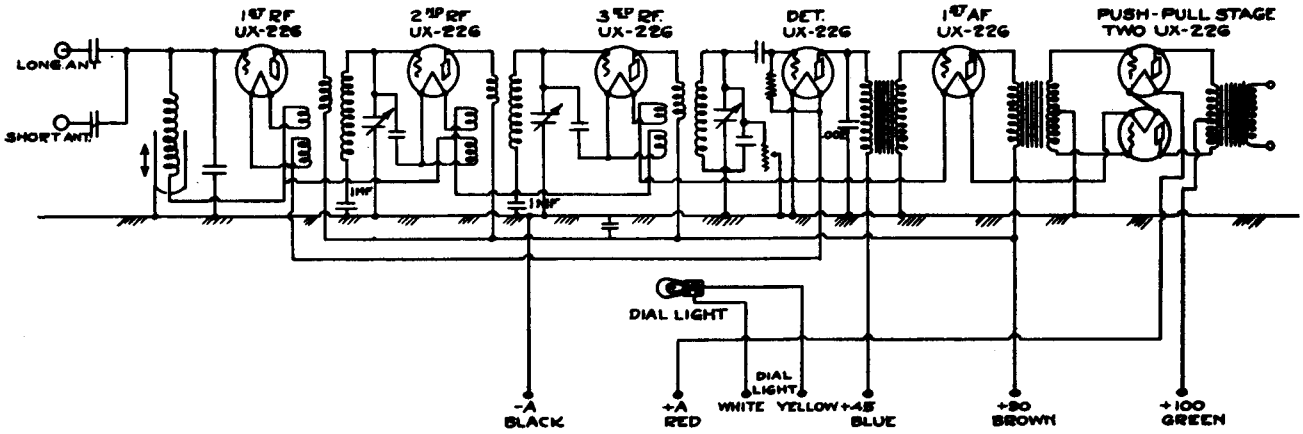
Models 66, 76, and 76L Receivers—The "Cruiser"

A.C. RECEIVER



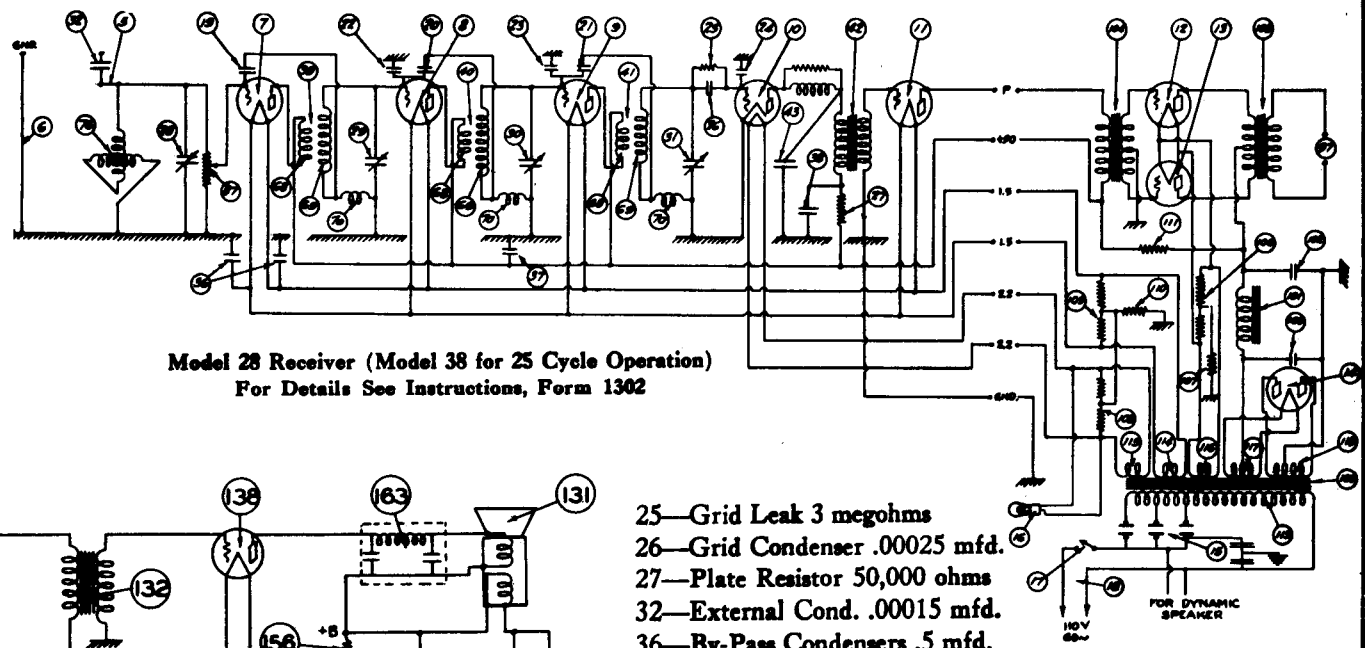
Model 107 Receiver (for AC operation)

AMERICAN BOSCH MAGNETO CORP.

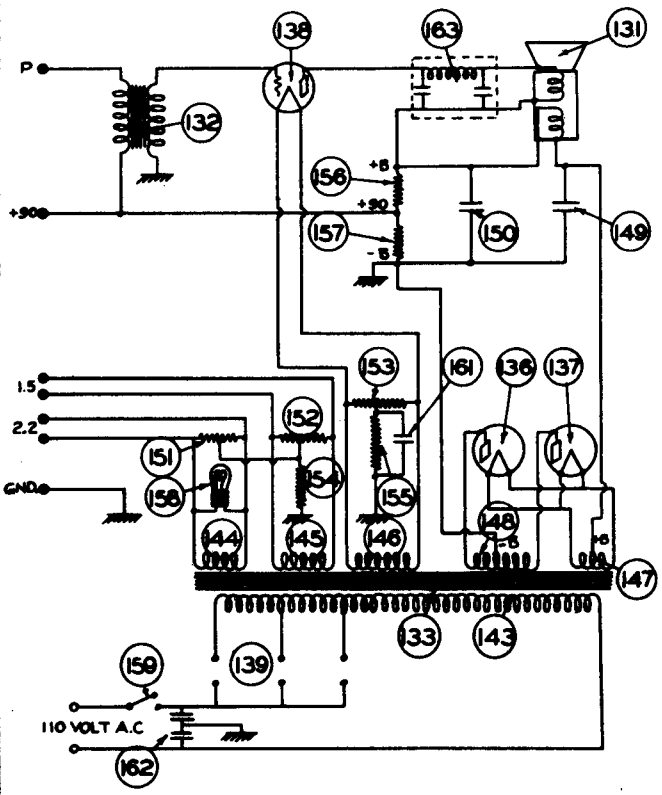


Model 96DC 110 Volt "Cruiser"

Model 156 Receiver "Cruiser"



Model 28 Receiver (Model 38 for 25 Cycle Operation)
For Details See Instructions, Form 1302



Model 825 Super Dynamic Power Pack. Used with Model 28 Chassis only to form Model 29 Receiver.

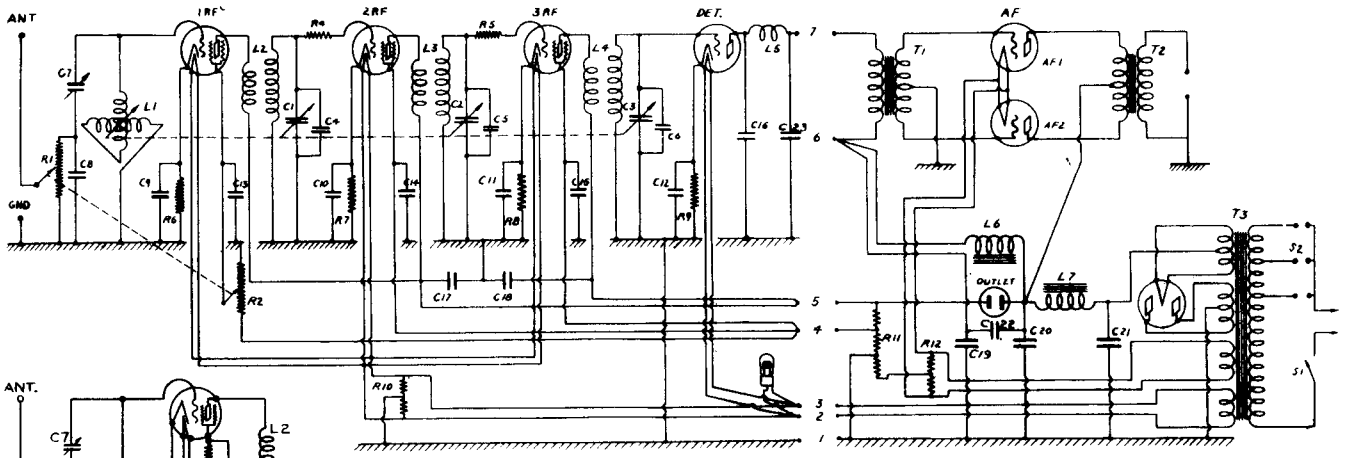
25—Grid Leak 3 megohms
26—Grid Condenser .00025 mfd.
27—Plate Resistor 50,000 ohms
32—External Cond. .00015 mfd.
36—By-Pass Condensers .5 mfd.
37—By-Pass Condenser 1. mfd.
38—By-Pass Condenser 1. mfd.
43—By-Pass Condenser .002 mfd.
87—Volume Control 500,000 ohms
102—Filter Condenser 2 mfd.
103—Filter Condenser 4 mfd.
107—Bias Resistor 1500 ohms
110—Bias Resistor 300 ohms
111—"B" Resistor 5000 ohms

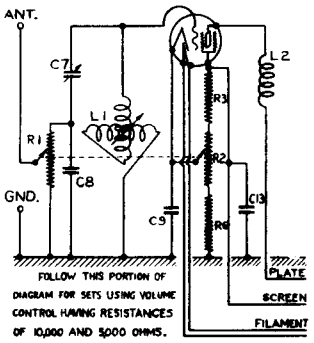
MODEL 825 POWER PACK

149—Filter Condenser 4 mfd.
150—Filter Condenser 2 mfd.
154—Bias Resistor 500 ohms
155—Bias Resistor 2000 ohms
156—Plate Resistor 10,000 ohms
157—Plate Resistor 10,000 ohms
161—By-Pass Condenser 1. mfd.
162—Buffer Condensers
163—Filter

AMERICAN BOSCH MAGNETO CORP.

MODEL 48 RECEIVER (MODEL 49 FOR 25~)





L1—Variometer
L2—2nd RF Coil
L3—3rd RF Coil
L4—Detector Coil
L5—Detector Plate Choke
L6—Small Filter Choke
L7—Large Filter Choke

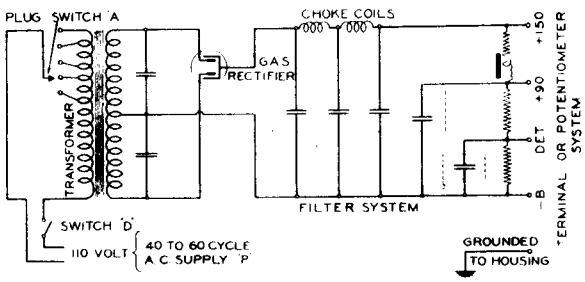
S1—Off and On Switch
S2—Voltage Tap Switch

C1—2nd RF Tuning Condenser
C2—3rd RF Tuning Condenser
C3—Detector Tuning Condenser
C4—2nd RF Alignment Condenser
C5—3rd RF Alignment Condenser
C6—Detector Alignment Condenser

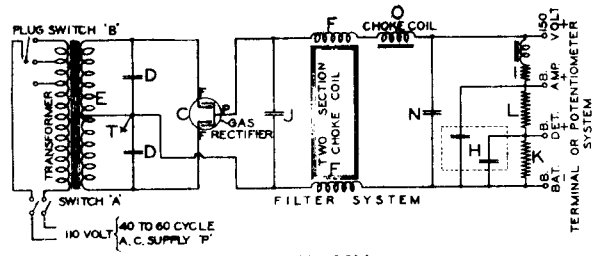
C7—Antenna Tuning Condenser
C8—Antenna Condenser .001 mfd.
C9—1st RF Cathode By-Pass Condenser .5 mfd.
C10—2nd RF Cathode By-Pass Condenser .5 mfd.
C11—3rd RF Cathode By-Pass Condenser .5 mfd.
C12—Detector Cathode By-Pass Condenser 1 mfd.
C13—1st RF Screen By-Pass Condenser .5 mfd.
C14—2nd RF Screen By-Pass Condenser .5 mfd.
C15—3rd RF Screen By-Pass Condenser .5 mfd.
C16—Detector Plate By-Pass Condenser .001 mfd.
C17—1st and 2nd RF Plate By-Pass Condenser .5 mfd.
C18—3rd RF Plate By-Pass Condenser .5 mfd.
C19—Filter Condenser 1 mfd.
C20—Filter Condenser 2 mfd.
C21—Filter Condenser 4 mfd.
C22—By-Pass Condenser {60 cycles .05 mfd. / 25 cycles .2 mfd.
C23—Detector Plate By-Pass Condenser .001 mfd

T1—Audio Input Transformer
T2—Audio Output Transformer
T3—Power Transformer

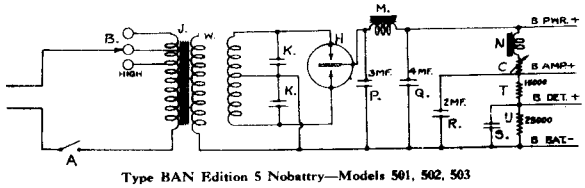
R1—Volume Control {10,000 / 10,000} ohms (Antenna)
R2—Volume Control {50,000 / 5,000} ohms
R3—1st RF Screen Resistor 25,000 ohms
R4—2nd RF Grid Resistor 500 ohms
R5—3rd RF Grid Resistor 500 ohms
R6—1st RF Bias Resistor 1500 ohms
R7—2nd RF Bias Resistor 1500 ohms
R8—3rd RF Bias Resistor 1500 ohms
R9—Detector Bias Resistor 15,000 ohms
R10—RF Center Tap Resistor
R11—Voltage Divider Resistor
R12—Audio Center Tap Resistor



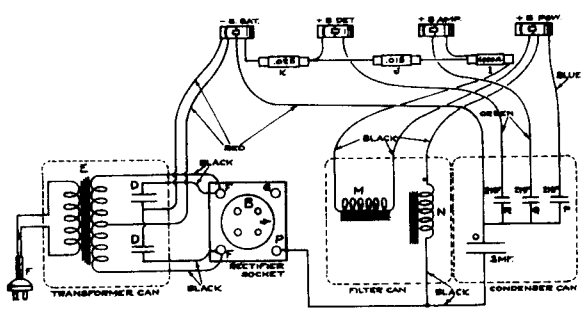
Type BAN Edition 2 Nobattry



Type BAN Edition 3 Nobattry
Type BAN Edition 4 Nobattry (for 25 cycles)
Type BAN Edition 4 Model 505 Nobattry



Type BAN Edition 5 Nobattry—Models 501, 502, 503



Type BAN Edition 6 Nobattry—Models 504 and 506

AMERICAN BOSCH MAGNETO CORP.

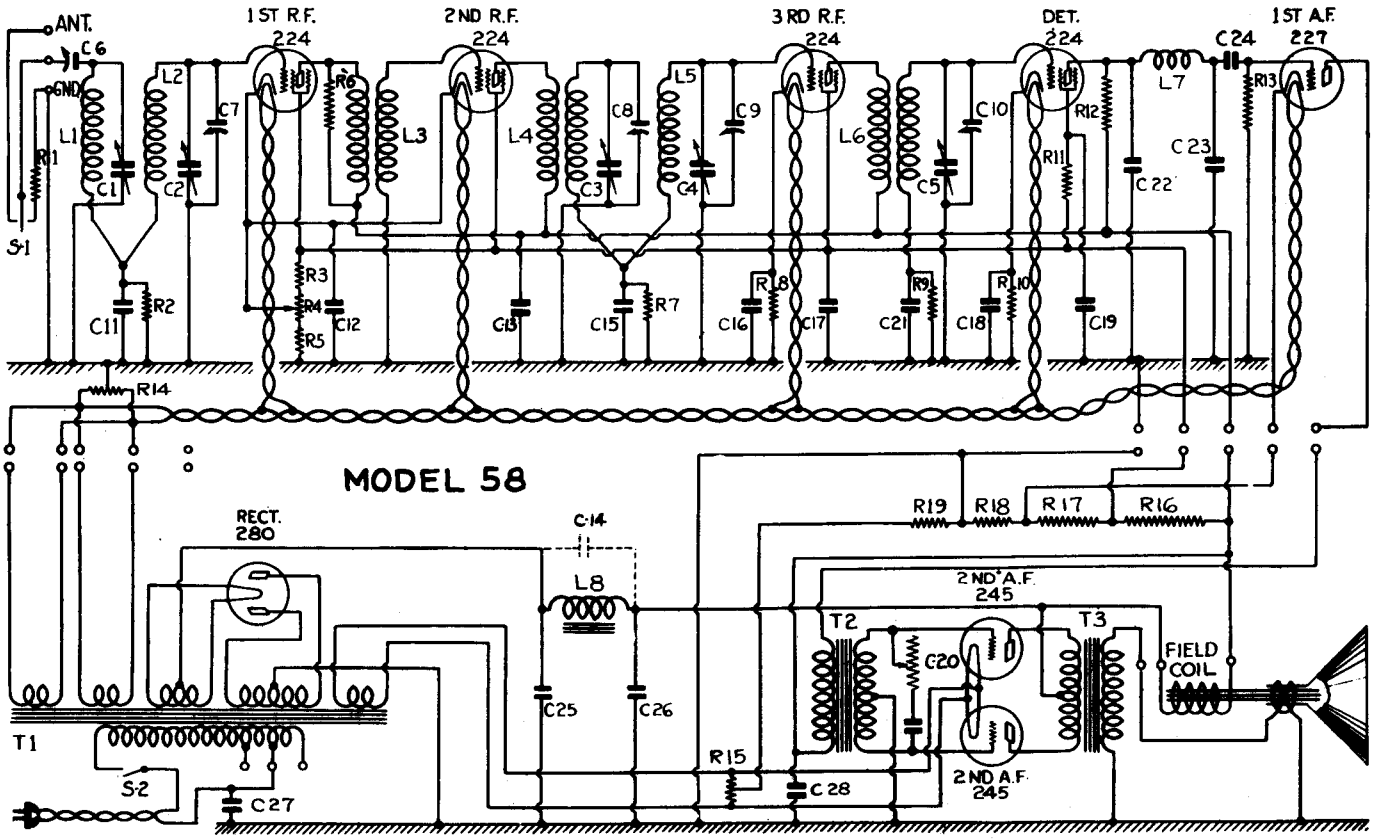


Figure 3—Schematic Diagram of Model 58 Receiver.

Model 58 Receiver

L1—1st RF Coil
L2—1st RF Coil
L3—2nd RF Coil (untuned)
L4—3rd RF Coil
L5—3rd RF Coil
L6—Detector Coil
L7—Detector Plate Choke
L8—Filter Choke

T1—Main Power Transformer
T2—Audio Input Transformer
T3—Audio Output Transformer

C1—1st RF Tuning Condenser
C2—1st RF Tuning Condenser
C3—3rd RF Tuning Condenser
C4—3rd RF Tuning Condenser
C5—Detector Tuning Condenser
C6—Antenna Trimming Condenser
C7—1st RF Alignment Condenser
C8—3rd RF Alignment Condenser
C9—3rd RF Alignment Condenser
C10—Detector Alignment Condenser
C11—1st RF Coupling Condenser .04 mfd.
C12—Cathode By-pass Condenser .5 mfd.
C13—Plate By-pass Condenser .5 mfd.
C14—Filter Condenser .2 mfd. (25 cycle only)
C15—3rd RF Coupling Condenser .04 mfd.
C16—Cathode By-pass Condenser .5 mfd.
C17—Screen By-pass Condenser .5 mfd.
C18—Detector Cathode By-pass Condenser 1. mfd.
C19—Detector Screen By-pass Condenser .5 mfd.
C20—Tone Control Condenser .006 mfd.
C21—Detector Condenser .04 mfd.
C22—Detector Plate By-pass Condenser .0001 mfd.
C23—Detector Plate By-pass Condenser .0001 mfd.
C24—Audio Coupling Condenser .006 mfd.
C25—Power Pack Filter Condenser 2 mfd.
C26—Power Pack Filter Condenser 2 mfd.
C27—Buffer Condenser 1 mfd.
C28—Audio By-pass Condenser 4 mfd.

R1—Antenna Resistor 500 ohms
R2—De-coupling Resistor 1,000 ohms
R3—Screen Resistor 20,000 ohms
R4—Volume Control 3,000 ohms
R5—Screen Resistor 250 ohms
R6—Untuned Transformer Resistor .1 megohm
R7—3rd RF de-coupling Resistor 1,000 ohms
R8—3rd RF Cathode Resistor 1,000 ohms
R9—Detector Grid Resistor 1,000 ohms
R10—Detector Cathode Resistor 50,000 ohms
R11—Detector Screen Resistor 1 megohm
R12—Detector Plate Resistor .25 megohm
R13—1st Audio Grid Resistor 2 megohms
R14—Center Tap Resistor (chassis)
R15—Center Tap Resistor (power pack)
R16—Screen Supply Resistor 2,050 ohms
R17—Audio Cathode Resistor 1,950 ohms
R18—Divider Resistor 180 ohms
R19—Audio Bias Resistor 950 ohms
R20—Tone Control .5 megohm

Model 60 Receiver

L1—1st RF Coil
L2—1st RF Coil
L3—2nd RF Coil (untuned)
L4—3rd RF Coil
L5—3rd RF Coil
L6—Detector Coil
L7—Detector Plate Choke
L8—Power Pack Filter Choke
L9—Speaker Field Coil
L10—Speaker Voice Coil

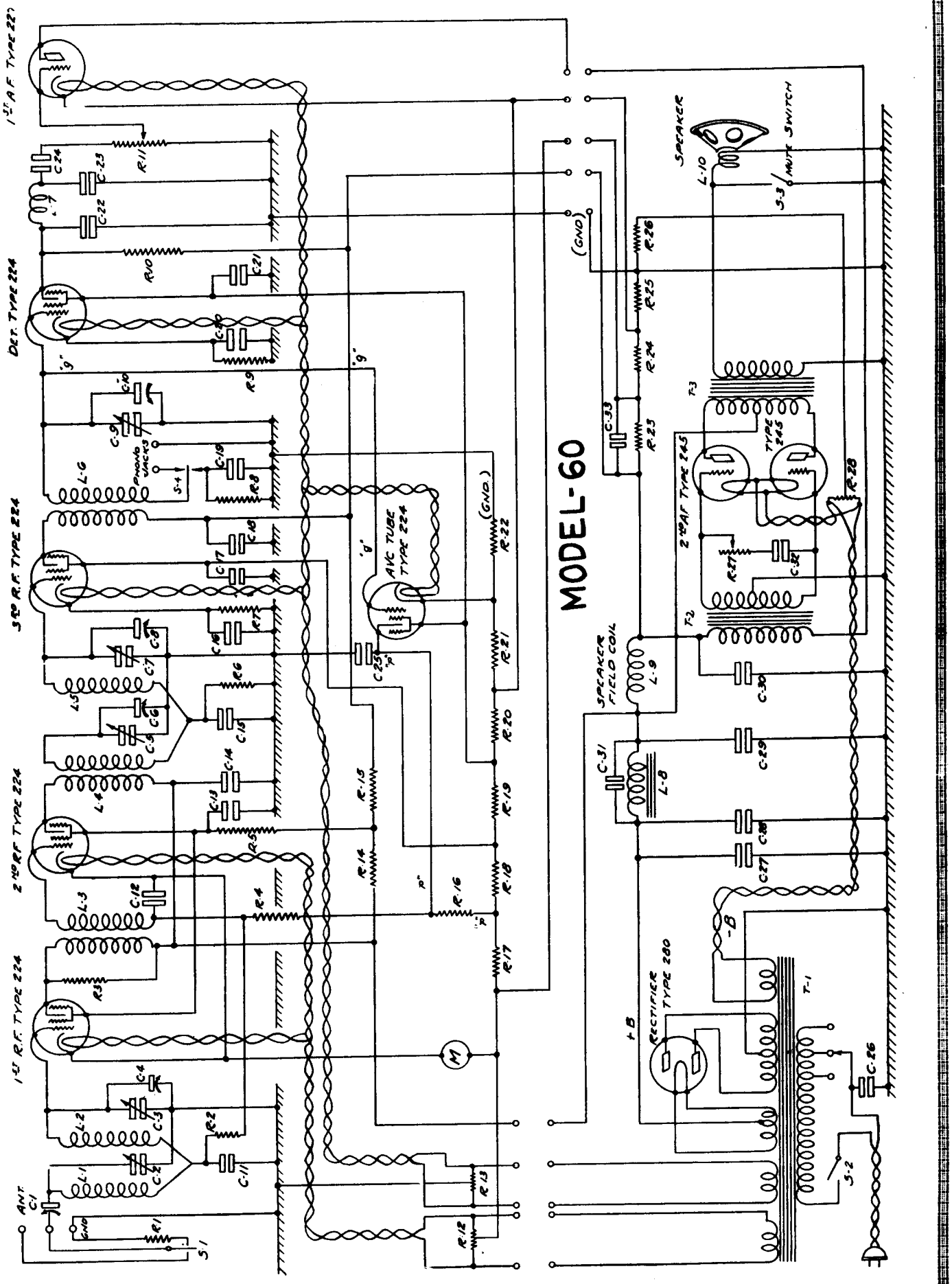
T1—Main Power Transformer
T2—Audio Input Transformer
T3—Audio Output Transformer

C1—Antenna Trimmer Condenser
C2—1st RF Tuning Condenser
C3—1st RF Tuning Condenser
C4—1st RF Alignment Condenser
C5—3rd RF Tuning Condenser
C6—3rd RF Alignment Condenser
C7—3rd RF Tuning Condenser
C8—3rd RF Alignment Condenser
C9—Detector Tuning Condenser
C10—Detector Alignment Condenser
C11—1st RF Coupling Condenser .04 mfd.
C12—2nd RF Grid Return Condenser .5 mfd.
C13—1st and 2nd RF Screen Condenser .25 mfd.
C14—1st and 2nd RF Plate Condenser .25 mfd.
C15—3rd RF Coupling Condenser .04 mfd.
C16—3rd RF Cathode Condenser .5 mfd.
C17—3rd RF Screen Condenser .5 mfd.
C18—3rd RF Plate Condenser .5 mfd.
C19—Detector Grid Return Condenser .04 mfd.
C20—Detector Cathode Condenser 1. mfd.
C21—Detector Screen Condenser .5 mfd.
C22—Detector Plate By-pass Condenser .0001 mfd.
C23—Detector Plate By-pass Condenser .0001 mfd.
C24—Audio Coupling Condenser .006 mfd.
C25—AVC Plate By-pass Condenser .006 mfd.
C26—Buffer Condenser .1 mfd.
C27—Power Pack Filter Condenser 2. mfd.
C28—Power Pack Filter Condenser 2. mfd.
C29—Power Pack Filter Condenser 4. mfd.
C30—Power Pack Filter Condenser 2 mfd.
C31—Filter Choke Tuning Condenser .075 mfd.
C32—Tone Control Condenser .006 mfd
C33—By-pass Condenser 2. mfd.

R1—Antenna Resistance 500 ohms
R2—1st RF de-coupling Resistor 1000 ohms
R3—Untuned Coil Resistor 50,000 ohms
R4—1st and 2nd RF Grid Resistor .5 meg.
R5—1st and 2nd RF Screen Resistor 20,000 ohms
R6—3rd RF de-coupling Resistor 1,000 ohms
R7—3rd RF Bias Resistor 1,000 ohms
R8—Detector Grid Resistor 1,000 ohms
R9—Detector Bias Resistor 50,000 ohms
R10—Detector Plate Resistor .5 meg.
R11—Volume Control .5 meg.
R12—1st and 2nd RF Center Tap Resistor
R13—Center Tap Resistor
R14—1st and 2nd RF Screen Resistor 20,000 ohms
R15—Resistor 10,000 ohms
R16—AVC Resistor .5 megohms
R17—Resistor 900 ohms
R18—3rd RF Screen Resistor 5,000 ohms
R19—AVC and Detector Screen Resistor 25,000 ohms
R20—Resistor 5,000 ohms
R21—1st AF Bias Resistor 2,000 ohms
R22—AVC Bias Resistor 2,000 ohms
R23—Voltage Divider Resistor 1,300 ohms
R24—Voltage Divider Resistor 2,380 ohms
R25—Voltage Divider Resistor 160 ohms
R26—2nd Audio Bias Resistor 950 ohms
R27—Tone Selector Resistor .5 megohm
R28—2nd Audio Center Tap Resistor

AMERICAN BOSCH MAGNETO CORP.

Note: Values of parts are given on page 90A



Radio Service Data Sheet

BOSCH MODEL 60 VOLUME-CONTROL RECEIVER

This receiver, the "Model 60" chassis with automatic volume control, is manufactured by the American Bosch Magneto Corp., Springfield, Mass.; the following parts values are used:

Condensers C1, C2, C3, C4, C5 are the usual tuning capacities; C6, an antenna trimmer; C7, C11, C14, .04-mf.; C8, C10, .25-mf.; C9, C12, C13, C17, 0.5-mf.; C15, C20, C26, .006-mf.; C16, 1.0 mf.; C18, C19, .0001-mf.; C21, C22, C27, 2 mf.; C23, C24, 4 mf.; C25, 0.75-mf. (exact).

Resistors R1, 500 ohms; R2, R4 R6, R8, R9, 1,000 ohms; R3, R11, R12, R13, R26, ½-meg.; R5, 20,000 ohms; R7, 10,000 ohms; R10, R28, 50,000 ohms; R16, 900 ohms; R17, R19, 5,000 ohms; R18, 25,000 ohms; R20, R21, 2,000 ohms; R22, 1,300 ohms; R23, 2,380 ohms; R24, 160 ohms; R25, 950 ohms.

The "Model 60" and the "Model 58" are very similar in general arrangement. The "60," however, is equipped with automatic volume control, a "mute" switch, and a larger reproducer. On the side of the cabinet is the tone control. In addition to the tubes required for the "58," the "60" requires a type '24 tube for the volume control, V8. An automatic "radio-phono." switch is operated by simply turning the tuning dial to zero. The "Model 61" corresponds to the "60," but is designed for use on 25-cycle, 100 to 130 volt A.C. supply. The chassis is the same, and the power pack differs only in the power transformer and filter condensers. Letters D and E refer only to the style of cabinet.

Lack of sensitivity may be due to incorrect connection of the three leads to the "local-distance" switch. It may be advisable, in some localities, to operate the set without a ground connection. Check the alignment of the tuning condensers.

Poor tone quality may be due to a defective '45 (which is ionized). Check also the remaining tubes in the receiver. If the plate currents of the type '45 tubes differ more than 5 ma., the output transformer will be overloaded and some distortion will result.

Operating voltages for this receiver follow: Filament potentials; V1, V2, V6, V7, 2.4 volts; V3, V4, V5, V8, 2.3 volts; V9, 5.0 volts. Plate potentials; V1, 170 volts; V2, 180 volts; V3, 185 volts; V4, 60 volts; V5, 150 volts; V6, V7, 250 volts; V8, 30 volts. Screen-grid potentials; V1, 70 volts; V2, 80 volts; V3, 85 volts; V4, 10 volts; V8, 20 volts. Control-grid potentials; V1, V2, 2.0 volts; V3, 1.5 volts; V4, 1.0 volt; V5, 0.1-volt; V6, V7, 50 volts; V8, 0.2-volt. Plate currents; V1, V2, 3 ma.; V3, 2 ma.; V4, 0.1-ma.; V5, 6 ma.; V6, V7, 30 ma.; V8, 0.2-ma.

The condenser drive-belt consists of a heavy stranded phosphor-bronze cable having a small loop at each end. Correct tension is maintained by means of a spring. After replacing the belt it is necessary to reset the dial; to do which, loosen the small gear on the knob shaft. Turn the shaft to the left as far as it will go. Set the dial against the stop at "100" position, and re-tighten the small gear. The procedure in replacing the belt is as follows: turn the condensers to the position of minimum capacity. Place the loop at one end of the drive-cable over the pin at the top right hand side of the large drive drum. Lead the belt along the groove and downward to the small grooved drum. Turn the condenser gear to the "100" position (condenser fully engaged). Start the belt at the center groove of the small drum and wind on 6½ turns in a clockwise direction (to the right), toward the front of the receiver. Bring the belt up and over the idler pulley. Follow down the groove of the large drum and hook the loop over the drum's tension spring. The spring can most easily be pulled into the correct position by looping a length of wire or strong cord around the spring hook.

The field coil of the dynamic reproducer has a resistance of 2,000 ohms; and the voice coil, one of 10 ohms. A copper shield ring over the core prevents feed back between voice and field coils and the "B" supply The only adjustment consists in centering the moving coil in the air gap. Do this as follows: loosen the holding screw. Insert in the air gap, around the moving coil, four gauges made of paper strips 0.01-in. thick. The strips should be about 6 in. long and 3/16 in. wide. Retighten the screw and remove the gauges. The connections to the reproducer are made at the terminal strip located under the name plate. The red and brown leads run to the voice coil; and the black lead to a terminal.

On the "Model 60" is a meter M which may be used in aligning the tuned stages. The meter will swing to the right as alignment is reached.

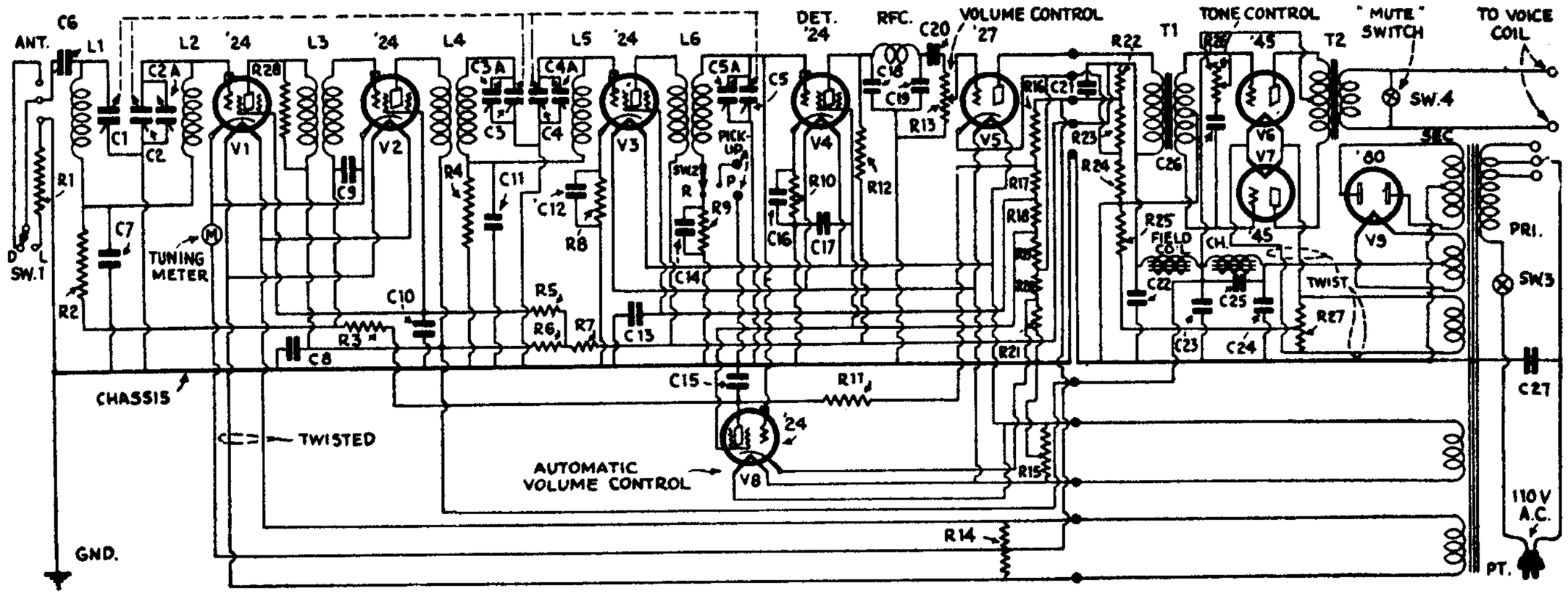
A grounding spring on one of the tuning condensers, in the third R.F. stage, grounds this condenser in the "phono" position, or dial zero setting, and in this position prevents circuit oscillation.

The operation of the automatic volume control circuit is as follows: When the signal being received increases in volume (as in tuning in a more powerful station) it results in a higher signal voltage on the detector tube. This higher voltage is applied to the grid of the automatic volume-control tube, by direct connection through one lead. A higher voltage on the grid of the automatic volume-control tube results in the tube drawing greater plate current through R3, which controls the grid bias on the first and second R.F. tubes. The increased plate current through R3 causes a greater increase in the voltage drop across this resistor. This change increases grid bias on the first and second R.F. tubes and thereby cuts down the signal. The tuning meter M is in the plate circuit of these two tubes; it also indicates, therefore, the action of the automatic volume control, swinging further to the right(low plate current) as the signal level rises on a powerful station. It will be noted that the filament, cathode, and grid circuits on the first two R.F. stages are separate from those of the rest of the receiver, and are at approximately the same voltage (above ground) as the plate of the automatic volume control tube.

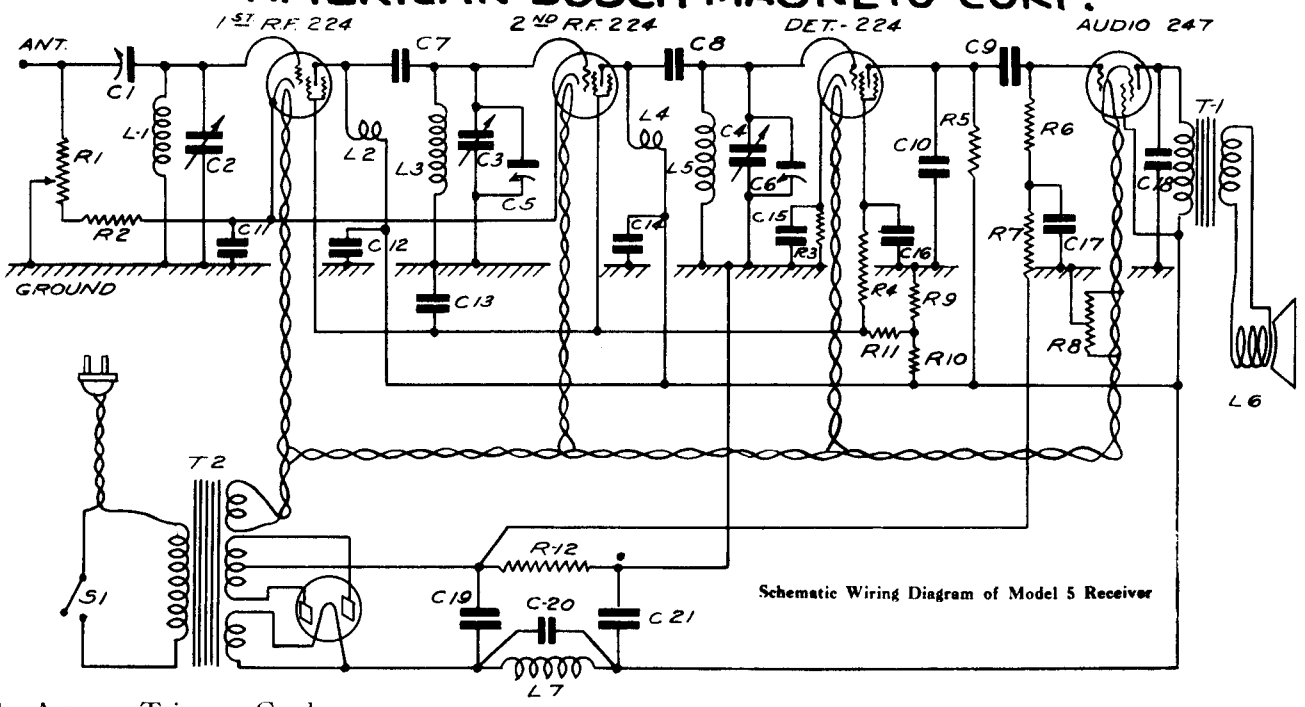
It is necessary, for the proper functioning of the receiver, that there shall be no points in the coils or wiring where leakage to ground may occur. It is also important, for proper operation, that the automatic volume-control tube should have proper characteristics. Such a tube can easily be selected as follows: have all the tubes in place except the automatic volume control, and switch the receiver "on"; but do not tune in a station. If the tubes are all operative, the meter needle will swing to the left from 3½ to 5 divisions. Insert the automatic volume-control tube, V8, and note the action of the needle. *The automatic volume-control tube tested is suitable if the needle remains in the same position.*

The various resistors in the receiver have the following color code: 250 ohms, white; 500 ohms, yellow; 900 ohms, black-brown; 1,000 ohms, white-red; 2,000 ohms, brown-yellow; 5,000 ohms, black-yellow; 10,000 ohms, blue-yellow; 20,000 ohms, green-yellow, 25,000 ohms, blue; 50,000 ohms, green-white; 0.1-meg., blue-white; 0.25-meg., brown; 1.0 megohm, black; 2 megohms, black-white.

R.F. transformer L3 is untuned, and signal amplification through this stage increases in the low-frequency region (100 on the dial). The antenna input system is so designed that one setting of the antenna trimmer condenser C6 will maintain the antenna in tune over the entire broadcast band. This condenser is provided with a small adjusting knob, and need be set only when it is installed or when subsequent changes are made in the aerial. It is recommended that this condenser be adjusted in the following manner: tune in a semi-distant station which comes in at some point between 40 and 60 on the dial. Reduce the volume until the station can barely be heard; then turn the adjustment knob until it is at the point of loudest reception.



AMERICAN BOSCH MAGNETO CORP.



Schematic Wiring Diagram of Model 5 Receiver

C 1—Antenna Trimmer Condenser
C 2—Tuning Condenser
C 3—Tuning Condenser
C 4—Tuning Condenser
C 5—Alignment Condenser
C 6—Alignment Condenser
C 7—Coupling Capacity
C 8—Coupling Capacity
C 9—Audio Coupling Condenser .006
C 10—Det. plate By-pass .0001 mfd.
C 11—RF Cathode By-pass .05 mfd.
C 12—RF Plate By-pass .05 mfd.
C 13—RF Screen By-pass .25 mfd.
C 14—RF Plate By-pass .05 mfd.
C 15—Det. Cathode By-pass 1.00 mfd.
C 16—Det. Screen By-pass .25 mfd.
C 17—Audio Grid By-pass .01 mfd.
C 18—Audio Plate By-pass .01 mfd.
C 19—Filter Condenser 4. mfd.
C 20—Field Condenser .08 mfd.
C 21—Filter Condenser 4. mfd.

S 1—Switch

R 1—Volume Control 10,000 ohms
R 2—RF Cathode Resistor 300 ohms
R 3—Det. Cathode Resistor 50,000 ohms
R 4—Det. Screen Resistor 2 megohms
R 5—Det. Plate Resistor 1 megohm
R 6—Audio Grid Resistor ½ megohm
R 7—Audio Grid Resistor 100,000 ohms
R 8—Mid Tap Resistor
R 9—Divider Resistor 50,000 ohms
R 10—Screen Resistor 50,000 ohms
R 11—Screen Resistor 10,000 ohms
R 12—Audio Bias Resistor 400 ohms

L 1—Antenna Coil
L 2—Primary } of RF Coil
L 3—Secondary }
L 4—Primary } of RF Coil
L 5—Secondary }
L 6—Speaker Moving Coil
L 7—Speaker Field Coil

T 1—Audio Output Transformer
T 2—Power Transformer

SOCKET VOLTAGES

Stage	Tube	Fil.	Plate	Screen	Cathode	Grid	Plate MA
1st RF	224	2.3	250	90	2.5	2.5	4.5
2nd RF	224	2.3	250	90	2.5	2.5	4.5
Det.	224	2.3	*150	*20	3.0	1.5	.5
Audio	247	2.3	250	250	.....	*16	32
Rect.	280	4.8			Plate current of each plate—20		

The readings were made with the volume control in the full "on" position.

*These voltages are the correct values. The average test kit will give much lower readings, (as low as 1/10 of these values) due to the low resistance of the meters compared to the high resistance included in the detector plate and screen circuits and the audio grid circuit.

When the volume control is reduced the

RF plate voltage remains constant
RF screen voltage increases
RF cathode voltage increases
RF grid voltage increases

Radio Service Data Sheet

BOSCH MODELS 60 AND 61 (Automatic Volume Control)

The Bosch Model 60 receiver incorporates an automatic volume-control tube, V8; a "mute switch" Sw4 (which should be closed, during the operation of tuning, to short the voice coil of the dynamic reproducer, thus eliminating the sounds incidental to tuning in programs, the automatic volume control's panel-meter being the resonance indicator) and connections for a phonograph pickup. The pickup circuit is controlled by an automatic switch, SW2, which, in the tuning dial's "O" position is designed to replace a 1,000-ohm resistor and its bypass condenser by a pick-up of approximately 1,000 ohms. At the same time, a ground spring makes contact with condenser C4; shorting it out of circuit and eliminating the need to detune the R.F. portion of the receiver.

The components of the "Model 60" receiver have the following constants: Condensers C1, C2, C3, C4 and C5 are tuning units, shunted by aligning condensers C2A, C3A, C4A and C5A in the positions indicated in the schematic circuit; C6, antenna trimmer; C7, band-selector coupling condenser; C8, C10, 0.25-mf.; C9, C12, C13, C17, C28, 0.5-mf.; C11, C14, .04-mf.; C15, C20, C26, .006-mf.; C16, 1 mf.; C18, C19, .0001-mf.; C21, C22, 2 mf.; C23, C24 (each two 2-mf. sections in shunt), 4 mf.; C25, .075-mf.; C27, 0.1-mf.

Resistor R1, 500 ohms; R2, R4, R8, R9, 1,000 ohms; R3, R11, R12, R13 (volume control), R26 (tone control), 0.5-meg.; R5, R6, 20,000 ohms; R7, 10,000 ohms; R10, R28, 30,000 ohms; R14, R15, R27, center-tapped resistors; R16, 900 ohms; R17, R19, 5,000 ohms; R18, 25,000 ohms; R20, R21, 2,000 ohms; R22, 1,300 ohms; R23, 2,380 ohms; R24, 160 ohms; R25, 950 ohms.

The resistor color code used in this receiver is as follows: 250 ohms, white; 500, yellow; 900, black-brown; 1,000, white-red; 2,000, brown-yellow; 5,000, black-yellow; 10,000, blue-yellow; 20,000, green-yellow; 25,000, blue; 50,000, green-white; 0.1-meg., blue-white; 0.25-meg., brown; 0.5-meg., gray; 1 meg., black; 2 megs., black-white.

Average operating voltages for the "60" are as follows. Filament potentials: V1, V2, V6, V7, 2.4 volts; V3, V4, V5, V8, 2.3 volts; V9, 5 volts. Plate potentials: V1, 170 volts; V2, 180 volts; V3, 185 volts; V4, 60 volts*; V5, 150 volts; V6, V7, 250 volts; V8, 30 volts*. Plate currents: V1, V2, 3 ma.; V3, 2 ma.; V4, 0.1-ma.*; V5, 6 ma.; V6, V7, 30 ma.; V8, 0.2-ma.*. Screen-grid potentials: V1, 70 volts; V2, 80 volts; V3, 85 volts; V4, 10 volts*; V8, 20 volts*. Control-grid potentials: V1, V2, 2 volts; V3, 1.5 volts; V4, 1. volt*; V5, 0.1-volt*; V6, V7, 50 volts; V8, 0.2-volt*.

These readings are made with the volume control full on. These figures followed by asterisks are measured through resistors of high value and, therefore, the reading will vary with the particular type of testing instrument used.

The trimmer condensers are located on the condenser gang. The antenna coupling condenser C1A is adjusted from the side of the chassis, when the set is installed, in the following manner: tune in a somewhat weak station at some point between 40 and 60 on the dial; reduce the volume until the station can be barely be heard; and then turn the adjustment knob of C1A until the signal is received with maximum volume.

The trimmer condensers may be adjusted for maximum motion (to the right) of the tuning meter M.

The automatic volume control circuit functions in the following manner. When the signal being received increases in volume (as when tuning in) a signal of increased strength is applied to the detector tube V4; and thus to the control-grid of screen-grid automatic volume control tube V8. This increase in the control-grid potential of V8 results in increased plate current, which must pass through resistor R11. The voltage drop across this resistor, which also is in the cathode circuit of the R.F. amplifier tubes V1 and V2, therefore increases; and this increased bias is effective on the control-grid of V1, and V2, causing a reduction in volume. This increase or decrease in cathode current is indicated on the meter M in the portion of the cathode circuit common to V1 and V2. (Motion to the right indicates a reduction in current; since the meter is wired to work "backward" to standard test meters).

Note that the filament, cathode, and control- and screen-grid potentials of V1 and V2 are at approximately the same potential above ground as the plate of V8. Therefore, particular attention should be given to the possibility of a short or leakage to ground through any portion of the wiring or the associated apparatus.

A suitable tube to use as V8 may be selected in the following manner: Note the meter indication with the set turned on, but detuned, and tube V8 out of the socket. The reading should be between 3½ and 5 divisions. Now insert V8; the needle should then remain stationary if the tube is suitable.

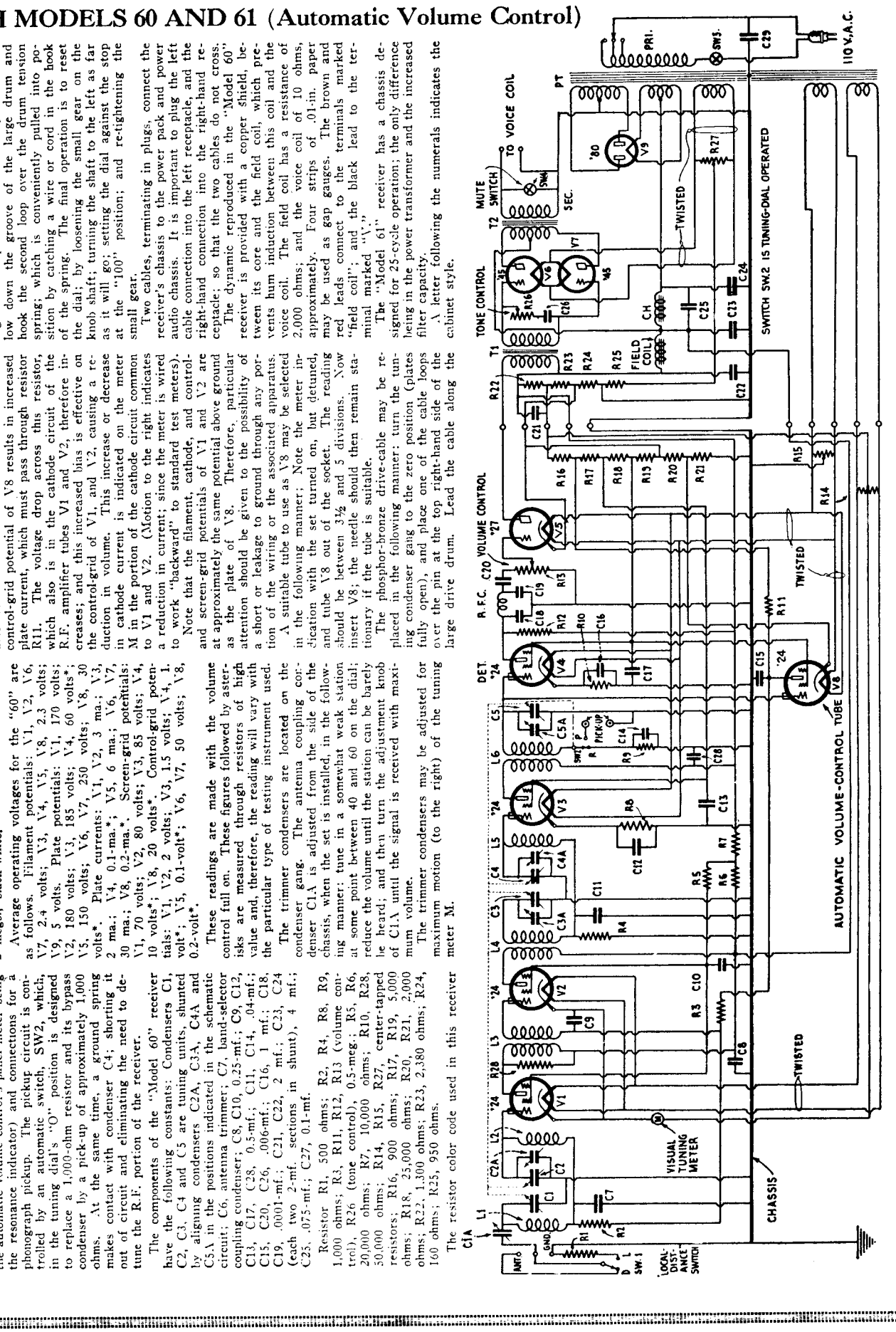
The phosphor-bronze drive-cable may be replaced in the following manner: turn the tuning condenser gang to the zero position (plates fully open), and place one of the cable loops over the pin at the top right-hand side of the large drive drum. Lead the cable along the groove and down to the small grooved drum, and turn the condenser gang to the "100" position. Next, start the cable at the center groove of the small drum and wind on 6½ turns in a clockwise direction (to the right); winding toward the front of the receiver, bringing the belt up and over the idler pulley. Follow down the groove of the large drum and hook the second loop over the drum tension spring; which is conveniently pulled into position by catching a wire or cord in the hook of the spring. The final operation is to reset the dial; by loosening the small gear on the knob shaft; turning the shaft to the left as far as it will go; setting the dial against the stop at the "100" position; and re-tightening the small gear.

Two cables, terminating in plugs, connect the receiver's chassis to the power pack and power audio chassis. It is important to plug the left cable connection into the left receptacle, and the right-hand connection into the right-hand receptacle; so that the two cables do not cross.

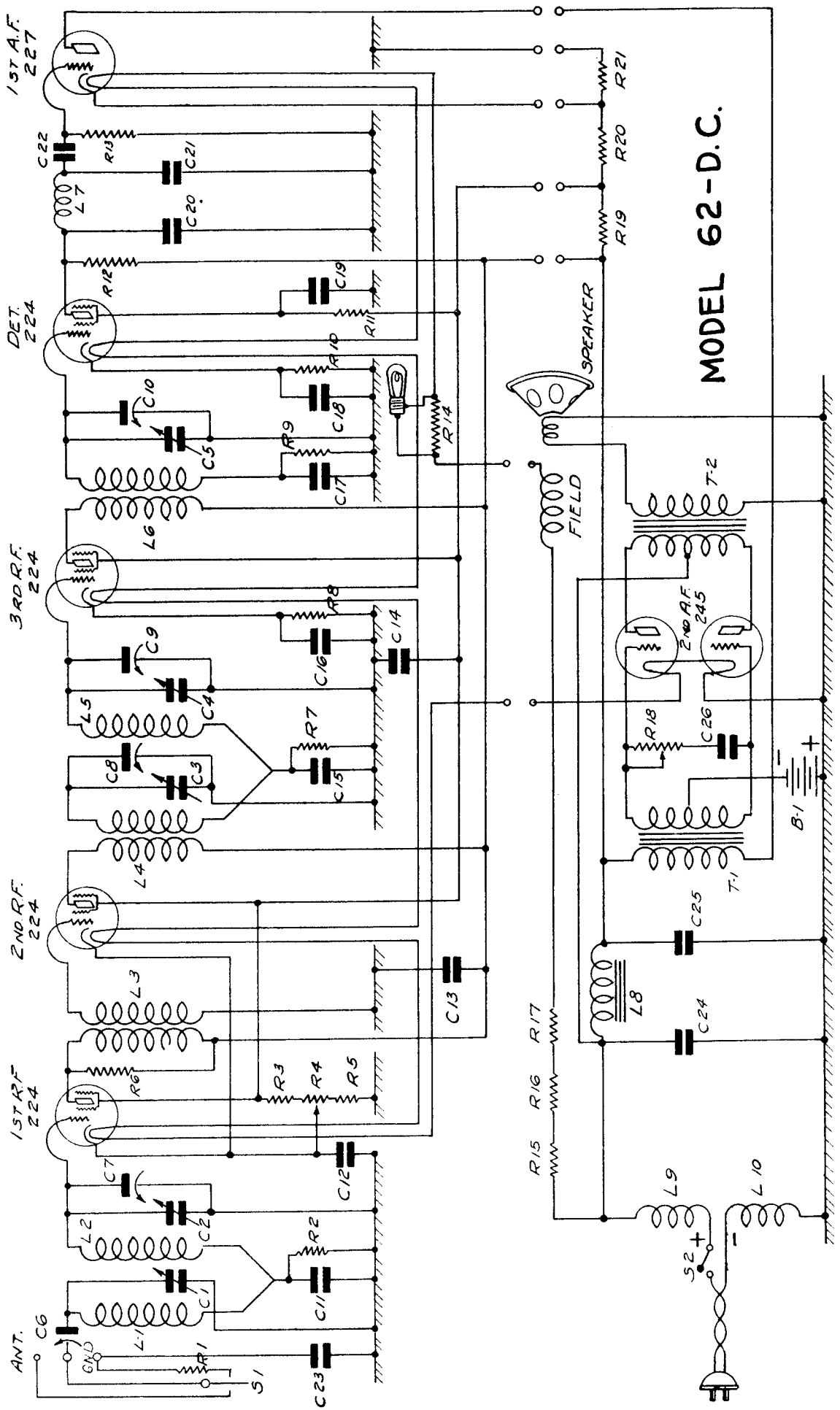
The dynamic reproduced in the "Model 60" receiver is provided with a copper shield, between its core and the field coil, which prevents hum induction between this coil and the voice coil. The field coil has a resistance of 2,000 ohms; and the voice coil of 10 ohms, approximately. Four strips of .01-in. paper may be used as gap gauges. The brown and red leads connect to the terminals marked "field coil"; and the black lead to the terminal marked "V."

The "Model 61" receiver has a chassis designed for 25-cycle operation; the only difference being in the power transformer and the increased filter capacity.

A letter following the numerals indicates the cabinet style.



AMERICAN BOSCH MAGNETO CORP.



~ SEE PAGE 90H FOR VALUES OF PARTS ~

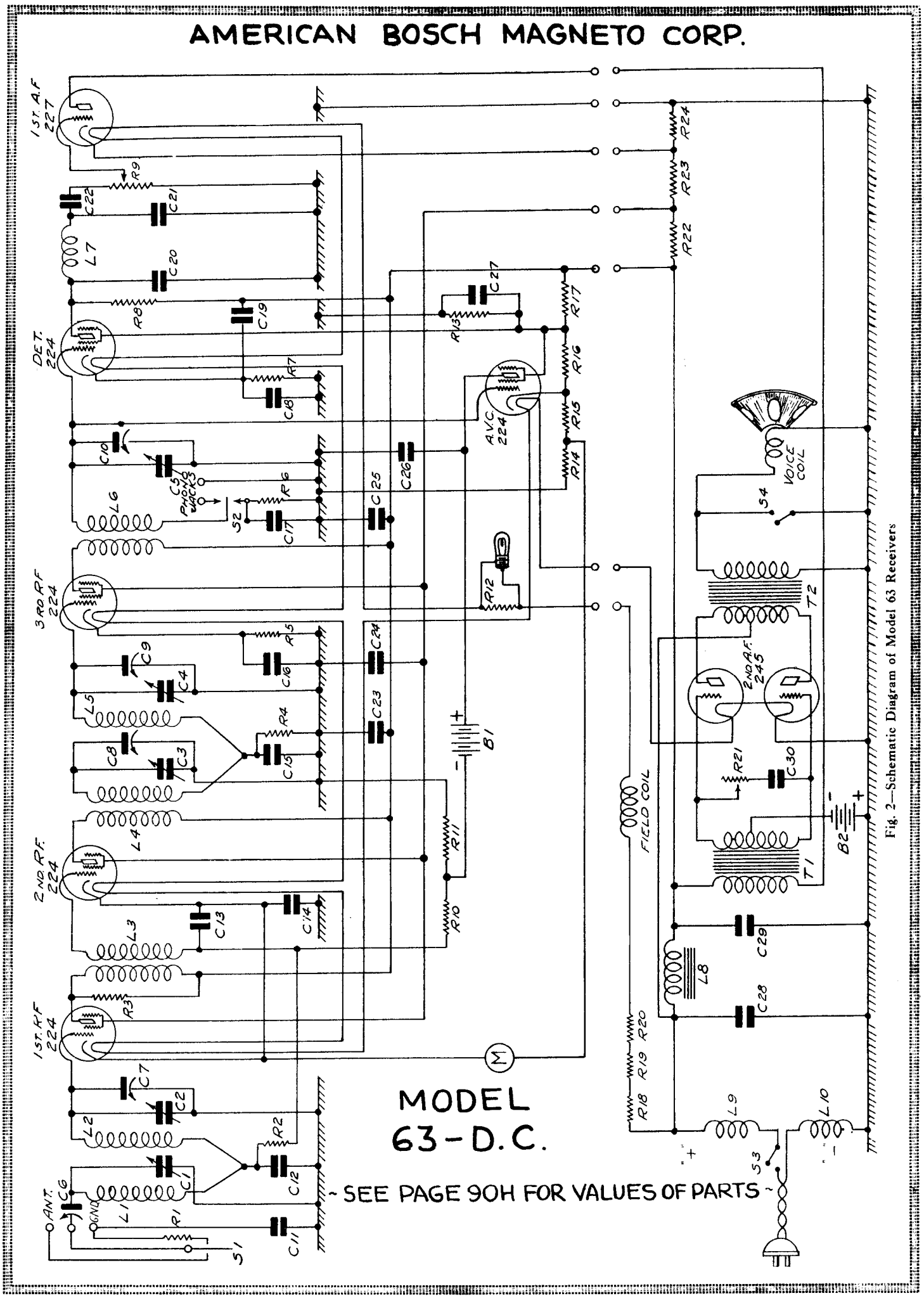


Fig. 2—Schematic Diagram of Model 63 Receivers

NOMENCLATURE
Model 62 Receiver

R 1—Antenna Resistor 500 ohms
R 2—De-coupling Resistor 1,000 ohms
R 3—Resistor 20,000 ohms
R 4—Volume Control 3,000 ohms
R 5—Resistor 150 ohms
R 6—Untuned Transformer Resistor .1 meg.
R 7—De-coupling Resistor 1,000 ohms
R 8—3rd RF Cathode Resistor 600 ohms
R 9—Resistor 1,000 ohms
R10—Detector Cathode Resistor 50,000 ohms
R11—Detector Screen Resistor 1 meg.
R12—Detector Plate Resistor .5 meg.
R13—1st Audio Grid Resistor 2 meg.
R14—Filament Resistor 1.8 ohms
R15—Filament Resistor 18 ohms
R16—Filament Resistor 18 ohms
R17—Filament Resistor 18 ohms
R18—Tone Selector Resistor .5 meg.
R19—Voltage Divider Resistor 1,400 ohms
R20—Voltage Divider Resistor 2,600 ohms
R21—Voltage Divider Resistor 250 ohms

C 1—1st RF Tuning Condenser
C 2—1st RF Tuning Condenser
C 3—3rd RF Tuning Condenser
C 4—3rd RF Tuning Condenser
C 5—Detector Tuning Condenser
C 6—Antenna Trimming Condenser
C 7—1st RF Alignment Condenser
C 8—3rd RF Alignment Condenser
C 9—3rd RF Alignment Condenser
C10—Detector Alignment Condenser
C11—1st RF Coupling Condenser .04 mfd.
C12—Cathode By-pass Condenser .5 mfd.
C13—Plate By-pass Condenser .5 mfd.
C14—Screen By-Pass Condenser .5 mfd.
C15—3rd RF Coupling Condenser .04 mfd.
C16—3rd RF Cathode Condenser .5 mfd.
C17—Detector Condenser .04 mfd.
C18—Detector Cathode Condenser 1. mfd.
C19—Detector Screen Condenser .5 mfd.
C20—Detector Plate By-pass Condenser .0001 mfd.
C21—Detector Plate By-pass Condenser .0001 mfd.
C22—Audio Coupling Condenser .006 mfd.
C23—Ground Condenser .006 mfd.
C24—Filter Condenser 4 mfd.
C25—Filter Condenser 4 mfd.
C26—Tone Selector Condenser .006 mfd.

S 1—Local-Long Distance Switch
S 2—Off and On Switch

B 1—"C" Battery—22½ volts

T 1—Audio Input Transformer
T 2—Audio Output Transformer

L 1—1st RF Coil
L 2—1st RF Coil
L 3—Untuned Transformer
L 4—3rd RF Coil
L 5—3rd RF Coil
L 6—Detector Coil
L 7—Detector Plate Choke
L 8—Filter Choke
L 9—Filter Choke
L10—Filter Choke

NOMENCLATURE
Model 63 Receiver

R 1—Antenna Resistor 500 ohms
R 2—De-coupling Resistor 1,000 ohms
R 3—Untuned Transformer Resistor 50,000 ohms
R 4—De-coupling Resistor 1,000 ohms
R 5—3rd RF Cathode Resistor 600 ohms
R 6—Detector Resistor 1,000 ohms
R 7—Detector Cathode Resistor 50,000 ohms
R 8—Detector Plate Resistor .5 meg.
R 9—Volume Control .5 meg.
R10—1st and 2nd RF Bias Resistor 1 meg.
R11—Bias Control Resistor 1 meg.
R12—Filament Resistor 1.8 ohms
R13—AVC Screen Resistor 20,000 ohms
R14—Voltage Divider Resistor 150 ohms
R15—Voltage Divider Resistor 900 ohms
R16—Voltage Divider Resistor 5,000 ohms
R17—Voltage Divider Resistor 20,000 ohms
R18—Filament Resistor 18 ohms
R19—Filament Resistor 18 ohms
R20—Filament Resistor 18 ohms
R21—Tone Control Resistor .5 meg.
R22—Voltage Divider Resistor 1,400 ohms
R23—Voltage Divider Resistor 2,600 ohms
R24—Voltage Divider Resistor 250 ohms

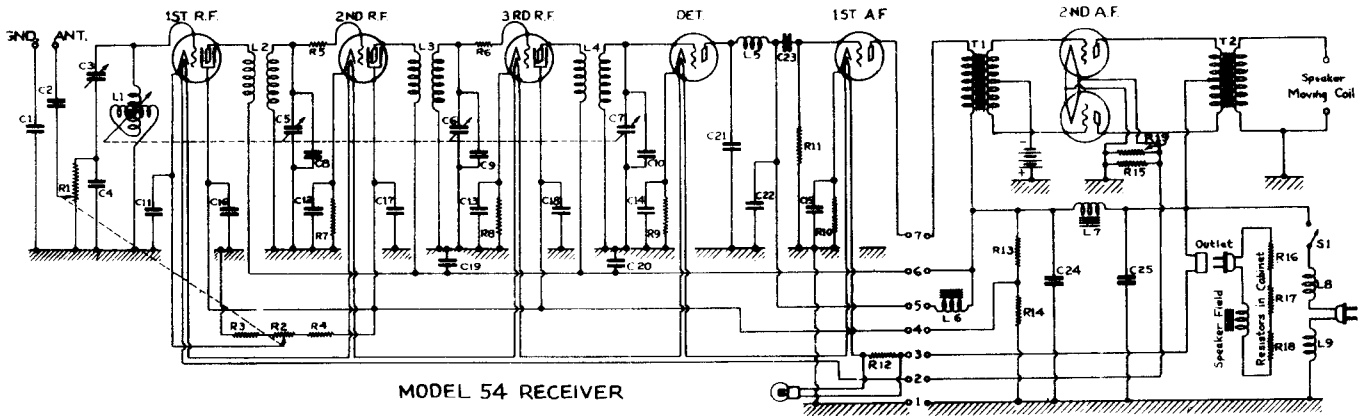
C 1—1st RF Tuning Condenser
C 2—1st RF Tuning Condenser
C 3—3rd RF Tuning Condenser
C 4—3rd RF Tuning Condenser
C 5—Detector Tuning Condenser
C 6—Antenna Trimmer Condenser
C 7—1st RF Alignment Condenser
C 8—3rd RF Alignment Condenser
C 9—3rd RF Alignment Condenser
C10—Detector Alignment Condenser
C11—Ground Series Condenser .0001 mfd.
C12—1st RF Coupling Condenser .04 mfd.
C13—2nd RF Condenser .5 mfd.
C14—Cathode By-pass Condenser .5 mfd.
C15—3rd RF Coupling Condenser .04 mfd.
C16—3rd RF Cathode Condenser .5 mfd.
C17—Detector Condenser .04 mfd.
C18—Detector Cathode Condenser 1 mfd.
C19—Detector Plate Condenser 1 mfd.
C20—Detector Plate Condenser .0001 mfd.
C21—Detector Plate Condenser .0001 mfd.
C22—Audio Coupling Condenser .006 mfd.
C23—Plate By Pass Condenser .25 mfd.
C24—Screen By Pass Condenser .25 mfd.
C25—Plate By Pass Condenser .5 mfd.
C26—AVC Plate By Pass Condenser .006 mfd.
C27—AVC Screen Condenser .5 mfd.
C28—Filter Condenser 4 mfd.
C29—Filter Condenser 4 mfd.
C30—Tone Control Condenser .006 mfd.

T 1—Input Transformer
T 2—Output Transformer

B 1—AVC Plate Battery 22½ volts
B 2—2nd Audio "C" Battery 22½ volts

S 1—Local Distance Switch
S 2—Phono Switch
S 3—Main Switch
S 4—Mute Switch

AMERICAN BOSCH MAGNETO CORP.



MODEL 54 RECEIVER

L 1—Variometer
L 2—2nd R. F. coil
L 3—3rd R. F. coil
L 4—Detector coil
L 5—Detector choke coil
L 6—Detector filter choke
L 7—Main filter choke
L 8—Line filter choke
L 9—Line filter choke

C 1—Ground condenser .005
C 2—Antenna condenser .001
C 3—Trimming condenser
C 4—Antenna condenser .00025 mfd.
C 5—2nd R. F. tuning condenser
C 6—3rd R. F. Tuning condenser
C 7—Detector tuning condenser
C 8—2nd R. F. alignment condenser
C 9—3rd R. F. alignment condenser
C10—Detector alignment condenser
C11—1st R. F. cathode by-pass condenser .5 mfd.

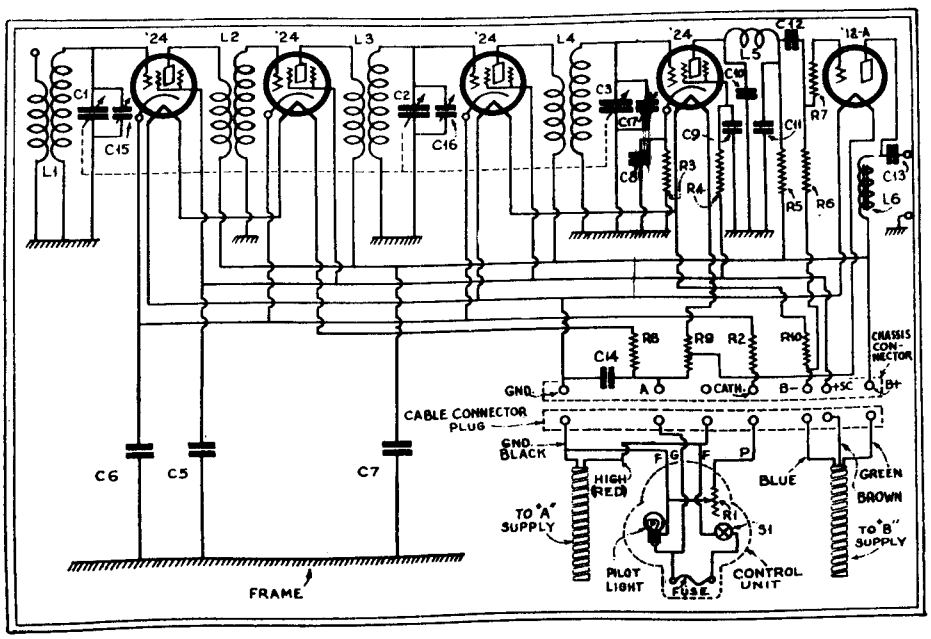
R 6—3rd R. F. grid resistor 250 ohms
R 7—2nd R. F. bias resistor 1500 ohms
R 8—3rd R. F. bias resistor 1500 ohms
R 9—Detector bias resistor 40,000 ohms
R10—1st A. F. bias resistor 1500 ohms
R11—1st A. F. grid resistor 1 megohm
R12—Dial light resistor .75 ohms
R13—Voltage divider resistor 25000 ohms
R14—voltage divider resistor 15000 ohms
R15—2nd A. F. filament resistor 5 ohms
R16—Filament resistor 20 ohms
R17—Filament resistor 20 ohms
R18—Filament resistor 20 ohms
R19—2nd A. F. filament resistor 22 ohms

TP—Terminal plate
S 1—Main switch

T 1—Audio input transformer
T 2—Audio output transformer

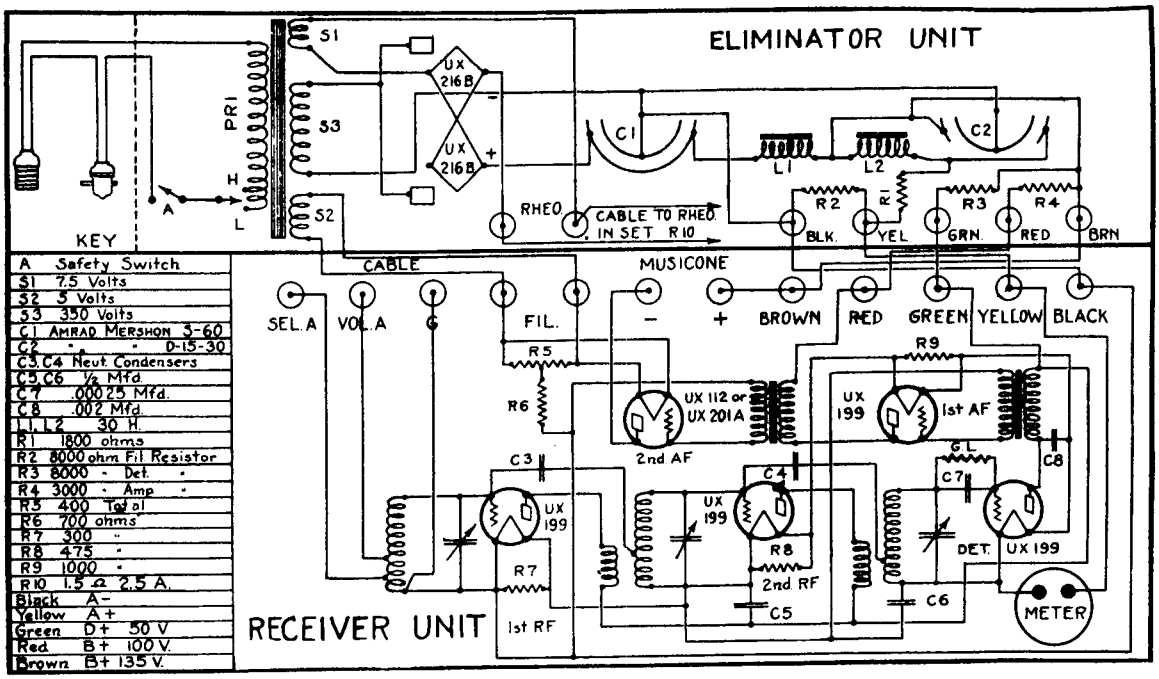
C12—2nd R. F. cathode by-pass condenser .5 mfd.
C13—3rd R. F. cathode by-pass condenser .5 mfd.
C14—Detector cathode by-pass condenser 1. mfd.
C15—1st A. F. cathode by-pass condenser 1. mfd.
C16—1st R. F. screen by-pass condenser .5 mfd.
C17—2nd R. F. screen by-pass condenser .5 mfd.
C18—3rd R. F. screen by-pass condenser .5 mfd.
C19—Plate by-pass condenser .5 mfd.
C20—Plate by-pass condenser .5 mfd.
C21—Detector plate by-pass condenser .001 mfd.
C22—Detector plate by-pass condenser .001 mfd
C23—1st A. F. coupling condenser .005 mfd.
C24—Filter condenser 4. mfd.
C25—Filter condenser 4. mfd.

R 1—Volume control 5000 ohms
R 2—Volume control 5000 ohms
R 3—Screen resistor 500 ohms
R 4—Screen resistor 25000 ohms
R 5—2nd R. F. grid resistor 250 ohms



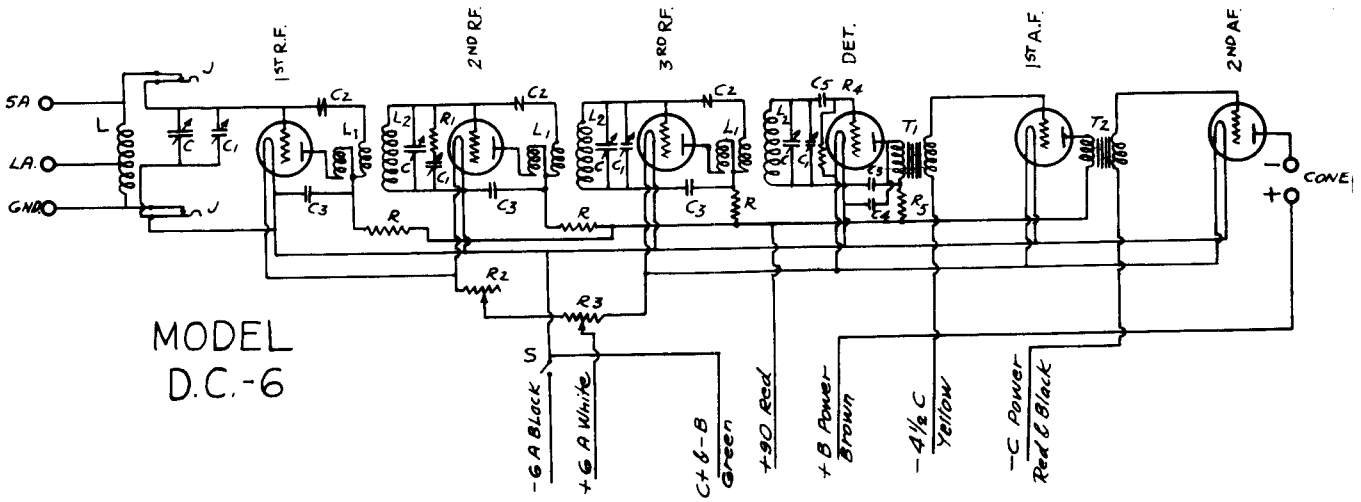
The schematic circuit of the Bosch Motor Car Radio receiver, made by the American Bosch Magneto Corp.; it includes four tuned-input, battery-operated, '24-type screen grid tubes, as R.F. and detector stages, and a single audio output tube, operating the built-on magnetic speaker.

AMRAD CORPORATION

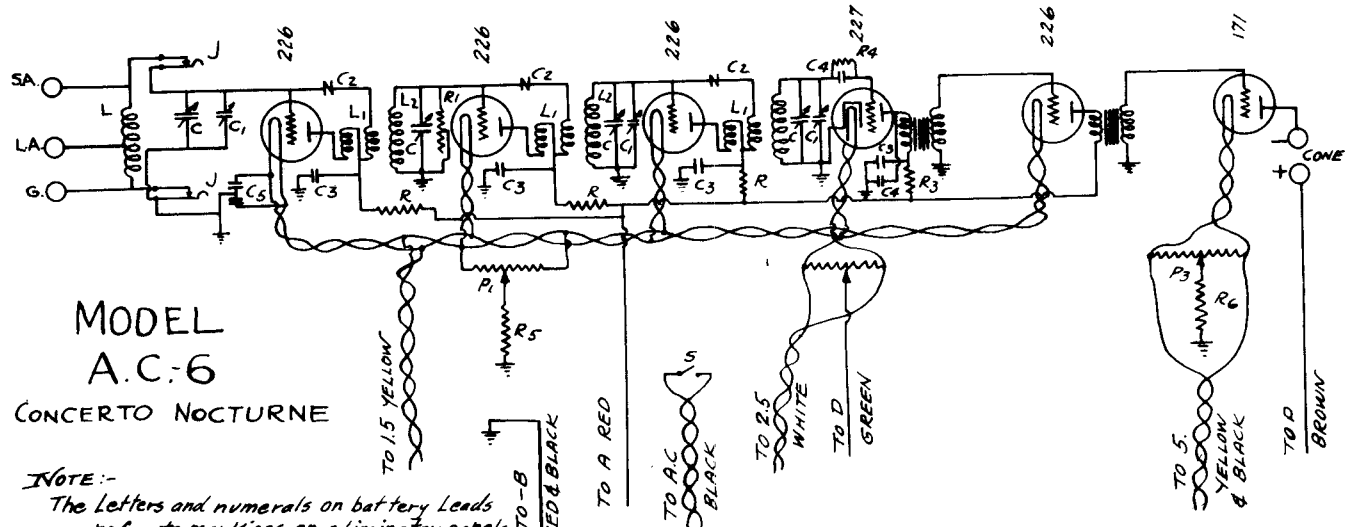


A	Safety Switch
S1	7.5 Volts
S2	5 Volts
S3	350 Volts
C1	Amrad Mershon 5-60
C2	" " D-15-30
C3,C4	Neut Condensers
C5,C6	½ Mfd.
C7	.00025 Mfd.
C8	.002 Mfd.
L1,L2	30 H.
R1	1800 ohms
R2	8000 ohm Fil Resistor
R3	8000 " Det. "
R4	3000 " Amp "
R5	400 Total
R6	700 ohms
R7	300 "
R8	475 "
R9	1000 "
R10	1.5 Ω 2.5 A.
Black	A-
Yellow	A+
Green	D+ 50 V.
Red	B+ 100 V.
Brown	B+ 135 V.

The Schematic Wiring Diagram of The Amrad Neutrodyne Receiver AC-5 Type and Power Unit



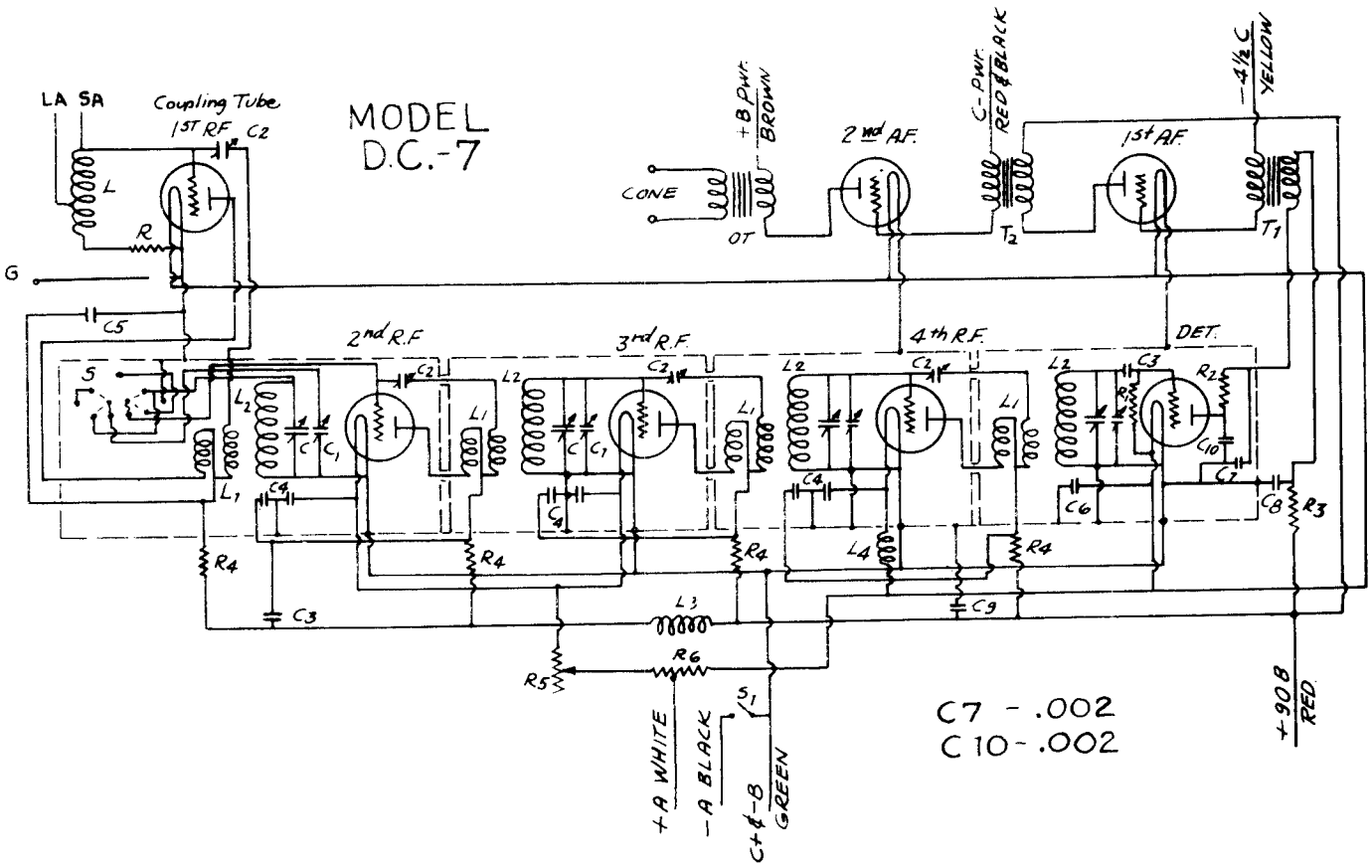
MODEL D.C.-6

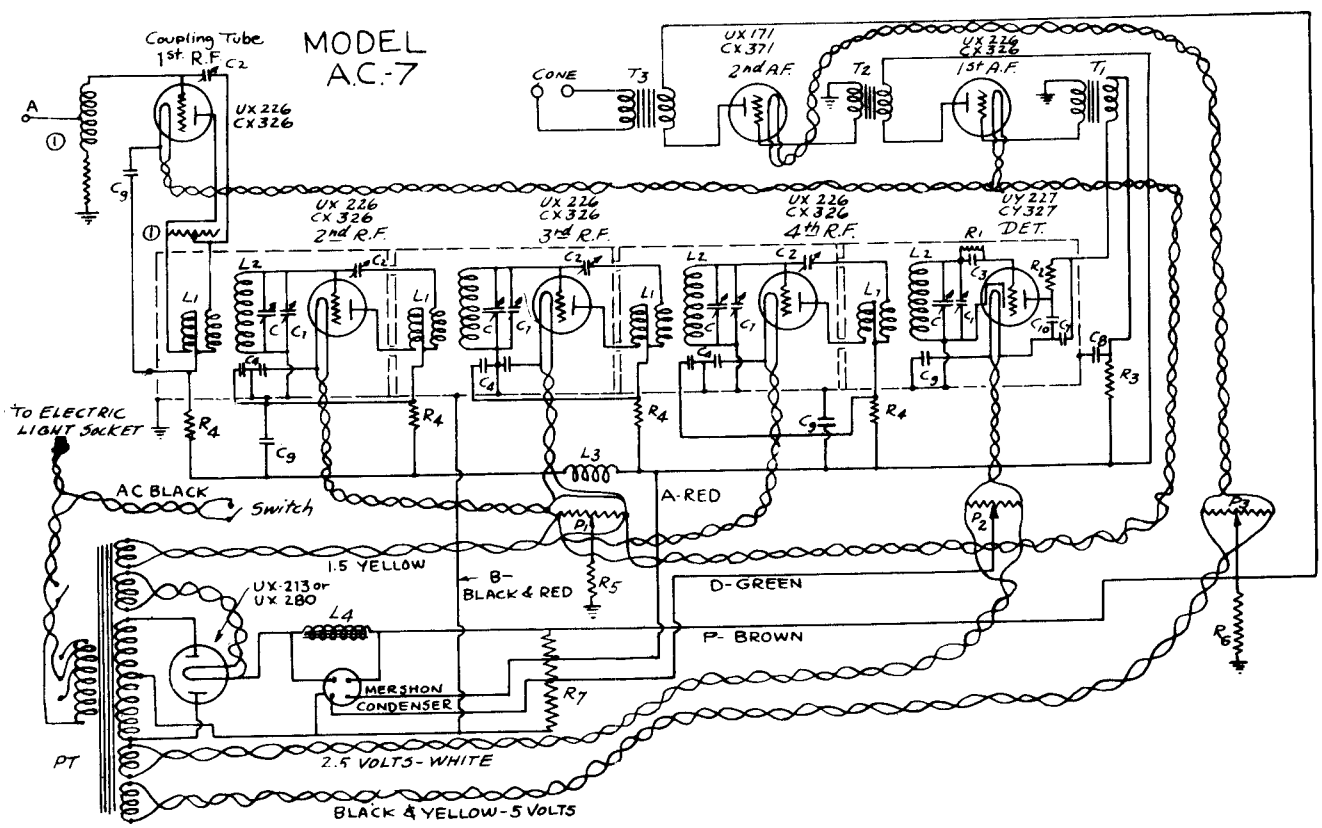


MODEL A.C.-6
CONCERTO NOCTURNE

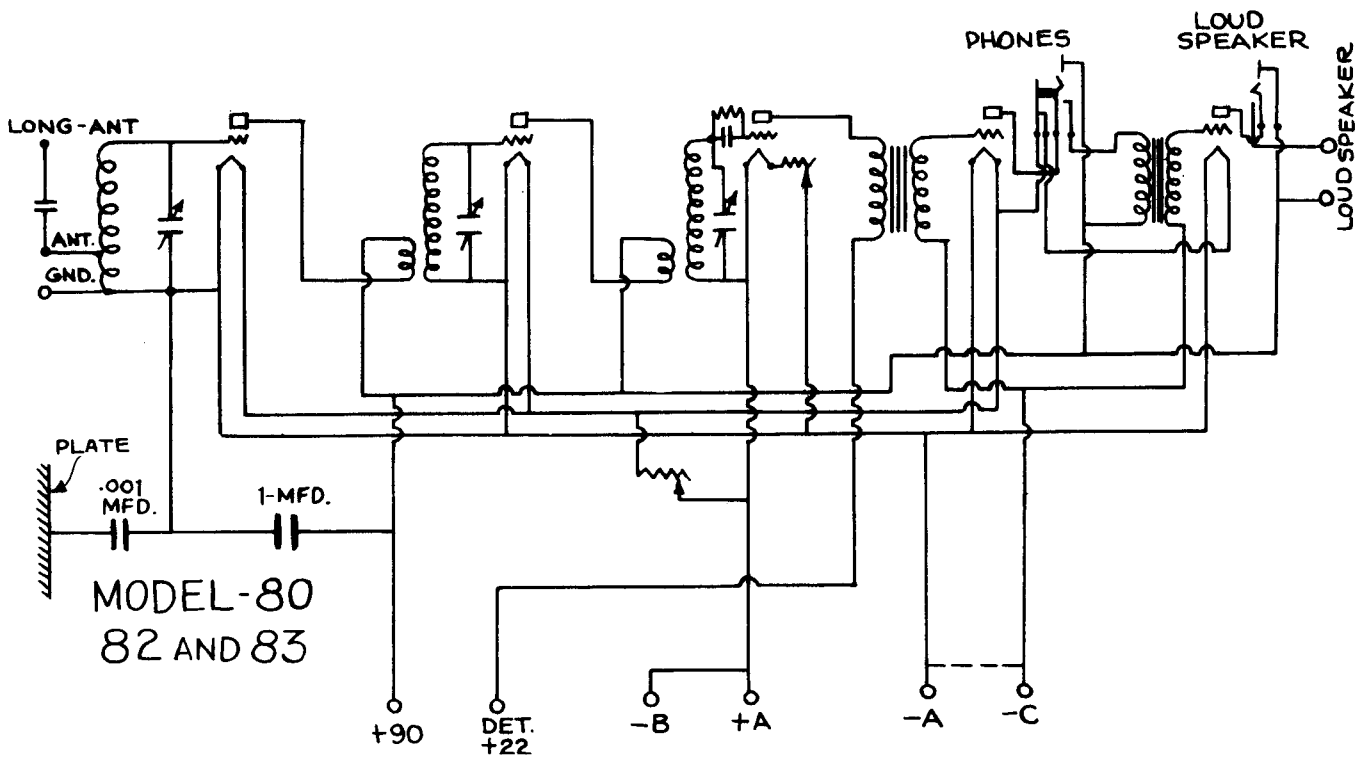
NOTE:-
The Letters and numerals on battery Leads refer to markings on eLiminator panels

AMRAD CORPORATION

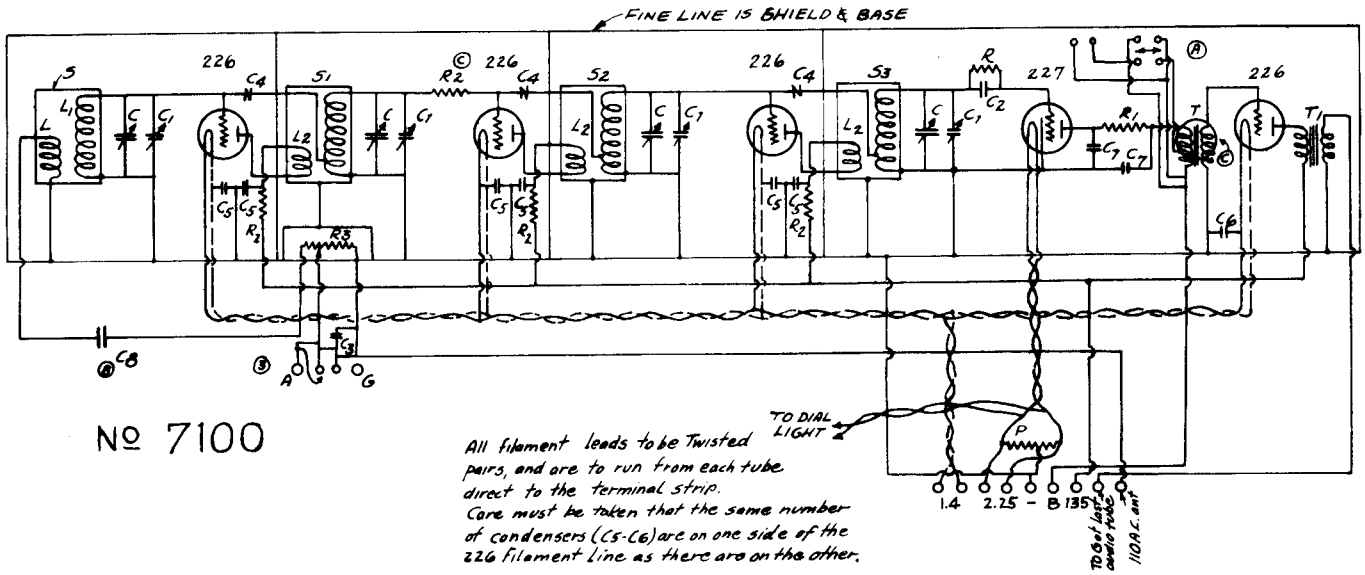




AMRAD CORPORATION

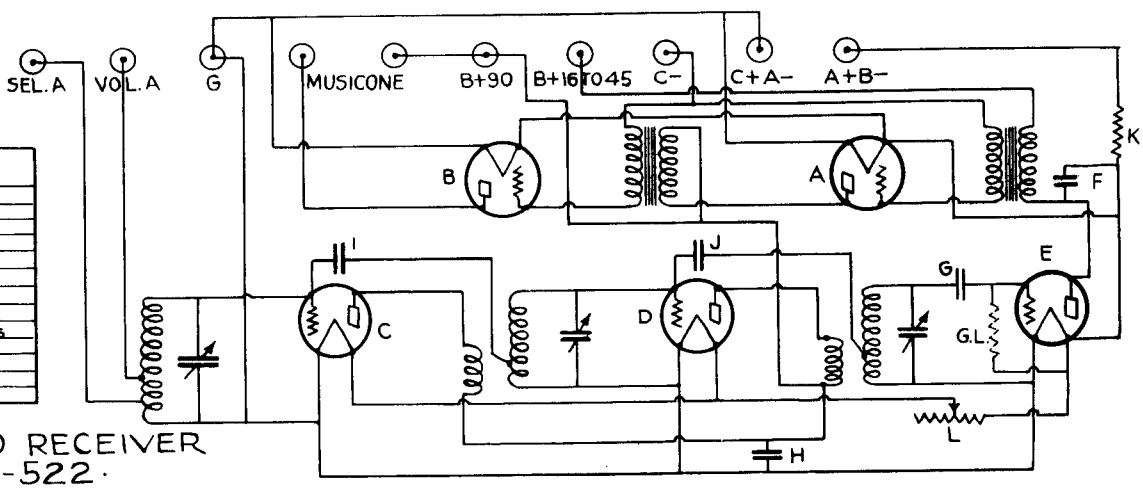


MODEL-80
82 AND 83



No 7100

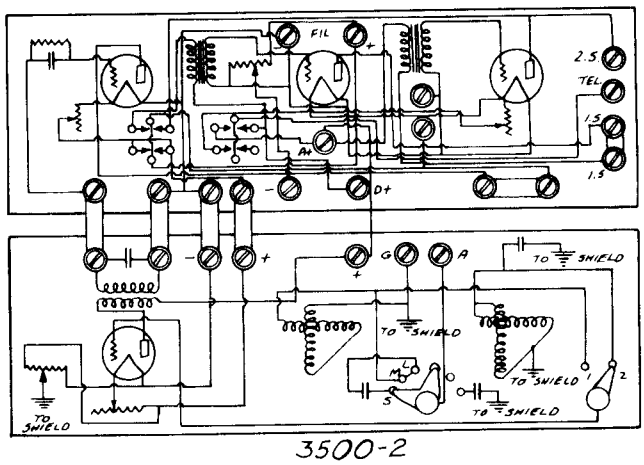
All filament leads to be Twisted pairs, and are to run from each tube direct to the terminal strip. Care must be taken that the same number of condensers (C5-C6) are on one side of the 226 filament line as there are on the other.



KEY	
A	1st. Audio Stage
B	2nd. " "
C	1st. Radio "
D	2nd. " "
E	Detector
F	.001 Mfd.
G	.00025 Mfd.
H	1 Mfd.
I, J	Neut. Condensers
K	.75 Ohms
L	6 Ohms

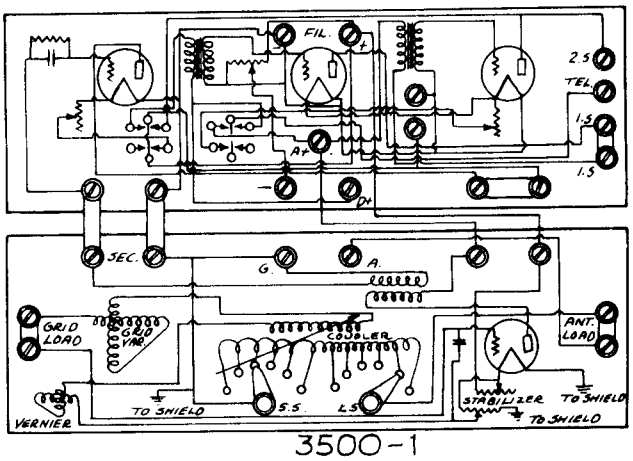
AMRAD RECEIVER
S-522.

AMRAD CORPORATION



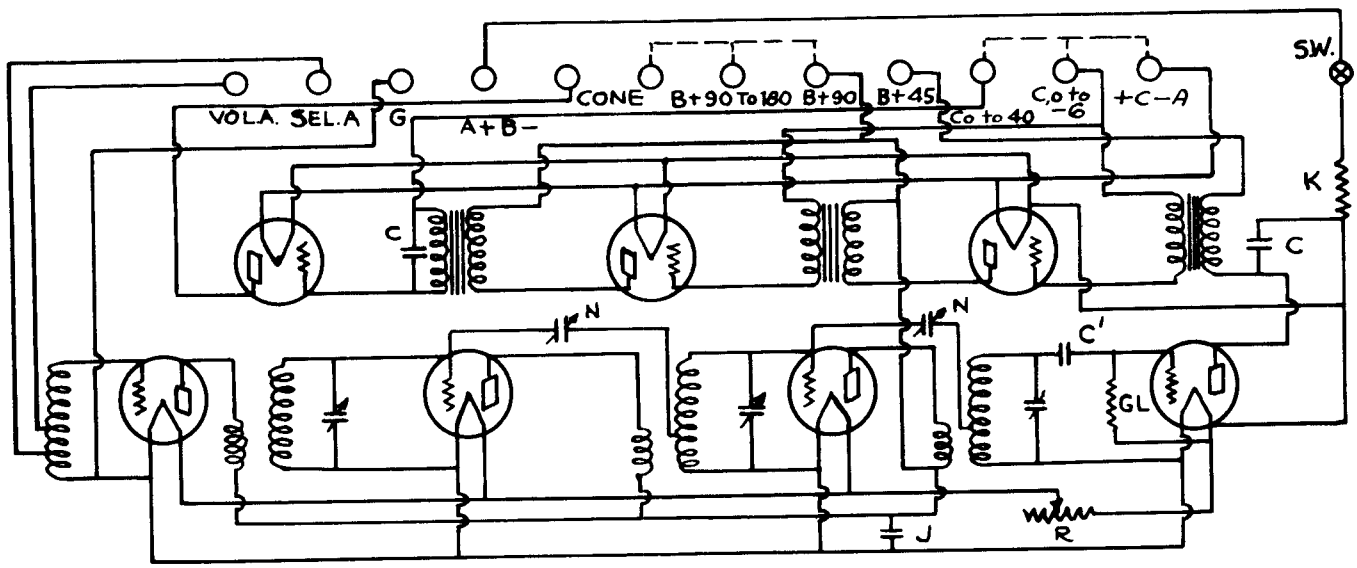
3500-2

SHOWING INTERNAL WIRING OF DETECTOR 2 STAGE AMPLIFIER 2634 AND BROADCAST TUNER 3730 AS VIEWED FROM FRONT OF INSTRUMENTS



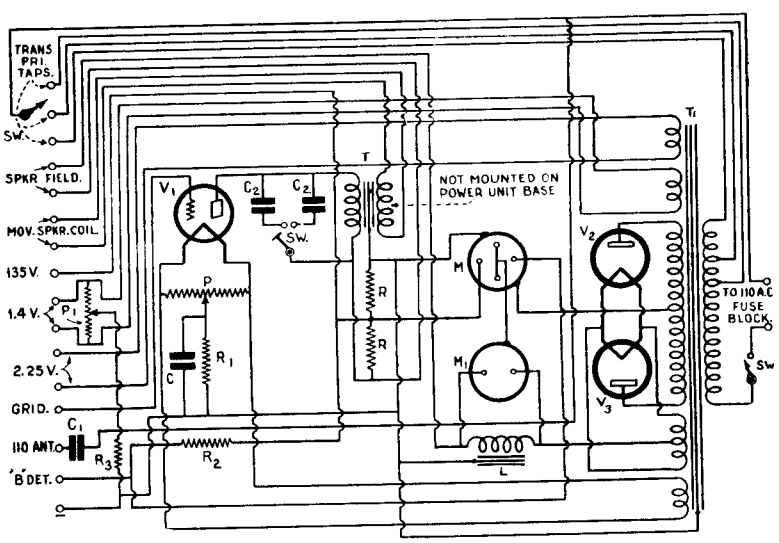
3500-1

SHOWING INTERNAL WIRING OF DETECTOR 2 STAGE AMPLIFIER 2634 & BROADCAST TUNER 3475 AS VIEWED FROM FRONT OF INSTRUMENT

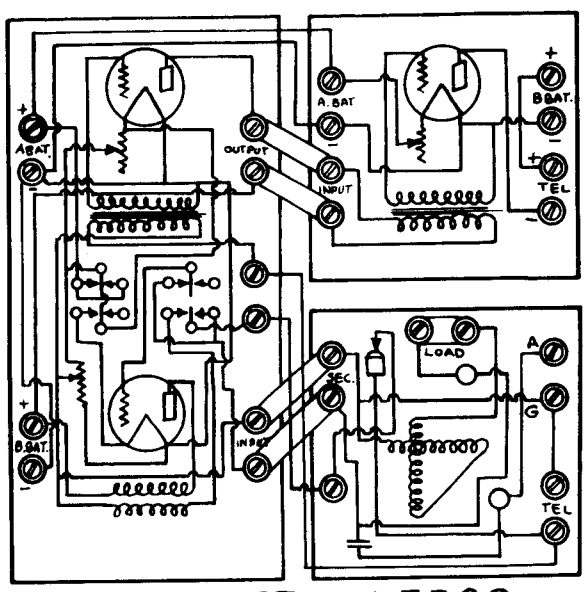


S-733

C-.002 MF. K-75 Ω R-6 Ω.
C-.00025 MF J-1.MF.



Schematic Circuit of the Amrad Type 7191 Power Unit designed for the Model 7100 receiver The Model 7100 receiver is designed to operate without an outside aerial, the radio frequency pick-up of the light line being sufficient in most localities to bring in the signals of distant stations. Units M and M1 are Mershon electrolytic condensers.



RECEIVER Nº 3590.

Radio Service Data Sheet

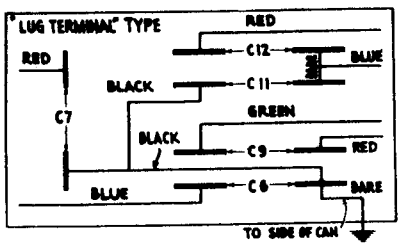
AMRAD MODEL 81 ("BEL CANTO" SERIES) RECEIVER

The tubes required for this receiver are as follows: V1, V2, V3, '24s; V4, V5, '27s; V6, V7, '45s; V8, '80; V9, 2.5-volt bulb.

R1 is the volume control and varies the voltage applied to the screen-grids of V1, V2, V3.

Further constants for this receiver may be obtained from the following list. C1, C2, C3, C4 constitute the four-gang tuning condenser; C5 has a capacity of .00025-mf. C6, C7, C9, C11, C12, are contained in "by-pass block condenser No. 8113" (which may have either lug or wire terminals, connected as shown in the accompanying illustrations), and the values are: C6, C7, C12, 1.0 mf., C9, C11, 0.5-mf. C8 has a capacity of 1.0 mf.; C10, .002-mf.; C13, 0.25-mf. The four units of the electrolytic condenser have the following ratings (the four terminals are the positive leads and the copper case is the common, grounded, negative side of the circuit): M1, 18 mf., M2, 8 mf., M3, 18 mf., M4, 8 mf.

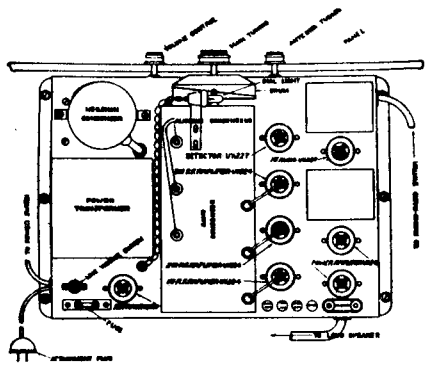
The resistors have the following values: R1, 50,000 ohms; R2, 21,000 ohms; R3, 1.5 megs.;



One type of filter-block terminals.

R4, 12,500 ohms; R5, 100,000 ohms; R6, 2,250 ohms; R7, 20 ohms; R8, 200,000 ohms; R9, 5,000 ohms; R10, 60 ohms; R11, 31 ohms; R12, 860 ohms; R13, 1,500 ohms. The resistor cartridges are colored as follows: R2, green; R4, black; R5, yellow; R6, orange; R9, brown; R13, purple.

The Model 81 chassis is fused at three amperes. The "antenna compensating control" is the 10-plate variable condenser marked C1A;



A view looking down on the "81" chassis.

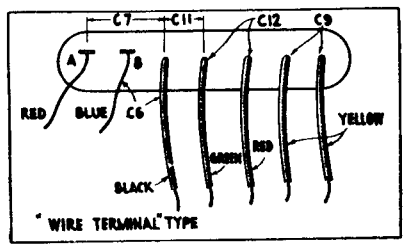
while the remaining trimming condensers are adjustable, through the shield can, with a screwdriver. Binding posts at the rear of the chassis permit selection of the correct tap on the antenna input inductance L1, for the required degree of selectivity and sensitivity. When the tube is renewed at V4, it will probably be necessary to readjust the setting of R8. If circuit oscillation should appear in the receiver, it may usually be traced to a defective '24 tube, which should be replaced.

The cord which operates the tuning dial is kept in tension by an adjustment which compensates for stretching; this is regulated by putting a screwdriver through a hole cut in the edge of the dial drum.

Each of the R.F. transformer primaries (L1, as well as P in L2, L3 and L4) consists of a winding of about 200 turns on a bobbin at the grid end of the secondary; it has a direct-current resistance of about 80 ohms. Ch1 has a resistance of about 100 ohms.

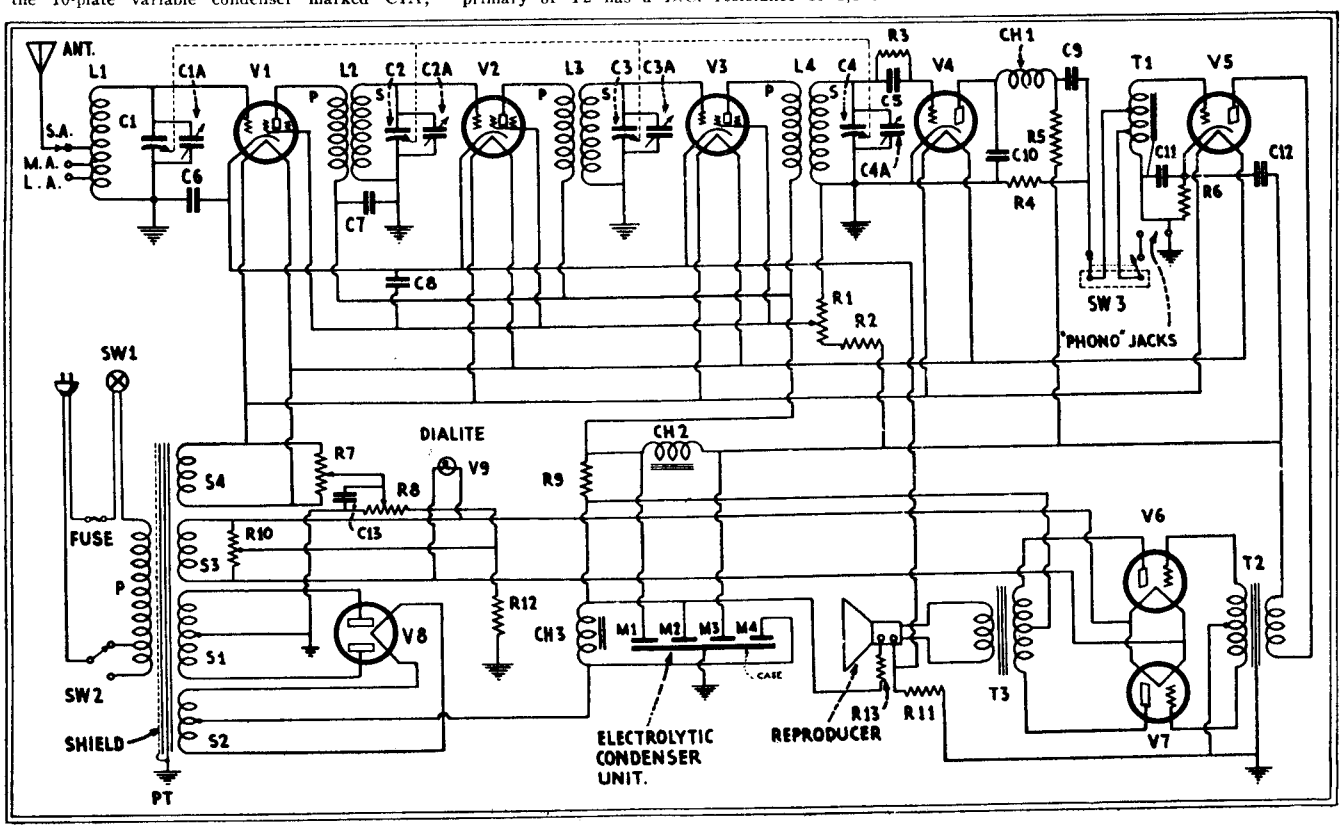
The D.C. resistance values of T1, between ground and the three higher-potential ends, are as follows: to phono tap, 20 ohms; to detector tap, 2,000 ohms; to grid lead, 12,000 ohms. The primary of T2 has a D.C. resistance of 1,690 ohms; the secondary has an over-all resistance value of 10,600 ohms, divided into 4,800 and 5,800 ohms for the grid circuits of V6 and V7. Transformer T3 has a primary D.C. resistance of 190 ohms on one side of the tap, and 220 ohms in the other; the secondary has a D.C. resistance of 0.8-ohm (approx.) to match the voice coil of an RCA "Type 106" dynamic reproducer. The field coil of this instrument has a D.C. resistance of 7000 ohms. As most Service Men know, the voice coil is easily centered by first loosening the center machine screw that clamps the cone-spider to the iron core. (The voice-coil leads of the "106" are marked "B" and the field-coil leads are lettered "C.").

Correct operating conditions for the "Model 81" Amrad are as follows: V1, V2 and V3, plate voltage 180, control-grid bias 1.5, plate current 4 ma.; V4, plate voltage 30 (with tube out of socket, 140 volts), grid bias 0.0, plate current 1.5 ma.; V5, plate voltage 160, plate

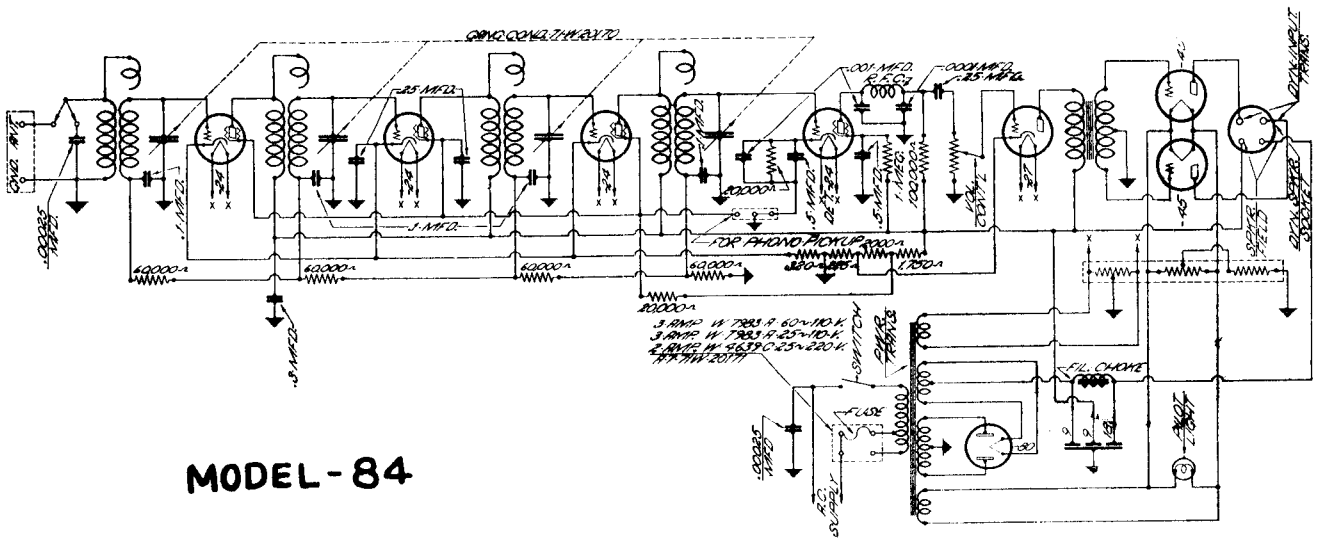


Another form of condenser connections.

current 4.1 ma., grid bias 10.5; V6, plate voltage 250, plate current 28 ma., grid voltage 50, filament voltage 2.25; V7, same; V8, plate output 110 ma., filament voltage 4.65. (All the other tubes have a filament voltage of 2.25; at the socket with the tube out, 2:32.) These values were obtained with the set adjusted for a 120-volt line supply, and the volume control full "on." The "C" bias figure of 10.5 volts for V5 will not be obtained unless the hum control R7 is turned to the ground side.



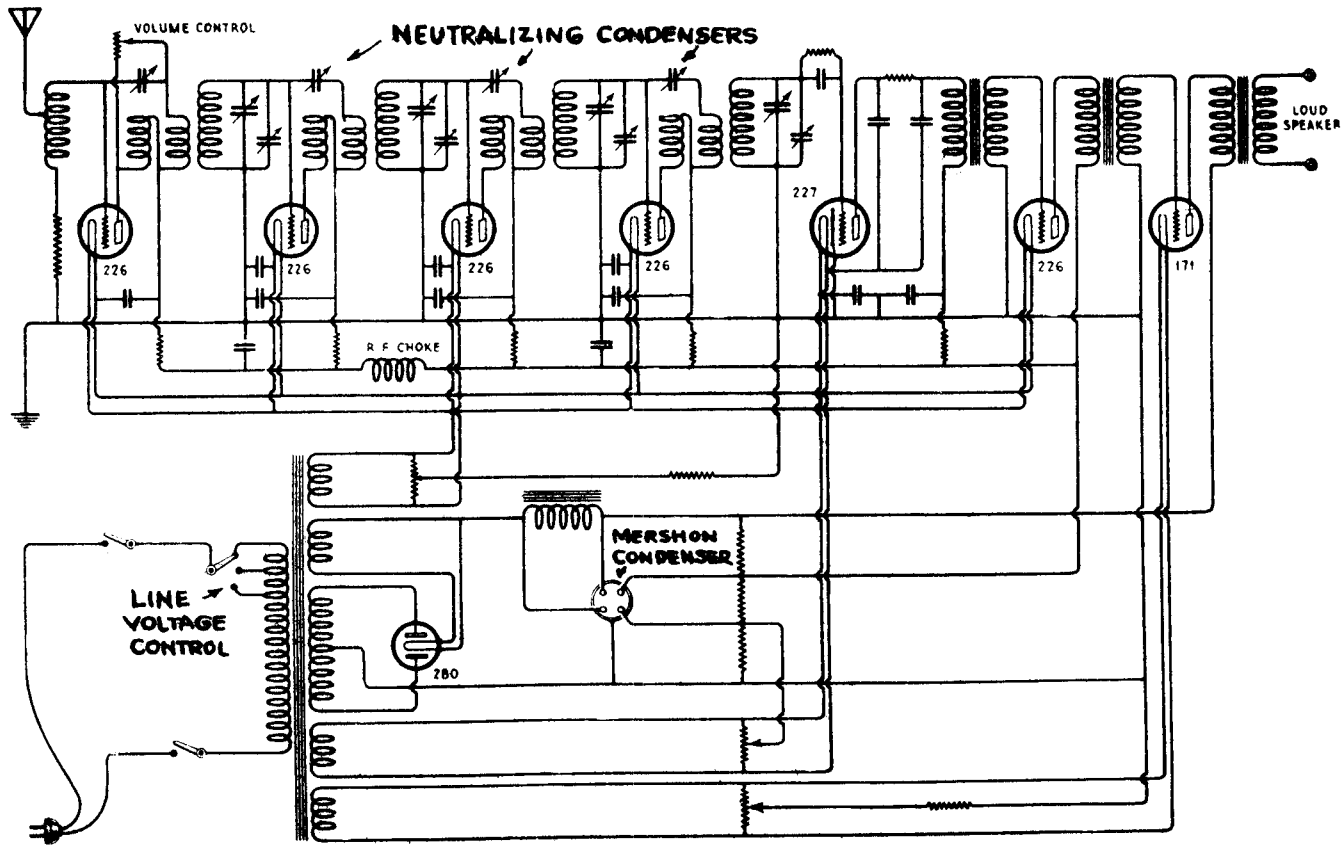
AMRAD CORPORATION



MODEL-84

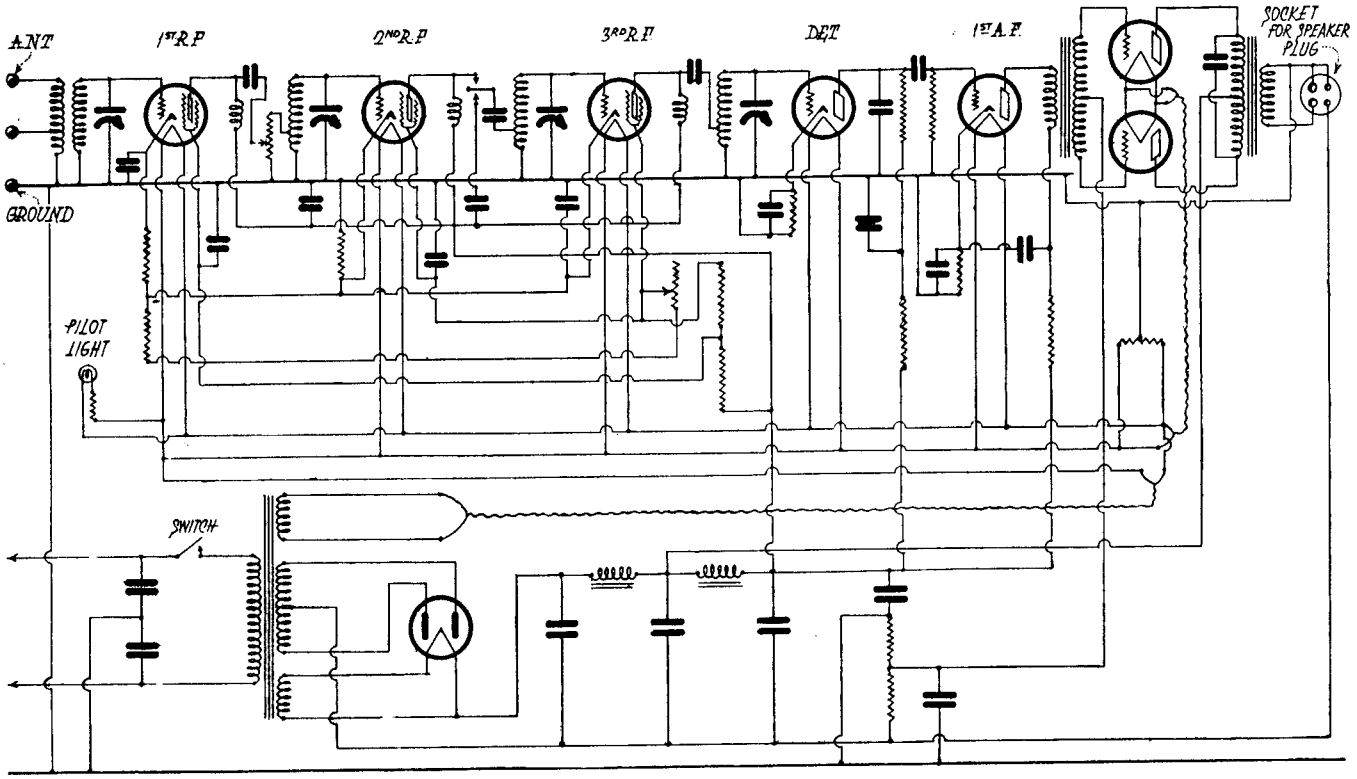
Tube Operating Voltages

Tube	Position	A	B	C	Screen
'24	1st r.f.	2.3	170	2.5	60
'24	2nd r.f.	2.3	170	2.5	60
'24	3rd r.f.	2.3	170	2.5	60
'24	detector	2.3	95	4.0	35
'27	1st a.f.	2.3	130	8.0	
'45	2nd a.f.	2.3	220	40	
'45	2nd a.f.	2.3	220	40	
'80	rectifier	4.6	250	--	



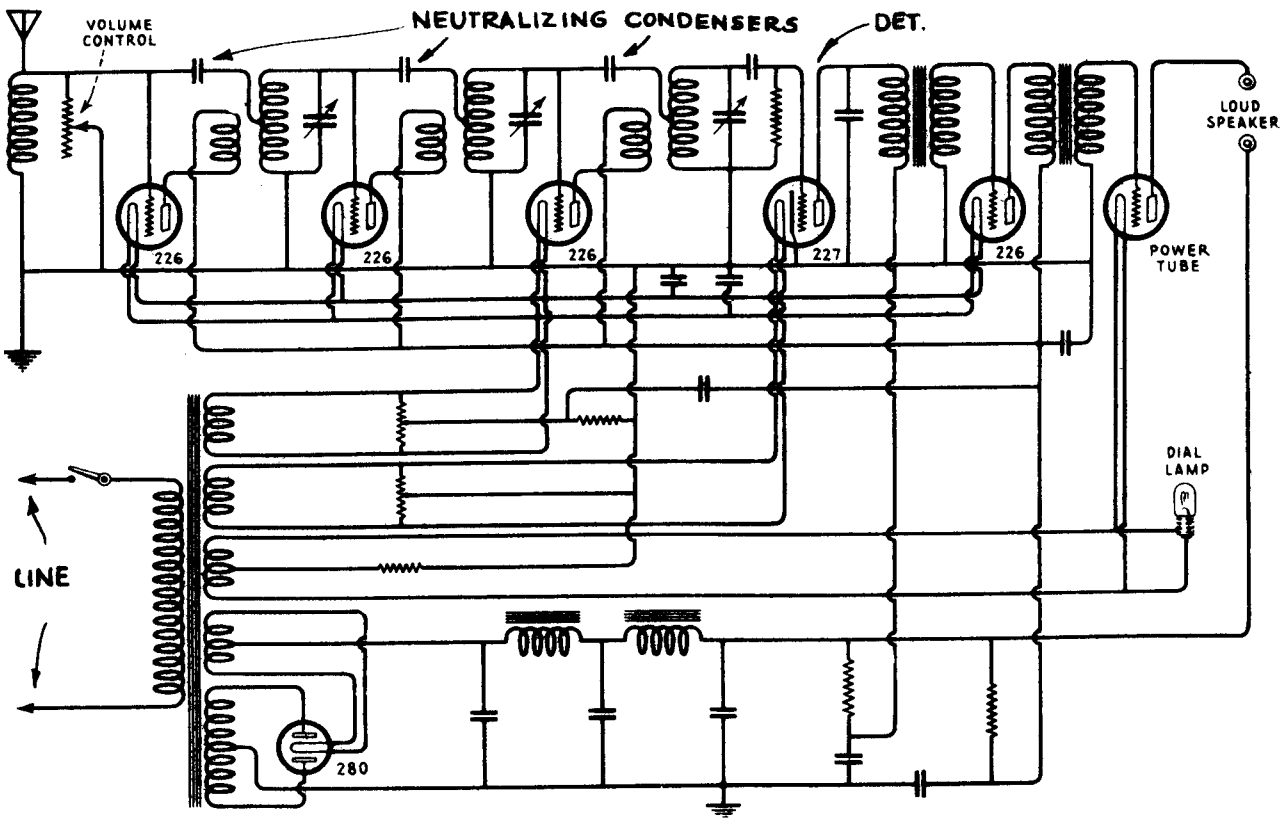
ATWATER KENT MFG. CO.

MODEL 60

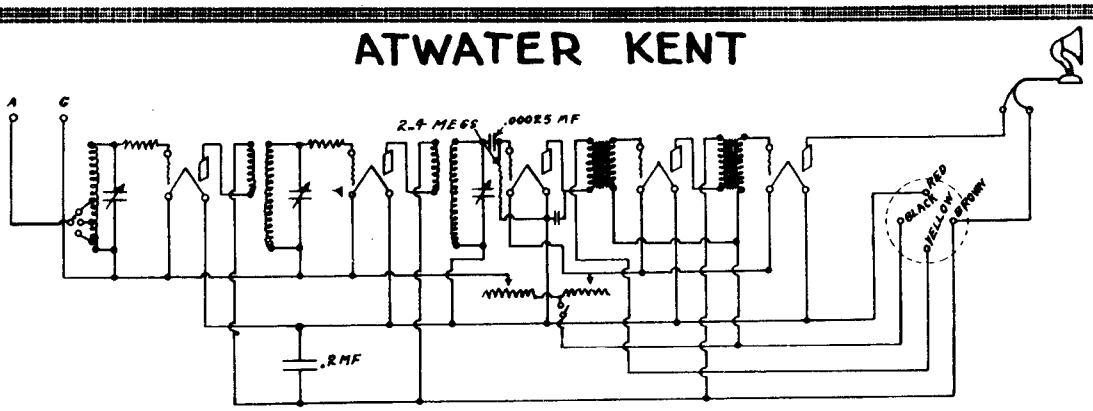


U.S. RADIO & TELEVISION CORP.

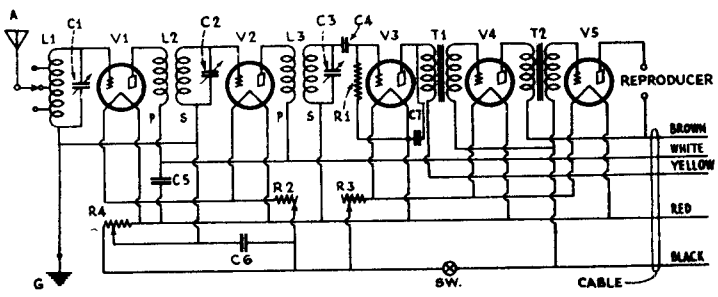
APEX MODEL 36



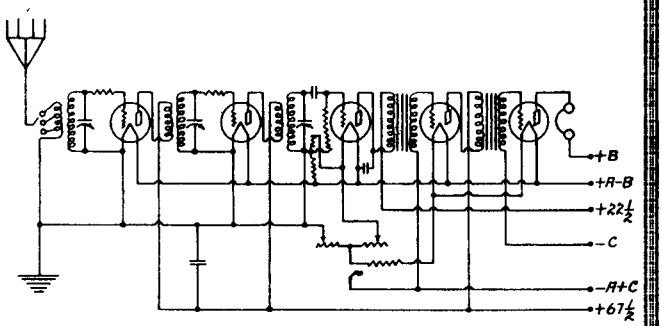
ATWATER KENT



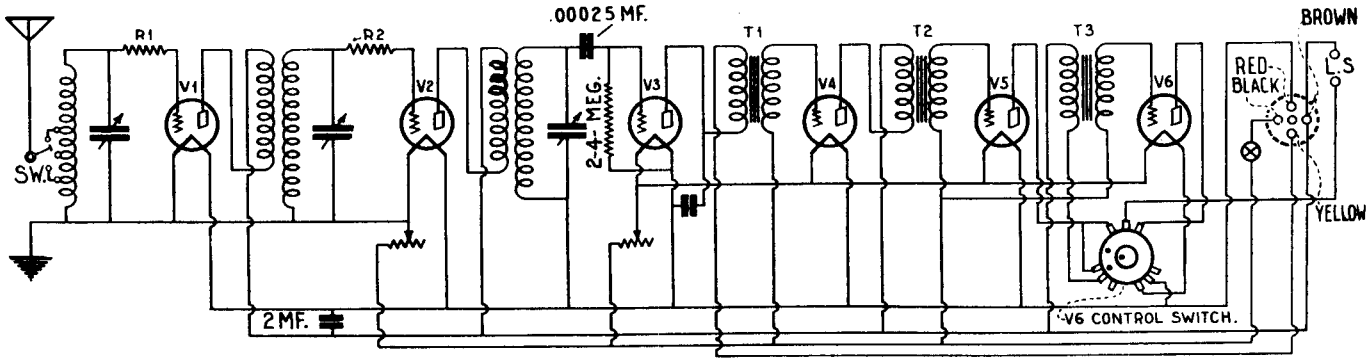
MODEL 10 SET No. 4700.



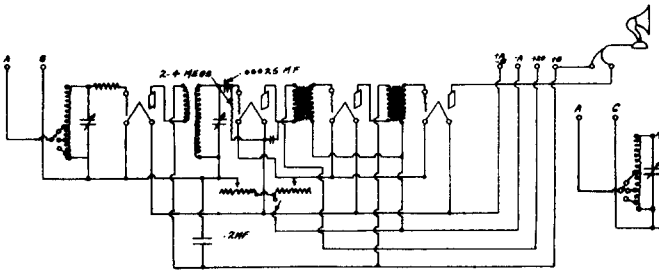
The Atwater Kent "Model 10B," a very early "breadboard" receiver. The circuit is quite simple, and the controls numerous. It is designed for storage-battery tubes, and has potentiometer R.F. control. It may be readily altered to use a power tube.



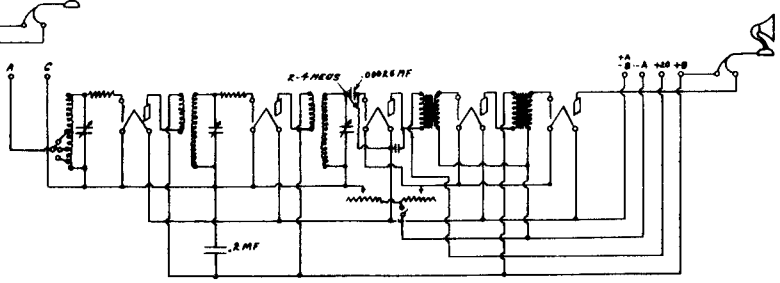
SCHEMATIC WIRING DIAGRAM OF MODEL 20 COMPACT SET.



Schematic arrangement of the Atwater Kent Model 12 receiver; this set is popularly referred to as the "breadboard" type of construction. The Model 12 set was one of the very first ones to incorporate "grid suppressors" to prevent circuit oscillation. The most usual complaint by owners of this receiver is that the tubes will not light. A check-up would indicate that one of the rheostats had burned out; because someone in the family had connected one side of the storage battery to ground. This put the full storage-battery current across the rheostat controlling the first two R.F. tubes.

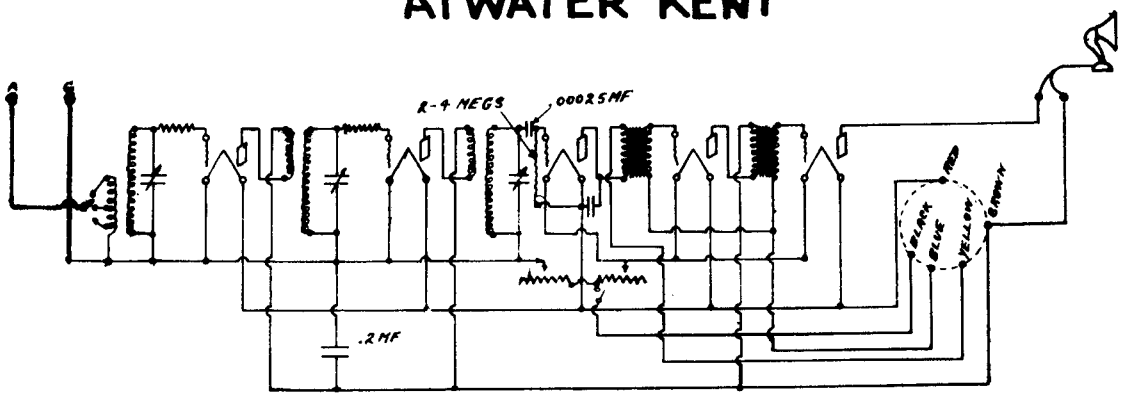


MODEL 19 SET No. 4880.

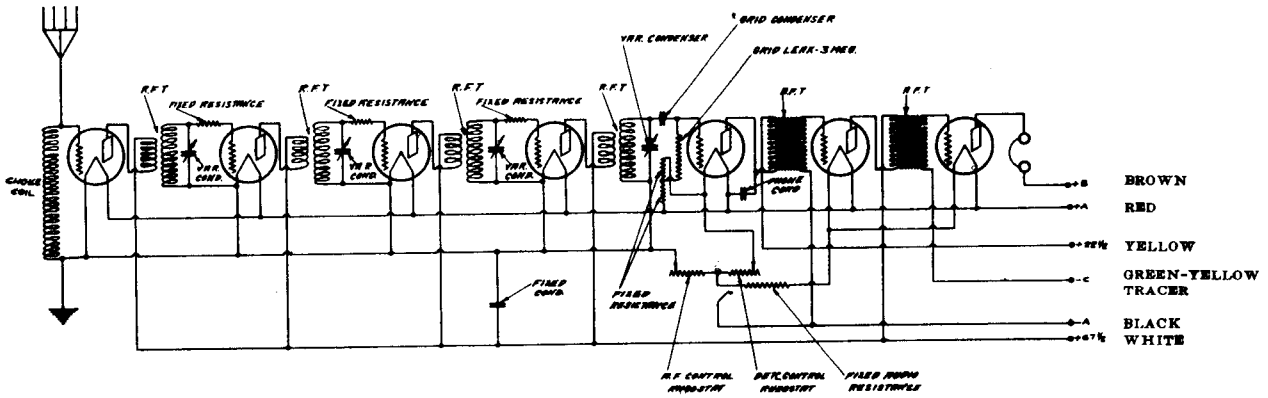


MODEL 20 SET No. 4640.

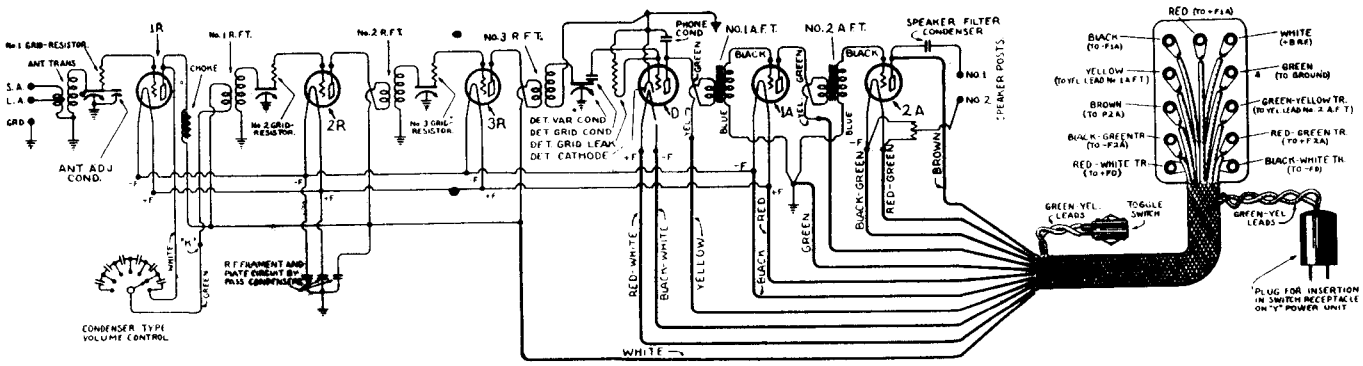
ATWATER KENT



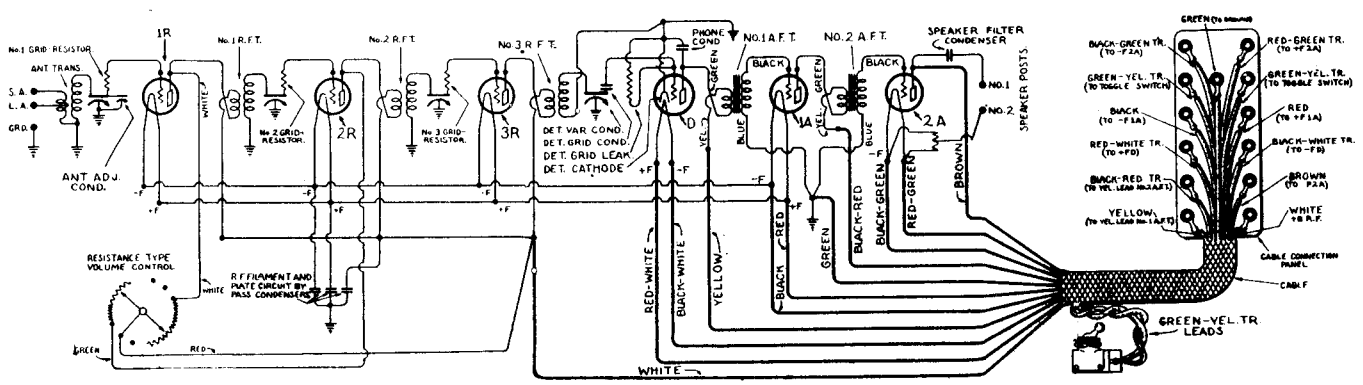
MODEL 21 DRY CELL SET No. 7780.



WIRING DIAGRAM OF MODEL 32.



WIRING DIAGRAM OF MODEL 36 WITH CONDENSER TYPE VOLUME CONTROL AND CABLE CONNECTION PANEL FOR EARLY MODEL "Y" POWER UNIT. (Note that the +B 1st A.F. cable lead is green with a yellow tracer. In some Model 36 sets, and in all other Atwater Kent A.C. receivers, a black-red tracer is used for this connection.)



WIRING DIAGRAM OF MODEL 36 WITH RESISTANCE TYPE VOLUME CONTROL AND CABLE CONNECTION PANEL FOR LATER MODEL "Y" POWER UNIT. (Note that the red and the black cable leads feed the R.F. filaments as well as the 1st A.F. filament. In some Model 36 sets, the +B 1st A.F. cable lead is green with a yellow tracer.)

Radio Service Data Sheet

ATWATER KENT MODELS 30, 33, 35, 48 AND 49

These receivers are six-tube sets of the single-dial, battery-operated type. They are often referred to by their factory catalog numbers, to wit: Model 30, No. 8000; Model 35, No. 8100; Model 48, No. 9840; Model 33, No. 8930; Model 49, No. 9860.

The models 33 and 49 have a tuned input (four tuned circuits); the models 30, 35 and 48 have an untuned input (three tuned circuits). Models 48 and Models 49 are code numbers showing that a gold-finished panel is used. Models 33 and 49 are so wired that R5 limits the current to V5 and V6 only while V4 is controlled by the additional variable resistor Rx. R in the first stage of these two circuits has the same value as equivalent resistors R1 and R2. C is the regular tuning condenser, in shunt to which is the circuit-balancing variable condenser Ca.

The purpose of the untuned antenna input of the 30, 35 and 48, shown in the larger diagram, is to eliminate the detuning effects of aerials of different constants.

If it becomes necessary to change a variable-condenser bank, make certain that the pulleys turn easily on the shafts; if they do not because of a damaged condenser shaft, replace the entire condenser group.

Each belt must be arranged with the eyelets, which clamp the two ends together, at the bottom of the belt loop. Each belt has two small holes; one to fit over a pin on the dial-condenser pulley and the other to fit over the pin on the pulley which is controlled by that belt.

Loosen screws in the outer condensers and move them toward the dial-condenser, so that the belts will fit easily over the pulleys. In moving condensers, hold them by the heavy frame of the stator plates, as this avoids strain on the different parts of the condenser assembly.

To arrange the belts on the 30, 35 and 48, first put on the belt which fits over the *inner* of the two pins on the dial-condenser pulley, and over the pulley of the third (right) condenser. Then, put on the belt that fits over the *outer* of the two pins on the dial-condenser pulley, and over the pulley of the first (left) condenser.

A bit different procedure must be followed in arranging the belts on the 33 and 49. Put on the belt that fits over the *inner* of the two pins on the dial-condenser pulley, and over the third pulley, as the first step. Then, put on the belt that fits over the *inner* of the two pins on dial-condenser pulley (this will bring it on top of the first belt) and continue on over the pulley of the fourth right condenser. The last step is to put on the belt that fits over the outer one of the two pins on the dial condenser pulley and over the pulley of the first or left condenser.

After the belts are in position the next step is to adjust the belt tension. See that the three screws holding the dial-condenser to chassis are tight, and that the three screws in each of the other variable condensers are slightly loosened. Note that the holes through which these latter screws pass are slotted, allowing the condenser to be moved horizontally a fraction of an inch toward or away from the dial condenser. Two pins projecting from the front of the condenser fit into two horizontal slots and serve to keep the condenser properly aligned. It is important to see that the pins of the condenser are not jammed outside but are in the slots. The frame of the metal-frame variable condensers will be found to partly cover a hole (on the side of the condenser nearest to the dial-condenser) that is provided in the front of the chassis and at the edge of each condenser for the purpose of tightening the belts. By inserting the blade of a screwdriver in this hole and twisting the blade, the condenser may be moved away from the dial-condenser; this motion tightens one belt. A little dexterity is required when the correct belt tension has been obtained; for the next step is to keep the condenser in the correct position while, with the right hand, a second screwdriver is used to tighten the three screws that pull the condenser to the chassis. Screws must be pulled up tight as soon as the tension is such that the variable condensers all move at the same instant, forward or backward, when the dial is adjusted, without any slack in the belts.

Following are a few details that relate specifically to the 30, 35 and 48. Adjust right-hand belt first; insert the blade of a screwdriver in the chassis hole at the left-hand edge of the third condenser and twist the blade, slowly. This will force the third condenser toward the right and increase the tension on the belt. When it seems to be at about the right tension, as judged by pressing the belt, tighten the three screws with a second screwdriver.

Special notes in connection with the 33 and 49 are as follows: the dial-condenser and third condenser belt should be adjusted first. Following this is the adjustment of the belt passing over the pulleys of the dial-condenser and fourth condenser. (Tension is tested by pressing down the belt between the third and fourth pulleys.) The left-hand belt is the last to adjust.

As it is necessary, in making certain replacements, to know the general classification of the R.F. inductance group of each model as regards its serial number, these data are included herewith. The identifying washer is found under the nut on the second R.F. transformer mounting; the colors of the washers are as follows: Model 30, 635,001 to 644,351, black; above 644,351, red. Model 35, below 900,000, no washer; 900,001 to 955,700, yellow or amber; above 955,701, gray. Model 33, Unit No. 9220: antenna coil has five leads (one red), L1 has one green lead, L2 has one yellow lead, and L3 has one blue lead.

To reduce inter-stage coupling to a minimum, the three R.F. inductances L1, L2 and L3 in the 30, 35 and 48 are so arranged that the axis of each is at right angles to that of the others. (The R.F. choke Ch is only about ½-in. long and has a negligible field); however, the 33 and 49 incorporate four tuned circuits and, to reduce interstage coupling, the coil design was entirely changed to "binocular" or "astatic" (non-inductive) windings. If, after carefully balancing the variable condensers, it is found that the variable condensers cannot be kept in tuning alignment throughout the tuning range, it is probable that one or more of the R.F. inductances is out of balance; it is then advisable to replace the entire set with a new unit.

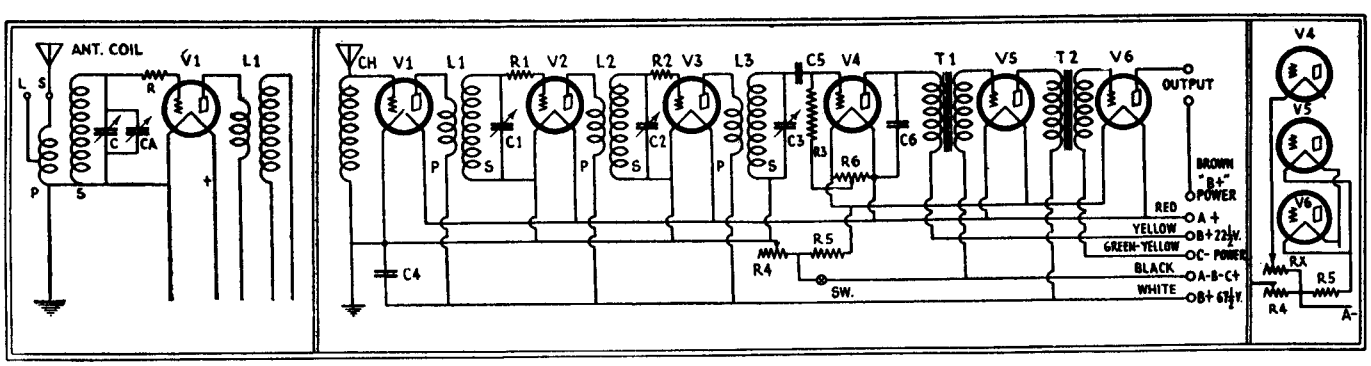
The A.F. output of any of these sets may be fed to a Weston "Model 424" thermocouple galvanometer, through an additional, or third, stage of A.F. amplification, to determine the alignment of variable condensers when the A.F. modulated output of an R.F. oscillator is picked up by the set. The oscillator should be coupled to the set to a degree which results in an approximate reading of 50 on the galvanometer, at about 50 on the tuning dial (as each stage is brought into resonance the meter reading will rise, and the oscillator coupling should be reduced to compensate for this.) First, resonate all the circuits for maximum deflection at about 40 on the dial; repeat performance at 80; then drop to 20 on the dial. After the condensers have been locked in position, the meter readings at 20 and 80 should not drop more than 30% below the reading at 40; a lower reading shows either a defective condenser gang or defective R.F. inductance bank. Inspection of both should then enable a decision to be made.

These sets are wired for a power tube in the last A.F. socket except for early types of the 30. To change the wiring of these, determine by continuity test the grid return lead of T2 which connects to the blue lead in the cable. Break this grid return lead, and attach a length of wire sufficient to reach the "C" battery. Then, connect the positive lead of the speaker (black and red, for Atwater Kent models) to the highest "B+" instead of the connction post on the set.

The A.F. transformers have the following color code for the leads: green to plate; yellow to "B" plus; black to grid; blue to "A—" or "C—". T1 has a ratio of 4:1; T2, 2½:1.

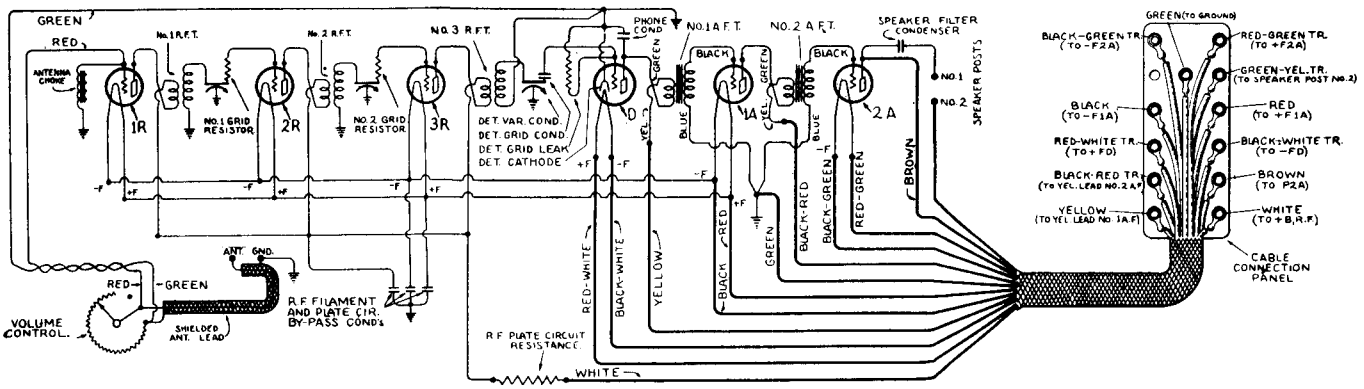
Approximate values for the parts used in these radio sets are as follows: C4, 0.5-mf.; C5, 0.00025-mf.; C6, .006-mf.; R1, R2, R3, R, 800 ohms; R4, 20 ohms; R5, 4 ohms; R6, 30 ohms, center-tapped; Rx, 20 ohms.

In the earlier diagrams "A+" is connected to "B—"; in later models, "A—" to "B—." This is purely external, however.

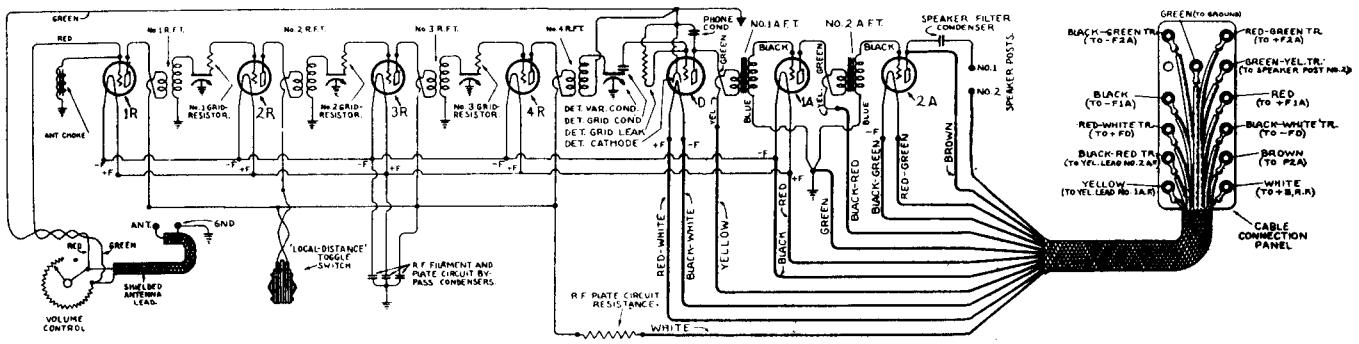


Left panel: R.F. input circuit of "Models 33 and 49"; right panel, their A.F. filament circuit. They are otherwise as shown in the large diagram.

ATWATER KENT



WIRING DIAGRAM OF MODEL 37. (A 2nd A.F. filament shunt resistance is used before Serial No. 1,385,000, in which case speaker post No. 2 connects to the centre-tap of this resistance, and the green-yellow tracer lead is not used. The R.F. plate circuit resistance is used after Serial No. 1,385,000. Note that the red and the black cable leads feed the R.F. filaments as well as the 1st A.F. filament.)



WIRING DIAGRAM OF MODEL 38

A 2nd A. F. filament shunt resistance is used before Serial No. 1,752,000 and the green-yellow tracer cable lead is not used. Connections for this resistance are shown in dotted lines in the diagram on page 71. Note that the black and the red cable leads feed the R. F. filaments as well as the 1st A. F. filament. A schematic diagram of the volume control is shown in Fig. 60.

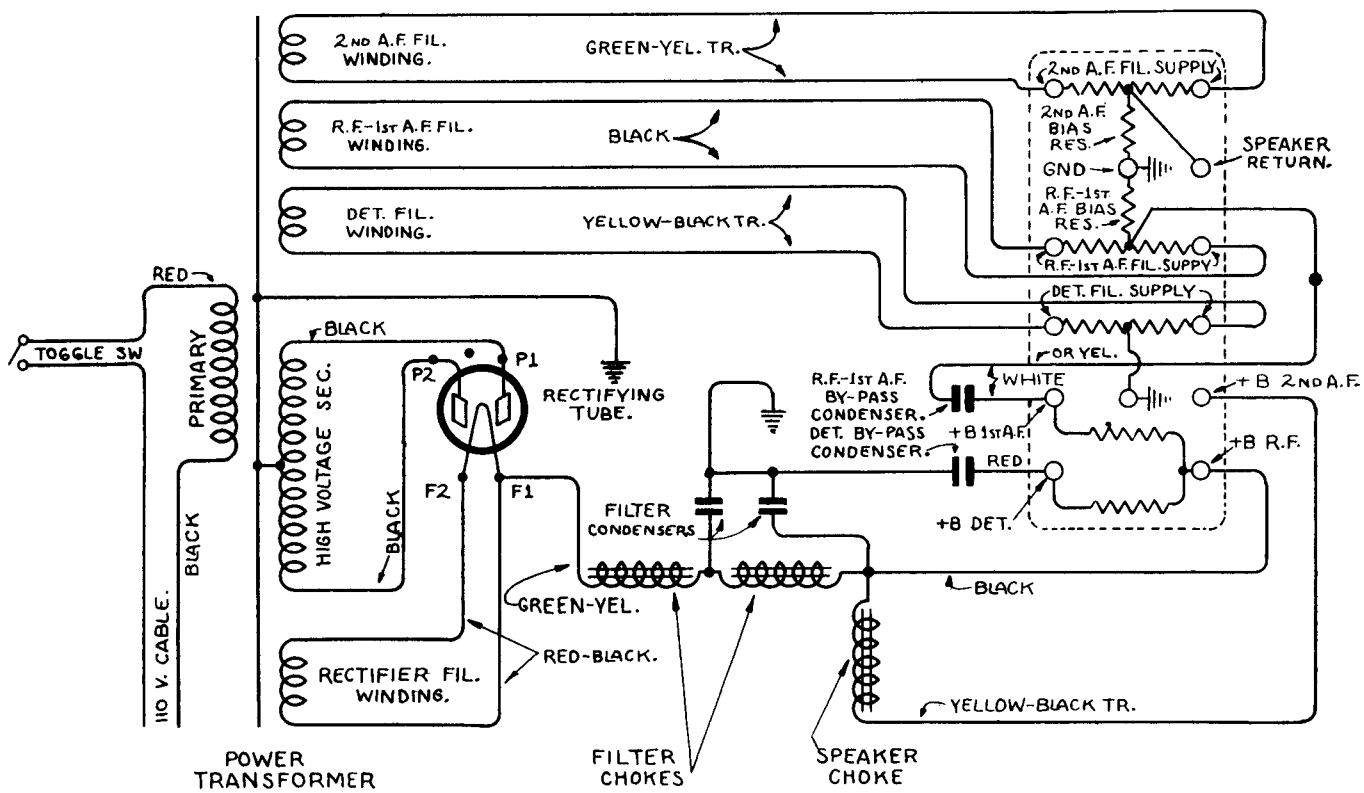
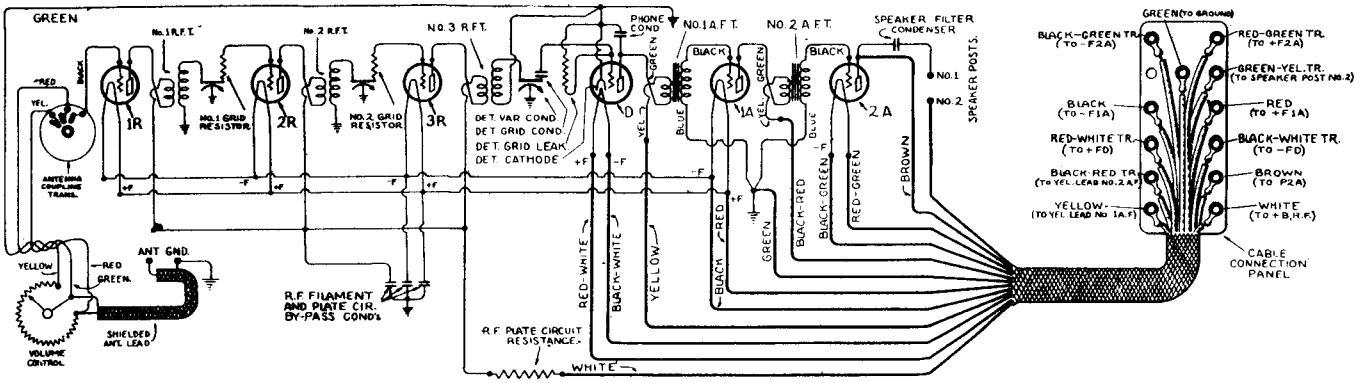


DIAGRAM OF POWER UNIT IN MODELS 37 AND 38

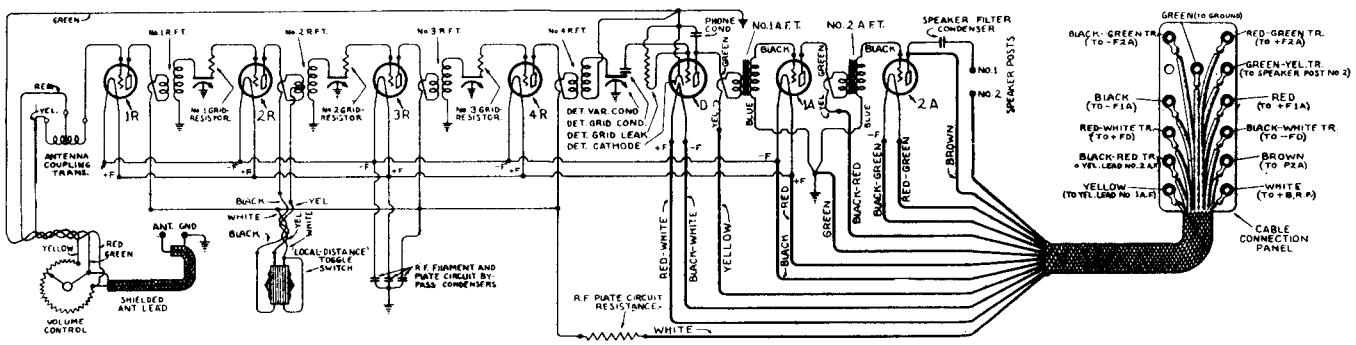
The diagram of the power unit in Models 40, 42, 44 and 52 is similar to that shown above with the following exceptions: A regulating resistance is connected in series with the primary circuit in Models 42, 44 and 52. A filter condenser is connected between F1 and ground. The junction point of the bias resistance is connected to the lower instead of the upper ground eyelet. The color scheme is different and is shown in Fig. 77.

ATWATER KENT

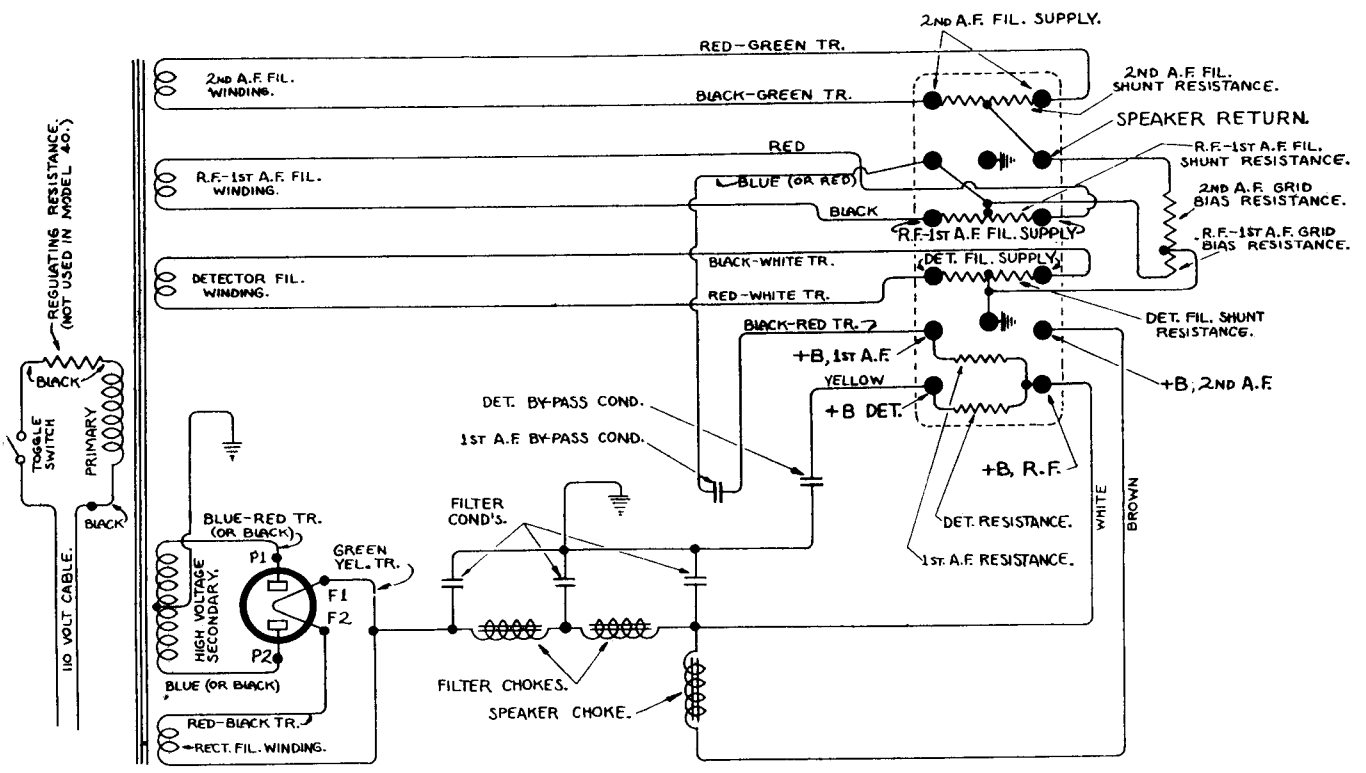


WIRING DIAGRAM OF MODELS 40, 42 AND 52

Model 52 does not have the shielded antenna lead, but is provided with two twenty-foot leads which are connected to the volume control, black for antenna and black-green tracer for ground.

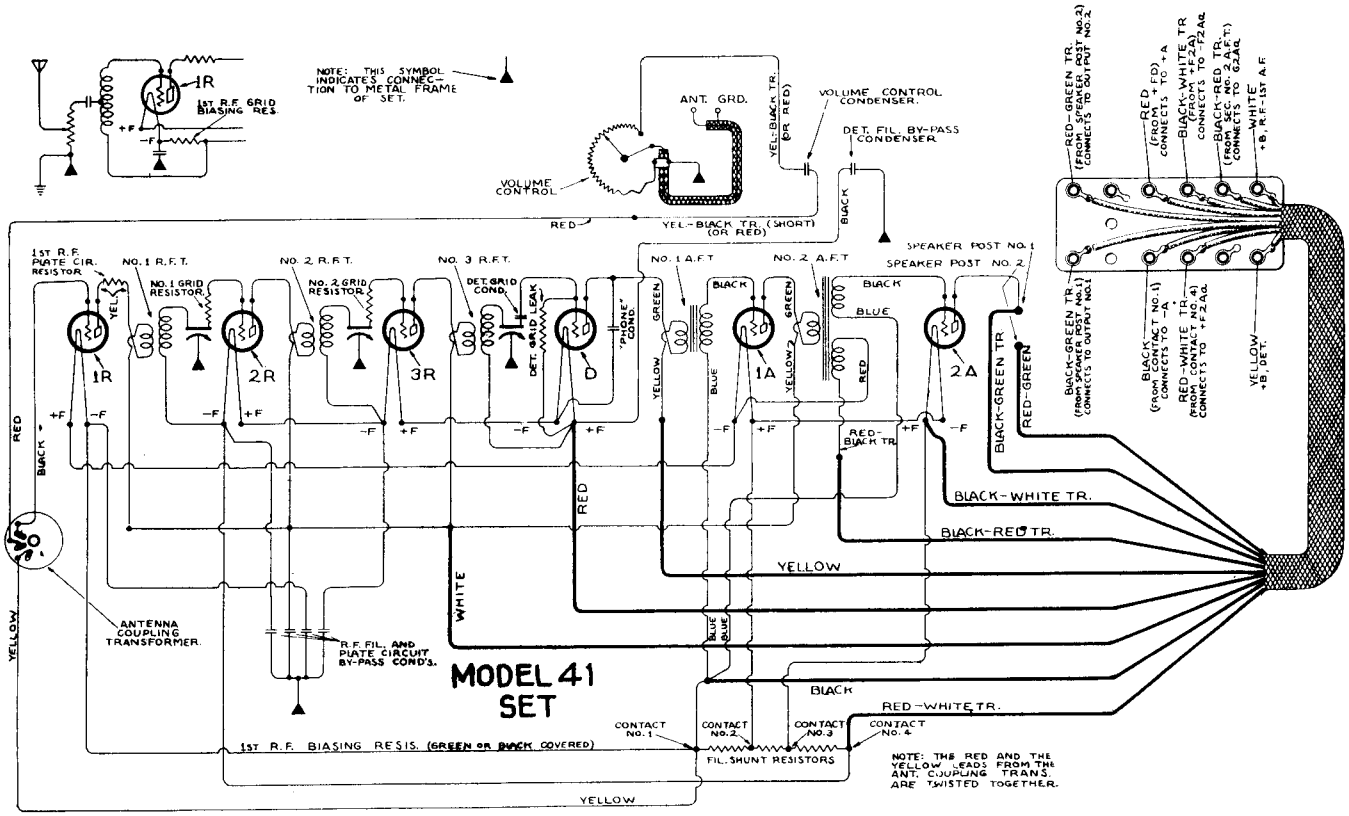


WIRING DIAGRAM OF MODEL 44



SCHEMATIC DIAGRAM OF POWER UNIT IN MODELS 40, 42, 44, AND 52.
SOME EARLY UNITS OF THIS TYPE HAVE COLOR SCHEME SIMILAR TO UNIT IN MODEL 38 SET.
NOTE THAT COLORS AS NOW STANDARDIZED CORRESPOND WITH THE COLORS OF SET-CABLE LEADS.

ATWATER KENT



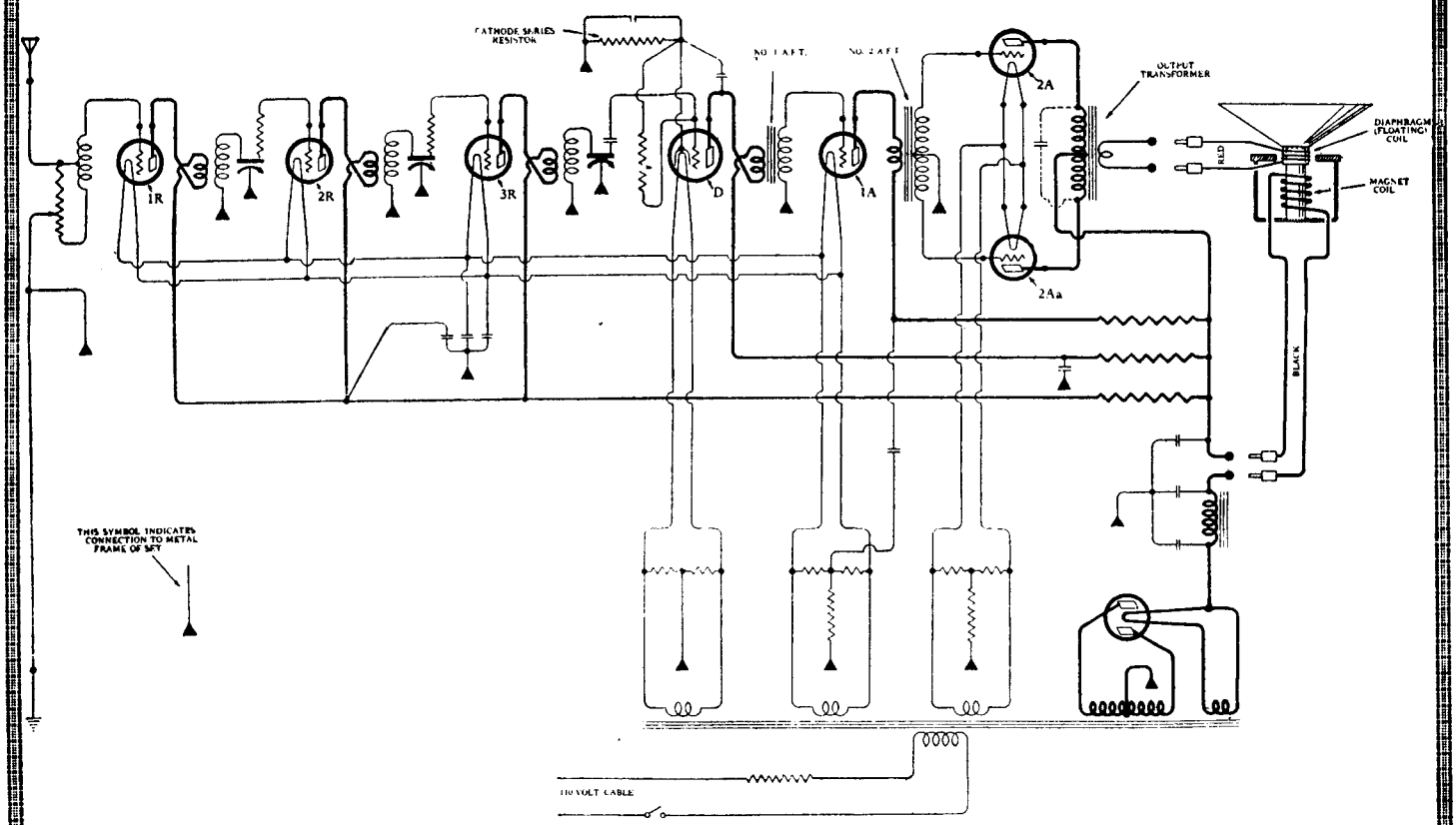
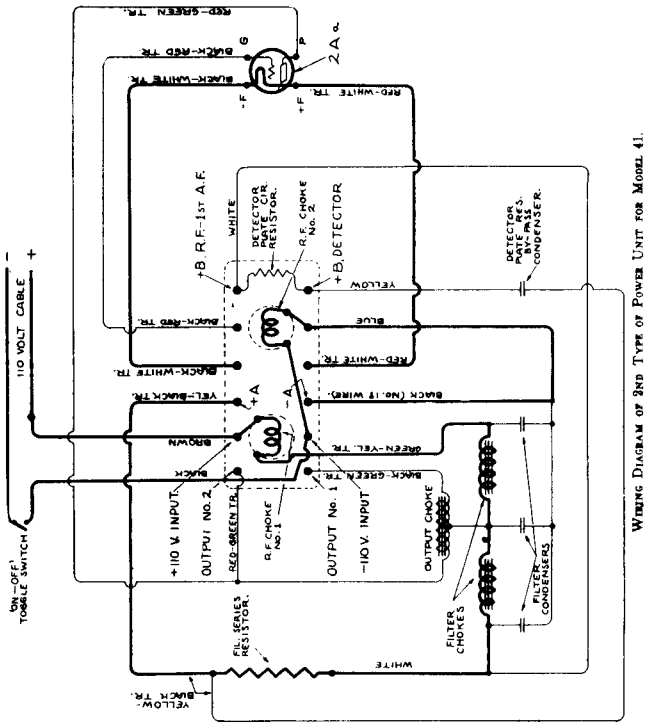
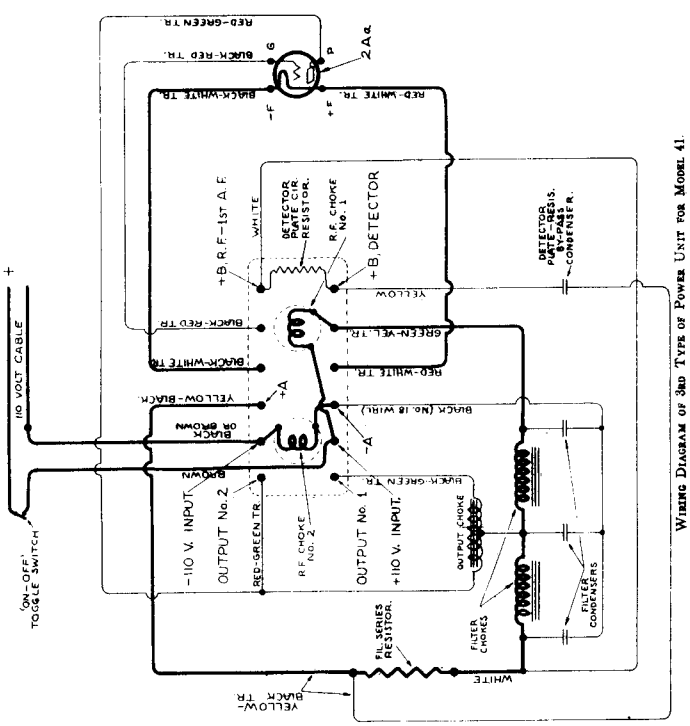


Diagram of Model 43 Set and Power Unit. The output transformer is sealed in the power unit.

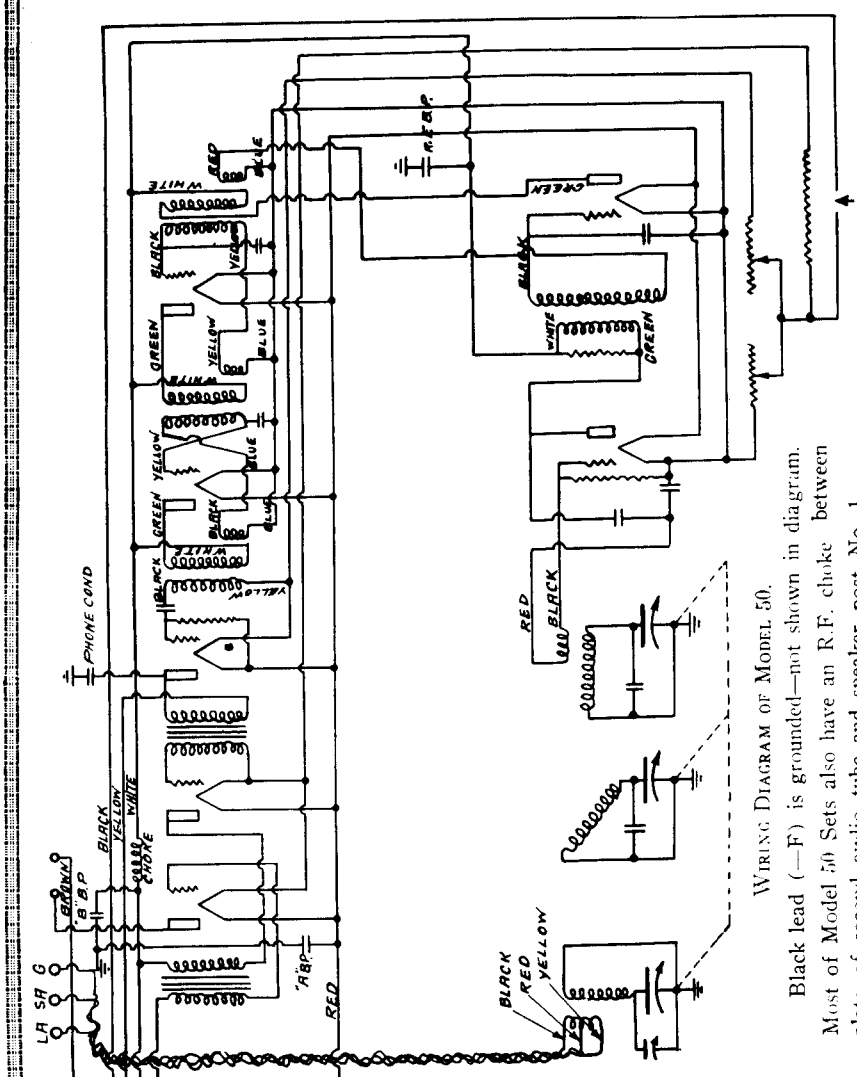
ATWATER KENT



Wiring Diagram of 2nd Type of Power Unit for Model 41.

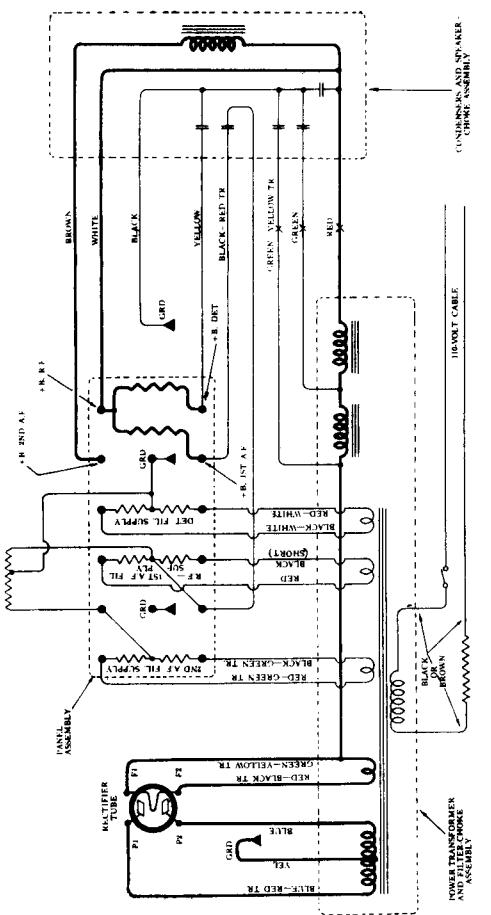


Wiring Diagram of 3rd Type of Power Unit for Model 41.



Wiring Diagram of Model 50.

Black lead (—F) is grounded—not shown in diagram. Most of Model 50 Sets also have an R.F. choke between plate of second audio tube and speaker post No. 1.



Wiring Diagram of 2nd Type of Power Unit for Model 44

Radio Service Data Sheets

ATWATER KENT MODEL 55 AND 55 C

The Model 55 receiver is a 6-tube (and rectifier) A.C. outfit representing a distinct departure in design from previous models.

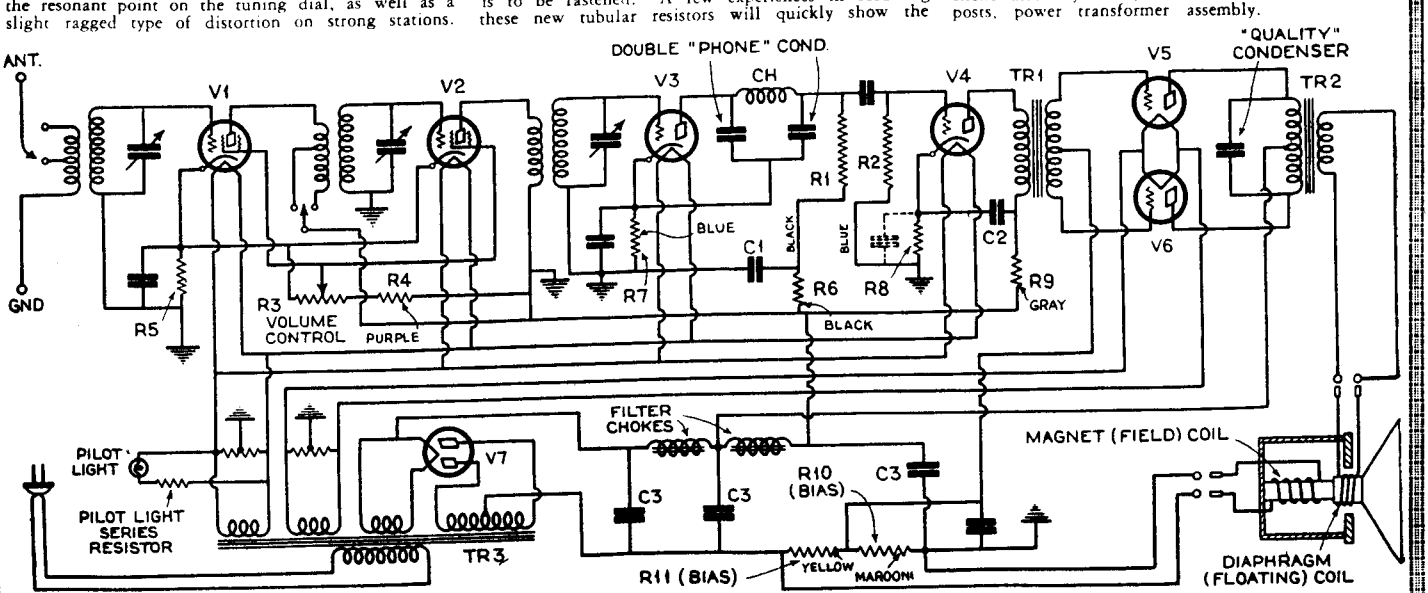
The screen-grid R.F. tubes furnish a high degree of amplification, and as the various units, including the tubes of the R.F. circuits are shielded, the selectivity and sensitivity are excellent. The resistance coupled audio stage assures that signals are passed into the push-pull audio output stage with minimum distortion where they are further greatly amplified with maximum fidelity. Among the other distinct advantages of this type receiver may be mentioned the following: (1) The various units of the power pack are mounted in separate metal containers, simplifying replacement. (2) An illuminated dial graduated in kilocycles makes for easier operation for the customer. (3) The volume control operates by regulating the voltage on the "screen grid" in the R.F. tubes, this voltage being continuously variable from zero to the maximum of about 75 volts. This gives quieter and smoother operation than previous designs which had the control in the antenna circuit. (4) The Model F-4 electro-dynamic speaker which can be used with Model 55 receiver uses for its field supply the entire "B" current supply, same as furnished to plates of all tubes. (5) Tube socket contacts, resistors, and other parts are of new, more rugged and efficient design. (6) The use of heater type tubes in the R.F. stages, detector and first audio stage, and the method of connecting the speaker field coil reduces the A.C. hum to a minimum. There is practically no hum. As in the other Atwater Kent single dial receivers, if one R.F. transformer is defective, the entire group must be replaced. Likewise if one variable condenser is defective, all three condensers must be replaced. It is necessary to remove the R.F. stages, detector and first audio stage, and transformers. Care must be taken to avoid scratching or otherwise injuring the coils when replacing the shields. Also note that a lead from the secondary of each R.F. transformer to the bottom stator-terminal on each variable condenser should pass under a slot at the base of the shield and must not be caught between the shield and the metal baseplate. To aid the installer it is pointed out that the Model 55 is very sensitive and does not require a large antenna. Two antenna posts are provided on the set, marked "Long Antenna" and "Short Antenna." The Long-Antenna post will give greater selectivity and should be used if the aerial is 30 feet or more in length. The Short-Antenna post should be used if a very short (inside) antenna is employed. If extreme selectivity is desired use a short antenna connected to the Long-Antenna post. Indoor aerials for Model 55 should be erected as far as possible away from grounded metal, such as pipes, electric wiring, etc. Ground connection *must* be used with Model 55. This set will also not operate (as some A.C. sets do) with either antenna post connected to the ground. The two A.F. output tubes used in the audio stage should be matched on a tube tester, otherwise the set may hum. Do not use any other model of Atwater Kent speaker with Model 55, than the type F-4 or F-4C. Do not remove speaker plug from socket when set is in operation. The set should be operated with the "Local-Distance" switch in the local position when receiving nearby stations. Failure to do this may result in overloading of the detector tube, which will be evidenced by a decrease of output volume at the resonant point on the tuning dial, as well as a slight ragged type of distortion on strong stations. The "Local-Distance" switch controls the number of turns in the plate circuit of V1. In later Model 55 receivers, the tubular resistors are made with cast metal caps or contacts, which have a comparatively low melting temperature. Accordingly it is necessary in replacing these units to exercise considerable care when soldering in order not to melt the entire cap. The soldering iron should be held in place only long enough to insure a good electrical connection between the cap and the lug to which it is to be fastened. A few experiences in soldering these new tubular resistors will quickly show the correct method required for good results every time. Whenever a tubular resistor of this type is replaced, the soldered connections should be tested for mechanical strength by endeavoring to push the resistor away from the contact lugs. For continuity testing, all of the socket contacts may be exposed by inverting the set and removing the plate. Separate parts may be tested for continuity with a voltmeter and battery in the usual way. If there is any doubt as to whether a part is shorted, grounded, or open, it is advisable to remove all connecting leads to that part and test it separately. When synchronizing the condensers, connect the oscillator pick-up lead to the Short-Antenna binding post, and place the local-distance switch in the "distance" position. Adjust the volume control to give about half scale reading on the output meter, and then leave the control in this average position. Owing to the design of the R.F. amplifying circuit in Model 55, it is necessary to use a top shielding plate when synchronizing the variable condensers, and in order to make the rotor of No. 1 condenser accessible for adjustment it is necessary to cut or file a hole in the top-shield over the rotor of No. 1 condenser. This hole should be about 1½ inches in diameter, with its center 2¼ inches from the left edge of the shield and about 1⅜ inches from the front edge. The rotor of No. 1 condenser may then be adjusted with one finger through this hole. No. 2 condenser rotor may be adjusted by turning the control knob, and No. 3 rotor may be reached from the right-hand side of the chassis, as will be seen. Connections to the various units may be found by use of the color code: First R.F.T., black to chassis (held under one of coil mounting bolts), blue to stator of variable condenser, green to short-antenna post, red to long-antenna post; second R.F.T., black to chassis (held under one of coil-mounting bolts), blue (with lug) to stator of variable condenser, green to plate of V1, red-white tracer to distance switch, blue (without lug) to distance switch; third R.F.T., black to chassis (held under one of coil mounting bolts), blue (with lug) to stator of variable condenser, green to plate of V2, blue lead (without lug) to grid of V3. Power transformer assembly—rectifier fil. winding, thin leads with black sleeving; primary winding, thick brown leads; V5 and V6 fil. winding—thin leads with black sleeving; fil. winding leads to V1, V2, V3 and V4 are thick leads with black sleeving. Push-pull input and output A.F.T. assembly, input pri.-black with red tracer and other lead is green, secondary center tap is black while cone grid lead is blue and other is red, the output primary center tap is black with white tracer and the two plate fields are both brown, the secondary leads which connect to the voice coil are both yellow with black tracer. Looking down into the receiver, the parts layout is as follows: Rear left corner, "long antenna" post; to the right, "short antenna"; next, "ground." The four prong receptacle in front of the antenna posts is for the dynamic reproducer; in front of that is the rectifier receptacle. The fully shielded unit in front left corner is the first R.F.T. The socket for V1 is next to the right, followed by the second R.F.T.; V2; third R.F.T.; V3; V4 (front right corner); V5 (next to tube in rear right corner); V6 (rear right corner). Going left along rear we find: the A.F.T. assembly; filter condenser assembly; filter choke assembly; and, next to antenna and ground posts, power transformer assembly.

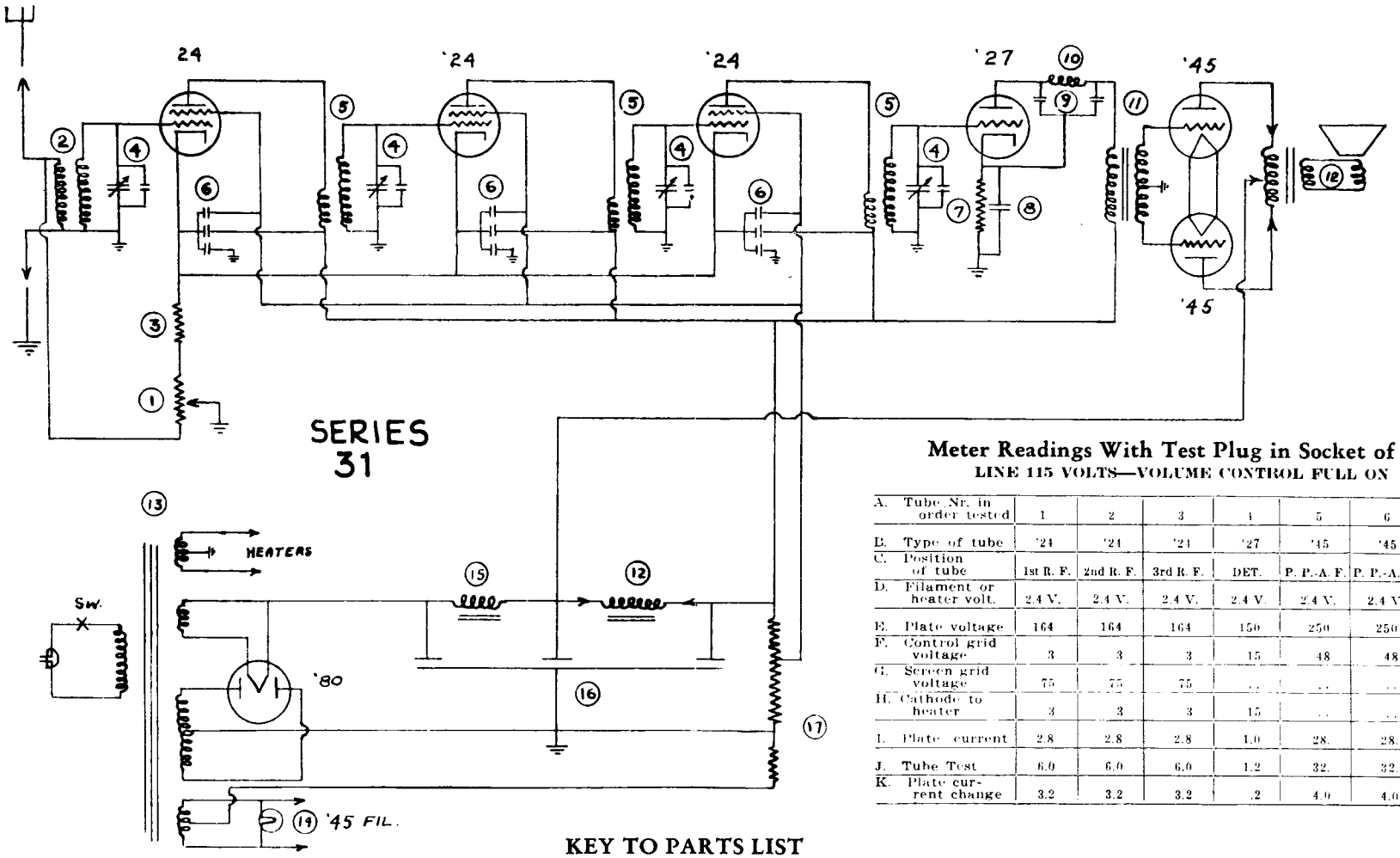
VOLTAGE REQUIREMENTS

Filament	Approx. Voltage
—F to +F contacts on V1, V2, V3 and V4	2.4 (a)
—F to +F contacts on V5 and V6	2.4 (a)
Filament contacts on V7	4.9 (a)
Plate	
Cathode to plate, V1 (m)	175 (b)
Ditto, V2 (m)	175 (c)
Ditto, V3	105 (d)
Ditto, V4	70 (e)
Filament to plate, V5 and V6	235 (f)
Control Grid	
Cathode to control grid, V1 (m)	3 (g)
Ditto, V2 (m)	3 (h)
Ditto, V3	12 (i)
Ditto, V4	22.5 (j)
Filament to grid, V5 and V6,	42 (k)
Screen Grid	
Cathode to screen grid, V1 and V2 (m)	85 (l)

Additional Test Information

Use high resistance D.C. voltmeter (about 0-50-250) to measure plate and grid voltages; and an A.C. voltmeter to measure filament potentials. Tests made with set in operation, all tubes and speaker plugged in sockets. Tests made in order listed. Low plate or grid voltages may indicate a partially shorted bypass or filter condenser; V3 plate voltage will be low, and V3 grid voltage high, if either of the double "phone" condensers are shorted. (m) denotes volume control set at maximum. NO READING indicates: (a) open filament winding or connection; (b) open high voltage winding, open speaker magnet coil, open filter choke, open primary of 2nd R.F.T., or R5 open; (c) open primary of 3rd R.F.T.; (d) open V3 filter resistor (black) R6, coupling resistor (black) R1, R.F. choke CH, or V3 bias resistor (blue) R7; (e) open V4 filter resistor (gray) R9, primary of TR1, or V4 bias resistor R8 (mounted under maroon and yellow, bias resistors R10 and R11; (f) open TR2 primary; (g) open secondary of 1st R.F.T.; (h) open secondary of 2nd R.F.T.; (i) open secondary of 3rd R.F.T.; (j) open V4 resistor (blue) R2; (k) open V5-V6 bias resistor (yellow) R11, or open secondary of TR1 (if bias resistor R10 is open V3 grid potential will be approximately 85 volts); (l) open connection to slider of volume control R3, open R3, or open bleeder resistor (purple) R4. Make all voltage tests first to get a general idea of the trouble, then disconnect the set and test the suspected parts for opens, shorts and grounds. A condenser, not shown in schematic, by-passes the screen-grids.





Meter Readings With Test Plug in Socket of Set

LINE 115 VOLTS—VOLUME CONTROL FULL ON

A. Tube Nr. in order tested	1	2	3	4	5	6	7
B. Type of tube	'24	'24	'24	'27	'45	'45	'80
C. Position of tube	1st R. F.	2nd R. F.	3rd R. F.	DET.	P. P.-A. F.	P. P.-A. F.	RECT.
D. Filament or heater volt.	2.4 V.	2.4 V.	2.4 V.	2.4 V.	2.4 V.	2.4 V.	4.9 V.
E. Plate voltage	164	164	164	150	250	250	276
F. Control grid voltage	3	3	3	15	48	48	..
G. Screen grid voltage	75	75	75	..	..	..	..
H. Cathode to heater	3	3	3	15	..	..	..
I. Plate current	2.8	2.8	2.8	1.0	28.	28.	58.
J. Tube Test	6.0	6.0	6.0	1.2	32.	32.	..
K. Plate current change	3.2	3.2	3.2	.2	4.0	4.0	..

KEY TO PARTS LIST

1. 10,000 ohm volume control.
2. Antenna input RF transformer.
3. 300 ohm RF C bias resistor.
4. 4 gang variable condenser, 370 mmf, with trimmer.
5. Intermediate stage radio frequency transformer.
6. 3-.1 RF by-pass condenser block.
7. 15,000 ohm detector bias resistor.
8. .5 mfd detector by-pass condenser.
9. 2-.001 detector plate by-pass condensers.
10. Detector plate RF choke.
11. Push-pull input audio transformer.
12. Dynamic speaker assembly with plug and 4 conductor cable; 2500 ohm field; voice transformer in speaker chassis.
13. 100 watt power transformer.
14. 2.5 volt pilot light.
15. 150 ohm, 3 henry filter choke.
16. 3-8.0 mfd filter condenser.
17. Voltage divider resistor 2300-2100-850 ohm.

Note: Models incorporating "Tone Control" have a third knob in center below escutcheon plate, which rotates a one megohm variable resistor (part No. 18), in a series with a .001 mfd condenser (part No. 19) connected grid to grid in the push-pull stage.

BALKITE PRODUCTS COMPANY

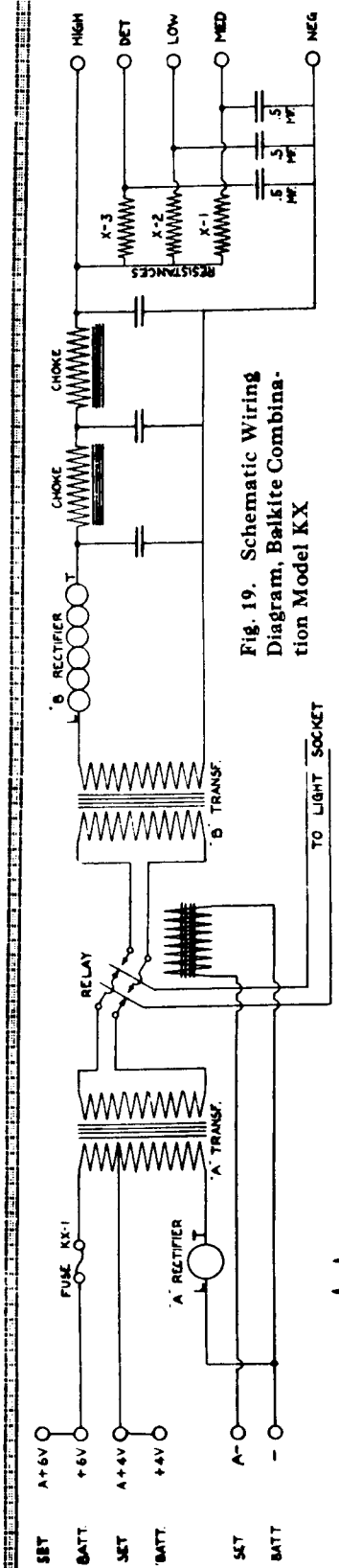
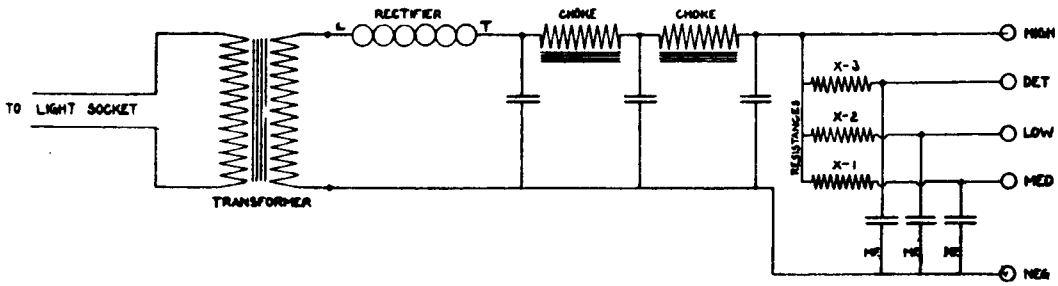
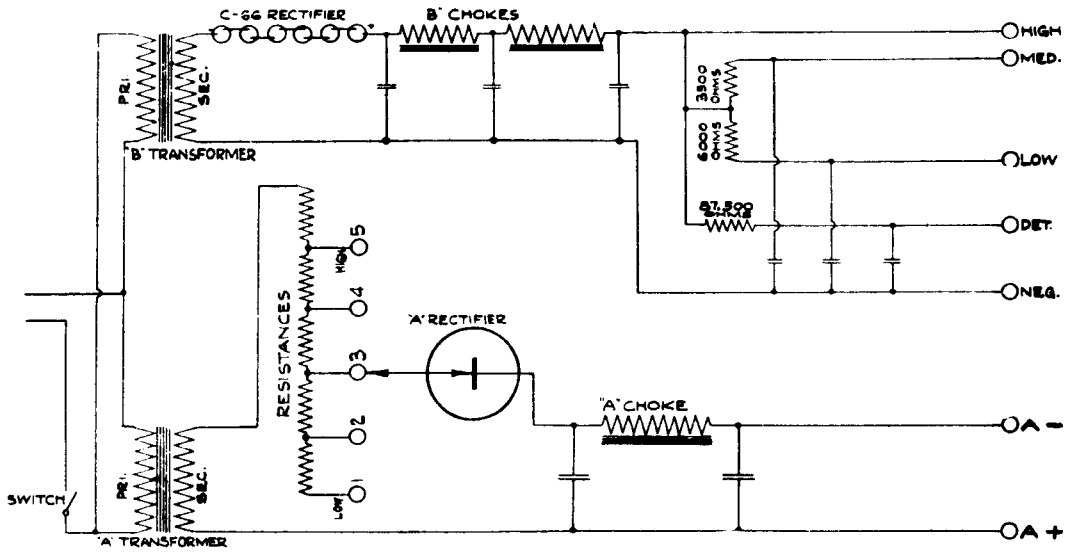


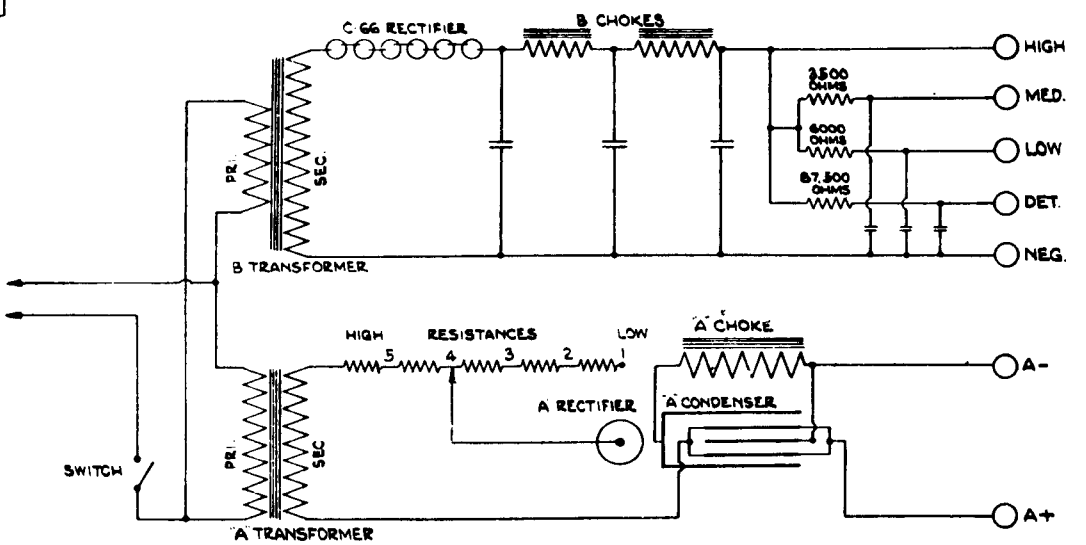
Fig. 19. Schematic Wiring Diagram, Balkite Combination Model KX



Balkite BX



Balkite AB 6-135, Form A

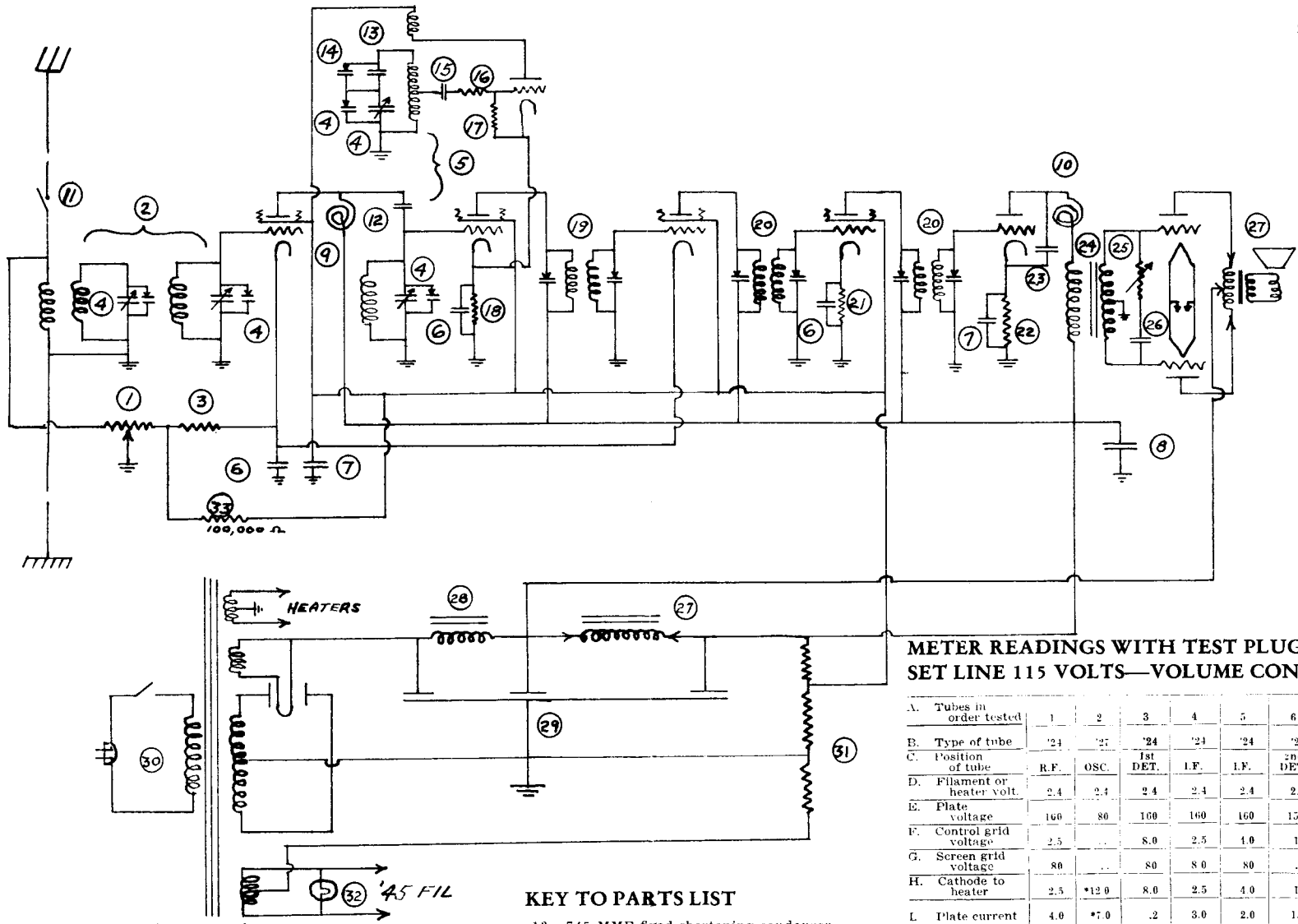


Balkite AB 6-135, Form B

Balkite Electrolyte

The electrolyte used in the various Balkite Radio Power Units differs considerably Electrolyte for chargers should not be used in B current supplies and under no circumstances should Balkite A refill be used in any other Balkite unit or should Balkite electrolyte be used in the Balkite A as in either case destruction to the unit would result.

SUPERHETERODYNE RECEIVER
AUDIOLA RADIO
CHICAGO
DWG # 92430



METER READINGS WITH TEST PLUG IN SOCKET OF SET LINE 115 VOLTS—VOLUME CONTROL FULL ON

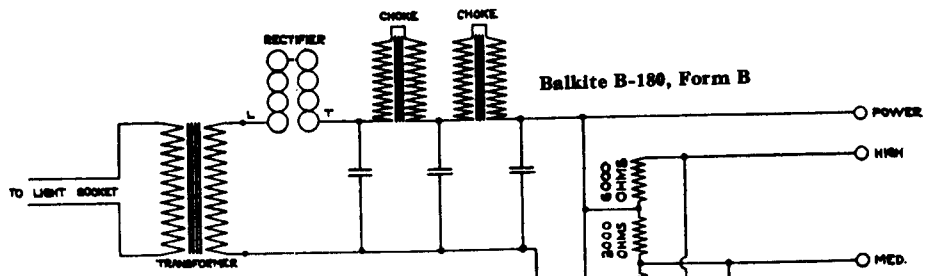
	1	2	3	4	5	6	7	8	9
A. Tubes in order tested									
B. Type of tube	'24	'27	'24	'24	'24	'27	'45	'45	'80
C. Position of tube	R.F.	OSC.	1st DET.	I.F.	I.F.	2nd DET.	P.P. A.F.	P.P. A.F.	RECT.
D. Filament or heater volt.	2.4	2.4	2.4	2.4	2.4	2.4	2.35	2.35	4.7
E. Plate voltage	160	80	160	160	160	150	245	245	260
F. Control grid voltage	2.5	..	8.0	2.5	1.0	18	48	48	..
G. Screen grid voltage	80	..	80	80	80	..	..	..	..
H. Cathode to heater	2.5	*12.0	8.0	2.5	4.0	18	..	..	..
I. Plate current	4.0	*7.0	.2	3.0	2.0	1.0	28	28	58

*Non-Oscillating.

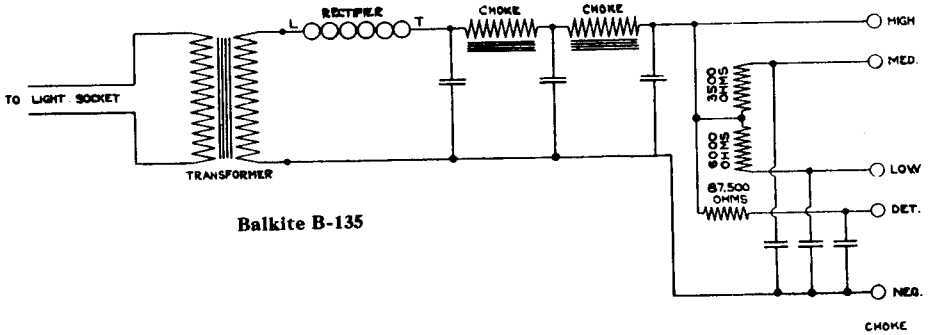
KEY TO PARTS LIST

1. 10,000 ohm volume control.
2. Antenna—Pre-selector inductance assembly.
3. 250 ohm R. F.—1st I. F. C Bias resistor.
4. 4 gang variable condenser, 330 mmf., with trimmers.
5. Detector—oscillator inductance assembly.
6. .1 mfd. 150 volt by-pass condenser.
7. .5 mfd. 150 volt by-pass condenser.
8. .5 mfd. 250 volt Plate Supply by-pass condenser.
9. R. F. choke coil.
10. Detector choke coil.
11. Local-distance switch.
12. 5 M.M.F. R.F. Coupling condenser.
13. 745 MMF fixed shortening condenser.
14. 60 MMF trimming condenser.
15. 745 MMF grid condenser.
16. 6000 ohm resistor.
17. 40,000 ohm grid leak.
18. 2000 ohm detector-oscillator bias resistor.
19. First I. F. transformer.
20. 2nd and 3rd I. F. transformer.
21. 2000 ohm bias resistor.
22. 15,000 ohm bias resistor.
23. .002 by-pass condenser.
24. Push-pull input transformer.
25. 1 Megohm tone control.
26. .004 MFD condenser.
27. 2500 ohm dynamic field and speaker assembly with input transformer.
28. 150 ohm, 3 Henry choke.
29. Triple 8 mfd. Mershon Condenser.
30. Power Transformer.
31. Voltage divider resistor. 2450—3150—850 ohms.
32. 2.5 volt dial light bulb.
33. 100,000 ohm resistor.

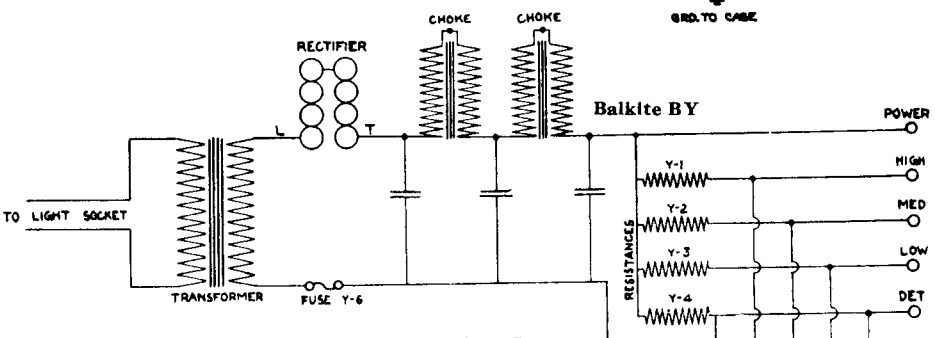
BALKITE PRODUCTS COMPANY.



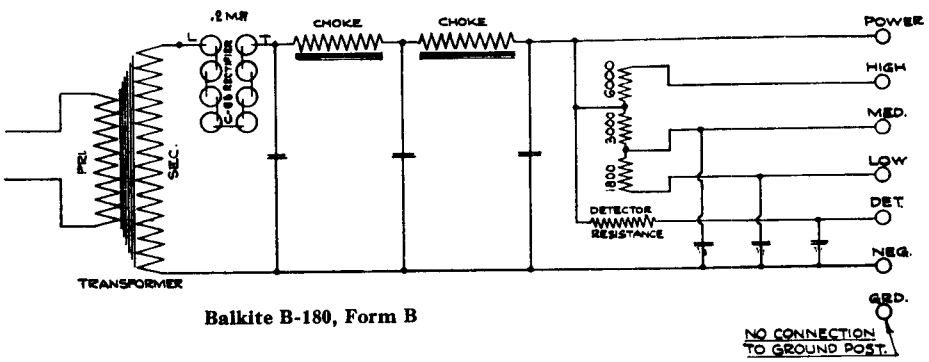
Balkite B-180, Form B



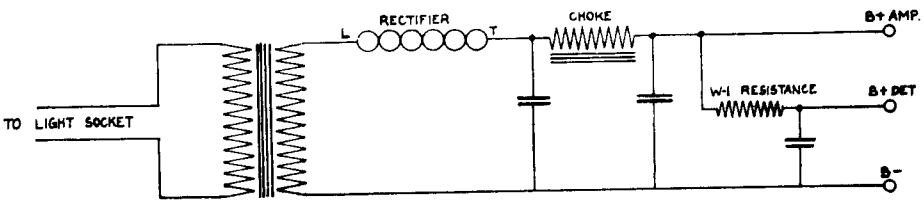
Balkite B-135



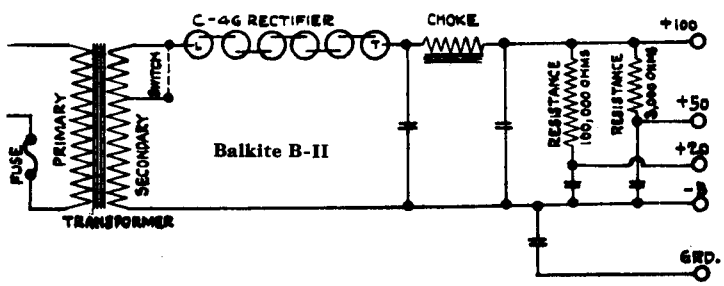
Balkite BY



Balkite B-180, Form B



Balkite BW or Balkite B, Model D



Balkite B-II

BALKITE PRODUCTS COMPANY

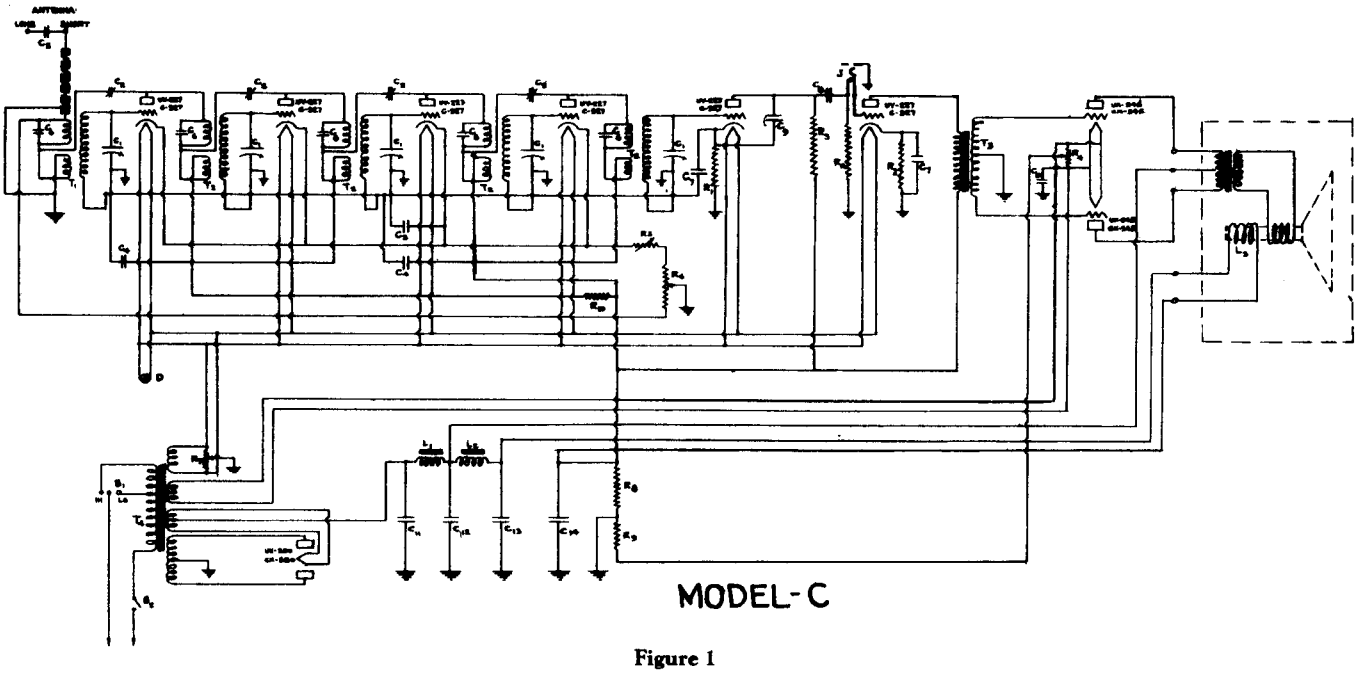


Figure 1

C-1	Tuning Condenser		
C-2	Neutralizing Condenser		
C-3	R. F. Grid Bias Condenser	.25	MF
C-4	R. F. Plate By-Pass Condenser	.25	MF
C-5	Antenna Condenser	.00025	MF
C-6	Primary By-Pass Condenser	.00025	MF
C-7	Grid Bias Condenser	1.0	MF
C-8	1st Audio Coupling Condenser	0.1	MF
C-9	Detector Plate Condenser	.002	MF
C-10	By-Pass Condenser	.25	MF
C-11	Filter Condenser	2	MF
C-12	Filter Condenser	2	MF
C-13	Filter Condenser	2	MF
C-14	Filter Condenser	1	MF
J	Phonograph Jack		
L-1	Filter Choke		
L-2	Filter Choke		
L-3	Speaker Field		
R-1	Detector Grid Bias Resistance	25,000 Ohms	
R-2	1st Audio Grid Bias Resistance	1,750 Ohms	
R-3	1st Audio Coupling Resistance	.1 Megohn	
R-4	Mid-Tap Resistance	20 Ohms	
R-5	R. F. Grid Bias Resistance	2,000 Ohms	
R-6	Volume Control	15,000 Ohms	
R-7	Hum Control	20 Ohms	
R-8	Loss Current Resistance	3,600 Ohms	
R-9	245 Grid Bias Resistance	770 Ohms	
R-10	R. F. Plate Rsistance		
R-11	1st Audio Grid Resistance	.5 Megohn	
T-1	Antenna Transformer		
T-2	R. F. Interstage Transformer		
T-3	Input Push-Pull Transformer		
T-4	Power Transformer		
B-1	HI-LO S.P.D.T. Toggle Switch		
B-2	S.P.S.T. Toggle Switch		
D	Dial Lamp		

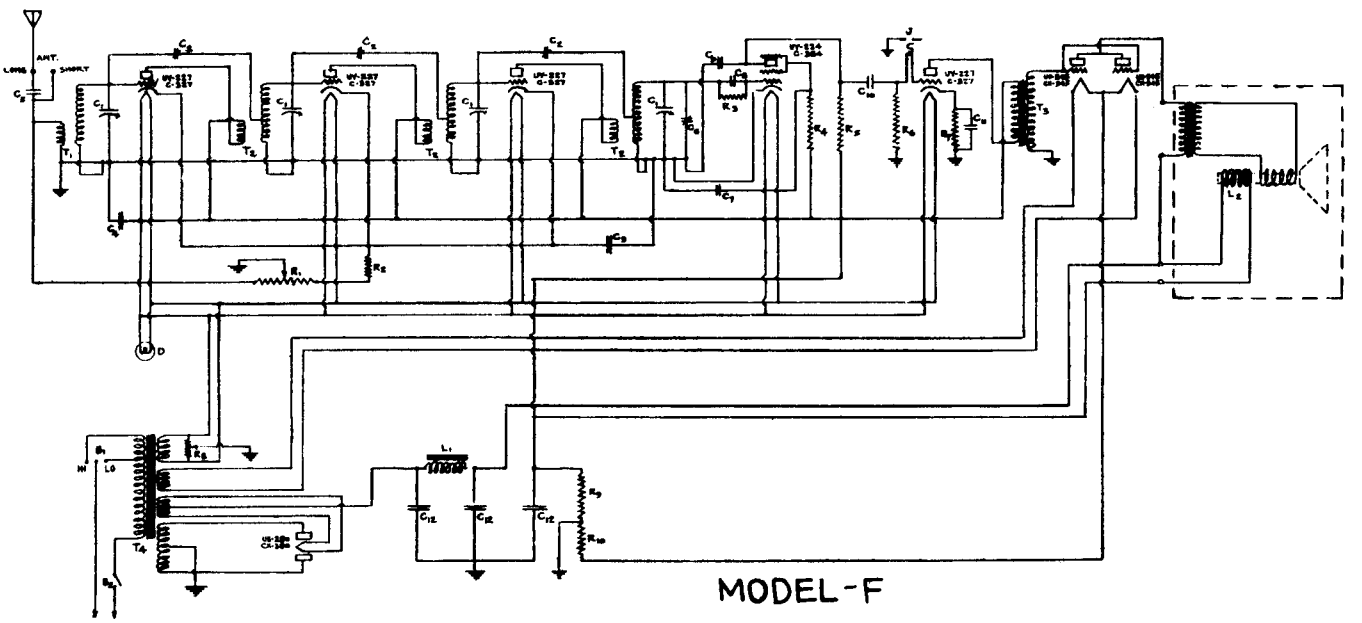
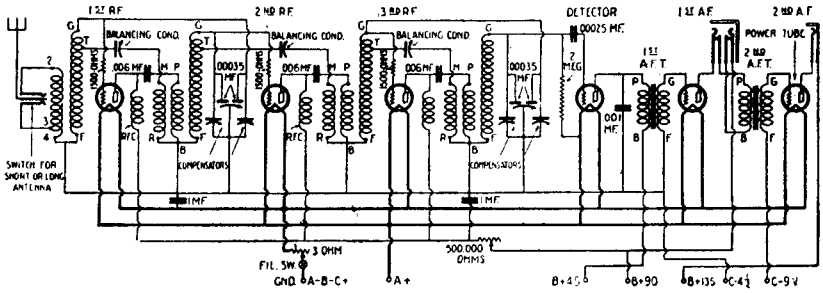


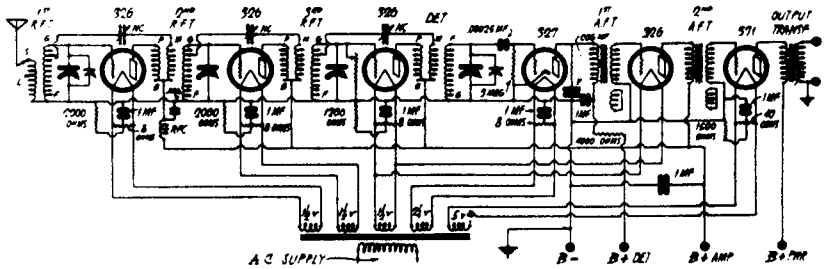
Figure 1

C_1	Tuning Condenser.	C_{11}	1st Audio Grid Condenser 0.5 MF.
C_2	Neutralizing Condenser.	C_{12}	Filter Condensers 8.0 MF Each
C_3	R.F. Grid Bias Condenser .25 MF.	L_1	Filter Choke.
C_4	R.F. Plate By-Pass Condenser .25 MF.	L_2	Speaker Field 2500 Ohms.
C_5	Antenna Condenser .00025 MF.	J	Phonograph Jack.
C_6	Det. Padding Condenser.	D	Dial Lamp.
C_7	Det. Screen Grid Bias Condenser .25 MF.	R_1	Volume Control 15,000 Ohms.
C_8	Det. Control Grid Condenser .0001 MF.	R_2	R.F. Grid Bias Resistance 620 Ohms.
C_9	Det. Plate Condenser .0005 MF.	R_3	Det. Control Grid Resistance .5 Megohm.
C_{10}	1st Audio Coupling Condenser 0.1 MF.	R_4	Det. Screen Grid Resistance .5 Megohm.
		R_5	1st Audio Coupling Resistance .1 Megohm.
		R_6	1st Audio Grid Resistance .5 Megohm.
		R_7	1st Audio Grid Bias Resistance 1750 Ohms.
		R_8	Hum Control 20 Ohms.
		R_9	Loss Current Resistance 4500 Ohms.
		R_{10}	245 Grid Bias Resistance 650 Ohms.
		T_1	Antenna Transformer.
		T_2	R.F. Inter stage Transformer.
		T_3	Input Audio Transformer.
		T_4	Power Transformer.
		B_1	Hi-Lo S.P.D.T. Toggle Switch.
		B_2	S.P.S.T. Toggle Switch.

BREMER-TULLY MFG. CO.

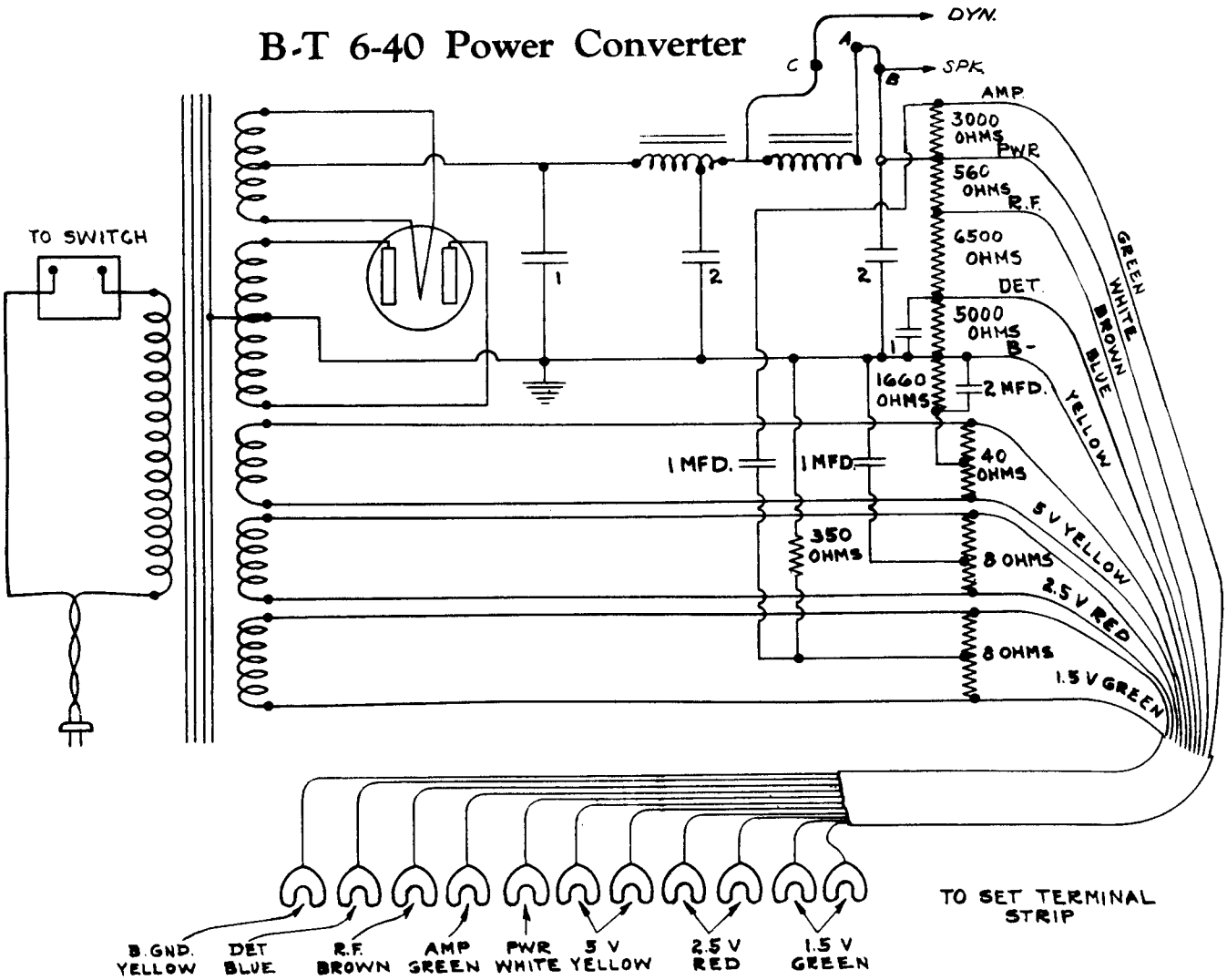


The B. T. Counterphase circuit using six tubes; three stages of R. F. amplification, detector and two stages of A. F. amplification.



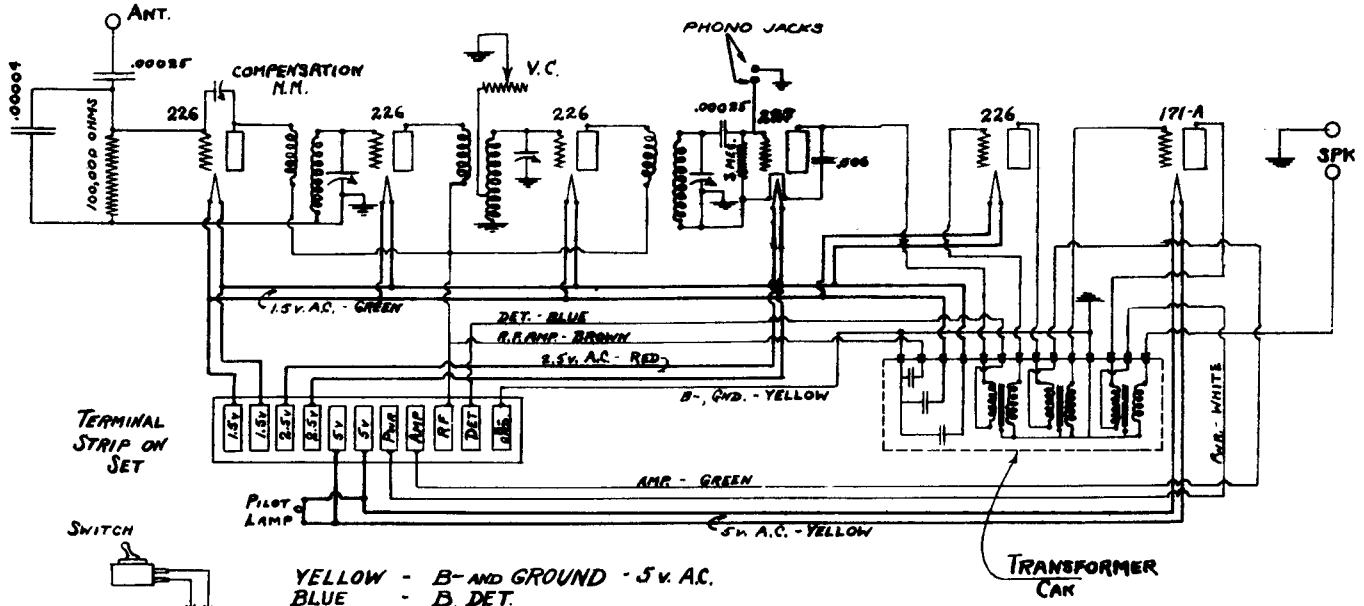
Circuit for A. C. Bremer-Tully Counterphase 8.

B-T 6-40 Power Converter



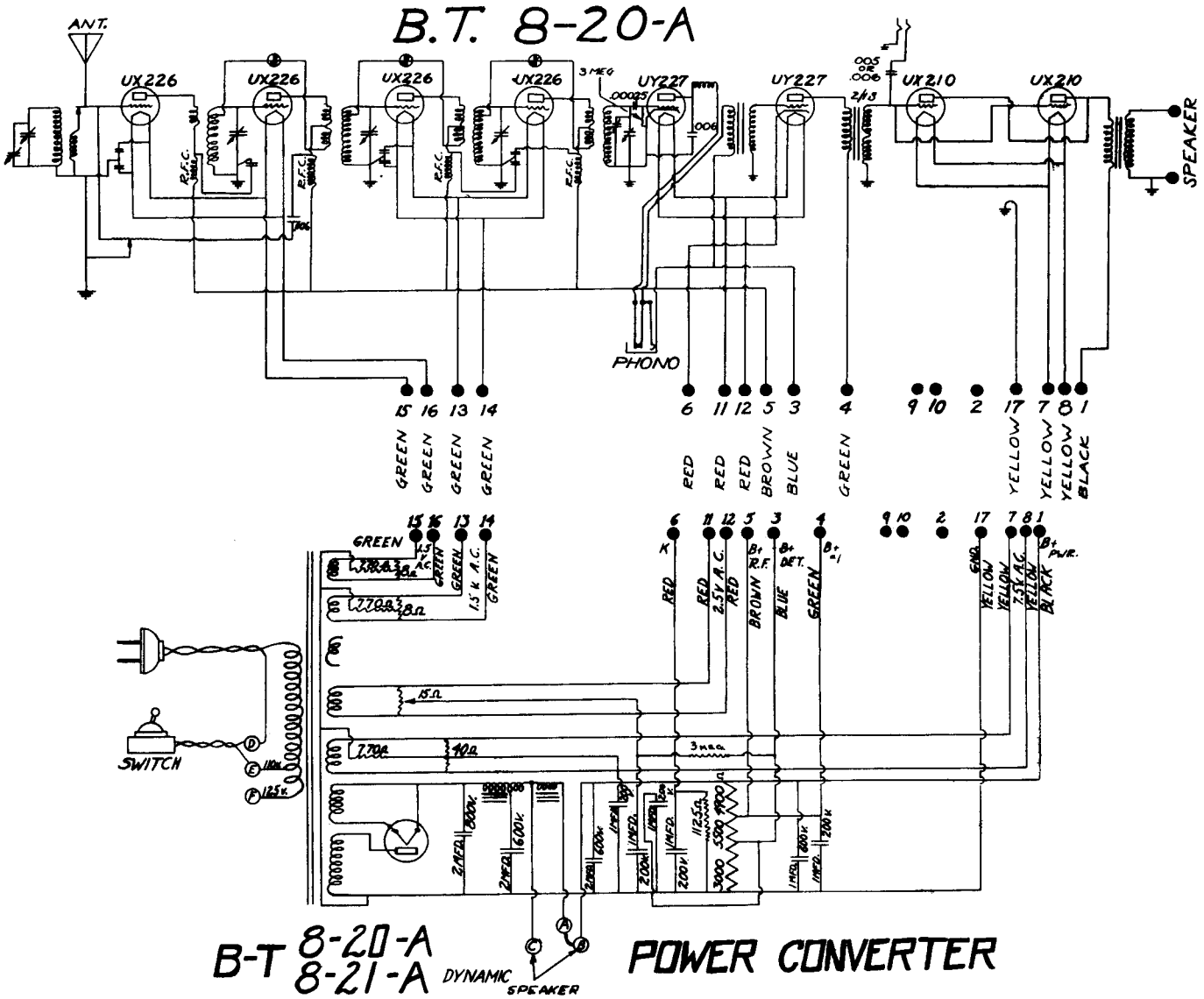
BREMER-TULLY MFG. CO.

B-T 6-40 Circuit Diagram



YELLOW - B- AND GROUND - 5 v. A.C.
BLUE - B, DET.
GREEN - B, AMP. - 1.5 v. A.C.
BROWN - B, R.F. - ANT.
WHITE - B, PWR - SPK.
RED - PLATE LEADS - 2.5 v. A.C.
BLACK - GRID LEADS

B.T. 8-20-A

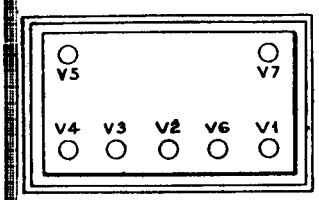


B-T 8-20-A
B-T 8-21-A POWER CONVERTER

Radio Service Data Sheet

BREMER-TULLY MODEL 7-70 AND 7-71

This receiver includes three stages of tuned radio-frequency amplification, neutralized in the "Counterphase" manner. To test this part of the circuit, a continuity tester is used to check the connections which include, (in the circuit V1, for example), L2N, C5, and a few turns at the grid end of L1S. The "micro-mikes" or neutralizing condensers C5, C6 and C7 are located at the right of the respective tube sockets. The procedure of balancing a receiver using the Counterphase neutralizing method will be described. Usually it is convenient to use a vacuum tube with one of the filament prongs shortened so that the filament circuit is open when the grid, plate and *one side* of the filament are making contact. Now, tune in a loud signal, adjusting all tuning controls very carefully for exact resonance. Replace V3 with the special tube. (Always start with the R.F. stage next to the detector). Retune all controls until maximum volume is obtained. The "micro-mikes" are now adjusted. The best tool for this purpose is a piece of bakelite rod which has been shaped to a screw-driver edge. The correct position for the "micro-mike" of any stage is *between* the point where the signal disappears and that where it is again heard. Now, replace the dummy tube by V3, retune set carefully, and proceed to the next stage; working toward the aerial. "Micro-mikes" C5, C6 and C7 are located underneath the chassis, directly beneath the holes in the aluminum plates or shields. Condensers C1A and C8 are circuit balancers; C8 is another "micro-mike" adjusted (for maximum volume) with the insulated screw-driver. C1A is operated from the panel as a "sensitivity" control.

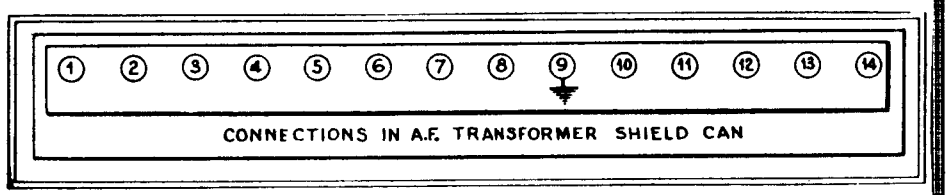


Tube layout of the B-T "7-70" and "7-71."

This receiver is designed to operate at a line potential of 115 volts, and the resulting tube voltages at this line value are given in a table below. If the line potential is below 100 volts, the power pack will not function properly and hum will result; the plate reading of V1, V2 and V3 will be about 135 volts.

The electrical values of the units in this receiver are listed below:

Resistors R2 and R3, 40 ohms; R4, 8 ohms; R5, 770 ohms; R6, 4,000 ohms; R7, 1,700 ohms; R8, 34,100 ohms; R9, 1,125 ohms; R10, 3 meg.; R11, 1,540 ohms. Condenser C9, 0.25-mf.; C10, 0.25-mf.; C11, 0.5-mf.; C12, .006-mf.; C13, 0.5-mf.; C14, .00025-mf.; C15, .003-mf.; C16, .01-mf.; C17, .00025-mf.; C18, 1 mf., (400 V.); C19, 2 mf., (400 V.); C20, 2 mf., (400 V.); C21, 1 mf., (160 V.); C22 1 mf., (400 V.); C23, 1 mf., (400 V.); C24, 1 mf., (400V.); C25, .00025-mf.



C9, C10 and C11 in one case and C13 in another (C9 and C10 have blue leads and C11 has brown leads, and C13 has a yellow lead), are mounted on AFT shield can, above lugs 9, 10 and 11.

The "resistance network" of the "Power Converter," as the current supply unit is called, has its return circuit to "B—" completed through the internal resistance of the tubes, instead of through an external resistor.

If a magnetic reproducer or separately-excited-field dynamic is used, "jumper" connects posts A and B in power pack; when a high-resistance-field dynamic reproducer is used its field coil may be energized by connection to posts A and B, "jumper" then shorting CH2 by being connected to posts A and C.

The Color Code

1—Green, V1, V2 and V3 filament supply, 1.5 volts;
2—Green, same as above;
3—Red, Filament supply for V4, V5 and V9;
4—Red, same as above;
5—Yellow, filament of V6 and V7;
6—Yellow, same as above;
7—White, "B+" power;
8—Green, "B+ for V5;
9—Brown, "B+" for V1, V2 and V3;
10—Blue, "B+" for V4 (detector);
11—Yellow, "B—" and chassis ground.

Typical Voltage Readings

Tube No.	Tube Type	Voltages "A"	"B"	"C"	Plate Current (Ma.) Normal	(Grid Test)
V1	'26	1.4	150	9	5	12
V2	'26	1.4	150	9	5	12
V3	'26	1.4	150	9	5	12
V4	'27	2.1	60	0	2	2
V5	'27	2.1	150	8	5	8
V6	'71A	4.9	150	30	18	41
V7	'71A	4.9	150	30	18	41

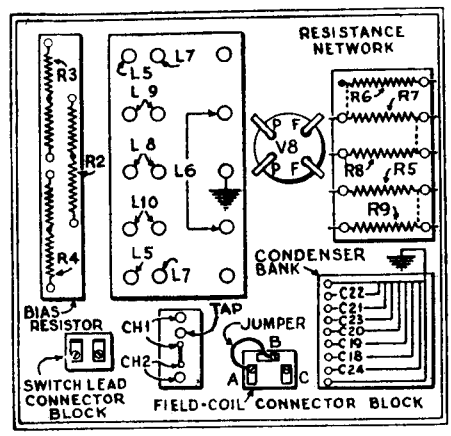
A special design is followed in the construction of AFT1; the primary is tapped, the smaller portion having the correct impedance for the phonograph pick-up.

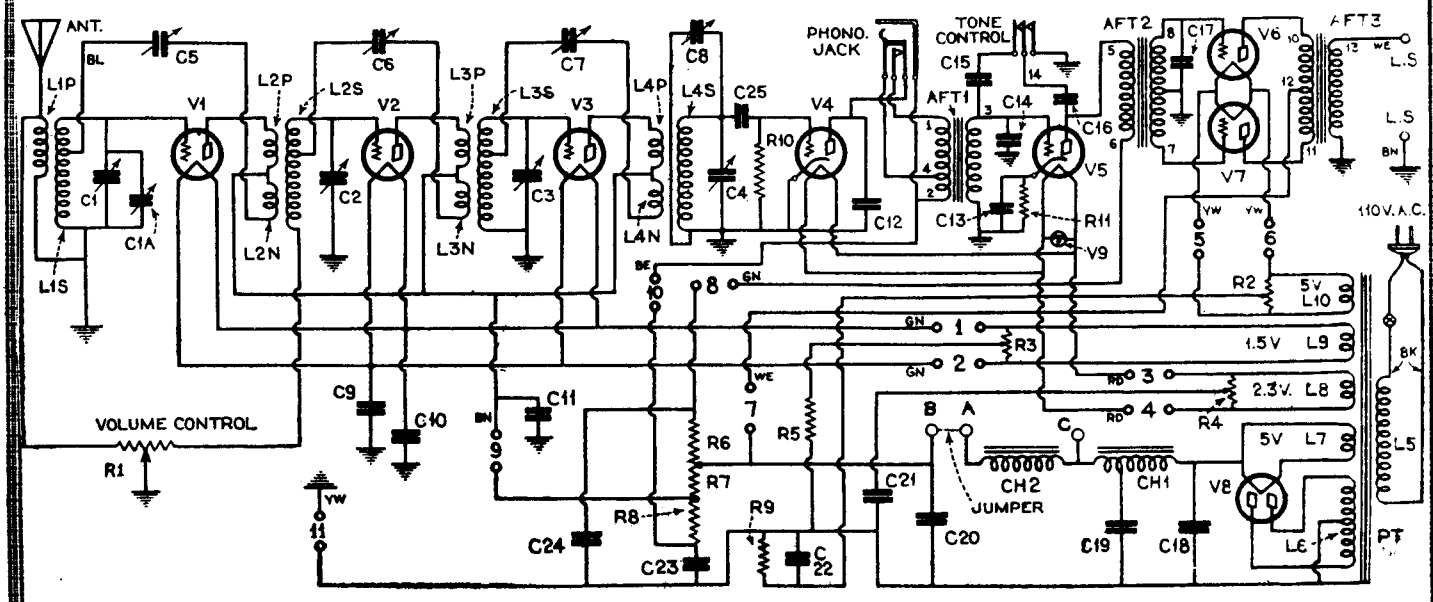
Terminals for the reproducer are indicated in the schematic circuit as LS.

AFT1, AFT2, AFT3 and C16 are housed in a single shield can, the connections being brought to soldering lugs. They are represented in these columns by the numerals one to fourteen in small circles.

The panel switch marked "Tone Control" functions by shunting the secondary of AFT1 with C15 and the primary of AFT2 with C16. Normally, there is a shunt capacity of .00025-mf. connected to the secondary of AFT1; it is C14. One side of the secondary of AFT2 is shunted by C17, the purpose of which is to eliminate oscillation of the push-pull circuit due to variations in tubes when purchased or during the life of the power tubes.

R10 and R11 are tubular resistors connected at the tube sockets.





BROWNING DRAKE CORP.

CONSTANTS FOR MODEL 69

1. - 400 ohms 1 watt
2. - 600 ohms 1 watt
3. - 50,000 ohms 1 watt
4. - 3000 ohms 1 watt
5. - .5 megohms 1/3 watt
6. - 1 megohm 1/3 watt
7. - 45,000 ohms 2 watt
8. - 20,000 ohms 3 watt
9. - .25 megohms 1/3 watt
10. - 60,000 ohms 2 watt
11. - 90 ohms wire wound
12. - .25 megohms 1/3 watt
13. - .25 megohms 1/3 watt
14. - 2 megohms 1/3 watt
15. - 2000 ohms wire wound
16. - 2000 ohms wire wound
17. - .25 megohms 1/3 watt
18. - .25 megohms 1/3 watt
19. - 30 ohms C.T. wire wound
20. - Vol. Cont. Pot. 10,000 ohms
21. - .1 megohms 1/3 watt

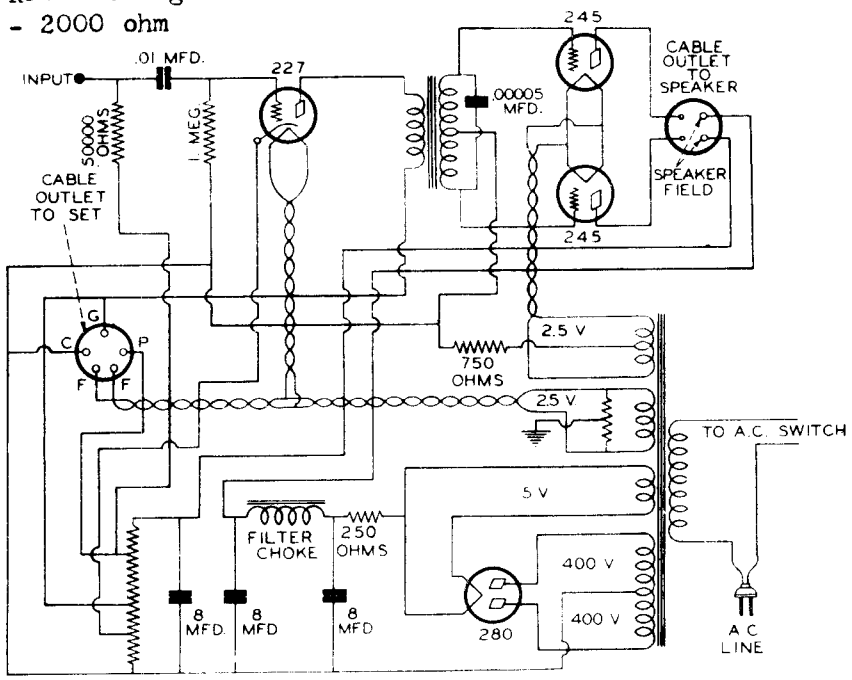
CONDENSERS

101.1 - .5 MF 200 volt
101.2 - .5 MF 300 volt
102.1 - .5 MF 200 volt
102.2 - .5 MF 300 volt
103 - .1 MF Midget
104.1 - .2 MF 200 volt
104.2 - .2 MF 300 volt
104.3 - .2 MF 200 volt
104.4 - .2 MF 200 volt
104.5 - .2 MF 300 volt
104.6 - .5 MF 200 volt
105 - .01 MF Midget
106 - .00025 MF Midget
107 - .00025 MF Midget
108 - 8 MF Electrolytic
109 - 8 MF Electrolytic
110 - .01 MF Midget

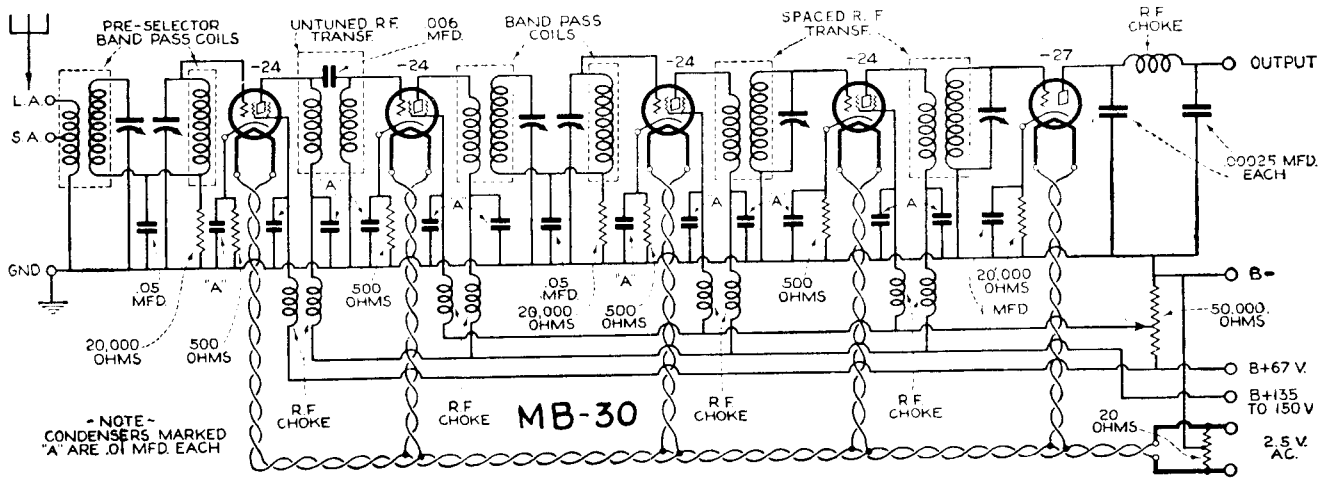
CONSTANTS FOR MODELS 70 & 71

R1 R2 R3 R14 R13 - .25 meg.
R4 R5 R6 - 10,000 ohm
R7 R8 R9 - 20,000 ohm
R10 R29 - 1 meg.
R11 R18 R19 - 40,000 ohms
R12 - .1 meg.
R16 - 40,000 ohm
R17 - 90,000 ohm
R20 - 200,000 ohm
R21 - 300 ohm
R22 - 45 ohm
R23 - 20 ohm
R24 - .5 meg.
R25 - .15 meg.
R26 - 20 ohm
R27 - 10,000 ohm
R28 - 20,000 ohm
R30 R32 - 2 meg.
R31 - 2000 ohm

C1.1 C2.1 C3.1 C1.2 C2.2
C3.2 - .1 MF 200 volt
C1.3 C2.3 C3.3 - .1MF 300 V
C4.1 C4.2 - .1 MF 200 V.
C4.3 - .25 MF 300 V.
C5.1 C5.2 - 1 MF 200 V.
C6 C7 C13 - .00025 MF
C8 - .01 MF
C10.1 - .25 MF 200 V.
C10.2 - .5 MF 300 V.
C10.3 - .1 MF 300 V.
C10.4 - .2 MF 200 V.
C10.5 - 2 MF 200 V.
C14 - .00025 MF

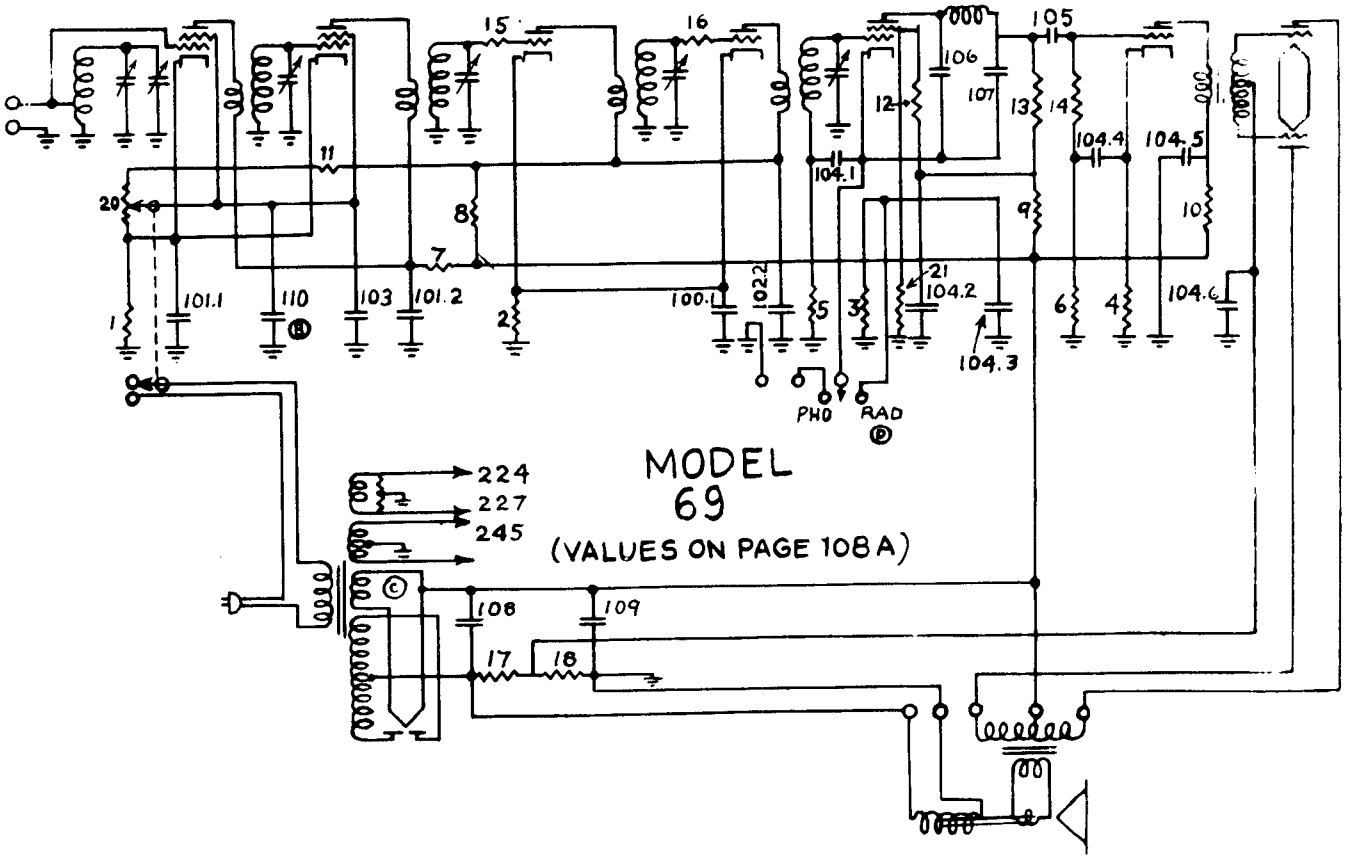


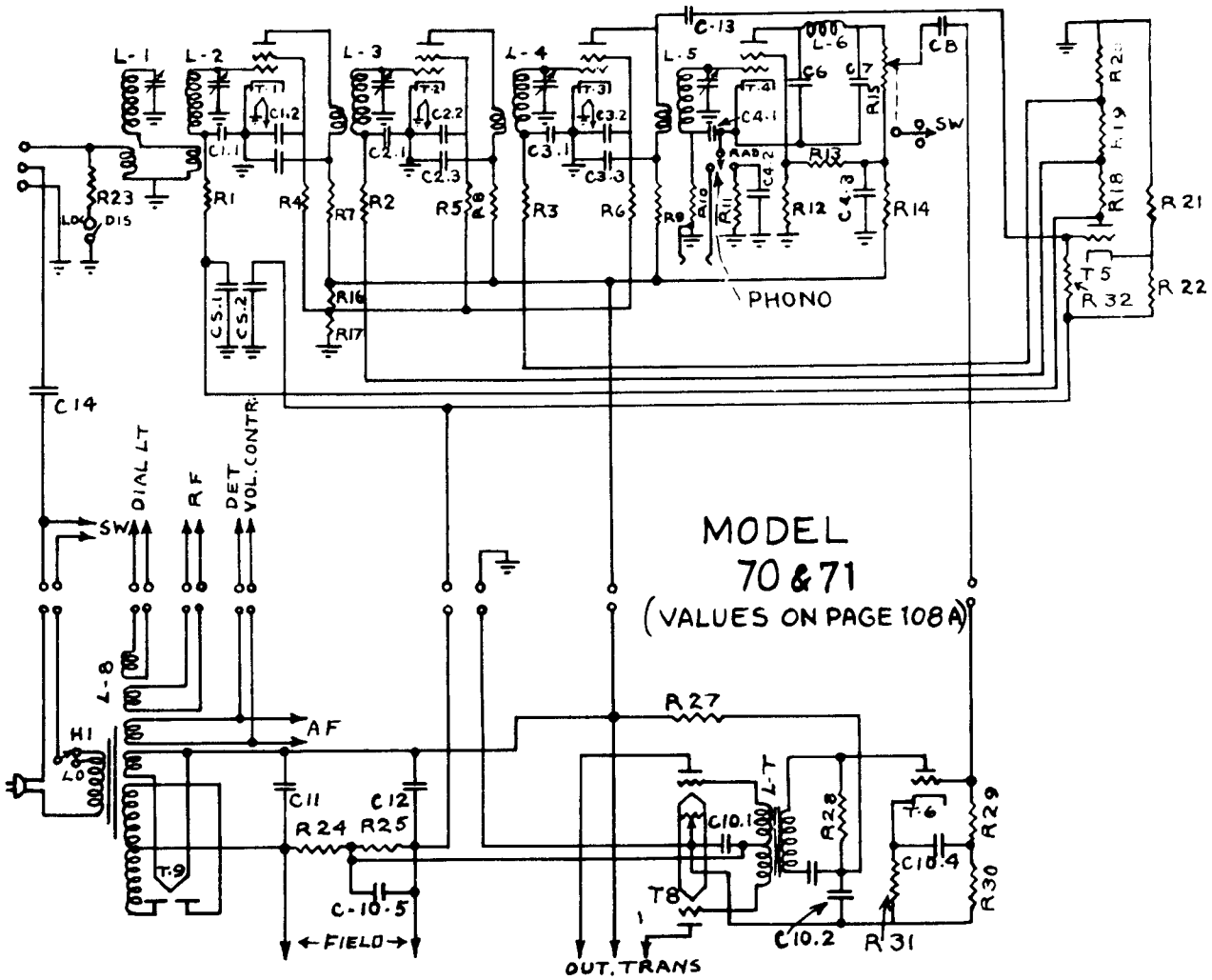
Circuit diagram of the type VSA Speaker-Amplifier for use with the MB30 tuner.



The complete circuit of the five-tube tuner. Note the band pass or "Vreeland" circuit as used in the antenna tuning system. Note also that the second s.g. tube works into an untuned coupling stage for leveling out the overall r.f. gain of the tuner

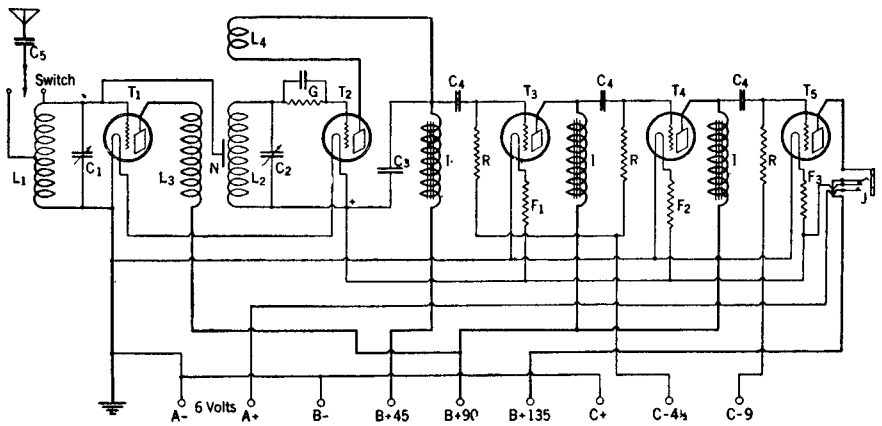
BROWNING DRAKE CORP.





BROWNING-DRAKE CORP.

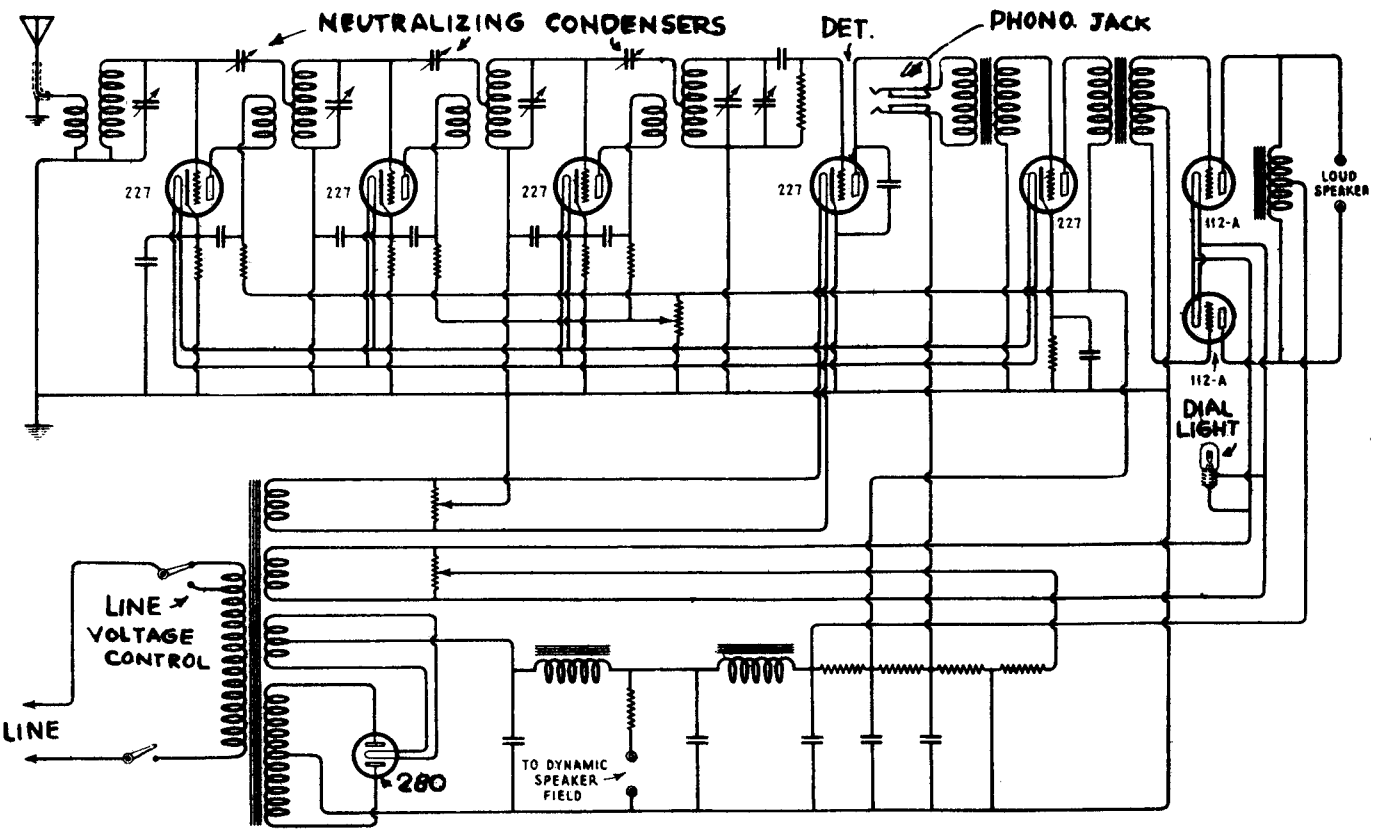
FOUR-TUBE BATTERY OPERATED.



C_1—.0005-mfd. variable condenser.
C_2—.00025-mfd. variable condenser.
C_3—.00025-mfd. fixed condenser.
C_4—.0.1-to 1.0-mfd. fixed condenser.
C_5—.0001-mfd. fixed condenser.
L_1—46 turns No. 20 d.s.c. wire on a form 3 inches in diameter, with a center tap.
L_2—75 turns No. 20 d.s.c. wire on a 3-inch form.
L_3—24 turns No. 28 d.c.c. wire wound in a groove and placed under the filament end of the secondary.
L_4—20 turns No. 28 d.c.c. wire wound on a 2½-inch form to fit in grid end of secondary (L_2).
I —100-henry choke coils.
R —1-megohm grid leaks.
N—Neutralizing condenser, consisting of a small brass disc about an inch in diameter, mounted so as to make its position, in relation to L_2, variable.
F_1, F_2, F_3,—Fixed filament control resistances to match the type of tubes employed.
J —Single-circuit filament control jack.
G —.00025-mfd. grid condenser and leak (6-megohm).
T_1, T_2,—Two UV–199 tubes.
T_3, T_4,—Two UV–201–A or High-mu tubes. If the latter are used, F_1 and F_2 may be omitted.
T_5,—Semi power tube.

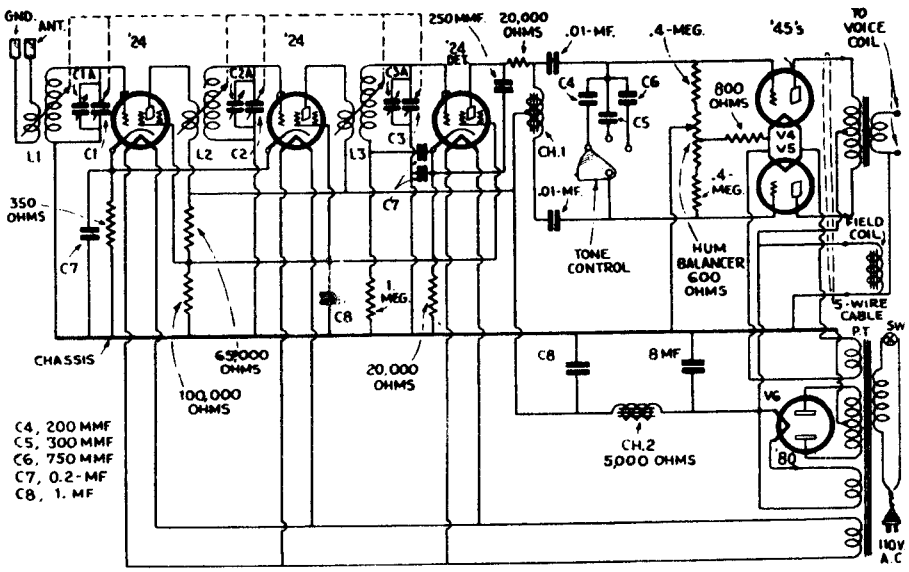
FANSTEEL PRODUCTS CO.

BALKITE MODEL-A.



COLONIAL RADIO CORP.

MODEL 36



Note the manner in which push-pull operation is obtained from the screen-grid detector output; through the use of a center-tapped A.F. choke coil. The primary coils of the R.F. transformers turn with the motion of the main tuning dial; while auxiliary adjustment of this coupling is used to obtain volume control. The kilocycle setting of the dial should correspond to the station frequency when the last cipher of the latter is omitted.

A hum-control resistor is situated at the left of the light-line. The tone control is the extreme left knob on the front of the panel.

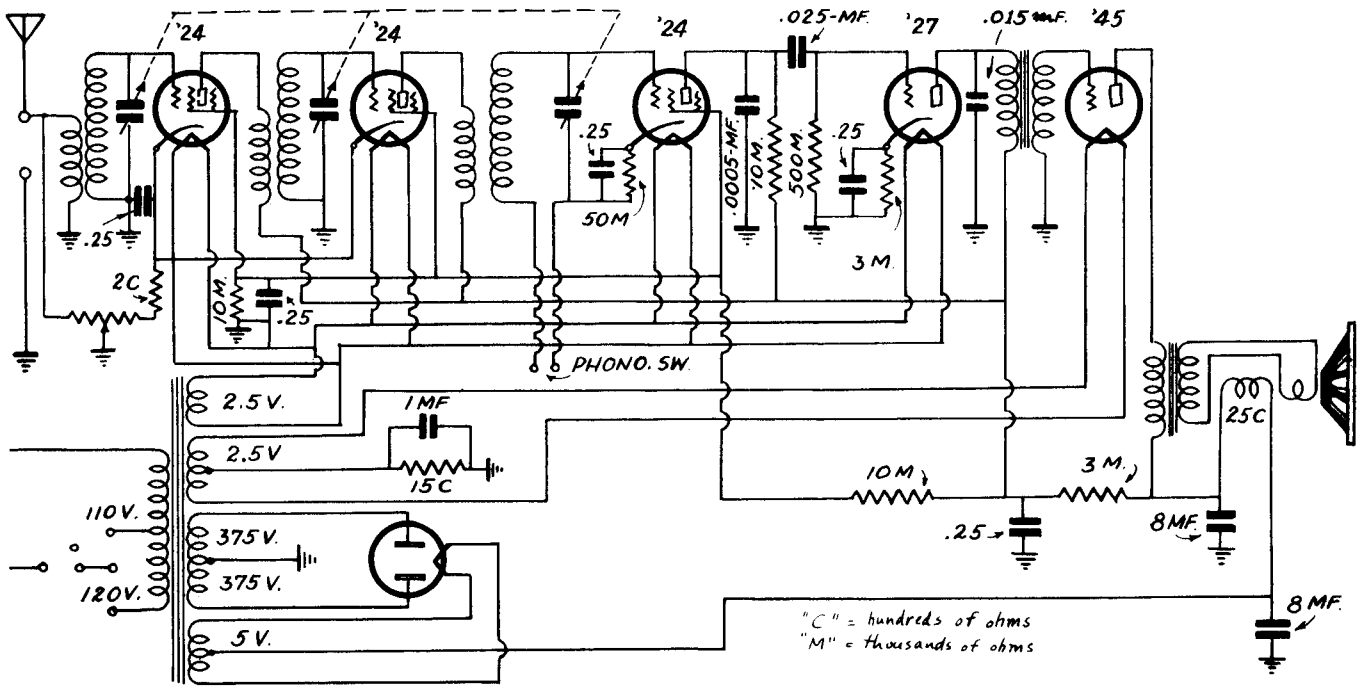
The following data are offered to Service Men by the manufacturers, for use when it becomes necessary to replace either the tuning condensers or the R.F. transformers:

The station selector dial should be set to the frequency of some strong local station, above 1,000 kc. and preferably between 1,200 and 1,400 kc.; and the volume control then reduced until the signal is barely audible. The compensating condensers should be adjusted (preferably by means of the three screws reached through the three holes in the top of the tuning condenser's cover) until the signal is at a maximum. Care must be taken not to adjust the compensating condensers too tight; or the receiver will not tune to 1,500 kc. Service Men are cautioned against changing the settings of these condensers unless the tuning units have been replaced.

Of course, it is well to reduce the volume control's setting each time the signal is brought up with the compensating condenser; since any change in volume is more easily detected at a low signal level.

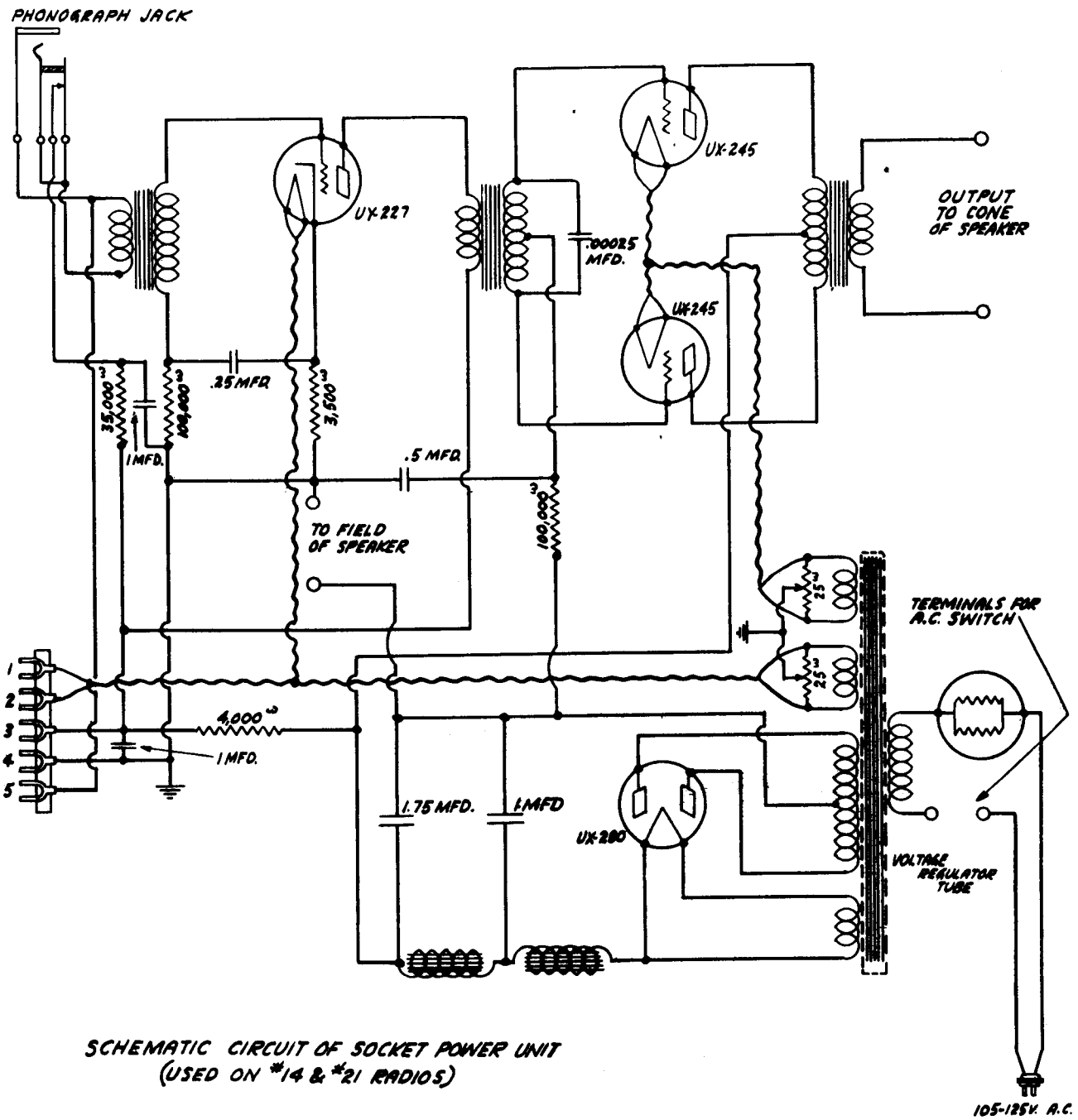
LONG RADIO CO.

"CARDINAL" MODEL 70.



BRUNSWICK BALKE COLLENDER CO.

The Brunswick Models 14, 21 and 31 employ identically the same R.F. chassis and essentially the same socket power unit. In the Model 31 S.P.U. the pickup jack has been replaced with a radio-record switch, cable and input transformer. The input transformer is necessary in order that the low impedance pickup as used on this model may be matched with the relatively high input impedance existing in the primary of the first audio frequency transformer. Commercially available pickups such as can be purchased for use with Models 14 and 21 are of the high impedance type and therefore do not require the use of this extra input transformer.



SCHEMATIC CIRCUIT OF SOCKET POWER UNIT
(USED ON #14 & #21 RADIOS)

Radio Service Data Sheet

BRUNSWICK MODEL 31 COMBINATION RADIO AND PANATROPE

In this receiver a radio-record switch, Sw2, cable and input transformer, T4, are used, in order that the low-impedance of the pick-up may be matched with the relatively high input impedance existing in the primary of T1.

Referring to the parts layout sketch, units TC1, TC2, TC3 and TC4 are trimmer condensers in shunt to the tuning condensers but not shown in the schematic circuit.

This receiver is in three sections: The R.F. chassis, the "SPU" (socket-power-unit) chassis and the dynamic reproducer. Field current for the latter is supplied by the SPU. Note that operation of the receiver should not be attempted unless either the field coil of a dynamic or a 600-ohm resistor is connected across the terminals for the two "field" leads; this resistor must be capable of carrying 100 ma.

To facilitate service, the R.F. chassis and SPU chassis are bolted to a single mounting board which, in turn, may be removed from the cabinet by removing retaining bolts at the rear of the mounting board.

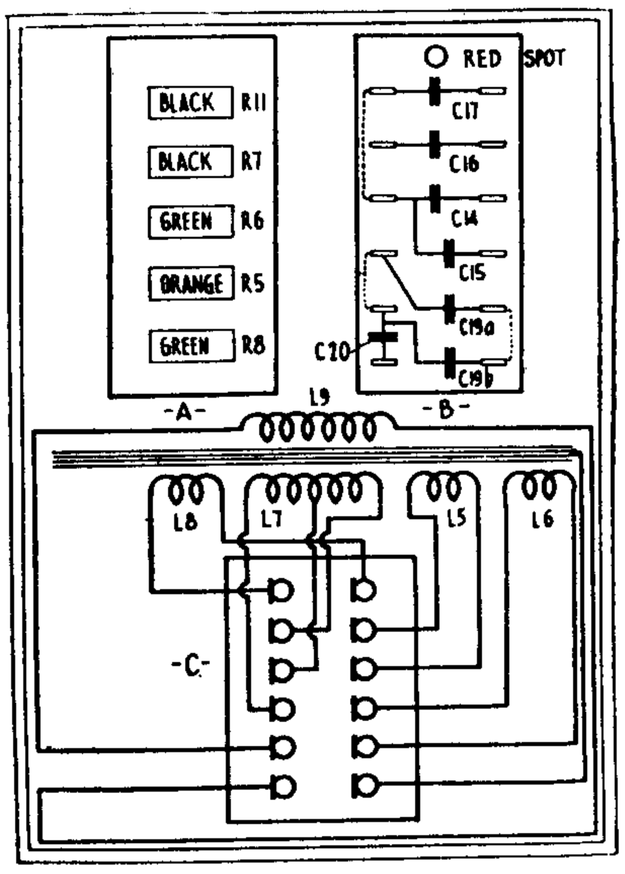
For hum control, two filament shunt resistors, R9, R10, with variable center taps, are provided on the SPU chassis. R9 is adjusted first and then R10. If R10 appears unresponsive, try other '27s at V4 and V5. Abnormal hum may be due to one or more of the following causes: (1) One or more R.F. stages oscillating; (2) low-emission tube, particularly a '45 or the '80; (3) open filter or by-pass condenser; (4) open grid lead in R.F. or audio amplifier; (5) center arms of R9 or R10 not grounded or poorly grounded.

Abnormal hum, which appears usually on a strong local or nearby station and cannot be balanced out with R9 or R10, may be due to condition (1), above, and must be remedied before further adjustment of R9 or R10. At the factory, these receivers are neutralized for standard tubes, and the neutralizing screws then sealed with collodion to maintain adjustment. Before attempting to re-neutralize the receiver, it is advisable to test the tubes or try others; as an abnormal one may be the cause of circuit oscillation.

Additional checks on the possibility of R.F. circuit oscillators are these indications: Distorted reception of any or all stations—usually on the lower wavelengths; a whistle or squeal preceding the station being tuned in and *not* due to a two-station carrier heterodyne; motor-boating on all portions of the broadcast band.

Standard practice in neutralizing this receiver is as follows: Adjust an audio-modulated oscillator for 1400 kc. and couple it to the "long antenna" post of the receiver with a five-foot wire, one end of which should be wrapped two or three times about the oscillator coil. Tune in the oscillator signal on the radio to maximum volume, using both the tandem-condenser control and C5.

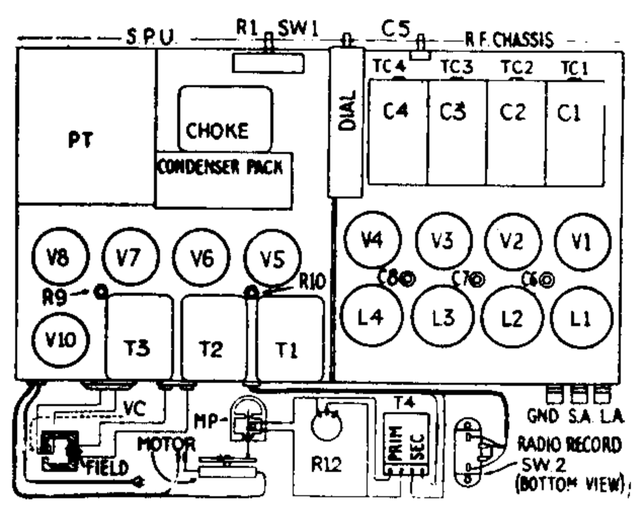
Then allow the receiver and oscillator to operate for about a minute (in order that the tubes may become thoroughly warmed up and "stable") and replace the first R.F. tube with a tube of average characteristics which is known not to cause oscillation in a receiver which has previously been



neutralized; this tube must have an open filament circuit. A fault into which some service men fall is to neutralize with one make of tube and then, after neutralizing, insert a different make—the circuit may then oscillate more than before.

Adjust C6 (see parts layout) for minimum signal. The signal intensity will be so great that an entirely silent point cannot be found.

Replace the neutralizing tube with the standard tube, and repeat performance for tubes V2 and V3; in each instance allowing



about a minute for the oscillator and receiver tubes to become stabilized.

If any difficulty is experienced in the neutralizing process, check supply potentials and the by-pass condensers. An *open* condenser may allow sufficient R.F. feed-back to the previous stage to make it impossible to find a good signal minimum. Also, a dummy tube that does not have quite the necessary constants may make it difficult to balance the circuits.

The normal line-current drain of this receiver is approximately 115 watts. The average voltages indicated at the terminals of the tubes are given in an accompanying table.

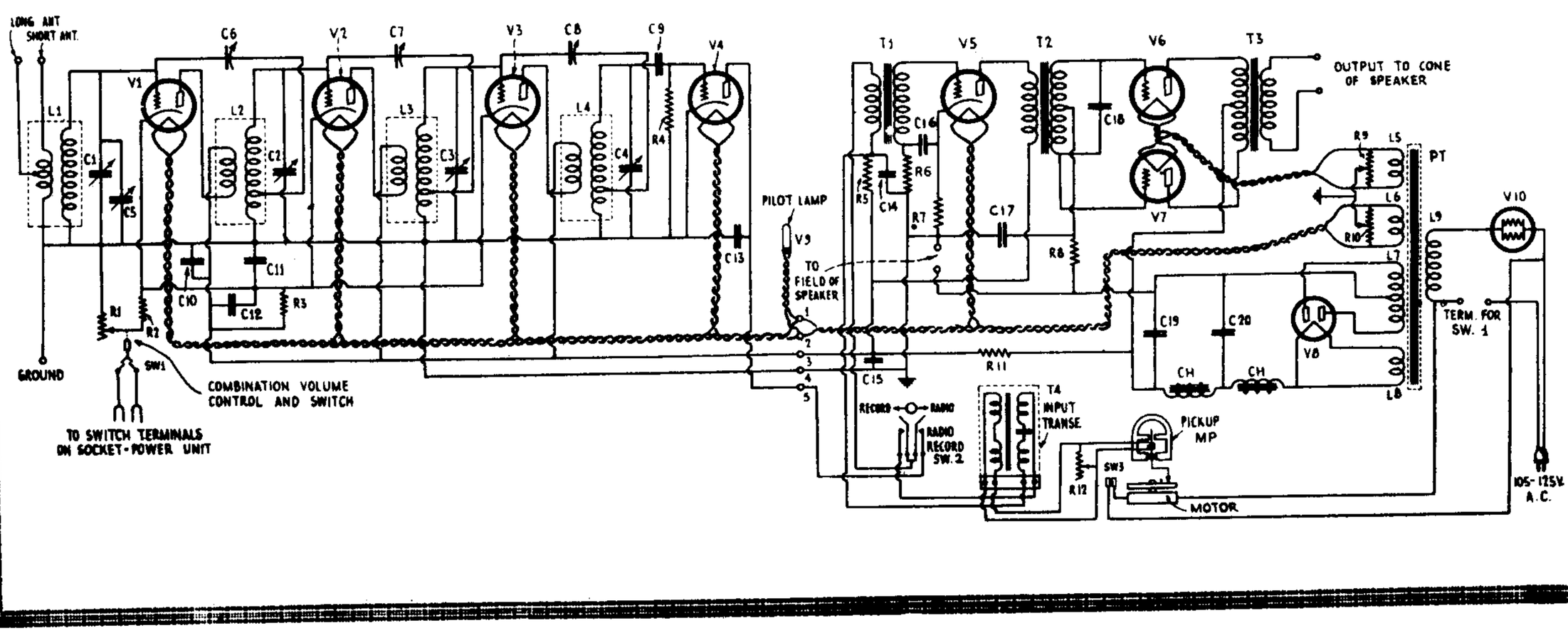
Tube No.	Type Tube	Voltage "A"	Voltage "B"	Voltage "C"	Plate Ma. "Normal"
V1	'27	2.5	150	12	5.5
V2	'27	2.5	150	12	5.5
V3	'27	2.5	150	12	5.5
V4	'27	2.5	45	0	3.4
V5	'27	2.5	145	9	3.6
V6	'45	2.4	240	27	30.0
V7	'45	2.4	240	27	30.0
V8	'80	5.0	....	....	....

The values of the parts in this receiver are as follows: R1, 25,000 ohms; R2, 800 ohms; R3, 35,000 ohms; R4, 2 megohms; R5, 35,000 ohms; R6, 100,000 ohms; R7, 3,500 ohms; R8, 100,000 ohms; R9, 25 ohms; R10, 25 ohms; R11, 4,000 ohms; R12, 70 ohms. The capacities used are as follows: C9, .00015-mf.; C10, 0.2-mf.; C11, 0.2-mf.; C12, 0.02-mf.; C13, .002-mf.; C14, 1.5-mf.; C15, 1-mf.; C16, 0.25-mf.; C17, 0.5-mf.; C18, .00025-mf.; C19, 1.75-mf.; C20, 1.0-mf. The positions of L1, L2, L3, L4, L5, L6, L7, L8 and L9 are obvious.

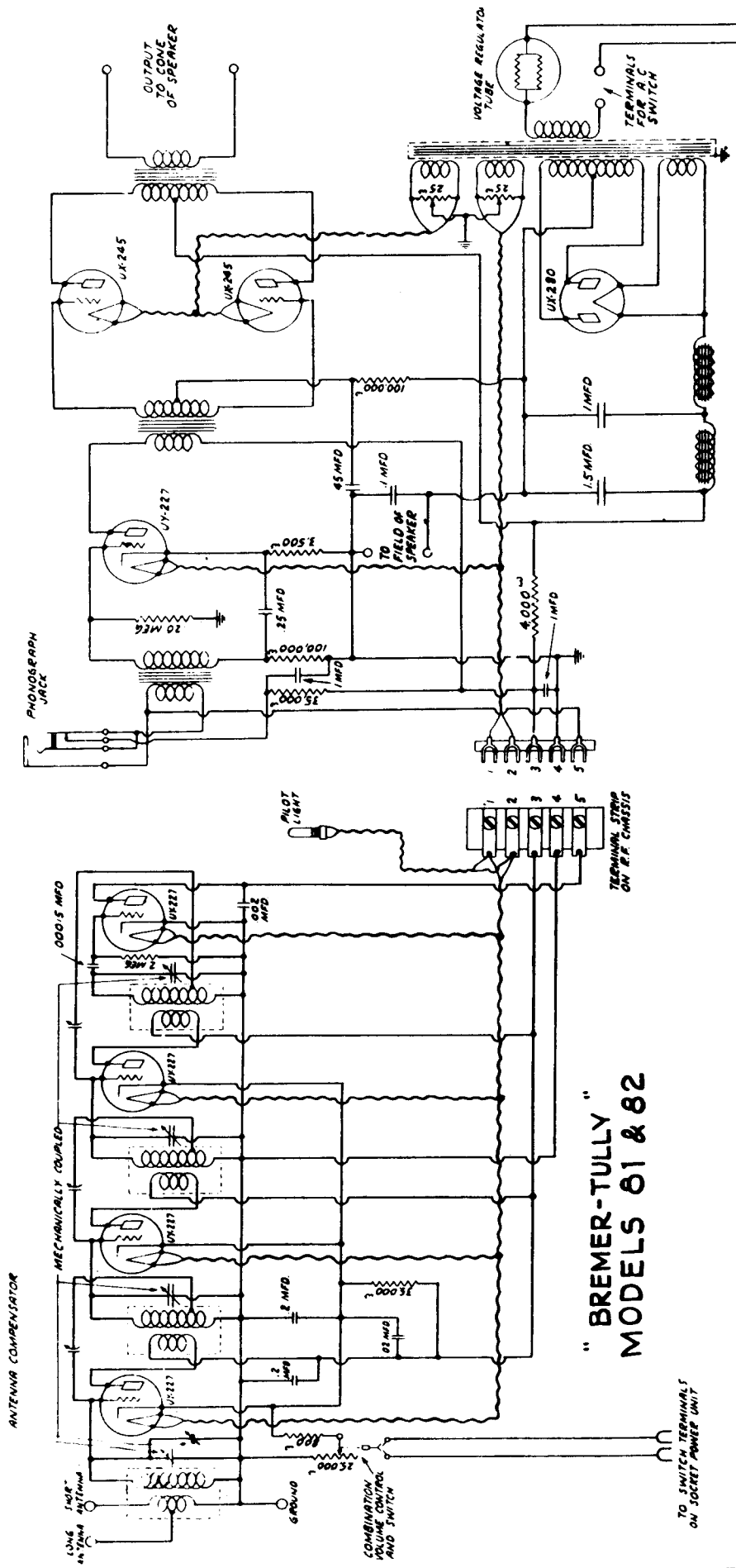
Trouble with the Panatrope portion of the receiver may usually be classed as: (1) Magnetic pickup MP out of adjustment; (2) Sw2 out of adjustment; (3) motor speed irregular.

There are four points on the turntable unit which require lubrication: (1) Upper turntable bearing; (2) lower turntable bearing; (3) governor bearing, weight end; (4) governor bearing, worm-gear end. To operate noiselessly and at constant speed it is necessary that the motor be kept in good condition. To remove the motor for oiling, proceed as follows: (1) Remove the record turntable by pulling it upward; (2) remove the four motor-securing bolts; (3) detach the motor leads from the cable in the cabinet and lift motor from cabinet. After this, all parts should be cleaned. Then, using a light-grade oil, proceed to lubricate the motor at the points mentioned above. This lubrication process should be followed every six months.

A noisy turntable motor may usually be traced to: (1) Governor shaft bearings loose; (2) lamination loose in one or more of the four coils; (3) coil loose on its core; (4) defective spring in governor. If the speed is not constant, it may be due to (1) or (4), above. To tighten governor bearing, loosen set screw, push bearing gently toward center of motor and tighten screw. Do not force bearing in too far, or it may bind the governor shaft. (Be sure set screw of opposite bearing is tight.) Laminations may be pressed together by tightening the retaining bolts. If a coil is found loose on its core, force a small wedge of soft wood between coil and core, to prevent the coil from vibrating, and thus stop the noise. A bent or broken governor spring should be replaced.



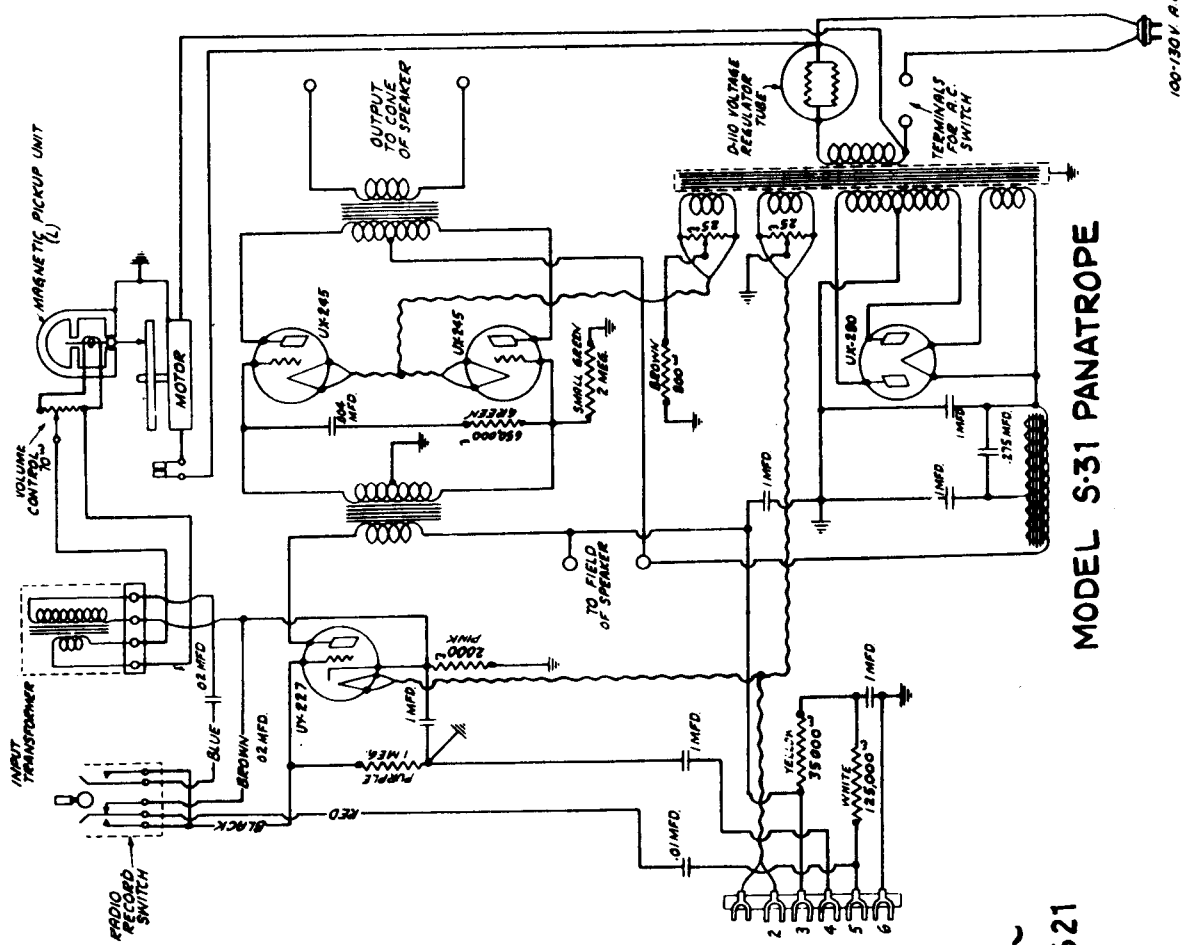
BRUNSWICK RADIO CORP.



"BREMER-TULLY" MODELS 81 & 82

Tube No. in Order	Type of Tube	Position of Tube 1st R. F., Det., Etc.	A Volts	B Volts	C Volts	Normal Plate M. A.
1	227	1st R. F.	2.5	150	12	5.5
2	227	2nd R. F.	2.5	150	12	5.5
3	227	3rd R. F.	2.5	150	12	5.5
4	227	Detector	2.5	45	0	3.4
5	227	1st Audio	2.5	145	9	3.6
6	245	1st P-P	2.4	240	27	30
7	245	2nd P-P	2.4	240	27	30
8	280	Rectifier	5			
9	D98	Ballast				

BRUNSWICK RADIO CORP.



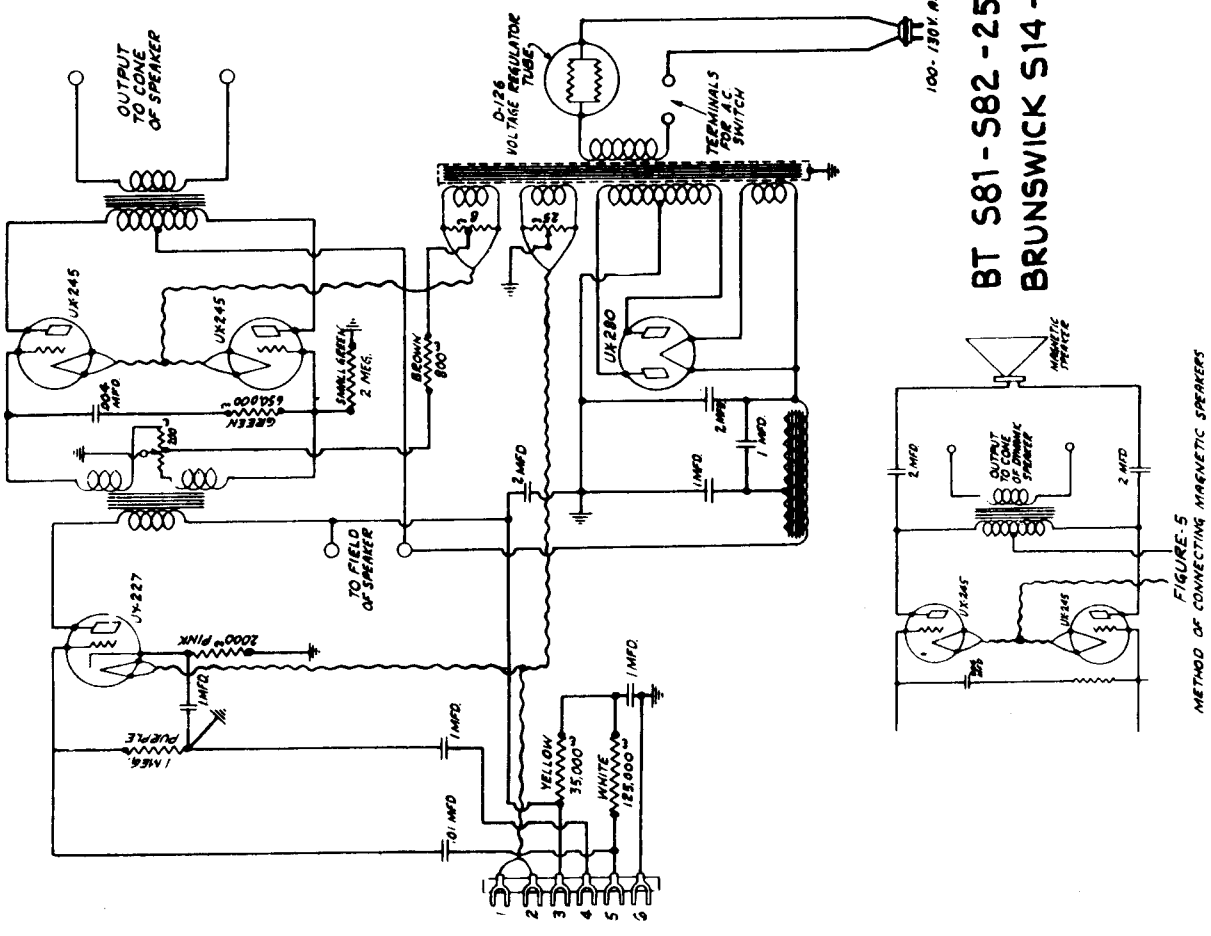
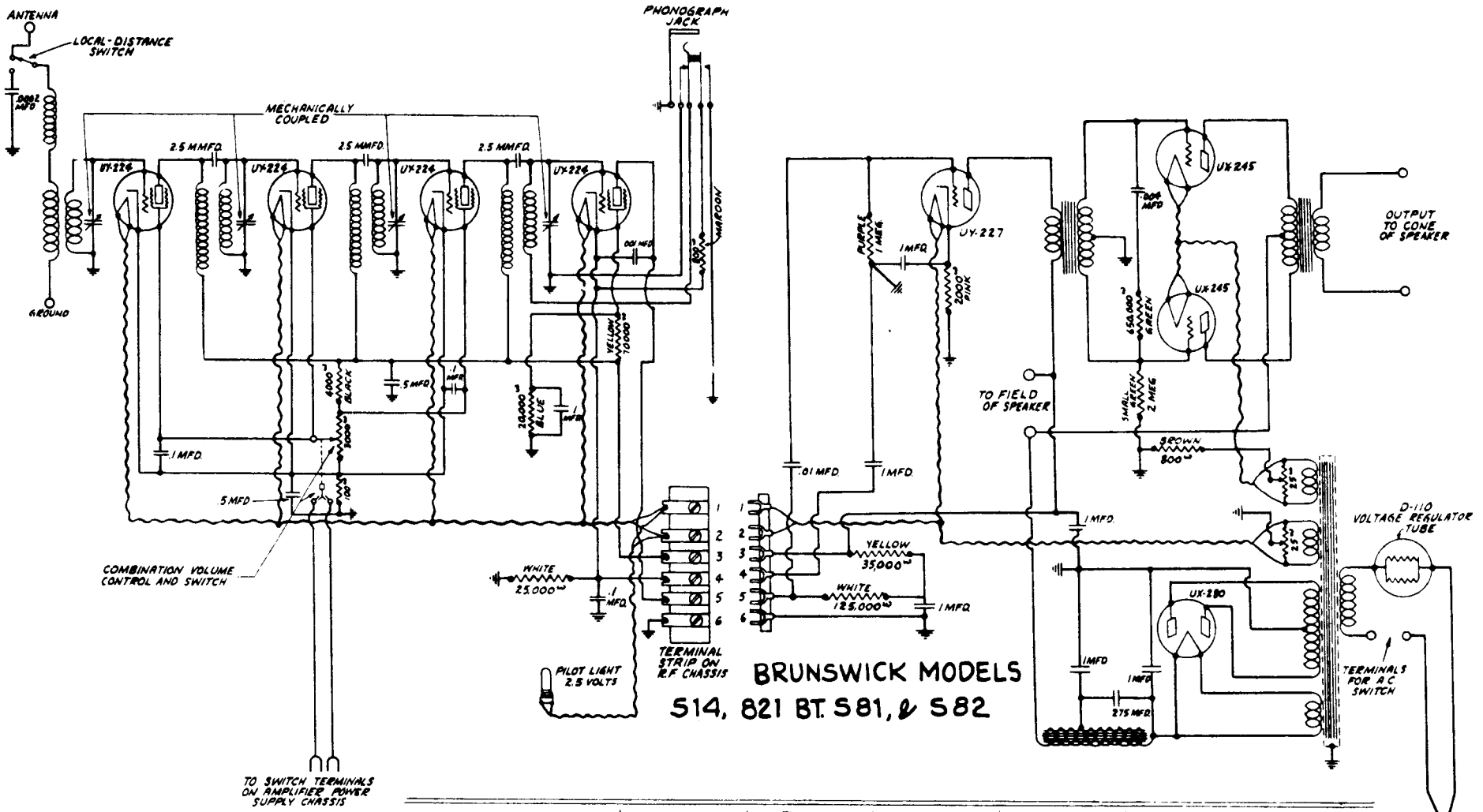


FIGURE-5
METHOD OF CONNECTING MAGNETIC SPEAKERS



BRUNSWICK RADIO CORP.

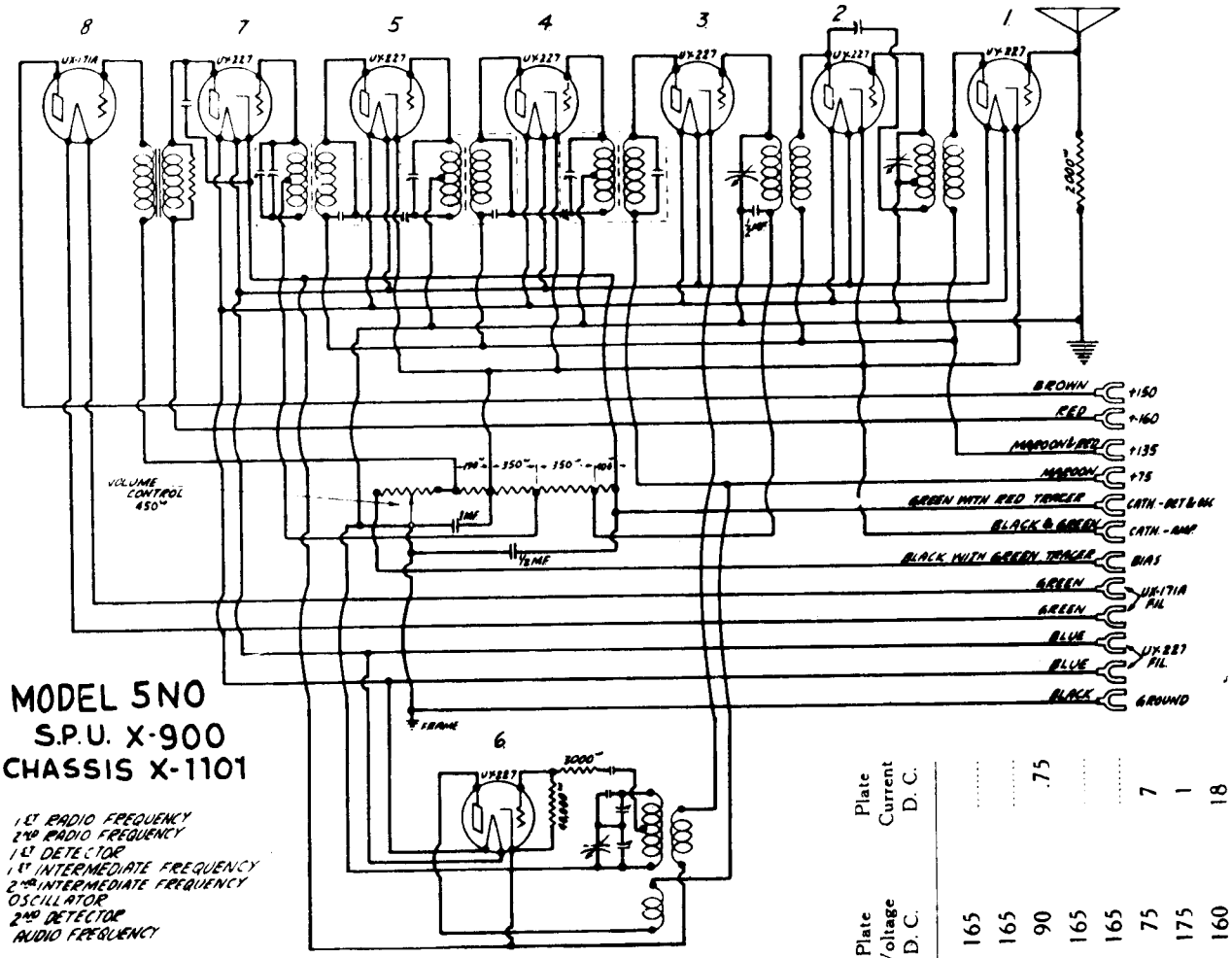
BRUNSWICK MODELS 514, 821 BT. 581, & 582

VOLTAGE AT SOCKETS
(Volume control at maximum.)

*Readings may vary considerably depending on resistance of voltimeter used.

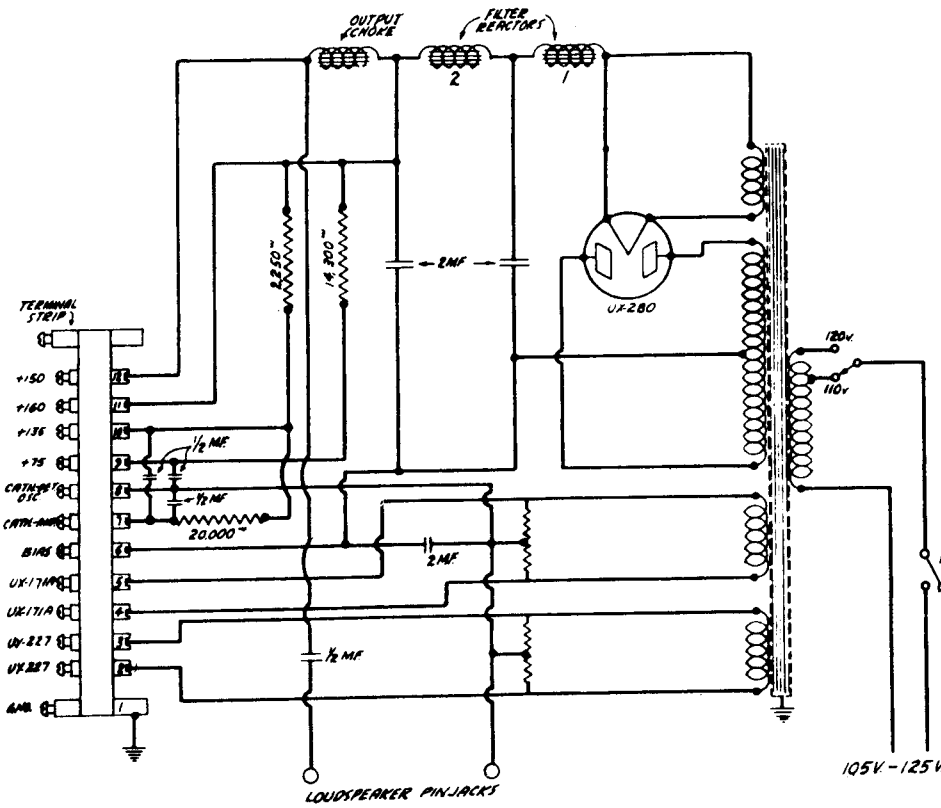
Position of Tube	Heater to Cathode Volts	Control Grid to Cathode Volts	Screen-Grid to Cathode Volts	Plate to Cathode Volts	Plate Current Milamps	Filament or Heater Volts
1st, 2nd, 3rd R. F.	—2.5	—2.5	60	135	1.7	2.5
Detector	*—5	*— 5	*13	*84	.2	2.5
1st A. F.	—8	*—.27		130	4.5	2.5
Power Stage		—45		245	28	2.5
Rectifier					45 per Plate	5

BRUNSWICK RADIO CORP.



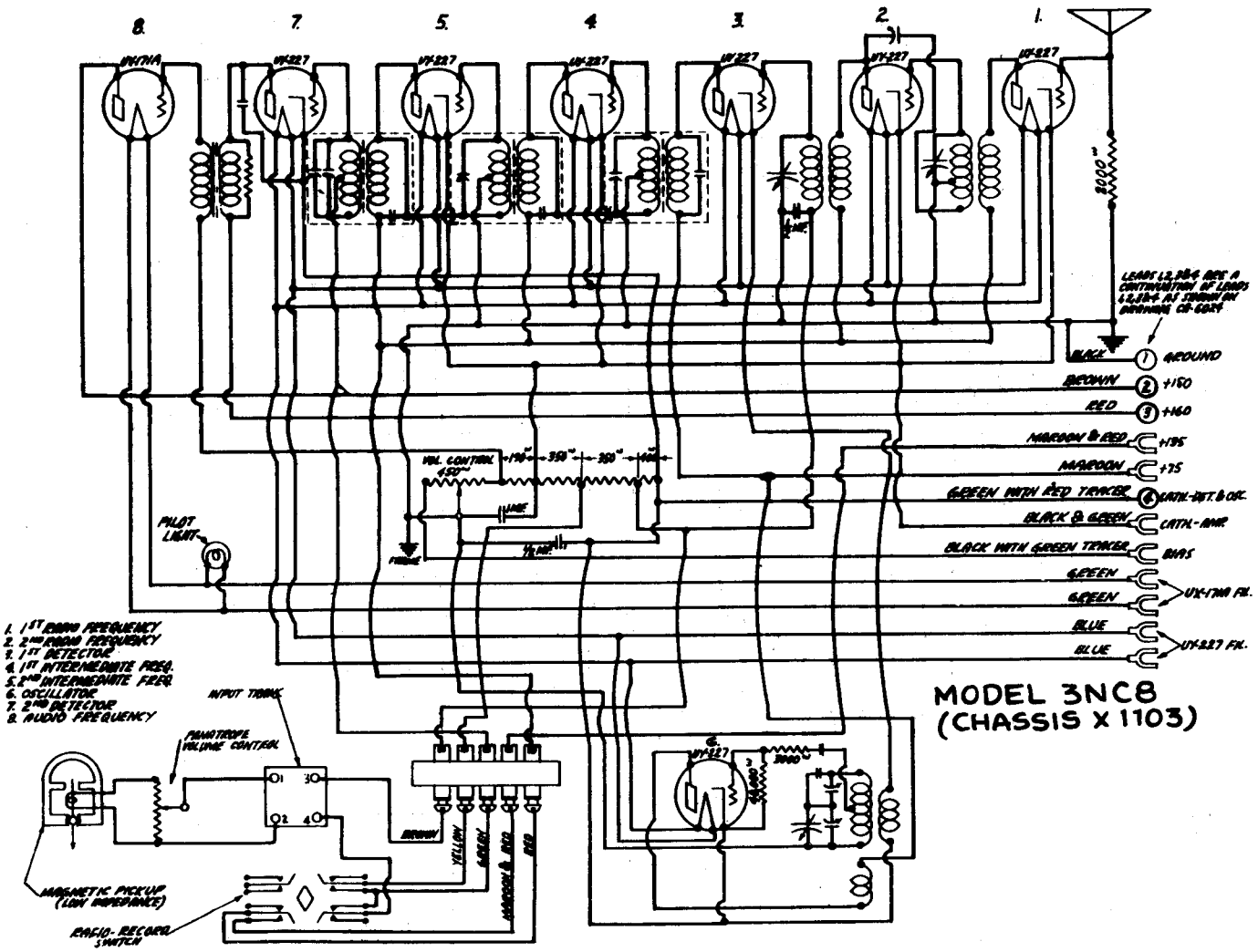
MODEL 5NO
S.P.U. X-900
CHASSIS X-1101

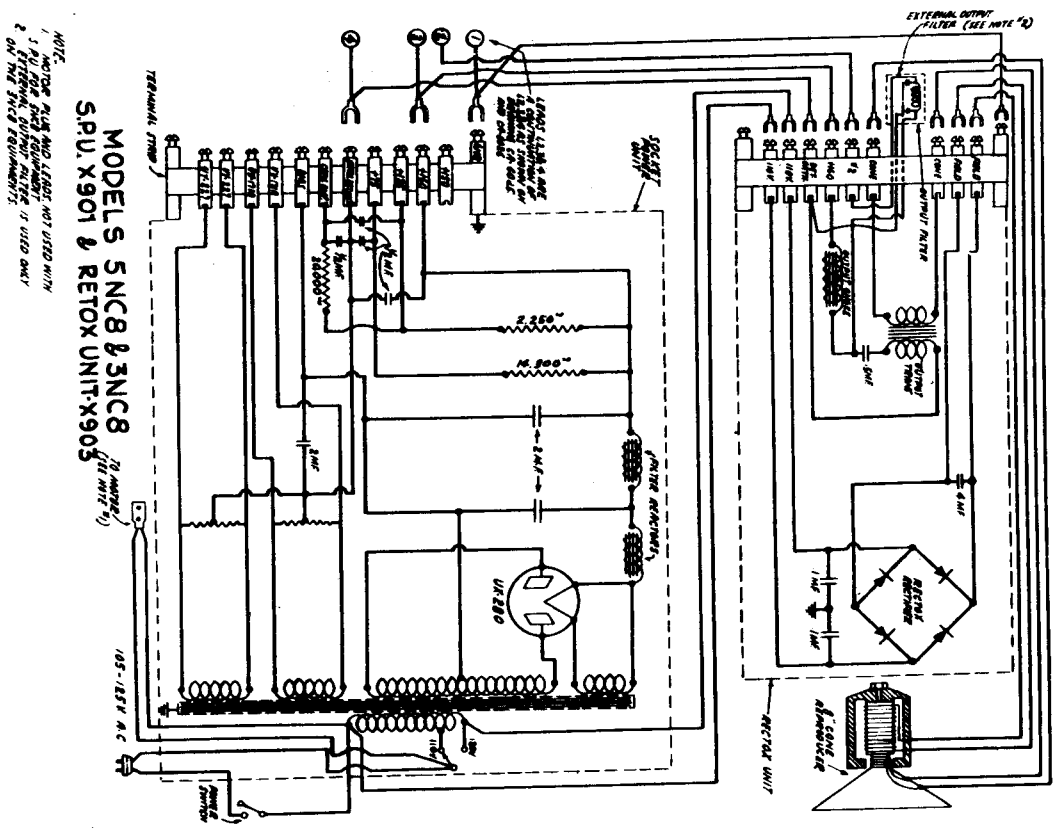
1 1ST RADIO FREQUENCY
2 2ND RADIO FREQUENCY
3 1ST DETECTOR
4 1ST INTERMEDIATE FREQUENCY
5 2ND INTERMEDIATE FREQUENCY
6 OSCILLATOR
7 2ND DETECTOR
8 AUDIO FREQUENCY



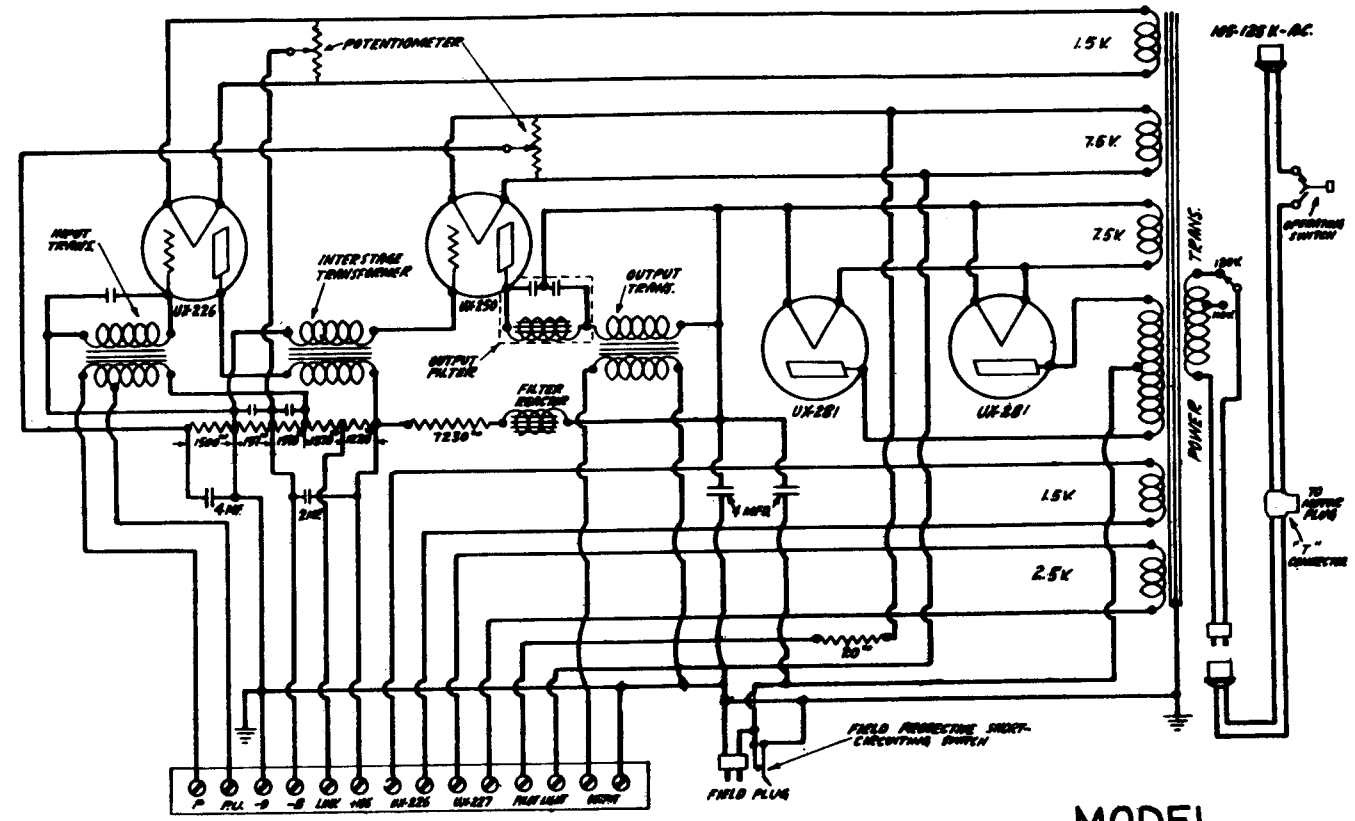
Socket Purpose	Tube Type	Filament Voltage A. C.	Grid Voltage D. C.	Cathode Voltage D. C.	Plate Voltage D. C.	Plate Current D. C.
1st R. F.	UY-227	2.25	30	30	165	.....
2nd R. F.	UY-227	2.25	30	30	165	.....
1st Det.	UY-227	2.25	11	....	90	.75
1st I. F.	UY-227	2.25	30	30	165	.....
2nd I. F.	UY-227	2.25	30	30	165	.....
Oscillator	UY-227	2.25	....	....	75	7
2nd Det.	UY-227	2.25	20	....	175	1
Audio	UX-171-A	5.	37	....	160	18

BRUNSWICK RADIO CORP.

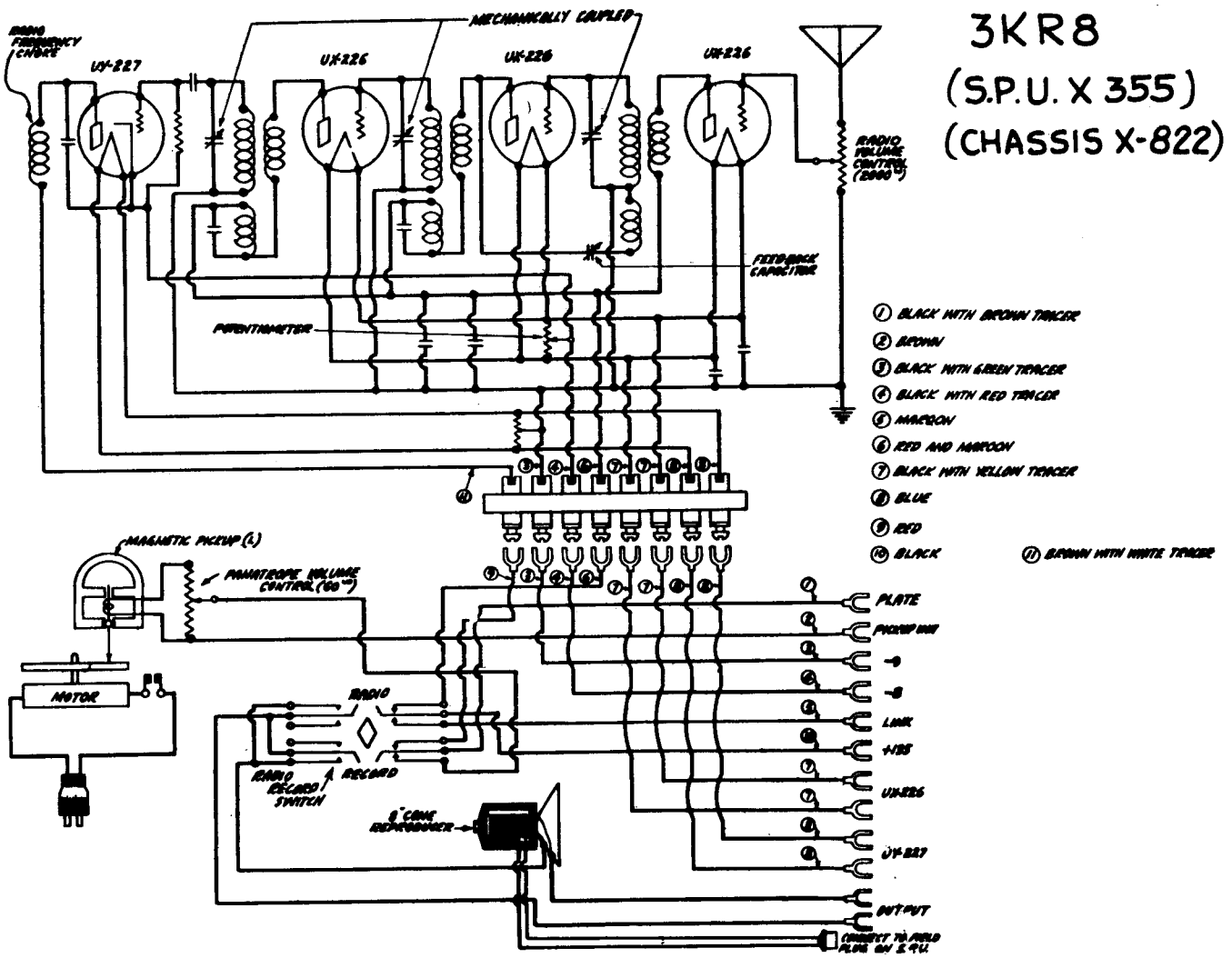




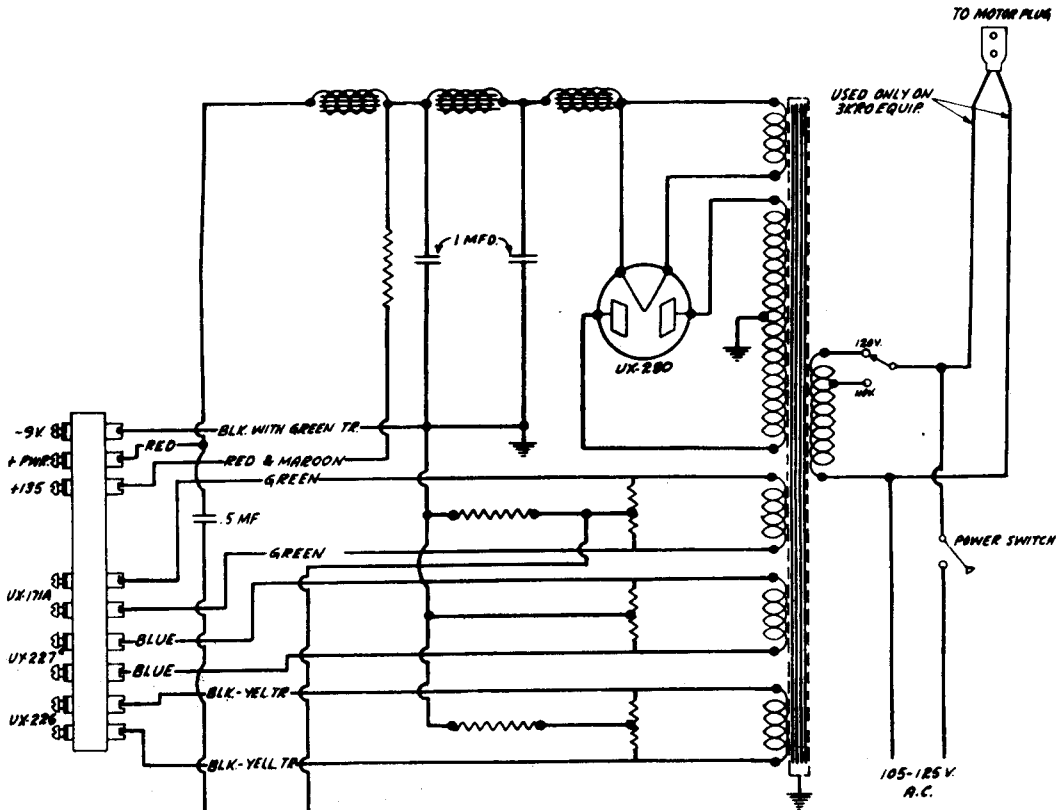
BRUNSWICK RADIO CORP.



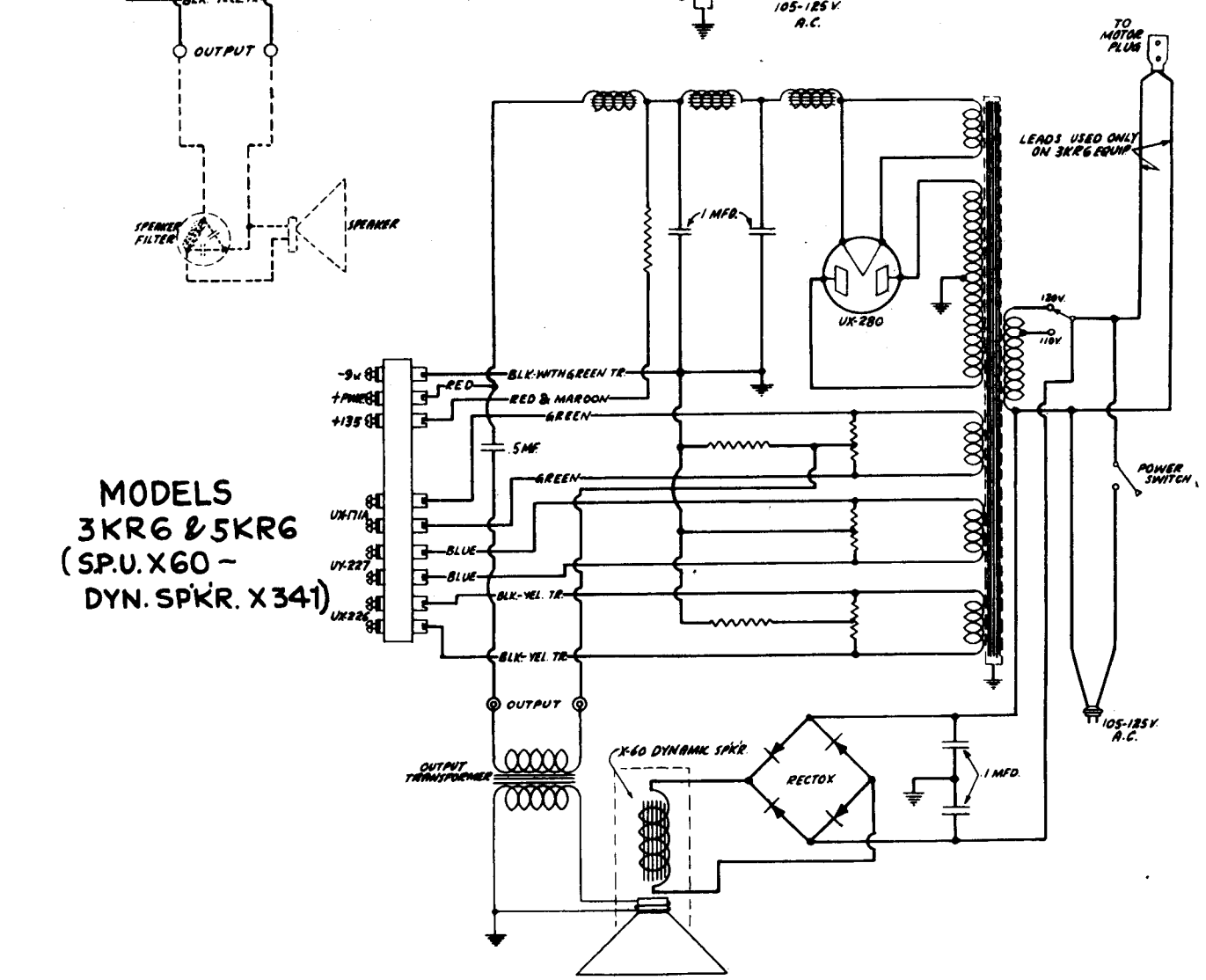
MODEL 3KR8 (S.P.U. X 355) (CHASSIS X-822)



BRUNSWICK RADIO CORP.

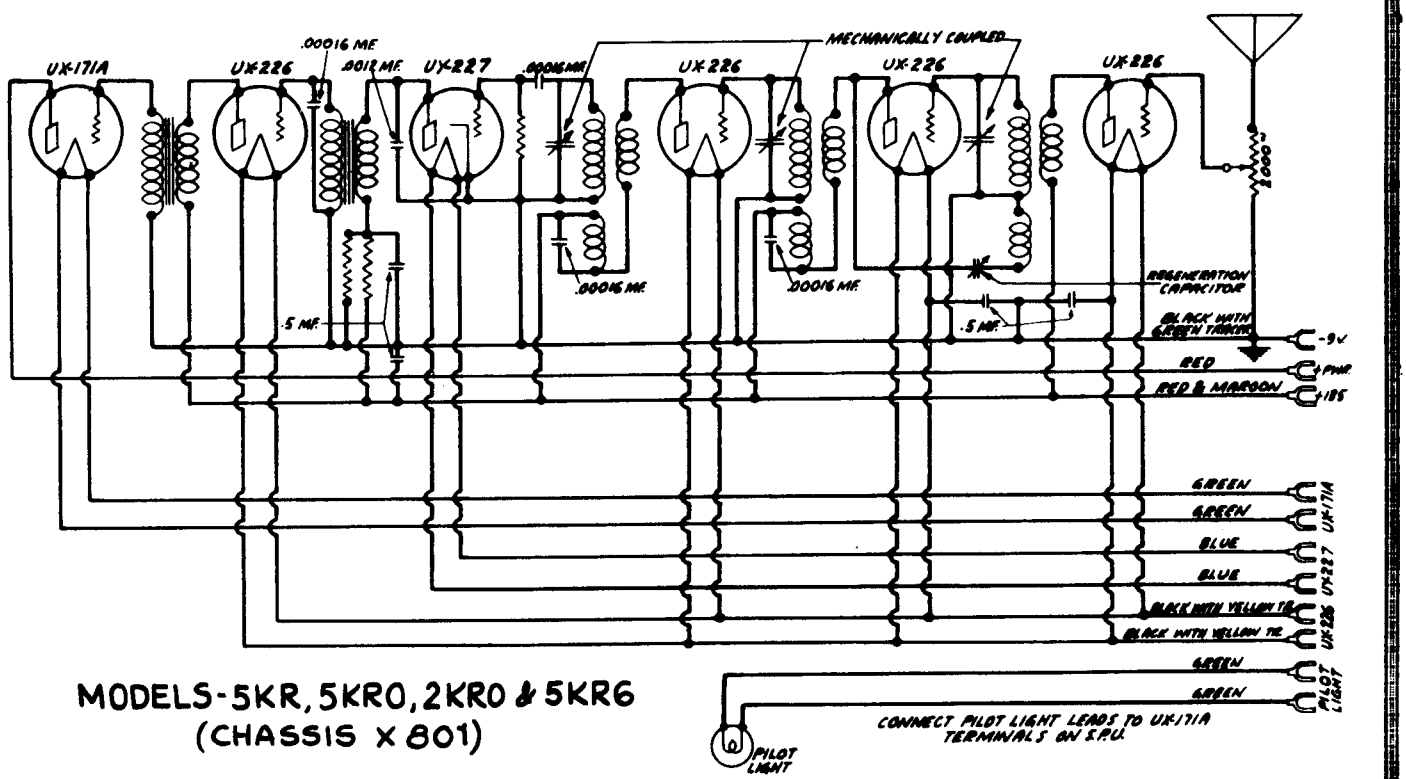


MODELS
5KR, 5KRO,
2KRO & 3KRO.
(S.P.U. X-341)

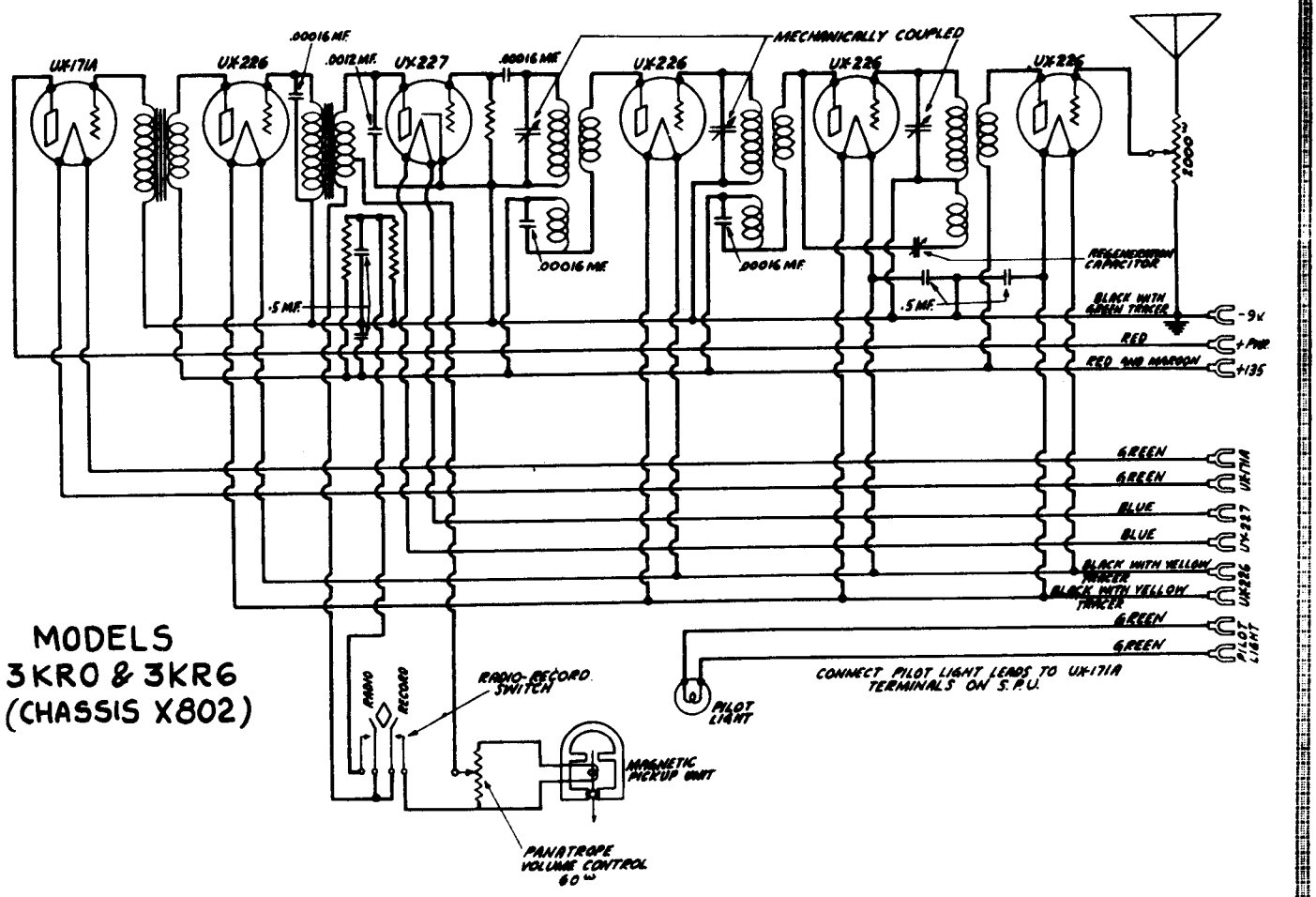


MODELS
3KR6 & 5KR6
(S.P.U. X60 -
DYN. SP'KR. X341)

BRUNSWICK RADIO CORP.

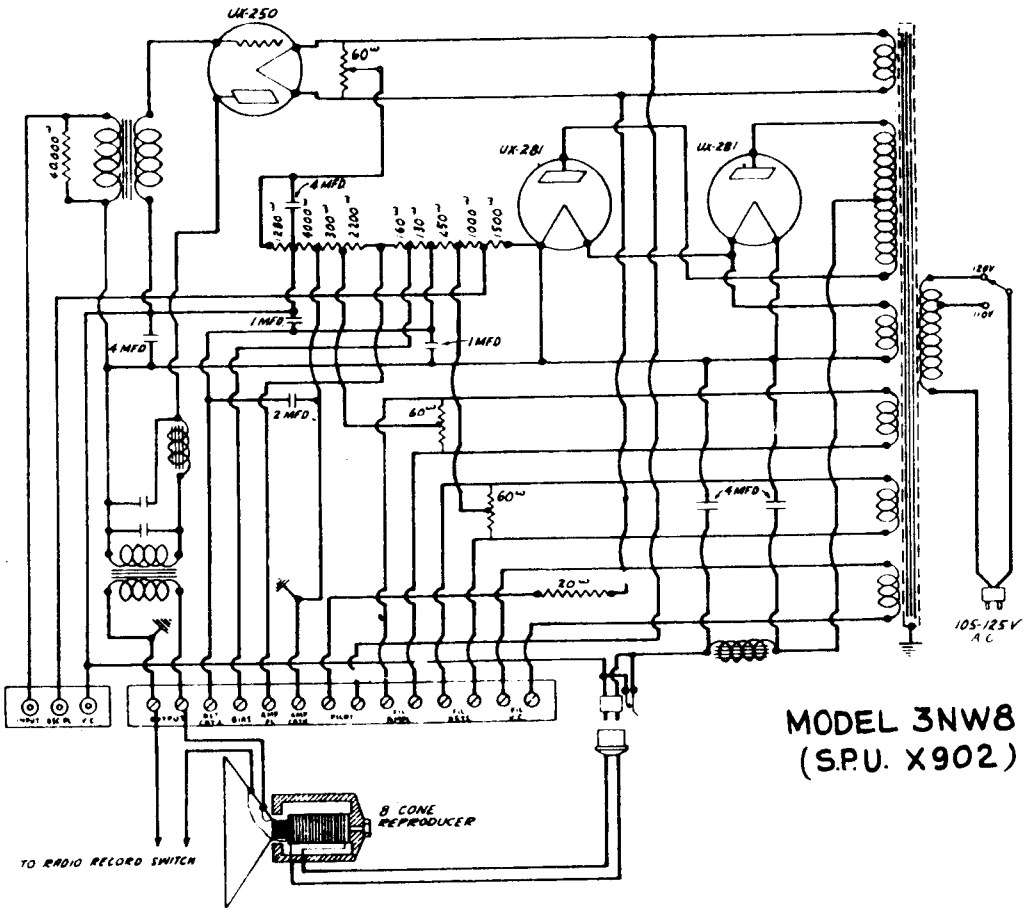


MODELS-5KR, 5KRO, 2KRO & 5KR6
(CHASSIS X 801)

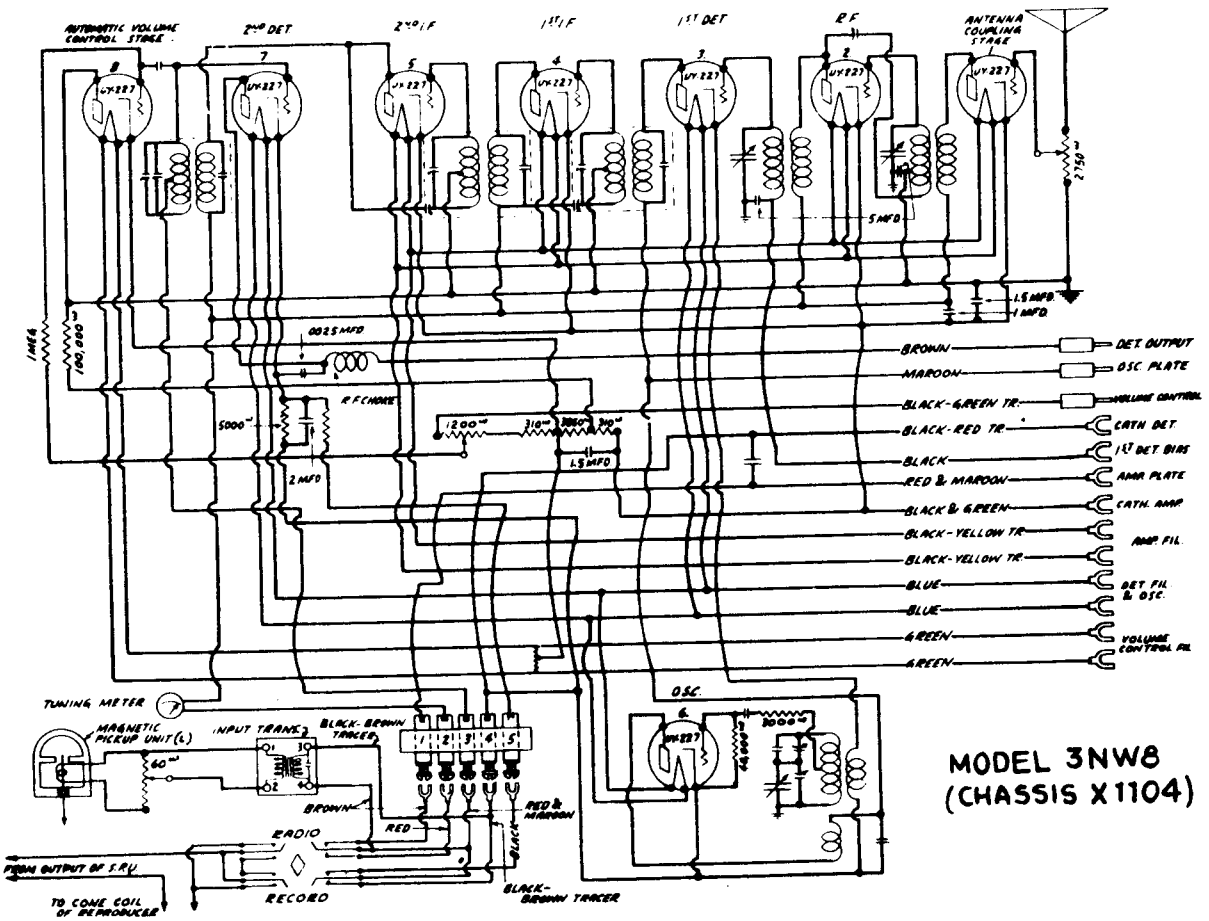


MODELS
3KRO & 3KR6
(CHASSIS X802)

BRUNSWICK RADIO CORP.

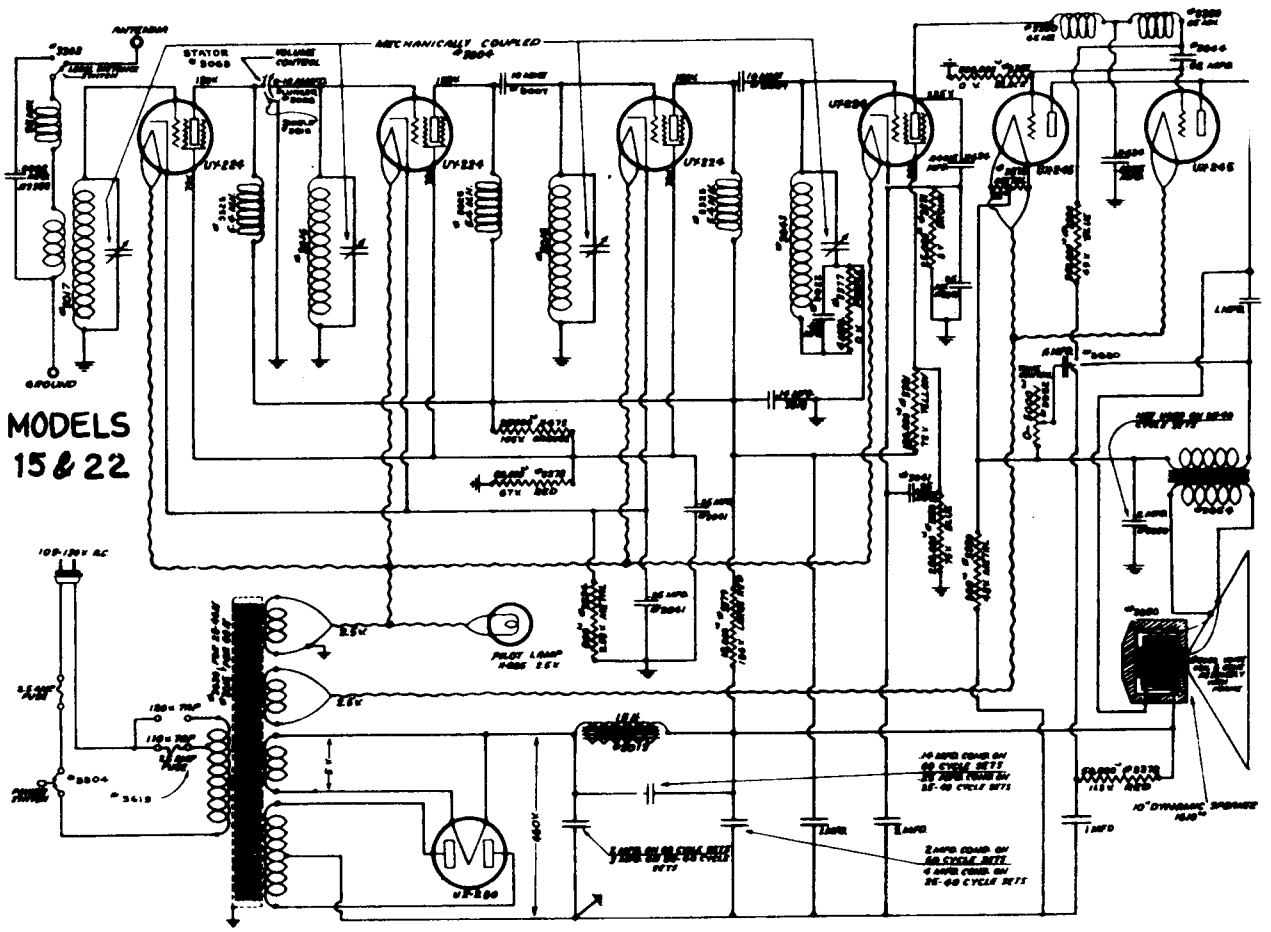


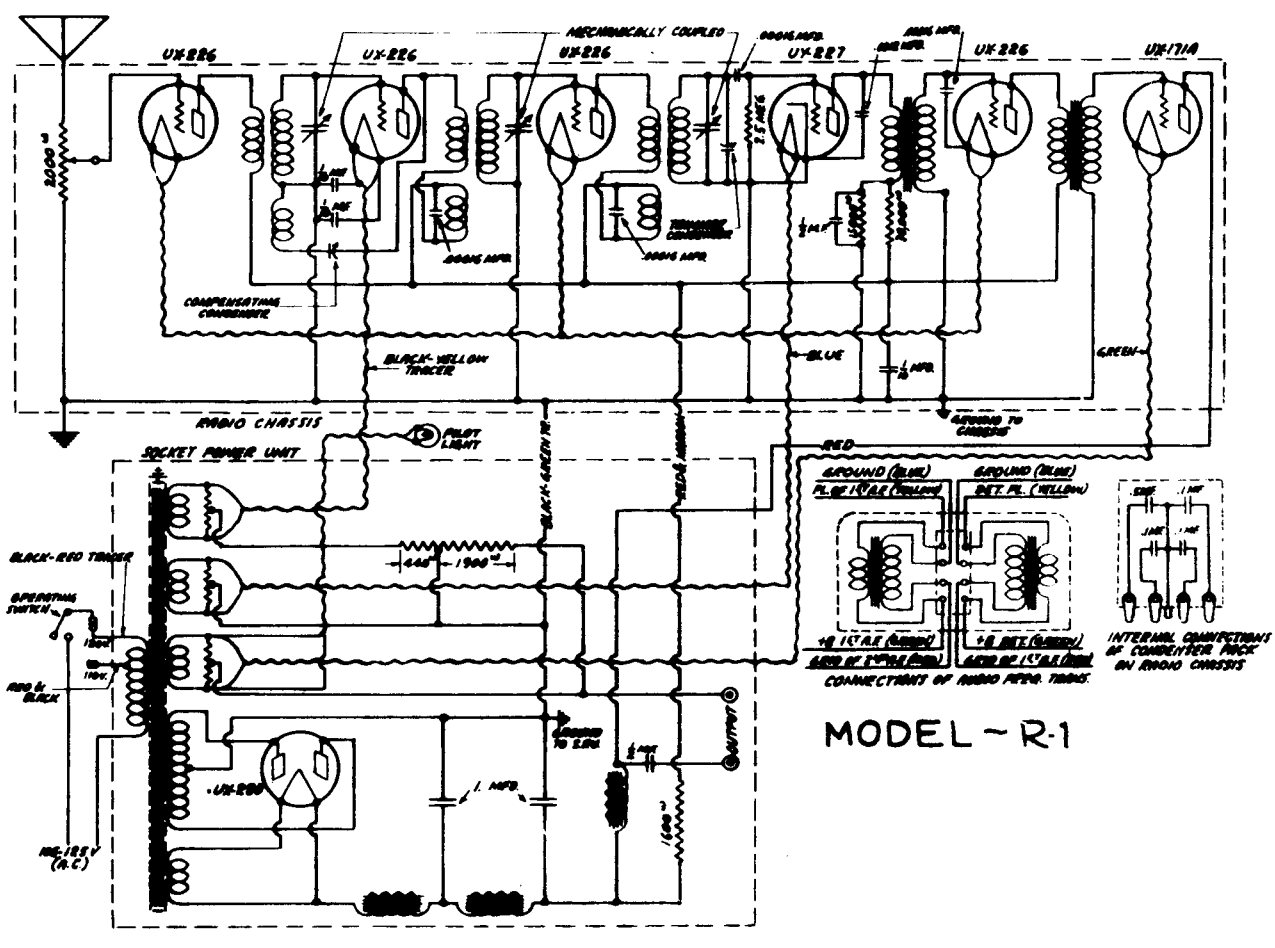
MODEL 3NW8
(S.P.U. X902)



MODEL 3NW8
(CHASSIS X1104)

BRUNSWICK RADIO CORP.





Radio Service Data Sheet

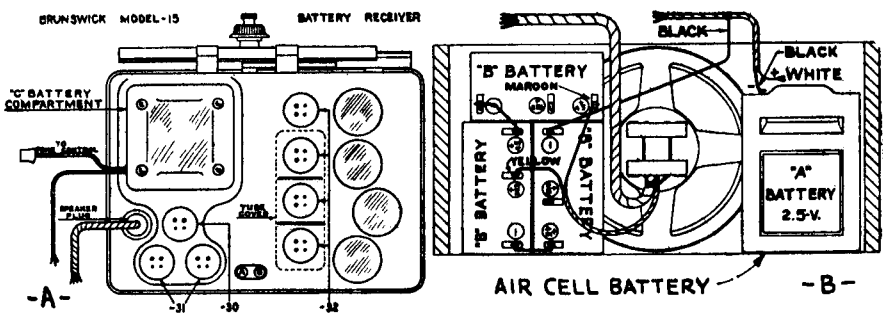
BRUNSWICK MODEL B-15 "UNI-SELECTOR" RECEIVER

This screen-grid receiver, a product of the Brunswick Radio Corp., New York City, incorporates four of the 2-volt type-'32 screen-grid tubes (three R.F. stages and a screen-grid detector, to obtain high amplification); a type '30 A.F. amplifier; and two type '31 power tubes in push-pull. The completed receiver is designed to operate three "B" batteries, a "C" battery, and 2-volt "A" battery, particularly the Eveready type A-600 "Air-Cell."

The values of the various construction units are itemized in the following list:

Resistor R1, 750,000 ohms; R2, 250,000 ohms; R3, 500,000 ohms; R4 (tone-control variable resistor), 0-50,000 ohms; R5, 2 megs.; R6, filament current limiting resistor, 0-6-ohm.

The condensers in the "B-15" have the following designations and respective capacities: C, 10 mmf.; C1, tuning condensers, C2, C3, C4, .000425-mf.; C5 (volume control) variable dual condenser, 10 mmf.; C6, C7, 10 mmf.; C8, .0002-mf.; C9 ("A +" by-pass to chassis) C10 and C12 ¼-mf.; C11, 0.14-mf.; C13, .0002-mf.; C14, .02-mf.; C15, .03-mf.; C16 and C17, 1 mf. The A.F. transformer T has a ratio of 2:1.



At left, top view of the Brunswick "Model B-15," designed to work with 2-volt tubes, an "inductor dynamic" reproducer, and an air-cell "A" battery; the last unit, approximately the size of a storage battery, will be noted in the sketch at the right.

In connection with the voltage readings obtained, during analysis at the tube sockets, it must be remembered that, because of the large resistances in the plate and screen-grid circuits of the detector tube, V4, the reading on most set analyzers will be in the neighborhood of 5 volts; whereas, the values indicated, in the list below, are the effective operating potentials.

The potential applied to each tube filament is the same—2 volts. The plate potentials applied to these tubes have various values, depending upon the tube's position in the circuit, as follows: V1, V2, V3, V6, V7, 135 volts; V4, 67.5 volts (note comment above); V5, 67.5 volts. Control-grid potentials: V1, V2, V3, V4, V5, 3 volts; V6, V7, 22.5 volts. Screen-grid potentials, V1, V2, V3, V4, 69 volts. The plate-current readings are as follows: V1, V2, V3, 1.1 ma.; V4, 0.03-ma.; V5, 2.4 ma.; V6, V7, 6.2 ma.

From consideration of these figures it will be noted that the total plate current consumption is only slightly over 18 ma.

The color code of the resistors used in the "B-15" is as follows: R1, purple; R2, blue; R3, black; R5, green.

The reproducer is special; this "inductor dynamic" unit reproduces low notes with more efficiency than the ordinary magnetic reproducers, while it does not require the field-current supply used by the regular dynamic reproducers.

The moving voice-coils of the inductor dynamic reproducer, like the coils in an ordinary magnetic reproducer, are of the high-impedance type.

The small tone-control knob is located directly below the "Uni-Selector" control, which is, really, a combination of two knobs; one of these governs the tuning condensers; the others is a multiple control. Pushed in, it operates switch Sw1 for "local" station reception; pushed out, for distant reception. When turned to the extreme left, switch Sw2 is placed in its "off" position; turning it to the right puts it "on," and continuing to turn this knob to the right increases the volume.

The arrangement of the tubes in their sockets, and the location of the "C" battery, are shown in the detail sketch. It will be noted that the "A" battery's terminal reading is 2.5 volts; in the set this is reduced to the required 2 volts by the drop through resistor R6.

The accessories are specially recommended for use in the Model B-15. The color code for the battery leads is as follows: "A—," "B—" and "C +" black; "A +," white; "B + 67½," yellow; "B + 135," maroon; "C — 3" (and chassis), brown; "C — 22½," yellow.

There are a few precautions to be observed when checking this receiver; probably the most important is not to use any method of testing which will put a short circuit across the tube filaments, or the "A" supply.

The reason for this is, that if the current output of the air-cell "A" battery exceeds the value of 0.75-amp., the carbon electrodes of the battery will become filled with the electrolyte in the cells, and cannot again be made to function. Service Men accustomed to shorting the "A" circuit (as when a storage battery is used for the "A" supply) cannot use the same test procedure in connection with the air-cell battery without permanently damaging the latter.

Another point to be observed is that this characteristic of the air-cell requires that no more tubes than are shown here be employed in the circuit; consequently, a pilot light must not be placed in the set as an additional convenience, since these lamps usually consume at least ¼-amp.

At the present moment, there is no convenient way of determining the life remaining in an air-cell battery; except by making a rough estimation on the basis of its normal life. This will be about 1,000 operating hours, when operating a receiver of the type exemplified in the Brunswick "Model B-15," for three hours per day. A voltmeter of the low-resistance type will draw too much current, and will endanger the air-cell battery. Also, it probably will lack the accuracy required to determine the output voltage of the battery at a particular point on its discharge curve; although, with a high-resistance voltmeter, a certain approximation of the "life-expectation" of the air-cell may be obtained in this manner.

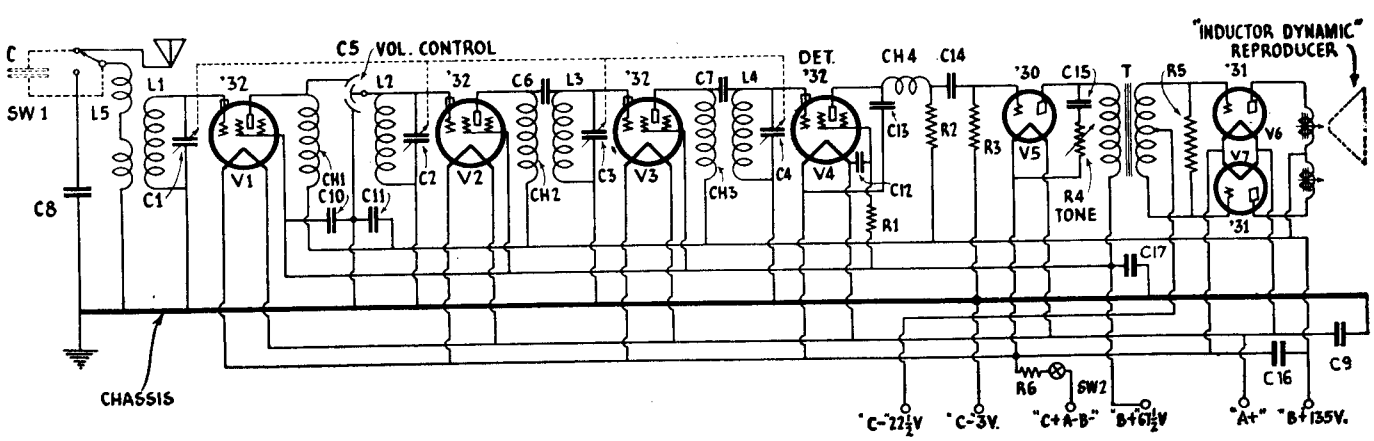
It is a common practice among service men, in an effort to speed the testing of receivers, to successively tap the tubes in a receiver. In the "B-15" this is inadvisable, because the danger of shorting the elements of a tube, and thus destroying the air-cell "A" battery through the added current drain.

About six quarts of water will be required to fill the air-cell battery. It is not necessary to use distilled water; ordinary drinking water being satisfactory.

This current-supply unit is ot the "primary" type; that is, it generates its own current. Consequently, it cannot be charged like a storage or "secondary" battery. Also, unlike other primary batteries having a liquid electrolyte, this is not designed to permit replenishing the elements or the solution after the useful life of the battery has ended.

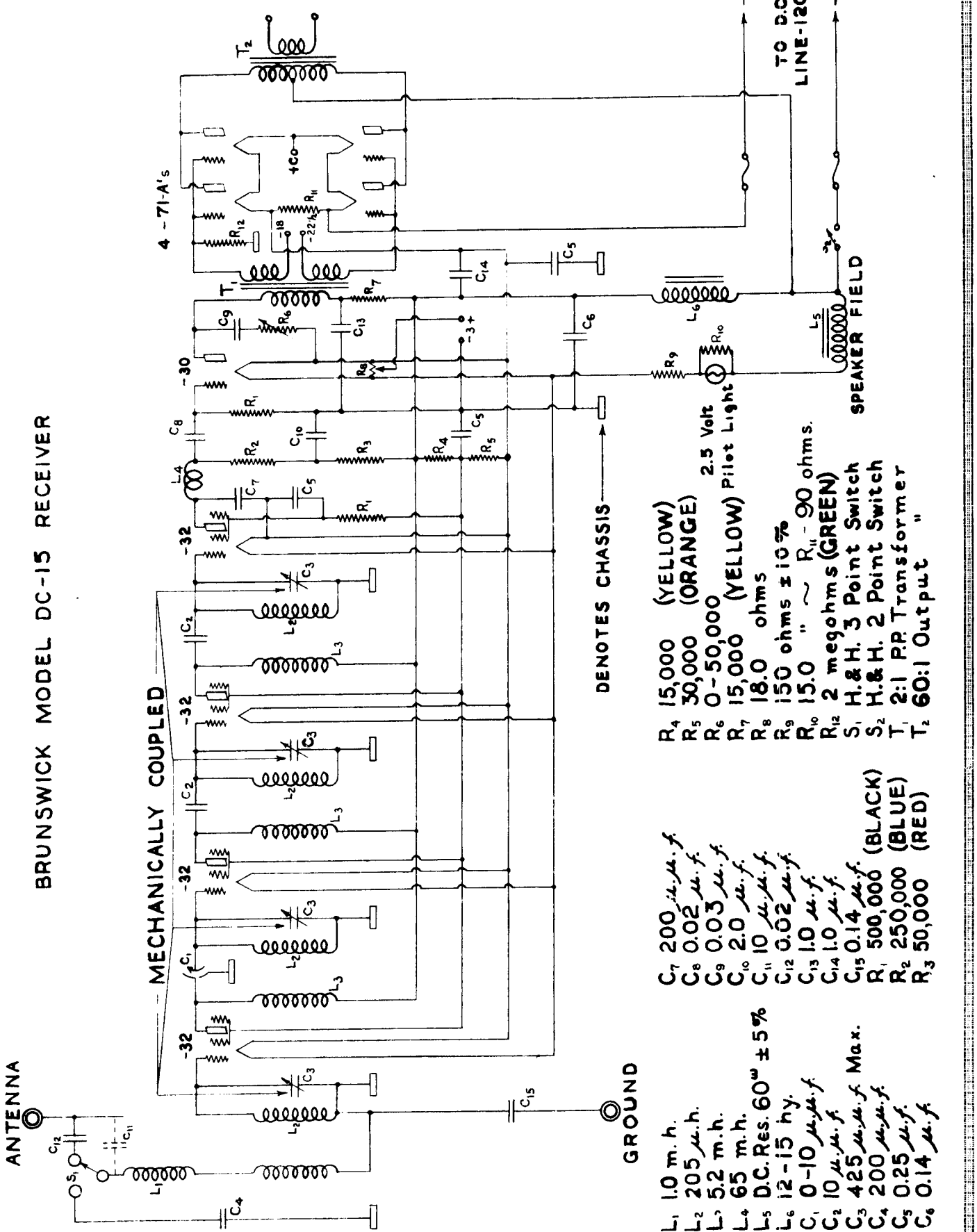
Care should be taken to use only the correct tubes in this set, as any change probably would cause an overload of the "A" supply. For this reason only tested tubes of rated characteristics should be used.

Unlike the average modern radio set, this receiver was designed for the use of a long outdoor aerial, up to a hundred feet, well elevated; though its location, and distance from the nearest broadcast station, must be controlling. It is intended for a distance-getter, having a rated sensitivity of 5 microvolts per meter, on the standard antenna.



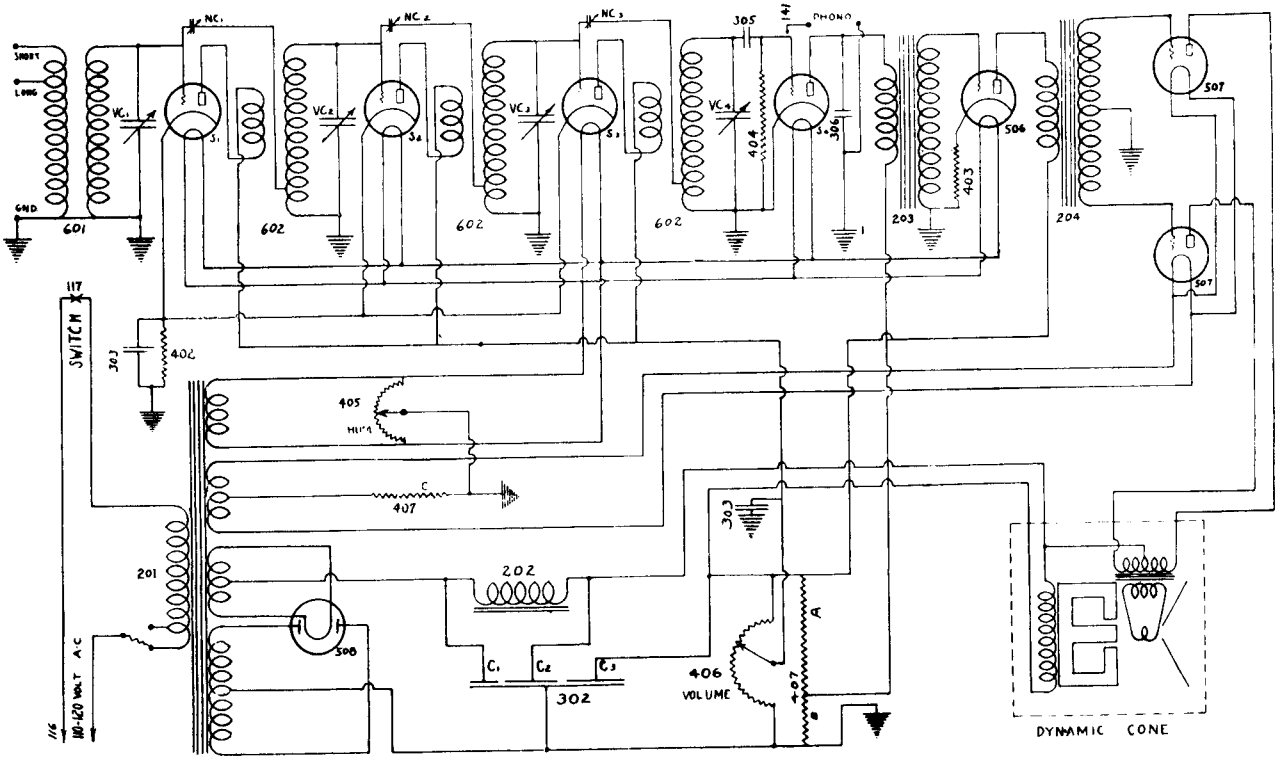
BRUNSWICK RADIO CORP.

BRUNSWICK MODEL DC-15 RECEIVER



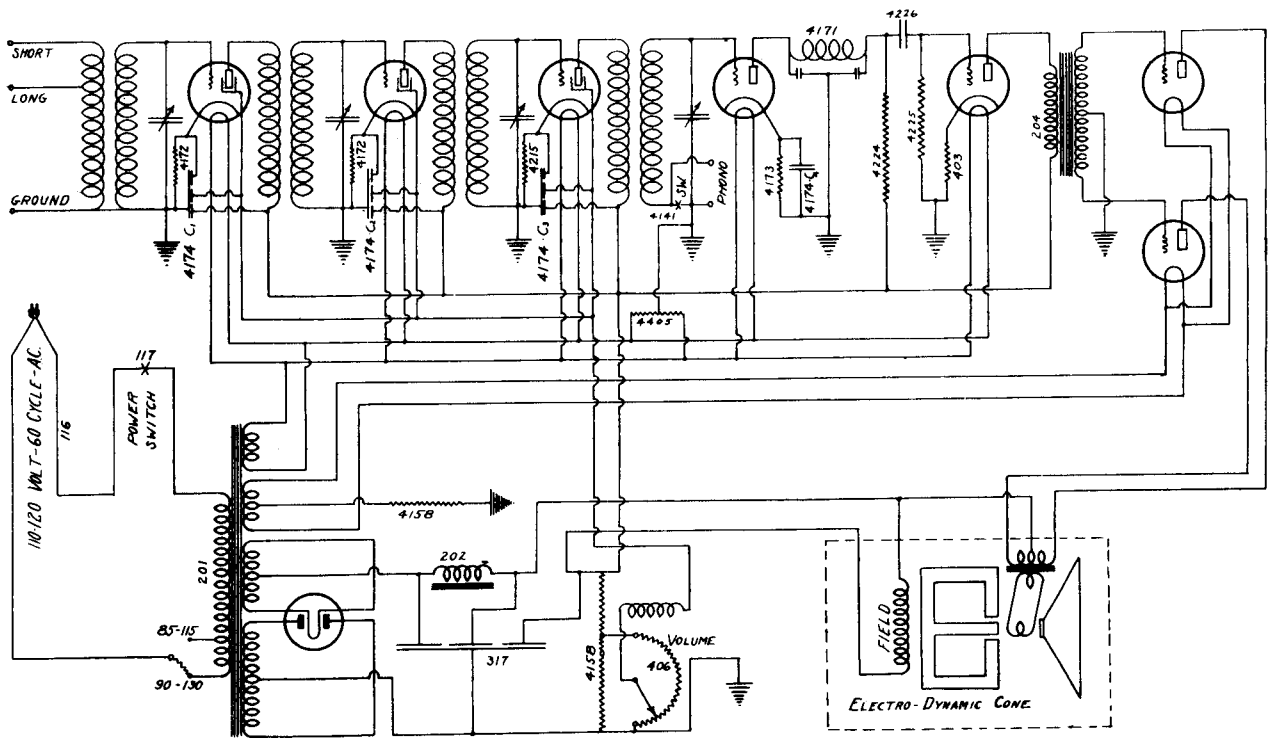
L_1 1.0 m.h.
L_2 205 μ.h.
L_3 5.2 m.h.
L_4 65 m.h.
L_5 D.C. Res. 60Ω ±5%
L_6 12-15 hy.
C_1 0-10 μμf.
C_2 10 μμf.
C_3 425 μμf. Max.
C_4 200 μμf.
C_5 0.25 μf.
C_6 0.14 μf.
C_7 200 μμf.
C_8 0.02 μf.
C_9 0.03 μf.
C_{10} 2.0 μf.
C_{11} 10 μμf.
C_{12} 0.02 μf.
C_{13} 1.0 μf.
C_{14} 1.0 μf.
C_{15} 0.14 μf.
R_1 500,000 (BLACK)
R_2 250,000 (BLUE)
R_3 50,000 (RED)
R_4 15,000 (YELLOW)
R_5 30,000 (ORANGE)
R_6 0-50,000
R_7 15,000 (YELLOW)
R_8 18.0 ohms
R_9 150 ohms ±10%
R_{10} 15.0 " ~ R_{11} - 90 ohms.
R_{12} 2 megohms (GREEN)
S_1 H.&H. 3 Point Switch
S_2 H.&H. 2 Point Switch
T_1 2:1 P.P. Transformer
T_2 60:1 Output "

BUSH AND LANE PIANO CO.



No. 10 De Luxe

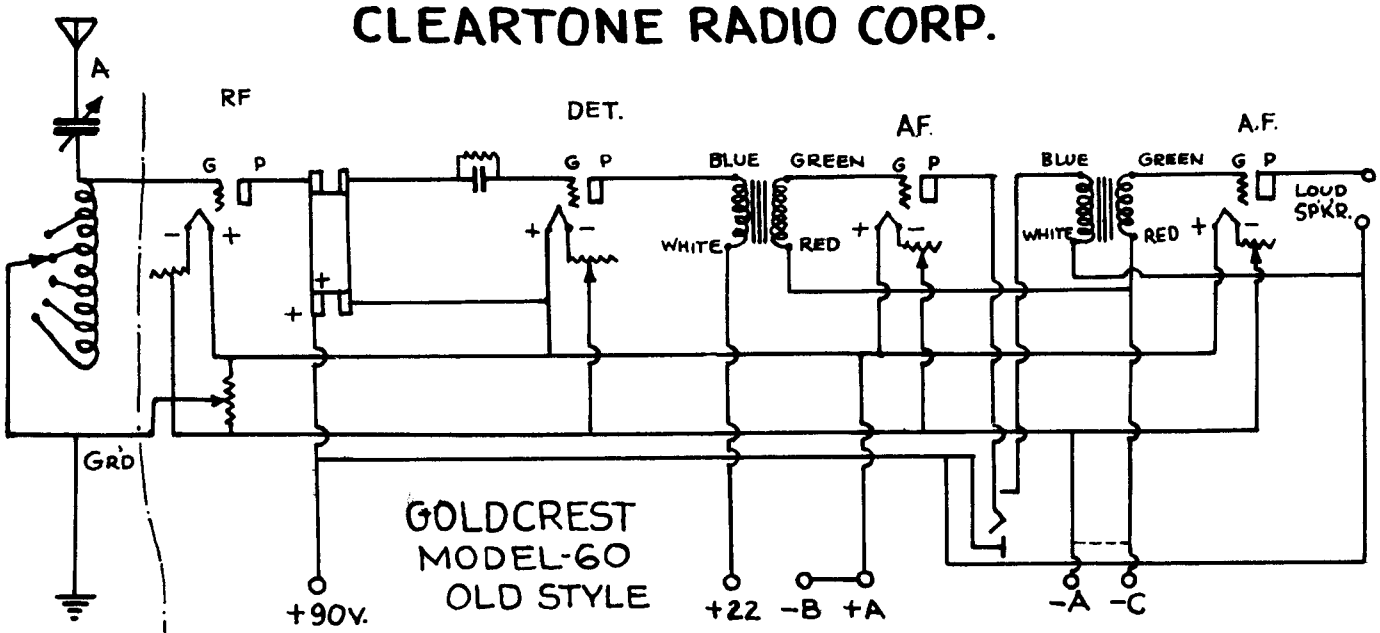
301—Four-gang Tuning Condenser.
302—Filter Condenser Block.
303—Double By-pass Condenser, ½ Mfd. and ⅛ Mfd.
305—.00025 Mfd. Grid Condenser (included with 4-socket panel also).
306—.002 Mfd. Detector Plate By-pass Condenser.
402—550 ohm Bias Resistor for the three R. F. stages.
403—1500 ohm Bias Resistor for the first audio stage.
404—Grid Leak, 2 megohms.
405—Hum Control, 20 ohm potentiometer.
406—Volume Control 10,000 ohm potentiometer.
409—Volume Control Insulating Washer, flat.
410—Volume Control Insulating Washer, extruded.
411—Volume Control Mounting Nut.
407—Voltage Divider Resistor, 5,250 ohm total.
A—3,000 ohms.
B—1,500 ohms.
C— 750 ohms.



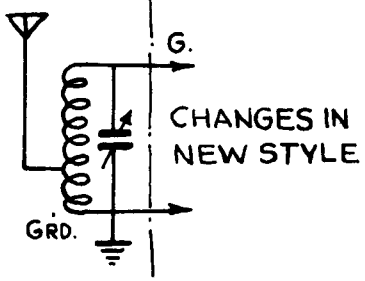
No. 12 Screen Grid

4174—Ten Section By-Pass Condenser, C1, C2, C3, C4.
4173—10,000 Ohm Detector Bias Resistor.
4215—5,000 Ohm R.F. Bias Resistor
4172—3,000 Ohm R.F. Bias Resistor } R1, R2, or R3
4175—1,500 Ohm R.F. Bias Resistor
4405—20 Ohm Center-Tapped Hum Balance Resistor.
4158—Voltage Divider Resistor 5750 Ohms, Total.
406—10,000 Ohm Volume Control.
317—Electrolytic Filter Condenser Assembly.

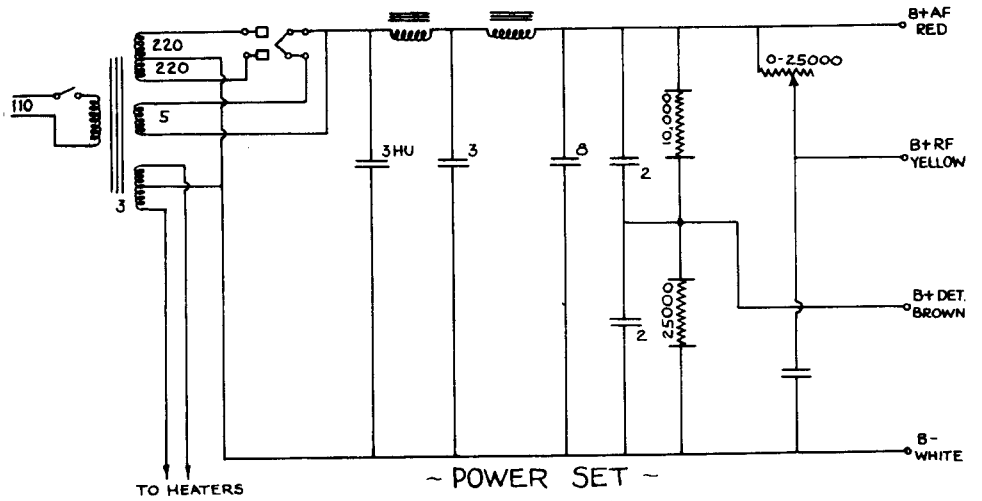
CLEARTONE RADIO CORP.



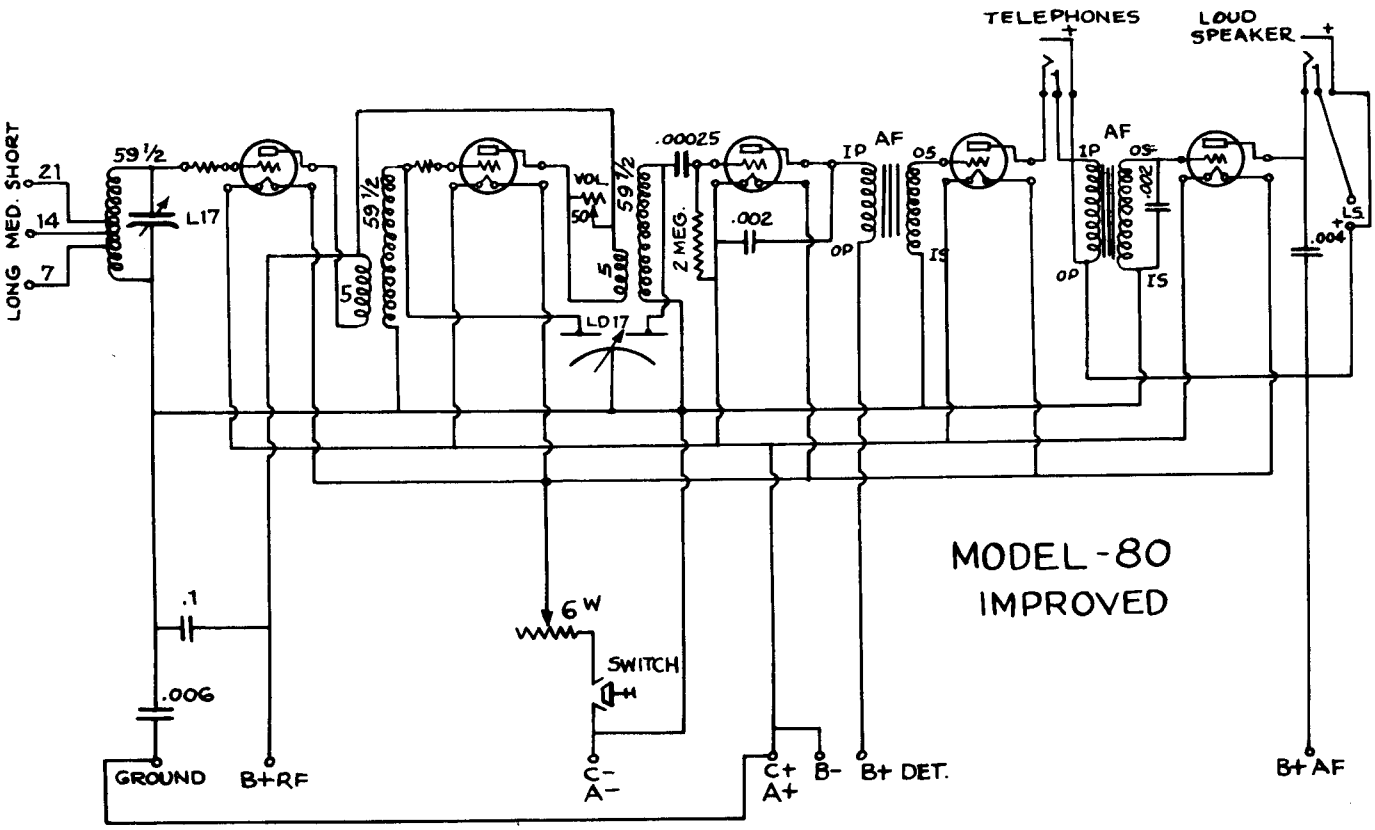
GOLDCREST
MODEL-60
OLD STYLE



CHANGES IN
NEW STYLE

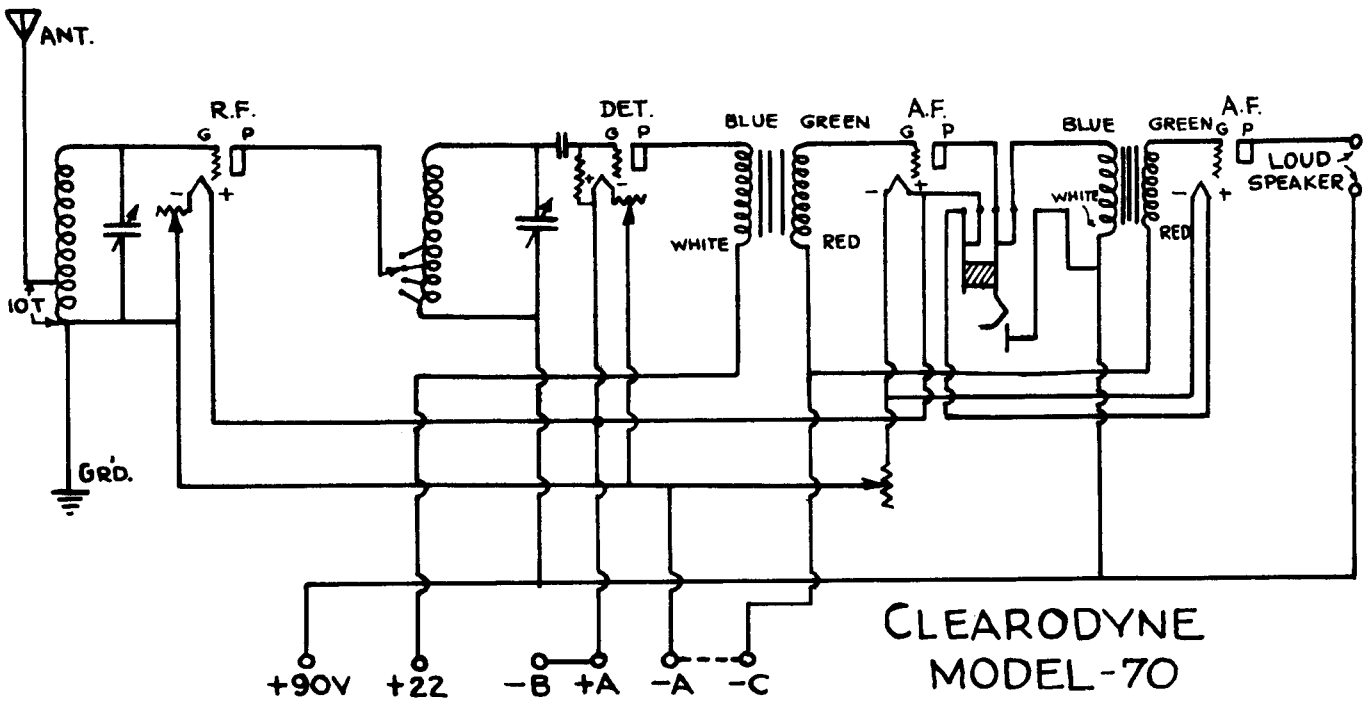


~ POWER SET ~



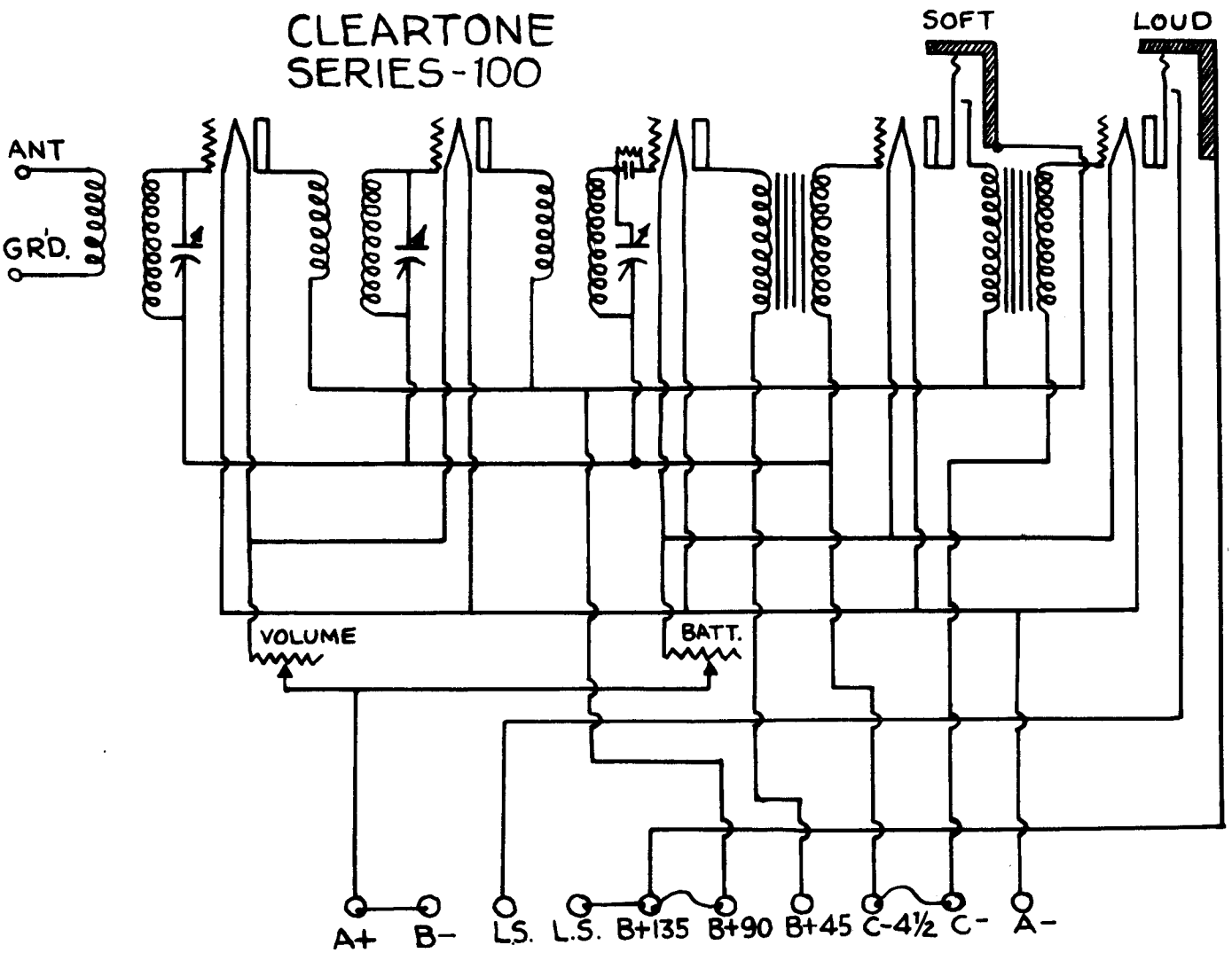
MODEL-80
IMPROVED

CLEARTONE RADIO CORP.



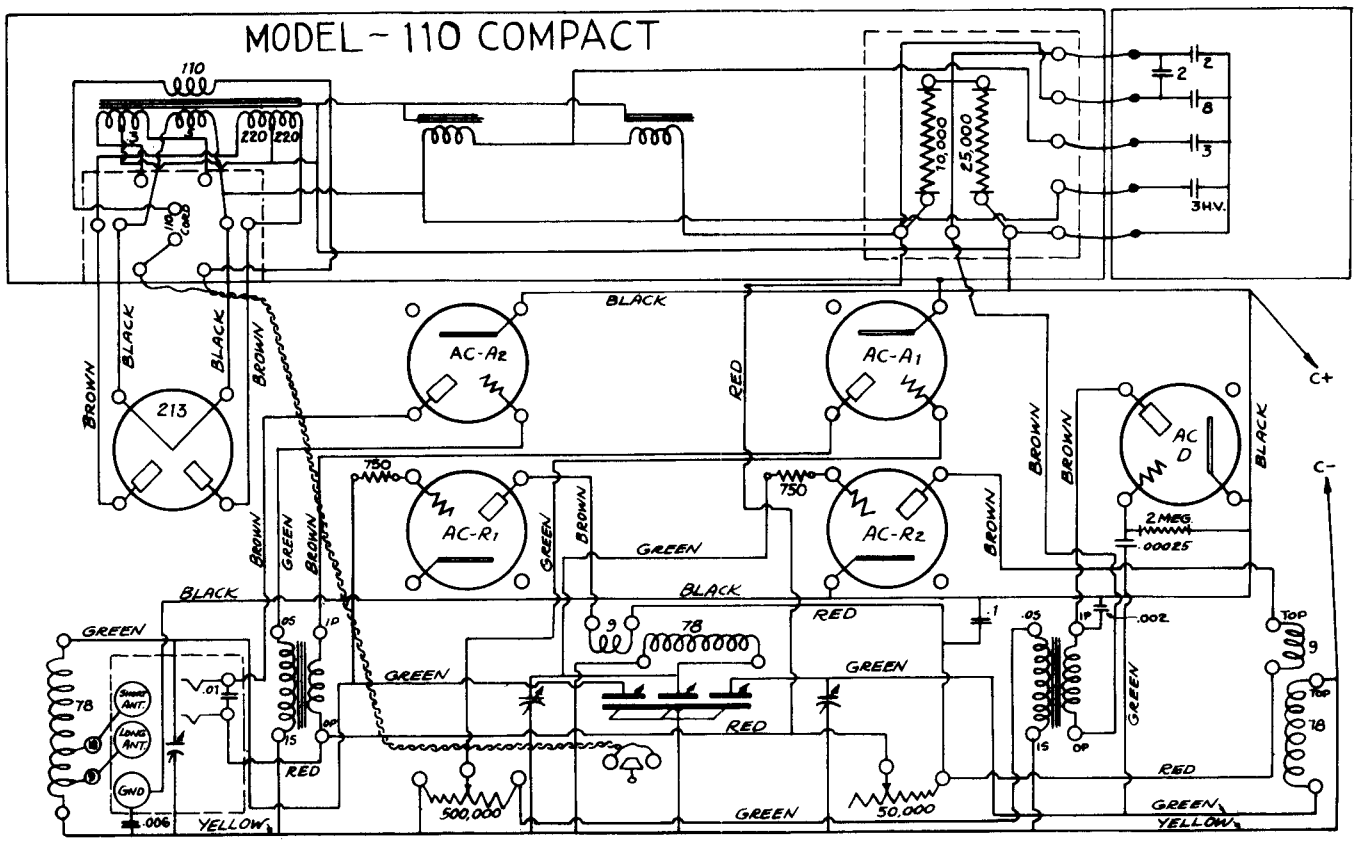
CLEARODYNE
MODEL-70

CLEARTONE SERIES-100

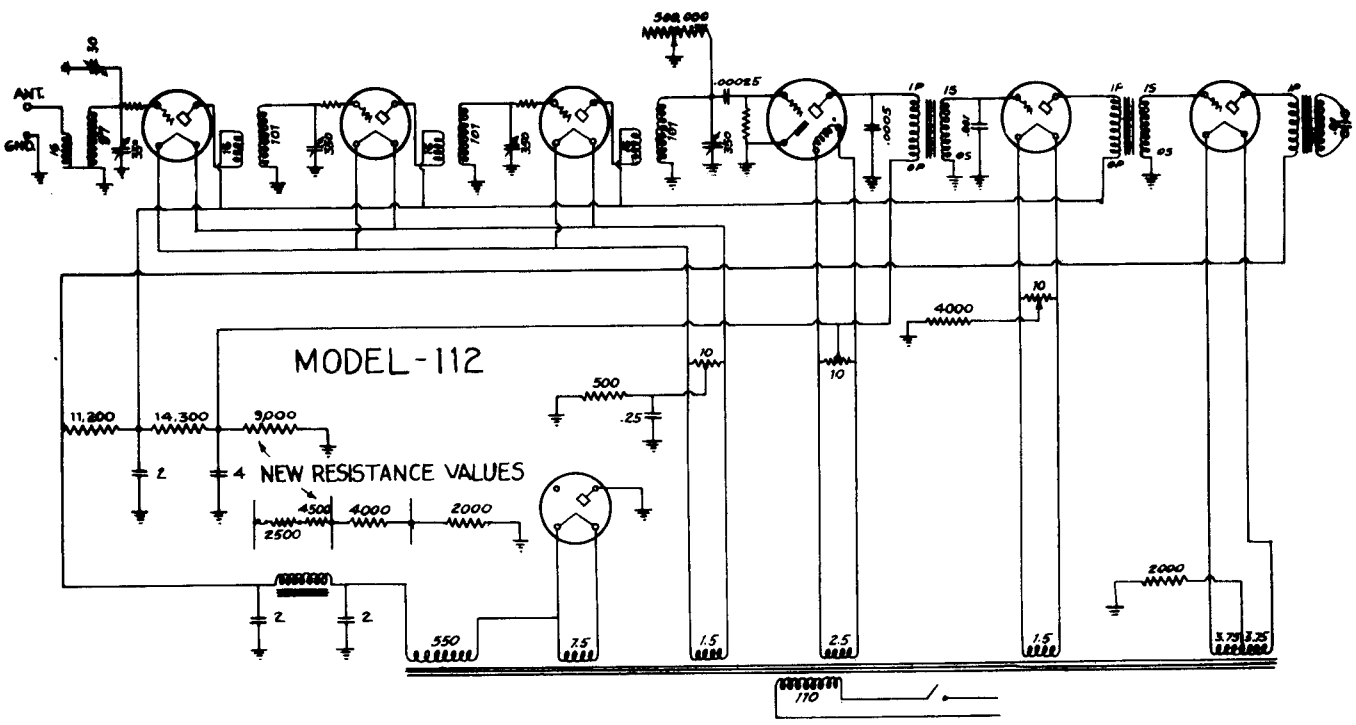


CLEARTONE RADIO CORP.

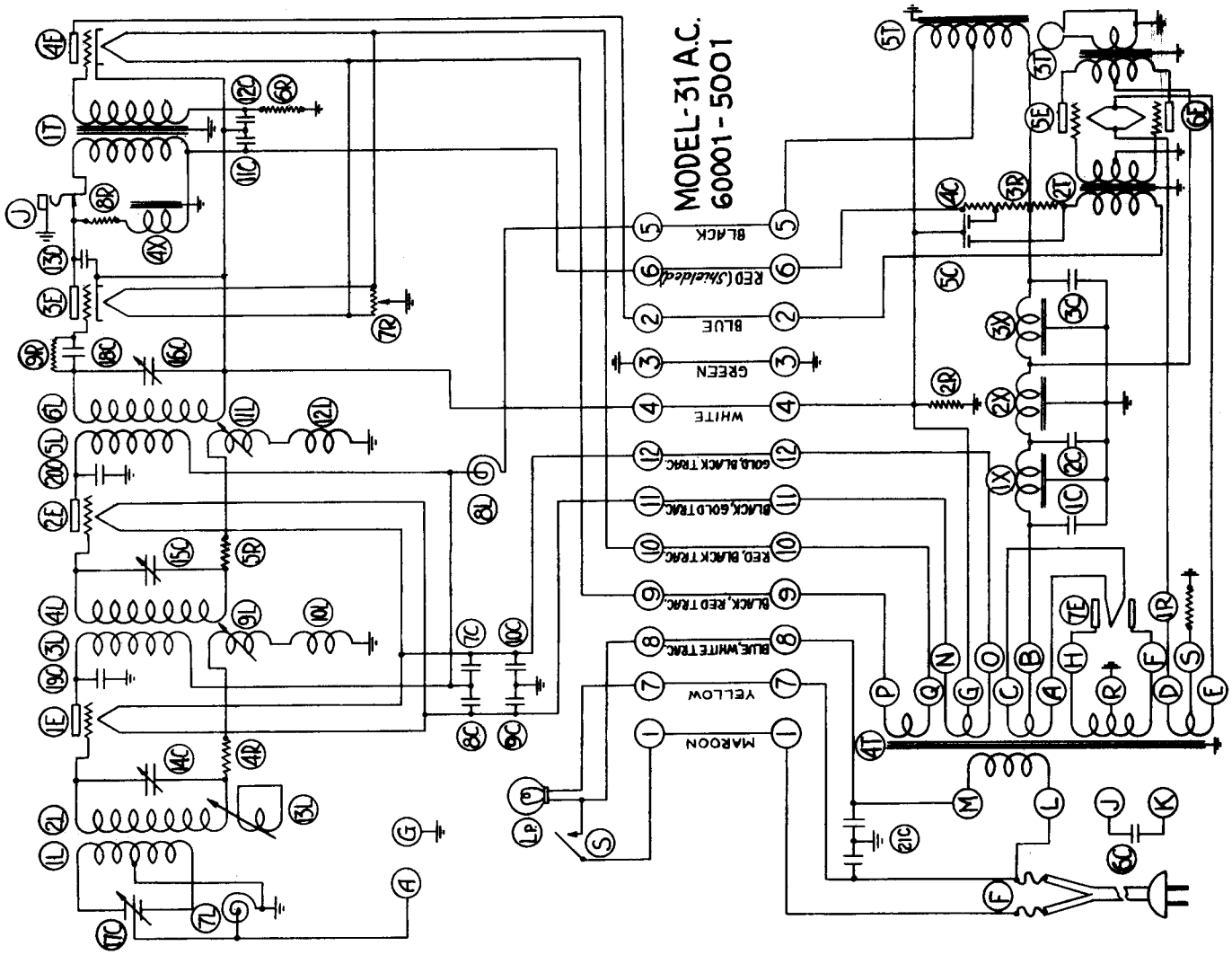
MODEL-110 COMPACT



MODEL-112



COLONIAL RADIO CORP.



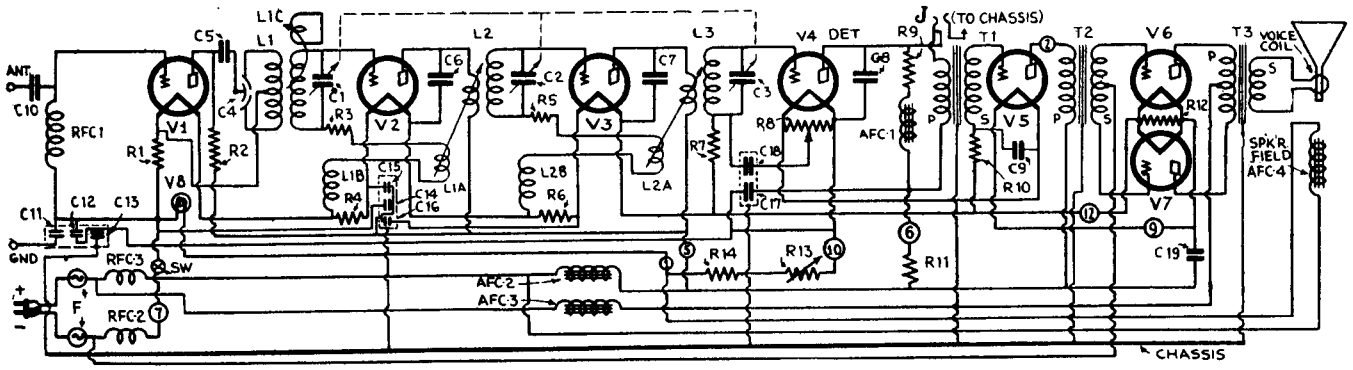
POWER UNIT WIRING

Model 31 AC 5002

CODE	COLOR	TYPE
A-$7E_3$	GREEN + YELLOW TRAC.	A CAB.
B-$1X_1$	RED	"
C-$7E_4$	MAROON	"
D-$6E_4$	GREEN	"
E-$6E_3$	BLUE	"
F-$7E_2$	YELLOW	"
G-2R	BLUE + RED TRAC.	"
H-$7E_1$	DAVIS BROWN	"
$1X_1$-1C	RED	"
$1X_2$-2C	RED + BLUE TRAC.	"
L-7	BLACK	B CAB.
M-8	WHITE	"
N-11	BLACK + GOLD TRAC.	"
O-12	GOLD + BLACK TRAC	"
P-9	BLACK + RED ' TRAC.	"
Q-10	RED + BLACK TRAC.	"
$6E_3$-$5E_3$	BLUE	JUMP.
$6E_4$-$5E_4$	GREEN	"
$1X_2$-$2X_1$	RED	"
$2X_2$-$3X_1$	RED	"
$3X_2$-3C	RED	"
S-$1R_1$	BLUE	"
R-$1R_2$	WHITE	"
2T-$6E_1$	WHITE	LEAD
2T-$5E_1$	YELLOW	"
$3T$-$5E_2$	YELLOW	LEAD
$3T$-$6E_2$	GREEN	"
$3T$-$3X_1$	RED	"
5T-4	WHITE	"
5T-5	BLACK	"
5T-3C	BROWN	"
F_2-1	BLACK	JUMP.
F_4-7	BLACK	"
2T-2	BLUE	LEAD
J-6C	BLACK	"
K-6C	BLACK	"
2R-4	WHITE	JUMP.
$3X_2$-$3R_2$	RED + WHITE 50-50	"
$3R_4$-6	RED + WHITE 50-50	"
3G-3	BARE	"

Radio Service Data Sheet

COLONIAL 31 AND 32 D.C.



Complete schematic circuit of the Colonial 31 D.C. receiver. The filament wiring is shown in simplified form below.

The Colonial "31 D.C." which has had very wide distribution, incorporates a number of unusual design features. For instance, volume is controlled by varying condenser C4; with the middle plate centered the signal is balanced out. An absorption loop (L1C) improves the tuning characteristic.

The cable color code is as follows: 7, yellow; 1, maroon; 5, black; 2, blue; 6, red; 12, gold with black tracer; 9, black with red tracer; 10 red with black tracer; 3, green; 4, 8 and 11 are not used.

V1, V2, V3, V4 and V5 are '26 tubes; V6, V7, are '71As; while V8 is a 110 V. "miniature base" 15-watt lamp.

The following parts are contained in the power pack: F, 5-amp. fuses; C19, 2-mf.; AFC2, AFC3, 1½-henry chokes; T2, A.F. push-pull input transformer; T3, A.F. push-pull output transformer; AFC4, 18-ohm reproducer field; R11 100,000 ohms; R12 9.1 ohms; R13 20-ohm power rheostat; R14 60 ohms; radio-frequency chokes RFC2 and RFC3; and the tubes V6 and V7.

Following are the constants for the receiver chassis: RFC1, R.F. choke; C5, C6, C7, C8, C10, .002-mf.; C11, C13, 0.5-mf.; C9, C12, C18, 0.1-mf.; C14, C15, C16, 0.4-mf.; C17, 1 mf.; C19, 2 mf. R1, R4, R6, 2.5 ohms; R2, R7, R10, 100,000 ohms; R3, 200 ohms; R5, 100 ohms; R8, 30-ohm potentiometer; R9, 10,000 ohms. Jack J is the connection in the plate circuit of detector tube V4 for a phonograph pickup.

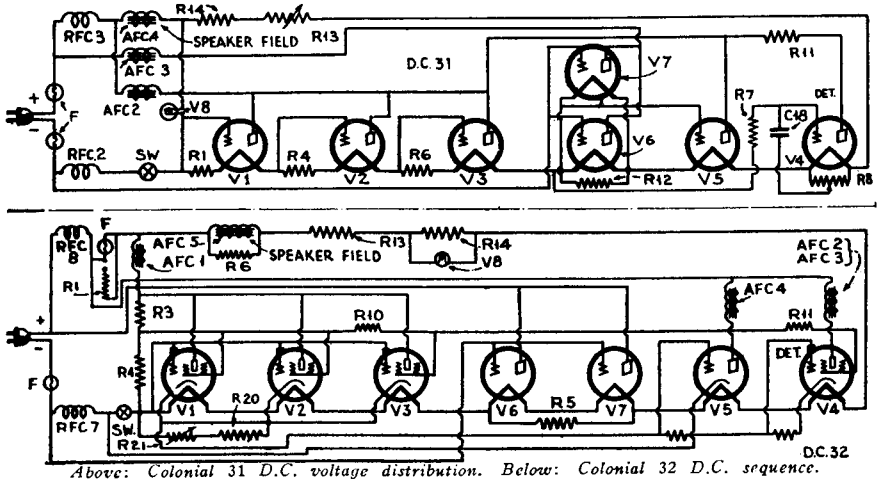
A variation of 25% from the following average operating current values is permissible: Grid potential, V1, V2, V3, V4, 3 volts; V5, 2.25 volts; V6, V7, 14 volts. Filament potential, V1, V2, V3, 1.5 volts; V4, V5, 1.4; V6, V7, 4.7 volts. Plate potential, V1, 70 volts; V2, 98 volts; V3, V6, V7, 95 volts; V4, 55 volts; V5, 85 volts. Plate current, V1, 3.5 ma.; V2, V3, 7.5 ma.; V4, 0.3-ma.; V5, 4 ma.; V6, V7, 14 ma.

The following are the values for the chassis parts of the Colonial "32 D.C." screen-grid receiver. Condensers: C1, C2, C3, C4, .00035-mf.; C5, .00025-mf.; C6, C7, C8, C9, 5 mmf.; C10, 0.2-mf.; C11, C12, C14, C15, C16, C18, C19, C21, C22, C23, C32, C33, C35, 0.1-mf.; C13, C17, C20, 0.25-mf.; C24, C25, .00025-mf.; C26, C34, 1.0 mf.; C31, .05-mf. Resistors: R2, 10,000 ohms (volume control); R3, 35,000 ohms (pink); R4, 65,000 ohms (orange); R7, R8, R9, R12, 750,000 ohms (red); R10, 10,000 ohms (blue); R11, 250,000 ohms (white); R15, 50,000 ohms (black); R20, 200 ohms (black, wire-wound); R21, 75,000 ohms.

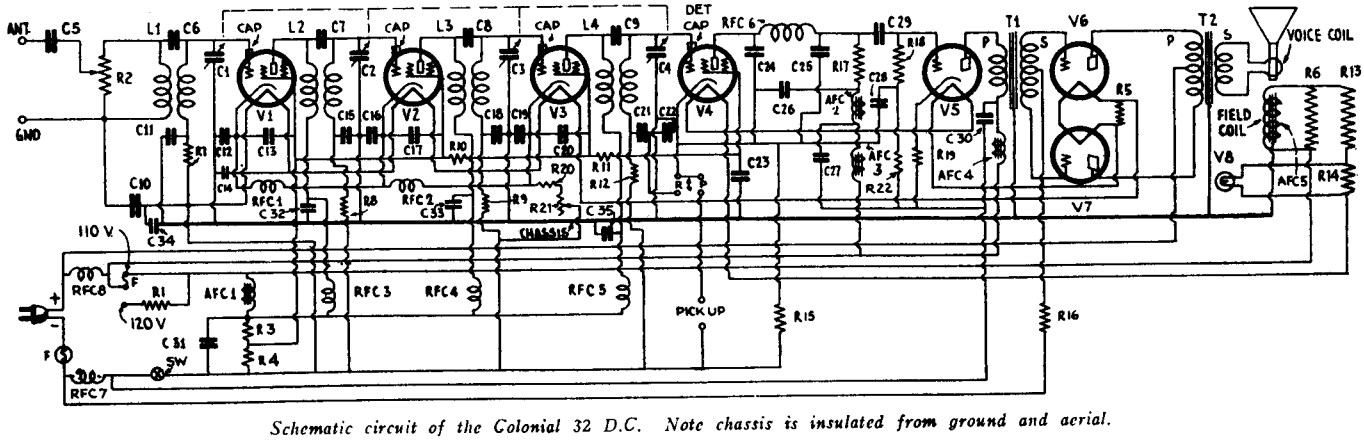
The following units are mounted in the power pack: condensers C27, 1.0 mf.; C28, C30, 0.5-mf.; C29, 0.1-mf.; resistors R1, 5.7 ohms, (vitreous); R5, 20 ohms (vitreous); R6, 200 ohms (black, wire wound); R13, 34.9 ohms ("chimney" type); R14, 1.43 ohms (vitreous); R16, 100,000 ohms (green); R17, 50,000 ohms (black); R18, R22, 100,000 ohms (green); R19, 2,000 ohms (red, wire-wound).

The chokes RFC7 and RFC8 are 930 microhenry; AFC1, AFC2, AFC3, AFC4, 50 henry; AFC5, 11.7 ohms. V8 is the pilot light. Fuses are 3- to 5-amp. rating.

The meter readings for the "Model 32 D.C." are approximately as follows: plate current, V1, V2, 1.3 ma.; V3, 1.2 ma.; V4, 0.15 ma.; V5, 3 ma.; V6, V7, 16 ma. Plate voltage, V1, V2, 91 volts; V3, 92 volts; V4, 81 volts; V5, 93 volts; V6, V7, 104 volts. Screen-grid potential, V1, V2, 32 volts; V3, 27 volts; V4, 5 volts. Control-grid potential, V1, V2, V3, V4, too low to read; V5, 2.25 volts; V6, V7, 5 volts.



Above: Colonial 31 D.C. voltage distribution. Below: Colonial 32 D.C. sequence.



Schematic circuit of the Colonial 32 D.C. Note chassis is insulated from ground and aerial.

Why not service those radio sets with fresh tubes?



IMPROVEMENTS are constantly being made in radio tubes as well as in radio sets. For the past twenty-five years, the DeForest organization has led and continues to lead in radio tube research and engineering development. What is more, those improvements and refinements are translated into everyday terms—into tubes available to you—without delay. And that's what counts from the servicing and merchandising standpoint.

Operating on a controlled production schedule rigidly geared to actual demand, the DeForest organization offers you *fresh* tubes—tubes produced a month or two ago, and not tubes piled up in big inventories and consequently without the latest improvements and refinements.

If you would know the latest technique in radio tubes and what it means in radio set operation, insist on *fresh* DeForest Audions. And for your guidance—

Here's how you can identify fresh, up-to-date tubes:

Improved Tone Quality resulting from greater rigidity and therefore minimum microphonic effects, together with suppression of distortion arising from undesirable regeneration.

Quiet Background brought about by DeForest research into causes of hum and crackle, resulting in one-fiftieth the noise level heretofore considered standard, together with lower gas content made possible by unique DeForest exhaust units now in use.

Positive Characteristics because of the doubling of the diameter of some support wires and better bracing and spacing, together with tightened electrical characteristic tolerances.

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Quick Heating averaging about 10 seconds for the 427 and the 424 types, due to patented DeForest notched cathode insulator, without sacrificing life, reliability or quiet operation.

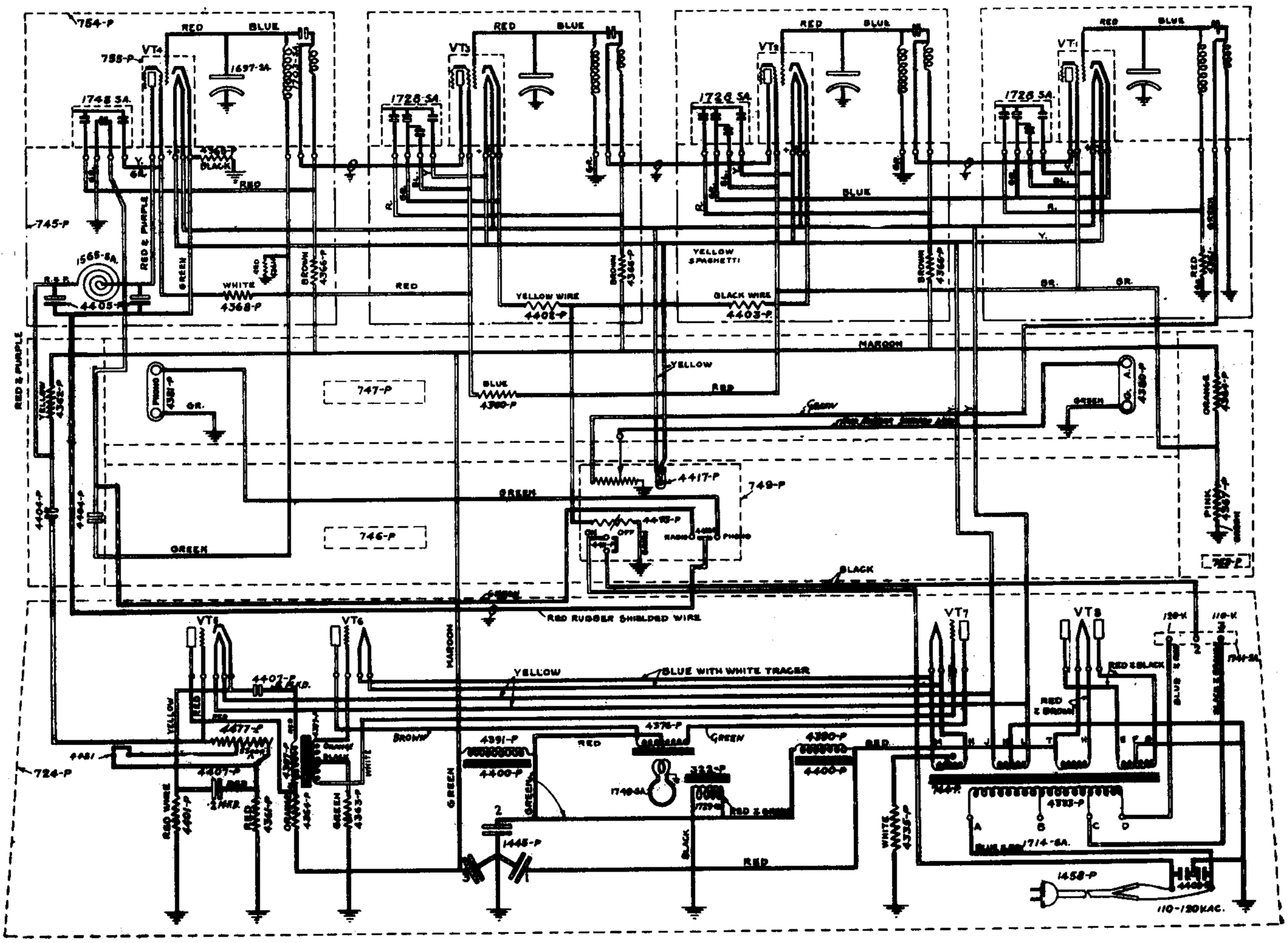
Higher R.F. Amplification due to the latest DeForest 424 H.G. (High-Gain) Audion, or 60 instead of usual 30 per stage, ideal for midget sets. Also, more uniform grid-plate capacity permits of maximum stability or minimum regeneration for highest gain without distortion.

And after all, fellows, there's no substitute for 25 years' experience!

DE FOREST RADIO COMPANY :: PASSAIC, N. J.

de Forest (AUDIONS) RADIO TUBES

COLONIAL RADIO CORP.



MODEL 32A.C. 100001-Issue-J

Part No	Value	
4473—P	10,000 ohms	Volume control
4367—P	35,000	Pink
4364—P	65,000	Orange
4361—P	750,000	Red
4366—P	35,000	Brown
4366—P	35,000	Brown
4366—P	35,000	Brown
4402—P	400	Yellow wire wound resistor.
4403—P	200	Black wire wound resistor.
4473—P	75,000	Volume control.
4360—P	10,000	Blue
4368—P	250,000	White
4361—P	750,000	Red
4365—P	50,000	Black
4362—P	400,000	Yellow
4364—P	65,000	Orange
4361—P	750,000	Red
4401—P	2,000	Red wire wound resistor.
4477—P	80,000	
4363—P	100,000	Green
4335—P	1,000	White—mounted on power transformer

	0.000005 mfd.	Built into R.F. transformer.
1728—SA	0.1	Green lead
1728—SA (1st R.F. compartment)	0.1	Red lead
1728—SA (1st & 2nd R.F. compartments)	0.25	Brown lead
1728—SA (3rd R.F. compartment)	0.25	Brown lead
1748—SA	0.1	Yellow lead
1728—SA (2nd R.F. compartment)	0.1	Red lead
1728—SA (3rd R.F. compartment)	0.1	Red lead
1748—SA	0.1	Red lead
1697—SA	0.00035	Tuning condenser
4404—P	0.1	
1748—SA	0.5	Green leads
4405—P	0.00025	
4404—P	0.1	
4407—P	0.2	
4407—P	0.5	
1445—P	8	Mershon condenser
4409—P	0.1	



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to the SERVICE MAN

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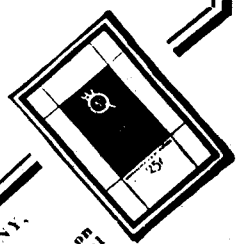
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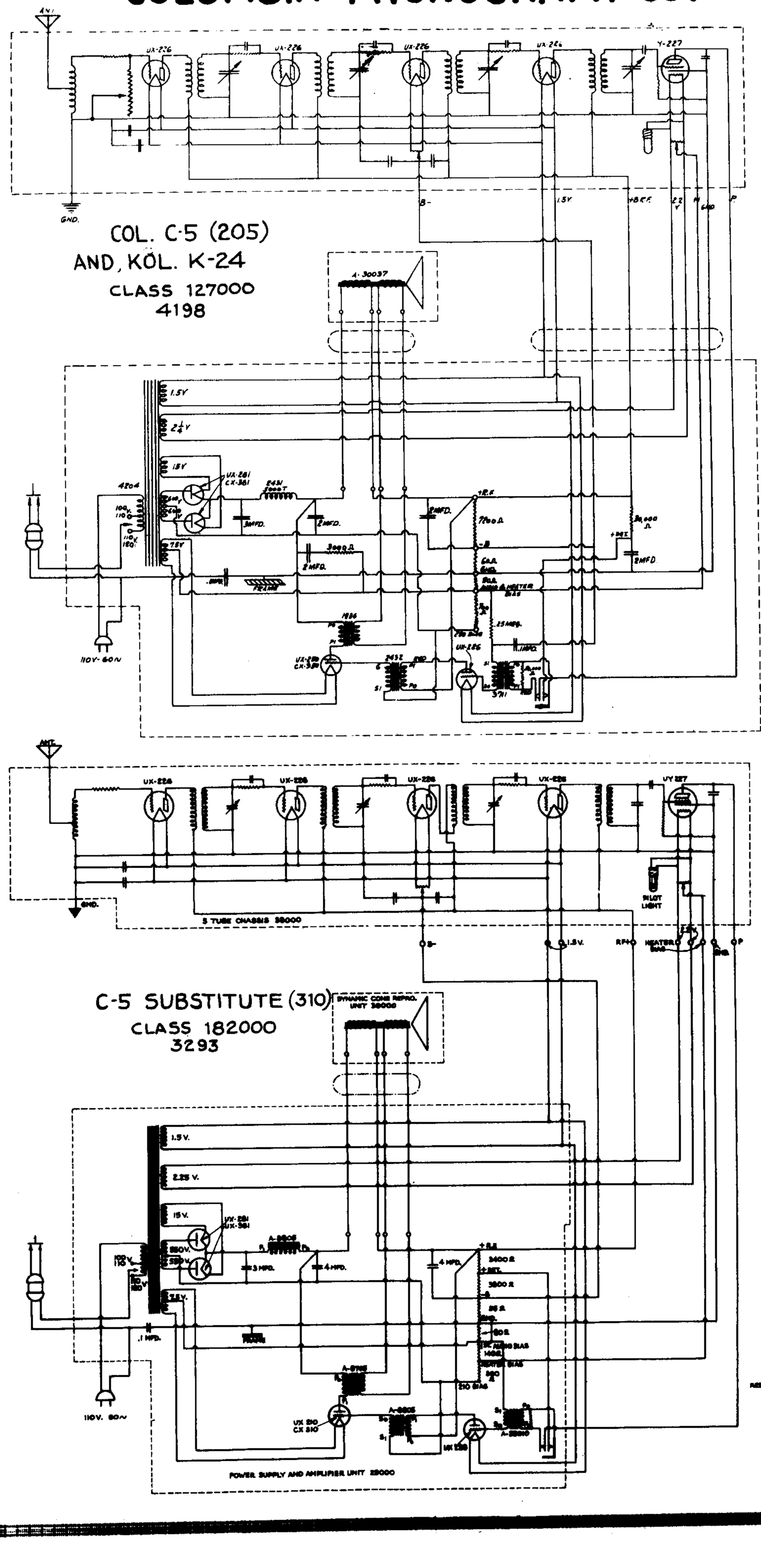


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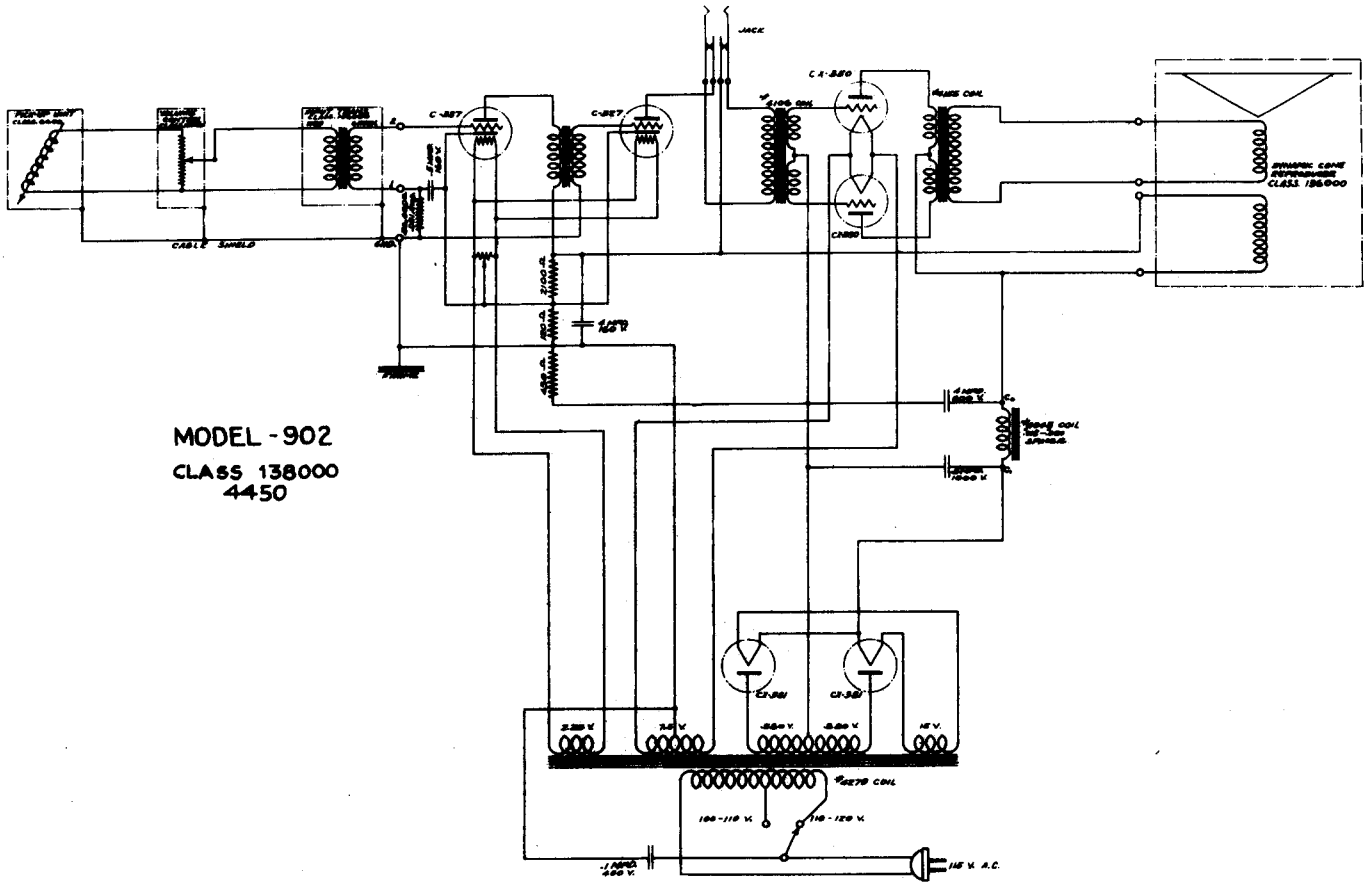
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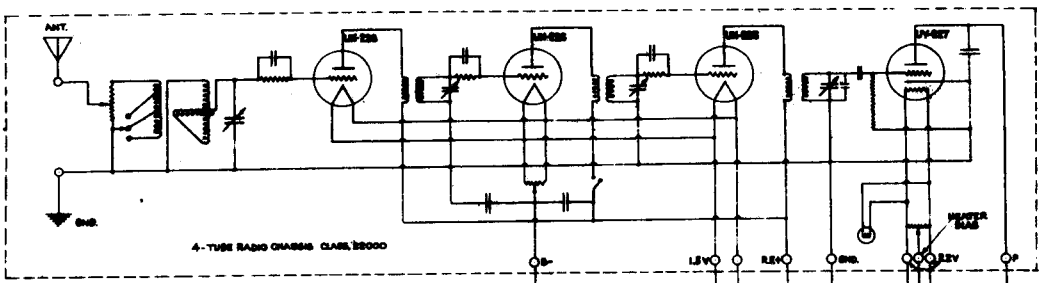
COLUMBIA PHONOGRAPH CO.



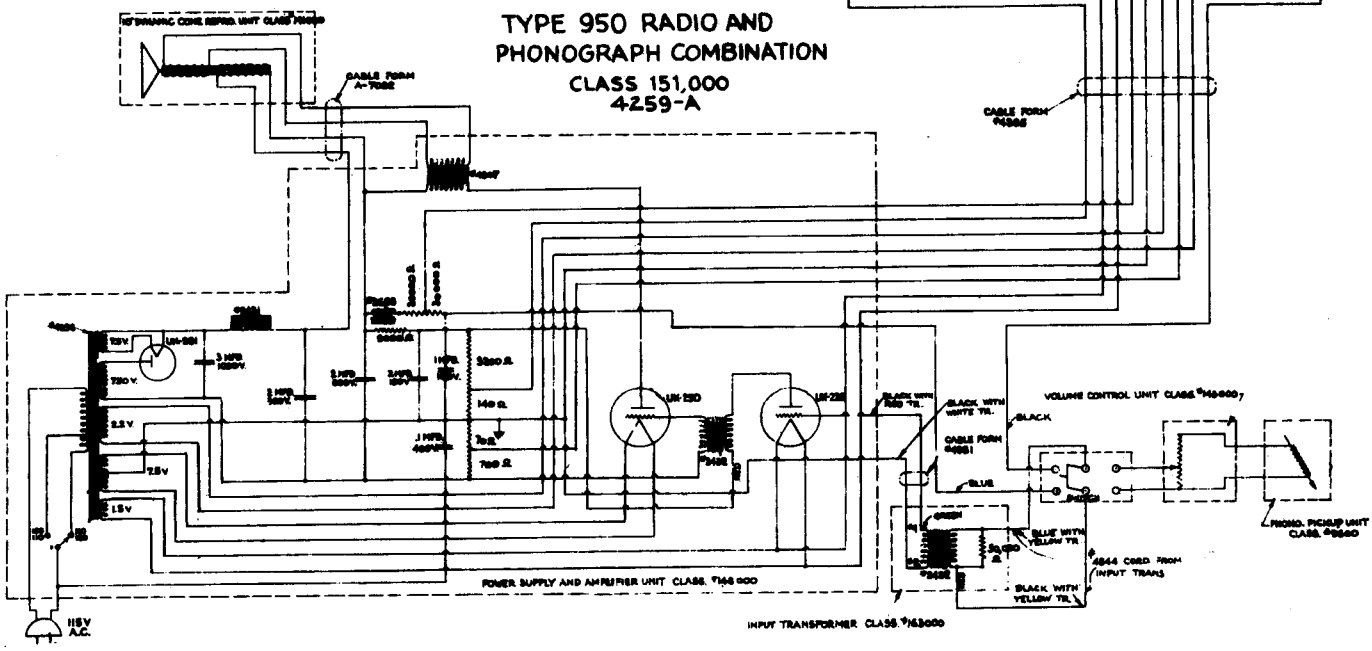
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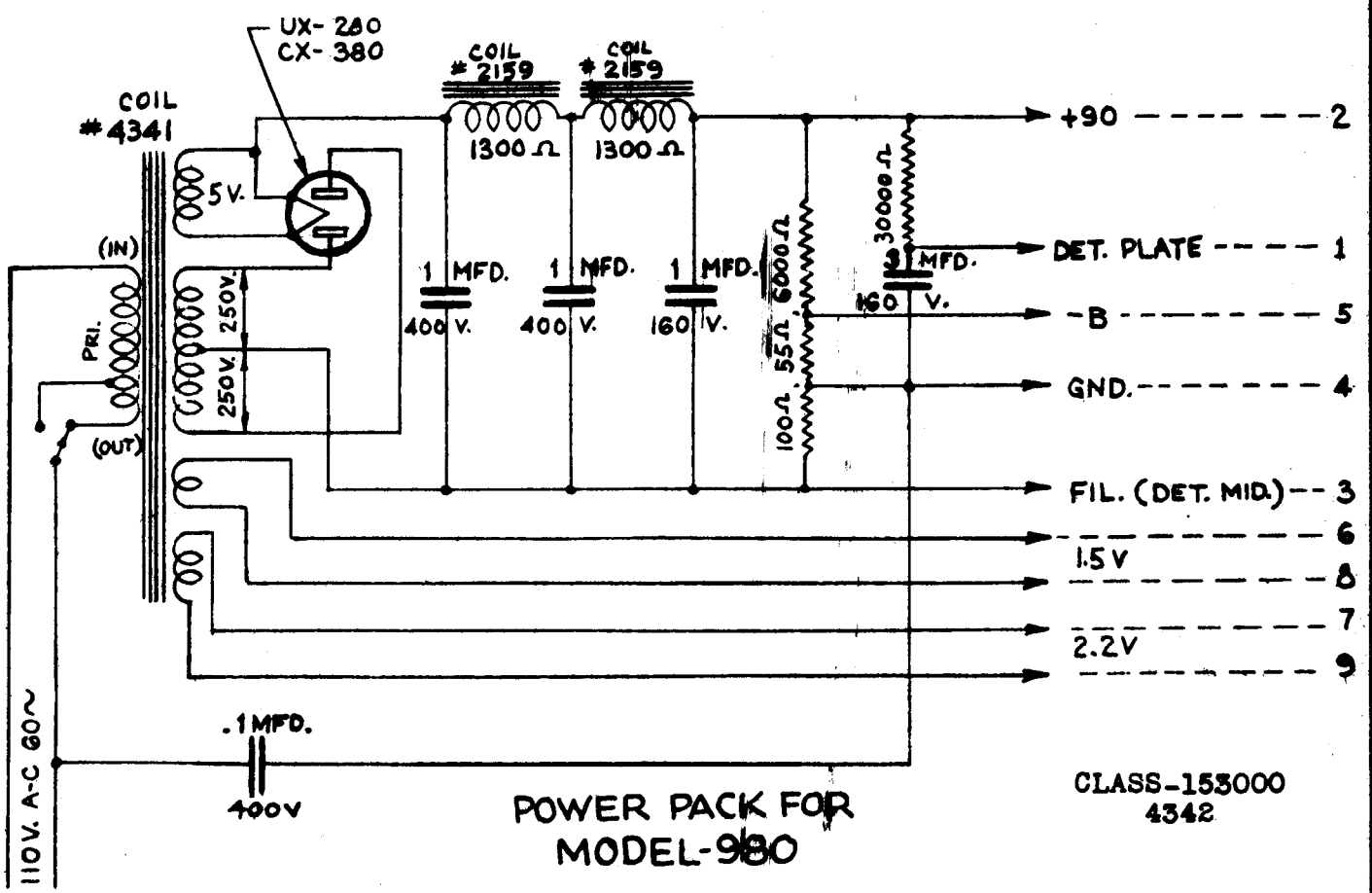
MODEL - 902
CLASS 138000
4450



TYPE 950 RADIO AND
PHONOGRAPH COMBINATION
CLASS 151,000
4259-A

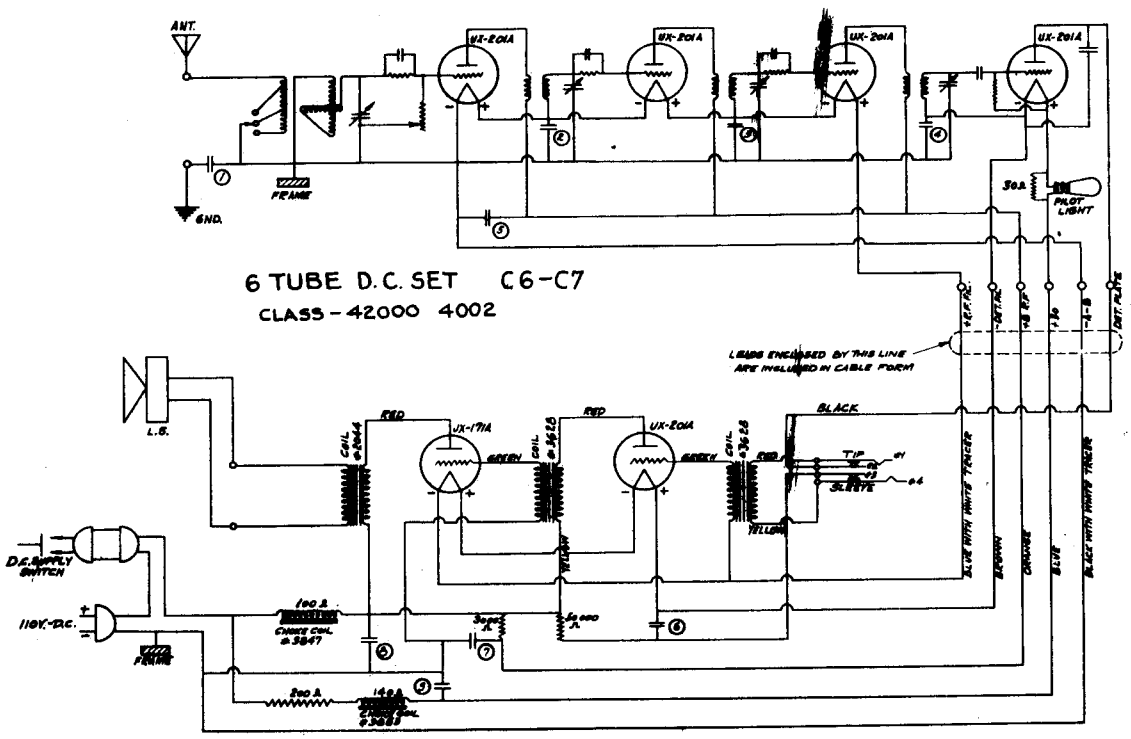


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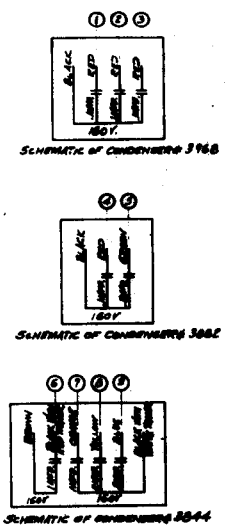


POWER PACK FOR MODEL-980

CLASS-153000 4342

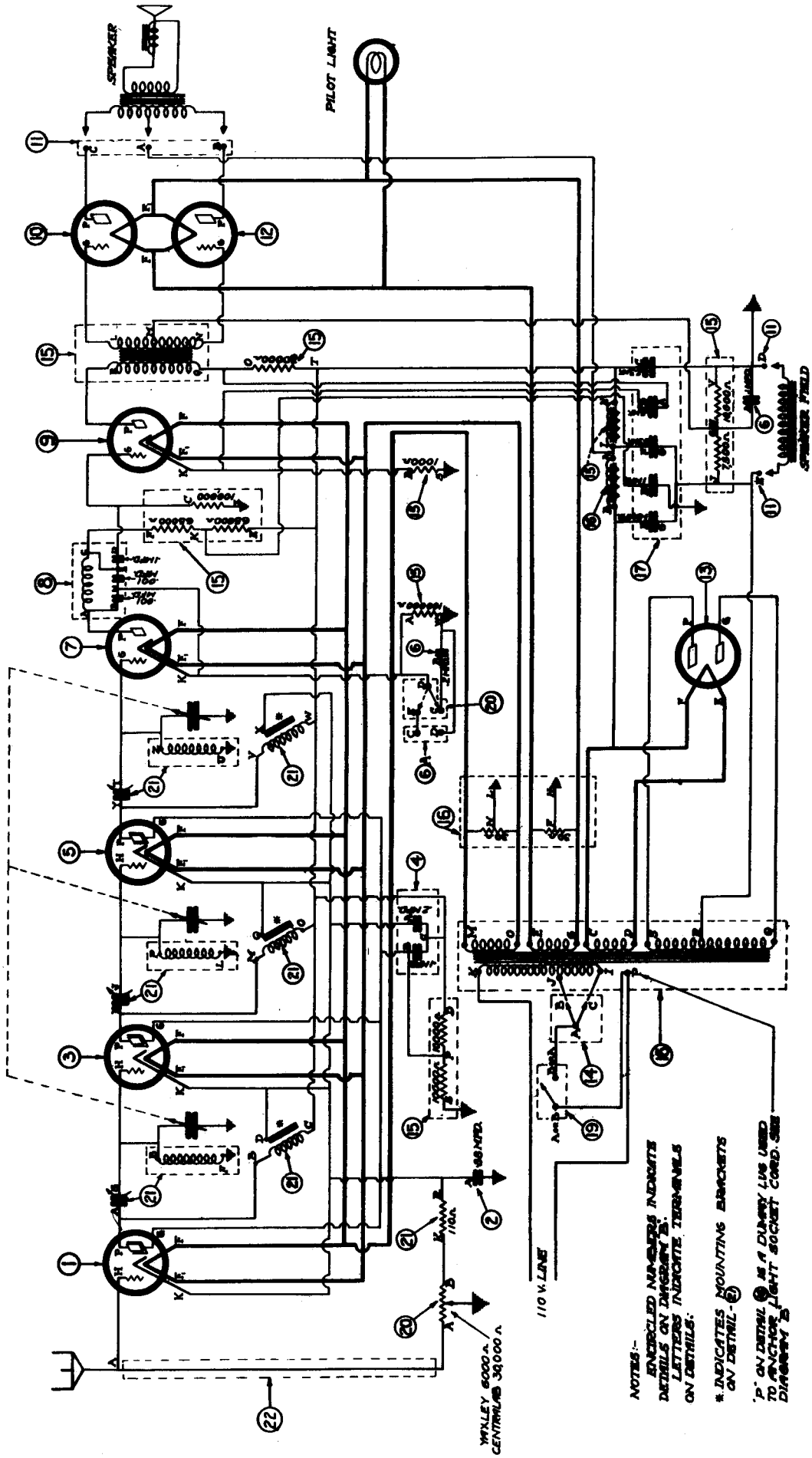


6 TUBE D.C. SET C6-C7
CLASS-42000 4002

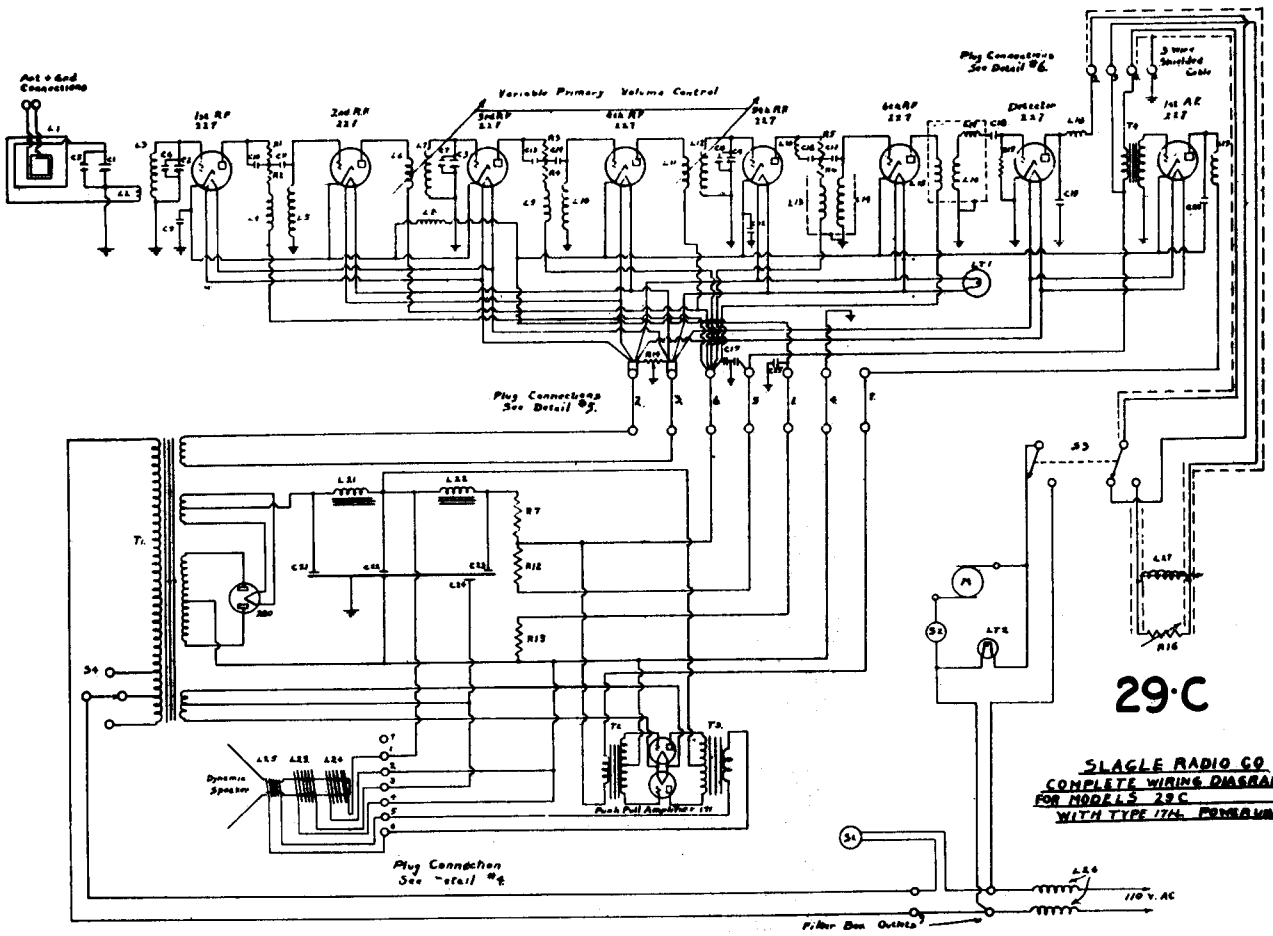


COLUMBIA RADIO CORP.

COLUMBIA SCREEN GRID-8

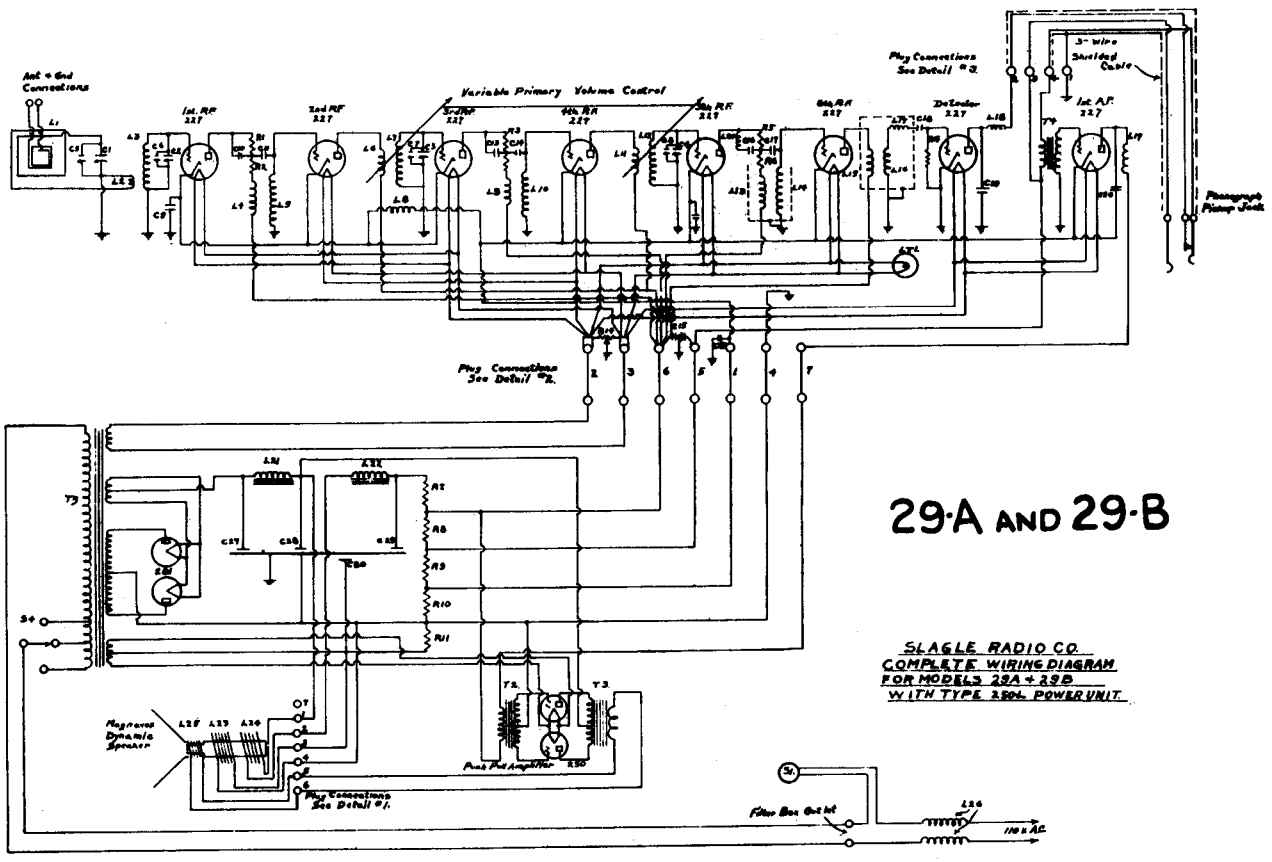


CONTINENTAL RADIO CORP.



29-C

SLAGLE RADIO CO
COMPLETE WIRING DIAGRAM
FOR MODELS 29C
WITH TYPE 17/4 POWER UNIT

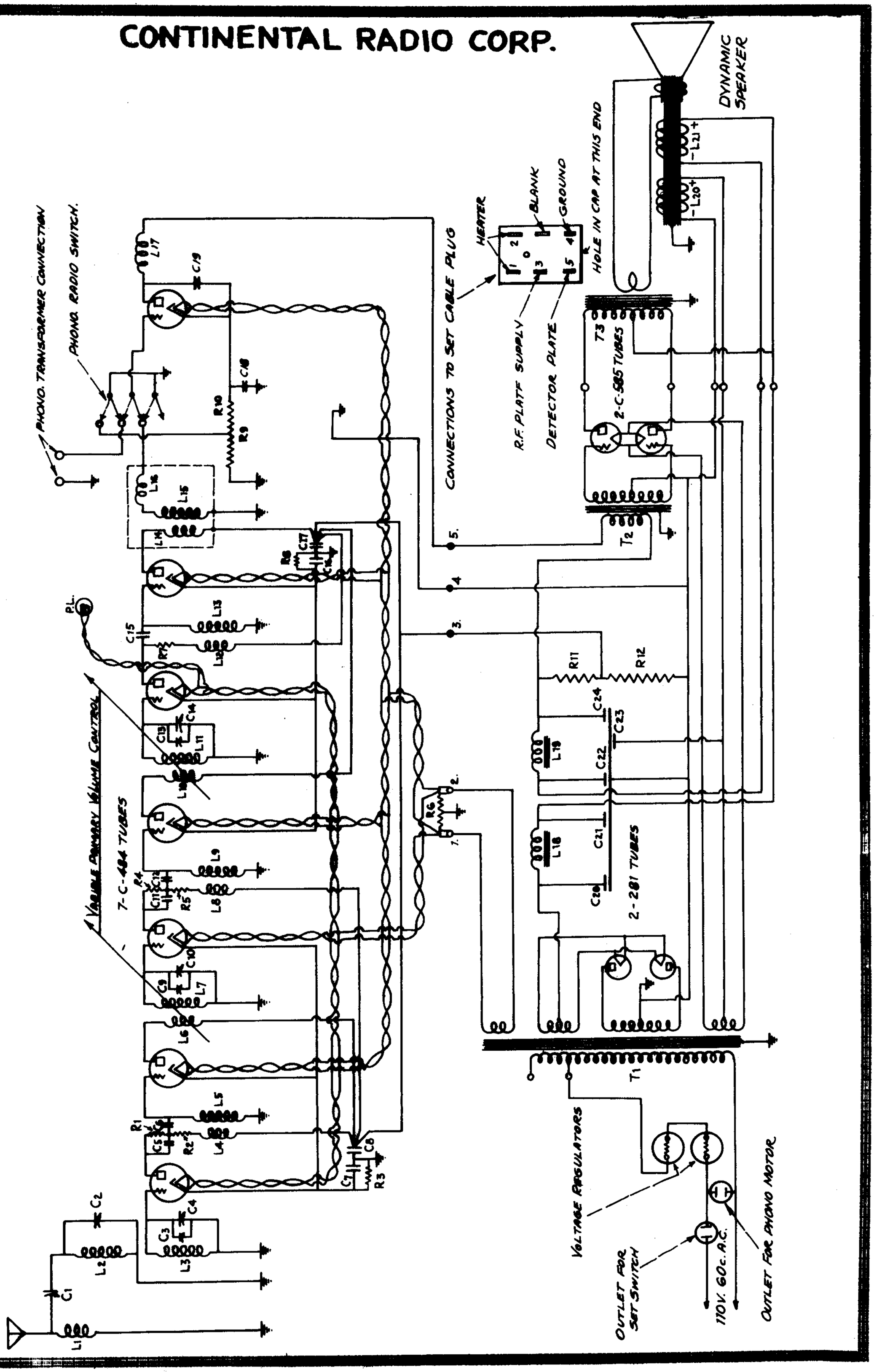


29-A AND 29-B

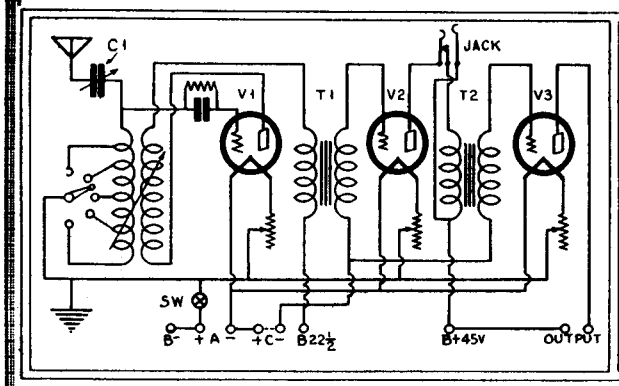
SLAGLE RADIO CO.
COMPLETE WIRING DIAGRAM
FOR MODELS 29A + 29B
WITH TYPE 250L POWER UNIT

CONTINENTAL RADIO CORP.

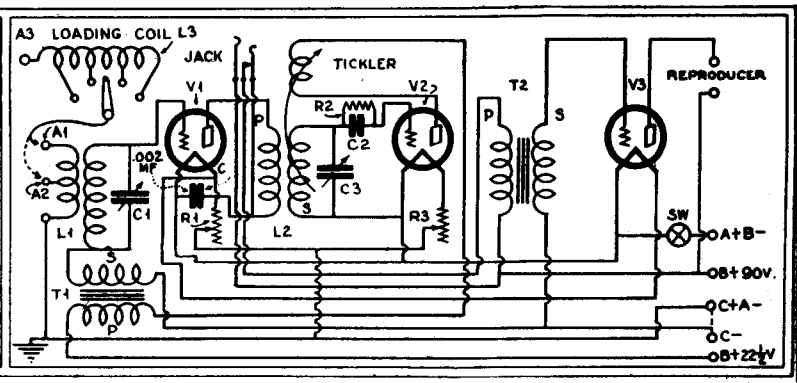
~ ALL MODELS ~



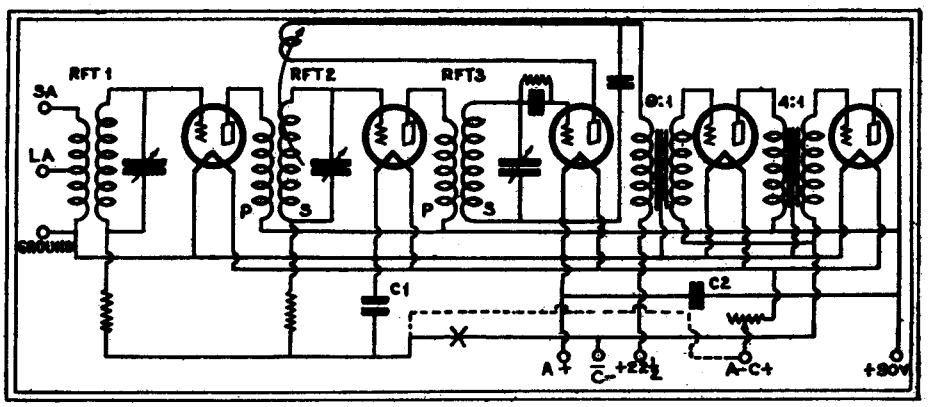
CROSLEY RADIO CORP.



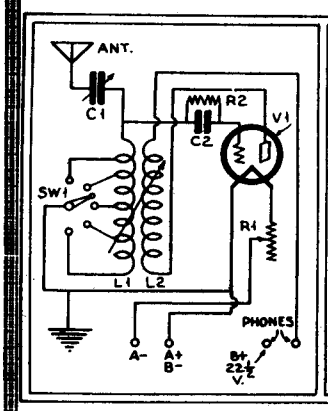
Above, the schematic of the Crosley "Model 3B" and 3C," which, like the "Type V," uses a variocoupler in the two-circuit regenerative detector stage.



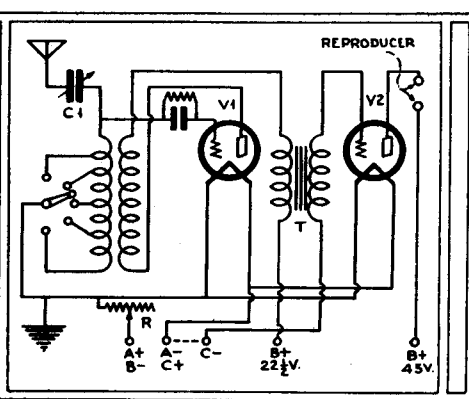
The famous Crosley "Trirdyn" (Model 3R3) which incorporates a reflexed stage of R.F. and first A.F. Unlike earlier models, this receiver used a condenser with meshing rotor plates.



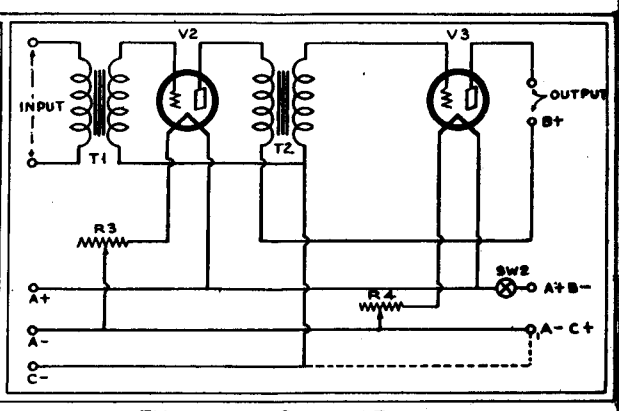
The Crosley "5-38" tuned radio-frequency receiver, battery model, at one time a very popular receiver, obtained exceptional sensitivity by the use of controlled regeneration. Feed-back was obtained through RFT2, instead of RFT3, as with most regenerative circuits. Dotted lines indicate the grid returns of early-production models of the set wherein a "C" battery was not used.



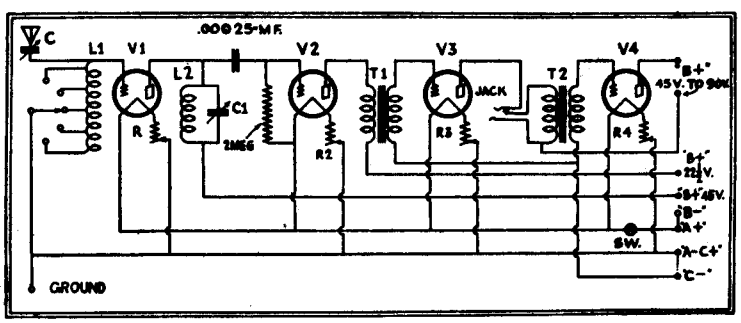
The single-tube Crosley "Type V"; the red tickler lead runs to the plate of the tube.



The Crosley two-tube "Model 51," in which there is a "C" lead for the single stage of A.F. amplification. Replacing C1 with a .0005-mf. condenser will increase the tuning range.

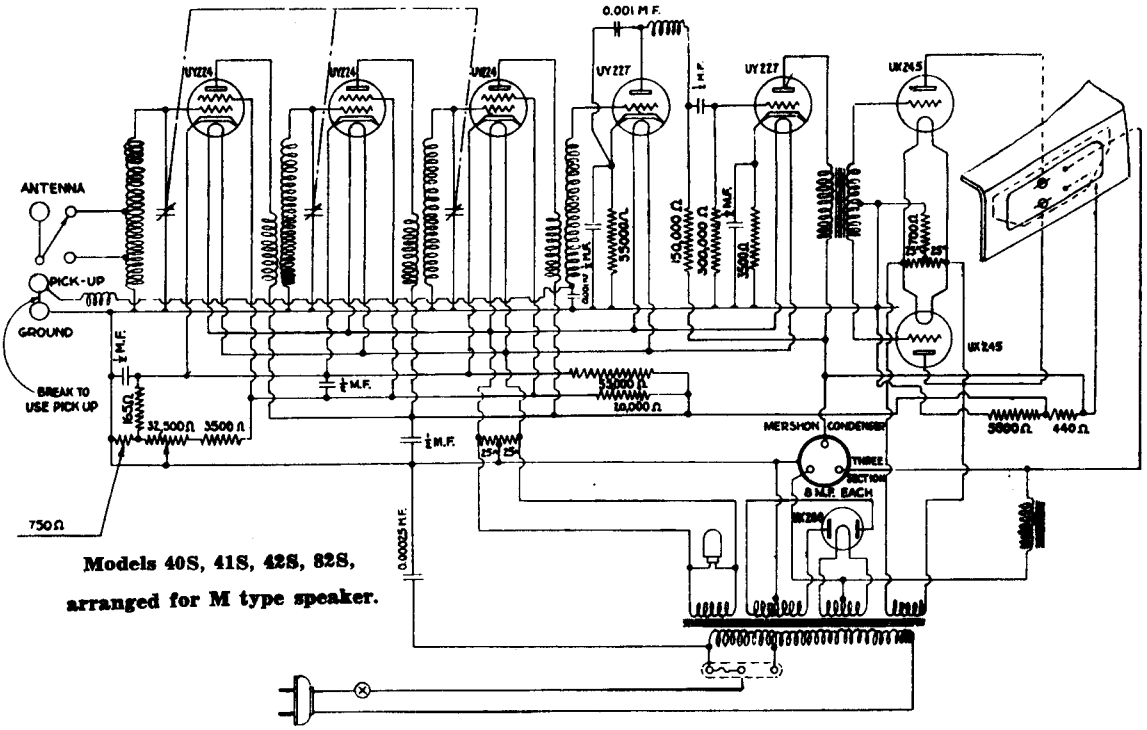


This two-stage Crosley A.F. amplifier was designed for use with the single-tube "Type V" tuner diagrammed at the left. The "B—22½" double post of the tuner affords a connection with the battery and across the primary of T1.

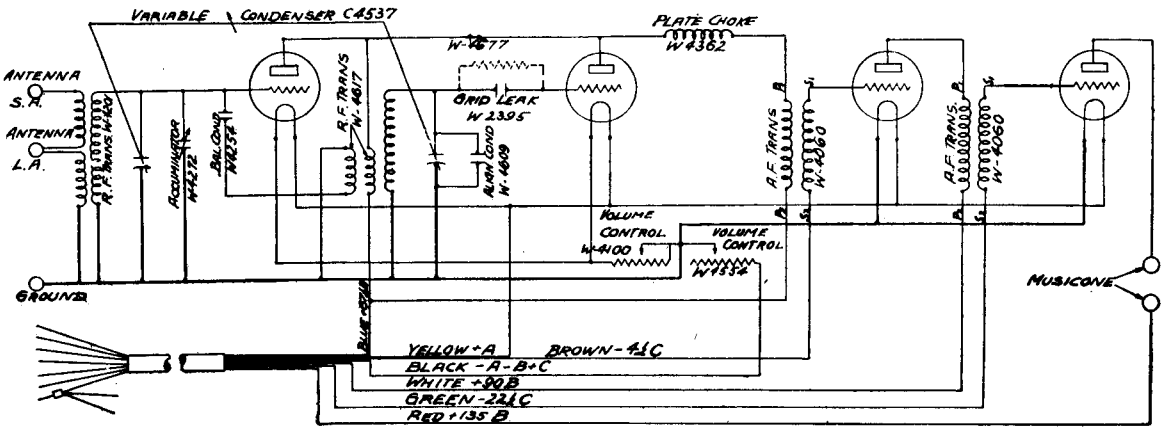


In the Crosley "Model XI" (and "XL") a stage of impedance-coupled R.F. amplification precedes the non-regenerative detector. Note that the antenna coupler L1 is without the adjustable coupler of previous models.

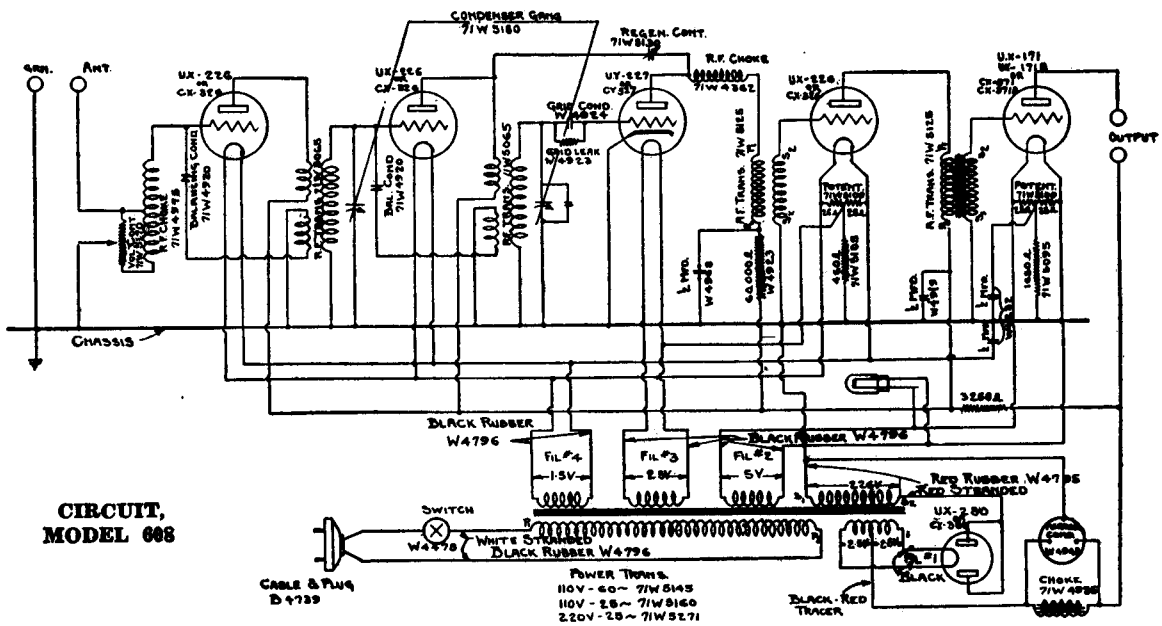
CROSLEY RADIO CORP.



Models 40S, 41S, 42S, 82S, arranged for M type speaker.



CIRCUIT, MODEL 401



CIRCUIT, MODEL 608

Radio Service Data Sheets

CROSLEY MODEL 601

The circuit used in this receiver incorporates the Hazeltine neutralization system. Tubes V1 to V5 are '01As; V6 may be either a '12A or '71A, the latter being preferable. To take chassis from "can," remove the three knobs; remove the escutcheon by taking out the drive screws; remove two cap screws in front and two in rear, using socket wrench or pliers; raise rear of case until it clears coil shields; then slide the case forward until it clears the shafts of the tuning controls; and lift off. A total antenna-and-lead-in length of 50 to 100 feet is recommended, except where a shorter length reduces interference. For best results, ground must be connected to only one point, the ground binding post. Connection to the "A" battery may result in burning out a resistor; if set is being tested in the service shop, care must be taken that *only one ground connection is made to the set.* Study of the schematic circuit will show why this is necessary. The volume control regulates the filament current of the first three tubes; the "acuminators," or trimming condensers, resonate the secondary circuits of V2, and V3; the variable capacity in shunt with the tuning capacity in the grid circuit of V4 is an "aligning" condenser which is adjusted at the factory and has no panel control. To balance receiver, leave bottom attached, balancing with case on or off. Tune to a strong signal near 210 meters (using headphones at output) and insulate filament of V3. Insert long-shank No. 4 socket wrench (insulated handle) through balance-condenser hole in chassis (third from left, as seen from front). Tune set for loudest response and balance for minimum signal *with wrench removed.* Repeat operation with V2, using second balance condenser from left; following to V1 and balance condenser at extreme left. The "aligning" condenser is directly in front of V4. To adjust, tune to strong local with "acuminators" at about middle setting; remove V3 and tune receiver until maximum signal is heard, adjusting right acuminator as required. Insert socket wrench on aligning condenser and adjust for maximum signal, *with wrench removed.* Replace tube and adjust right acuminator for maximum signal, slightly changing setting of station selector if necessary. Acuminator should then be at or slightly above middle position. To replace R.F. transformer, remove case and bottom from receiver. With set upside down, remove the two nuts holding copper can to chassis over coil to be replaced, and lift off can. Unsolder R.F.T. leads and remove two nuts holding R.F.T. to chassis. Solder leads to lugs and replace can. If necessary to replace a tuning condenser, remove case as described, also underside chassis nuts holding condenser shield to bottom of chassis, and remove two screws on front panel holding shield in place. Press shield gently back until it clears the top edge of the front panel, raise vertically, and remove. Unsolder leads and loosen screw which controls belt tension. Remove belt from condenser pulley and remove pulley. Take out three screws attaching condenser to front panel, and remove condenser. Attach new one to front panel by three screws provided and replace pulley and belt, tightening latter. Solder leads and replace shield. Note that it is necessary to remove indicator dial, pulley and both belts if center condenser must be replaced. To remove this indicator dial, or to replace belts, take out three screws attaching indicator dial to center pulley and remove dial. Loosen screws which control tension of belts and take off belts. Put new belts in position with drive pins on pulleys through holes in belts. Tighten tensioning screws. To replace detector by-pass condenser, or grid-leak-and-condenser mounting, unsolder leads, remove supporting screws, place new unit in position and resolder leads. A 3-megohm grid leak is recommended.

Color Code

Black "A—," "B—," "C+;
Blue "B+45";
White "B+90";
Red "B+Power";
Brown "C—4½";
Green "C—Power";
Yellow "A+."

Continuity Test

(Two test prods and a 10 w. lamp in series with the 110 v. circuit.)

Contact	*Correct*	*Otherwise*
Gnd-A	light	Open wire or L1B
Gnd-V1G	"	Open L1A or wiring
Gnd-V2G	"	Open wire or L4
Gnd-V3G	"	Open wire or L7
Gnd-V4G	no light	Shorted C5 or R4
Gnd-bk.	light	Open wire, R1 or R2
Gnd-whi.	no light	Shorted C3
Whi-V1P	light	Open wire or L2
Whi-V2P	"	Open wire or L5
Whi-V3P	"	Open wire or L8
Whi-V5P	"	Open wire or T2 pri.
Blue-V4P	"	Open wire or T1 pri.
Blk-V4F	"	Open wire or R3

(With Headphone and Battery.)

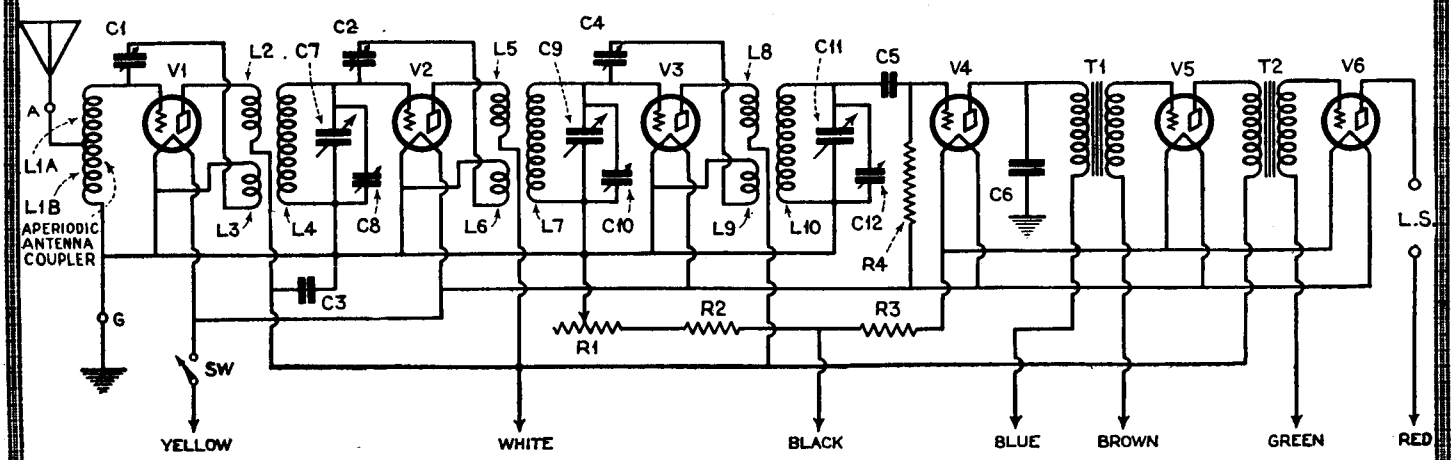
Connect:
Gnd-V2G; rotate station selector; if click C7 shorted; adjust left acuminator; if click C8 shorted.
Gnd-V3G; duplicate above. Clicks show shorted C9 or C10.
Gnd-V4G; Clicks show shorted C11 or C12.
Green-V6G; no click shows open wire or T2 sec.
Brown-V5G; no click shows open wire or T1 sec.

This set is not critical to antenna lengths, and will give good results with a short indoor antenna. A total length of from 50 to 100 feet for the antenna and lead-in combined is recommended for average conditions. If locals cause interference, an aerial of 25 to 50 feet, including lead-in, may give better results. The recommended lengths may be exceeded, of course, in many instances with excellent results. Local conditions must govern the choice of antenna length. A good ground should be used.

There are four binding posts on the set, two for the reproducer, one for the aerial, one for the ground. Battery connections are made to the cable attached to the set, in accordance with the color code in the preceding column.

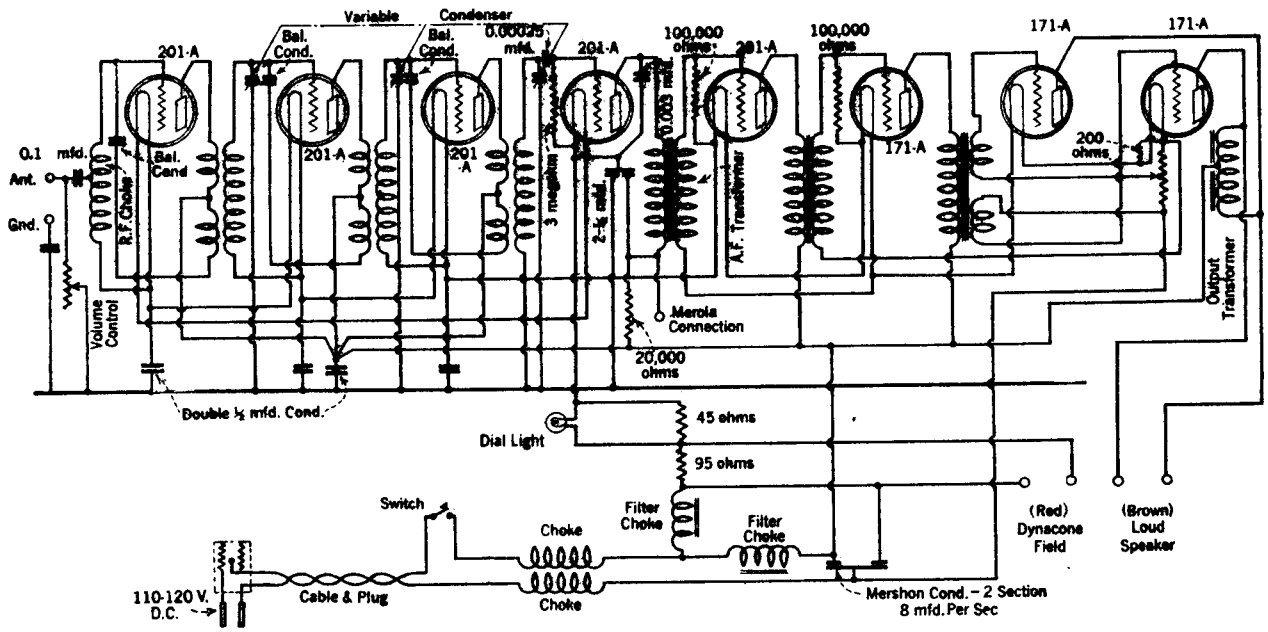
The use of '01As throughout is recommended by the manufacturer, with a '71 power tube; though a '12 may be used to economize batteries. A separate "C" battery is recommended for the first audio (brown lead) stage.

Lack of sensitivity, critical operation, motorboating, distorted reception, may often be checked to an open R4 leak. (Most of these effects may be experienced if the leak has too high a resistance; replace it with a leak of two to three megs. resistance.) The tube layout of this receiver is as follows: Looking at front of set, first R.F. tube socket is in left corner, front; second R.F., left, rear; third R. F. is next, followed by the detector; first A.F. socket is right rear and second A.F. or power stage is front right socket. Note that a wavelength of about 210 meters is recommended for neutralizing the receiver; but that one of about 300 meters is recommended for balancing the aligning condenser. If condensers C1, C2 and C4 should short-circuit, there is no danger of shorting "B" batteries or burning out tube filaments (as would be the case with sets using neutralizing circuits which obtain the neutralizing potential by tapping to a point on the plate-circuit coil); for the neutralizing potential in this receiver is obtained from the plate circuit inductively by means of coils L3, L6 and L9. The effect of a low-resistance short in C1, C2 or C4 will be broad tuning, circuit oscillation and weak reception. If the leads to L3, L6 or L9 are reversed; it will be impossible to neutralize the receiver; this fault will occur only if the receiver was partly re-wired during servicing, and is readily localized by following through the neutralizing process. Start from the detector tube and work toward the antenna; the stage upon which a "zero point" or silence-point cannot be obtained is the faulty one. Noisy operation during manipulation of R1 indicates poor contact. (Instead of the variation of resistance being smooth, it is being effected in relatively large jumps.) The remedy is to clean the resistor and sliding contact with sandpaper. This must be done carefully, to prevent taking out the spring tension of the slider arm, when the arm will no longer make contact with the wire. A short in condenser C6 will cause the set to "go dead," as far as broadcast reception is concerned; in this case, a test from detector plate to filament will show a lower resistance than if the resistance of the primary of T1 were effective, instead of shorted out.

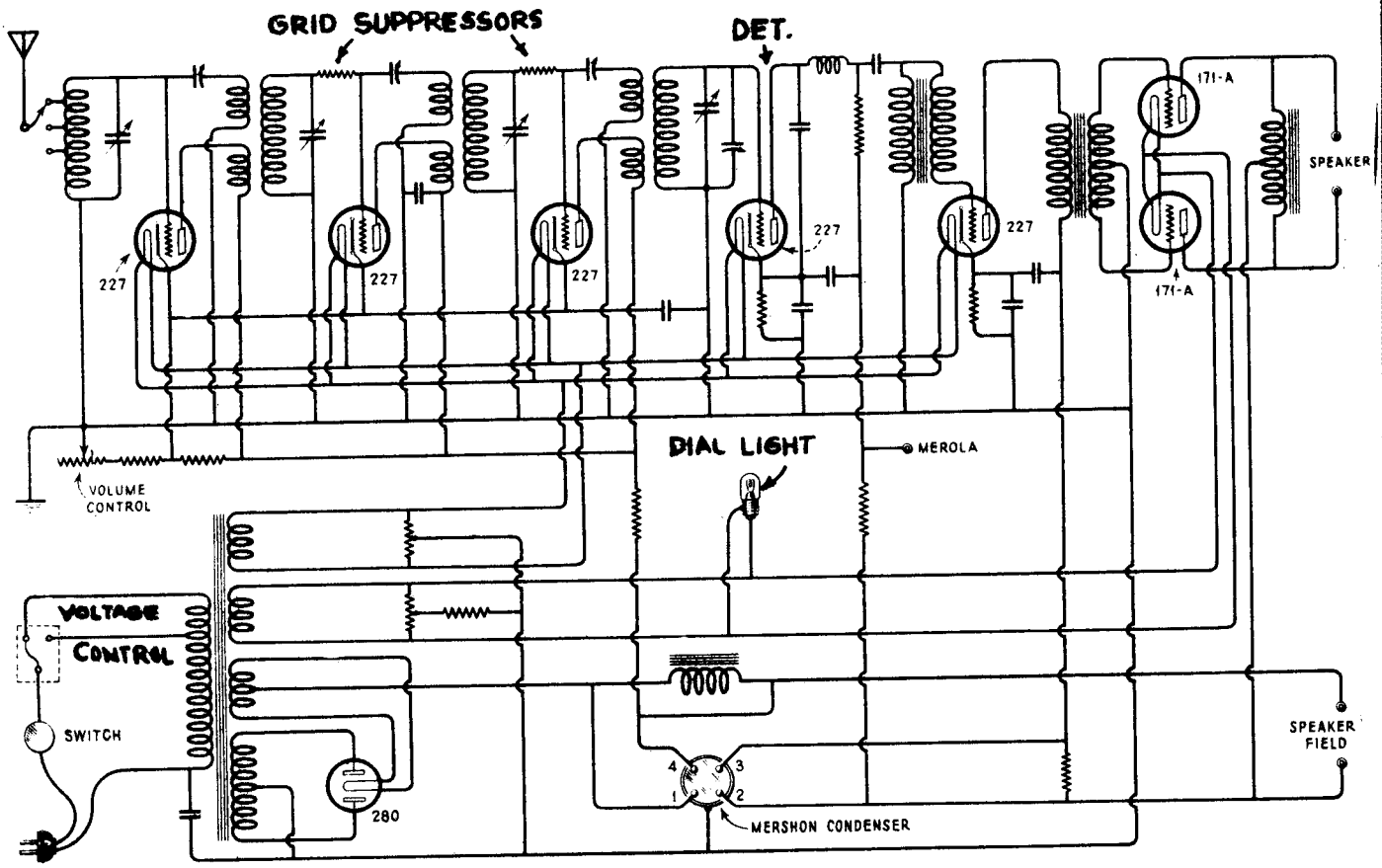


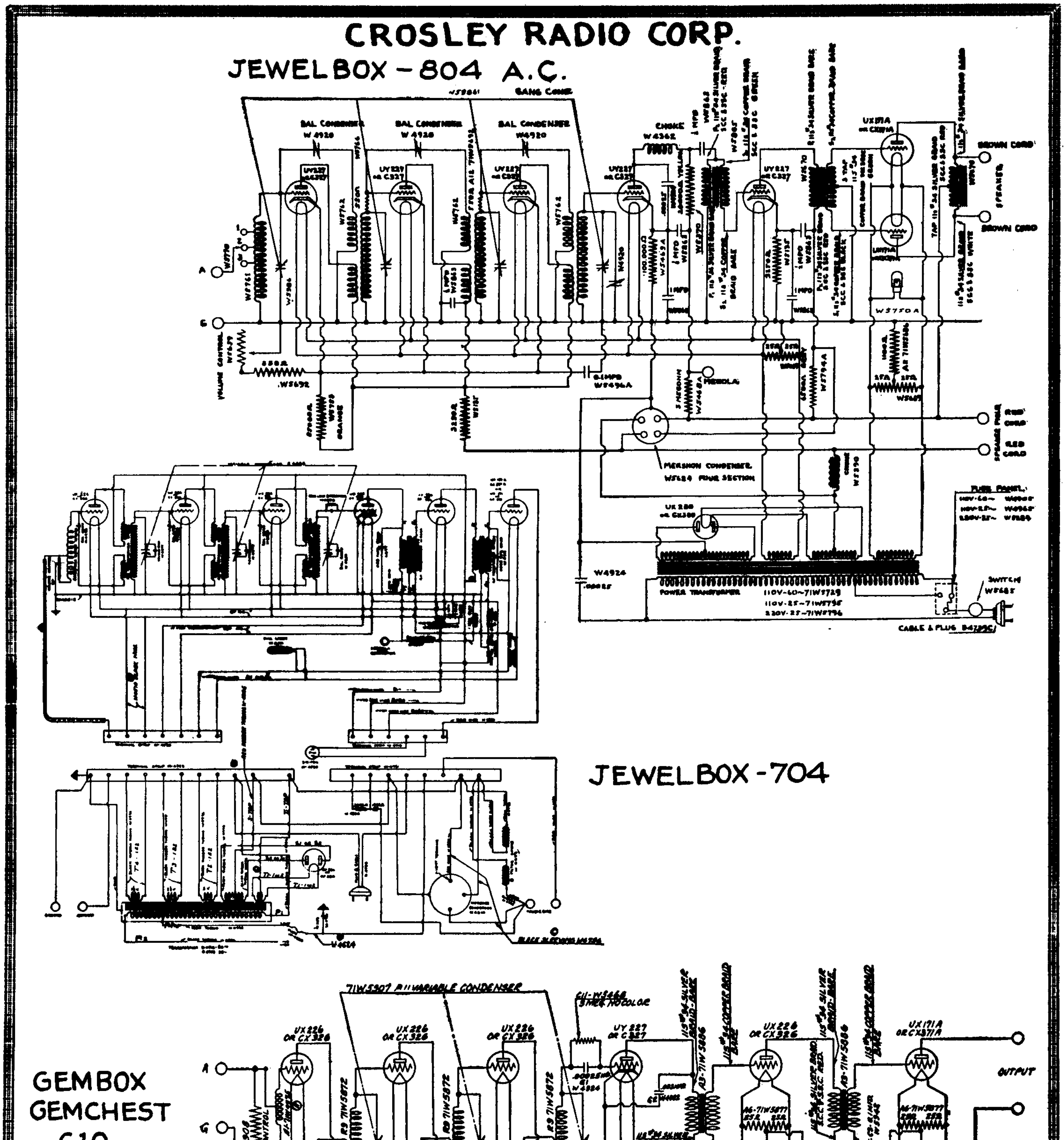
CROSLEY RADIO CORP.

MODEL 705

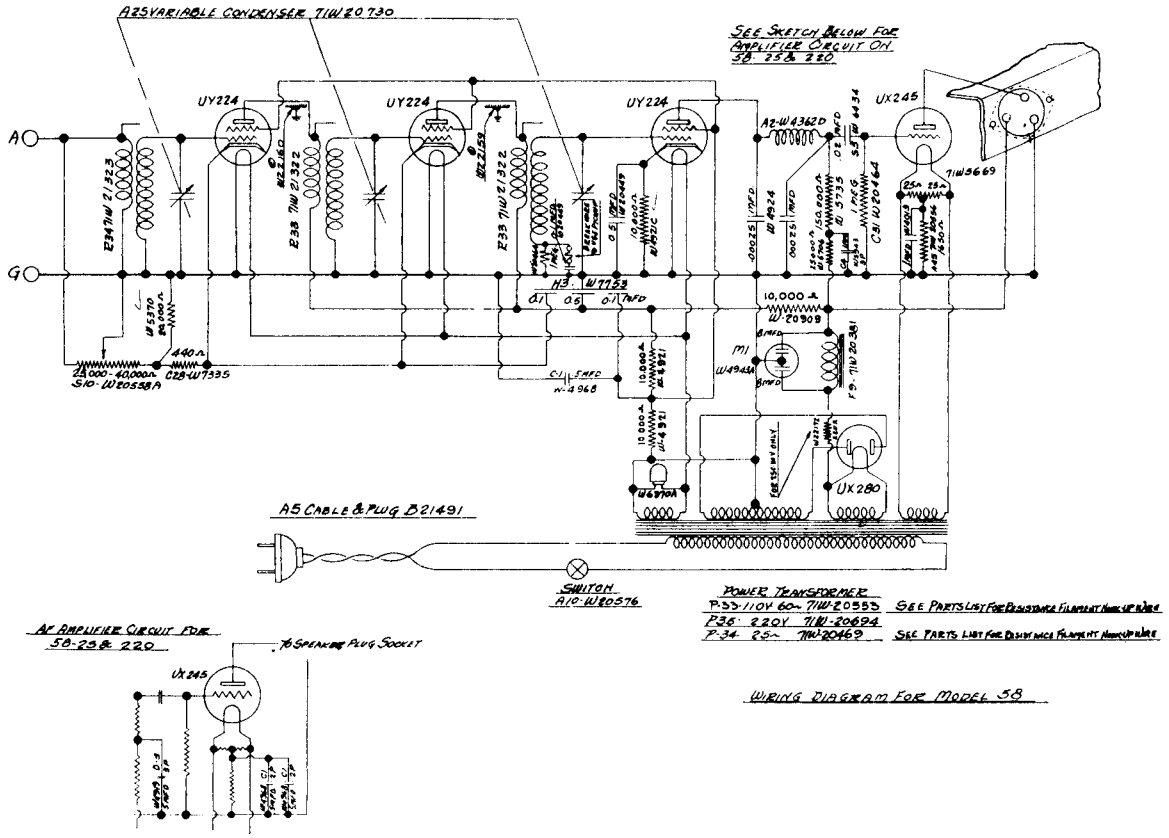


MODEL 804

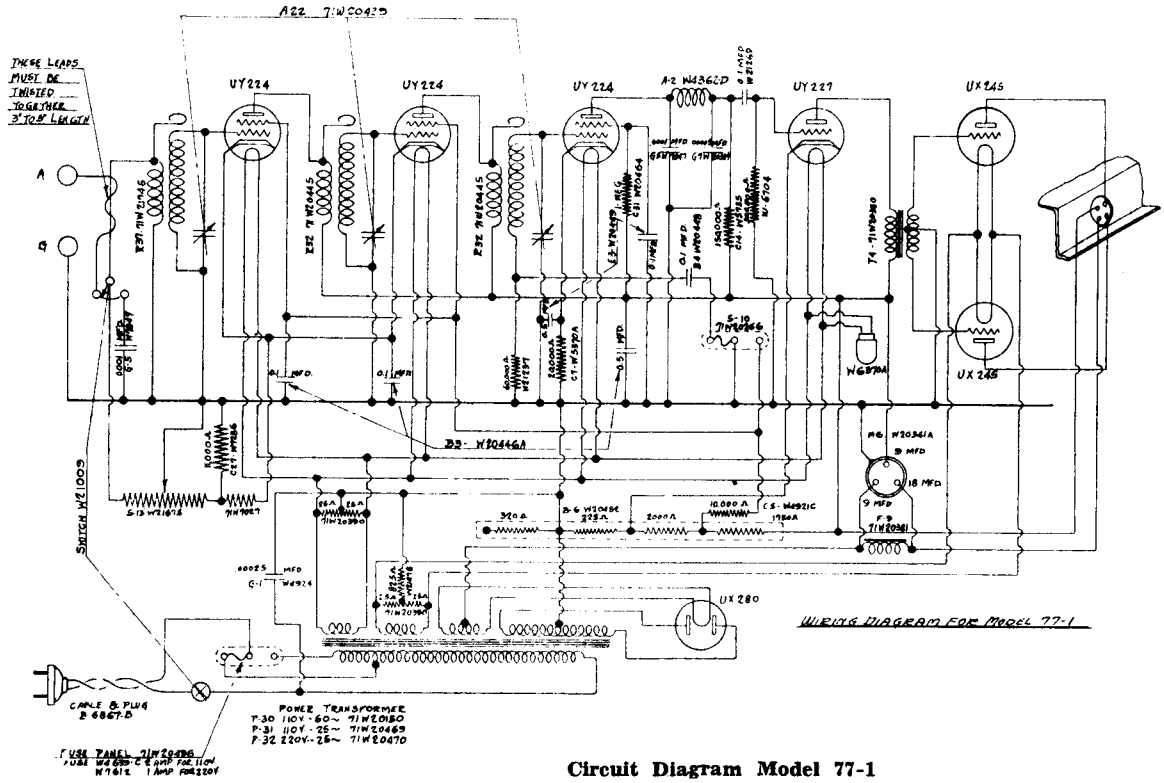



CROSLEY RADIO CORP.
JEWELBOX - 804 A.C.
JEWELBOX - 704
GEMBOX
GEMCHEST
610
609
A.C.

CROSLEY RADIO CORP.

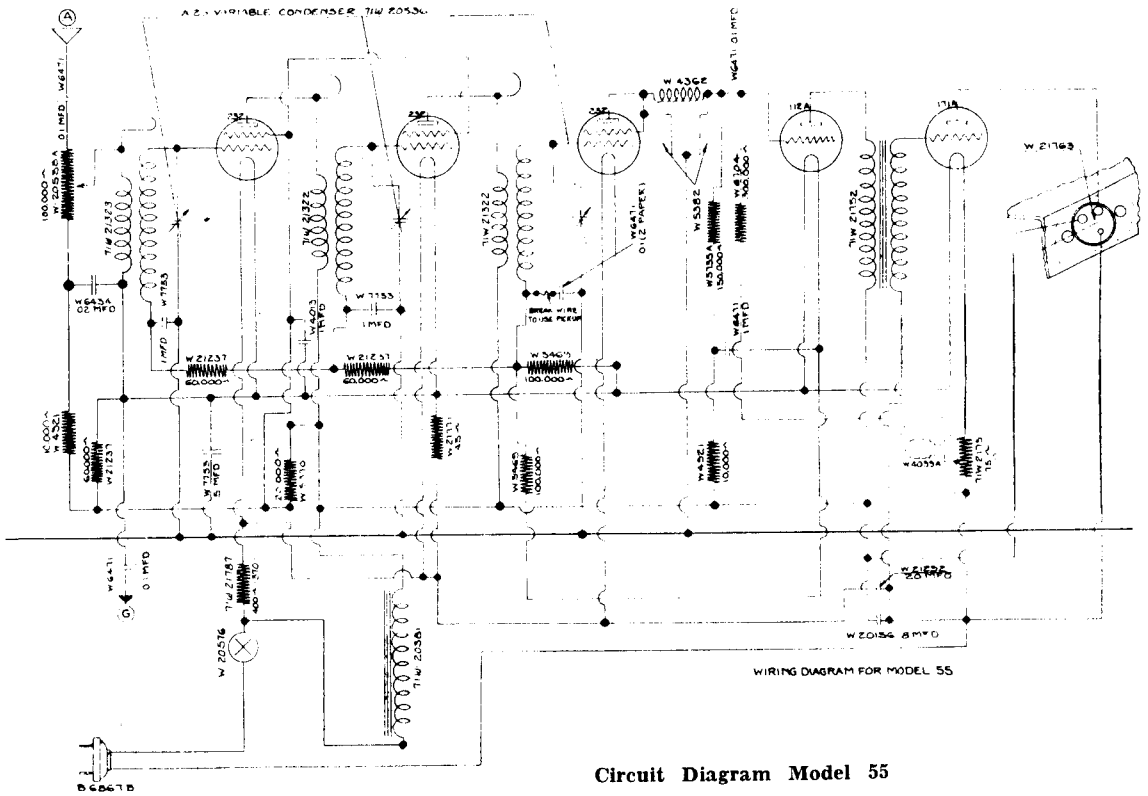


Circuit Diagram Model 58

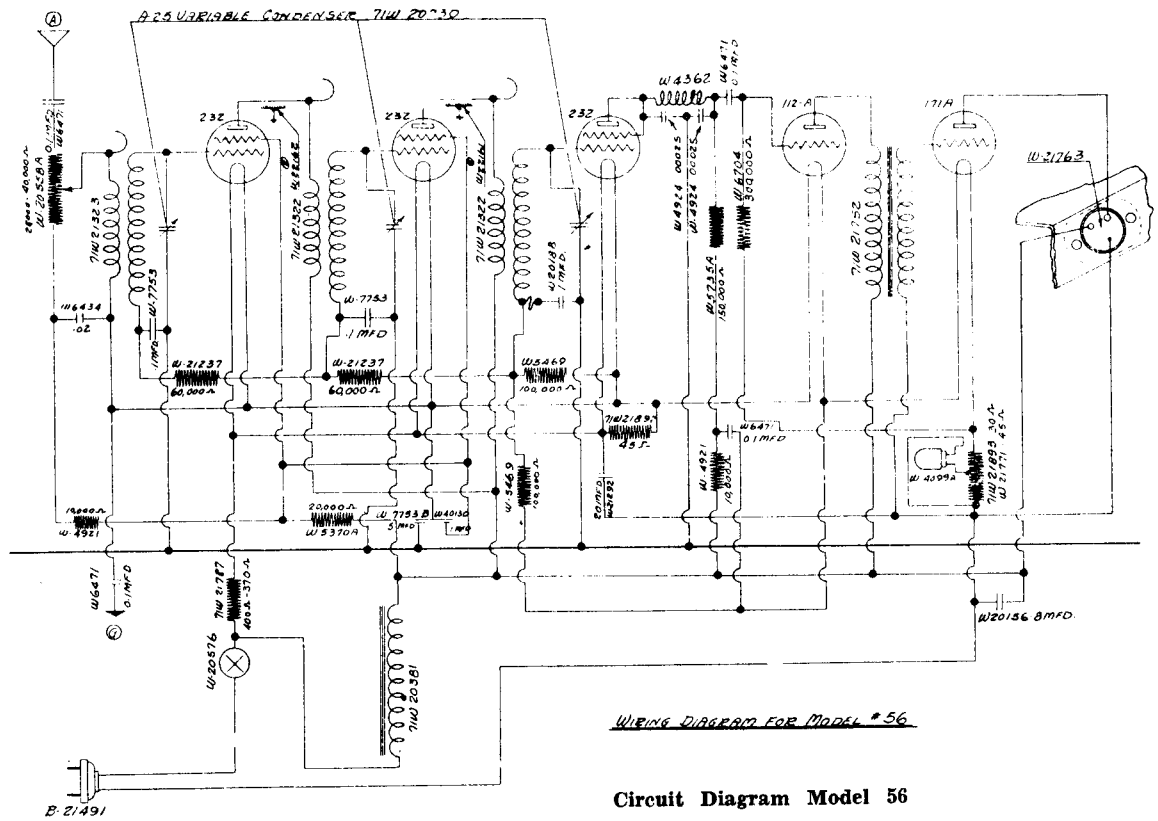


Circuit Diagram Model 77-1

CROSLEY RADIO CORP.



Circuit Diagram Model 55



Circuit Diagram Model 56

Radio Service Data Sheet

CROSLEY MODEL 120 SENIOR SUPERHETERODYNE (PLIODYNATRON) CHASSIS

"Super-Sondo," "Super-Rondeau," and "Super-Administrator" Receivers

In the diagram below is shown the foundation chassis incorporated in a number of superheterodyne receivers manufactured by the Crosley Radio Corp., Cincinnati, Ohio. Standard consoles are the models Super-Administrator and Super-Rondeau; while the Super-Sondo console is a radio and phonograph combination. Available constants for the components will be the first consideration.

Condensers C6, C13, C14, 0.5-mf.; C7, C8, C9, C10, 0.1-mf.; C11, .001-mf.; C12, C15, .02-mf.; C16, C20, C21 (optional), .00025-mf.; C17, C19 (electrolytic), 9 mf.; C18 (electrolytic), 18 mf.; C3B, .001-mf. (fixed); C3C, 50 to 300 mmf. (variable).

Resistor R1 (volume-control potentiometer, ganged to power switch Sw), 10,000 ohms; R2, R4 (flexible), 375 ohms; R3 (flexible), 165 ohms; R5 (red, black, orange dot), 20,000 ohms; R6, 6,500 ohms; R7 (tone-control potentiometer), R8, 1750 ohms; R9, 2,000 ohms; R10, 545 ohms; R11, R13, 10 ohms (each half); R12, 850 ohms.

Normal operating readings (as measured with speaker connected, volume control on full, and line potential of 117 volts with fuse in "high" position; or 107 volts with fuse in "low" position), are as follows:

Plate potentials, V1, V4, 160 volts; V2, 155 volts; V3, 20 volts; V5, 145 volts; V6, V7, 260 volts; V8 (each plate), 275 volts. Filament potentials, V1, V2, V3, V4, V5, V9, 2.5 volts; V6, V7, 2.4 volts; V8, 4.9 volts. Screen-grid potentials, V1, V2, V3, V4, 90 volts. Control-grid potentials, V1, V4, 3 volts; V2, 7 volts; V3, 1.0 volts; V5, 15 volts; V6, V7, 54 volts.

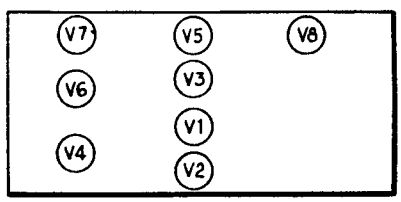
A long antenna on this receiver is a detriment to good reception.

Phonograph pick-up connections P, C, S, will be noted in the grid-return circuit of the second detector, V5. The pick-up must be connected to the detector circuit through an audio coupling transformer, and a volume control must be provided; since the volume control on the receiver operates in the R.F. portion of the circuit. Phonograph motorboards are supplied with Crosley phonograph combinations. It is merely necessary to connect the marked leads from the pick-up switch to the terminals P, C and S on the chassis, and to break the wire between terminals P and C. If the pick-up is later disconnected, a wire must be connected between terminals P and C for radio reception.

The "fixed tune" I.F. stages (including variable condensers C4A-C4C, and C5A-C5B) are tuned to the intermediate frequency of 175 kc. Since care is taken at the factory to properly align these circuits, no attempt should be made by the experienced Service Man to re-align them, unless tests indicate positively that they are in need of readjustment. In that case, the following procedure will apply:

Remove oscillator tube V3 from the chassis, and remove the clip wire from the control-grid of I.F. amplifier tube V4. Connect the output leads of an *accurate* 175-kc. oscillator to the control-grid of V4 and the chassis. Adjust the two screws (C5A-C5B) on either side of the rear I.F. coil L5 (between the socket of V4 and the power tubes), until the test-oscillator signal gives the largest reading on an output meter connected to the audio output circuit of the receiver.

Next, replace tube V3, connecting screen-grid clip to the top of the tube. Remove the first detector tube V2, and connect the oscillator output from the control-grid of V2 to the chassis; then adjust the two screws C4A-C4C on either side of the front I.F. coil, L4, for maximum output meter reading. Slight readjustment of the screws beside the rear coil may improve the output somewhat.



Tube layout, Crosley Model 120.

Oscillator V3 is a screen-grid tube connected as an oscillator of the dynatron type (more correctly, a "pliodynatron"; the generic term applied by Dr. Hull to a 4-element or screen-grid oscillator as differentiated from the dynatron" or 3-element oscillator). Its plate potential is lower (20 volts) than its screen-grid; which is at a positive potential of 90 volts. It may be necessary to try two or three tubes in this position to obtain a satisfactory one.

The volume-control resistor R1 performs the dual functions of increasing the control-grid bias of amplifiers V1 and V4, and grounding the antenna—that is, when reducing volume—and vice versa. The tone-control circuit is ingenious and should be carefully noted as to electrical values and arrangement.

If, when receiving some signals, the volume control is turned up so far that the first detector is overloaded, a whistling note will be heard. This is a perfectly normal characteristic of superheterodynes, and does not mean that anything is wrong with the receiver: when the volume is adjusted for normal reception, the whistle does not occur.

If it becomes necessary to re-align the main tuning-condenser gang, the procedure is as follows: leave the shield cover in place, and tune in a station or modulated-oscillator signal near 1,400 kc. Turn the volume control on fully. If all signals within the required range are too loud, connect a fixed condenser C21 to the posts marked "A" and "G," and loosely couple the antenna to the leads of the local distance switch.

If, when the receiver is carefully turned to the middle of the band, the dial reading does not correspond to the frequency of the signal, but is not more than two channels off, set the dial at the correct frequency, and adjust the trimming condenser C3A (the control farthest toward the rear of the chassis) until the signal is loudest. Check the tuning by readjusting the station selector. It may be impossible to regulate the oscillator trimming condenser C3A so that the oscillator condenser is properly aligned with the *exact* dial setting; in which case align the trimming condenser with a dial setting as close to the actual frequency as practicable.

After aligning the oscillator circuit by adjustment of C3A, adjust the trimmers C1A and C2A for greatest volume. This completes the adjustments for best reception at the *low* wavelengths. Now proceed as described below, for test and possible re-adjustment at *high* wavelengths.

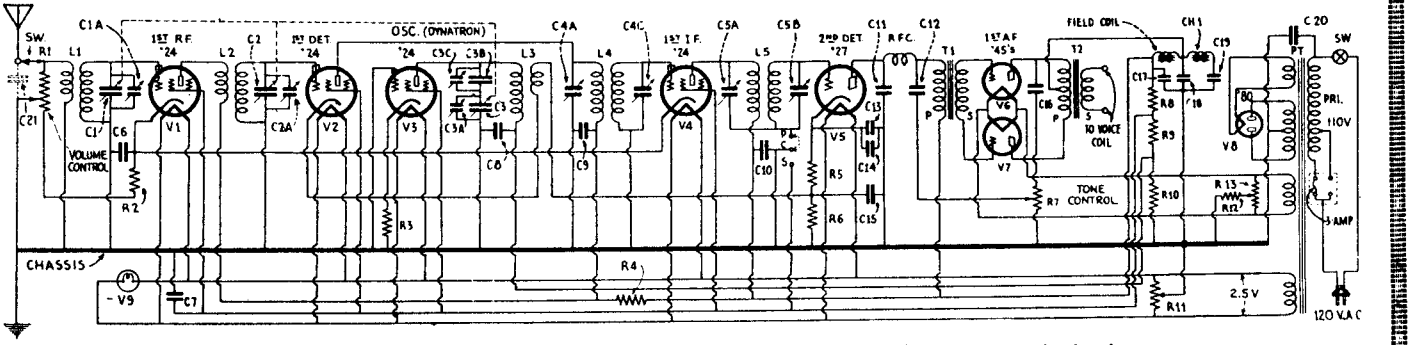
Tune to a signal near 600 kc. If the dial setting, when carefully adjusted, is not more than a single channel (10 kc.) away from the actual frequency of the signal, it is possible to align the low-frequency tracking. DO NOT MAKE THIS ADJUSTMENT UNLESS ABSOLUTELY NECESSARY.

For this purpose, a bakelite screwdriver will be required. The low-frequency adjustment (condenser C3C) is at the rear of the chassis, behind the shield, and is sealed at the factory. It is necessary to break this seal before the screwdriver can be inserted and turned. Turn the tuning control until the actual frequency of the signal is indicated by the dial reading, and adjust for best volume. If it is not possible to align the condenser with the dial set at the exact signal frequency, set the dial as close as practicable to the exact frequency.

If signals are not heard after trying a new tube, the circuits may be checked as follows: remove the top of the condenser shield and, having removed the antenna, touch it to C2A. Tune to a strong signal; if not received, the oscillator may not be functioning, or remainder of set requires checking. Touch antenna to C1A; if signal is not increased, check the circuits of V1. Of course, lack of signal only at the antenna post indicates a defect in the antenna circuit. In lieu of a powerful broadcast station, an A.F.-modulated R.F. oscillator, operating in the broadcast range, may be used.

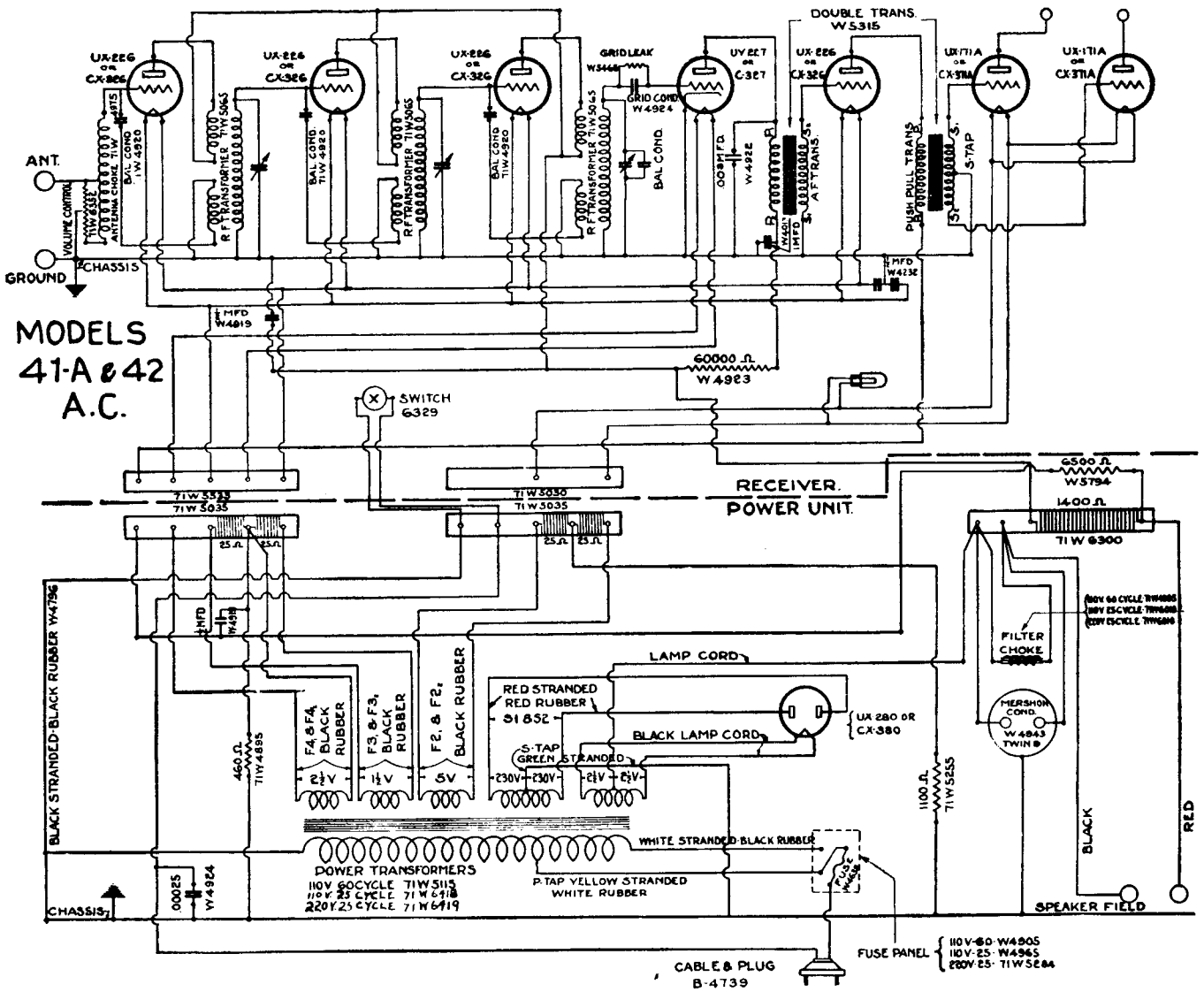
Switch Sw1 is the "local-distance" adjustment. The manufacturers refer to the tone control as the "static and tone control."

The Model 120 receiver may be considered non-radiating; since V3 and its circuits are shielded, and preceded by circuits sharply tuned off the oscillator frequency.

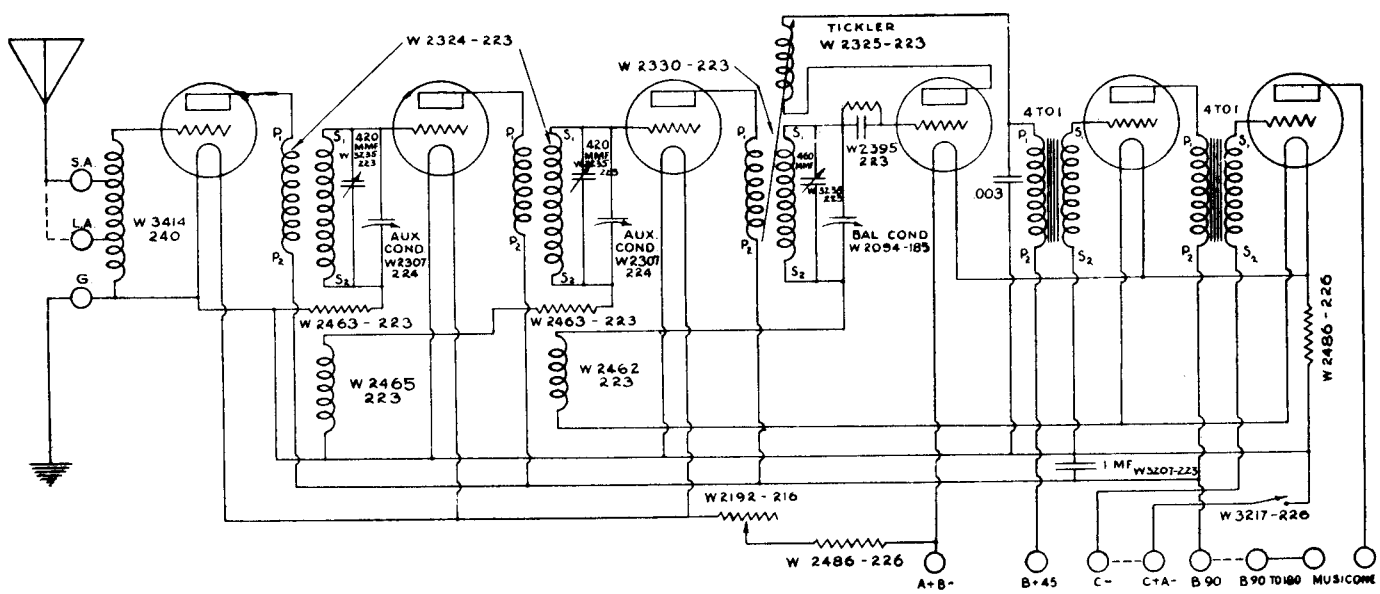


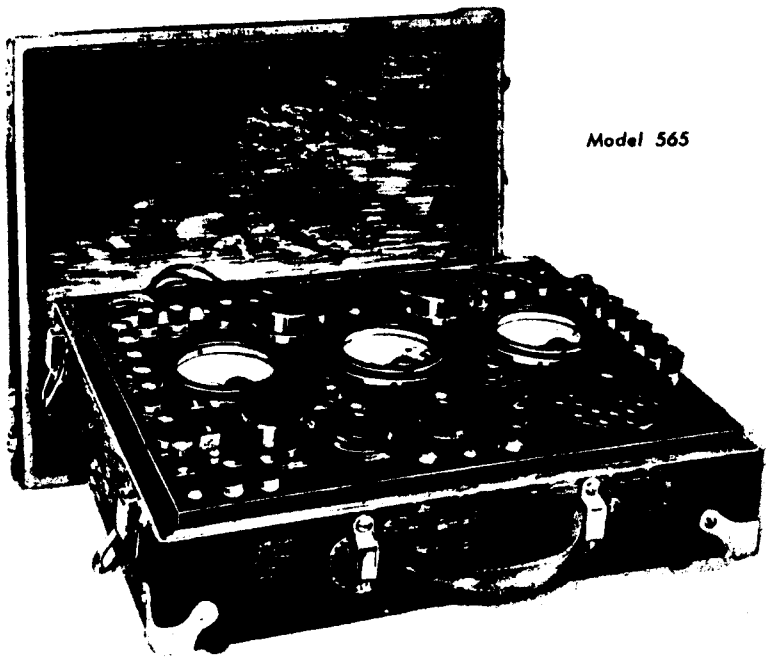
Schematic circuit of the Crosley Model 120 series "Senior Superheterodyne" (Pliodynatron) chassis.

CROSLEY RADIO CORP.



MODELS 6-60 AND 6-85 CIRCUIT





Model 565



Model 564



Model 566

ELECTRICAL MEASURING INSTRUMENTS FOR EVERY RADIO USE

WESTON is the instrument headquarters of the entire electrical world. Since 1888 Weston has set the standards of quality, dependability, and accuracy in electrical measuring instruments. Today, the wide scope of Weston instruments includes test sets for radio servicing, meters for radio transmitting panels, and instruments for radio laboratories, and manufacturing plants.

Illustrated above are three of Weston's recent contributions to better radio servicing. They are outstanding in design, speed of operation and reliability.

Whatever your instrument requirements may be, Weston can serve you.

MODEL 564—VOLT OHMMETER for voltage and resistance measurements and continuity tests. The compact construction, low cost and simplicity of operation make this small instrument suitable for shop and factory tests, radio laboratory use, and as accessory equipment for home, automobile and airplane radio servicing. Four voltage ranges 600/300/30/3 volts and two resistance ranges 0-100,000 and 0-10,000 ohms.

MODEL 565—THE COMPLETE RADIO SERVICE TEST SET with an Oscillator and Tube Checker, Practically a portable radio testing laboratory. Checks all types A. C., D. C., Pentode and Rectifier tubes and all types A. C. and D. C. Sets.

MODEL 566 — RADIO SERVICE TEST SET. For radio dealers and service men who desire a lower priced but less complete test set than Model 565. Checks tubes under same conditions as exists when in their sockets. Checks all type A.C., D.C. tubes and all makes of Radio Receivers.

WESTON

ELECTRICAL INSTRUMENT CORP.

578 Frelinghuysen Avenue • • • • Newark, N. J.

MOELS R6 AND R7

BOTTOM VIEW OF RECEIVER UNIT SHOWING FILTER UNIT TERMINALS AND RESISTORS

R-10 AUTOMATIC VOLUME CONTROL VOLTAGE DIVIDER
R-11 " " " " "
R-12 DETECTOR OUTPUT FILTER RESISTOR
R-13 3RD R.F. PLATE ISOLATING "
R-14 " " GRID " "
R-15 1ST + 2ND R.F. GRID " "

R-20 1ST + 2ND R.F. PLATE ISOLATING RESISTOR
R-21 2ND + 3RD " BIAS "
R-22 HIGH POTENTIAL END S. G. VOLTAGE DIVIDER
R-23 1ST A.F. PLATE ISOLATING RESISTOR
R-24 1ST R.F. BIAS "
R-25 1ST SCREEN GRID ISOLATING "

R-30 TONE BALANCE RESISTOR
R-31 HUM BUCK "
R-32 2ND A.F. BIAS "
R-33 PLATE COUPLING "
R-34 LOW POTENTIAL END S.G. VOLTAGE DIVIDER
R-35 1ST A.F. BIAS RESISTOR
R-36 GRID LEAK

#200165 DETECTOR FILTER UNIT (WITH RESISTORS)

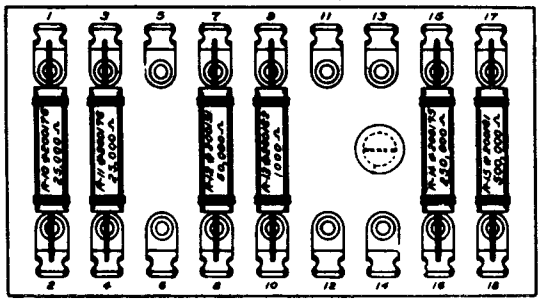


FIG. 1

#200156 R.F. FILTER UNIT (WITH RESISTORS)

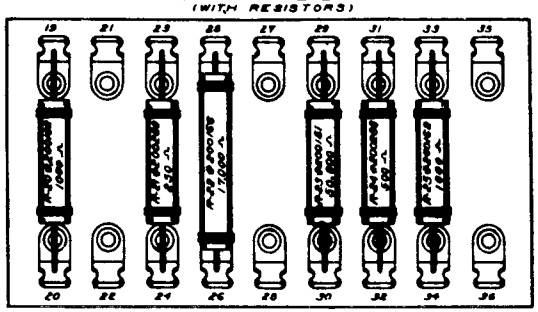


FIG. 2

#200131 A.F. FILTER UNIT (WITH RESISTORS)

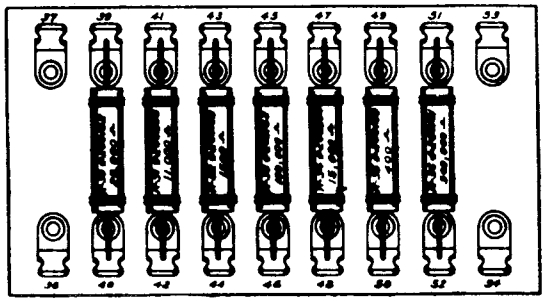
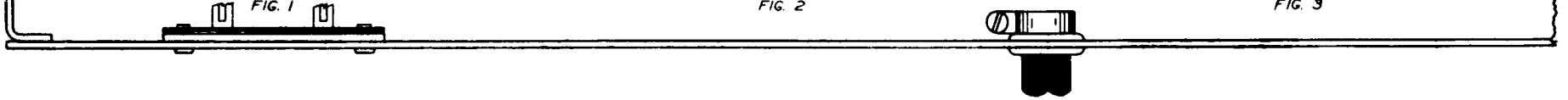


FIG. 3



SCHEMATIC DIAGRAM FOR FILTER UNITS (RESISTORS NOT SHOWN)

#201048 DETECTOR FILTER UNIT

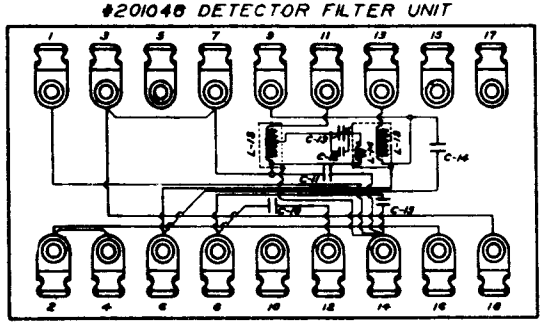


FIG. 1-A

C-10	0.25 MF	#200130	DETECTOR COUPLING	CONDENSER
C-11	.0001 "	#200648	AUTO. V.C. RES. BY-PASS	"
C-12	40 MMF	#201800	FIXED COUPLING	"
C-13	80 MMF	#200373	ADJUSTABLE "	"
C-14	.05 MF	#200388	3RD R.F. PLATE BY-PASS	"
C-15	.0006 "	#200168	DETECTOR OUTPUT FILTER	"
L-13		#200170	AUTO TRANSFORMER	
L-13 + L-14		#200178	COUPLING	"

#201045 R.F. FILTER UNIT

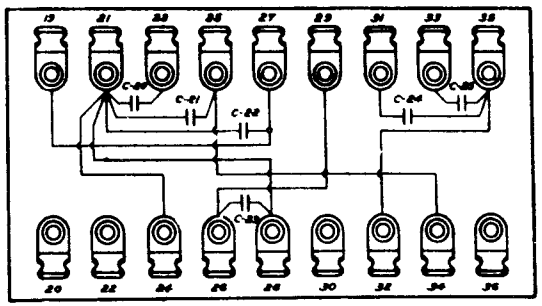


FIG. 2-A

C-20	0.5 MF	2ND + 3RD R.F. BIAS	BY-PASS	CONDENSER
C-21	1.0 "	" " SCREEN GRID	"	"
C-22	.05 "	1ST + 2ND R.F. PLATE	"	"
C-23	1.0 "	2ND A.F. PLATE	"	"
C-24	0.5 "	1ST R.F. BIAS	"	"
C-25	0.1 "	" SCREEN GRID	"	"

#201044 A.F. FILTER UNIT

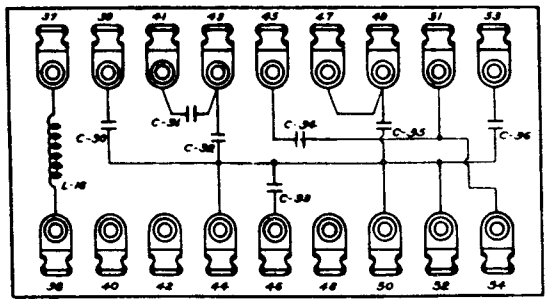


FIG. 3-A

C-30	0.25 MF	TONE BALANCE CONDENSER #1		
C-31	0.5 "	HUM BUCK "		
C-32	1.0 "	2ND A.F. BIAS	BY-PASS	CONDENSER
C-33	1.0 "	1ST " PLATE "		"
C-34	0.25 "	" " PLATE COUPLING		"
C-35	1.0 "	" " BIAS	BY-PASS	"
C-36	.0005 "	TONE CONTROL		"
L-16		RADIO FREQUENCY CHOKE		

THOMAS A. EDISON, INC.

Radio Service Data Sheets

EDISON R-4, R-5 AND C-4

In the Edison Receiver, Models R-4, R-5 and C-4, the R.F. amplifying circuit employed is a form of "constant gain" circuit, wherein two primaries are used in each radio frequency transformer, one resonated below and one above the broadcast frequency spectrum. The four R.F. transformers employed are identical with each other and their secondaries are tuned by identical tuning condenser sections. Referring to the Schematic wiring diagram L1, L2, L3 and L4 are low frequency primaries, resonated to approximately 450 kilocycles by means of the condensers C5, C6, C7 and C8; L5, L6, L7 and L8 are high frequency primaries, not shunted by any condenser; L9, L10, L11 and L12 are secondaries tuned by the variable condenser sections C1, C2, C3 and C4, which are shunted by the trimming capacities C1A, C2A, C3A and C4A. Stabilization of the R.F. amplifier is accomplished by the use of grid circuit neutralization: *i.e.*, the employment of neutralizing condensers, C10, C11 and C12, connected from the plate of each R.F. amplifying tube to a coil tightly coupled to the secondary of the input transformer of that tube. These coils in the diagram are L5, L6 and L7, which are at the same time the high frequency primaries of the first, second and third R.F. transformers. Substantial resonance of the first R.F. input circuit to the resonant frequency of the second and third R.F. and detector input circuits is maintained by holding the effective antenna-ground capacity to a value less than 100 micromicrofarads. Antennas of less than this capacity are to be connected to the binding post marked "Antenna," while antennas of greater than this capacity are to be connected to the "Long Antenna" binding post. This latter connection places the condenser C9 in series with the antenna-ground capacity, reducing the effective value of the latter to less than 100 micromicrofarads for antennas of capacities up to 500 micromicrofarads. Self-bias of the first R.F. amplifying tube is secured by the use of resistor R1, by-passed by the capacity C20. Isolation of the R.F. component of the plate current of this tube is accomplished by the use of resistor R2 and capacity C19. Self-bias of the second and third R.F. amplifying tubes in common is effected by the resistor R3 and the section A of the volume control by-passed by the capacity C23. Isolation of the R.F. components of the plate currents of those two tubes in common results from the use of the resistor R5 and the capacity C22. The volume control operates to reduce volume in the following manner: As the contact shown in the diagram is moved leftward from the extreme right-hand end position, the resistance B, lying across the primary system of the first R.F. transformer, is reduced in value following a special resistance taper. After approximately mid-position has been reached, this resistance B has become and is maintained at substantially zero value. A remains at zero value until approximately mid-position of the control has been reached and thereafter increases in value uniformly with angular rotation of the control knob. Resistance A forming part of the bias resistance for the second and third R.F. amplifying tubes, a leftward motion of the contact of the volume control after approximately mid-position has been passed increases the bias on these tubes. The resistor R4 limits the necessary amount of resistance in the section A of the volume control by increasing the current at minimum volume setting of the control from a fraction of a milliampere to between 3 and 4 milliamperes. When minimum volume setting of the control has been reached, a further slight turn of the control throws the radio-phonograph switch, S1, from its lower to its upper diagram position: *i.e.*, from radio to phonograph position, this being the sole means provided for the throw of this switch. The detector "B" is obtained from the plate supply for the R.F. and first A.F. amplifying tubes through a two-stage resistance-and-condenser filter, consisting of R9, C25, R8 and C24. This filter serves a triple purpose: it effects the necessary reduction of plate voltage, the isolation of the A.F. current in the detector plate circuit and a reduction of ripple in the detector plate supply. A positive bias is placed on the heater of the detector tube with respect to its cathode by the connection of the variable contact of the hum adjuster R6 to the cathode of the first R.F. amplifying tube. A high frequency cut-off is provided by the capacity C15 shunting the secondary, L15, of the A.F. amplifying transformer, the primary of which is shown as L14. Hum due to residual 120-cycle ripple in the plate supply for the first A.F. amplifying tube is eliminated by the use of the series circuit C21, R10, connected between the positive of the plate supply and the cathode of this tube. The impedance of this circuit is arranged to be 9 (the mu of the tube) times the impedance of the parallel circuit C26, R11, and the phase angles of the two circuits to be the same. This results in the impression on the grid of this tube of a voltage proper in both phase and amplitude to counteract the effect of the residual ripple of the plate supply. The second A.F. transformer has a primary L16, and two separate half-secondaries, L17 and L18. These half-secondaries are separate in order to permit the insertion between their low potential ends of the resistor R13. Between the center-tap of the filament winding for the second stage amplifying tubes and the fixed center tap of R13 is connected the self-bias resistor for these tubes. A variable contact operating on R13 is connected to the negative of the plate supply. The function of R13 is to permit the increase of the bias on either of the two second A.F. tubes at will by the amount necessary with any two given tubes to balance out residual hum. L32, part of the power transformer primary, is designed for use from 100 to 110 volts; L32 and L33 together from 110 to 120 volts; and L32 and L34 together from 130 to 140 volts. R15 is a bleeder or "loss-current" resistor, the function of which is to build up to the required value the excitation current flowing through L22 and to stabilize the plate voltage on the R.F. and first A.F. tubes for varying values of plate current in the second and third R.F. amplifying tubes.

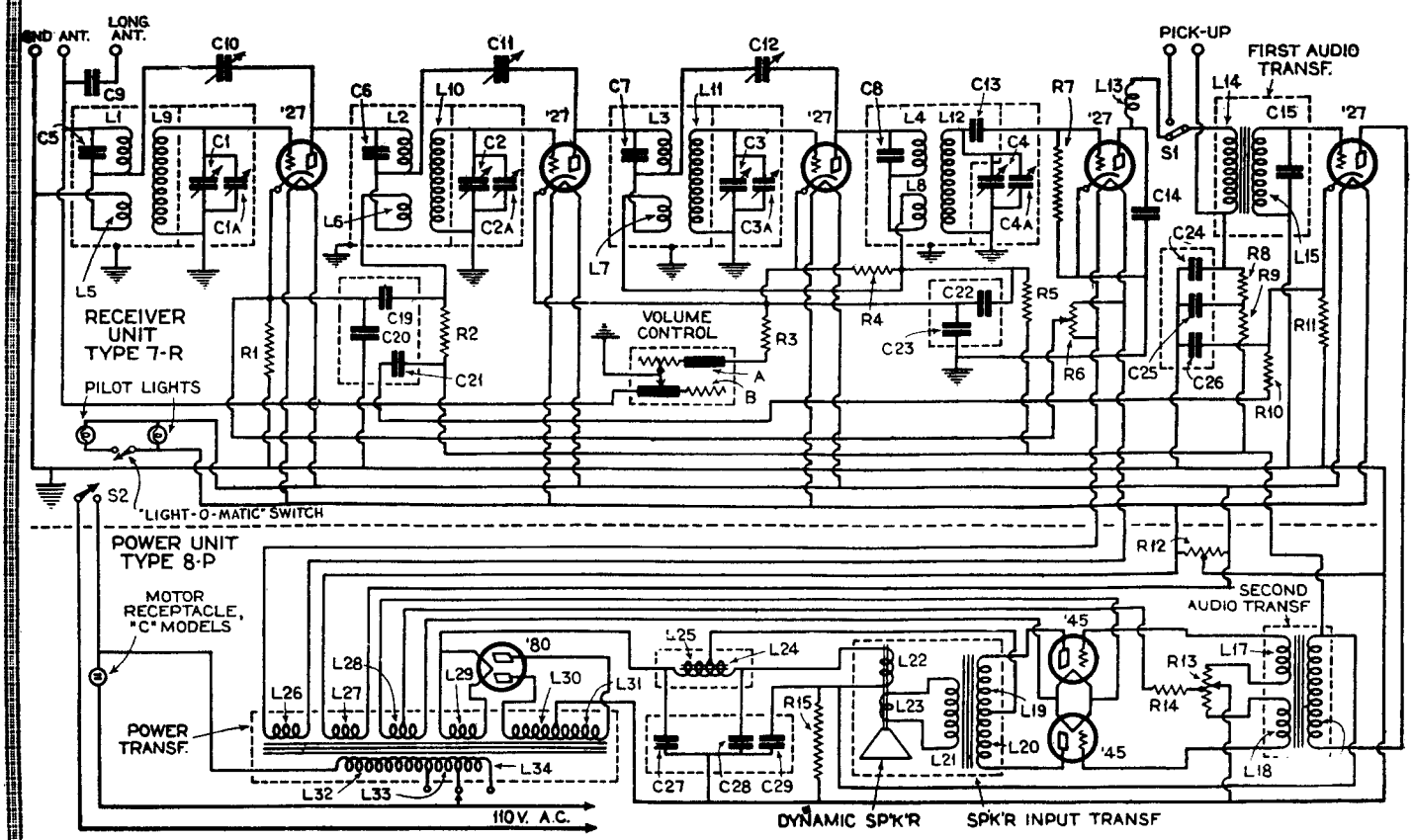
IDENTIFICATION OF PARTS

C1, C2, 2-gang, .000355 mf. each; C3, C4, ditto; C5, C6, C7, C8, .00025 mf. each; C9, .000125 mf.; C10, C11, C12, 40 to 80mmf., variable; C13, .0001 mf.; C14, .001 mf.; C15, .00045 mf.; C19, 0.1 mf., 300 V.; C20, ditto; C21, 0.16 mf., 300 V., (C19, C20 and C21 in same can); C22, 0.1 mf., 300 v.; C23, 1.0 mf., 150 v., (C22 and C23 in same can); C24, 1.0 mf., 300 v.; C25, 0.5 mf., 300 v.; C26, 1.0 mf., 150 v., (C24, C25 and C26 in same can); C27, 2 mf., 600 v.; C28, ditto; C29, 1.0 mf., 300 v.; C1A, C2A, C3A and C4A trimmers on side of variable condenser section which each shunts.

R1, 1000 ohms, 1 watt; R2, ditto; R3, 400 ohms, 1 w.; R4, 40,000 ohms, 1 w.; R5, 400 ohms, 1 w.; R6, 20 ohms; R7, 1.5 meg., 1 w.; R8, 25,000 ohms, 1 w.; R9, 25,000 ohms, 1 w.; R10, 6000 ohms, 1 w.; R11, 2,000 ohms, 1 w.; R12, 20 ohms; R13, 200 ohms; R14, 780 ohms, 5 w.; R15, 10,000 ohms, 5 w.

L1, L2, L3 and L4, 500 mhys., each; L5, L6, L7 and L8, 7½ turns, each; L9, L10, L11 and L12, 245 mhys., each (measured in shield); L13, 50 to 65 millihys.; L14 and L15, 4-to-1 A.F.T.; L16, L17 and L18, 5-to-1 ratio A.F.T. with separate secondaries connected in series by variable resistance R13; L19, L20, speaker input transformer (mounted in speaker frame) having center-tapped primary; L21, secondary, speaker input transformer; L22, dynamic reproducer field coil, 4,500 ohms; L23, voice coil for above; L24, inside third of filter choke, 20 hys., 375 ohms; L25, outside two-thirds of choke.

S1, radio-phonograph switch, S.P.D.T. toggle, opened by volume control shaft; S2, Line switch, S.P.S.T. toggle; Light-O-Matic switch, located in dial mechanism, operating Light-O-Matic pilot light.



Radio Service Data Sheet

ERLA MODEL 224 A.C. SCREEN-GRID RECEIVER

This receiver is manufactured by Electrical Research Laboratories, Inc., Chicago, Ill. The following values are used in this circuit:

Condensers C1, C2, C3, C4 are the tuning capacities; C5, C15, 0.5-mf.; C6, C7, C8, C12, C13, 0.25-mf.; C9, C10, .001-mf.; C11, C19, 1. mf.; C14, 0.1-mf.; C16, C17, 2 mf.; C18, 3 mf.

Resistors R1, R6, R7, 70,000 ohms; R2, 5,600 ohms; R3, R12, 6,000 ohms; R4, 80 ohms; R5, R8, 100,000 ohms; R9, 1,000 ohms; R10, R11, 10,000 ohms; R13, R14, 20 ohms.

Average current readings for this set are as follows: filament potentials; V1, V2, V3, V4, V5, 2.4 volts; V6, V7, 2.5 volts; V8, 5 volts. Plate potentials; V1, V2, V3, 175 volts; V4, 70 volts; V5, 95 volts; V6, V7, 245 volts; V8, 350 volts. Screen-grid potentials; V1, V2, V3, 80 volts. Ground-to-cathode; V1, V2, V3, 1.5 to 2 volts; V4, 6 to 7.5 volts; V5, 4.5 volts. Grid-to-filament, V6, V7, 50 volts.

This chassis is well shielded and normally does not oscillate. However, if a tube shield is left off, or if the aerial lead is allowed to dangle in around the tubes or control-grid leads, oscillation may occur. If the bottom shield of the chassis is removed, oscillation is generally encountered. It is likewise important that the ground and the aerial leads be connected as oscillation may occur if these are left unconnected. It is also important that all the shielding, particularly on the gang condenser, be in place and fastened securely. Changing the screen-grid tubes around may correct oscillation or tendency to motorboat.

Considerable heat and loud humming of the transformer should be investigated for short circuits across one of the windings of the transformer. A piece of wire or solder may have become loose, or the insulation of one of the leads may have been cut through, and short-circuited one or more of the transformer's windings. In any of these cases, if the transformer has not been allowed to remain in this short-circuited condition too long, correction of the short or separation of the shorted leads and the insertion of new leads will correct this and, usually, the transformer will again operate satisfactorily.

If the switch leads of the "high-low" voltage switch become shorted, considerable heating and danger to the power transformer will result. If one of the plates of the '80 should become quite red and its filament bright, whereas the other filament and plate are comparatively cool, the trouble is due to improper connection of the high-voltage winding to the plates of the '80 tube. Voltage tests will generally show a considerably higher reading on one plate than on the other. This is due to the connection of the tap on this winding to one plate, instead of the tap's being connected to its proper circuit connection. Filter chokes of this power-supply unit generally will give very little trouble; however, if either should be shorted, a considerable increase of hum, as well as abnormally high plate voltages, will result. An open circuit of either choke coil will result in absence of voltage across this coil, as well as the circuits to which it supplies. The filter condenser used in the power supply is considerably oversize, and there should be very few cases of breakdown of these units. Excessive hum may be due to an open resistor, which will require replacement.

The volume control-and-switch combination is a particularly rugged unit; the resistor being rated considerably above its operating value. The possible troubles from this unit are an open circuit, due to cutting of the resistor wire, or improper operation of the phono-radio switch. The cutting may be caused by hitting with a sharp tool or the like. Care should be exercised in working on this unit, in order not to injure the resistor element. If this resistor is open at one end, there will be no control of volume on weak or strong signals. This, of course, should not be confused with the somewhat abrupt variation of control when attempting to control strong local volume in the "distance" switch position. If this resistor is open at the other end, there will be no signals received, since no voltage is then impressed on the screens of the screen-grid tubes. A check for either of these conditions may be made by connecting a voltmeter from the screen to the cathode; and varying the volume control should show variation of the screen-grid voltage.

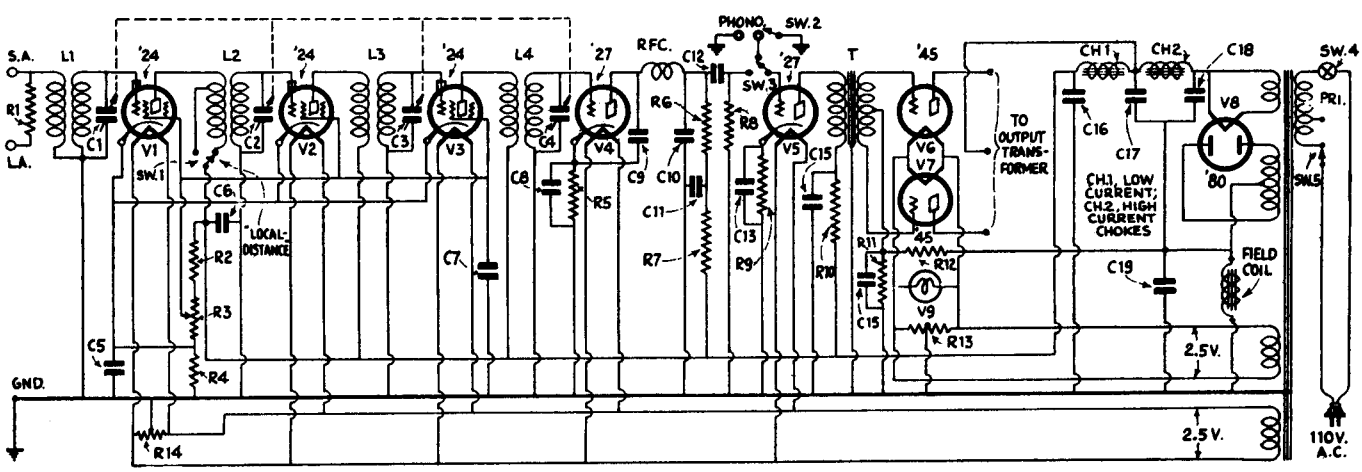
If the single-pole switch, governed by the shaft of this control does not operate, when the control is turned toward the extreme left in the "off radio and on phono" position, no phonograph operation will be had. An examination of this switch will generally reveal either condition, and the method of its correction by re-adjustment. A little roughness in the volume control will be overcome by applying a touch of light oil with the finger tips across the resistor element. It should be noted that the shaft and body of this control must be insulated from the chassis frame.

Distorted signals may be due to poor '27's or '45's, but there are a number of other possible causes of this trouble. Low "B" voltages resulting from a defective '80 will, of course, cause distortion. If the distortion is due to rattles in the speaker, this may be defined by substituting another speaker. Generally a speaker which rattles will have its moving coil rubbing on the center pole-piece. This can generally be felt, by slightly pressing the diaphragm in and out, and noting whether any rubbing exists. Another cause of distortion, which is generally very bad, is caused by either reversed connections in the speaker transformer or by an open or shorted connection at this point. Open grid-biasing resistors, or shorted bias condensers in the first audio or push-pull stage will result in distortion and increase in the hum level. An open field connection will also result in distortion and weak signals. Voltage readings across the field connections will be abnormal and, also, no magnetic pull will be felt on touching an iron or steel tool to the center pole-piece. An open winding on one side of the push-pull transformer will also result in some distortion, principally on strong signals; this latter condition will bring about some increase in the hum level.

The field coil of the reproducer in this receiver has a resistance of 1,000 ohms and is designed to carry 100 milliamperes.

Mounted on top of the condenser shield is the pilot lamp and receptacle. On looking at the front side of the condenser shield, the four aligning condenser adjusting nuts will be seen; these serve to align the tuned stages, and seldom require readjustment. To make adjustments in the alignment of the tuning condenser, the receiver must first be removed from the cabinet and connected up on a bench with antenna and ground as for receiving. By looking to the left of the tuning dial, four holes will be seen along the shield can of the tuning condensers. Through three holes can be seen four hexagonal nuts, which are to be adjusted for aligning the tuning condenser. Any wrench which will fit these nuts whether insulated or not may be used. Proceed as follows, to align the circuits: Tune in an oscillator signal between 220 and 240 meters; use an indicating meter. Set the "local-distance" switch on the "distance" position. Turn down the volume control until station can just be heard. With the No. 4 Spintite wrench turn the adjusting nut (nearest the tuning dial) first to the right and then to the left. If this section of the tuning condenser is properly aligned, the signal will get weaker whichever way the nut is turned; however, adjust for strongest signal. Follow this procedure with the remaining circuits.

It is important that the proper polarity in connecting the pick-up leads to the chassis be observed. One jack is marked "R," meaning red or grid side of cord; and the other is marked "B," for the ground side of cord. Connection to the incorrect terminals may result in hum, or lack of phonograph volume.



Schematic circuit of the Earl "Model 224 A.C." screen-grid receiver. Note that the field coil of the reproducer is in series with the "B—" lead of the power pack; and the phonograph pick-up connects to the input of the first audio tube, V5. A novel "local-distance" switch, Sw1, is part of the design.

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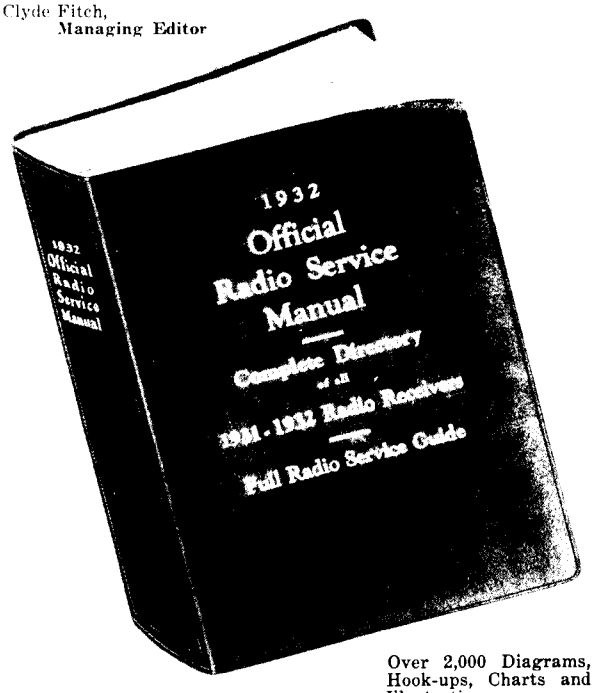
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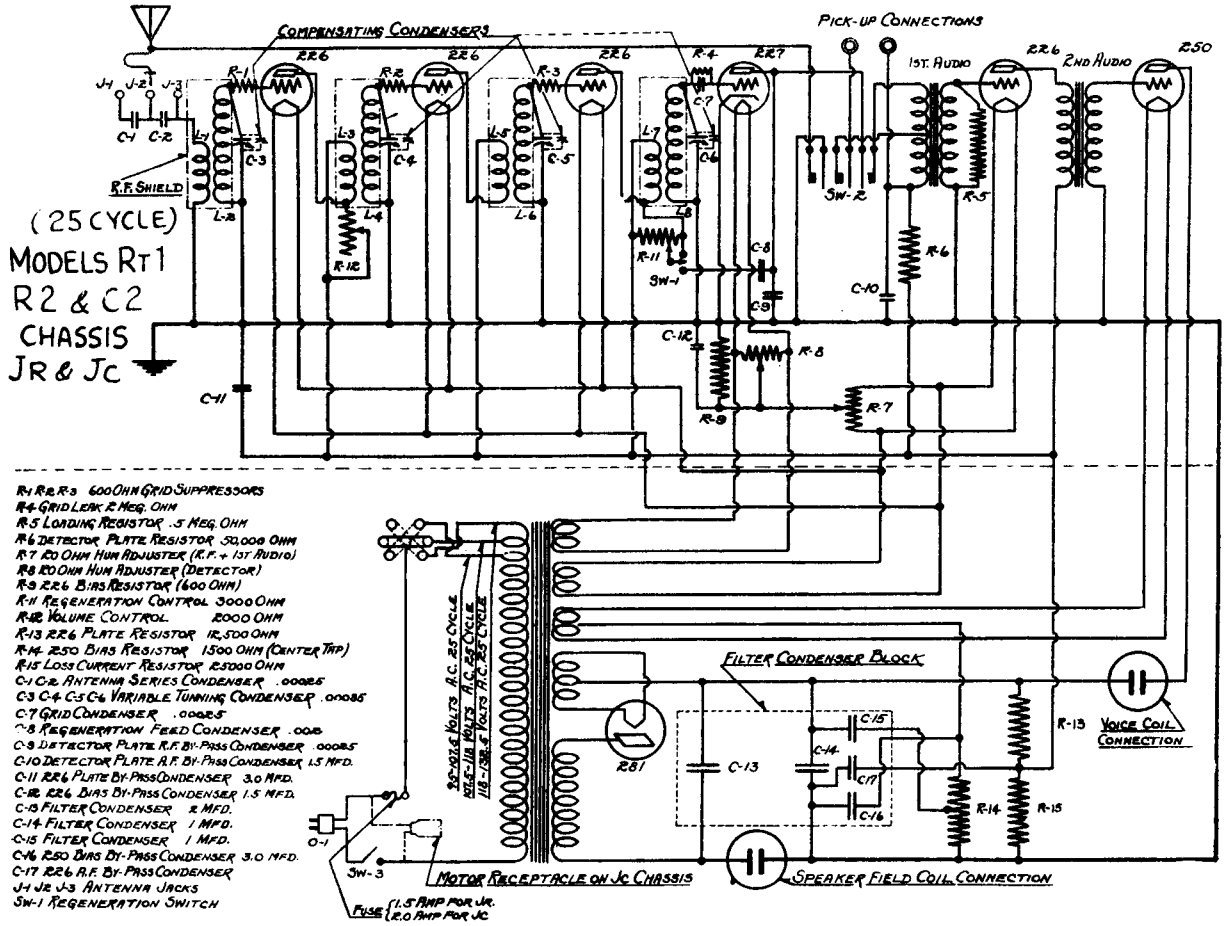
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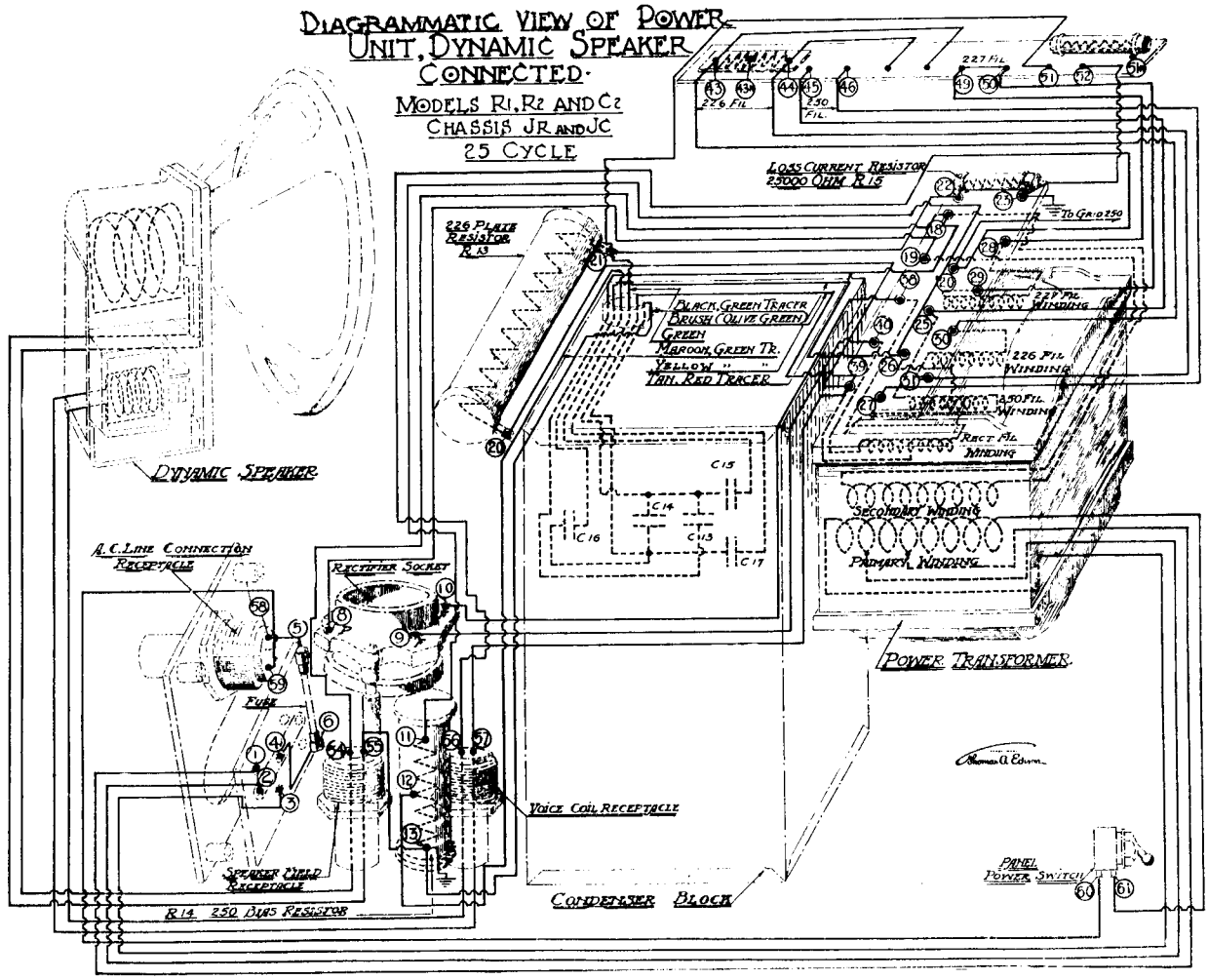
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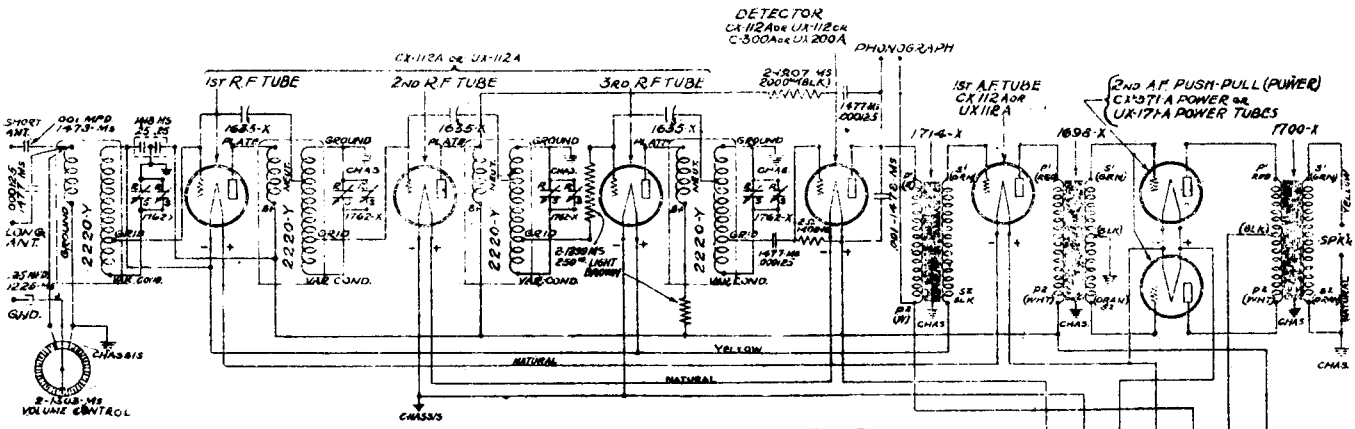


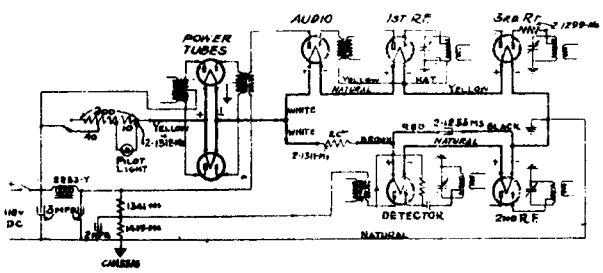
DIAGRAMMATIC VIEW OF POWER UNIT, DYNAMIC SPEAKER CONNECTED.

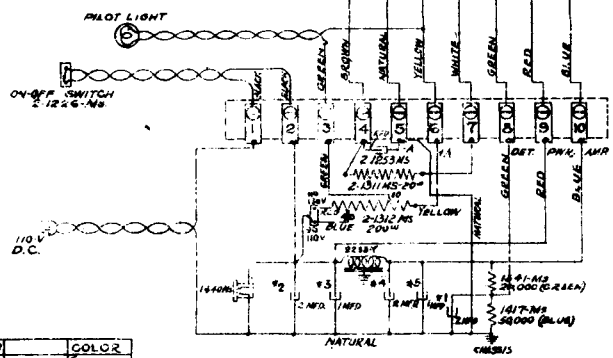
MODELS R1, R2 AND C2
CHASSIS JR AND JC
25 CYCLE

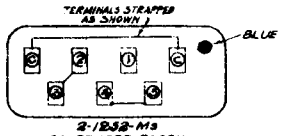


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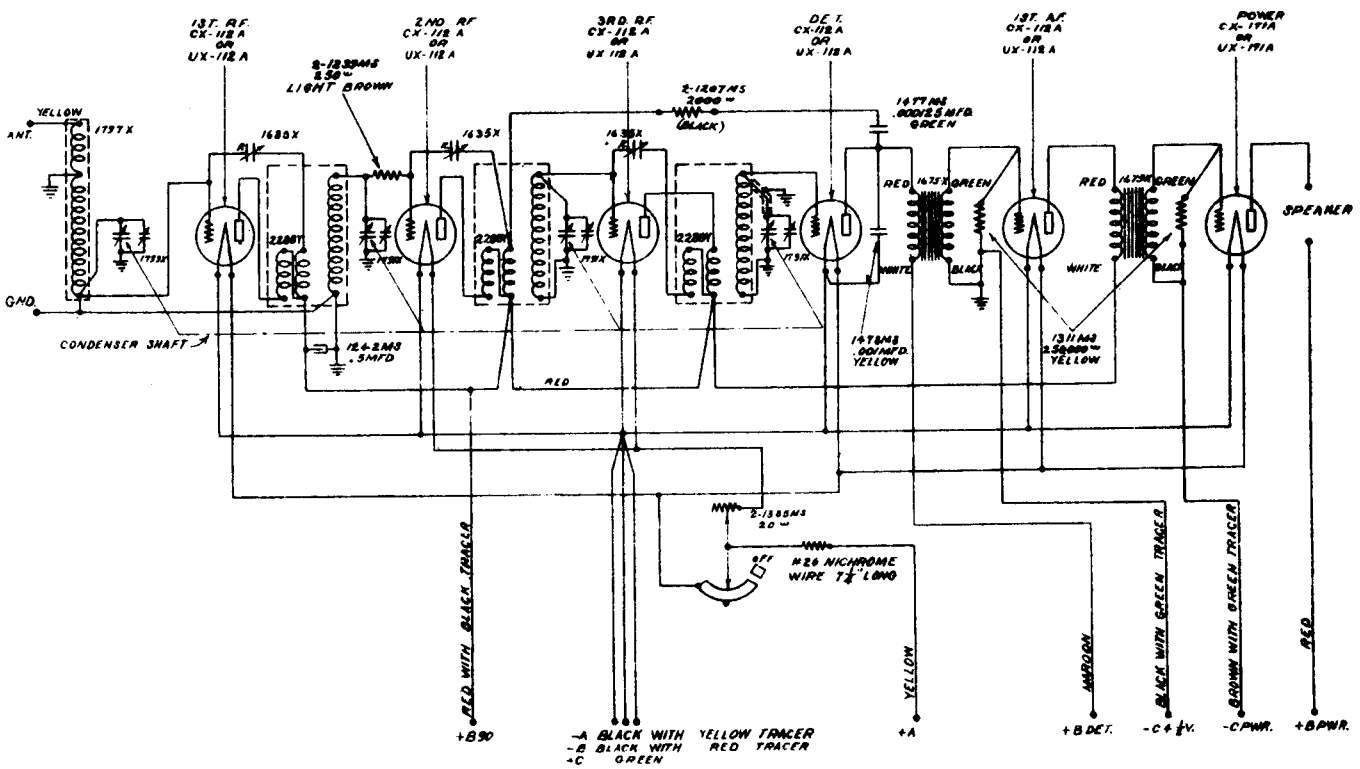






No.		COLOR
1	SWITCH	TWISTED
2	SWITCH	PAIR
3	PILOT LIGHT	GREEN
4	+A DET.	BROWN
5	CHASSIS	NATURAL
6	+A PWR.	YELLOW
7	+A PWR.	WHITE
8	+B DET.	GREEN
9	+B PWR.	RED
10	+B AMP.	BLUE

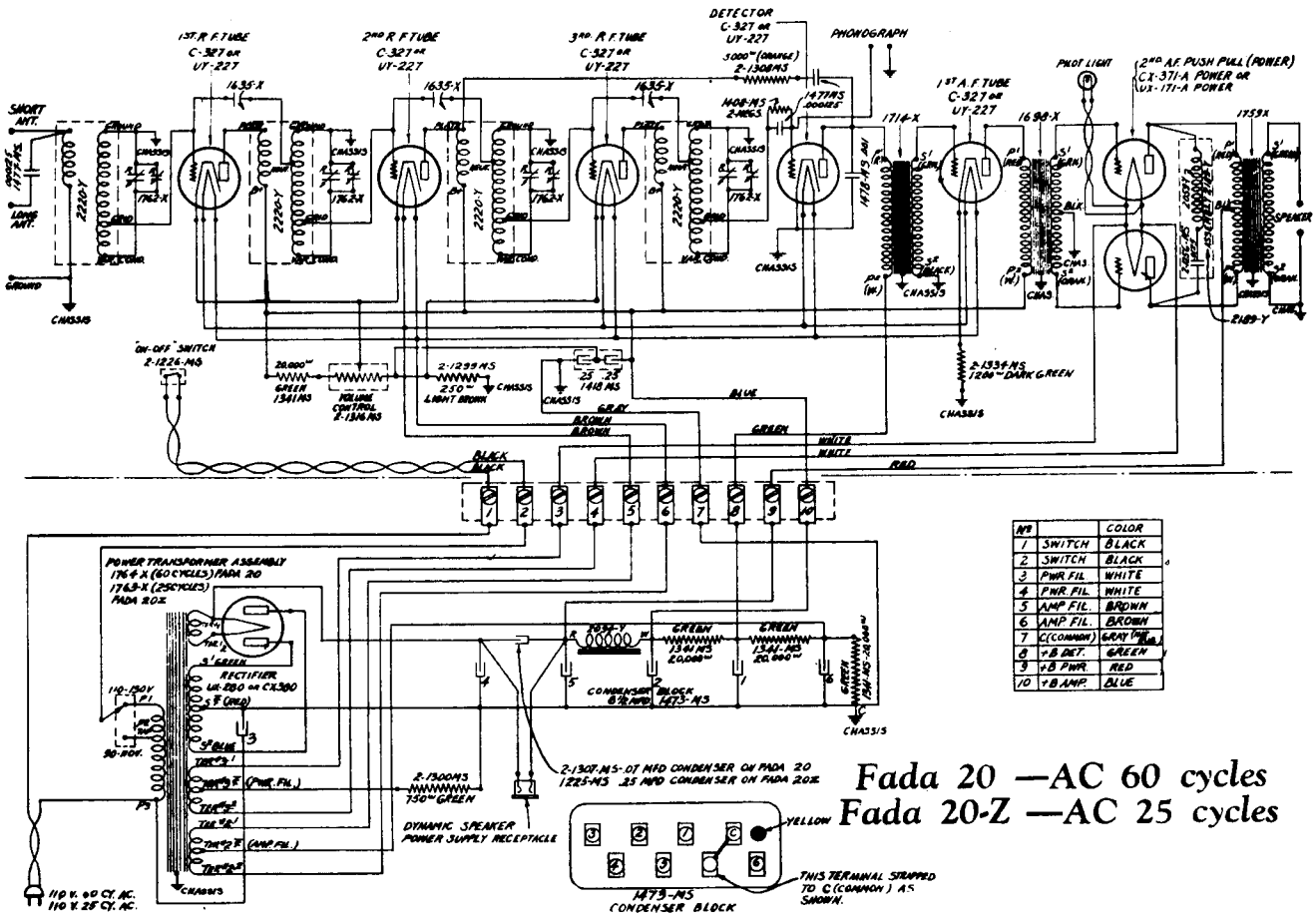
Fada 18 DC Receiver
for use with direct current only



Fada 22 Battery Model Receiver

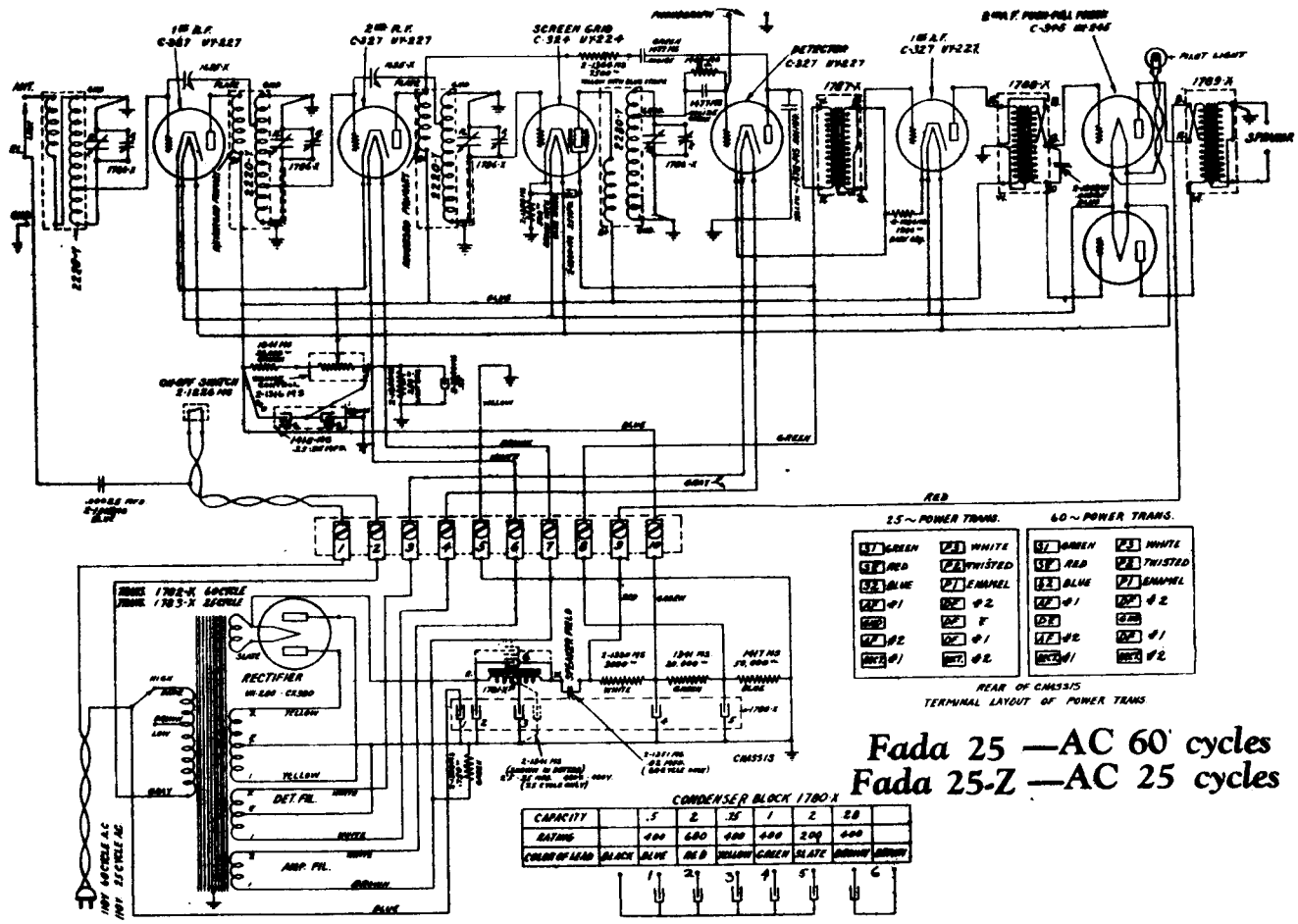
BATTERY CABLE 2090Y

F.A.D. ANDREA, INC.



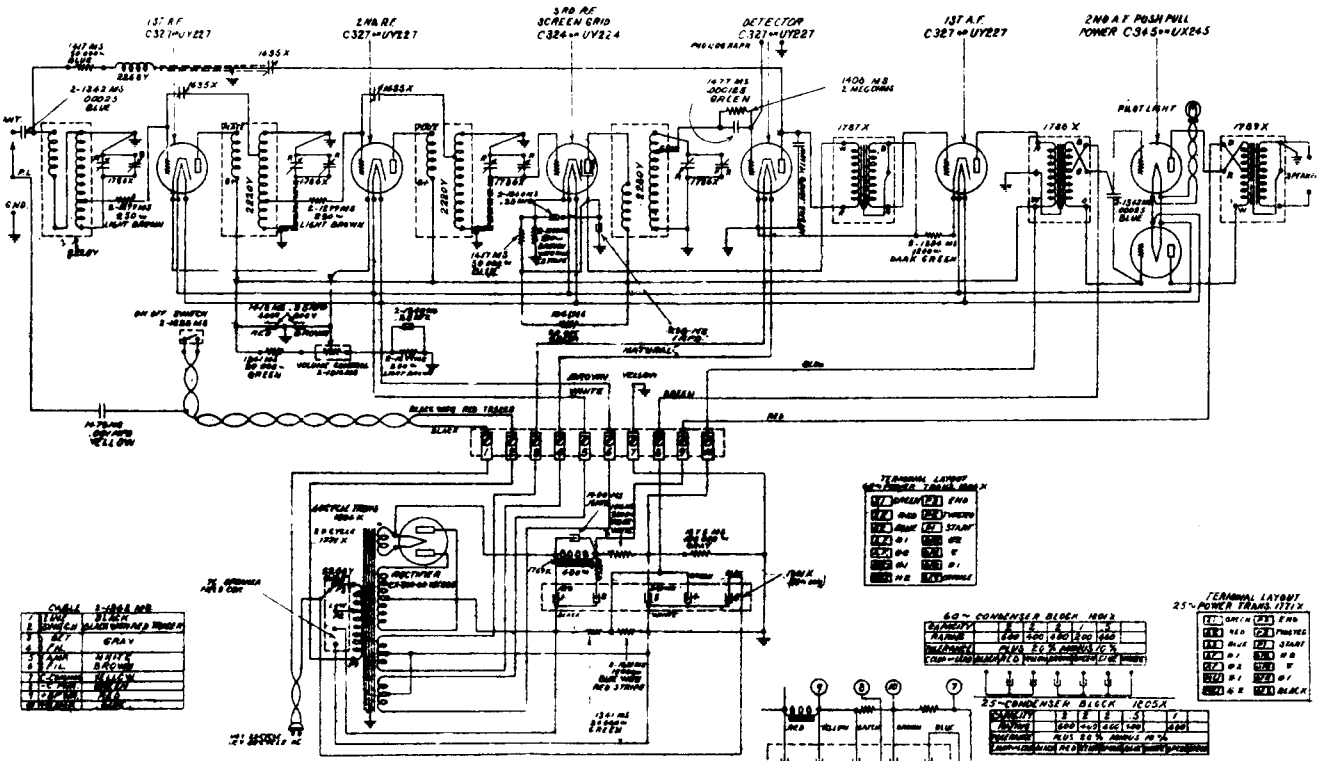
No.		COLOR
1	SWITCH	BLACK
2	SWITCH	BLACK
3	PWR. FIL	WHITE
4	PWR. FIL	WHITE
5	AMP. FIL.	BROWN
6	AMP. FIL.	BROWN
7	C (COMMON)	GRAY
8	+B DET.	GREEN
9	+B PWR.	RED
10	+B AMP.	BLUE

Fada 20 —AC 60 cycles
Fada 20-Z —AC 25 cycles

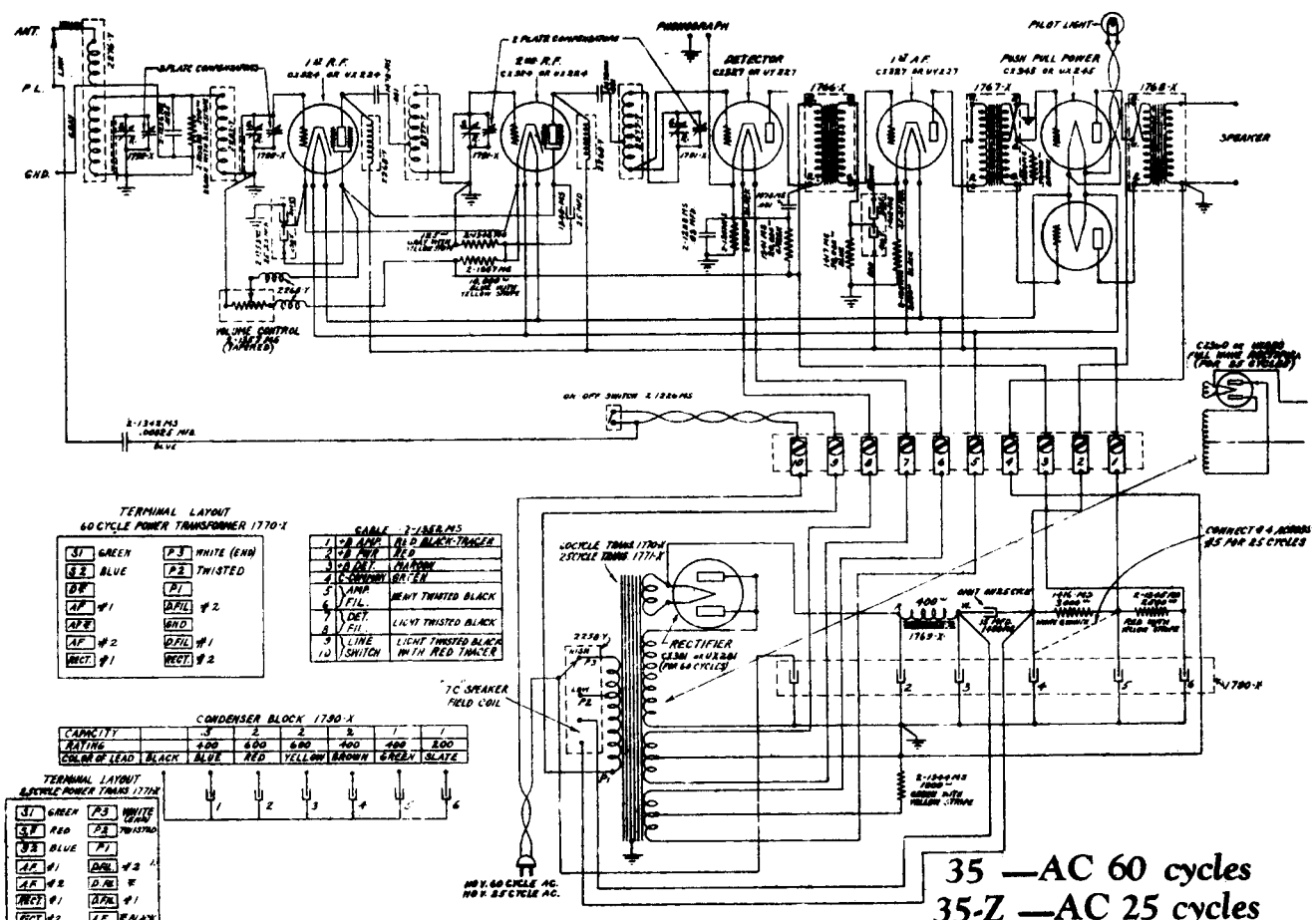


Fada 25 —AC 60 cycles
Fada 25-Z —AC 25 cycles

F.A.D. ANDREA, INC.

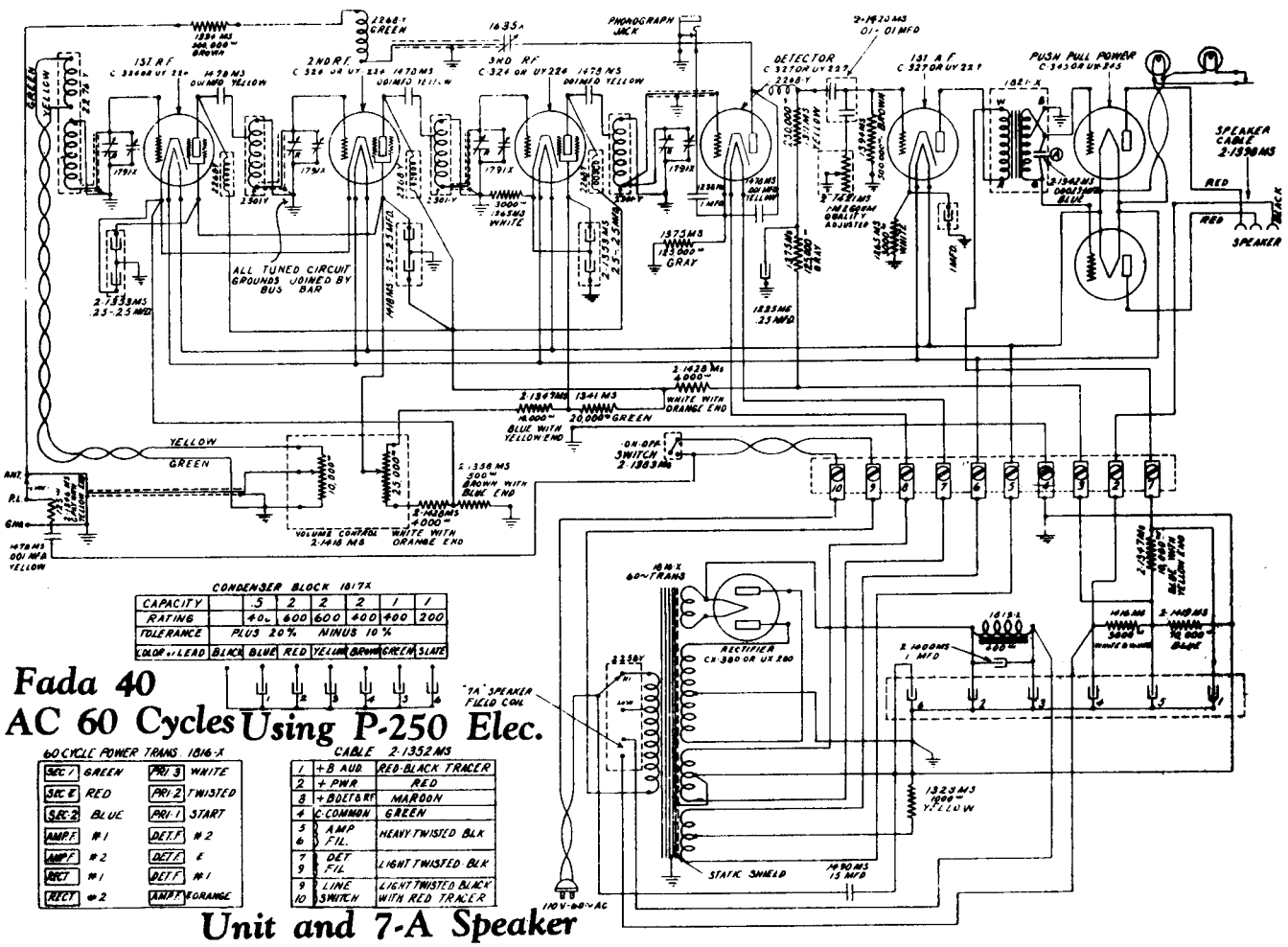


Fada 25 and 25-Z Receivers used with M-250 and M-250-Z Electric Units



35 —AC 60 cycles
35-Z —AC 25 cycles

F.A.D. ANDREA, INC.



CONDENSER BLOCK 1817X

CAPACITY	.5	2	2	2	1	1
RATING	400	600	600	400	400	200
TOLERANCE	PLUS 20%		MINUS 10%			
COLOR of LEAD	BLACK	BLUE	RED	YELLOW	BROWN	GREEN	SLATE

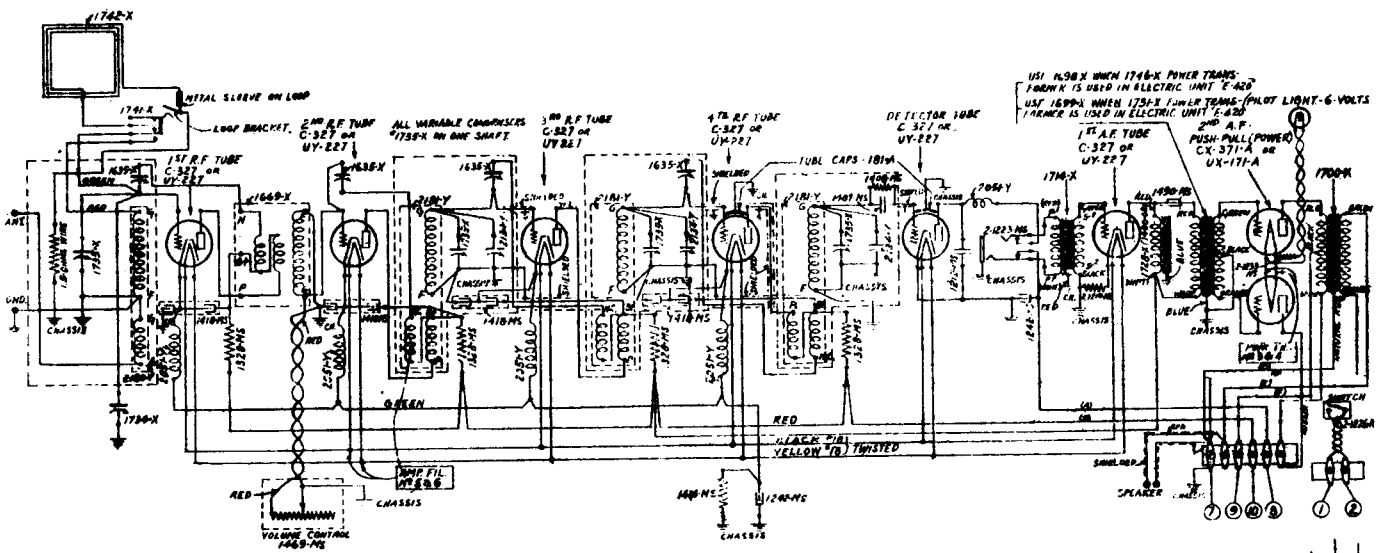
Fada 40
AC 60 Cycles Using P-250 Elec. Unit and 7-A Speaker

60 CYCLE POWER TRANS 1816-X

SEC 1	GREEN	PRI 3	WHITE
SEC E	RED	PRI 2	TWISTED
SEC 2	BLUE	PRI 1	START
AMP F	#1	DET F	#2
AMP F	#2	DET F	E
RECT	#1	DET F	#1
RECT	#2	AMP F	ORANGE

CABLE 2-1352 MS

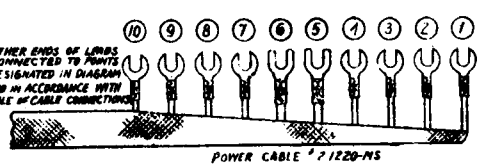
1	+B AUD	RED-BLACK TRACER
2	+ PWR	RED
3	+ DET & RF	MAROON
4	C COMMON	GREEN
5 6	AMP FIL.	HEAVY TWISTED BLK
7 9	DET FIL	LIGHT TWISTED BLK
9	LINE	LIGHT TWISTED BLACK
10	SWITCH	WITH RED TRACER

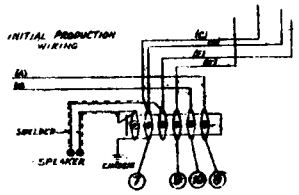


Fada 50, 70, 71 and 72 Receivers

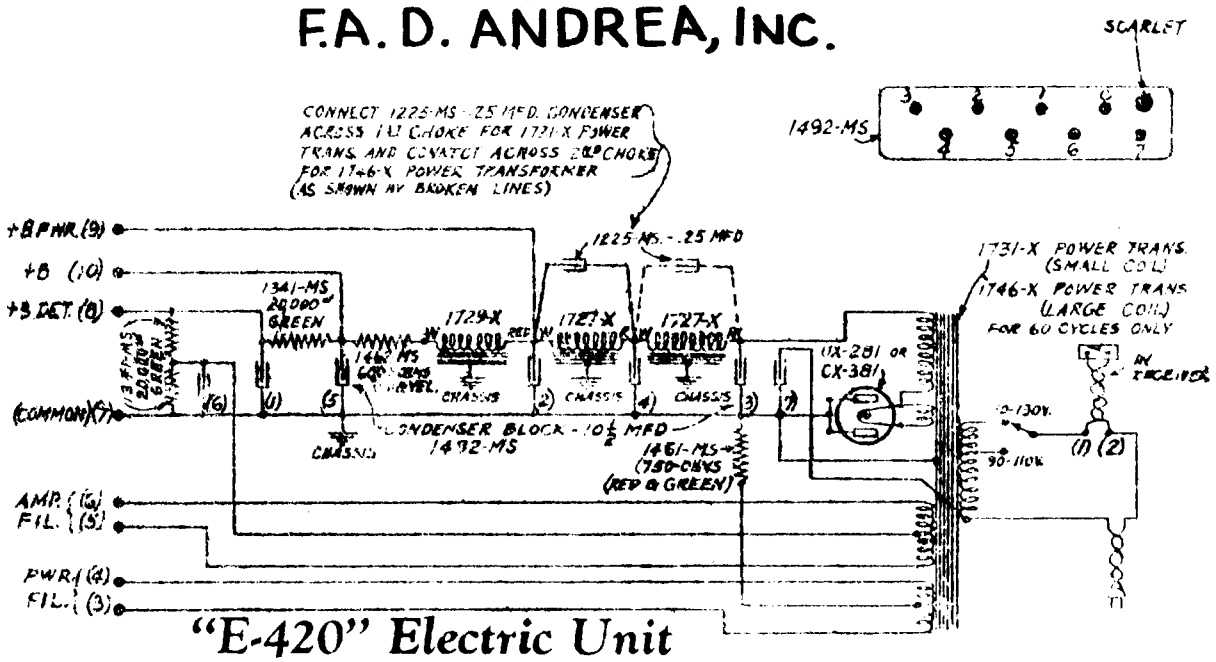
TABLE OF CABLE CONNECTIONS

NO	COLOR	
1	LINE	BLACK WITH RED TRACER	LIGHT TWISTED
2	SWITCH	BLACK	
3	PWR.	BLACK	LIGHT TWISTED
4	FIL.	BLACK	
5	AMP.	BLACK	HEAVY TWISTED
6	FIL	BLACK	
7	C (COMMON)	GREEN	
8	+B DET	MAROON	
9	+B PWR.	RED	
10	+B 30	RED WITH BLACK TRACER	

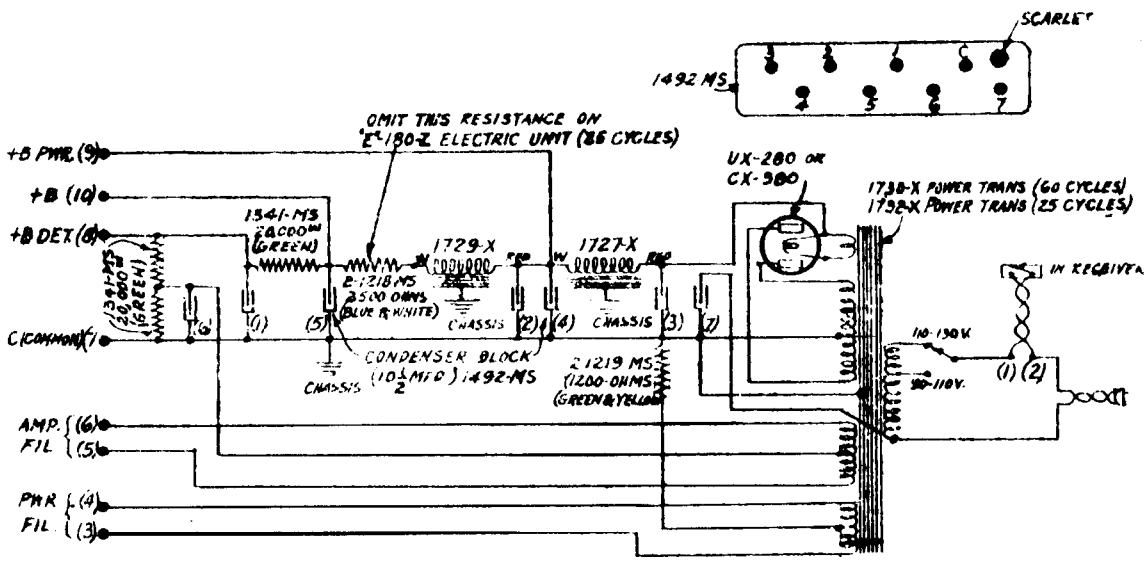




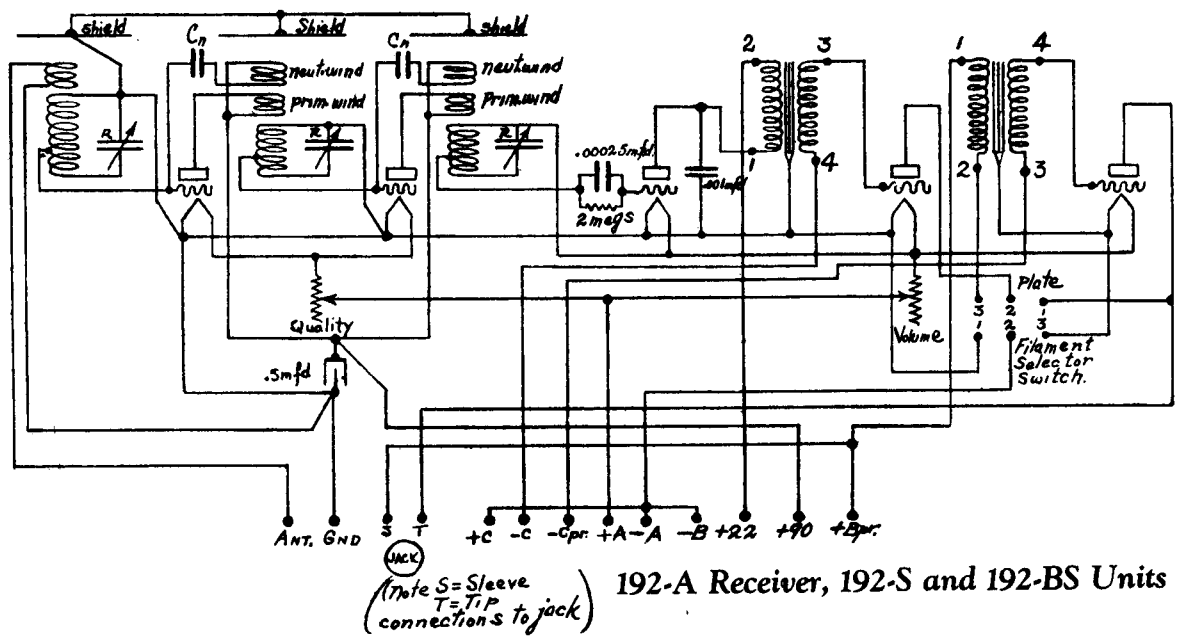
F.A.D. ANDREA, INC.



"E-420" Electric Unit —For Fada 50, 70, 71 and 72 Receivers

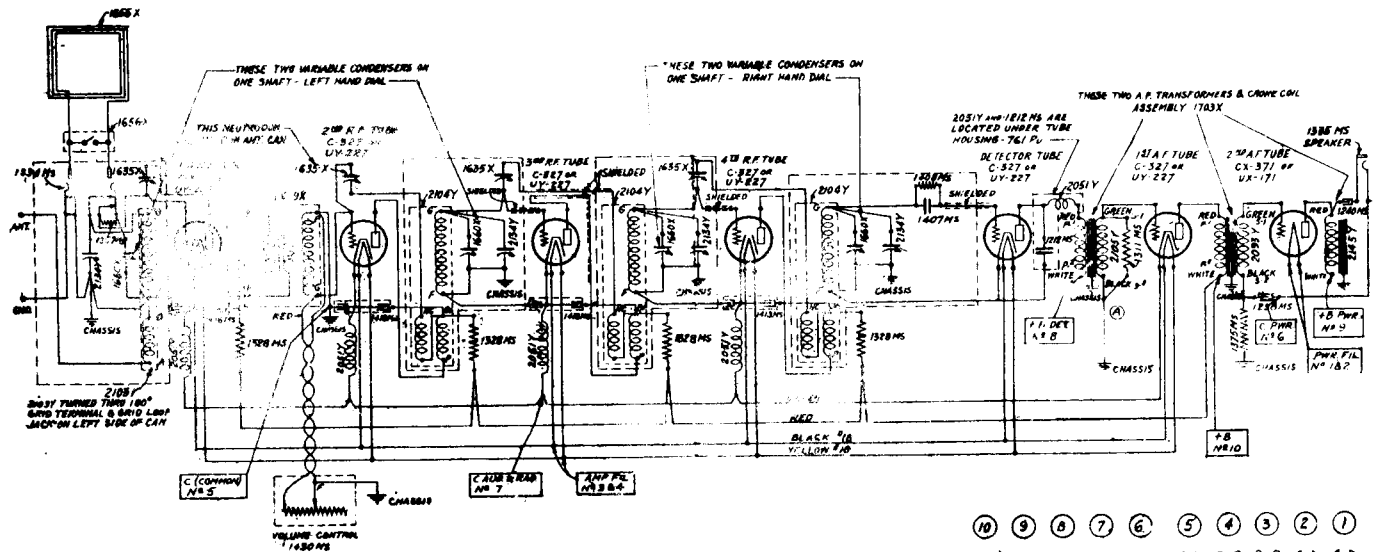


"E-180" Electric Unit—For Fada 50 and 70 Receivers



192-A Receiver, 192-S and 192-BS Units

F.A.D. ANDREA, INC.



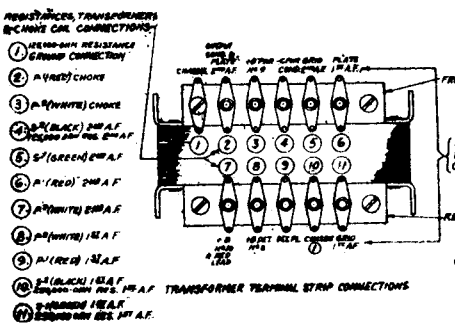
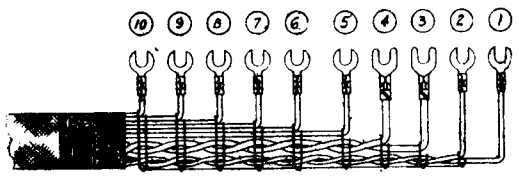
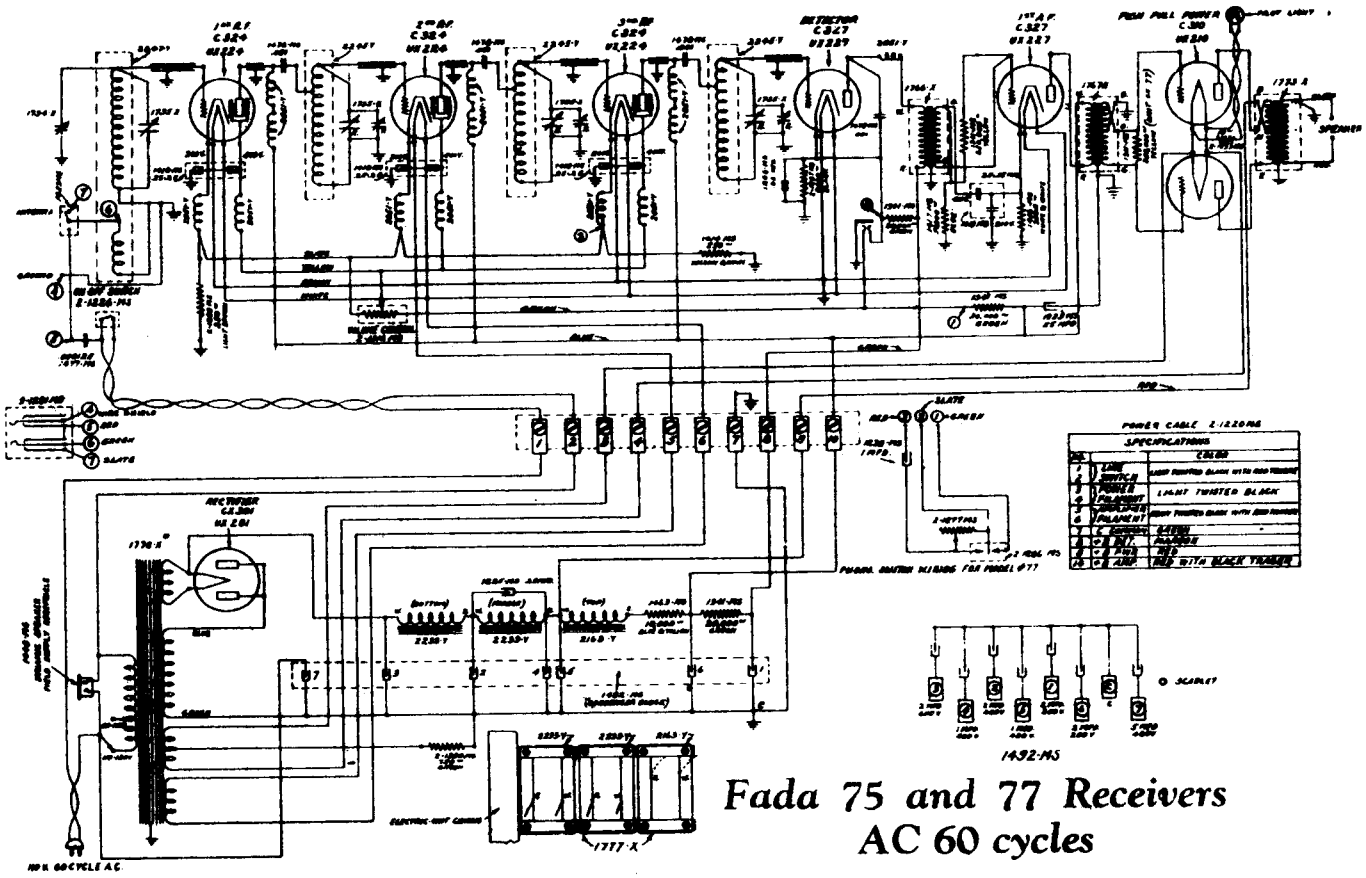


TABLE OF CABLE CONNECTIONS		
No		COLOR
1	PWR. FIL	BLACK LIGHT TWISTED
2	PWR. FIL	BLACK
3	ANR FIL	BLACK
4	ANR FIL	BLACK HEAVY TWISTED
5	C (common)	GREEN
6	C PWR	BROWN WITH WIDE GREEN T...
7	CABLE HEAD	BLACK with WIDE GREEN TRACER
8	+B DET	MAROON
9	+B PWR	RED
10	+B	RED WIDE BLACK TRACER



OTHER ENDS OF LEADS CONNECTED TO POINTS DESIGNATED IN DIAGRAM AND IN ACCORDANCE WITH TABLE OF CABLE CONNECTIONS

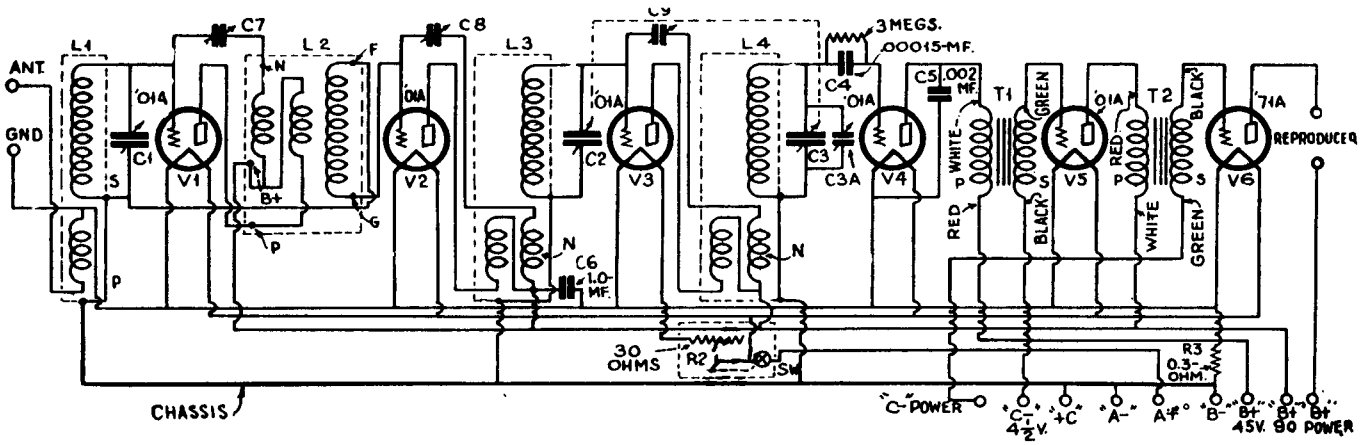
"7" AC 4[illegible]A or CA and SF45/75-UA or CA
4[illegible]2-UA or CA and SF45/72-UA or CA



Fada 75 and 77 Receivers
AC 60 cycles

Radio Service Data Sheet

FADA "SPECIAL" MODEL 265-A AND FADA "7" MODEL 475-A



Circuit connections in the "Special" Fada "Model 265-A" receiver, battery-operated.

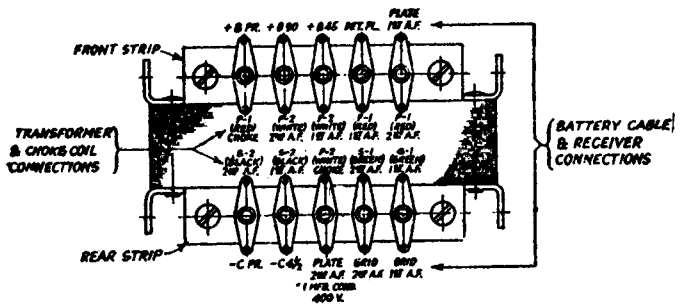
The following is the procedure to be followed for neutralizing the Fada "Model 265-A" battery set: the neutralizing condensers C7, C8, C9 are located from left to right in the set.

Balance V3, V2, V1, in the same order, using a tube with an open filament. Adjust on a wavelength between 250 and 300 meters. To neutralize this receiver it is recommended that a type '01A tube be used in the detector position, V4; replacing, when balanced, with a type '00A tube.

The compensating condenser C3A is located at the right of the third tuning condenser and is adjusted with a long screwdriver.

In the Fada "Model 475-A" receiver, C7 is accessible through the left hole (facing front of set) in terminal board in first can; and the second neutralizing condenser C8 through the right hole. Condenser C9 is reached through the right-hand hole in the second can; and C10, through the right-hand hole in the third can. Each of these condensers is numbered according to the stage it balances. It is recommended that headphones be used to obtain a null point when balancing the receiver. Tune for a strong signal on a wavelength of 250 to 300 meters, when balancing this set, using the loop for signal pick-up.

Note: The FADA model 265-A receiver shown above is used with the RP-65 Unit. The FADA 475-A battery operated loop set shown below is used with the SF 45/75 receivers.



Detail of the connection strip (on the audio assembly) provided for the battery-cable connections in the "Model 475-A." The color-code of the cable appears in this illustration.

The input circuit compensator C1A is the thumb screw marked "antenna adjuster" on the terminal board in the first can. Condensers C2A, C3A and C4A are accessible through holes in their respective shield cans.

Wavelength compensation in the various tuned stages is obtained by tuning to a strong local station (using the loop) on a wavelength between 250 and 300 meters. After obtaining the loudest signal at a single point, remove the loop plugs and connect an aerial and ground to the set. Without moving left-hand dial, turn antenna adjuster screw to left or right to point of maximum signal.

The following values are used in this set: C1, C2, C3, C4, .00035-mf.; C5, .001-mf.; C6, C12, C13, C14, C15, C16, 0.5-mf.; C11, .00015- to .00025-mf.; C17, 1.mf. Resistors R1, R2, R3, R4 are 1,000 ohms; R5, 250,000 ohms; R6, 500,000 ohms; R7, 125,000 ohms; R8, 500,000 ohms; R9, 6 to 20 ohms. Type '01A tubes are used as V1, V2, V3, V4, V5 (or a type '00A may be used here) and V6; and a '71A for V7. Unit L2 is an untuned R.F. transformer.

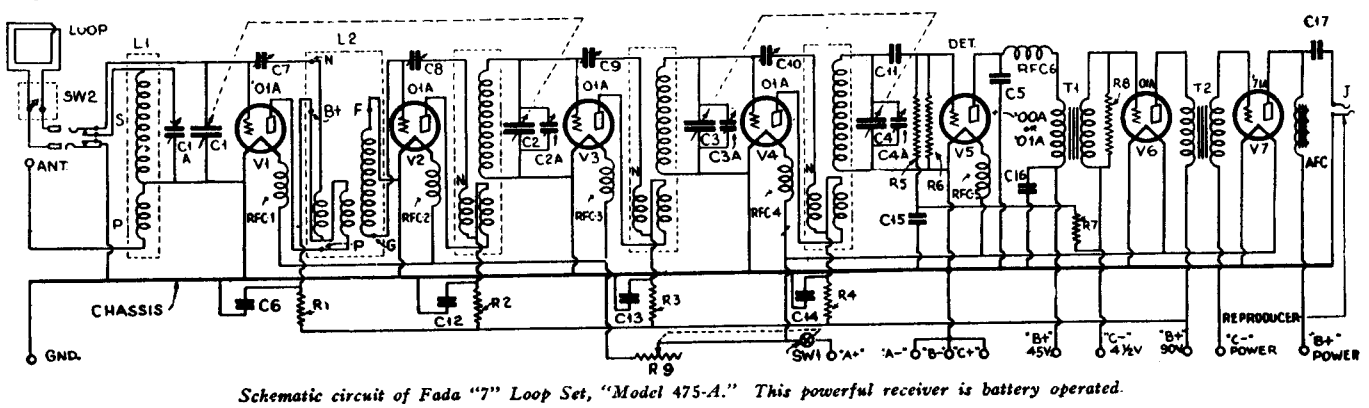
When servicing the "475-A" check for open resistors R1, R2, R3 or R4; also for an open output condenser C17. If it is difficult to stop circuit oscillation, determine whether a low-resistance ground is being used; and whether any of the by-pass condensers are open.

In both the "265-A" and the "475-A" receivers the filament rheostat and off-on switch are combined in one unit. Both of these sets are two-dial control.

In the "high gain" Fada "475-A," the R.F. chokes RFC1, RFC2, RFC3, RFC4, RFC5 are inserted in the positive "A" leads of the first five tubes to prevent circuit oscillation due to this common lead.

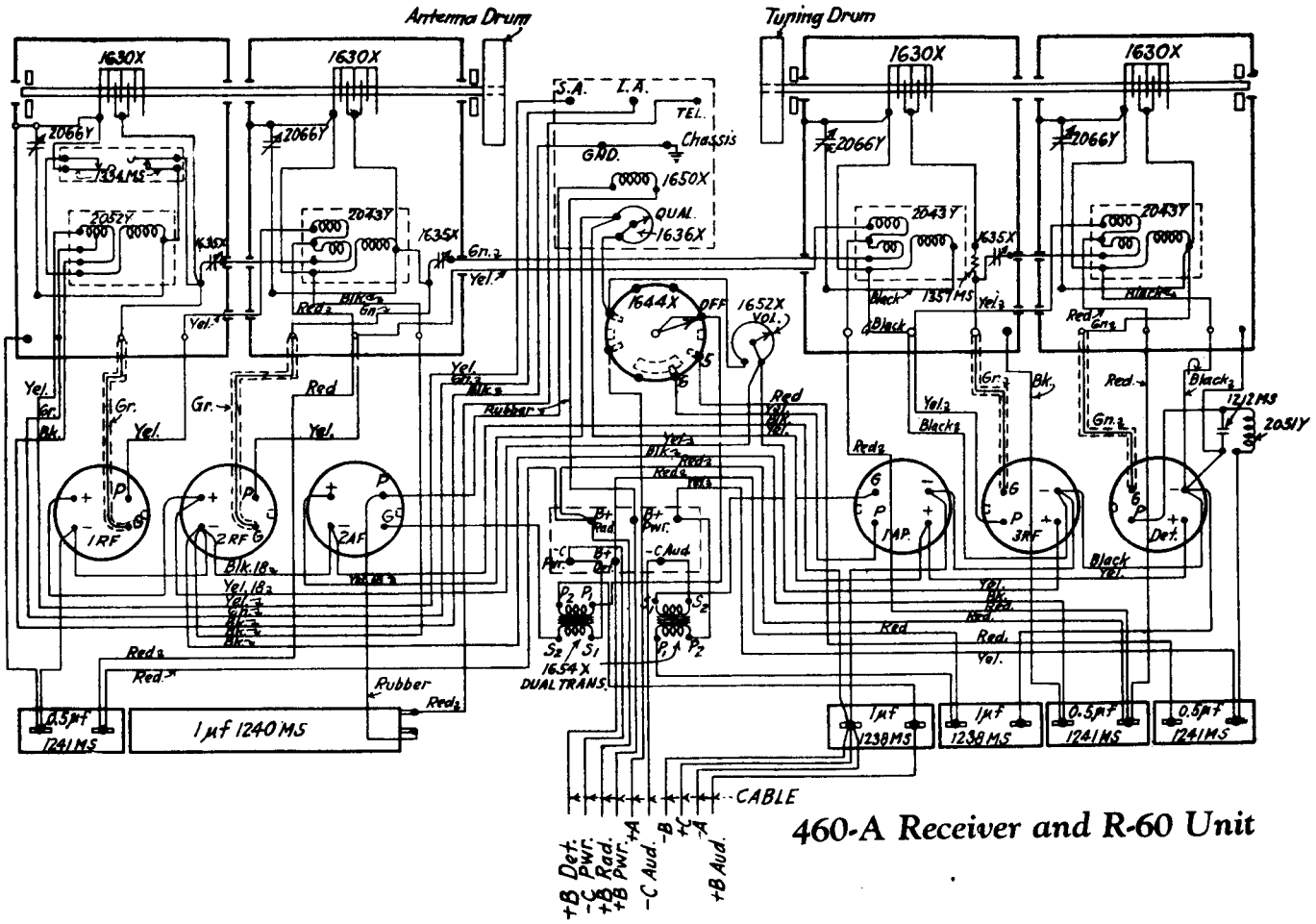
The battery cable for the "475-A" connects to terminal strips on the unit comprising T1, T2 and AFC. These strips are shown in an accompanying illustration.

Note the connections and values of R5, R6, R7. An open R1, R2, R3, or R4 resistor may indicate a short in C7, C8, C9, C10.

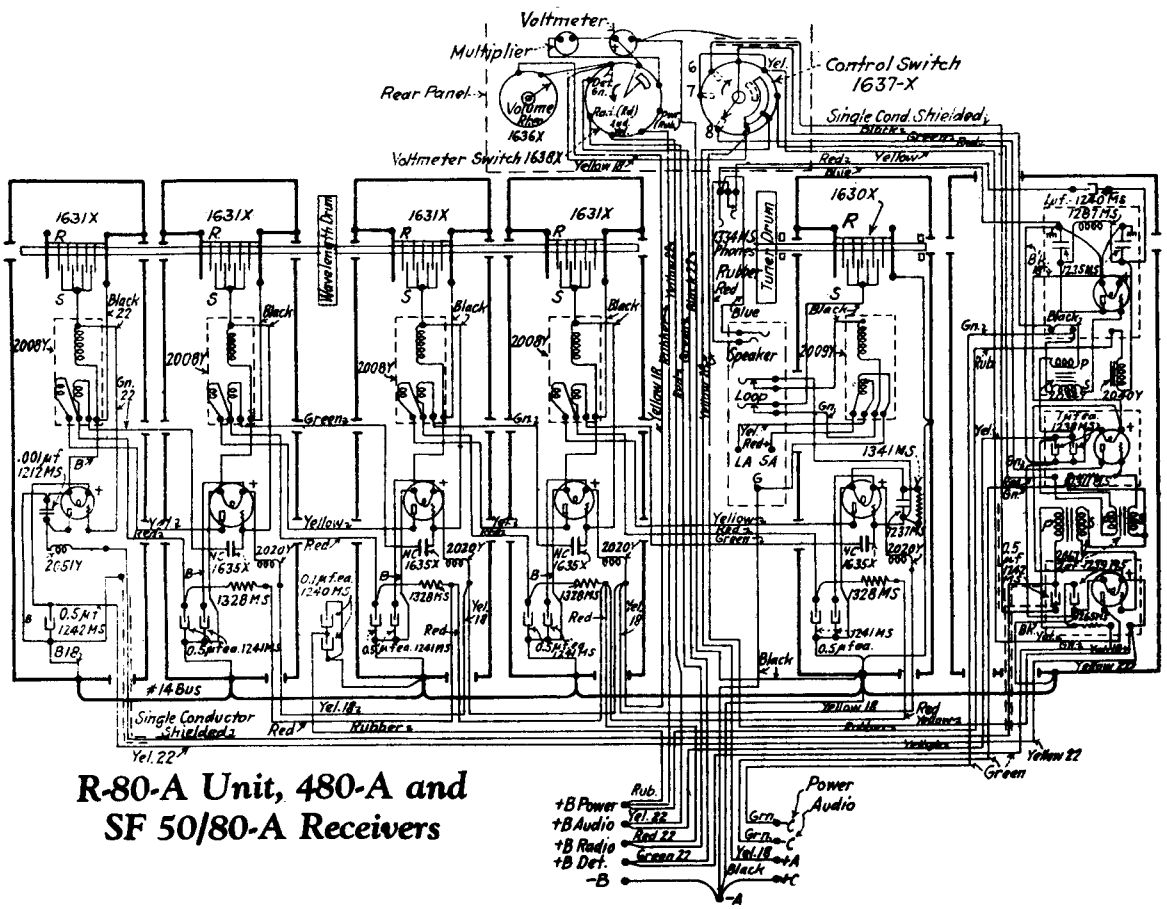


Schematic circuit of Fada "7" Loop Set, "Model 475-A." This powerful receiver is battery operated.

F.A.D. ANDREA, INC.



460-A Receiver and R-60 Unit



R-80-A Unit, 480-A and SF 50/80-A Receivers

F. A. D. ANDREA, INC.

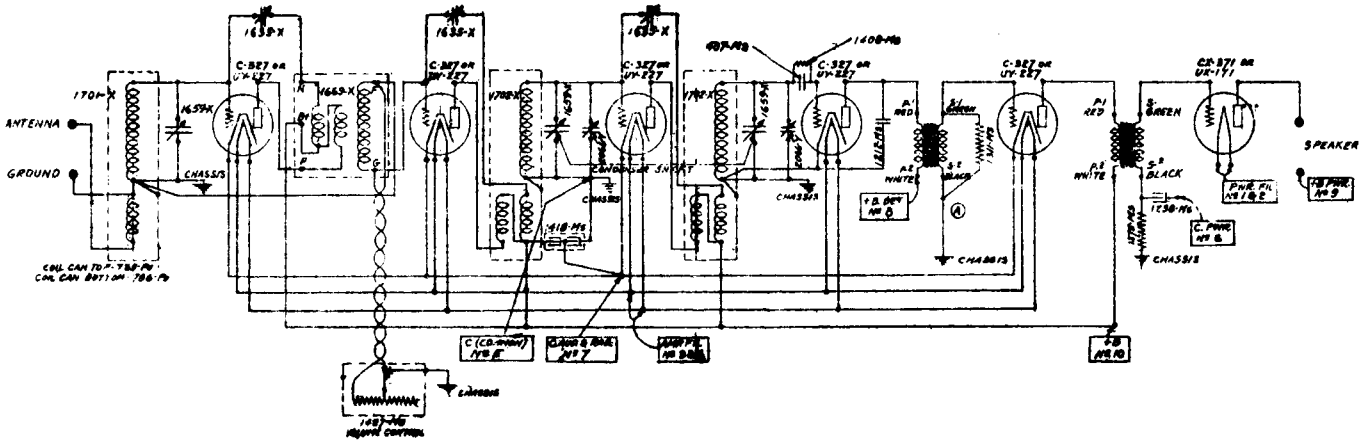
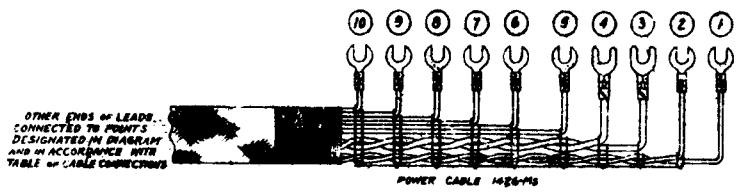
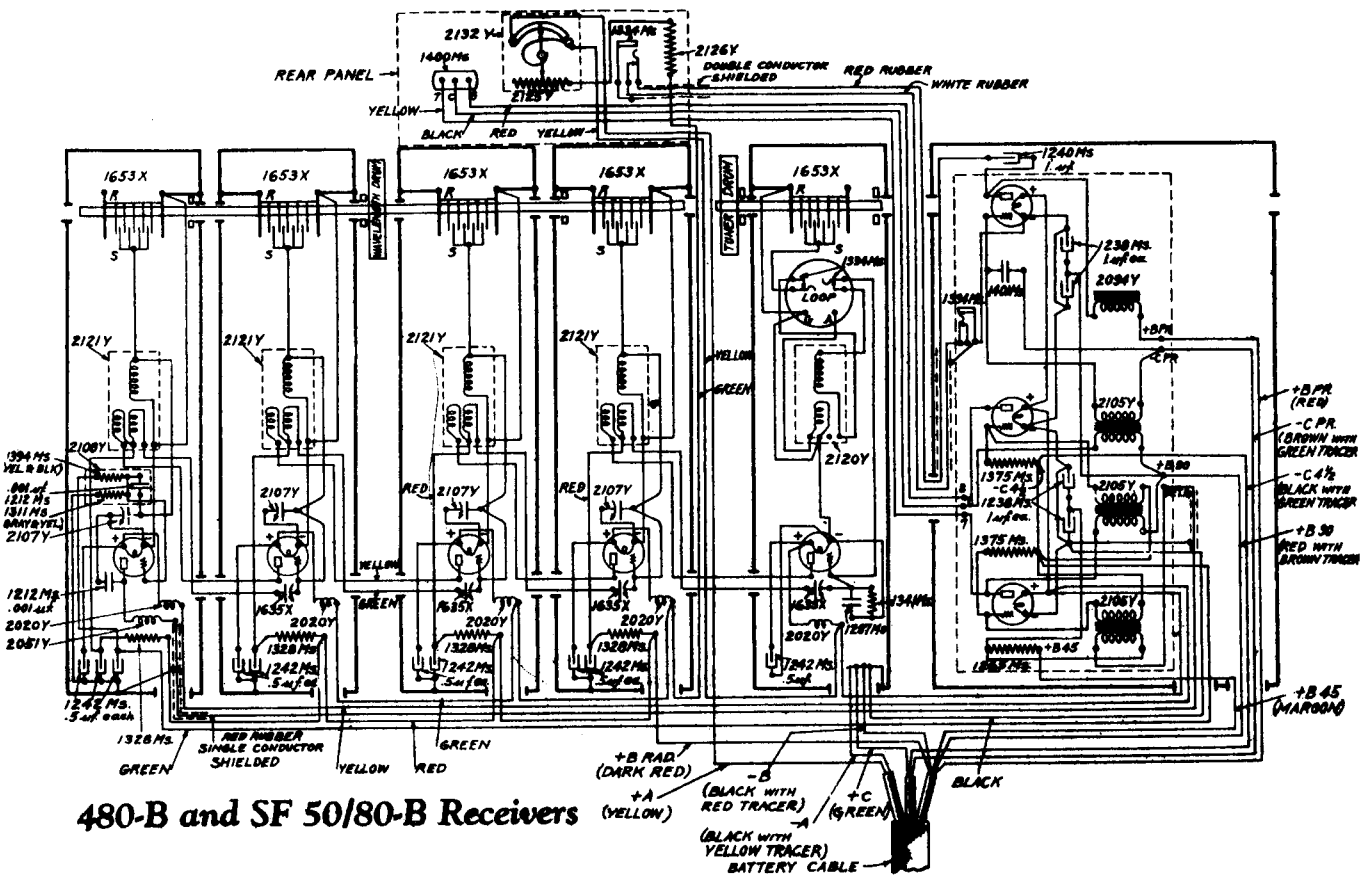


TABLE OF CABLE CONNECTIONS		
NO.		COLOR
1	PWR FIL.	BLACK (LIGHT TWISTED)
2	PWR FIL.	BLACK
3	AMP FIL.	BLACK (HEAVY TWISTED)
4	AMP FIL.	BLACK
5	C (Common)	GREEN
6	C PWR.	BROWN WITH WIDE GREEN TRACER
7	CAN-BRAID	BLACK WITH WIDE GREEN TRACER
8	+B DET.	MAROON
9	+B PWR.	RED
10	+B	RED WITH WIDE BLACK TRACER

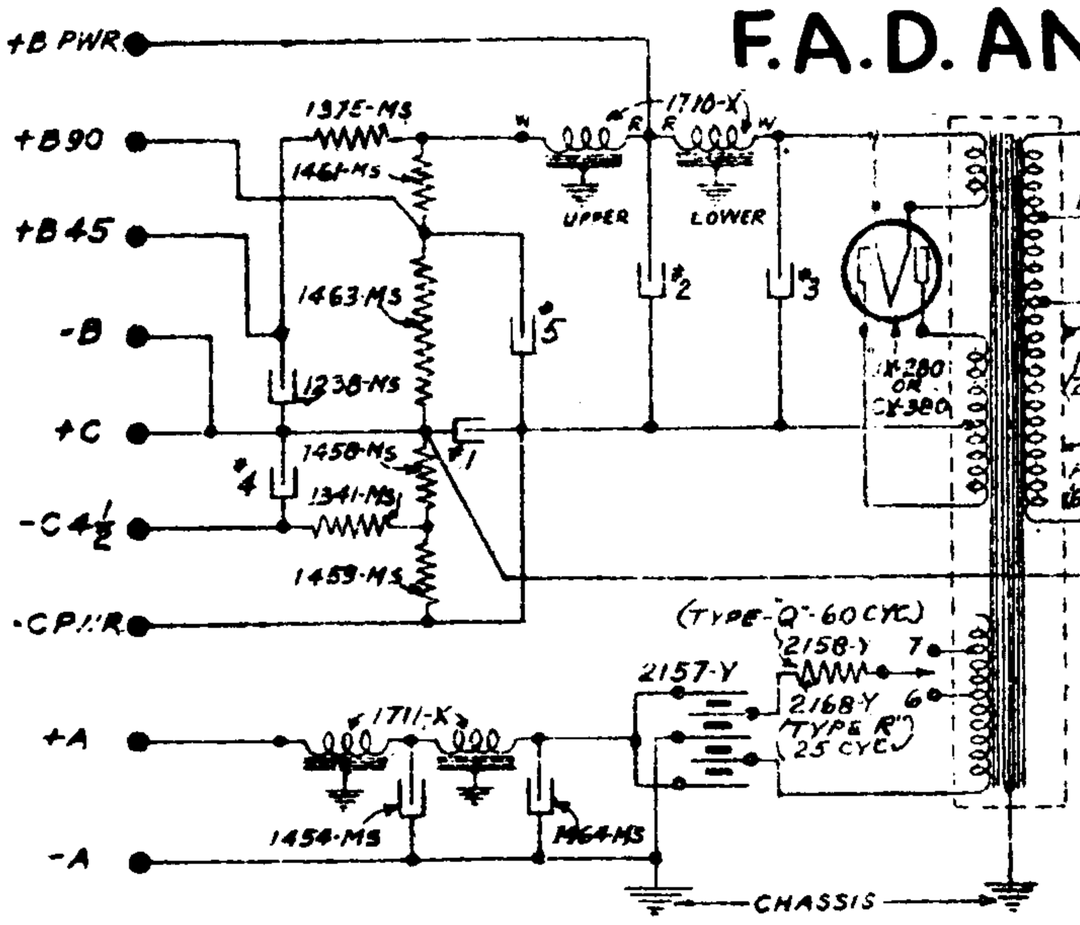


"Special" AC Receiver 265-UA or CA and RP-65-UA or CA 262-UA or CA and RP-62-UA or CA



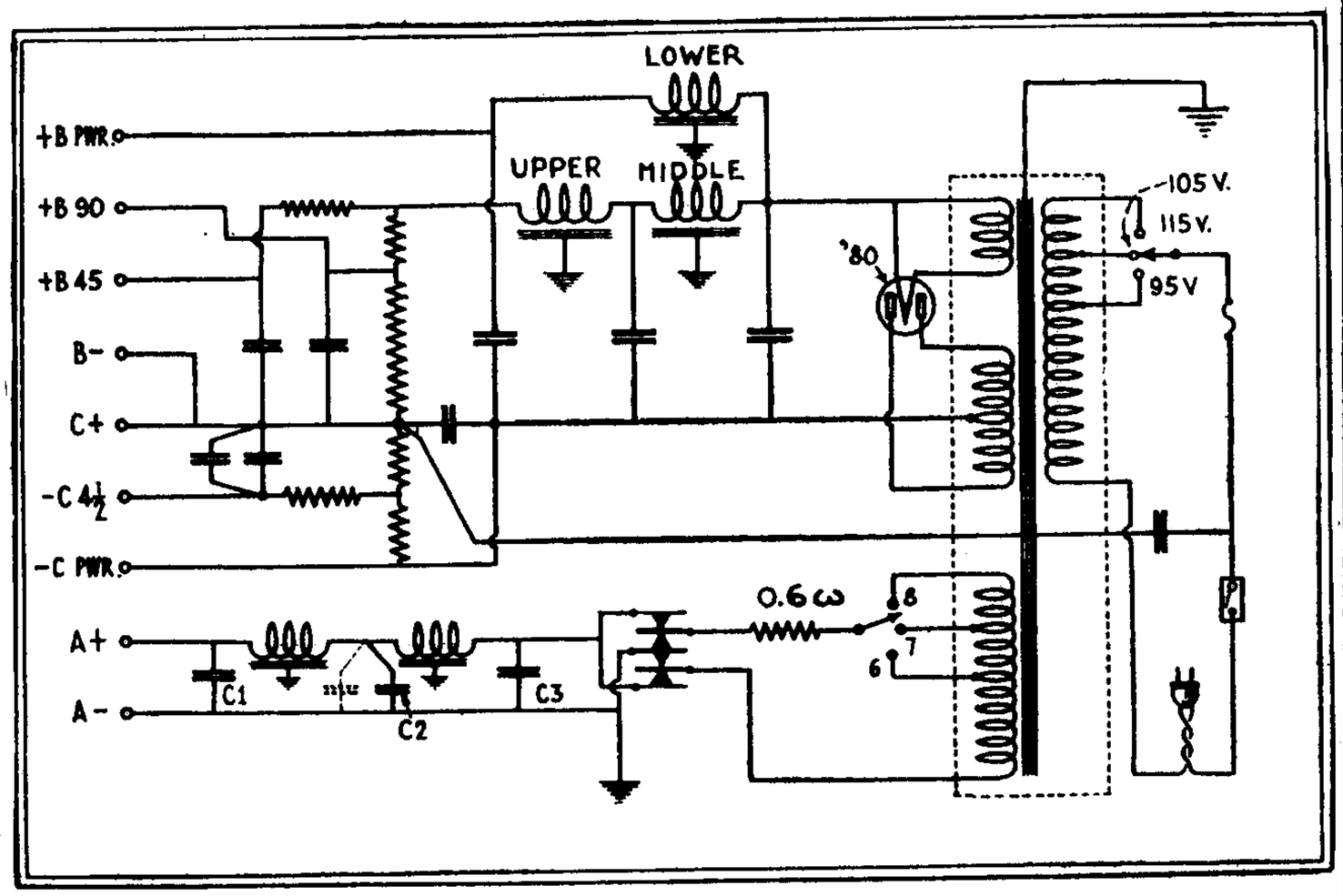
480-B and SF 50/80-B Receivers

F.A.D. ANDREA, INC.



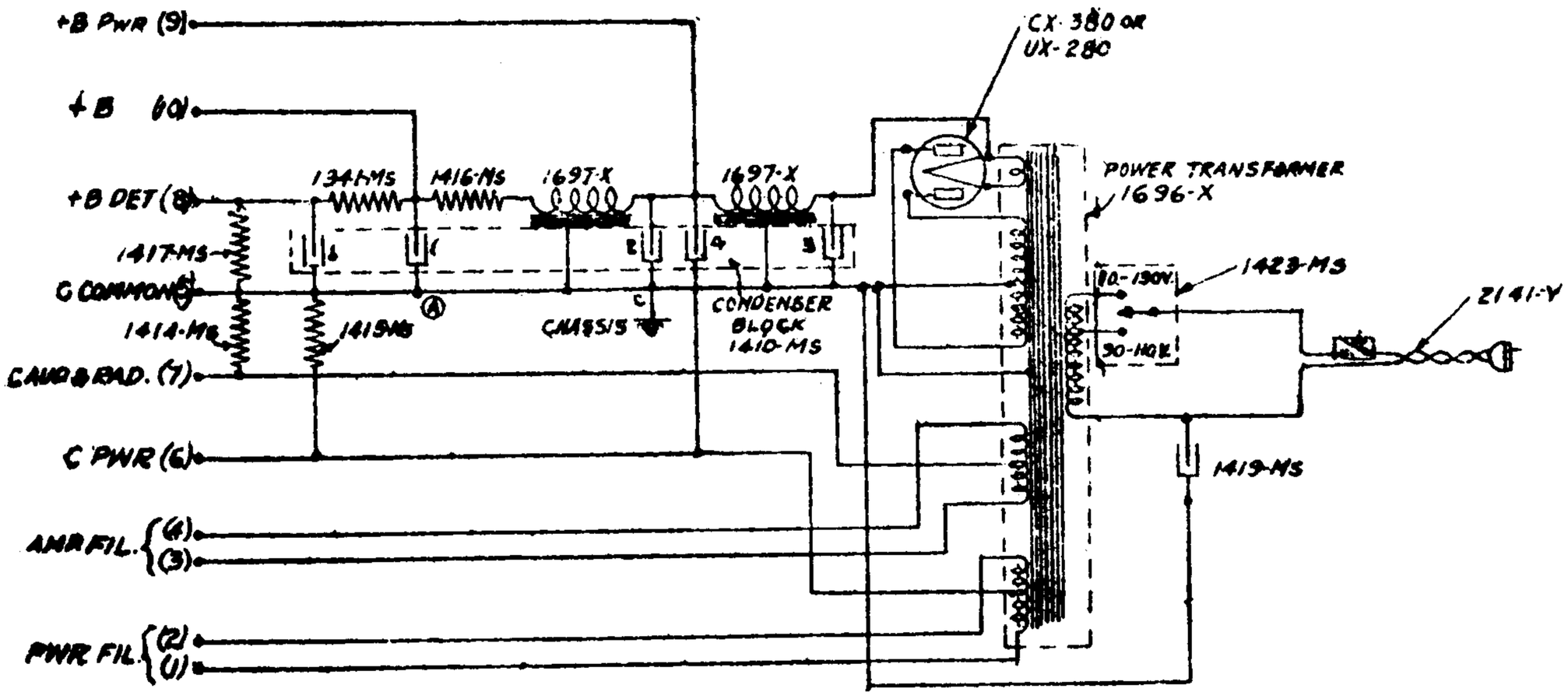
"ABC" Six Volt Tube Supply Unit — Types 66-Q and 62-R

The FADA "A-B-C" Power unit shown at the right uses three Elkon. 1500-mf. "dry" condensers in the "A" filter system. If a very bad hum is heard in installations using this power unit, check the "dry" condensers, C1, C2, C3. The trouble is most conveniently checked by disconnecting one condenser after the other, until the hum suddenly drops. As the hum is less with all of the condensers out of the circuit than with a single defective condenser in circuit, the location of the defective unit is simple.



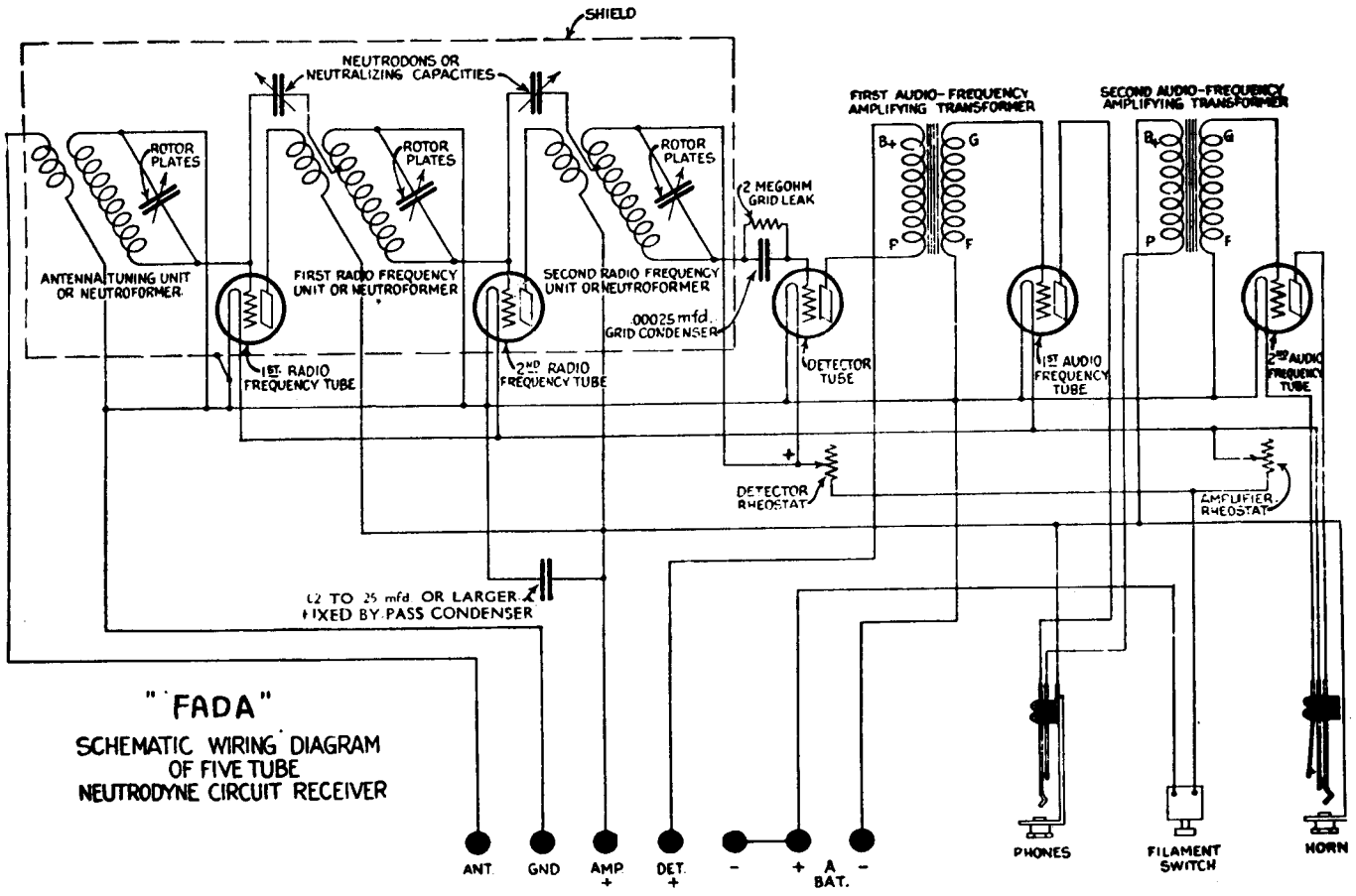
"ABC" six-volt tube-supply unit of Fada types "86-V" and "82-W," illustrating an application of the 1500-mf. dry "A" condensers.

Type "J" unit for 25 cycle current is similar, except that a 1706X power transformer is used instead of the 1696X transformer as indicated on the type "C" unit for 60 cycles.



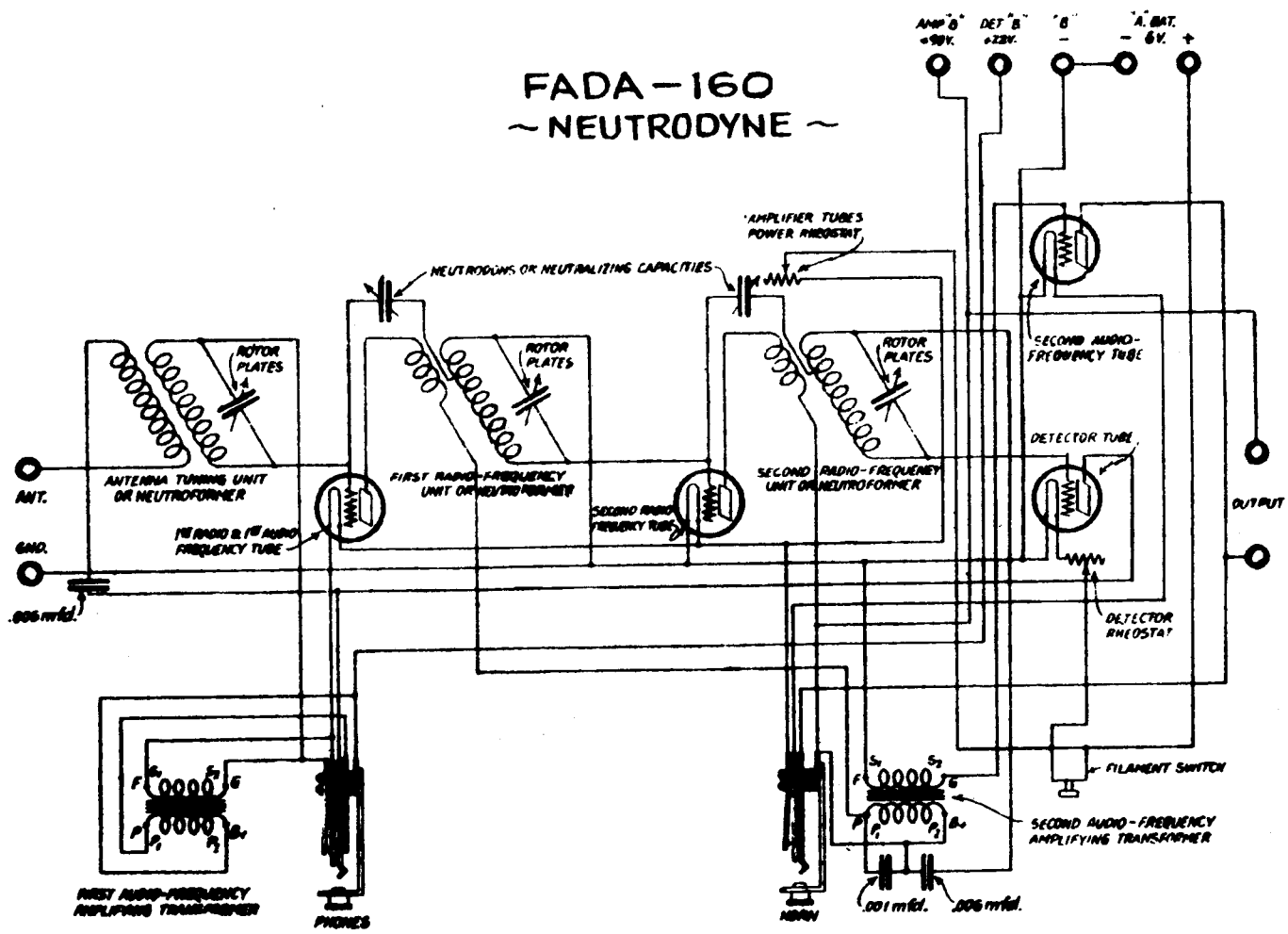
Type "C" Electric Unit, used with "Special" and "7" AC

F.A.D. ANDREA, INC.



"FADA"
SCHEMATIC WIRING DIAGRAM
OF FIVE TUBE
NEUTRODYNE CIRCUIT RECEIVER

FADA—160
~ NEUTRODYNE ~



F.A.D. ANDREA, INC.

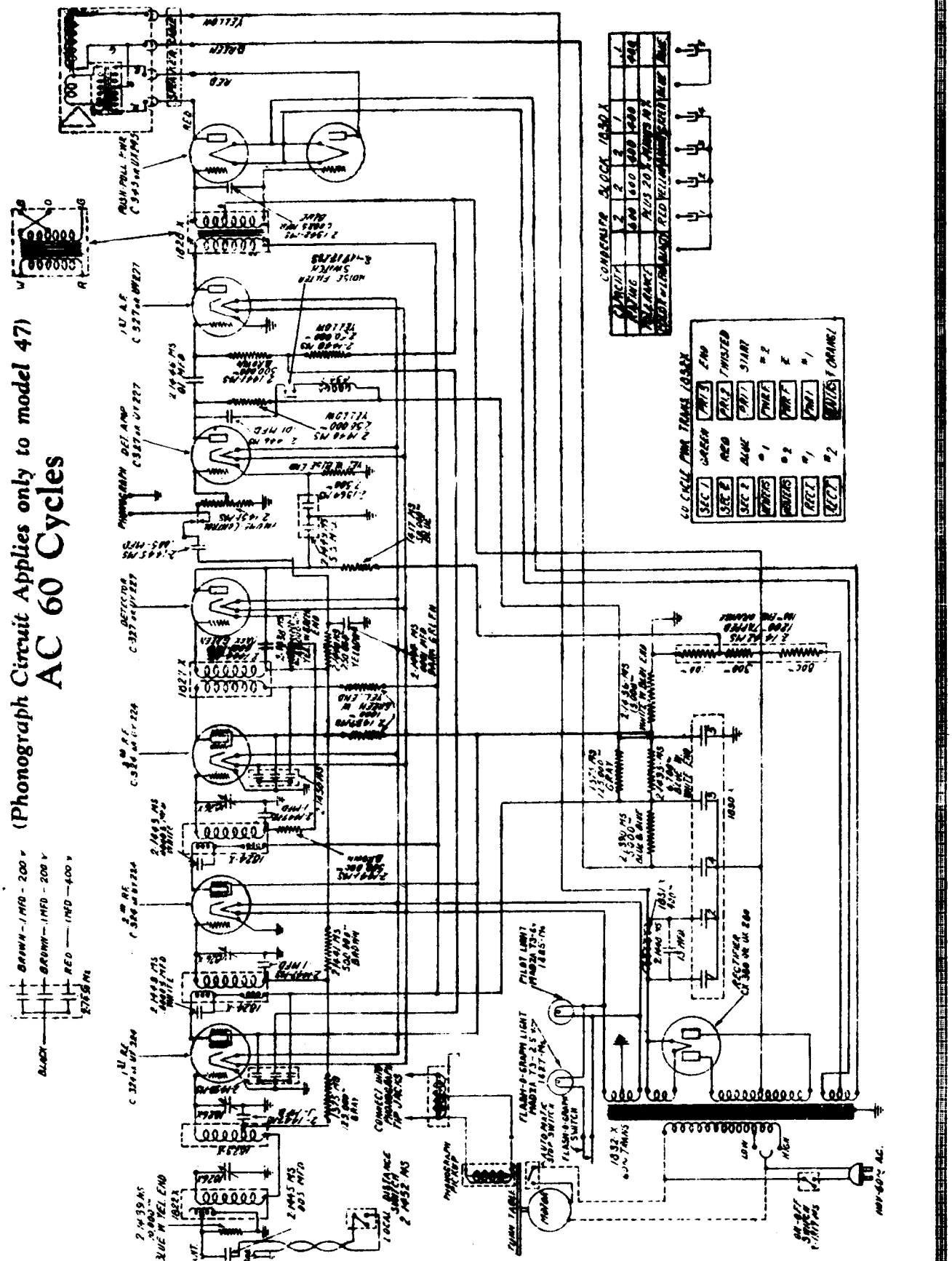
KA-60 CHASSIS

Fada Models 42-44-46-41-47

(Phonograph Circuit Applies only to model 47)

AC 60 Cycles

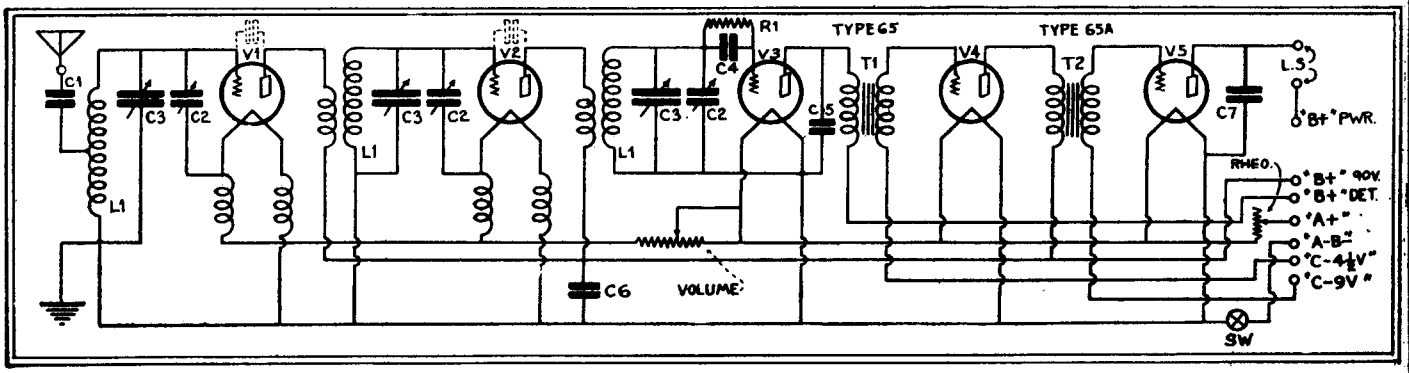
This circuit makes use of a two element detector working out of an untuned coupling transformer in the third screen grid amplifier stage.

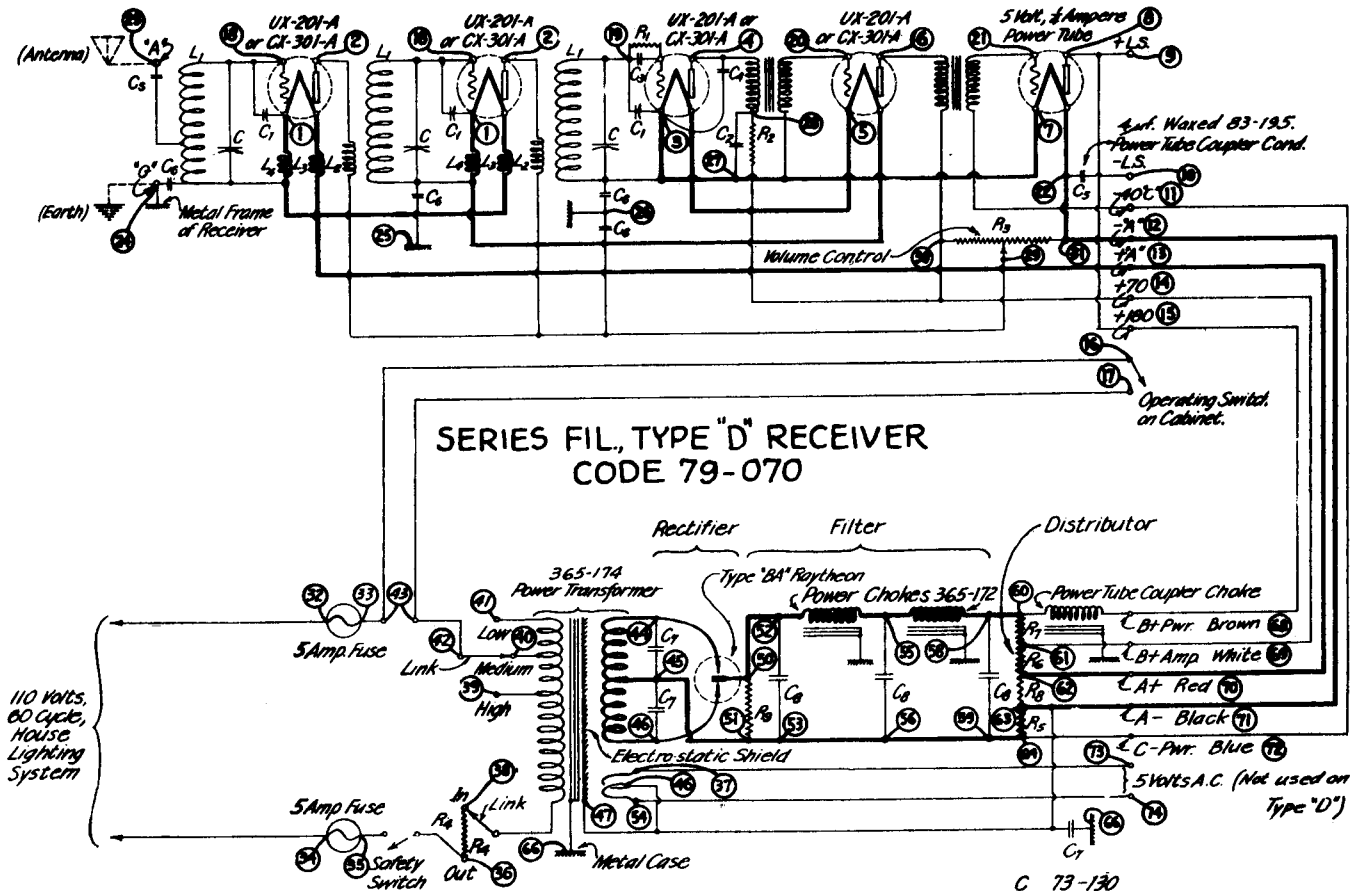


FEDERAL RADIO CORP.

FEDERAL ORTHO-SONIC RECEIVER
TYPE - D

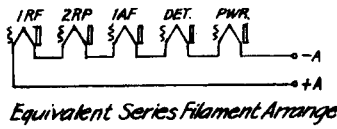
Condenser C1, 100 mmf.; C3, .0005 mf.; C2, 42 mmf.; C6, 1.0 mf.; C4, 200 mmf.; C5, .001 mf.; The grid-plate capacity of about 9 mmf. has been represented in dotted lines: C7, .05 mf.; R1, 1 meg.; L1, 165 mh.





60 Cycle Power Supply Unit, Code 79-001.

(Filament Circuit in Heavy Lines)



Equivalent Series Filament Arrangement.

C_7	83-151	(2 - ½ mf.)
C_8	83-150	4 mf.
R_4	97-180	4 ohms
R_5	79-149	135 ohm section
R_6	79-149	200 " "
R_7	79-149	350 " "
R_8	79-149	2000 ohm section
R_9	97-185	20000 " "

C	73-130
C_1	Balance Cond.
C_2	83-184 1 mf.
C_3	73-287 .0002 mf.
C_4	72-299 .001 "
C_5	83-195 4 mf.
C_6	83-189 and 83-190 .5 mf. each.
C_9	72-238 .0001 mf.
R_1	1 Meg ohm (not shown 10667)
R_2	97-176 160,000 ohms.
R_3	79-155 50,000 ohms.
L_1	71-223 and 79-124
L_2	Plate Coil (Green, Single Winding)
L_3	+F Coil (Green, Double Winding)
L_4	-F Coil (White, Double Winding)

Radio Service Data Sheets

FEDERAL MODEL K

In the Model K receiver the volume control is a 700,000-ohm variable resistor R6, in shunt to the secondary of T6. The plate-supply resistors are mounted in the set chassis, instead of the power unit.

The first consideration is the line-voltage. Having noted its value, plug the 3-amp. fuse F into the pair of clips marked with the nearest corresponding voltage. Continuity tests are made with cable disconnected from the power unit and all tubes removed from receiver. The terminal blocks of the receiver chassis and power pack are illustrated. When testing connections on latter, remove all cable leads from the chassis and also the fuse, and plug into the A.C. line. Connect a 0-150 V., A.C. meter between 1 and 7, or between 1 and 16 (note in some units 7, 8 and 9 are the incoming common terminals, in others 16,, 17 and 18 are common). The meter should read the A.C. line voltage, or the cord is defective. Next, replace the fuse in the proper clips and, if the meter reads the same between 1 and both sides of the fuse, fuse is good. Short posts 1 and 2 with a piece of wire, and put the type '80 tube in the socket. Immediately take the readings between the following posts on a 0-250 v. high-resistance D.C. voltmeter: 14 to 6, 14 to 15. Both readings should be off scale. (Note 14 is the negative post.) Using a 0-5 A.C. meter, check the filament voltages. 3 to 12, approx. 3.3 volts A.C.; 4 to 13 off scale. Shut off power by pulling the plug as soon as the readings are taken; because this test subjects the condensers to very high voltages. If the power unit fails to deliver the rated voltages the entire unit should be exchanged.

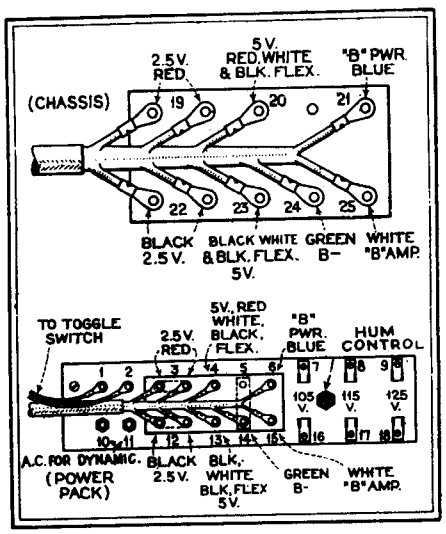
When checking the receiver chassis, make sure cable is properly connected; then turn receiver switch "on." Contact to socket terminals is easily obtained as the heads of the spring-holding eyelets are above-panel.

Special note: operating voltage of screen-grid to frame should not rise above 70 volts. A defective screen-grid tube can be easily identified by the fact that its low emission causes the screen-grid potential to frame to rise above 70 volts.

The troubles that are found from the sequence test must be located with the aid of the schematic circuit. Remove the cable from the power unit, and follow through any faulty circuits with the aid of a high-resistance voltmeter (50-volt connection) and a 22½-volt battery in series. Shorts in the plate circuits will show up as readings on the voltmeter when one lead is touched to frame and one to the plate. If opens are indicated by previous voltage readings, the circuit must be traced and each piece checked until fault is located. If VC rotors and stators rub, set will operate on low wavelengths when plates come out of mesh. High hum level usually due to defective '27, V3 or V4. Hum control is located in power unit and between fuse slips. Keep the two cables to "On-Off" switch far from V3.

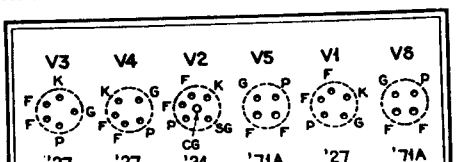
In the K41 type, high hum in isolated cases may be due to loose step-down transformer laminations in dynamic reproducer assembly; tap laminations lightly with hammer to reset them and reduce hum level.

In rare instances, high hum may be occasioned by high-frequency radiations originating in the dry rectifier in the reproducer power assembly. To check this, disconnect the reproducer leads and attach a separate reproducer. If hum is heard through the latter disconnect A.C. leads to the dynamic reproducer at the power unit. If hum disappears it may be assumed that the rectifier is defective and should be replaced. Looking at chassis from front, VC3 is at left. Use middle VC as pilot when reganging,



though rarely necessary. Turn volume control "Full On" and loosen two locking screws on left-hand VC, reaching through the slot left in the VC shield. Turn eccentric back and forth until weak signal is loudest and tighten. VC1 has panel vernier and need not be touched.

If changing tubes, and all other efforts, does not stop circuit oscillation, tune in station near 210 meters and, with a non-metallic screwdriver adjust NC1, NC2 and NC3. NC2 (upper left-hand) adjustment not critical. Re-check on 360 meters and seal. Under load, rectifier transformer secondary



(dynamic reproducer) should read close to 11 volts; rectifier output should be 5.5 to 6 volts.

Continuity Test

Terminals	*Correct*	*Cause if Wrong*
24-frame	full	Open in cable
V3F-22 or 19	full	Do.
V3P-25	17.5	Do., T1 pri. or R8
V3G-fr.	0.5	Open or shorted R7
V3K-fr.	full	Open Gnd. lead
V4F-22 or 19	full	Open in cable
V4P-25	full	Do., or T2 pri.
V4G-fr.	20	Open in T1 sec.
V4K-fr.	full	Open R9
V2F-22 or 19	full	Open in cable
V2P-25	20	Do., R5, or T6 pri.
V2CG-fr.	full	Open in sec. of T5
V2SG-25	13	Open R4
V2K-fr.	full	Open R3
V5F-23 or 20	full	Open in cable
V5P-21	full	Do., or T3 pri.
V5G-fr.	21	Open T2 sec.
V1F-22 or 19	full	Open in cable
V1P-25	20	Do., R2, or T5 pri.
V1G-fr.	full	Open T4
V1K-fr.	full	Open R1
V6F-23 or 20	full	Open in cable
V6P-21	full	Do. or T3 pri.
V6G-frame	21	Open T2 sec.
Any rotor-fr.	full	Open fr. lead
VC1 stator-fr.	full	Open T4 or T4 leads
VC2 stator-fr.	full	Open T5 sec. or leads
VC3 stator-fr.	full	Open T6 sec. or leads
Ant. post-fr.	no r'd'g.	Shorted C13
L.S.-L.S.	full	Open T3 sec. or leads
V8F-23 or 20	full	Open in cable
Any Plate prong-fr.	no r'd'g.	Sh't'd bypass or pl. lead
V1F or V2F-fr.	Do.	Sh't'd bypass or fil. lead
V3F-fr.	Do.	Shorted heater lead
V4F-fr.	Do.	Shorted fil. lead
V5F or V6F-fr.*	full	Open R10 or R11*

*(Tubes and dial lamp out of sockets.)

Transformer Tests

T1 P1-P2	full	Open pri.
T1 S1-S2	full	Open sec.
T2 P1-P2	full	Open pri.
T2 S1-S2	full	Open sec.
T3 P1-P2	full	Open pri
T3 S1-S2	full	Open sec.

Operating Voltages of Set

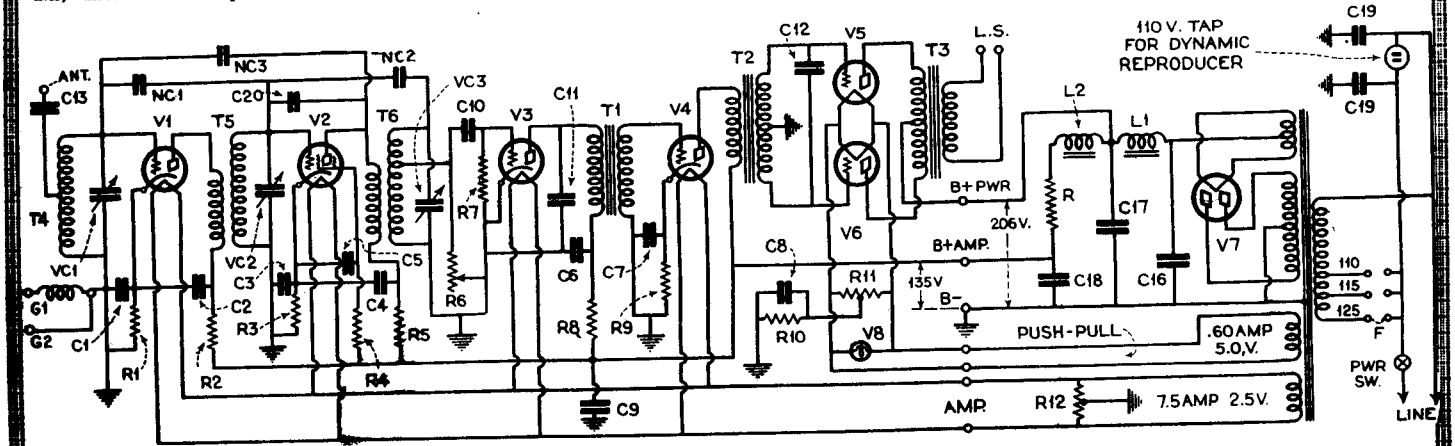
(Turn volume control to off position.)

V3F-F, 2.5 A.C.; V3P-fr., 65.0 D.C.; V3G-K, below 1 D.C.; V4F-F, 2.5 A.C.; V4P-fr., 135.0 D.C.; V4G-K, 7.5 D.C., V2F-F, 2.5 A.C.; V2P-fr., 110.0 D.C.; V2CG-K, 1.5 D.C.; V2SG-fr., 60.0 D.C.; V5F and V6F-F, 5.0 A.C.; V5P and V6P-fr., 205.0 D.C.; V5 and V6G-F, 40.0 D.C.; V1F-F, 2.5 A.C.; V1P-fr., 120.0 D.C.; V1G-K, 7.5 D.C.

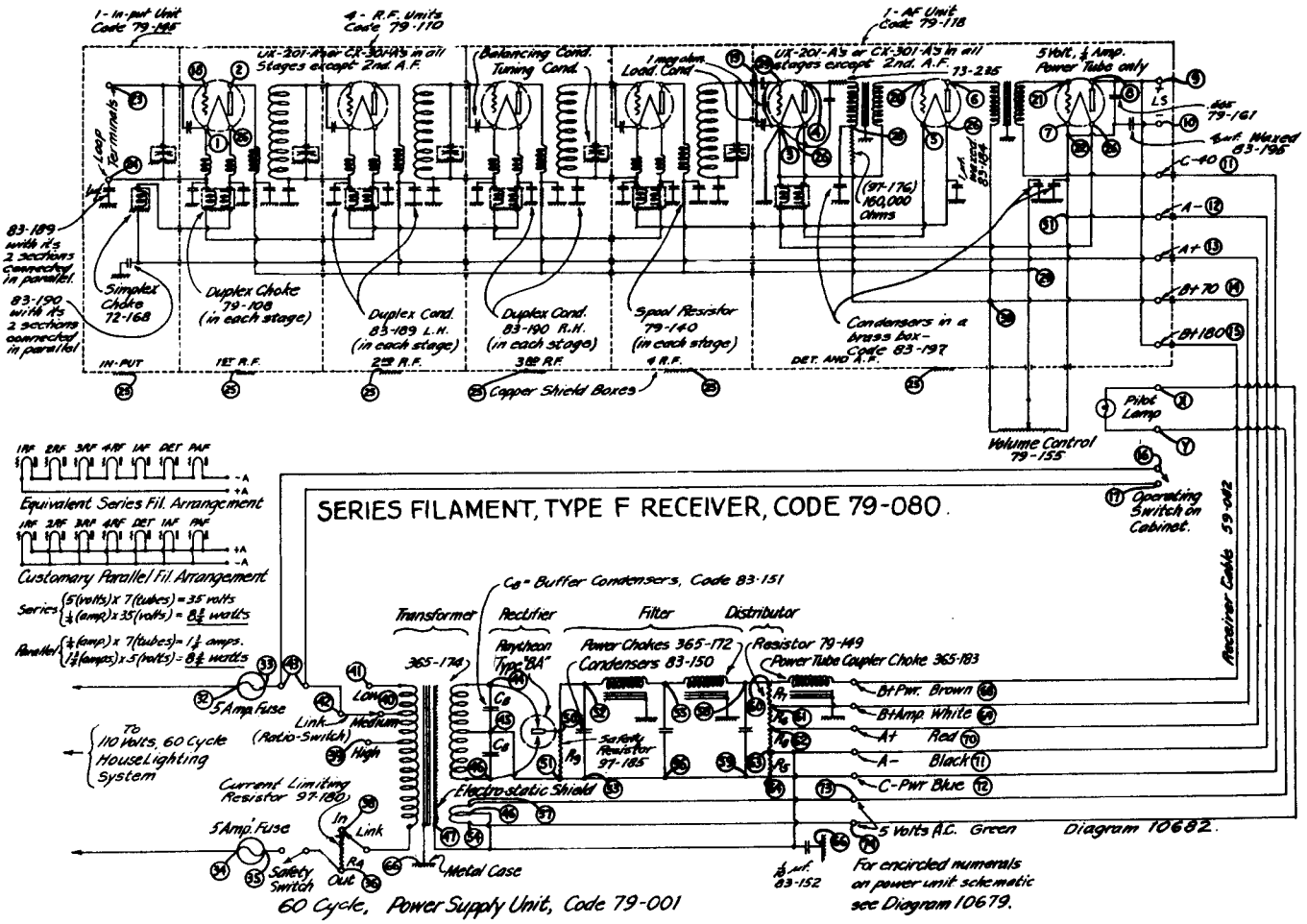
Values of Parts

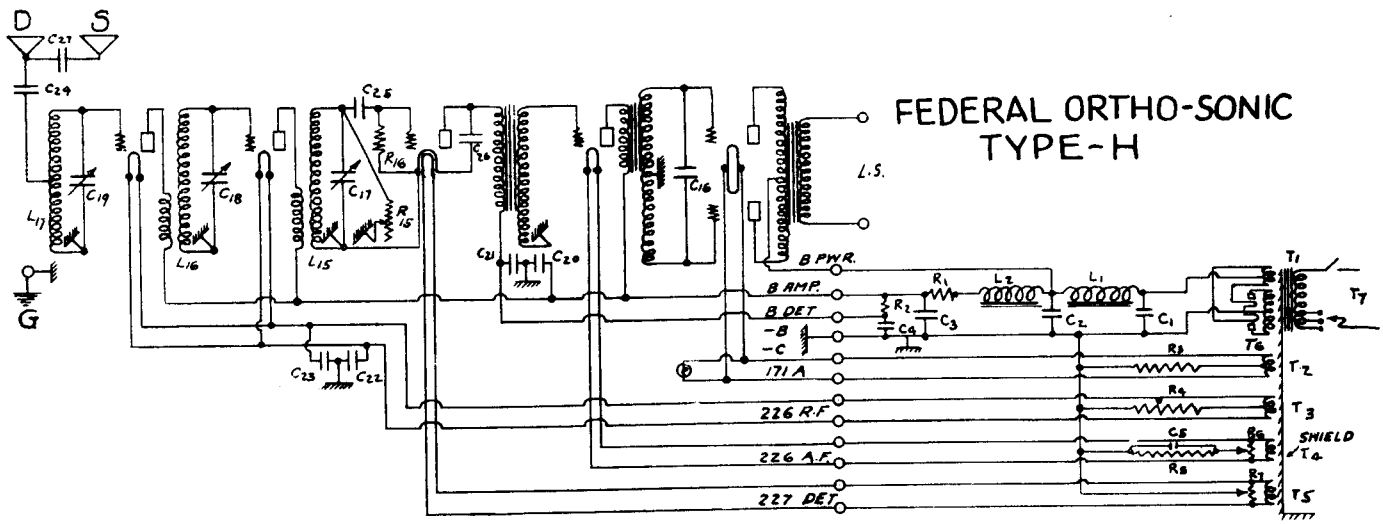
Receiver: C1 to C9, inclusive, 0.25-mf.; C10, C12, .0002; C11, .001; C13, .0001; R1, R9, R10, 1,500 ohms; R2, 6,000; R3, 300; R4, 40,000; R5, 6,000; R6, 700,000; R7, 2-meg.; R8, 13,000 ohms; R11, R12, 40 ohms.

Power unit: R, 1,300 ohms; L1, 15-henry, 285-ohm; L2, 60-henry, 1,570-ohm; C16, C17, 1-mf. C18, 2 mf.; C19, 0.1-mf.



FEDERAL RADIO CORP.



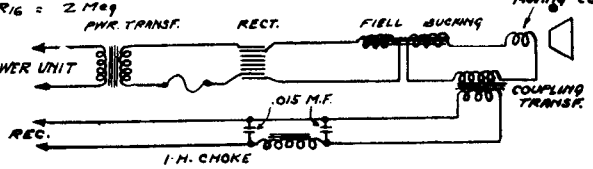


PARTS LIST FOR REC.

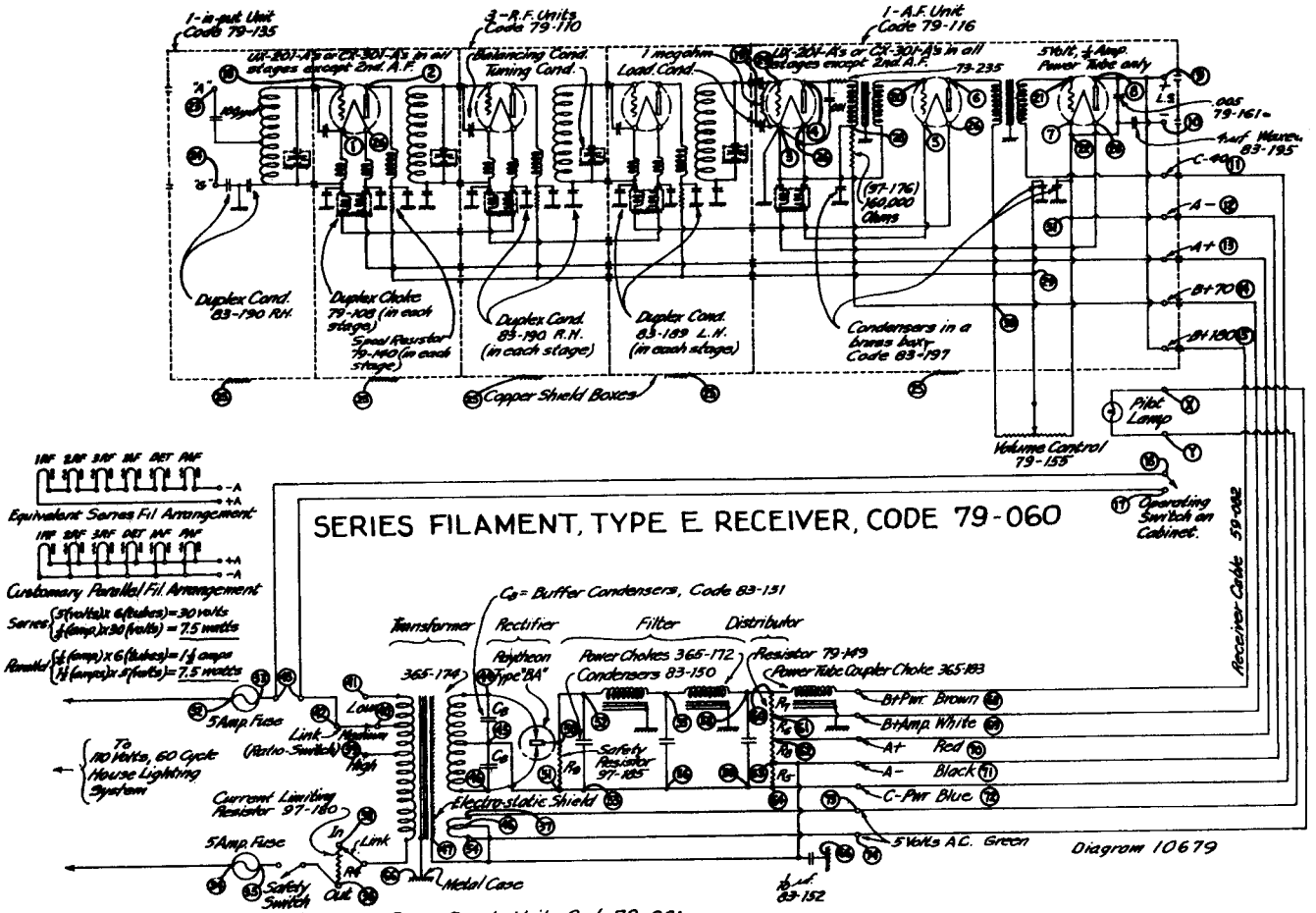
C_{16} = .0002 mf		L_{15} = 262 μh	
C_{17} = .0003 mf		L_{16} = 262 μh	
C_{18} = .0003 mf		L_{17} = 262 μh	
C_{19} = .0003 mf			
C_{20} = ½ mf			
C_{21} = ½ mf		R_{15} = 500,000 Ω	
C_{22} = ⅒ mf		R_{16} = 2 Meg	
C_{23} = ⅒ mf			
C_{24} = .0001 mf			
C_{25} = .0002 mf			
C_{26} = .001 mf			
C_{27} = 50/35 mmf.			

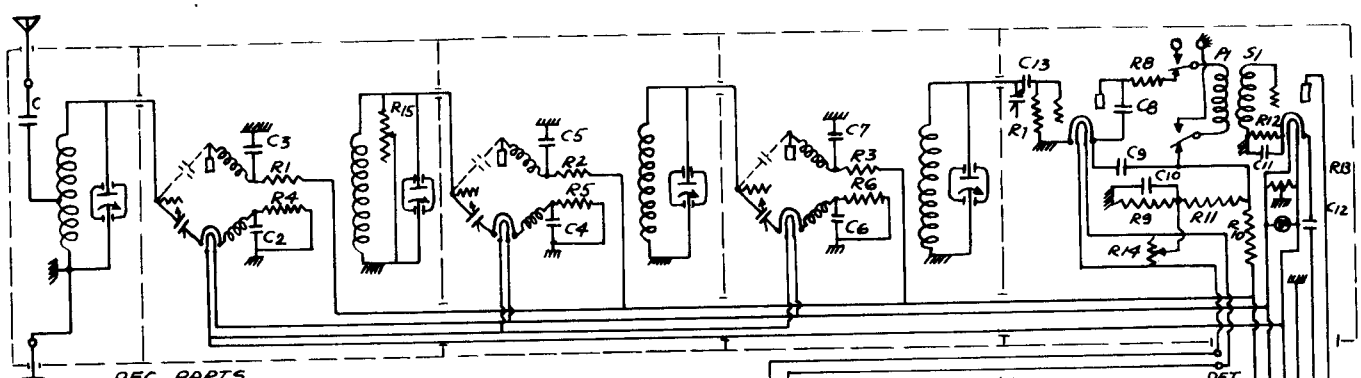
PARTS LIST FOR POWER UNIT

C_1 = 1 mf	R_1 = 3500 Ω	L_1 = 15 h - 285 Ω	T_1 = 24
C_2 = 1 mf	R_2 = 13,000 Ω	L_2 = 55 h - 1600 Ω	T_2 = 24
C_3 = 2 mf	R_3 = 1300 Ω		T_3 = 8
C_4 = 1 mf	R_4 = 1400 Ω		T_4 = 8
C_5 = ½ mf	R_5 = 2500 Ω		T_5 = 12
	R_6 = 40 Ω		T_6 = 2390
	R_7 = 40 Ω		T_7 = 573



FEDERAL RADIO CORP.





REC. PARTS

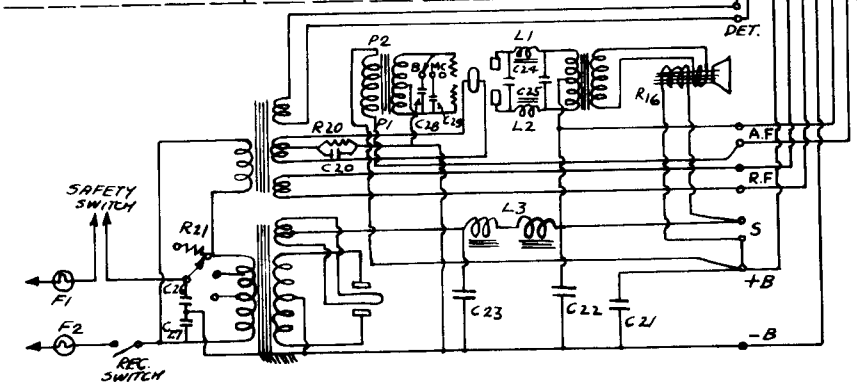
UNIT	CAP.	DIELECTIC	D.C. VOLT RATING
C	.0001 M.F.	MICA	1400
C2	.25	"	200
C3	.25	"	400
C4	.25	"	200
C5	.25	"	400
C6	.25	"	200
C7	.25	"	400
C8	.001	MICA	1400
C9	1.	PAPER	400
C10	1.	"	200
C11	1.	"	200
C12	.003	MICA	1400
C13	.000019	"	1400

R1	200 OHMS
R2	200
R3	200
R4	1500
R5	1500
R6	1500
R7	5 MEG
R8	200 OHMS
R9	13,000
R10	13,000
R11	40,000
R12	1500
R13	40
R14	30
R15	500,000
R16	5,700

POWER UNIT PARTS

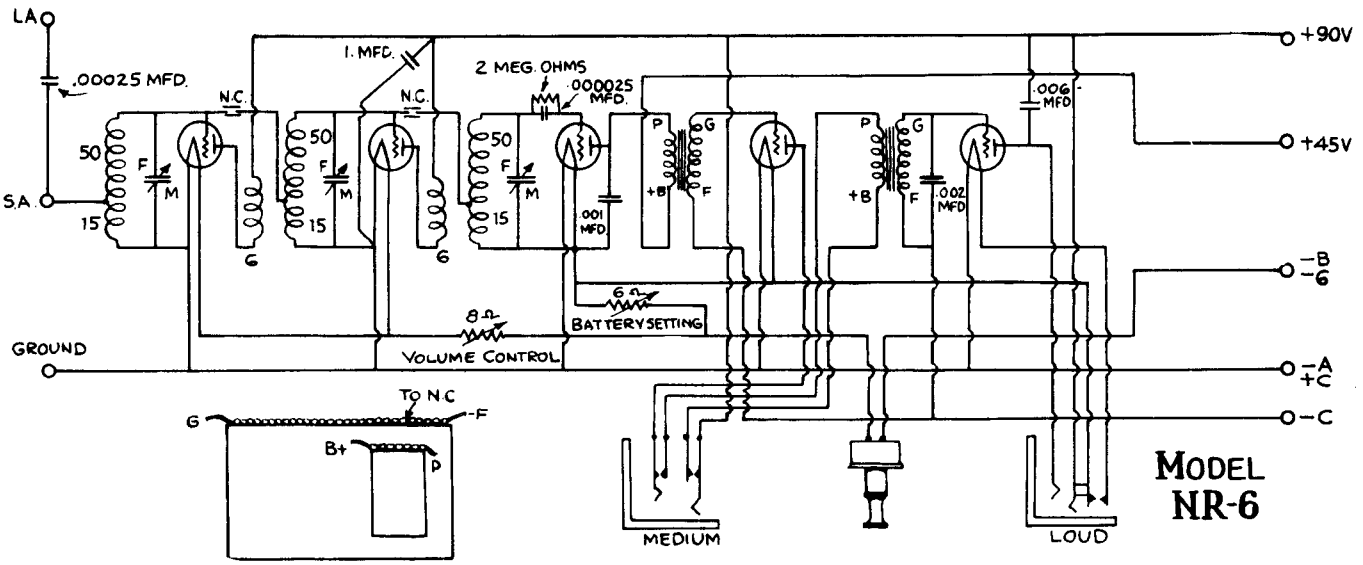
C20	1.	PAPER	200
C21	1.	"	600
C22	1.	"	600
C23	2.	"	600
C24	.015	"	1400
C25	.020	"	1400
C26	.015	"	1400
C27	.015	"	1400
C28	.003	"	1400
C29	.0015	"	1400

R20	800 OHMS
R21	14 OHMS
F1	5 AMP.
F2	5 AMP.
L1	
L2	
L3	

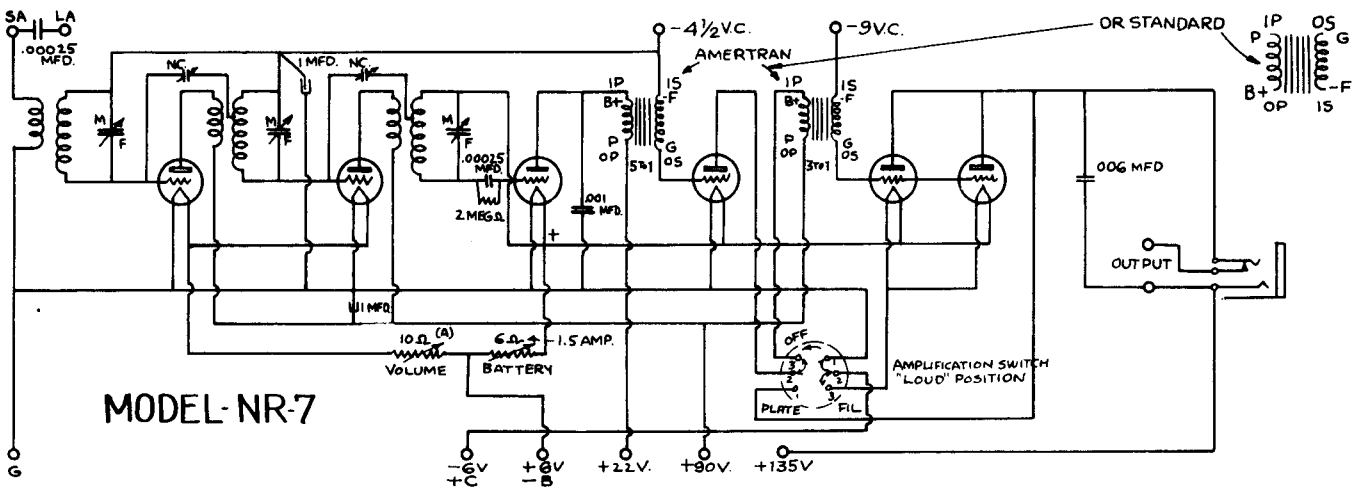


FEDERAL TYPE-M

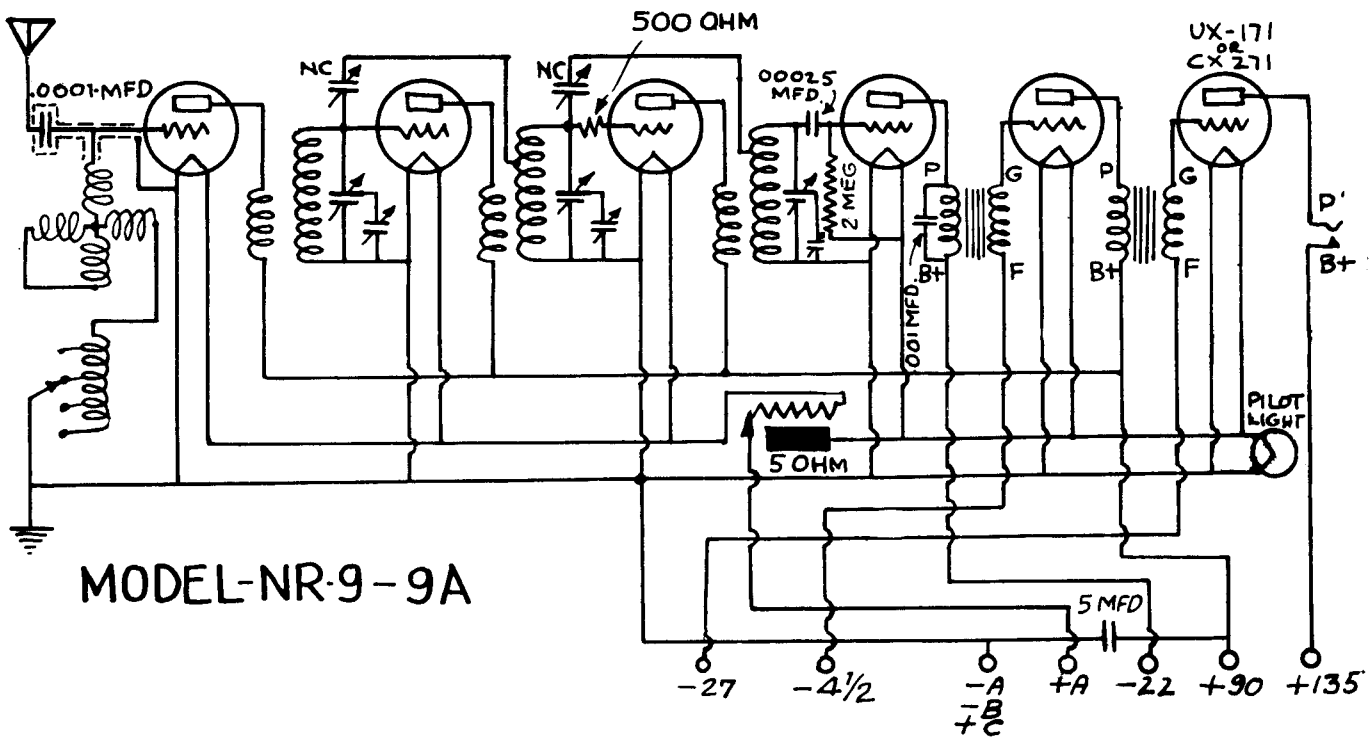
FREED-EISEMANN RADIO CORP.



MODEL NR-6

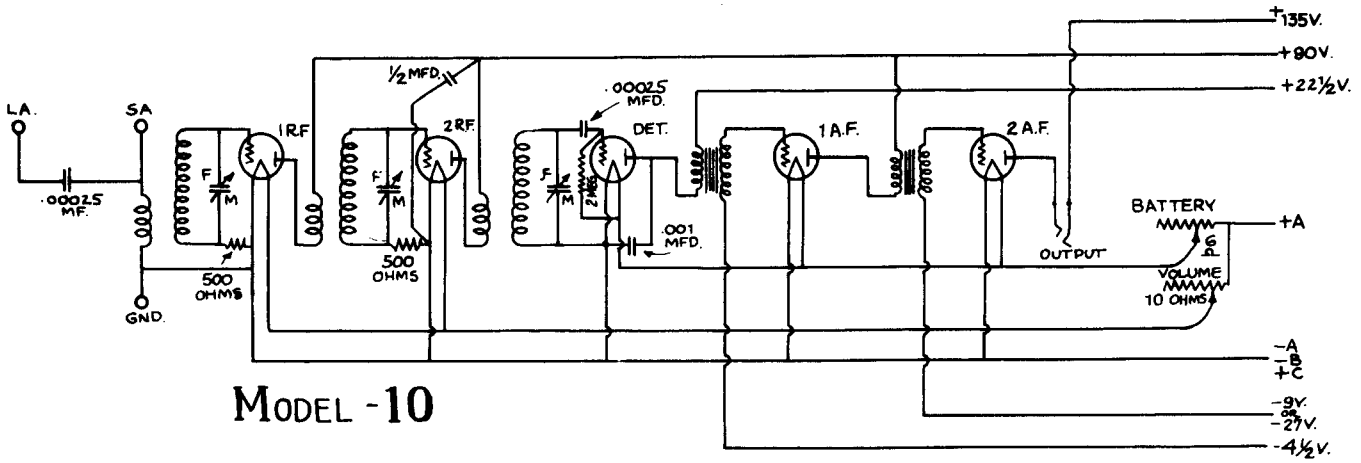


MODEL-NR-7

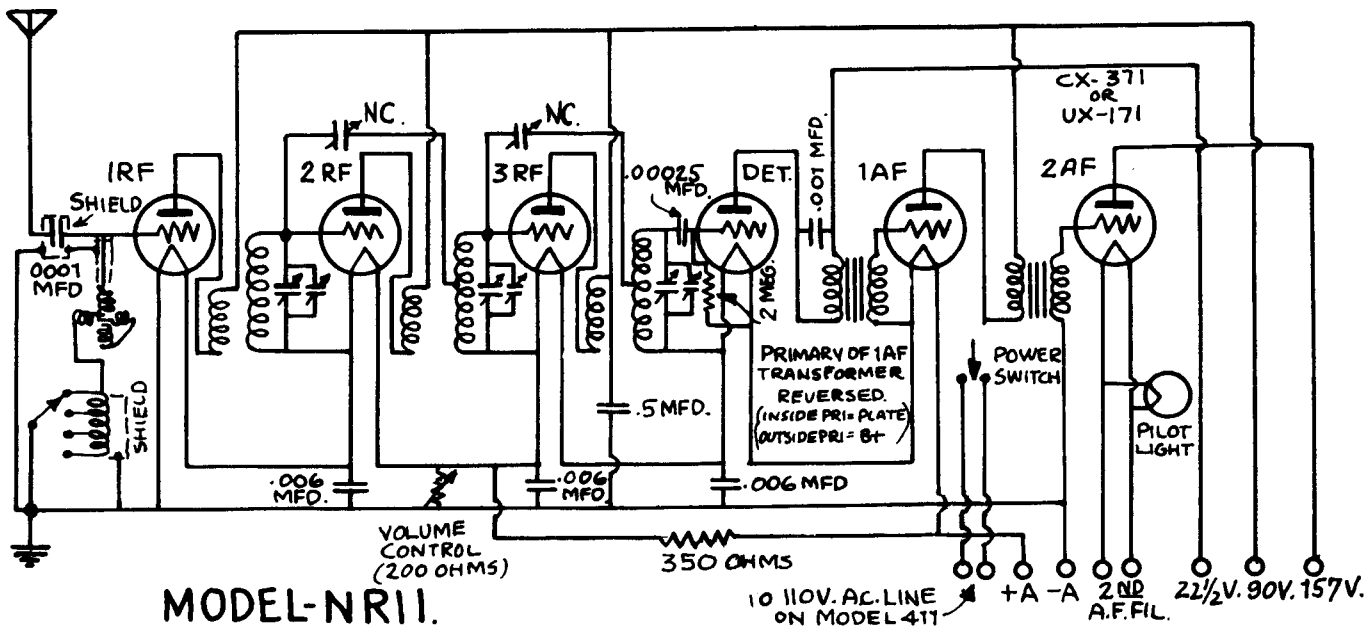


MODEL-NR-9-9A

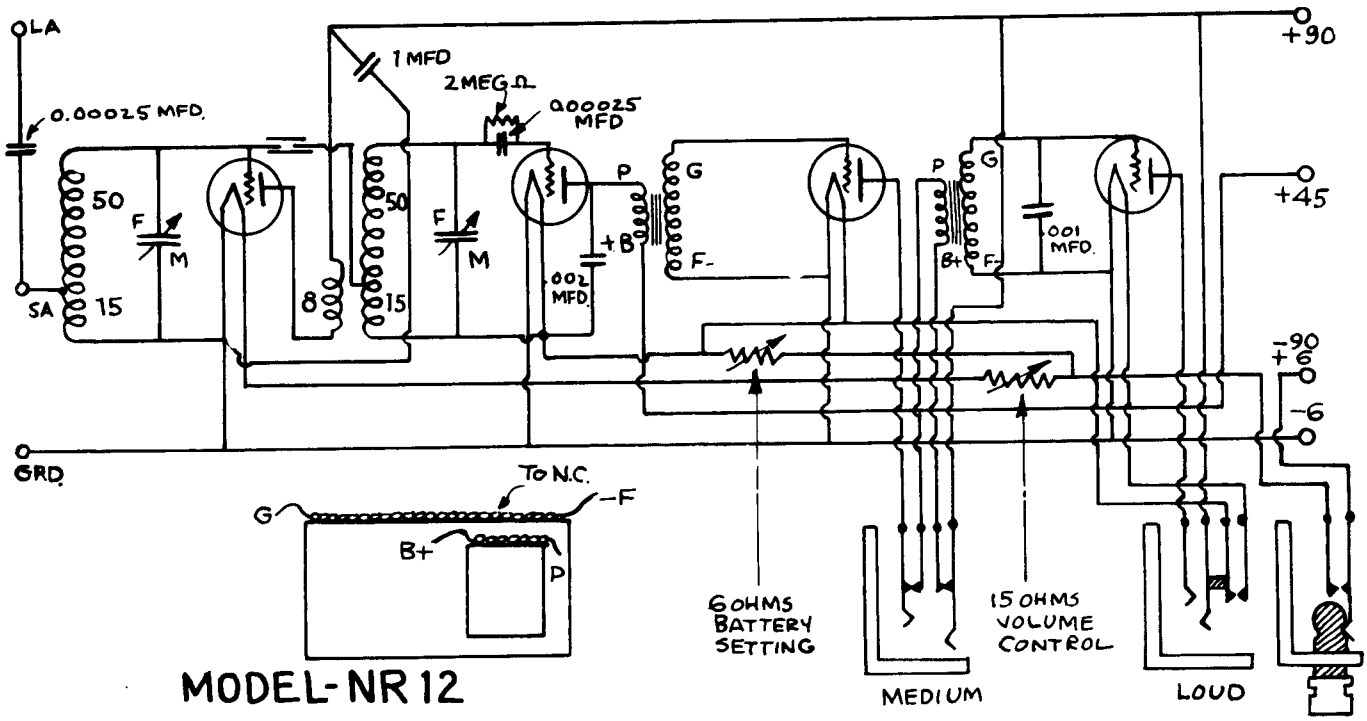
FREED-EISEMANN RADIO CORP.



MODEL -10

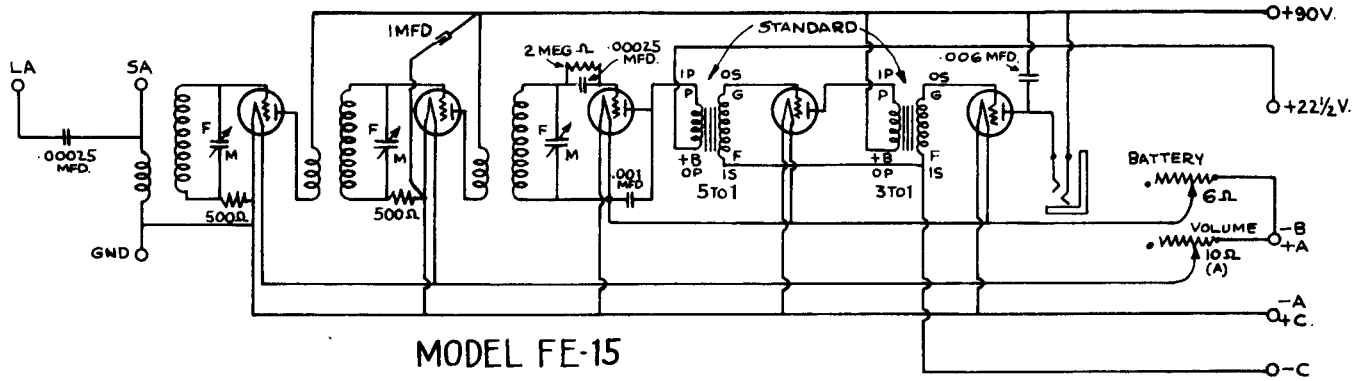


MODEL-NR11.

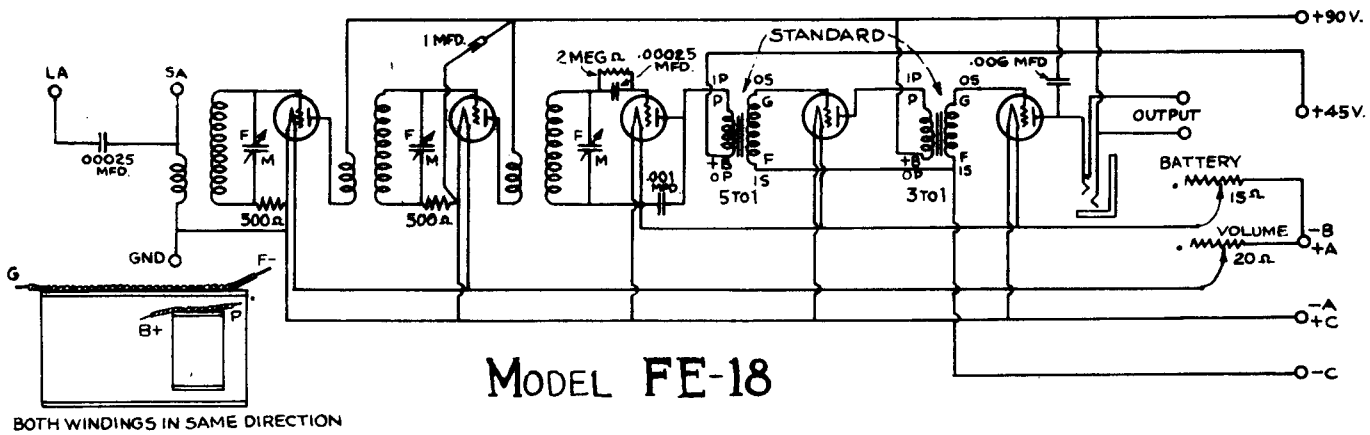


MODEL-NR12

FREED-EISEMANN RADIO CORP.

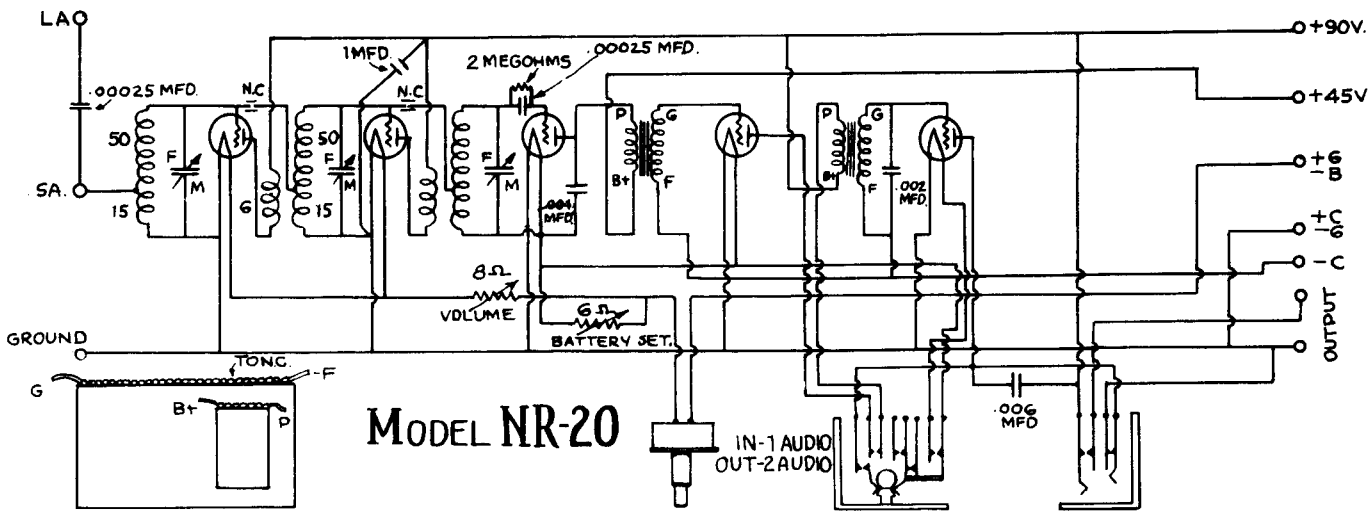


MODEL FE-15

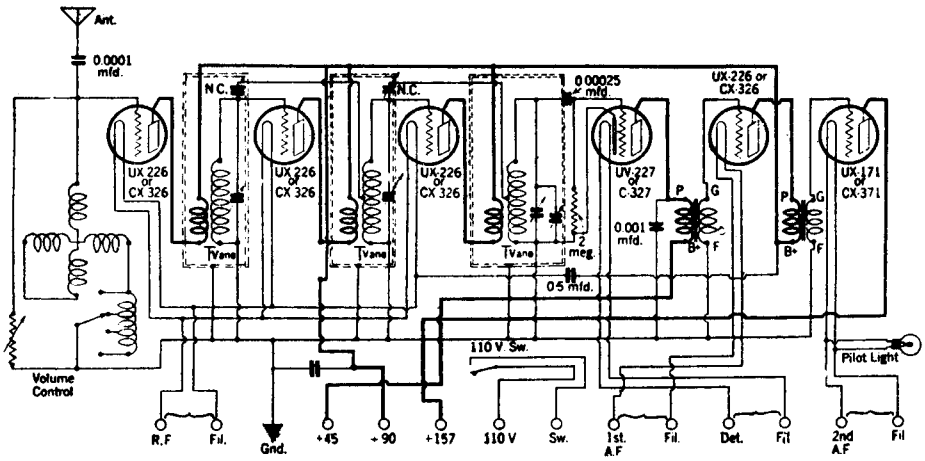


MODEL FE-18

BOTH WINDINGS IN SAME DIRECTION

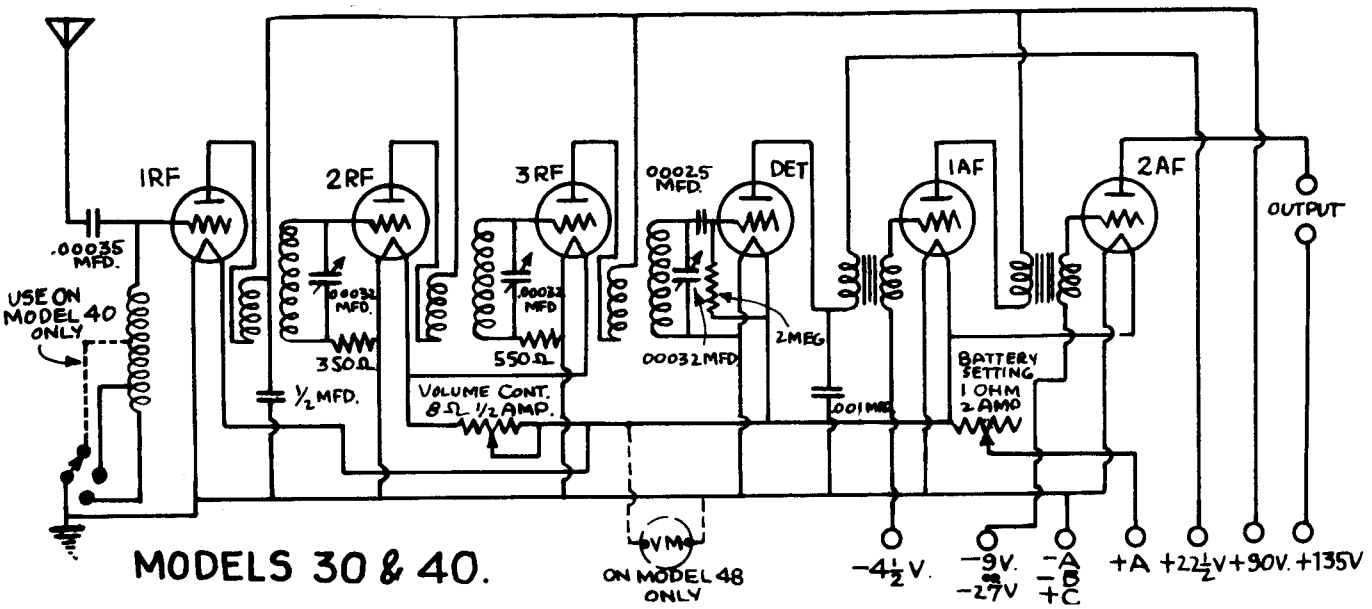


MODEL NR-20

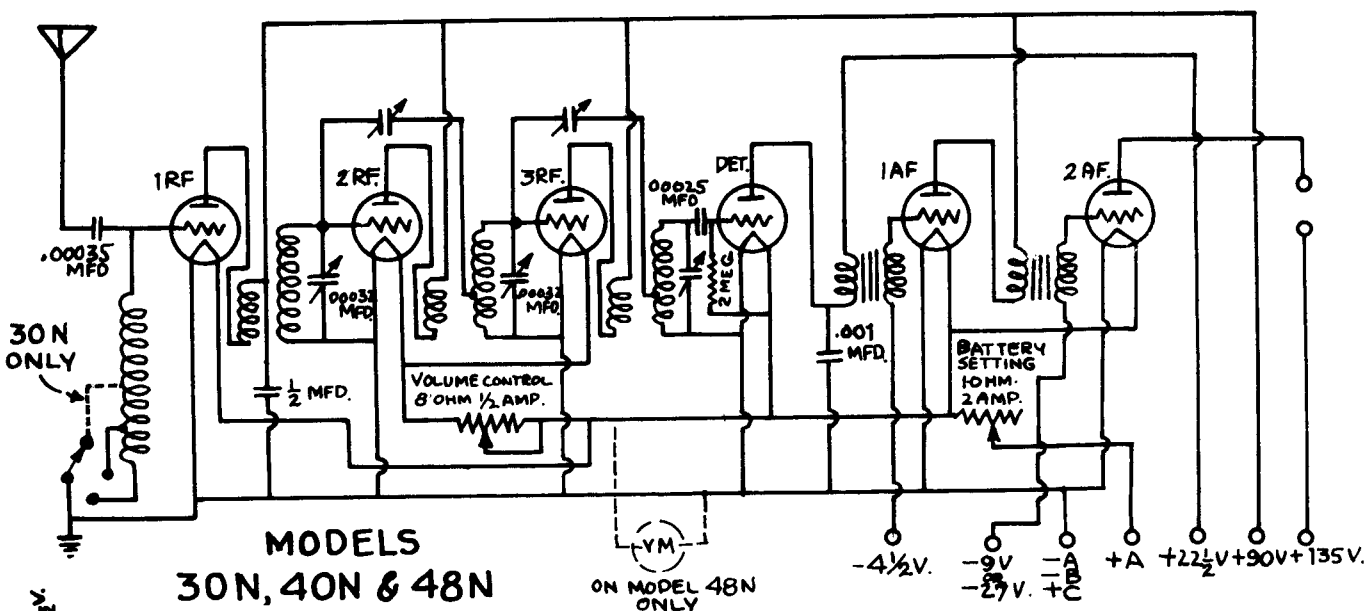


Circuit Diagram of the NR-60.

FREED-EISEMANN RADIO CORP.

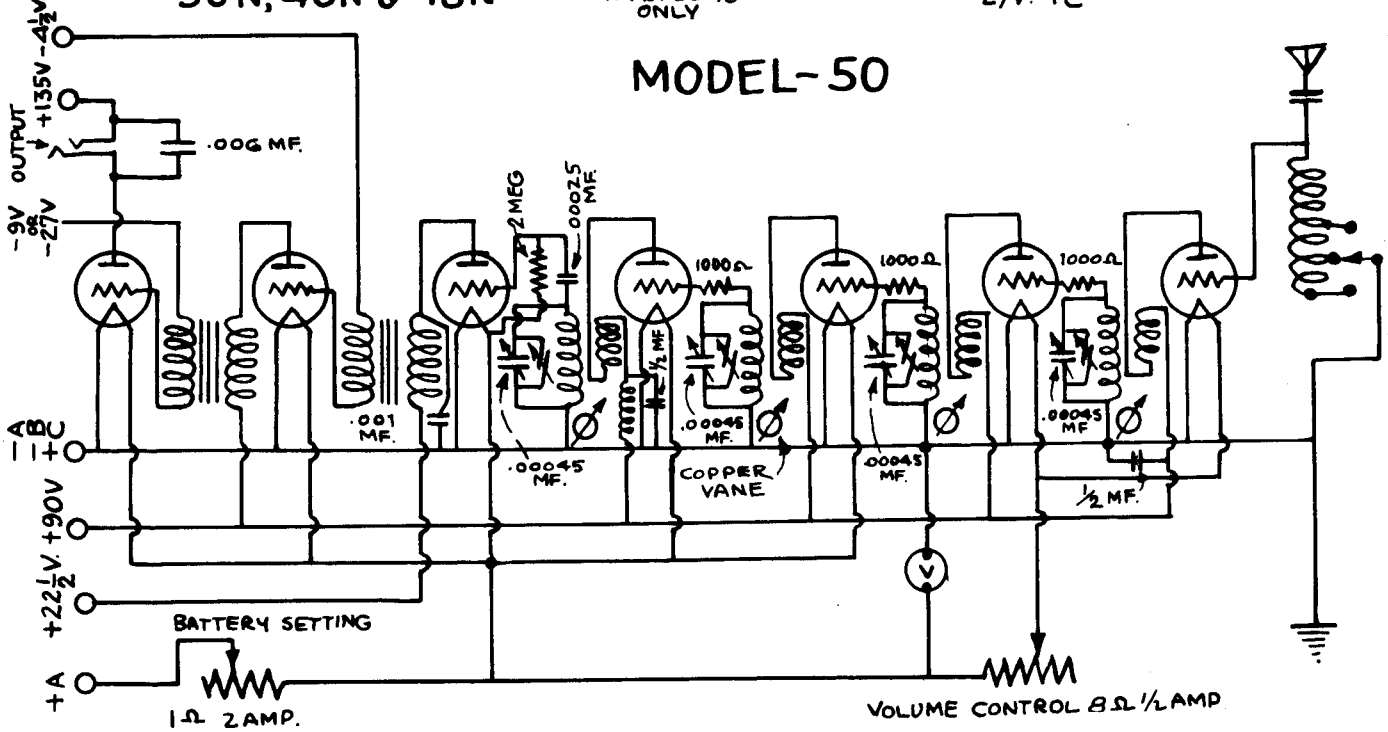


MODELS 30 & 40.

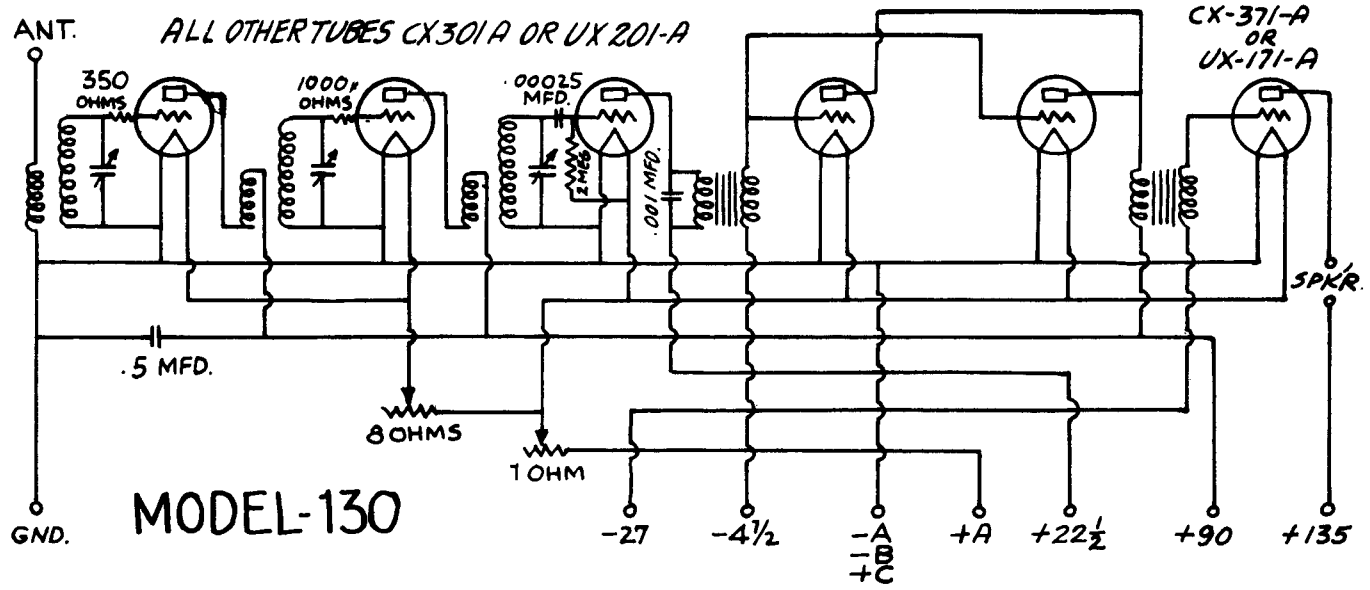


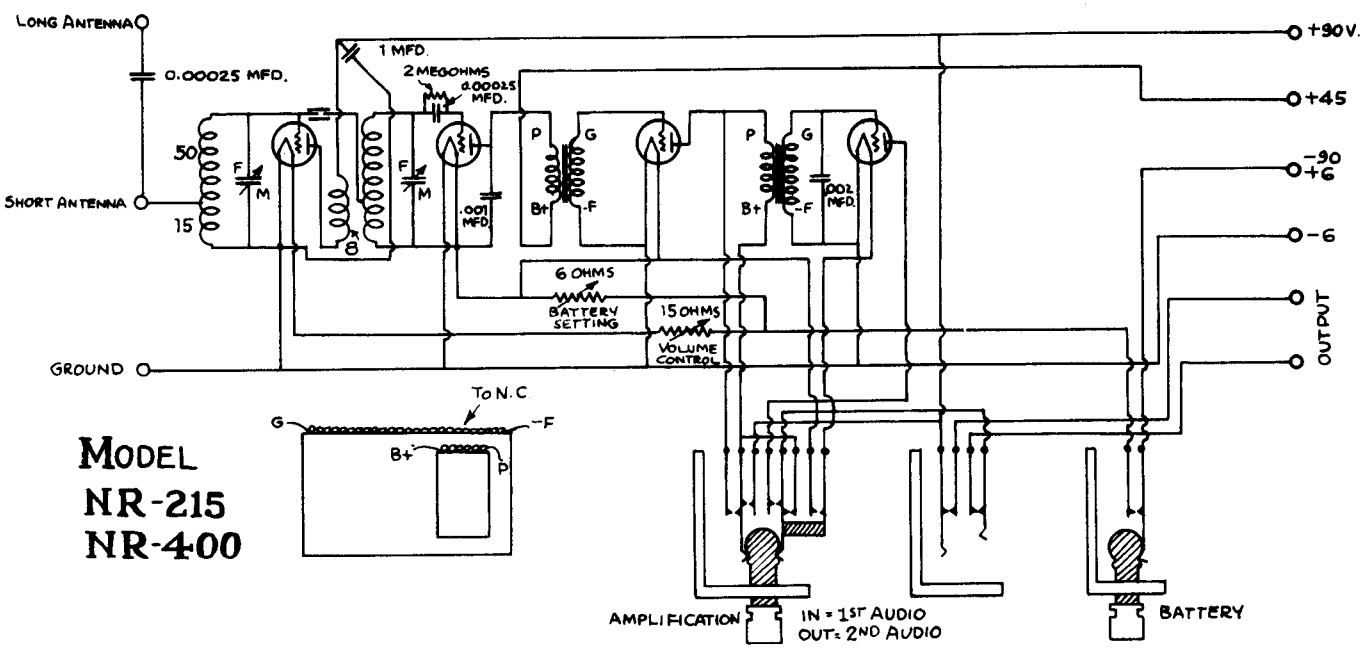
MODELS 30N, 40N & 48N

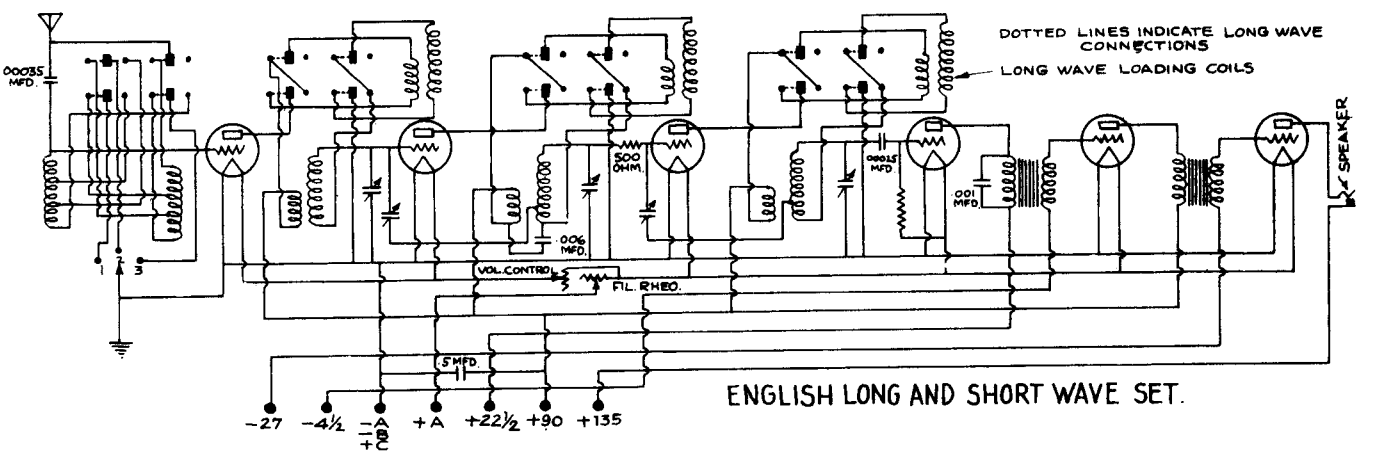
MODEL-50



FREED-EISEMANN RADIO CORP.

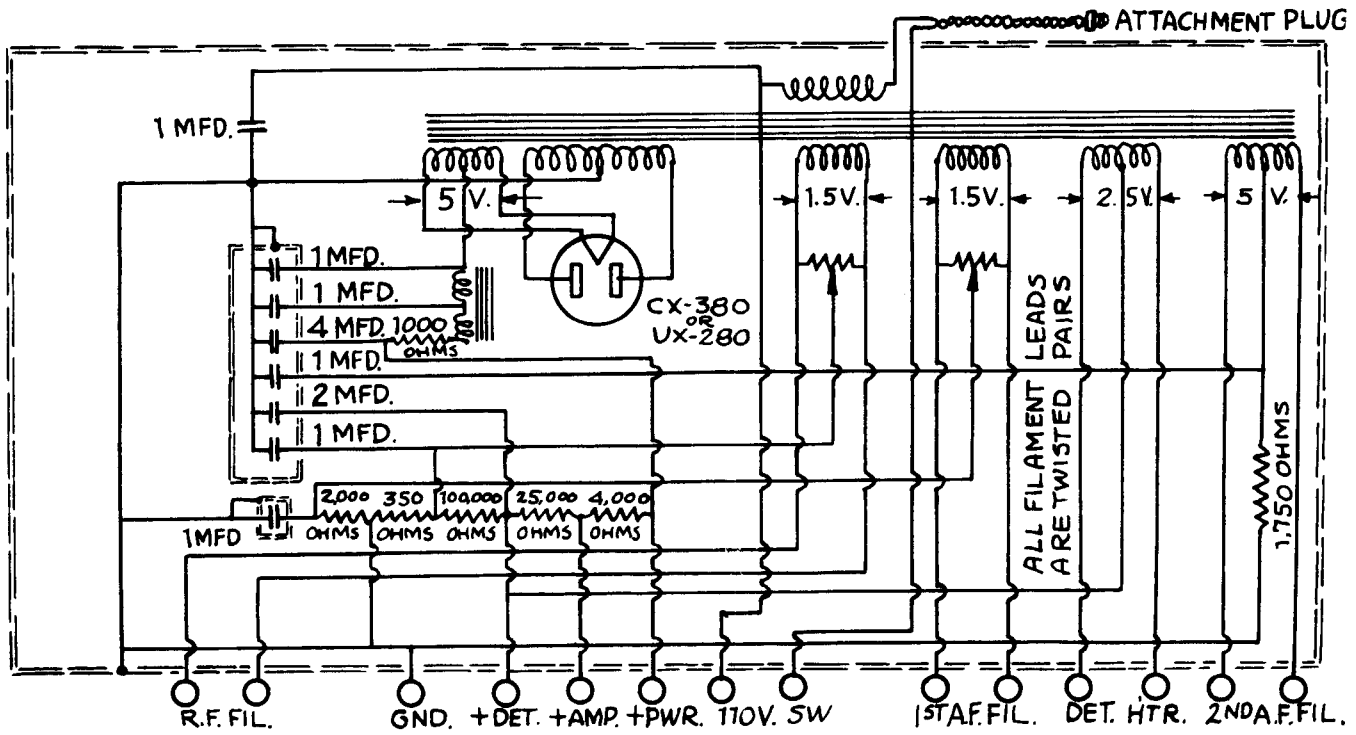






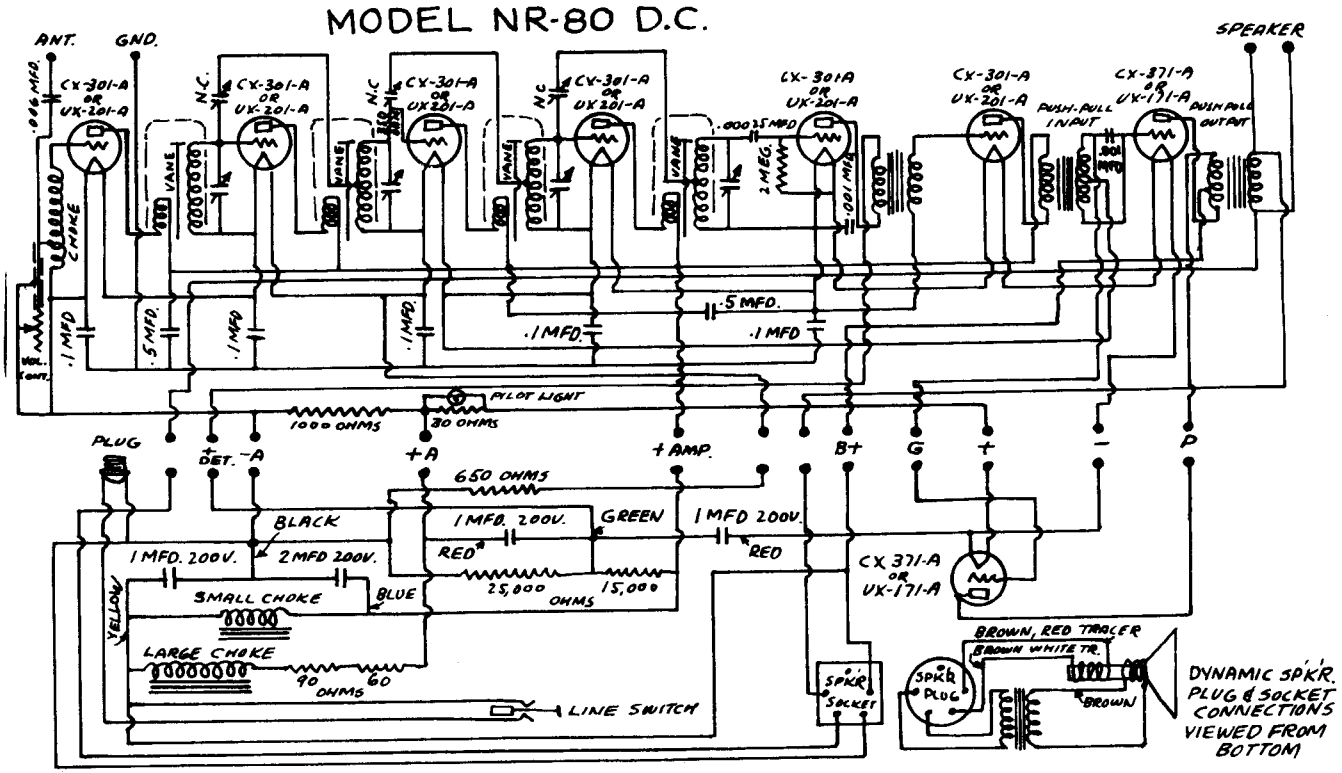
ENGLISH LONG AND SHORT WAVE SET.

FREED-EISEMANN RADIO CORP.



MODEL 457 POWER UNIT

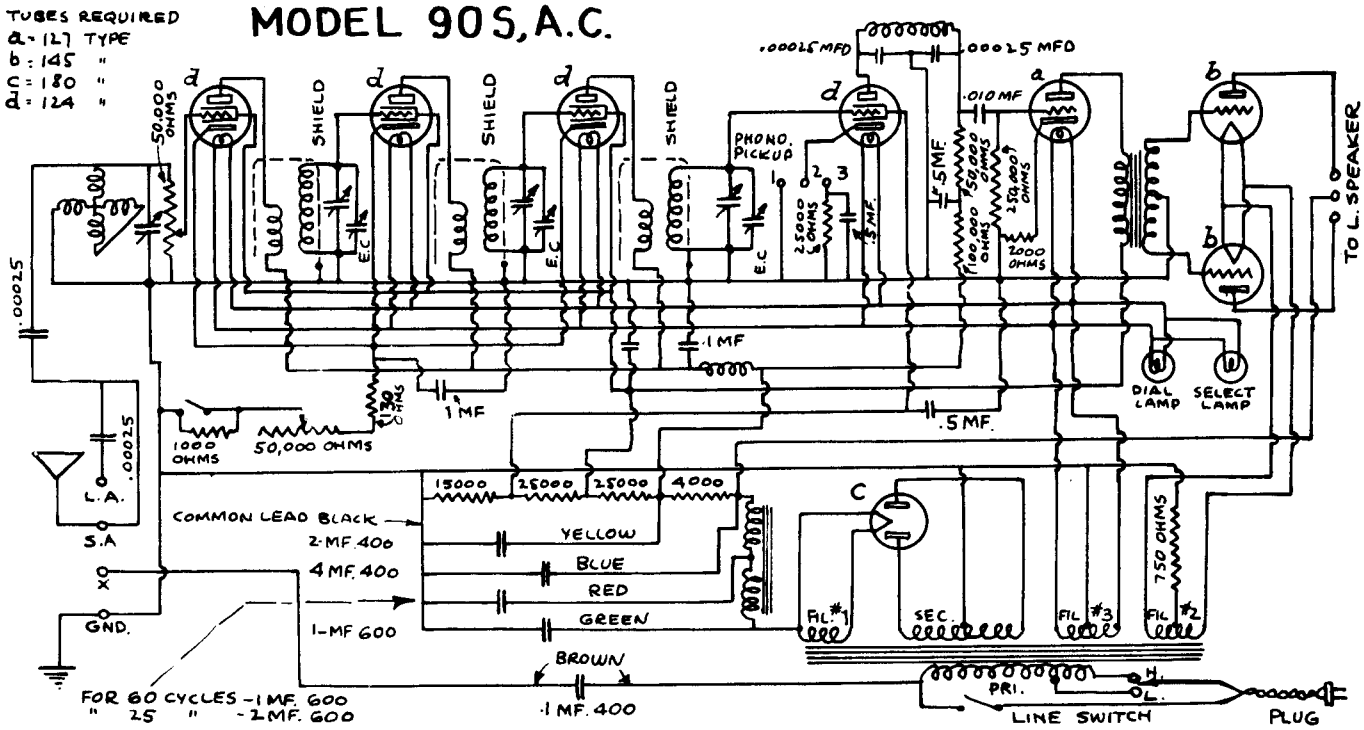
MODEL NR-80 D.C.



FREED-EISEMANN RADIO CORP.

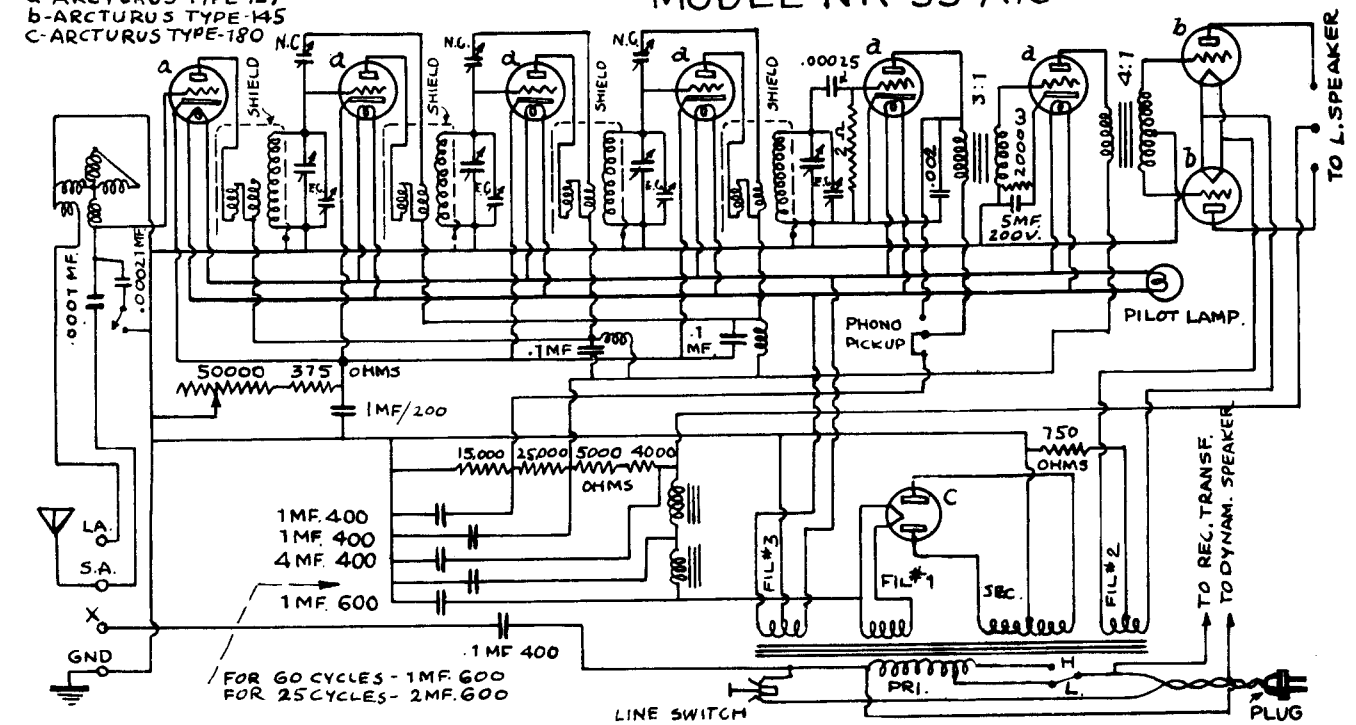
MODEL 90 S, A.C.

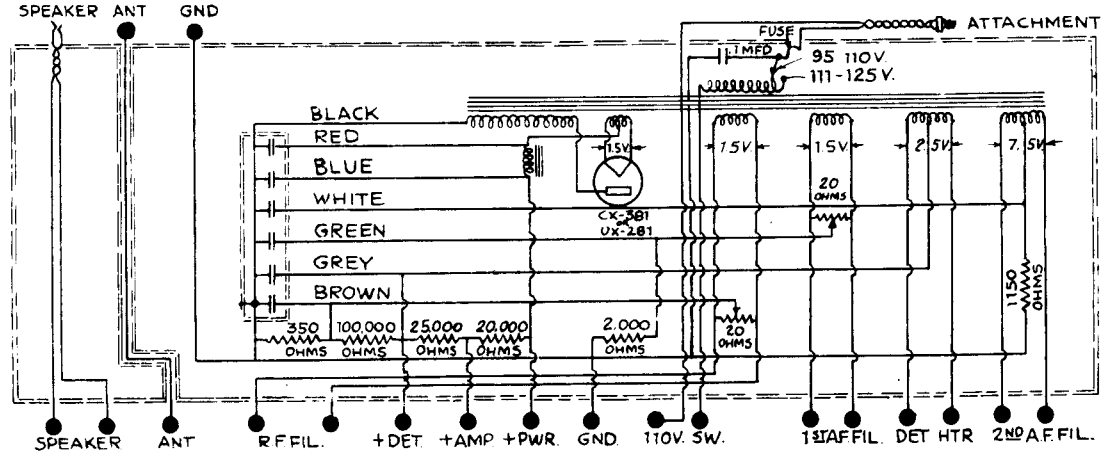
TUBES REQUIRED
a - 247 TYPE
b - 145 "
c - 180 "
d - 124 "



MODEL NR 95 A.C

a-ARCTURUS TYPE-147
b-ARCTURUS TYPE-145
C-ARCTURUS TYPE-180

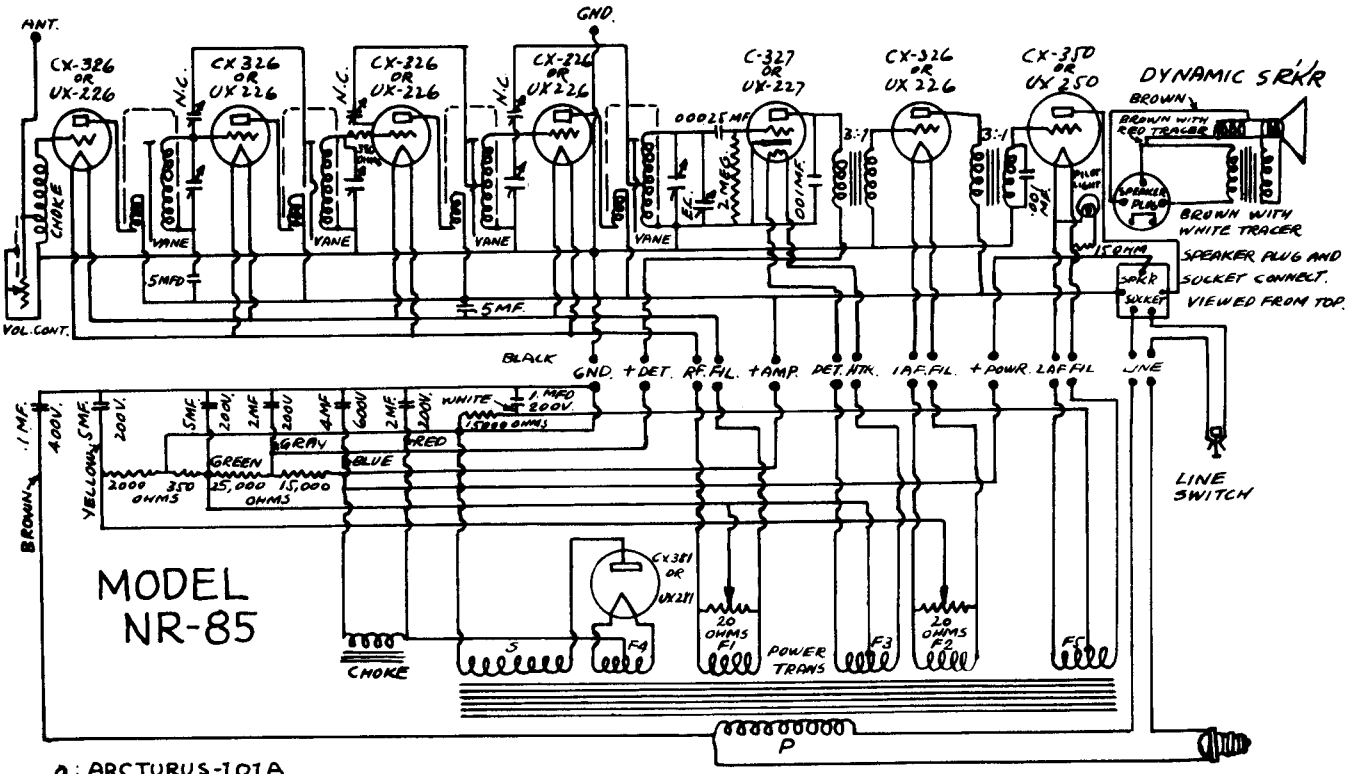




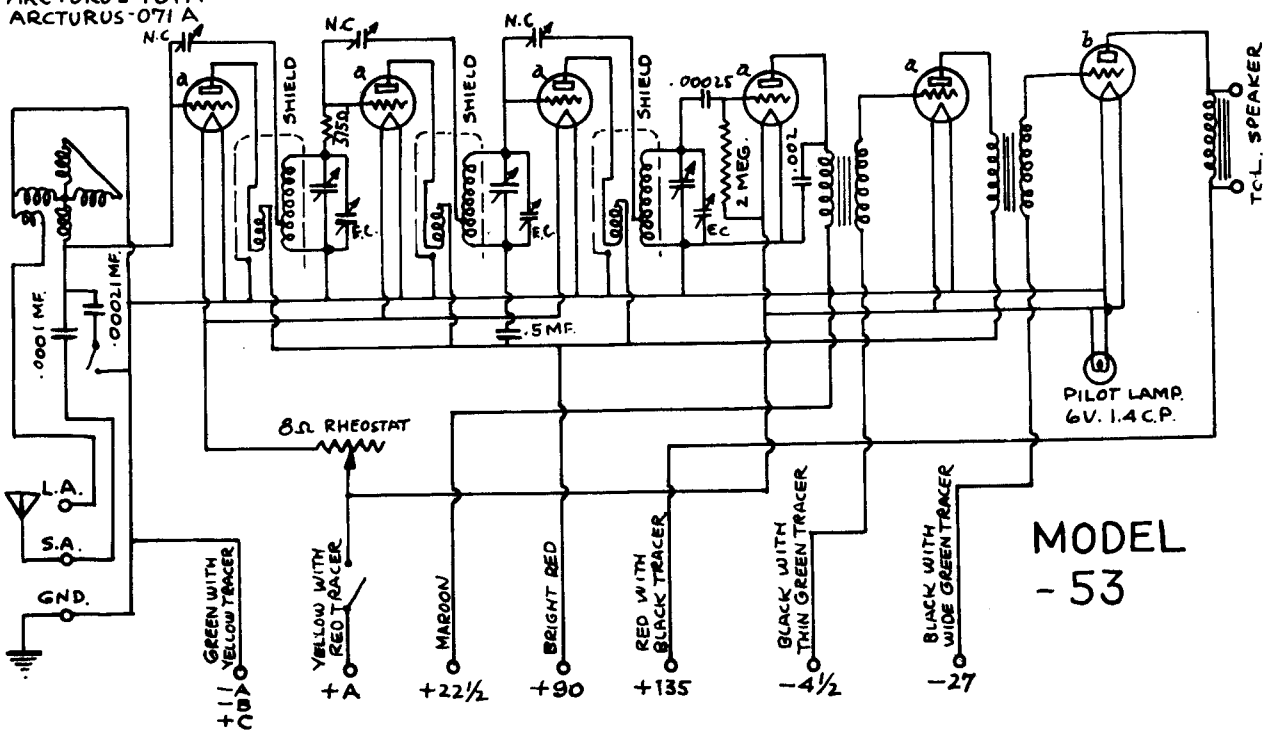
NOTE
2,000, 350 & 1,150 OHM RESISTANCES WOUND ON SAME TUBE.
20,000 OHM RESISTANCE COMPOSED OF 2-10,000 OHM RESISTANCES CONNECTED IN SERIES

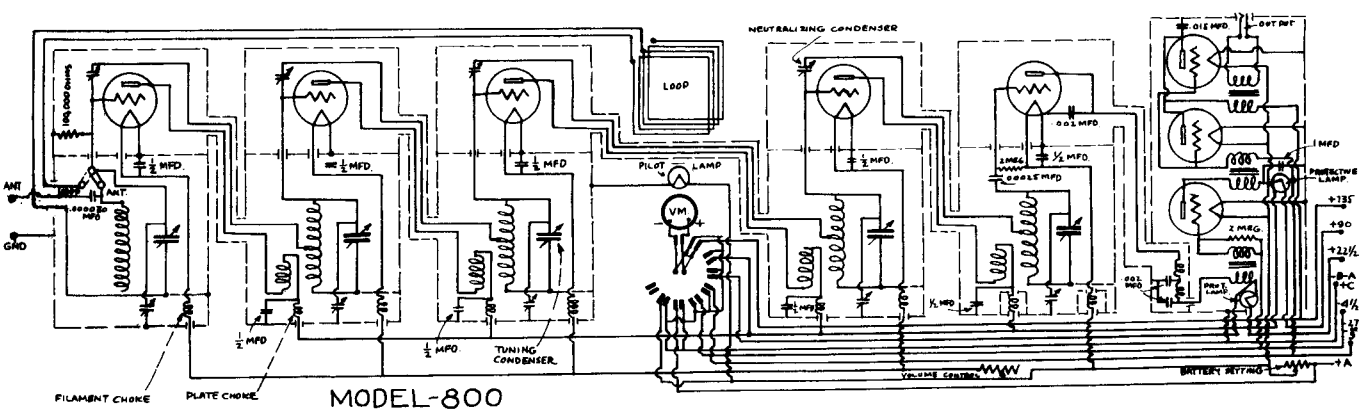
MODEL
470

FREED-EISEMANN RADIO CORP.



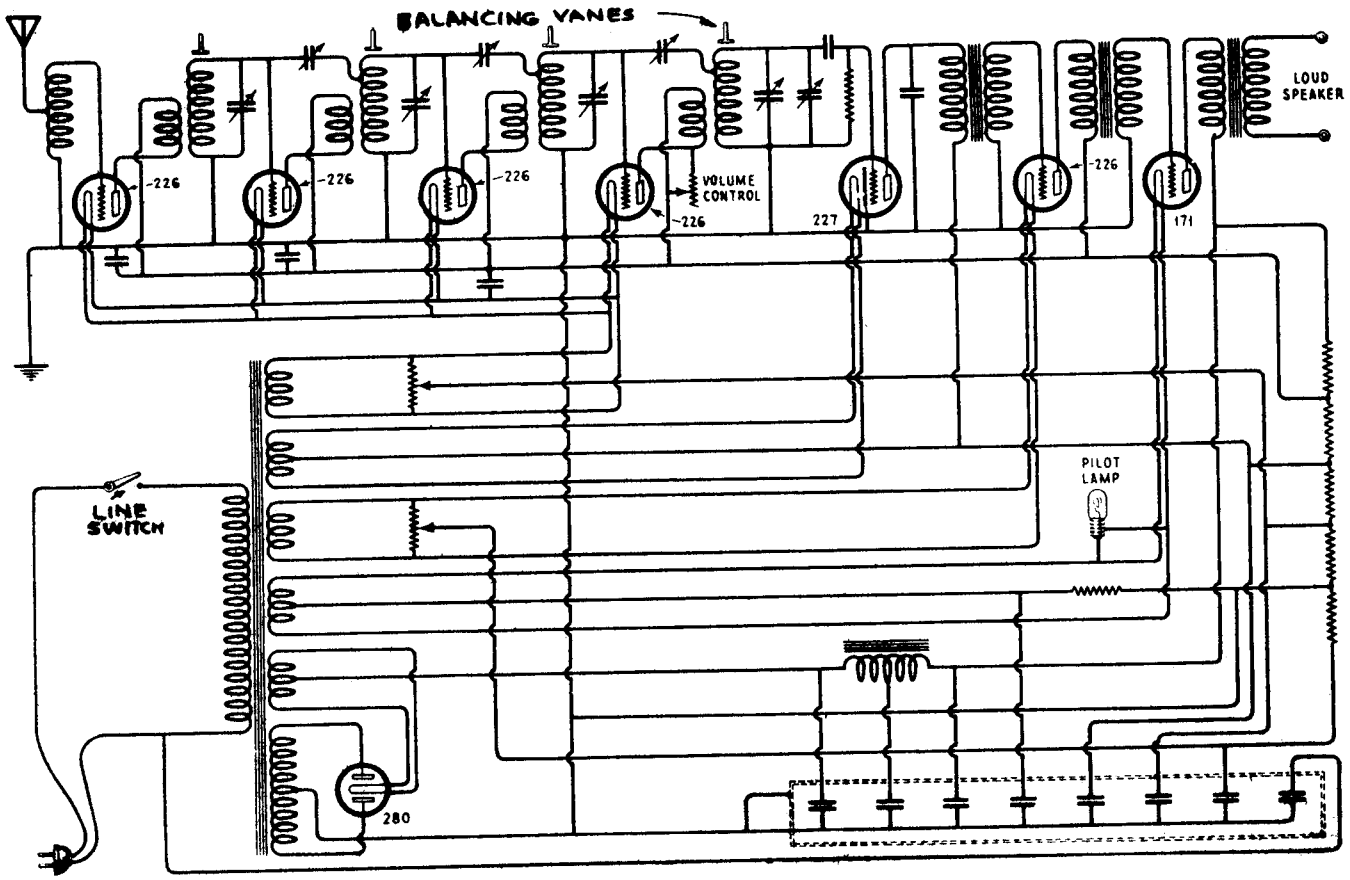
a: ARCTURUS-101A
b: ARCTURUS-071A



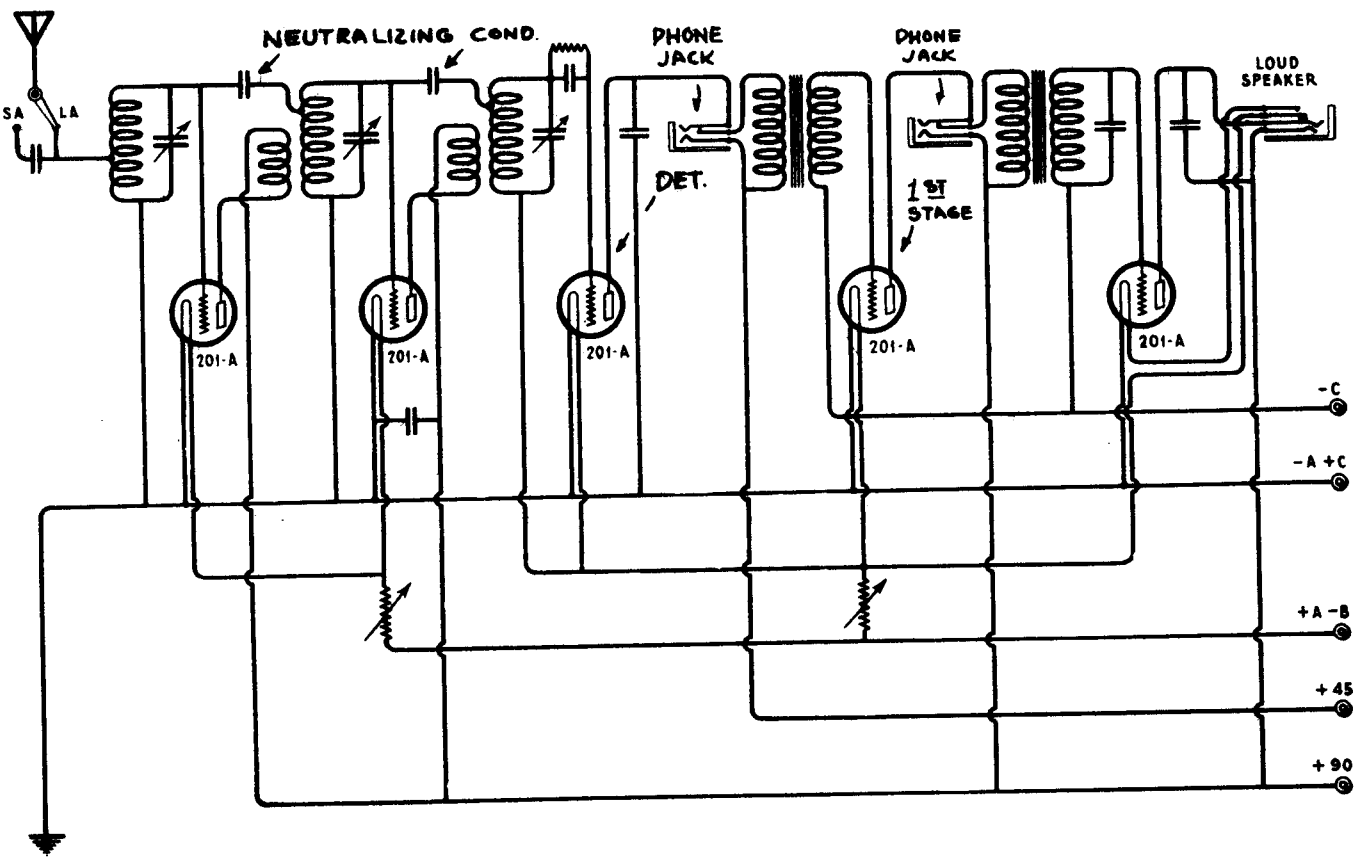


FREED EISEMANN RADIO CORP.

MODEL NR-80 A.C.

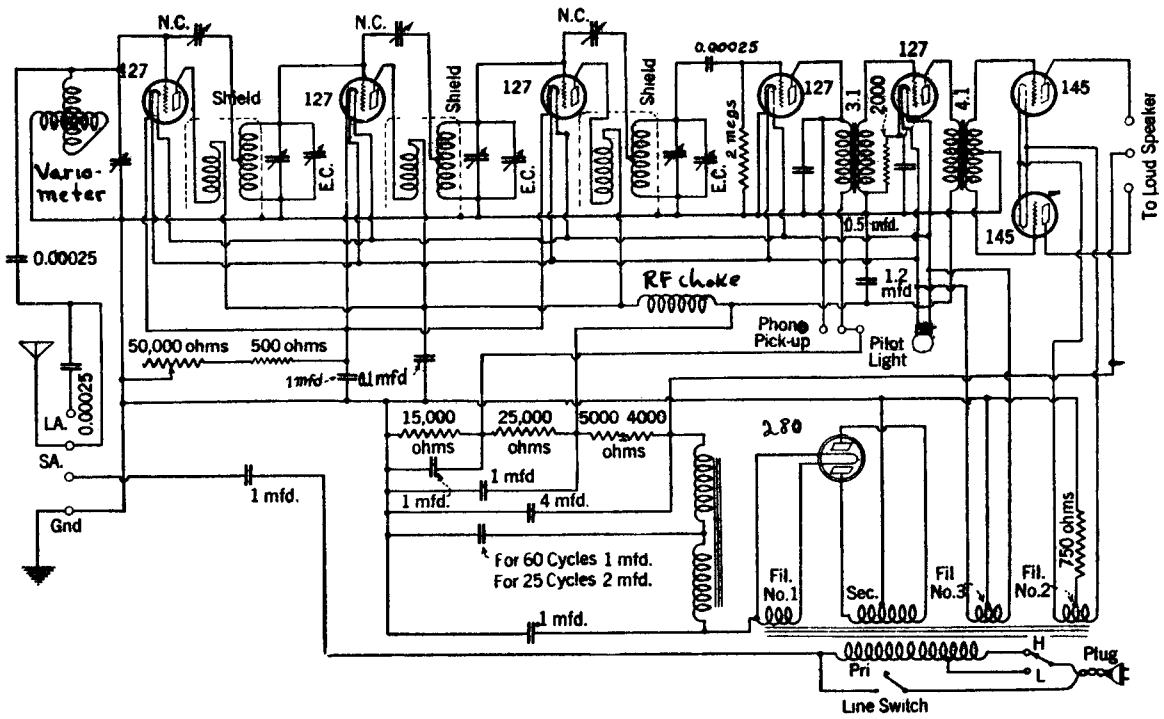


MODEL NR-5

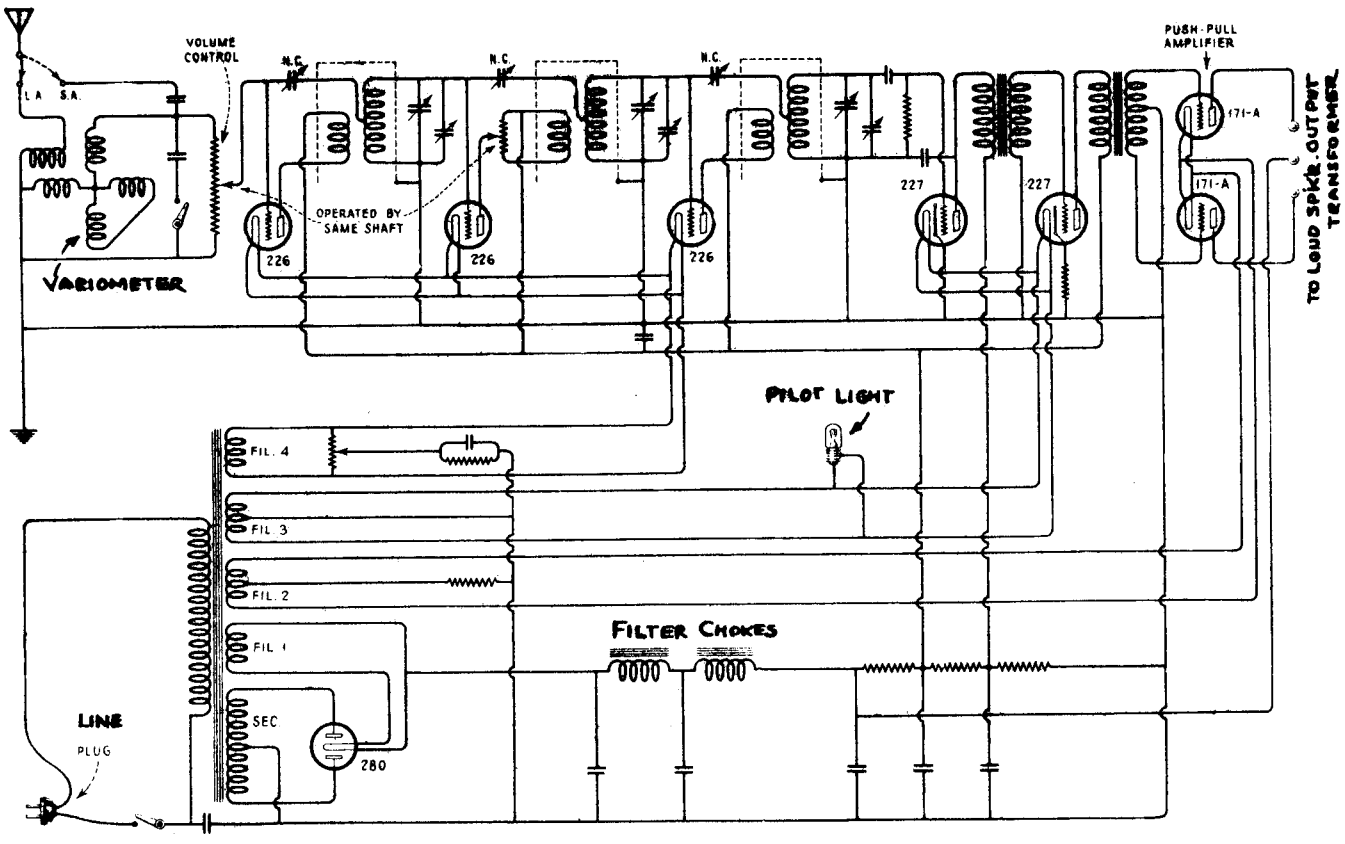


FREED EISEMANN RADIO CORP.

MODEL NR-78 A.C.

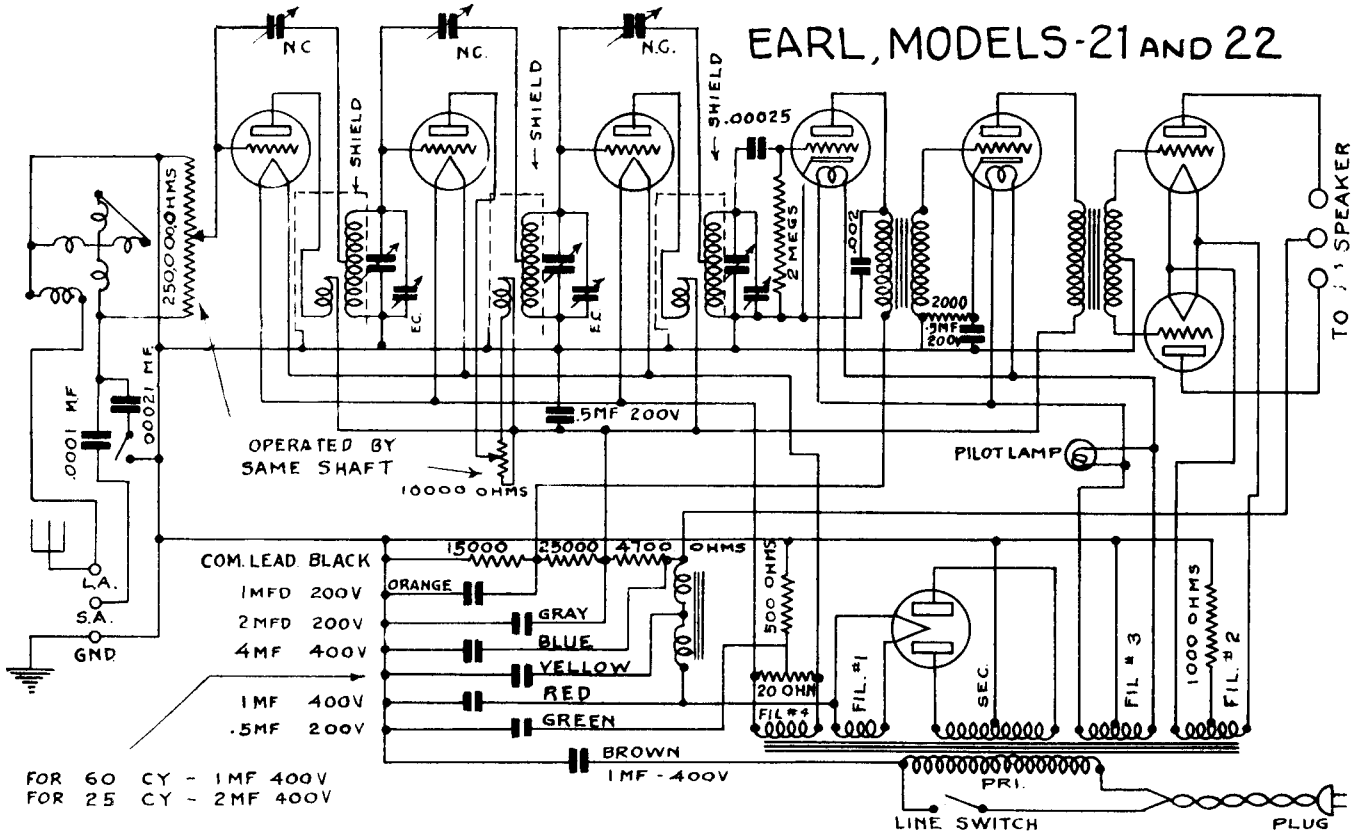


MODEL NR-55 A.C.

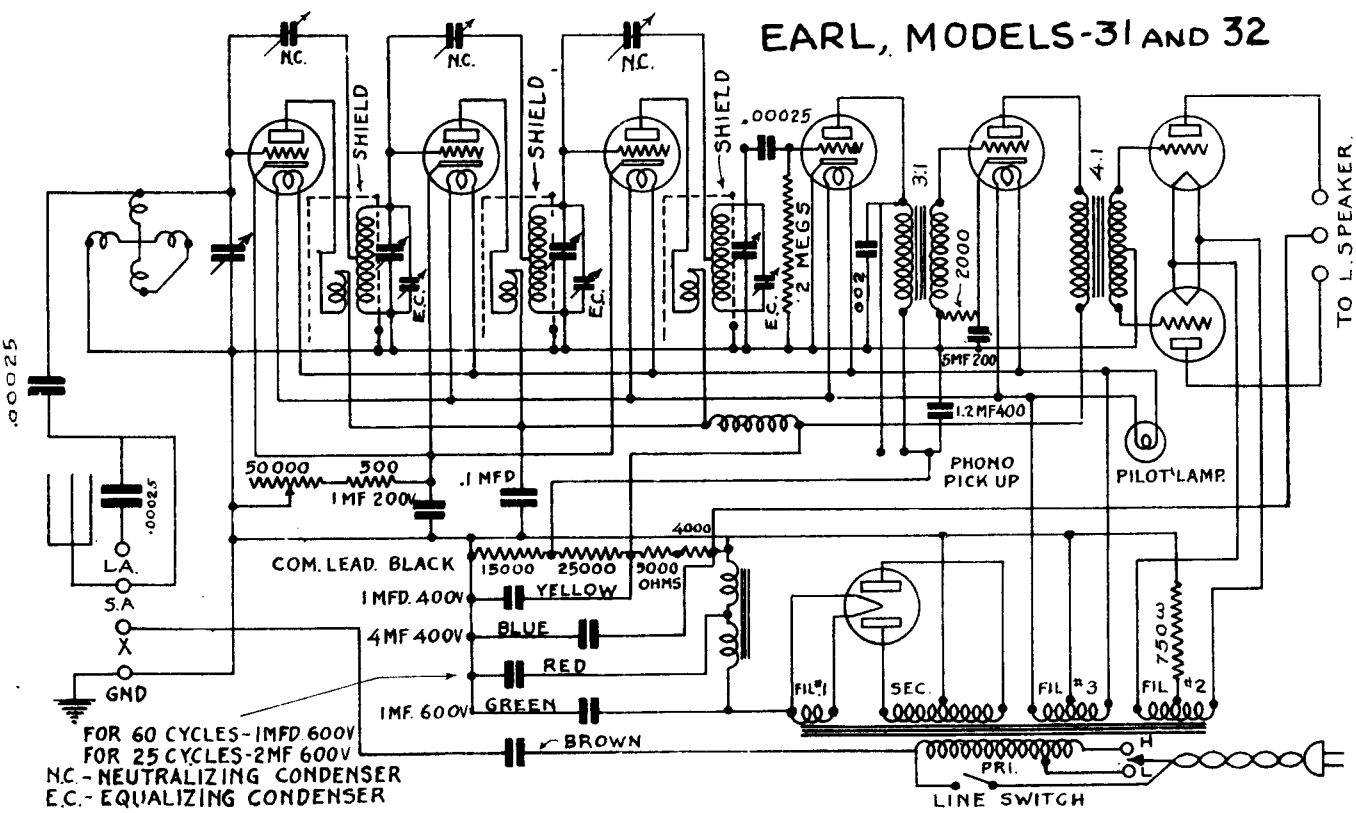


CHAS. FRESHMAN CO., Inc.

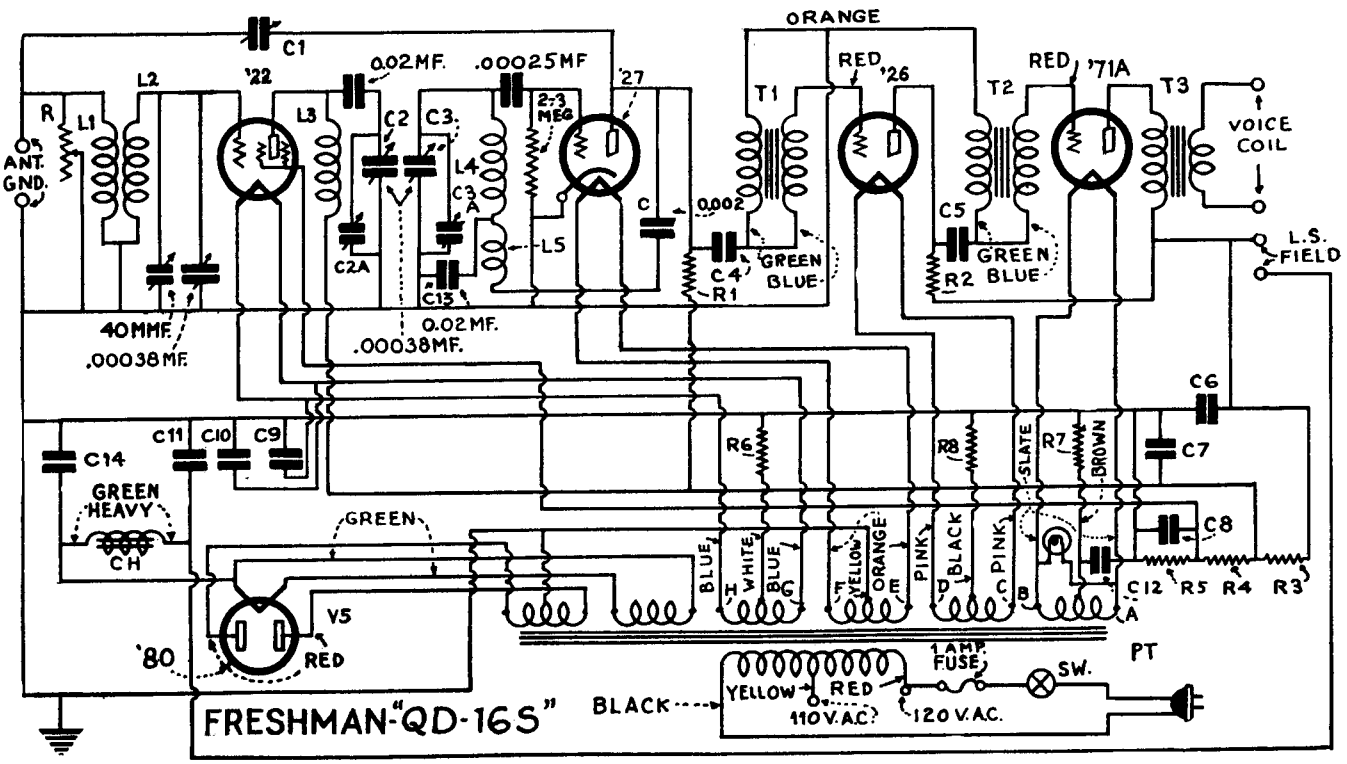
EARL, MODELS-21 AND 22



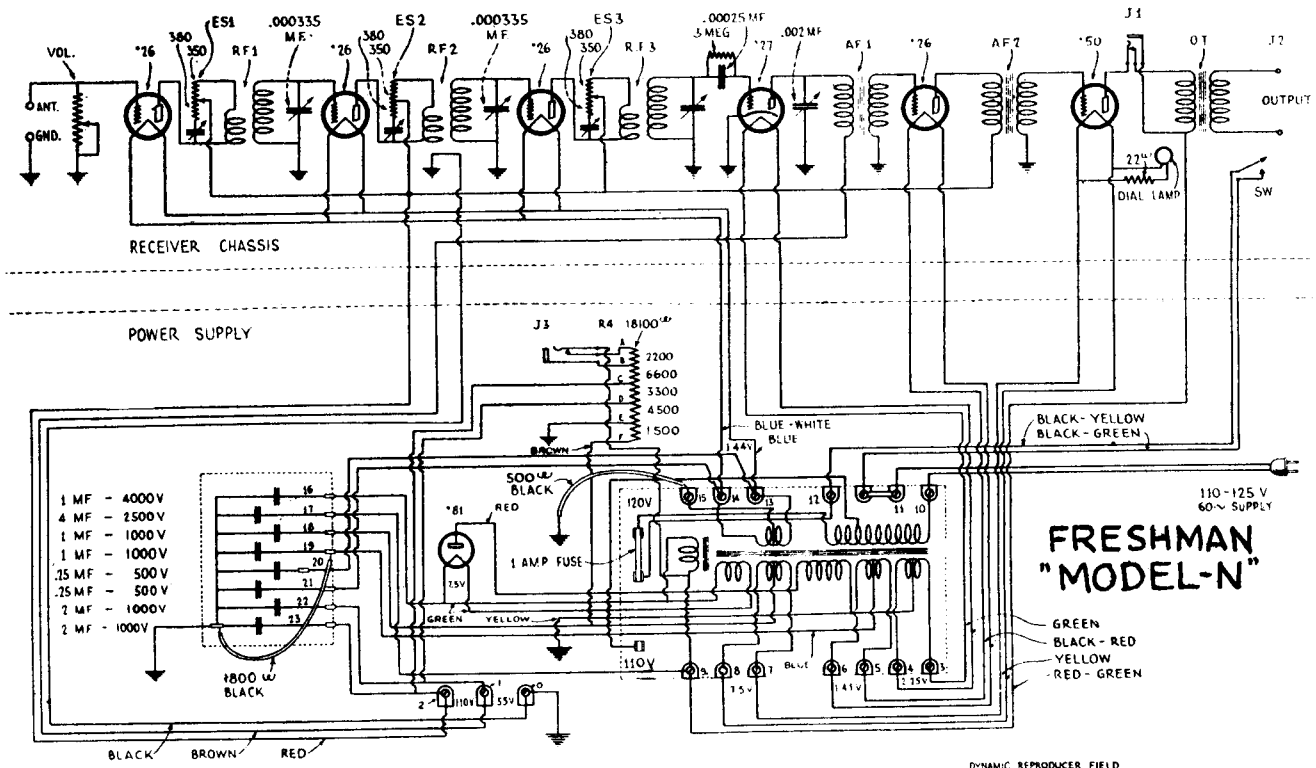
EARL, MODELS-31 AND 32



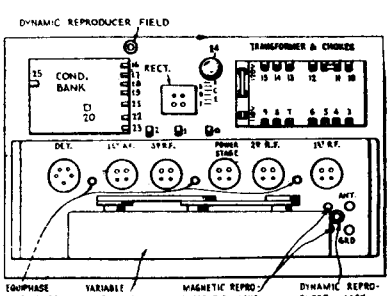
CHAS. FRESHMAN CO., Inc.



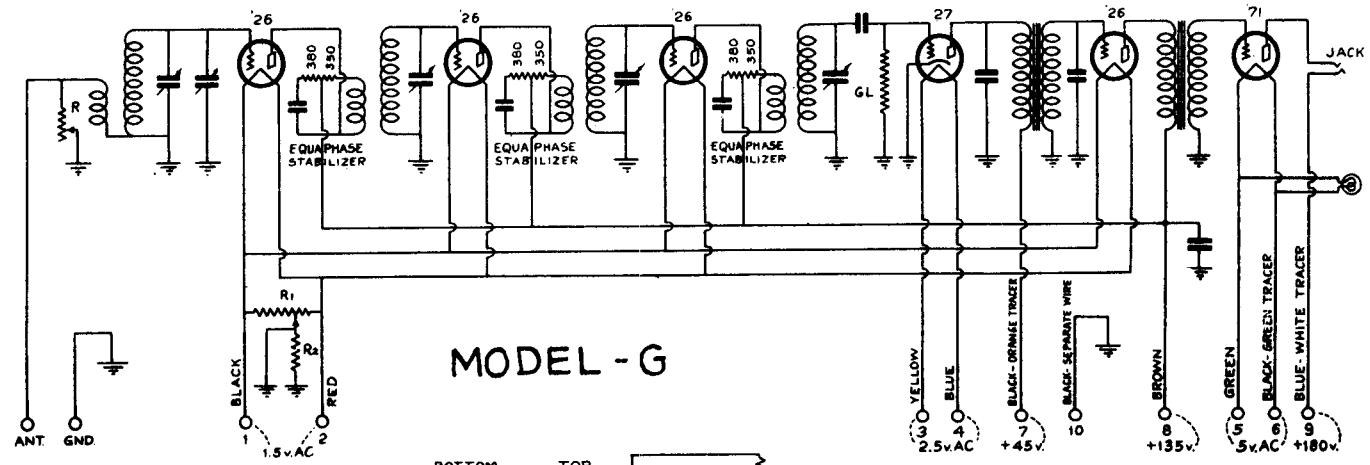
Schematic circuit of the Freshman "QD-16S" screen-grid receiver; correct coupling between L3 and L4 is an important selectivity factor in this set. Values not shown above are: C1, 35 mmf.; C4, C5, 0.25-mf. (1500 v.); C6, 2 mf.; C14, C11, 1 mf. (2000 v.); C7, C8, C12, 1 mf. (1000 v.); C9, C10, 0.25-mf. (500 v.). R1, R2, R3, R4, R5 are 40,000, 25,000, 12,500, 12,500, and 10,000 ohms, respectively

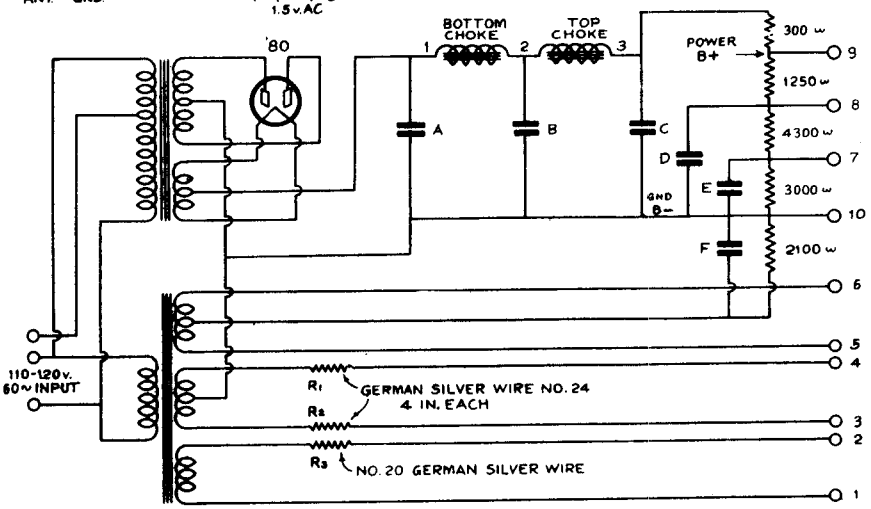


The Freshman "Model N" and its power pack; the numbering of the terminals shown here may be compared with that in the diagram of the layout at the right. The capacities and ratings of the condensers in the power unit are shown opposite each, respectively, at the left. Note the special 1800-ohm resistor lead shown here.

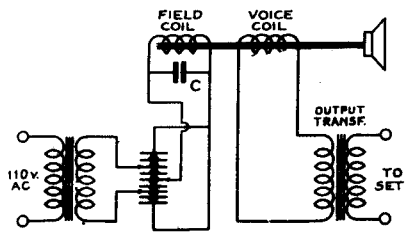


CHAS. FRESHMAN CO., Inc.

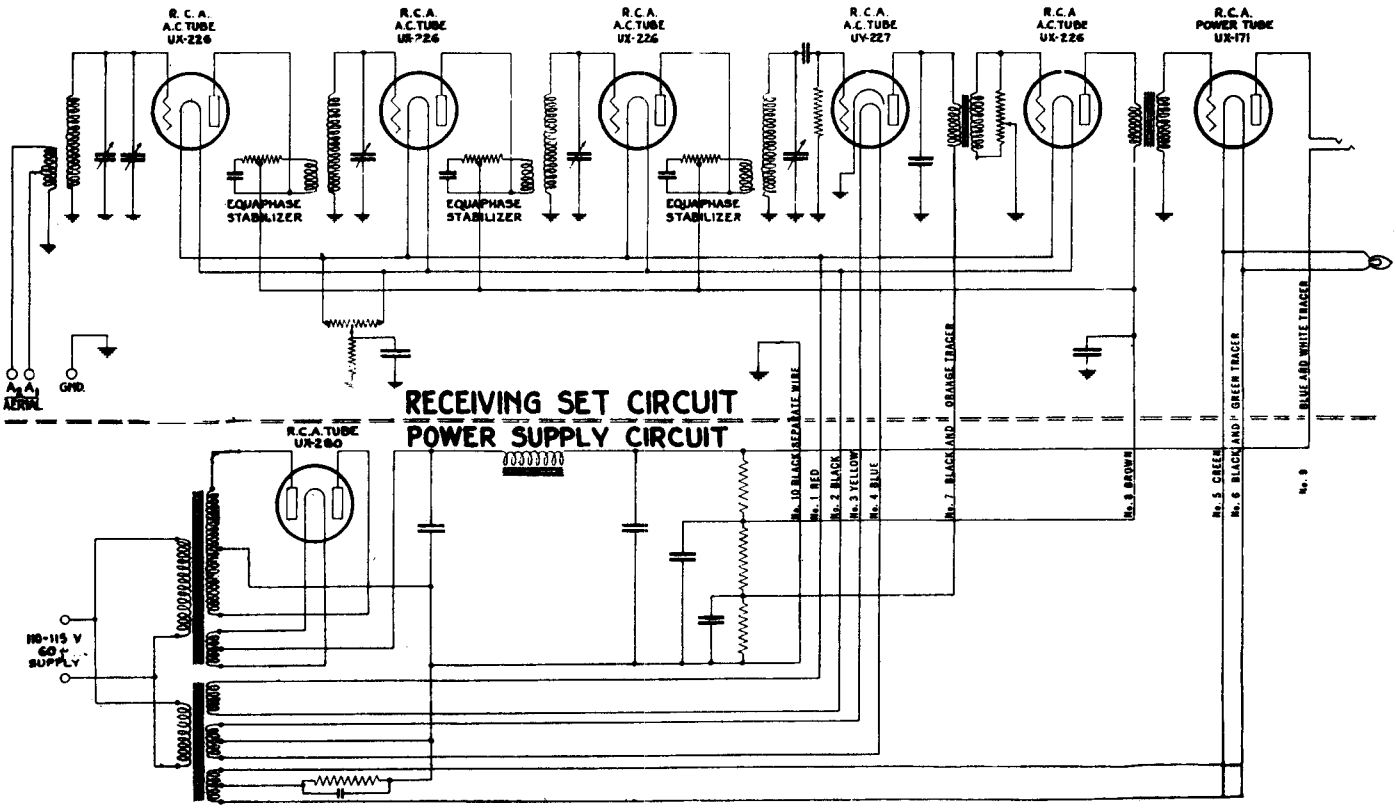




Wiring of Model "G" power pack. The values of the condensers are as follows: A, 2-mf. (2,000); B, 2-mf. (2,000); C, 6-mf. (2,000); D, 4-mf. (1,000); E, 2-mf. (1,000); F, 1-mf. (1,000). The numerals in parentheses indicate the break-down potentials.

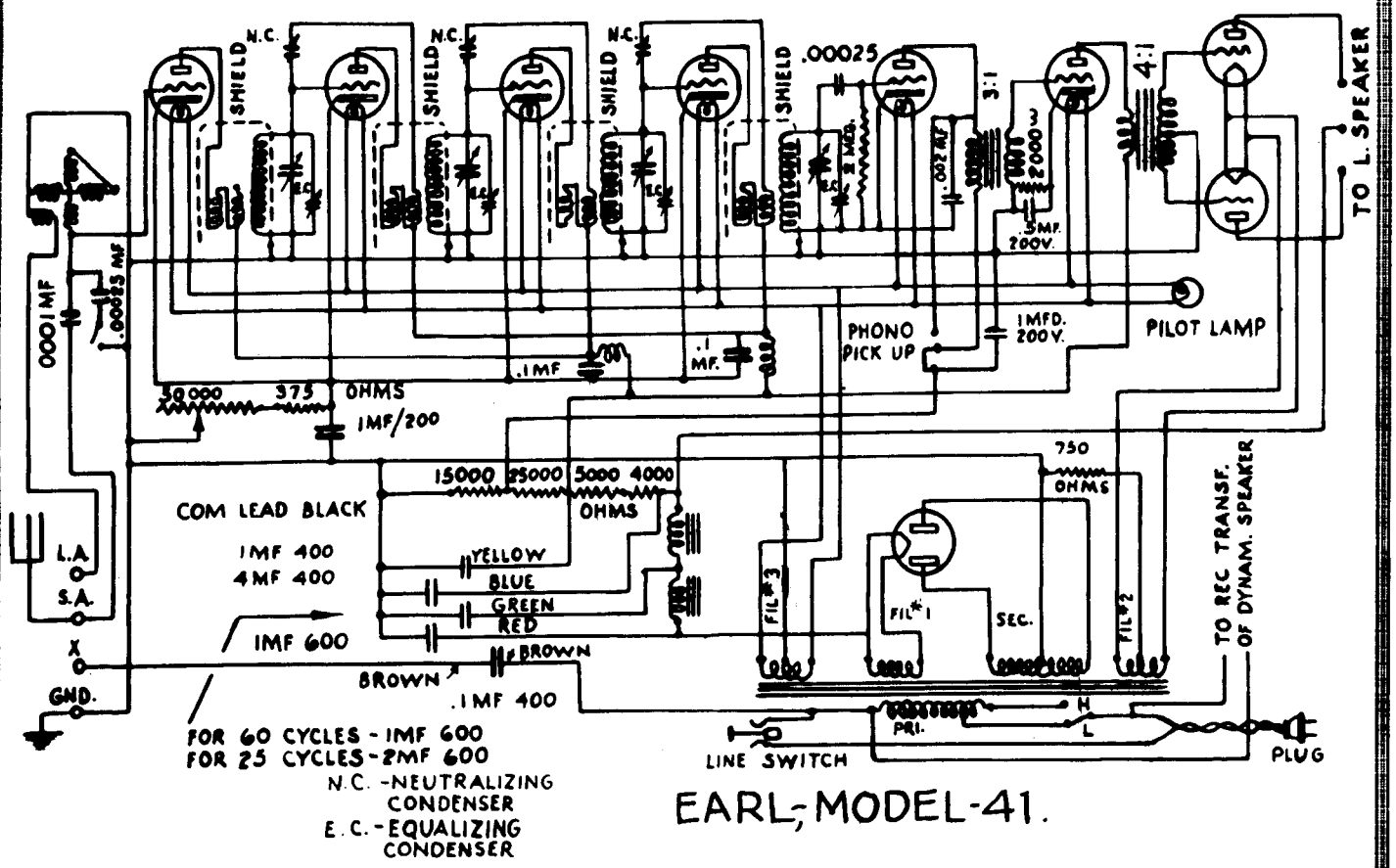


Wiring of the dynamic reproducer components.

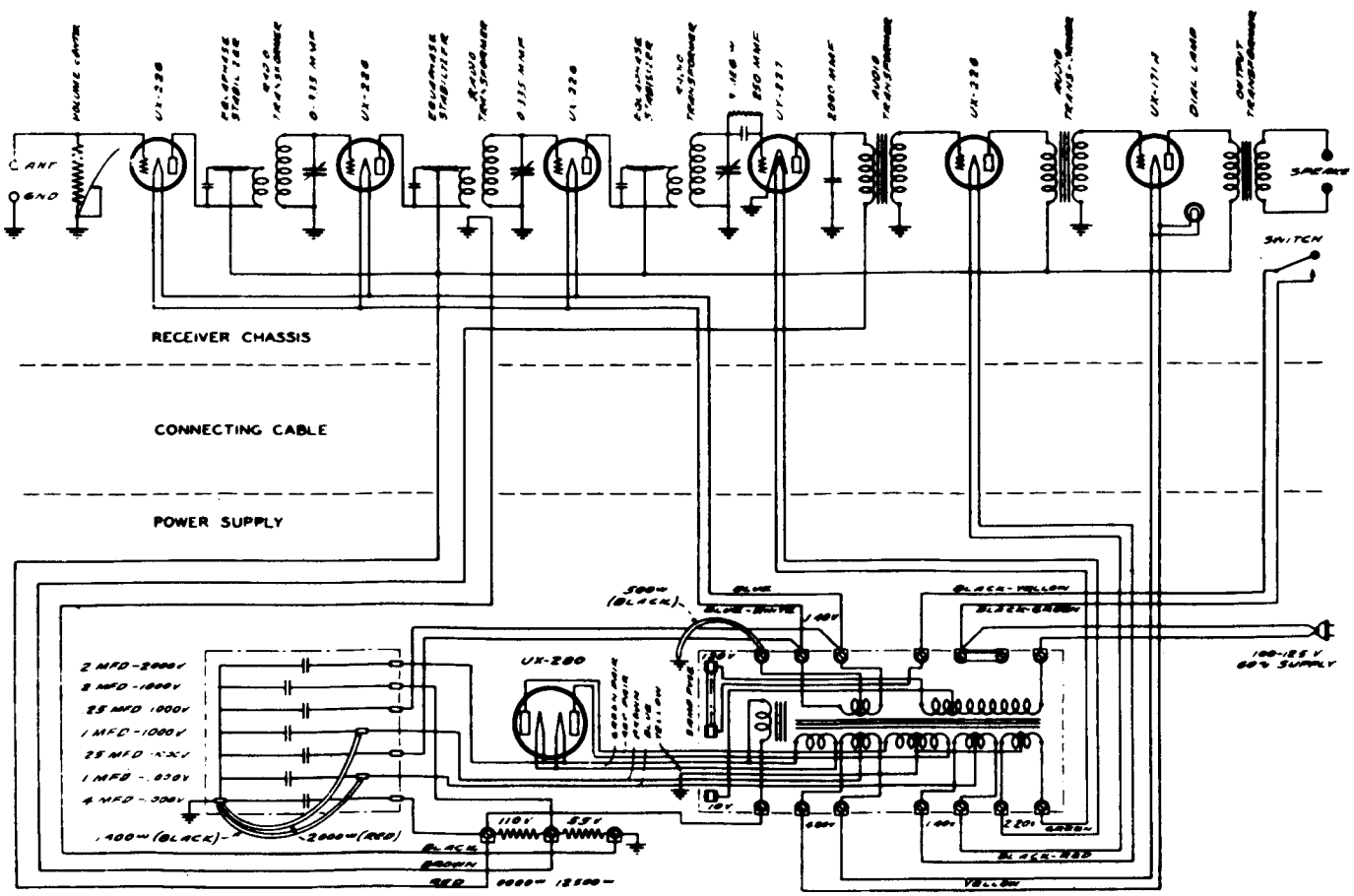


Schematic diagram of Model "G" Chassis and Model G-60-S Power Supply.
Note the one choke coil in Power Supply Circuit.

CHAS. FRESHMAN CO., Inc.

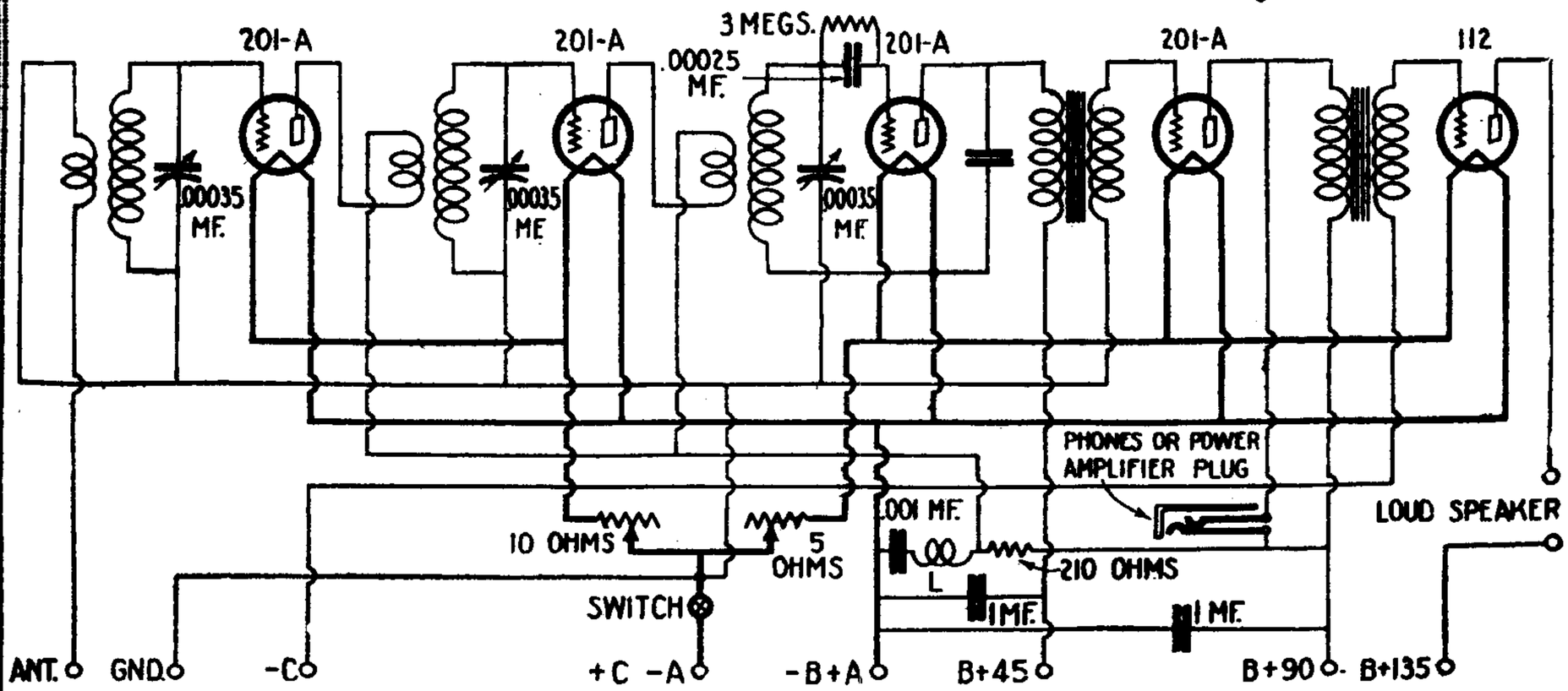


EARL; MODEL-41.

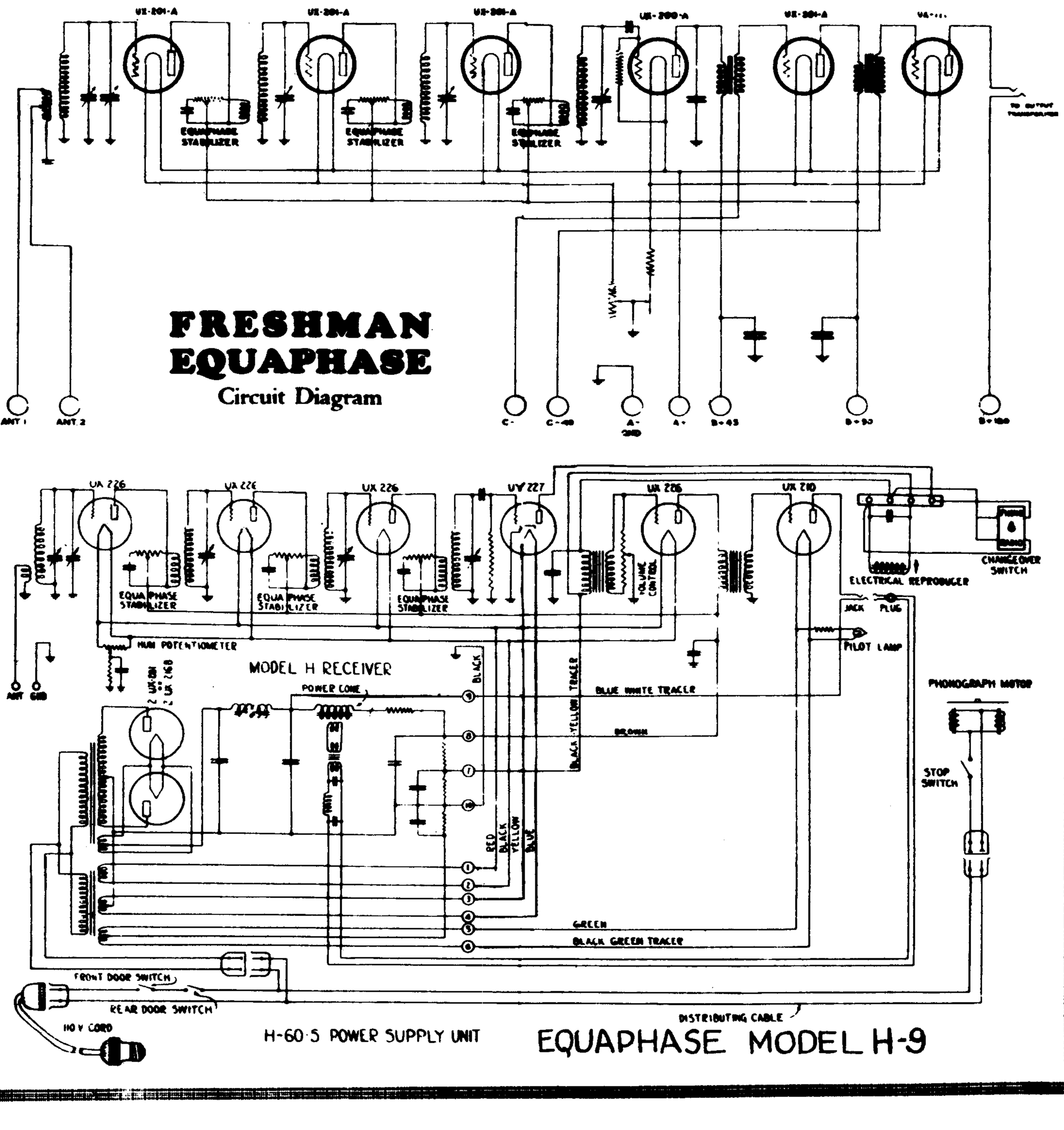


Freshman — Model M Receiver and M-60-S Power Supply Circuit

CHAS. FRESHMAN CO., Inc.



FRESHMAN MASTER-PIECE.



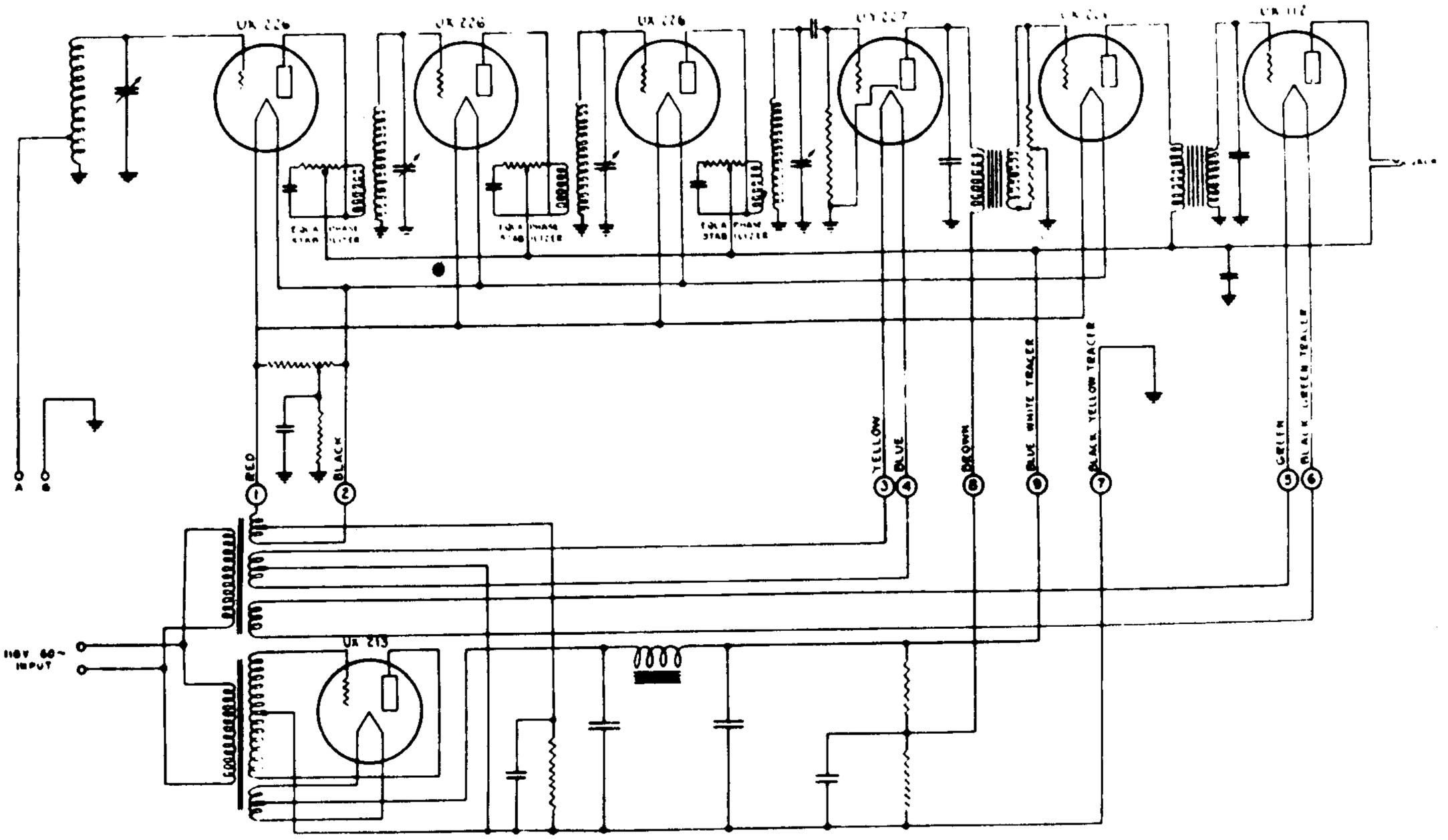
FRESHMAN EQUAPHASE

Circuit Diagram

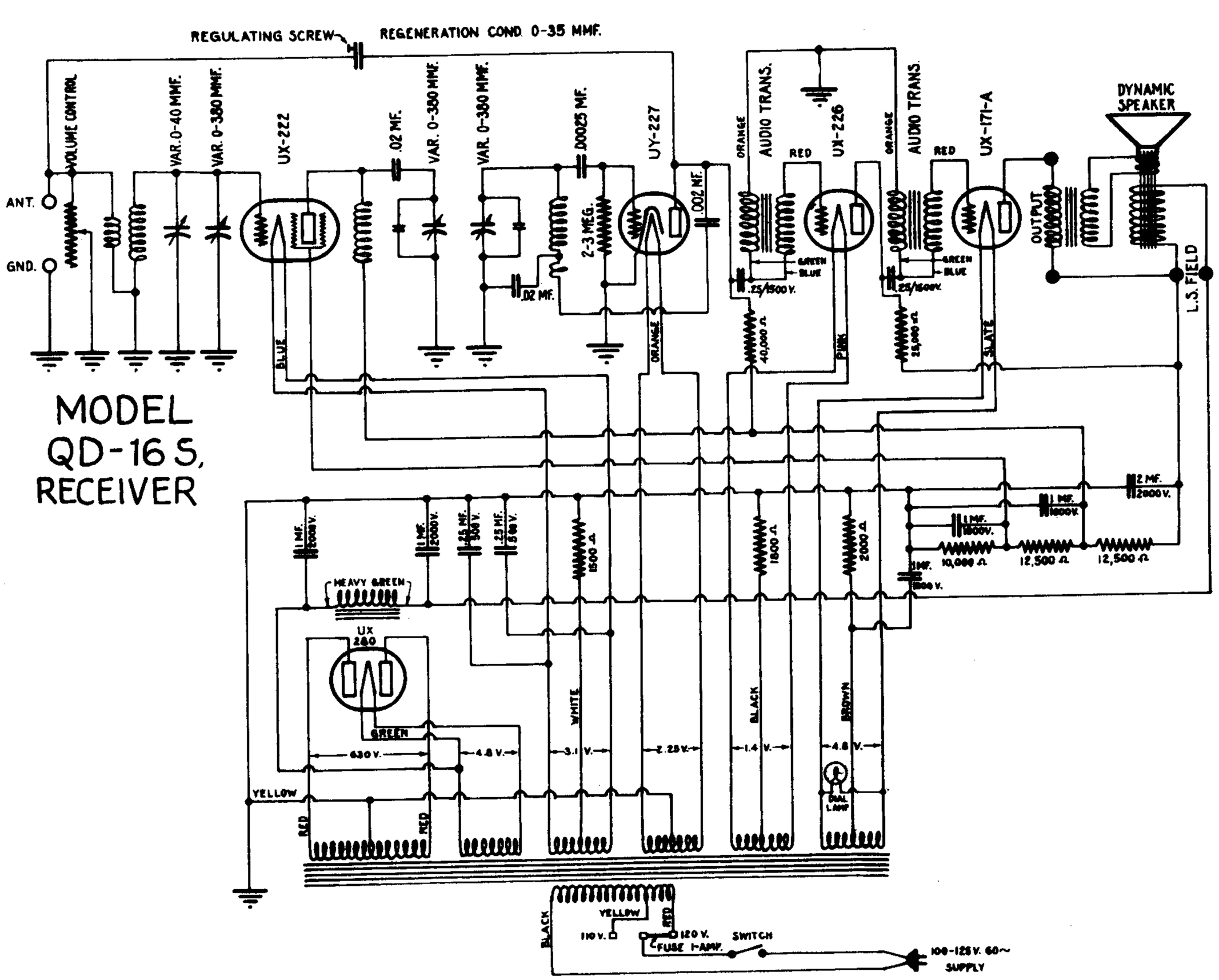
H-60-S POWER SUPPLY UNIT

EQUAPHASE MODEL H-9

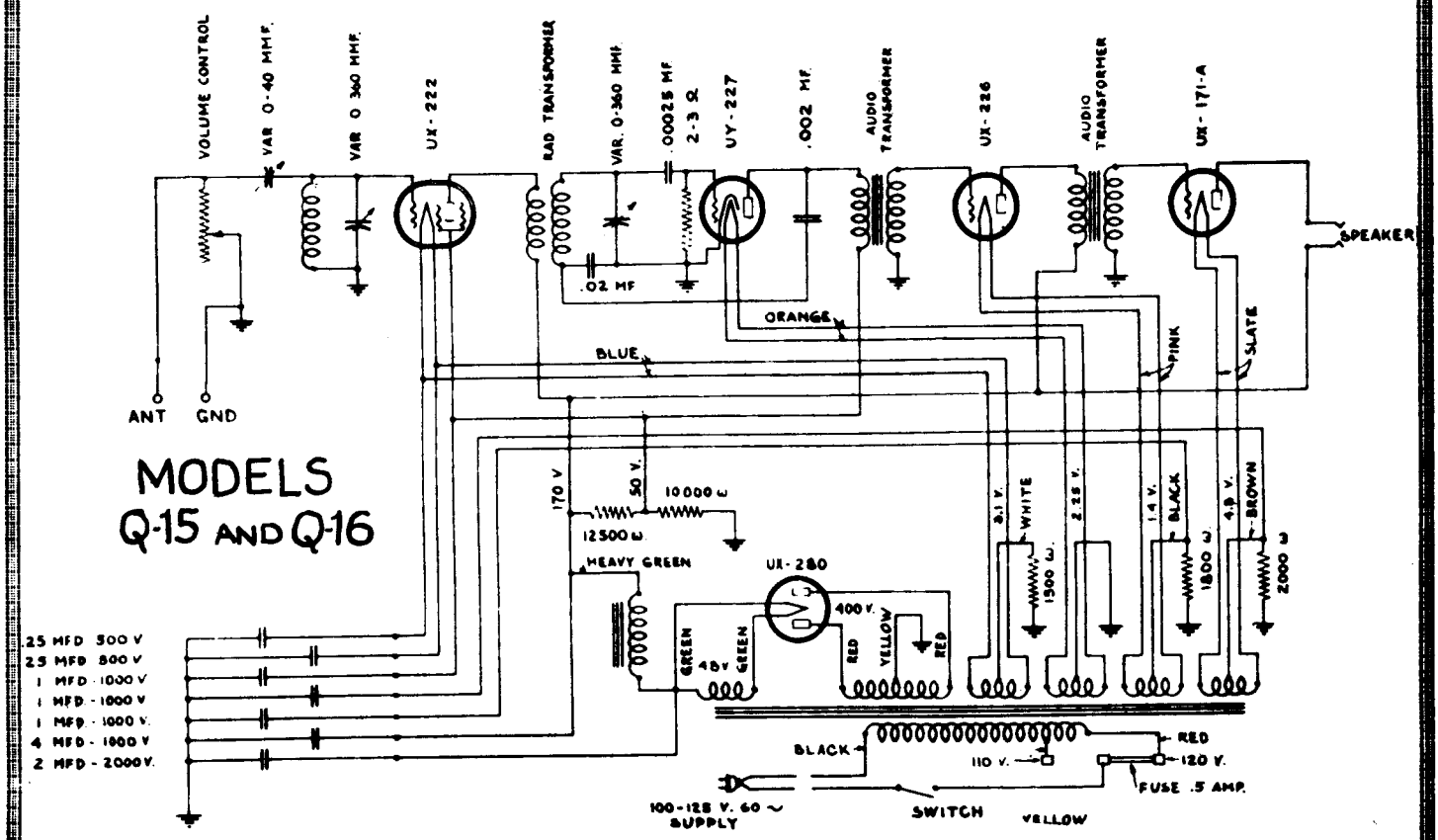
CHAS. FRESHMAN CO., Inc.

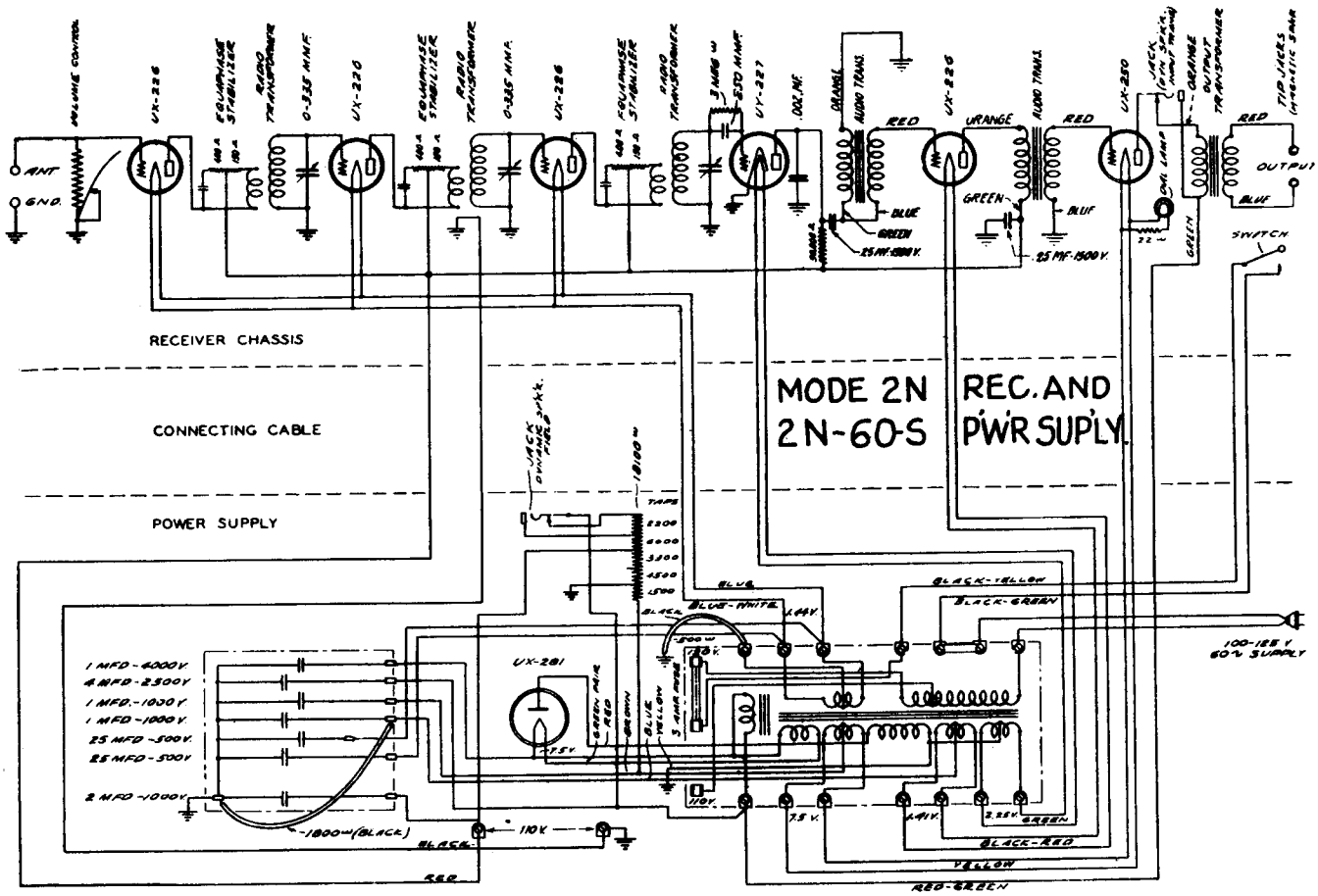


Combination Model K & K-60-S



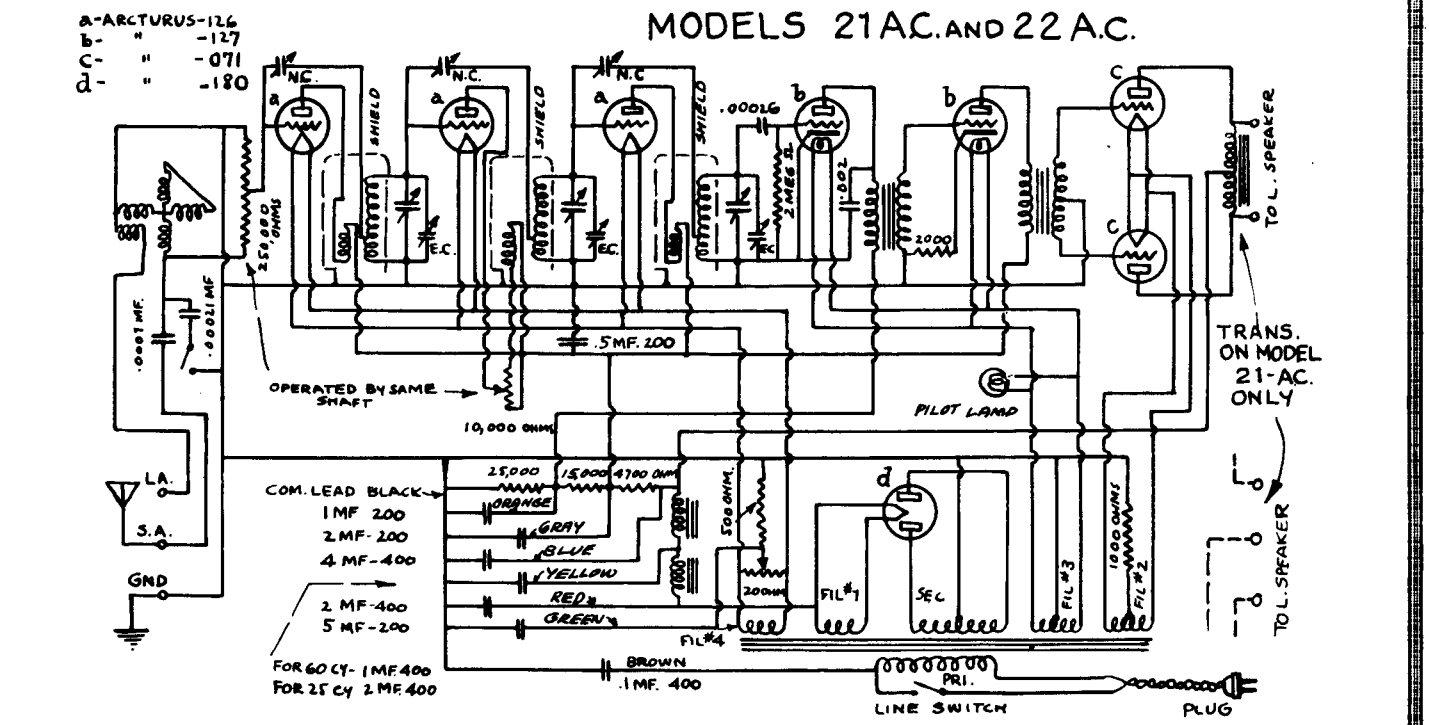
CHAS. FRESHMAN CO., Inc.



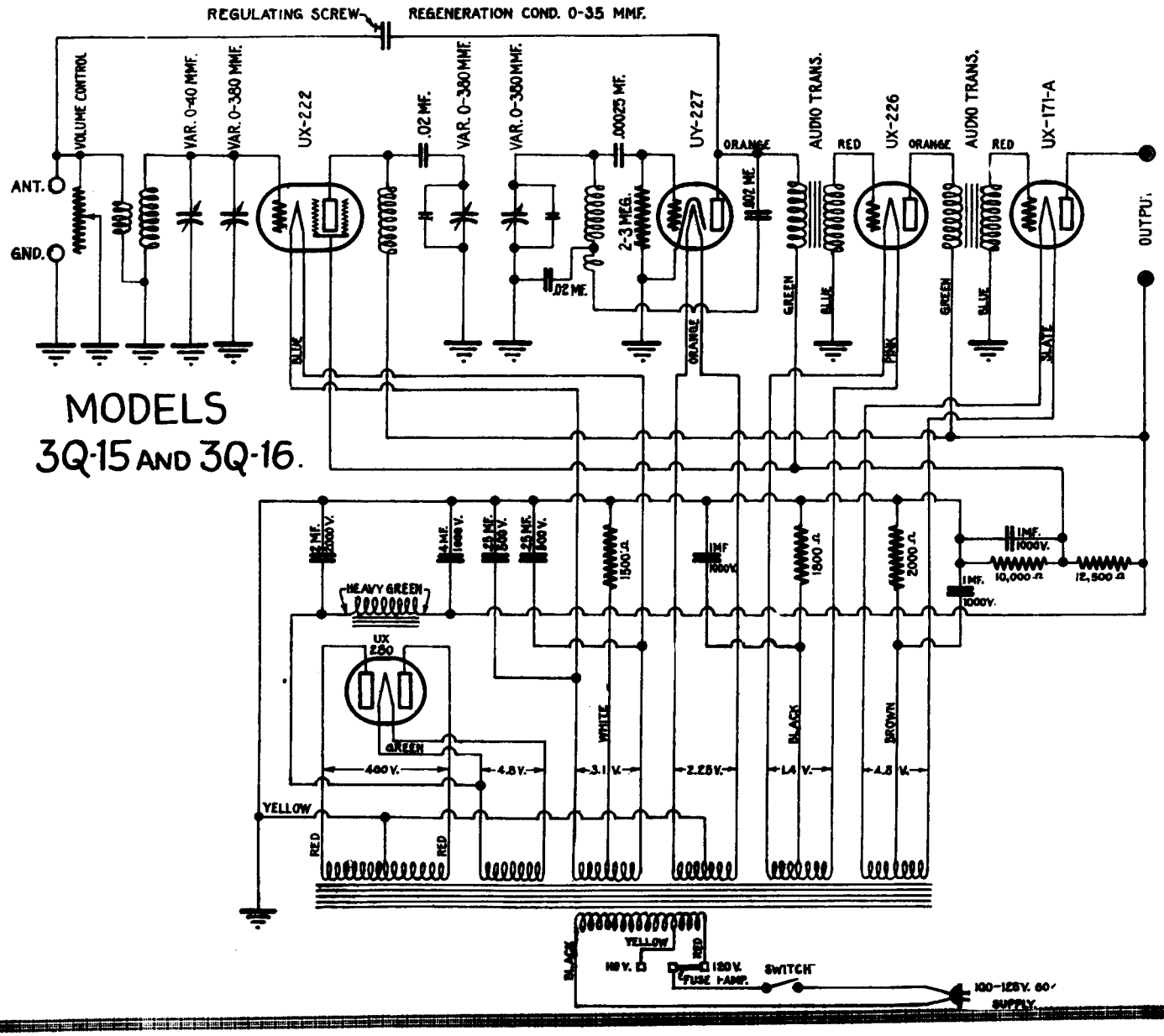


CHAS. FRESHMAN CO., Inc.

MODELS 21 AC. AND 22 A.C.

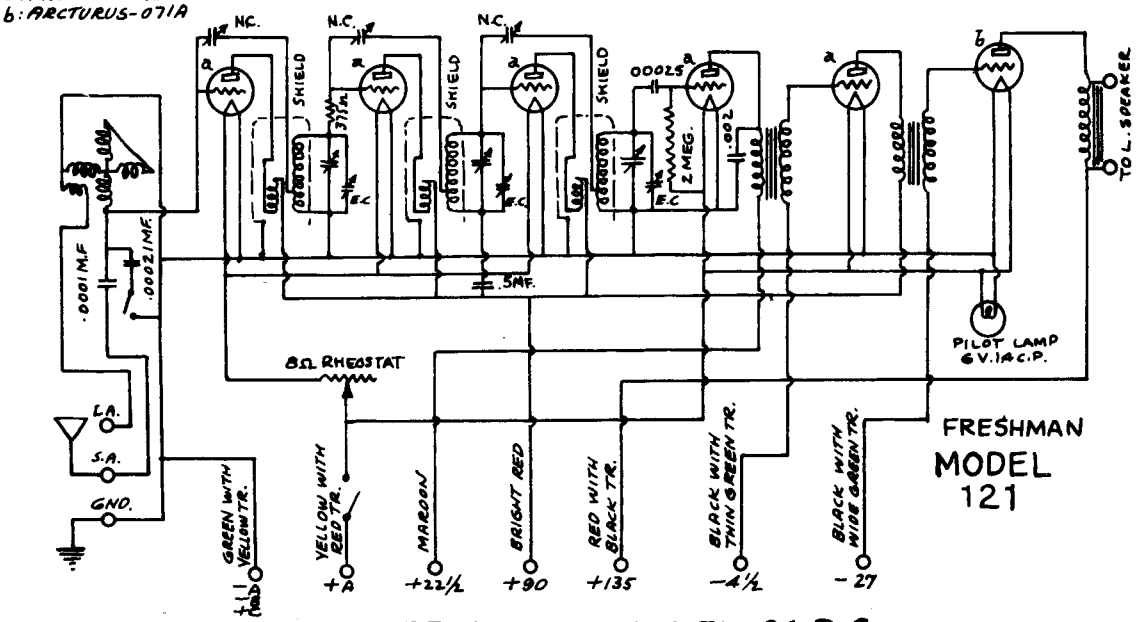


MODELS 3Q-15 AND 3Q-16.



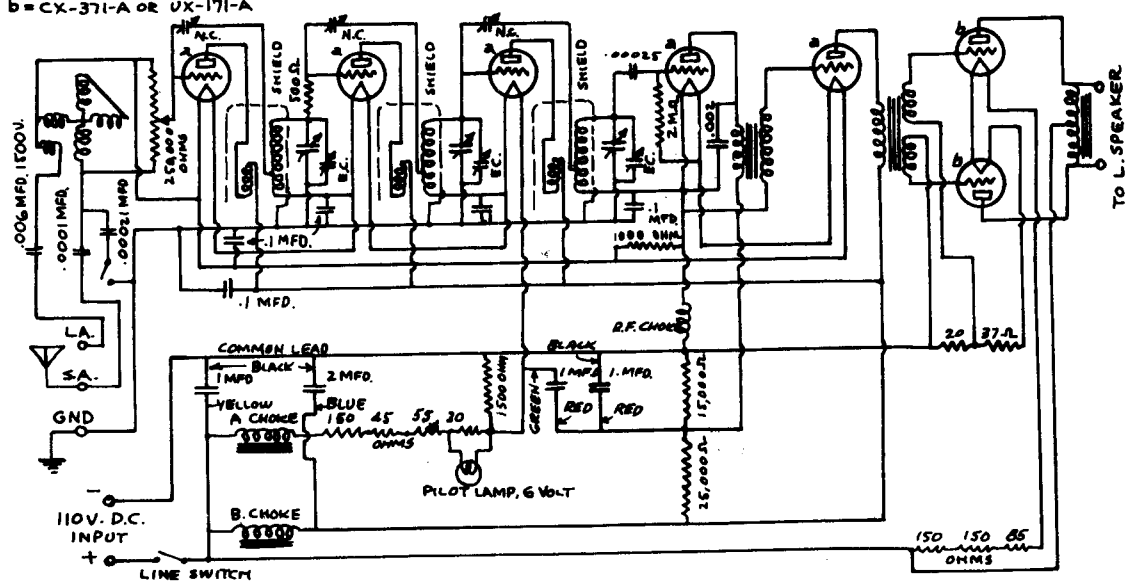
CHAS. FRESHMAN CO., Inc.

a: ARCTURUS —101A.
b: ARCTURUS-071A

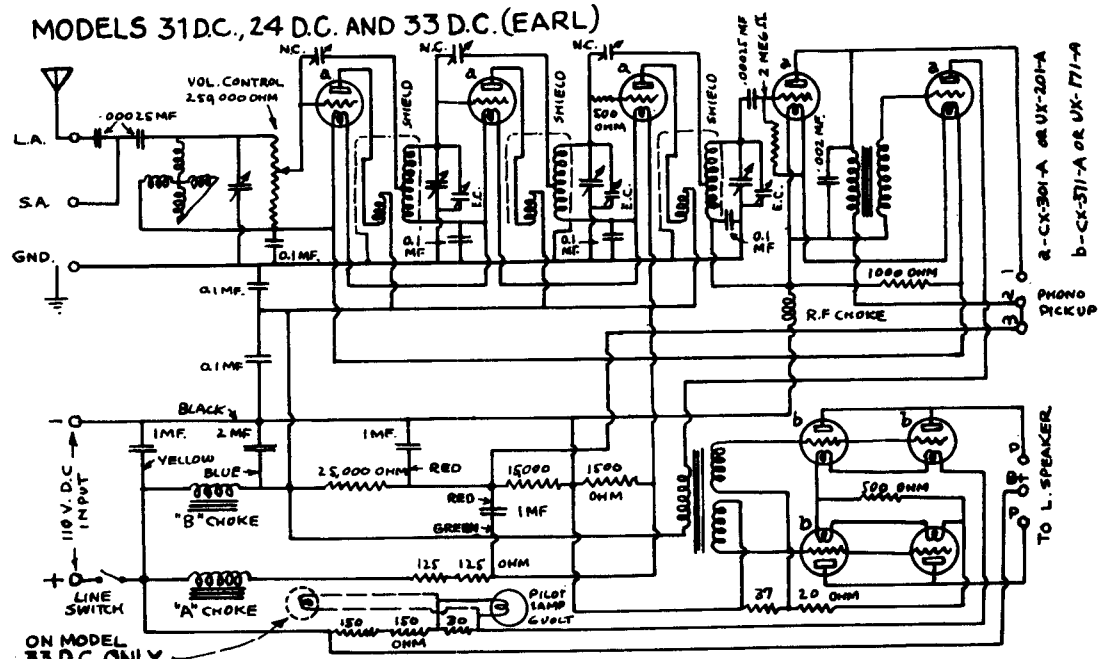


a = CX-301-A OR UX-201-A
b = CX-371-A OR UX-171-A

FRESHMAN — MODEL 21 D.C.



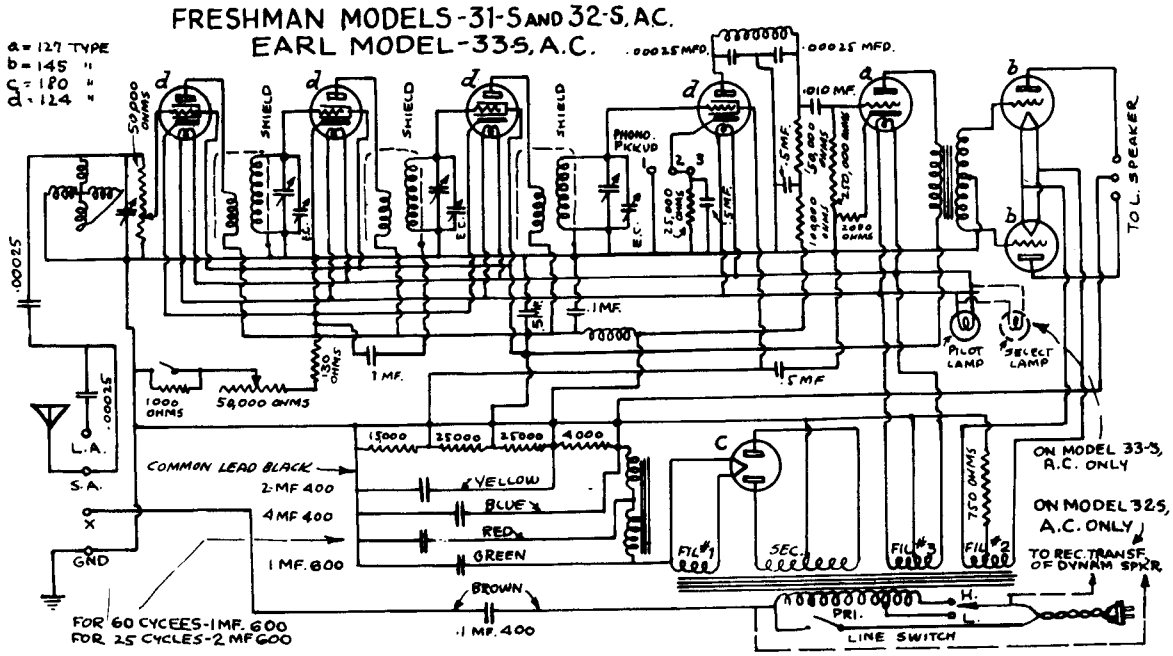
MODELS 31 D.C., 24 D.C. AND 33 D.C. (EARL)



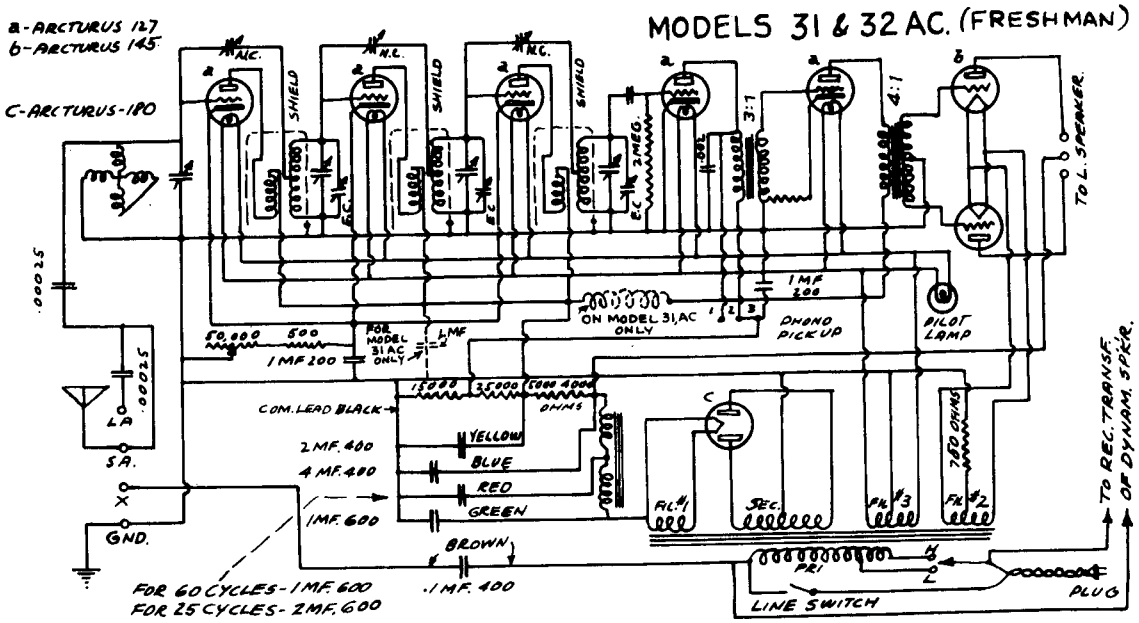
NOTE: RESISTANCES 30 20 AND 37 OHMS WOUND ON ONE TUBE

CHAS. FRESHMAN CO., Inc.

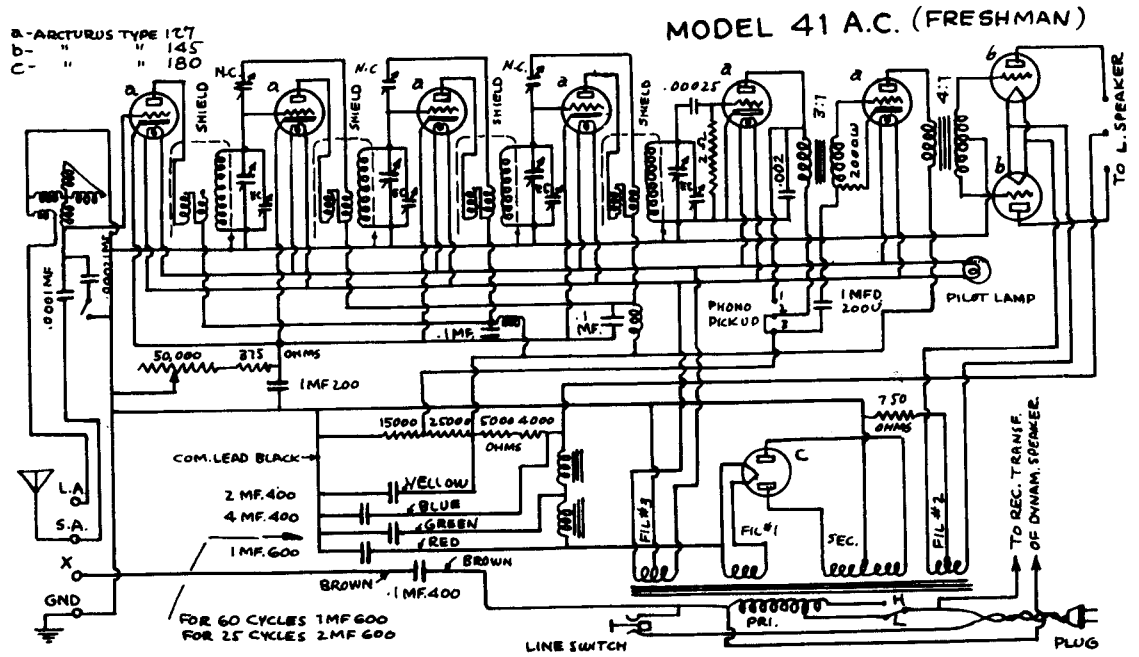
FRESHMAN MODELS-31-S AND 32-S, A.C.
EARL MODEL-33-S, A.C.



MODELS 31 & 32 AC. (FRESHMAN)

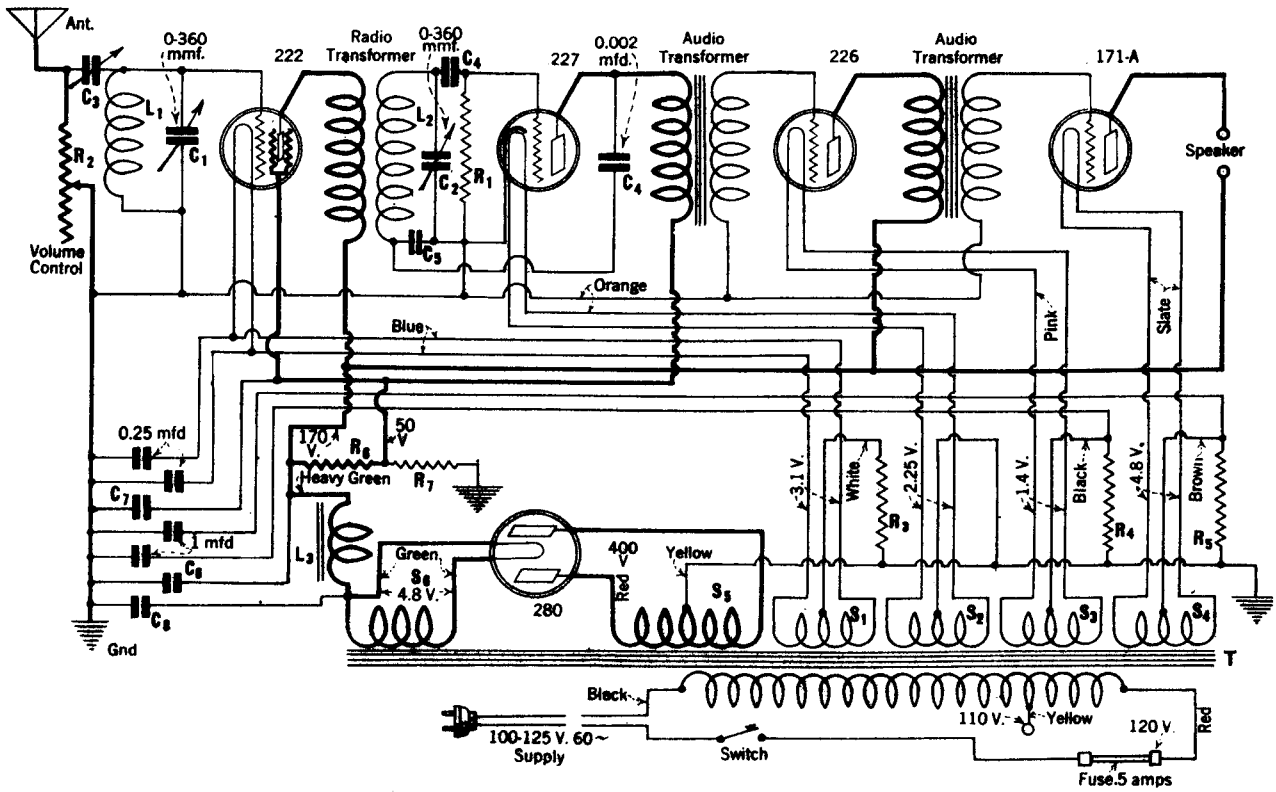


MODEL 41 A.C. (FRESHMAN)

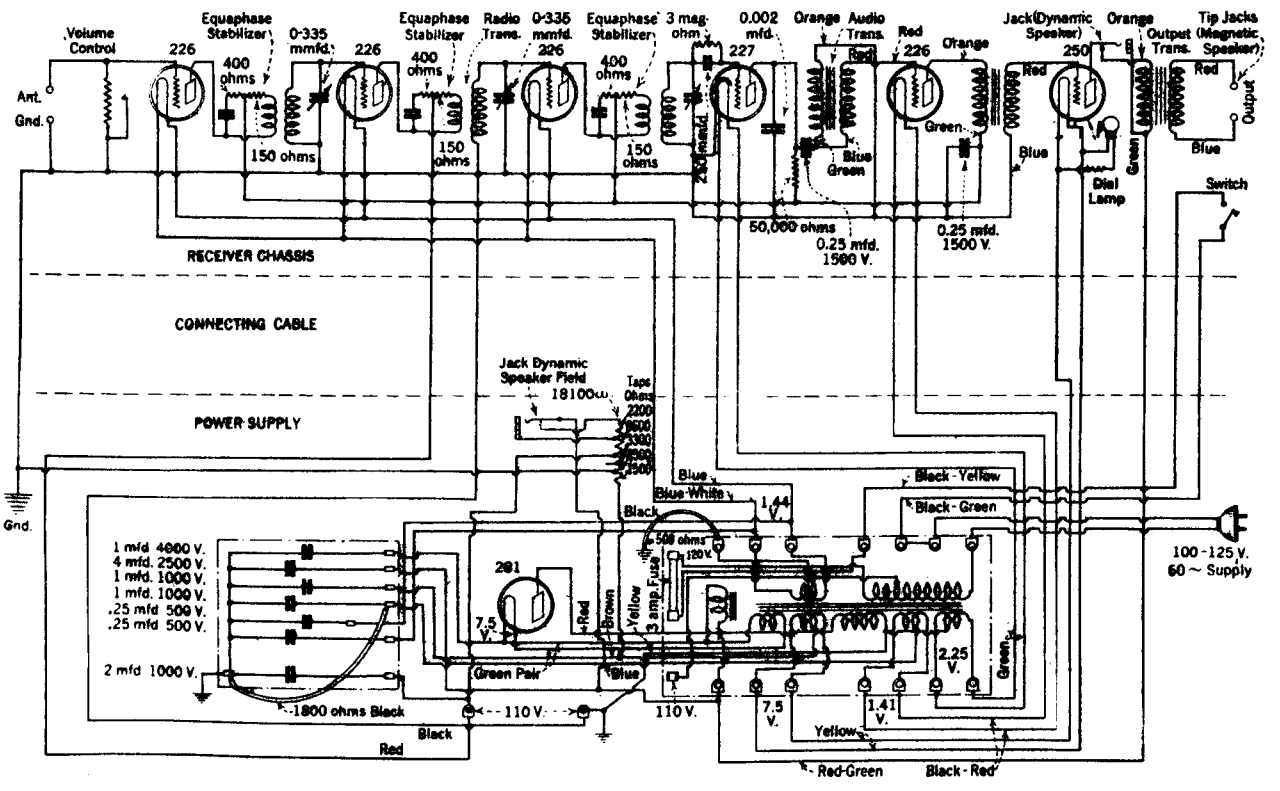


CHARLES FRESHMAN, INC.

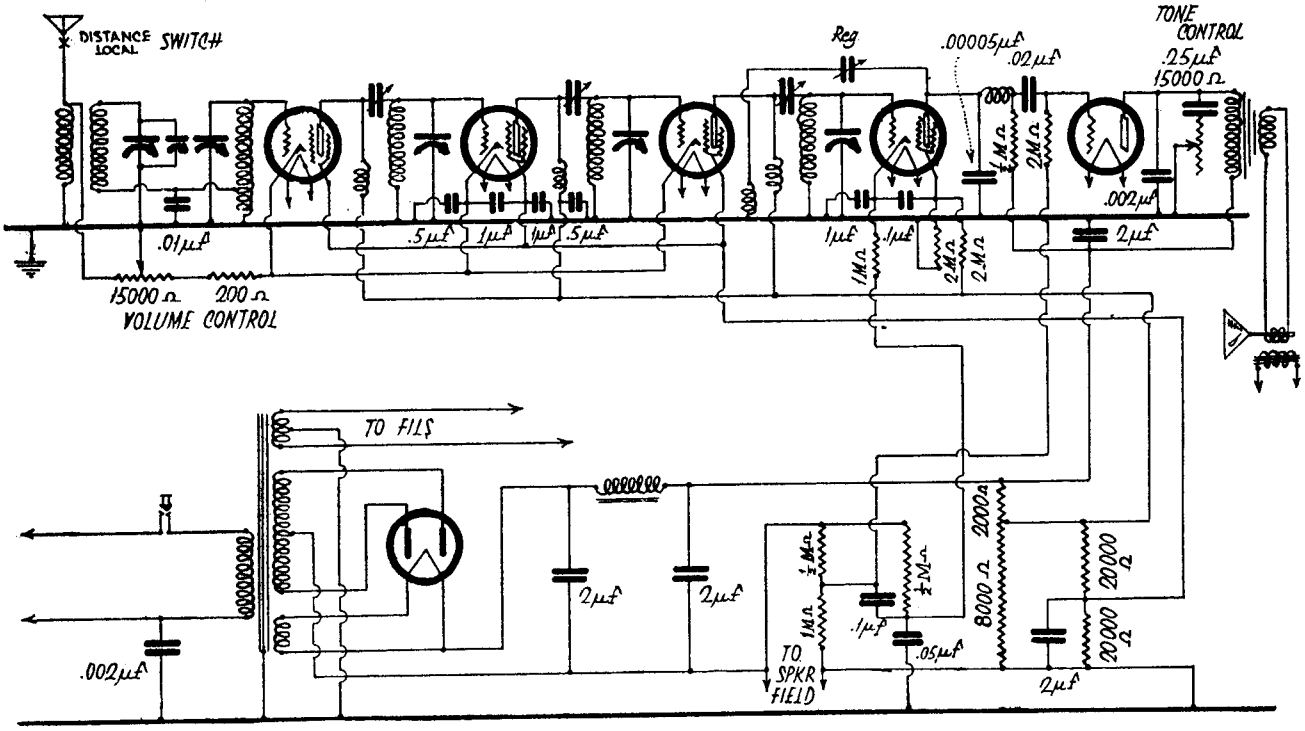
MODEL "Q"



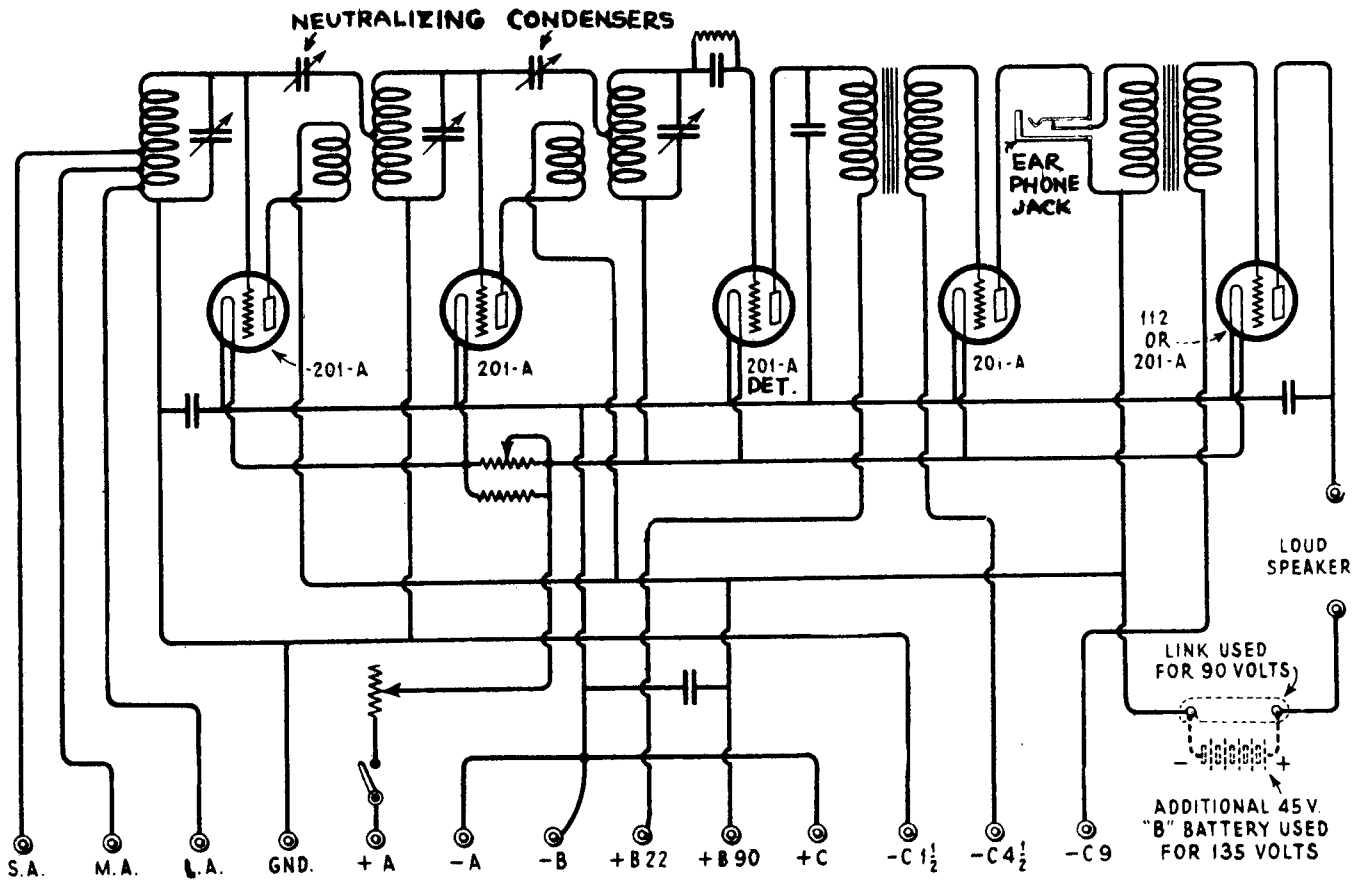
MODEL 2N-12



GILFILLAN BROS., INC.

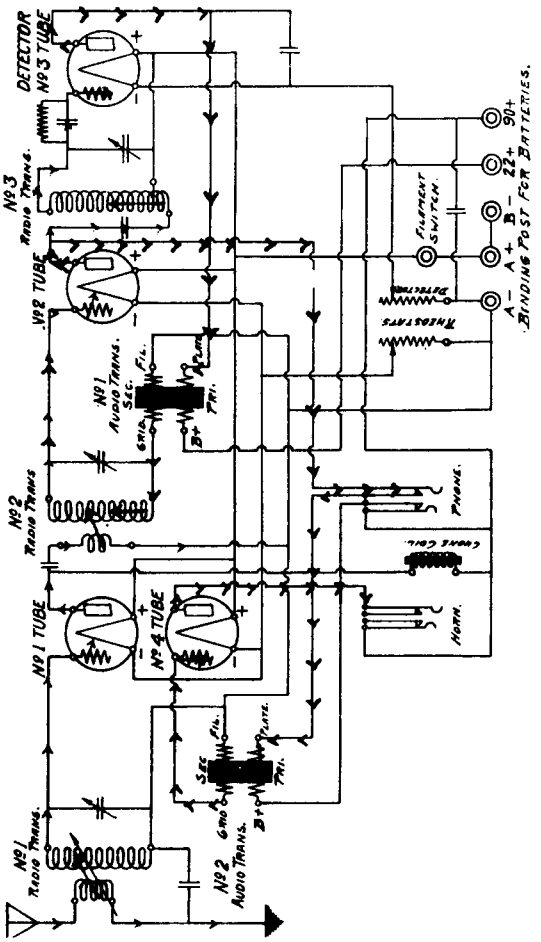


MODELS 105 AND 106

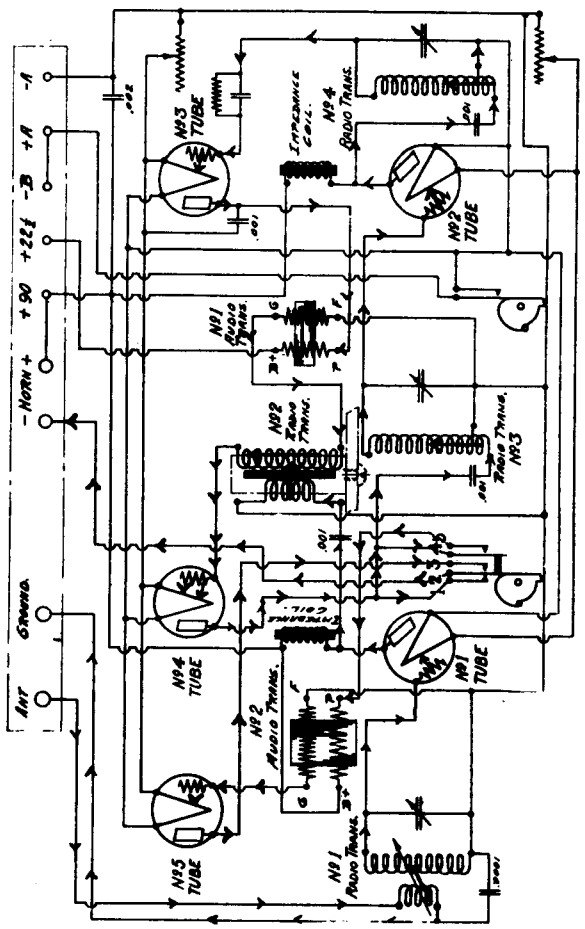


GILFILLAN GN6

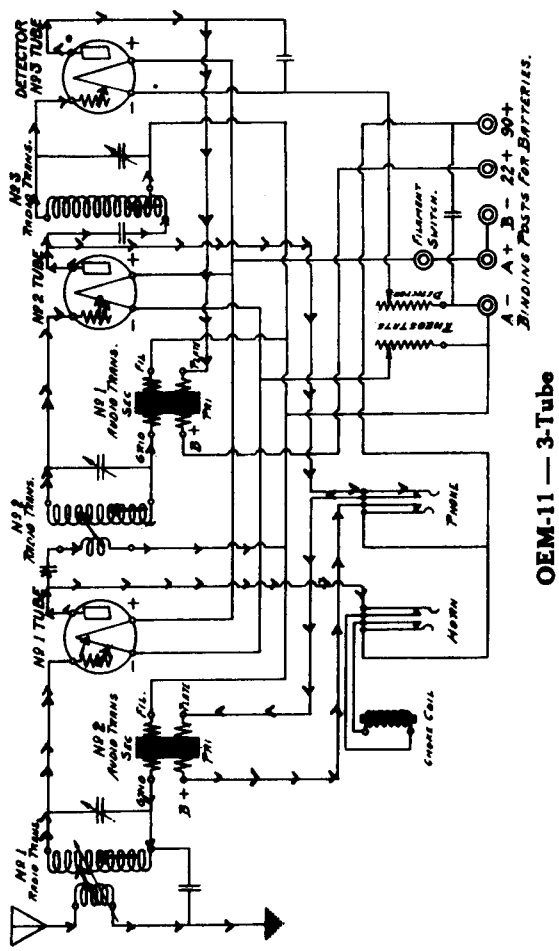
GENERAL MOTORS RADIO CORP.



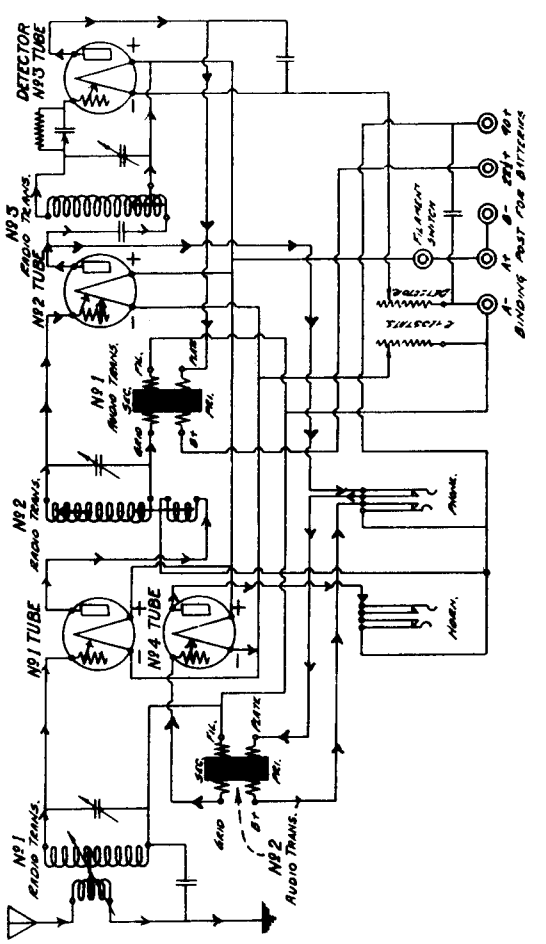
OEM-7 — 4-Tube



DAY-FAN FIVE — 5-Tube — 1925 Model



OEM-11 — 3-Tube



OEM-7 — Super-Selective

Radio Service Data Sheets

DAY-FAN FIVE "5044"

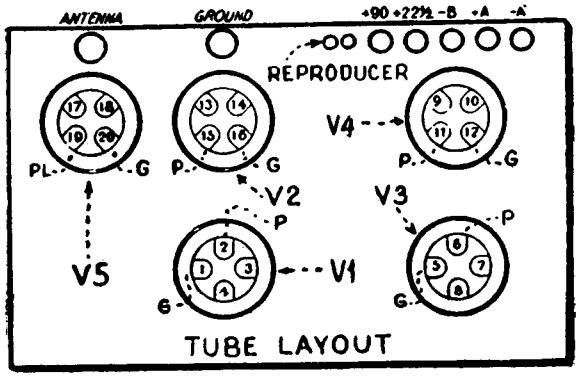
The circuit used in this receiver is reflexed. Thus, V2 functions as an amplifier of both radio- and audio-frequency currents. With SW1 in position on 1, the audio output of V2 is fed to the reproducer; in position 2, V5 is introduced as a third stage of A.F. amplification.

Units R.F. Choke 1 R.F. Choke 2 and R.F.T. 2 are iron-core instruments in radio-frequency circuits.

A Continuity Test of the receiver should check as indicated below. The reference numbers appear on the "Tube Layout."

Terminals	*Correct*	*Cause if Wrong*
Plus 90-2	High resis.	Open or shorted R.F. Choke 1 or open lead
Plus 90-6	High resis.	Open or shorted R.F. Choke 2 or open lead
Plus 22½-11	High resis.	Open or shorted pri. of AFT1 or open lead
Plus 90-15	High resis.	(Sw. 1 on 2.) Open or shorted AFT2 or open lead
Plus 90-19	High resis.	(Reproducer plugged in and SW 1 on 2.) Open or shorted reproducer or lead
Minus "A"-1	Dead short	Open RFT1 sec. or open lead
Minus "A"-5	Dead short	Open RFAT3 or open lead
Plus "A"-C3 stator	Dead short	(SW2 closed.) Open lead
Minus "A"-16	High resis.	Open or shorted RFT2 sec., AFT1 sec. or open lead.
Minus "A"-20	High resis.	Open or shorted AFT2 sec. or open lead
Aerial-ground	Dead short	Open RFT1 pri. or open lead
Minus "A"-2	Open	Shorted .001 mf. coupling cond.
Minus "A"-tap 3 of RFAT3	Dead short	Open pri. part of RFAT3 or open lead
Minus "A"-15	Open	(Sw1 open) Shorted .001-mf. coupling cond.
Plus "A"-tap 3 of RFAT4	Dead short	Open pri. part of RFAT4 or open lead
Plus "A"-6	Open	(Sw2 closed.) Shorted .001-mf. coupling cond.
Minus "A"-11	Open	Shorted .001-mf. by-pass cond.

"Off logging" may be due to the pointers having slipped, or to the rotor and stator plates of the tuning condenser not being in correct register. The former may be corrected by tuning to a particular station, loosening the pointer lock-nut, setting the pointer to approximately the correct point for that station, and tightening the lock-nut. The condenser adjustment may require centering the rotor plates in relation to the stator plates. A lock-nut on the end of the rotor shaft is available for this purpose; it is loosened, the rotor an dstator plates are centered, and then tightened. If one or two of the plates remain out of alignment, they may be centered by careful bending of the plates. If difficulty is experienced in getting distant stations while locals are on, it will be well to check the length of battery leads. Those which are too long will pick up sufficient energy from the locals to cause these signals to "ride in" on top of distant station programs. The solution is to keep battery leads as short as possible.



A peculiarity of this particular receiver is that an antenna length of less than sixty feet will not (contrary to usual practice) result in greater ease of tuning through local stations; a length of more than 100 feet is also inadvisable. The explanation lies in the "selector coil" of this receiver. With an antenna shorter than sixty feet, sufficient energy is not received from the distant station to allow the selector to be turned to a point where the local station is cut out, and at the same time the distant station is brought in. In other words, a strong signal from the distant station as well as from the local allows the user to select either station by proper use of teh selector. Selectivity in this receiver depends to a major extent on the setting of the RFT1 primary coil P in relation to S; reduced coupling increases the selectivity but at the same time the sensitivity, within certain limits. However, the service man may install a small variable condenser of the mica-dielectric type, inside the cabinet, and connect it in series with the antenna lead to the RFT1 primary. By adjustment of this unit and of the inductive coupling, a point of optimum selectivity and sensitivity may be obtained. (This receiver was designed for selectivity conditions not as stringent as those of the present day, and it is not as easy now to obtain interference-free reception in congested districts as formerly.) A suggestion for obtaining additional selectivity is to connect a compact air-dielectric variable condenser from 6 to 11, adjusting it to cause regeneration. It may be mounted at a convenient point on the panel. If regeneration on the longer waves is insufficient, it may be necessary to reduce to .001-mf. the capacity of the by-pass condenser, connected from the plate of V4 to "A —." Still stronger regeneration may be obtained by connecting a radio-frequency choke coil between the plate and AFT1 primary lead of V4. A safety measure recommended for these receivers when operating from "B" batteries is the insertion of a fixed condenser of .01-mf. capacity in series with the variable regeneration condenser mentioned above. A caution regarding this installation is to keep leads as short as possible, and to shield these new leads. The voltage tests of this particular model receiver were obtained with a Weston Student Galvanometer Model 375. With a 4½-volt battery supply, a 7,000-ohm series resistor is used. (An approximation of this value is secured by the use of the secondary of a "replacement" A.F. transformer.) "Sw 1" is the "Speaker Switch."

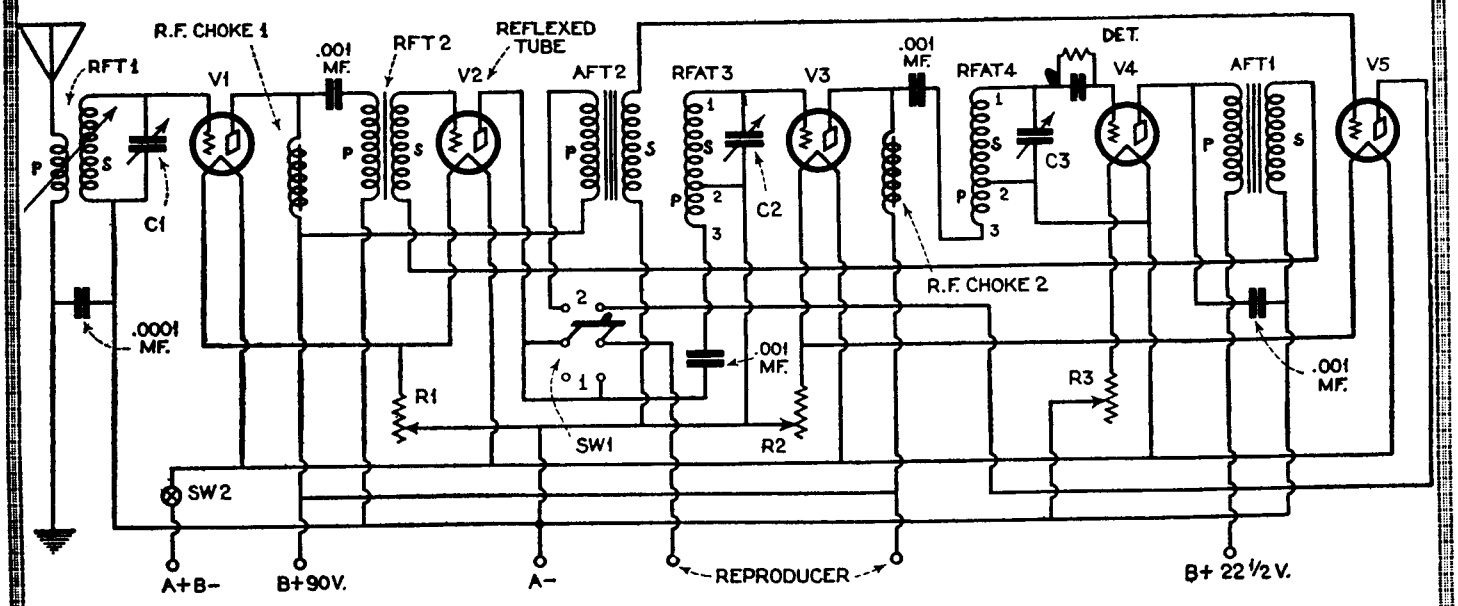
The Reflex Circuit

An explanation of the paths which the varying R.F. and A.F. currents follow may be an aid to deterfining the faults which may be encountered in receivers of this type.

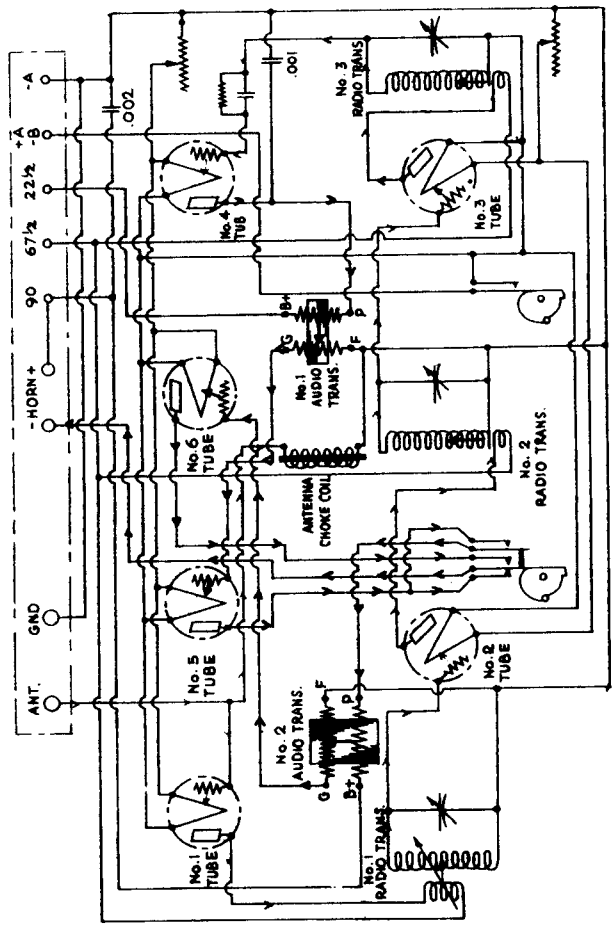
The R.F. input is amplified by V1; R.F. Choke 1 forces the R.F. signal to pass through RFT2 to V2; here another plate-circuit impedance (AFT2 pri. or the reproducer) keeps back the R.F., which continues to V3, via RFAT3, and then to V4, being again blocked by R.F. choke 2. The A.F. output of V4 is "reflexed" through AFT1 back to V2; and the A.F. output of V2 either actuates the reproducer or is passed on through AFT to V5 (the option being determined by SW1). Consequently, V1 is the first R.F. tube; V2 is second R.F. and first A.F.; V3 is third R.F.; V4 is the detector; and V5 is the second A.F.

Other reflex receivers made by Day-Fan are the "OEM-11" 3-tube; "OEM-7" 4-tube; "OEM-7" 4-tube "Super-Selective;" and "OEM-12" 4-tube. A word picture distinguishing one from the other follows. The OEM-21 receiver has two stages of tuned R.F. and two of A.F. amplification.

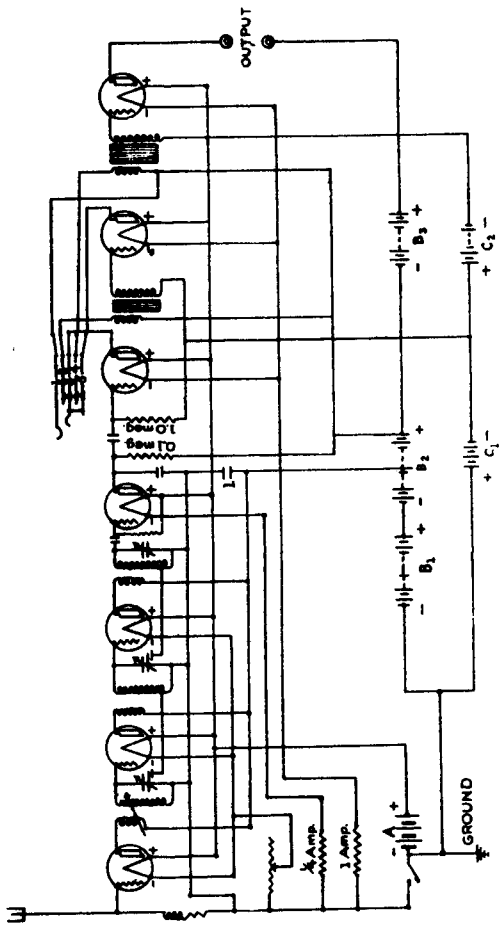
The "OEM-7" receiver has one T.R.F. stage followed by another T.R.F. stage reflexed for first A.F. The second A. F. is a separate tube. The "Super-Selective" varies from this model only in the looser coupling, through the R.F. transformer; as does the "OEM-12" from the "OEM-11."



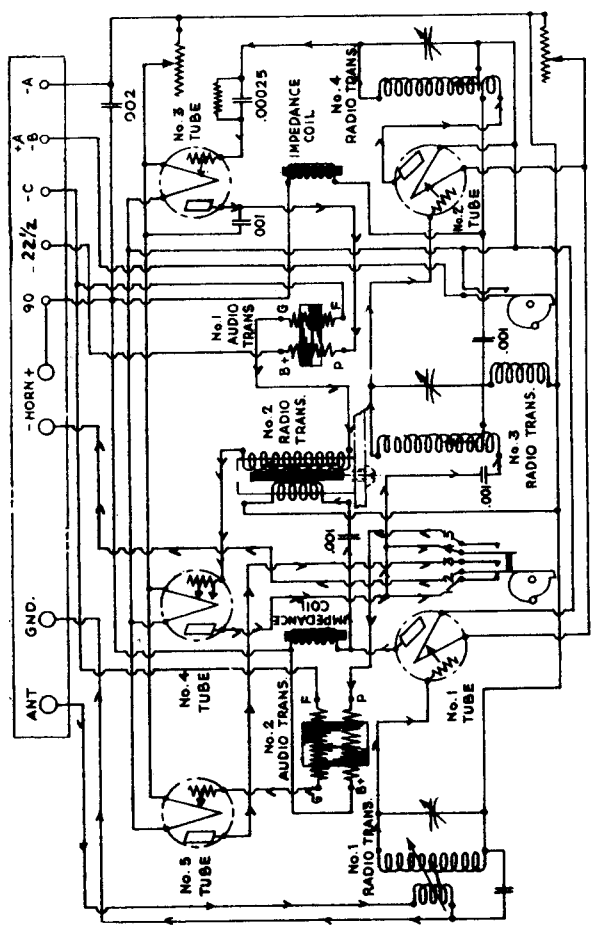
GENERAL MOTORS RADIO CORP.



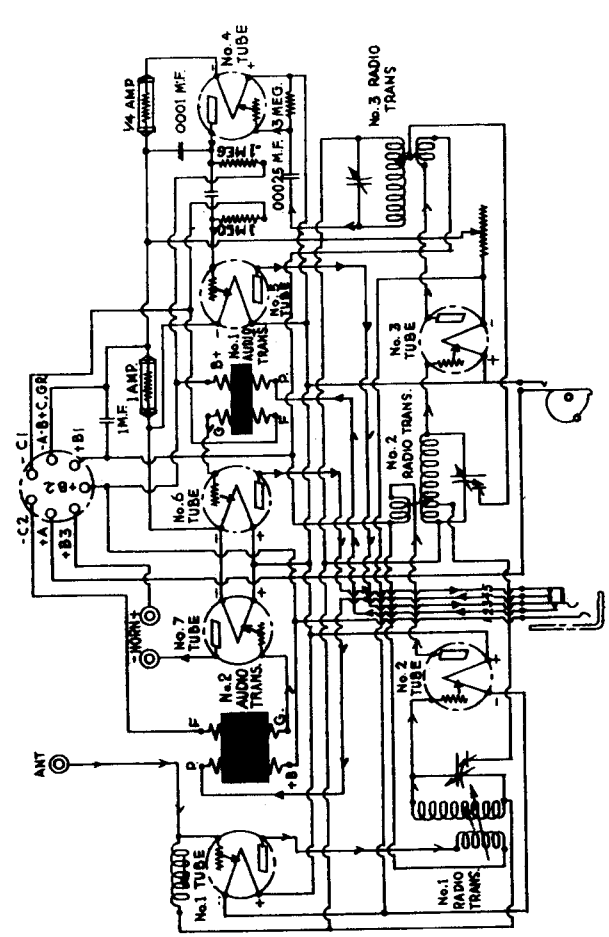
Day-Fan Six—6-Tube



DAY-FAN 7—7 TUBE

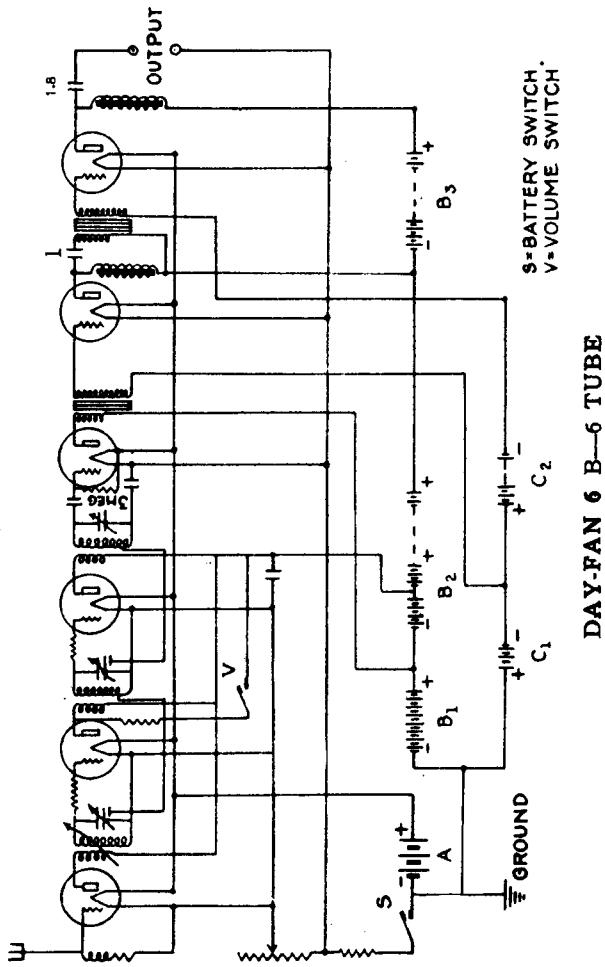


Day-Fan Five Twenty-Seven—5-Tube

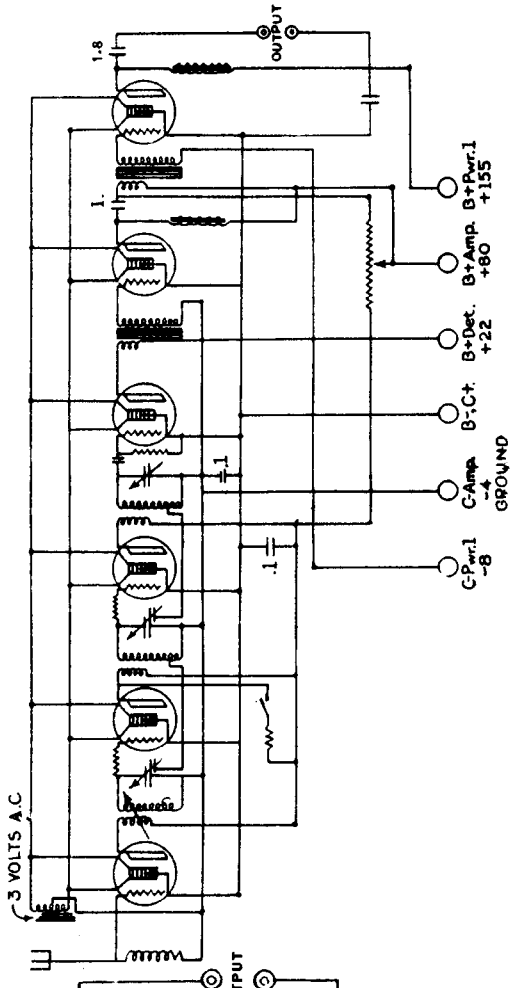


Day-Fan Seven—7-Tube

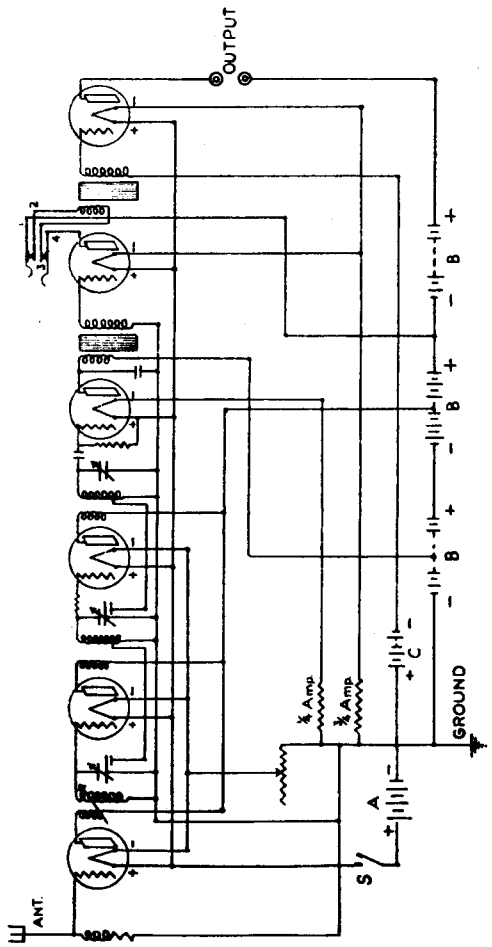
GENERAL MOTORS RADIO CORP.



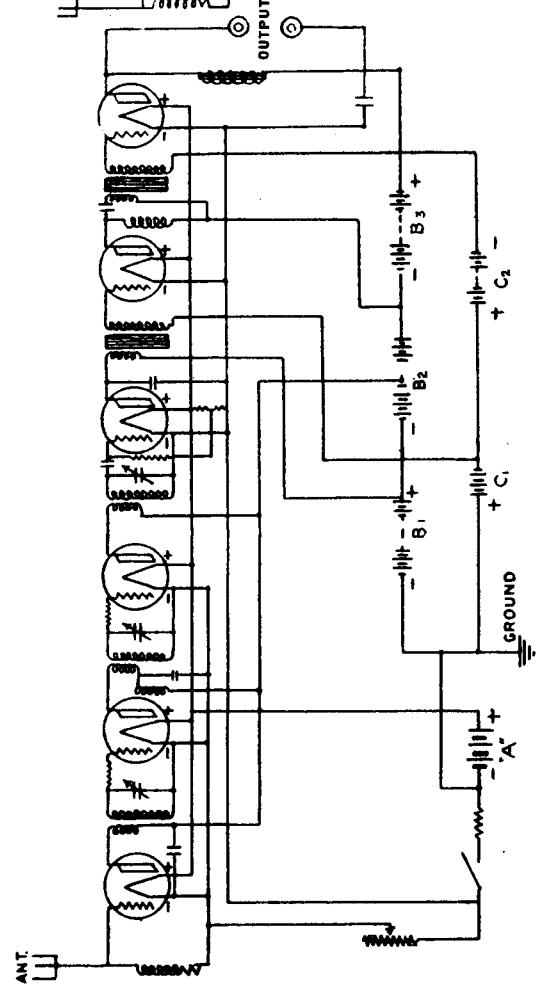
DAY-FAN 6 B—6 TUBE



DAY-FAN 6 A. C.—6 TUBE

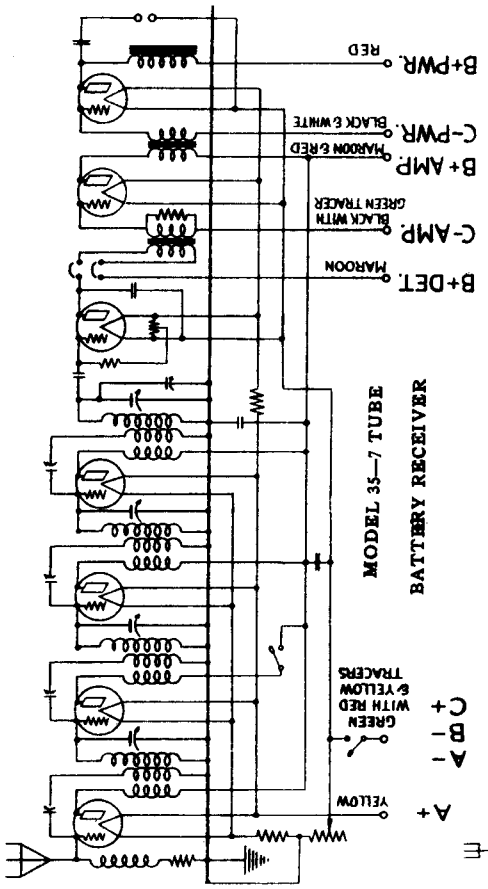


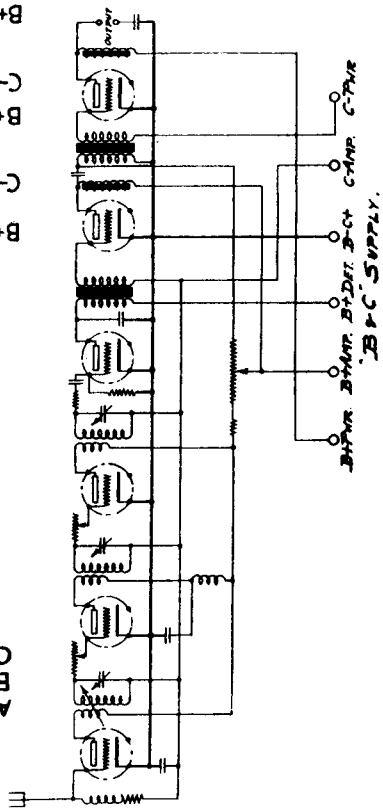
DAY-FAN 6—61—6 TUBE

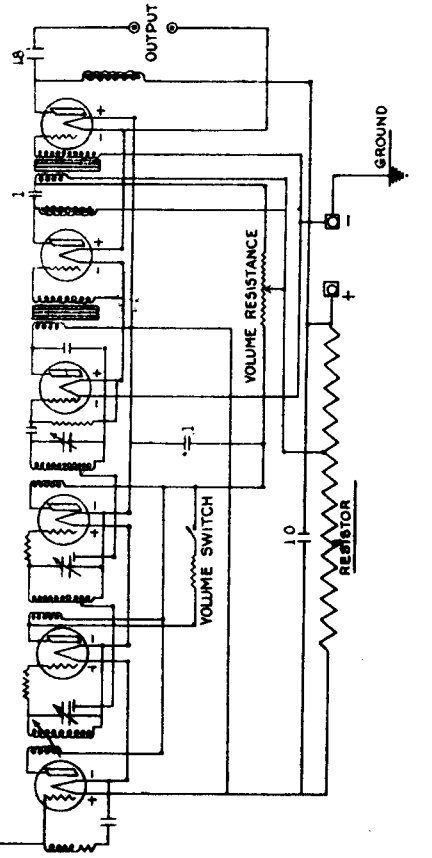


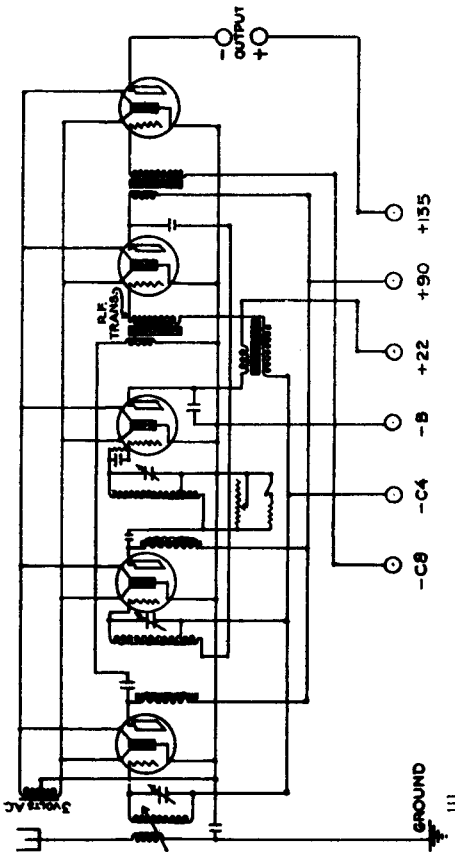
DAY-FAN 6 JUNIOR—6 TUBE

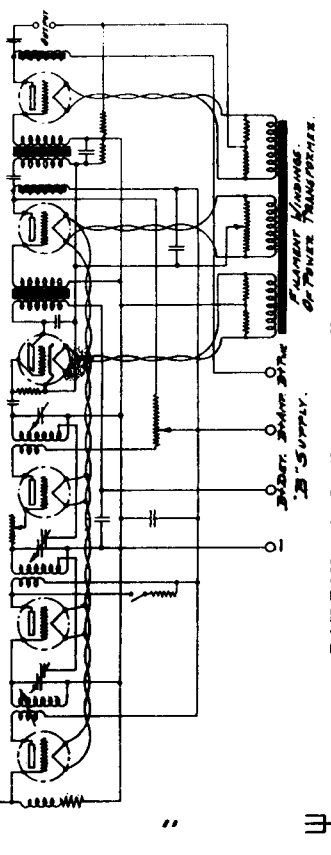
GENERAL MOTORS RADIO CORP.

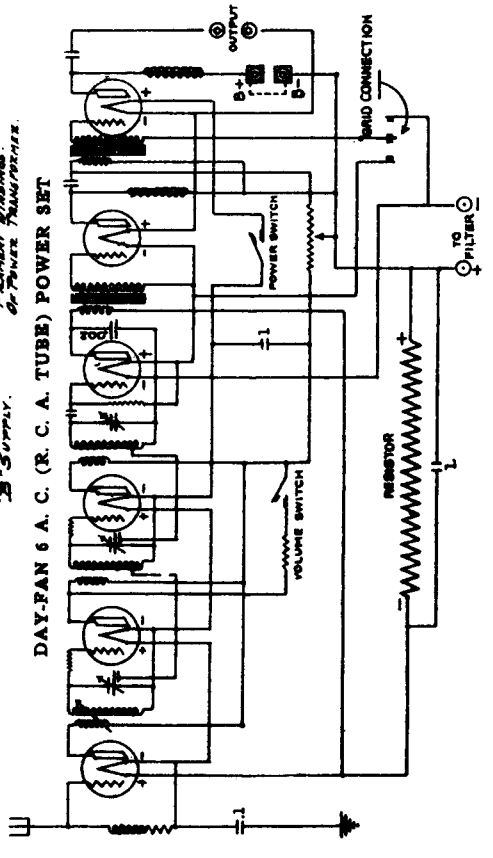




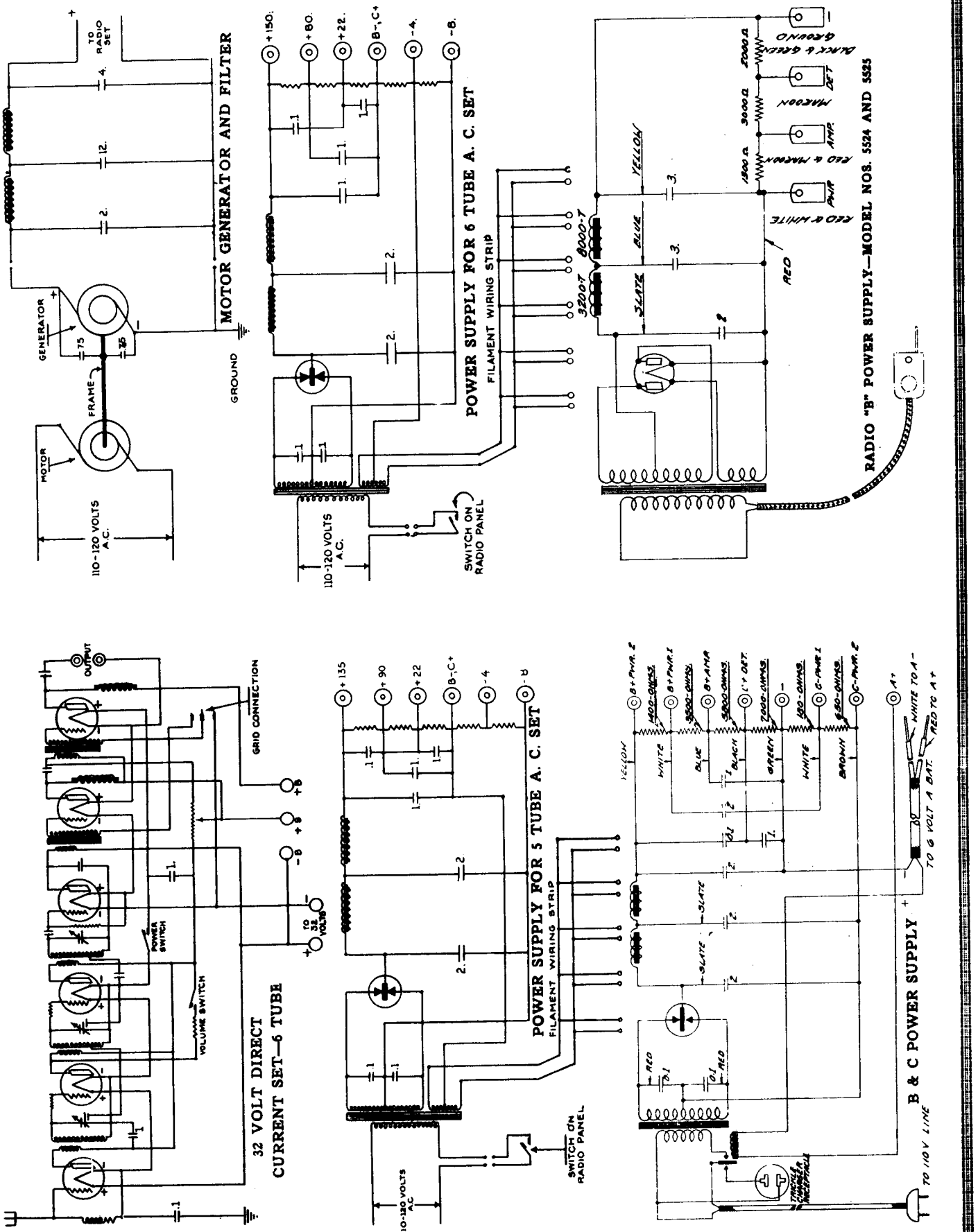


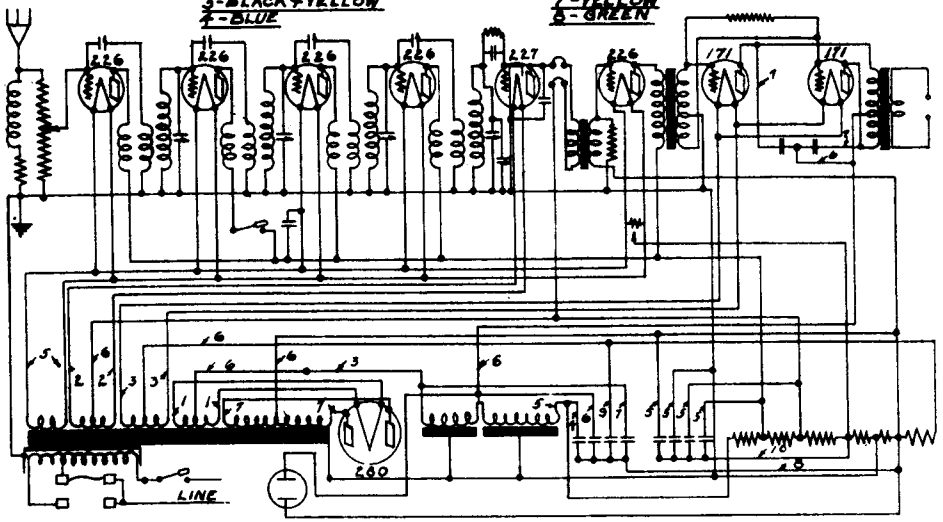




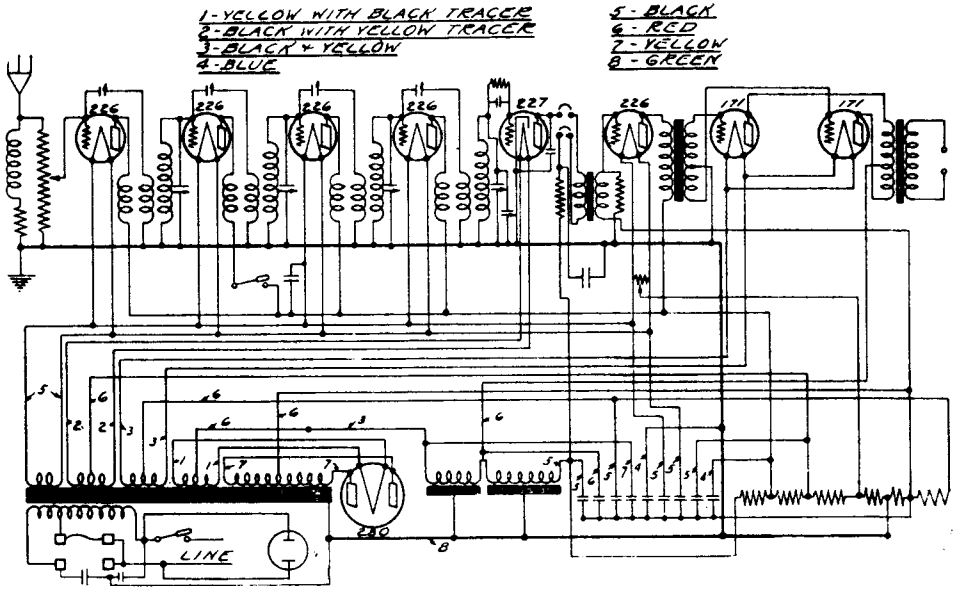


GENERAL MOTORS RADIO CORP.



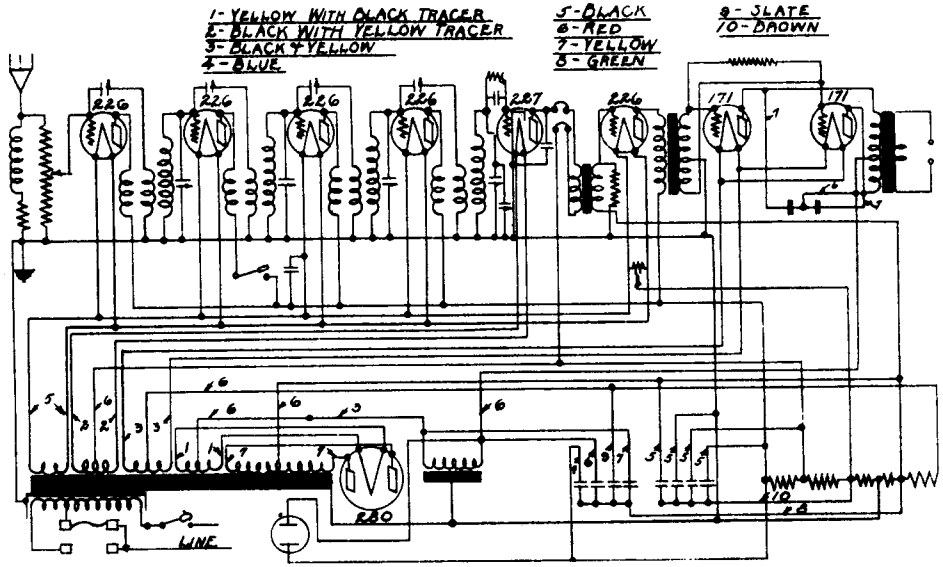


DAY-FAN 8-TUBE—MODEL 5077
(For Use with 200-Volt D. C. Dynamic Speaker)

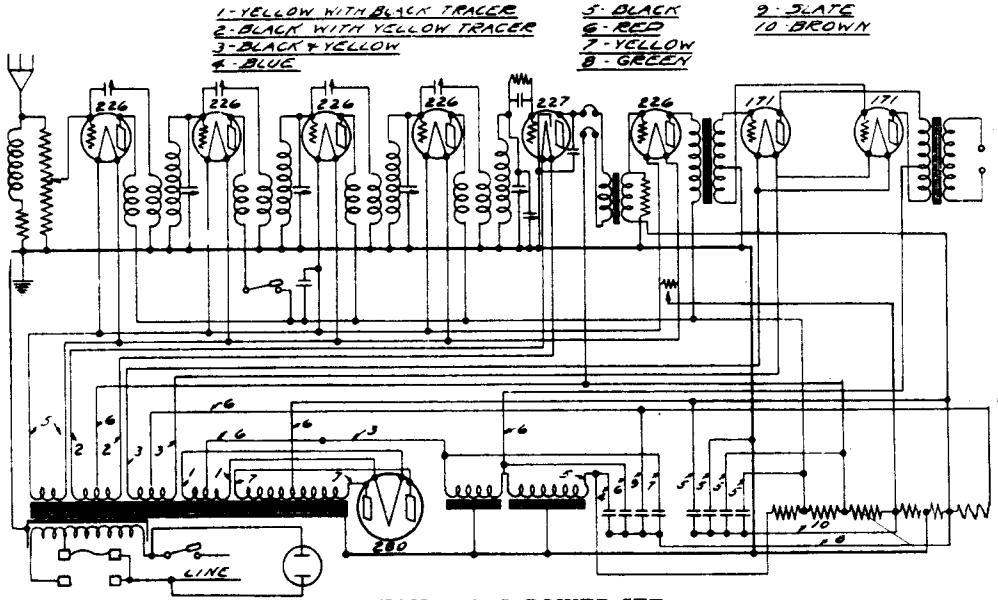


DAY-FAN 8—A. C. POWER SET

Note—Use this circuit diagram for receivers equipped with sealed power blocks, or condenser blocks not having brown nor slate colored leads.



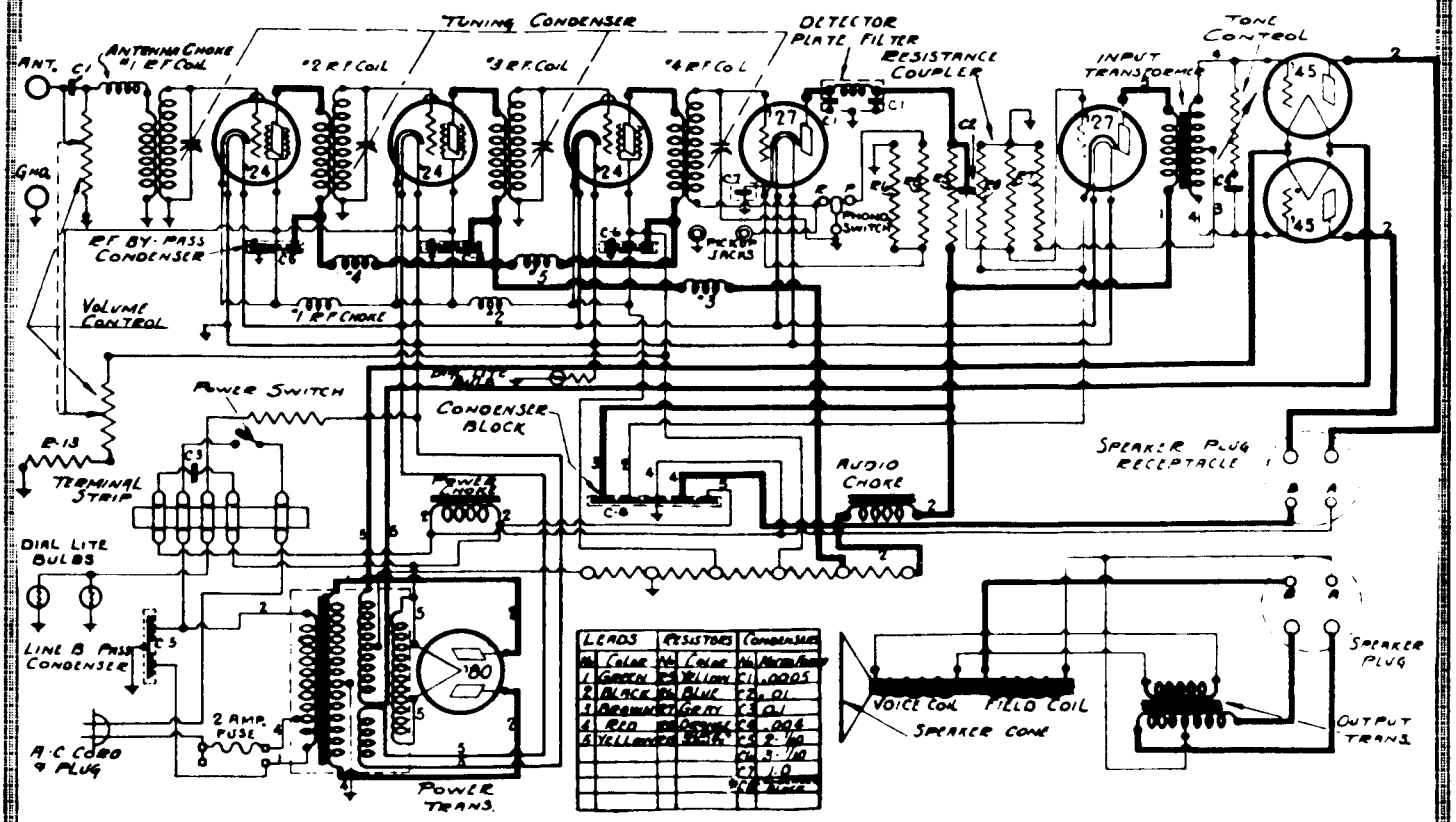
DAY-FAN 8-TUBE—MODEL 5080
(For Use with 110-Volt D. C. Dynamic Speaker)



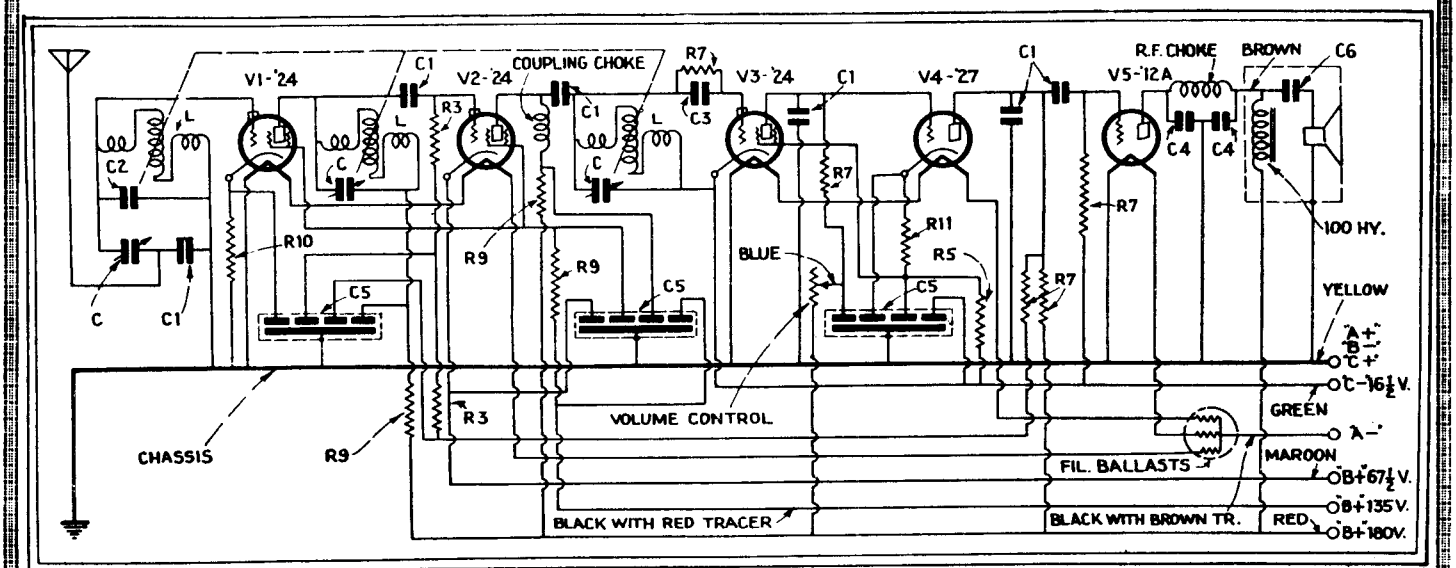
DAY-FAN 8—A. C. POWER SET

Note—Use this circuit diagram for receiver equipped with power blocks having removable covers, or condenser blocks having one brown and one slate colored lead in addition to those used for circuit shown on page 4 Sec. 6.

GENERAL MOTORS RADIO CORP.



MODEL "A" CHASSIS



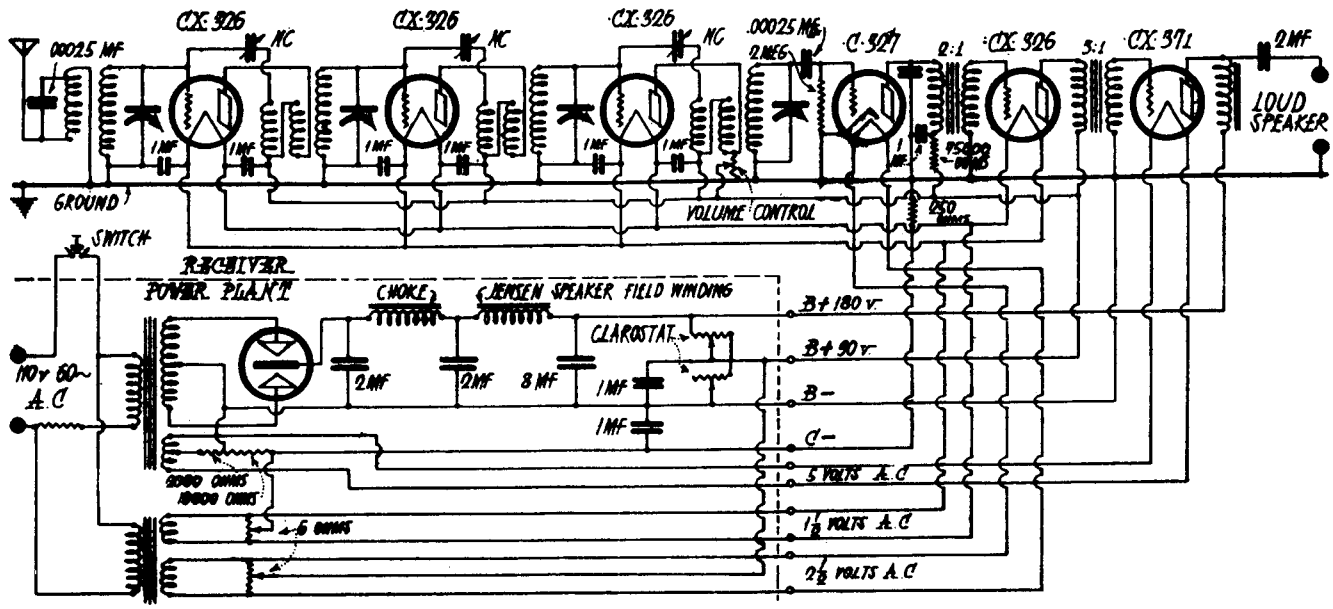
DELCO AUTOMOTIVE RADIO

(above)
The circuit of the Delco automotive receiver. The variometer tuning arrangement and other novelties are obvious.

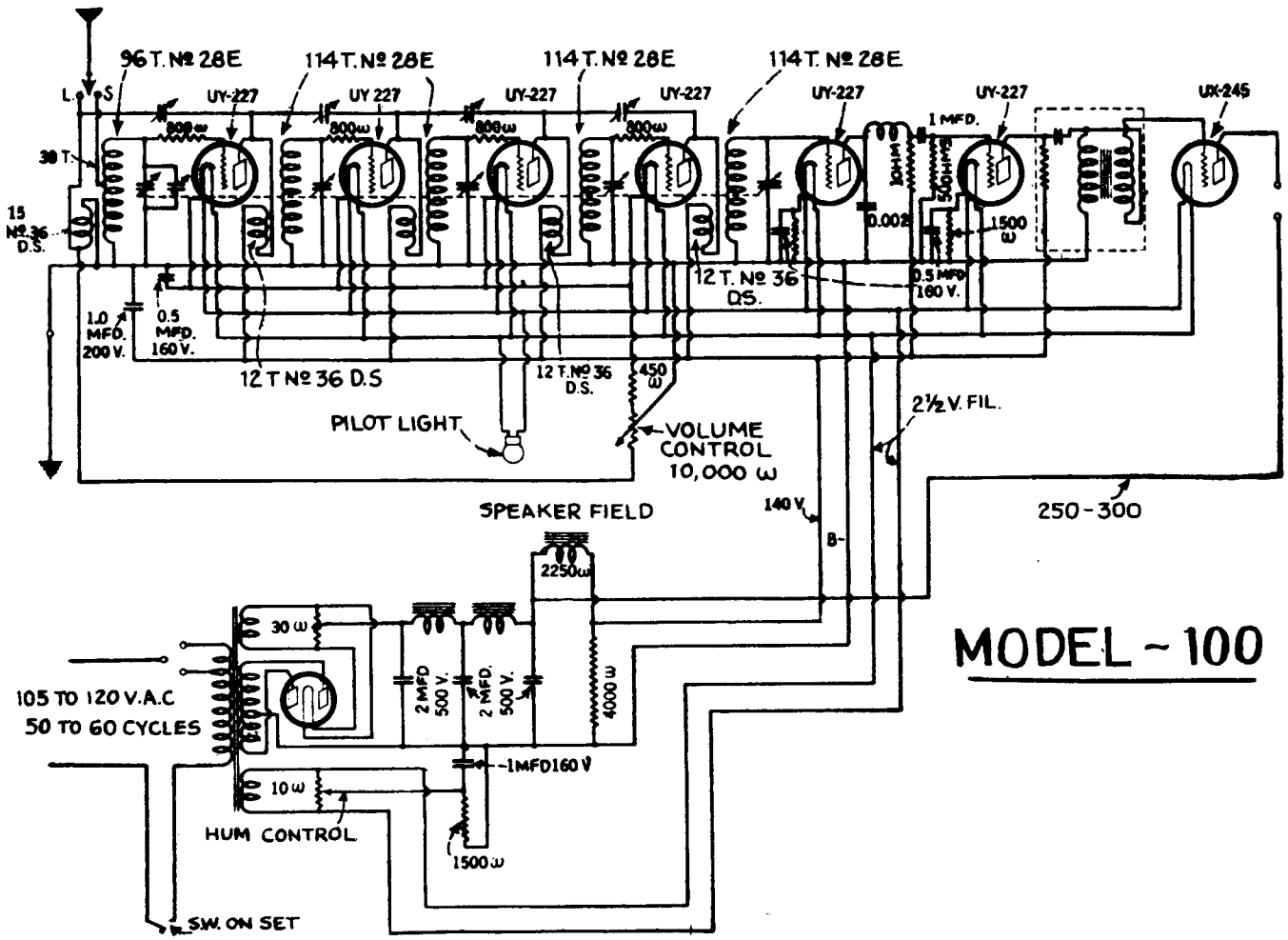
(right)
Appearance of the Delco chassis, with cables connected. The switch and volume control are seen in the foreground, separately



GILFILLAN BROS, Inc.



—Circuit of the Gilfillan A. C. Model 60 Receiver.

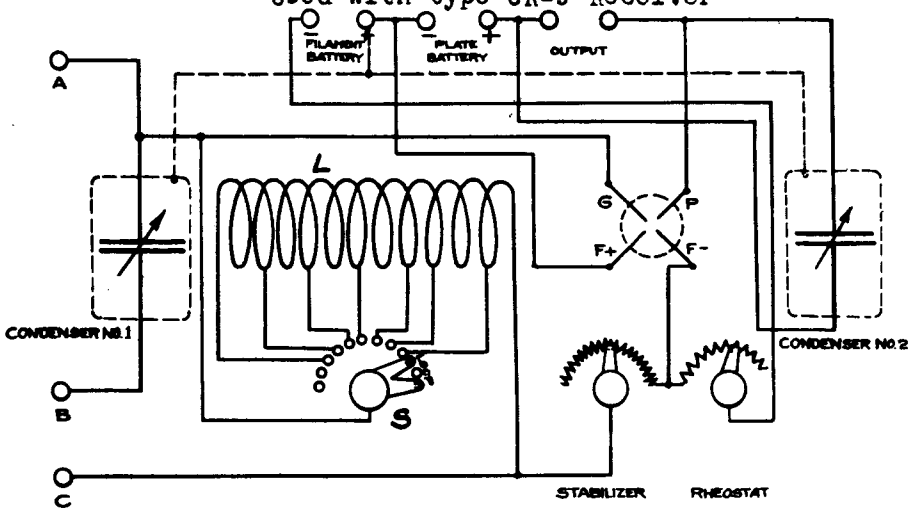


MODEL-100

GREBE TUNED RADIO AMPLIFIER, TYPE RORN.

A. H. GREBE & CO., INC. RICHMOND HILL, N.Y.

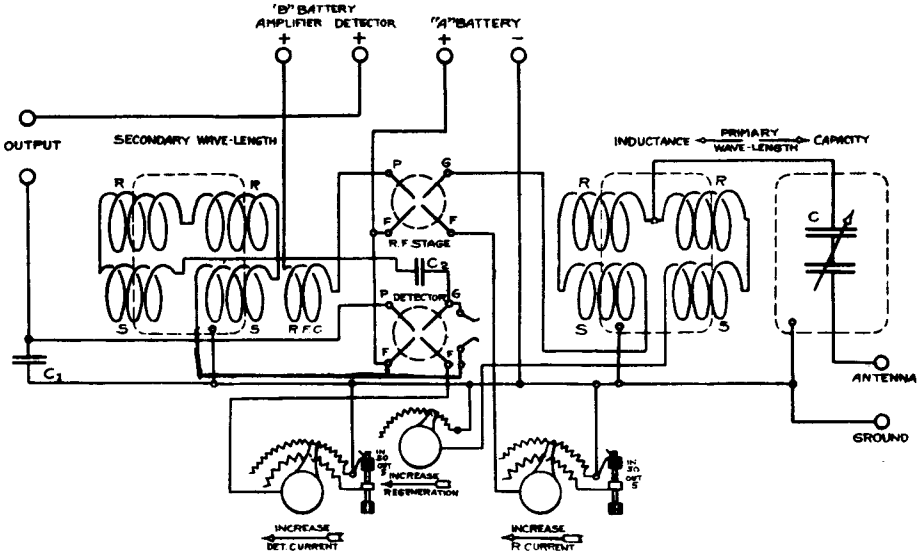
Used with type CR-9 Receiver



GREBE "13" REGENERATIVE RECEIVER, 80 TO 300M.

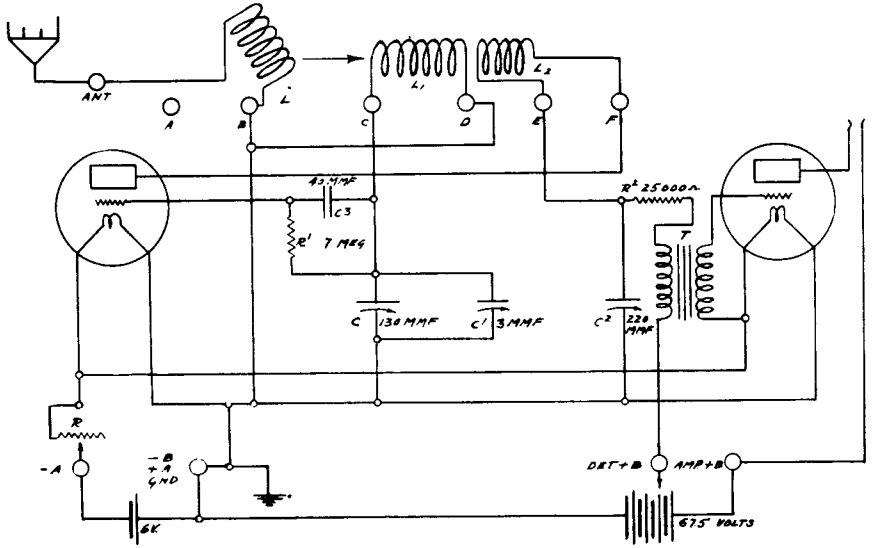
TYPE CR-13

A. H. GREBE & CO., INC. RICHMOND HILL, N.Y.



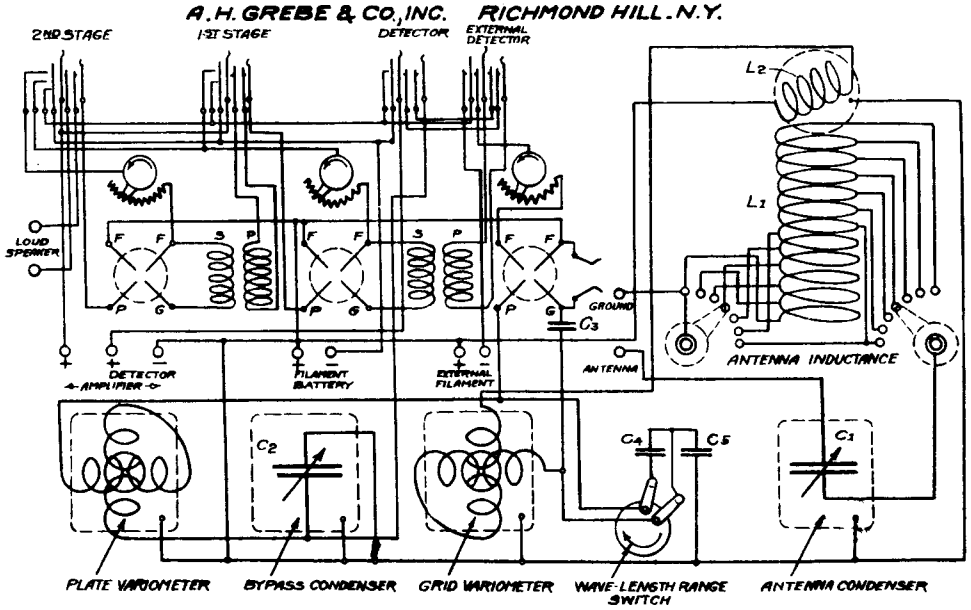
GREBE SHORT WAVE RECEIVER TYPE CR-18

A. H. GREBE & CO., INC. RICHMOND HILL, N.Y.



GREBE SHORT-WAVE REGENERATIVE RECEIVER, TYPE CR-6.

A. H. GREBE & CO., INC. RICHMOND HILL, N.Y.

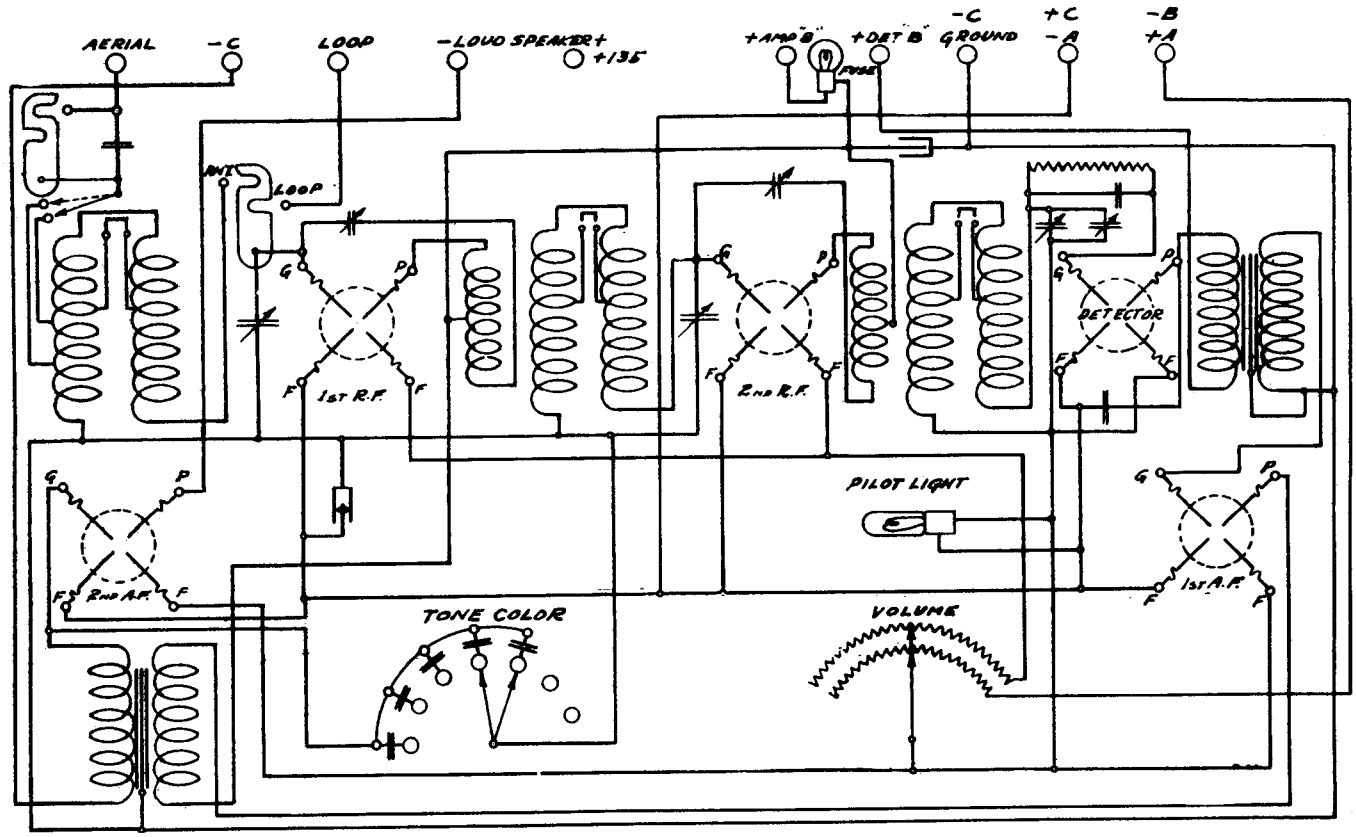


A. H. GREBE & Co.

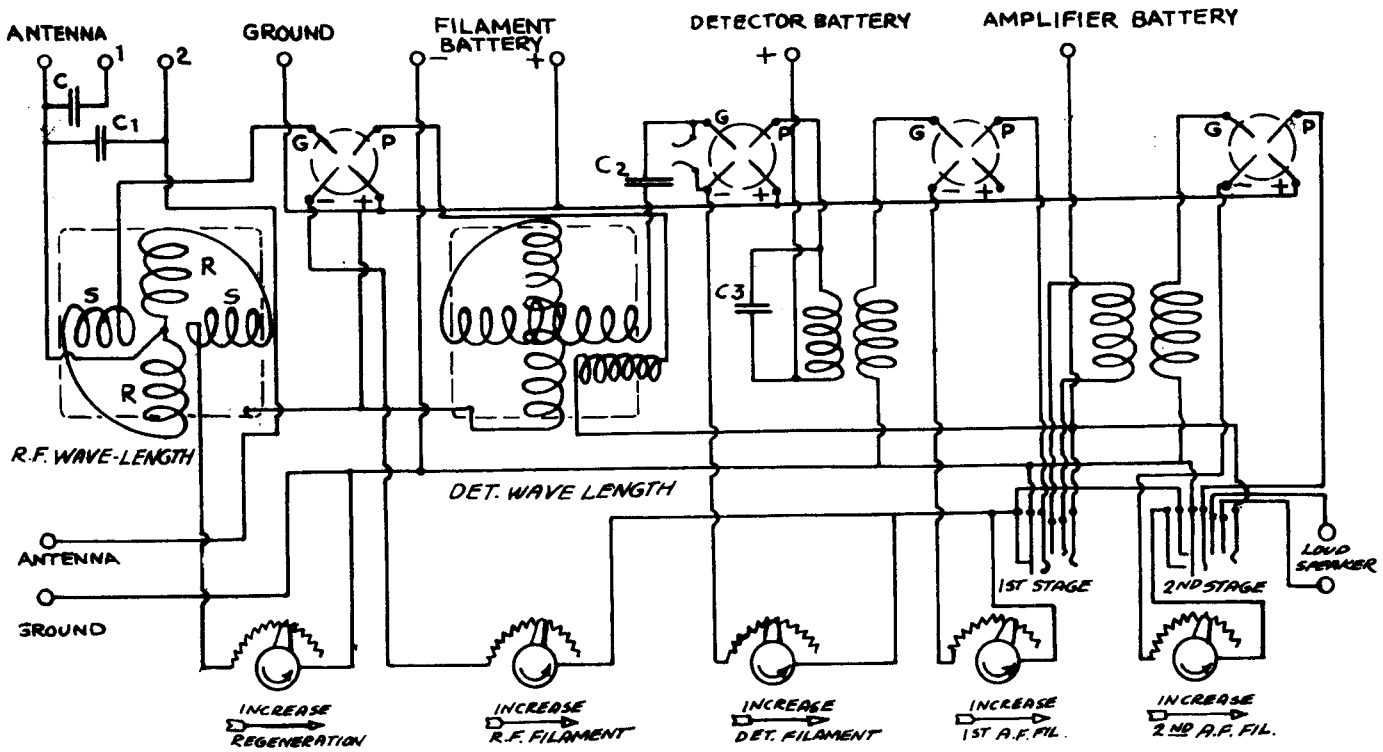
A.H. GREBE & Co.

GREBE SYNCHROPHASE RECEIVER TYPE MU-1

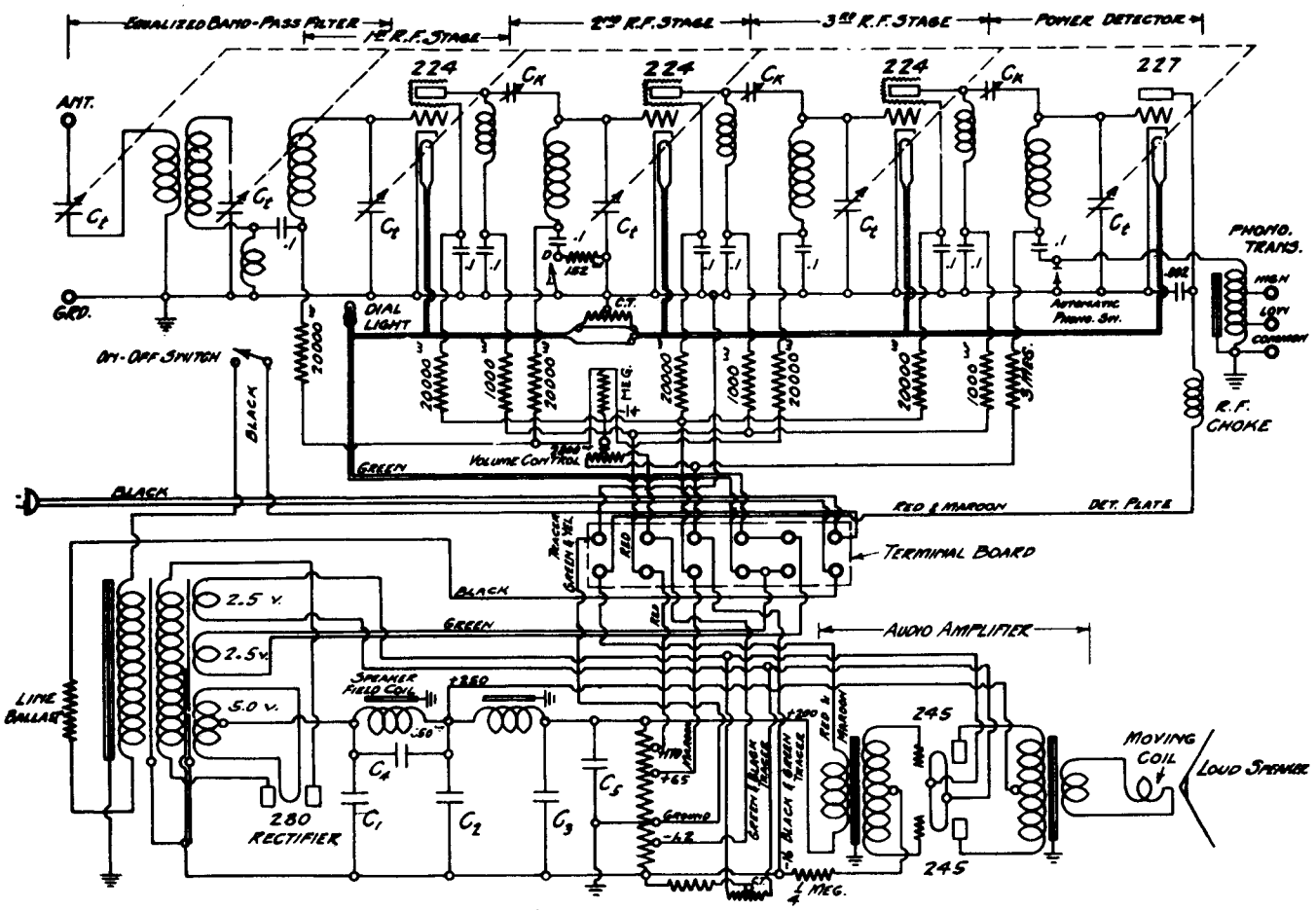
A.H. GREBE & CO., INC. RICHMOND HILL, N.Y.



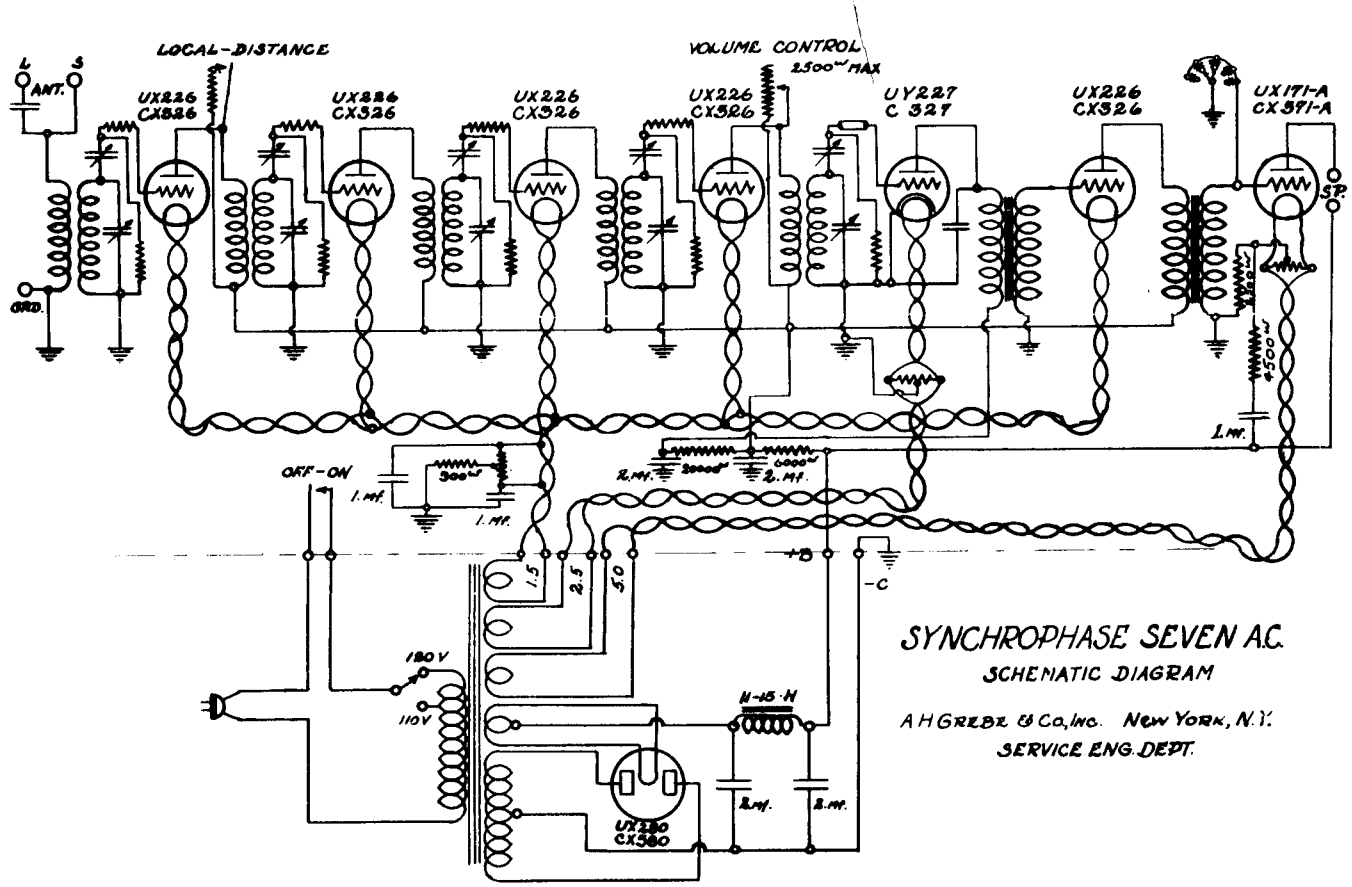
GREBE BROADCAST RECEIVER ~ 1923.



A.H. GREBE & Co.



Wiring Diagram
Super Synchrophase Type SK-4



SYNCHROPHASE SEVEN A.C.
SCHEMATIC DIAGRAM
A.H. GREBE & Co. Inc. New York, N.Y.
SERVICE ENG. DEPT.

Radio Service Data Sheet

GREBE SUPER-SYNCHROPHASE A.C. RECEIVER MODEL SK-4

This A.C. screen-grid receiver, a product of A. H. Grebe and Co., Richmond Hill, N. Y., incorporates a band-selector input to the first R.F.; the resistor bypass-condenser type of filter in control-grid, screen-grid and plate leads; a power detector; push-pull '45's; and an auto-transformer (Phono. T., in the diagram, with common tap C, low-impedance pickup tap L, and high-impedance pickup tap H) for phonograph pickup connection.

It is important that the correct line ballast be used at R21, in accordance with the following line-voltage ranges and ballast model numbers: 95-110 V., No. 6310; 105-125 V., No. 6412; 115-138 V., No. 6420; 213-252 V., No. 5932 (used in special 230-volt, 60-cycle sets); 107-129 V., No. 2404 (in 25-cycle sets.)

To remove chassis: Take off the knobs of the volume control R13 and local-distance switch SW1; remove the five screws holding the panel escutcheon; loosen lock-nut holding SW3 to escutcheon, and then remove knurled ring on front of this plate; loosen hook-bolts holding R.F. chassis to console; disconnect cable at terminal plate, and lift out chassis.

Following are the constants of the units comprising this set: R1, R2, R6, R8, R10, 20,000 ohms; R3, R7, R11, 1,000 ohms; R4, R14, 7 ohms; R5, 152 ohms; R9, R22, ¼-meg.; R12, 1/10-meg.; R13, 2,800 ohms; R15, 677 ohms; R16, 2,200 ohms; R17, 62 ohms; R18, 7,000 ohms; R19, 10,000 ohms; R20, 1,500 ohms; dynamic reproducer field coil, 650 ohms.

The condensers in this receiver have the following capacities: C1, C2, C3, C4, C5, C7, 350 mmf.; C6, C11, C12, C13, C14, C15, C16, C17, C18, C19, C25, 0.1-mf.; C8, C9, C10, 7 mmf.; C20, .002-mf., C21, 1.0 mf., C22, 1.5 mf.; C23, 1.5 mf., C24, 2 mf.

Coupling coil L6 has 6 turns of bare No. 26 wire wound on a tube about 1⅛ in. in diameter, the turns being spaced about ⅛-in.

Hum is occasionally traced to reversed field coil connections to the reproducer. Other sources of audio distortion are included in this listing: loose fiber wedges between the transformer windings and core; power transformer cover not tight; tube shields loose; loose chassis hooks or bolts; console doors not fitting well; poor contact at caps of control-grids; defective cone paper.

Circuit oscillation may be a matter of tubes. Then again, the ground may not be sufficiently good; or even an accumulation of dirt under the contact brakes on the condenser rotor shaft may cause circuit oscillation (usually between 550 and 700 kc.). Merely clean the contact surfaces—do not use oil.

Compensating condensers of about 30 mmf. capacity shunt each of the tuning condensers although they are not shown in the diagram. The leads from these units to the coils must be correctly placed with regard to the chassis and each other, in order to prevent circuit oscillation.

Circuit oscillation not remedied by any of these corrective measures may respond to adjustment of the three adjustable "gain screws" protruding through the base of the R.F. chassis; these screws control C8, C9 and C10. This adjustment will not be necessary except in rare instances. At the factory the correct setting is obtained by turning down the screws tightly and then backing them all out, ¾-turn each. If this position does not stop oscillation, the screws may be turned out an additional 1/16 or ⅛ of a turn. (More than ⅛-turn will change the resonance of the tuned circuits and necessitate re-calibration of the kilocycle scale. The over-all sensitivity of the receiver is also reduced by turning out the gain screws—which are most effective for correcting circuit oscillation in the frequency range from 1200 to 1500 kc.)

Checking the alignment of the gang condenser is accomplished by watching for maximum reading on an 0-5 or 0-10 ma. milliammeter (or, an 0-15, or less, voltmeter connected as a milliammeter) in the plate circuit of detector V4, when an audio-modulated R.F. oscillator calibrated at 1400, 800, and 550 kc. (used in this order) is the circuit driver. The circuits of L1, L2, L3, L4, may be checked by inserting a small shorted coil (on the end of an insulating bar) into these inductances; correct adjustment being shown by a reduced reading on milliammeter (increased reading denotes circuit out of resonance; and reducing the inductance of the coil, through use of the shorted ring, has brought the circuit into resonance with the oscillator). Since L5 is covered by a shield can, which, if removed, would throw the circuit out of balance the shorted-coil test cannot be applied here; hence it is necessary to use the equivalent plan of carefully bending outward, slightly, the end plate of condenser C5, and noting the meter reading (which should remain fixed or decrease).

This procedure completes the check on the high-frequency side of resonance; now we will check the low side. Using an insulated rod, gently press inward the end plates of C1, C2, C3, C4 and C5. This increase of capacity should result in the meter's indicating no change, or else a little reduction in the scale reading; an increase indicates lack of resonance on the low side of the oscillator frequency. The antenna condenser C7, is not in a sharp-tuning circuit and will not require balancing; incidentally, this condenser, mounted on the extreme right of the condenser gang, is insulated from the remaining condensers.

Before correcting an off-resonance condition, make sure that the three "gain" control studs are set as previously mentioned; then, if necessary, adjust (at 1400 kc. only) the aligning condensers on the rear of the gang-condenser frame in this order: C1, C2, C3, C4, C5.

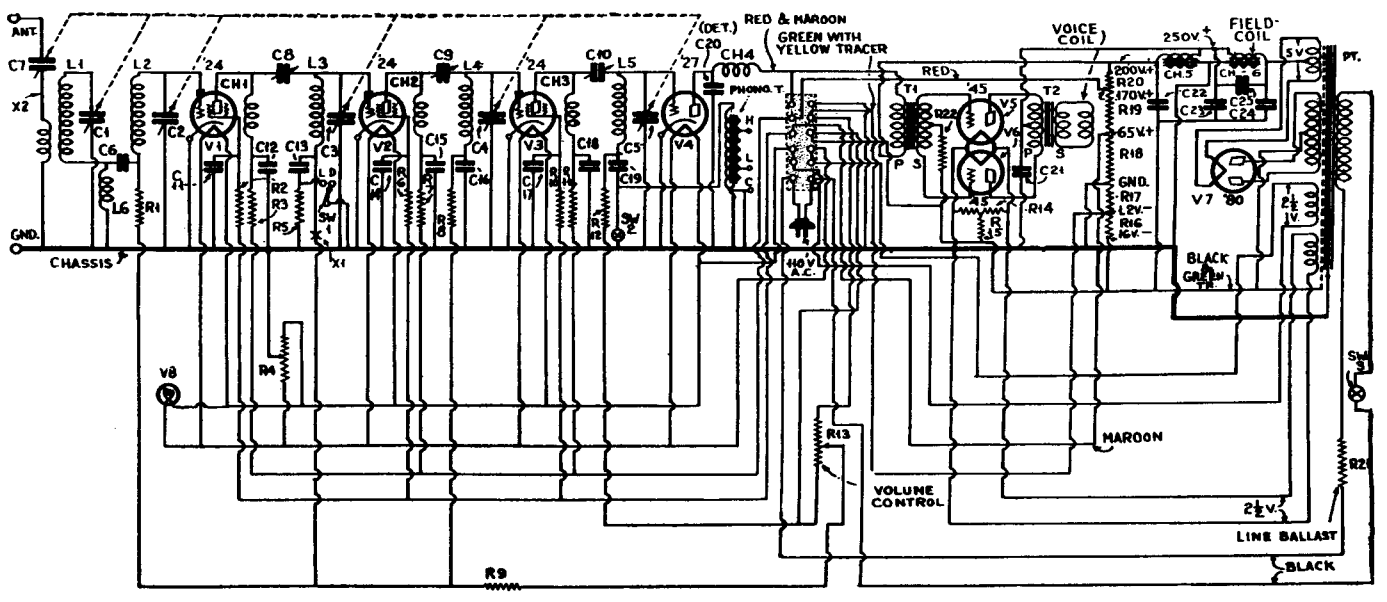
If an alignment test at 800 kc. indicates the necessity for aligning one or more of the circuits, this may be done by *carefully* bending the rotor end plate at the point where it meshes with the stator, (the aligning condensers being used only at 1400 kc.). Repeat this cycle of operations at 550 kc.

Modulation hum in earlier sets (a strong 60- or 120-cycle hum heard only when set is tuned to one of several local, powerful stations) may be corrected by inserting a ¼-meg. resistor in the lead to the arm of the volume control, and shorting the control-grid filter resistor of V2. As this change has been made in later production of the Super-Synchrophase, the circuit shown below incorporates these modifications; R9 is the ¼-meg. resistor, and X1 denotes the former position of the filter resistor.

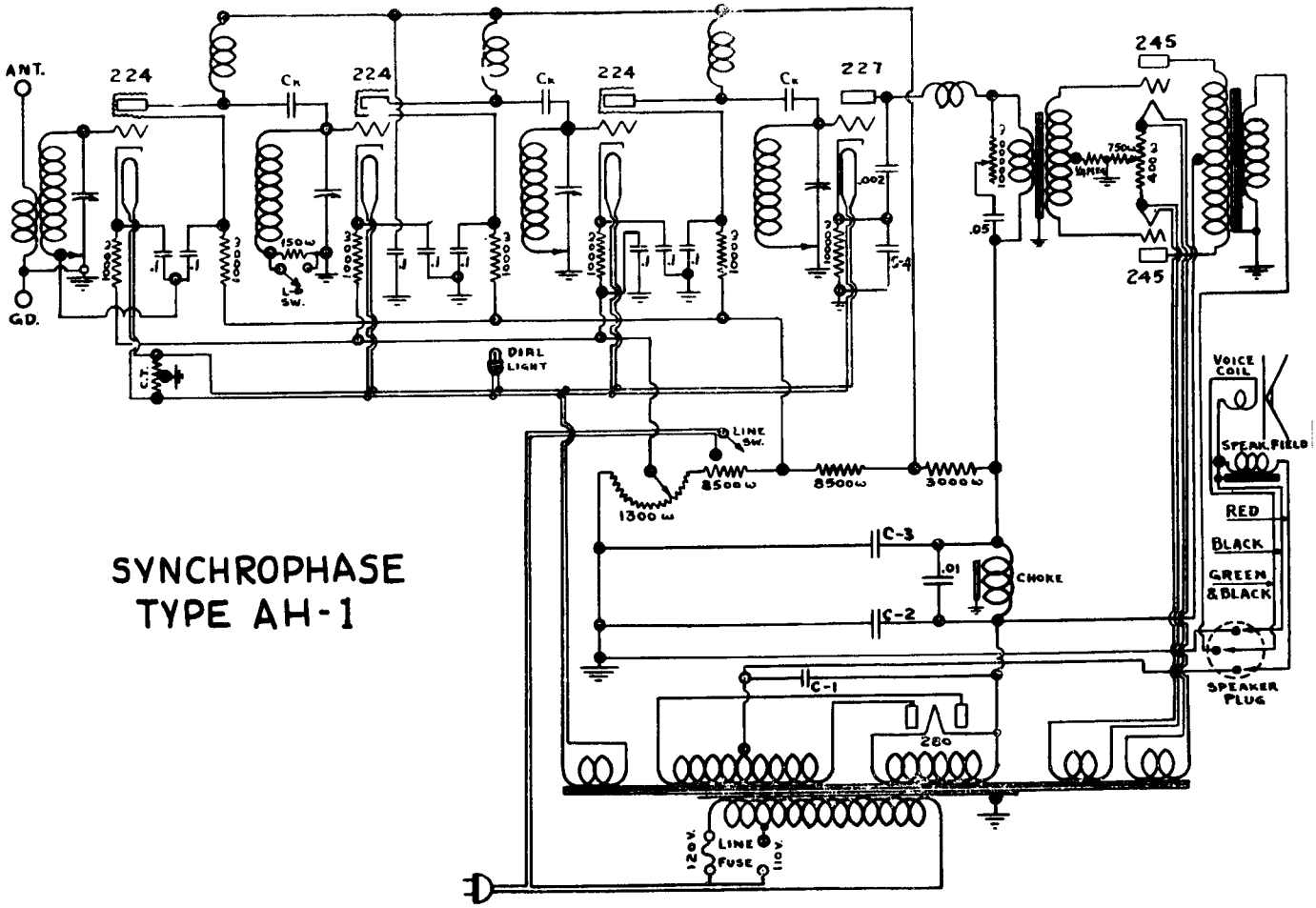
If strong local stations which are separated 30 kc. interfere with each other, the trouble is probably due to pickup via the light lines.

Weak signal, or no signal, may be due to the screen-grid tubes; and it may be handy for the Service Man to know that a convenient test may be applied. The screen-grid caps are removed and the control-grid is touched with a moistened finger; when a hum will result if the tube is good.

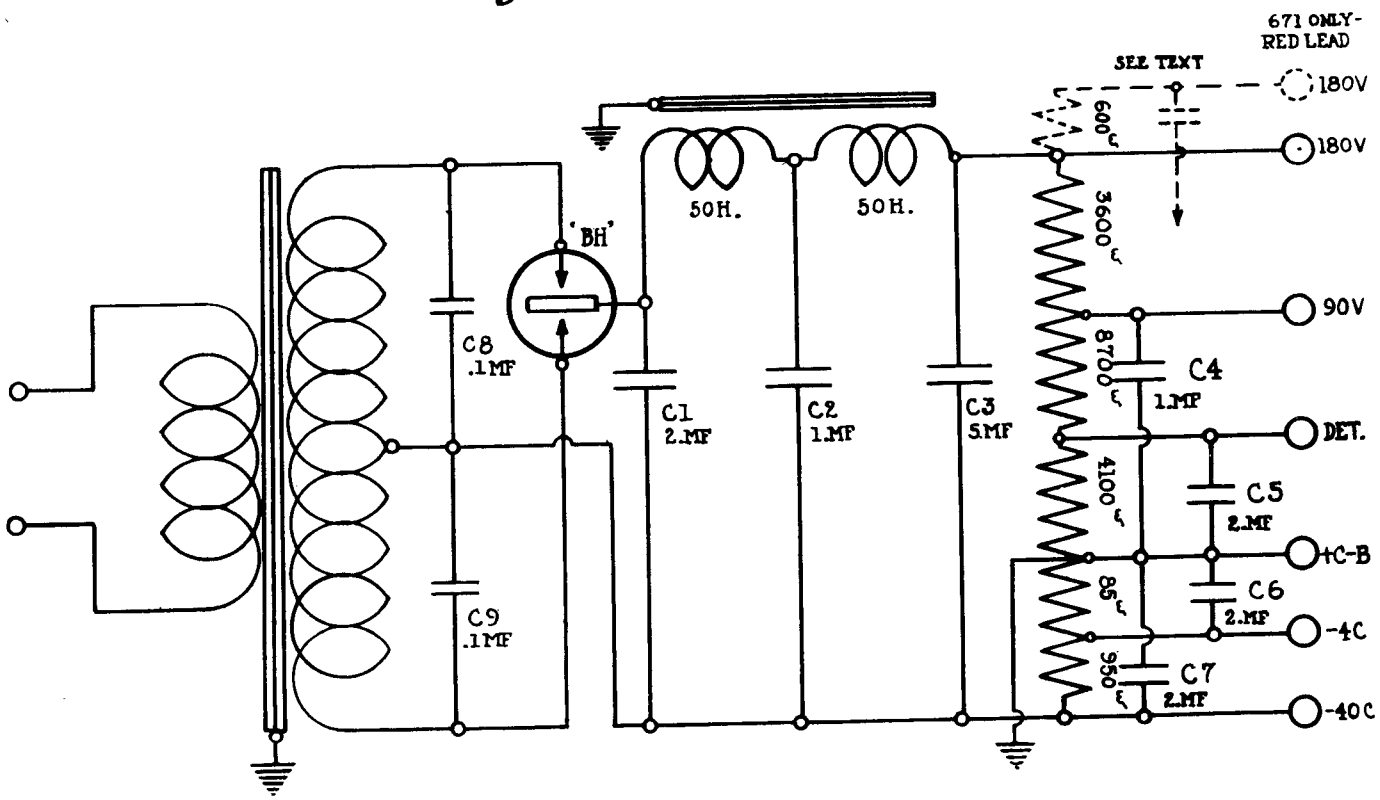
Fading and intermittent reception may be due to defective tubes, grid-to-cathode leakage, or intermittent grounds inside bypass or filter condensers. In the second instance, the fault will not develop until the tubes have been heated for some time; advancing the volume control then brings the signal back, but it fades again. The remedy is to replace R12, if it has a value of 3 megs. (silver ends), with a resistor of the type used in late sets. This is ½- to 1 meg., with brown ends.



A.H. GREBE & CO.



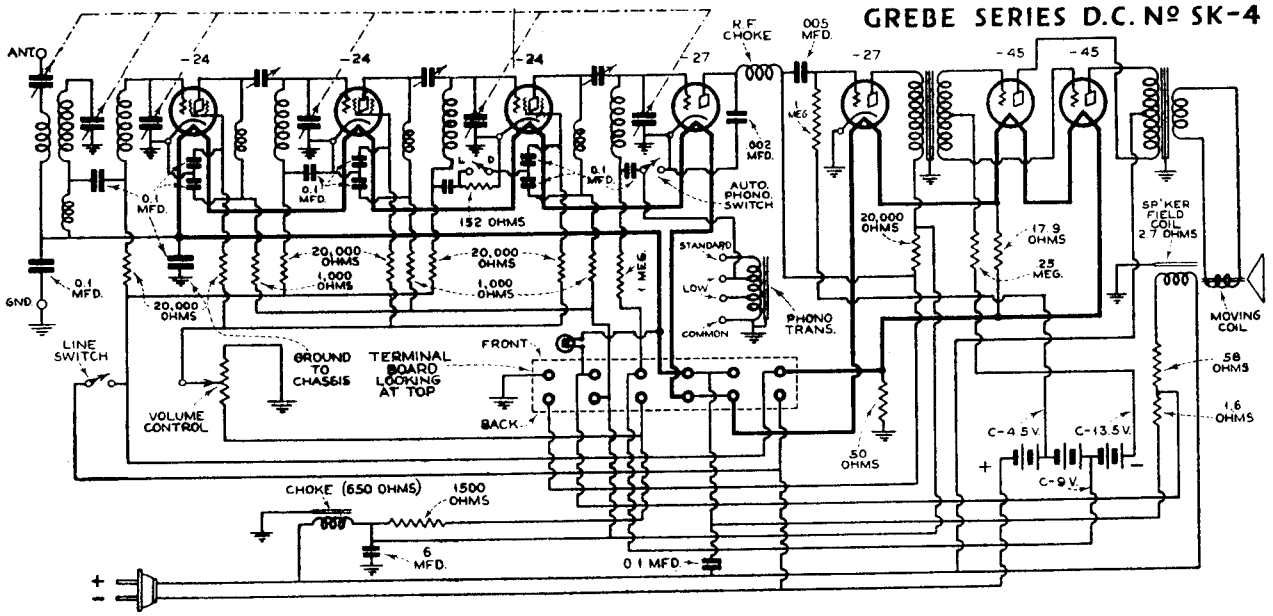
SYNCHROPHASE TYPE AH-1



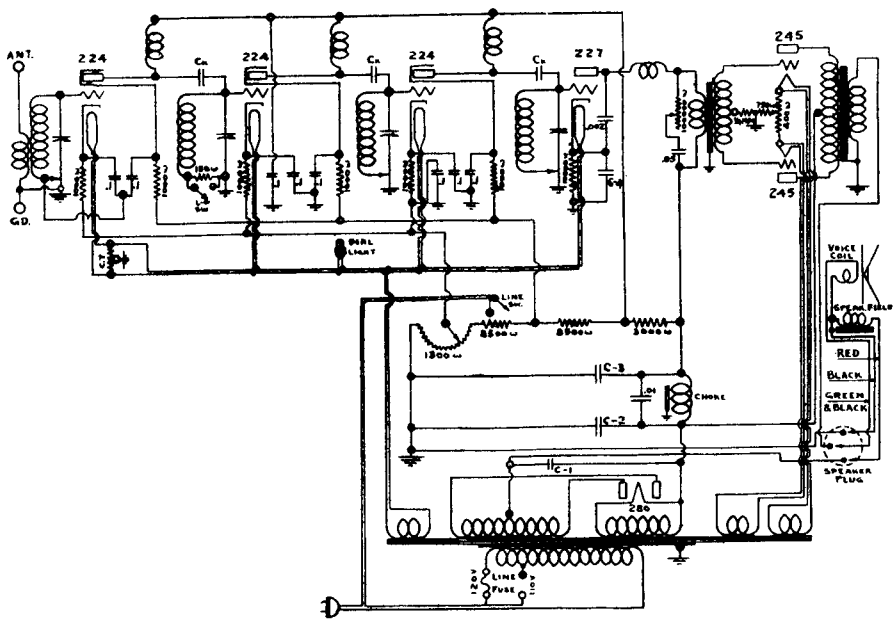
B & C SOCKET POWER
TYPE 671-B

A.H. GREBE & CO.

GREBE SERIES D.C. Nº SK-4



MODEL AH-1



Line Voltage 115—Volume Control Full On

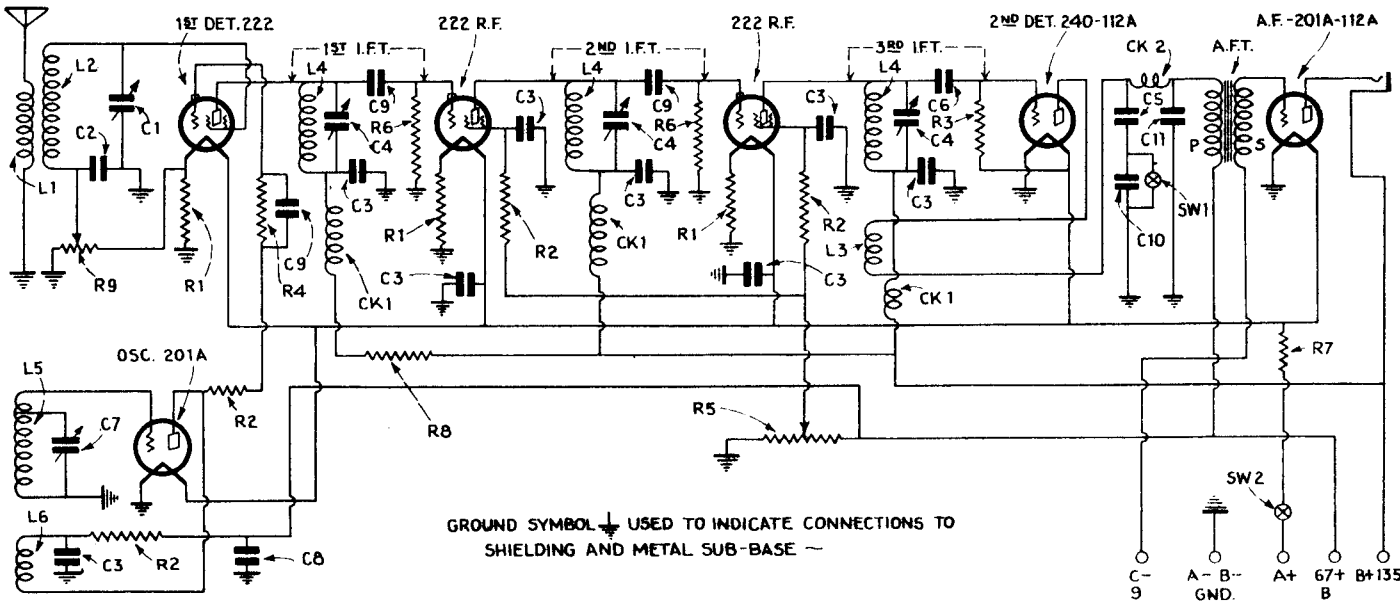
TUBE NO. IN ORDER TESTED	TYPE OF TUBE	POSITION OF TUBE IN SET	METER READINGS WITH JEWELL TEST PLUG IN SOCKET OF SET — OPERATING VOLTAGES: FILAMENT OR HEATER	PLATE OR ANODE	CONTROL GRID — SPACE — GD +	NORMAL GRID — SCREEN — GD +	CATHODE TO HEATER	MILLIAMPERES: SCREEN GD L. H. SO PLATE	PLATE R. H. SO PLATE	TUBE TEST	PLATE CURRENT CHANGE
1	224	1 R.F.	2.4	160	2.5	80	-	-	2.5		
2	224	2 R.F.	2.4	160	2.5	80	-	-	2.5		
3	224	3 R.F.	2.4	160	2.5	80	-	-	2.5		
4	227	Det.	2.4	200	-	20	-	-	2.0		
5	245	PP-AF	2.6	250	-	14	-	-	50		
6	245	PP-AF	2.6	250	-	14	-	-	50		
7	280	Rect.	4.8	-	-	-	-	50	50		
8											
9											
10											

Volume Control Minimum

TUBE NO. IN ORDER TESTED	TYPE OF TUBE	POSITION OF TUBE IN SET	METER READINGS WITH JEWELL TEST PLUG IN SOCKET OF SET — OPERATING VOLTAGES: FILAMENT OR HEATER	PLATE OR ANODE	CONTROL GRID — SPACE — GD +	NORMAL GRID — SCREEN — GD +	CATHODE TO HEATER	MILLIAMPERES: SCREEN GD L. H. SO PLATE	PLATE R. H. SO PLATE	TUBE TEST	PLATE CURRENT CHANGE
1	224	1 R.F.	2.4	190	15	90	-	-	2.5		
2	224	2 R.F.	2.4	190	15	90	-	-	2.5		
3	224	3 R.F.	2.4	190	15	90	-	-	2.5		
4	227	Det.	2.4	225	-	21	-	-	2.0		
5	245	PP-AF	2.4	250	-	14	-	-	50		
6	245	PP-AF	2.4	250	-	14	-	-	50		
7	280	Rect.	4.8	-	-	-	-	50	50		
8											
9											
10											

HATRY AND YOUNG, INC.

"H-Y" SHORT-WAVE 6



List of Constants

L1—Detector coil primary or antenna winding;

L2—Detector coil grid winding;

L3—Second-detector tickler. 8 turns of No. 30 D.S.C. on top of L4 at "B+" end;

L4—I.F.T. winding, 140 turns No. 30 D.S.C. on 1-inch (outside diameter) tubing. Three required;

L5—Oscillator-coil grid winding;

L6—Oscillator coil plate winding;

CK1—R.F. chokes, Hammarlund shielded type. In manufactured I.F. transformers for the "HY-7," CK1, L4 (and L3 in one), and C3 are within the shielding can along with C9 or C6. Thus live circuits are fully shielded;

CK2—Hammarlund shielded R.F. choke. One or three required;

A.F.T.—National A-100 audio transformer.

C1—50-mmf. Hammarlund or Pilot midget condenser for first-detector tuning; two required;

C2—.01-mf. Sangamo fixed condenser, by-pass for R9;

C3—0.25 mf. Sprague midget fixed condenser, six required;

C4—100-mmf. mica variable condensers (Hammarlund "EC80" equalizers), three required;

C5—.001-mf. Sangamo fixed condenser, two required if second detector is '40. (C5 becomes .0002-mf. if second detector is '12A);

C6—200-mmf. Sangamo fixed condenser. Grid condenser for detector;

C7—Same as C1, but tuning condenser for oscillator;

C8—1-mf. Tobe fixed condenser;

C9—500 mmf. Sangamo fixed condenser, three required unless second detector is '12A (see C10);

C10—500-mmf. for '40 second detector, or 200-mmf. for '12A;

C11—.001 mf. Sangamo fixed condenser;

R1—15-ohm Yaxley filament resistor, three required;

R2—2000- or 3000-ohm Electrad flexible resistors. Used for R.F. choking or filtering effect, 4 required; if substituted in place of CK1s in home-made job, 7 would be required;

R3—Second-detector grid-leak, Electrad metallic type. 7 megs. for the '12A as second detector, or 4 megs. for the '40;

R4—100,000-ohm Electrad metallic fixed resistor, leak type. Reduces D.C. voltage placed on space-charge grid;

R5—50,000- or 100,000-ohm Electrad "Royalty" variable resistor, potentiometer type for volume control;

R6—2-megohm Electrad metallic leak, two required;

R7—Resistance to set filament voltage on tubes. Yaxley 4L or any 2-ohm rheostat or resistor adjustable to approximately 0.9 ohm;

R8—10,000-ohm Electrad

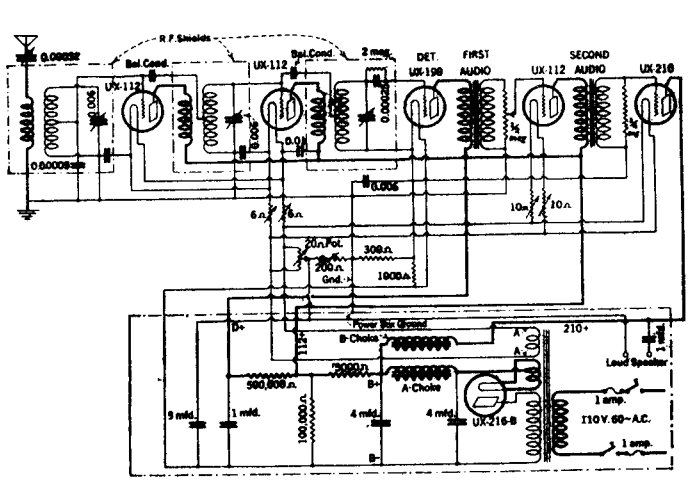
R9—50,000-ohm Electrad

SW1—Battery switch,

SW2—Same as SW1

GAROD RADIO CO.

MODEL EA



Radio Service Data Sheets

GREBE SYNCHROPHASE—7

Several models of Grebe instruments are available under the name of "Synchrophase"; the 7-tube receiver is described and diagrammed this month. In the coupling chain controlling the left-hand dial there is play to permit condenser variation, to compensate for differences in antenna capacities. This should be about two or three degrees. Between center and right-hand dials, only one-half degree is allowed as compensation for variation in parts and tube manufacture.

Condenser C1 has a capacity of .00022-mf. Units *a*, *b*, *c*, *d* and *e* ("Tonecolor") have a capacity of 1750, 1450, 950, 600 and 175 mmf., respectively.

Resistors R1, 2, 3, 4, are 400 ohms; X is a "dummy" cartridge having a copper wire in place of a high resistance. Resistors R5, 6, 7, 8 and 9 are 5 to 7 megohms.

CONTINUITY TEST

Beneath Aluminum Deck

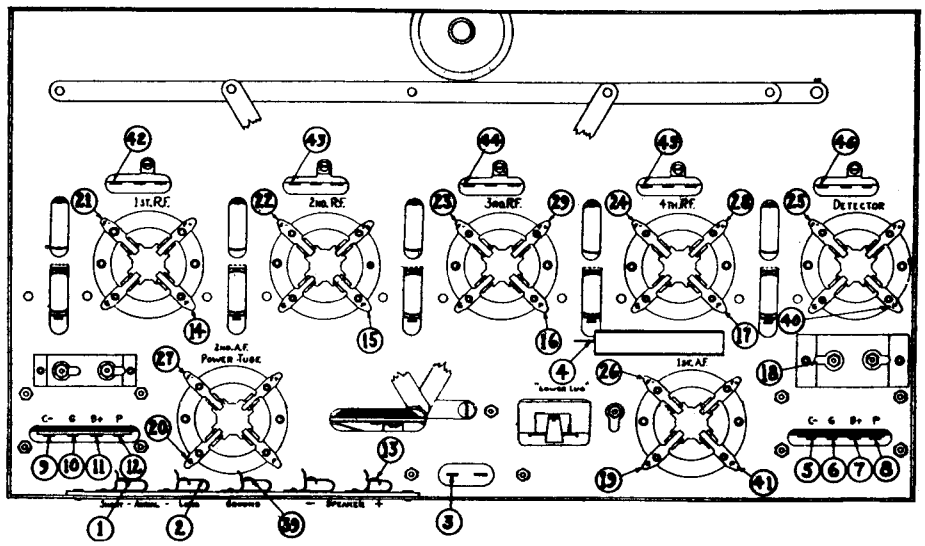
Test Leads	*Correct*	*Fault, if Otherwise*
1-39	full	L1 open
1-2	none	C1 shorted
3-39	none	C14 shorted
4-39	none	C13 shorted
5-6	about 1/3	T1 sec. open
7-8	about ¾	T1 pri. open
7-39	none	T1 pri. grounded
5-39	none	T1 sec. grounded
5-7	none	T1 pri. short to sec.
9-10	about 1/3	T2 sec. open
11-12	about ¾	T2 pri. open
11-39	none	T2 pri. grounded
9-39	none	T2 sec. grounded
9-11	none	T1 pri. short to sec.

Test of Cable Leads

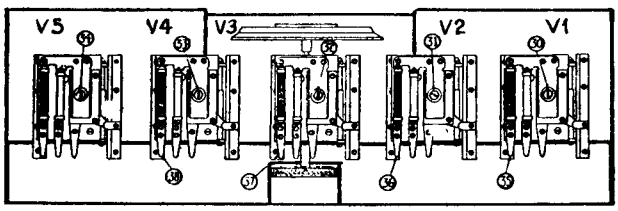
39-"180v."	none	Lead grounded
13-"180v."	full	Lead open
39-"90v."	none	Lead or R.F. pri. grounded.
14, 15, 16, 17, in turn, to "90 v."	full	Open pri. in respective R.F.T.
39-"Det."	none	Lead grounded
40-"Det."	about ¾	Lead or T1 pri. open
18-"Det."	none	Shorted C7
39-"C+"	full	"B—" open
39-"C4½"	none	"C4½" grounded
41-"90v."	about ¾	Lead or T2 pri. open
19-"C4½"	about 1/3	Lead or T1 sec. open
39-"C40"	none	"C40" grounded
20-40v.	about 1/3	T2 sec., or lead open
20-39 (rotate "Tonecolor")	none	"Tonecolor" grounded
39-"A—"	full	Lead open
21, 22, 23, 24, 25, 26, 27, respectively, to "A—"	full	"A" circuit open
42, 43, 44, 45, 46 to "A—"	full	L2, L4, L6, L8 or L10, respectively, open
39—"A+"	none	Lead grounded
28—"A+" (rotate rheostat)	full	Rheostat or contact bad
29—"A+"	full	As above

Inside Receiver

C8, C9, C10, C11, C12, to 30, 31, 32, 33, 34, respectively	Shorted C2, C3, C4, C5, C6, respectively
none	Almost full R1 open
30-35	Almost full R2 open
31-36	Almost full R3 open
32-37	Almost full R4 open
33-38	

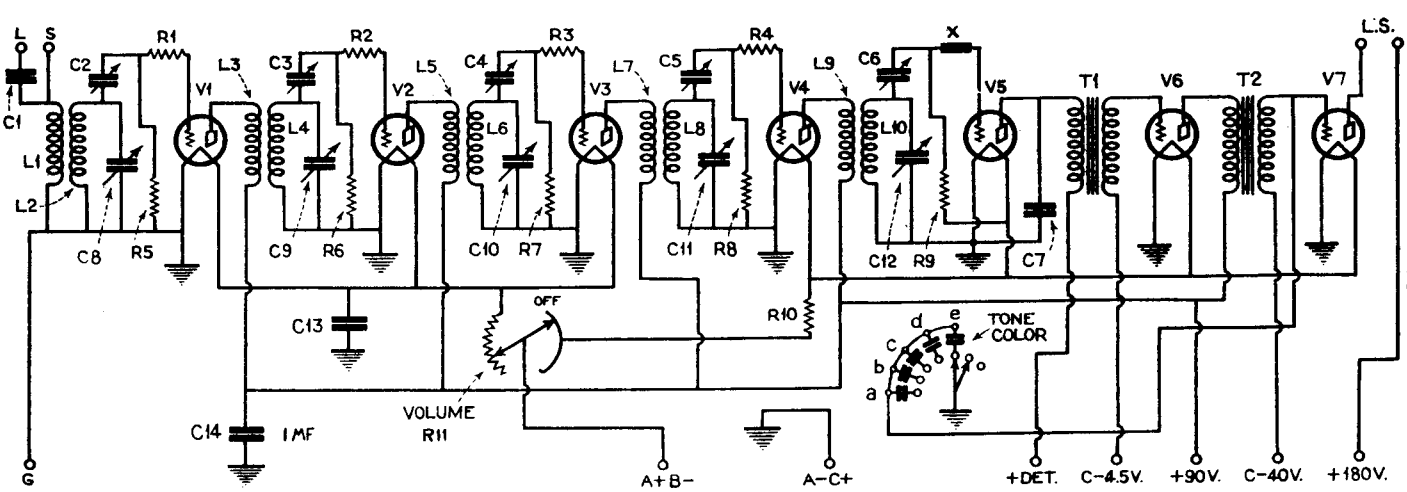


BOTTOM VIEW: Set turned on its back, bottom panel facing operator.



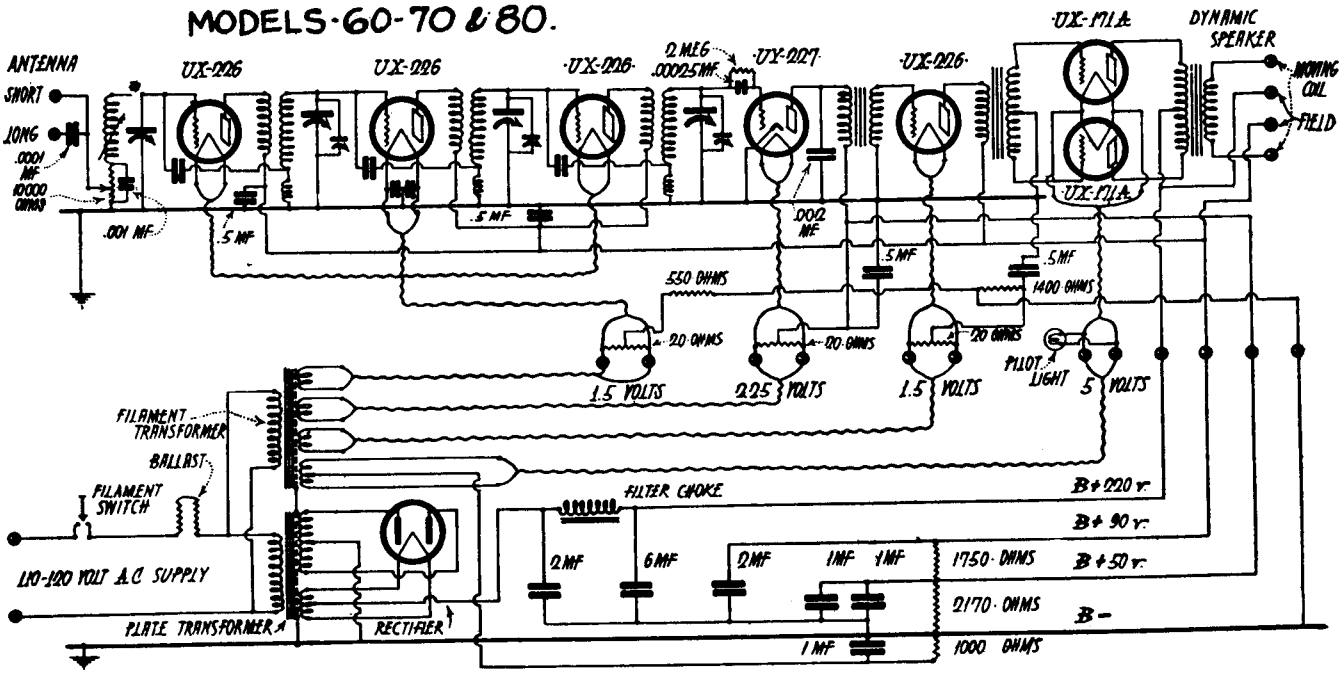
The heavy black bar at the left of the unit marked V5 is the dummy bus referred to in these columns. Each block comprises a coupling condenser, grid leak, and grid suppressor.

In any receiver it may occur that an audio transformer primary open-circuits. The service man may conveniently apply to T1 and T2 the same test used in production. Referring to bottom view of chassis, the north-seeking pole of a compass placed over 5-6-7-8 or 9-10-11-12 should point to the right (with plate current flowing). Both primaries and secondaries may be tested through use of the current in the average continuity-test kit; provided the polarity of the prods is known. With "plus" test lead to 7 or 11 and "minus" lead to 8 or 12, the compass should swing to the right; and also to the right when "+" lead of prod is connected to 6 or 10 and "—" to 5 or 9.



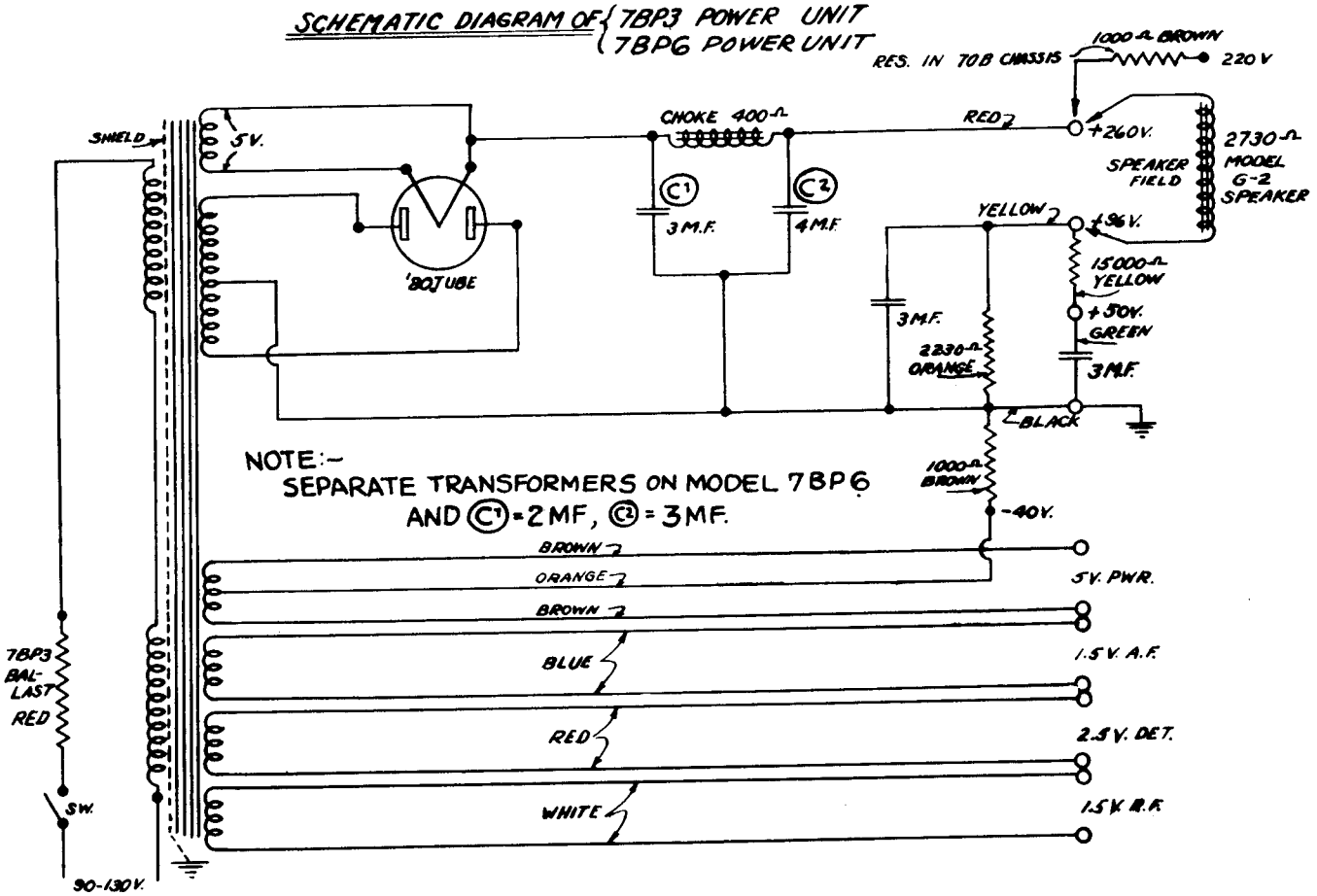
GRIGSBY-GRUNOW CO.

MODELS-60-70 & 80.

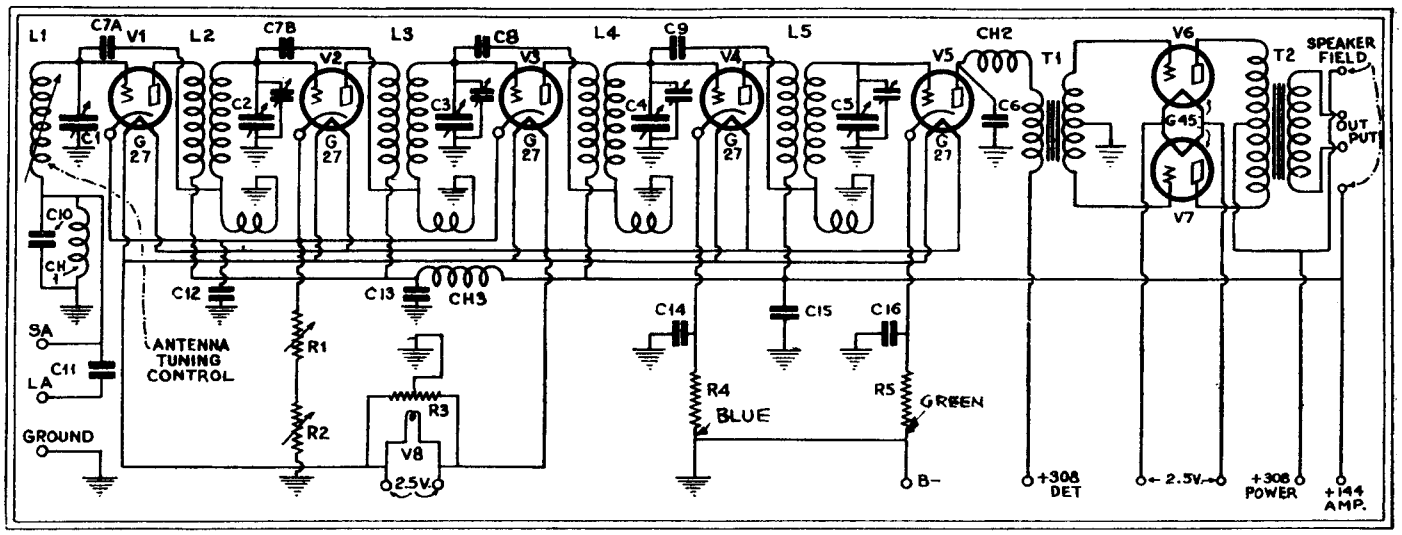


NOTE: In some models of the "70," the center-tap of the detector filament connects to the center-tap of the R.F. tube filaments, and the detector plate potential is then only about 30 volts.

SCHEMATIC DIAGRAM OF { 7BP3 POWER UNIT / 7BP6 POWER UNIT



GRIGSBY-GRUNOW CO.



Schematic circuit of the Majestic "Model 90" receiver chassis Several circuit innovations are to be noted; such as the variometer tuning of L1, and the use of four tuned, neutralized R. F. stages.

MODEL~90

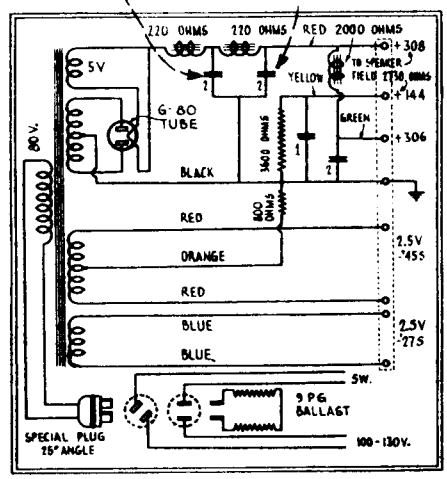
The constants are as follows: V1, V2, V3, V4, V5, type '27 tubes; V6, V7, '45s; V8, 3-volt pilot lamp; R1, 75,000 ohms, variable (volume control); R2, adjustable resistor, 500 to 2500 ohms; R3, non-inductive, center-tapped, 1.6 ohms total; R4, 1800 ohms (blue); R5, 35,000 ohms (green); C6, .004-mf.; C10, .001-mf.; C11, .0001-mf.; C12, C13, C14, C15, 0.5-mf.; C16, 1.0-mf. Ch1, Ch2 and Ch3 are R.F. chokes.

Volume is controlled by varying the grid bias of V1, V2, V3.

The voltage readings for this set should be as follows: filaments of V1, V2, V3, V4, V5, 2.35; of V6, V7, 2.45; plates of V1, V2, V3, V4, 130; of V5, 270; of V6, V7, 250; grid biases of V1, V2, V3, 8 volts; V4, 9 volts; V5, 30; V6 and V7, 50. The plate current of V1, V2, V3 is 5.5 milliamperes; V4, 5 ma.; V5, 1 ma.; V6, V7, 32 ma. These readings are exact only when the receiver is tuned to 550 kc., the volume control is set at maximum, and the line potential is 115 volts A.C.

R2 is secured to, and rotated by, the gang condenser shaft. It varies the grid bias of V1, V2 and V3 from 9 to 32 volts. This serves automatically to maintain even amplification throughout the tuning range. (This equalizer should have a resistance of 500 ohms at 550 kc., 1,500 ohms at 1,000 kc., and 2,500 ohms at 1,500 kc.)

"9P3"-4 MFD.



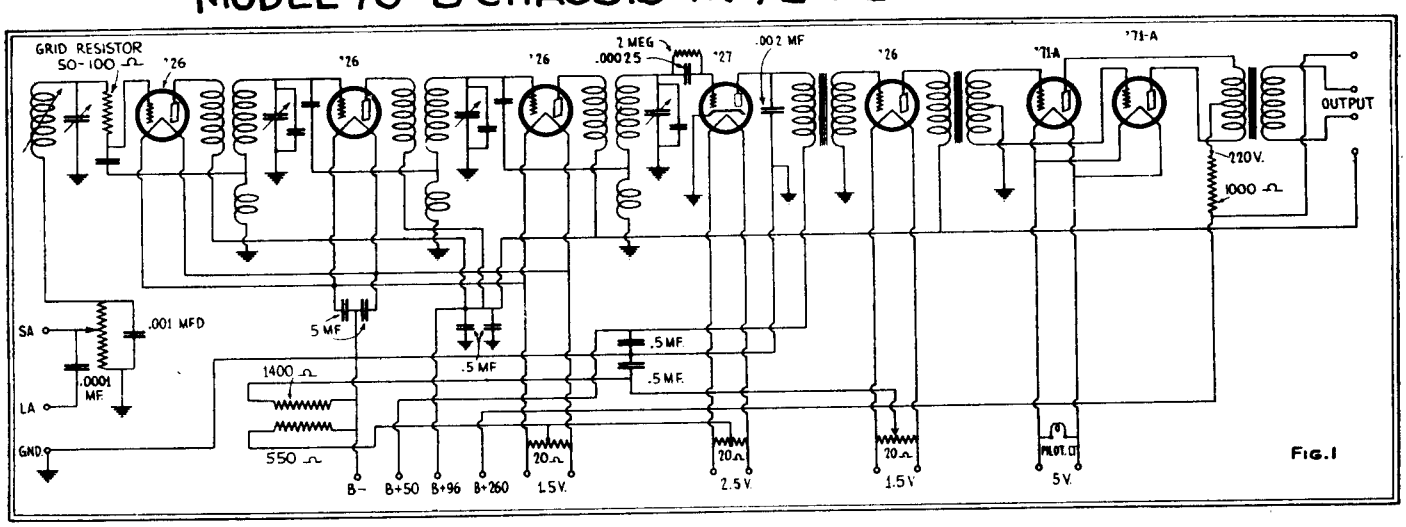
MAJESTIC "9P6" CONDENSER PACK FOR MODEL 90 RECEIVER~

WHEN testing the power pack in the Majestic "9P6," for shorts in the condenser bank, a reading will be obtained (in the earlier models) between the second and the fifth taps. This is due to a choke coil, which is mounted inside the condenser can, and connected between these two taps.

In the later models, this choke has been replaced by a resistor. In case of an open in this choke or resistor, there will be no plate voltage at the detector tap.

The schematic circuit of the earlier Majestic "9P6" power pack, showing the choke between detector and power-amplifier tap.

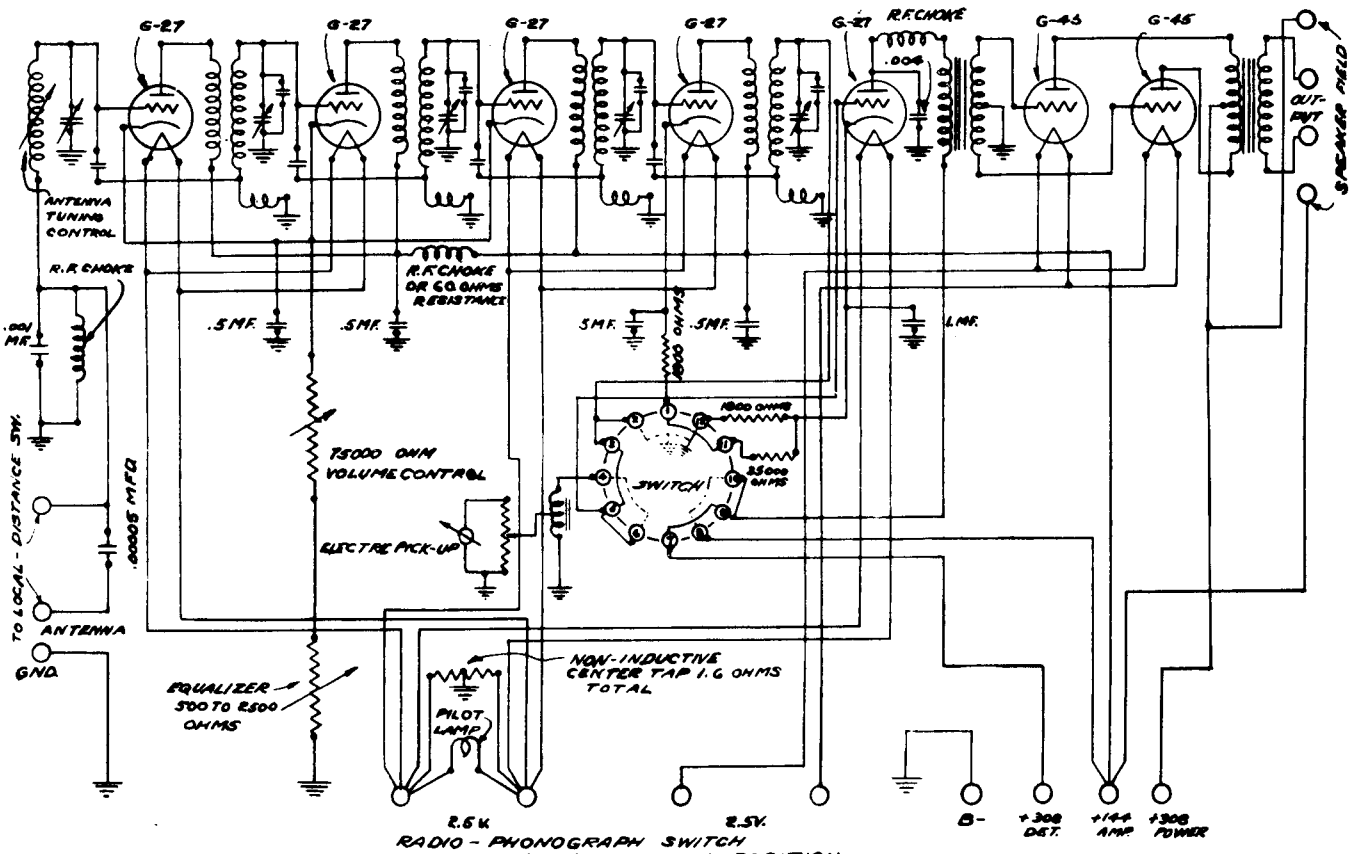
MODEL 70-B CHASSIS IN 72 RECEIVER~



Schematic circuit of the Majestic 70-B chassis used in the model 72 receiver. In contrast with most neutrodyne arrangements it is noticed that the neutralizing potential is obtained from the grid circuit; the coil being part of the tuned secondary circuit. The service man must remember this important point should occasion arise for servicing one of these modern radio sets. *Two* adjustable 20-ohm "hum balancers" are used in this set.

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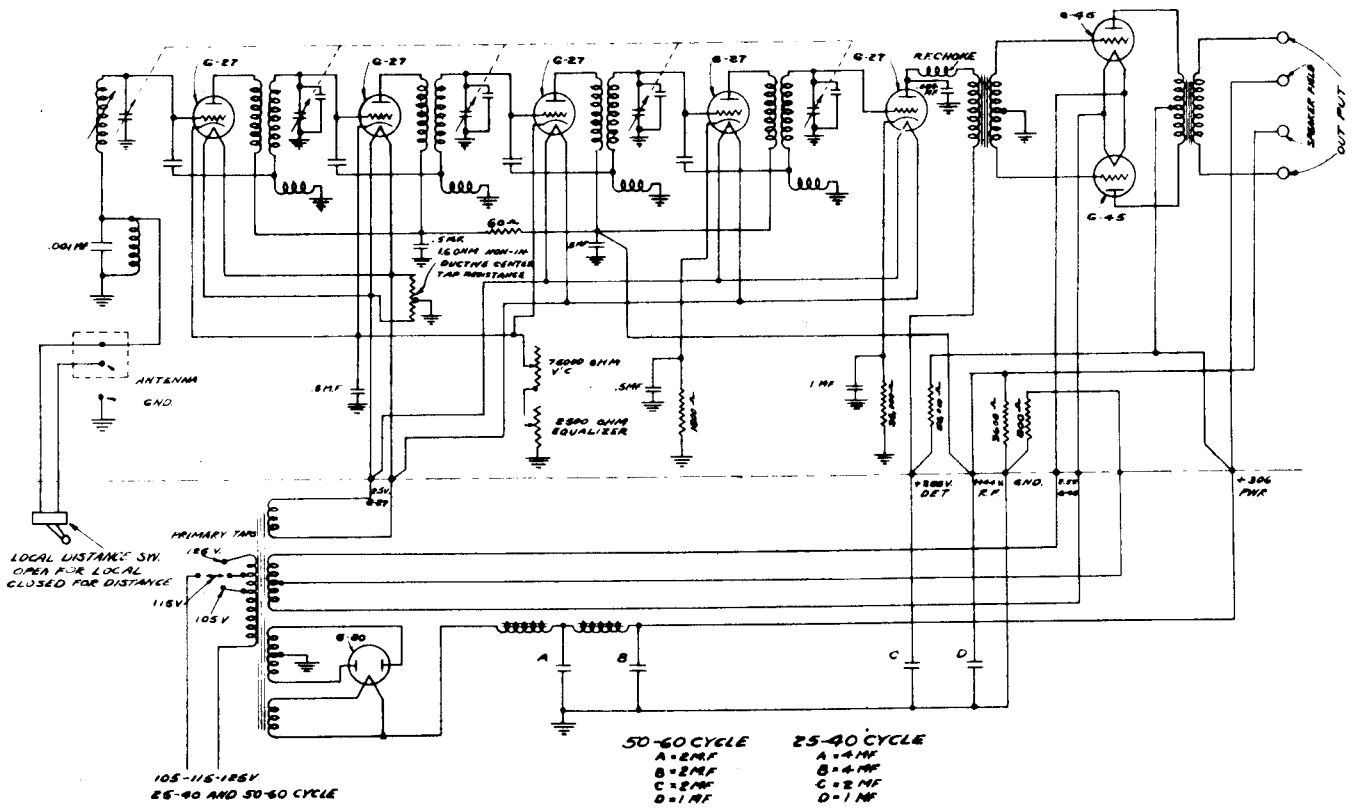
SCHEMATIC DIAGRAM FOR MODEL 100 MAJESTIC RECEIVER



RADIO - PHONOGRAPH SWITCH
FULL LINE INDICATES RADIO POSITION
DOTTED LINE INDICATES PHONOGRAPH POSITION

SCHEMATIC DIAGRAM FOR MODEL 90-B MAJESTIC CHASSIS

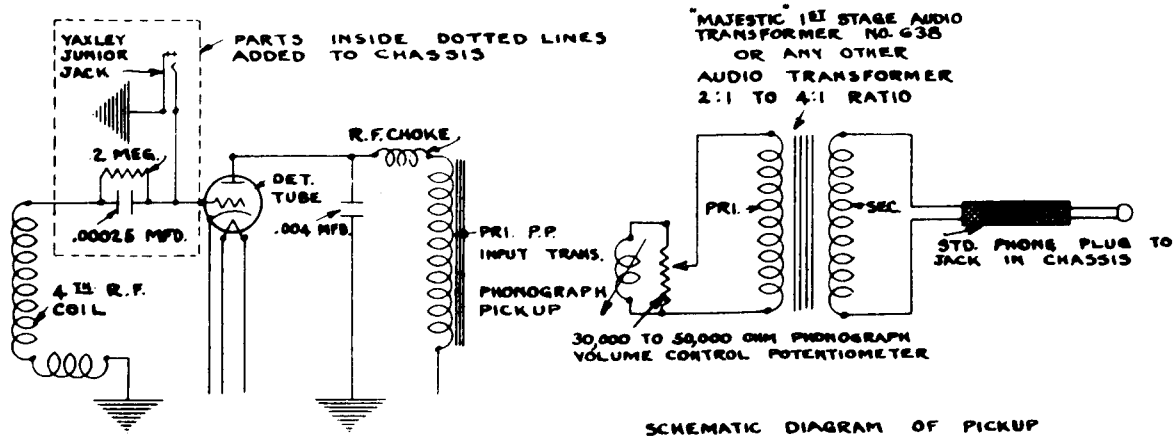
25-40 AND 50-60 CYCLE



50-60 CYCLE	25-40 CYCLE
A = 2 MF.	A = 4 MF
B = 2 MF.	B = 4 MF
C = 2 MF.	C = 2 MF
D = 1 MF.	D = 1 MF

GRIGSBY-GRUNOW CO.

METHOD OF ADDING PHONOGRAPH JACK TO MODEL 90 CHASSIS



PICKUP JACK CONNECTIONS IN CHASSIS

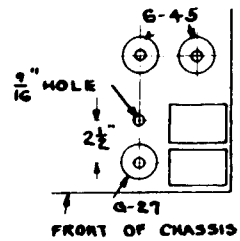
SCHEMATIC DIAGRAM OF PICKUP CONNECTION TO PLUG

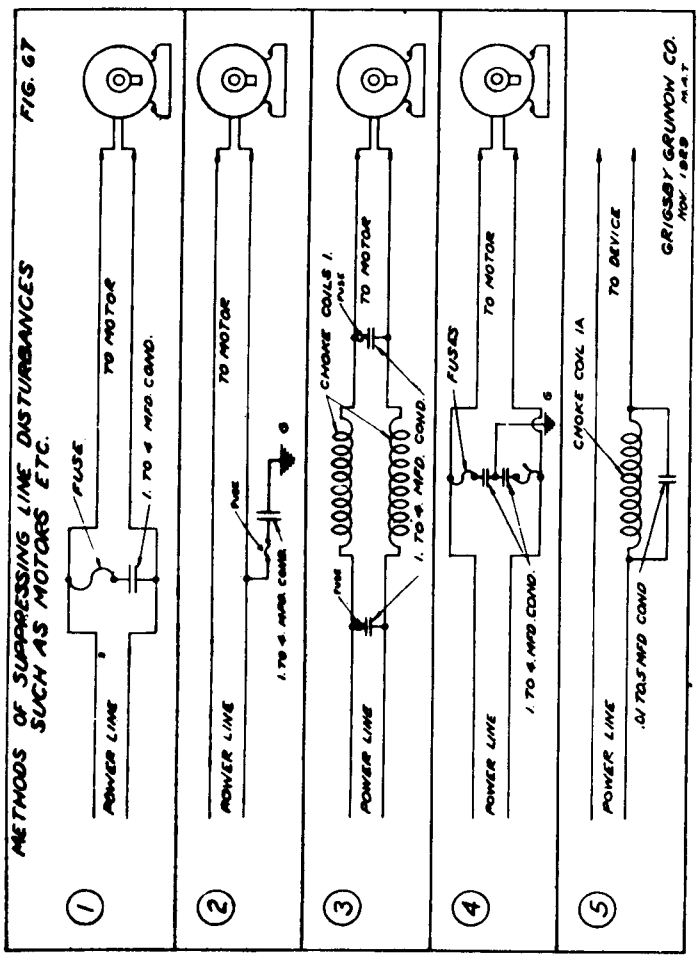
PARTS ADDED TO CHASSIS:-
1- YAXLEY JUNIOR JACK-OPEN CIRCUIT TYPE.
1- .00025 MFD. CONDENSER.
1- 2 MEGOHM RESISTOR.

4TH R.F. STAGE MUST BE RE-ALIGNED AFTER THE ADDITION OF ABOVE ITEMS.

WHEN USING THE PHONOGRAPH PICKUP THE RADIO VOLUME CONTROL MUST BE TURNED TO A MINIMUM, OTHERWISE BROADCASTING STATIONS MAY BE HEARD THROUGH THE PHONOGRAPH MUSIC.

WHEN USING RADIO, THE PHONOGRAPH PLUG MUST BE REMOVED FROM JACK.





Methods of Suppressing Line Disturbances Such as Motors, Etc.

This illustration shows you various methods of eliminating disturbances caused by motors, generators, and other electrical devices.

FIGURE No. 1 Shows power line connected to the motor. Across this 110 volt A C line we place a 1. to 4. MFD condenser. In series with this condenser, a fuse of about 3 amperes must be used.

FIGURE No. 2 Shows you how a 1. to 4. MFD condenser is connected to one lead of the line and grounded.

FIGURE No. 3 Shows the application of two 1. to 4. MFD condensers across the line and also the application of one choke coil in each line. Choke coils used in this installation are made by winding approximately 560 turns of No. 18 B & S gauge double cotton covered or enamel wire on to the fibre, bakelite, or treated wooden spool having a core diameter of ⅜" and outside diameter of 1½" and winding space of two inches wide. This type choke is for a load of 5 amperes or less.

FIGURE No. 4 Shows method of connecting two 1. to 4. MFD condensers in series across the A C line. In series with these condensers you will note a fuse of 3 amperes, the connection between the two condensers should be grounded.

FIGURE No. 5 Shows method of connecting a choke coil and condenser in parallel, in one side of the line. The condenser in this case should be .1 to .5 MFD capacity. Choke coil is to be used made by winding 150 turns of No. 18 DCC magnet wire on a fibre or bakelite tube 3" in diameter and approximately 3" long. Only one layer of wire is wound on it.

The arrangement shown in Figure No. 5 can be used for eliminating the line disturbances of various electrical devices. This method has been found advisable where it has not been possible to clear interference in any other way. The idea is to tune the interference to a frequency which does not fall within the receiving band.

Radio Service Data Sheet

MAJESTIC "MODELS 50," "51" AND "52" SUPERHETERODYNE RECEIVER

The "Model 50" chassis is used in the "Model 52" Majestic superheterodyne; removing the legs from the small cabinet, thus making a radio set of the mantel type, results in the "Model 51" receiver. This circuit is one of the latest developments of the Grigsby-Grunow Company, Chicago, Ill.

Referring to the diagram, the following parts values will apply: (C1, C2, C3, ganged variable condensers); (C5, C6, C8, C9, C10, C11, C12, C13, are built into the receiver assembly as circuit-aligning units); C4, C7, C17, C18, .001-mf.; C14, C15, C21, C22, C23, C28, 0.15-mf.; C16, C19, C24, 1.0 mf.; C20, .04-mf.; C25, 3 mf., C26, 2 mf.; C27, .09-mf.

The resistors have the following ohmic values: R1, 10,000; R2, 100,000; R3, 12,500; R4, 500; R5, 35,000; R6, 25,000; R7, 800; R8, 60; R9, 2,680; R10, 4,170; R11, 4,030; R12, 645; R13, 116.

Filter choke Ch1 has a resistance of 330 ohms; the field coil is filter choke Ch2, 1,000 ohms. A 3.2-volt pilot light is used at V9. The volume control is a double unit; the ganged resistors R1, R12.

Lack of plate voltage on the second detector may be reported in some instances; probably due to an open resistor (R6).

Condenser C8 is the antenna compensator.

Operating current values are as follows: Filament potentials, V1, V2, V3, V4, V5, V6, V7, 2.35 volts; V8, 4.8 volts. Plate potentials, V1, V2, 180 volts; V3, 256 volts; V4, 225 volts; V5, 90 volts; V6, V7, 250 volts; V8, 358 volts. Plate currents, V1, V5, 3 ma.; V2, 0.8-ma.; V3, 4 ma.; V4, 0.5-ma.; V6, V7, 25 ma.; V8, 40 ma. Control-grid potentials, V1, V3, 3 volts; V2, 8 volts; V4, 20 volts; V6, V7, 37.5 volts (on analyzer, the grids may read about 1.75 volts; to get true reading, measure from filaments to ground). Screen-grid potentials, V1, V2, V3, 90 volts. (Cathode potentials, same as control-grids.)

Following are the correct (manufacturer's) code numbers for the Majestic tubes recommended for the receiver: V1, V2, V3, "G-24;" V4, "G-27;" V6, V7, "G-45;" V8, "G-80." V5 is a "427" de Forest tube.

Where the line potential exceeds 118 volts, it will be necessary to use a line-voltage regulator; there is available a special unit which is recommended in such instances. It is designed with three outlets marked "110," "120," and "130" volts, rating the corresponding inputs.

It is extremely important that an accurately-calibrated oscillator be used to supply the 175-kc. frequency required for aligning the receiver; and that the procedure be followed accurately.

To align the intermediate-frequency oscillator, connect the output of the I.F. oscillator to the grid of first detector V2. Tune the oscillator to a frequency of 175 kc., and align the plate circuit of V2, the grid and plate circuits of V3, and the grid circuit of V4 for maximum deflection of a milliammeter or thermogalvanometer connected (in place of the dynamic reproducer's voice-coil) across the output secondary terminals of the output transformer T2. This alignment should be done with great caution, inasmuch as it materially affects the entire selectivity of the receiver.

If the I.F. circuits are so far out of alignment that no signal can be heard, it may be necessary to put the oscillator output (which should be adjustable) on the grid of V3 and roughly align the second half of the I.F. stage, first; then proceed with the remainder of the steps indicated above. The four aligning condensers are located on the rear of the chassis about midway down the right-hand side; from left to right (facing the receiver from the rear) their order is: C10, C11, C12, C13.

The procedure to follow in aligning the R.F. circuits is given below. The locations of the small circuit-aligning condensers are as follows: C5 (aligning condenser balancing the minimum capacity of the oscillator tuning condenser C3 to the minimum capacities of the band-selector tuning condensers C1, C2-C9), is accessible from the bottom side of the chassis, and is located next to the end of the gang condenser on which the cable drive is mounted; C6 ("tracking" condenser, shaping the tuning graph of the oscillator to accurately match that of the band-selector), is accessible from the rear side of the chassis through a hole in the R.F. base assembly, and just to the right of the power transformer; C8, the first antenna alignment condenser, is accessible from the back of the chassis, just slightly upward and to the right of the antenna and ground binding posts; C9, the second antenna or band-selector alignment condenser, is accessible from the bottom of the chassis and is located through the center hole of the chassis base.

Tune in a station at approximately 1,280 kc. and align the oscillator and antenna or band-selector condensers C5, C8, C9. Next, tune in a 600-kc. signal and adjust the tracking condenser C6, while slightly rocking the tuning condenser knob from side to side, until maximum signal strength is obtained, (as indicated on the output meter). The third step is to set the main tuning dial to exactly 1,500 kc. and tune in, by means of the oscillator aligning condenser C5, a 1,500-kc. signal. It now will be necessary to readjust condensers C8 and C9. At this point, the dial reading should be checked by tuning in a broadcast station with a known frequency higher than 1,000 kc.; and then the dial strip is to be slipped to the correct setting with respect to the index of the dial escutcheon. As a final check, test the receiver for sensitivity and selectivity; and, if necessary, repeat the operation until satisfactory results are obtained.

Note that in some cases maximum output may appear to fall at either the maximum or the minimum capacity setting of the oscillator tracking condenser C6. A simple check to determine whether this is actually the maximum output is as follows: after obtaining the best setting of C6, try a slight readjustment of C9. If this readjustment results in nothing more than slight improvement, the adjustment of C6 is satisfactory.

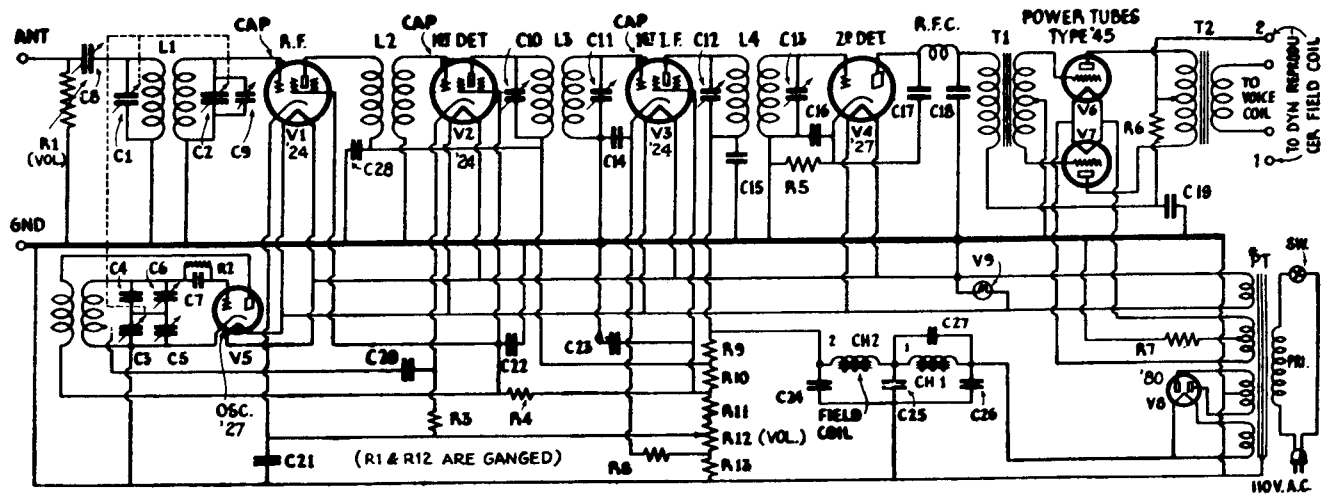
Resistor R6 is located at the right of the connecting terminals, inside the can above the power transformer; it is below and between the sockets of the power tubes.

Resistor R1 varies the signal input to the R.F. amplifier tube V1. The other half of the volume control (R12) controls the biasing voltage on the R.F. amplifier V1 and the first detector, V2.

Condenser C8 is adjustable through a hole in the rear of the chassis. When the installation of the receiver is complete, a station between 1,000 and 1,400 kc. should be tuned in, and the volume control adjusted to low volume. Then adjust C8 until maximum volume is obtained. Further adjustment of this condenser will not be necessary unless the length or position of the antenna is changed.

The manufacturers advise that *under no conditions* should an attempt be made to use a ground connection on the antenna binding post.

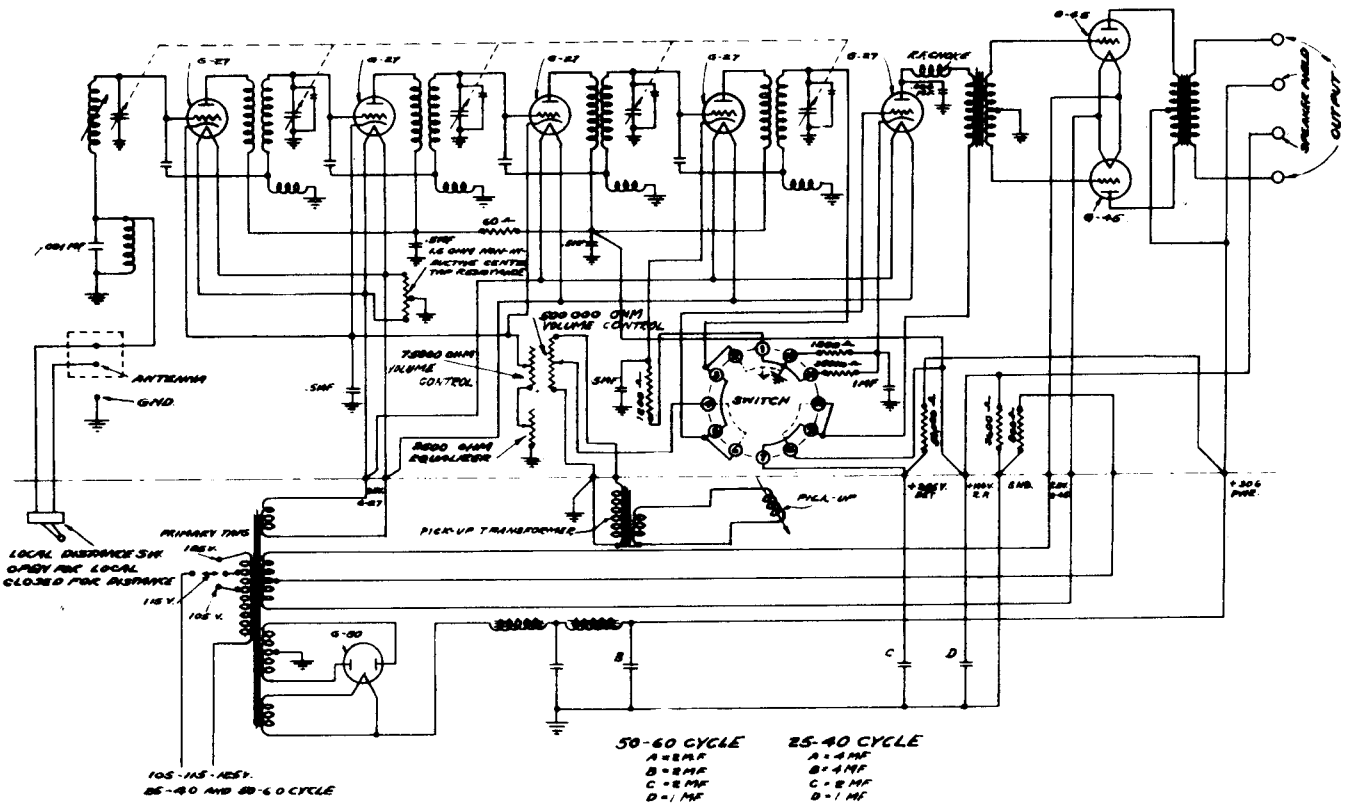
A tuned filter choke-and-condenser system (Ch1, C27) is used to reduce the hum level to a minimum. For this reason, a replacement condenser of exactly the right capacity must be used, if it becomes necessary to change condenser C27; otherwise, the absorption circuit (Ch1, C27) will not resonate at the correct frequency.



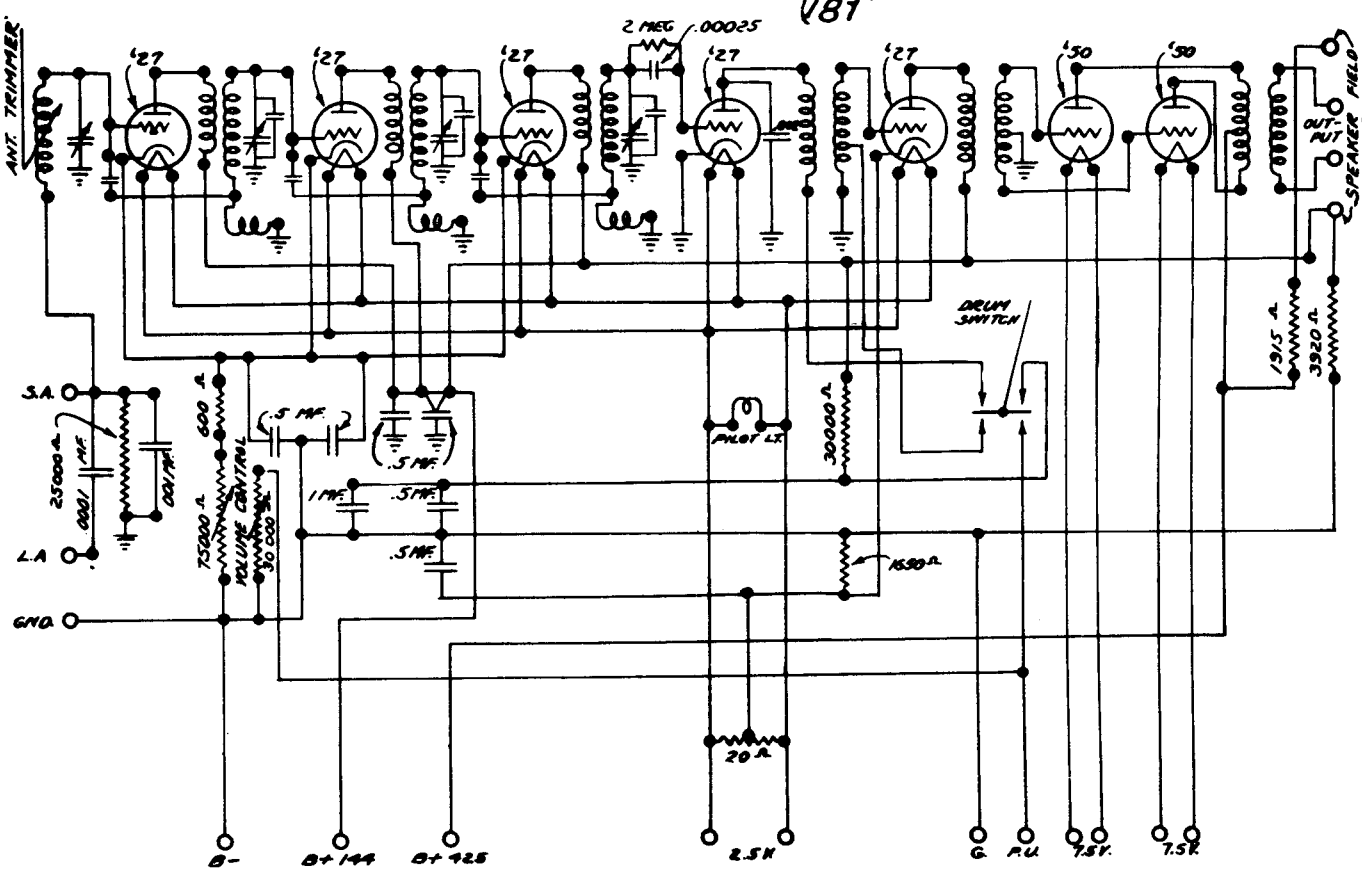
The Majestic "Model 50" chassis is the most compact of the A.C.-operated superheterodynes yet produced, being adaptable to even a midget cabinet. It has a single stage (screen-grid) of intermediate-frequency amplification, working at 175 kc. The tuning is single-dial; the R.F. stage's tuning condenser being ganged with that of the oscillator.

GRIGSBY-GRUNOW CO.

SCHEMATIC DIAGRAM FOR MODEL 100-B MAJESTIC CHASSIS
25-40 AND 50-60 CYCLE

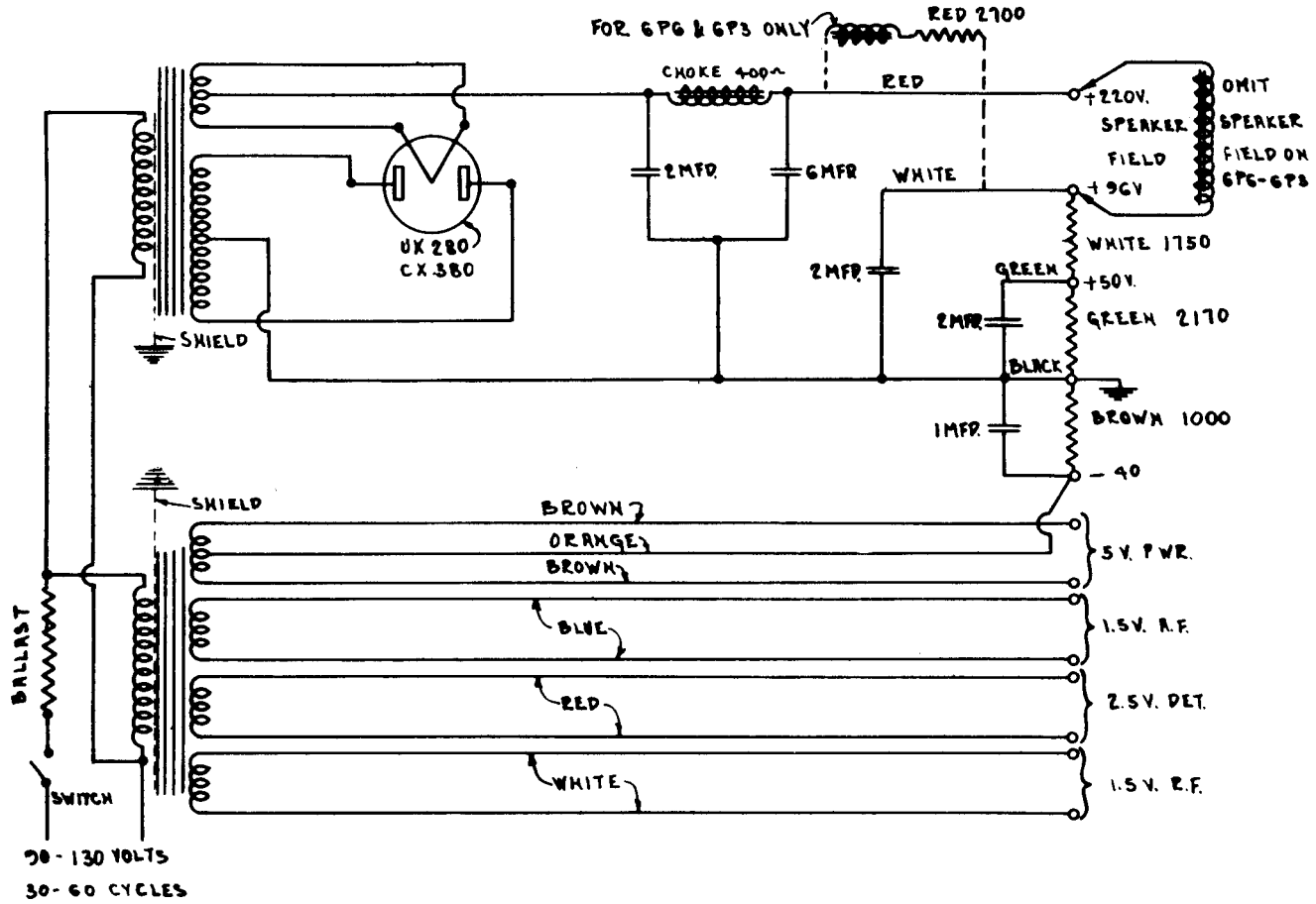


SCHEMATIC DIAGRAM FOR MODEL {180 / 181} MAJESTIC RECEIVERS

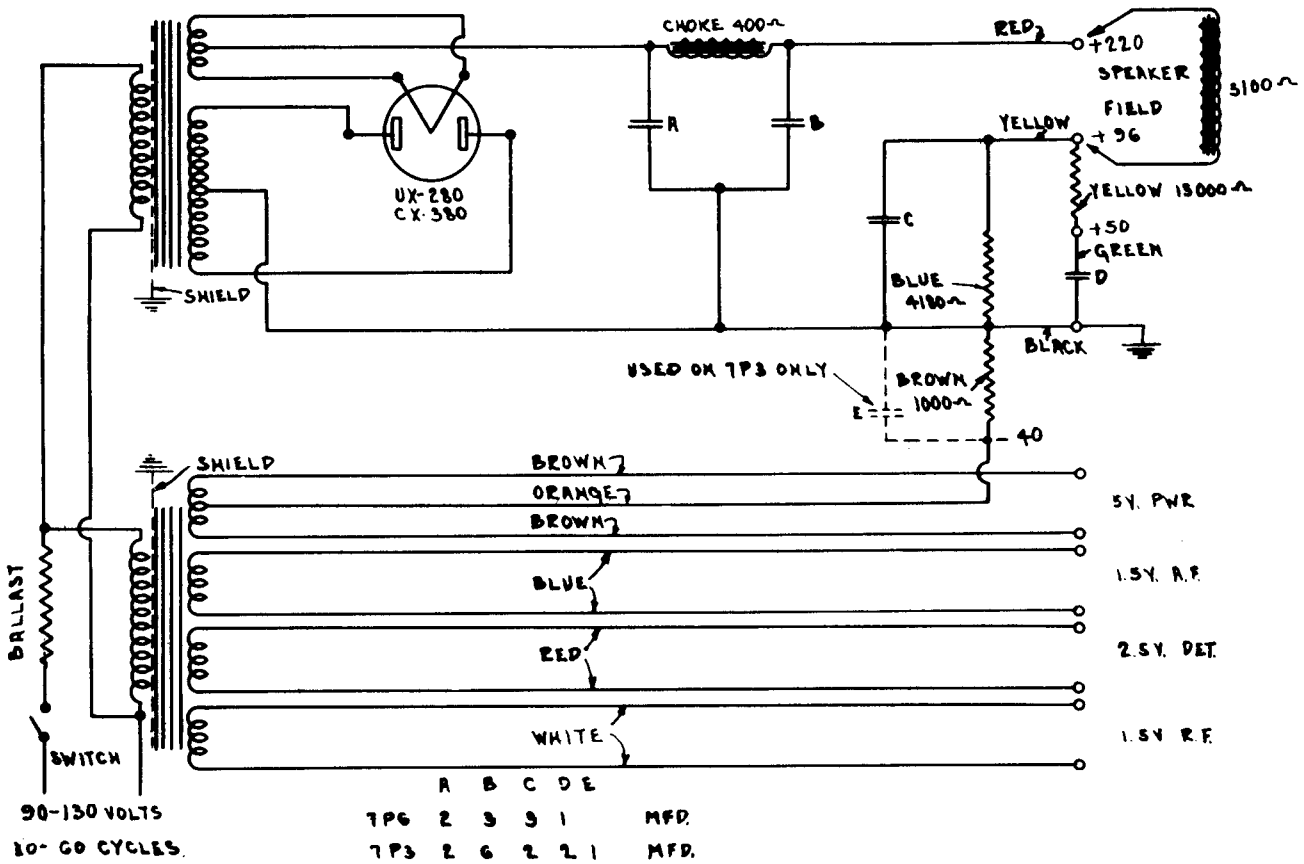


GRIGSBY-GRUNOW CO.

SCHEMATIC DIAGRAM OF 7P6-7P3 POWER PACK (OLD WIRING)



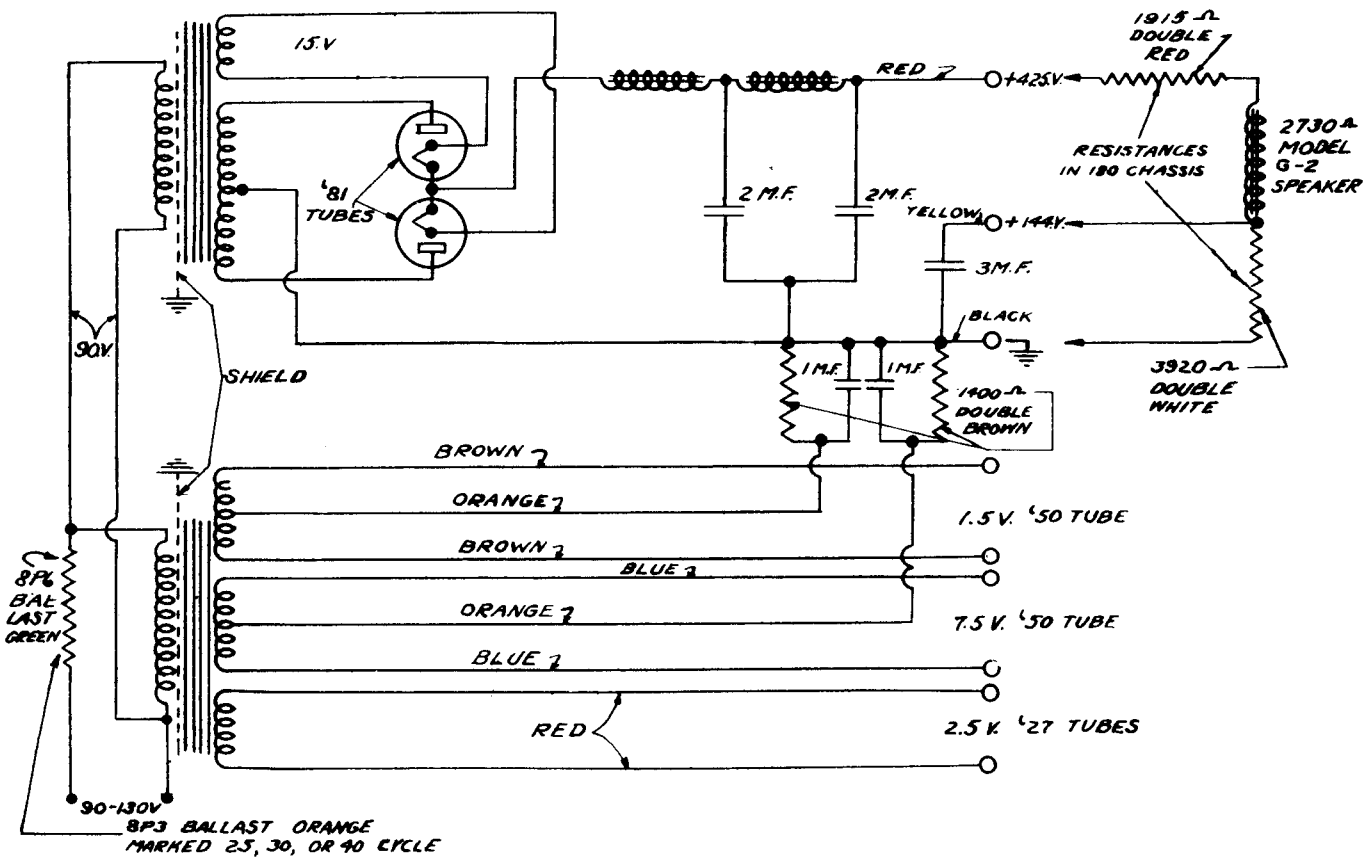
SCHEMATIC DIAGRAM OF 7P6-7P3 POWER PACK



	A	B	C	D	E	
7P6	2	3	3	1		MFD.
7P3	2	6	2	2	1	MFD.

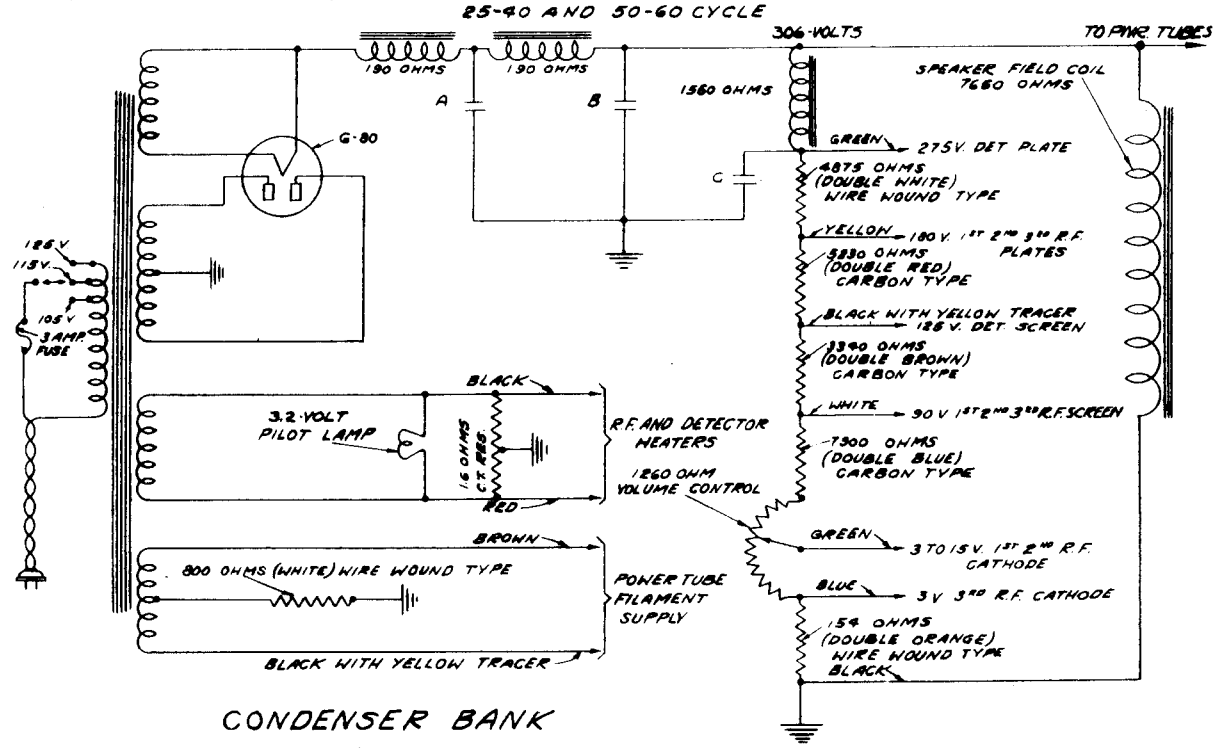
GRIGSBY-GRUNOW CO.

SCHEMATIC DIAGRAM OF 8P6 & 8P3 POWER UNITS



SCHEMATIC DIAGRAM OF POWER UNIT AND VOLTAGE DIVIDER SYSTEM MODEL 130-A MAJESTIC SUPER SCREEN GRID CHASSIS

25-40 AND 50-60 CYCLE



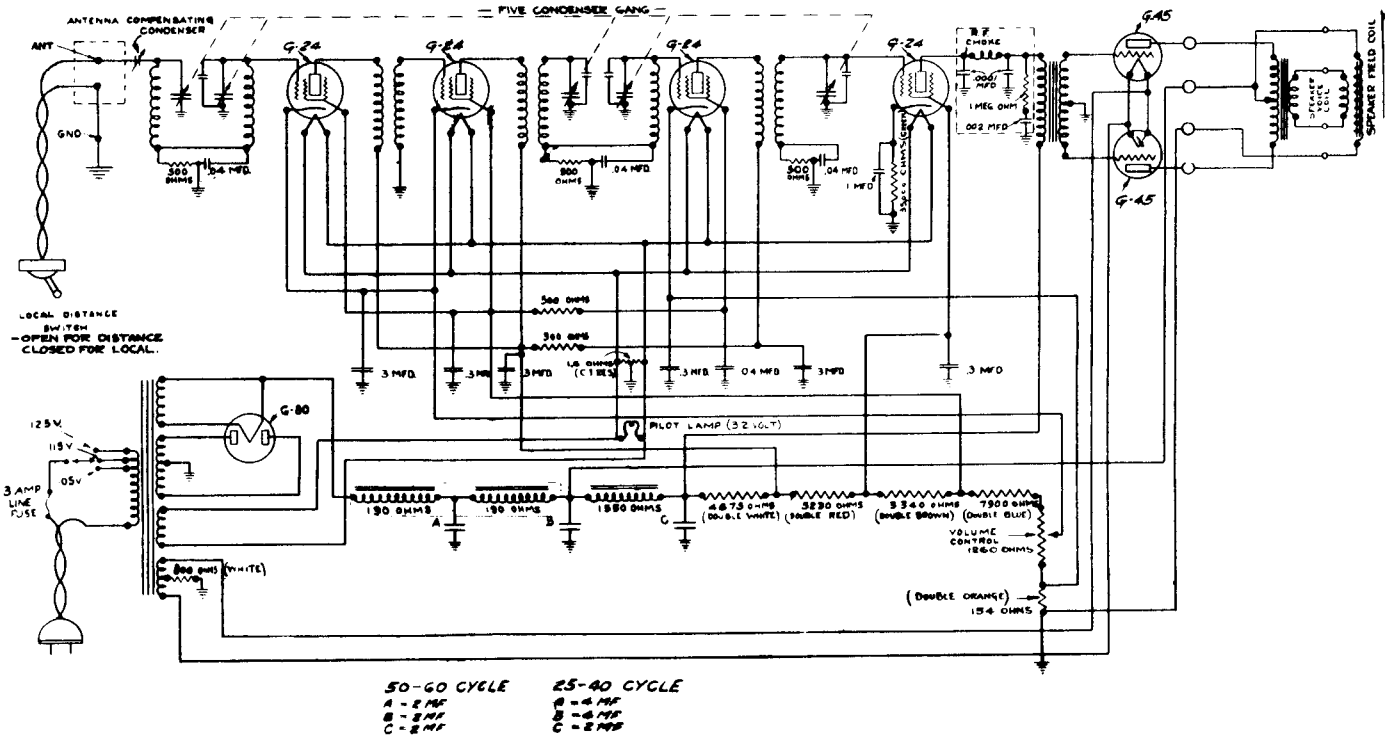
CONDENSER BANK

50-60 CYCLE	25-40 CYCLE
A – 2 MFD	A – 4 MFD
B – 2 MFD	B – 4 MFD
C – 2 MFD	C – 2 MFD

GRIGSBY-GRUNOW CO.

SCHEMATIC DIAGRAM of MAJESTIC SUPER SCREEN GRID RECEIVER

MODEL 130-A CHASSIS 25-40 & 50-60 CYCLE



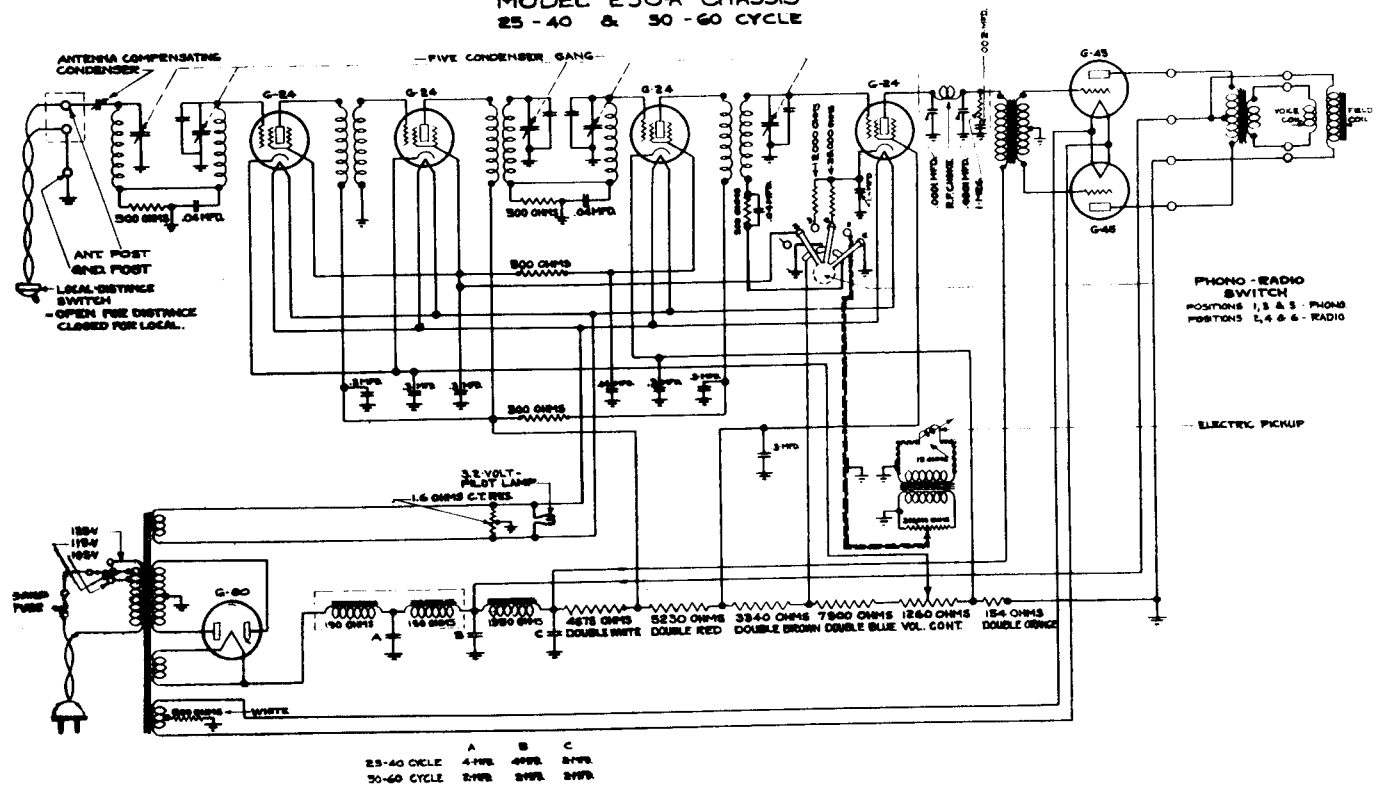
50-60 CYCLE
A - 2 MF
B - 2 MF
C - 2 MF

25-40 CYCLE
A - 4 MF
B - 4 MF
C - 2 MF

SCHEMATIC DIAGRAM of MAJESTIC SUPER SCREEN GRID RECEIVER

MODEL 230-A CHASSIS

25-40 & 50-60 CYCLE



	A	B	C
25-40 CYCLE	4 MFD.	4 MFD.	2 MFD.
50-60 CYCLE	2 MFD.	2 MFD.	2 MFD.

Radio Service Data Sheet

HOWARD "MODEL SG-A" SCREEN-GRID RECEIVER

This radio set is a product of Howard Radio Co., South Haven, Mich. A novelty in its design is the type of the tuning scale, which is a white strip, graduated in kilocycles, arranged to slide from side to side.

Following are the parts values used in this receiver: Tuning condensers C, .00036-mf.; C1, 0.25-mf.; C2, C3, C5, 0.9-mf. (in individual shield cans); C4, 0.5-mf.; C6, C7, .001-mf.; C8, C9, C10, each 8 mf. (Mershon electrolytic triple unit).

Volume in this receiver is controlled by the tandem unit R1-R2. The resistance of R1 is 20,000 ohms; R2, of the "tapered" type, has a resistance of 10,000 ohms maximum (two-thirds turned, about 2,500 ohms; and one-third reading, about 10 to 25 ohms); R3, 300 ohms; R4, R6, 10 ohms; R5, 15,000 ohms; R7, 900 ohms; R8, 1,600 ohms; R9, 2,300 ohms. The reproducer's field coil has a resistance of 2,400 ohms; and Ch. 2 is a 200-ohm unit rated at 20 henries.

The primary of L1 has a resistance of 9.5 ohms; while the primaries of L2, L3, L4 have a considerably higher resistance—245 ohms. The resistance of the primary of the input transformer T1 is 1,200 ohms; of the secondary, total, 10,000 ohms. The primary of T2 has a resistance of 400 ohms.

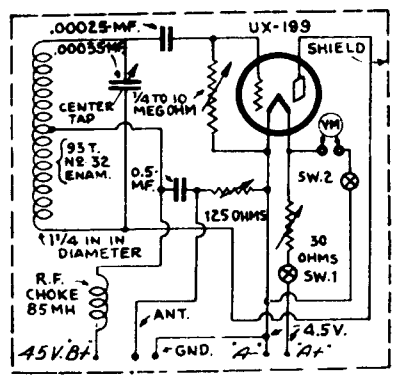
Operating current supply values for this set follow (tube out of socket): Filament potentials, V1, V2, V3, 2.45 volts; V4, 2.47 volts; V5, V6, 2.33 volts; V7, 5.60 volts. Plate potentials, V1, V2, V3, 171 volts; V4, 167 volts; V5, V6, 272 volts

With the tube under test placed in a standard analyzer the following readings may be obtained: Filament voltages, V1, V2, V3, 2.3 volts; V4, 2.35 volts; V5, V6, 2.18 volts; V7, 4.56 volts Plate potentials, V1, V2, V3, 164 volts; V4, 152 volts; V5, V6, 254 volts. Grid bias potentials, V1, V2, V3, 2.88 volts; V4, 14.7 volts; V5, V6, 48 volts. Cathode potentials, V1, V2, V3, 3.12 volts; V4, 12.4 volts. Normal plate current readings, V1, V2, V3, 3.6 milliamperes; V4, 1.1 ma.; V5, V6, 26 ma.; V7, 60 ma. Screen-grid potentials, V1, V2, V3, 68 volts.

These values were obtained with a line potential of 110 volts, and the power transformer PT set on 110-volt tap, volume control full on and tuning control turned to lowest frequency.

If a bridge is available for measuring the mutual conductance of the tubes to be used in the set, note that a value of 1050 mmhos. is average, 750 mmhos. is low, and tubes reading higher than 1300 mmhos. probably will cause circuit oscillation. Screen-grid tubes having a plate current ranging between 2.5 and 3.1 ma. usually are good ones for this receiver; those reading higher may cause circuit oscillation, and those reading lower may result in poor volume.

In instances where the set has been allowed to stand idle for some time, it may be found that there is a very noticeable hum in the reproduction; this is an indication that the electrolytic condensers are in need of re-forming. This is simply done by leaving the set turned on for about fifteen minutes, with all tubes except rectifier V7 removed from their sockets. (This puts about 400 volts across the filter electrolytic condensers.) However, the correct forming time will depend upon the length of time the set has been idle; merely repeat performance until correct operation is obtained. The reason the set may act in this way, when first turned on, lies in the fact that the leakage current through the electrolytic condensers has increased appreciably, thus lowering the voltage



In this modulated R.F. oscillator, the variable grid leak controls the audio note. Voltmeter VM may connect externally for initial settings; the tip-jacks being insulated from the shield. The number of coil turns will vary with the tuning capacity employed; the oscillator may be calibrated against broadcast stations, if desired. The amount of testing signal coupled into the set under inspection is determined by the 125-ohm variable resistor.

on the tubes. Checking the voltages is a convenient way of finding out when the condensers again are fully formed. This forming operation will not be necessary if the set is in operation at least one hour each day.

Each make of radio set has its own particular design, which responds best to certain types of service procedure; and therefore the method of re-ganging the condensers in this receiver (called by the manufacturer "re-gaining the set") will be described.

In no case, when re-gaining the set, should the compensator condensers be adjusted with the set cover removed. Before attempting to improve the gain of the receiver, it is necessary to see that, when the tuning dial is swung as far as possible to the right, all the condensers are entirely meshed; otherwise, the condensers will not track over the entire tuning range. Should this procedure indicate that one or more of the condensers is not entirely meshed, adjustment of this condenser may be made by rotating it, and for this operation, set screws holding the condenser to the drive pulley are provided.

If it is necessary to adjust the trimmers to an extreme setting for maximum reading on a meter (connected across the voice coil as M), re-adjust them to a more central position, and move the serrated plates on the condenser rotors until meter M shows maximum deflection.

An oscillator of somewhat unusual circuit design is recommended as particularly convenient for re-gaining this set; its circuit connections are reproduced here. To complete the connections for the use of this test unit, connect an A.C. voltmeter, with a scale of 0-3, across the leads of the voice coil of the dynamic reproducer.

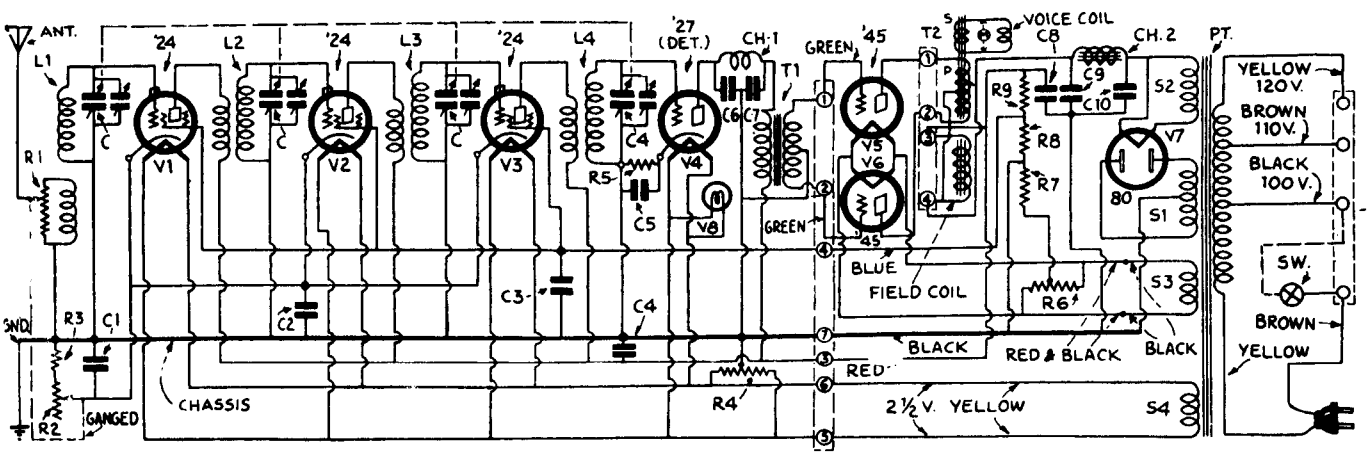
Next, with a "twisted pair," connect the "Ant." and "Gnd." of the set to the posts provided on the *shielded* R.F. service oscillator, adjust the oscillator for a frequency of 1400 kc., and adjust the 30-ohm filament rheostat until the voltmeter VM reads 3 volts. Then, adjust the 125-ohm rheostat (which may be a 125-ohm potentiometer connected as a rheostat) until the A.C. meter M indicates 1.0 volt.

Now, insert a screwdriver in the hole provided in the chassis cover and adjust the compensator on the variable condenser tuning the input circuit of V1, until maximum deflection of the A.C. voltmeter is obtained. Then follow to the next stage, adjusting the rheostat for a 1-volt deflection. Duplicate these operations at 950 and 550 kc.

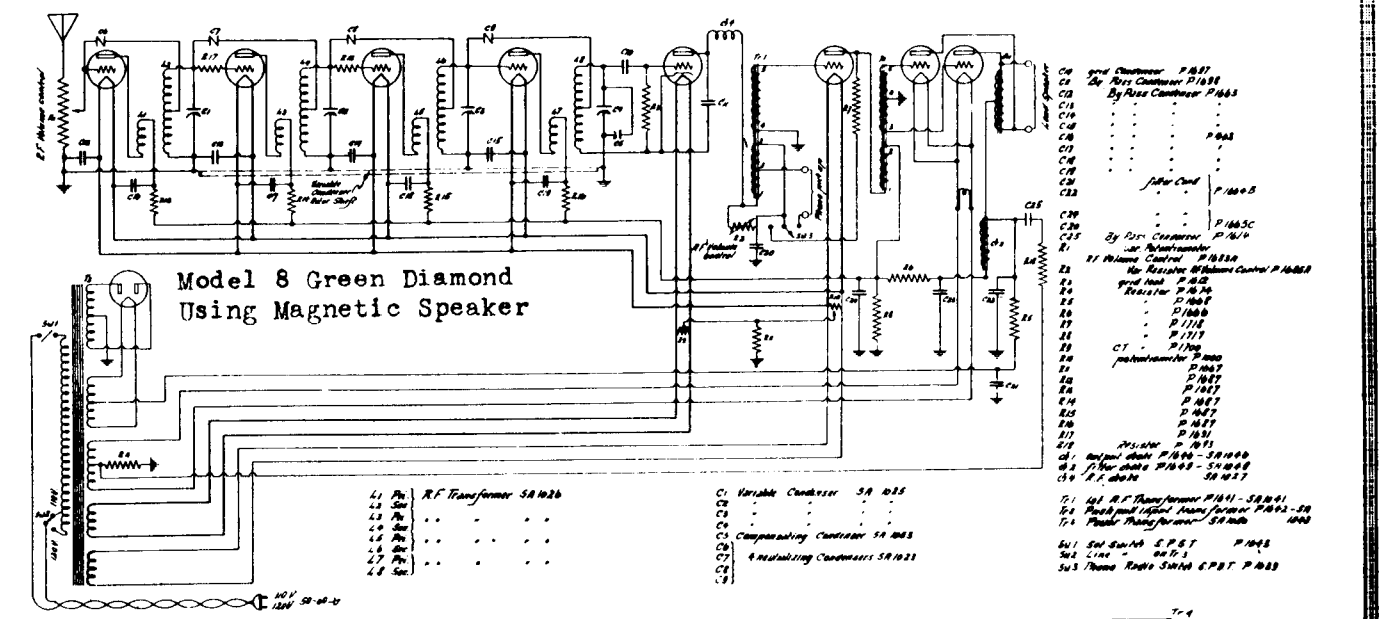
The Service Man is cautioned to check carefully the line connections to this receiver, if it has become necessary to remove these leads, and to make sure that the connections are in accord with the diagram of the receiver. Otherwise, either a short may result and cause a fuse to blow, or a portion of the primary winding of PT may be burned out.

For proper ventilation (and therefore longer life of the screen-grid tubes) the set cabinet should be placed at least three inches from the room wall.

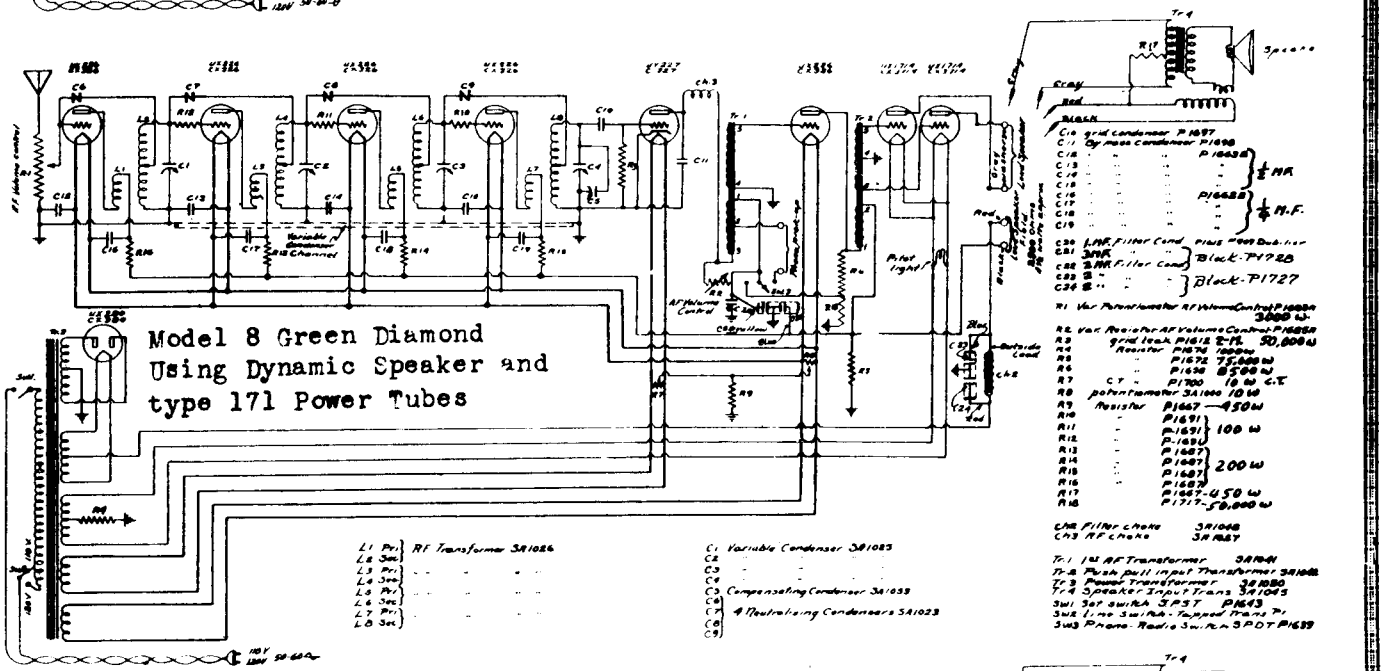
To check the line terminal plug connections for best operation, follow this procedure: tune in a distant station, reduce the volume, and then very quickly reverse the position of the line plug in the wall plate (before the tubes' heater elements have a chance to cool). Increased signal strength often will be noted in one position of the line plug.



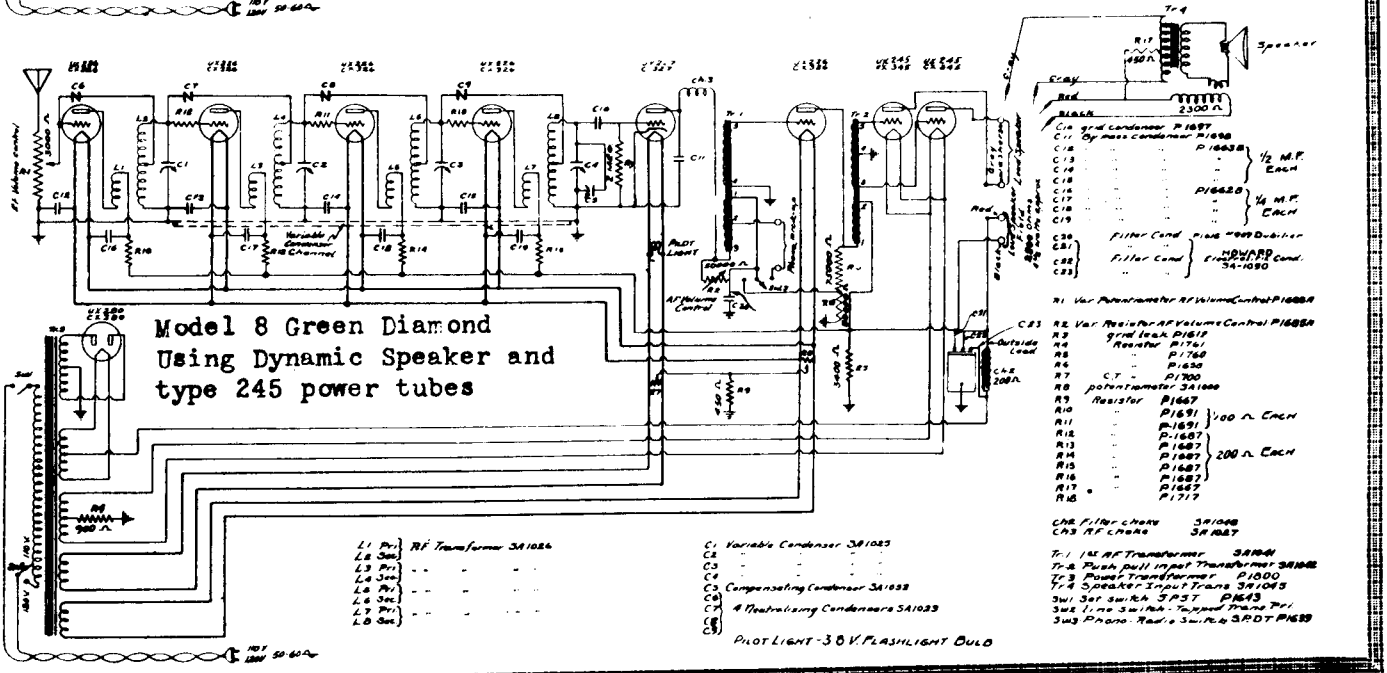
HOWARD RADIO CO.



Model 8 Green Diamond
Using Magnetic Speaker



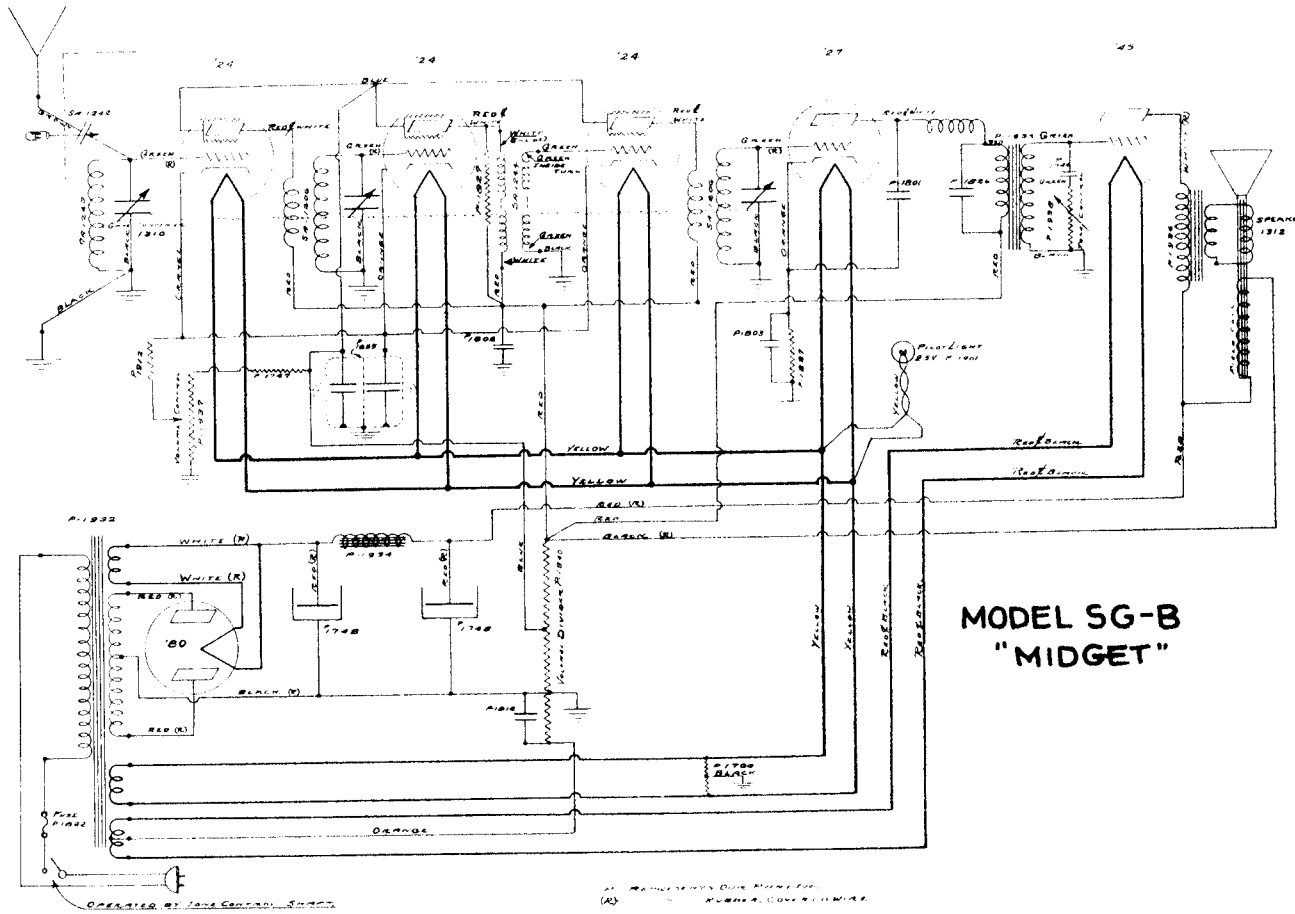
Model 8 Green Diamond
Using Dynamic Speaker and
type 171 Power Tubes



Model 8 Green Diamond
Using Dynamic Speaker and
type 245 power tubes

PILOT LIGHT - 3.8 V. FLASHLIGHT BULB

HOWARD RADIO CO.



MODEL SG-B "MIDGET"

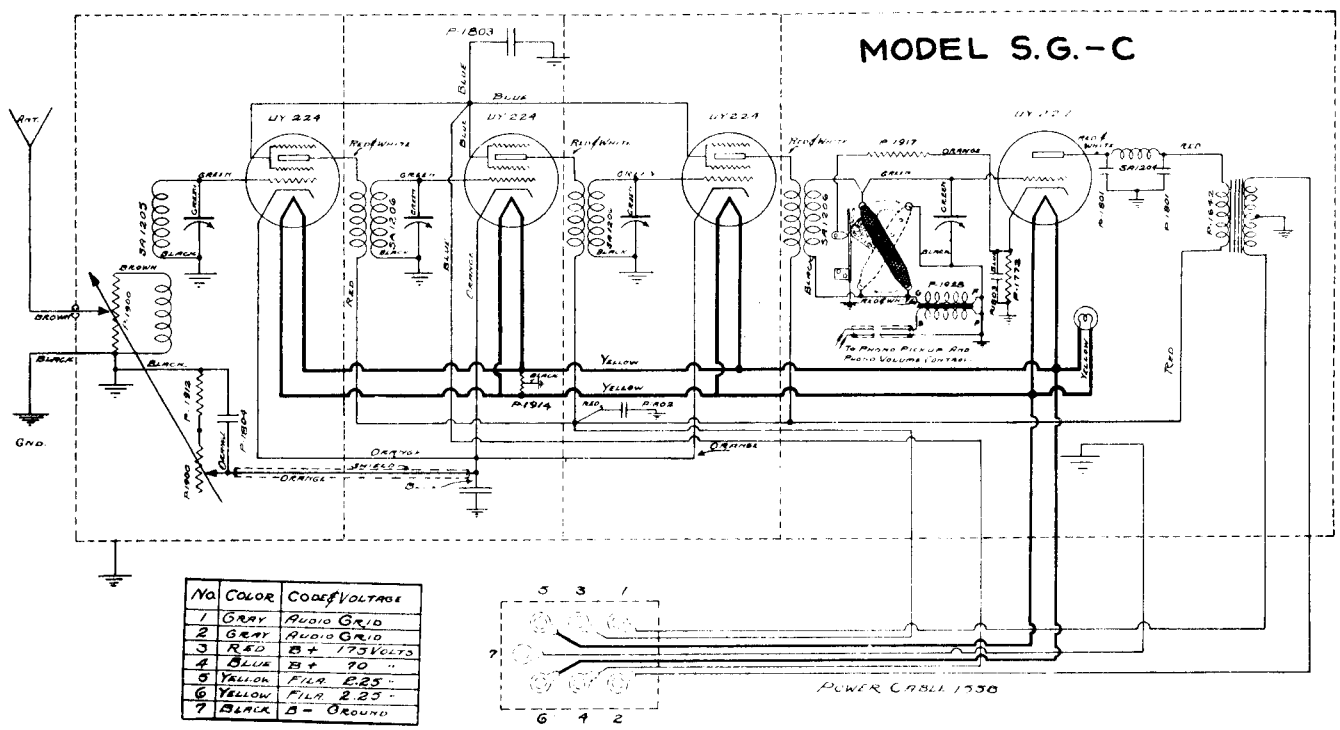
LIST OF PARTS

Part Numbers	Description	Remarks
1310	Gang tuning condenser	
1827	Resistor	(Used only on sets numbering 150,000 to 151,000)
1801	Condenser	.001 mfd. (fixed)
1826	Condenser	.005 mfd. (fixed)
1744	Condenser	.004 mfd. (fixed)
1802	Condenser	.5 mfd. (fixed)
1803	Condenser	1.0 mfd. (fixed)
1912	Resistor	300 Ohm, ½ Watt
1937	Potentiometer	10,000 Ohm, (tapered)
1747	Resistor	50,000 Ohm, ½ Watt
1827	Resistor	30,000 Ohm, ½ Watt
1938	Variable Resistor	2.5 megohms (tapered)
1935	Audio Transformer	Ratio 3:1
1825	Condenser	¼ mfd. and ½ mfd.
1832	Fuse	2 amp.
1932	Power Transformer	
1748	Electrolytic-condenser	8 mfd. ea. unit
1934	Choke	10 henry
1940	Resistor	Voltage divider 7400 ohms.
1812	Condenser	½ mfd. (fixed)
1700	Resistor (Center tap)	10 ohms.
1312	Speaker	2400 ohm. Field
1936	Output Transformer	

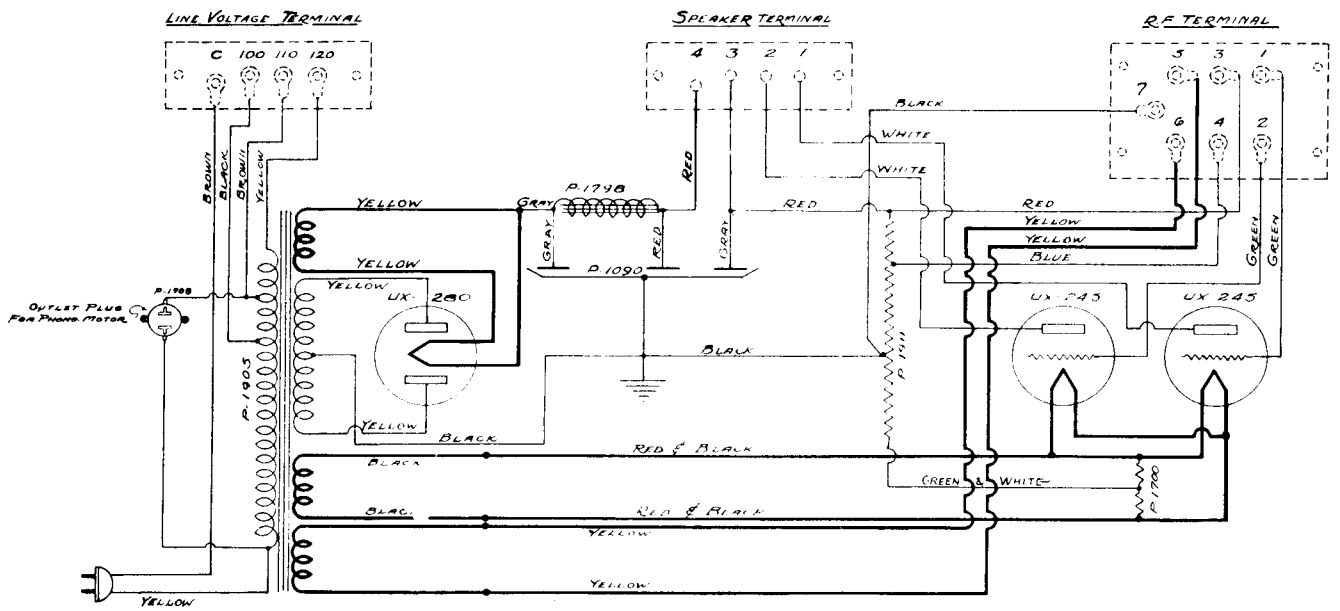
Sub-Assembly Numbers	Description
1242	Antenna compensating, cond.
1243	Antenna coil
1206	Radio frequency transformers
1244	Broad band transformer
1245	Radio frequency choke coil

HOWARD RADIO CO.

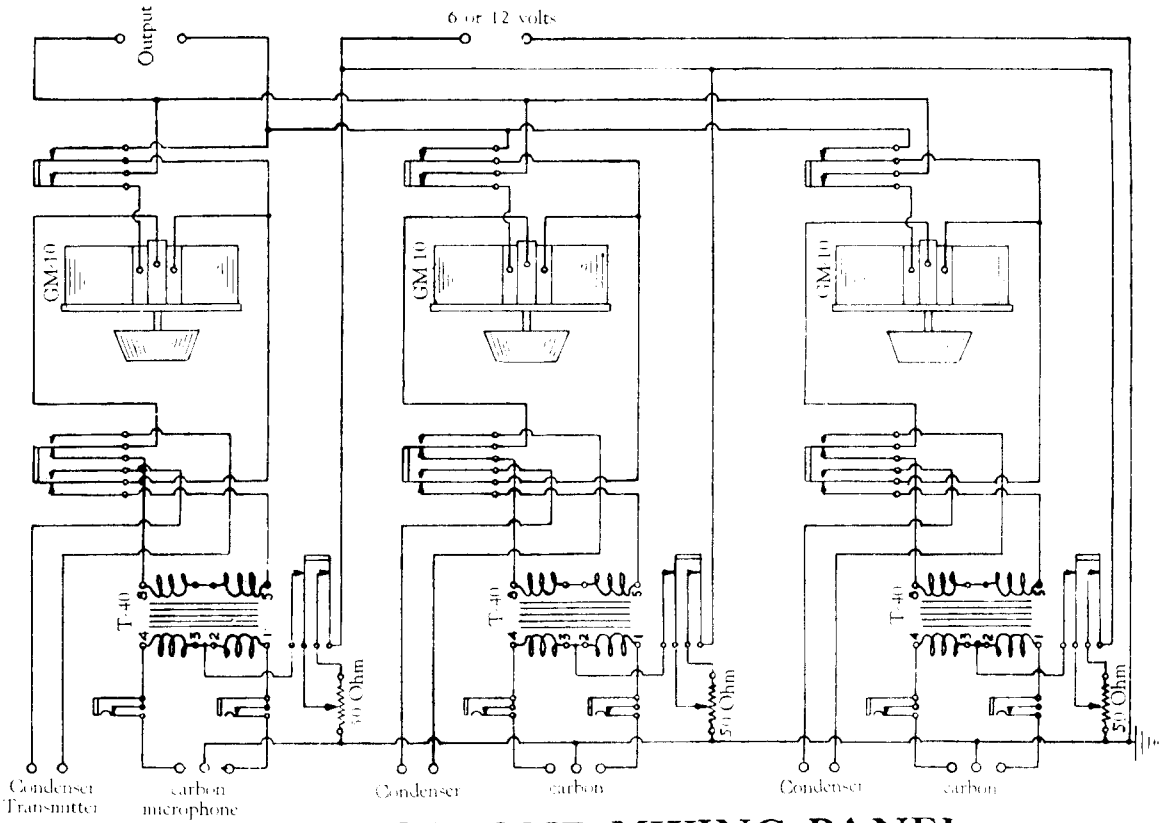
MODEL S.G.-C



No.	Color	Code of Voltage
1	Gray	Audio Grid
2	Gray	Audio Grid
3	Red	B+ 175 Volts
4	Blue	B+ 90 "
5	Yellow	Fila. 2.25 "
6	Yellow	Fila. 2.25 "
7	Black	B- Ground

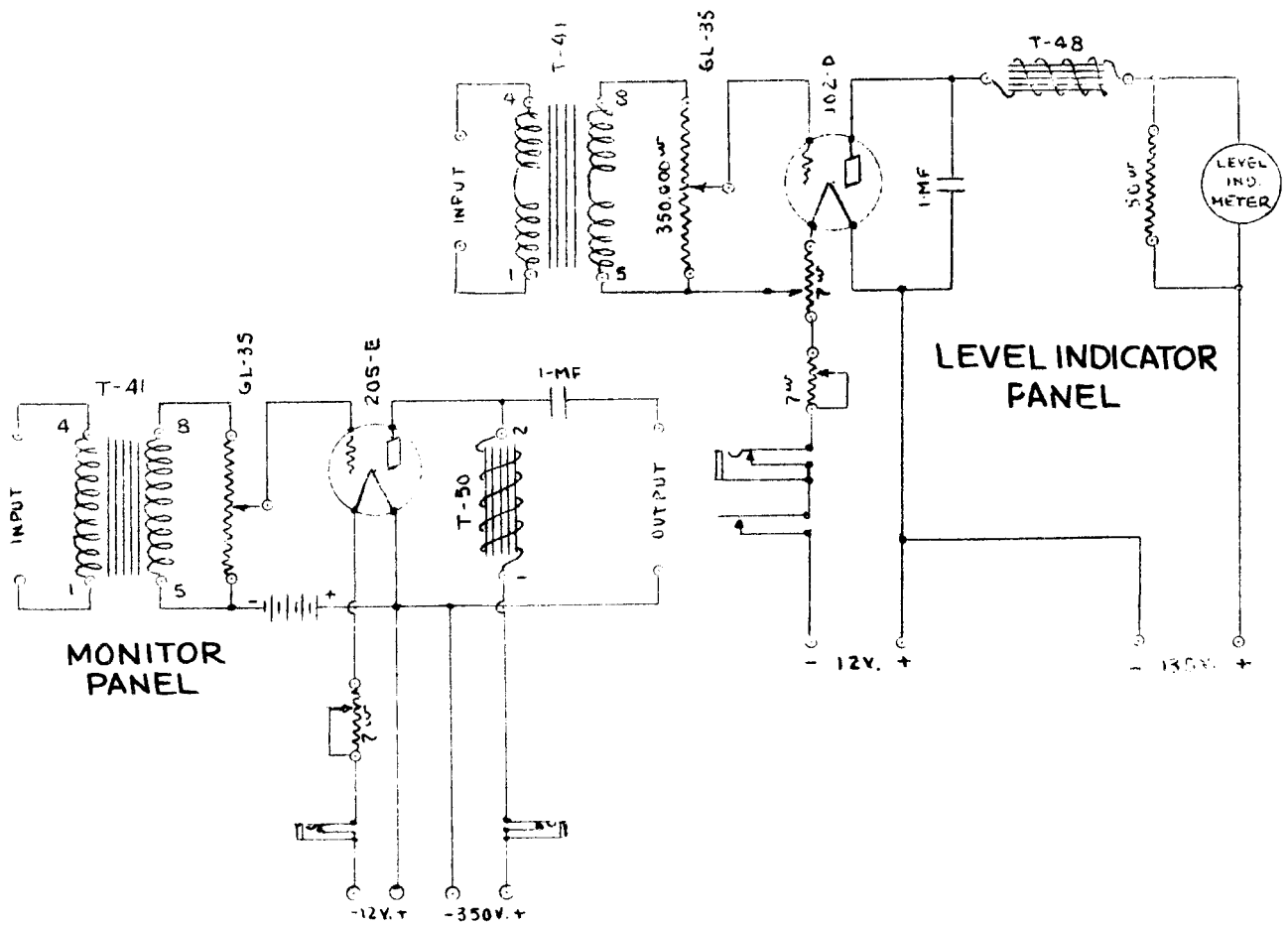


JENKINS AND ADAIR, INC.

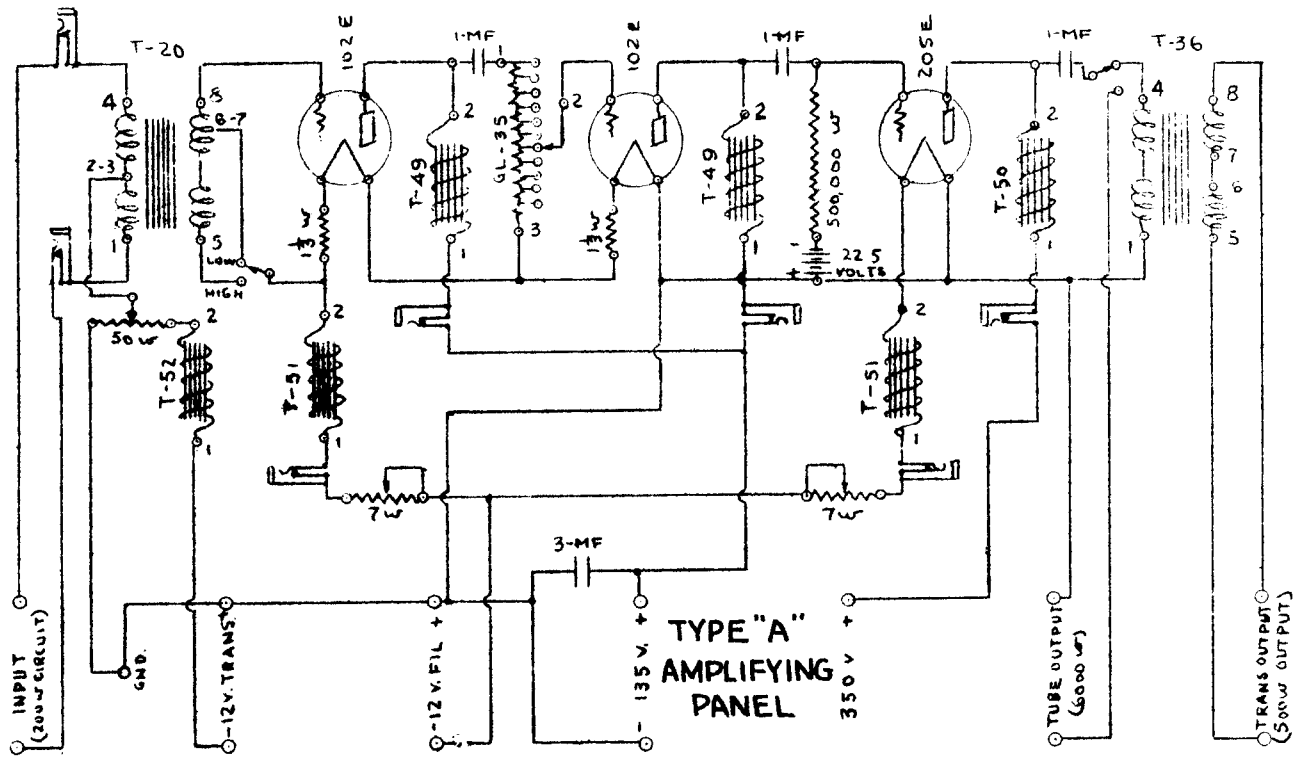


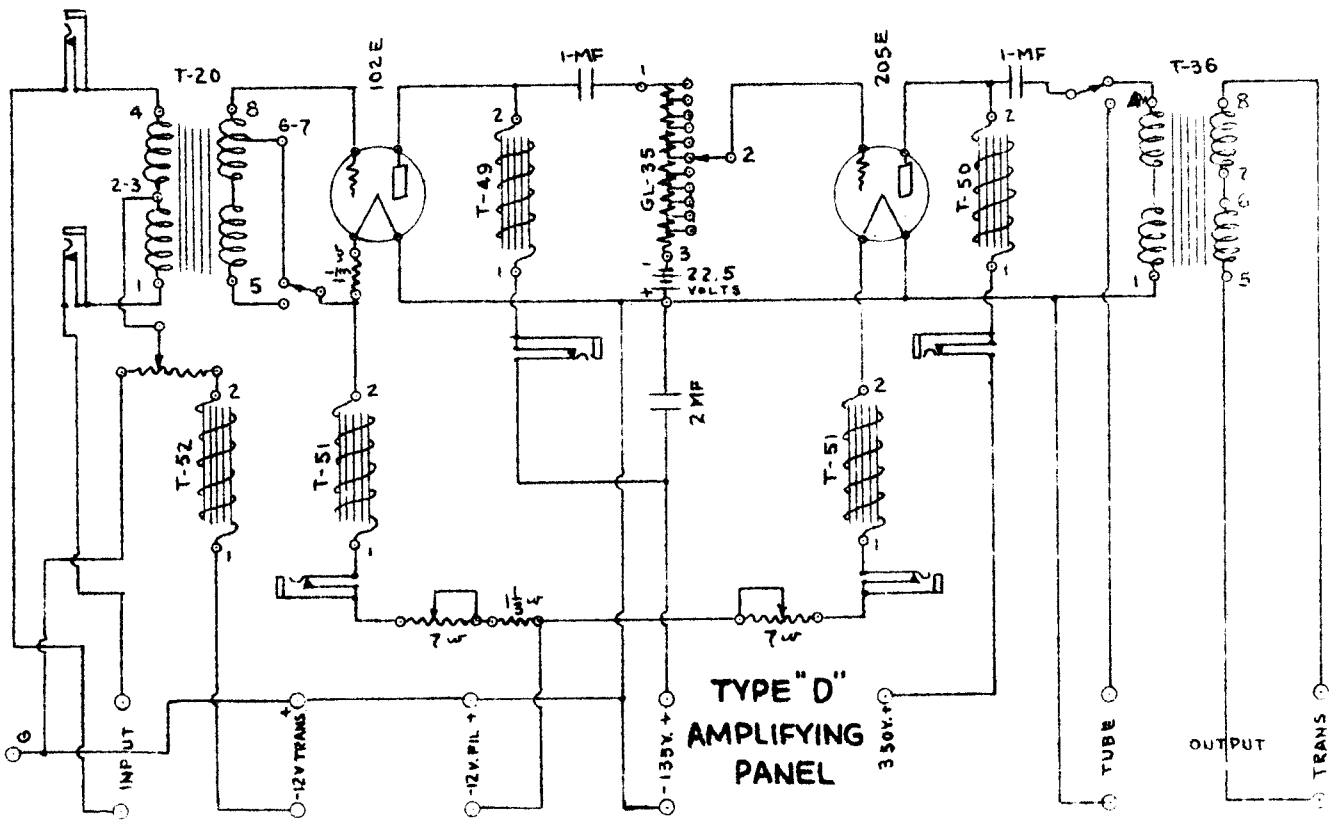
MICROPHONE MIXING PANEL

TYPE 3-B



JENKINS AND ADAIR, INC.





GULBRANSEN COMPANY

CARBON RESISTORS

CODE—Fig. 1	STOCK NO.	RESISTANCE	COLOR*
R2	90953	350 ohms	Orange-green-brown
R3	90954	250,000 ohms	Red-green-yellow
R4	90910	½ to ¾ megohm	Pink
R6	90932	70,000 ohms	White
R7	90931	8,660 ohms	Black and red
R8	90905	15,000 ohms	Brown-green-orange
R9	90958	1,800 ohms	Brown-gray-red
R10	90959	20,000 ohms	Red-black-orange
R11	90934	4,000 ohms	Yellow-black-red
R12	90932	70,000 ohms	White
R14	90959	20,000 ohms	Red-black-orange
R15	90937	12,300 ohms	Brown-red-orange

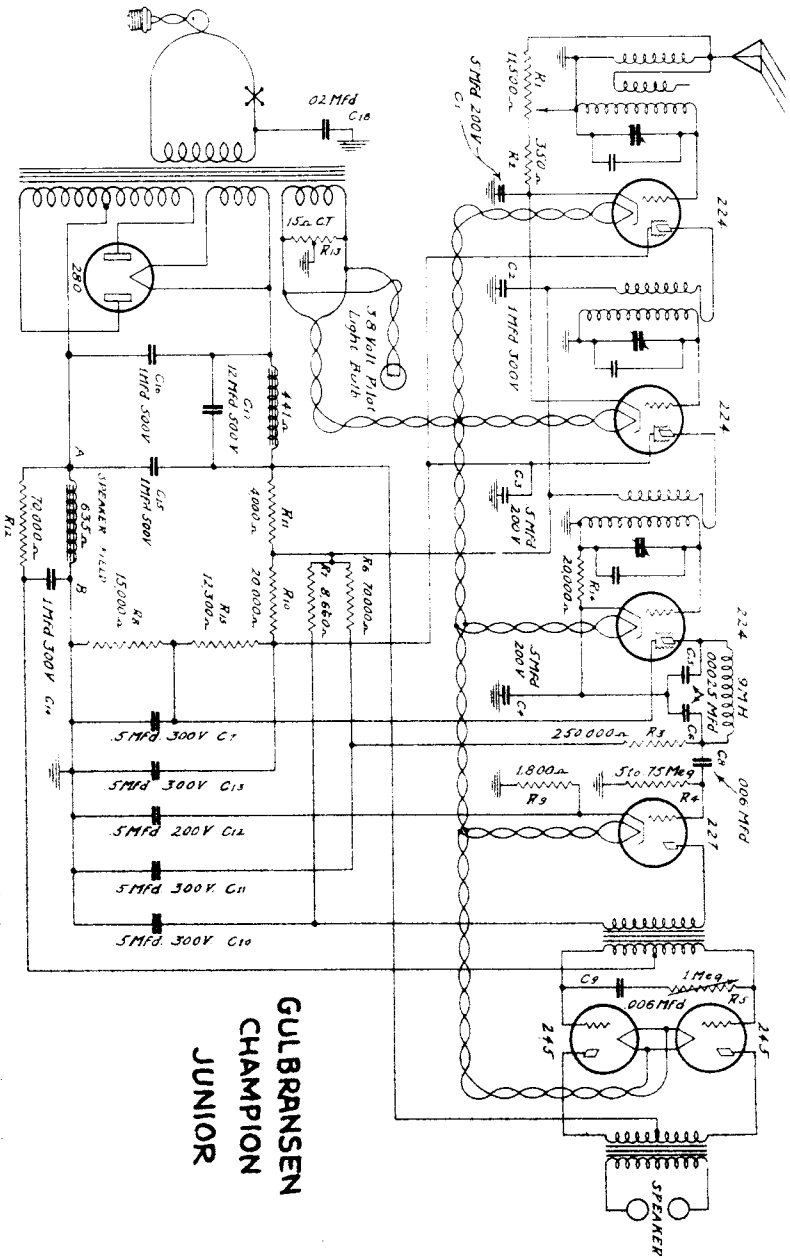
**Where three colors are given, the first color indicates the color of the body of the resistor, the second color indicates the end color, and the third color indicates the color of the dot placed in the middle of the resistor.*

VOLTAGE CHARACTERISTICS

ALL D.C. VOLTAGES TAKEN WITH A 1,000 OHM PER VOLT VOLTMETER
CHECK YOUR LINE VOLTAGE BEFORE TAKING READINGS
VOLUME CONTROL FULL ON

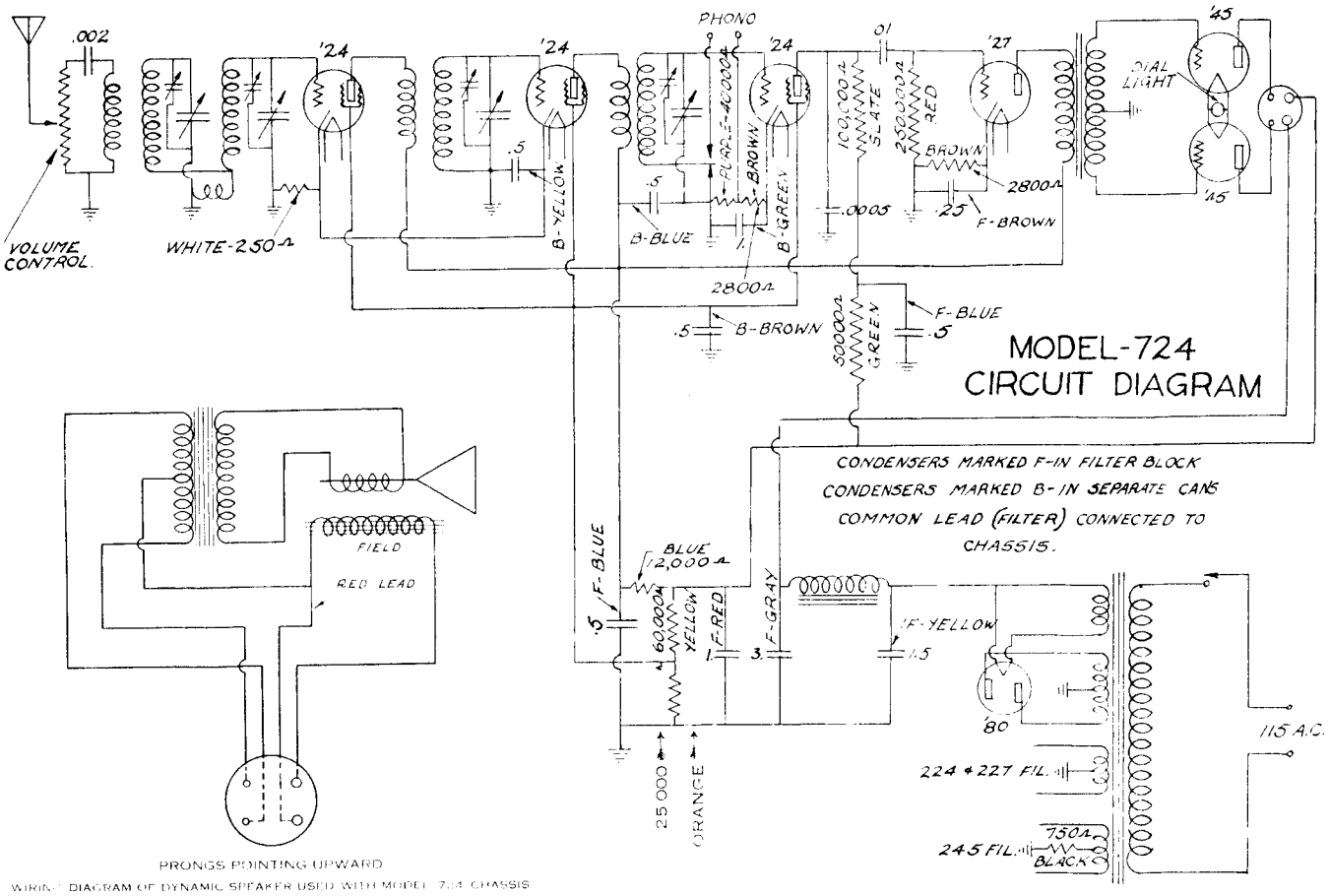
TUBE CIRCUIT UNDER TEST		LINE VOLTAGE 90 V.	100 V.	110 V.	120 V.	130 V.
224 R. F.	Fil.	1.75	1.95	2.17	2.3	2.57
	Plate	130	150	169	183	193
	Screen	68	78	86	94	100
	Cathode*	2.0	2.43	2.83	3.2	3.6
224 Detector	Fil.	1.77	1.97	2.19	2.33	2.6
	Plate	35	40.8	45.5	50.5	55
	Screen	37.5	43	48	52	56.8
	Cathode*	2.55	3.1	3.65	4.2	4.8
227 1st A. F.	Fil.	1.79	1.99	2.22	2.34	2.62
	Plate	95	108	118	122	138
	Cathode	5.7	6.7	7.5	8.4	9.3
245 2nd A. F.	Fil.	1.8	2.0	2.23	2.35	2.62
	Plate	180	210	233	255	280
	Grid	—35	—42.3	—49	—55	—62
280 Rect.	Fil.	3.66	4.1	4.55	4.8	5.35
	Plate Current	54 ma	64 ma	73 ma	82 ma	90 ma

**Control grid voltages on the 224 tubes are measured from cathode to ground.*



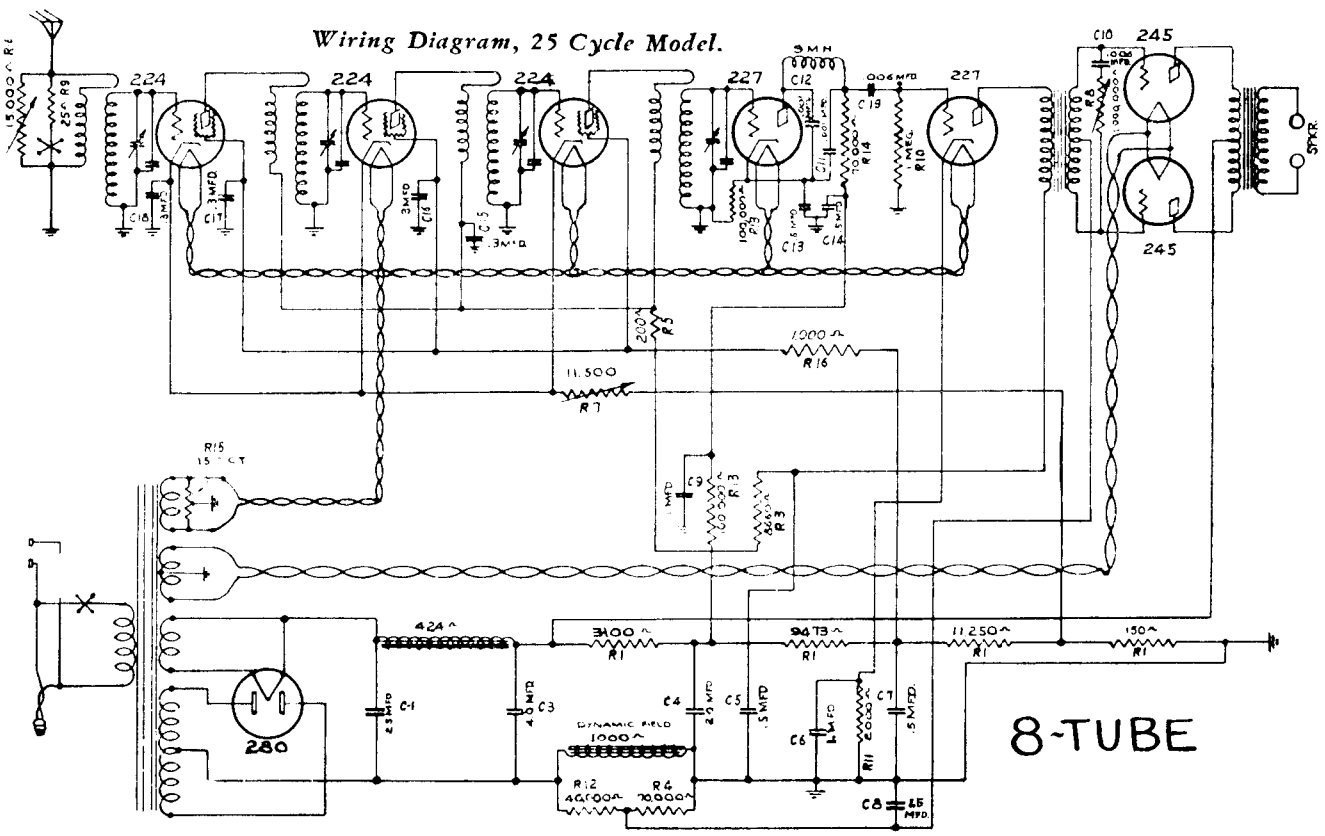
GULBRANSEN CHAMPION JUNIOR

GULBRANSEN COMPANY

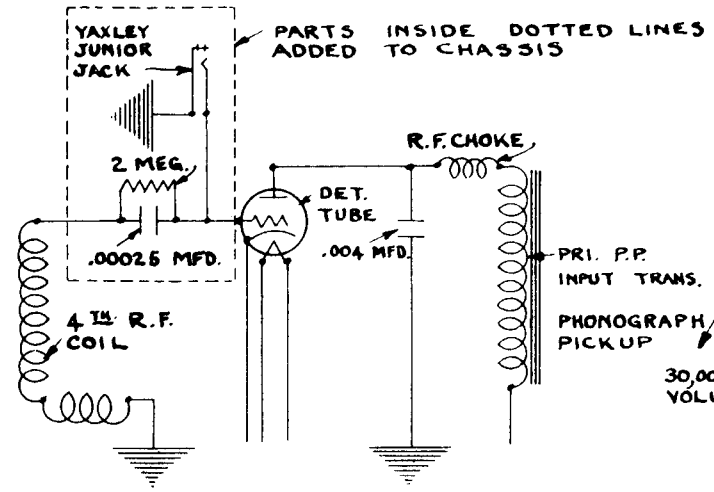


WIRING DIAGRAM OF DYNAMIC SPEAKER USED WITH MODEL 724 CHASSIS

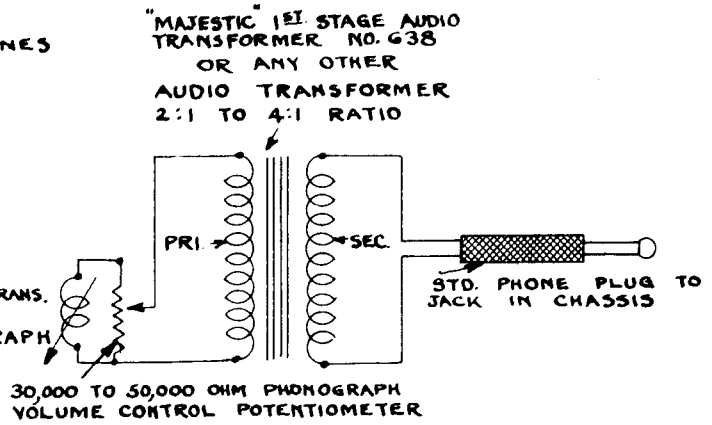
Wiring Diagram, 25 Cycle Model.



GRIGSBY-GRUNOW CO.(MAJESTIC)
MODEL 90



PICKUP JACK CONNECTIONS IN CHASSIS



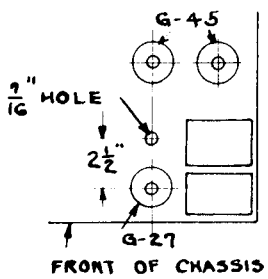
SCHEMATIC DIAGRAM OF PICKUP CONNECTION TO PLUG

PARTS ADDED TO CHASSIS:-
1- YAXLEY JUNIOR JACK - OPEN CIRCUIT TYPE.
1- .00025 MFD. CONDENSER.
1- 2 MEGOHM RESISTOR.

4TH R.F. STAGE MUST BE RE-ALIGNED AFTER THE ADDITION OF ABOVE ITEMS.

WHEN USING THE PHONOGRAPH PICKUP THE RADIO VOLUME CONTROL MUST BE TURNED TO A MINIMUM, OTHERWISE BROADCASTING STATIONS MAY BE HEARD THROUGH THE PHONOGRAPH MUSIC.

WHEN USING RADIO, THE PHONOGRAPH PLUG MUST BE REMOVED FROM JACK.



Method of Adding Phonograph Jack to Model 90

Table of Voltages

The voltage readings given below were taken with the receiver tuned to 550 kilocycles, and the volume control set at maximum. When taking comparative readings on Majestic Model 90 receivers, be certain that receiver is tuned to 550 kilocycles and volume control is set at maximum.

Model 90 Receiver

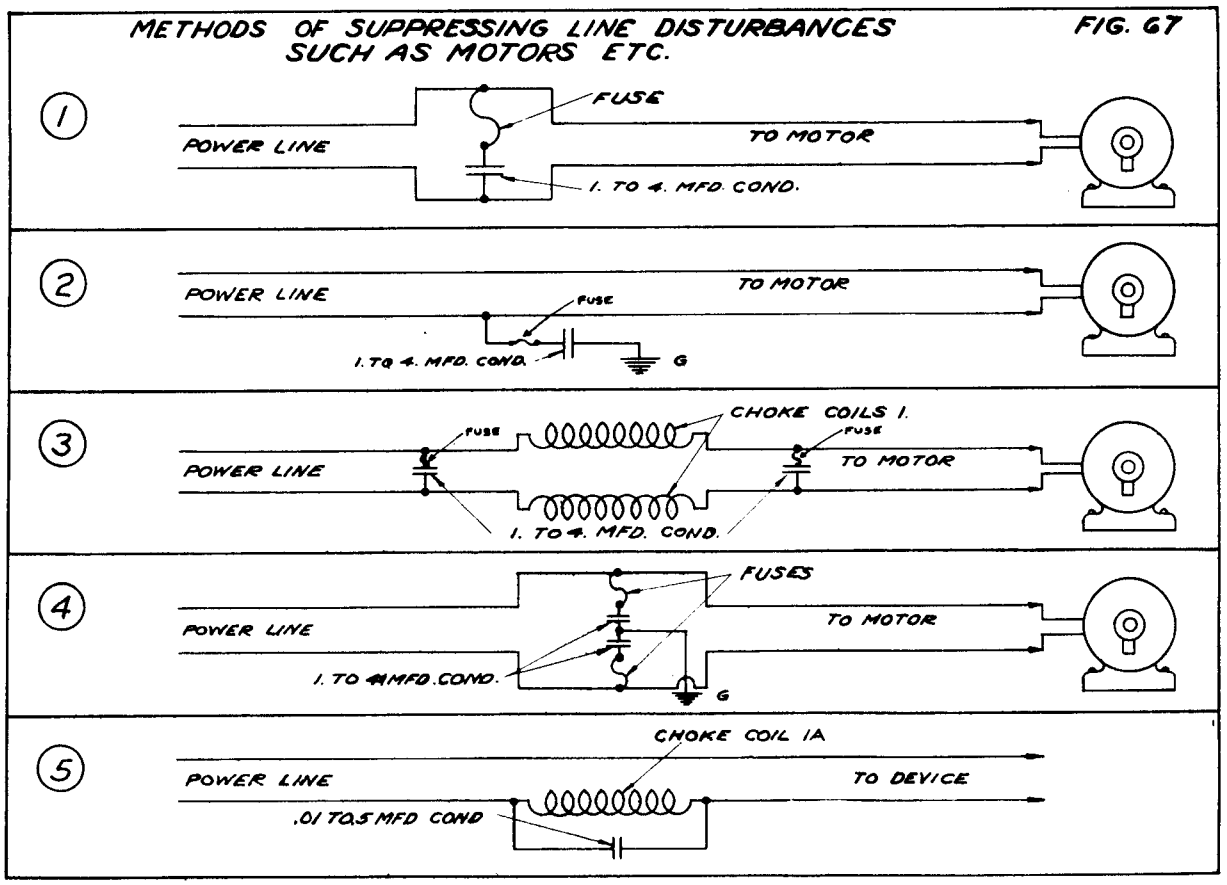
Type of Tube	Position	A Volts	B Volts	C Volts	Cathode Volts	Normal Plate M. A.
G-27	1st R. F.	2.35	130	8	8	5.5
G-27	2nd R. F.	2.35	130	8	8	5.5
G-27	3rd R. F.	2.35	130	8	8	5.5
G-27	4th R. F.	2.35	130	9	9	5.0
G-27	Detector	2.35	270	30	30	1
G-45	Power	2.45	250	50	.....	32
G-45	Power	2.45	250	50	.....	32

Line Voltage 115 A. C.

Variations in voltage readings will occur, due to different line voltage, tubes, etc. The accuracy of the meters used affects, to a great degree, the readings obtained. When using other than accurate meters, a variation of from 5 to 10% from the above readings may be noted.

INTERFERENCE SUPPRESSION.

(SUGGESTED BY GRIGSBY GRUNOW CO.)



Methods of Suppressing Line Disturbances Such as Motors, Etc.

This illustration shows you various methods of eliminating disturbances caused by motors, generators, and other electrical devices.

FIGURE No. 1 Shows power line connected to the motor. Across this 110 volt A C line we place a 1. to 4. MFD condenser. In series with this condenser, a fuse of about 3 amperes must be used.

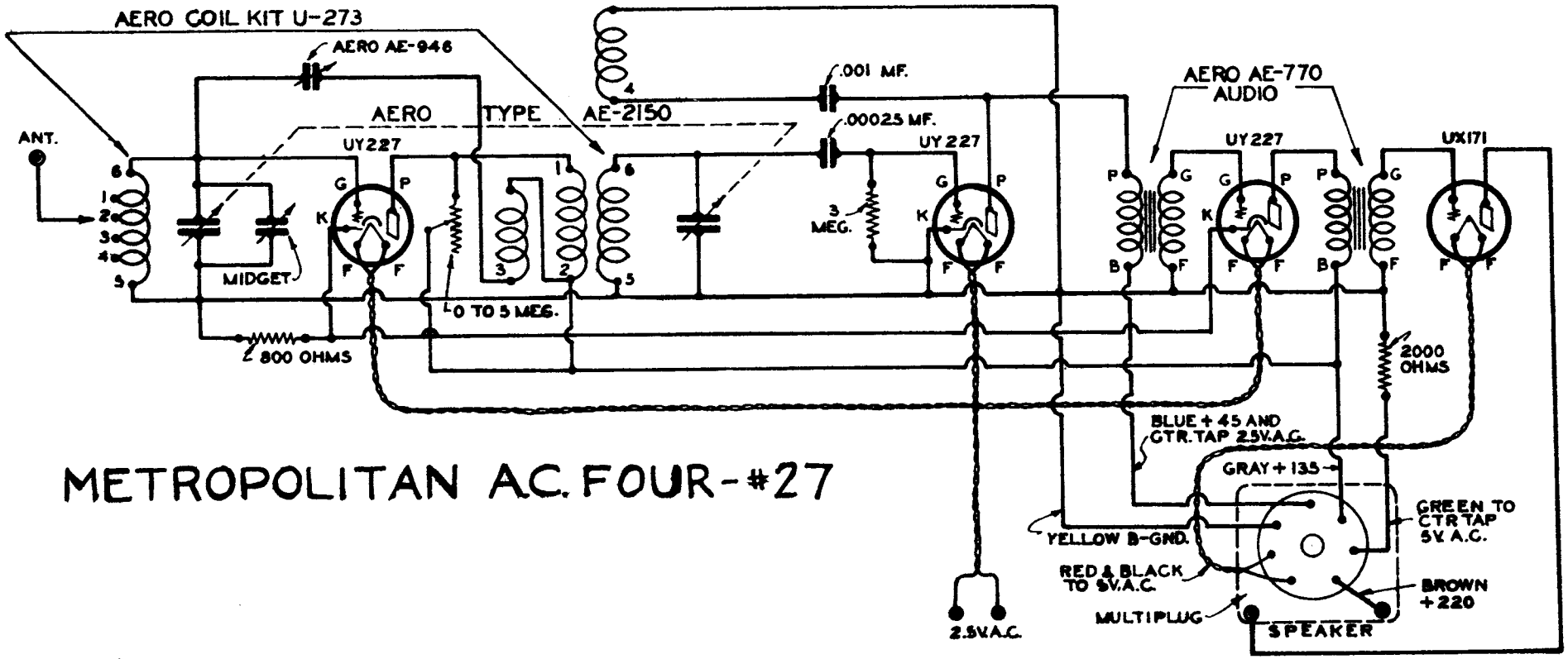
FIGURE No. 2 Shows you how a 1. to 4. MFD condenser is connected to one lead of the line and grounded.

FIGURE No. 3 Shows the application of two 1. to 4. MFD condensers across the line and also the application of one choke coil in each line. Choke coils used in this installation are made by winding approximately 560 turns of No. 18 B & S gauge double cotton covered or enamel wire on to the fibre, bakelite, or treated wooden spool having a core diameter of ⅜" and outside diameter of 1½" and winding space of two inches wide. This type choke is for a load of 5 amperes or less.

FIGURE No. 4 Shows method of connecting two 1. to 4. MFD condensers in series across the A C line. In series with these condensers you will note a fuse of 3 amperes, the connection between the two condensers should be grounded.

FIGURE No. 5 Shows method of connecting a choke coil and condenser in parallel, in one side of the line. The condenser in this case should be .1 to .5 MFD capacity. Choke coil is to be used made by winding 150 turns of No. 18 DCC magnet wire on a fibre or bakelite tube 3" in diameter and approximately 3" long. Only one layer of wire is wound on it.

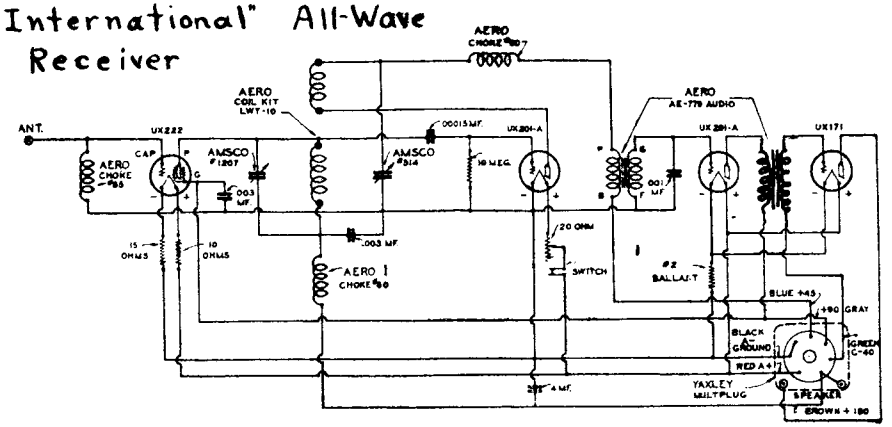
The arrangement shown in Figure No. 5 can be used for eliminating the line disturbances of various electrical devices. This method has been found advisable where it has not been possible to clear interference in any other way. The idea is to tune the interference to a frequency which does not fall within the receiving band.



METROPOLITAN A.C. FOUR-#27

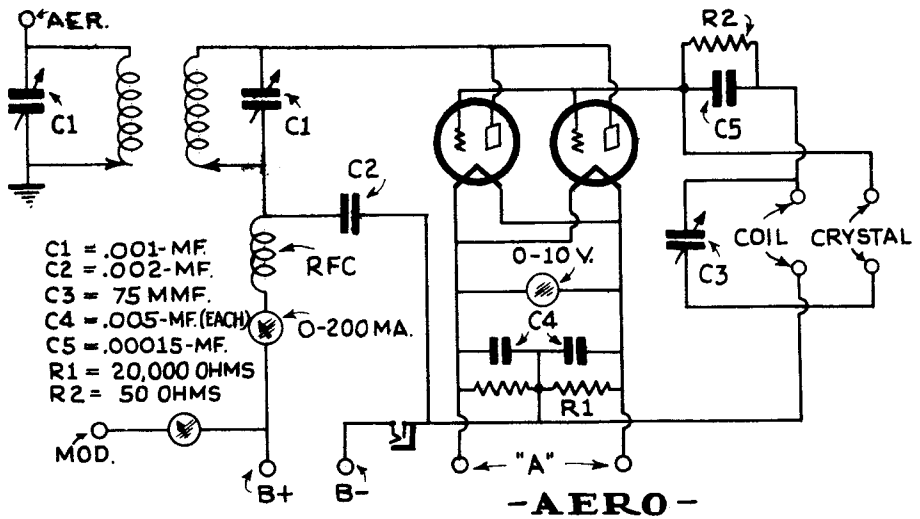
CHAS. HOODWIN (AERO)

"International" All-Wave Receiver



LIST OF PARTS

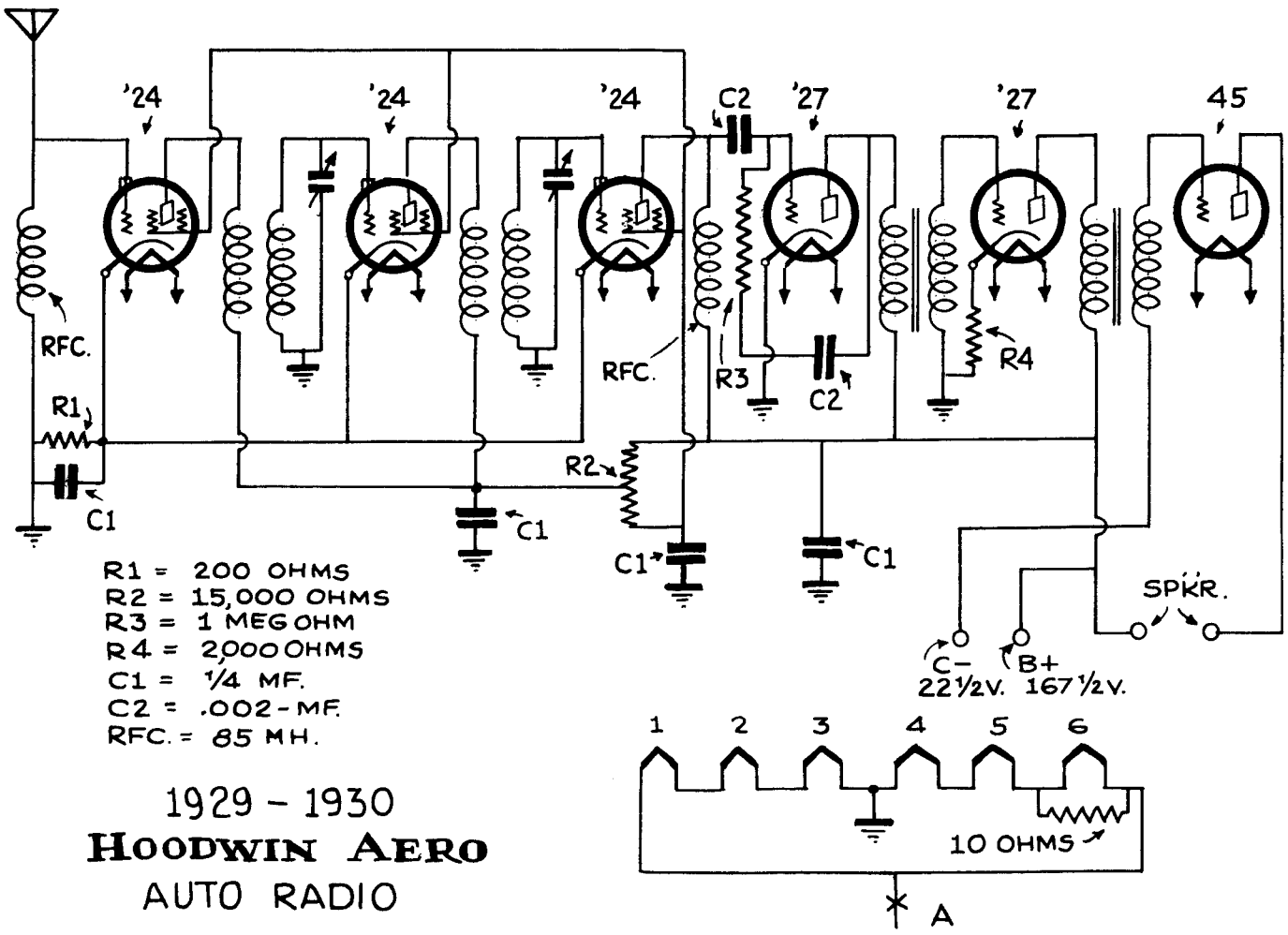
1—Aero Base Unit No. 8. 1—Aero Coil Kit LWT -10. 2—Aero C-60 R. F. Chokes. 1—Aero C-65 R. F. Choke. 2—Aero AE-770 Audio Frequency Transformers. 1—Aero Special Amsco Condenser. .00014. 1—Amsco S. L. 1. .00025 Condenser. 1—Aerovox Mica Condenser .00015. 1—Aerovox Mica Condenser .001. 2—Aerovox Mica Condenser .003. 1—No. 520 Yaxley Rheostat, 20 Ohm. 1—No. 500 Yaxley Rheostat Switch. 1—No. 669 Yaxley Cable Connector. 1—10 Ohm Yaxley Resistance. 1—15 Ohm Yaxley Resistance. 1—Daven No. 2 Ballast without mounting. 1—Type E. National Dial. 1—Carter Shield Grid Connector No. 342. 1—Eby Binding Post. 1—Bradley 10 Megohm Grid Leak.



-AERO-

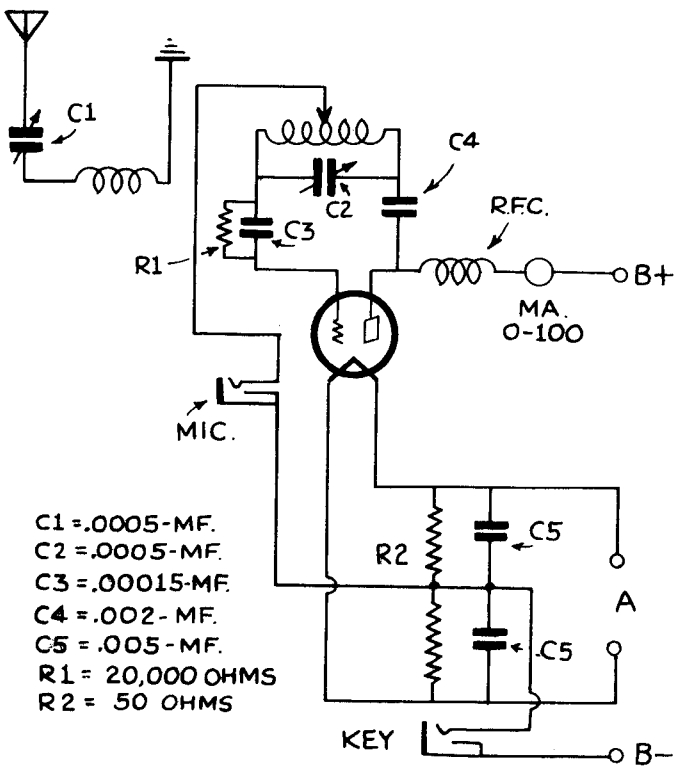
15-30 WATT TRANSMITTER

CHAS. HOODWIN (AERO)



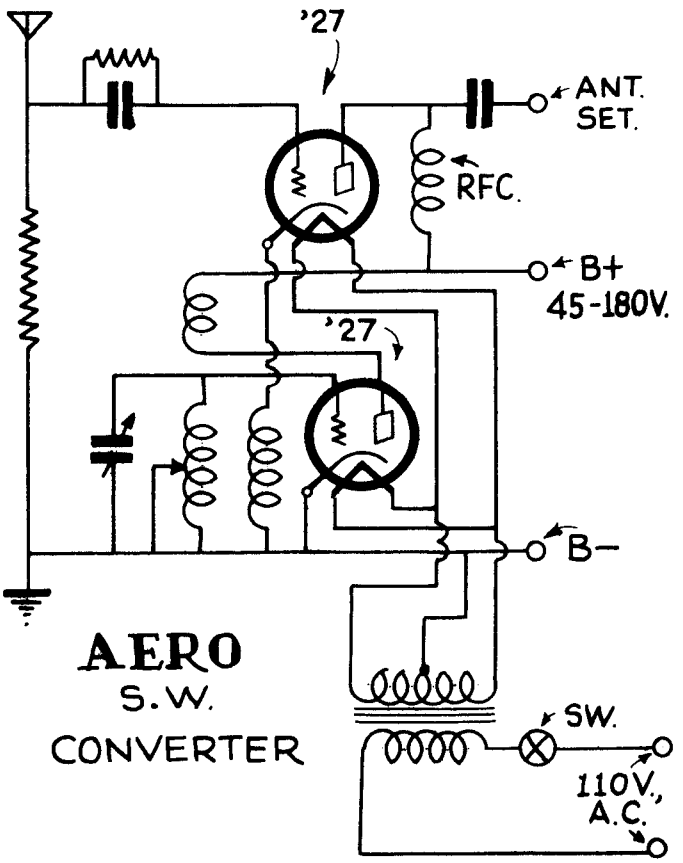
R1 = 200 OHMS
R2 = 15,000 OHMS
R3 = 1 MEGOHM
R4 = 2,000 OHMS
C1 = ¼ MF.
C2 = .002-MF.
RFC. = 85 MH.

1929 - 1930
HOODWIN AERO
AUTO RADIO



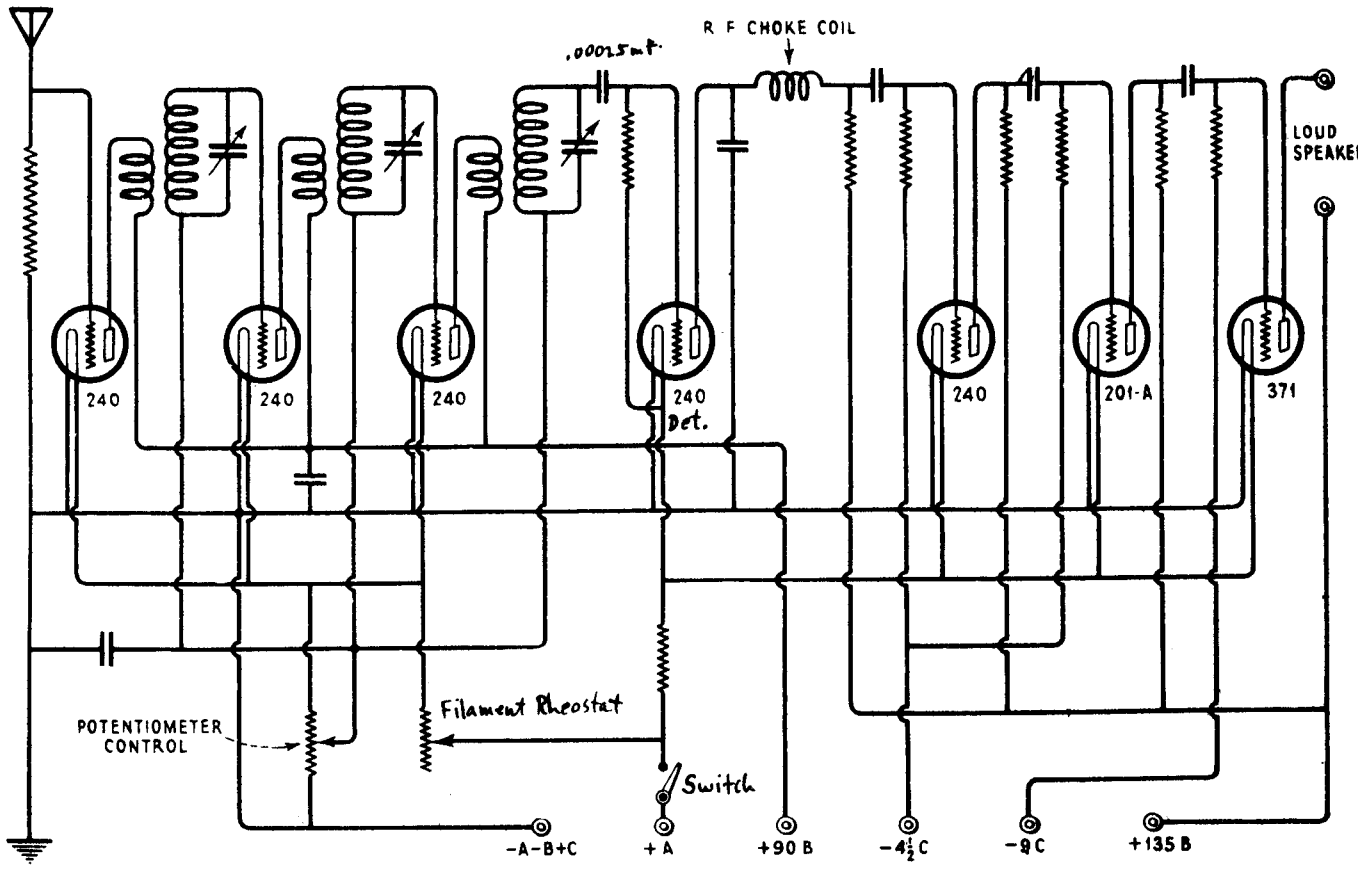
C1 = .0005-MF.
C2 = .0005-MF.
C3 = .00015-MF.
C4 = .002-MF.
C5 = .005-MF.
R1 = 20,000 OHMS
R2 = 50 OHMS

AERO Lo-Power
TRANSMITTER
1931

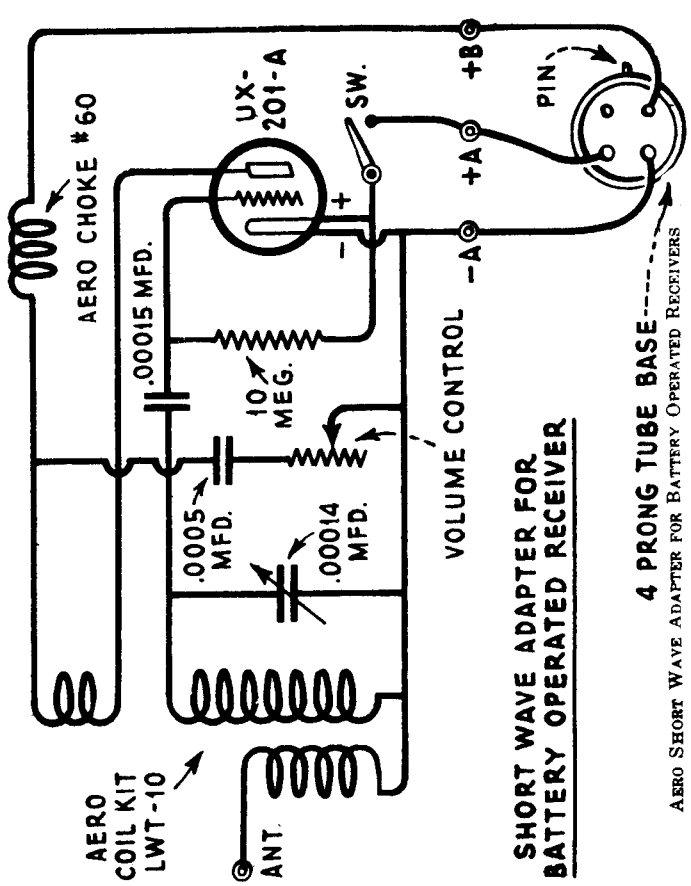


AERO
S.W.
CONVERTER

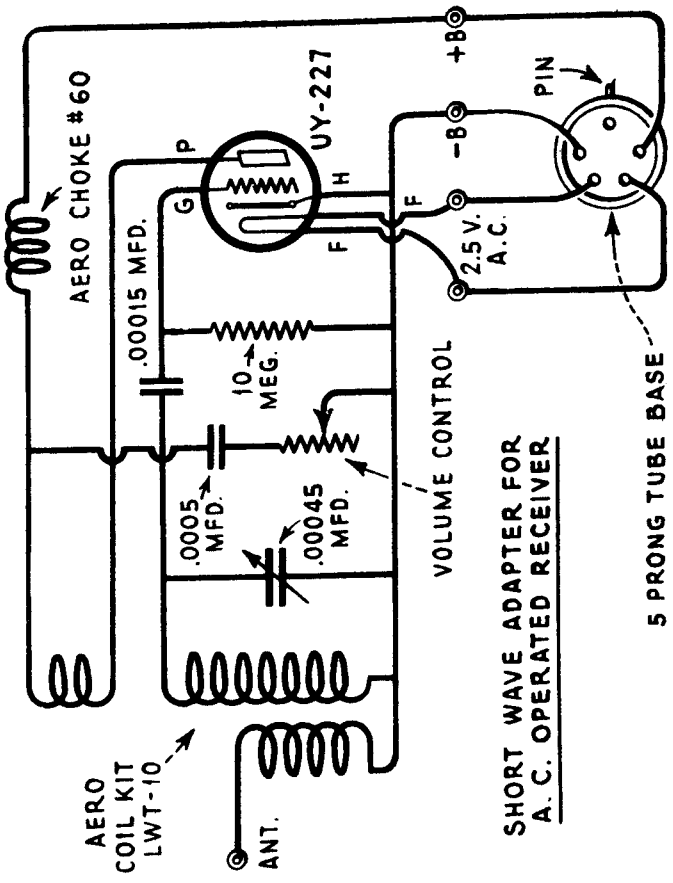
CHARLES HOODWIN CO. (AERO)



AERO SEVEN

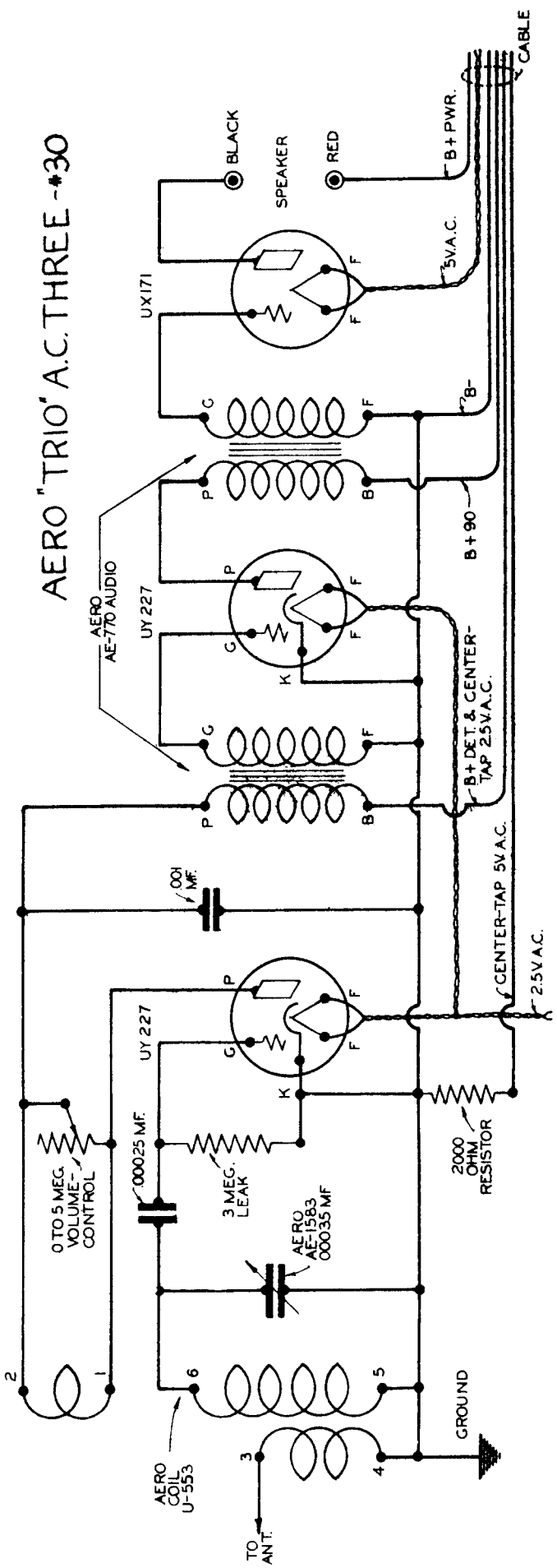


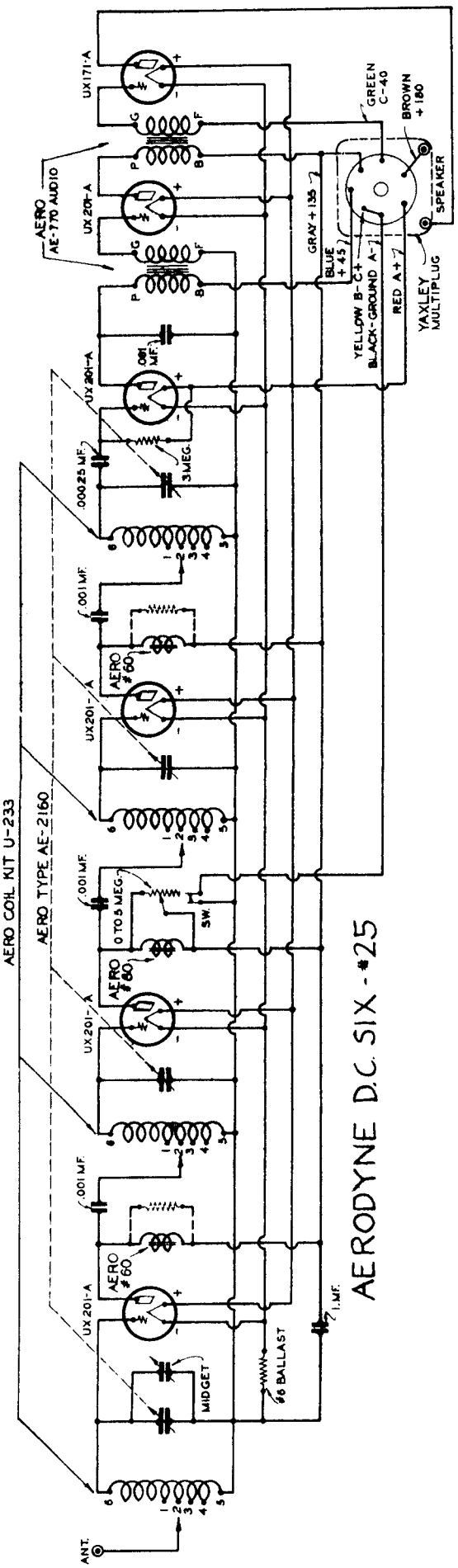
AERO SHORT WAVE ADAPTER FOR BATTERY OPERATED RECEIVERS



AERO SHORT WAVE ADAPTER FOR A.C. RECEIVERS

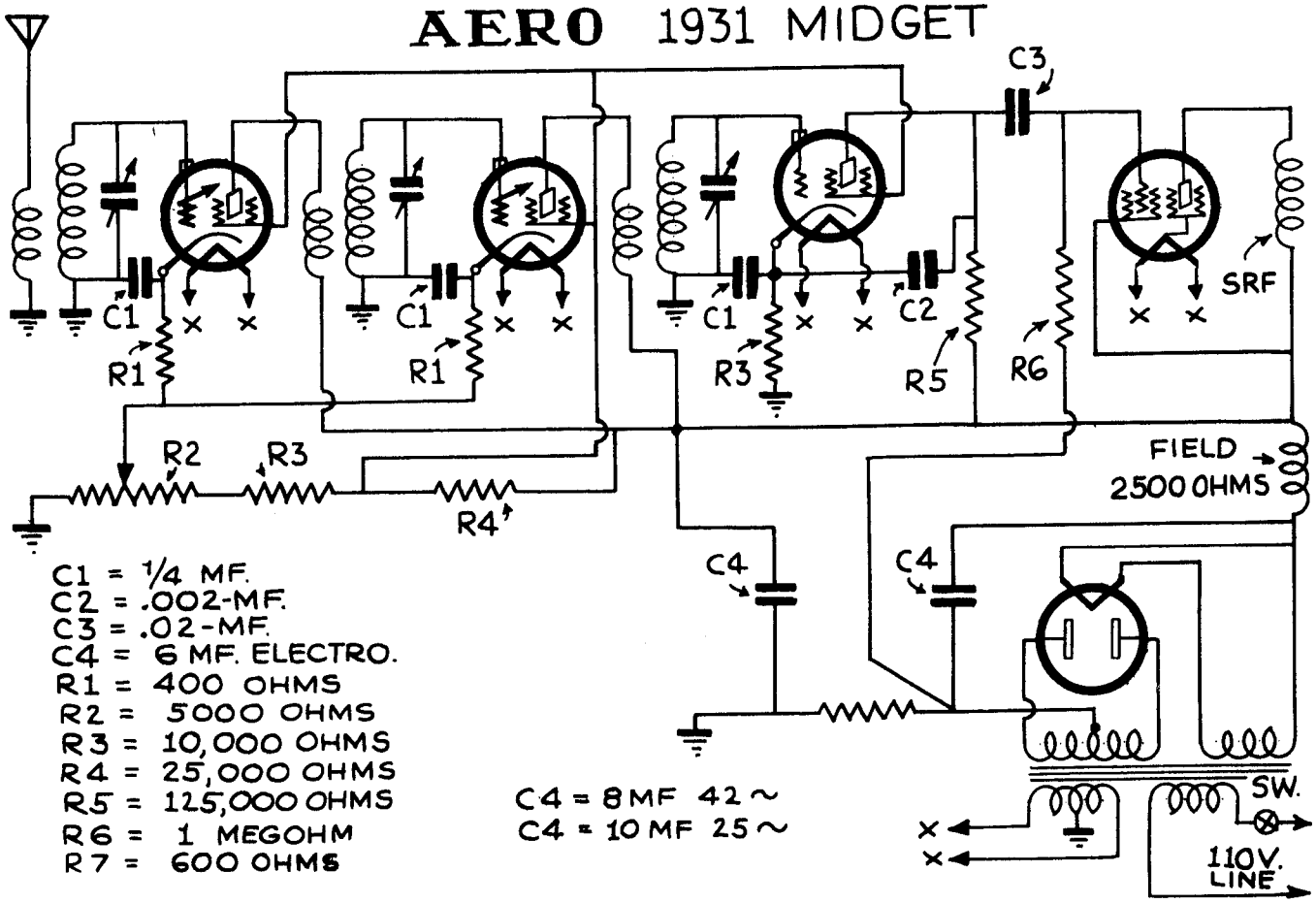
CHARLES HOODWIN CO. (AERO)





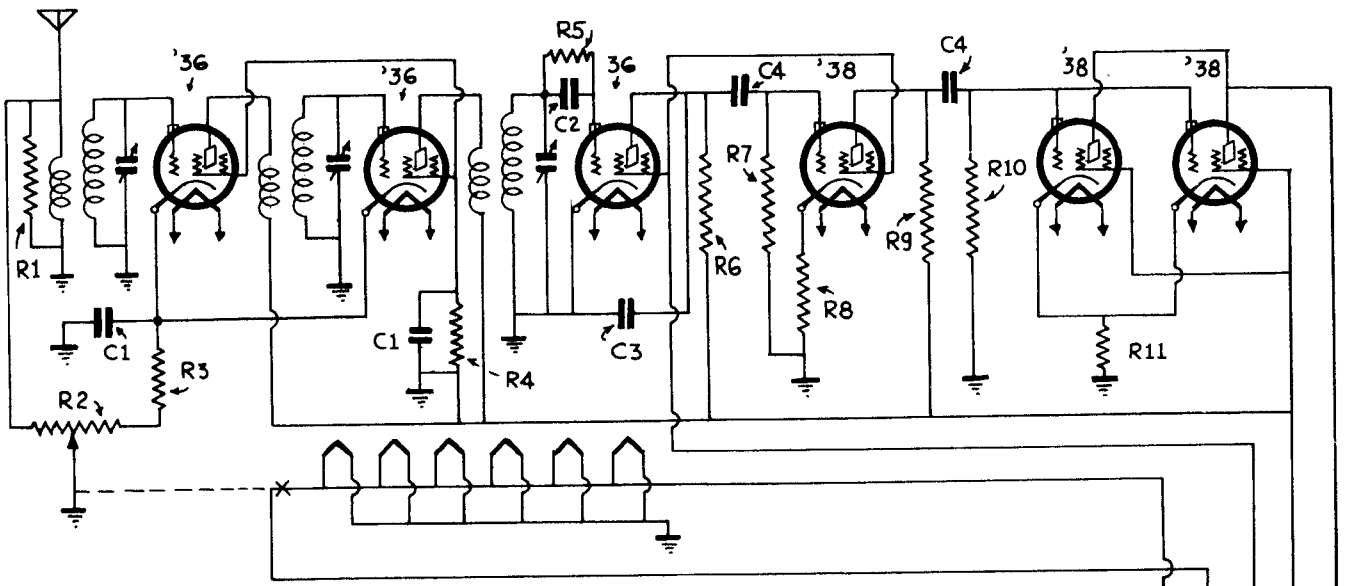
CHAS. HOODWIN CO. (AERO)

AERO 1931 MIDGET



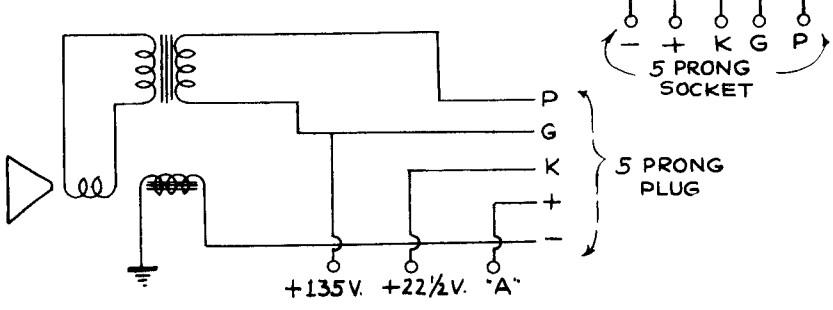
C1 = 1/4 MF.
C2 = .002-MF.
C3 = .02-MF.
C4 = 6 MF. ELECTRO.
R1 = 400 OHMS
R2 = 5000 OHMS
R3 = 10,000 OHMS
R4 = 25,000 OHMS
R5 = 125,000 OHMS
R6 = 1 MEGOHM
R7 = 600 OHMS

C4 = 8 MF 42 ~
C4 = 10 MF 25 ~



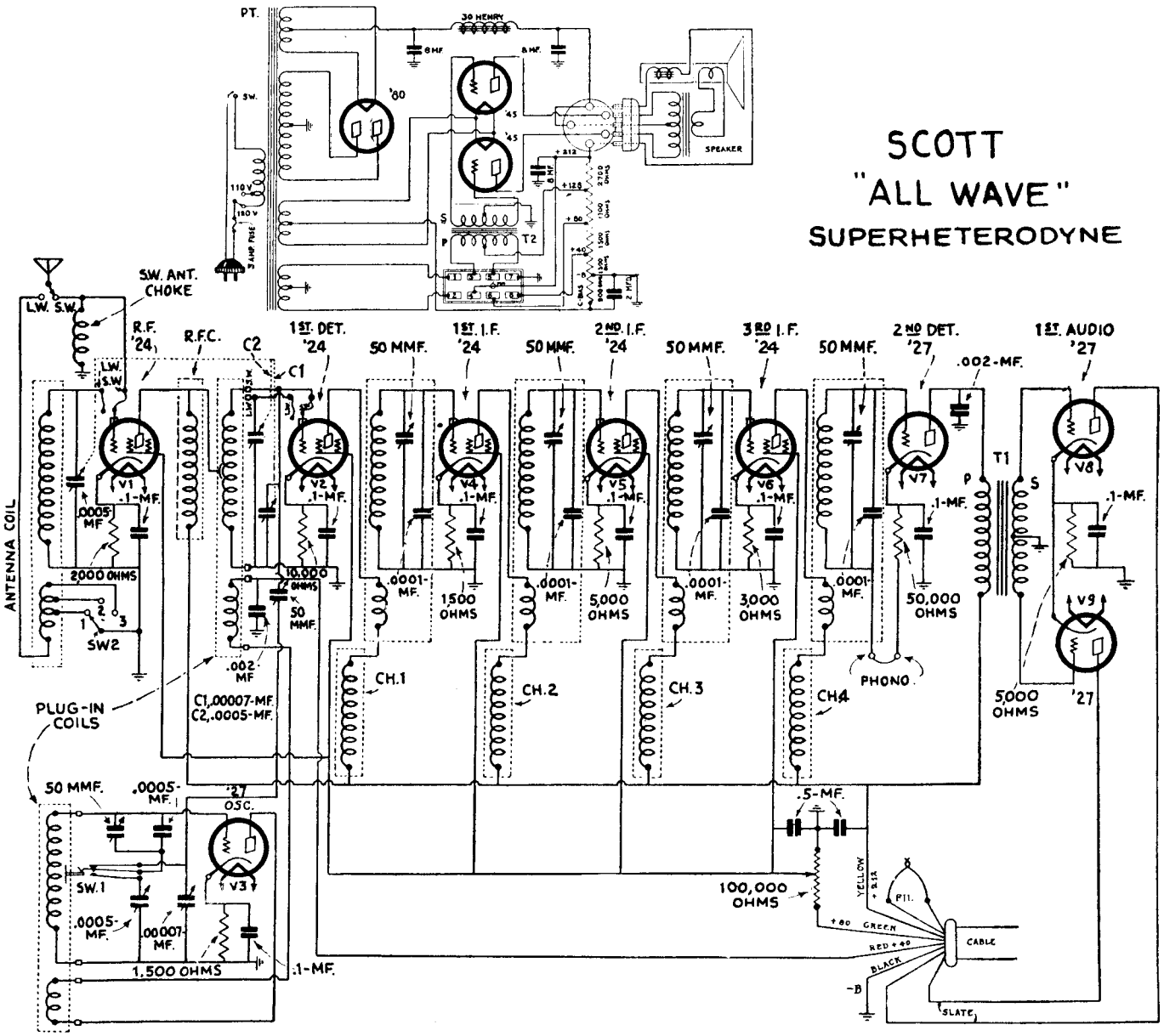
R1 = 10,000 OHMS
R2 = 30,000 OHMS
R3 = 200 OHMS
R4 = 25,000 OHMS
R5 = 1. MEGOHM
R6 = 1/4 MEGOHM
R7 = 1. MEGOHM
R8 = 2000 OHMS
R9 = 1/4 MEGOHM
R10 = 1. MEGOHM
R11 = 1000 OHMS

C1 = 1/4 MF
C2 = .00025-MF.
C3 = .002-MF.
C4 = .02-MF.
C5 = .02-MF.



AERO 1931 AUTO RADIO

SCOTT "ALL WAVE" SUPERHETERODYNE



Schematic circuit of the receiver chassis of the Scott "All-Wave" superheterodyne. The long-wave antenna post is at the rear of the chassis; and the short-wave post on the shield over the tuning gang. The output feeds a push-pull '45 pack (Fig. 2); a push-pull '50 unit is also obtainable.

ATWATER-KENT MFG. CO

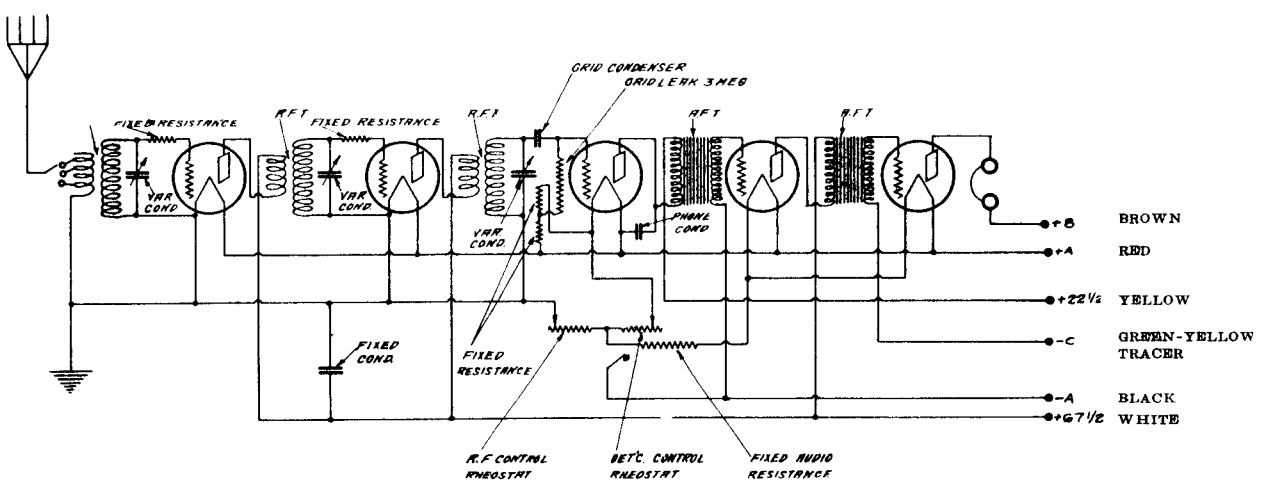
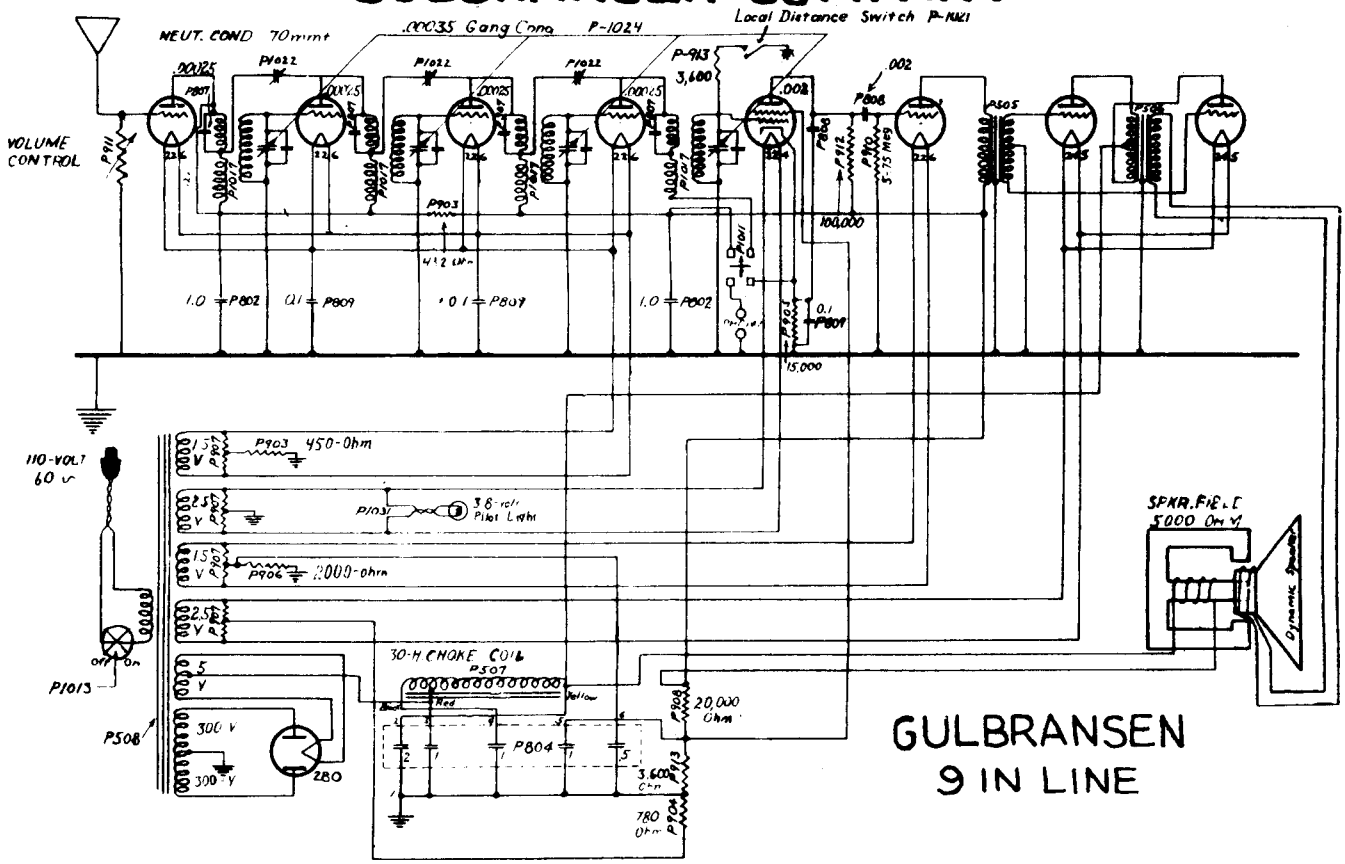
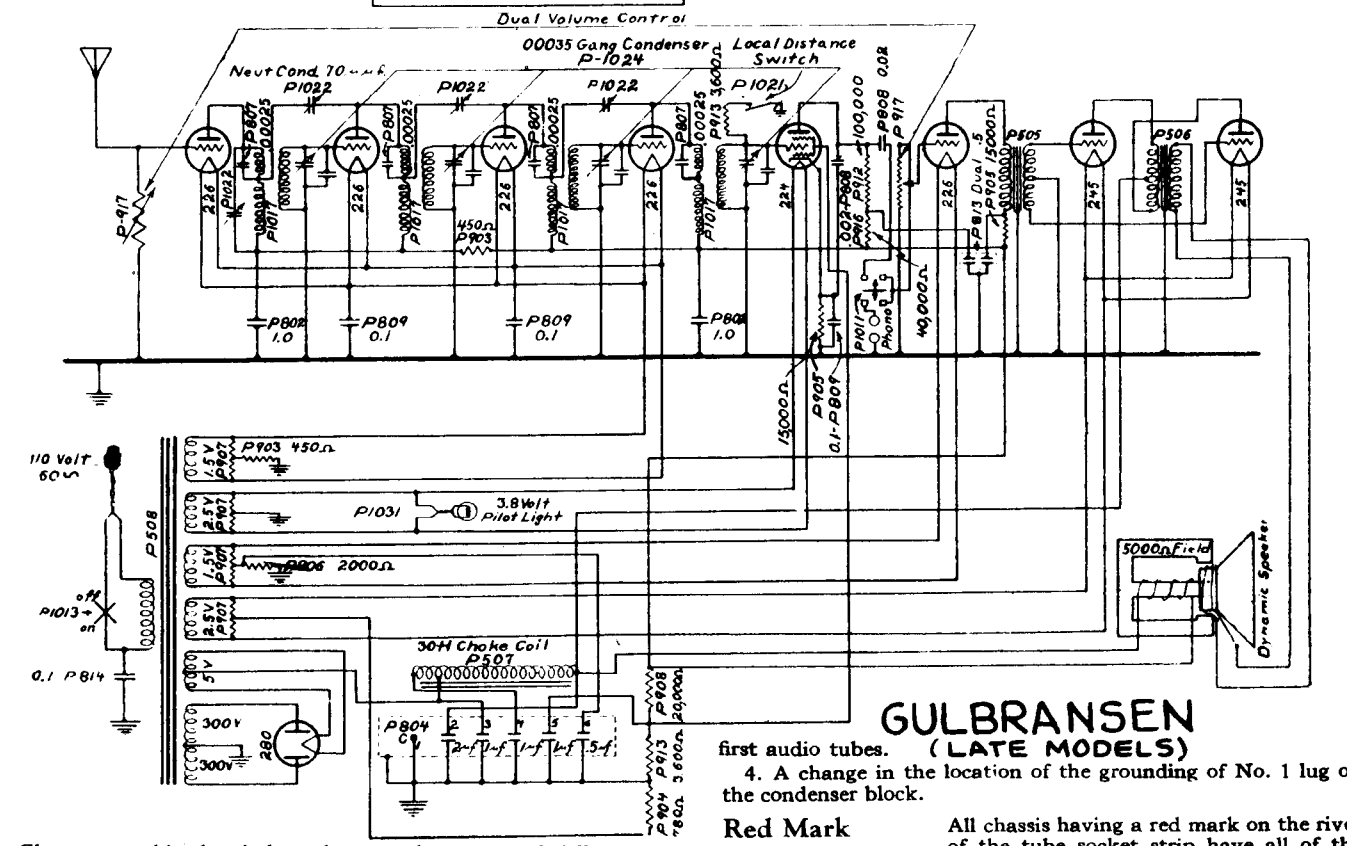


DIAGRAM OF MODEL 20 COMPACT NO. 7960.

GULBRANSEN COMPANY





Changes on this chassis have been made on several different occasions and to distinguish how one chassis differs from another, an identification mark is placed on each one changed. This identification mark is a dot of paint found on the end rivet of the tube socket strip.

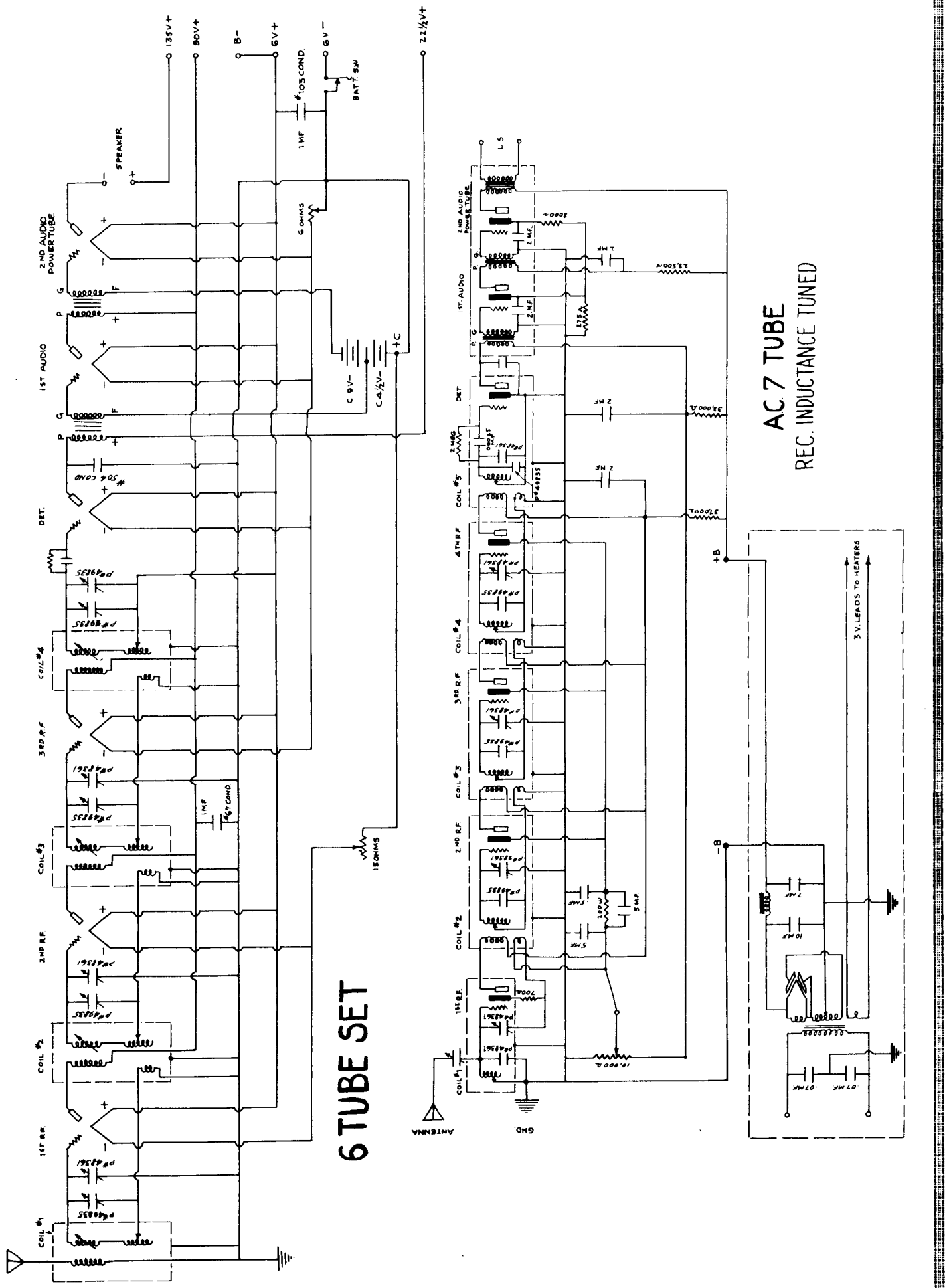
Yellow Mark The chassis having the first changes may be identified by the yellow indicating mark. This involves four changes.

1. A "dual volume control" in place of the single type.
2. An interchange of position of the two audio transformers.
3. An addition of a "dual half microfarad condenser" (P. 813) and two carbon resistors in the "B" circuit of the detector and first audio tubes.
4. A change in the location of the grounding of No. 1 lug on the condenser block.

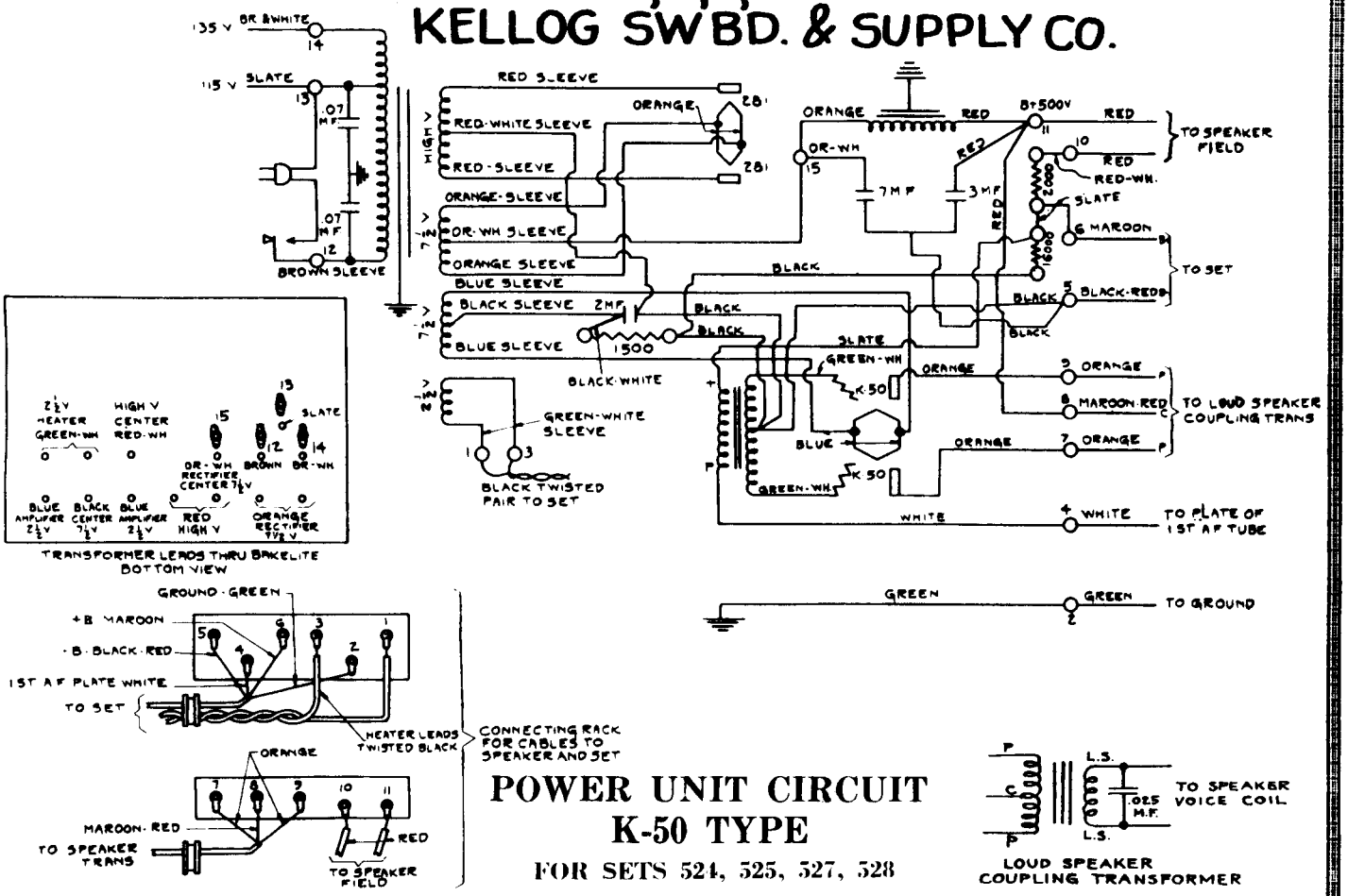
Red Mark (Serial Number 39,000-42,999) All chassis having a red mark on the rivet of the tube socket strip have all of the changes mentioned above and in addition, have a one-tenth microfarad condenser (P. 814) connected from ground to one side of the 110 volt line

Green Mark (Serial Number 43,000 and up) All Chassis with a green mark on the rivet of the tube socket strip contain the above changes and in addition have a change in the "combination phonograph switch" circuit. This changed circuit makes use of only the audio system of the set for phonograph reproduction. whereas the original circuit included the detector tube

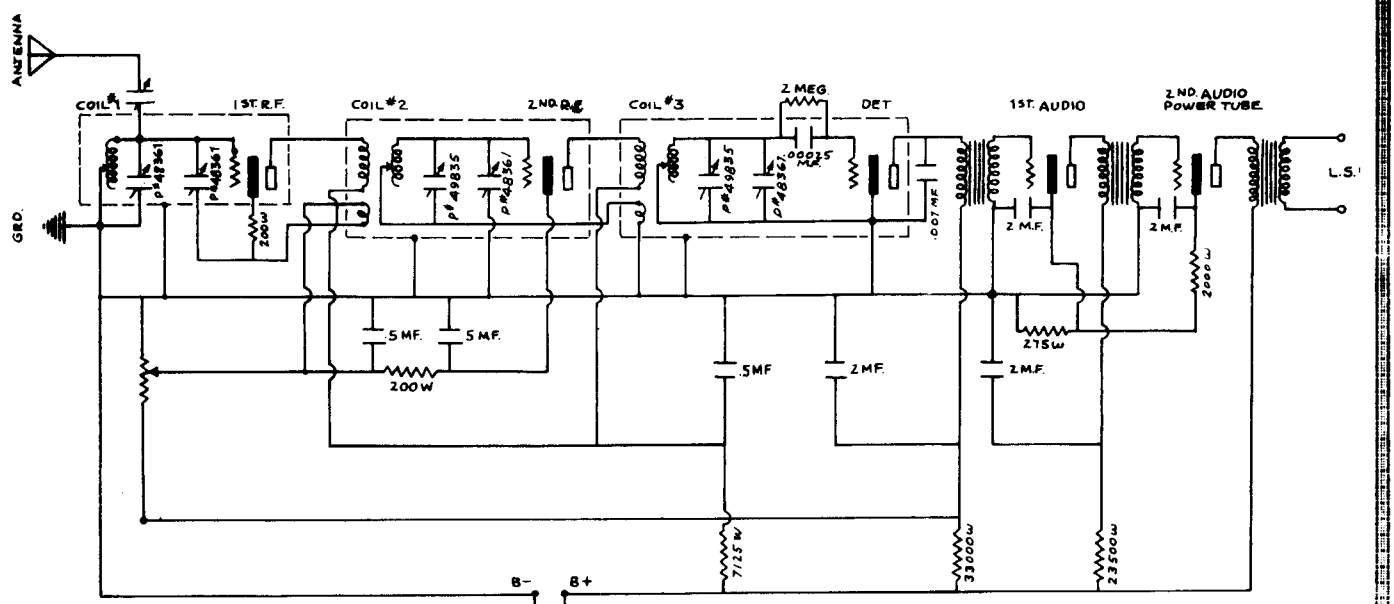
KELLOG S'W'B'D. & SUPPLY CO.

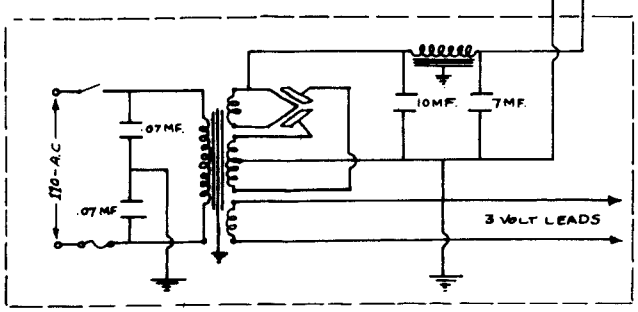


KELLOG SW'BD. & SUPPLY CO.



POWER UNIT CIRCUIT
K-50 TYPE
FOR SETS 524, 525, 527, 528





CHASSIS "B"

Radio Service Data Sheet

KELLOGG 523 AND 526

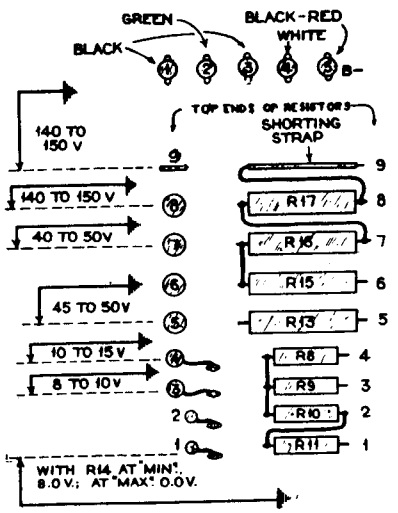
These two models differ only in the power supply to which they are adapted: their R.F. chasses are identical. The "523" is designed for standard 60-cycle alternating current; the "526" for operation on a lower frequency—25 cycles up—and is recommended for even 50-cycle supply. The receiver proper has three stages of '24-type screen-grid amplification, with '27-type detector and first audio; and employs a '27 type tube in a special circuit as an automatic volume control, described later. The push-pull '45-type power stage and power supply is a separate unit, different in the two models. This unit is accompanied by a dynamic reproducer, built into the console; its field-coil resistance is 2000 ohms.

The complete circuits are shown in schematic diagram below: the values of the parts shown are as follows:

Resistors: R1, the manual volume control (operated by lower right-hand knob) 50,000 ohms; R2, R4, R6, each 2 megohms; R3, R5, R7, R15, R18, R19, each 1000 ohms; R8, 10,000 ohms; R9, 2,000 ohms; R10, 100,000 ohms; R11, 50,000 ohms; R12, 500 ohms; R13, 130 ohms; R14, 200 ohms; R16, 1,500 ohms; R17, 3,000 ohms; R21, 30 ohms center-tapped; R22, 750 ohms. Capacities are as follows: C2, C4, C6, each .0005-mf.; C8, .001-mf.; C9, C11, C12, C13, C15, C16, C17, C19, C20, each 0.3-mf.; C10, C14, C18, C23, each 0.5-mf.; C21, C22, C25, C27, (high-voltage), C28, each 2.0-mf.; C26 (high-voltage), 5.0-mf.; C24, .0005-mf.; C29, C30, each .07-mf.; C31, .025-mf. R20 has a value of 3,300 ohms, with a '45 tube; and the "Strap" illustrated replaces a resistor used with '50 amplifiers.

The plate circuit of V3 is coupled through C24 to the grid circuit of V6, the automatic volume-control tube, which automatically governs the amplification of V1 and V2 by changing the grid bias of these tubes; and thus maintains a constant R.F. voltage output. R14, adjusted by the knob at lower left, is the manual control for correct regulation of this tube; at its extreme setting, in a counter-clockwise direction, the magnetic pick-up is connected to the A.F. amplifier binding posts, while the detector is disconnected by Sw1.

V6 is located in the round shield can and may require replacing. To check the operation of this tube, turn the automatic volume control on full and remove the tube. The volume should remain approximately the same. Now replace the tube and (after it has again become sufficiently heated) change the volume control setting to low volume. If the tube should now be removed, the volume will be restored to approximately the same level as with the volume control turned on full. If the volume increases during the first test, the tube is over-controlling and should be changed. (Such a tube will operate exceptionally well as a detector or first audio tube.) If the volume does not increase during the second test, or if the control does not reduce the volume to a whisper, the volume-control tube is under-controlling and should be replaced. Such a tube may be found defective for operation in any other position.



A bottom view of connections at the right of the chassis: showing positions of terminals at top and in the center. The figures at the right edge show the positions of the terminals in the circuit; the voltages at the left, the respective readings between them and ground. "B—" or No. 5 terminal, is below ground potential. The sequence of tubes in the set is from left to right, with V6 between V4 and V5.

R.F. choke Ch1 (located on a single mounting on the lower side of the sub-panel) is catalog No. P55516. Ch2 has a D.C. resistance of about 325 ohms. The primaries of T1 and T2 have resistances of about 800 ohms each.

The voltages shown in the illustration are the operating potentials obtained with a 115-volt supply. Accidental grounding of a high-potential lead, during test, may burn out resistors, damage V9, or blow fuses.

The aligning condensers, mounted on the front of each unit of the gang condenser, are reached by removing the chassis and adjusting through the four round holes in the front of the upper shield. This operation is to be performed while the set is tuned to a weak signal, of a frequency below 1,300 kc. (230 meters); or, since the volume of a station is continually varying, an A.F.-modulated R.F. oscillator may advantageously be used instead. Start the alignment process with the circuit of V1. The maximum capacity of C7 is not the same as for C1, C3 or C5; hence the "apparent" selectivity at high frequencies (low wavelengths, and due to the increased number of dial-scale-divisions per station-carrier position) will not be as great as in the other stages.

To change the drum dial lamp, turn the drum dial so that the opening is on top. The bulb may then be reached with the fingers.

The sensitivity of this set is so great that the antenna binding post will pick up sufficient energy, in certain localities and under certain conditions, to give loud-speaker reproduction of the signal without antenna or ground being connected to the set. If this energy is in the form of interference from radiating electrical equipment or a powerful broadcast station, it may cause disturbance with R1 and R14 adjusted for maximum volume.

Oscillation or squealing, if not due to a station heterodyne, is almost certain to be due to a defective by-pass condenser or faulty tube.

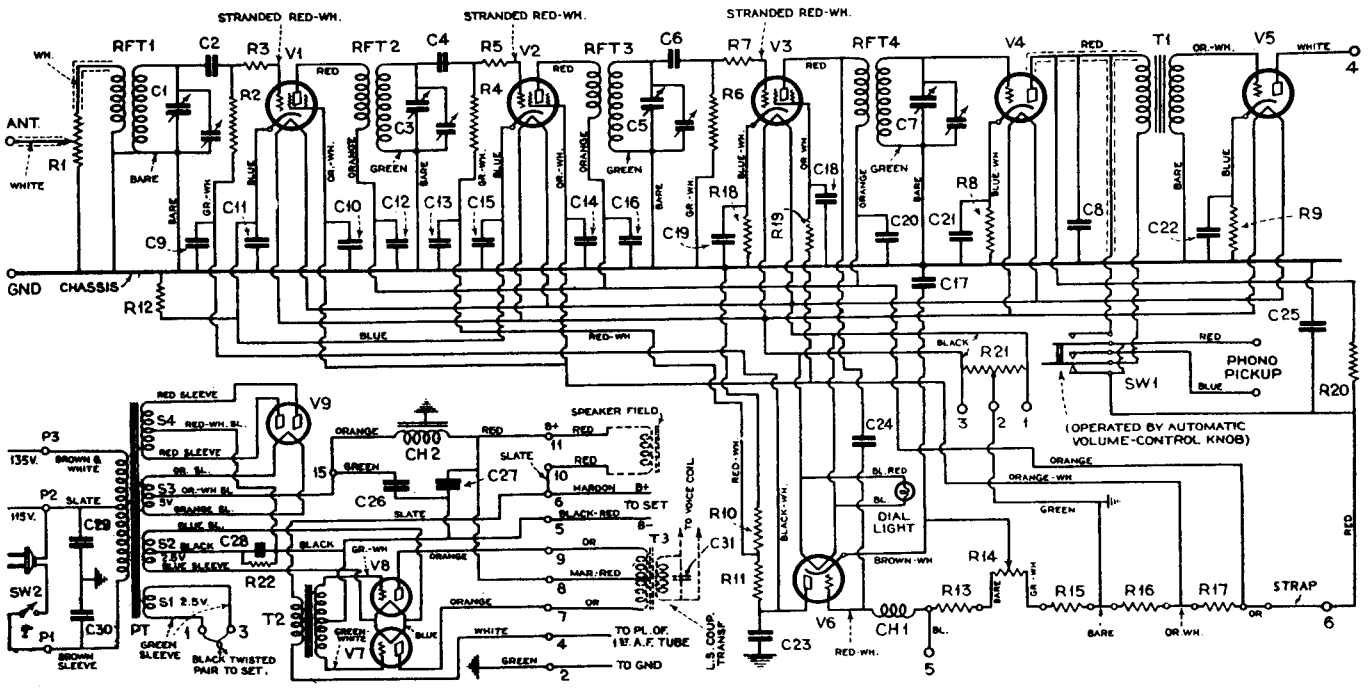
Resistors R11, R10, R9, R8, R13, R15, R16, and R17 are placed in this order and underneath the sub-panel; the last four are of the vitreous type. R12 and R18 use a double mounting, inside the base. R19 is mounted singly inside the base at the rear.

The rating of a replacement fuse is 3 amps.

The chassis is held by four large machine screws through the bottom of the cabinet.

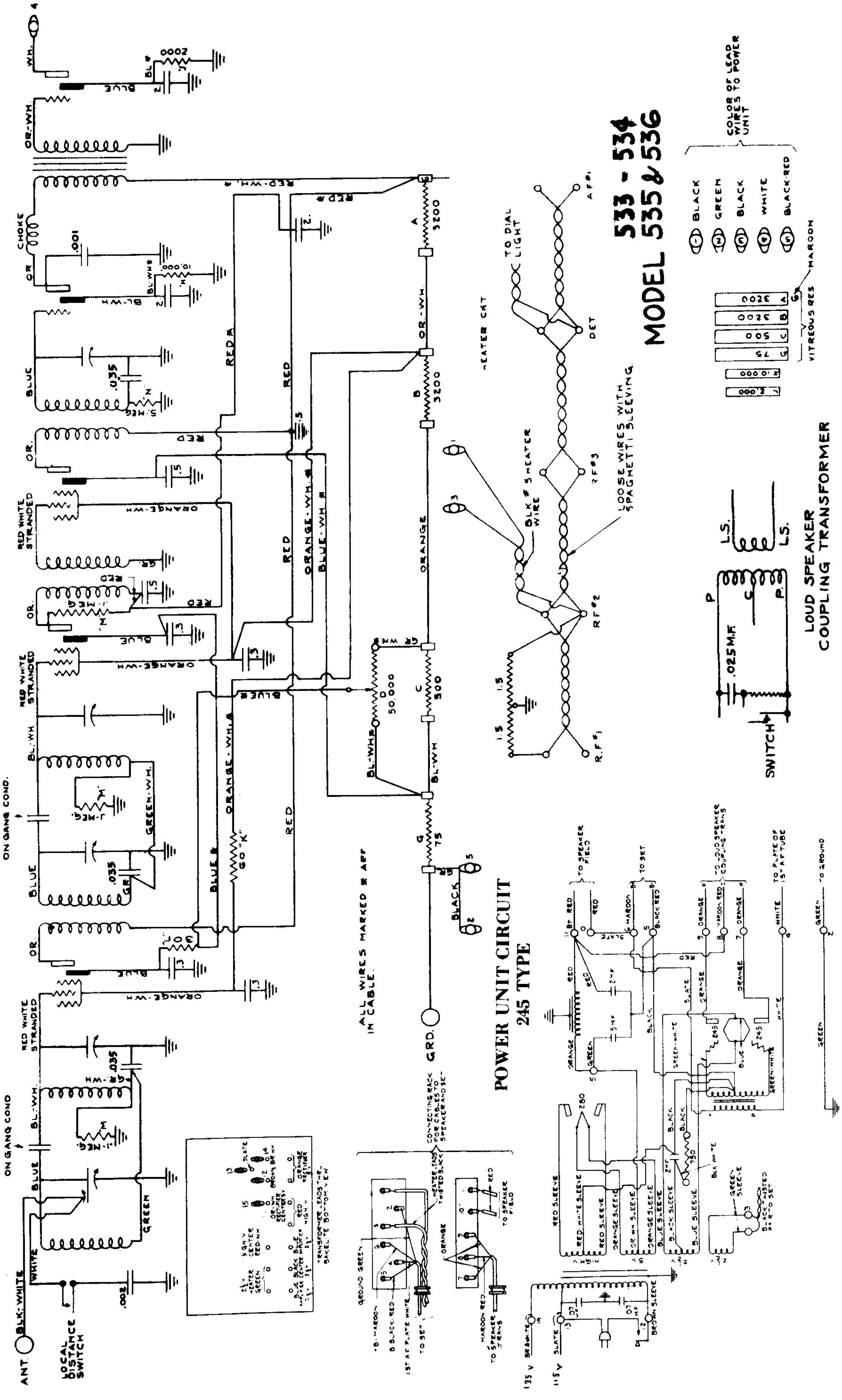
The output transformer T3 is held by four screws and covered by a steel protector, held by two wood screws.

This receiver works best with a good ground connection.



Power Unit Type 245 is used with the 523 and 526 receivers.

KELLOGG SW'BD. & SUPPLY CO.



Radio Service Data Sheet

SILVERTONE "F," "FF," "G," "H" AND "J"

The Silvertone, it will be remembered, is the trade name of a line of radio receivers sold by Sears, Roebuck & Co., Chicago, Ill. The "Model FF" and "J" are two of the older sets dating back to 1926, which were manufactured for this company by King Mfg. Co., Buffalo, N. Y.

These two complete diagrams, shown below, have been selected as representative of the circuits followed in the following models: "F," "FF," "G," "H," "J." A few words will serve to distinguish them:

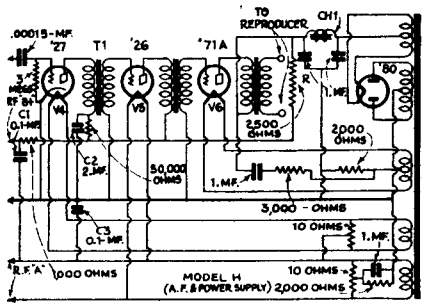
The "Model F" Silvertone radio set is a 5-tube receiver using four '01A's and a power tube which is either a '12A or a '71A. It is a battery set of the neutrodyne type, with single control. The grid condenser has a value of .00015-mf.; and the grid leak of 3 megs. The detector plate by-pass capacity is .006-mf. The detector grid leak does not shunt the grid condenser, but returns directly to the positive side of the detector filament; and between this point and the "A" supply lead is a 2-ohm resistor. This detector filament lead and the positive filament leads of the two audio tubes connect to a 1-ohm resistor; which is also wired to the "A+" post, as well as a 10-ohm rheostat to complete the positive "A" circuit of the two R.F. tubes. This rheostat is the volume control. The off-on switch is in the "A—" lead, which is grounded. The R.F. tube circuits are designed to operate at 90 volts on the plate. The first and the second audio stages have independent "B" and "C" supply leads. The reproducer connects directly in the plate circuit of the last tube.

When this standard 5-tube neutrodyne battery set is made all-electric, it becomes the "Model FF" shown below. The color code of the battery cable is as follows: Yellow, "A+"; blue, "90 V.+; maroon, "45 V.+"; blue-red, "B+1st A.F."; black-green, "C—1st A.F."; black-yellow, "A—"; brown-green, "C—power"; black-red, "B—"; green, "C+"; red, "B+power."

Consulting the diagram of the "Model FF," the resistor values are as follows: R1, 10,000 ohms; R2, 3 megs. (red); R3, 2,500 ohms (large, black); R4, 1,000 ohms (brown); R5, 50,000 ohms (gray); R6, 3,000 ohms (green); R7, 2,000 ohms (small, black); R8, 300 ohms, wire-wound; R9, R10, 20 ohms, each.

The capacity values are as follows: C1, C2, C3, tuning condensers; C4, C5, neutralizing condensers; C6, 0.1-mf.; C7, .00015-mf.; C8, .006-mf.; C9, C10, C11, C12, C13, C14, 1-mf., each.

Turning now to the "Model G," we find that it is substantially the same as the Model F; except that there has been added a stage



of R.F. amplification, making six tubes in all. Other details are as follows.

There is in the antenna circuit a fixed .001-mf. condenser; one side of this is connected to the chassis; the other to a binding post, to which the ground may be connected, to reduce noise or increase selectivity. Across the filament leads of the first R.F. tube is shunted a fixed 0.1-mf condenser; another of the same rating being similarly connected in the filament circuit of the third R.F. tube. Three neutralizing condensers are incorporated in the design. The grid condenser is a .00015-mf. unit; and the 3-megohm grid leak connects to the positive side of the tube filament. The two A.F. tube filament positive leads are connected together and return to the "A+" connection through a 1-ohm resistor; the detector's positive filament lead returning, through a 2-ohm resistor, to the juncture of the tube filaments and the 1-ohm resistor. The "A+" of the three R.F. tubes returns to the battery through a 5-ohm rheostat. All the "A—" leads connect together and are grounded. In series with the plate supply lead to the three R.F. tubes is a 1,000-ohm resistor; by-passed to ground through a 1-mf. fixed condenser. The cable color code for the "Model G" Silvertone is the same as in the "Model F" battery set.

Two all-electric versions of the basic 6-tube circuit used in the "Model G" receiver are the Models H and J; the latter having a push-pull output.

The slightly more complicated circuit of the "Model J" Silvertone is shown in full. Condensers C1, C2, C3, C4 (which are to be balanced at 720 and 1400 kc.) are the regular tuning capacities; C5, C6 and C7 are used to neutralize the R.F. circuits. C8 may be used for obtaining added selectivity; its capacity is .0001-mf.. C9, C10, C11 are 0.1-mf.; C12, .00015-mf.; C13, C14, C18, 3mf.; C15, C16, 1 mf.; C17, 2 mf.; C19, .006-mf.

The resistors in the "Model J" radio set have the following values: R1, 10,000-ohm potentiometer; R2, 3 meg.; R3, 1,000 ohms; R4, R10, 20 ohms; R5, 50,000 ohms (gray); R6, 2,500 ohms (black); R7, 10,000 ohms (blue); R8, 1,000 ohms, (brown); R9, 3,000 ohms (green); R11, 300 ohms.

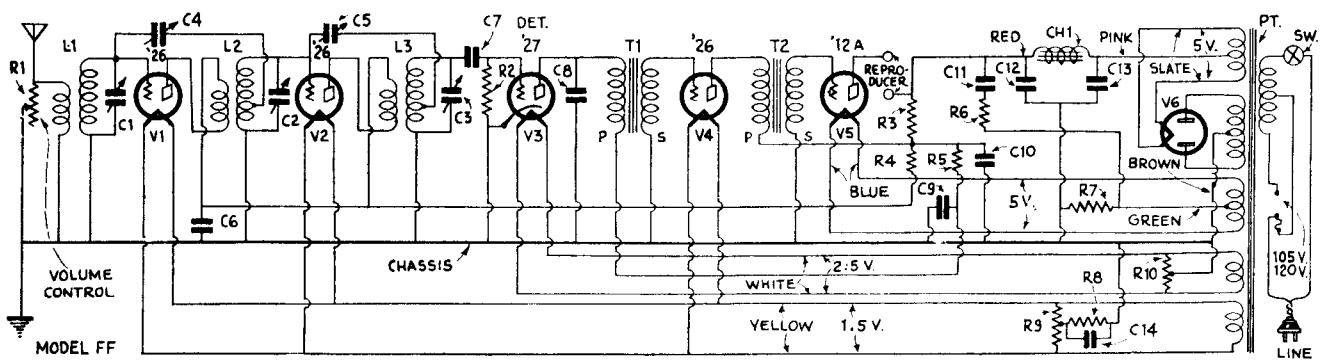
Following are the approximate operating voltages of the A.C. Silvertone models: Filament potentials; R.F. amplifier stages, 1.4 volts; detector, 2.4 volts; first A.F., 1.4 volts; power tube, 5 volts. Plate potentials; R.F. amplifier, 140 volts; detector, 35 volts; first A.F., 140 volts; power tube, 180 volts. Grid potentials; R.F. amplifier, 9 volts; detector, zero; first A.F., 9 volts; power tube, 35 volts.

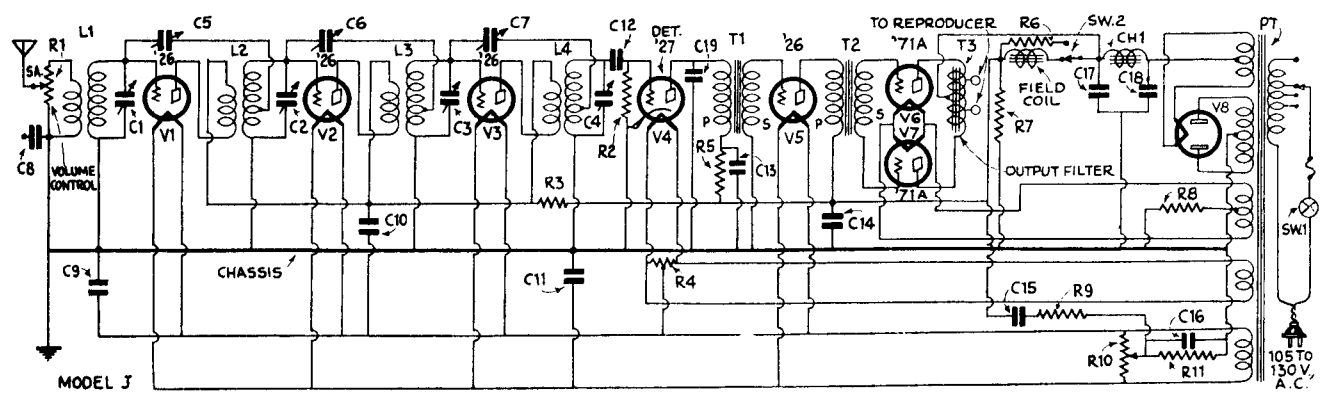
Loss of volume or noisy operation in any of these models may be due to a faulty volume-control resistor.

A toggle switch (Sw.2) connects a 2,500-ohm resistor R6 into circuit when the field coil of a dynamic reproducer is not utilized as the second filter choke.

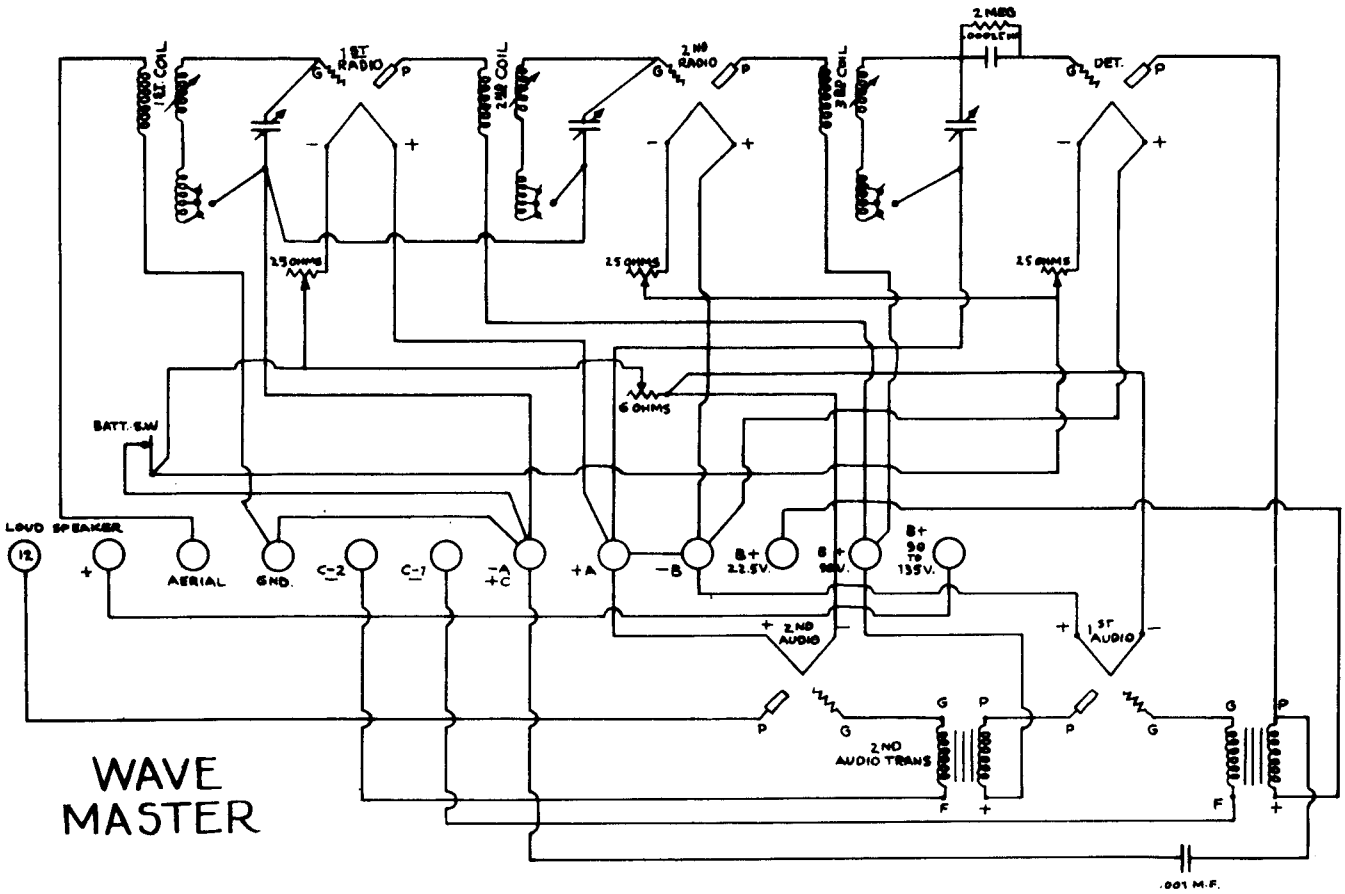
The power transformers for the "Models H" and "J" receivers are not interchangeable.

Thanks are extended to Mr. R. Hartwell Allen for the use of references in the preparation of this Data Sheet.

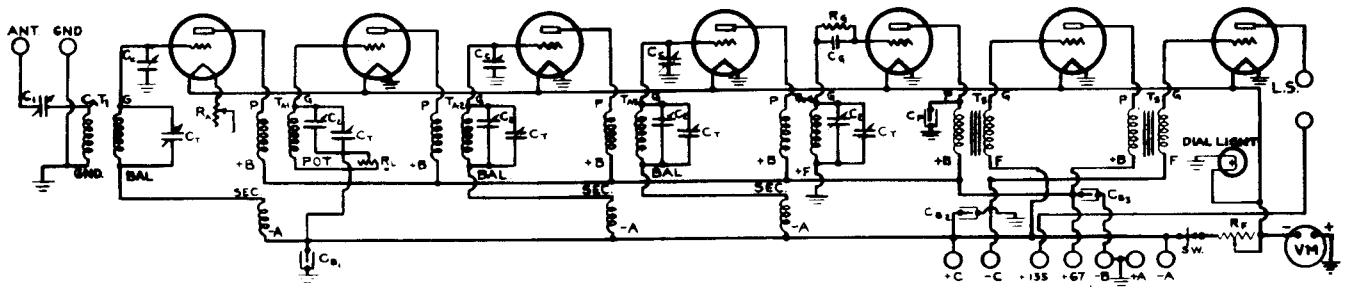




KELLOG S'W'BD. & SUPPLY CO.



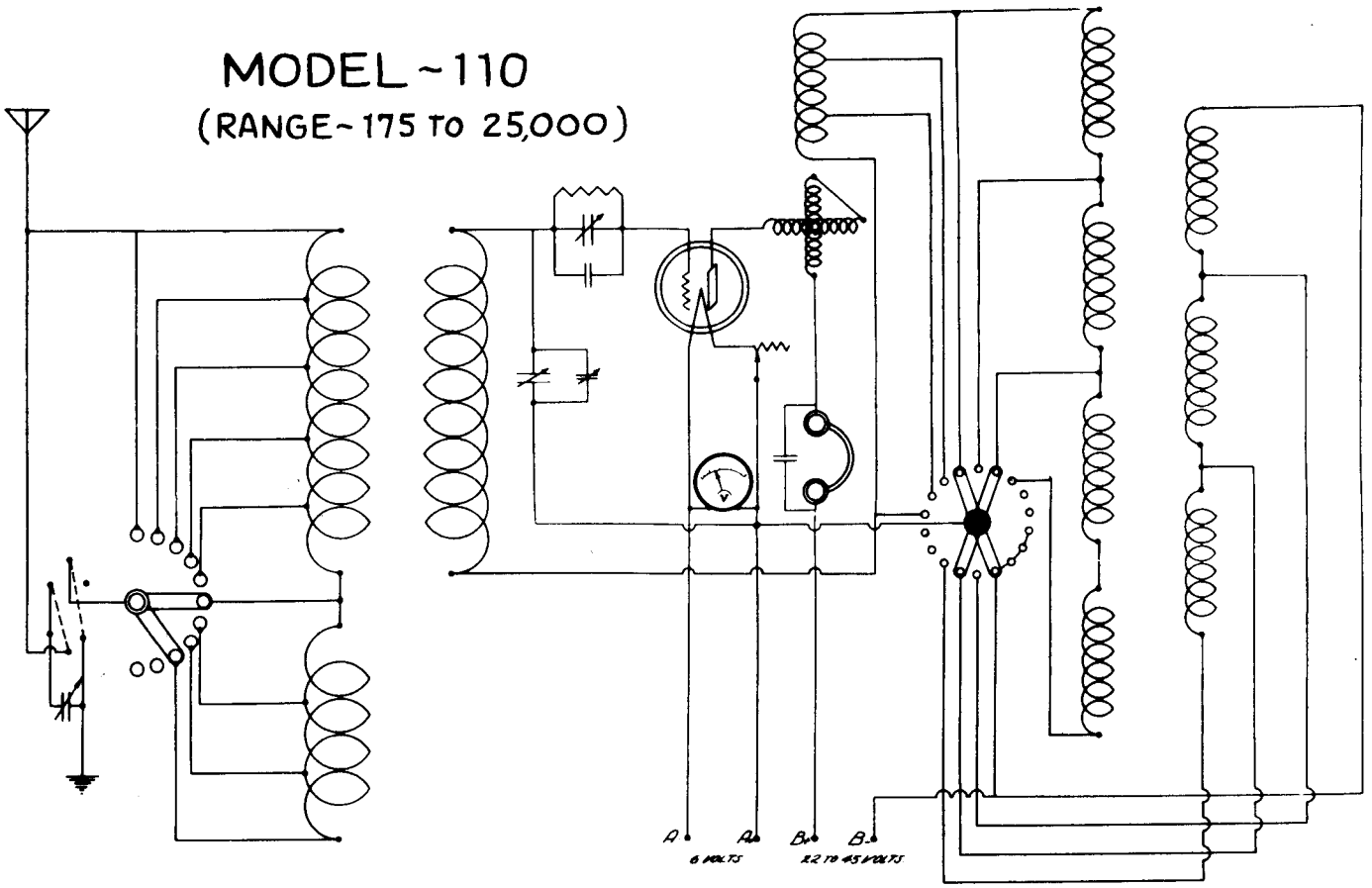
R.F.L.- 7-TUBE CASCADE RECEIVER



C_1 ANTENNA EQUALIZER .00027 MF.
C_2 TUNING ALIGNMENT CONDENSER.
C_B BYPASS CONDENSER 1 MFD.
C_C BALANCING CONDENSER .000080 MF.
C_G GRID CONDENSER .00025 MF.
C_P BYPASS CONDENSER .001 MF.
C_T GANG CONDENSER .0005 MF UNITS [STATION SELECTOR.]
L DIAL LIGHT.
R ROTOR PLATES OF VARIABLE CONDENSER
R_F FILAMENT RHEOSTAT 4 OHMS.
R_G GRID LEAK 2½ MEGOHMS.
R_L NON-INDUCTIVE WIRE RESISTANCE 200 OHMS. } VOLUME CONTROL
R_A RHEOSTAT 20 OHMS. } VOLUME CONTROL
S STATIONARY PLATES OF VARIABLE CONDENSER.
SW. FILAMENT SWITCH.
T_{RF} RADIO FREQUENCY TRANSFORMERS.
T_I INPUT TRANSFORMER
T_S KELLOGG AUDIO TRANSFORMER
VM FILAMENT VOLTMETER
⏚ GROUND TO SHIELD

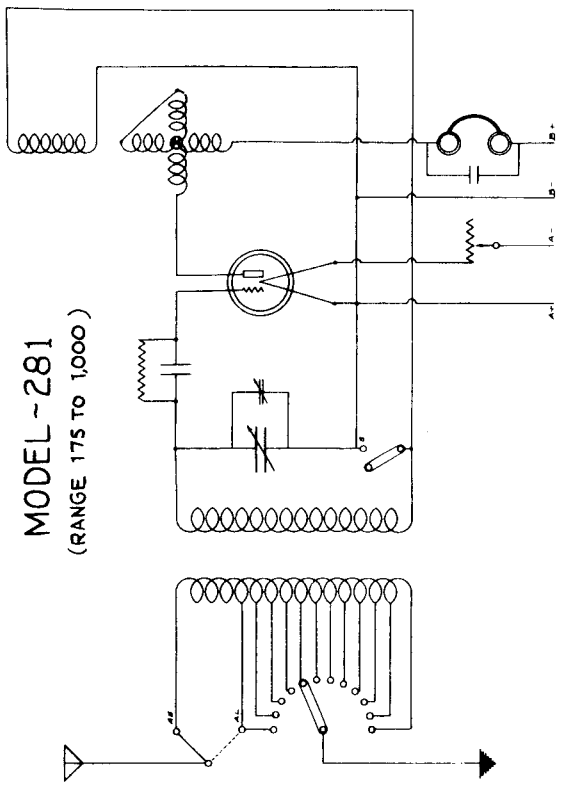
COLIN B. KENNEDY CORP.

MODEL ~ 110
(RANGE ~ 175 TO 25,000)

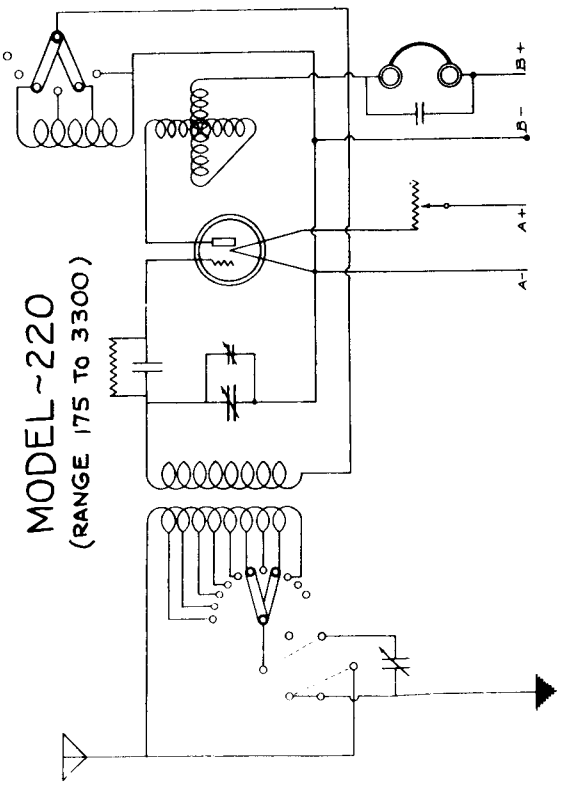


CAUTION — WHEN THIS SET IS USED WITH AMPLIFIER IT IS NECESSARY TO USE A SEPERATE "B" BATTERY FOR EACH UNIT

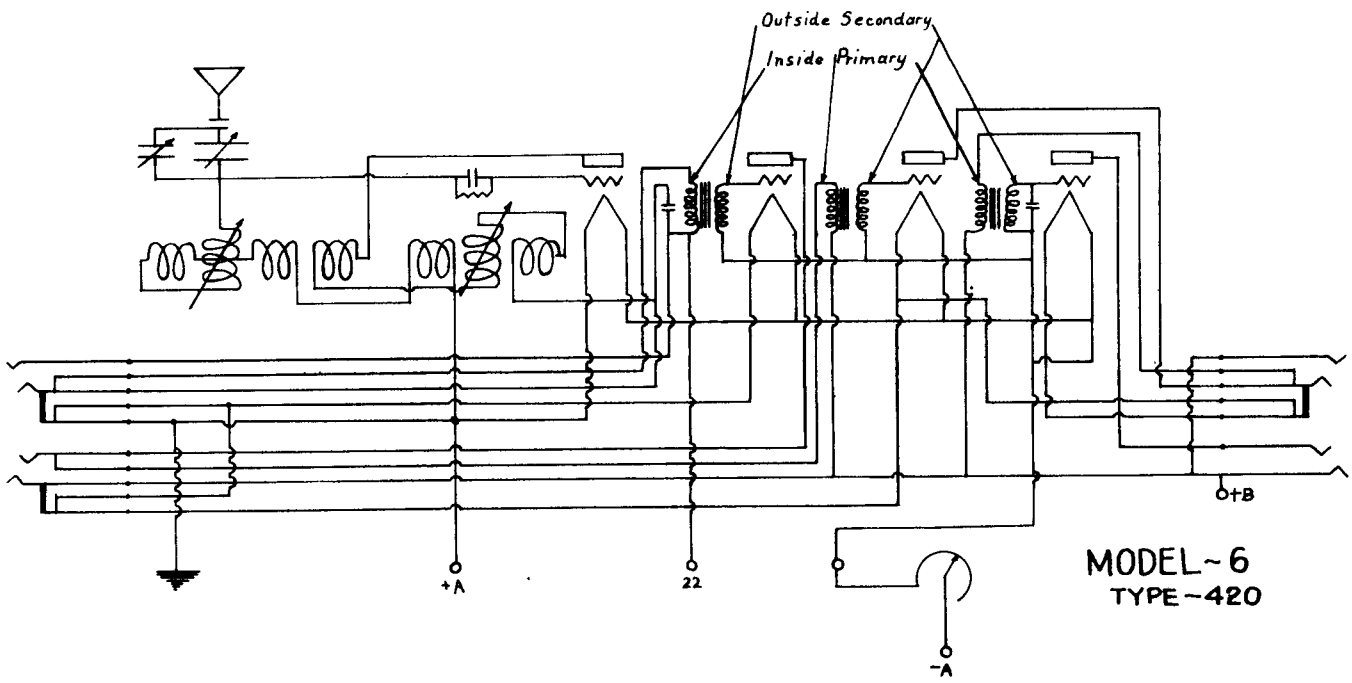
MODEL ~ 281
(RANGE 175 TO 1,000)



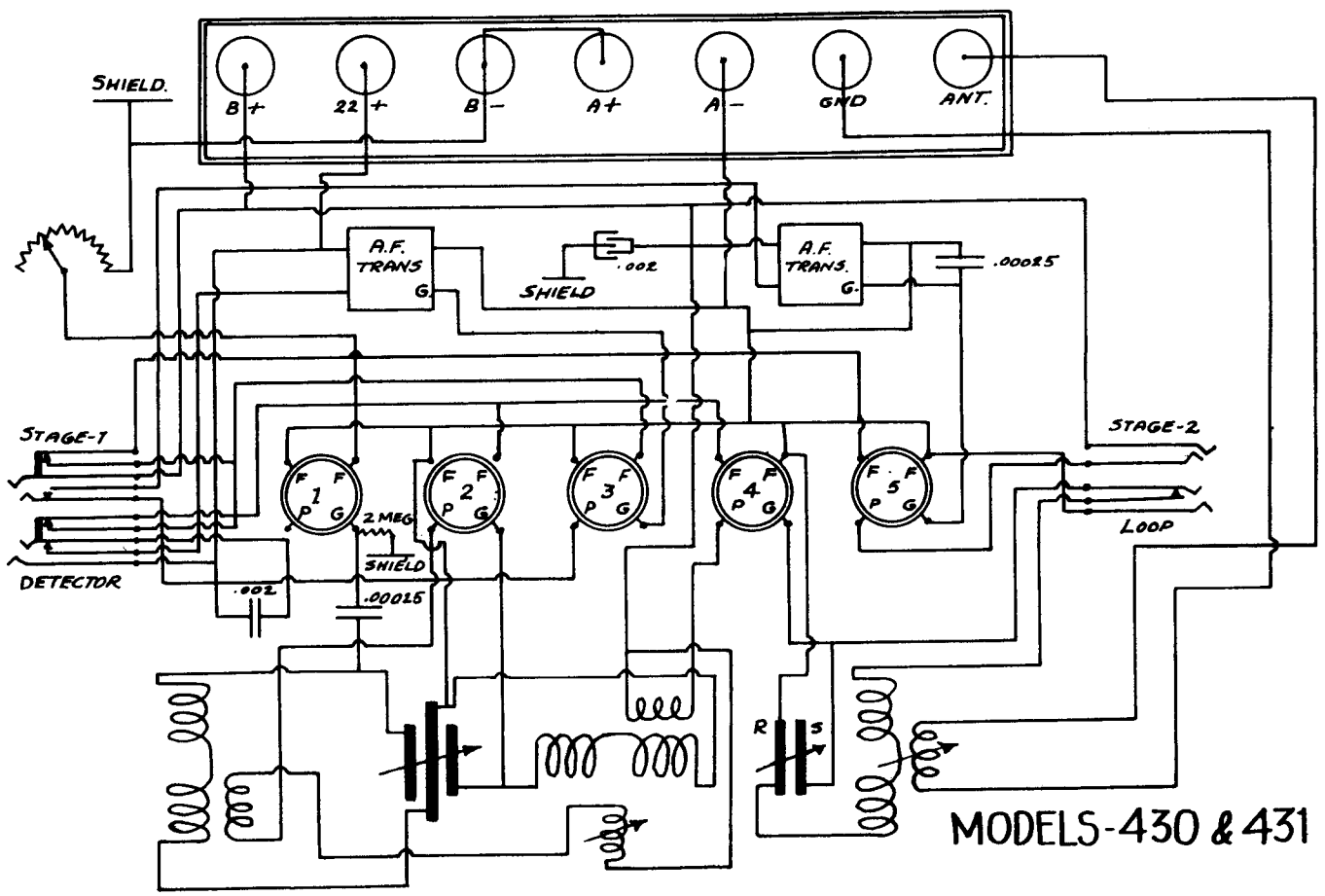
MODEL ~ 220
(RANGE 175 TO 3300)



COLIN B. KENNEDY CORP.

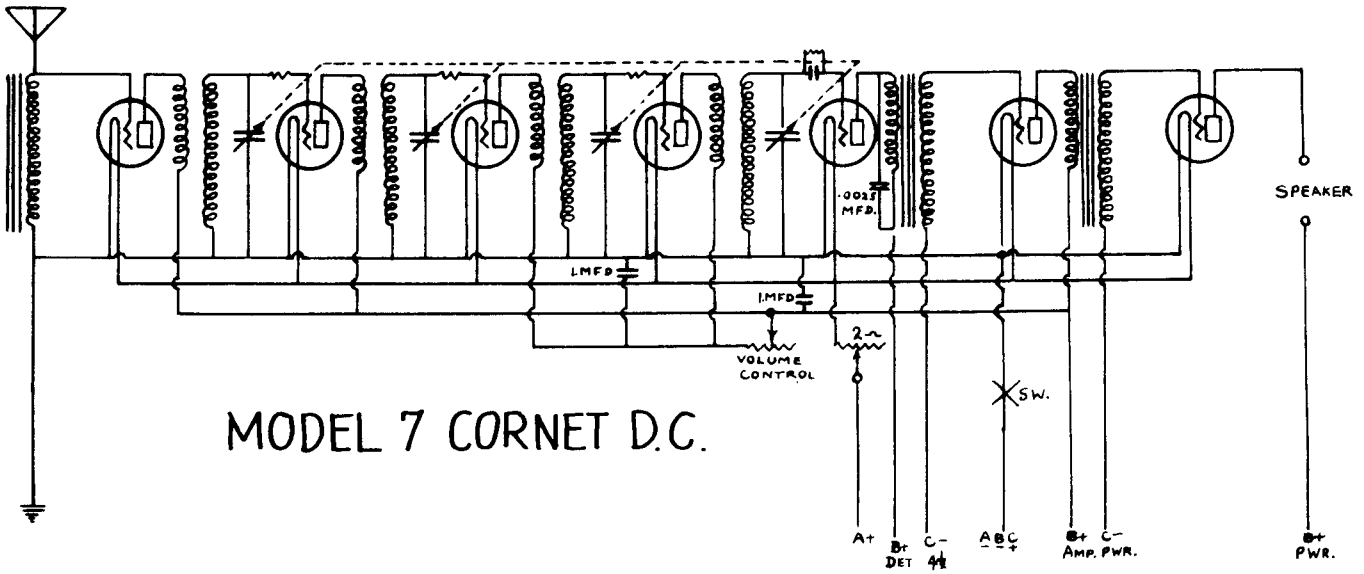


MODEL-6
TYPE-420

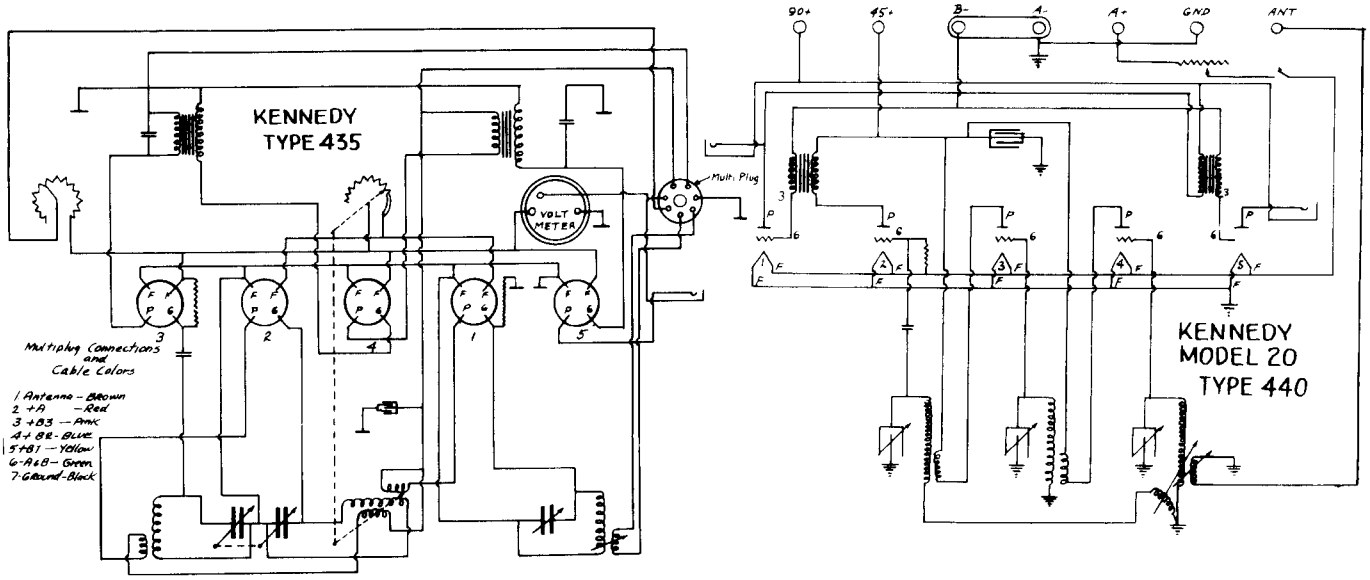


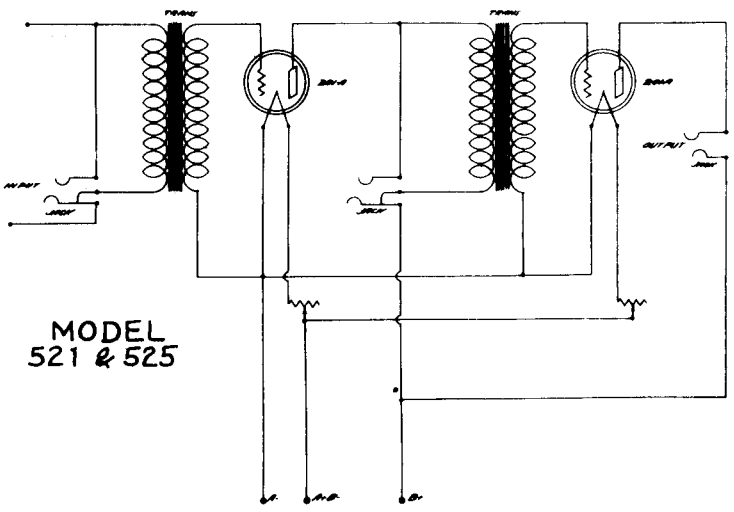
MODELS-430 & 431

COLIN B. KENNEDY CORP.



MODEL 7 CORNET D.C.





MODEL 521 & 525

Radio Service Data Sheet

KENNEDY "MODEL 826B" COMBINATION RECEIVER

With the "Model 826B" broadcast receiver, the Colin B. Kennedy Co., South Bend, Ind., pioneers the field of mass-produced "combination-wave" radio receivers. The long-wave chassis, covering the regular broadcast band (and a bit more), tunes from about 195 to 550 meters, and is "Model 26;" the short-wave chassis, "Model 34," tunes over three wave-length bands of 15-25, 25-50 and 50-100 meters, each band being switch-selected. The two chasses, in a "Model 826" cabinet, comprise the Kennedy "Model 8261" receiver; the latest diagram of connections appears below. The receiver has a tone-control (R8-C17).

The parts used in the short-wave chassis are distinguished by the letter S in the following lists.

Condenser C1S, .00016-mf.; C2S, midget condenser of small capacity (built-in); C3S, C5S, C6S, C11S, C13S, C14S, ¼-mf.; C4S, C8S, .0001-mf.; C7S, 2 mf.; C9S, .0005-mf.; C10S, .06-mf.; C12S, .002-mf.

Resistor R1S, 2 megs.; R2S, ½-meg.; R3S, 500 ohms; R4S, 1,500 ohms; R5S R12S, 25,000 ohms; R6S, R7S, R8S, R10S R11S, 50,000 ohms; R9S, 10,000 ohms. The color code of these resistors is as follows Yellow, 50,000 ohms; red, 1,500 ohms; red (large) 2 megs.; grey, 25,000 ohms; brown, 500,000 ohms; black (flexible, covered resistor) 500 ohms. The volume and regeneration control is potentiometer R9S. Unit RFC 1S is a wire-wound resistor of 1,000 ohms acting as an R.F. choke. Component L5 is an R.F. choke consisting of 50 turns of No. 30 enamelled wire, spaced .005-in. on a spool 0.5-in. in diameter. R.F. chokes RFC 2S, RFC3S, and RFC 4S are of the standard 1,000-turn type. A.F. choke AFC5 is an audio transformer with primary and secondary in series (aiding).

The "Model 26" chassis is composed of the following units: Condensers C1, C2 C3, C4 are the tuning condensers (ganged); C5, C6, C7, C8, C9, C10, C11, C12, C13, 0.25-mf.; C14, 1.0-mf.; C15, C16, .0005-mf. C17, .04-mf.; C18, C19, C20, 8-mf. (electrolytic); C21, .06-mf.; C22, .0001-mf.

The resistors have the following values R1, R7, 10,000 ohms; R2, R8, R12, 50,000 ohms; R3, 25,000 ohms; R4, R11, 5,000 ohms; R5, R6, 3,000 ohms; R9, 750 ohms R10, 20 ohms (center-tapped); R13, 0.5-meg.; R14, 1,500 ohms. Color code (biasing resistors): green, 3,000 ohms; blue, 5,000 ohms; grey, 10,000 ohms; yellow, 50,000 ohms; brown, 0.5-meg.; red, 1,500 ohms.

The tubes in chasses 26 and 34 test as follows (line potential, 120V.): Filamen potentials, V1S, V2S, V3S, V1, V2, V3 V4, V5, 2.3 volts; V6, V7, 2.3 volts; V8 4.8 volts. Plate potentials: V1S, V1, V2, V3, 160 volts; V2S, 140 volts; V3S, 55 volts; V4, 125 volts; V5, 155 volts; V6, V7, 210 volts. Control-grid bias, V1S, 1.1 volts; V3S, 5 volts; V1, V2, V3, 3.5 volts; V4, 10 volts; V5, 9 volts; V6, V7, 45 volts. Screen-grid potentials: V1S, 70 volts; V2S, (volume control at maximum) 30 volts; V3S, 160 volts; V1, V2, V3, 85 volts. Detector V2S is of the grid-leak and-condenser type; tube V4 is a power detector. Screen-grid tube V3S is connected as an oscillator of the "dynatron" type, (requiring no grid circuit inductance), working at the fixed frequency of approximately 1550 kc. (about 196 meters).

Switches Sw1 and Sw2 (for change-over between long and short-wave units) are ganged. The power pack and long-wave chasses are connected by a 5-wire cable terminating in plugs; to this cable is connected a 4-wire cable for the short-wave chassis.

The cable color codes are as follows: 5-wire cable; 1, large black; 2, large white; 3, red; 4, black; 5, yellow. In the 4-wire cable, on the contrary, they are: 1, black; 2, white; 3, small black; 4, red.

Facing the unit, the shielded coil at the left, toward the rear, is the 50-100 meter coil; shielded coil at right front corner 25-50 meters; unshielded coil in center of base, 15-25 meters.

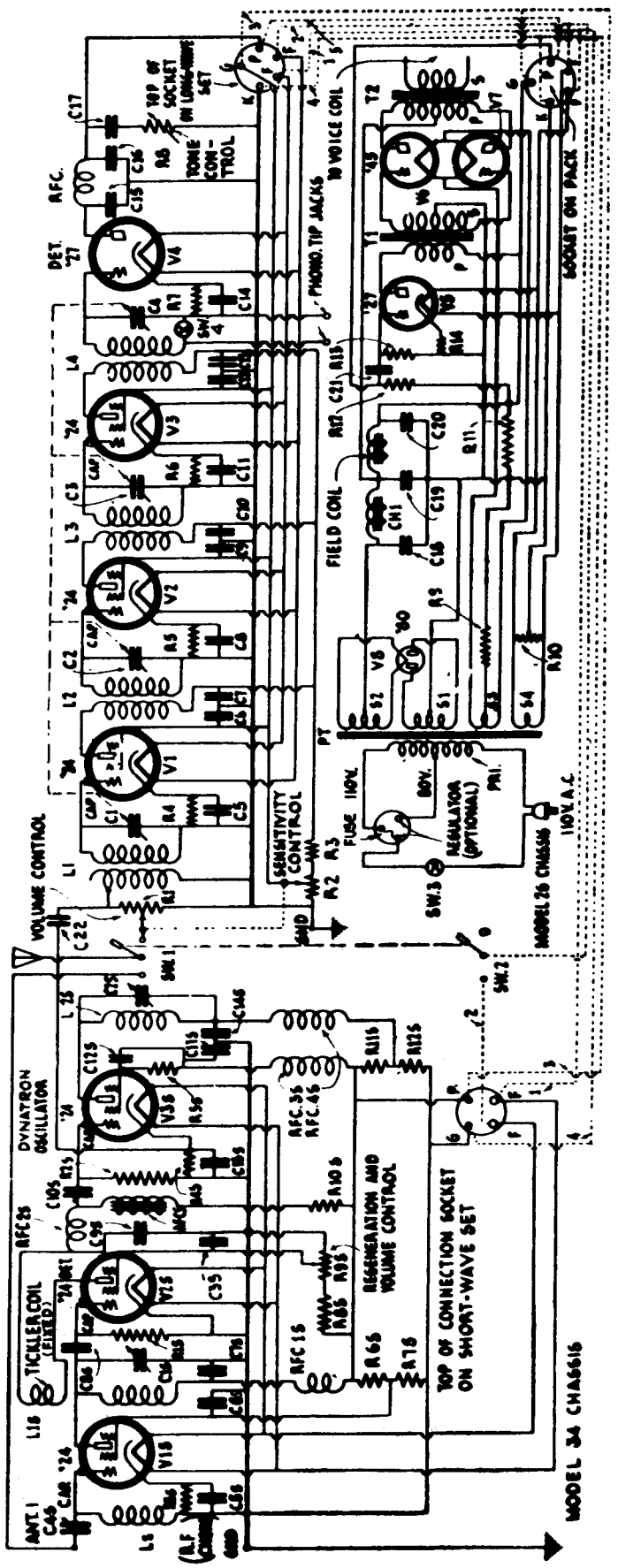
The midget condenser C2S tunes the oscillator in the neighborhood of 1500 kc., and compensates for variation in internal tub capacities.

The following modifications for increasing the sensitivity of the "Model 826D" receiver are recommended only to the experienced Service Man, and are to be applied with care: Change C13S to .04-mf., and shunt the old 0.25-mf. unit across C14S. Replace C22 by a .002-mf. unit. The shielding of the oscillator output wire must be grounded to the chassis. A good ground connection must be used for the combination set. Tube variations will be more evident in a set of this nature and, for best results, it is advisable to try several of each type;

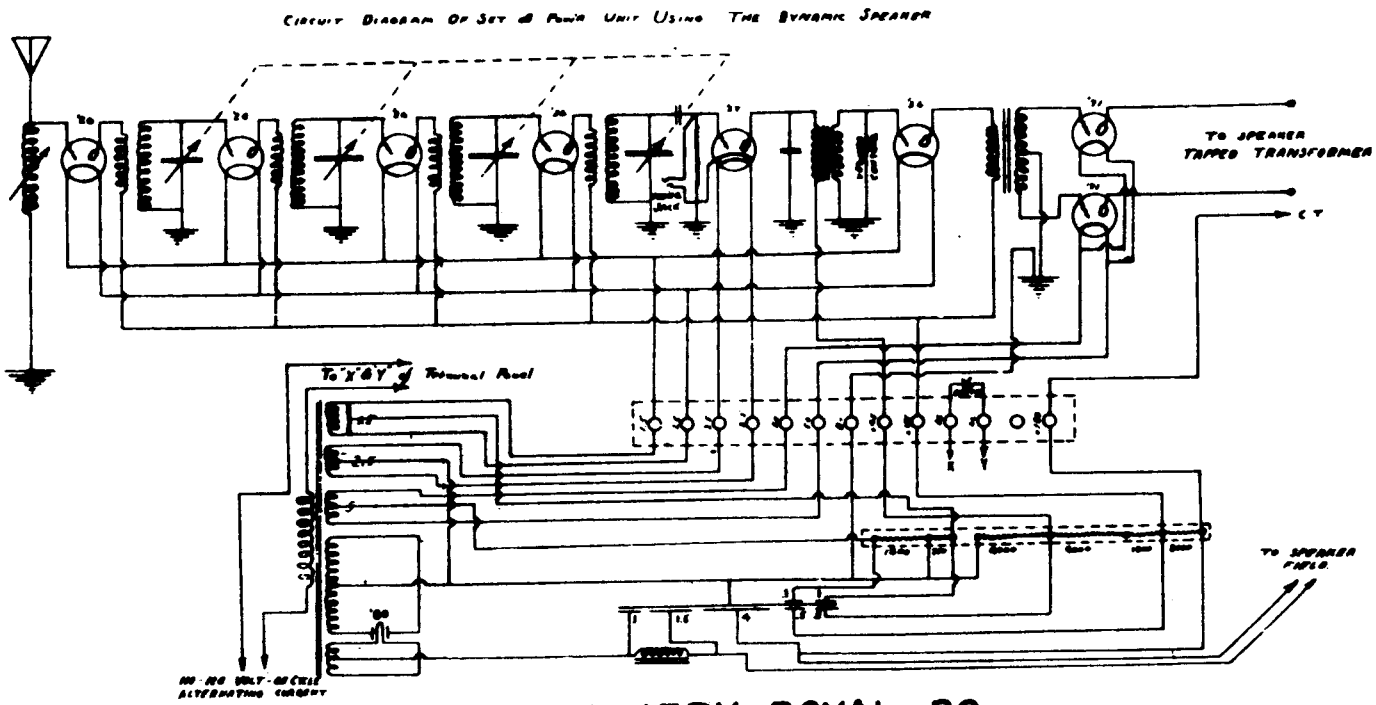
All shielding must be fastened tightly The shielded coil at the rear center of the base is L2S; midget condenser C2S is on its shield top.

Referring now to the "Model 26" chassis, the dynamic reproducer field coil has a resistance of 2250 ohms. Note that all wiring must remain in the original positions. Phonograph pick-up switch Sw4 is part of R1-R2. Abnormal hum with chassis inverted is natural, and due to the disturbance of the electrolytic condensers; otherwise, exceptional hum (in normal position) often may be corrected by interchanging the connections of the electrolytic condenser sections.

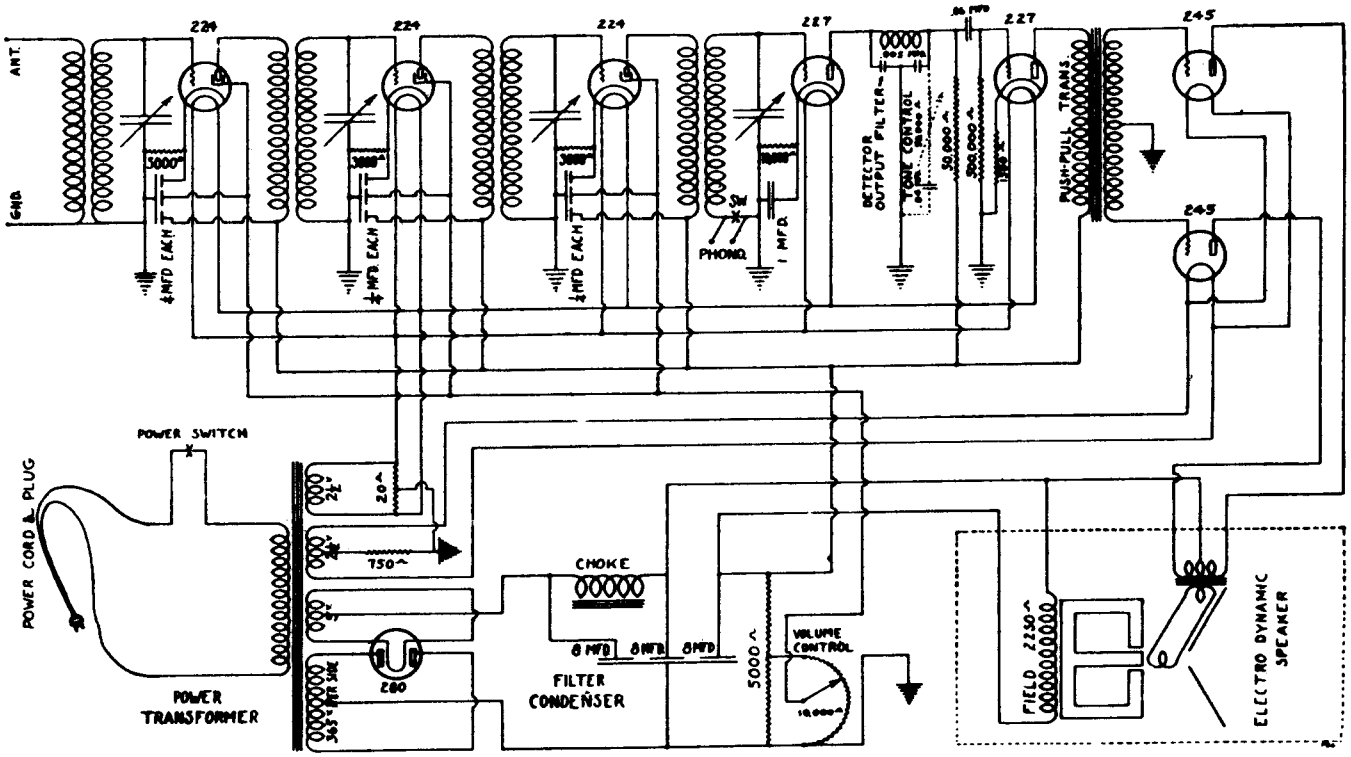
Test for circuit oscillation only with chassis right-side up and with base-plate screwed on. If one R.F. coil becomes defective, change the set of four (otherwise, volume and selectivity may not be satisfactory). The line fuse is in a plug which is to be removed if the regulator tube is used. Excessive circuit oscillation may be to open or high-resistance R3 (graphite).



COLIN B. KENNEDY CORP.

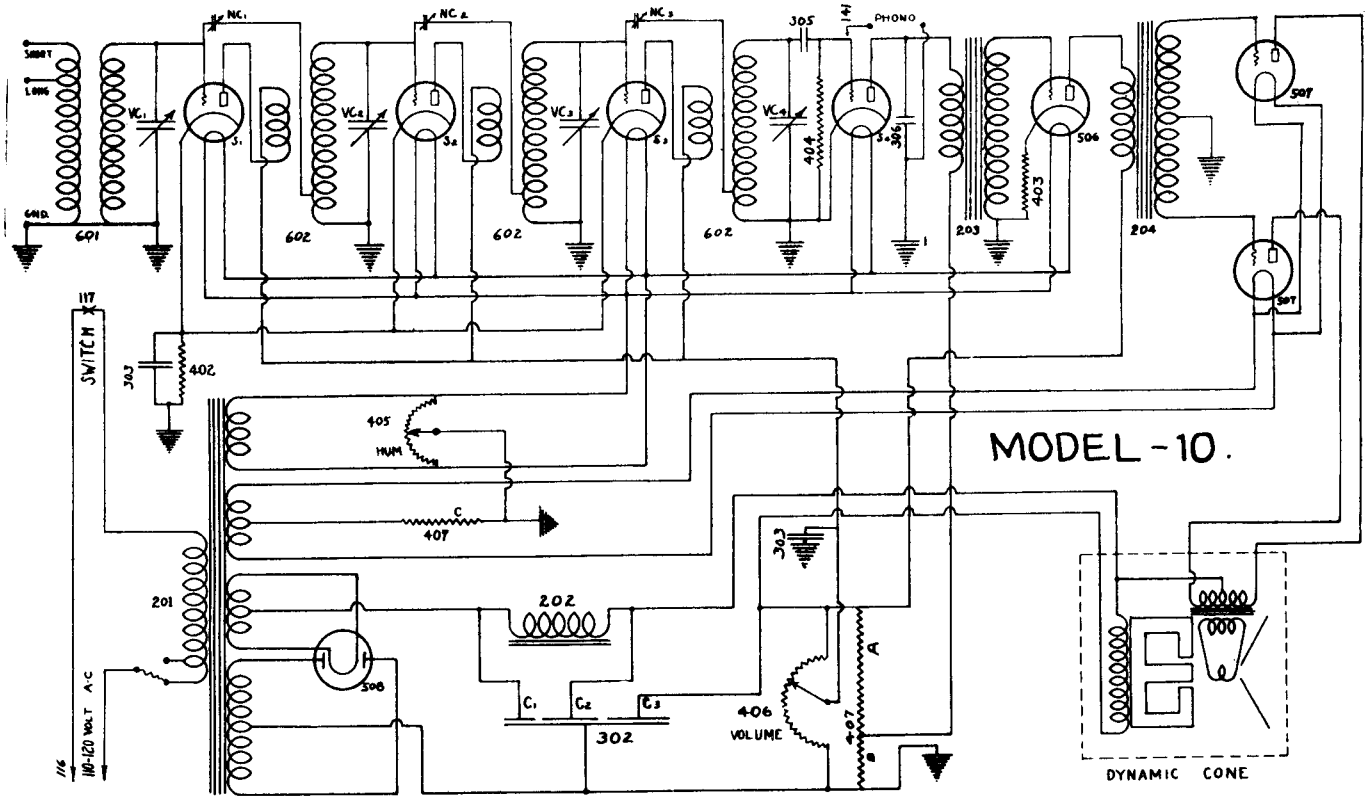


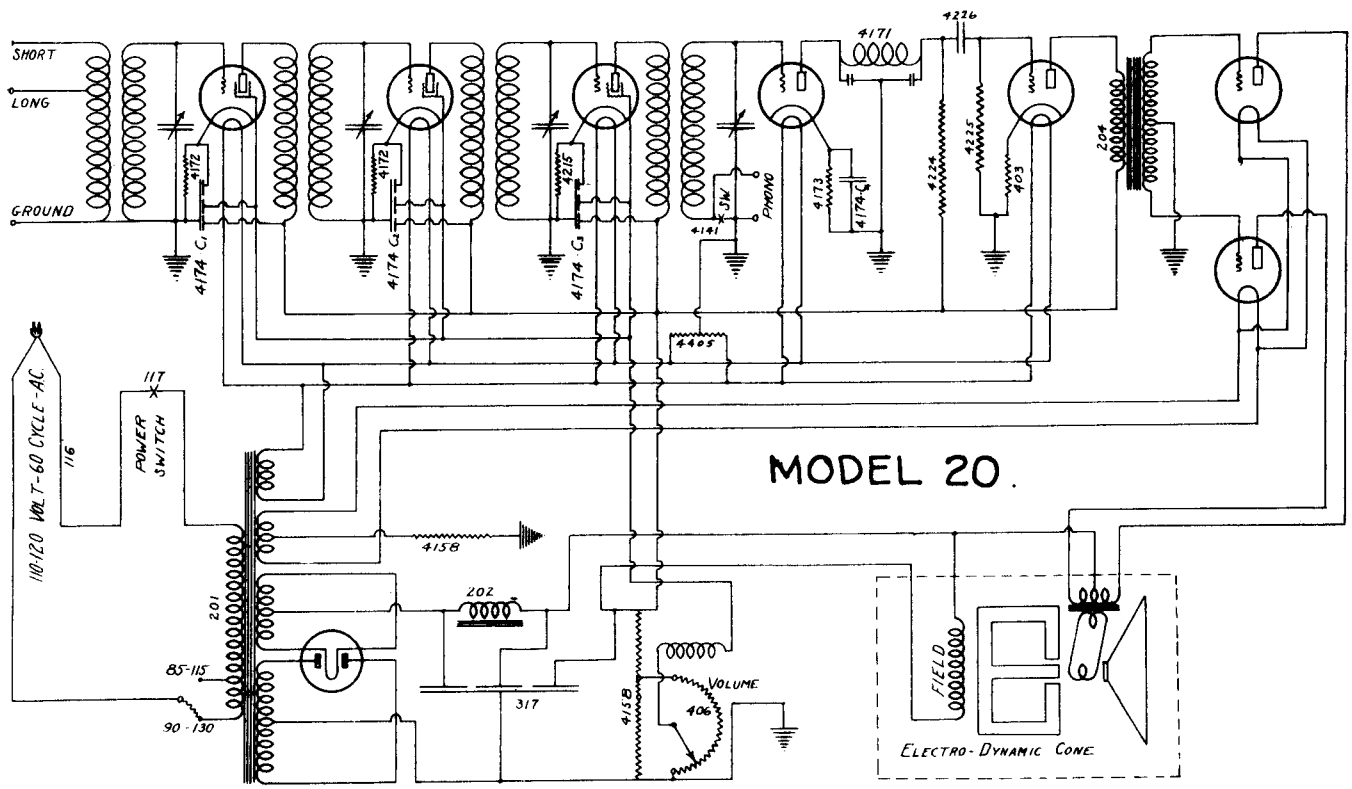
KENNEDY ROYAL-80



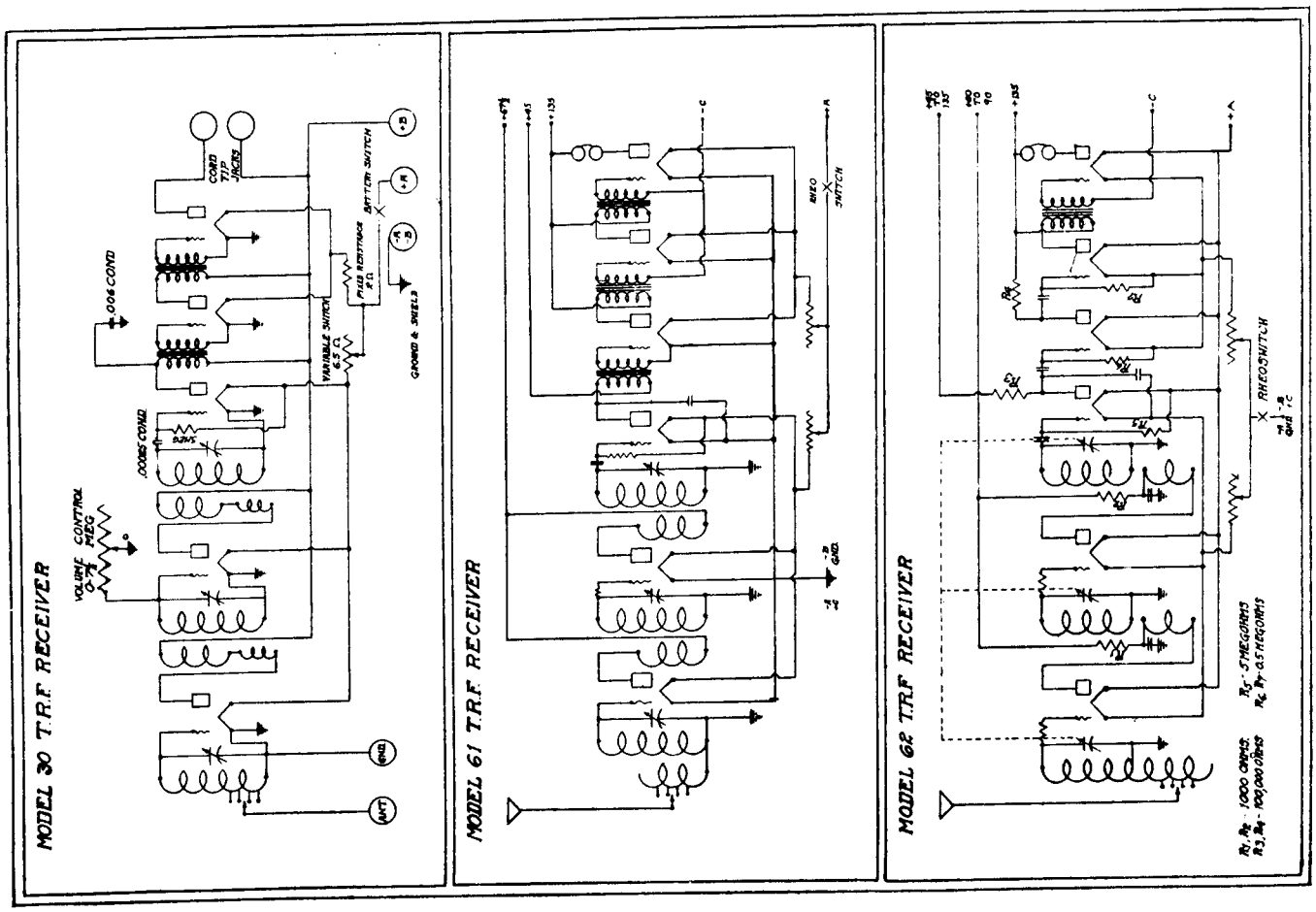
MODEL 30 AND 32

COLIN B. KENNEDY CORP.

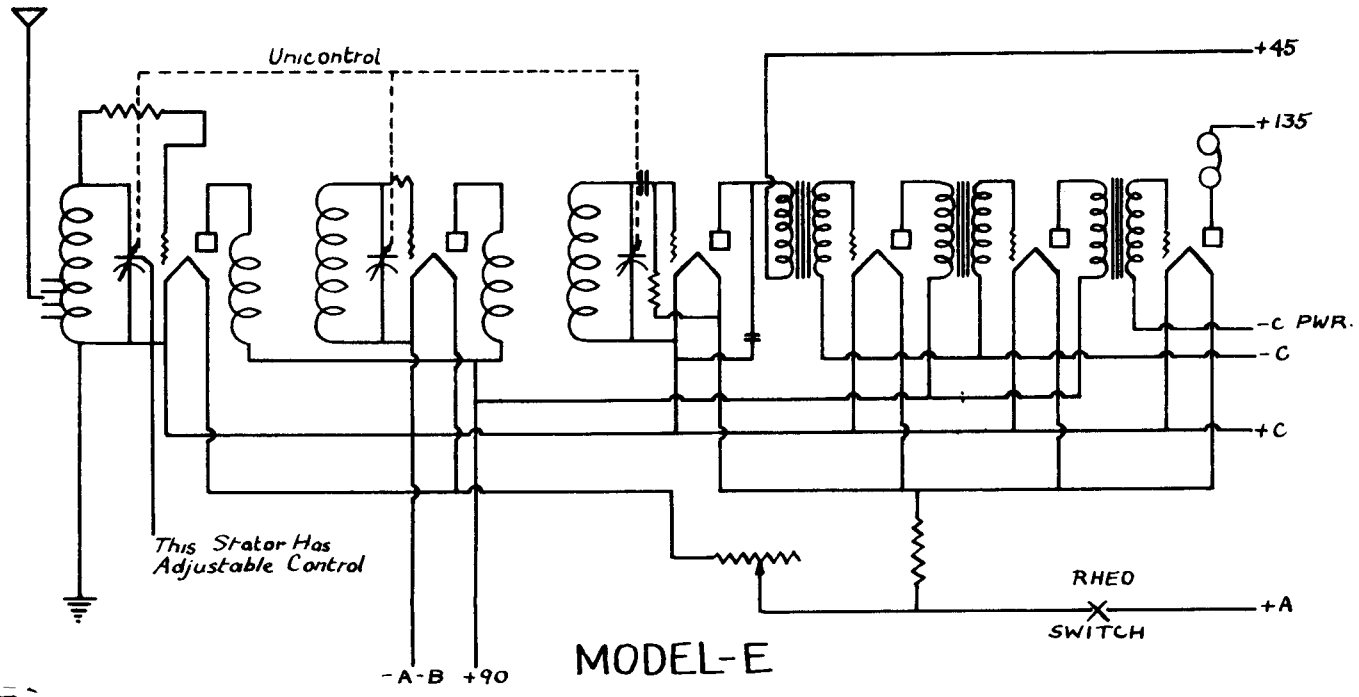




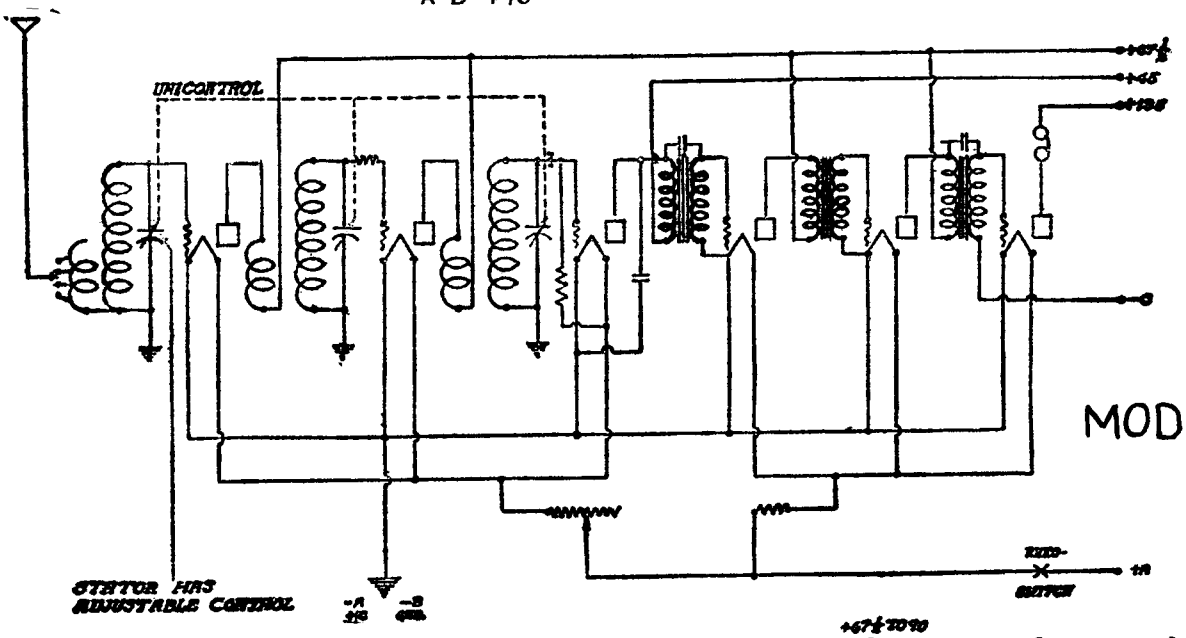
KING MFG. CORP.



KING MFG. CORP.



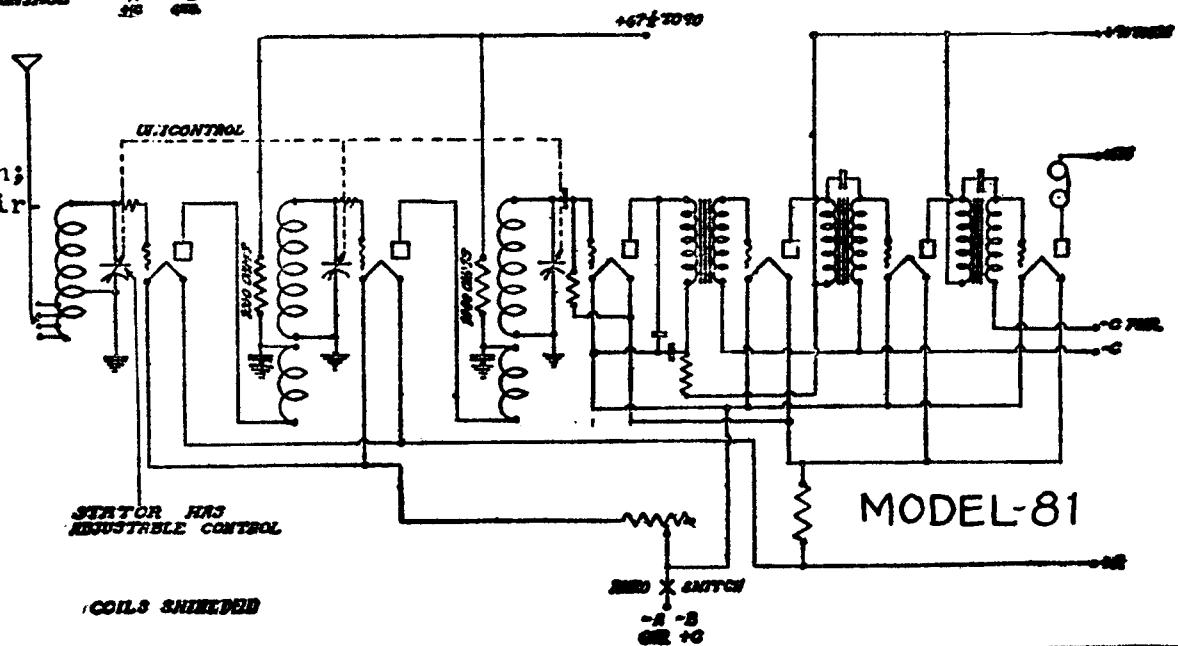
MODEL-E



MODEL 80. By-pass condensers on 1st and 3rd. A.F. transformers are .1 mf. capacity.

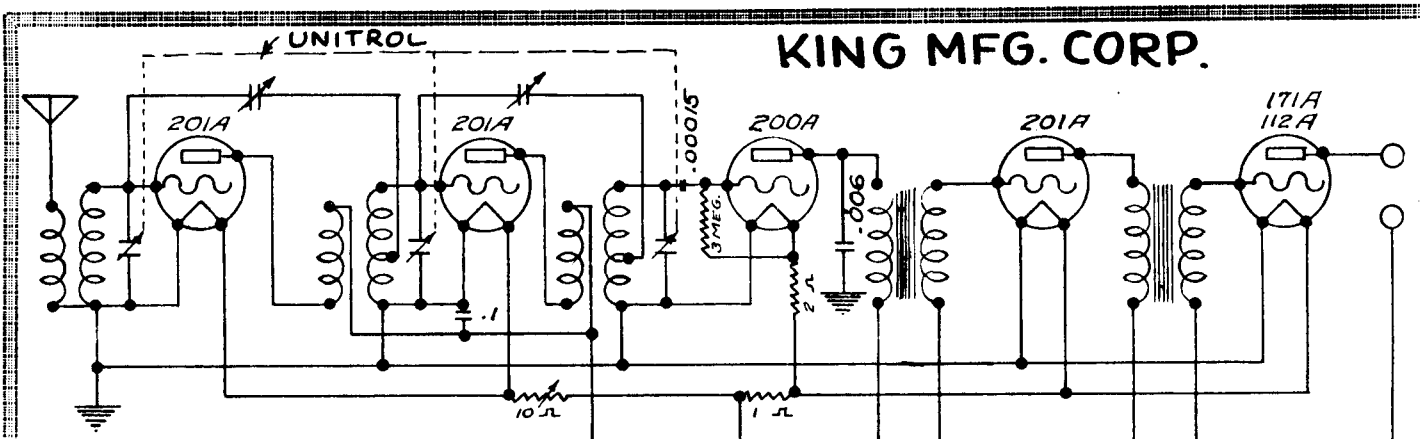
MODEL-80

MODEL 81. Plate resistors in R.F. circuit are 1000 ohms each; in detector circuit, 100,000 ohms. By-pass condensers in R.F. cans and A.F. circuit are .1 mf. capacity.

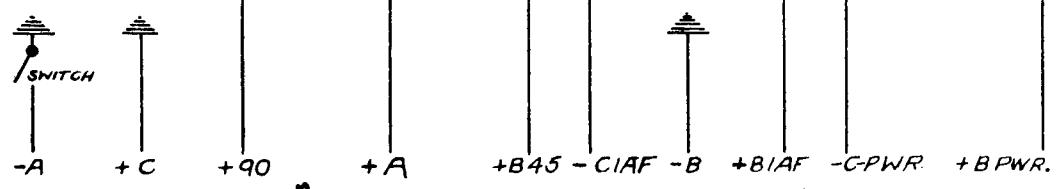


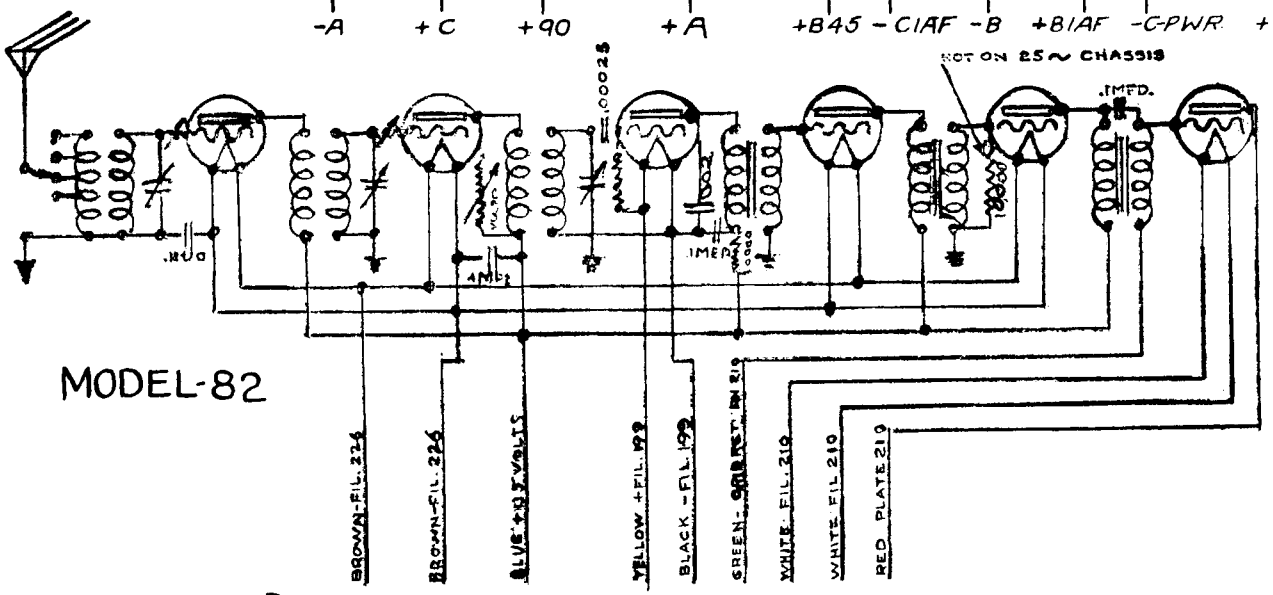
MODEL-81

KING MFG. CORP.

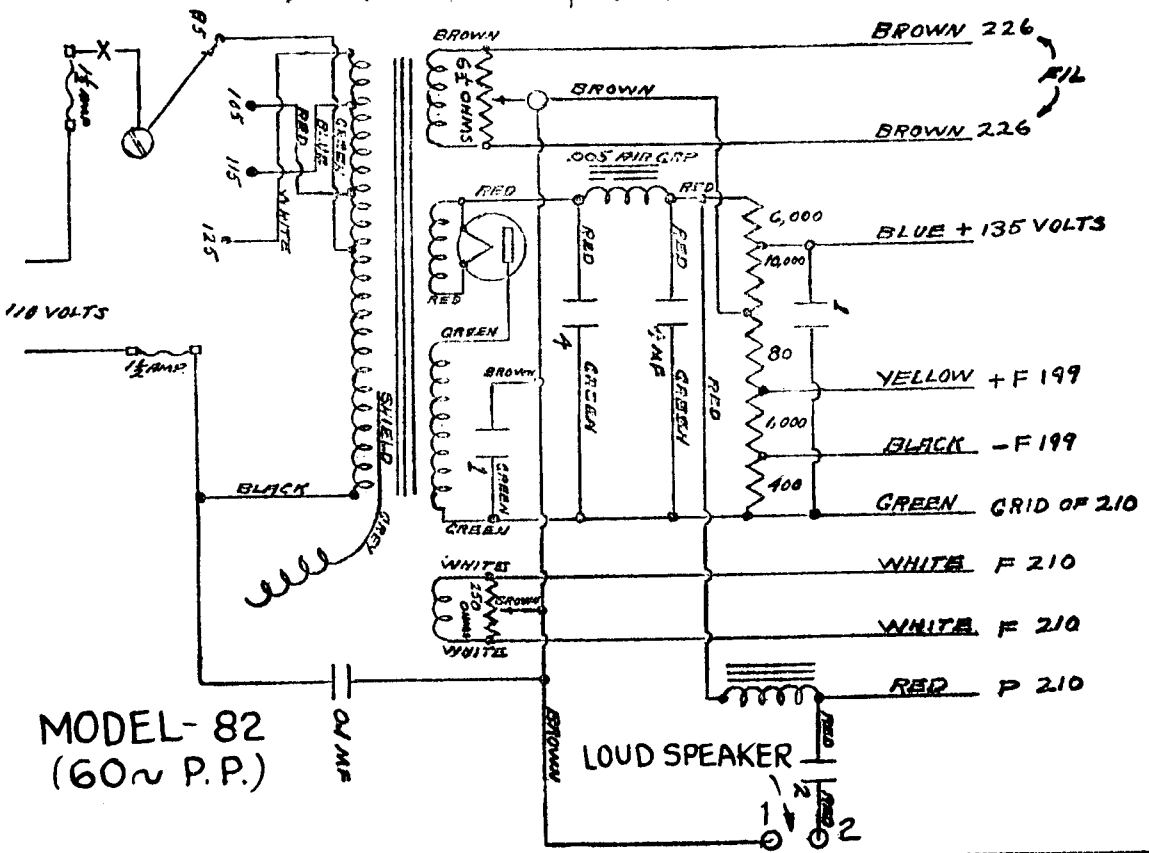


Model F, R4430



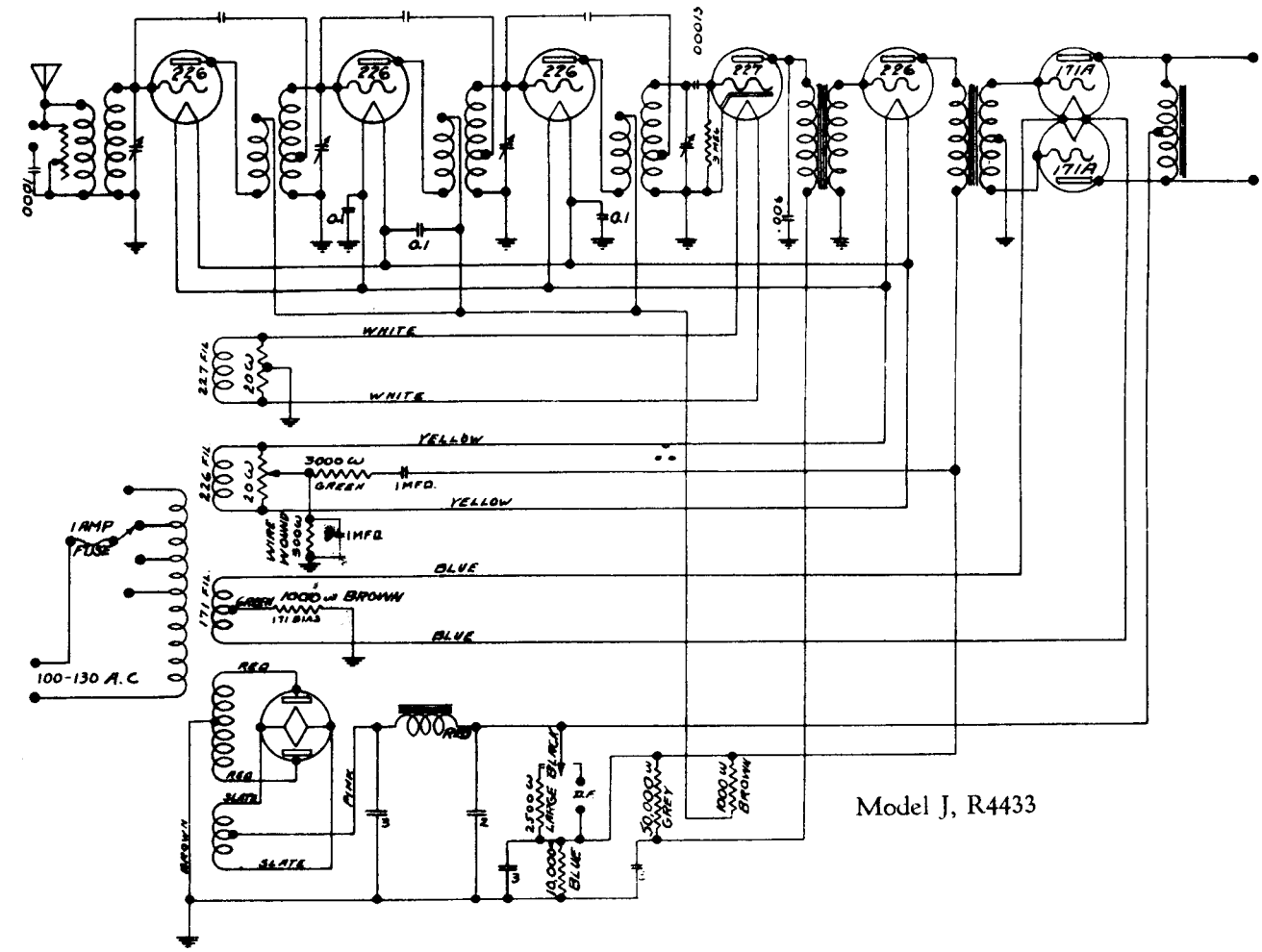


MODEL-82

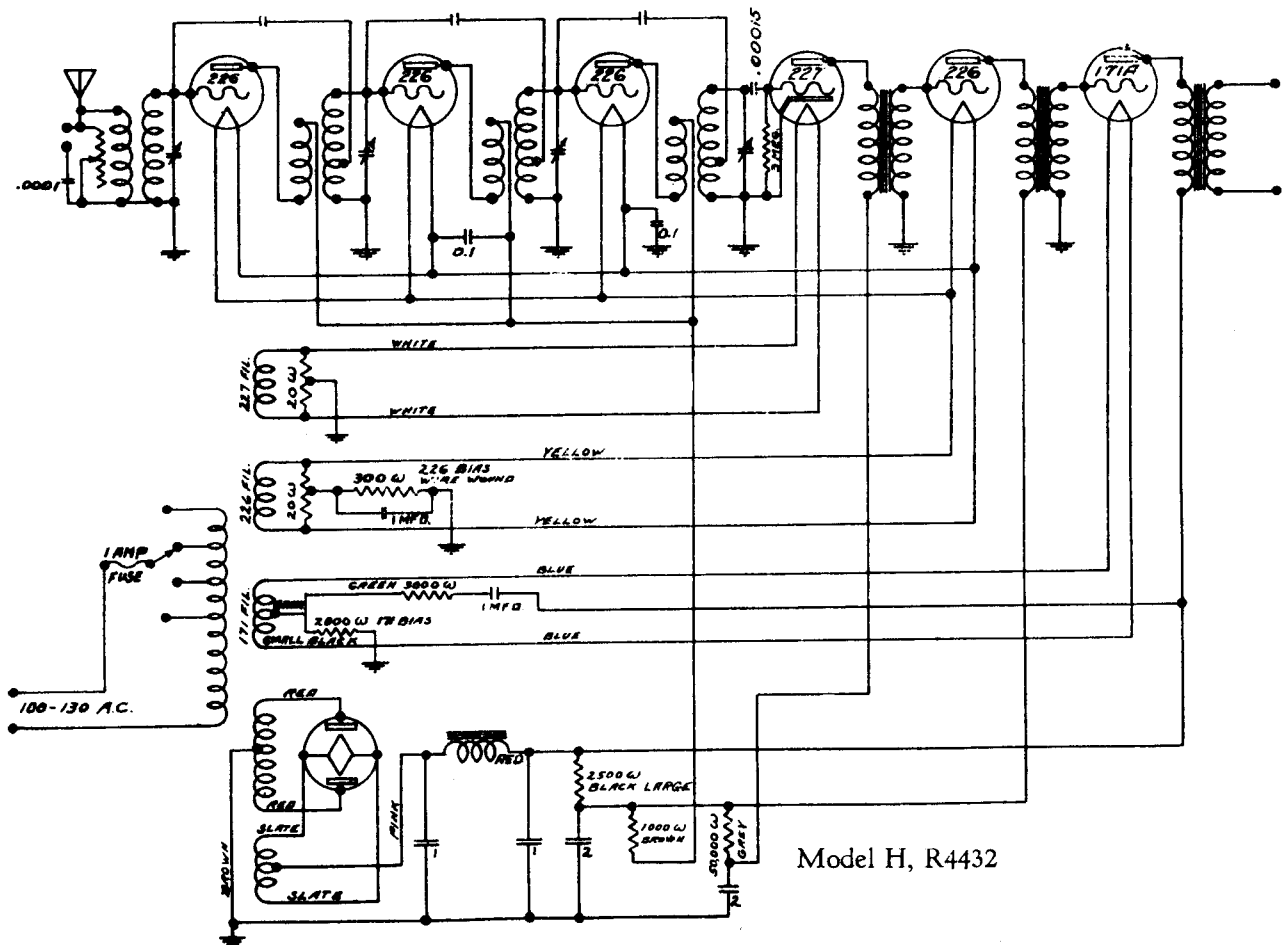


MODEL-82 (60~ P.P.)

KING MFG. CORP.

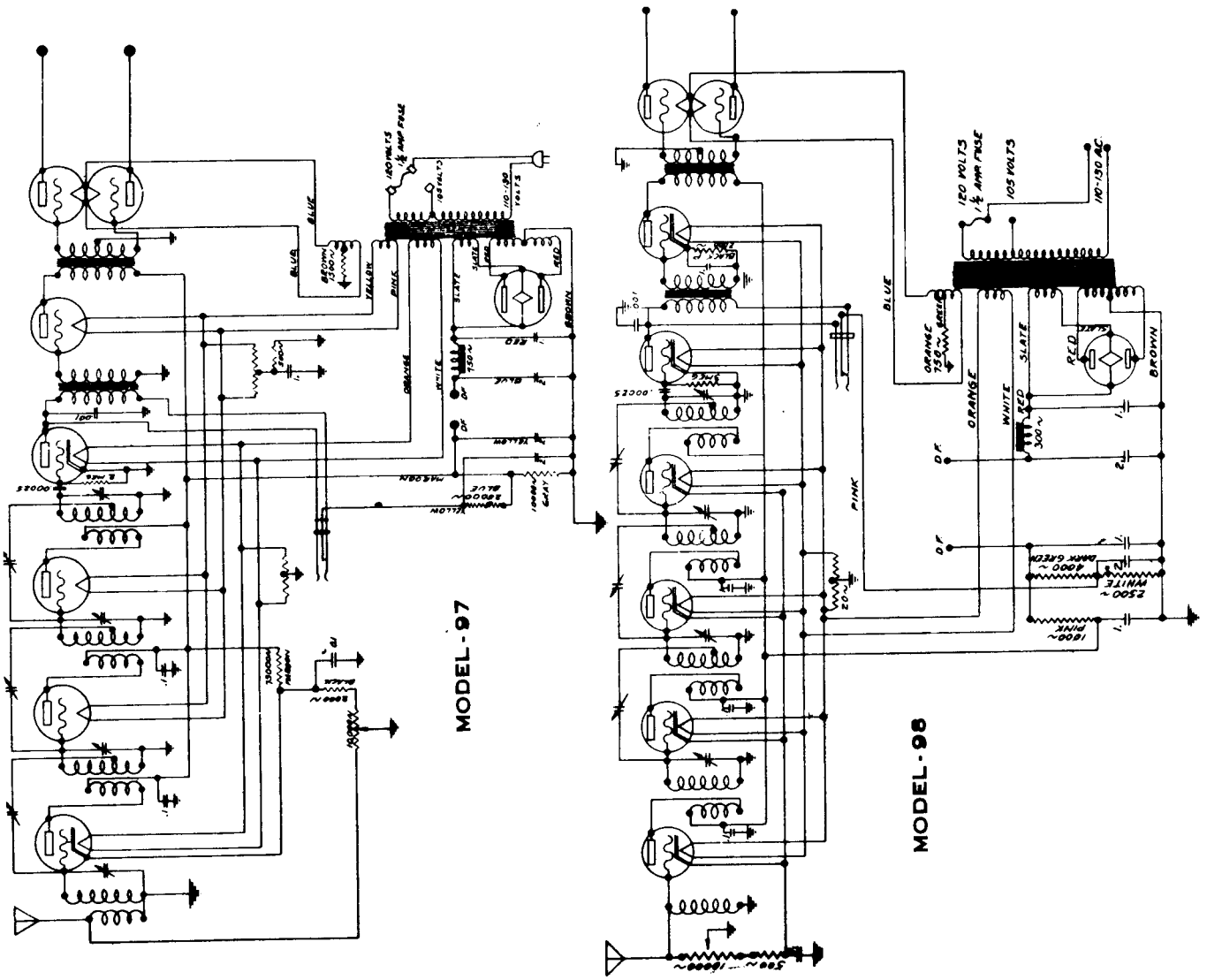


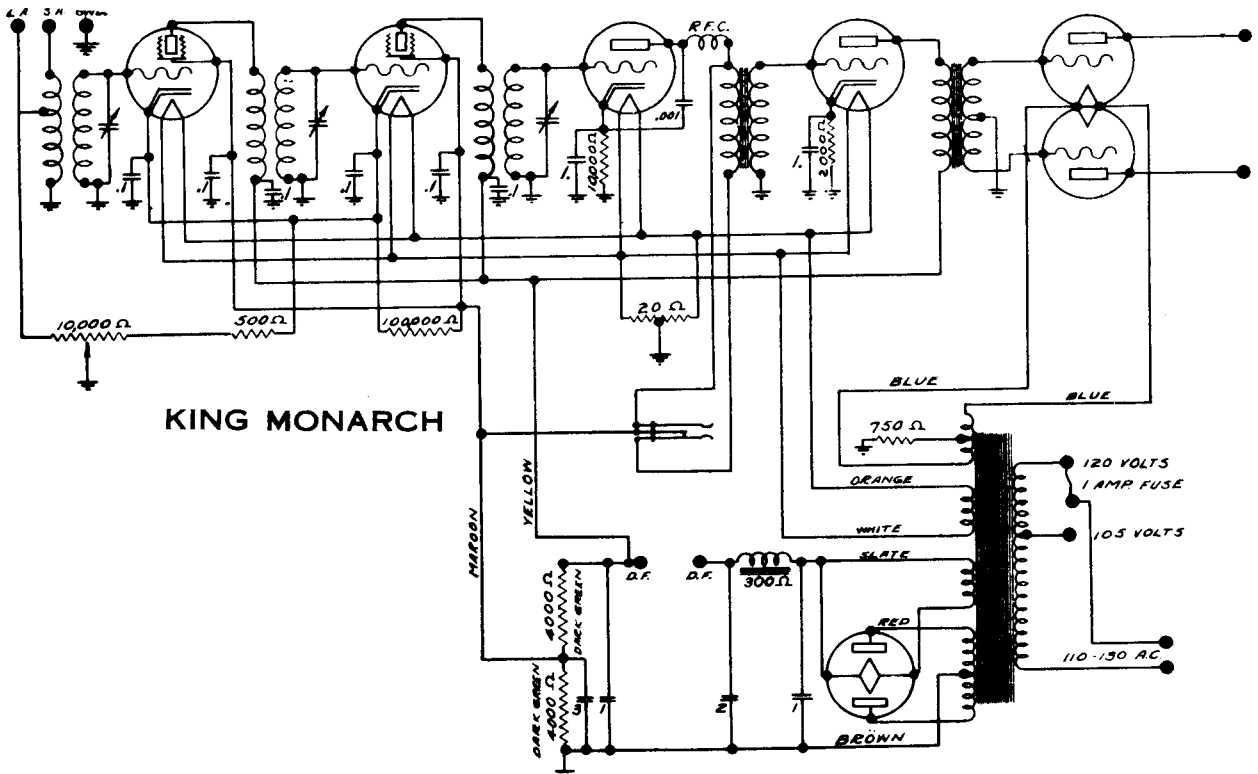
Model J, R4433



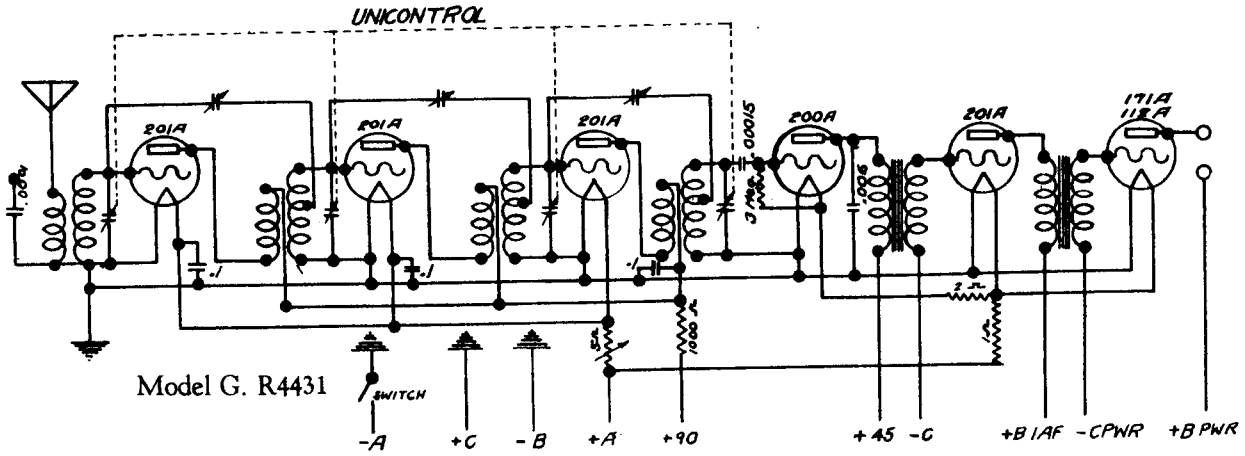
Model H, R4432

KING MFG. CORP.



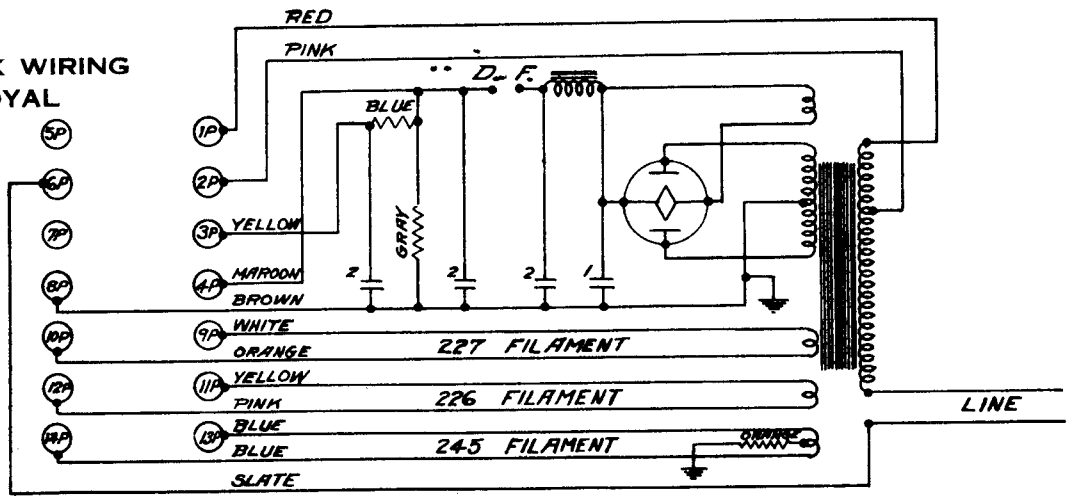


KING MFG. CORP.

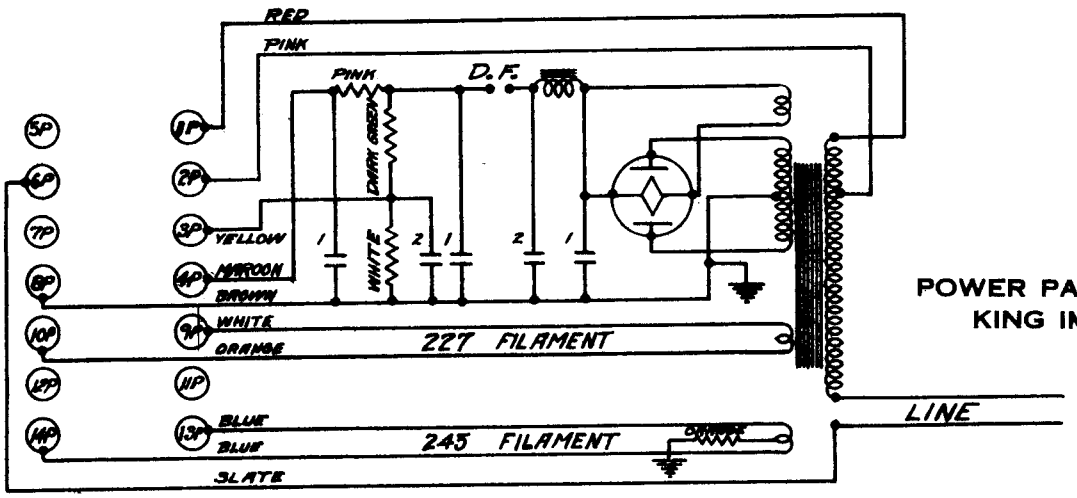


Model G. R4431

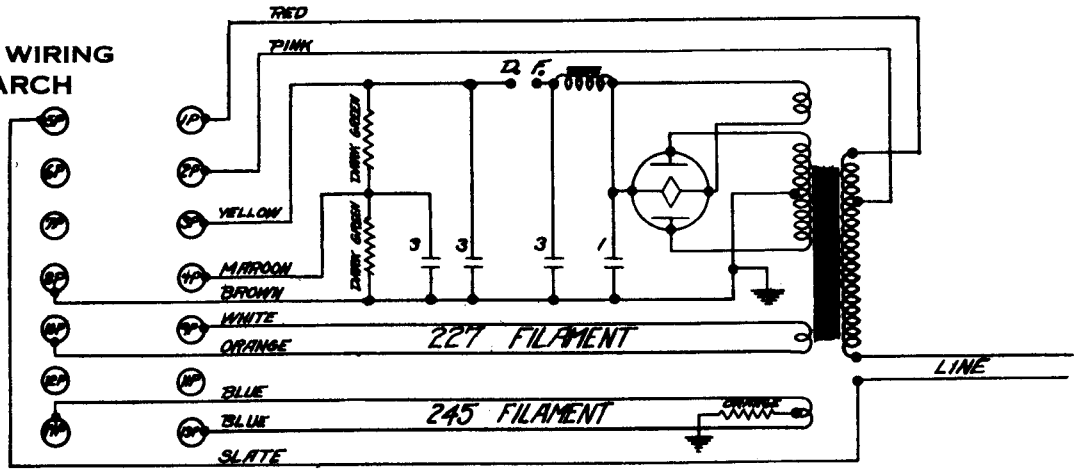
POWER PACK WIRING KING ROYAL



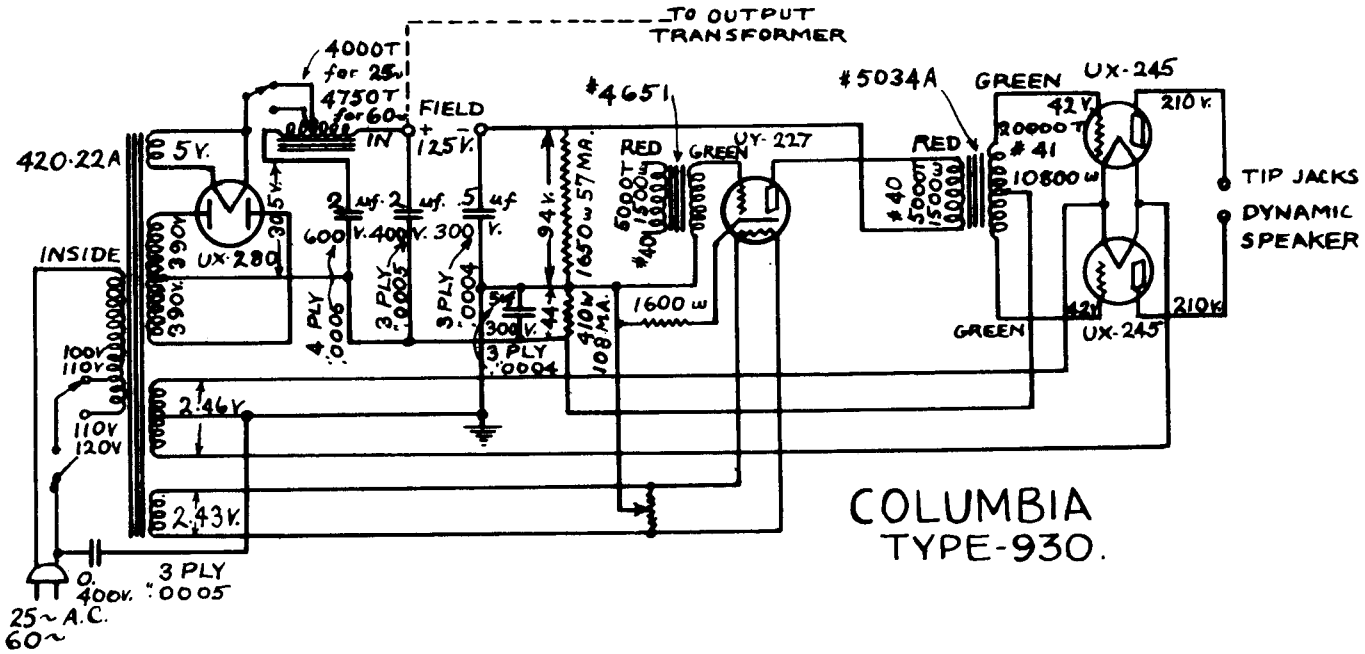
POWER PACK WIRING KING IMPERIAL



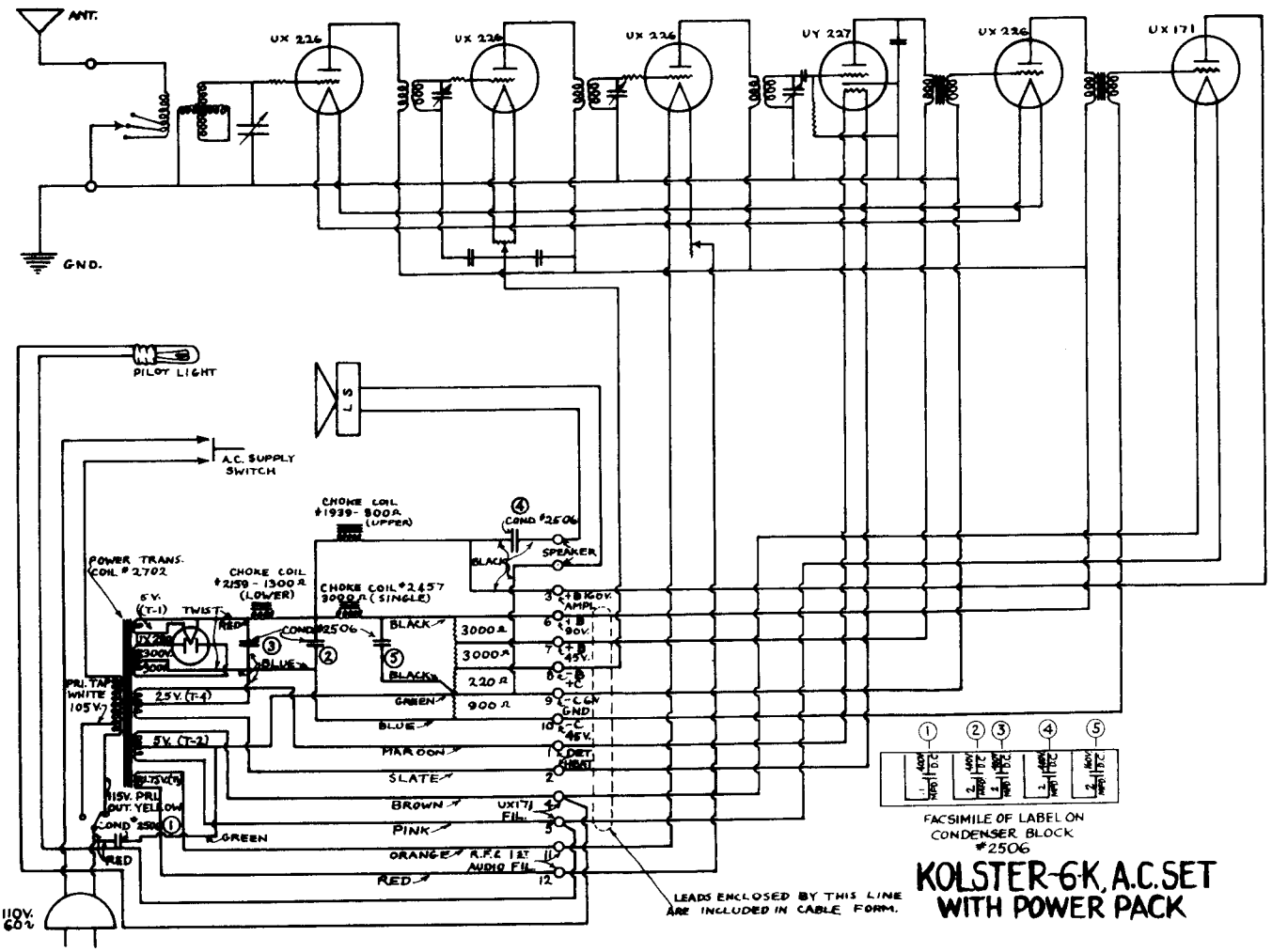
POWER PACK WIRING KING MONARCH



KOLSTER RADIO CORP.

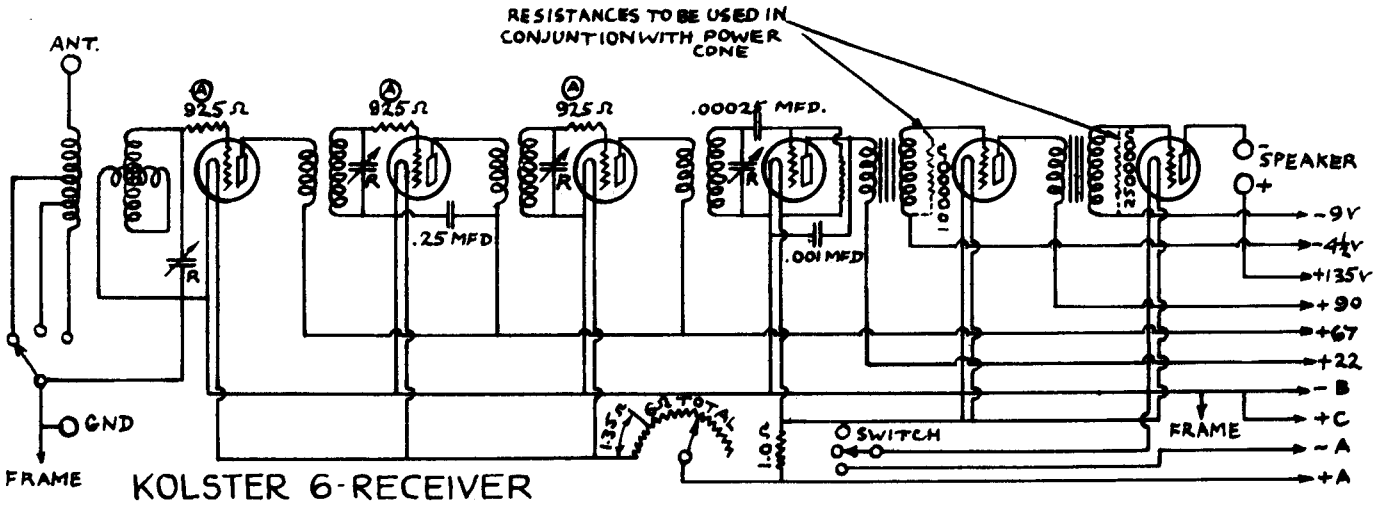


COLUMBIA
TYPE-930.

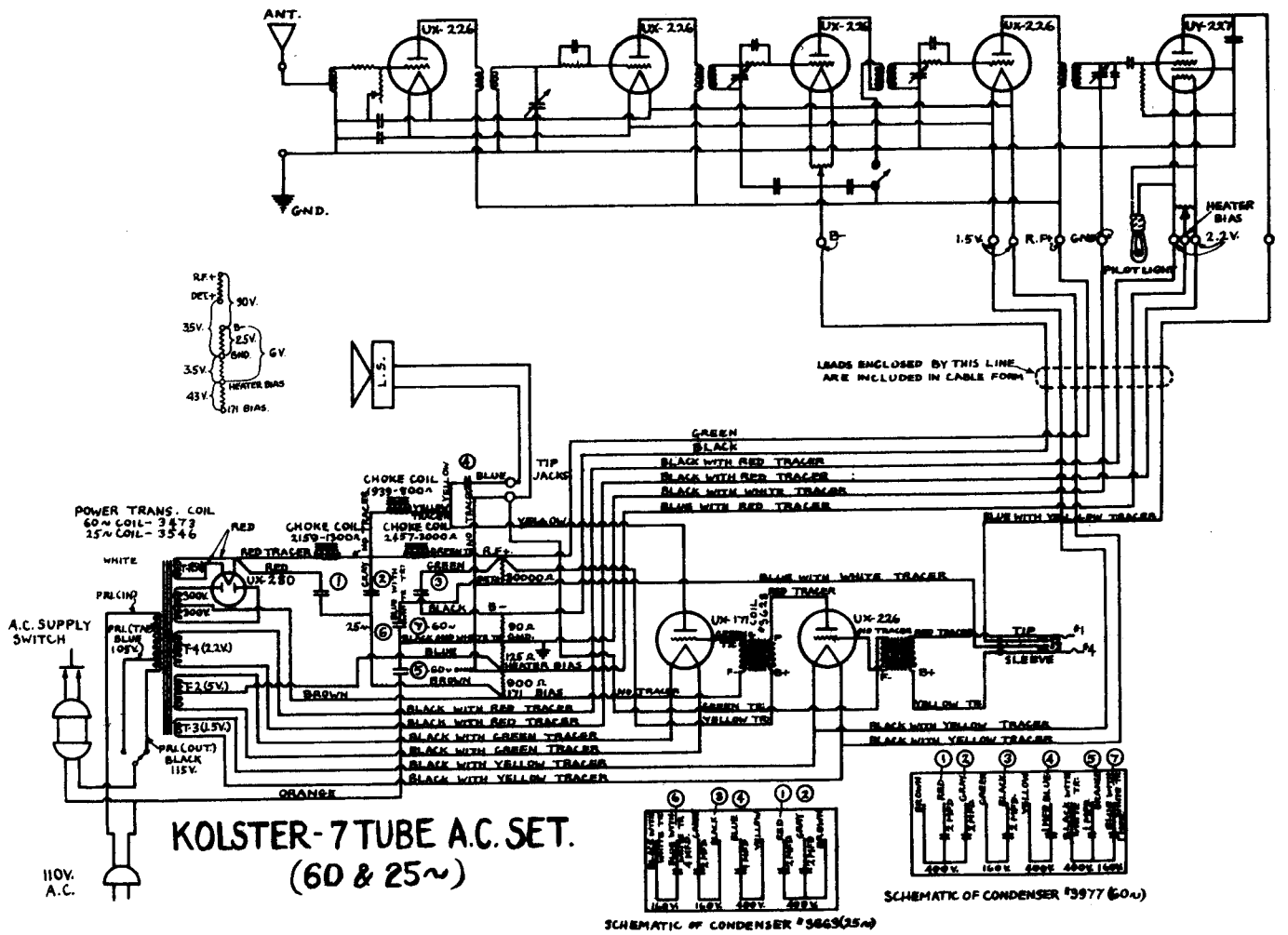


KOLSTER-6K, A.C. SET WITH POWER PACK

KOLSTER RADIO CORP.



KOLSTER 6-RECEIVER

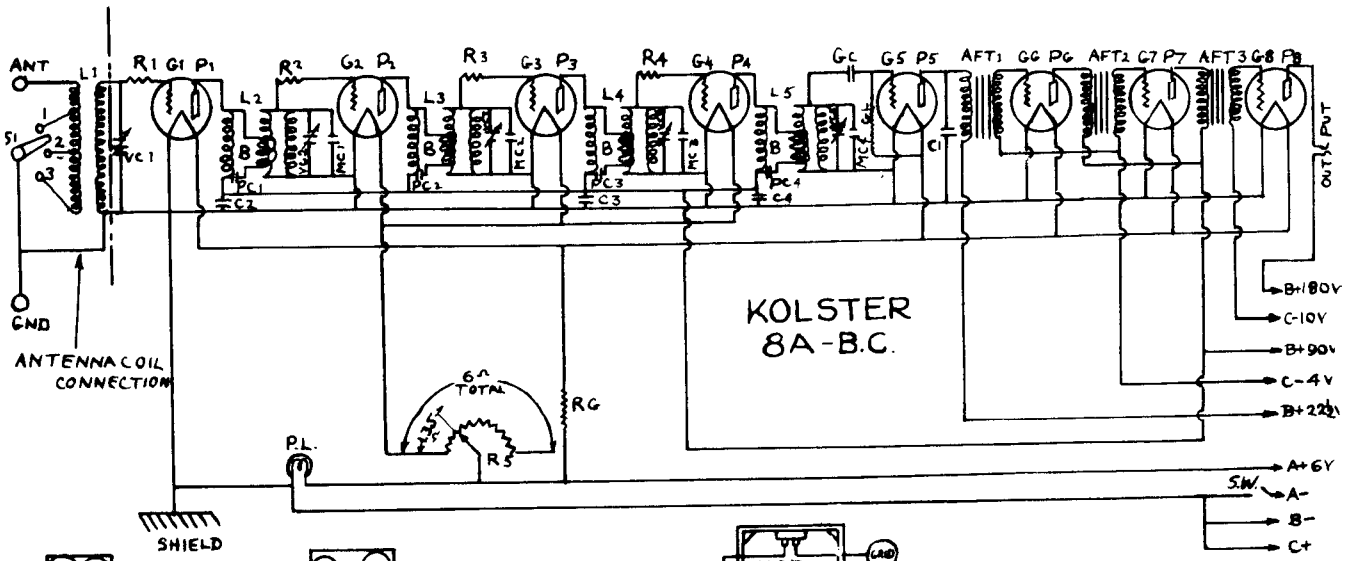


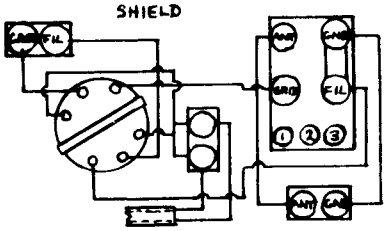
KOLSTER-7 TUBE A.C. SET.
(60 & 25~)

SCHEMATIC OF CONDENSER #3977 (60~)

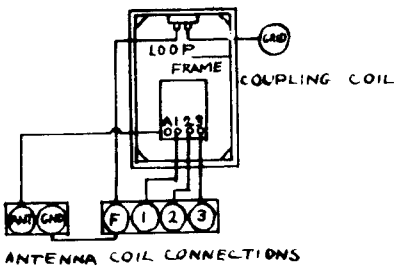
SCHEMATIC OF CONDENSER #3869 (25~)

KOLSTER RADIO CORP.

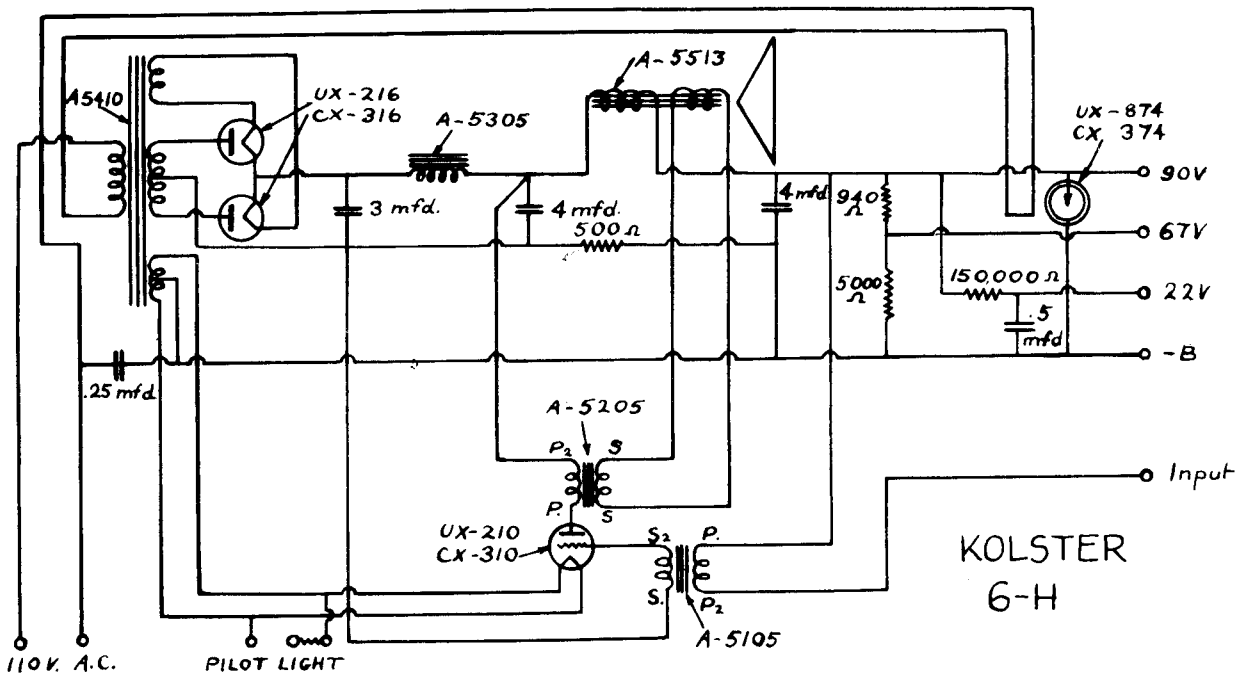


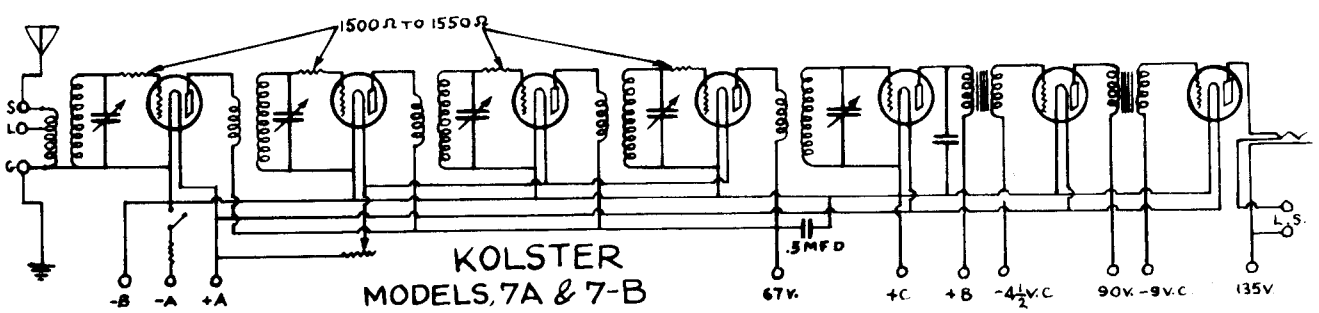


MODEL 8-B

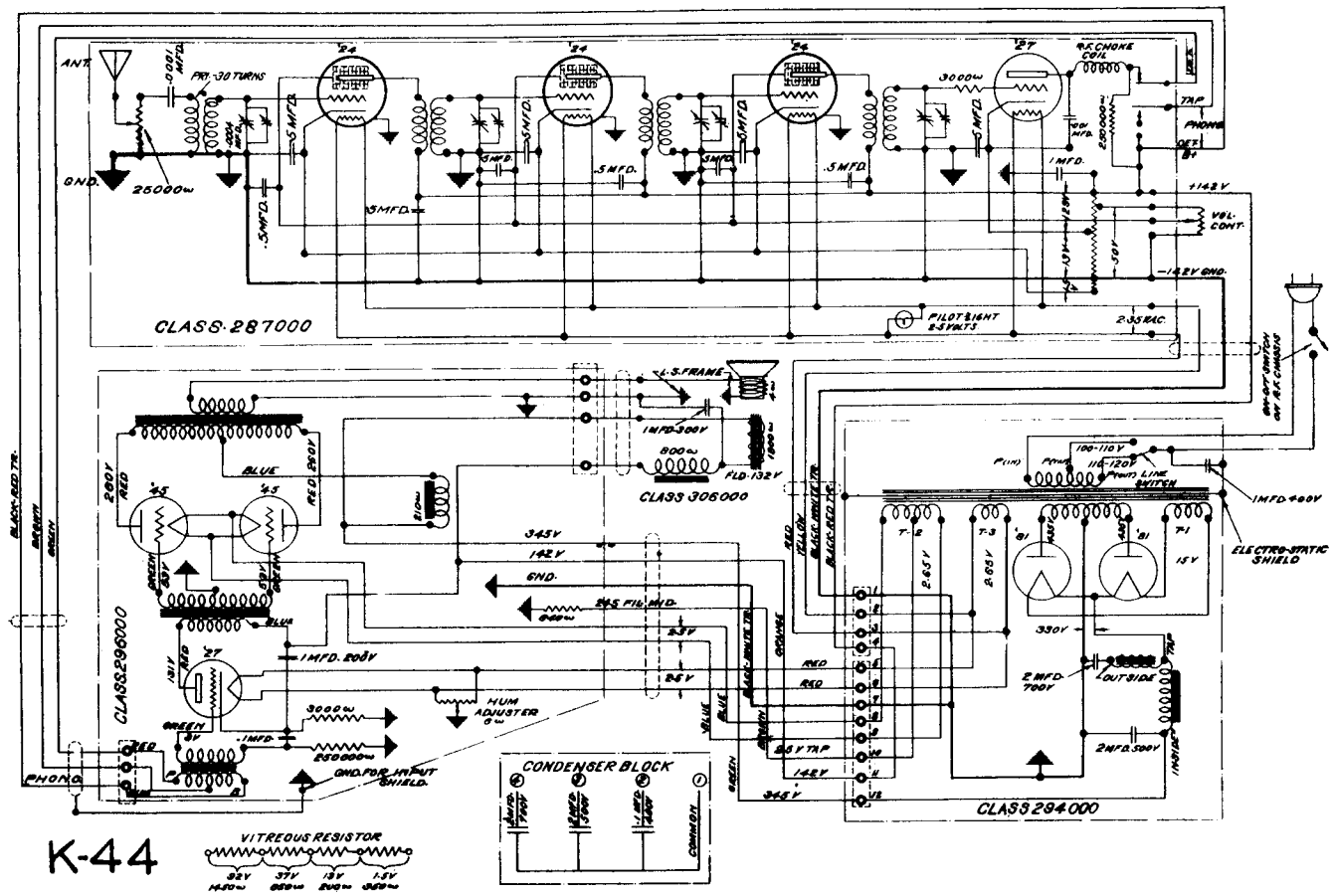


MODEL 8-C



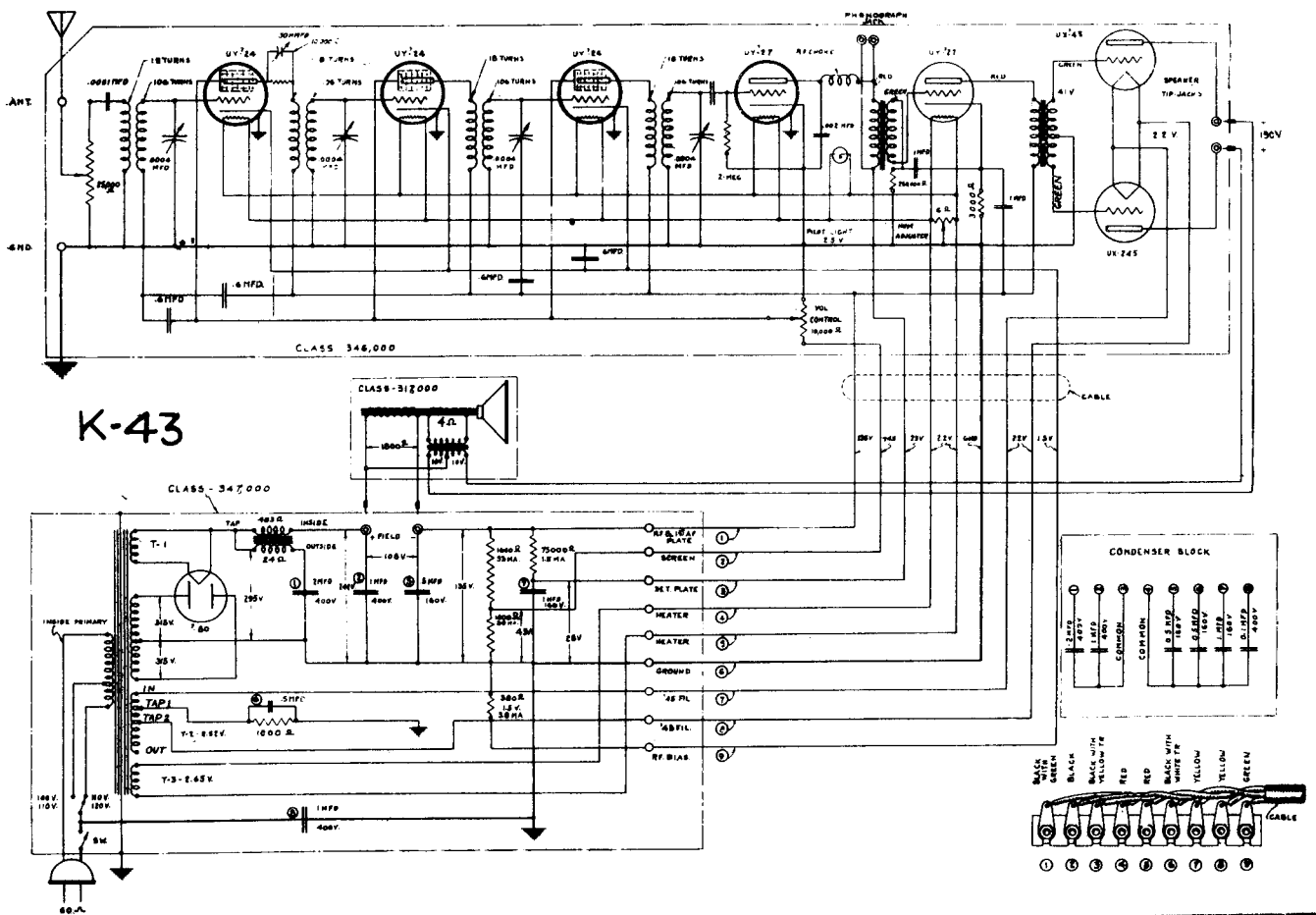


KOLSTER RADIO CORP.



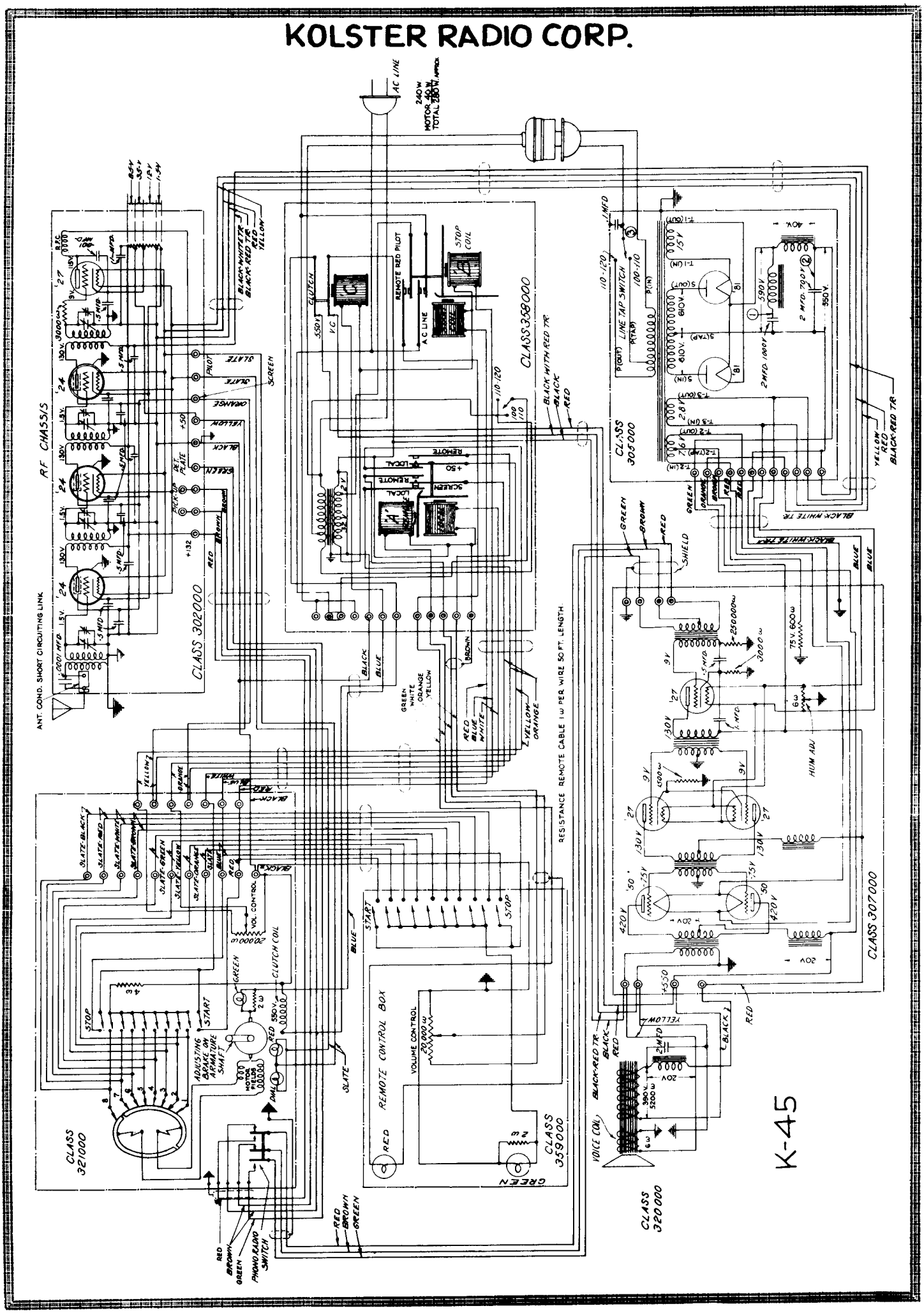
K-44

VITREOUS RESISTOR



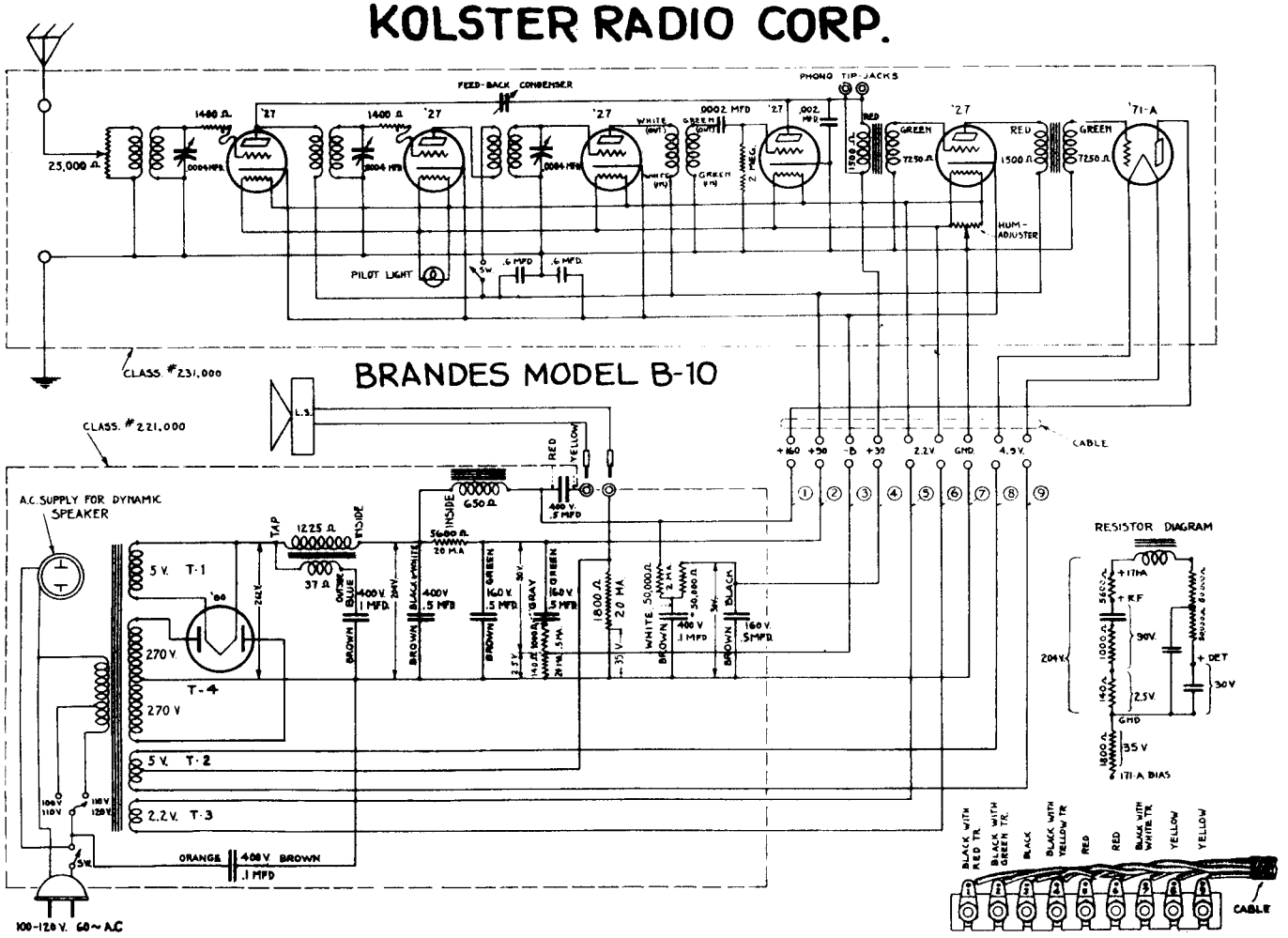
K-43

KOLSTER RADIO CORP.

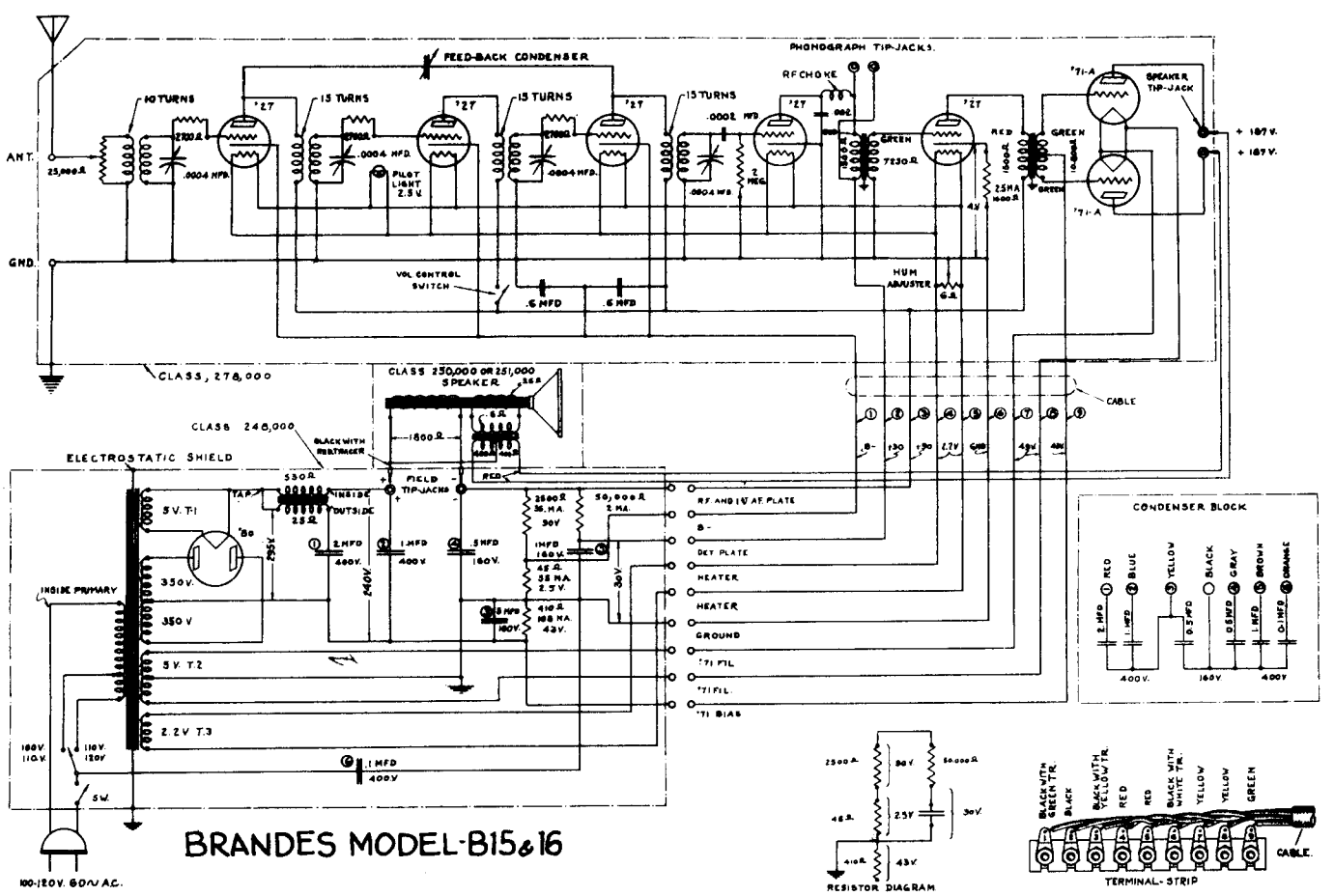


KOLSTER RADIO CORP.

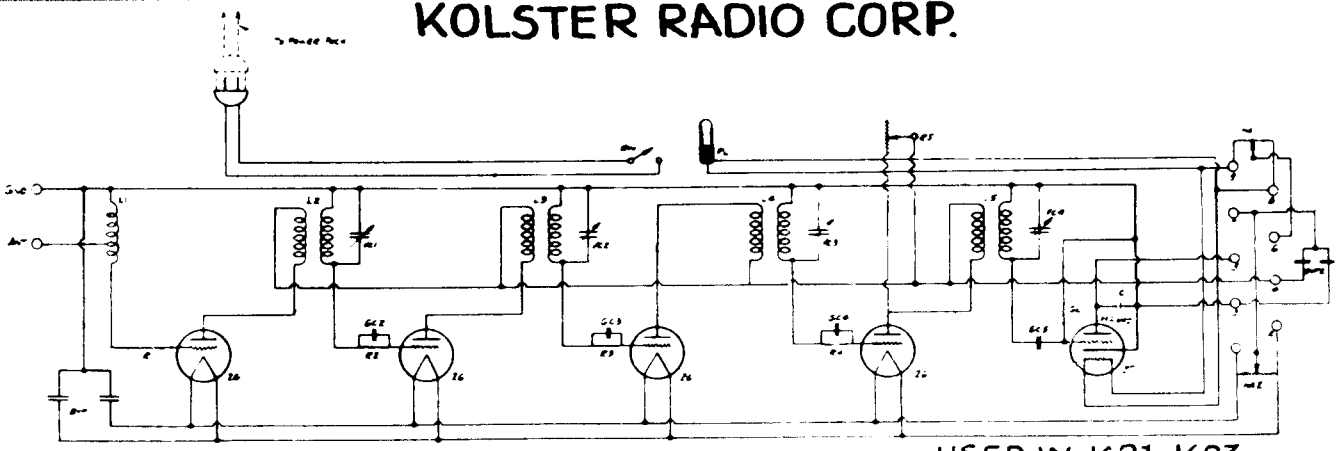
BRANDES MODEL B-10



BRANDES MODEL-B15 & 16

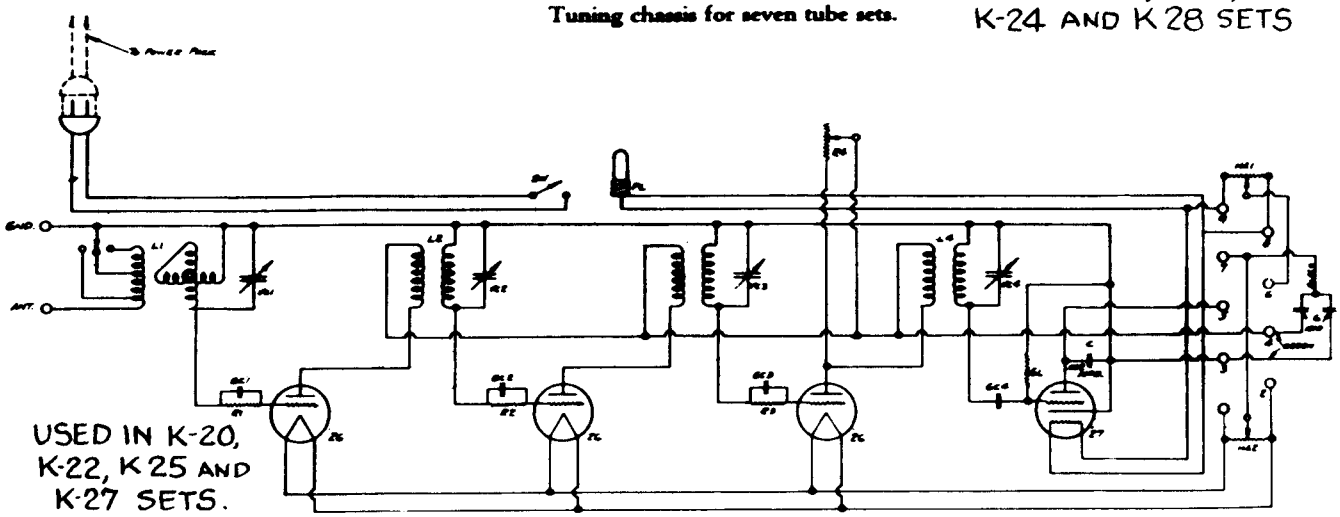


KOLSTER RADIO CORP.



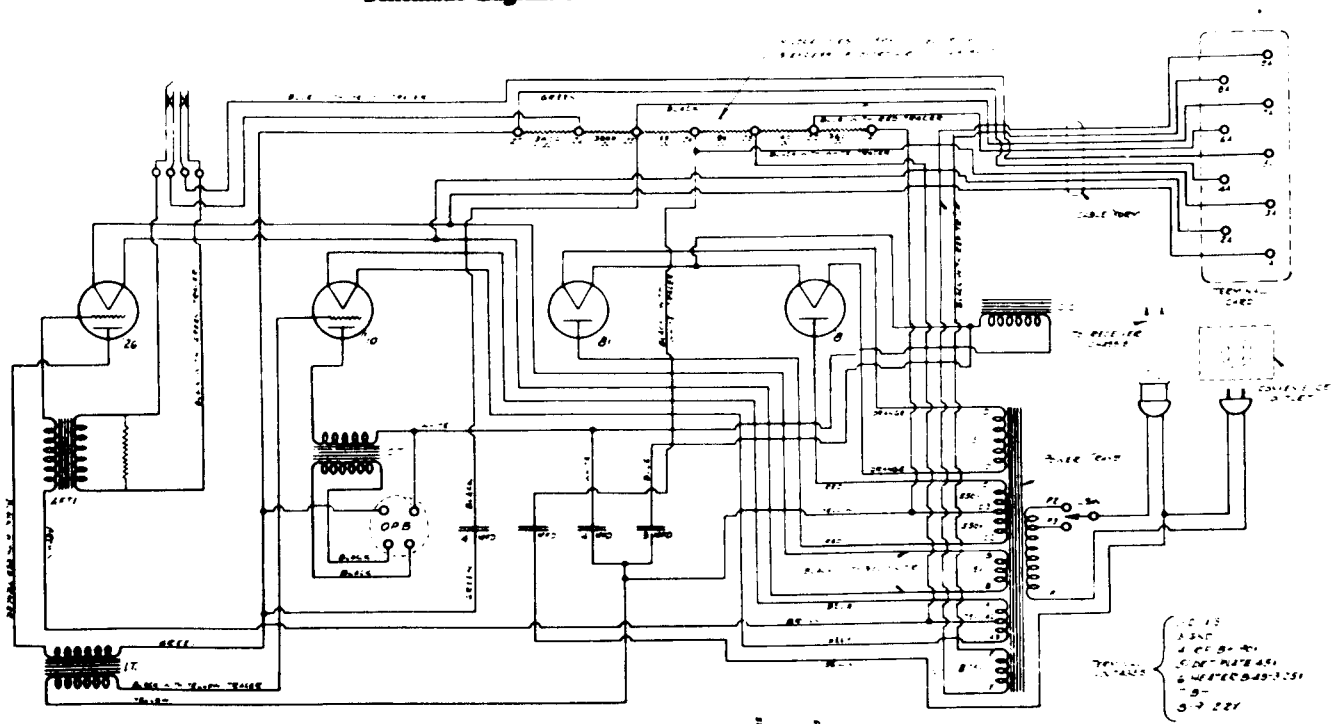
USED IN K-21, K23, K-24 AND K 28 SETS

Tuning chassis for seven tube sets.

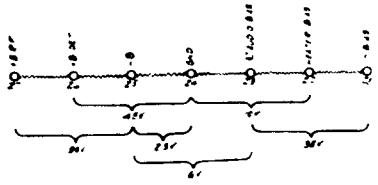


USED IN K-20, K-22, K 25 AND K-27 SETS.

Schematic diagram of the four tube chassis as used with six tube sets.



Power Supply and Power Amplifier Unit.
(USED WITH K-24)



Radio Service Data Sheet

KOLSTER K20, K22, K25, K27 AND K37 SIX-TUBE RECEIVERS

Before proceeding with a detailed description of these Kolster receivers, of which the "K20" is the most popular representative, we will point out the major differences that differentiate the several models broadly referred to as the "six-tube" sets. The "K20" model is a table-type radio receiver incorporating the four-tube chassis and the two-tube audio amplifier, which is combined with the 60 cycle power-supply unit shown in the schematic circuit; the "K25" has the same general design for operation on 25 cycles. The "K22" is a console arrangement of the tuner chassis and power pack used in the K20; while the "K27" is a console adaptation of the 25-cycle equipment. Another model of the Kolster line was designed for use as a portable demonstrator; this number, the K37, employs the circuit of the K20.

The service department of the Kolster Radio Corp. points out that the use of a lamp for testing continuity in the Kolster sets will probably cause the grid resistors R1, R2 or R3 to burn out; a high-resistance meter and low voltage should be used, instead.

The unit at the left end of the panel, constituting the "sensitivity" control, comprises a tap-switch controlling the inductance value in the antenna coil that is being used; and also tunes the combined variometer and variocoupler L1.

It is pointed out that the low-frequency response characteristic of the A.F. transformers used in these sets is particularly good and this should be considered when there is a complain of exceptional hum; for the least bit of disturbance of the circuits may develop an A.C. hum that would not be evident in many other makes.

Volume control is centered in R5.

Following are the values of the parts used in all the models mentioned above: Resistors R1, R2, R3, 1700 ohms; R4, 2 or 5 megs.; R5, 25,000 ohms; R6, R7, 6 ohms. These values are found in the vitreous voltage-divider: R8, 840 ohms; R9, 60 ohms; R10, 220 ohms; R11, 3,000 ohms; R12, 3,000 ohms.

Condensers C5, C6, C7 are 45-mmf. capacity; C8 is .00025-mf.; C9, .002-mf.; C10, C11, 0.6-mf.; C12, 1.0-mf., 400 V.; C13, 2 mf., 160 V.; C14, 2 mf., 400 V.; C15, 2 mf., 400 V.; C16, 1.0 mf., 400 V. The condenser bank in the power pack contains units that may be identified by the following color code for the leads: C12, blue, and yellow; C13, black, and green; C14, gray, and brown; C15, red, and brown; C16, orange, and black with white tracer. The values given are for 60-cycle operation; for 25-cycle operation the following changes are to be noted: condenser C16 has a capacity of 4 mf., and returns to the tap between R8 and R9, instead of the tap between R9 and R10 (chassis ground).

Choke Ch1 has a resistance of 3,000 ohms; Ch2, 1,300 ohms; Ch3, 800 ohms.

Jack J is the provision for phonograph pick-up connection.

Pilot light V8 is of the 2.5-volt type and operates at 2.2 volts.

Hum control resistor R6 is located at the top right front corner of the tuner chassis; while hum control R7 is placed at the rear.

The tube sockets, mounted along the back of the receiver chassis, are in numerical order; with V1 at the left and V4 at the right, behind the grid leak.

Following are the average normal voltages at the terminals on the connection panel: 1-2 (R.F. filament) 1.5 V., A.C.; 3-6 (heater bias) —3 V., D.C.; 3-5 (detector plate) +45 V., D.C.; 3-7 (grid bias) —6V., D.C.; 4-7 (R.F. plate) +90 V., D.C.; 8-9 (detector heater) 2.2 V., A.C. The power-transformer output is 300 volts A.C. on each side of the center tap.

Accidental grounds of instruments to chassis may be due to defective fiber washers.

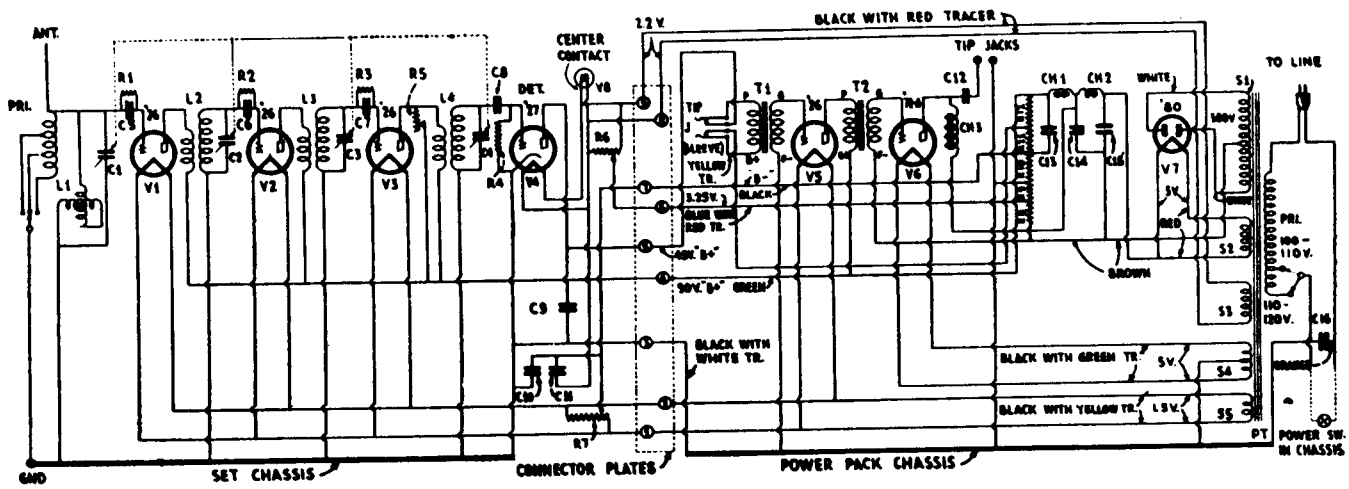
Circuit oscillation may occur in any receiver; the possible sources of the trouble will vary with the individual design of each receiver. In the case of Kolster sets incorporating the circuit shown, this fault may usually be localized to one of the following causes: poor tubes; shorted R1, R2 or R3; excessive voltage at tap 4 on the connector plate; C10 or C11 open or shorted; antenna too long; poor ground conditions; reversed primary winding of the special R.F. transformer combination L1; shorted C5, C6, C7, C8 or C9; or open C9.

Microphonic howl will yield to service attention directed with regard for the same factors as mentioned above in connection with circuit oscillation. Substitution of a 5-meg. resistor, for the more usual value of 2 megs. in the grid leak R4, is sometimes a successful curative measure. Additional palliatives may be necessary; such as changing the positions of the exposed corner plates of C5, C6 and C7, and noting the result upon retuning; or bending the bus-bar leads to the circuit balancing condenser at the right of the variable condenser gang (and therefore on the side toward the connector plate—as we call the power pack-chassis connection posts) so that it is further removed from the shield of this 4-gang component. (This variable condenser, in shunt with C4, is not shown in the schematic circuit.) Increasing the value of R1, R2 and R3, up to 2,100 ohms each, also may reduce the sensitivity to a satisfactory value. If the resistors in the grid leads of V1, V2 and V3 are uniformly changed in value the balance in these circuits will not be disturbed. Another resort may be to remove entirely one of the grid condensers, preferably C6, (leaving the shunting resistor in circuit). A thorough inspection should be made for looseness in the cabinet, and to determine whether the chassis is properly mounted so that it floats on the rubber cushions.

To remove this chassis, first take out the power pack; then unscrew the cap screws in the bottom of the set. Next, remove the three knobs on the control shafts (the antenna switch lever is to be removed by unscrewing a screw and lock-nut; there is also an escutcheon nut to be removed from the control switch, and another nut which fastens the volume-control shaft to the panel).

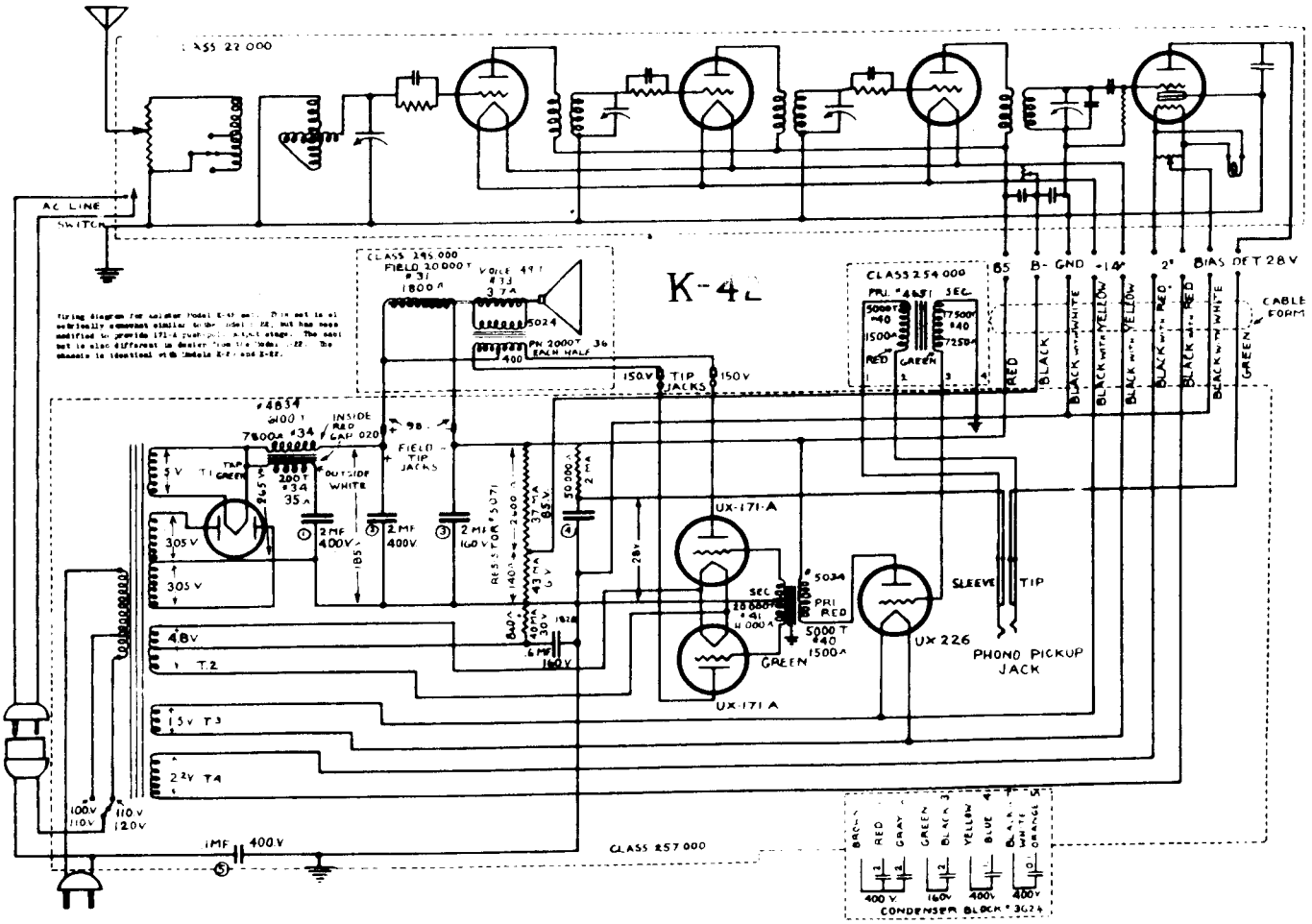
To replace a drive cord there will be needed a pair of long-nose pliers, a screw-driver, and a No. 7 Spintite wrench. The replacement cord should measure 13 inches, from knot to knot, after being thoroughly stretched. Now, turn chassis upside down and put both ends of cord through the opening in the chassis, so that the cord will loop around the main drive pulley. Next, turn the chassis to obverse side and rotate the tuning drum; so that, holding the drum tightly, one end of the cord can be threaded over the rear idler pulley, underneath the drum, and the cord brought up until the knot can be placed in the socket (at about 12 on the dial). The other end is to be looped over the other idler pulley and under the dial drum to the front of the set; it may then be grasped with the pliers, and the knot caught into the slot in the tension spring provided.

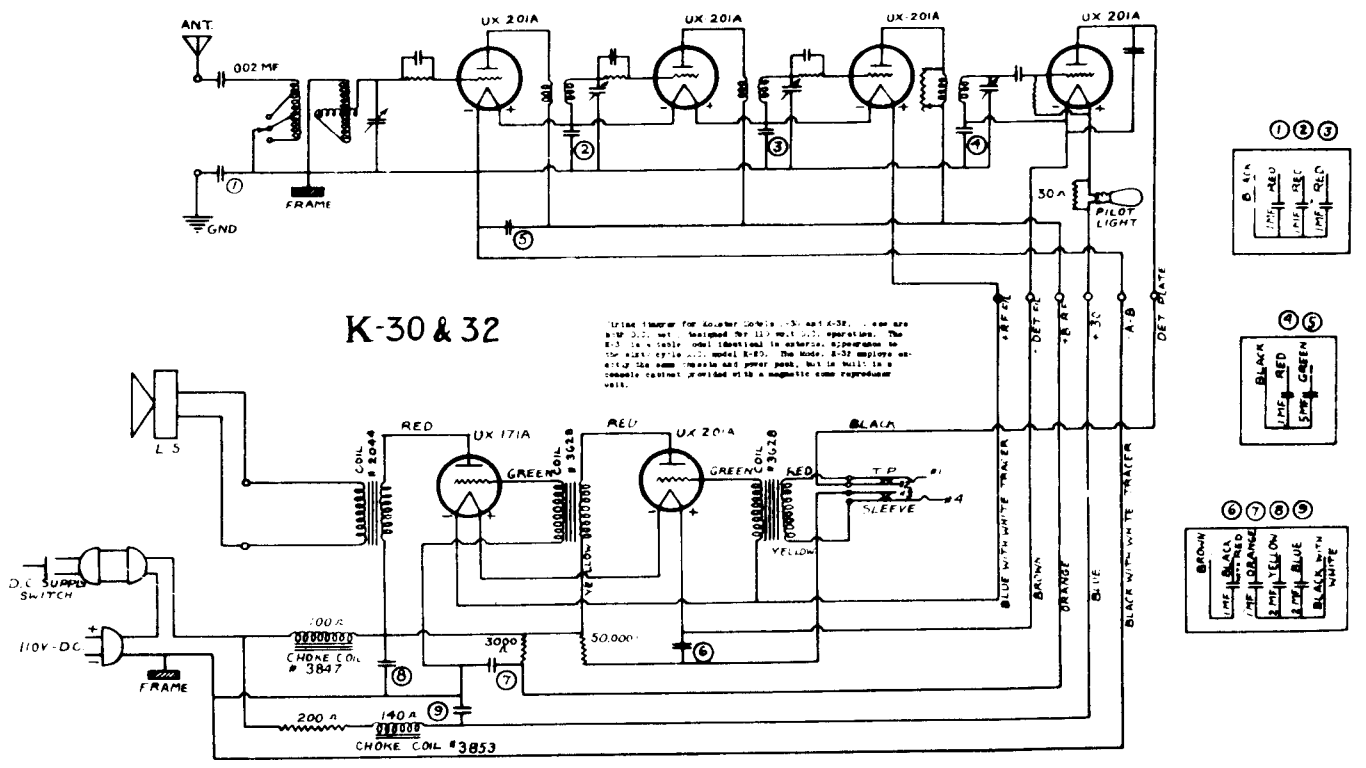
The line-current consumption of these models is 50 watts; and the following resistance values may be used for resistors in series with the line where it is deemed necessary to reduce the line voltage (the first figure is the potential of the line above the desired 110 volts, and the second is the value of the series limiting resistor): 112.7 V., 7.0 ohms; 114.0 V., 10 ohms; 115.1 V., 2.5 ohms; 116.1 V., 15 ohms; 119.0 V., 22 ohms; 122.7 V., 31 ohms; 128.7 V., 45 ohms; 136 V., 62 ohms.



Above, the circuit used in the group of Kolster models listed at the top of the page. The details and connections of the R.F. chassis (left) and the audio amplifier and power pack (right) are those of the 60-cycle models.

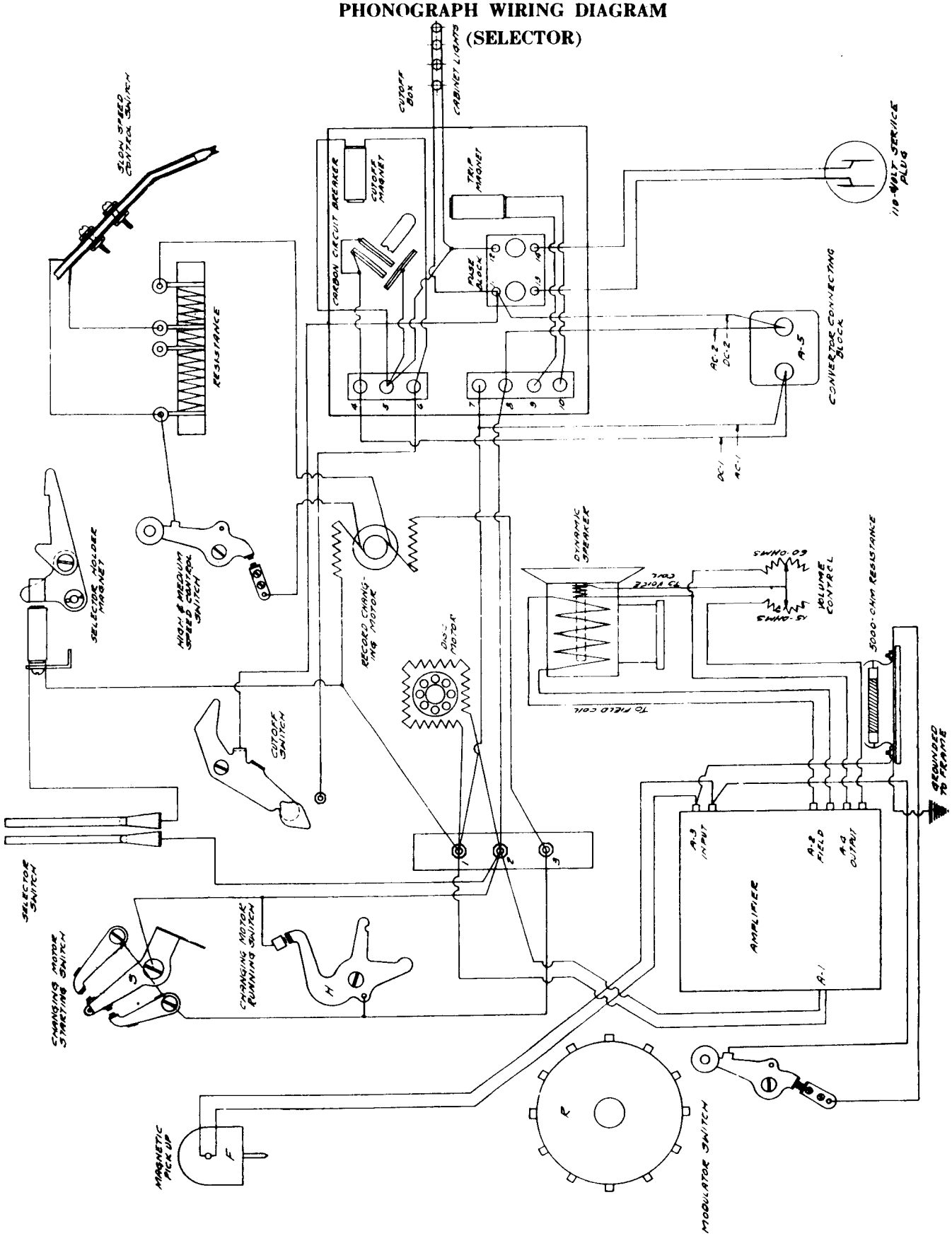
KOLSTER RADIO CORP.





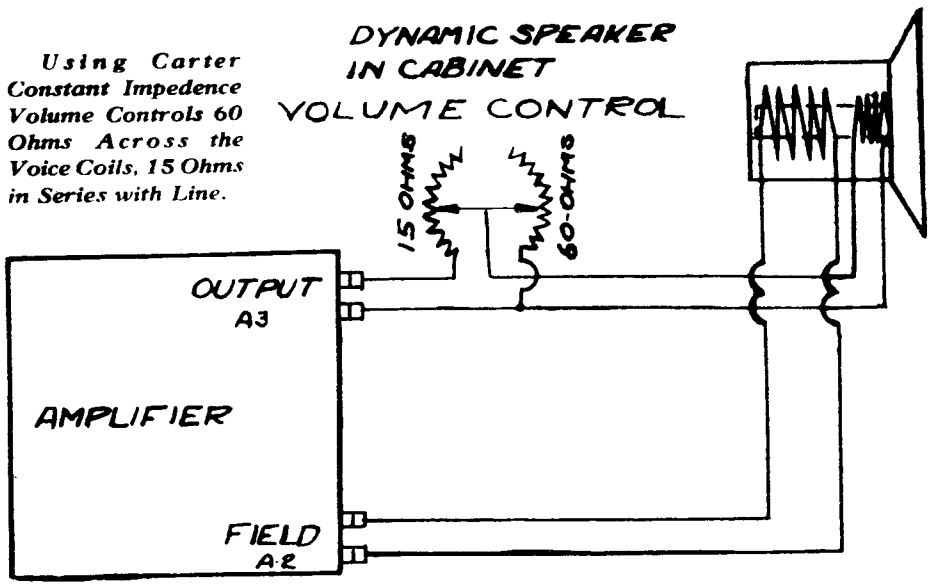
MILLS NOVELTY CO.

PHONOGRAPH WIRING DIAGRAM
(SELECTOR)



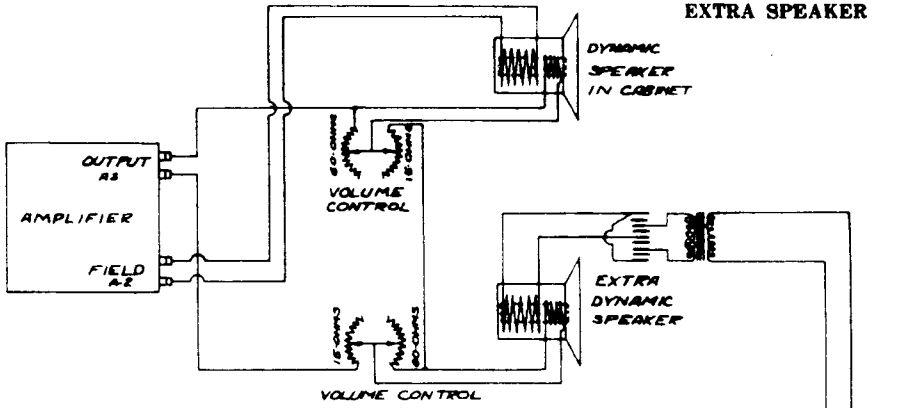
Using Carter Constant Impedence Volume Controls 60 Ohms Across the Voice Coils, 15 Ohms in Series with Line.

DYNAMIC SPEAKER IN CABINET



PHONOGRAPH SPEAKER WIRING DIAGRAM WITH EXTRA SPEAKER

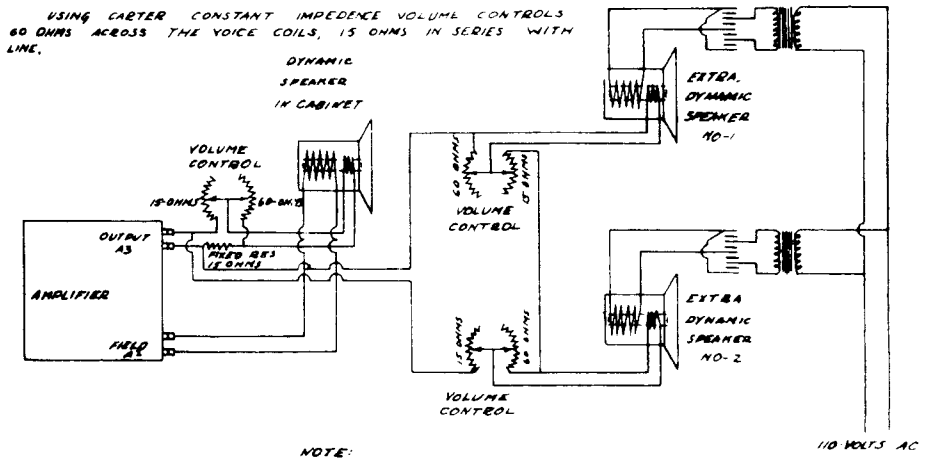
USING CARTER CONSTANT IMPEDENCE VOLUME CONTROLS 60 OHMS ACROSS THE VOICE COIL & 15 OHMS IN SERIES WITH LINE



NOTE
EXTRA SPEAKERS FOR MILLS PHONOGRAPH ARE A SPECIAL TYPE AND MAY BE PURCHASED AT MILLS NOVELTY COMPANY

PHONOGRAPH SPEAKER WIRING DIAGRAM WITH TWO EXTRA SPEAKERS

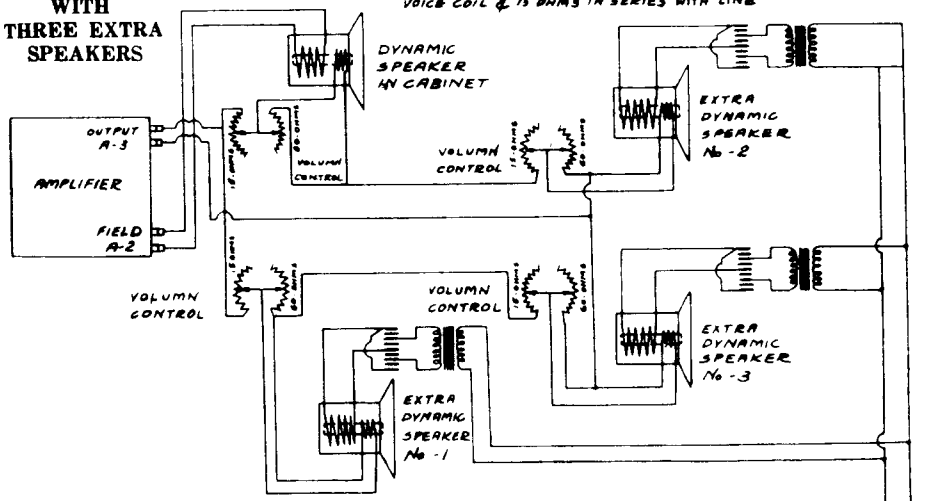
USING CARTER CONSTANT IMPEDENCE VOLUME CONTROLS 60 OHMS ACROSS THE VOICE COILS, 15 OHMS IN SERIES WITH LINE.



NOTE:
EXTRA SPEAKERS FOR MILLS PHONOGRAPHS ARE A SPECIAL TYPE AND MAY BE PURCHASED AT MILLS NOVELTY COMPANY

PHONOGRAPH SPEAKER WIRING DIAGRAM WITH THREE EXTRA SPEAKERS

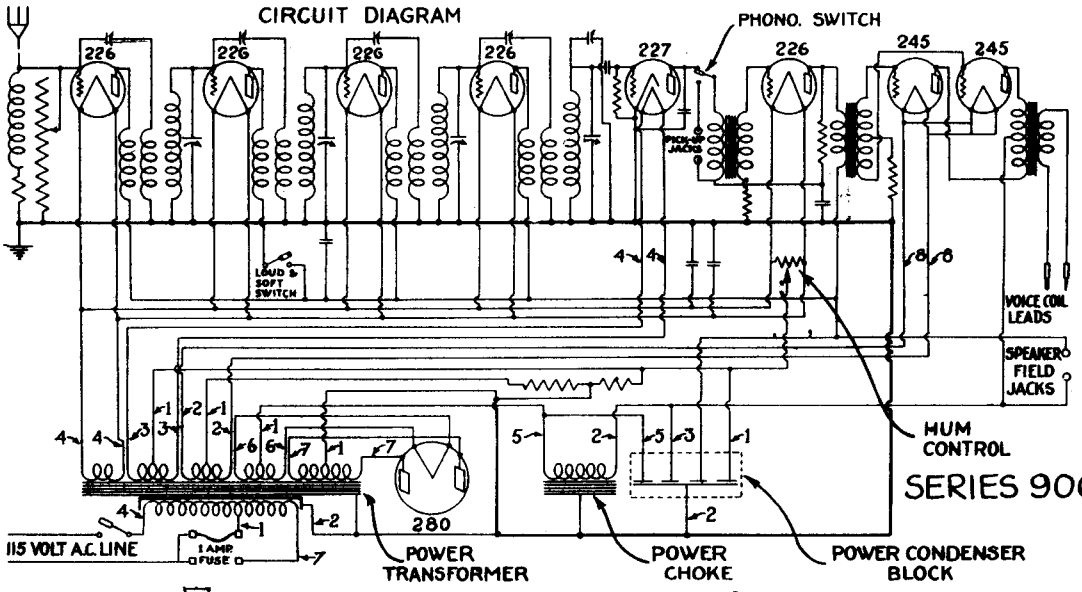
USING CARTER CONSTANT IMPEDENCE VOLUMN CONTROLS - 60 OHMS ACROSS THE VOICE COIL & 15 OHMS IN SERIES WITH LINE

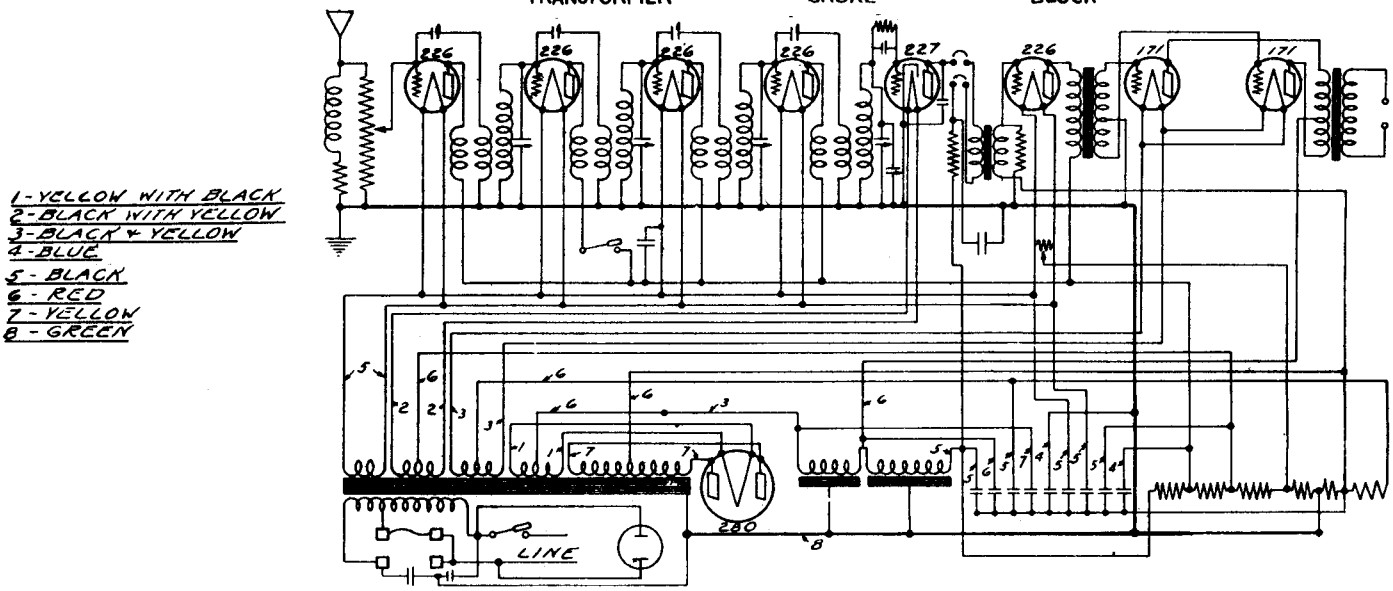


NOTE:-
EXTRA SPEAKERS FOR MILLS PHONOGRAPHS ARE A SPECIAL TYPE AND MAY BE PURCHASED AT THE MILLS NOVELTY COMPANY

MILLS NOVELTY CO.

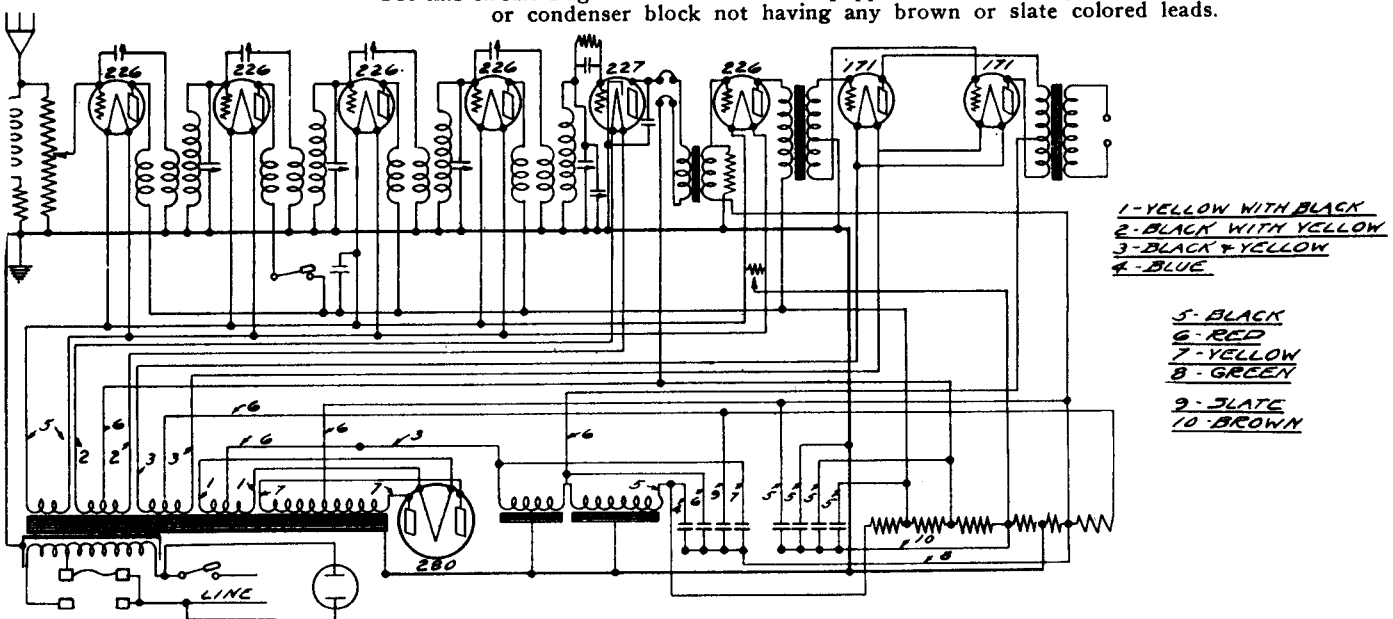
Mc MILLAN RADIO CO.





McMILLAN 8—A. C. POWER SET

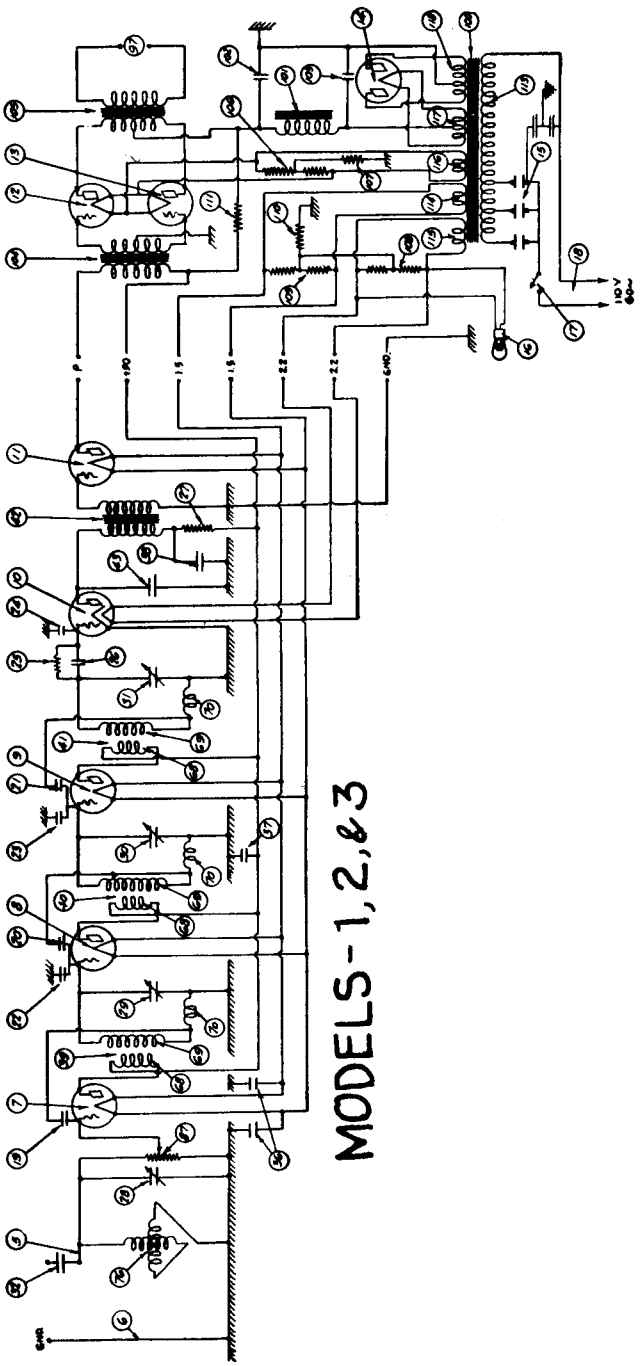
Use this circuit diagram for all receivers equipped with a sealed power transformer block, or condenser block not having any brown or slate colored leads.



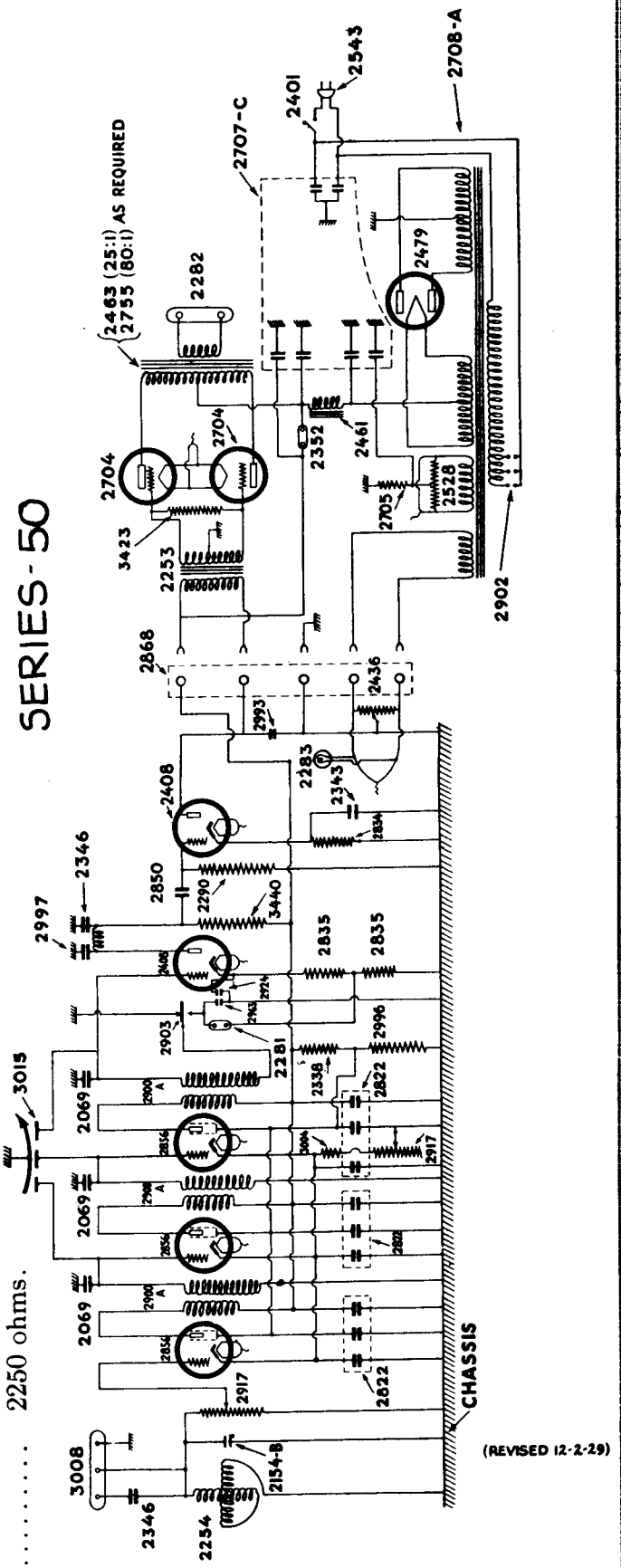
McMILLAN 8—A. C. POWER SET

Use this circuit diagram for receivers equipped with power transformer block having removable cover, or condenser block having one brown and one slate colored lead in addition to the colors used for circuit diagram shown above.

NATIONAL CARBON CO., Inc.



MODELS - 1, 2, & 3

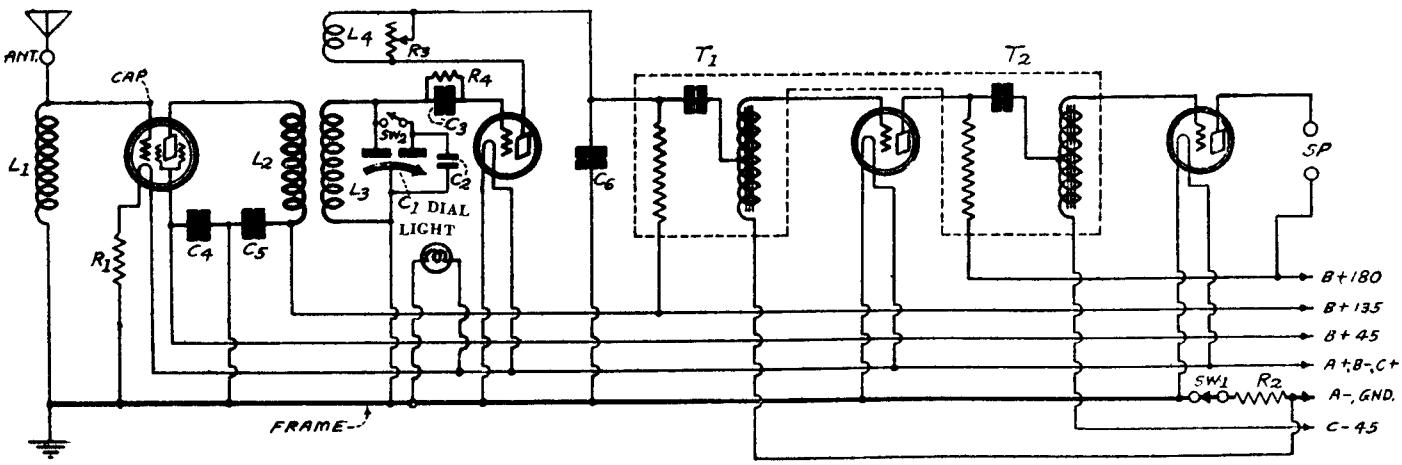


FIXED RESISTORS
SERIES - 50

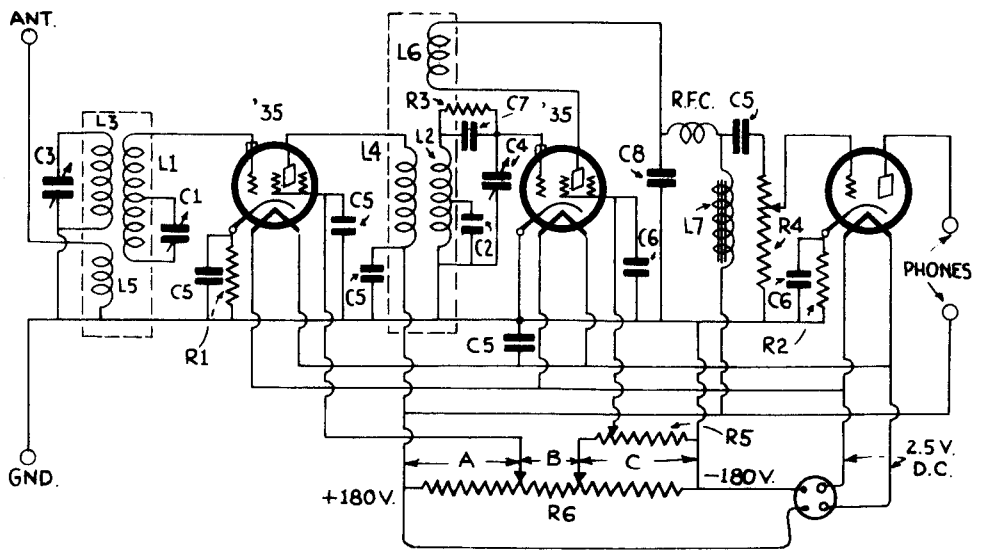
2290	2 megohm.
2835	4000 ohms.
3440	125000 ohms.
3004	200 ohms.
2834	3000 ohms.
2338	2500 ohms.
2996	2250 ohms.

NATIONAL CO., INC.

NATIONAL SW-4

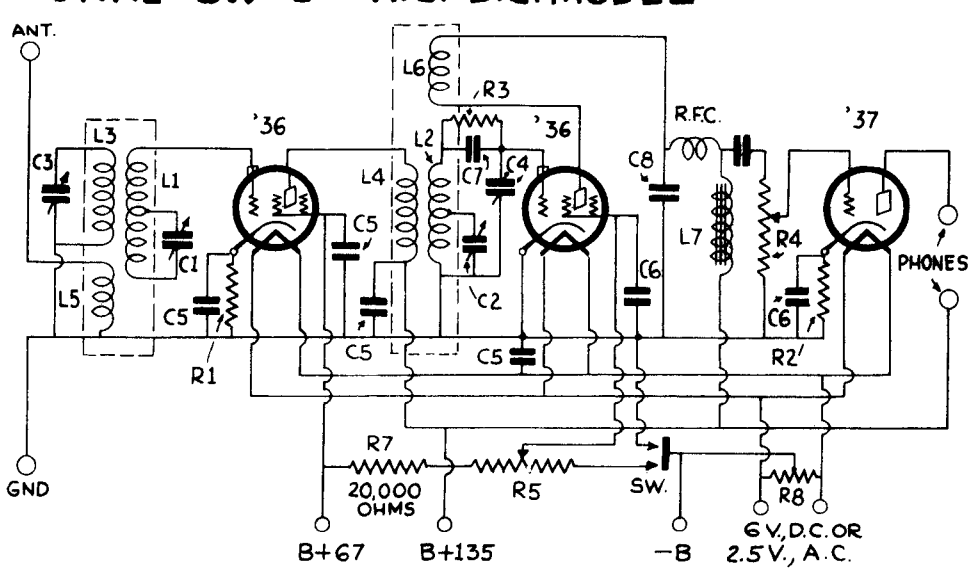


NATIONAL SW-3 A.C. MODEL



L_1, L_2, L_3, L_4, L_5, and L_6 — r.f. transformers.
L_7 — 750-henry plate coupling reactor. A good audio transformer with primary and secondary connected in series might be used.
C_1 and C_2 — 90-μfd. ganged tuning condensers with insulating shaft coupling.
C_3 — Midget type trimmer condenser.
C_4 — 8-μfd. detector transformer trimmer condenser (incorporated in coil form), Hammarlund No. 35.
C_5 — .01-μfd. non-inductive mica fixed condensers.
C_6 — .5-μfd. non-inductive paper fixed condensers.
C_7 — 100-μμfd. mica grid condenser, small type. Incorporated in detector r.f. transformer.
C_8 — 250-μμfd. mica by-pass condenser.
R_1 — 500-ohm cathode resistor, 2-watt type.
R_2 — 2000-ohm cathode resistor, 2-watt type.
R_3 — 5-megohm grid leak, one in each detector transformer.
R_4 — 500,000-ohm calibrated tapered type potentiometer. See text.
R_5 — 50,000-ohm regeneration control potentiometer.
R_6 — B-voltage divider, total resistance 12,000 ohms divided as follows: A, 6900 ohms; B, 2000 ohms; C, 3100 ohms.

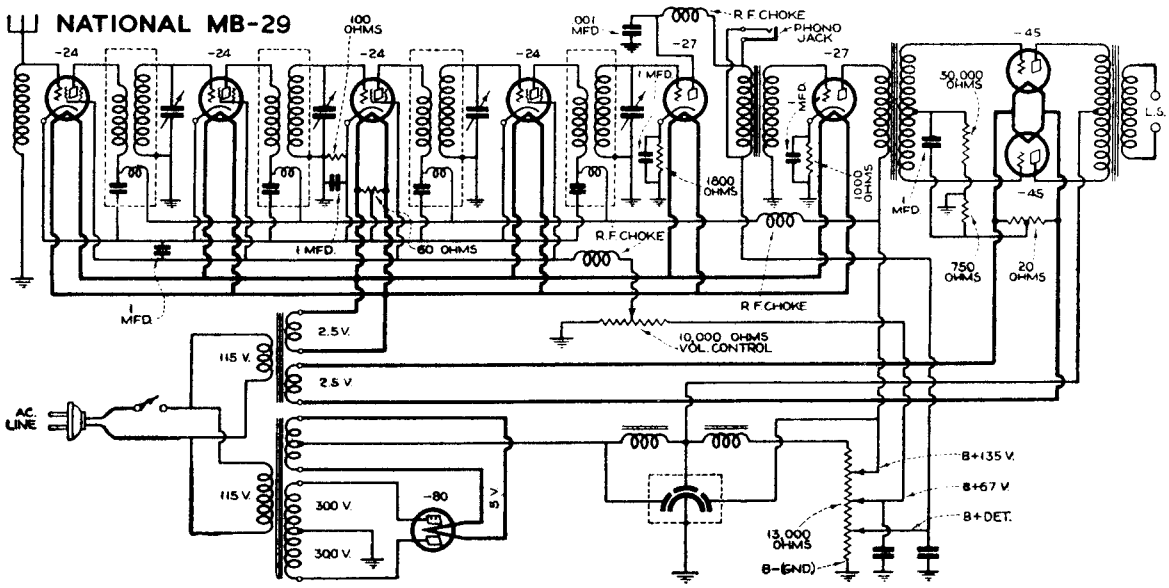
NATIONAL SW-3 A.C.-D.C. MODEL

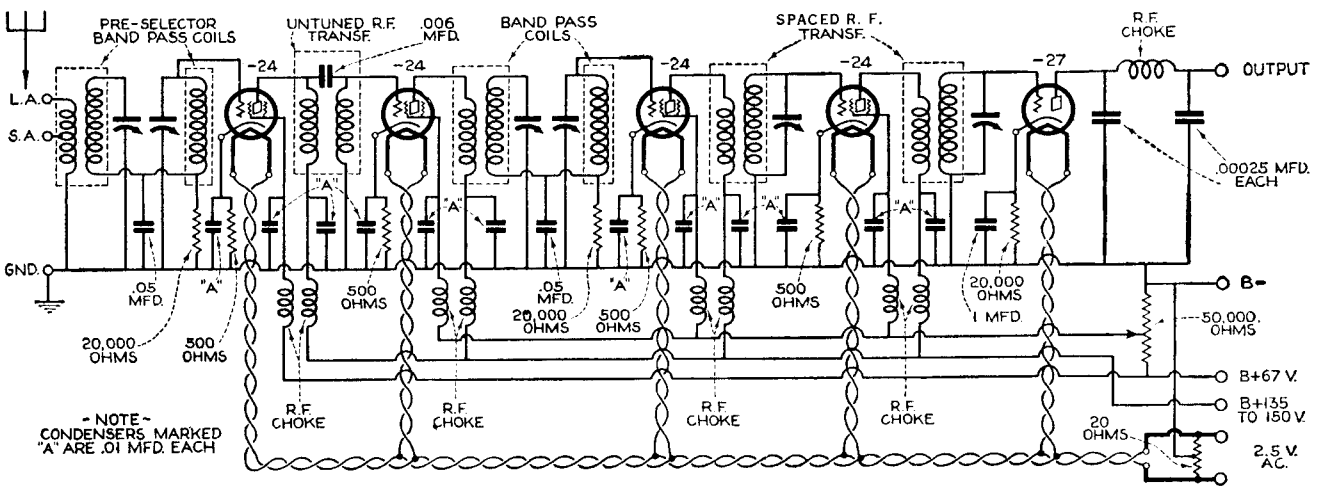


R_1 — 20,000-ohm 2-watt type resistor.
R_8 — 50- or 100-ohm filament center-tap resistor, necessary only with a.c. filament supply.
SW — Regeneration control and cathode circuit switch.

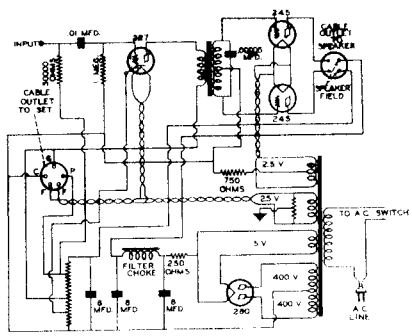
NATIONAL CO., INC.

NATIONAL MB-29





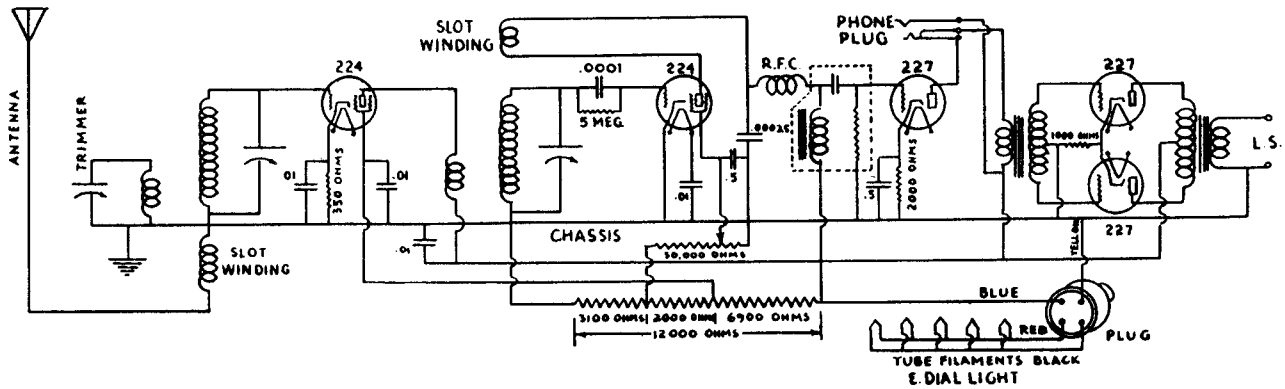
NATIONAL MB-30



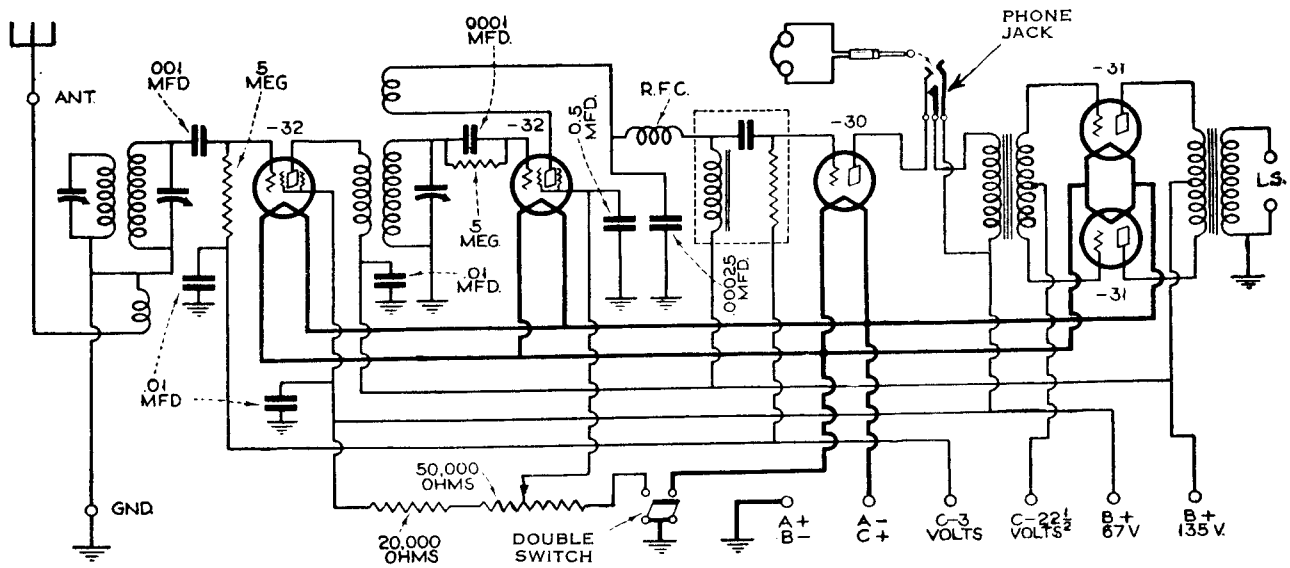
Circuit diagram of the type VSA Speaker-Amplifier for use with the MB30 tuner.

NATIONAL CO., INC.

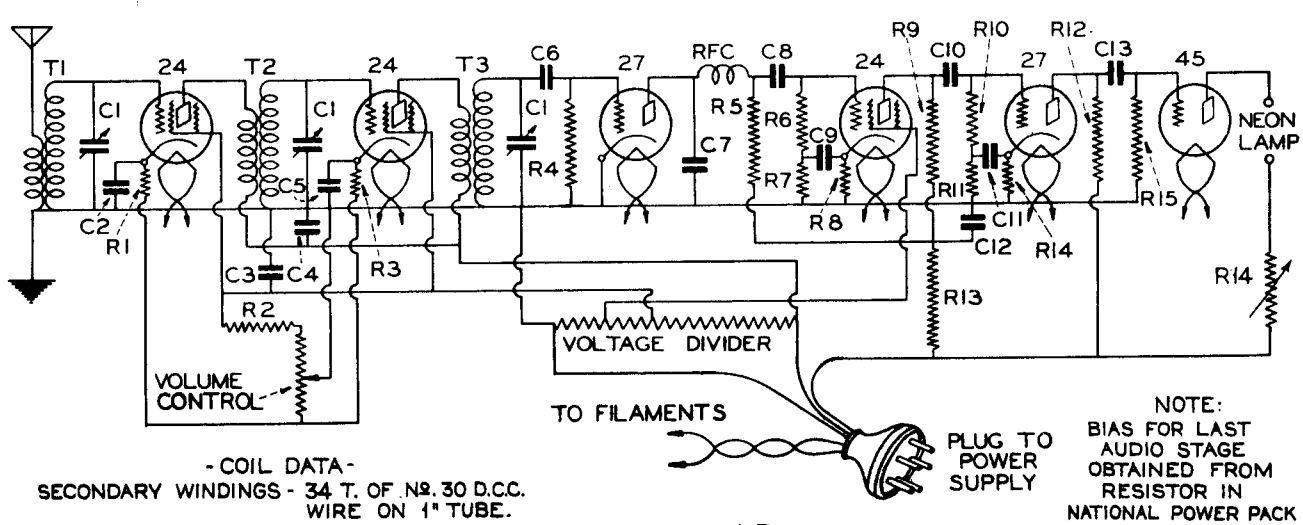
NATIONAL SW-5 — AC. MODEL



NATIONAL SW-5 — BATTERY MODEL



SPECIAL TELEVISION RECEIVER



NOTE: BIAS FOR LAST AUDIO STAGE OBTAINED FROM RESISTOR IN NATIONAL POWER PACK

- COIL DATA -
SECONDARY WINDINGS - 34 T. OF No. 30 D.C.C. WIRE ON 1" TUBE.
PRIMARY WINDINGS - 20 T. OF No. 34 D.S.C. WIRE.

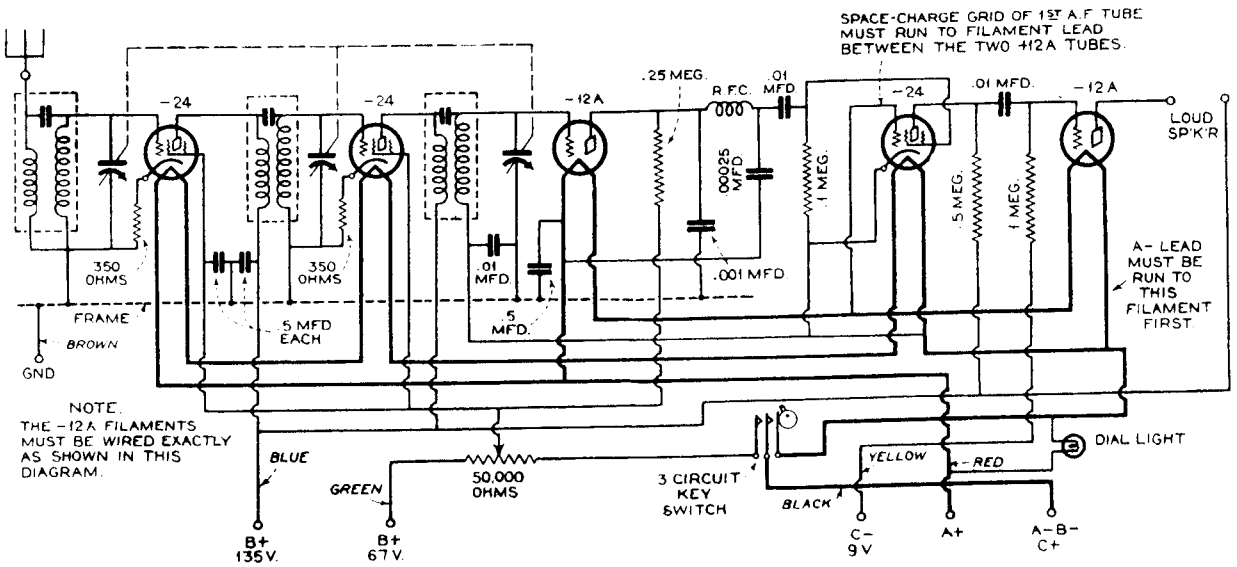
Metal chassis containing 6 sockets, binding posts and necessary mounting brackets; National type E Velvet Vernier Dial; National-Scovil 3 gong Variable Condenser (C1); National shielded R.F. transformers, set of 3 (T1 T2 T3) for television range; Lynch Fixed Resistors; 350 ohms 2 watt R1, 3, 8; 2,000 ohms 2 watts R14; 50,000 ohms 2 watt R11, 7, 13, 5, 9, 12; 5 megohms

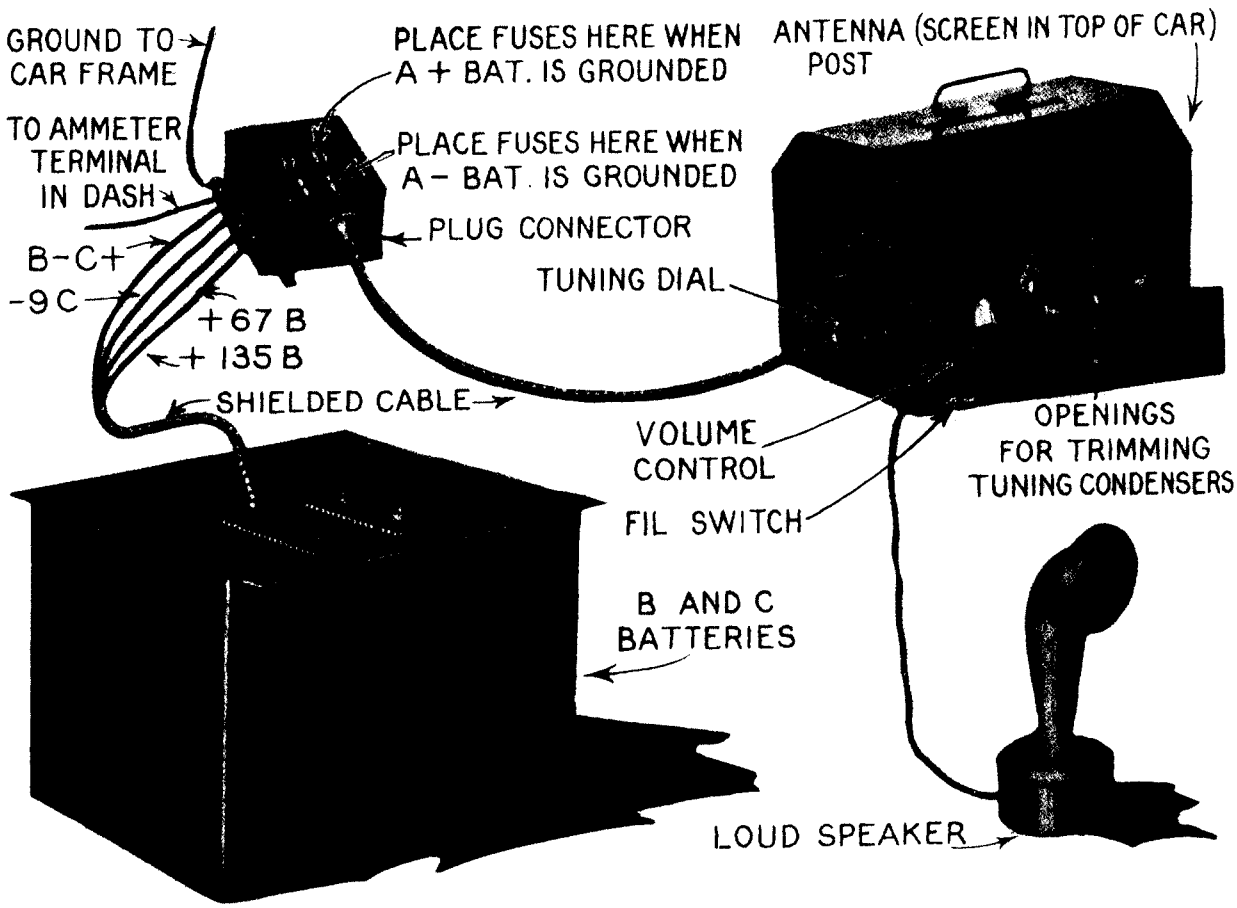
List of Parts

1 watt R4; ¼ megohm 1 watt R6, 10, 15; .5 mfd.—C2, 5, 9, 11, 12; .01 mica—C8, 10, 13; .0002 mica—C6, 7; Aerovox Fixed Condensers; Variable Resistors—R2—50,000 ohms, R14—10,000 ohms (wire); National Voltage Divider; National R.F. Choke; Cable, plug, grid grips, wire, etc.; National Power Pack.

NATIONAL CO., INC.

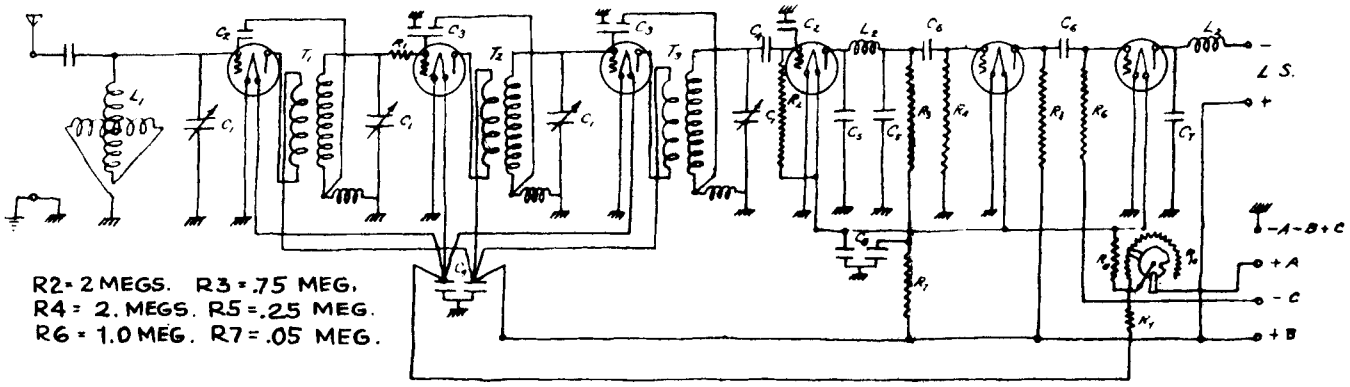
NATIONAL AUTOMOBILE RECEIVER



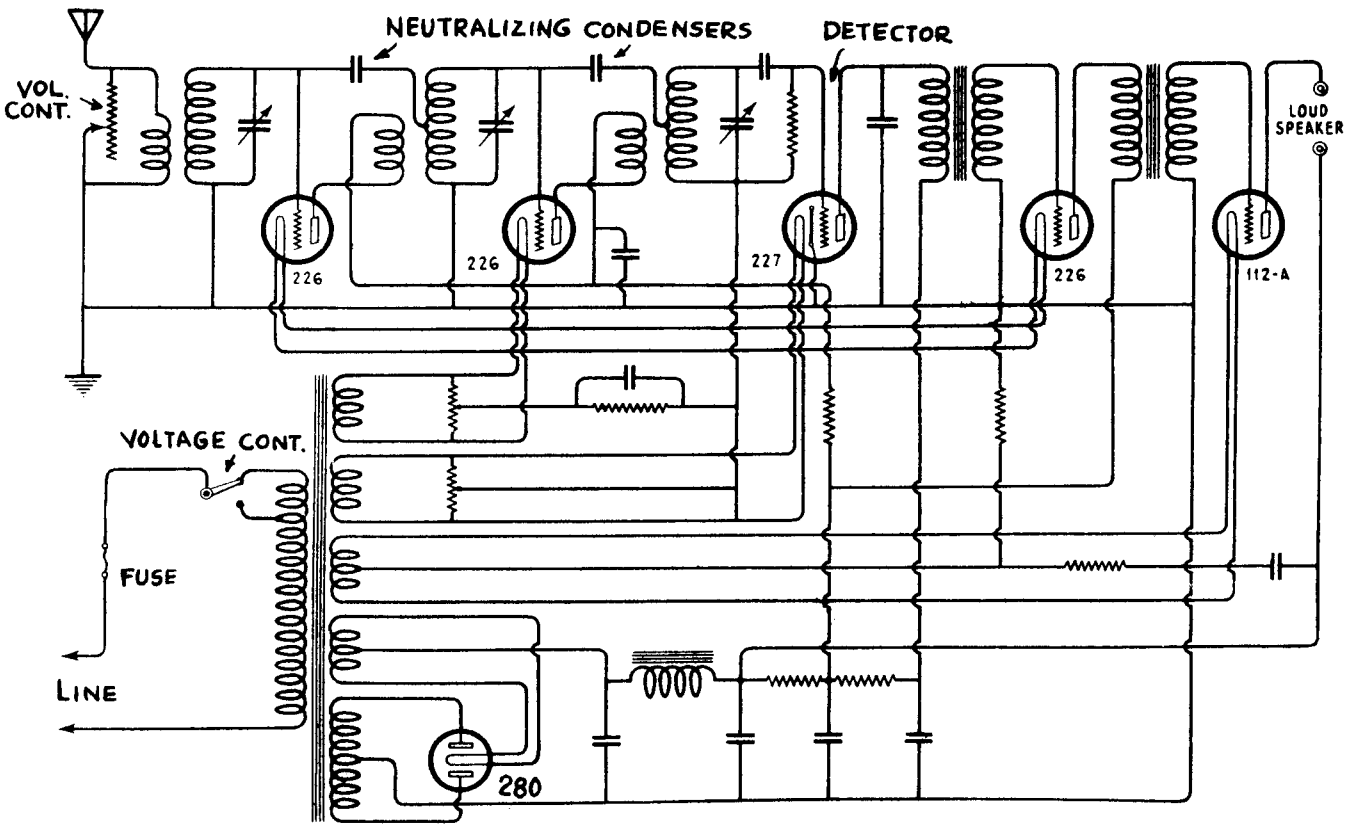


NATIONAL CARBON CO.

EVEREADY MODELS 20-21



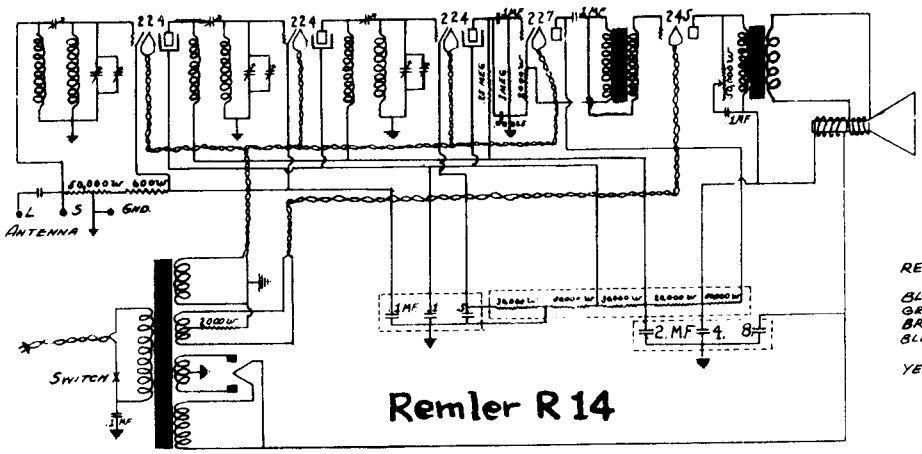
KING MFG. CORP.



KING—MODEL FF

GRAY & DANIELSON MFG. CO.

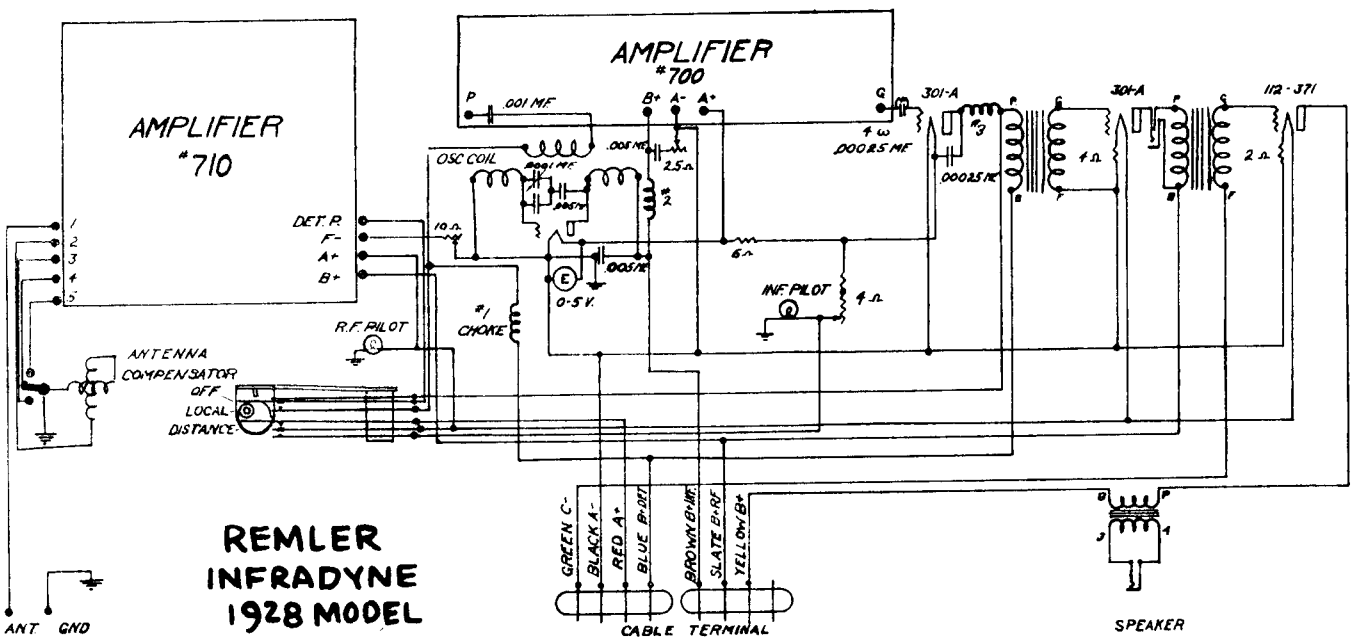
"REMLER" SETS



REMLER R-14

– WIRE COLOR CODE –

RED - FILAMENT RECTIFIER - KATHODE A.F. - PLATE R.F. PLATE POWER TUBE - SPEAKER FIELD.
BLUE - FILAMENT POWER TUBE - PLATE DETECTOR + B.R.F
GREEN - KATHODE DETECTOR - GRID POWER TUBE
BROWN - FILAMENT R.F. TUBES AND DETECTOR
BLACK - FILAMENT 1ST A.F. TUBE - DETECTOR KATHODE - SPEAKER VOICE COIL.
YELLOW - SHIELD GRID - PLATE 1ST A.F. - PLATE RECTIFIER

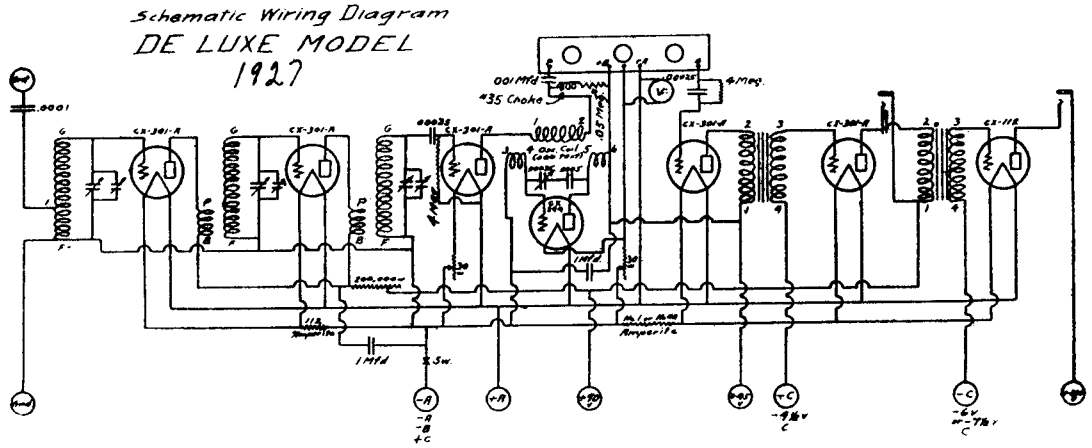


SARGENT-RAYMENT INFRADYNE

Schematic Wiring Diagram

DE LUXE MODEL

1927



Radio Service Data Sheet

EVEREADY SERIES 30, SERIES 30-C AND SERIES 40 RECEIVERS

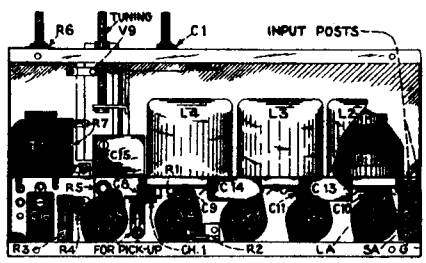
Changes in the audio chassis and reproducer are the only things that distinguish the "Series 40" circuit from the "Series 30;" the former uses type '45 tubes in push-pull, the latter type '71A. To supply the power for the '45s, (S4 wound to deliver 2.5 volts and S1, 250 volts) the No. 2708 unit must replace No. 2460 (PT); a higher-voltage-rating condenser bank, No. 2707, replaces No. 2295 (C19); correct "C" bias is obtained across a 900-ohm resistor No. 2705, instead of No. 2339 (R8); tube sockets No. 2704 (designating '45 tubes) replace sockets No. 2252 for V6 and V7; the output transformer No. 2463 (T3) used in "Series 30-C" and "Series 40" receivers for Eveready dynamic reproducers has a ratio of 25-to-1; while this dynamic unit has a field resistance of 5,000 ohms. "Model 30" (table model) has a No. 2293 A.F. transformer unit, T3, with a ratio of 1-to-1. Jensen D-5 or Newcombe-Hawley NH-7 reproducers may be used with the No. 2463 transformer in the "30-C"; the field current available from the receiver is 4 watts at approximately 110 volts D.C.

An unusual feature of the design of these receivers is the use of a variometer, L1, which is ganged to the variable condensers C2, C3, C4.

The tubes used in the "30," "30-C," and "40," are as follows: V1, V2, V3, V4, V5, type '27; V6, V7, type '71A or type '45, as explained above; V8, type '80; V9 is a 2.5-volt pilot light.

Additional data on the remaining units is given below: Condenser C1, in shunt with L1, is operated from the panel and serves as an antenna trimming unit; C2, C3, C4 have a common shaft and, if the rotor plates loosen, it is necessary to remove the R.F. shield, drive cable, and variometer, and then replace the three-gang condenser with another No. 2192 assembly; C5, C6, C7, in shunt with C2, C3, C4, are aligning units, each mounted on one end of the respective tuning unit; C8 has a capacity of .00025-mf.; C9, .0001-mf. C10, C11, C12 are neutralizing condensers, mounted on a hard rubber strip in the R.F. sub-panel and reached through three holes in the rear of the chassis; C13, C14 are 0.5-mf.; C15 is 2 mf.; C16, 1 mf., C17, C18, 1 mf., C19, 2 mf., and C20, 4 mf., constitute filter bank No. 2295, and the capacities are tapped in this order; C20 being nearest to the mounting base of the bank; The can is the common, grounded side. C21 has a capacity of .0002-mf.

Grid leak R1 (red stripe) has a resistance of 2 meg.; hum-balancing potentiometer R2 is 10 ohms; R3, 1,750 ohms; R4 (green stripe) 17,500 ohms; R5, 3,500 ohms; R6, volume-control potentiometer, 600 ohms; R7, 175 ohms; R8, 1,000 ohms; R9 is the usual center-tapped resistor (which may be 15 or 20 ohms). R10, of 2,500 ohms, takes the place of the reproducer's field coil in models in which the dynamic speaker is not used.)



Under view of the receiver chassis of the Eveready "30," "30C," and "40" receivers; the variometer, mounted on the top of the chassis, is on the same shaft with the tuning condensers.

Voltage compensation in PT is obtained by putting the "plug" into the hole marked with the line-voltage figure which is nearest to the measured value of the power supply.

To facilitate shop service, Service Part No. 2715, an extension cable with terminals to fit over the connector strips on the R.F. and A.F. chasses, is available for the purpose of making external substitution of an R.F. or A.F. chassis; which enables checking by the substitution method, without removing either cabinet chassis.

Volume control R6 varies the positive potential of the cathodes of V1, V2, V3, in relation to ground; inversely, this varies the negative bias on the grids of these tubes, the grid returns of which are grounded. Defects in this part of the circuit may occur as a short of the movable arm of R6 to ground (chassis); broken wire in winding of R6; short leads to R6.

If, for any reason, the braided-copper drive cable around the tuning drum becomes too loose to grip the drum dial properly, a new cable (unit No. 2257) or spring should be installed.

It is recommended that, to neutralize the set, a dummy tube be used in conjunction with an oscillator and an indicating meter; and adjustment be made for zero indication, starting with C12 (V3).

To align the circuits, the same oscillator and meter are recommended; adjustment being made of C5, C6, C7 (in this order). Align for maximum meter reading of A.F. output. To adjust the variometer, tune the receiver and oscillator to resonance at about 40 on the dial; loosen the two screws holding the variometer bracket to the gang condenser cradle, and rock variometer for maximum signal; tighten the two screws. Repeat this procedure at 75 and 25 on the dial. If the tuning circuits do not tune as sharply as normal, or signal strength is not at par, make certain before aligning that the condenser plates are not out of position.

For aligning and neutralizing, an insulated wrench is required.

The R.F. inductances are matched in one group. The voltage drop across the portion in the secondaries is the neutralizing potential.

Hum often may be eliminated by changing detector tubes, readjusting R2 for each tube.

The voltages normally found in these Eveready receivers are as given below:

Tube	*"A"*	*"B"*	*"A"*	*"B"*	*"C"*	*"K"*	*Ma.1*	*Ma.2*
V1	2.5	109	2.45	100	6.0	6.0	2.5	6.0
V2	2.5	109	2.45	100	6.0	6.0	2.5	6.0
V3	2.5	109	2.45	100	6.0	6.0	2.5	6.0
V4	2.5	109	2.45	50	0.0	0.0	3.0	3.2
V5	2.5	109	2.45	100	4.5	4.5	3.0	4.3
V6	5.2	192	5.10	175	37.5	—	20.0	24.0
V7	5.2	192	5.10	175	38.0	—	20.0	24.0
V8	—	—	5.10	—		—	44.0	—

These tests were made with a line voltage of 119, "plug" in the 115-volt tap, and the volume control turned full on. The second and third columns, "A" and "B," are readings with the tube not yet placed in tester; Ma.1 indicates normal plate current and Ma2, plate current upon grid test.

The circuit shown in the diagram is an "R.F.L." (Radio Frequency Laboratories) hook-up; all Eveready receivers in the "30" series are identical as respects the chassis.

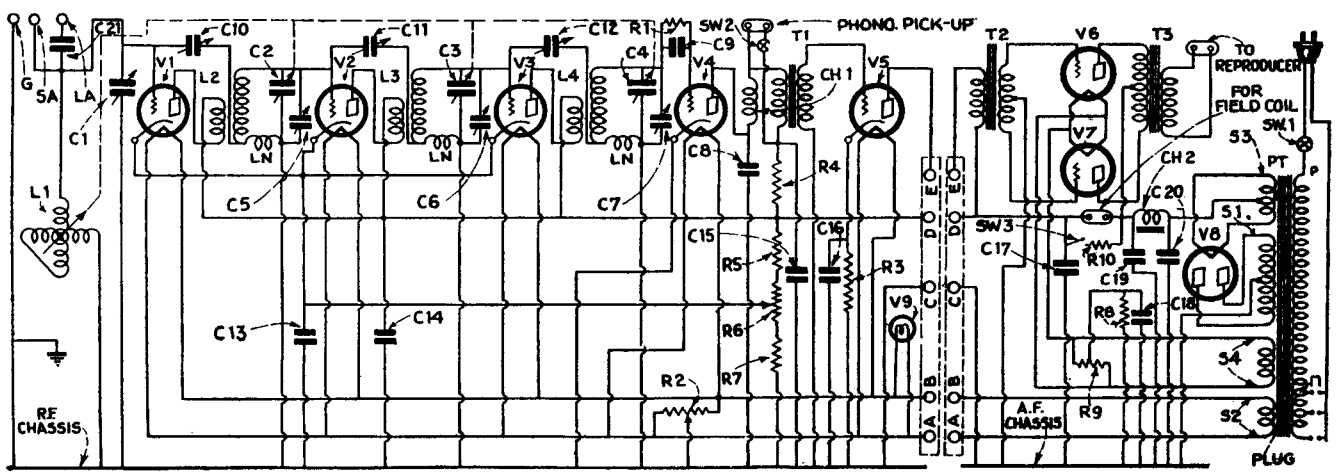
The response characteristic of a circuit tuned by a variometer is exactly the reverse of one tuned by a condenser; that is, the circuit becomes more sensitive as it is tuned to the higher wavelengths. The two methods are combined in the design of this receiver to obtain even amplification throughout the tuning range.

Volume control R6 is a wire-wound unit.

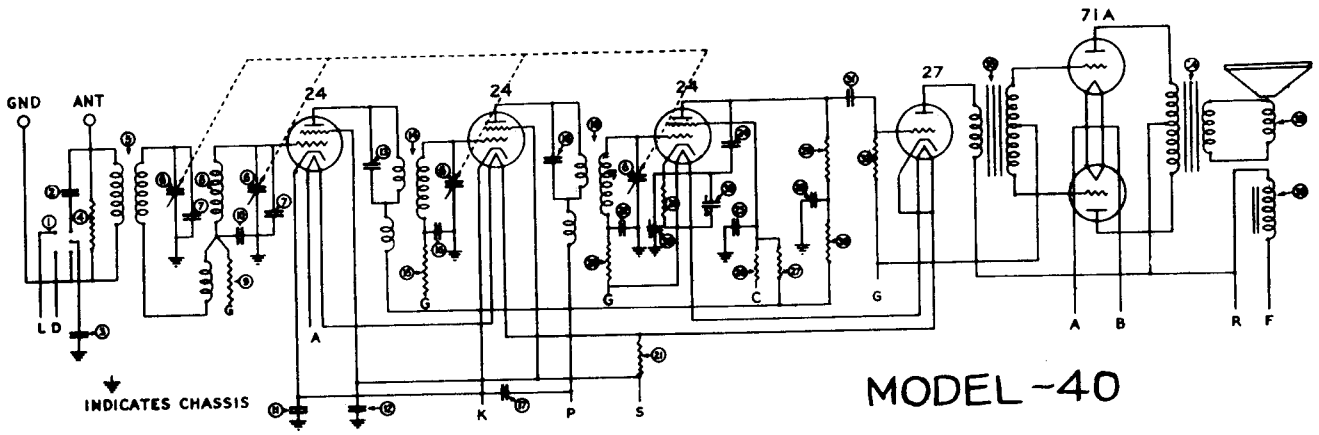
Directly below the field terminal jacks on the Table Model is a snap switch (SW3) which is thrown one way for dynamic, and the other for magnetic, speaker operation. The field coil of the reproducer plugs into pin jacks located on the rear face of the power plant; and the voice coil into two pin jacks mounted between the power tubes.

The insulated terminal board, for adjustment to compensate line-voltage conditions, is mounted on top of the power plant between the power tubes and the rectifier; the removable plug is to be inserted in one of the three holes in the top of this board.

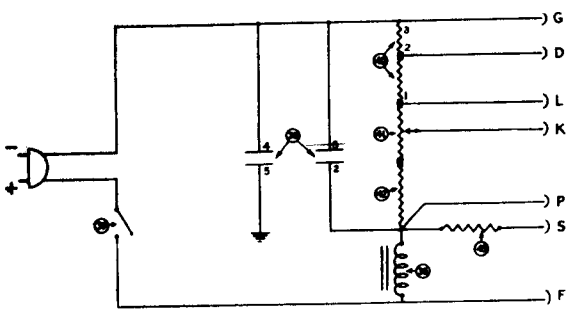
The "Model 30" chassis is designed for easy servicing by separate removal of either the set chassis or the power chassis. When the two units are reconnected, care should be taken to see that the busses are tightly bolted.

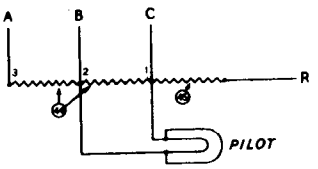


PHILADELPHIA STORAGE BATT.,CO.



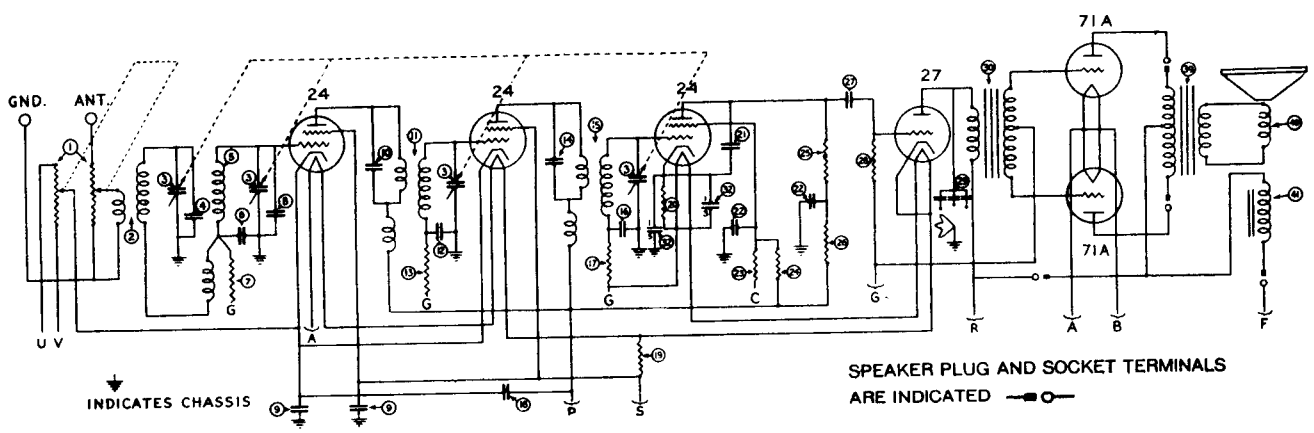
MODEL-40





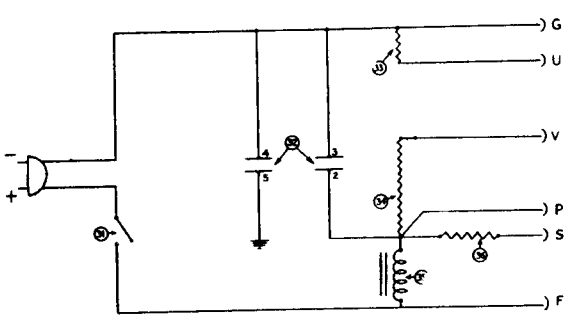
NOTE. Switch 1 Right-Hand Terminals are shorted in local position. Left-Hand Terminals are shorted in distance position.

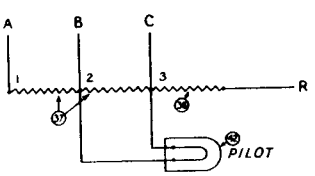
Resistor (46) is mounted at bottom of cabinet.



SPEAKER PLUG AND SOCKET TERMINALS ARE INDICATED —■—○—

MODEL-41

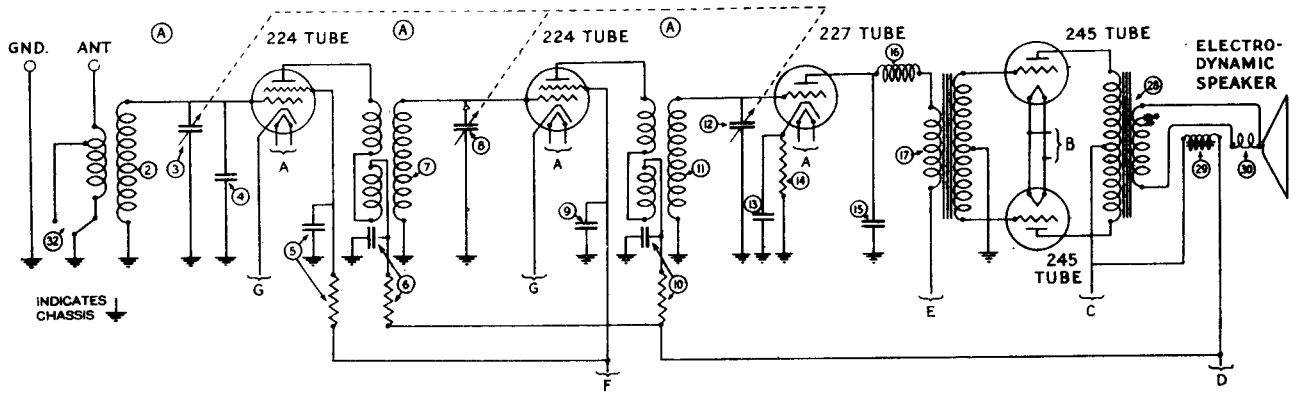


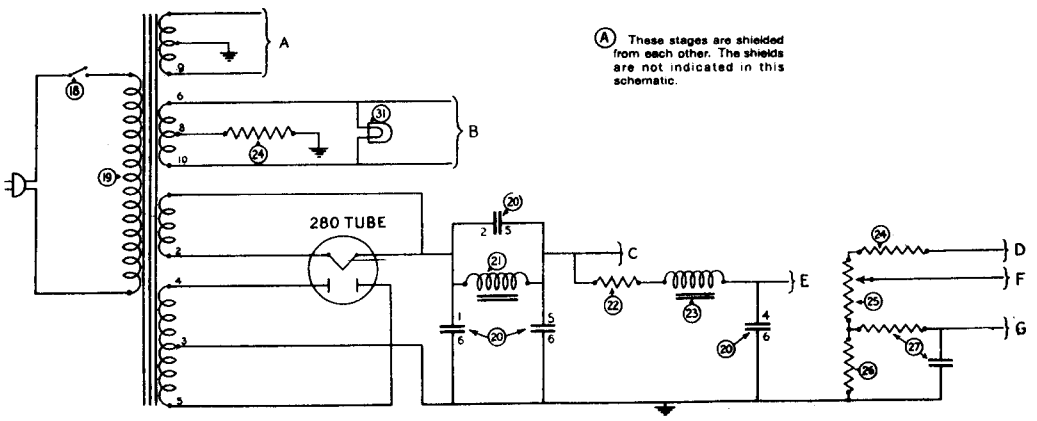


RESISTOR (58) IS MOUNTED AT BOTTOM OF CABINET

PHILADELPHIA STORAGE BATT.,CO.

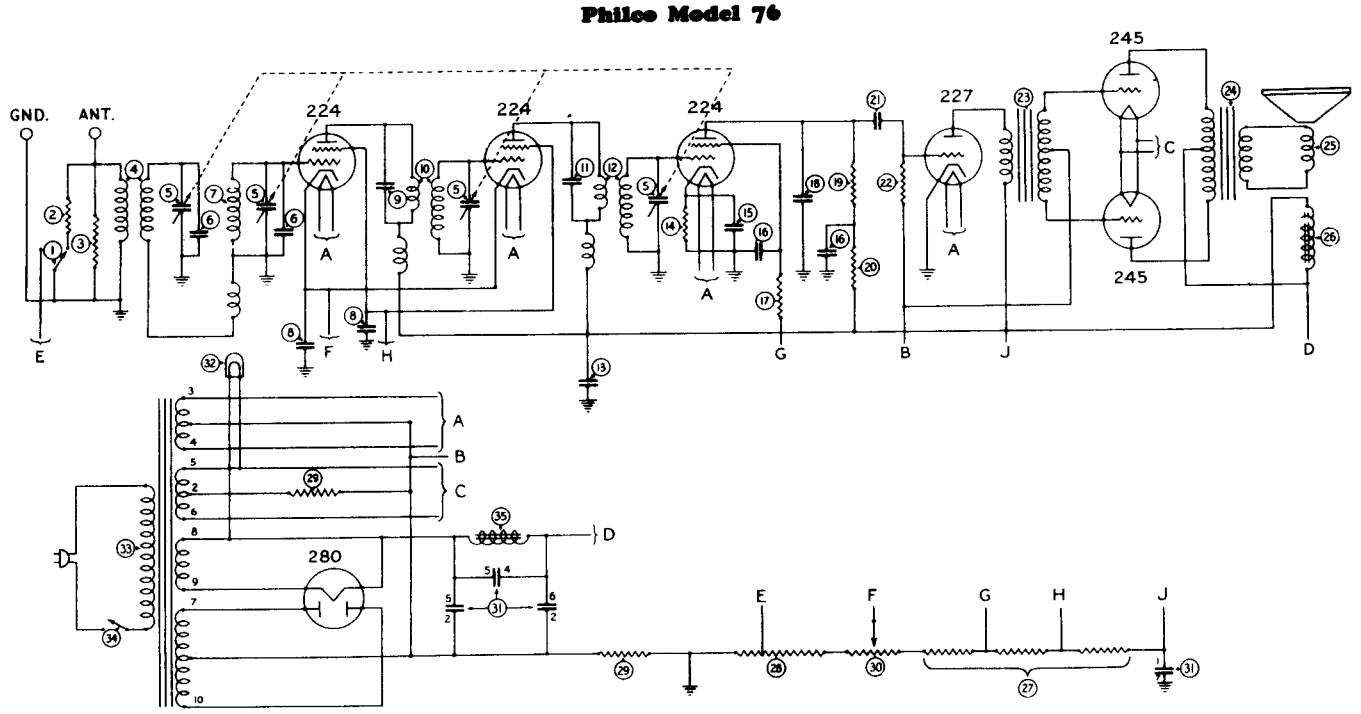
Philco Model 65



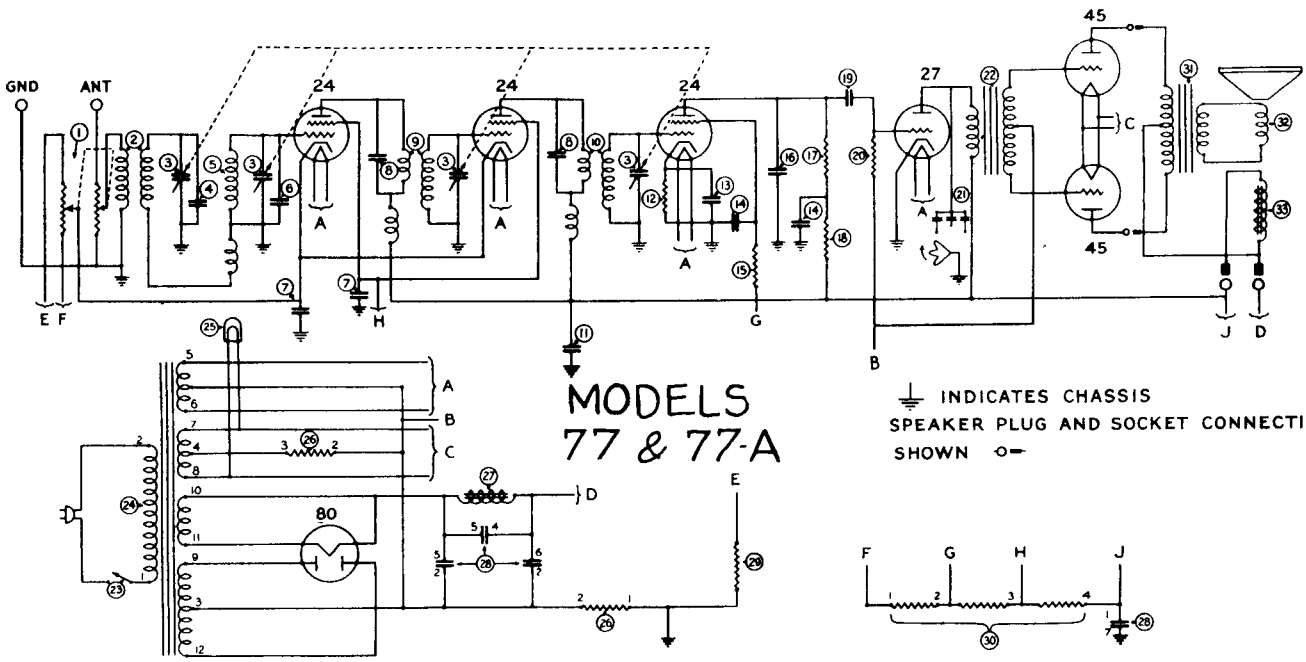


(A) These stages are shielded from each other. The shields are not indicated in this schematic.

Philco Model 76



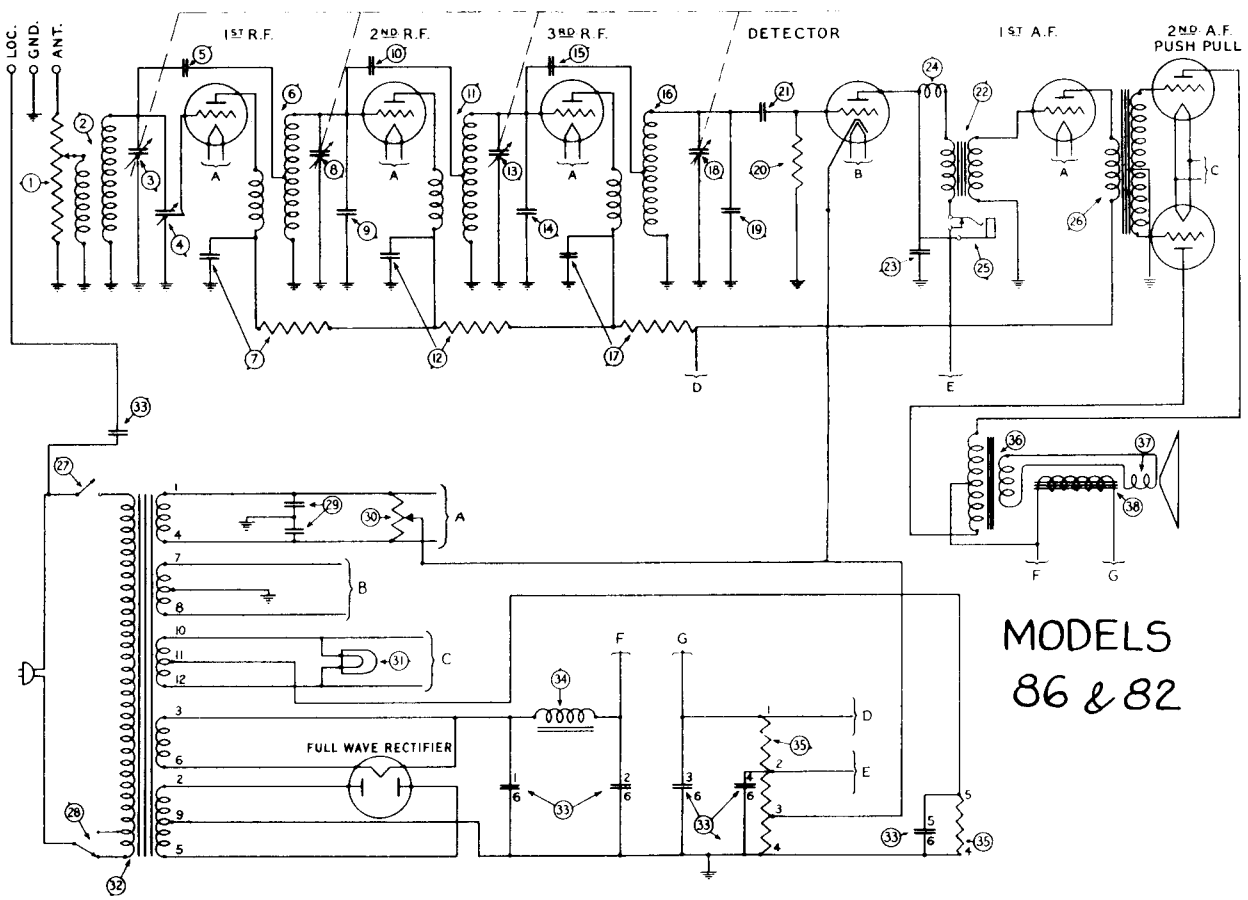
PHILADELPHIA STORAGE BATT.,CO.



MODELS 77 & 77-A

⏚ INDICATES CHASSIS

SPEAKER PLUG AND SOCKET CONNECTIONS SHOWN



MODELS 86 & 82

Radio Service Data Sheet

PHILCO 87

This receiver is of the neutralized, tuned-radio-frequency type. For local reception, in certain localities, good results will be obtained when the light-line is used as the antenna. To do this, connect a jumper from "Loc." to "Ant."; coupling to the line is then obtained through the series condenser C21 in the filter block. The receiver is shipped with this connection already made.

High selectivity in this receiver has been achieved by the use of four tuned stages, ganged, with compensating condensers for balancing the tuning of each stage, in addition to the panel-mounted compensating condenser, VC, which carries a spring contact. This last control resonates the antenna stage of R.F.; when this condenser is rotated counter-clockwise the grid of the first tube V1 is disconnected from the input circuit and grounded. This is the short-range position, used for strong signals. For weak signals the knob should be rotated clockwise, to reconnect the grid of V1 to the input circuit. Further adjustment to the right allows finer tuning of the antenna circuit.

When using the light socket as an antenna it is advisable to reverse the light-socket plug to determine the best connection for maximum signal strength and minimum hum.

The tubes used in this receiver are: four '26s, V1, V2, V3, V5; one '27, V4; two '45s, V6, V7; one '80, V8.

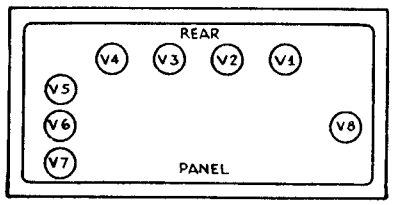
A good ground connection should always be used with the "Model 87" receiver, which uses the Hazeltine neutralizing system.

The tuning scale used on this set is numbered from 55 to 150. The numbers represent the 96 authorized broadcast channels, and by adding a cipher after each, give the kilocycles. For example, 85 on the scale represents channel number 85 and a frequency of 850 kilocycles.

Lack of sufficient voltage on the R.F. tubes may be due to a grounded hum adjuster R6.

The "Loc." connection is convenient for testing the general efficiency of the outside antenna. If signals are not heard with the outside antenna connected, but good reception is obtained when the "Loc." terminal is connected to "Ant.", the outside antenna system should be checked.

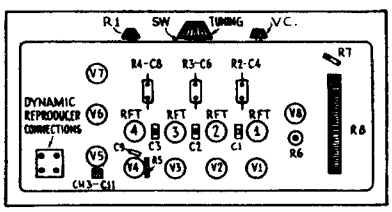
The efficiency of the ground connection may be checked by removing the ground connection while weak signals are being received. There should be a reduction of the volume if the ground connection is good; no reduction denoting a poor ground. (This reduction in volume will not be noticed if the test is made on strong signals.)



Tube layout of the Philco "Model 87."

If the neutralizing condensers (C1, C2, C3) should short-circuit the plate voltage of the R.F. tubes will be increased, in addition to the circuit's "going dead" so far as signal strength is concerned. A grounded neutralizing condenser will result in very weak signals.

If the circuit tunes broadly, after care has been taken to balance the tuning of each stage, one of the R.F. transformers may be at fault. These are readily replaceable and interchangeable; the constants all being standardized.



Under-chassis arrangement of the "87." In the open or local position of Vc, the neutralizing condenser C1 becomes a coupler to V2, which is then the first R.F. tube.

A caution is issued by the manufacturer with regard to the tuning-condenser gang. If it has been positively determined that the trouble lies in the alignment of the condenser plates, remove the entire condenser and return it for adjustment. The screws holding the stator plates of the tuning condenser in place, and those holding the rotor bearings, should never be loosened. The compensating condensers C5, C7 and C10 may be adjusted with a wrench to equalize the tuned circuits. Replacement R.F. transformers of standard values are separately obtainable.

If trouble has been localized to the dynamic reproducer, a check with a voltmeter across the field coil should show approximately 135 volts drop.

With a line-voltage of 125, the "Model 87" draws 95 watts from the power line, and the correct set voltages are as follows:

Three R.F., and the first A.F. stages, filaments 1.5 (winding A); plate 90; grid bias 6. R2, R3, R4 are low in resistance and do not reduce plate voltage perceptibly.

Detector heater 2.5 (winding B); plate 30; grid bias 0.

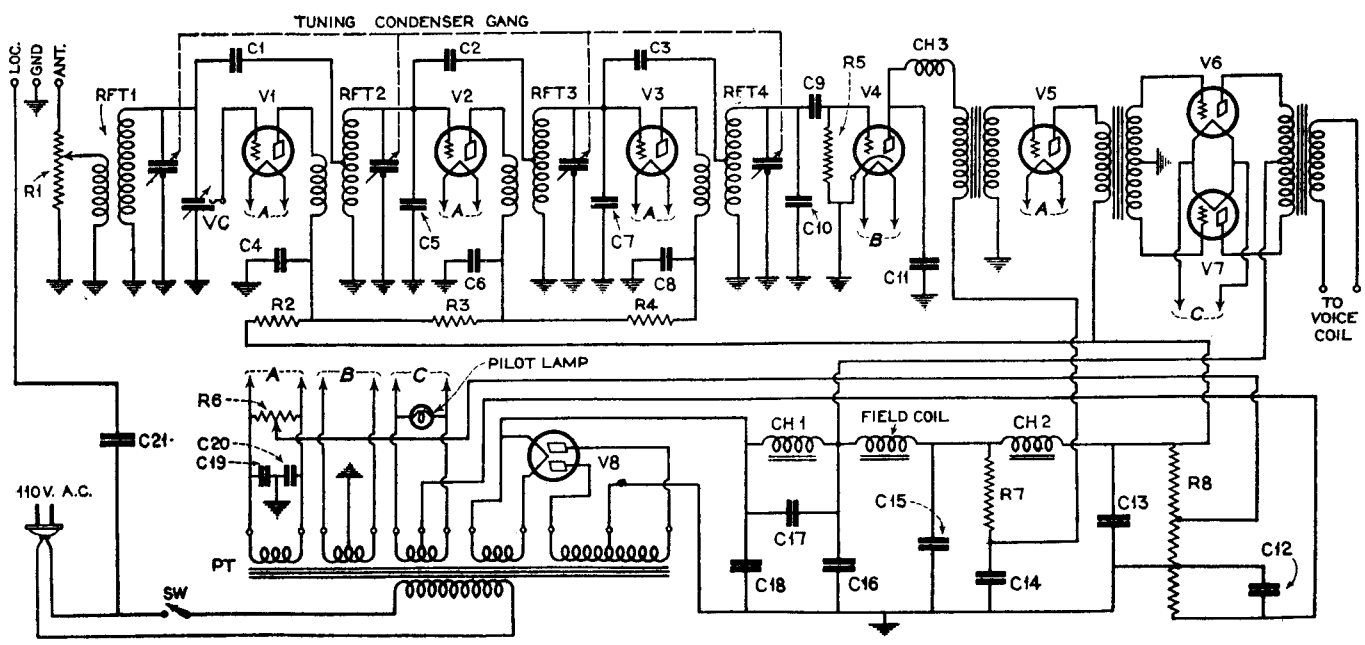
Second A.F. (and pilot lamp) filaments 2.5 (winding C); plate 245; grid bias 45.

Rectifier filament, 5 volts; across secondary 700.

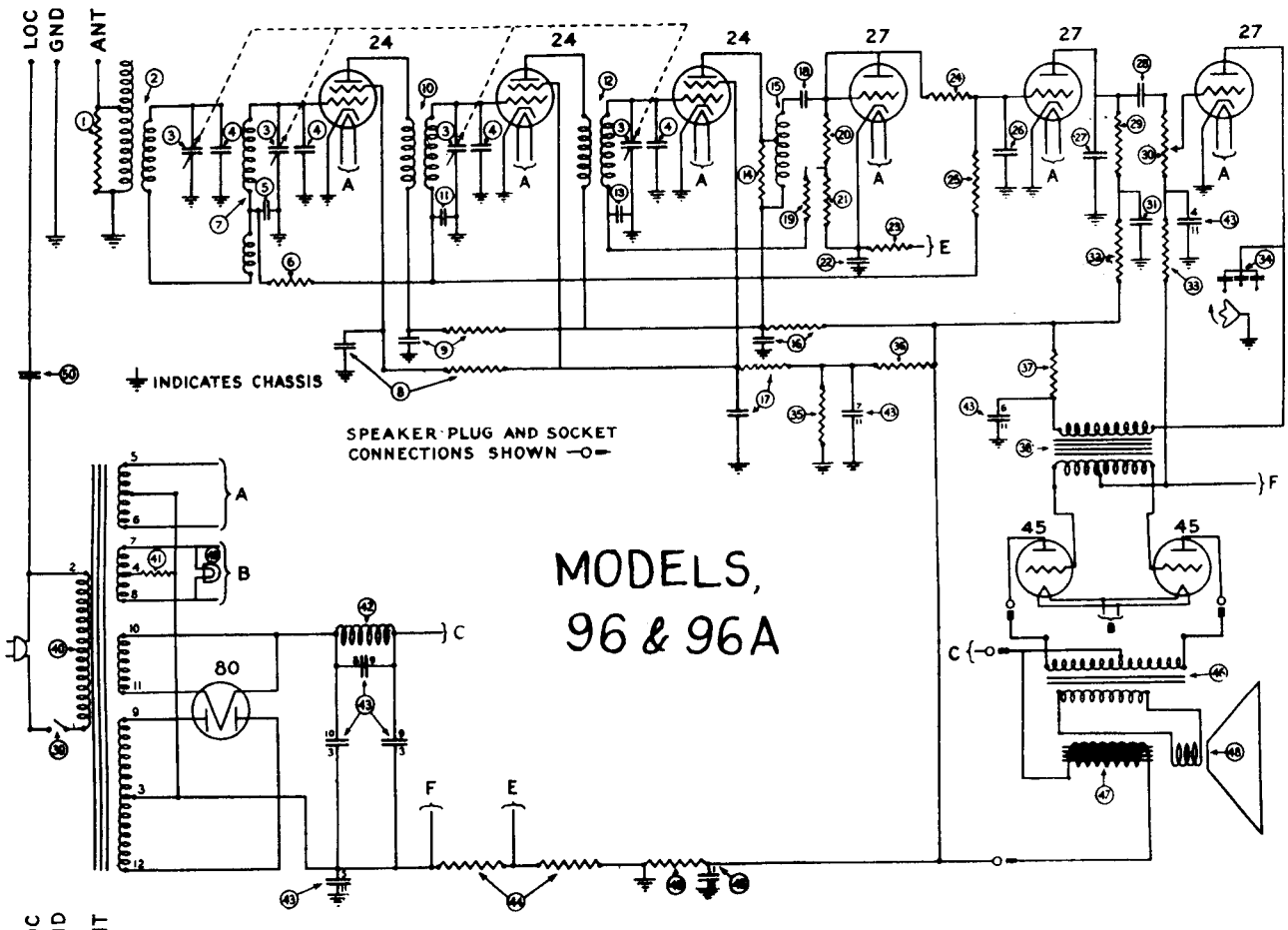
The code used in wiring the receiver is:

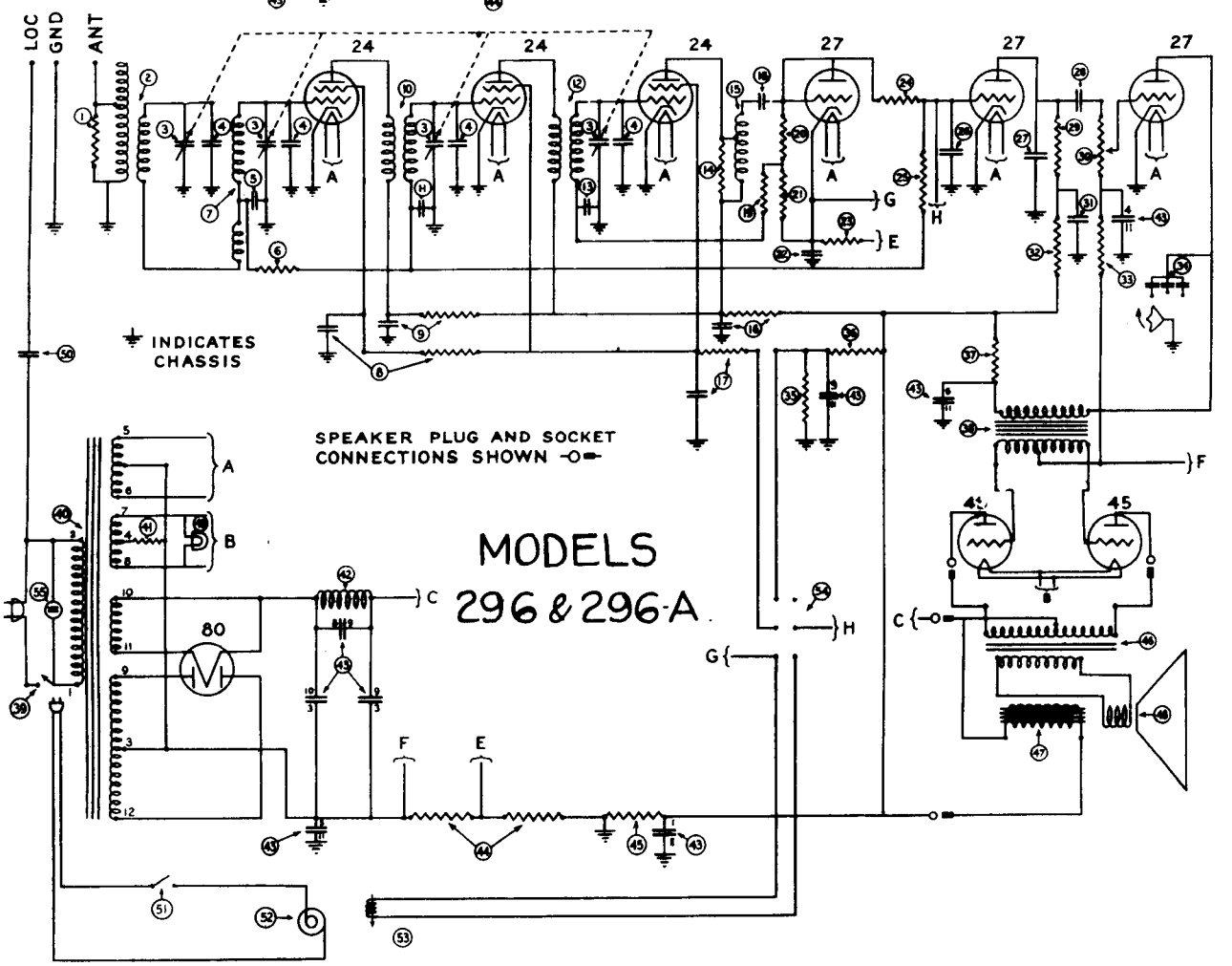
Leads from	*Colors*
A.C. Supply	Green rubber covered
A.C. Supply	Black rubber covered
A.C. Supply to C21	Blue, white tracer
"Loc" post to C21	Black
Winding A ('26 filaments)	White, black tracer
Winding A ('26 filaments)	Black, white tracer
Winding B ('27 heater)	Yellow, green tracer
Winding B ('27 heater)	Yellow, plain
Winding C ('45 filaments)	Green, yellow tracer
Winding C ('45 filaments)	Green, plain
Winding C center tap	Green, black tracer
Rectifier winding center tap	Yellow, rubber covered
Ch 1 (high-voltage side)	White
Ch 1 (low-voltage side) Push-Pull plate lead and Field Coil, high side	Black, yellow tracer
Ch 2 (high-voltage side) and Field Coil, low side	Blue, plain
Ch 2 (low-voltage side) and amplifier plate leads	Yellow, green tracer
R7 (low-voltage side) and "B+" on A.F. transformer (detector plate)	Yellow.

Values of parts are given as follows: R1, 10,000 ohms; R6, 6 ohms. C4, C6, C8 (units include R2, R3, R4), each 0.1-mf.; C11, 001-mf.; C19, C20, 0.5-mf. The following are included in the filter block; C12, 0.1-mf.; C13, C15, 1-mf.; C14, C16, C18, 2-mf.; C17, C21, 0.15-mf. R7, 70,000 ohms; R8, 4,582 ohms tapped at 157, 640 and 3,785 ohms.

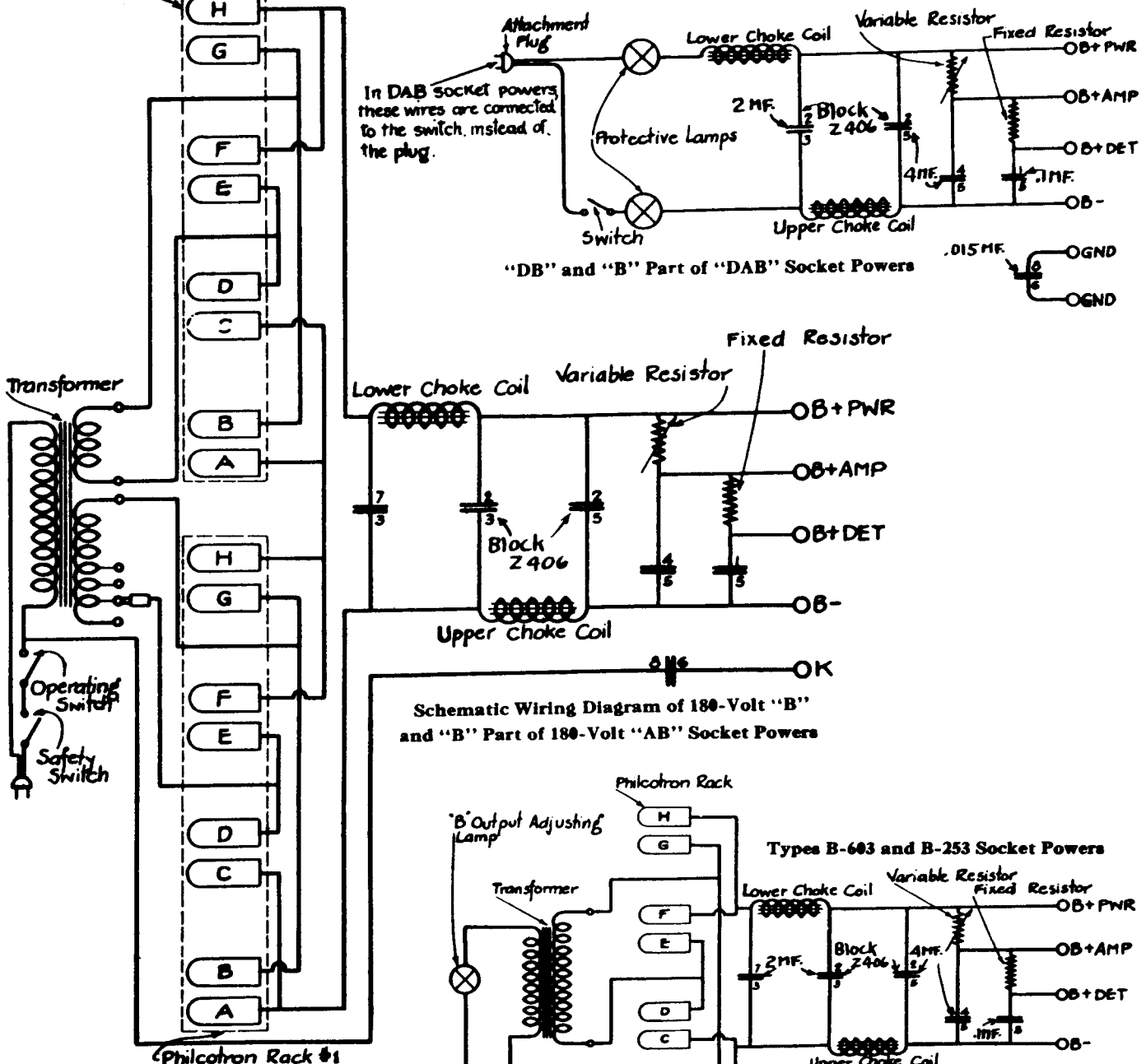


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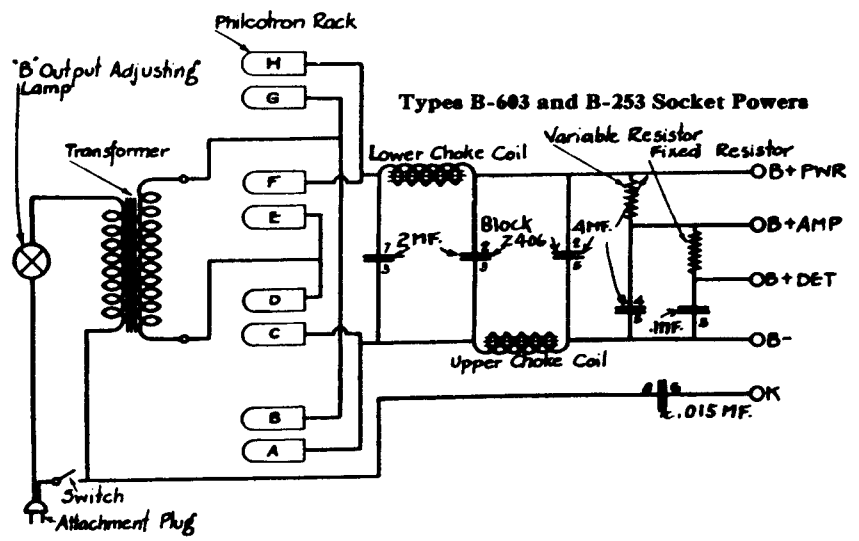


PHILADELPHIA STORAGE BATT. CO.

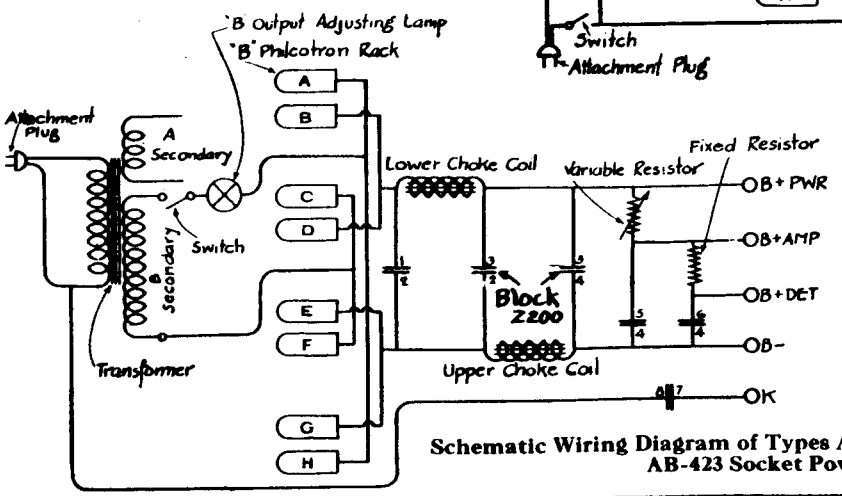


"DB" and "B" Part of "DAB" Socket Powers

Schematic Wiring Diagram of 180-Volt "B" and "B" Part of 180-Volt "AB" Socket Powers



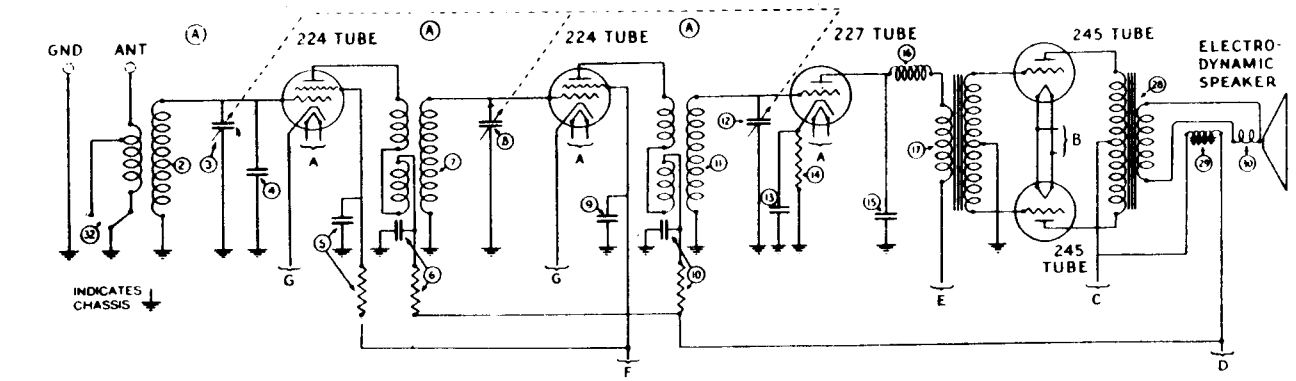
Types B-603 and B-253 Socket Powers

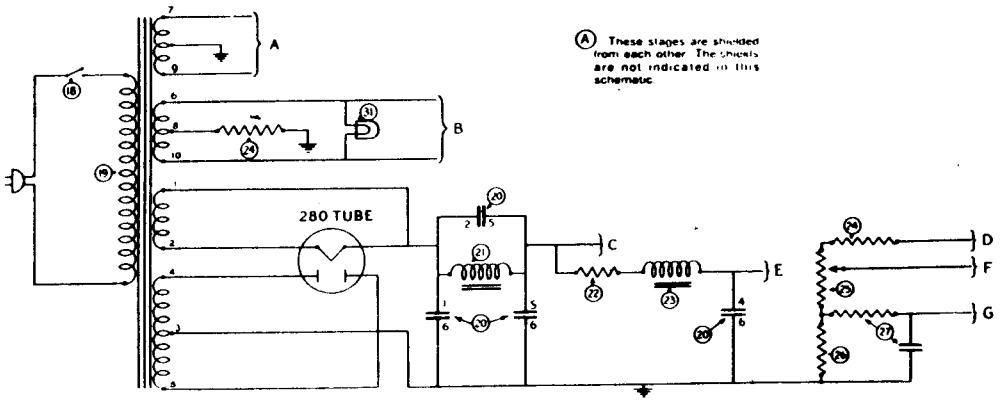


Schematic Wiring Diagram of Types AB-663, AB-623, AB-463, AB-423 Socket Powers

PHILADELPHIA STORAGE BATT., CO.

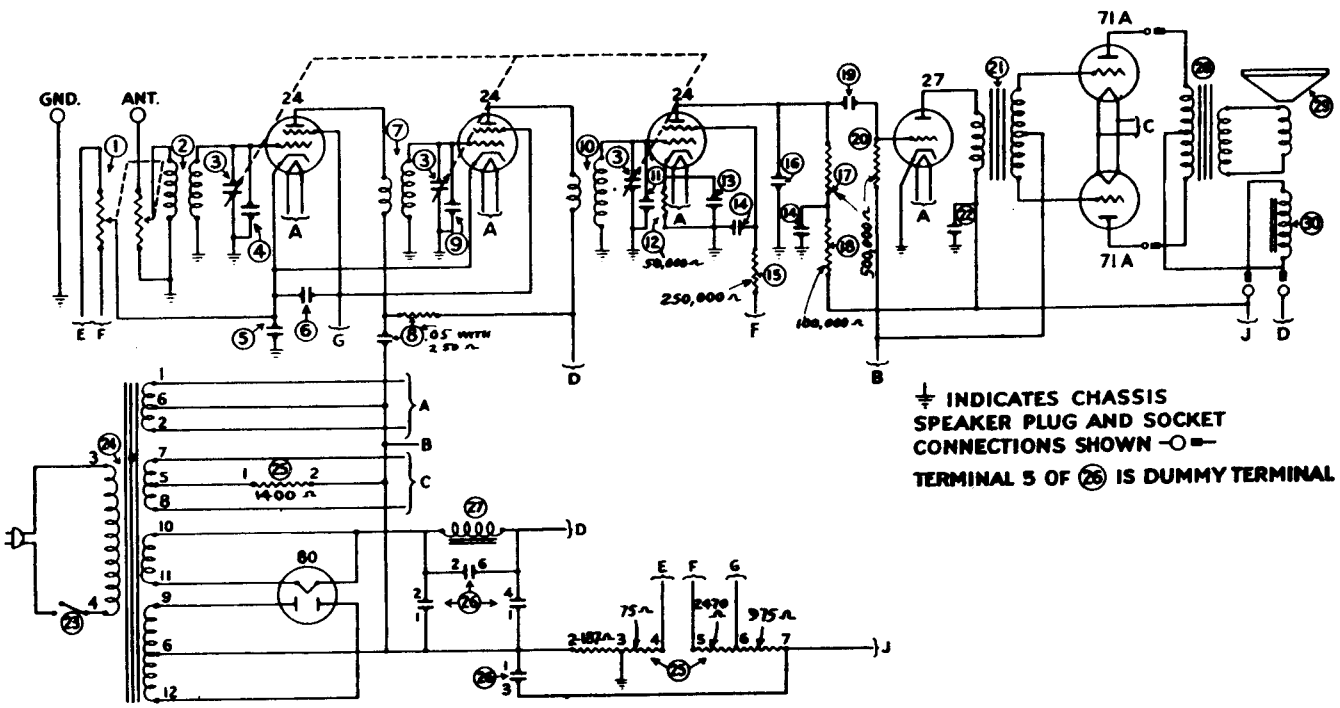
Philco Model 65





(A) These stages are shielded from each other. The shields are not indicated in this schematic.

Models 20 and 20-A



⏚ INDICATES CHASSIS
SPEAKER PLUG AND SOCKET CONNECTIONS SHOWN -O=-
TERMINAL 5 OF (26) IS DUMMY TERMINAL

Radio Service Data Sheet

PHILCO "SCREEN-GRID PLUS" RECEIVERS MODELS 92, 95, 95E, 96, 96A, 96E, 296, 296A, 296E.

Perhaps the best known type of radio receiver made by the Philadelphia Storage Battery Company, Philadelphia, Pa., is found in the line of "Screen-Grid Plus" chasses. The circuits used in the various models differ as follows: "Model 92" is a 25-cycle model; the "Model 95," the standard 60-cycle, 110-volt chassis, which is illustrated below; the "95E" is a 210-270-volt model, of the "95"; "Model 96" adds a tone control; the "96 A" is designed for 25-cycle operation; "96 E" is the "96" for 210-270-volt line supply. "Model 296" is the "96" in combination with a phonograph; "296A," the same for 25-cycle supply; and "296E" is equipped to use a 210-270- volt power supply.

Automatic volume control and the "Multiplex" linear power detector V4, which has two-element or "diode" connection of the type '27 tube giving exceptionally fine audio quality characterize these "Screen-Grid Plus" Philco models.

Since the "95" is the foundation circuit, and is illustrated in the figure, data directly applicable to it will be first considered.

The parts indicated in the diagram have the following values: Condensers C are the aligning condensers; C1, C2, C3, C4, the tuning capacities; C5, C6, C7, C8, C9, C10, C11, C17, C22, C29, 0.15-mf.; C12, .0005-mf.; C13, C19, 0.5-mf.; C14, C18, .05-mf.; C15, C20, C27, 1.0-mf.; C16, C28, .0025-mf.; C21, .01-mf. (each); C23, 0.25-mf.; C24, C26, 2-mf.; C25, 0.15-mf.

The resistors measure as follows: R1, 5,000 ohms; R2, 20 ohms; R3, R16, R18, 70,000 ohms; R4, R5, R7, R12, 250 ohms; R6, R11, R13, R14, ½-meg.; R8, R19, 13,000 ohms; R9, R10, R21, 1/10-meg.; R15, R25, ¼-meg.; R17, 25,000 ohms; R20, 8,300 ohms; R22, R23, 70 ohms each side; R24, 800 ohms. Choke Ch measures 200 ohms.

Early models of the "95" did not have resistors R7 and R12; these units having been added shortly after production started. Their inclusion in the circuit prevents oscillation when using the "Loc." terminal.

Following are the readings indicated for the average set analyzer: filament potentials; V1, V2, V3, V4, V5, V6, 2.15 volts; V7, V8, 2.2 volts; V9, 4.5 volts. Plate potentials; V1, V2, V3, 155 volts; V4, zero; V5, 27 volts; V6, 85 volts; V7, V8, 250 volts. Control-grid potentials, V1, V2, V3, zero; V4, V5, 0.5-volt; V6; 0.2-volt to 2.0 volts; V7, V8, 41 volts. Screen-Grid potentials, V1, V2, V3, 95 volts. Cathode potentials, V1, V2, V3, 5.3 volts; V4, 0.7-volt; V5, V6, 5.5 volts. Plate current, V1, V2, V3, 4 ma.; V4, V5, zero; V6, 2.5 ma.; V7, V8, 28 ma.; V9, 43 ma. per plate. The current drain of the screen-grids of V1, V2, V3, is 0.8-ma.

The color code, or other identification, of the resistors is as follows: R1, golden yellow; R2, flat wire-wound; R3, R16, R18, jade green; R4, combined with C7; R5, combined with C8; R6, R11, R13, battleship gray; R7, combined with C11; R8, R19 Belgian blue; R9, R10, R21, silver gray; R15, R25, white; R17, auto buff; R20, wire-wound tube, 6 in. long; R22, R23, flat wire-wound, center-tapped; R24, wire-wound tube, 2 in. long.

The power transformer's connections may be determined by referring to the diagram; observe the lugs of this unit with the chassis inverted and the power transformer at the right. Counting from left to right, the top two are, 1, 2; second row, 3, 4, 5, 6; third row, 7, 8, 9, 10. Two leads are primary connections; instead in the "96," two lugs at the left of 1 and 2 are provided.

In the 25-cycle models, condensers C24 and C26 rate 3 mf.; and condenser C25, 0.3-mf.

In the Models "96" and "296," resistor R2 and switch Sw. 1 are not used; see the smaller diagram (detail A) at the lower left. Also, the dynamic reproducer plugs into the circuit at X1, X2, X3, X4. The tone control C21-Sw4 is found in the "96" and "296." Condensers C23 are not used in the "Model 96"; but they are retained in the "296." Condenser C22 is not found in the "96" and "296" chasses.

In these last, the pilot light V10 may be replaced without removing the chassis from the cabinet; merely remove the screw fastening the lamp bracket to the condenser housing, and bring the bracket out over the condenser.

When taking voltage readings, keep the R.F. shields on; and tune to eliminate circuit oscillation. The two condensers C23 are provided to reduce the tendency toward circuit oscillation.

In the diagram, the standard pick-up connection is shown, using a high-impedance pick-up. In a few early models of the "296" there will be found a low-impedance pick-up and a special matching transformer; the latter is part "No. 4145." The lubricant of its turntable motor's worm-gear is clear petroleum jelly; and of the motor, a few drops of clear, thin oil.

The "Screen-Grid Plus" receivers are to be aligned at some frequency between 1200 and 1400 kilocycles; first adjusting the aligning condenser of C4. If it is desired to use the meter method of aligning, a convenient manner of making the test is to connect the negative side of a 250-volt (1000-ohms-per-volt) meter to the chassis; and its positive side, by means of an adapter plug, to the cathode of V3. Align for maximum deflection.

In detail B (lower left) is shown the arrangement of the condensers in the filter block "No. 3754"; at C, the tube layout.

Reception may be improved if the position of the line plug is reversed; this change will be particularly noticeable when the receiver is being operated with the connection "LOC" (to which may be attached any short wire, or a lead to metallic wall lathing). Do not operate the receiver without a good ground connection.

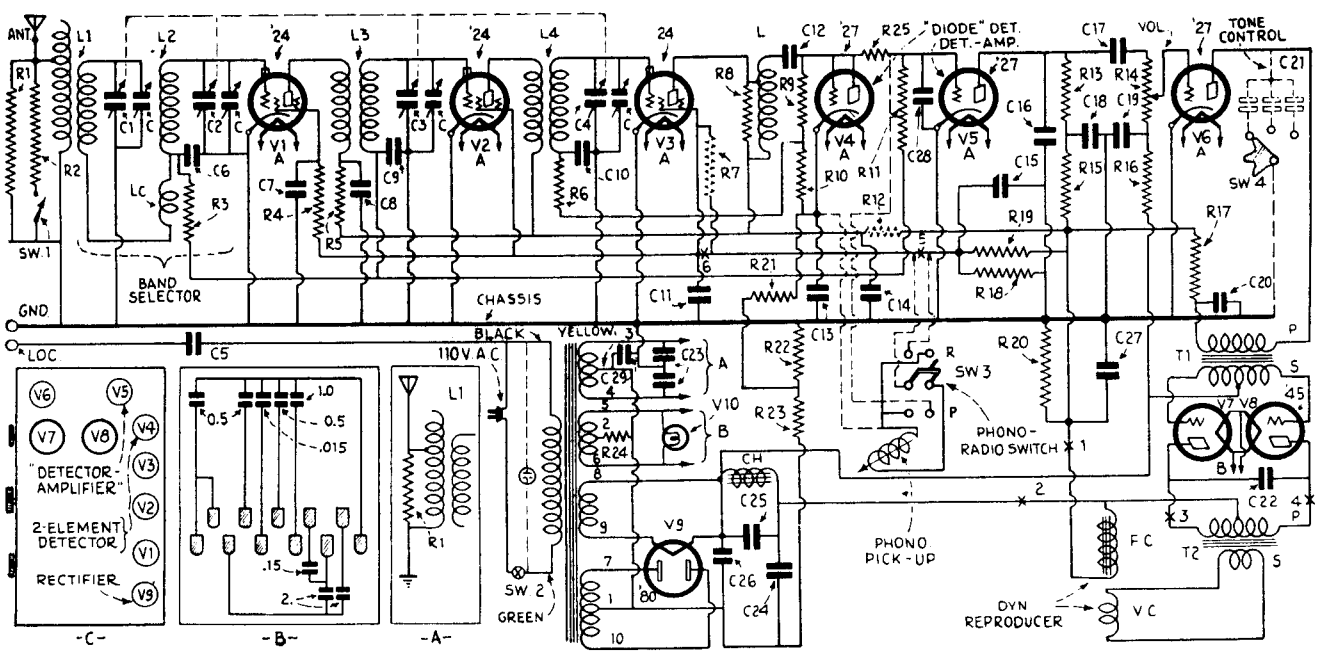
The light-line connection for the turntable motor and its switch is in shunt with the primary of the power transformer; and is shown dotted.

In some receivers of the "296" model, the motor's speed control will be found below the motor-board; it is to be reached from the back by a screw-driver.

"Fuzzy," distorted, or noisy reproduction in this model may be due to the motor-board's holding screws being too tight to permit the motor to "float" in the gum-rubber washers provided. Lack of lubrication may cause the same effect.

Chemically-pure vaseline may be used to eliminate noise due to the contact arm's rubbing on the wire of the volume control, R14.

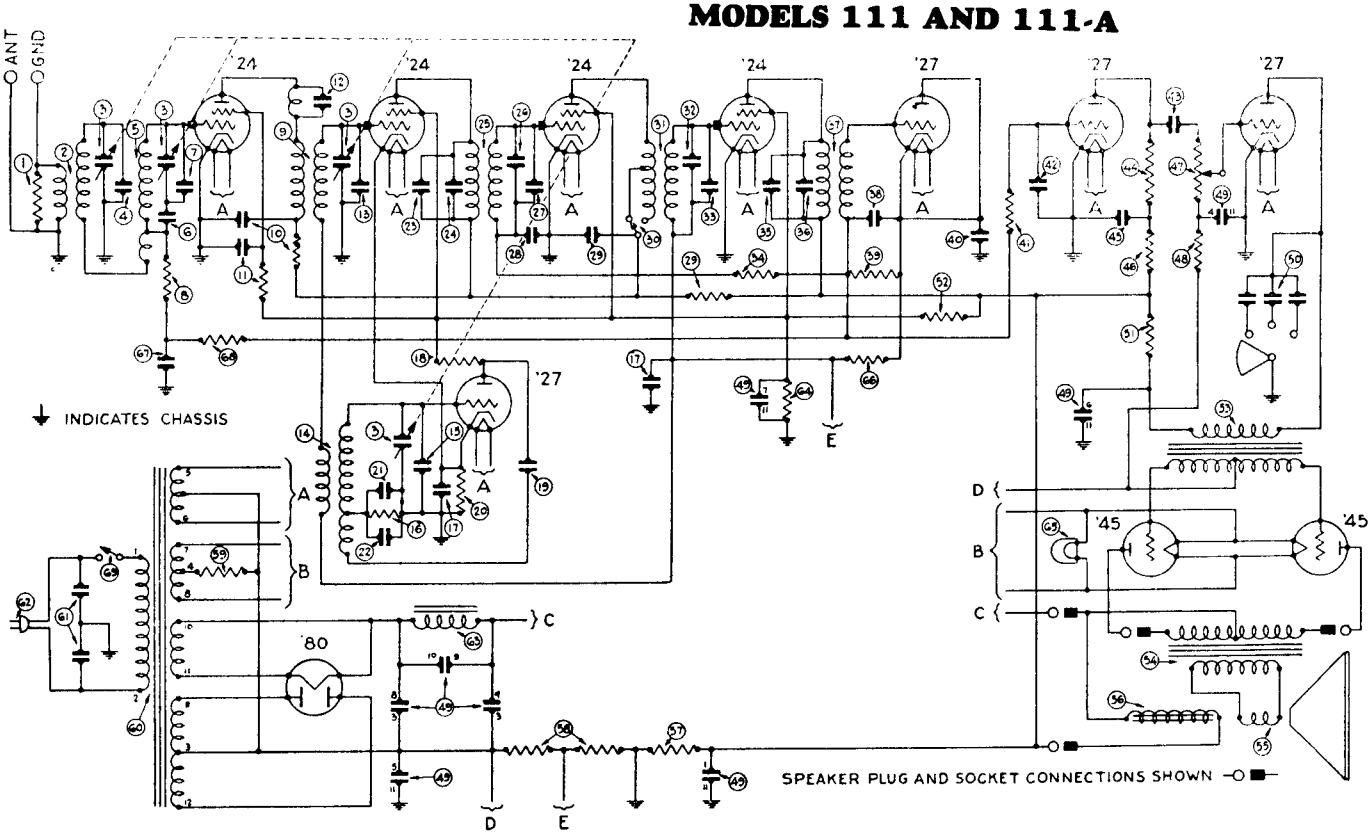
In locations where it is impossible to get a low-resistance ground connection, it is advisable to detune slightly the first aligning condenser shunted across C1; about one-eighth of a turn is usually sufficient. This will reduce the tendency toward circuit oscillation.



Schematic circuit of the Philco "Model 95" receiver, including the variations which distinguish several other models of the "Screen-Grid Plus" series. At the lower left, additional details of the sets are: A, the input connections of the "96" and the "296"; B, terminal connections of filter condenser block "No. 3754"; C, tube layout. Since V4 does not amplify, it is supplemented by V5.

PHILADELPHIA STORAGE BATT., CO.

MODELS 111 AND 111-A



NOTE: The connection shown between Condenser No. ⑦ and Condenser No. ⑥ should also be connected to ground.

Model 111 Receivers are for operation on 100-130 volt, 50-60 cycle AC lines
Model 111-A Receivers are for operation on 100-130 volt, 25-60 cycle AC lines

Table 1—Tube Socket Readings Taken with AC Set Tester AC Line—115 volts

Tube		Filament Volts	Plate Volts	Screen Grid Volts*	Control Grid Volts	Cathode Volts	Plate Milli-Amperes	Screen-Grid Milli-Amperes ‡
Type	Circuit							
24	1st R. F.	2.1	190	60	.2	5	1.7	1.75
27	Osc.	2.1	45	...	.7	7	1.6	.....
24	1st Det.	2.1	180	62	4.6	8	.5†	.15
24	1st I. F.	2.1	185	65	...	5	1.5	1.7
24	2nd I. F.	2.1	190	82	2.2	5	3	1.85
27	Det. Rect.	2.2	...	...	.4	.5	.....	.....
27	Det. Amp.	2.2	35	...	.4	5	.20‡	.....
27	1st A. F.	2.1	95	...	1.2	5	4.	.....
45	2nd A. F.	2.2	255	...	50	...	32.5	.....
45	2nd A. F.	2.2	255	...	50	...	32.5	.....
80	Rect.	4.9	...	...	...	...	50/Plate	.....

*Read with C 100 Scale.
†Read with 20 Mil. Scale.
‡Read with 2 Mil. Scale.

Note—Volume Control Off; Station Selector turned to Low Frequency End; Range Switch set in "Normal" Position.

Table 2—Power Transformer Voltages

Terminals	A.C. Volts	
1—2		Primary
3		Center Tap 80 Tube
4		Center Tap 45 Tubes
5—6	2.67	Heaters for 24 and 27 Tubes
7—8	2.68	Filaments for 45 Tubes
9—12	750	Plates 80 Tube
10—11	5.0	Filament 80 Tube
Rubber Covered Lead		Center Tap for 24 and 27 Tubes

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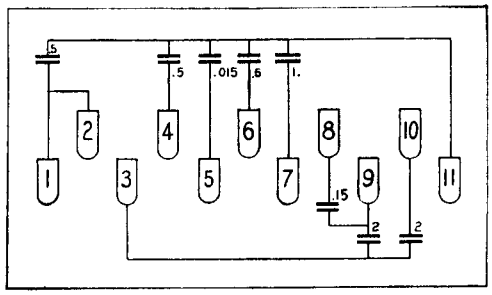
Table 3—Condenser Data
(Other Than Filter Condenser)

No. on Figs. 3 and 4	Capacity
6	.05
10 11	.05 and 250 Ohm Resistor
17	.25 (two sections)
19 23 27 33 38	.00011
21	.0007
28	.05
29	.05 and 250 Ohm Resistor
35	.00005
40	.5
42	.00025
43	.015
45	.05
61	.015 (two sections)
67	.05

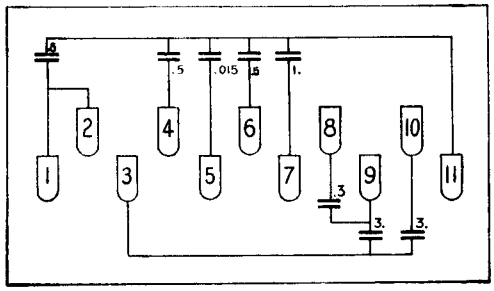
Table 4—Resistor Data

No. on Figs. 3 and 4	Resistance	Color
1	10,000	Black
8 39 41 66 68	100,000	Silver Gray—Yellow Tip
16	50,000	Orange
18	13,000	Belgium Blue
20	1,000	Brown Body—Black Tip—Red Dot
34	500,000	Battleship Gray
44	500,000	Battleship Gray
46	250,000	White
48—64	70,000	Jade Green
51—52	25,000	Auto Brown—Yellow Tip
57	10,000	Long Tubular
58	70	Flat Wire Wound (two sections)
59	800	Short Tubular

Model 111 Condenser Block Part No. 3754

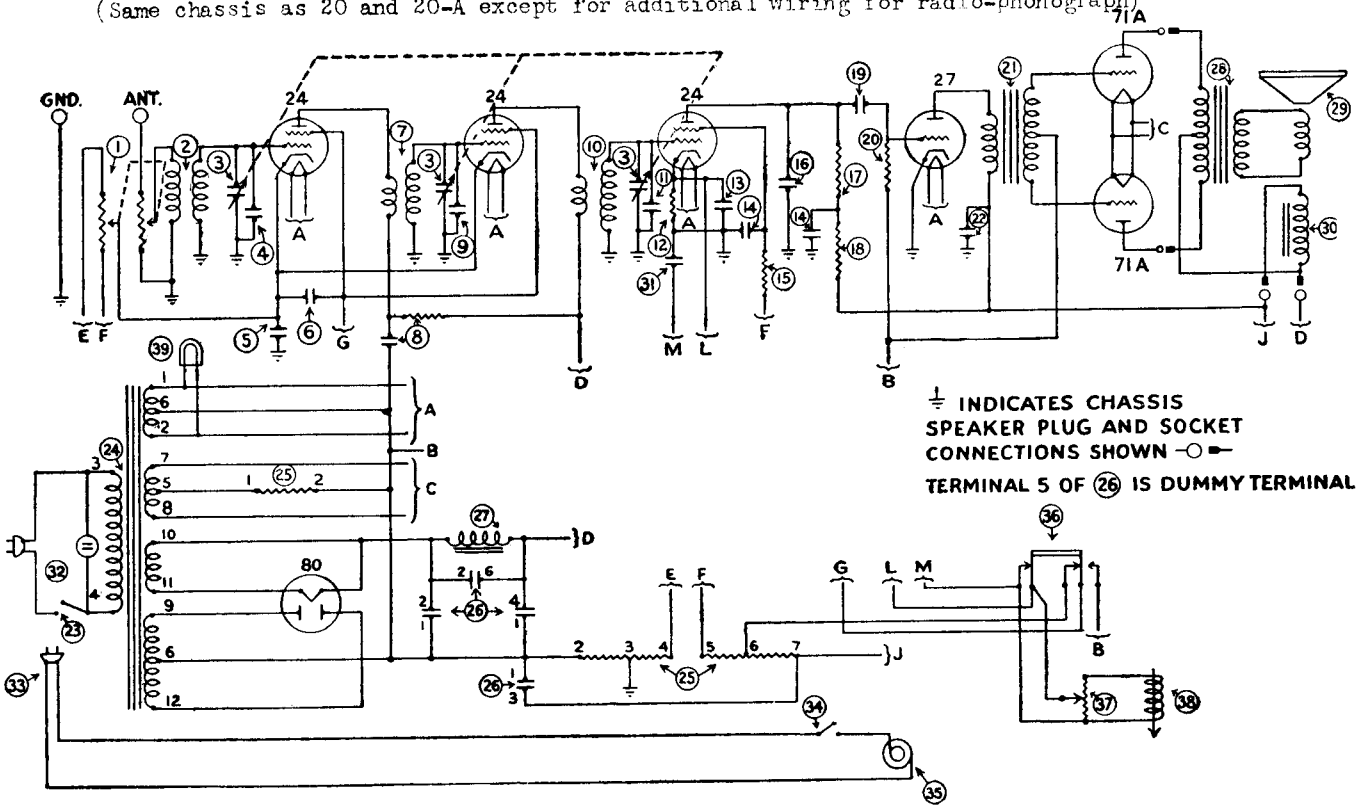


Model 111-A Condenser Block Part No. 3755



PHILCO MODELS 220 AND 220-A

(Same chassis as 20 and 20-A except for additional wiring for radio-phonograph)



DIFFERENT CIRCUIT ARRANGEMENT FOR MODEL 220-A

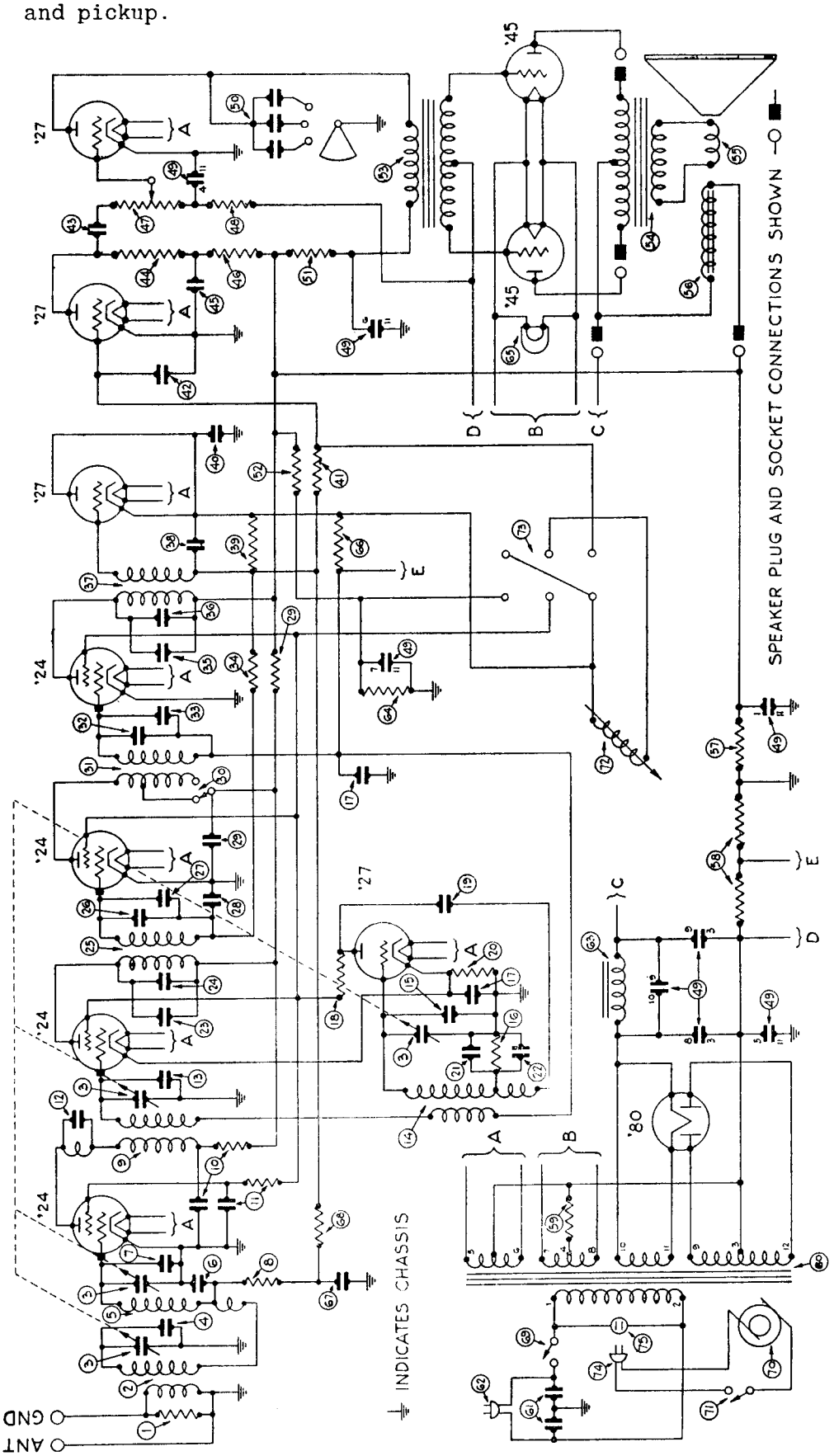
Model 220-A for use on 25-60 cycle lines is wired differently than the Model 220. The plate supply lead for the two 24 R. F. Tubes is taken from the low side of the Speaker field Coil. The lead "D" to the 24 tubes should be changed to "J" for the Model 220-A only. This will change the plate voltage from 250 volts to 115-125 volts. The plate current readings will also be lower than those given in the table.

PHILADELPHIA STORAGE BATT., CO.

MODEL 211 IS FOR USE ON 50-60 CYCLE 100-130 VOLT AC LINES
MODEL 211-A IS FOR USE ON 25-40 CYCLE 100-130 VOLT AC LINES

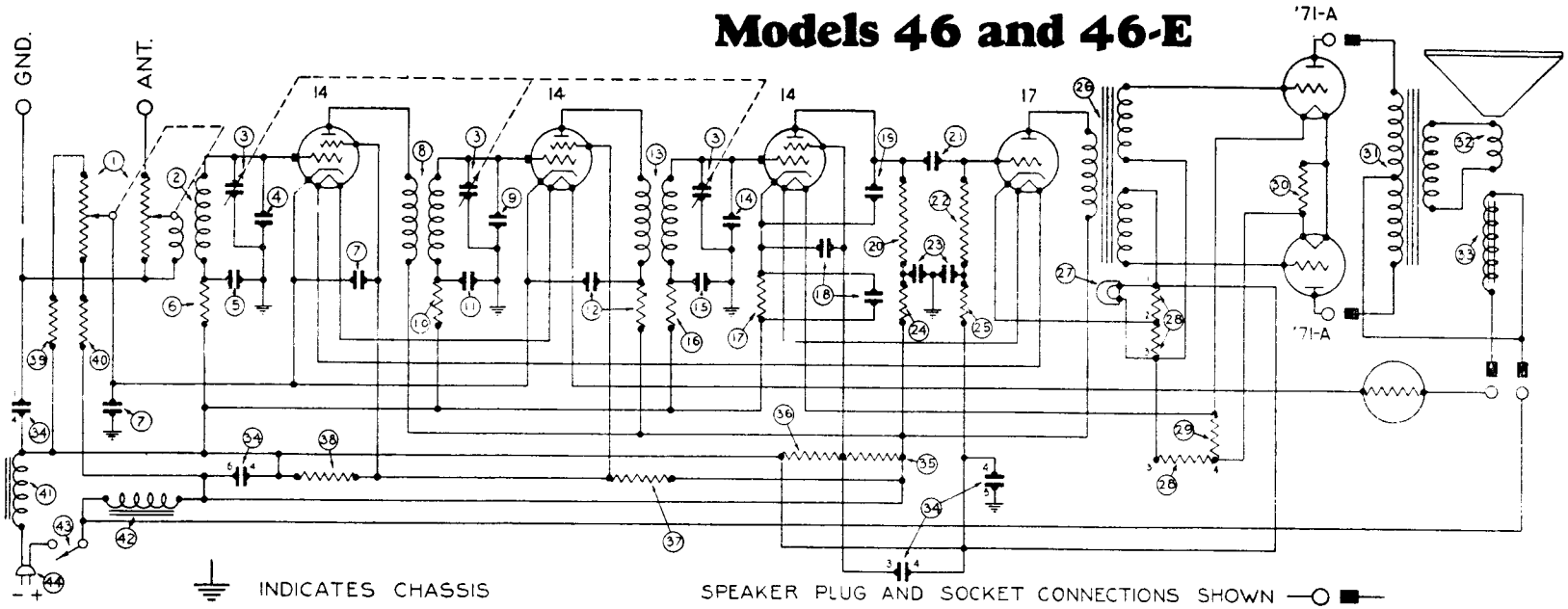
The chasses of the 211 and 211-A are the same as the chasses of the 111 and 111-A except for the additional wiring of the radio-phono switch and pickup.

MODEL 211 AND 211-A RADIO-PHONOGRAPH



NOTE:—Starting January 15th, the connection from the pick-up to the Detector Rectifier Cathode is changed so as to reach the connection between the volume control No. 47 and resistor No. 48. This change has been made by removing the green wire in the radio-phono switch cable from resistor No. 66, and lengthening it to reach the connection indicated at the volume control.

Models 46 and 46-E



Model 46 Receivers are for Operation on 105-125 volt, DC Lines.
Model 46-E Receivers are for Operation on 210-240 volt, DC Lines.

WARNING This Receiver is for use on DC current only. The type 2 ballast tube is to be used on 105 to 125 Volts DC and the type 3 ballast tube is to be used on 210 to 240 Volts DC. The type 14 and 17 tubes are designed especially for this Receiver, using a 14 volt filament. No other tubes are to be used in this Receiver.

Table 1—Tube Socket Readings Taken with Set Tester, DC Line, 115 Volts

Tube Type	Tube Circuit	Filament Voltage	Plate Voltage	Grid Voltage	Screen Grid Voltage	Cathode Voltage Measured with Prod	Plate Milliamperes
14	1st R. F.	13.5	100	1.5	60	2.5	2
14	2nd R. F.	13.5	100	1.5	60	2.5	2
14	Detector	13.5	30	1.0	25	2.5	.1
17	1st Audio	13.5	100	.25		4.5	5
71-A	2d Audio	4.5	90	15.5	...	...	11.5
71-A	Push-Pull	4.5	90	15.5	...	...	11.5
2	Ballast	8	...	...	...	...	...
3	Ballast	128	...	...	...	...	...

All readings taken with antenna disconnected and ground on. Volume Control on full.

The majority of set testers are not equipped to measure a DC filament voltage as high as 14 volts. In this case the volt meter binding post prods will have to be used. This method will also have to be used in checking cathode voltages across resistances No. 17 —No. 39 and No. 28 and No. 29.

The field coil of the Speaker used with this Receiver is of low resistance. It is not the same as the field coil used with the AC Electric Receiver. If, by mistake, a speaker from an AC Electric Receiver is plugged into the DC Receiver no damage will result.

Table 2—Condenser Data
Other than Filter Condenser

No. on Figs. 2 and 3	Capacity MFD
19	.0005
21	.01
5 — 11 — 13	.05
12	.05 and 250-ohm resistor
7	.25
18 — 23	.25 (two sections)

Part No.—4860

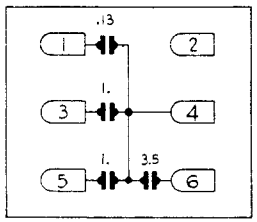


Fig. 1

Table No. 3—Resistor Data

No. on Figs. 2 and 3	Terminal	Resistance	Color
	2—3	10	
28	1—2	14	Tubular
	3—4	29	
29		200	Tubular
30		210	Flat Wire Wound
39		250	Flat Wire Wound
16		5,000	Yellow
37 — 40		13,000	Belgium Blue
6 — 10 — 17 — 36		33,000	Belgium Blue—Yellow Tip
35 — 38		70,000	Jade Green
24		100,000	Silver Gray—Yellow Tip
25		250,000	White
20 — 22		500,000	Battle Gray

Radio Service Data Sheet

PHILCO "MODELS 111" AND "111A" SUPERHETERODYNE RECEIVERS

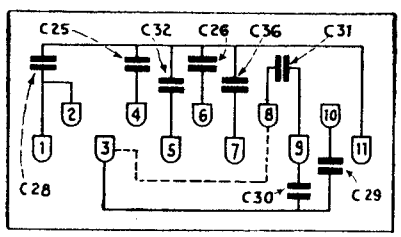
The fundamental circuit of the above listed Philco receivers, manufactured by the Philadelphia Storage Battery Co., Philadelphia, Pa., is the subject of this Data Sheet; with particular reference to the Model 111 set.

Available constants are listed, as follows:

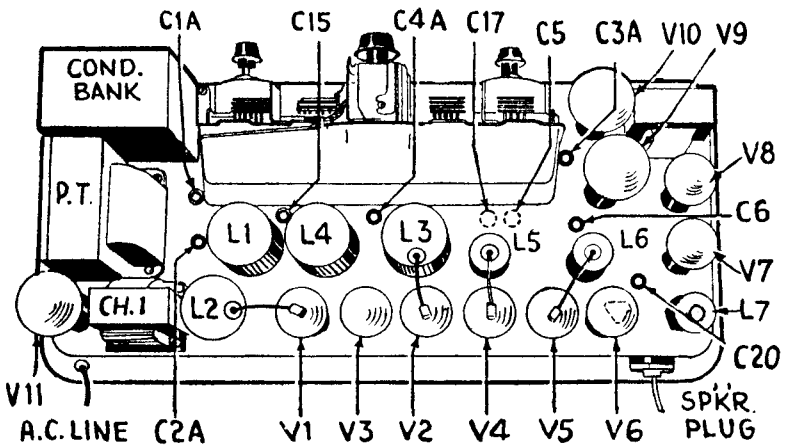
Condensers: C1, C2, C3, C4, tuning gang; and their H.F. trimmers, C1A, C2A, C3A, C4A. C5, C6, C17, C20 are I.F. trimmers; C6A, C7, C17A, C35, .00011-mf.; C8, C9, C10 (with resistor), C11 (with resistor), C18, C19, (and resistor), C23, .05-mf.; C13 and C16 (double unit), 0.25-mf.; C14, .0007-mf.; C15, L.F. trimmer; C12, L.F. resonator; C20A, .00005-mf.; C21, 0.5-mf.; C22, .00025-mf.; C24, .015-mf.; C25, C26, C28, C29, C30, C31, C32, C36 (in filter-condenser bank; see illustration of condenser connections); C27, tone control condenser bank; C33 and C34 (double unit), .015-mf.

Resistors: R1 (black), 10,000 ohms; R2, R3, R12, R13, R23 (silver gray, yellow tip), 100,000 ohms; R4, R5, R10 (with condensers), 250 ohms; R6 (orange), 50,000 ohms; R7 (brown body, black tip, red dot), 1,000 ohms; R8 (belgian blue), 13,000 ohms; R9, R14 (battleship gray), 500,000 ohms; R11, R18 (auto brown, yellow tip), 25,000 ohms; R15 (white), 250,000 ohms; R16, volume control; R17, R24 (jade green), 70,000 ohms; R19 (long tubular), 10,000 ohms; R20, R21 (one unit, flat, wirewound, center-tapped), 35 ohms (each half); R22 (short, tubular), 800 ohms.

The operating voltages for the "Model 111" are as follows: Filament potentials: V1, V2, V3, V4, V5, V8, 2.1 volts; V6, V7, V9, V10, 2.2 volts; V11, 4.9 volts. Plate potentials: V1, V5, 190 volts; V2, 180 volts; V3, 45 volts; V4, 185 volts; V7, 35 volts; V8, 95 volts; V9, V10, 255 volts. Screen-grid potentials: V1, 60 volts; V2, 62 volts; V4, 65 volts; V5, 82 volts. Control-grid potentials: V1, 0.2-volt; V2, 4.6 volts; V3, 0.7-volt; V5, 2.2 volts; V6, V7, 0.4-volt; V8, 1.2 volts; V9, V10, 50 volts. Plate currents: V1, 1.7 ma.; V2, 0.5-ma. (as read on 20-ma. scale); V3, 1.6 ma.; V4, 1.5 ma.; V5, 3 ma.; V7, 0.2-ma. (as read on 2 ma. scale); V8, 4 ma.; V9, V10, 32.5 ma.; V11, 50 ma. per plate. Screen-grid current (as read on 2-ma. scale): V1, 1.75 ma.; V2, 0.15-ma.; V4, 1.7 ma.; V5, 1.85 ma.

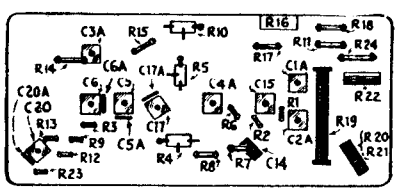


Condenser bank: note circuit change (dotted) in some models. Capacities are: C25, C26, C28, 0.5-mf.; C29, C30, 2 mf.; C31, 0.15-mf.; C32, .015-mf.; C36, 1 mf.; in 25-cycle model, C31, 0.3-mf; C29, C30, 3 mf.



Arrangements of parts on the top of the chassis of the Philco "111" Superheterodynes. Two trimmer condensers (C5, C17) seldom requiring attention are adjusted from the underside of the chassis. These two condensers connect, respectively, to the input and output windings of the first I.F. transformer, L5; and, in conjunction with this transformer, form a particularly selective input circuit for the first I.F. tube, V4. The oscillator adjustments are distinguished as "high-frequency" (C4A) and "low-frequency" (C15).

Note that these readings are taken with a line-potential of 115 volts, and volume control in the off position; with the station selector turned to the lowest frequency, and the range



Underside view of the Philco "111" chassis; showing only the fixed resistors and condensers, and the trimming condensers; their locations in the chassis may be fixed in relation to the long black resistor, R19.

switch SW 1 in the diagram set at "normal." Putting this switch in the "maximum" position increases greatly the sensitivity of the Philco "111" receiver. Positions "normal" and "maximum" are indicated in the diagram respectively as 1 and 2. Check the setting of this switch; since its incorrect use will result in the complaint of distorted reproduction and erratic operation, due to the overloading effect of powerful locals with the switch set at "maximum."

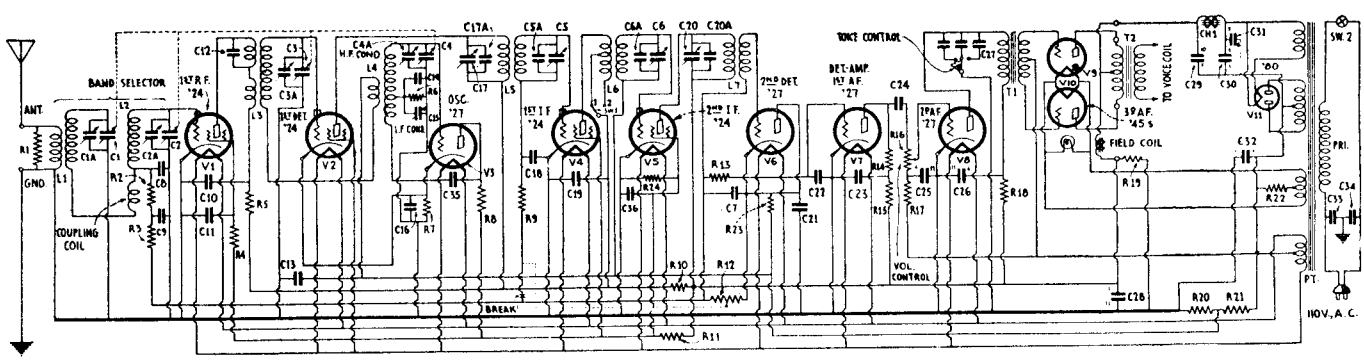
The factory makes the following observation concerning adjustment of the nine compensating or trimmer condensers: "These receivers are accurately adjusted at the factory prior to their shipment. Under no circumstances are the adjusting condensers to be changed in the field. This alignment requires special oscillator equipment, which all Philco distributors have. If for any reason the receiver needs adjustment, it must be returned to the distributor's service department."

"Model 111A" is a 25-cycle design, and its parts values vary slightly from the above. "Model 211" is a phonograph combination; while "211A" is its 25-cycle designation.

It will be noted, from the top-view illustration of the chassis, that two of the trimmer capacities are adjusted from the under side. Their locations, and the positions of all the resistors, are shown in the under view.

As indicated by dotted lines, those models dated later than March 15, 1931, are wired to place a higher bias on the first I.F. amplifier, V4. This connection is made by swinging the resistor R9 from the chassis to a center-tap which is obtained by changing R12 from a single 100,000-ohm unit to two 50,000-ohm units, and connecting them in series.

The intermediate frequency used in these models is 175 kilocycles. All final adjustments are to be made with switch Sw. 1 in its "normal" position, No. 1. A fiber wrench is required for adjusting the I.F. trimmers. The high-frequency circuits are to be adjusted at 1400 kc. The single "low-frequency" condenser C15 is to be adjusted at 600 kc. After adjusting the R.F. and I.F. stages, tune the receiver to the eighth harmonic of the I.F. circuits; the dial reading should then be 140. At this time, make any adjustment of the high-frequency condenser C4A which may be necessary.



Schematic circuit of the Philco "Model 111" Receiver. Tone control is obtained by shunting one to three fixed condensers across the output of the second A.F. tube, V8. Note that the center-tap of the high-voltage secondary does not connect directly to the chassis, but returns through two resistors, R20 and R21. The plate of V6 connects directly to the cathode.

Models 112 and 112-A Receivers

Model 112 Receivers are for operation on 100-130 volt, 50-60 cycle AC lines
Model 112-A Receivers are for operation on 100-130 volt, 25-60 cycle AC lines

Table 1—Tube Socket Readings Taken with AC Set Tester AC Line—115 volts

Tube		Filament Volts	Plate Volts	Screen Grid Volts*	Control Grid Volts	Cathode Volts	Plate Milli-Amperes	Screen-Grid Milli-Amperes ‡
Type	Circuit							
24	1st R. F.	2.1	190	60	.2	5	1.7	1.75
27	Osc.	2.1	45	..	.7	7	1.6	....
24	1st Det.	2.1	180	62	4.6	8	.5†	.15
24	1st I. F.	2.1	185	65	...	5	1.5	1.7
24	2nd I. F.	2.1	190	82	2.2	5	3	1.85
27	Det. Rect.	2.2	...	..	.4	.5	....	....
27	Det. Amp.	2.2	35	..	.4	5	.20‡	....
27	1st A. F.	2.1	95	..	1.2	5	4.	....
45	2nd A. F.	2.2	255	..	50	...	32.5	....
45	2nd A. F.	2.2	255	..	50	...	32.5	....
80	Rect.	4.9	...	..	...	...	50/Plate	....

*Read with C 100 Scale.
†Read with 20 Mil. Scale.
‡Read with 2 Mil. Scale.

Note—Volume Control Off; Station Selector turned to Low Frequency End; Range Switch set in "Normal" Position.

Table 2—Power Transformer Voltages

Terminals	A.C. Volts	
1—2		Primary
3		Center Tap 80 Tube
4		Center Tap 45 Tubes
5—6	2.67	Heaters for 24 and 27 Tubes
7—8	2.68	Filaments for 45 Tubes
9—12	750.	Plates 80 Tube
10—11	5.0	Filament 80 Tube
Rubber Covered Lead		Center Tap for 24 and 27 Tubes

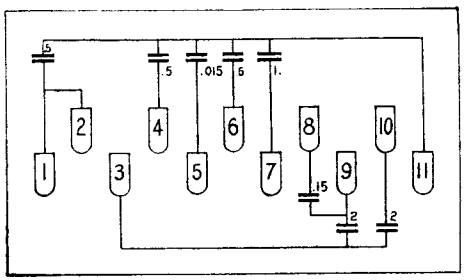
Table 3—Condenser Data
(Other Than Filter Condenser)

No. on Figs.	CAPACITY	COLOR
(6)	.05	Bakelite Container
(10) (11)	.05 and 250 Ohm Resistor	Bakelite Container
(17)	.25 (two sections)	Metal Container
(19) (23) (27) (33) (38)	.00011	Blue, Golden Yellow
(21)	.0007	White, Golden Yellow
(28)	.05	Bakelite Container
(29)	.05 and 250 Ohm Resistor	Bakelite Container
(35)	.00005	Light Blue, White
(40)	.5	Metal Container
(42)	.00025	Yellow
(43)	.015	Bakelite Container
(45)	.05	Bakelite Container
(61)	.015 (two sections)	Bakelite Container
(67)	.05	Bakelite Container

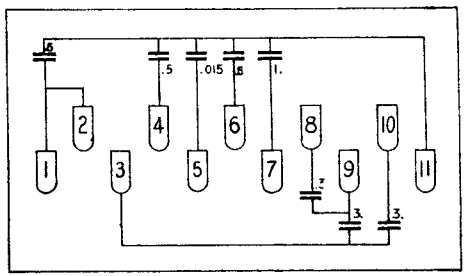
Table 4—Resistor Data

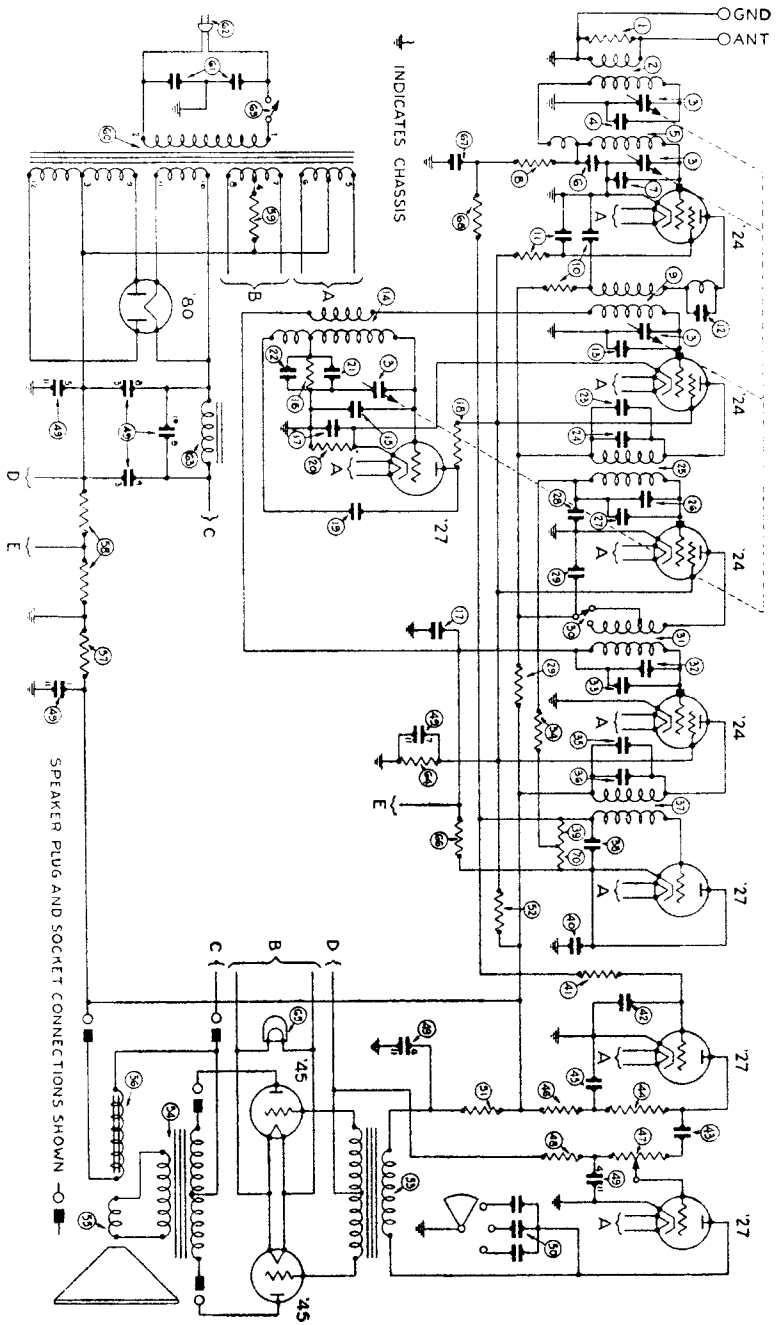
No. on Figs.	Power (Watts)	Resistance	COLOR Body	Tip	Dot
(20)	1.	1,000	Brown	—Black	—Red
(1)	.5	10,000	Brown	—Black	—Orange
(18)	1.	13,000	Brown	—Orange	—Orange
(51) (52)	1.	25,000	Red	—Green	—Orange
(16) (39) (70)	.5	50,000	Green	—Brown	—Orange
(48) (64)	1.	70,000	Violet	—Black	—Orange
(8) (41) (66) (68)	.5	100,000	White	—White	—White
(46)	1.	250,000	Red	—Yellow	—Yellow
(34)	.5	500,000	Yellow	—White	—Yellow
(44)	1.	500,000	Yellow	—White	—Yellow
(58)		70	Flat Wire Wound (two sections)		
(60)		800	Short Tubular		
(67)		10,000	Long Tubular		

Model 112 Condenser Block Part No. 3754



Model 112-A Condenser Block Part No. 3755



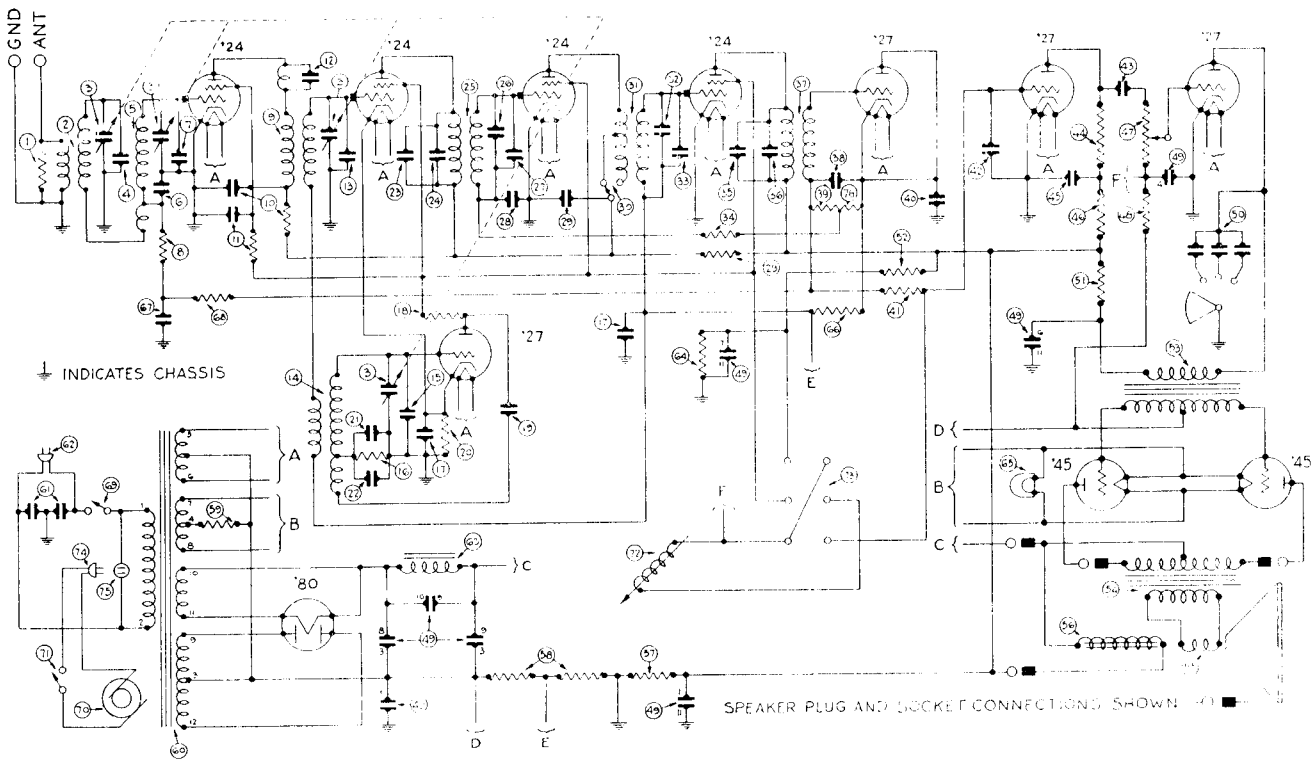


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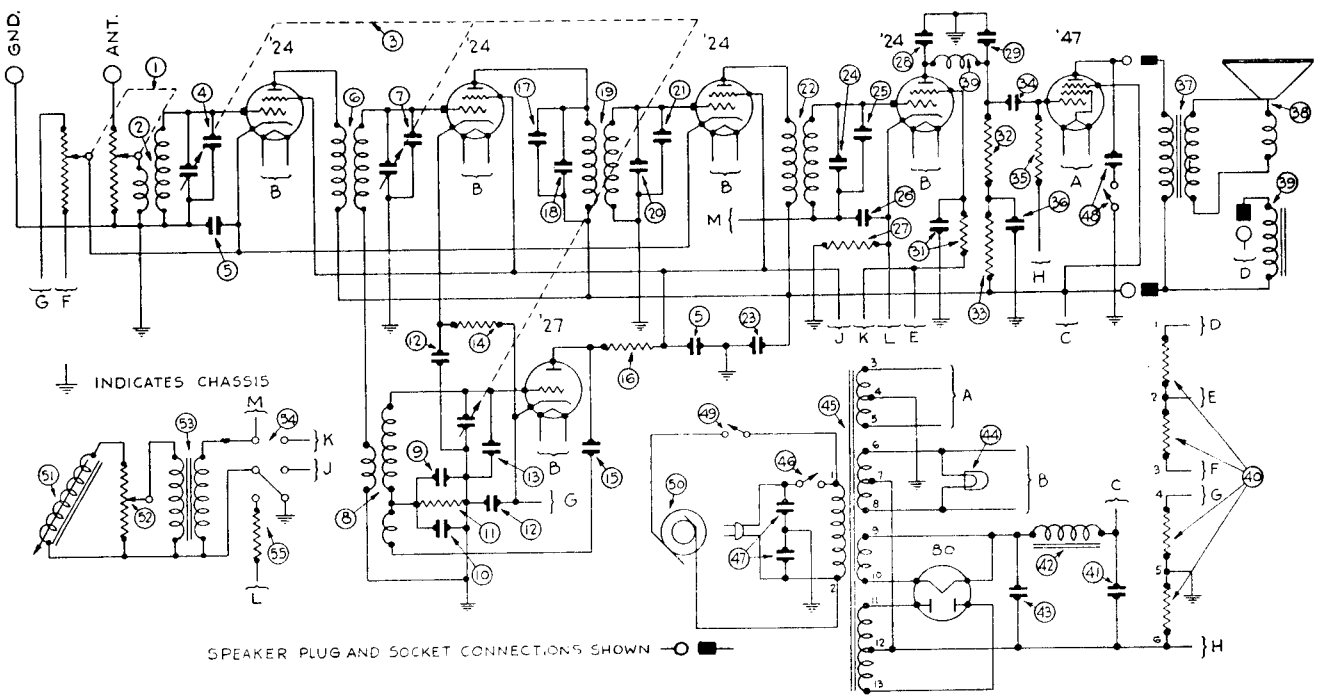
MODELS 112 AND 112-A

PHILADELPHIA STORAGE BATT. CO.

MODEL 212 AND 212-A RADIO-PHONOGRAPH



MODELS 270 AND 270-A



Models 70 and 70-A Receivers

Model 70 Receivers are for operation on 100-130 volt, 50-60 cycle AC lines
Model 70A Receivers are for operation on 100-130 volt, 25-60 cycle AC lines

Table 1—Tube Socket Readings Taken with AC Set Tester AC Line—115 volts

Tube Type	Tube Circuit	Filament Volts	Plate Volts	Screen Grid Volts	Control Grid Volts	Cathode Volts	Plate Milli-amperes
24	1st R. F.	2.25	250	85	3.	19.5	3.
24	1st Det.	2.25	250	87	5.5	21.5	.5
27	Osc.	2.25	85	...	2.	19.5	2.5
24	1st I. F.	2.25	250	87	3.	19.5	3.
24	2nd Det.	2.25	105	75	6.	22.	.1
47	Audio	2.25	245	255	1.	...	...
80	Rectifier	4.7	...	...	...	...	40 plate

Note—Volume Control Off; Station Selector turned to Low Frequency End.

Table 2—Power Transformer Voltages

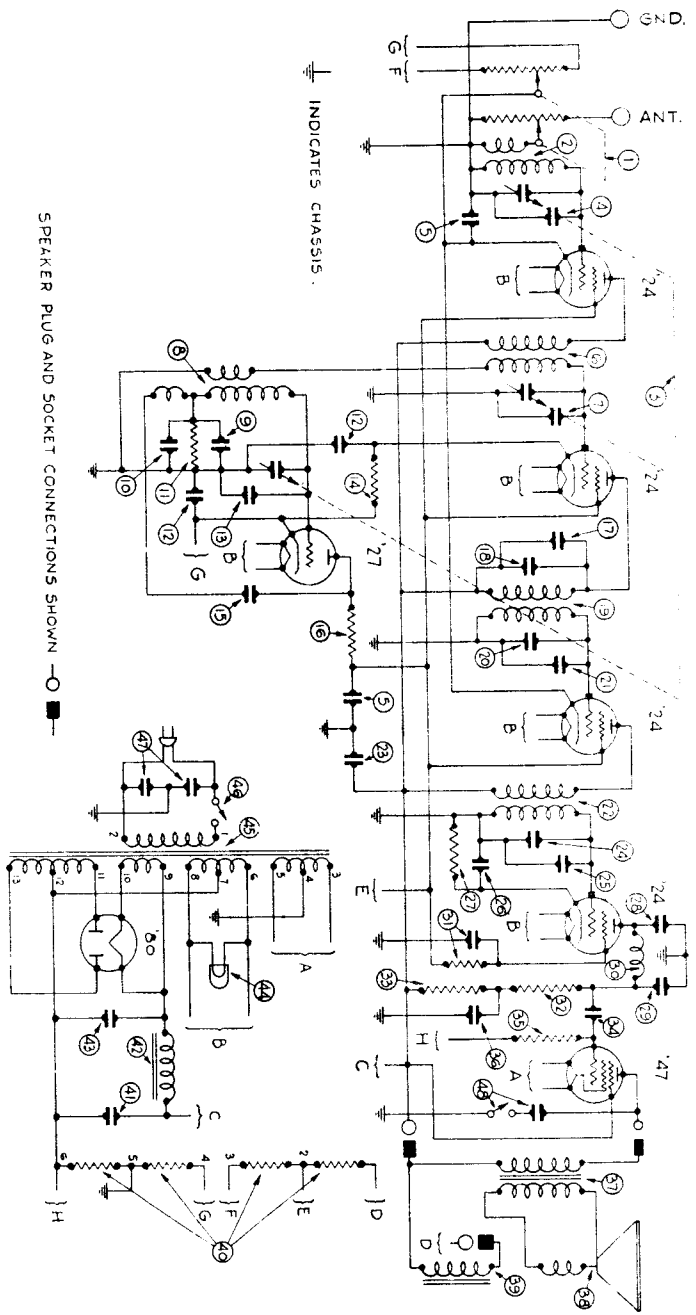
Terminals	A.C. Volts		
1–2	105 to 125	Primary	Black (Small Gauge)
3–5	2.5	Filament of 47	Dark Green
6–8	2.5	Filament of 24	Black (Heavy Gauge)
9–10	5.	Filament of 80	Light Blue
11–13	700.	Plates of 80	Yellow
4	...	Center Tap of 3–5	Black, Green Tracer
7	...	Center Tap of 6–8	Black, Yellow Tracer
12	...	Center Tap of 11–13	Yellow, Green Tracer

Table 3—Condenser Data

No. on Figs. 3 and 4	Capacity MFD	Color
5	.09	
9	.00041	Yellow Orange
12	.09	
15, 17, 21	.00011	Blue, Golden Yellow
23	.05	
25	.00005	Light Blue, White
26	.5	
28	.0005	Green
29	.00025	Yellow
31	.09 and 250 Ohm Resistor	
34	.01	
36	.25	
41	(25 to 40 cycles) 6.	
41	(50 to 60 cycles) 10.	
43	6.	

Table 4—Resistor Data

No. on Figs. 3 and 4	Resistance	Terminal	Color Body	Color Tip	Color Dot
11, 22	50,000	...	Green	Brown	Orange
14	5,000	...	Green	Black	Red
16	13,000	...	Brown	Orange	Orange
32, 35	250,000	...	Red	Yellow	Yellow
33	100,000	...	White	White	Orange
	1,060	1–2			
	2,300	2–3			
40	70	4–5	Long Tubular		
	180	5–6			



PHILADELPHIA STORAGE BATT. CO.

MODELS 70 AND 70-A

Models 90 and 90-A Receivers

Model 90 Receivers are for Operation on 105-125 volt, 50-60 cycle AC Lines.
Model 90-A Receivers are for Operation on 105-125 volt, 25-60 cycle AC Lines.

Table 1—Tube Socket Readings Taken with AC Set Tester, AC Line, 115 Volts

Tube Type	Tube Circuit	Filament Voltage	Plate Voltage	Grid Voltage	Screen Grid Voltage	Cathode Voltage	Plate Milliamperes
24	1st R. F.	2.1	250	3.3	83	15	3
27	Osc.	2.1	60	1	...	15	2
24	1st Det.	2.1	250	5.5	23	15	.5
24	1st I. F.	2.1	250	3.8	80	15	4.5
24	2nd Det.	2.1	48	3.7	42	15	3
27	1st Audio	2.1	140	.25	...	10	...
45	Audio	2.2	243	46	...	...	30
45	Audio	2.2	243	46	...	...	30
80	Rect.	4.5	...	...	...	...	...

All readings taken with antenna disconnected and ground on. Volume Control on full.

Table 2—Power Transformer Voltages

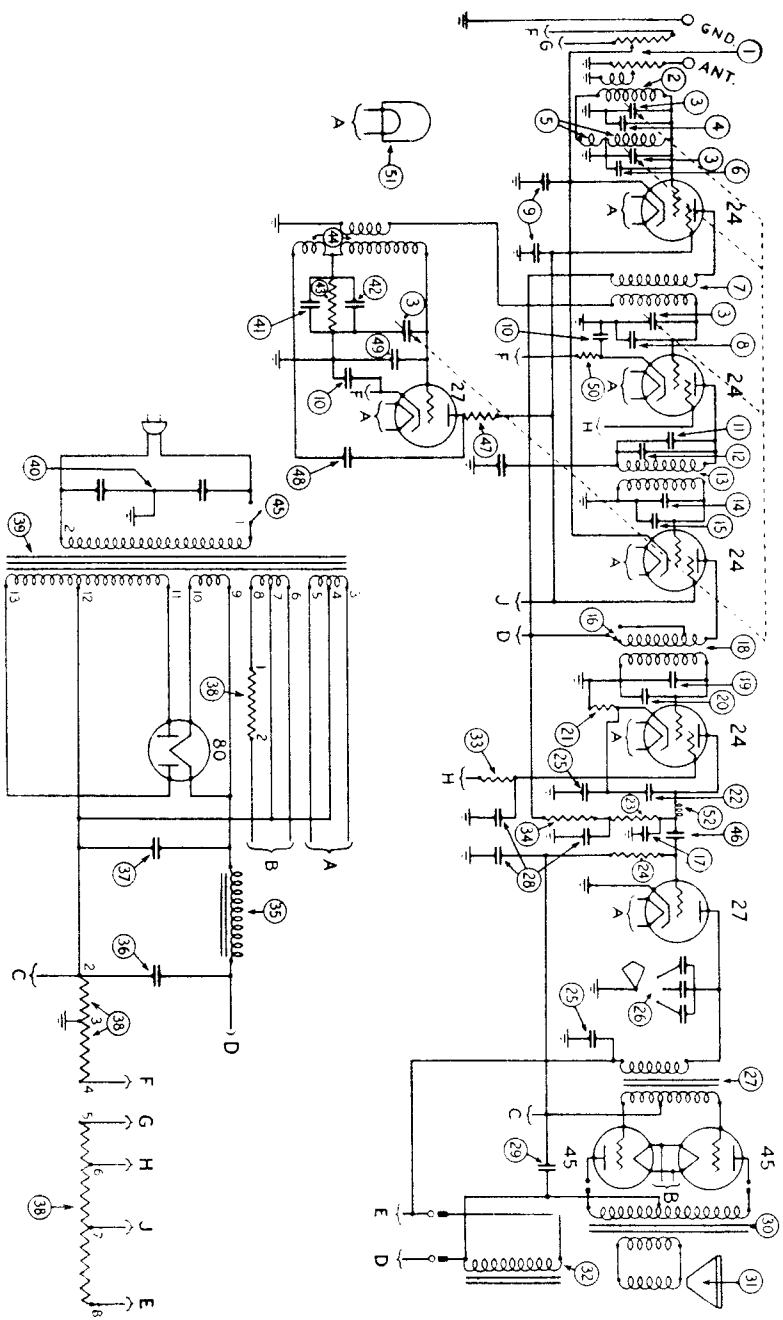
Terminals	A.C. Volts		Color
1—2	105 to 125	Primary	Black (Small Gauge)
3—5	2.5	Heaters of 24 and 27 Tubes	Black (Heavy Gauge)
4	2.5	Center Tap of 3—5	Black with Yellow
6—8	2.5	Filament of 45 Tubes	Dark Green
7	2.5	Center Tap of 6—8	Black with Green
9—10	5.0	Filament of 80 Tube	Light Blue
11—13	650.	Plates of 80 Tube	Yellow
12	...	Center Tap of 11—13	Yellow with Green

Table 3—Resistor Data

No. on Fig.	Terminal	Power (Watts)	Resistance	Color Body—Tip—Dot
	1—2	...	800	
	2—3	...	263	
	3—4	...	75	
35	5—6	...	370	(Long Tubular)
	6—7	...	1,800	
	7—8	...	1,430	
47	...	1.	13,000	Brown—Orange—Orange
31	...	.5	50,000	Green—Brown—Orange
43	...	1.	50,000	Green—Brown—Orange
32	...	1.	250,000	Red—Yellow—Yellow
44 32	...	.5	250,000	Red—Yellow—Yellow
34	...	.5	1,000,000	Brown—Black—Green

Table 4—Condenser Data

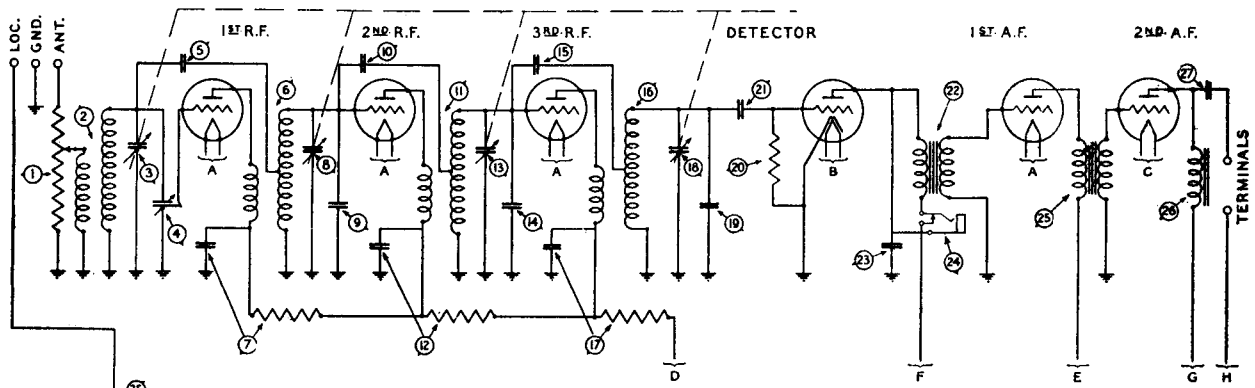
No. on Figs	Capacity	Color
9	.09 Double	Black Bakelite Container
10	.09 Double	Black Bakelite Container
11 14 16 20 45	.00011	Blue, Golden Yellow
17 22	.000035	Yellow and Green
23	.5	Metal Container
28	.25 Double (Black wires to Ground) .5 (White wire to Ground)	Metal Container
30	.05	Black Bakelite Container
35 37	6.	Electrolytic Type
1 (25 to 40 cycles)	10.	Electrolytic Type
40	.015 Double	Black Bakelite Container
42	.0007	White, Golden Yellow
49	.001	Green and White



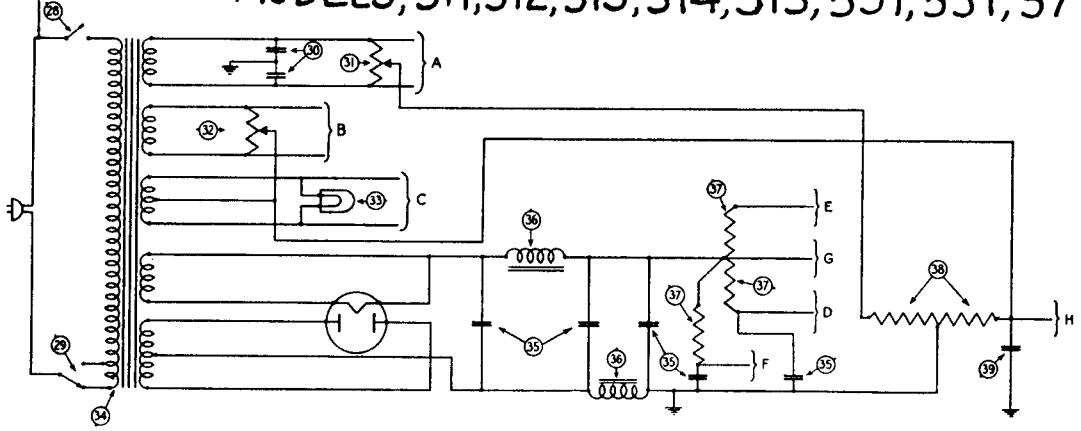
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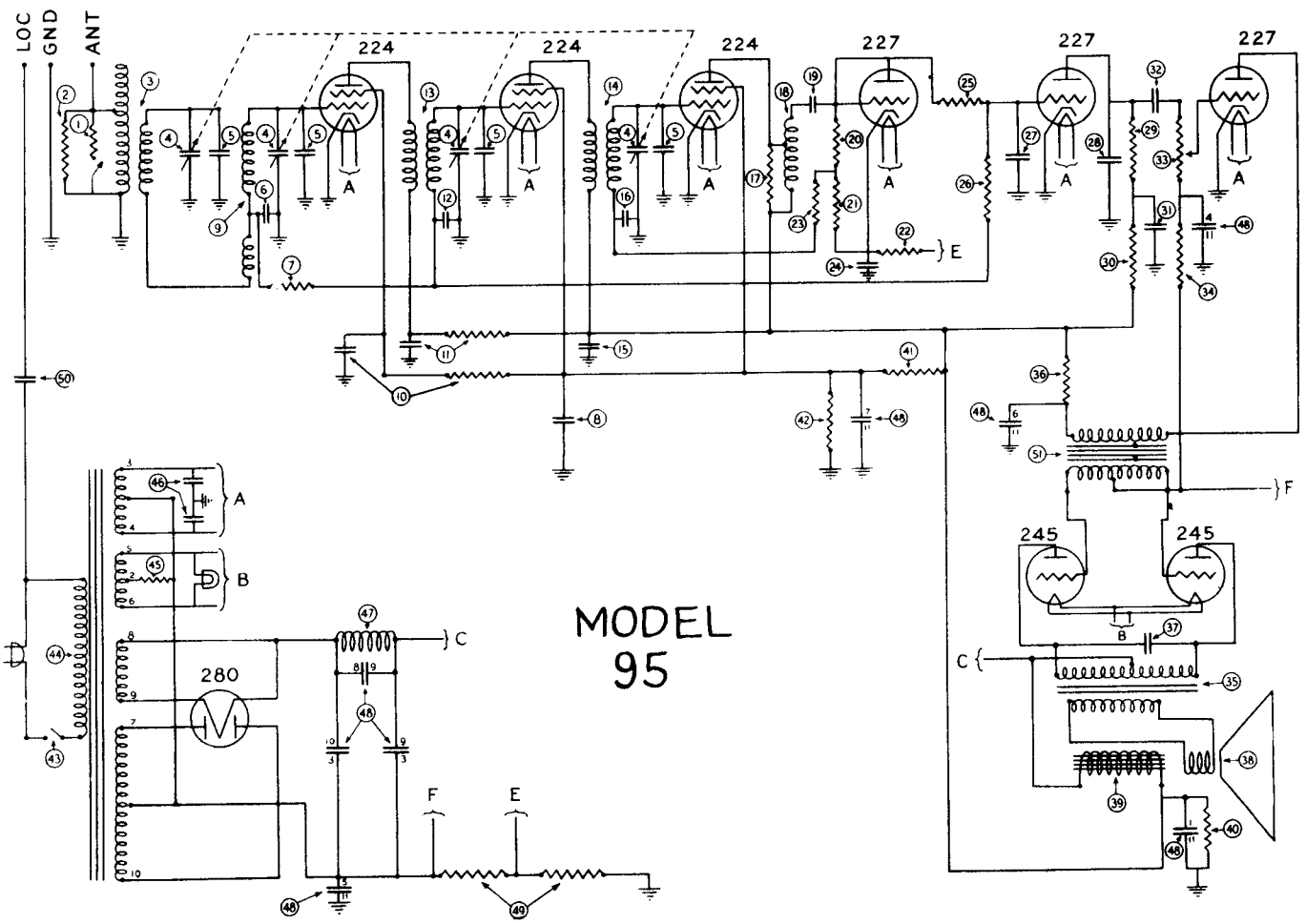
Models 90 and 90-A

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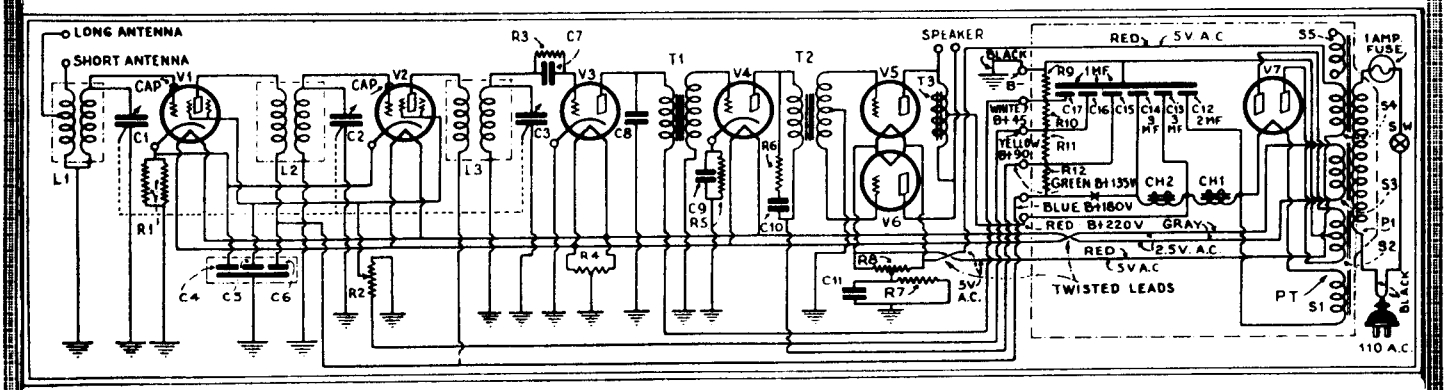
MODELS, 511, 512, 513, 514, 515, 531, 551, 571





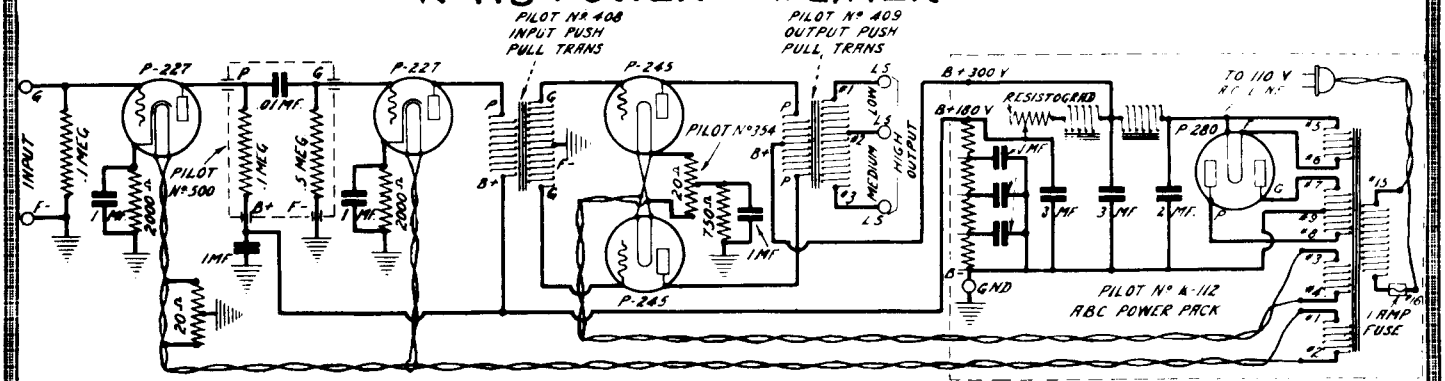
MODEL 95

PILOT RADIO & TUBE CORP.

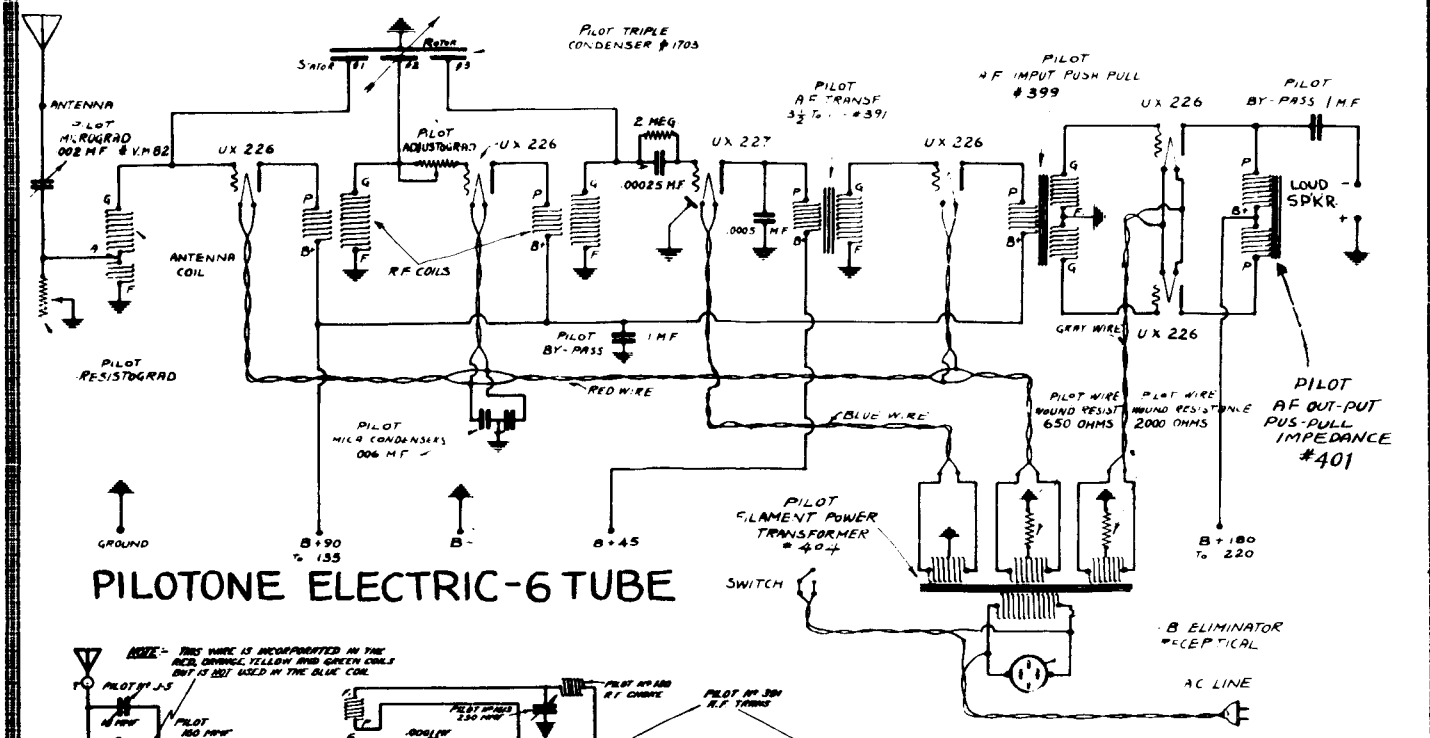


The circuit diagram of the Pilot "P. E. 6" broadcast receiver, at the left; the dotted square at the right encloses the "K-111" power pack, designed for push-pull '71.A operation. Circuit values and constants are given in the text and list of parts.

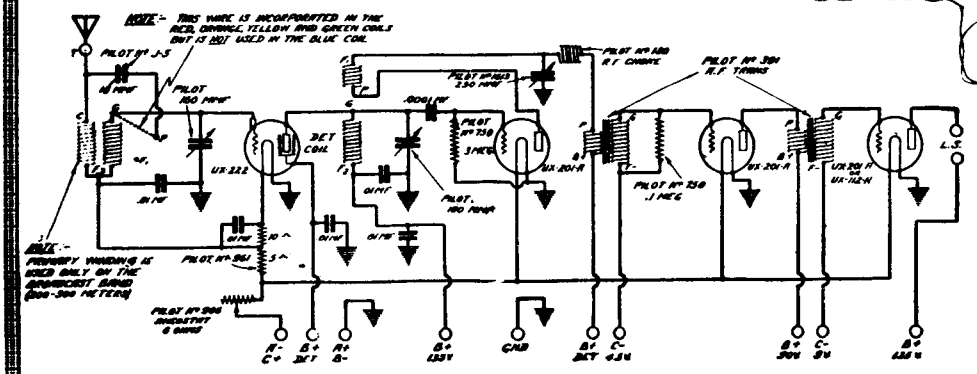
K-113 POWER AMPLIFIER



PILOTONE ELECTRIC-6 TUBE

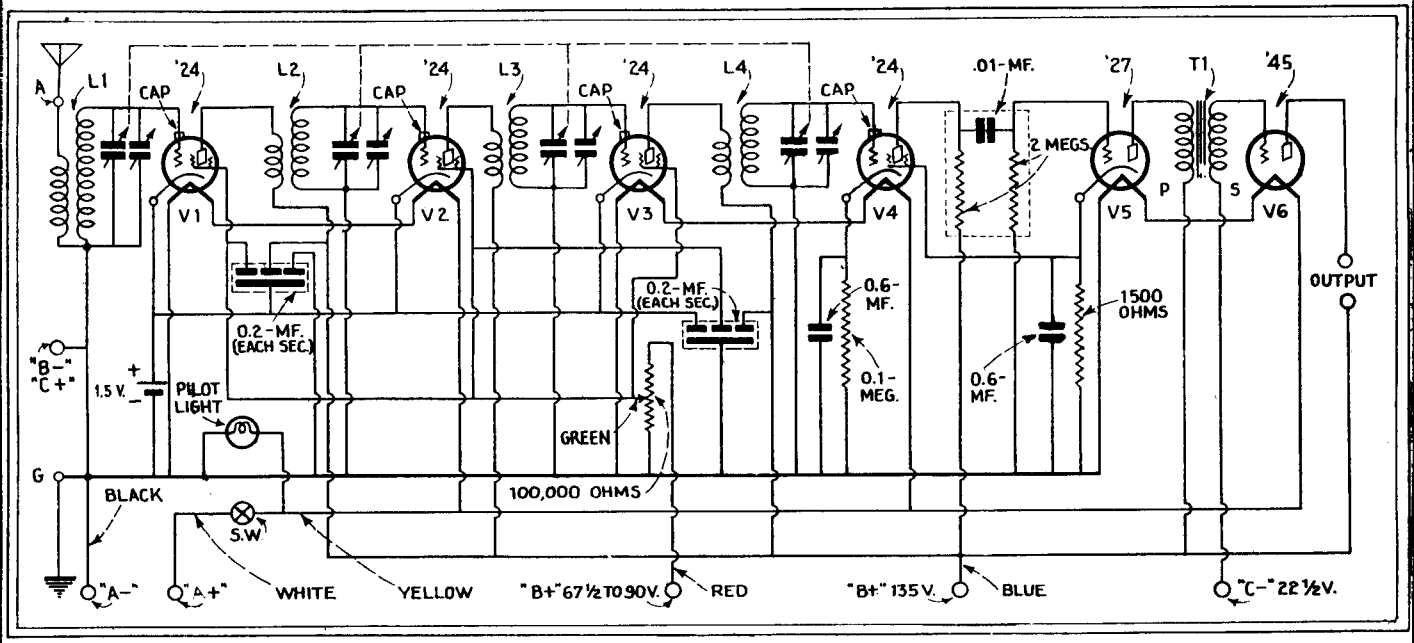


SUPER WASP

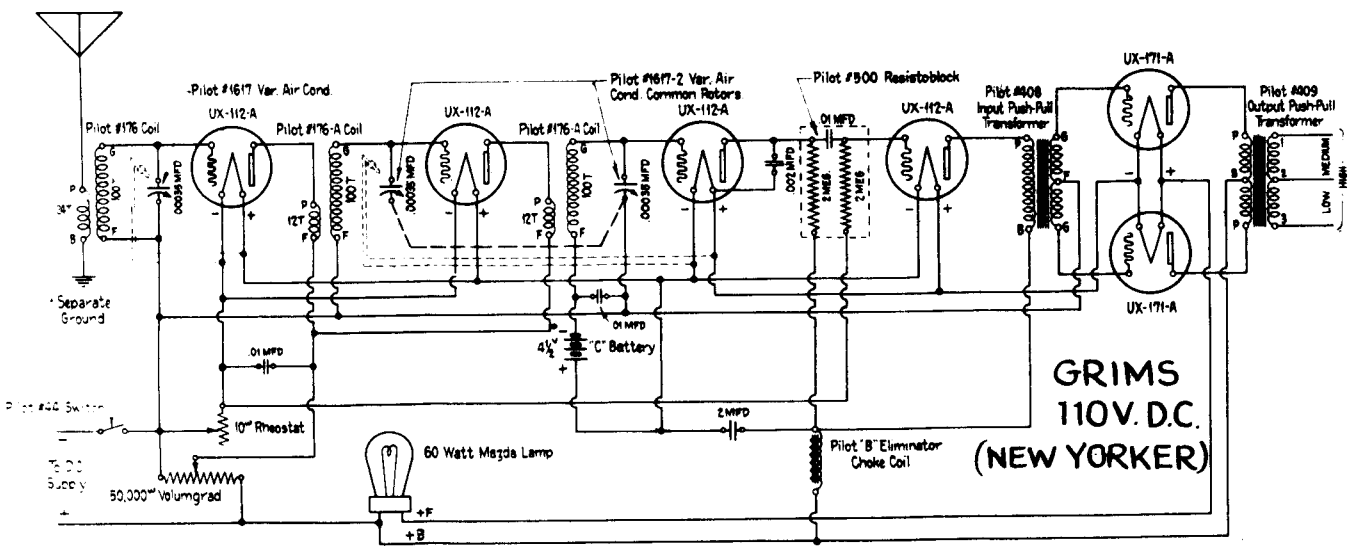


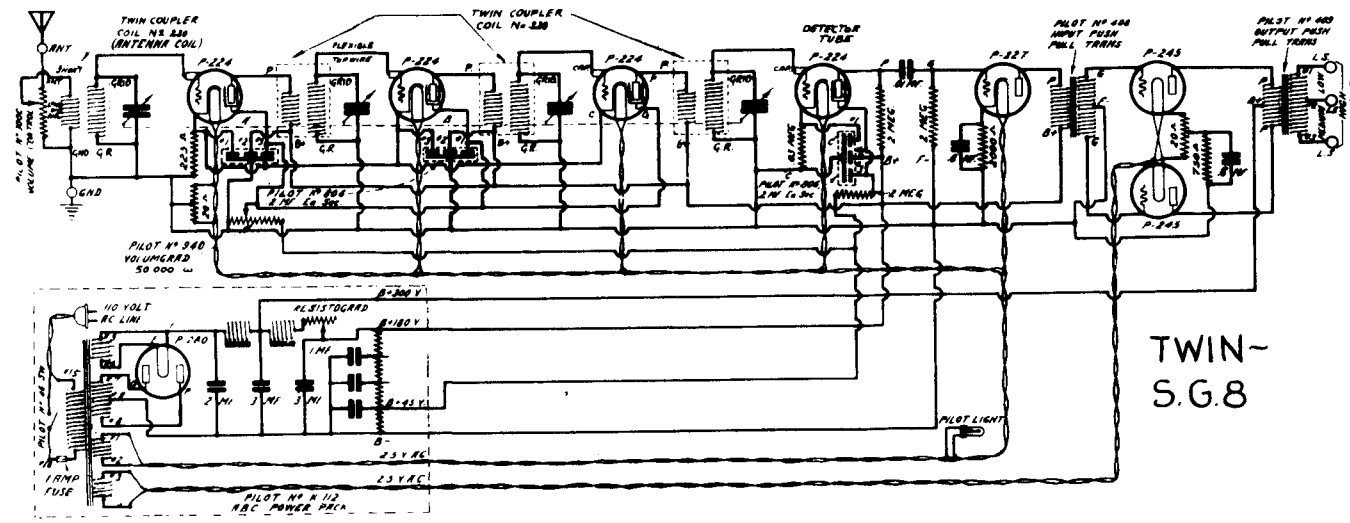
The complete schematic diagram of the Super-Wasp. The various ground symbols indicate connections to the metal chassis of the receiver.

PILOT RADIO & TUBE CORP.

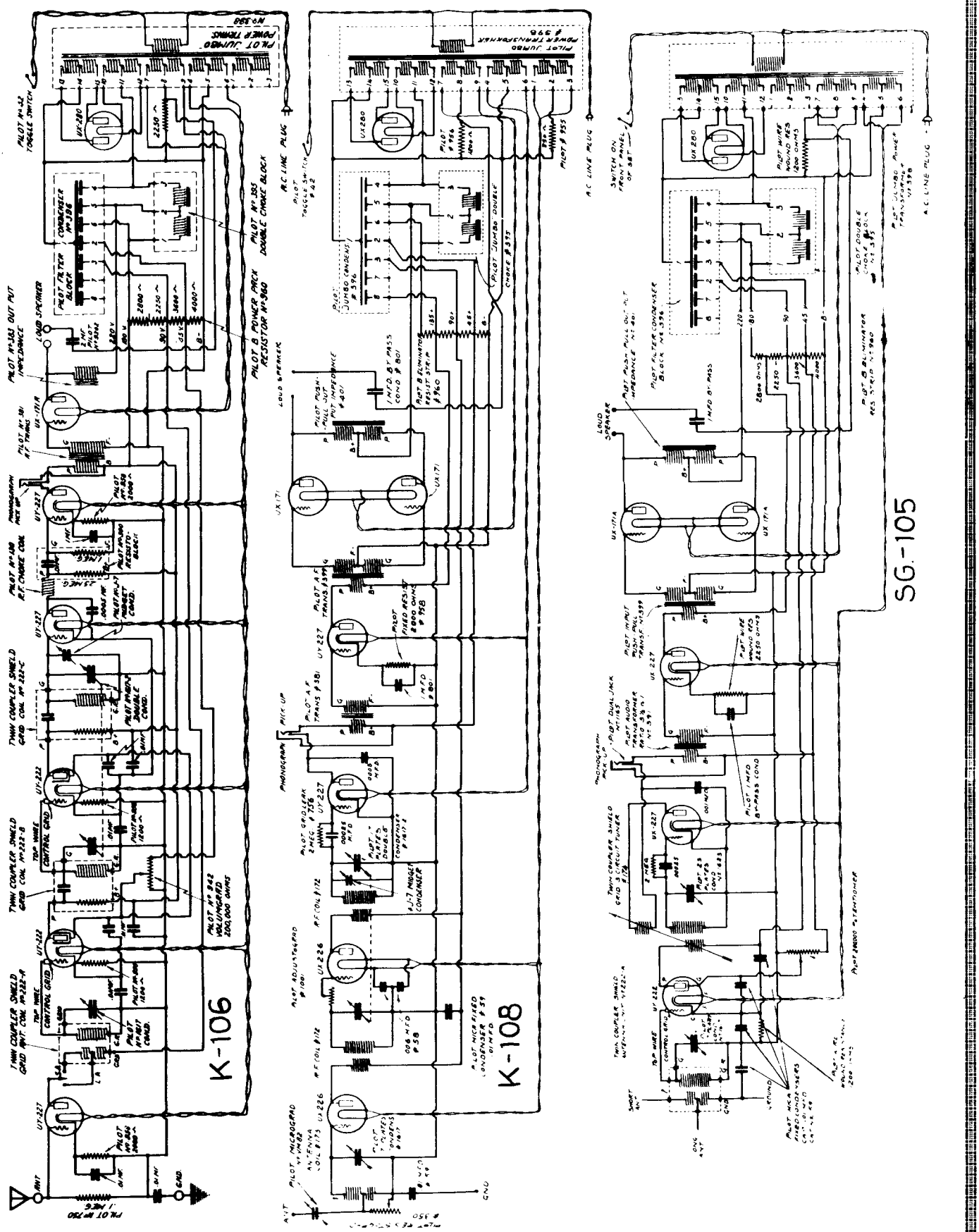


Circuit of the Pilot automotive radio receiver, with three stages of screen-grid R.F. amplification, screen-grid detector, resistance-coupled '27 first audio, and a '45 power tube, in place of the '12 commonly used; its use improves output and simplifies the circuit.

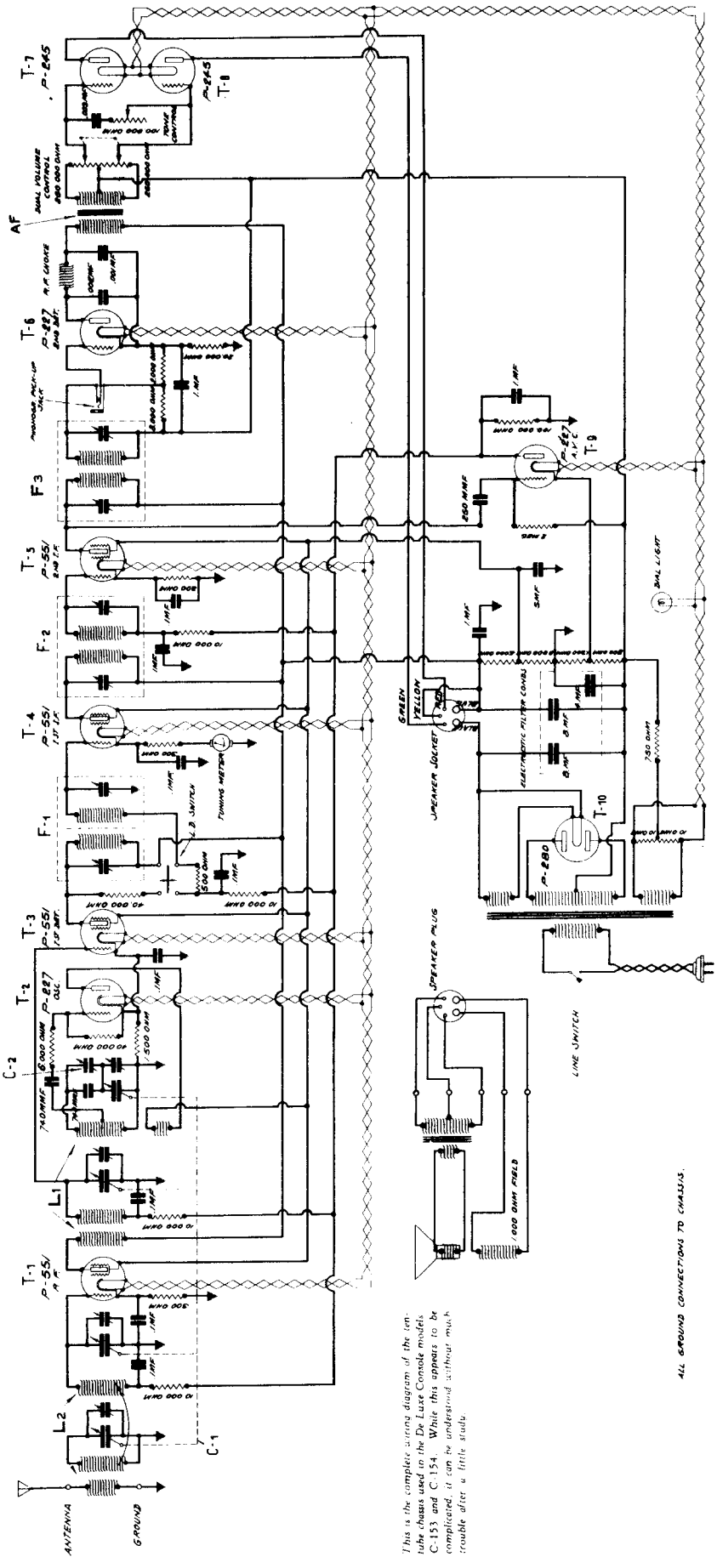




PILOT RADIO & TUBE CORP.

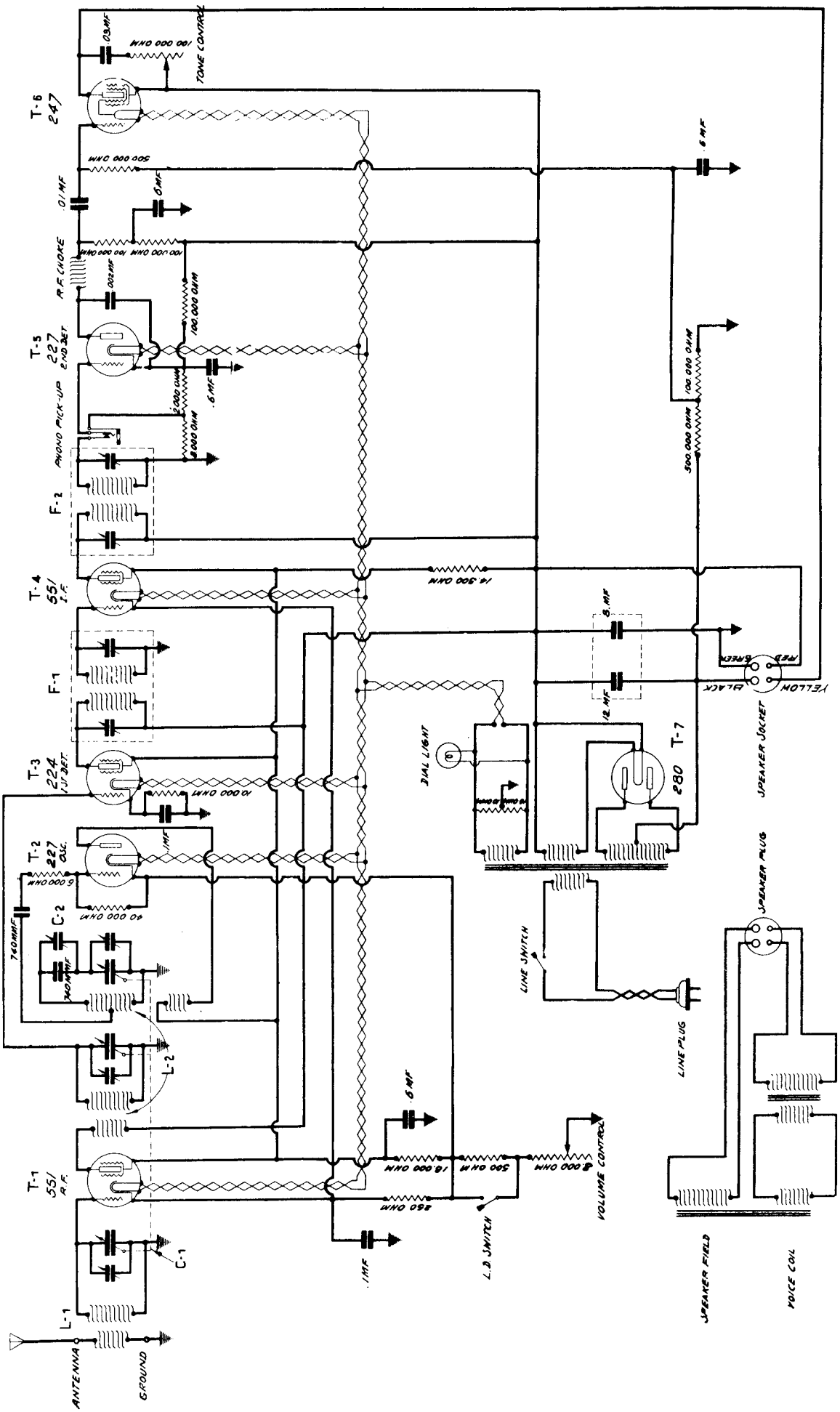


PILOT RADIO & TUBE CORP.



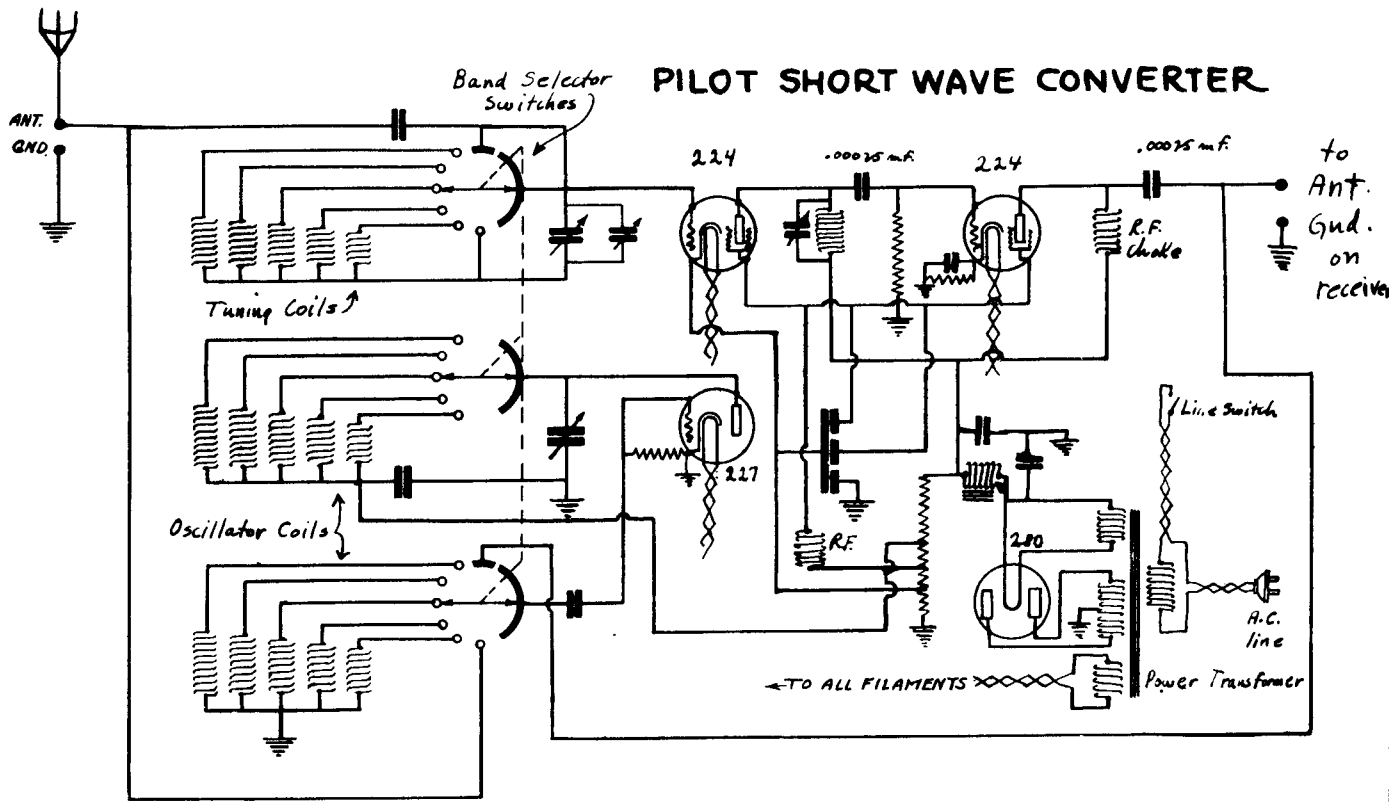
This is the complete wiring diagram of the console chassis used in the De Luxe Console models C-153 and C-154. While this appears to be complicated, it can be understood without much trouble after a little study.

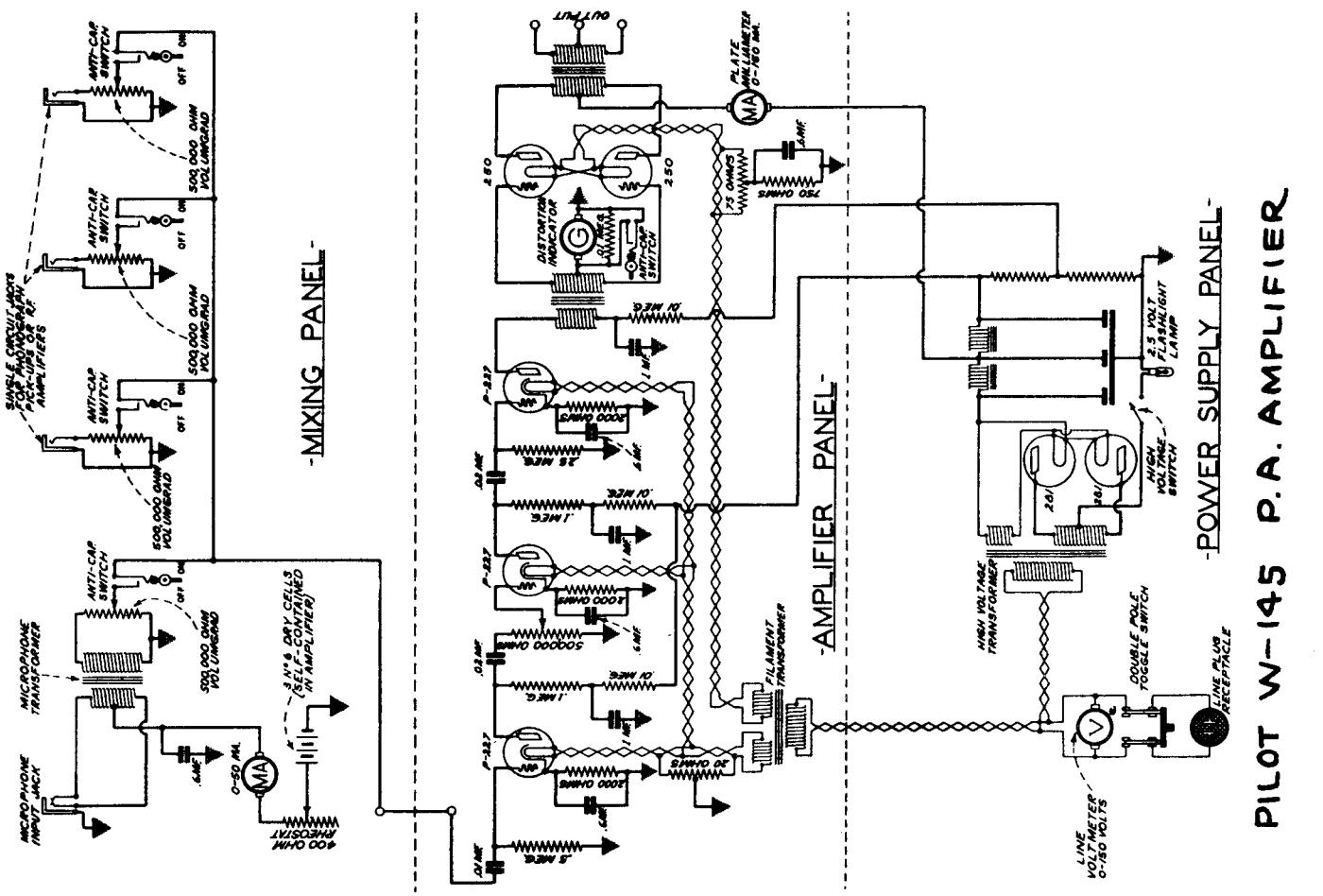
PILOT RADIO & TUBE CORP.



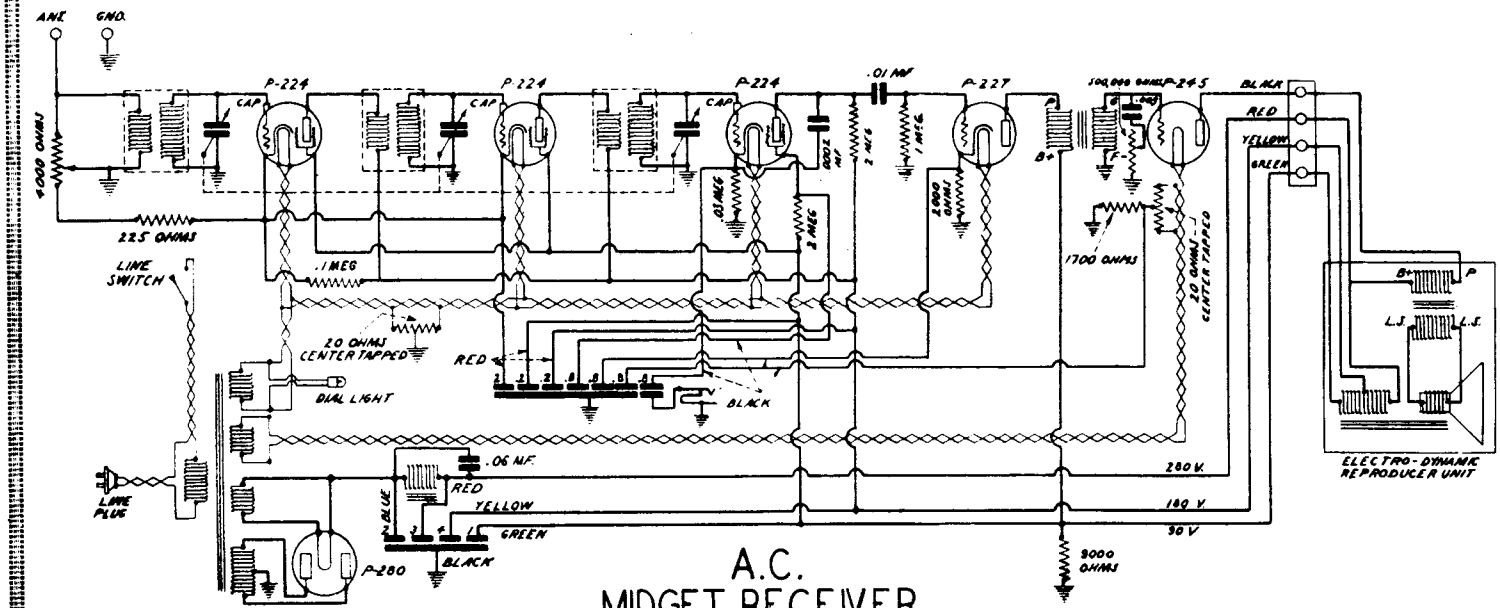
Pilot Super-Heterodynes Models S-148, S 164.
Also C-151, C1-62

PILOT RADIO & TUBE CORP.





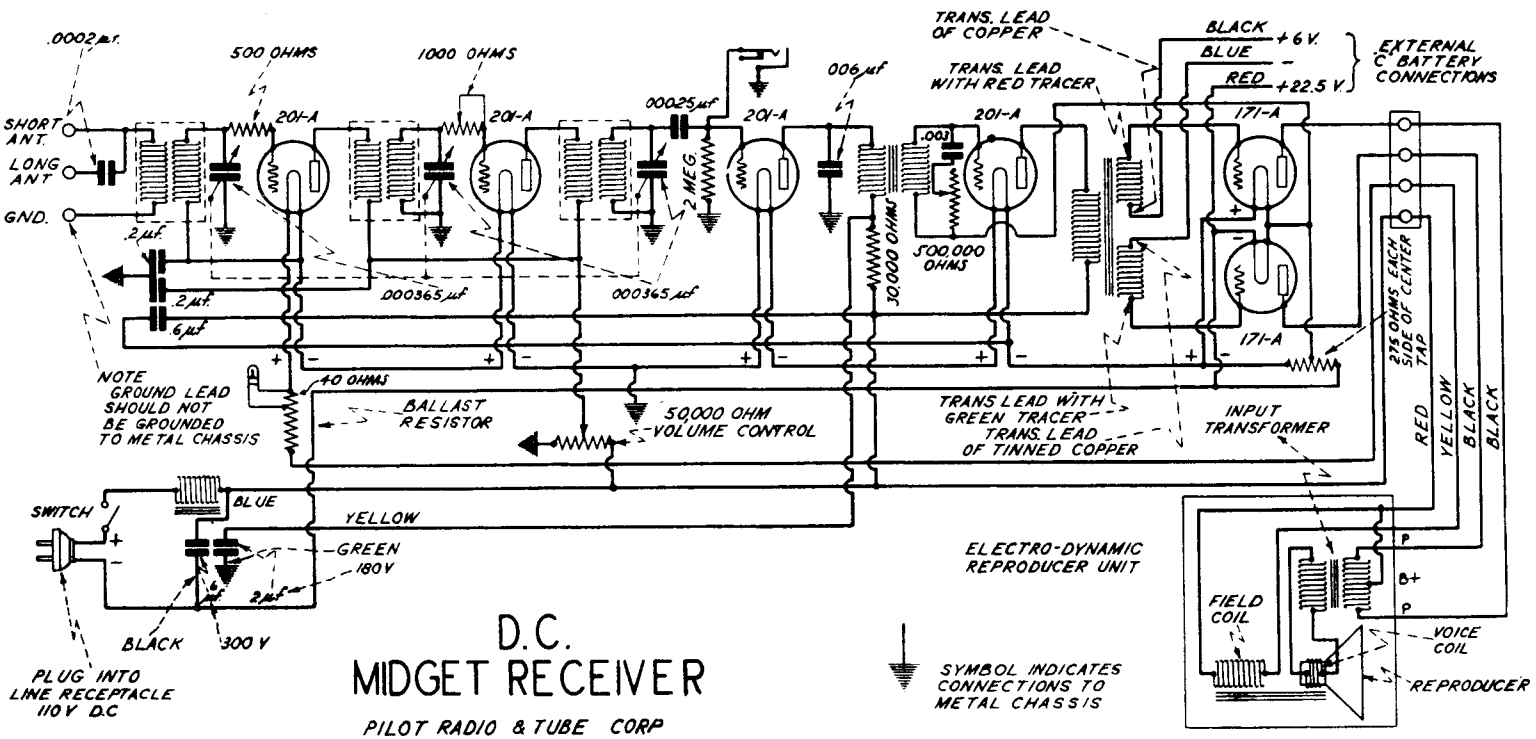
PILOT RADIO & TUBE CORP.



A.C.
MIDGET RECEIVER

Pilot Midget

Models S-155, C-157.
Also S-155A, S-155B,
S-155F, C-157A, C-157B,
C-157F



D.C.
MIDGET RECEIVER

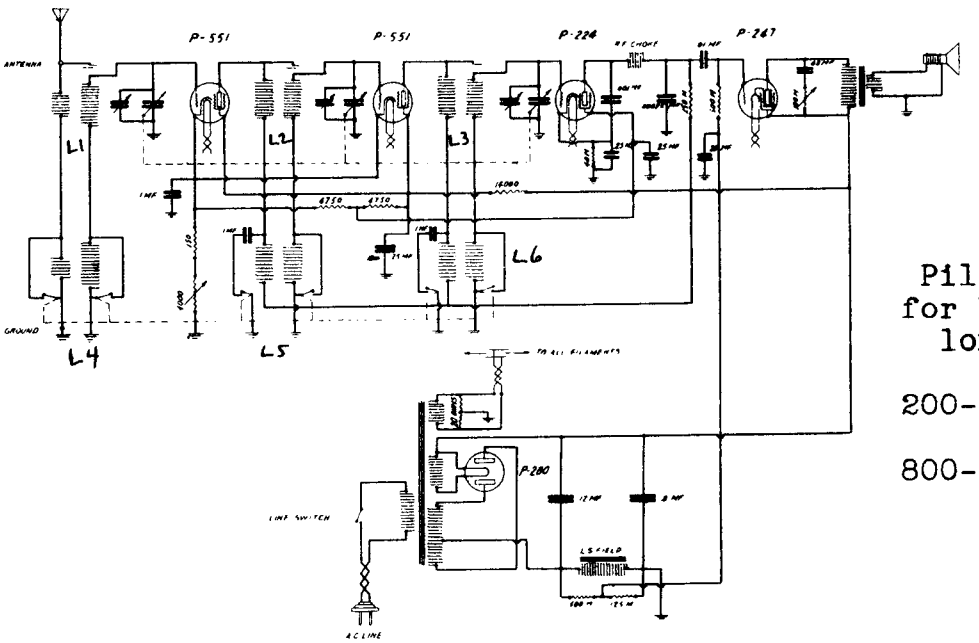
PILOT RADIO & TUBE CORP

SYMBOL INDICATES CONNECTIONS TO METAL CHASSIS

Pilot DC Midget

Models S-156, C-158

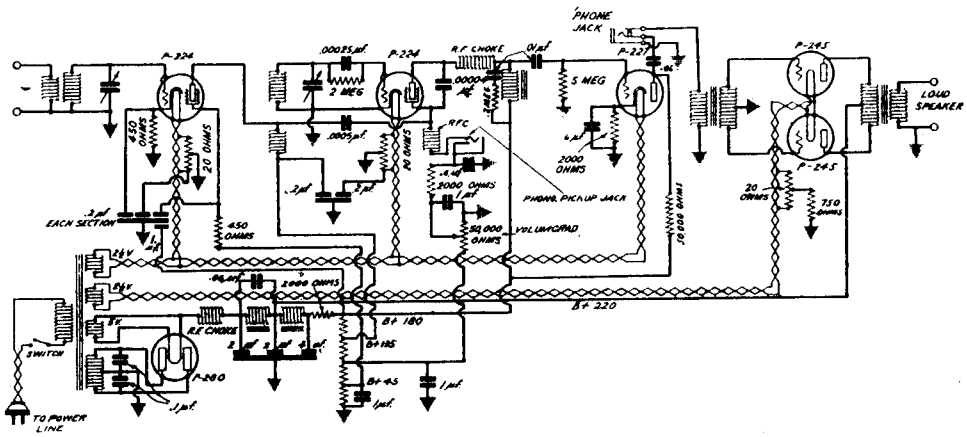
PILOT RADIO & TUBE CORP.



Pilot TRF Midget
for broadcast and long
long waves

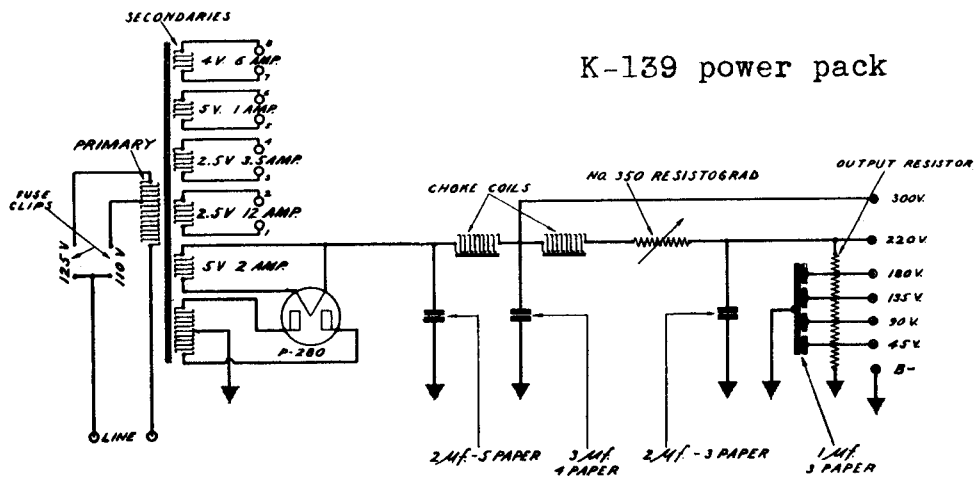
200-550 meters
and
800-2000 meters.

Pilot Universal
S-141

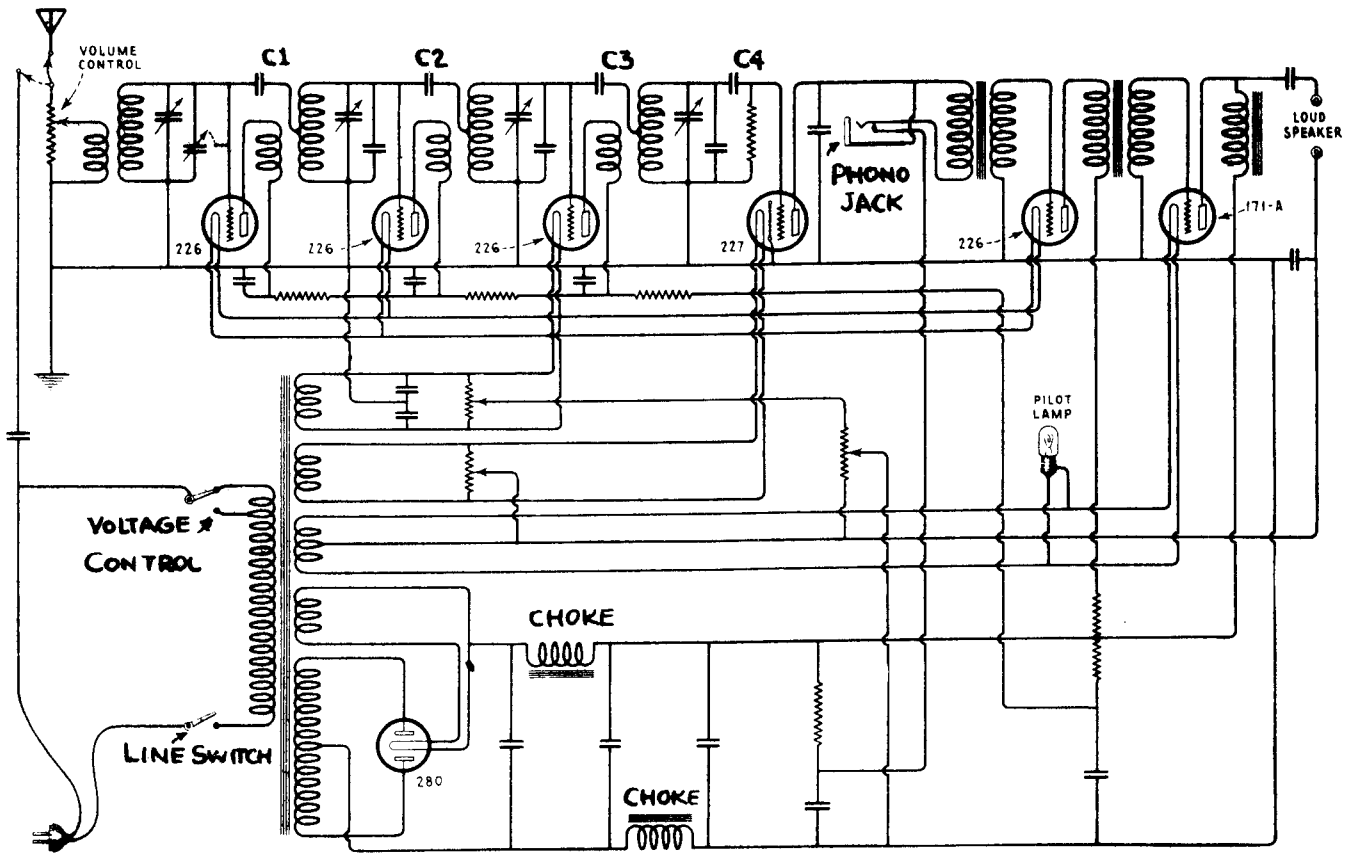


This schematic diagram of the Universal is a functional hook-up, and does not show the actual connections to the cam switches.

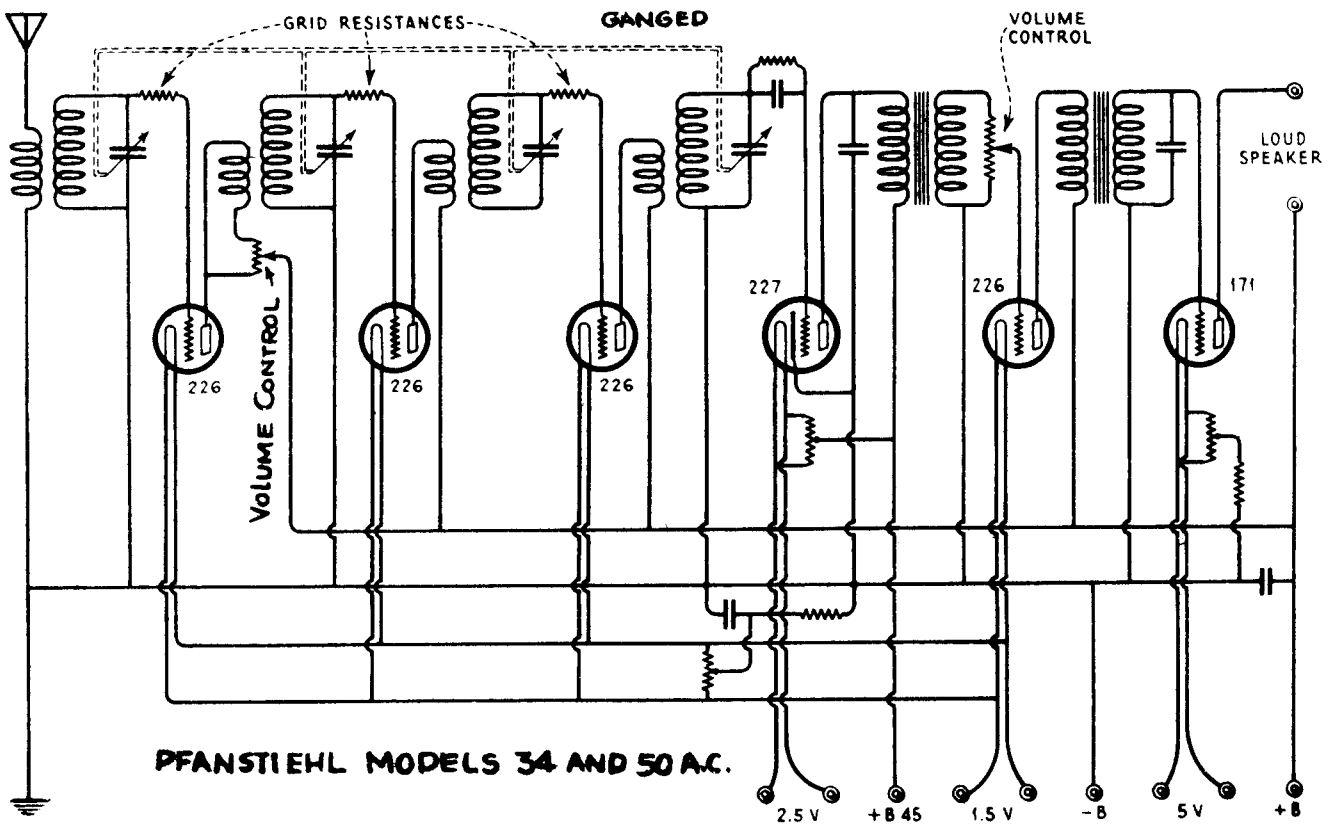
K-139 power pack



PHILADELPHIA STORAGE BATT. CO.

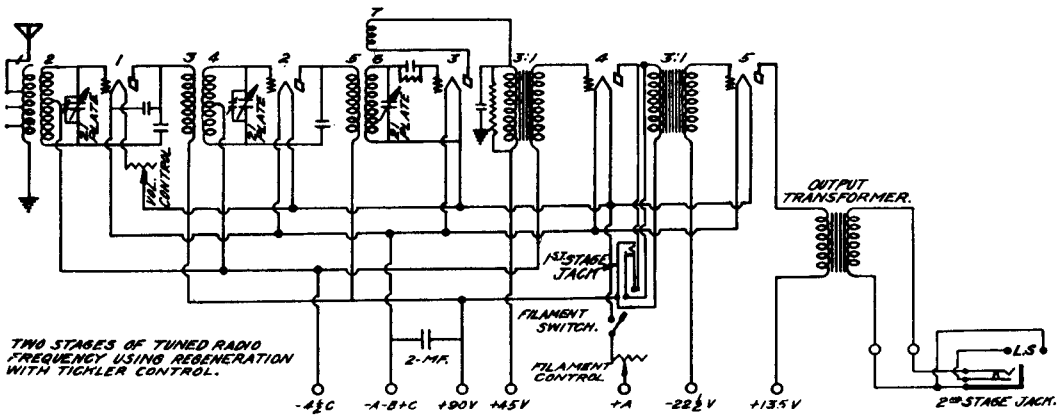


PFANSTIEHL PRODUCTS CO.

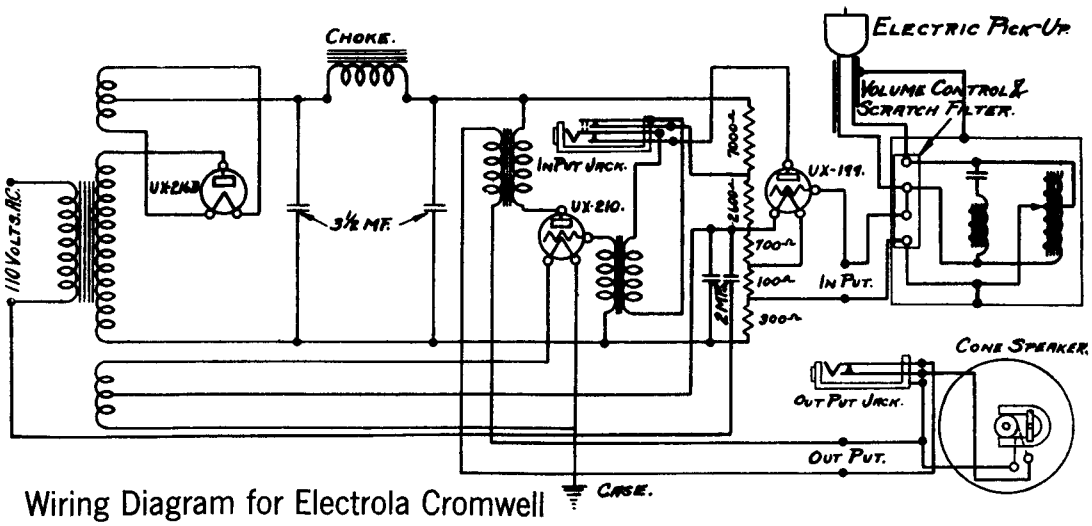


PFANSTIEHL MODELS 34 AND 50 A.C.

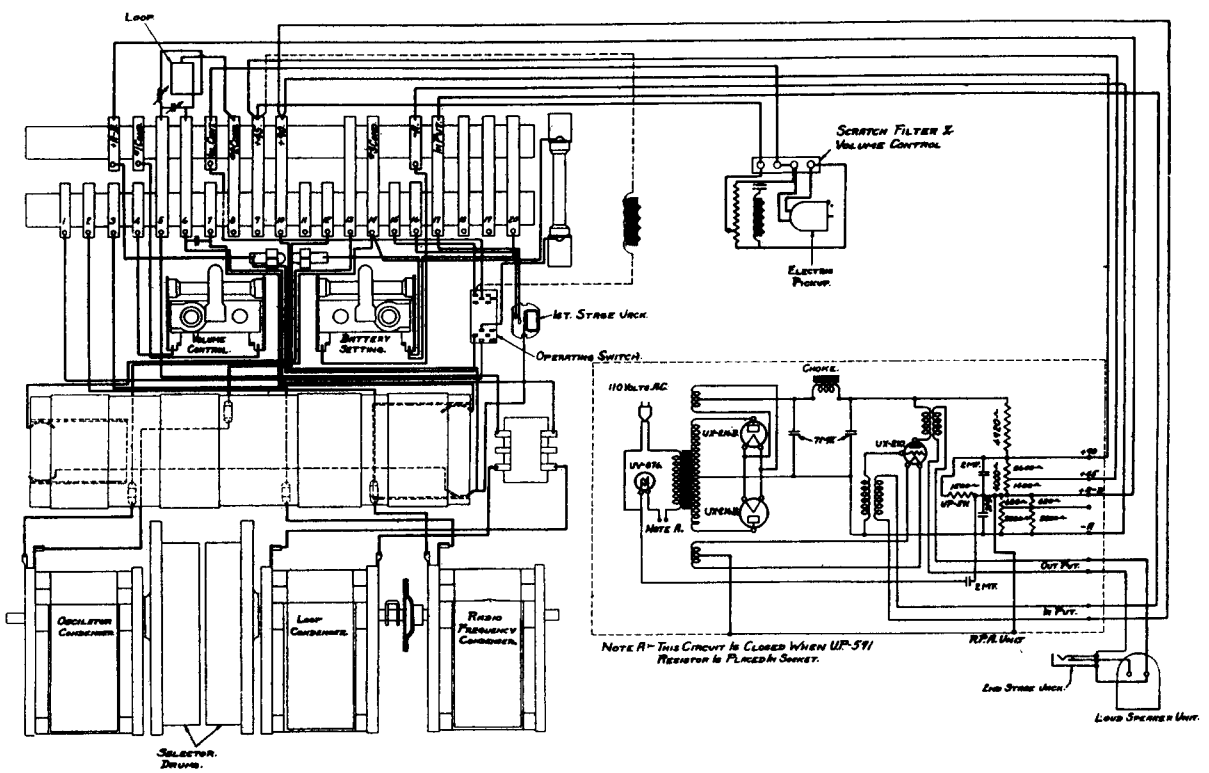
R.C.A. VICTOR CO.
(VICTOR DIV.)



Wiring Diagram Alhambra I (7-1)

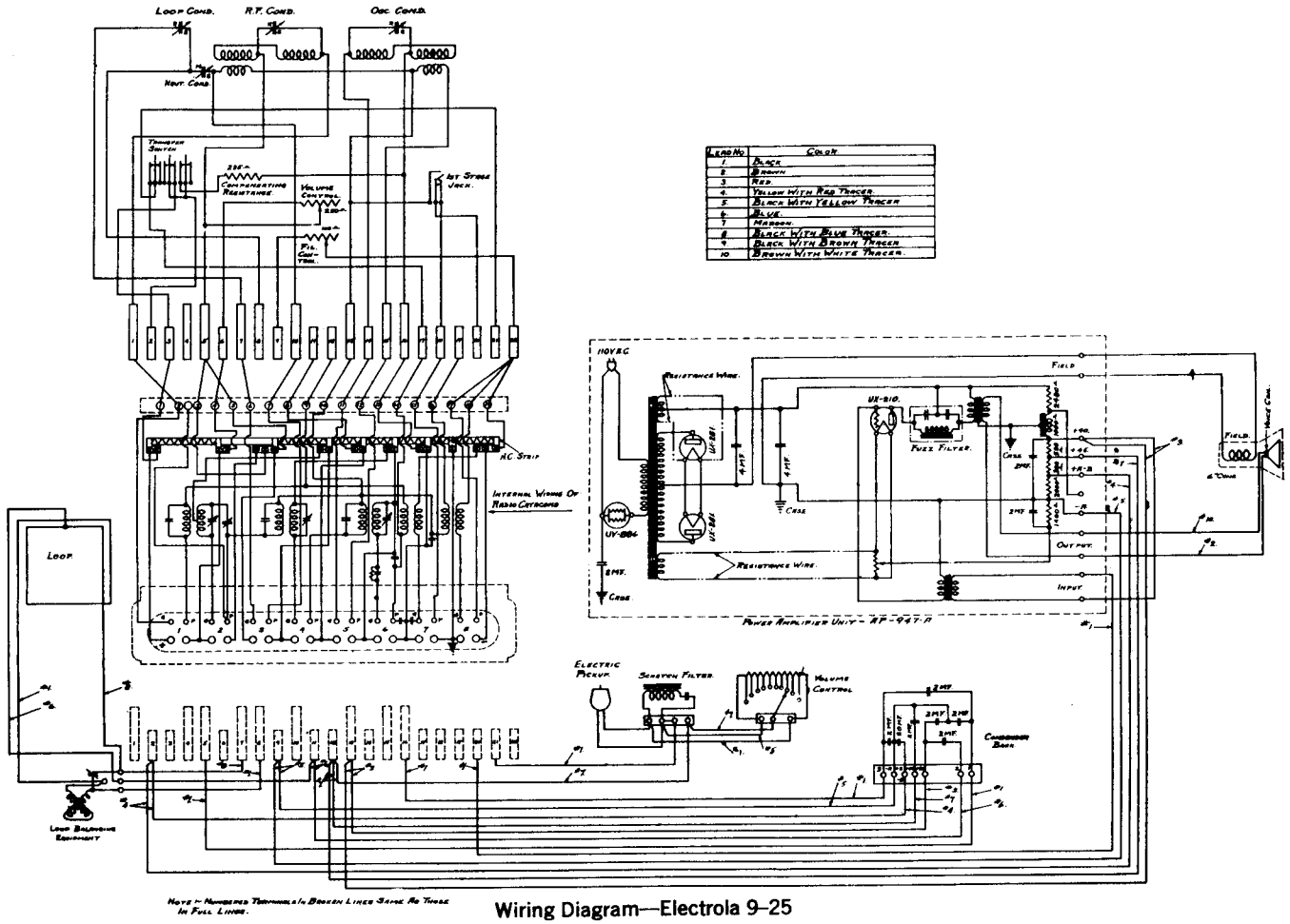


Wiring Diagram for Electrola Cromwell



Wiring Diagram for Borgia II

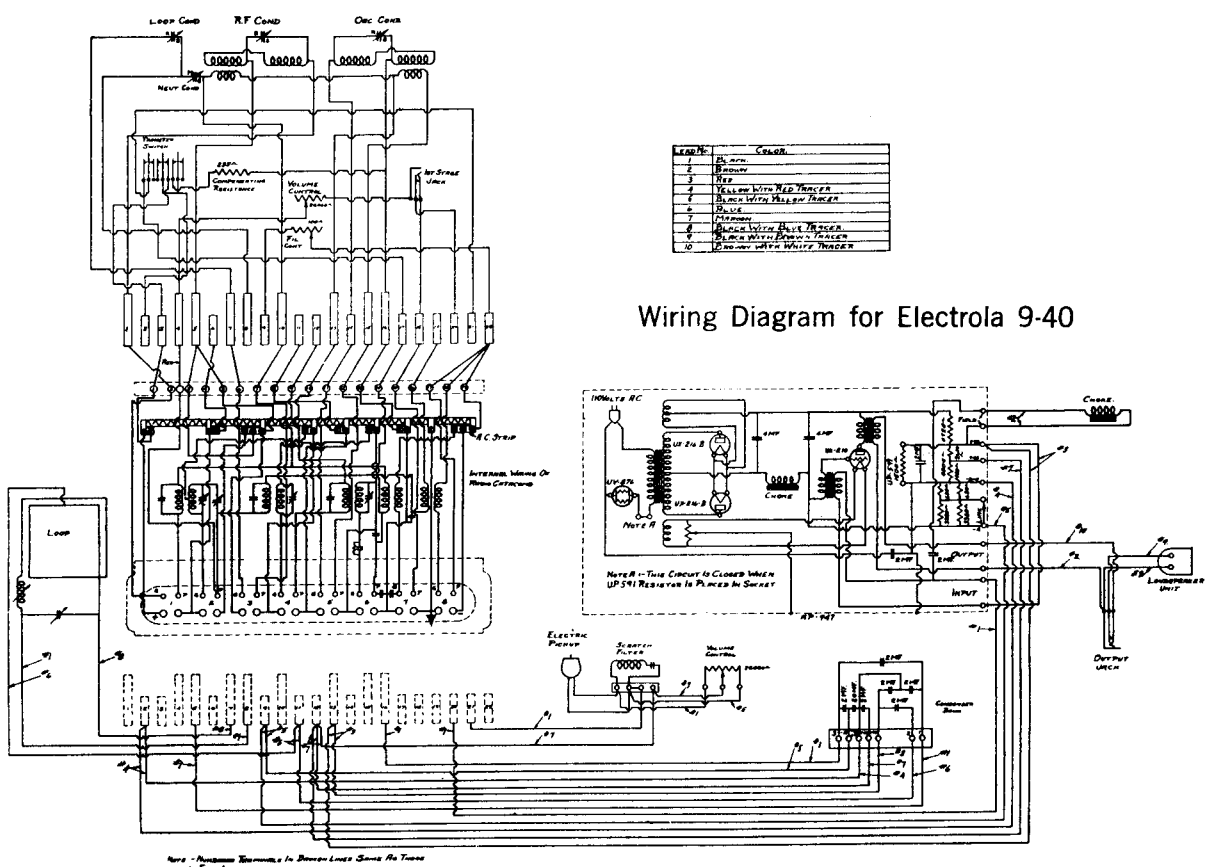
R.C.A.-VICTOR CO. (VICTOR DIV.)



Lead No.	Color
1	Black
2	Brown
3	Red
4	Yellow With Red Tracer
5	Black With Yellow Tracer
6	Blue
7	Maroon
8	Black With Blue Tracer
9	Black With Brown Tracer
10	Brown With White Tracer

Note 1 - Numbered Terminals In Broken Lines Same As Those In Full Lines.

Wiring Diagram—Electrola 9-25



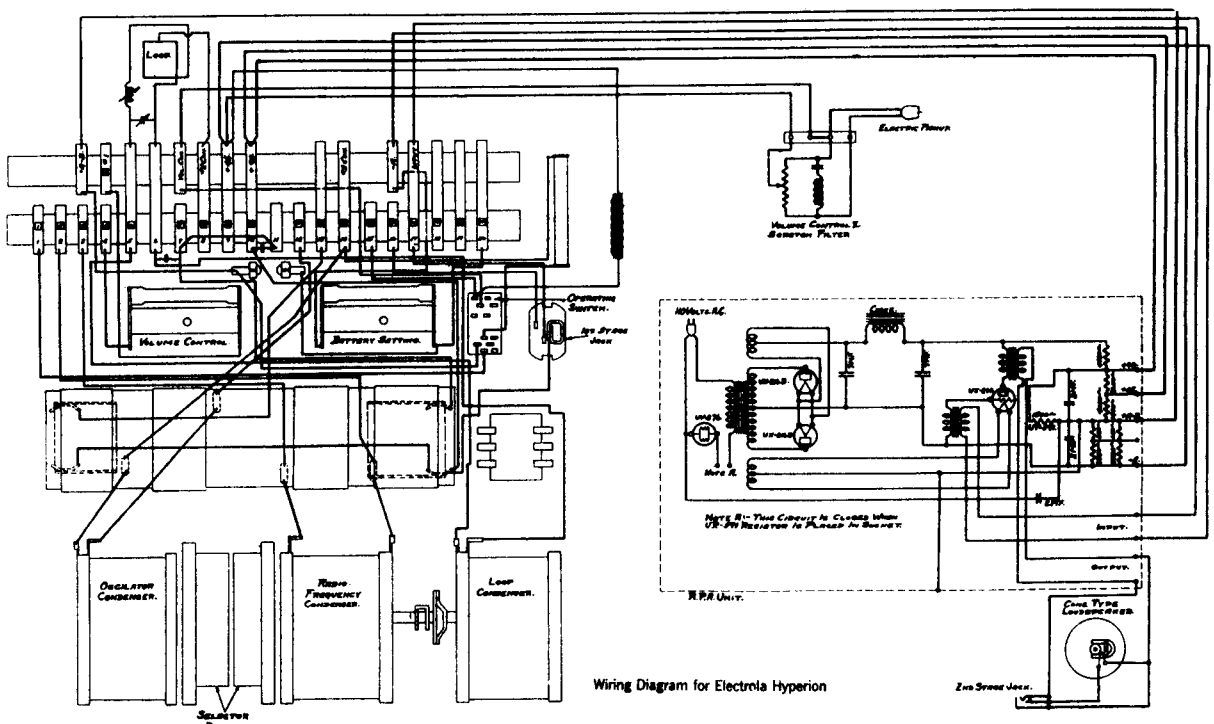
Lead No.	Color
1	Black
2	Brown
3	Red
4	Yellow With Red Tracer
5	Black With Yellow Tracer
6	Blue
7	Maroon
8	Black With Blue Tracer
9	Black With Brown Tracer
10	Brown With White Tracer

Note A - This Circuit Is Closed When UP-591 Resistor Is Placed In Socket

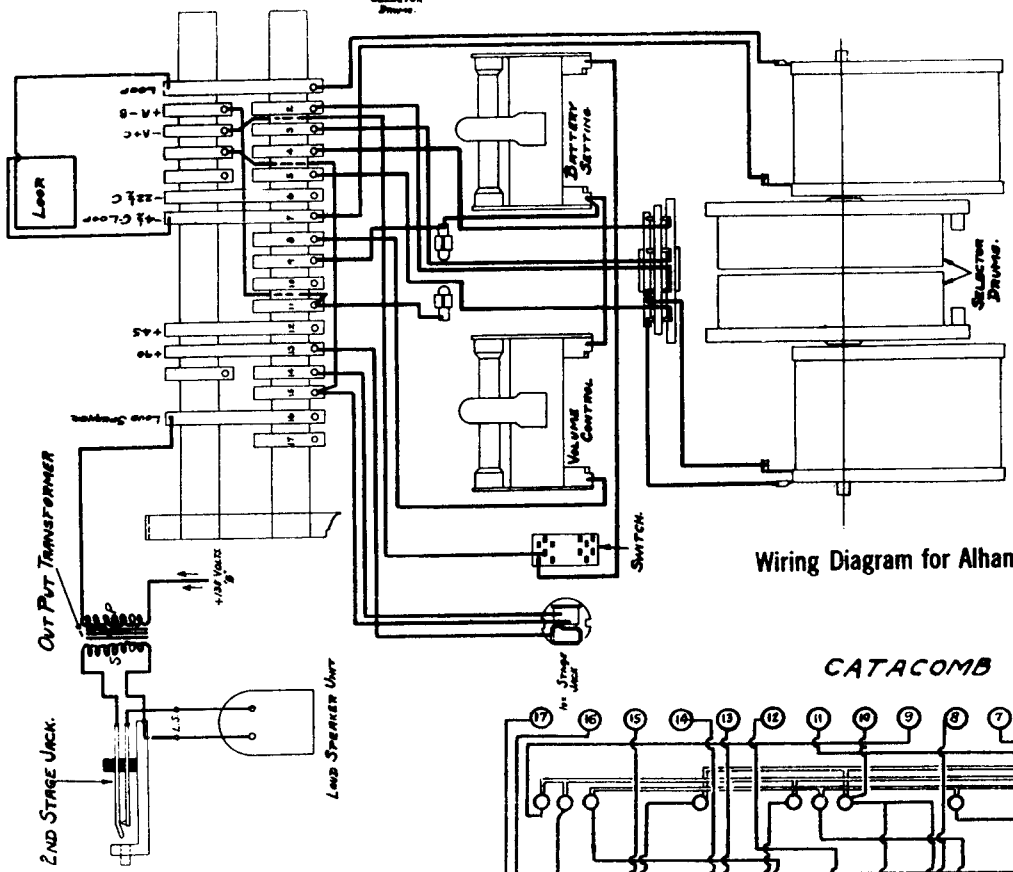
Note - Numbered Terminals In Broken Lines Same As Those In Full Lines

Wiring Diagram for Electrola 9-40

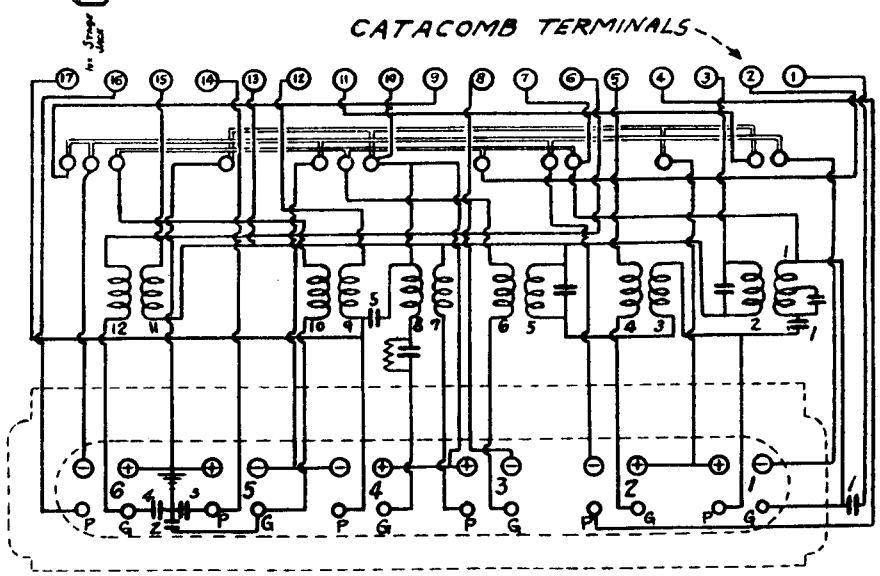
R.C.A.-VICTOR CO. (VICTOR DIV.)



Wiring Diagram for Electrola Hyperion



Wiring Diagram for Alhambra II and Florenza



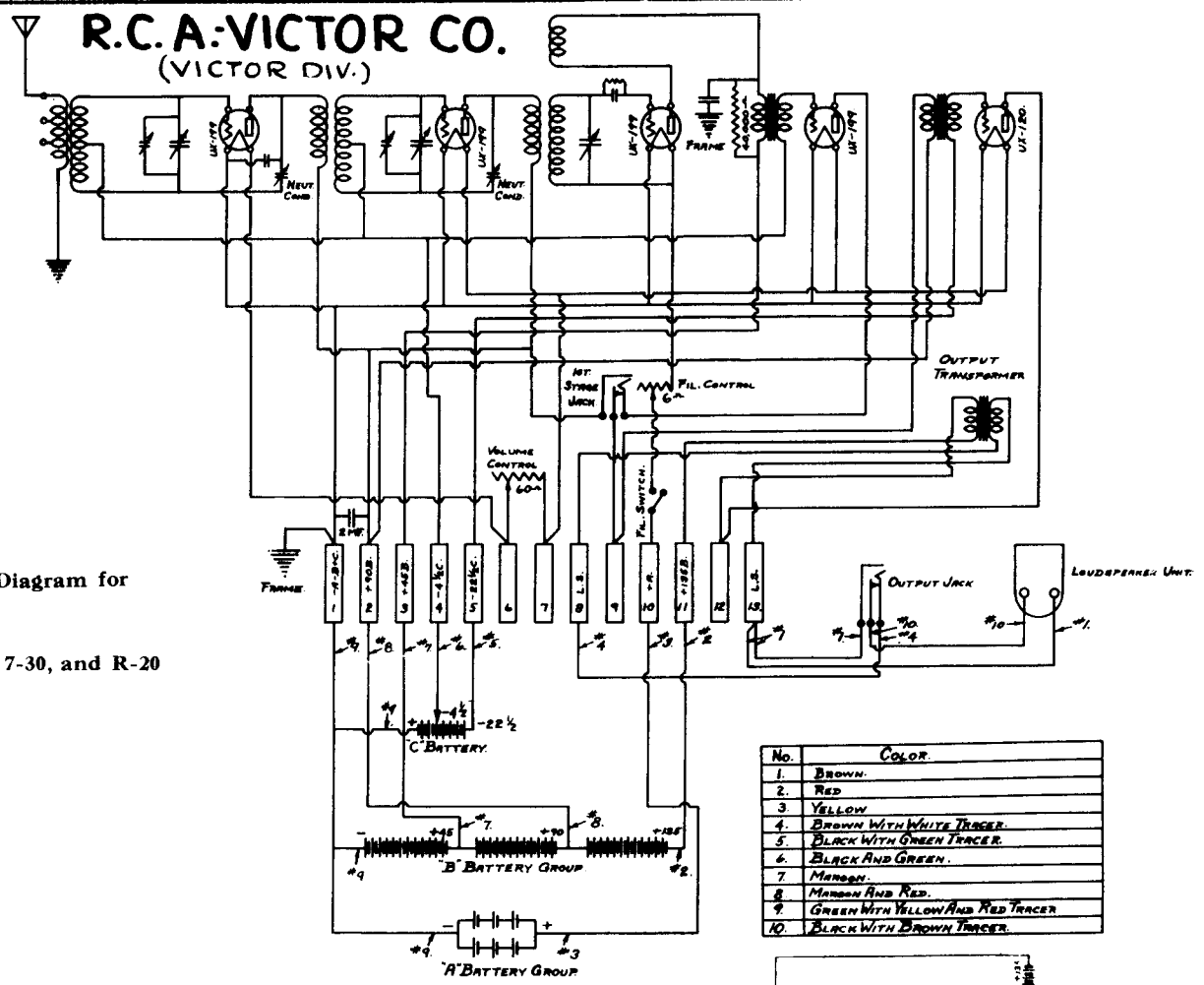
Radiola 25 Catacomb Continuity Diagram for

Alhambra II (7-2) and Florenza (9-1)

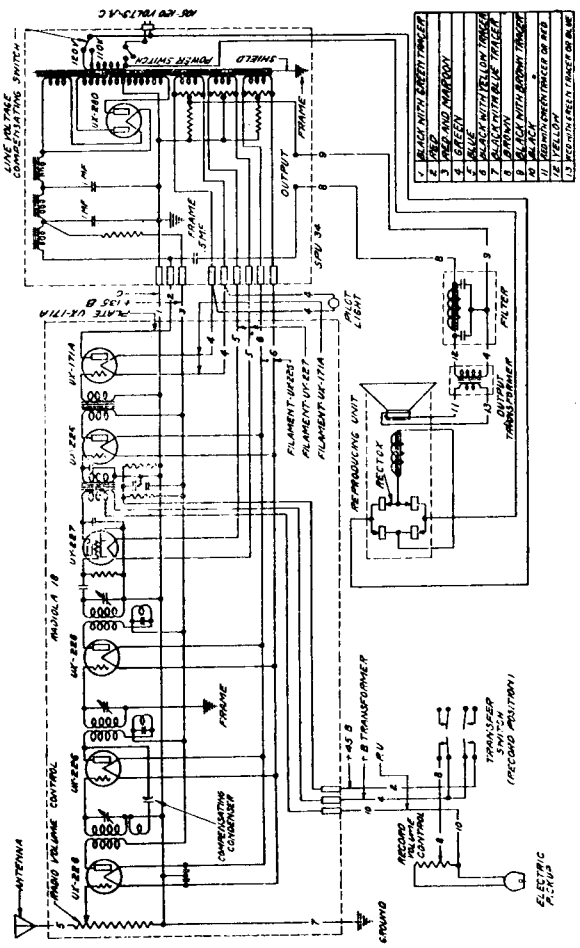
R.C.A. VICTOR CO.
(VICTOR DIV.)

Wiring Diagram for

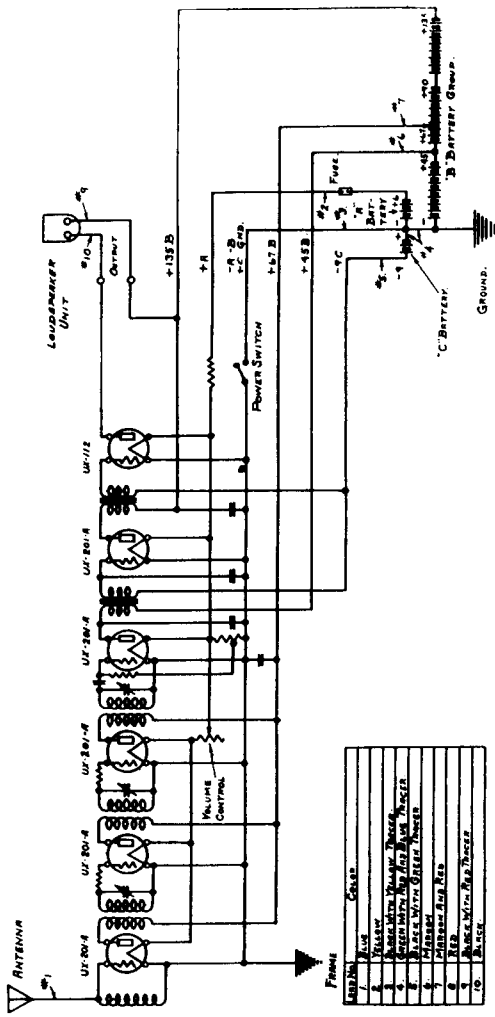
Models 7-3, 7-30, and R-20



No.	Color
1.	Brown.
2.	Red
3.	Yellow
4.	Brown With White Tracer.
5.	Black With Green Tracer.
6.	Black And Green.
7.	Maroon.
8.	Maroon And Red.
9.	Green With Yellow And Red Tracer
10.	Black With Brown Tracer.

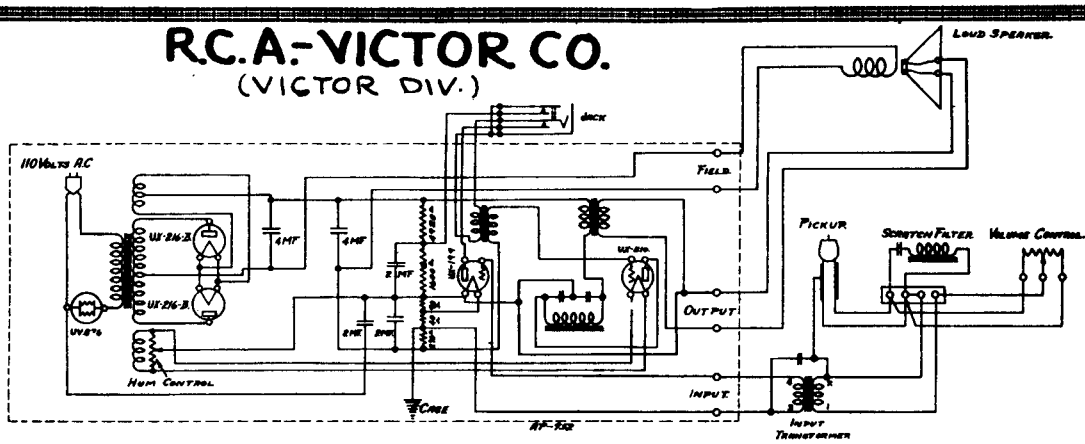


Schematic Wiring Diagram Electrola Radiola 7-26 Above Serial No. 12000

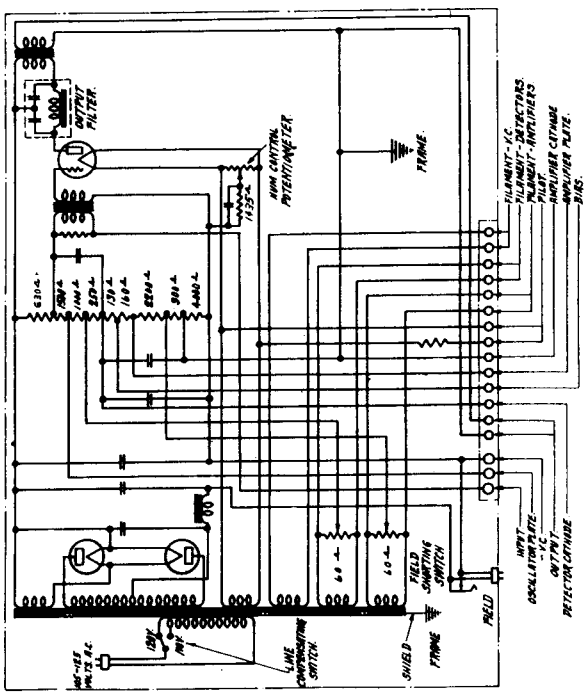


Wiring Diagram for Victor Radiola 16
(Used in Model 7-10)

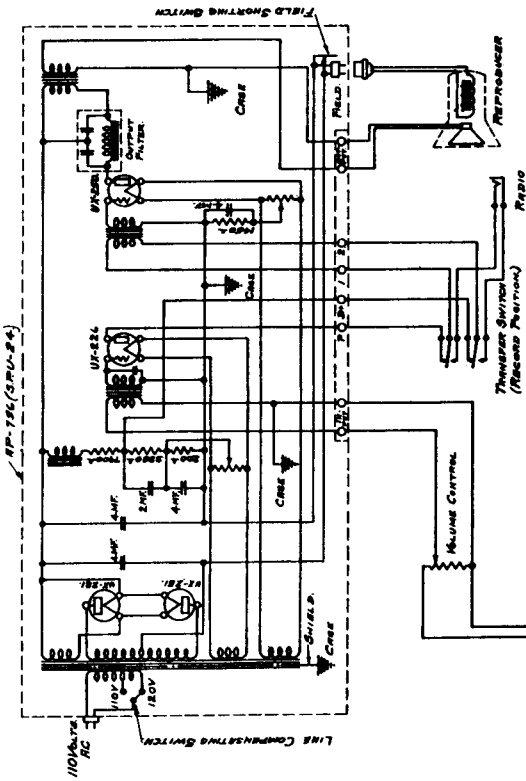
R.C.A.-VICTOR CO.
(VICTOR DIV.)



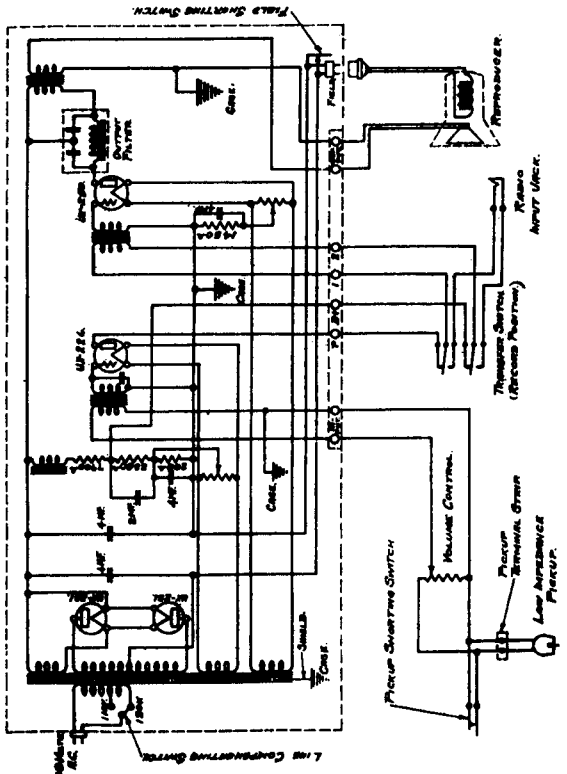
Wiring Diagram for Electrola 12-25



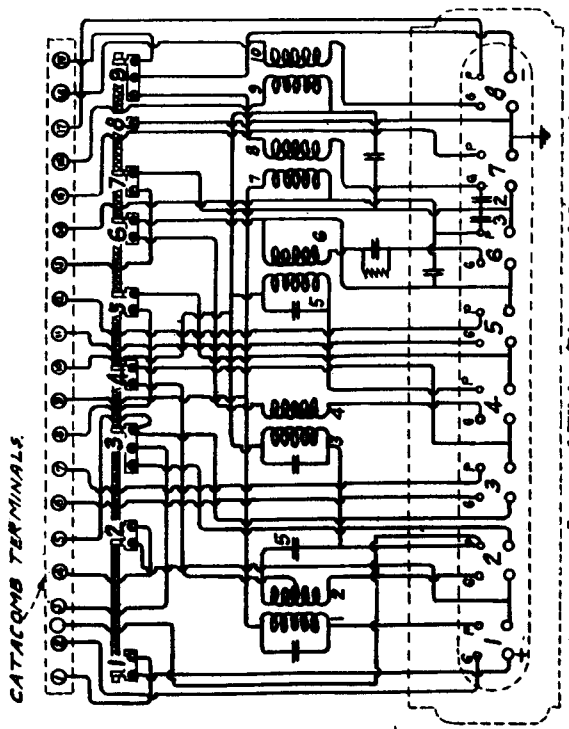
Schematic Wiring Diagram Power-Amplifier Unit AP-777-C



Wiring Diagram 12-15 above serial No. 2600



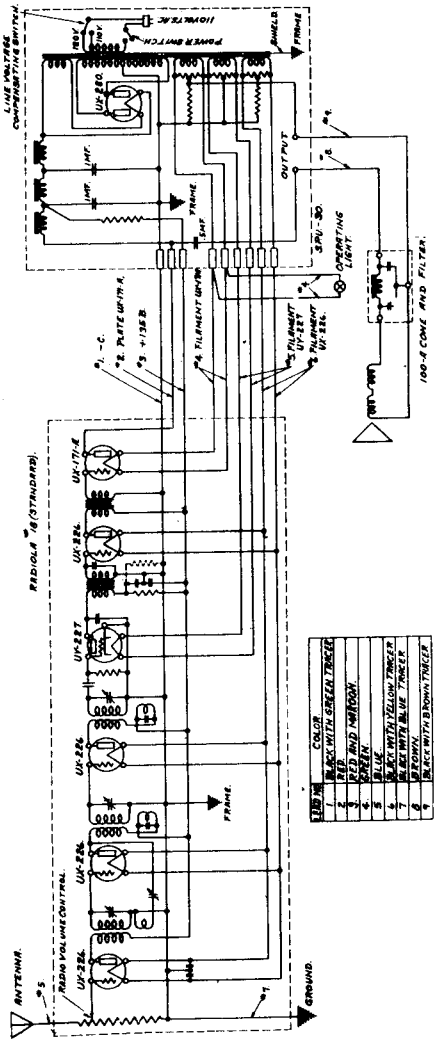
Wiring Diagram No. 10-70 above serial No. 2600



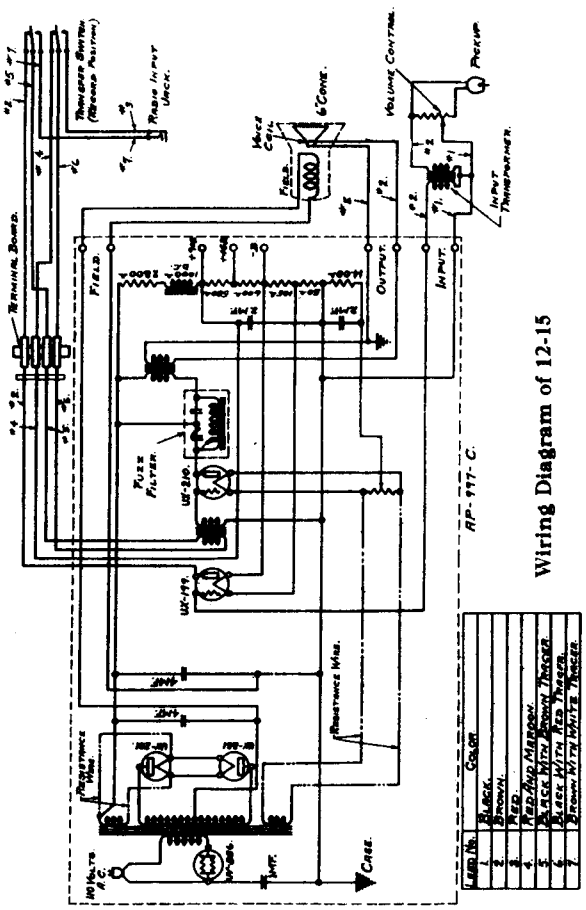
—Internal Wiring Diagram of Catacomb

RADIOLA-28

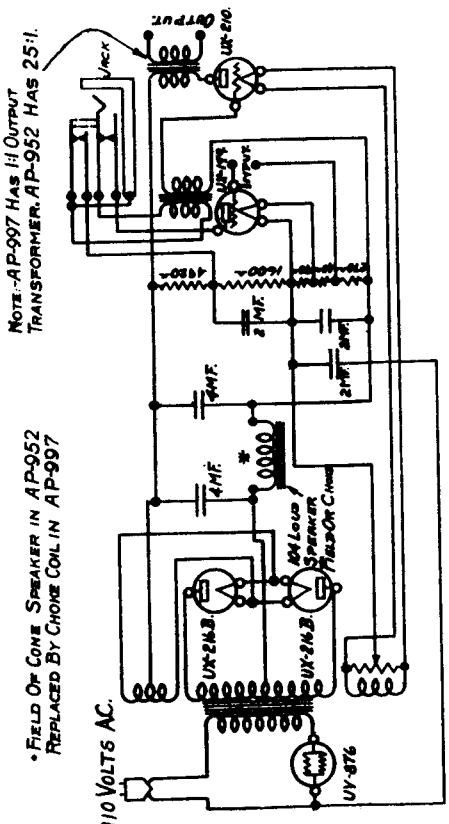
R.C.A.-VICTOR CO. (VICTOR DIV.)



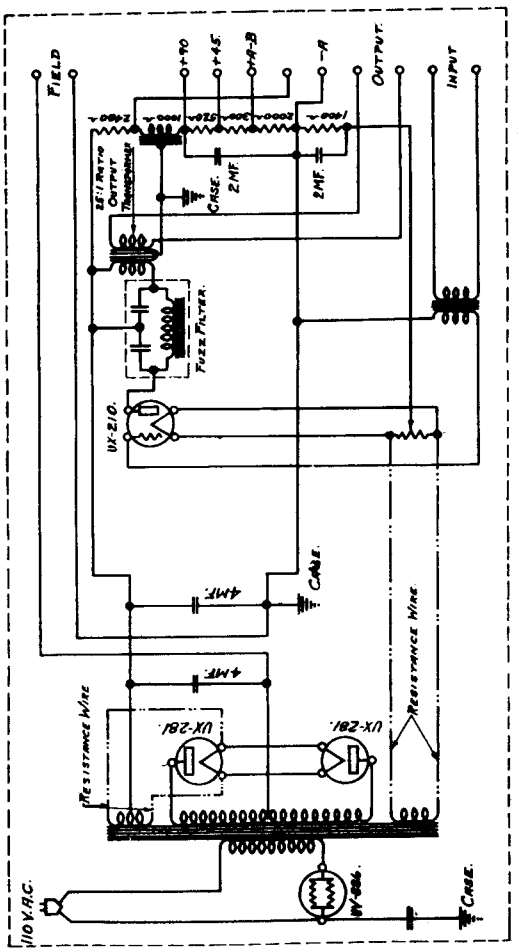
Wiring Diagram Victor Radiola 18
(Used in 7-11)



Wiring Diagram of 12-15

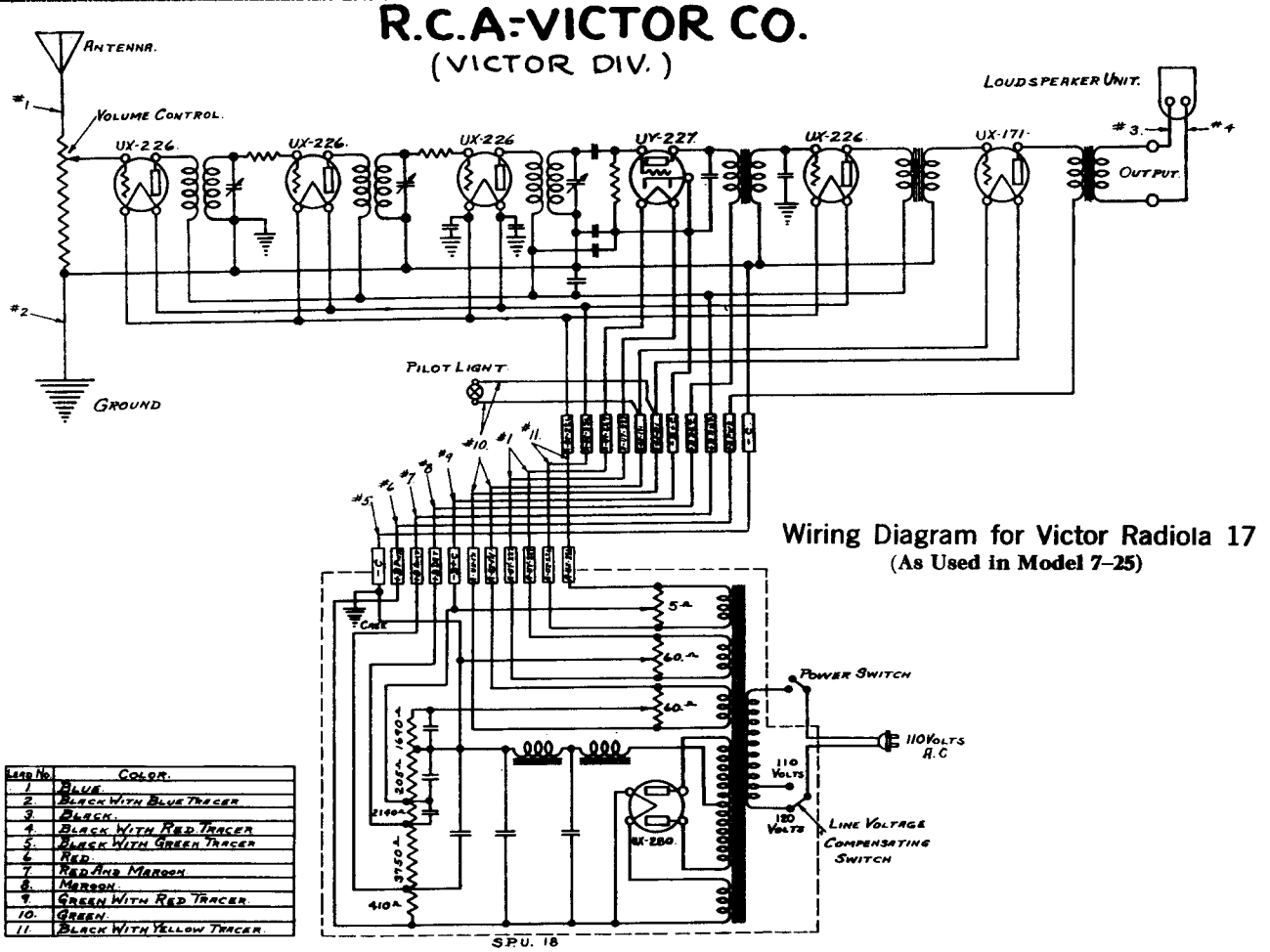


Wiring Diagram Power-Amplifier Units AP-952 and AP-997



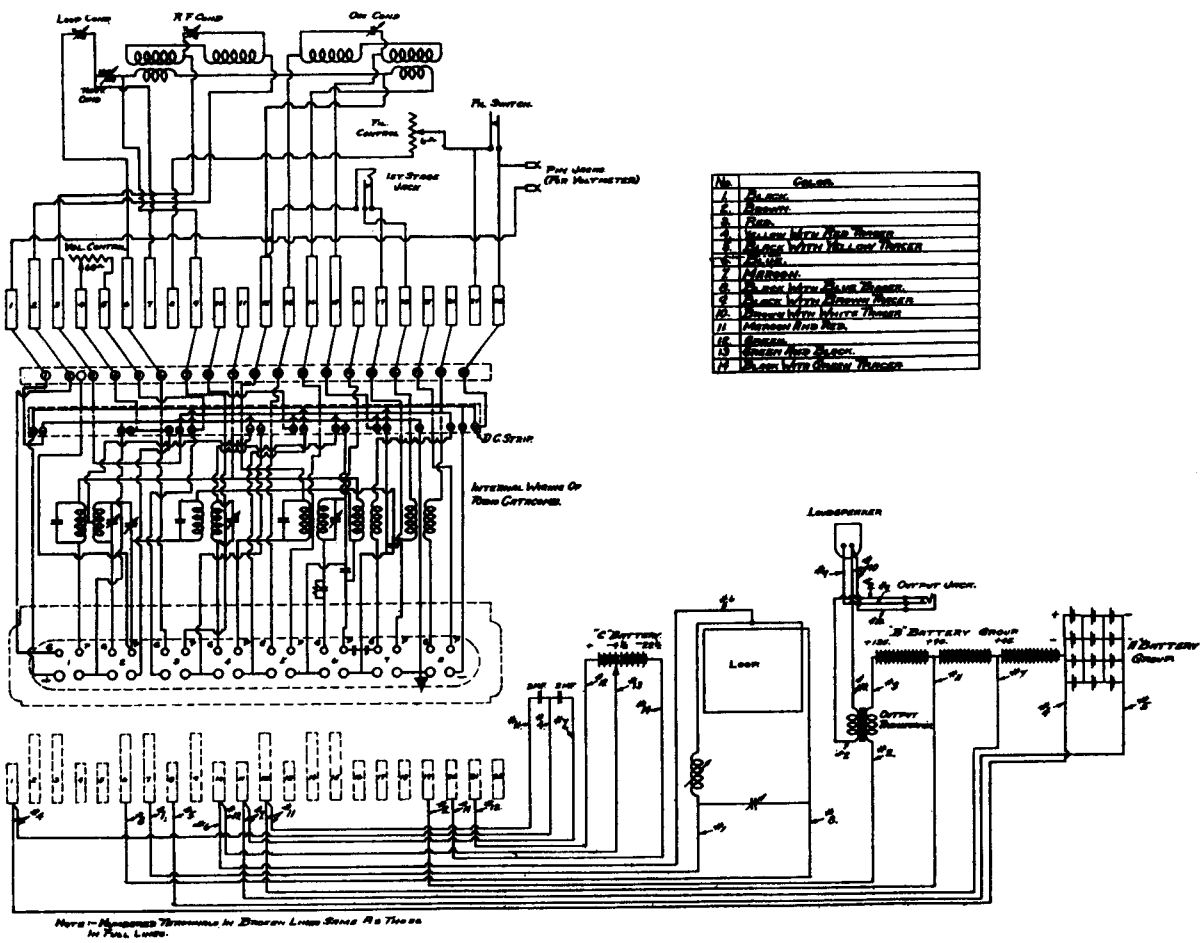
Wiring Diagram of Power-Amplifier Units AP-974-A, 951-A and 997-A
(Used in 9-25 and 9-55)

R.C.A-VICTOR CO.
(VICTOR DIV.)



LEAD No.	COLOR.
1	BLUE.
2.	BLACK WITH BLUE TRACER
3.	BLACK.
4.	BLACK WITH RED TRACER
5.	BLACK WITH GREEN TRACER
6	RED.
7	RED AND MAROON
8.	MAROON.
9.	GREEN WITH RED TRACER
10.	GREEN.
11	BLACK WITH YELLOW TRACER

Wiring Diagram for Victor Radiola 17
(As Used in Model 7-25)



No.	COLOR.
1	BLACK.
2.	BROWN.
3.	RED.
4	YELLOW WITH RED TRACER
5.	BLACK WITH YELLOW TRACER
6	BLUE.
7	MAROON.
8.	BLACK WITH BLUE TRACER.
9	BLACK WITH GREEN TRACER.
10.	GREEN WITH WHITE TRACER
11	MAROON AND RED.
12.	GREEN.
13	GREEN AND BLACK.
14	BLUE WITH GREEN TRACER

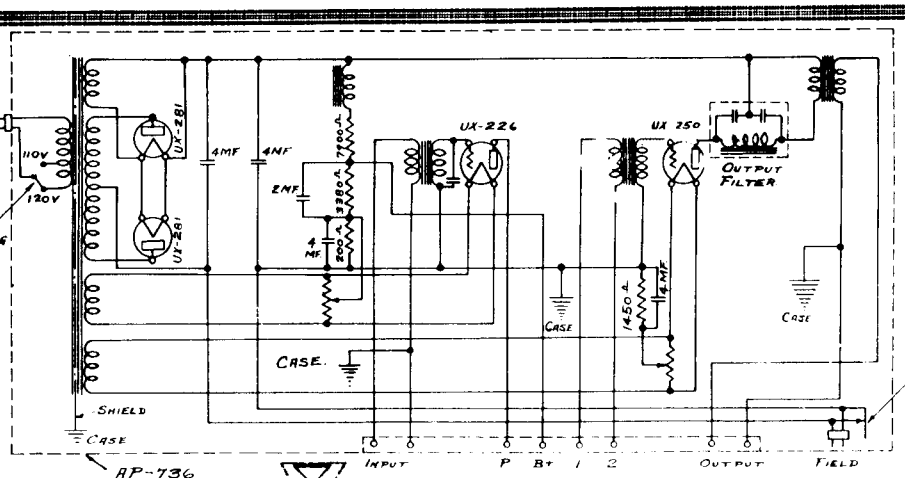
NOTE—NUMBERED TERMINALS IN BROKEN LINES SHOW A 5 TUBE SET.

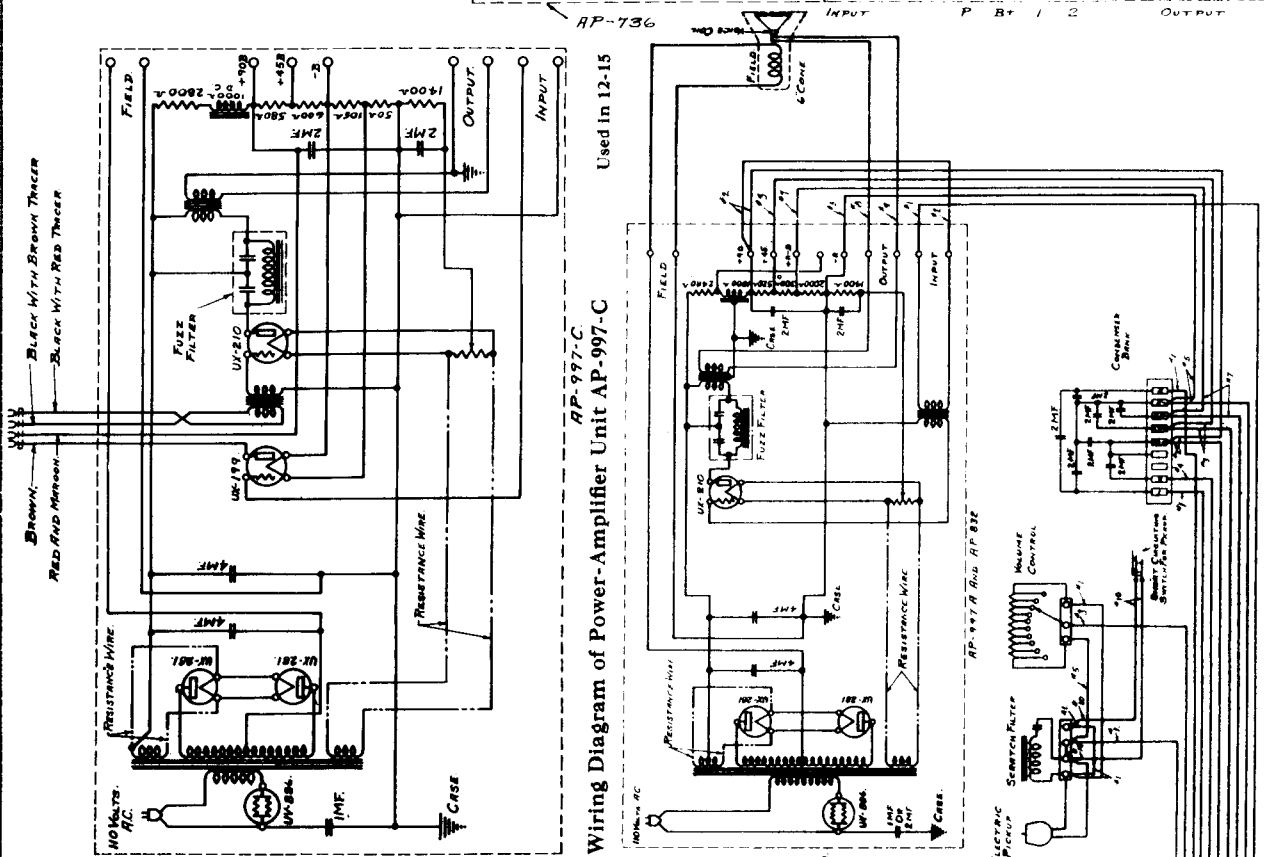
Wiring Diagram for 9-15

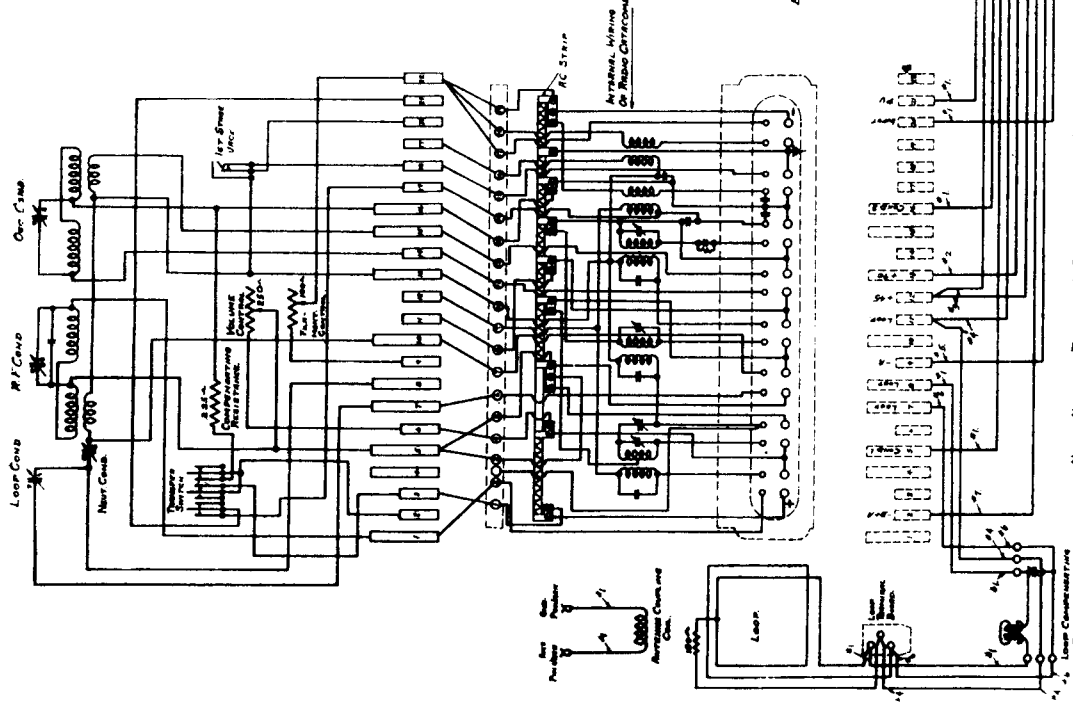
R.C.A. VICTOR CO. (VICTOR DIV.)

Wiring Diagram of

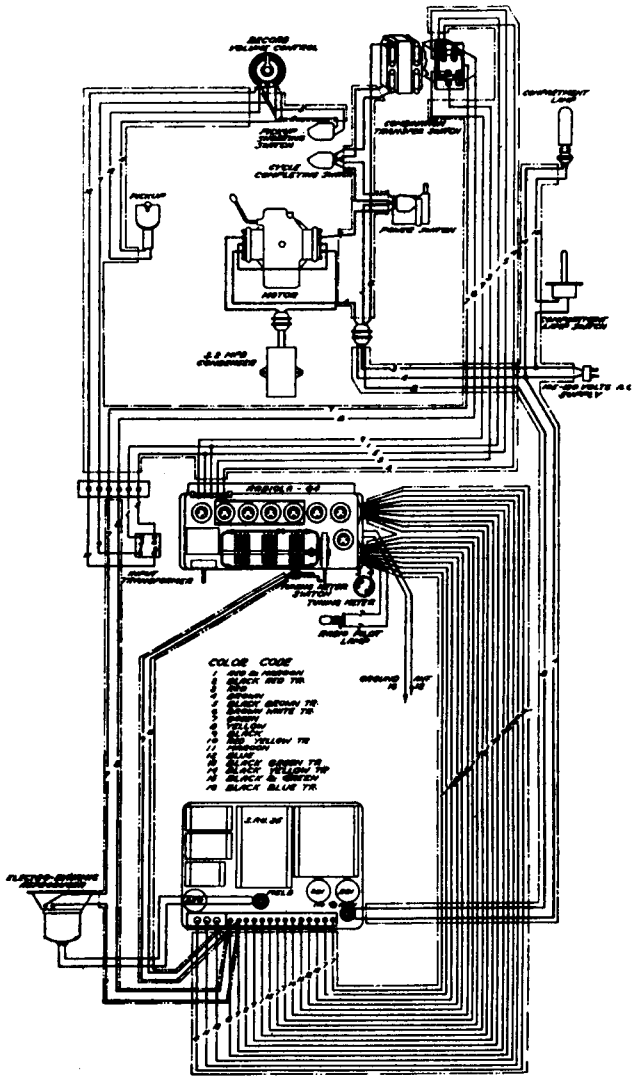
Power-Amplifier Unit AP-736



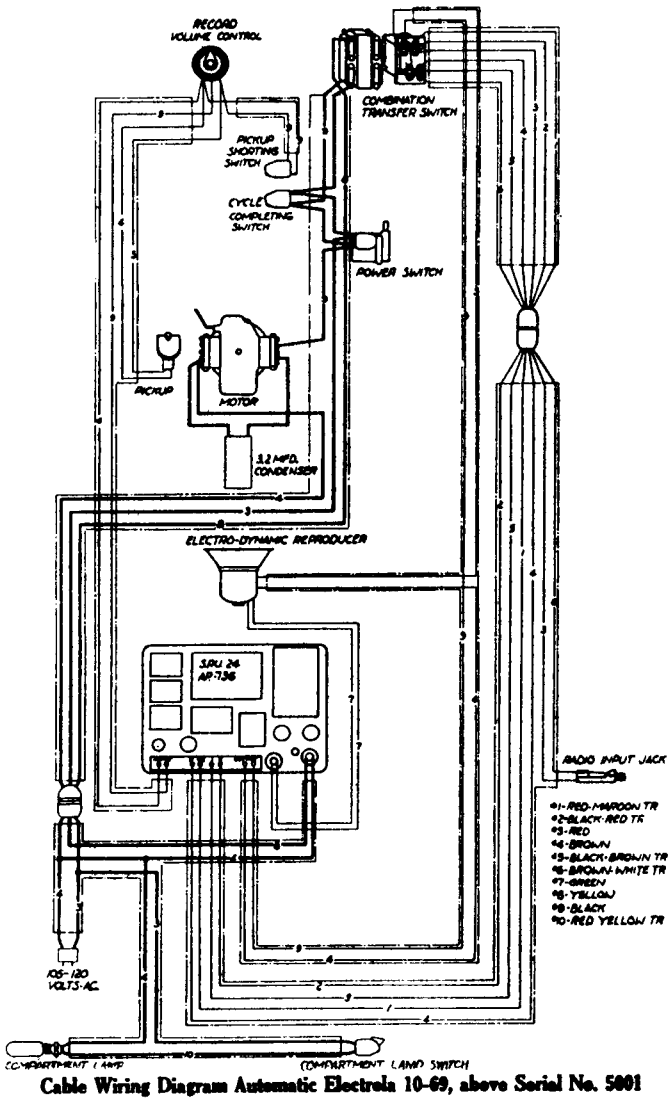




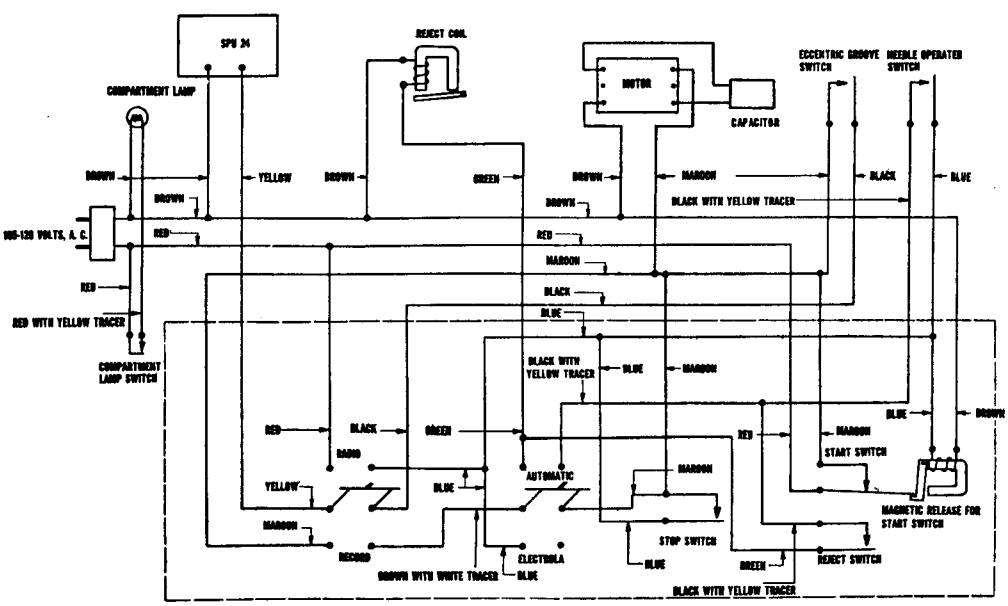
R.C.A.-VICTOR CO.
(VICTOR DIV.)



Cable Wiring Diagram Automatic Electrola Radiola 9-54 above Serial No. 6401

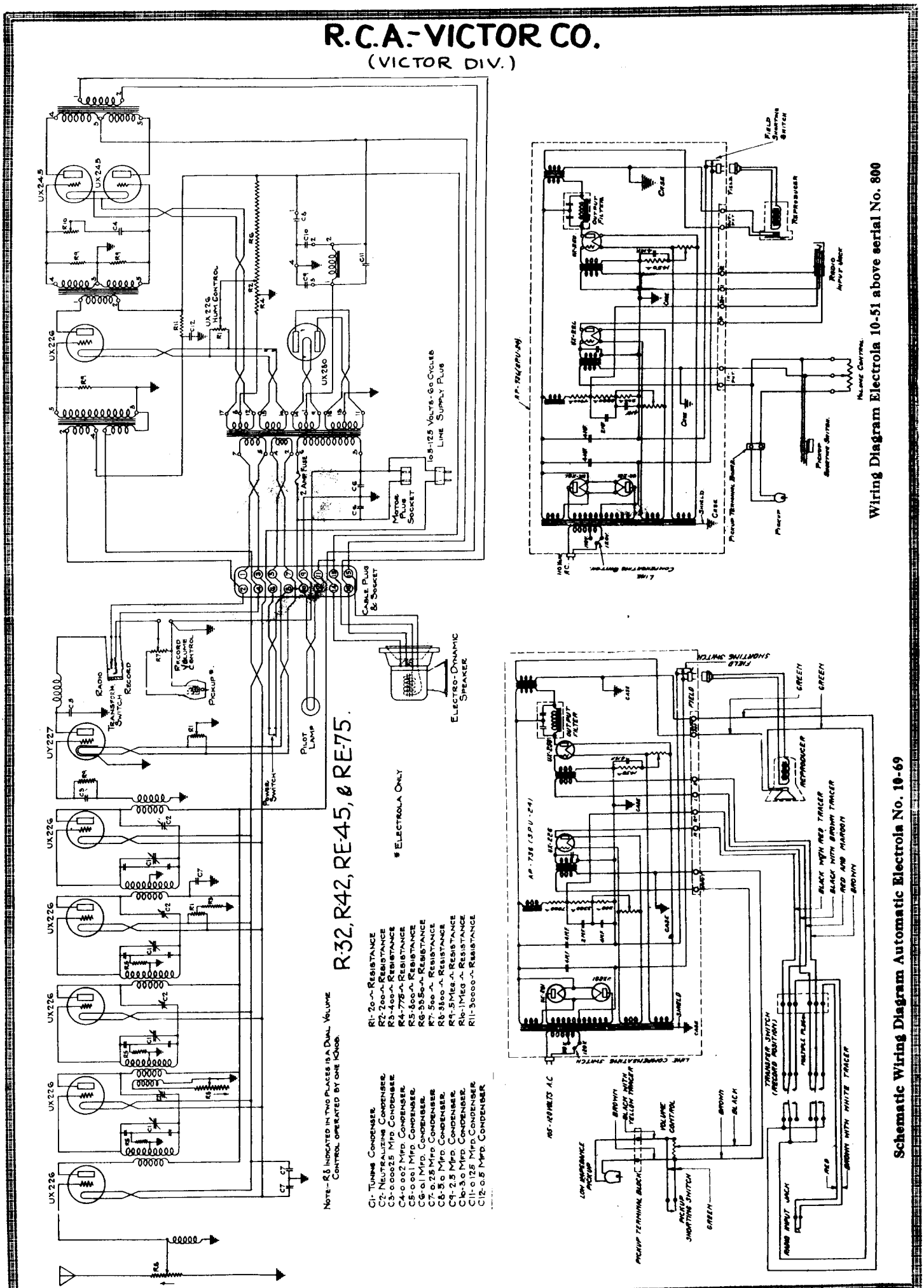


Cable Wiring Diagram Automatic Electrola 10-69, above Serial No. 5001



A. C. Power Wiring Diagram Automatic Electrola No. 10-69

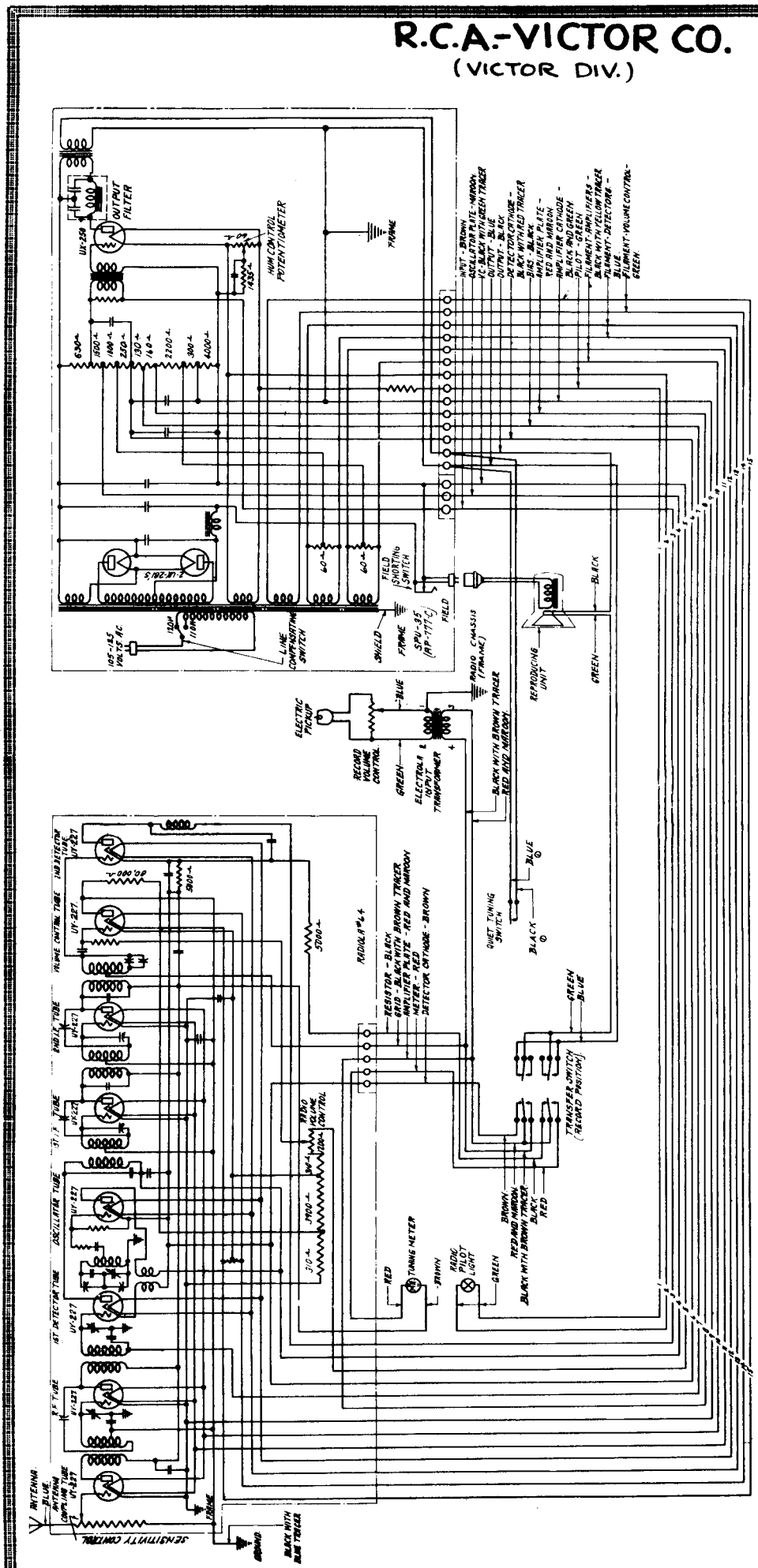
R.C.A.-VICTOR CO.
(VICTOR DIV.)



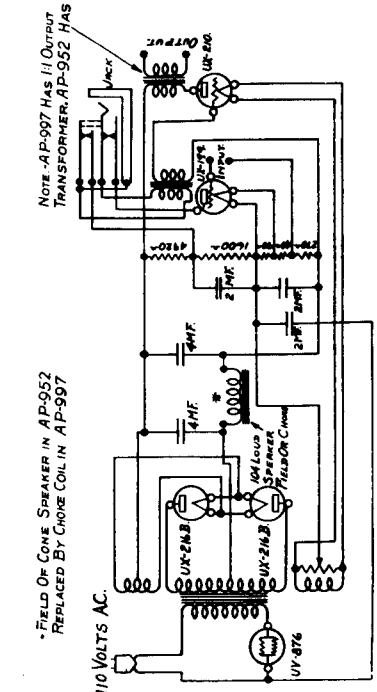
Wiring Diagram Electrola 10-51 above serial No. 800

Schematic Wiring Diagram Automatic Electrola No. 10-69

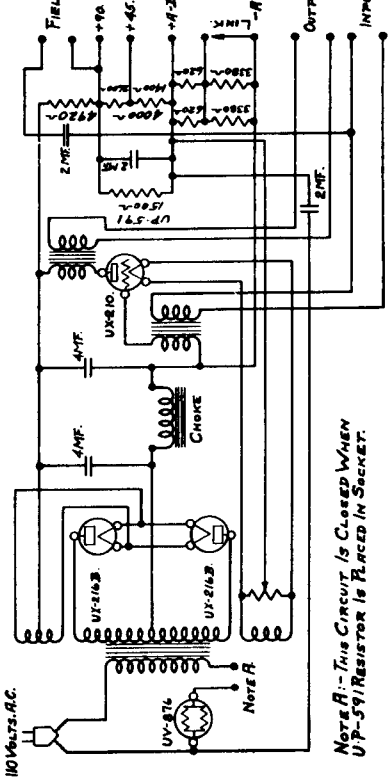
R.C.A.-VICTOR CO.
(VICTOR DIV.)



Schematic Wiring Diagram Electrola Radiola Model 9-18



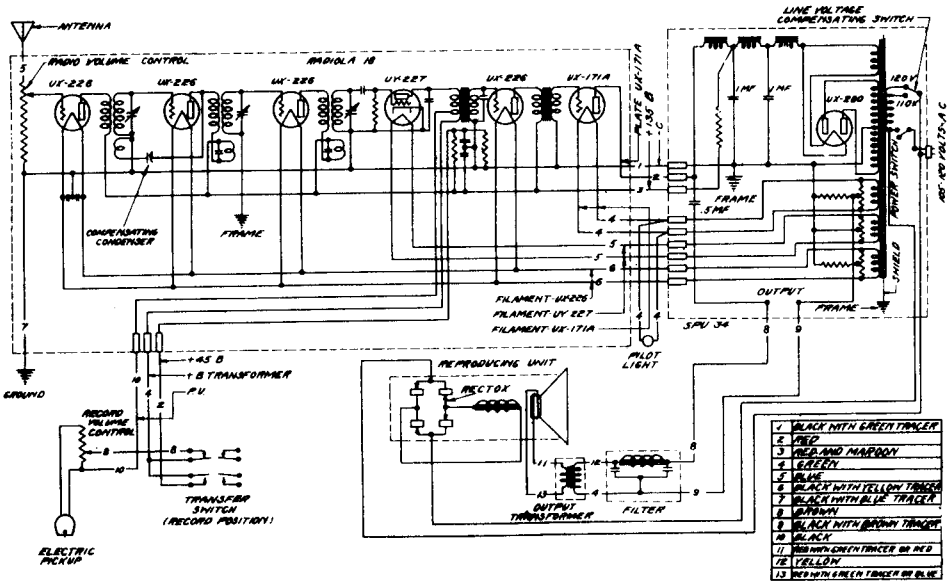
Wiring Diagram AP 952, and AP 997 (RPA-5 and RPA-5—Special)



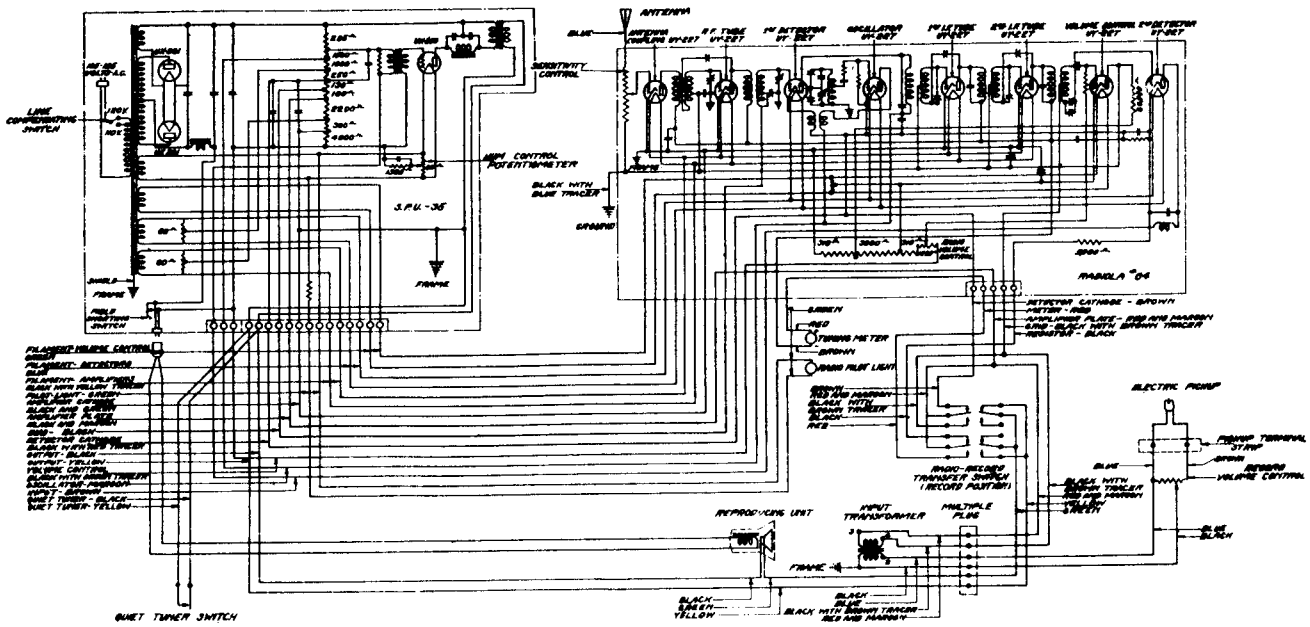
NOTE A:- THIS CIRCUIT IS CLOSED WHEN U.P.-591 RESISTOR IS PLACED IN SOCKET.

Wiring Diagram AP 947 (RPA 1-A)

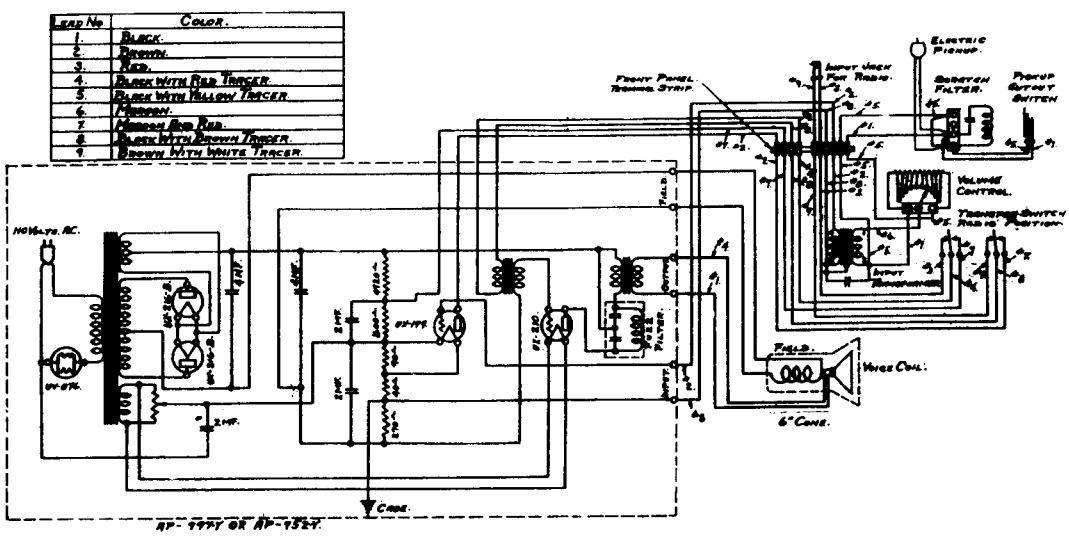
R.C.A.-VICTOR CO. (VICTOR DIV.)



Wiring Diagram Electrola Radiola 7-26 Above Serial No. 12000



Schematic Wiring Diagram Electrola Radiola 9-54

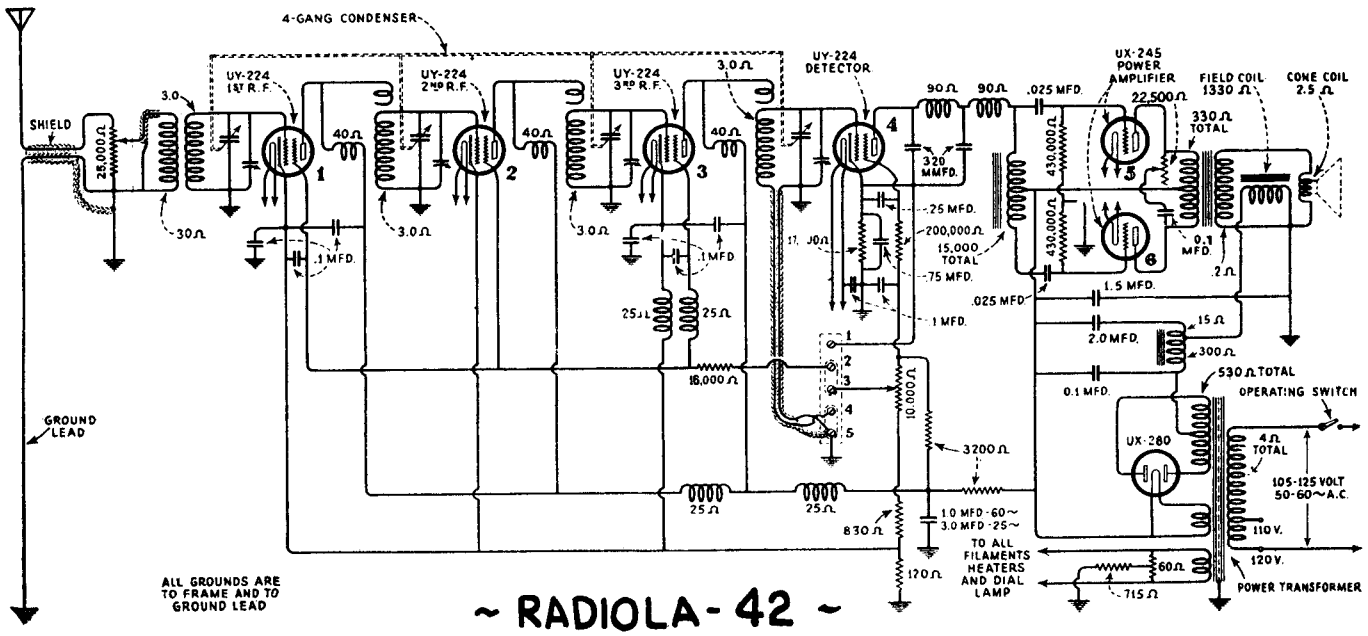


Wiring Diagram—Electrola 10-70

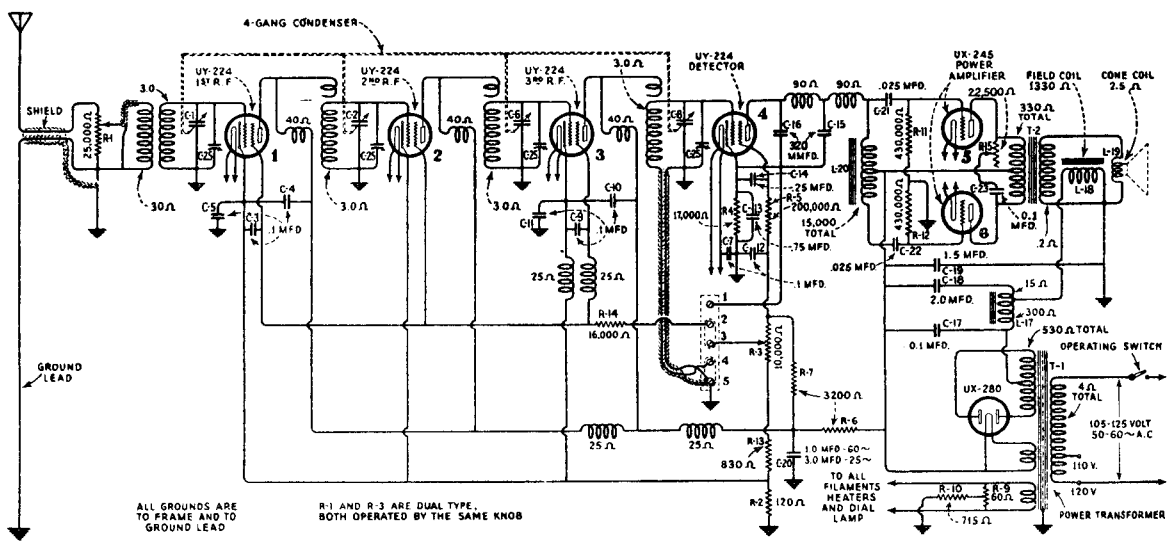
R.C.A. VICTOR CO.

RCA Radiola 42 is a four circuit, tuned radio frequency radio receiver utilizing the chassis and reproducer unit of Radiola 48 together with a tone control. The tone control is mounted on the side directly under the operating switch.

All the information contained in the Radiola 48 Service Notes will therefore apply to the Radiola 42. The wiring diagram is shown in Figures 1 and 2 and the schematic diagram in Figure 3.



It will be noted that a new volume control is used. The antenna section of this unit has a value of 25,000 ohms instead of 50,000 ohms as used in the Radiola 48. This volume control is also being used as a replacement in Radiola 48. The screen grid voltage section has a value of 10,000 ohms and the 12,000 ohm shunt resistor is not used. The 0.005 mfd. condenser across the plates of Radiotrons UX-245 has been omitted due to the connection of the tone control in the same position. When making replacements of the condenser and reactor unit it will be necessary to clip the two leads that are connected to the .005 mfd. condenser close to the container. The reason for this is that the replacement unit supplied is suitable for either the Radiola 42 or 48.



Schematic Wiring Diagram, Victor Radio R-14

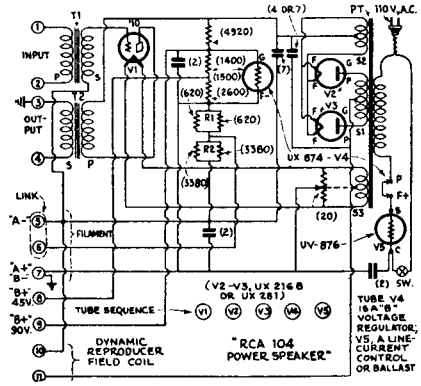
Radio Service Data Sheet

RADIOLA "28" SUPER AND "104" POWER SPEAKER

Condenser C1, in the principal diagram below, is the loop-tuning condenser, in the input circuit to the first R.F. tube (V1); this may be balanced by an experienced Service Man, in accordance with standard practice for superheterodyne circuits, to match the constants of the loop antenna, by the compensating condenser C4 (at the left of the loop socket, looking from the front). Condenser C2 tunes the input to the first detector, V2 (the numerical sequence of the tubes, when plugged into the catacomb sockets, is: V2, V4, V1, V5, V3, V6, V7, V8, as indicated by the numbers immediately beneath these in the diagram, which correspond to the numerals stamped in the bakelite top plate.) Condensers C1 and C2 are ganged, and are under the control of the left tuning drum; condenser C3, tuning the circuit of oscillator V3, is adjustable by means of the right drum. The first R.F. stage is neutralized by means of condenser C5 and the center-tapped loop; this condenser is mounted on the bakelite strip carrying the main terminal lugs. The primary of the first I.F. transformer is tuned to the intermediate frequency (40 kc.) by means of condenser C6; this I.F. circuit is neutralized by condenser C7 (inaccessible). The dotted rectangle denotes the shield can of the catacomb; everything inside this line, except the filament connectors, is under seal (to break which cancels all factory repair obligations). The remaining condensers inside the catacomb are also inaccessible; so is the grid leak, R3.

Low volume, howling, noisy or intermittent operation may be due to defective tubes. Noisy or intermittent operation may also be due to a loose screw holding the filament connection busbar (underneath the "whiskers" or catacomb leads). Noisy or poor operation may be due to a defective phosphor-bronze spring on the loop or in the loop receptacle; or a break in one of the flexible leads. Short "C" battery life may be due to a defective tube (grounded grid); or a loop spring grounding to the frame.

Lack of signals may be due to an open safety resistor (Lamp V9). For test, its three leads may be bonded together; or an auto lamp substituted (first making sure that the 2-mf. condensers, C12, C15, are not shorted). If condenser C12 or C15 is open, circuit oscillation and low volume may result. Noisy or intermittent operation may be due to one of the variable condensers' pigtails being open or grounding against the frame. The loop *must* be centered in the receptacle to take a vertical position. Interchanging tubes (except the power tube) may greatly improve operation. The



metal markers may cut through the insulation of the wires and short to other parts of the circuit.

Noisy operation—particularly during adjustment of either rheostat; and more especially when energized by the "Model 104" power speaker—may be due to imperfect contacts.

To insure satisfactory operation of the "28," by keeping the filament potential below 3 volts, a "pin-jack" voltmeter should be permanently plugged into the tip-jacks provided for this purpose. To improve the pick-up in shielded localities, an outdoor antenna may be inductively coupled to the receiver by placing one or two turns of the lead-in quite near the loop, L. Since the magnetic reproducer connects directly into the plate circuit, it must be correctly poled.

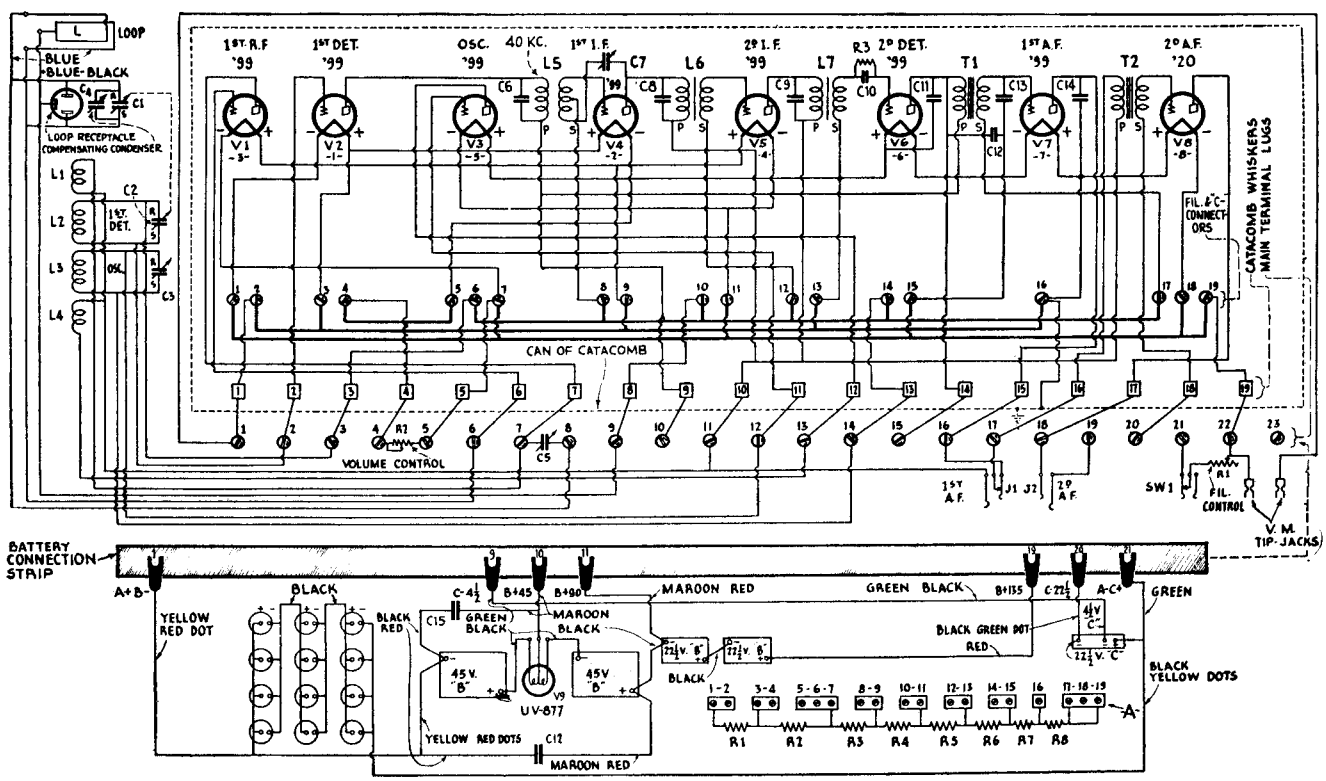
When current is derived from an A.C.-operated power unit, such as the "104" speaker, the filament-connector busbar underneath the catacomb whiskers (heavy lines in the diagram) must be replaced by a resistance strip (A in the diagram). The low-resistance rheostat R2 is then replaced with a resistance cartridge of 350 to 375 ohms, each section of strip A having the following resistance respectively: R1, 190 ohms; R2, 390 ohms; R3, 163 ohms; R4, 155 ohms; R5, 130 ohms; R6, 120 ohms; R7, 115 ohms; R8, 50 ohms. When R2 has a value of 250 ohms (as in the "Radiola 32"), the connecting strip A will have these values: R1, 271 ohms; R2, open; R3, 236½ ohms; R4, 197 ohms; R5, 183½ ohms; R6, 154½ ohms; R7, 145½ ohms; R8, 50 ohms.

When the "28" is A.C. operated, the low resistance cartridge of the filament-control rheostat R1 is replaced with a cartridge having a resistance of 185 ohms.

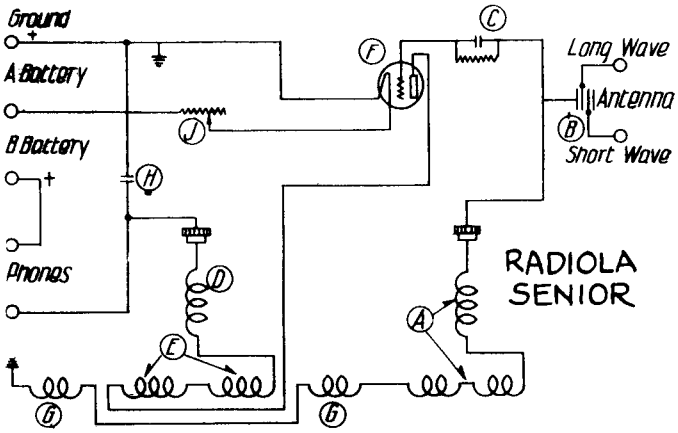
THE "104" POWER SPEAKER

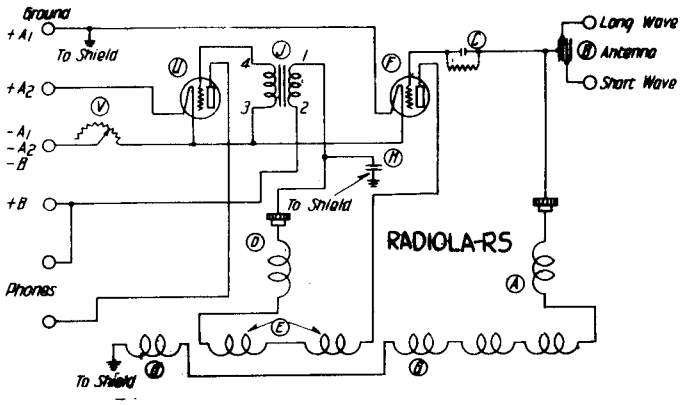
Before connecting the "104" to the "28," the strap marked "link" must be removed. Replacement resistance and capacity values shown in the diagram of the "104" are the figures in parentheses. In some models, the secondary S3 may be center-tapped, the potentiometer not being used. Resistor R1 may be a single unit of 310 ohms; and R2, another of 1690 ohms. In normal operation, tube V4 will glow pink or violet; and V5 will be dark but hot. Keep the ventilating stack over this tube.

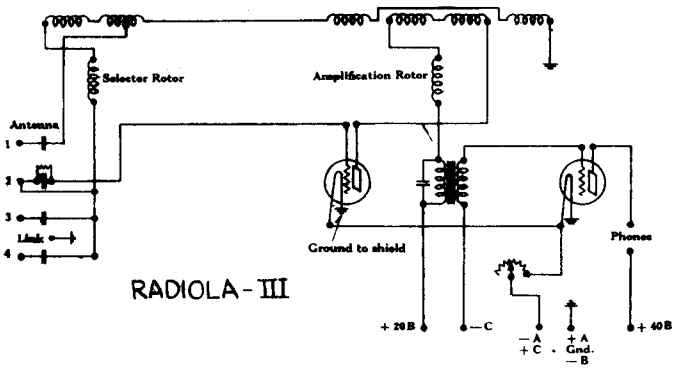
After connecting the "104" to the "28," the two filament leads should be shunted by a fixed capacity of 20-mf. or more (such as an electrolytic unit.) The "A" potential will be about 32 volts; and the battery-type filament voltmeter is no longer required. All voltage terminals should be by-passed by 2-mf. fixed condensers. A 30- to 50-henry choke, connected across main terminal lugs 10 and 195, may be necessary to stop "fluttering"; although changing the '99's usually is sufficient. When the "104" is used, tube V8, in the '20, is not needed; and the "Battery Switch" jack must be shorted—off-on control being obtained through a conveniently placed light-line snap switch. If the power speaker is too close to the "28," howling will result.

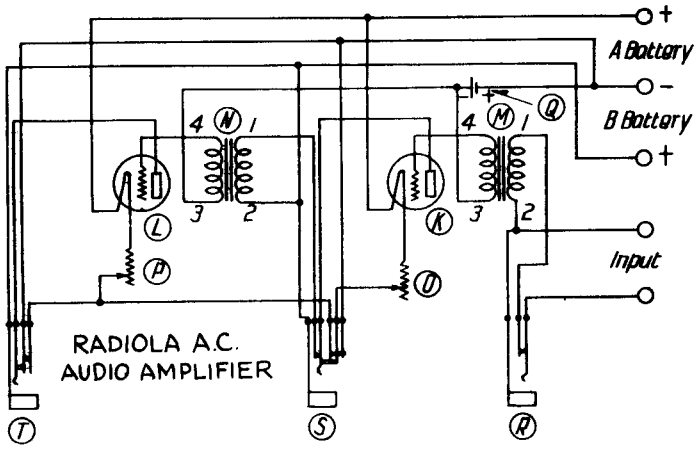


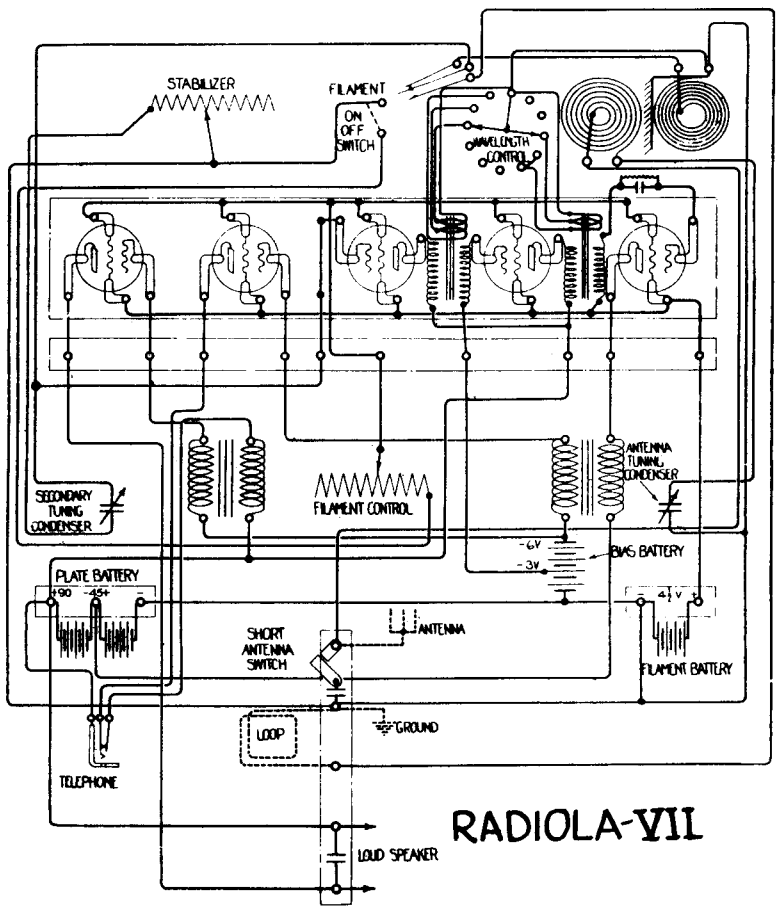
R.C.A.-VICTOR CO.

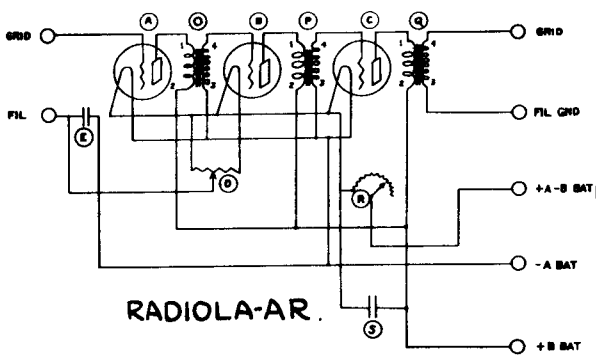


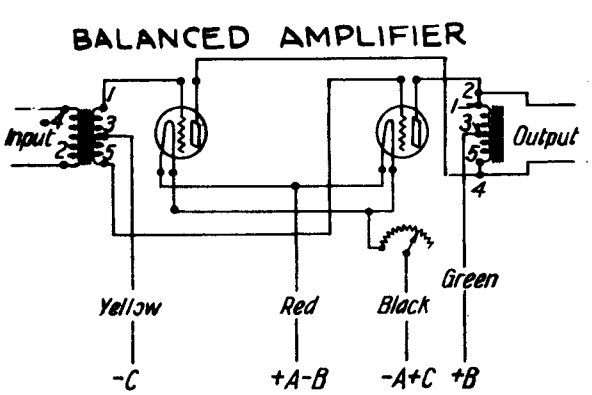




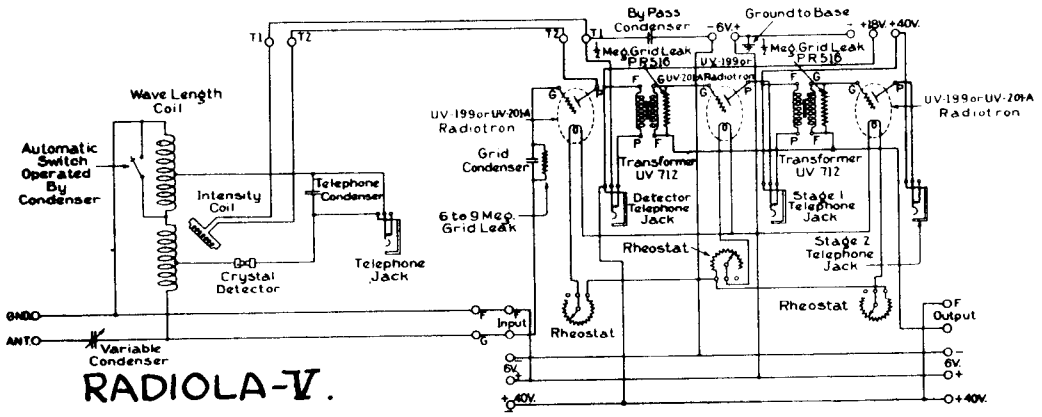




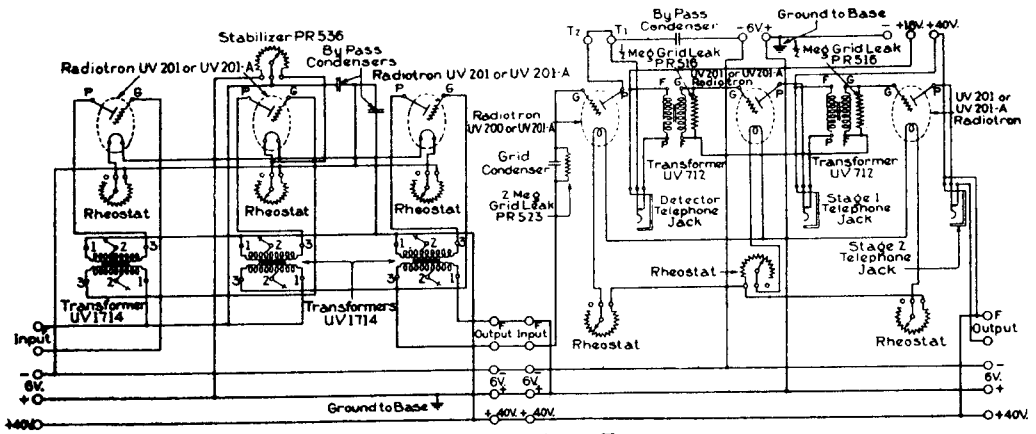




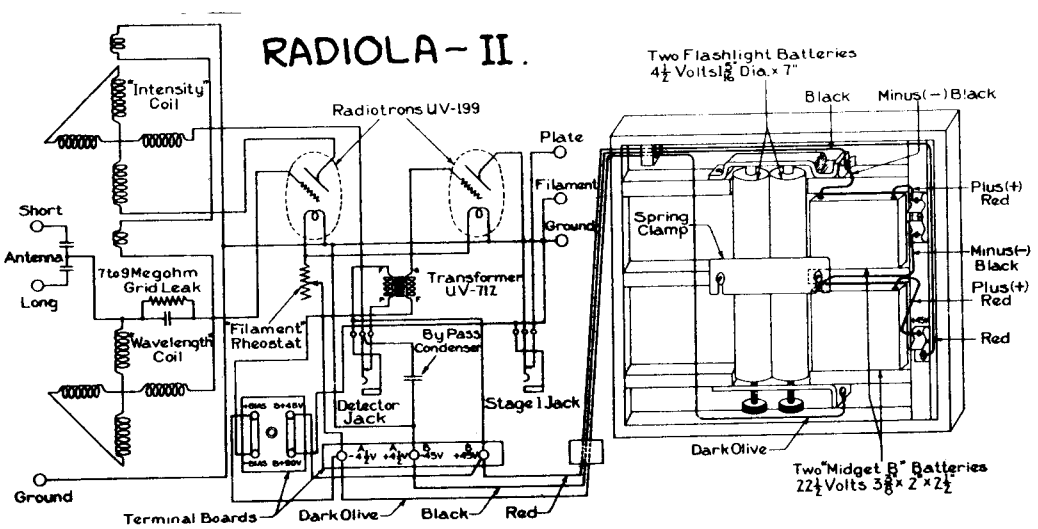
R.C.A.-VICTOR CO.

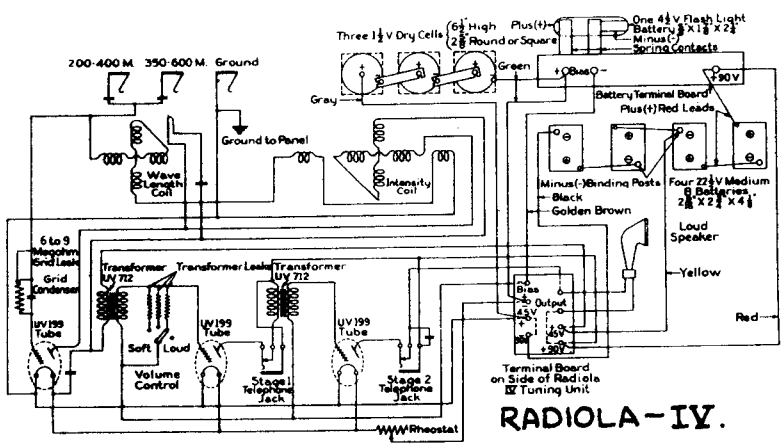


RADIOLA-V.



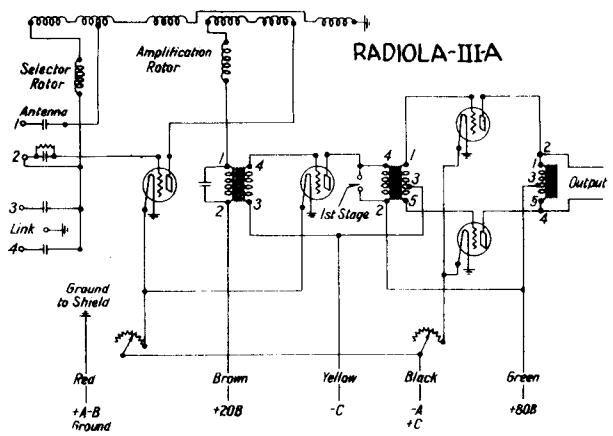
RADIOLA-VI

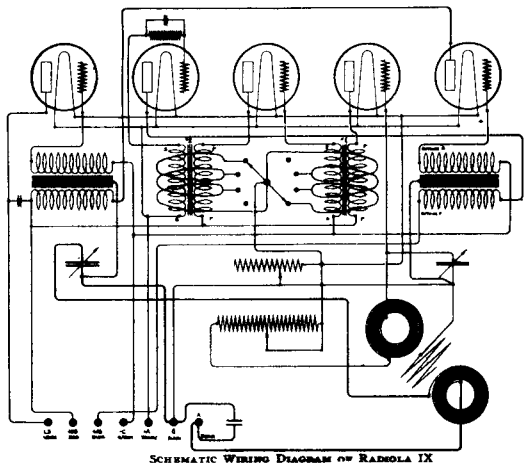




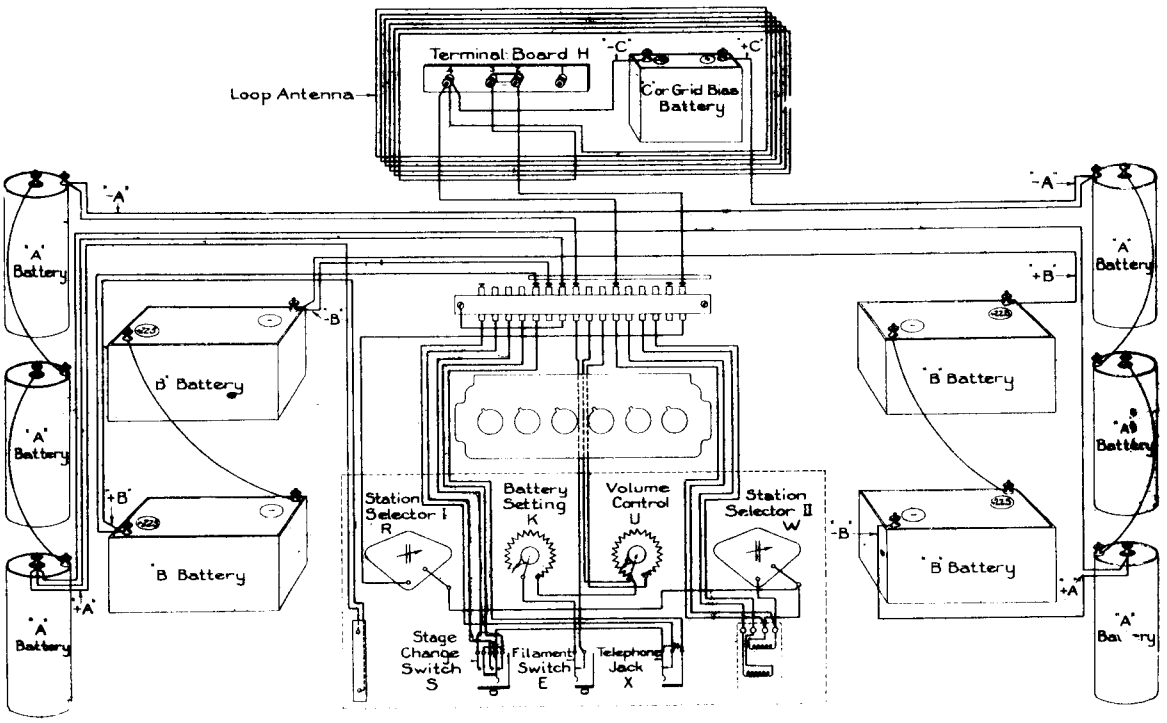
RADIOLA-IV.

R.C.A.-VICTOR CO.



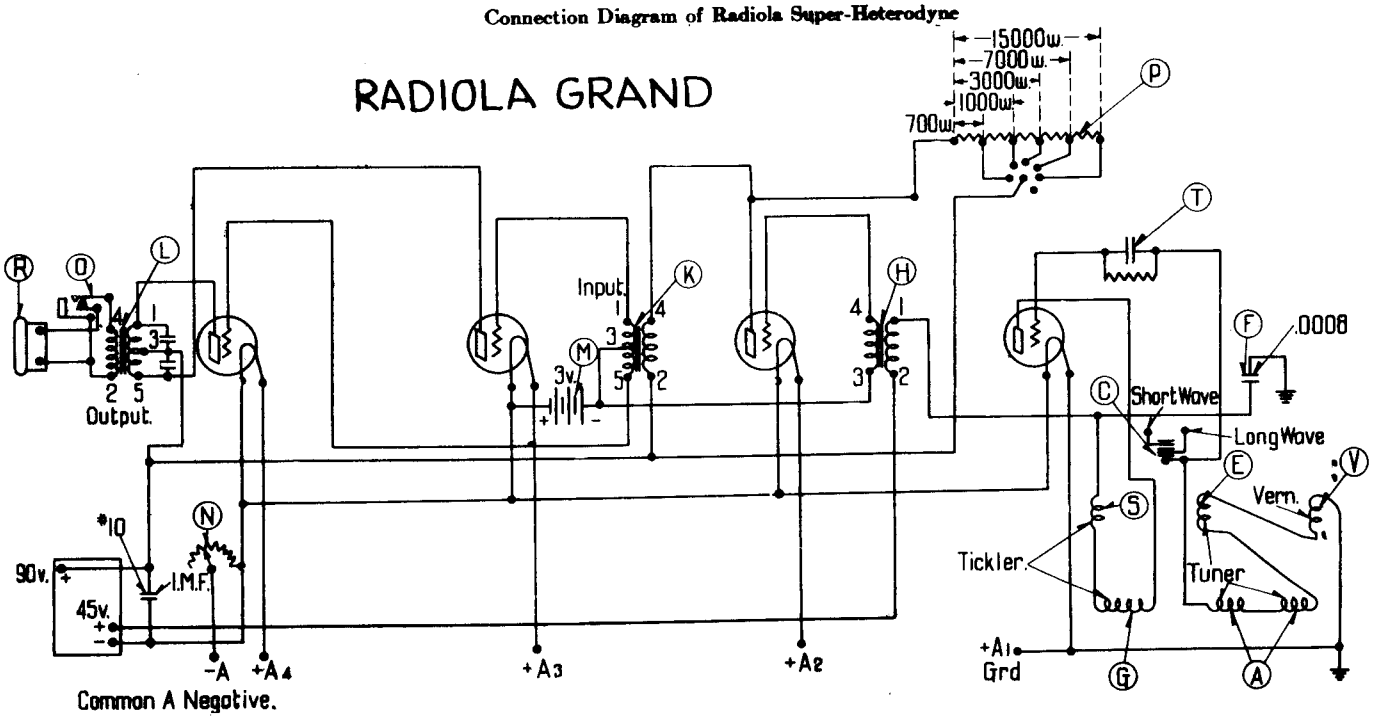


SCHEMATIC WIRING DIAGRAM OF RADIOLA IX

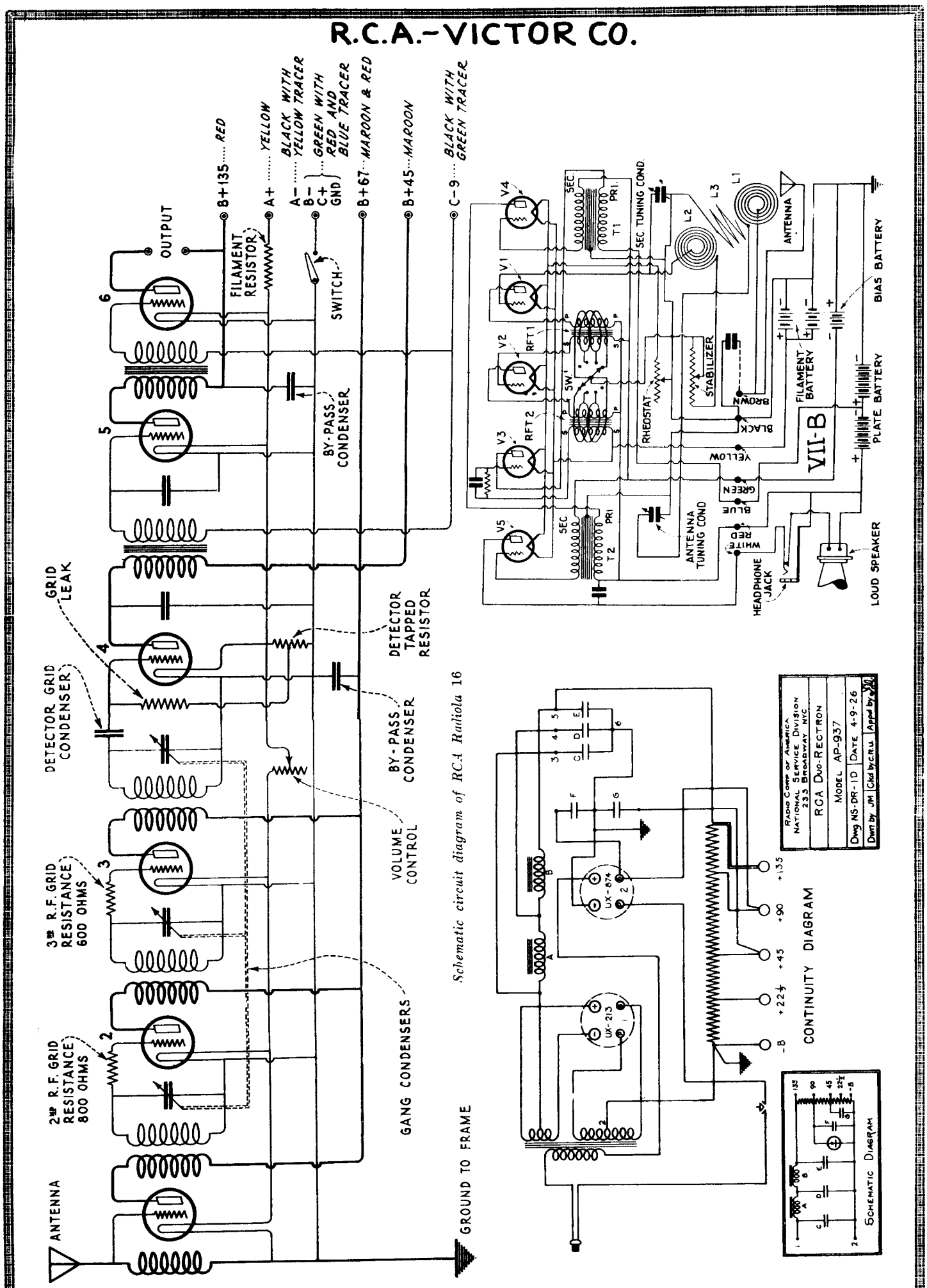


Connection Diagram of Radiola Super-Heterodyne

RADIOLA GRAND

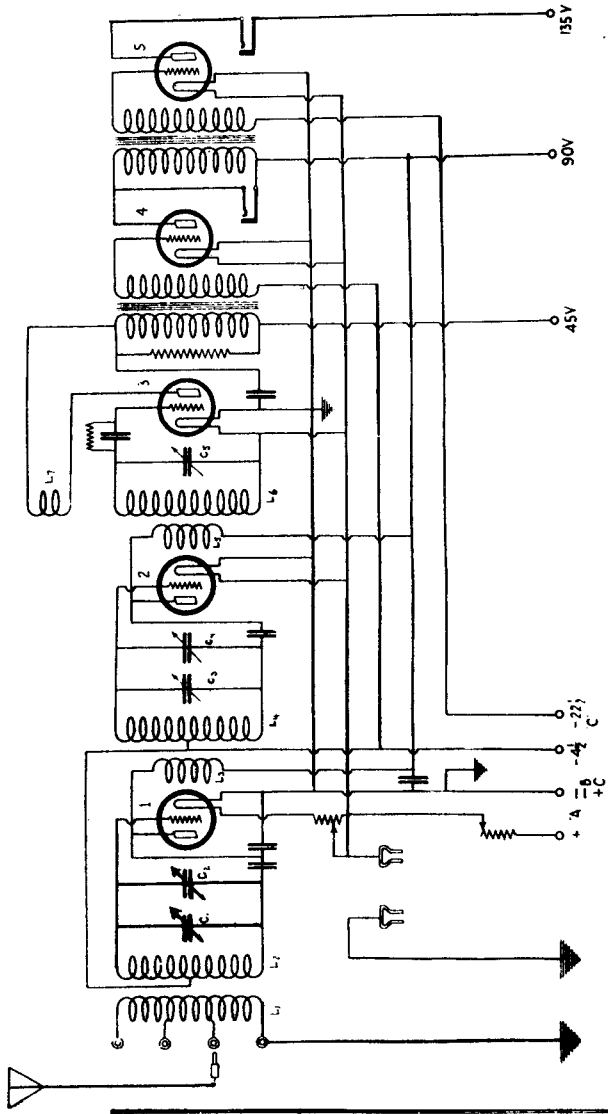


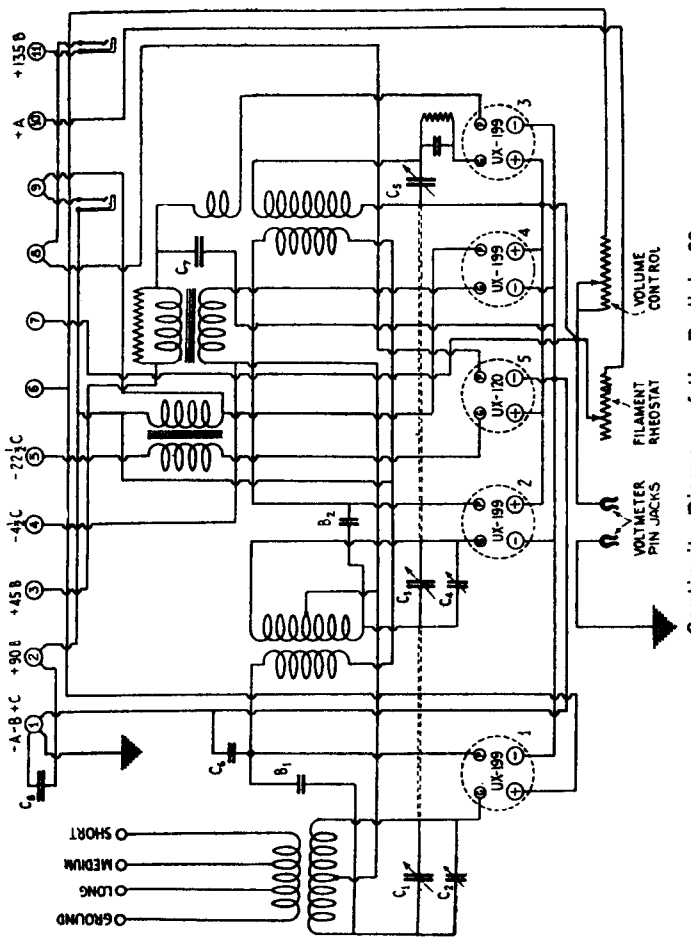
R.C.A.-VICTOR CO.

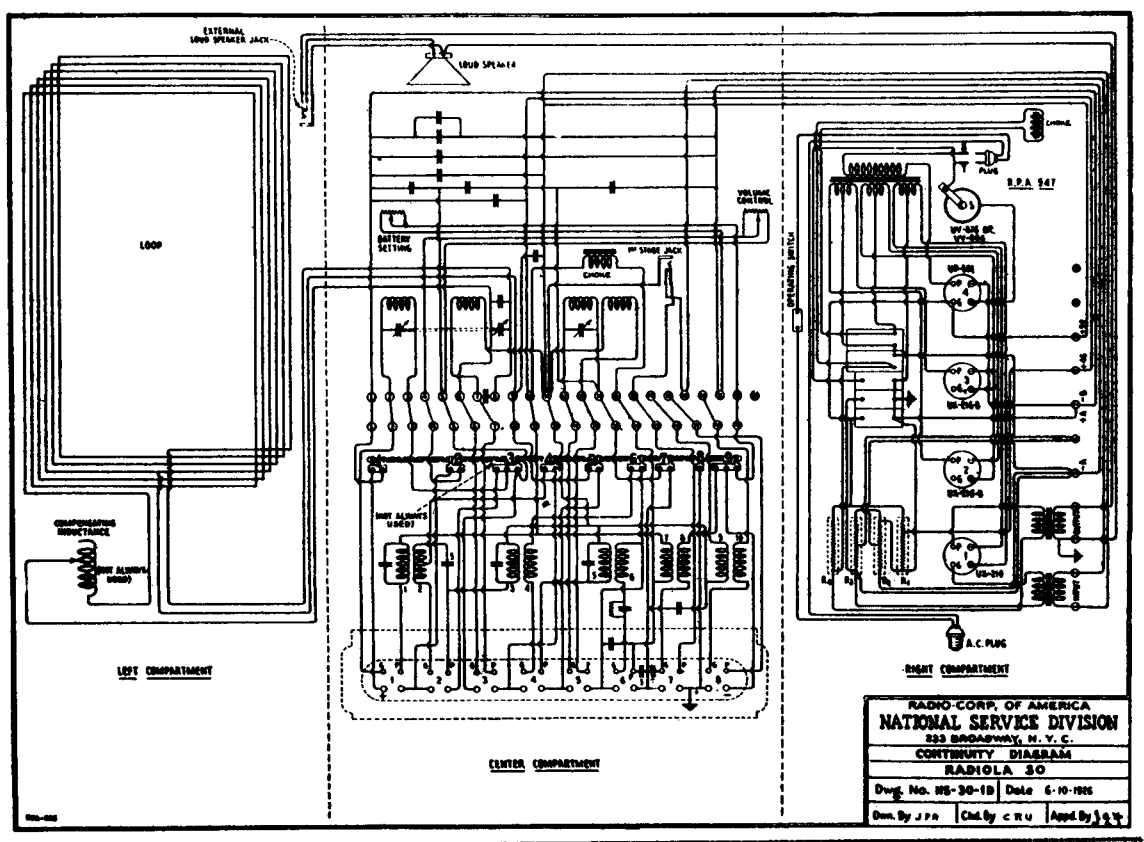


Schematic circuit diagram of RCA Radiola 16

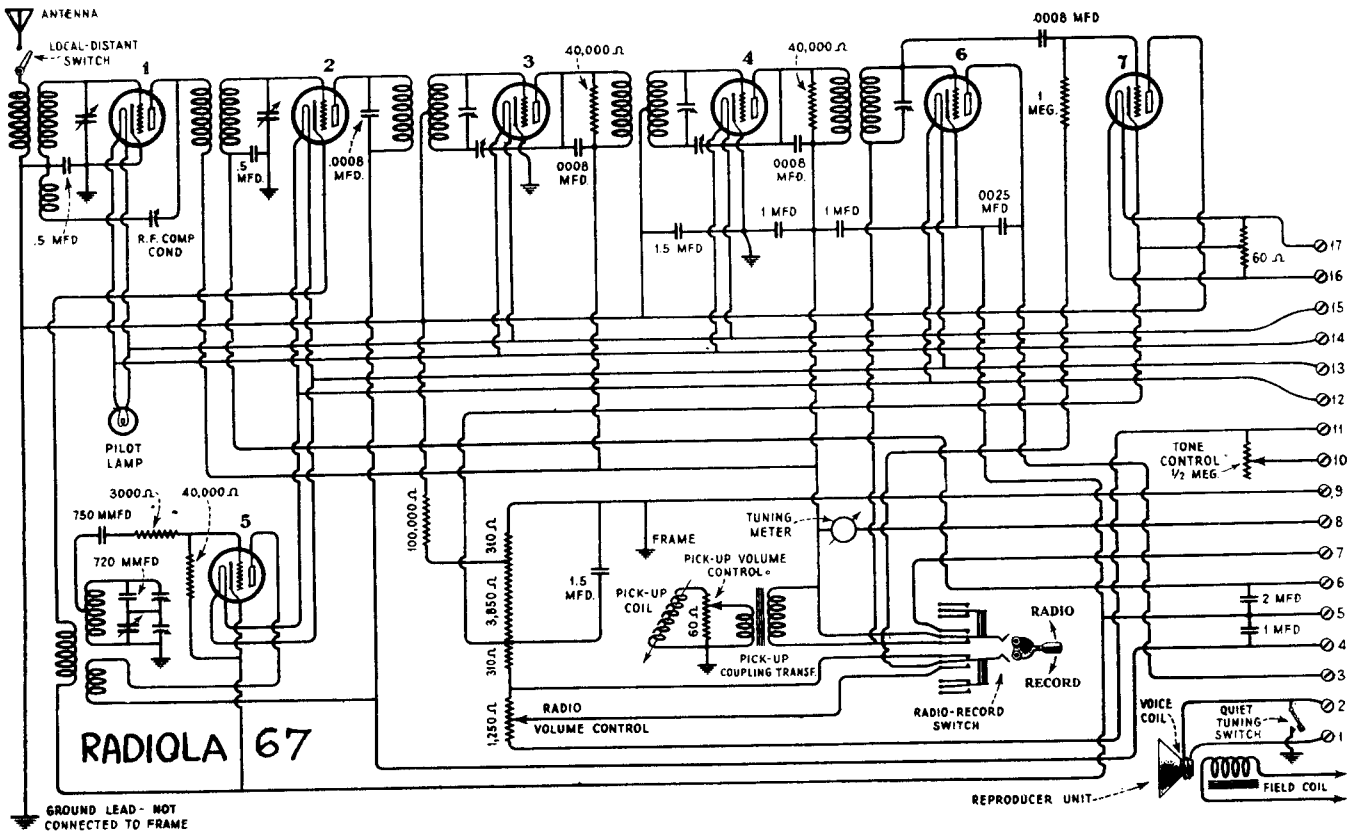
R.C.A.-VICTOR CO.

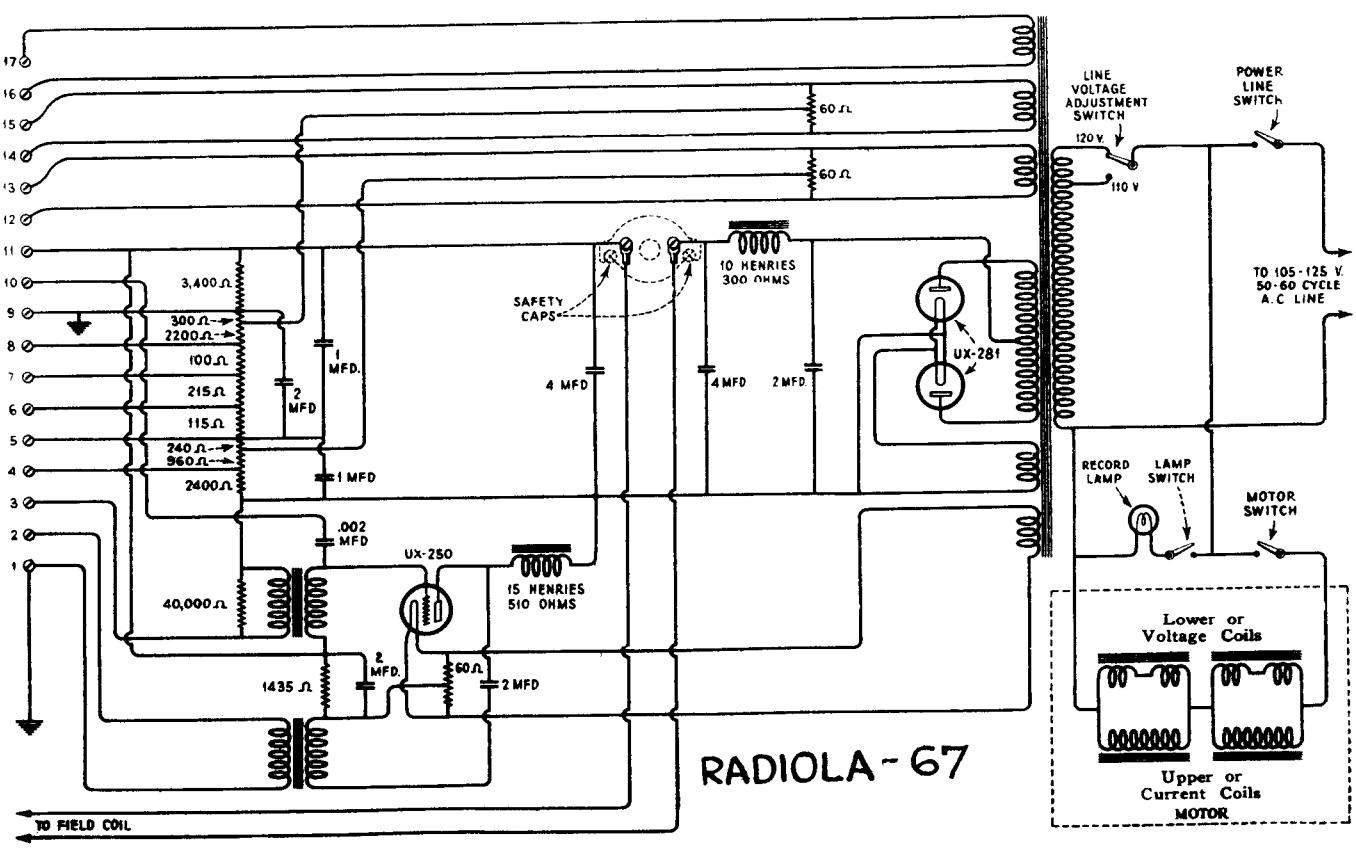






R.C.A.-VICTOR CO.





Radio Service Data Sheet

RADIOLAS "SUPER VIII" (AR-810), "SEMI-PORTABLE" (AR-812), 24 AND 26

These four Radiola superheterodynes use the same 6-tube catacomb, the first of this type put on the market by the Radio Corporation of America; differences lie in the mechanical arrangement of the units outside the catacomb, and in the electrical and artistic design.

The "812," to which most of this material specially applies, is an entirely self-contained semi-portable table cabinet set with a battery compartment at each end. The A.F. output is obtained at a jack; a plug-operated switch changes the circuit from one A.F. to two. Another switch controls the "A" circuit. There is a master rheostat ("Battery Setting"), R3 in the diagram on this page, and also a vernier rheostat ("Volume Control") R2; the latter controls I.F. amplifier V3. A fixed loop antenna is located in the rear of the cabinet. Phones or speaker may be used.

The "AR-810" or "Super VIII" has a highboy cabinet, with a large rotable loop and a loud speaker. The filament circuit is controlled by a door-operated switch instead of SW1, which is replaced on the panel by a knob that controls the loop.

Radiola 24 is a black-leather-covered portable with a built-in loud speaker and a rotable loop that fits into the cabinet when not in use on top.

Radiola 26, the well-known portable so often used for locating interference, is extremely compact, includes a loud speaker and batteries, and has a rotable loop that comprises part of one door. A "home battery box" is used for economical operation at a fixed post. Tip jacks are provided for headphones.

Six UV-'99-type (or UX-'99s with adapters) tubes are required; to use the UX-'20-type tube at V6 an adapter is required (such as the Na-ald "Type 420 Connectorald") which will permit the '20 to assume the horizontal position necessary in order to close the panel, as well as an additional 45-volt "B" battery and a 22½-volt "C" battery.

To prevent repetition of details, reference should be made to Data Sheet No. 16, "Radiola 25 Superheterodyne," April, 1930, issue of RADIO-CRAFT. The same sequence of signals is followed through the catacomb.

Looking at the rear or catwhisker side of the catacomb, and at the terminal strip, V1 is at the left and V6 at the right.

"Station Selector No. 1" is C1, and "Station Selector No. 2" is C2. The rotor side is indicated below by R.

In certain receivers of the Super-VIII model two loud speakers are used; in others, one. The connections, in the "810," are shown in dotted lines. C13 may have a capacity of about .006-mf.

Arrangement of the tube-socket contact springs is shown at the lower left of the schematic, and the correct connections for the oscillator coils directly above. The numbers on the mounting plate correspond with the circuit connections; if one coil is reversed, the set will be made inoperative.

The loop connects to a terminal board on the back of the cabinet. The normal position for "link" is shown in dotted lines; in the second position shown, an external loop may be led to posts 4 and 2, for increased pick-up or more directional reception. A short antenna may be used on post No. 2 or a longer one on No. 1, with either loop in use. A standard "R.F. transformer" designed for .0005-mf. condensers may be used instead of the loop; aerial and ground being connected to the primary, and the secondary leads to posts 4 and 2, with "link" open. This is usually unsatisfactory near strong stations. If the location is particularly shielded, good operation can sometimes be obtained by connecting post No. 1 to ground. Any external connection to this terminal board will change slightly the readings of Selector No. 1. A convenient method of obtaining just the right degree of signal input to the set is to make a coil of magnet wire, any size, about 30 to 50 turns bunched, with a diameter of about six inches, and connect it between aerial and ground; this loop is brought as close to the back of the cabinet as necessary for good coupling.

Absence of signal may be due to open loop or broken pigtail on C1. An open loop may be caused by wires twisting loose from the collector rings. Dirty or loose rings may cause noisy operation. (In later sets of the Super VIII flexible leads supersede the collector ring construction.) A rattling sound in the reproducer may be due to the catacomb springs touching the loop shaft.

Wrong jack-switch circuit change may be due to dirty or bent switch springs, or loose knob.

When working properly, distant stations can be heard in either of two positions of C2; local stations may come in at three or four places. A wave trap or relocation of the set may be necessary.

A cause of trouble may be one of the strands of one of the catwhiskers touching either an adjacent terminal lug or grounding to the can.

Occasionally an "oscillating catacomb" will be found, and the only remedy is to change the catacomb; for no manner of adjusting will stop the oscillations, which cause whistles to be heard on all station settings.

If it is necessary to turn R3 up high, even with new batteries, check the tubes and the "C" battery's polarity. (The "C" is at the rear—inside the loop.)

Any tube in sockets V1, V2 or V3 remaining lighted after switch SW1 has been turned to "off" is an indication that the filament is touching the grid. Tube requirements for V2 seem to be more critical than the others, and tubes subnormal in any way will show up markedly in this position. Rearrange tubes with this in mind. Failure of tubes in the Super VIII to light may be due to failure of switch operated by desk-fall to make contact; bend the spring contacts.

Weak or noisy reception, with C1 tuning considerably below C2, may be due to one or more shorted loop turns; inspect loop carefully. Noisy reception may be due to dirty socket springs; clean only with sandpaper and pull up springs. To do this without removing batteries or all tubes necessitates an insulated tool to prevent short circuits. The loop of the Semi-Portable is easily removed for inspection after catacomb, battery cable, by-pass condenser, "C," catch, and handle are out.

Using phones or a meter with a 4½-volt "C" battery, the following table may be used for making continuity tests on the catacomb of Radiola 24, AR-810 and AR-812, without removing it, when the battery cable is disconnected; and tubes are removed:

From	*To*	*Test*
1	V1 grid	Open
4	V2 plate	Closed
5	V2 grid	Closed
6	V1 plate	Open
6	V1 grid	Closed
6	V3 grid	Closed
6	V5 grid	*Closed
6	V6 grid	*Closed
7	V3 F—	Closed
8	V1, V2, V4, V5, V6 F—	Closed
10	V4 plate	Open
10	Catacomb can	Closed
10	All F+	Closed
10	V4 grid	Open
11	V4 plate	Closed
12	Terminal 3	Closed
12	V1 plate	Closed
12	V3 plate	Closed
12	Terminal 14	Closed
13	V5 plate	Closed
15	V6 plate	Closed

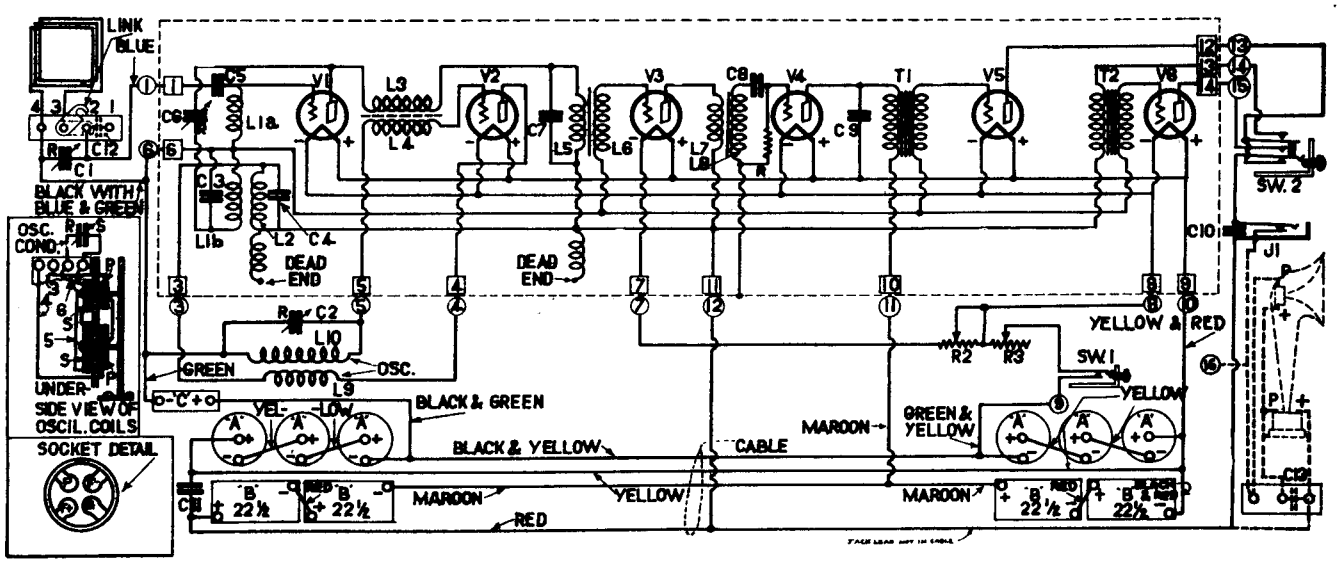
** With headphones, a weak click should be heard.*

The figures in the left column refer to the connection lugs on the terminal strip, to which the whiskers of the catacomb are connected; counting from left to right, and looking at the catacomb from the rear.

Catwhisker No. 2 does not appear on the catacomb; and terminal lug No. 2 is not used. Terminal connection No. 9 does not connect to the catacomb, nor No. 16; their connections to parts outside are shown.

To replace C12, a fixed .0001-mf. unit will usually serve. The value of C10 is .006-mf. C11 (rear of cabinet) may be replaced with a 1.0 or 2-mf. unit.

The catacomb of Radiola 26 is mounted differently, and the connections thereto are reversed. As a stage-change switch is not used, the built-in loud speaker is at all times connected to the second audio stage, and the phone-tip pin jacks to the first stage.



Above "Socket Detail" at lower lower left, the oscillator coils, their terminal strip, and C2; upper left, loop connections; lower right, "Super VIII" speaker connections. All "F+" leads (9-10) ground to can. Lead to center spring of J1 jumps over lower (sleeve), or "B+" contact. C6, within "cat.," comes adjusted for average '99s. Numbers in squares refer to catwhiskers; in circles, to terminal lugs. Loop has 14 turns of No. 18 wire, spaced 3/16-in., on a frame 9" x 18½". Batteries are in position for the "812."

Radio Service Data Sheet

RADIOLA 25 SUPERHETERODYNE

This circuit is one of the variations of the "Second-Harmonic" Radiola Superheterodyne in which the first tube is reflexed for the first stage of intermediate-frequency amplification. The "sequence" of signals in this circuit is as follows: V1 may be considered as both the first stage of R.F. amplification at the broadcast wavelengths, and the first stage of intermediate frequency amplification at 45 Kc.; V2 is the oscillator and first detector; V3 is the second intermediate-frequency amplifier; V4 is the second detector; V5 is first A.F.; and V6 is second A.F. The desired signals are selected by the loop and C1. Since L1A has a high impedance to the broadcast frequencies, the signal, having passed through C5, is amplified by V1 and the output fed to the grid of oscillator V2 through the aperiodic R.F. transformer L3-L4. (The grid circuit of V2 is tuned by L10-C2.) (To prevent circuit oscillation in V1, neutralization has been effected through the use of L1B-C3-C6. C6 is contained inside the catacomb and adjustment of this unit is made at the factory.) The intermediate-frequency component in the plate circuit of V2 is coupled by L2 to L1A and then amplified by V1. The amplified output of V1 at this frequency is coupled by L5-L6 to the second I.F. amplifier V3; and then, after amplification, by L7-L8 to the second detector V4. The A.F. output of this tube is amplified by V5 and V6 in the usual manner.

The units that comprise the "catacomb" are contained within a metal can, represented in the diagram as a dotted outline, and sealed with resin.

L9-L10 are mounted on a bakelite plate under C2. L10 is the upper and L9 is the lower coil (see detail at extreme left); while 5 and 4 are the outside leads, connected as shown in the schematic circuit.

A continuity test of L1A is completed by touching the brass stator-tube of C6; which is accomplished by gently prodding through the small hole, in the top plate, between the sockets for V1 and V2 ("CT," in the diagram).

If one of the two connected phosphor-bronze contact springs in the loop socket breaks, the unused spring (see X in detail at extreme left of diagram) may be used as a replacement. These springs drop into the receptacle and lock into position; they are removed by pushing a small screwdriver into the holes in the side of the bakelite receptacle. If the contact springs on the end of the loop become flattened because of misuse, they may be sprung out again by using a screwdriver placed underneath (this must be done very carefully, else the insulating shell will be split by the excessive pressure).

If the loop is so jarred as to lose its upright position, it may be re-located by loosening the four machine screws that lock the socket-collar in position, moving it around until the loop is again vertical, and then tightening the screws.

Since both sides of the loop are at a different potential from the "A" battery, a "dead" "C" battery may be an indication that one side of the loop circuit has become grounded; the loop may ground if it is carelessly inserted into the receptacle.

V7 is a protective lamp (No. UV-877). It is a double-filament bulb of the "double-contact" bayonet-base type; either or both filaments light or burn out if a short-circuit occurs. In some models of the "25" this lamp and its 1.0-mf. by-pass condenser C13 have been eliminated. If a replacement lamp is not available, temporary operation may be obtained by twisting together its three leads 1 (not numbered), 2 and 3.

Upon removing from the cabinet the chassis and looking at its rear, there will be seen a bakelite connection strip containing 20 connecting lugs; the loop connects to No. 1 at the extreme left, while No. 20 at the extreme right is not connected to anything. Seventeen black wires are seen to leave the catacomb and connect to the lugs shown in the schematic circuit as numbers within circles. By rocking the catacomb on its spring-cradle it will be possible to discern figures, stamped on a bakelite plate underneath the top of the "cat," numbering from 1, at left, to 17 (right) which appear in the diagram as numbers within squares. These stranded leads may short, in a few instances, between two connecting lugs; or between a lug and the case of the "cat." which is grounded to "A+"; or, they may break.

Also at the rear of the "cat." is a connection-panel called a "bus bar" which wires the filaments either in parallel (as shown in the circuit) or in series, when the connection-panel is the special one included in the "A.C. package" required for A.C. operation of this set. Unlighted tubes or noisy operation may be due to loose screws holding and connecting this D.C bus bar to the specially-provided filament connections of the tube sockets.

Looking at the front of the set, the loop-tuning condenser C1 is at the left; the oscillator-condenser C2 at the right. Noisy or no reception may be due to the rotor pigtail of C1 or C2 touching the stator.

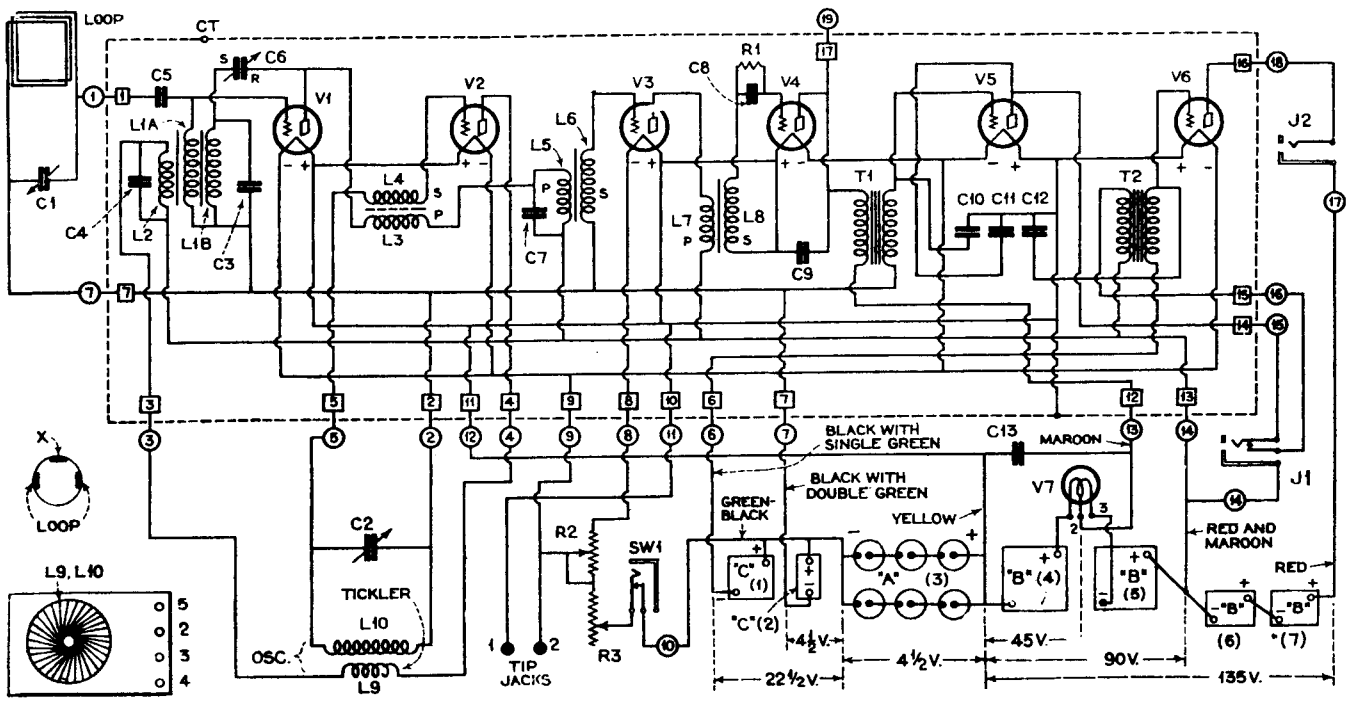
As will be noted from consideration of the diagram, the output of the detector may be connected to an external power amplifier through tap 19; or this tap may be connected to a phonograph pick-up to utilize the A.F. amplifier alone.

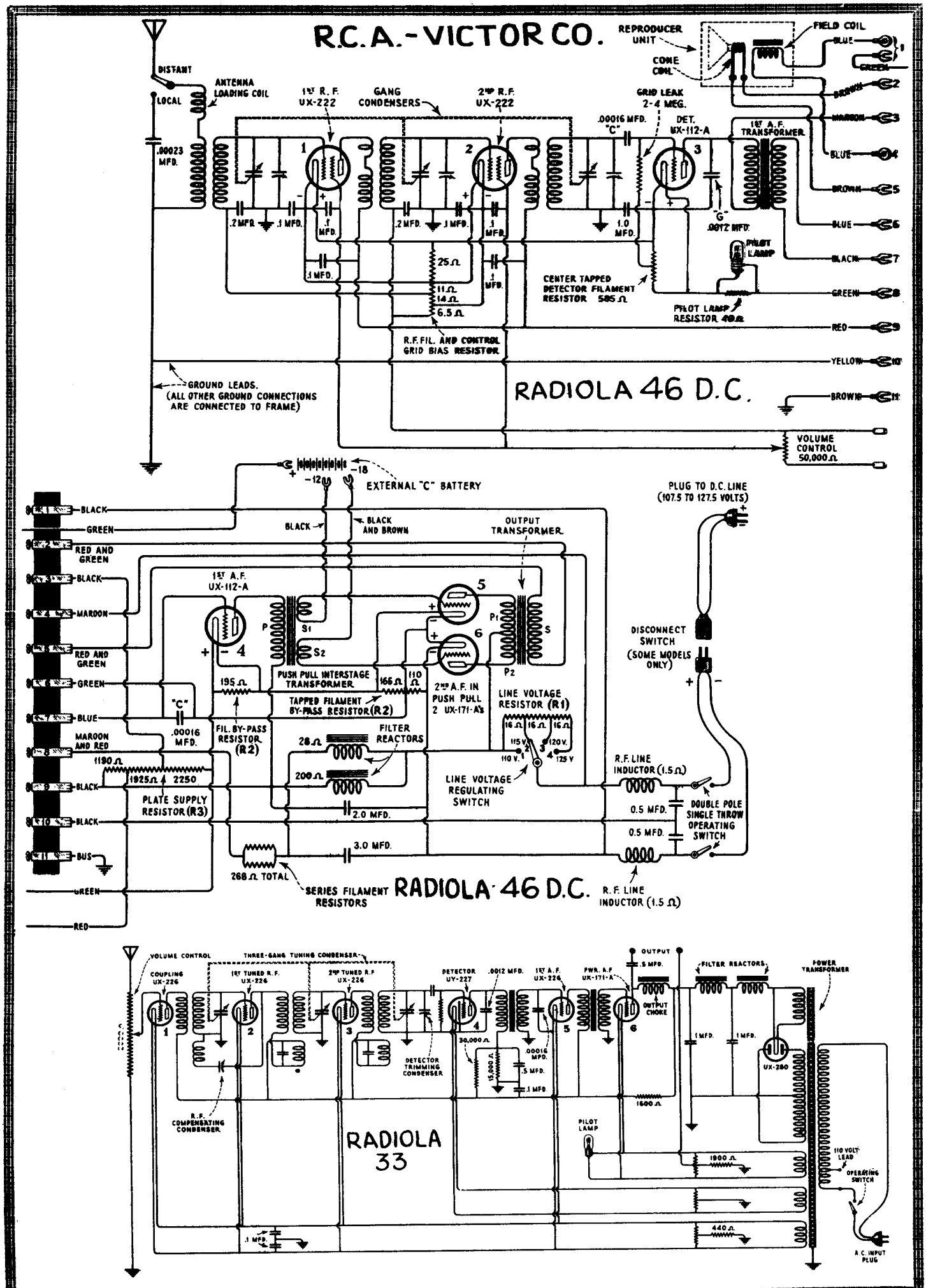
Looking at the "cat." from the front, and counting from right to left, tubes 1 to 5 are type '99 tubes marked V1 to V5 in the diagram; V6 (the left and sixth tube), is a type '30. If a single tube is much below par, it is necessary to overload the remaining tubes to bring reception up to standard, and then the tubes deteriorate rapidly; whereas normal life may well be a year and over. The filament potential should never exceed 3.3 volts, and to determine accurately when this voltage has been obtained, a good voltmeter should be connected to the two tip jacks provided on the front vertical panel, just above the filament switch, and shown in the schematic diagram as tip jacks 1 and 2. R3 is the left and master control ("Battery Setting") of these filament potentials; while R2 (right, or "Volume Control") still further reduces the voltage applied to V3.

Batteries of the correct size for the compartments of this set are as follows: C1, Burgess No. 5156BP or Eveready No. 768; C2, Burgess No. 2370 or Eveready No. 771; A3, 6 Burgess No. 6 or Eveready No. 7111 dry cells; B4, 2 45-volt Burgess No. 10308 or Eveready No. 770; B5, 2 22½-volt Burgess No. 2156 (or 2158) or Eveready No. 779.

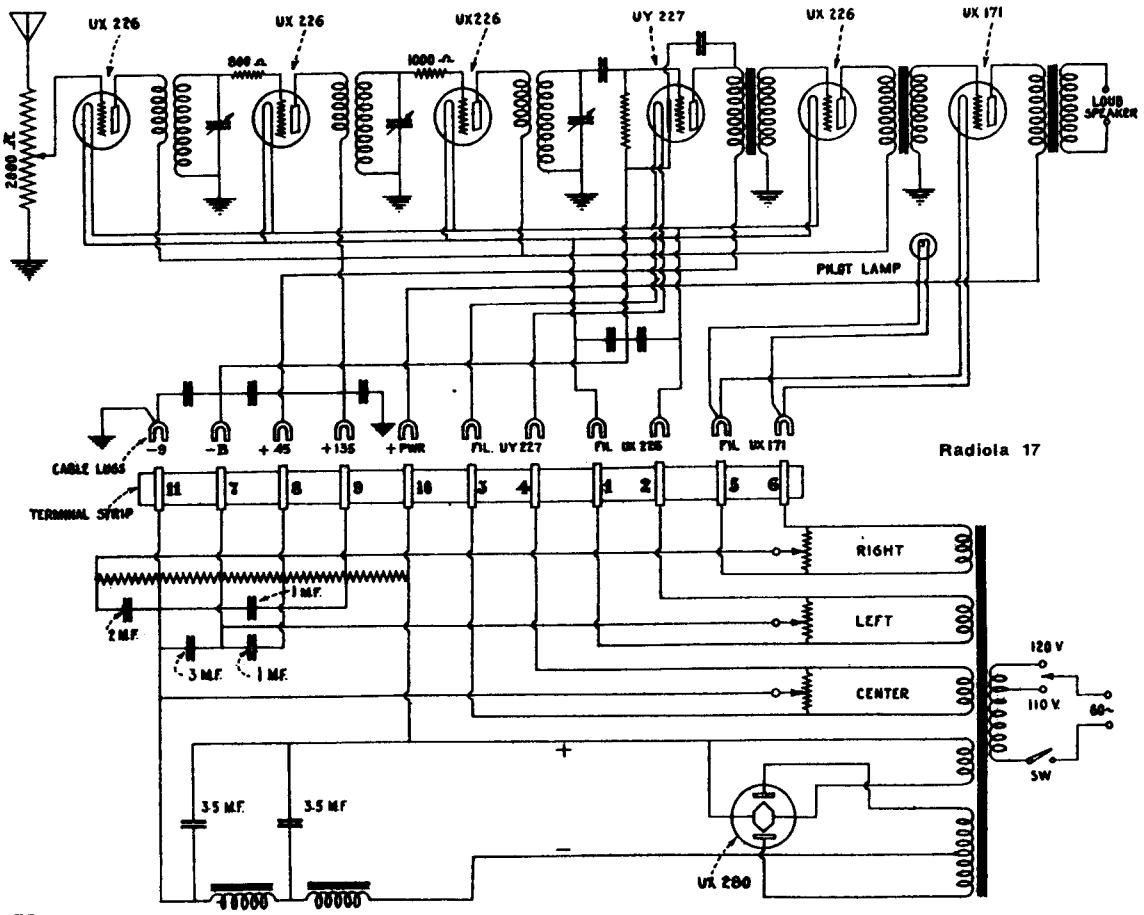
By plugging into the socket of V5 or V6 a dummy tube base, to the grid-prong of which is soldered a lead wire, it is possible to couple through T1 or T2 the output of V4 or V5 to an external power amplifier of any type, such as push-pull '45s.

The fixed condensers shown in the schematic circuit are, except for C13, within the "cat." non-replaceable, and have values which are not available here.



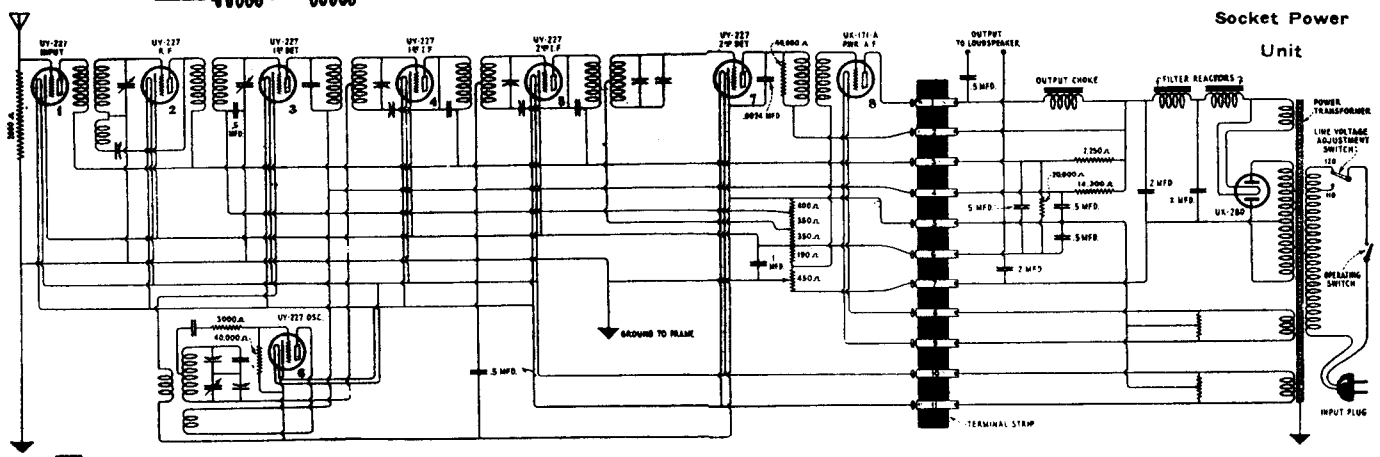

R.C.A.-VICTOR CO.
REPRODUCER UNIT
CONE COIL
FIELD COIL
BLUE
GREEN
BROWN
MAROON
BLUE
BROWN
BLUE
BLACK
GREEN
RED
YELLOW
BROWN
DISTANT
LOCAL
ANTENNA LOADING COIL
.00023 MFD.
1ST R.F. UX-222
GANG CONDENSERS
2ND R.F. UX-222
GRID LEAK 2-4 MEG.
.00016 MFD. "C"
DET. UX-112-A
1ST A.F. TRANSFORMER
"G" .0012 MFD.
PILOT LAMP
.2 MFD.
.1 MFD.
.1 MFD.
.2 MFD.
.1 MFD.
.1 MFD.
1.0 MFD.
25Ω
11Ω
14Ω
6.5Ω
.1 MFD.
CENTER TAPPED DETECTOR FILAMENT RESISTOR 585Ω
PILOT LAMP RESISTOR 40Ω
R.F. FIL. AND CONTROL GRID BIAS RESISTOR
GROUND LEADS. (ALL OTHER GROUND CONNECTIONS ARE CONNECTED TO FRAME)
RADIOLA 46 D.C.
VOLUME CONTROL 50,000Ω
-18
-12
EXTERNAL "C" BATTERY
PLUG TO D.C. LINE (107.5 TO 127.5 VOLTS)
BLACK
GREEN
RED AND GREEN
BLACK
MAROON
RED AND GREEN
GREEN
BLUE
MAROON AND RED
BLACK
BLACK
BUS
GREEN
RED
BLACK
BLACK AND BROWN
OUTPUT TRANSFORMER
1ST A.F. UX-112-A
PUSH PULL INTERSTAGE TRANSFORMER
TAPPED FILAMENT BY-PASS RESISTOR (R2)
195Ω
165Ω
110Ω
2ND A.F. IN PUSH PULL 2 UX-171-A's
LINE VOLTAGE RESISTOR (R1)
16Ω 16Ω 16Ω
115V 120V.
110 V. 125 V
"C" .00016 MFD.
FIL. BY-PASS RESISTOR (R2)
1190Ω
1925Ω 2250
PLATE SUPPLY RESISTOR (R3)
28Ω
200Ω
FILTER REACTORS
2.0 MFD.
3.0 MFD.
268Ω TOTAL
SERIES FILAMENT RESISTORS
LINE VOLTAGE REGULATING SWITCH
DISCONNECT SWITCH (SOME MODELS ONLY)
R.F. LINE INDUCTOR (1.5Ω)
0.5 MFD.
0.5 MFD.
DOUBLE POLE SINGLE THROW OPERATING SWITCH
R.F. LINE INDUCTOR (1.5Ω)
RADIOLA 46 D.C.
VOLUME CONTROL
THREE-GANG TUNING CONDENSER
COUPLING UX-226
1ST TUNED R.F. UX-226
2ND TUNED R.F. UX-226
DETECTOR UY-227
.0012 MFD.
1ST A.F. UX-226
PWR. A.F. UX-171-A
OUTPUT
.5 MFD.
OUTPUT CHOKE
FILTER REACTORS
POWER TRANSFORMER
30,000Ω
15,000Ω
.00016 MFD.
.5 MFD.
.1 MFD.
DETECTOR TRIMMING CONDENSER
R.F. COMPENSATING CONDENSER
1600Ω
1 MFD.
1 MFD.
UX-280
PILOT LAMP
1900Ω
110 VOLT LEAD
OPERATING SWITCH
440Ω
.1 MFD.
A.C. INPUT PLUG
RADIOLA 33

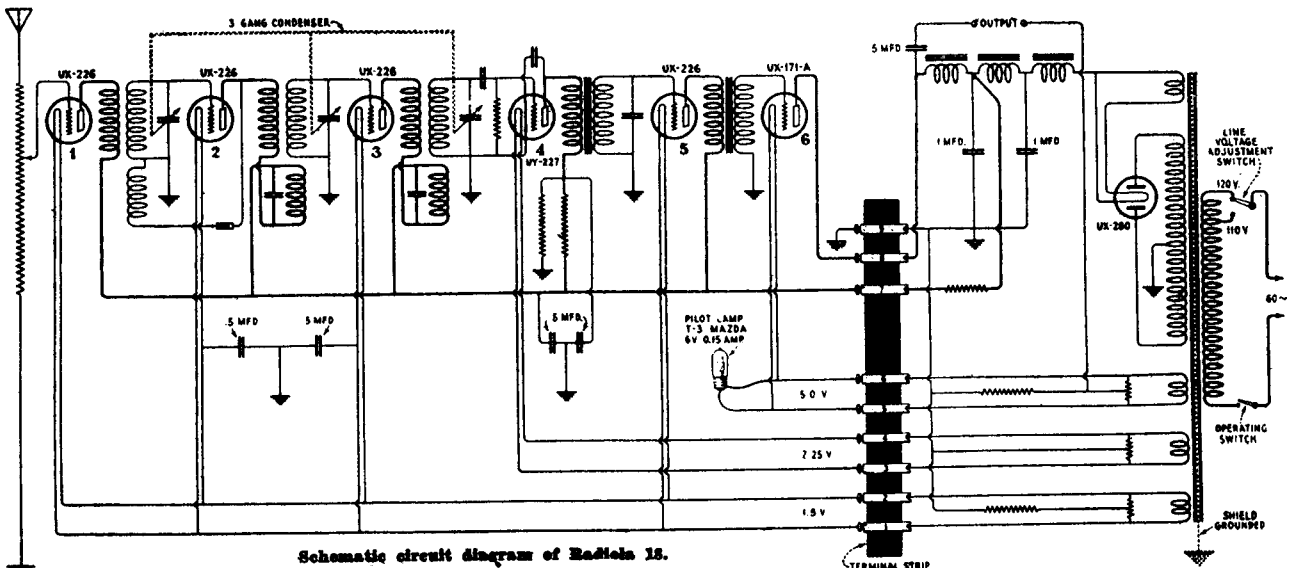
R.C.A-VICTOR CO.



Radiola 17

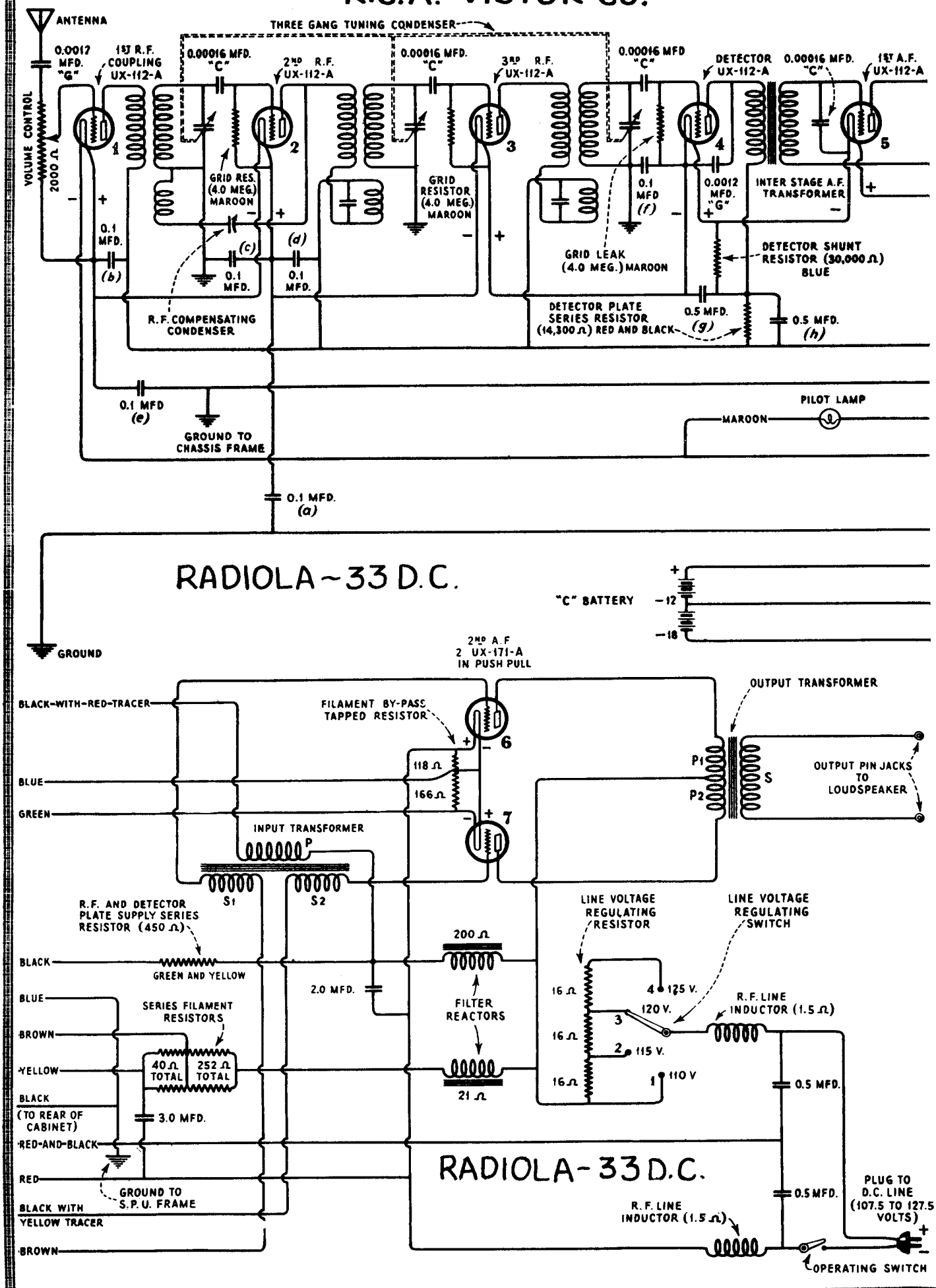
(Below)
Schematic Circuit Diagram of Radiola 60 and Socket Power Unit



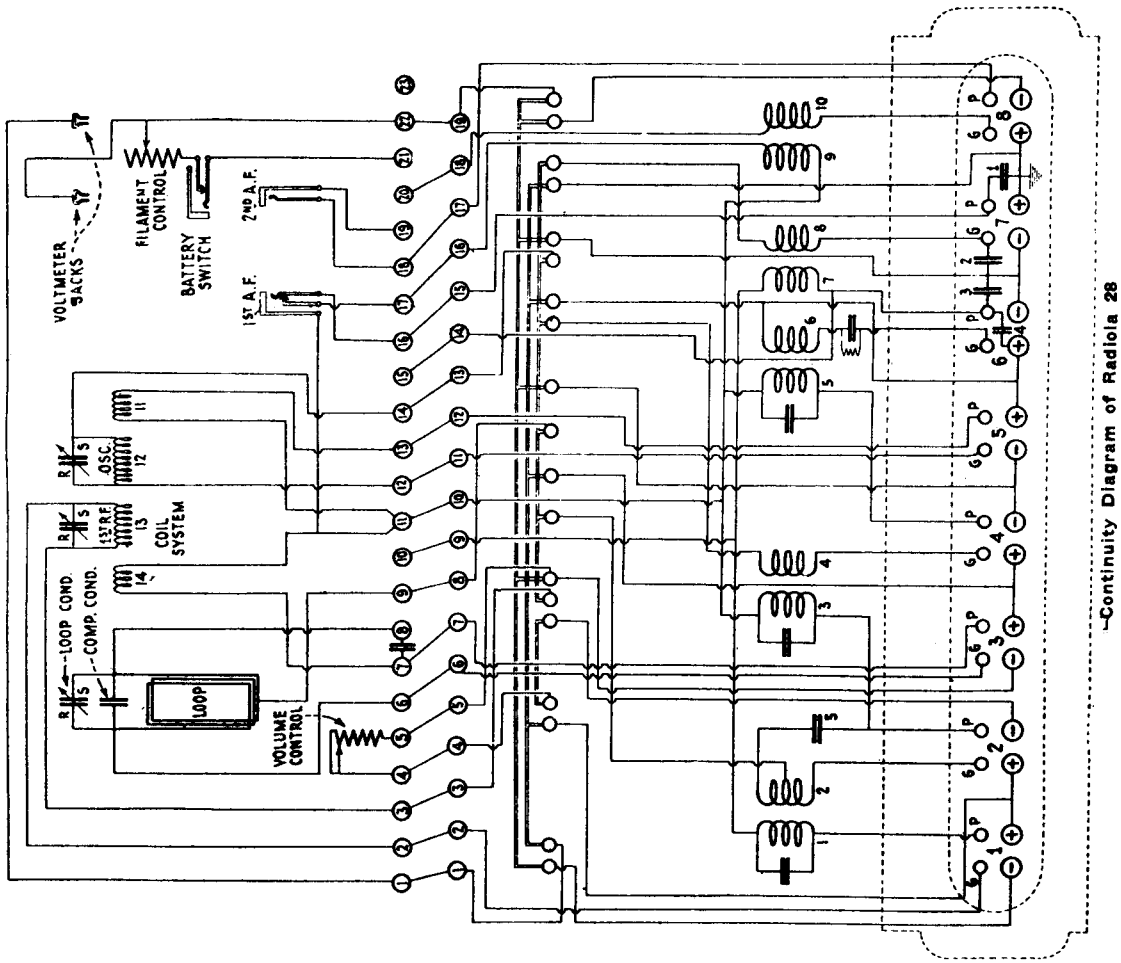


Schematic circuit diagram of Radiola 18.

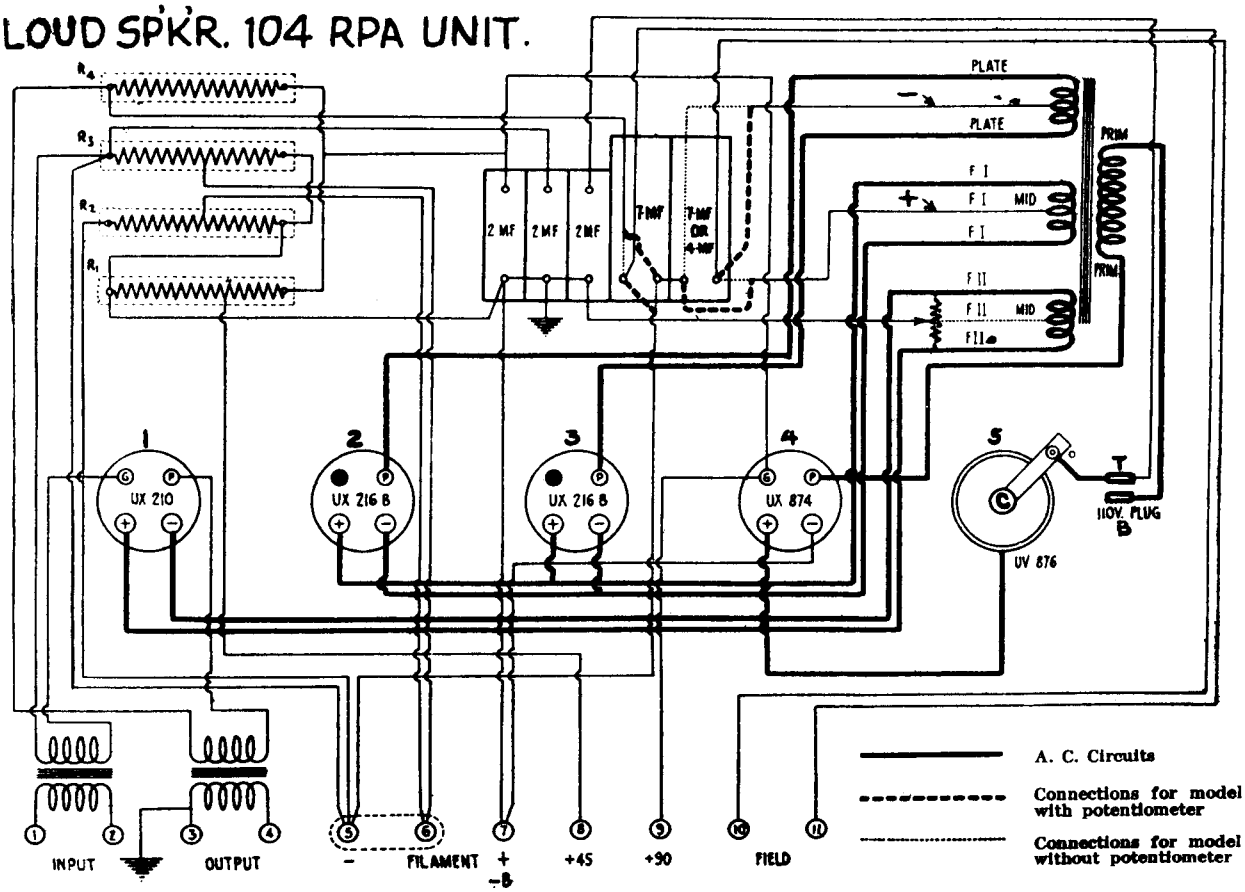
R.C.A.-VICTOR CO.



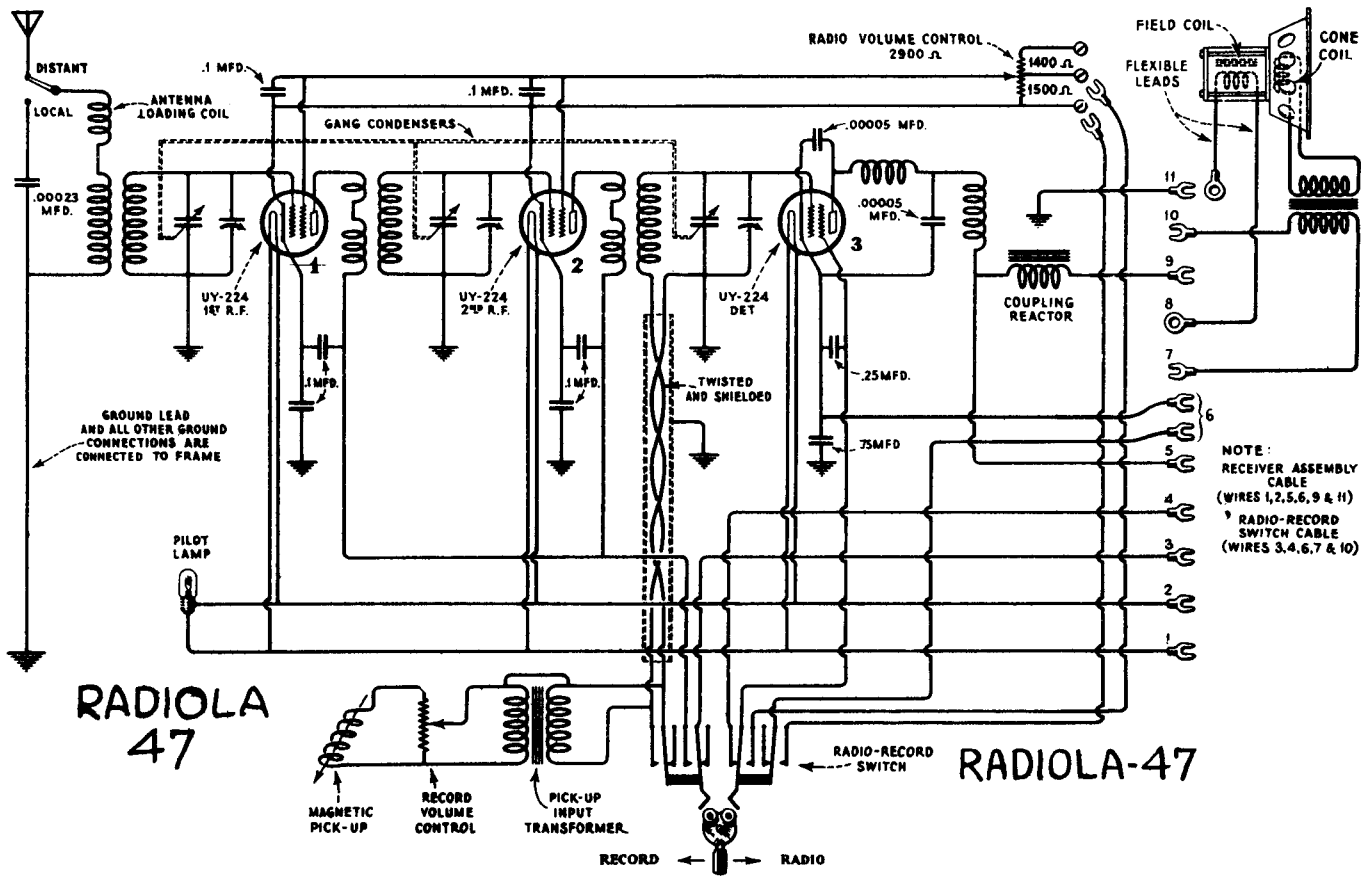
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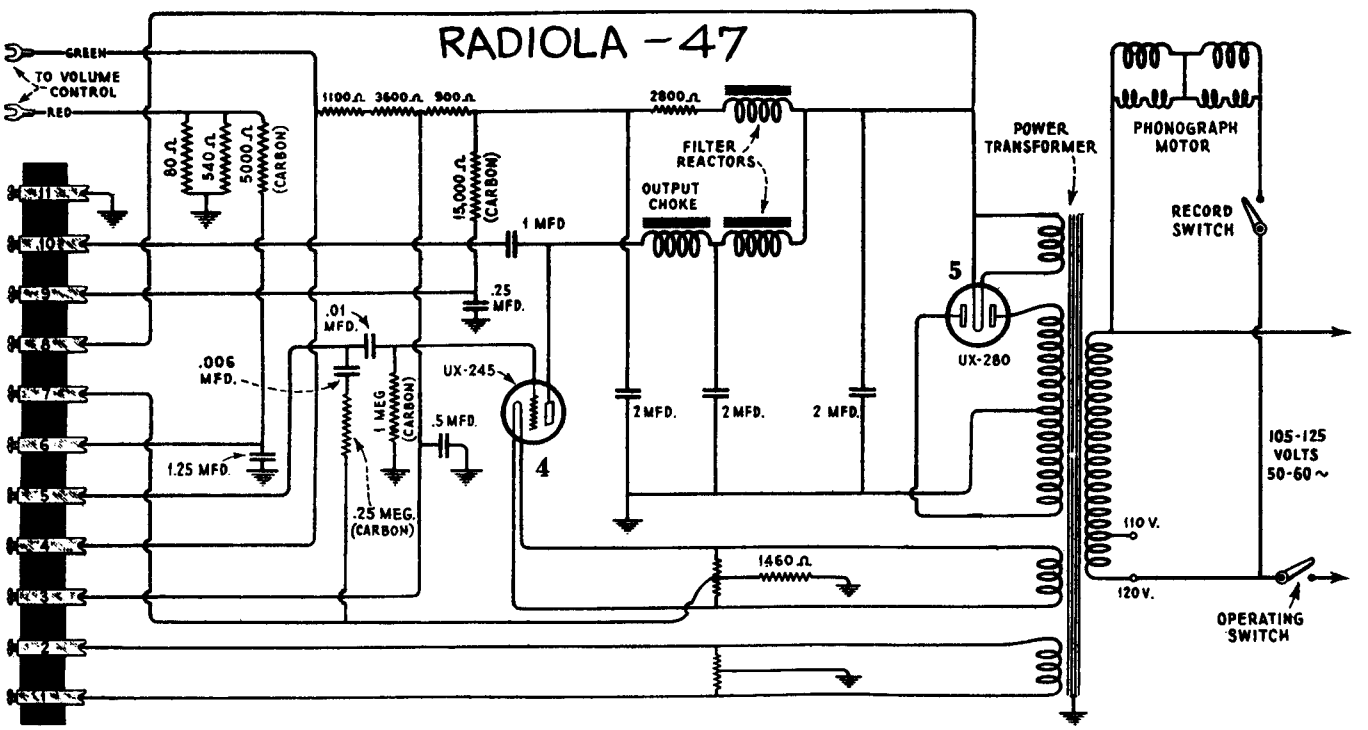


LOUD SP'KR. 104 RPA UNIT.

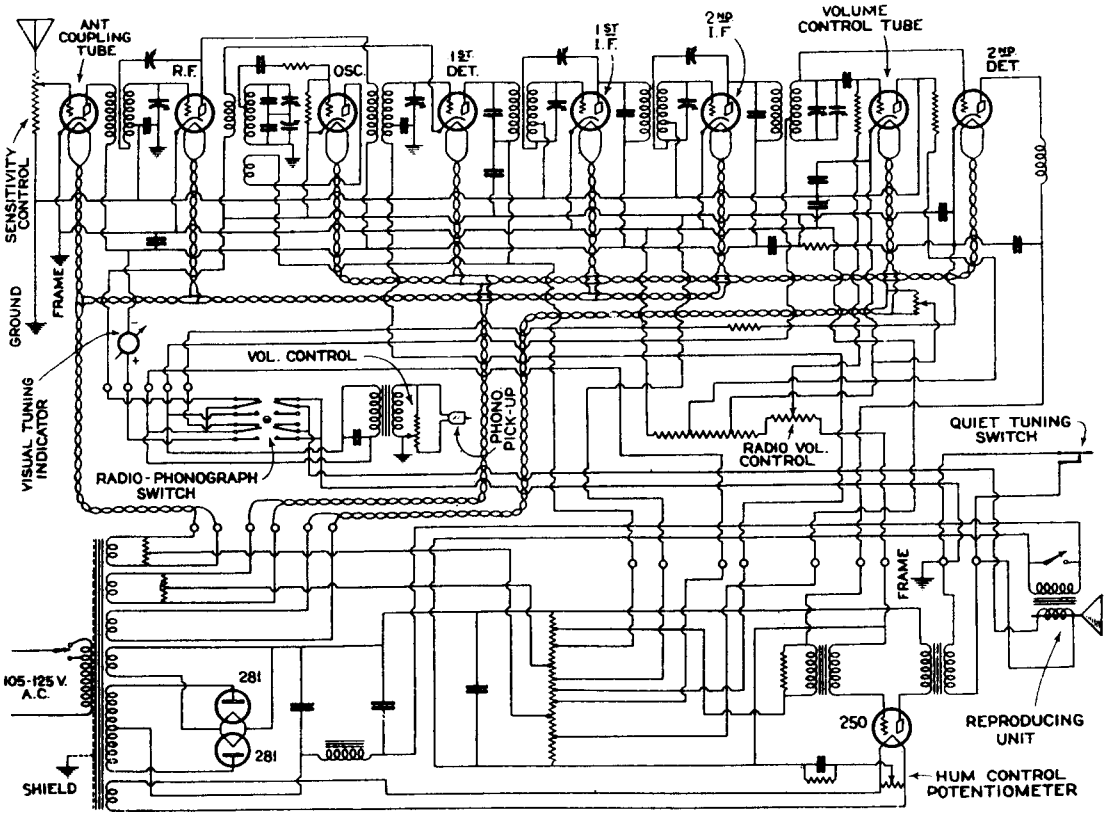


R.C.A:VICTOR CO.

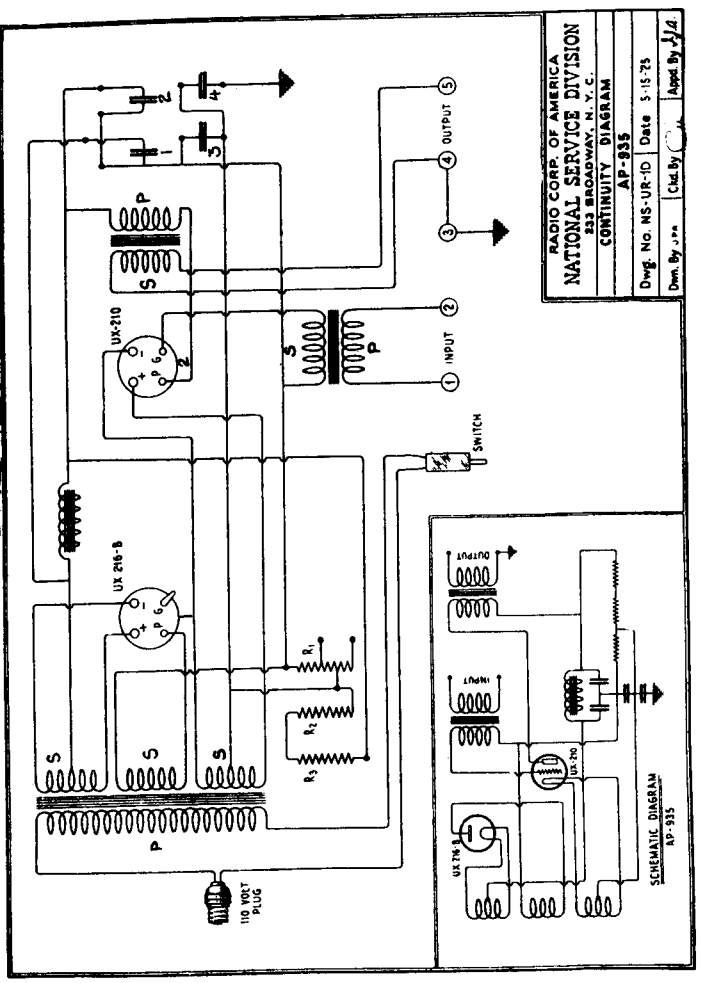


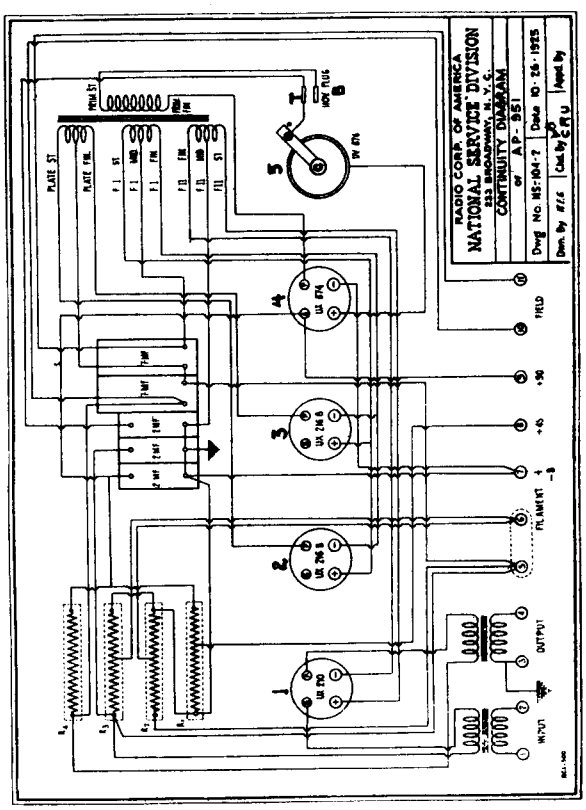


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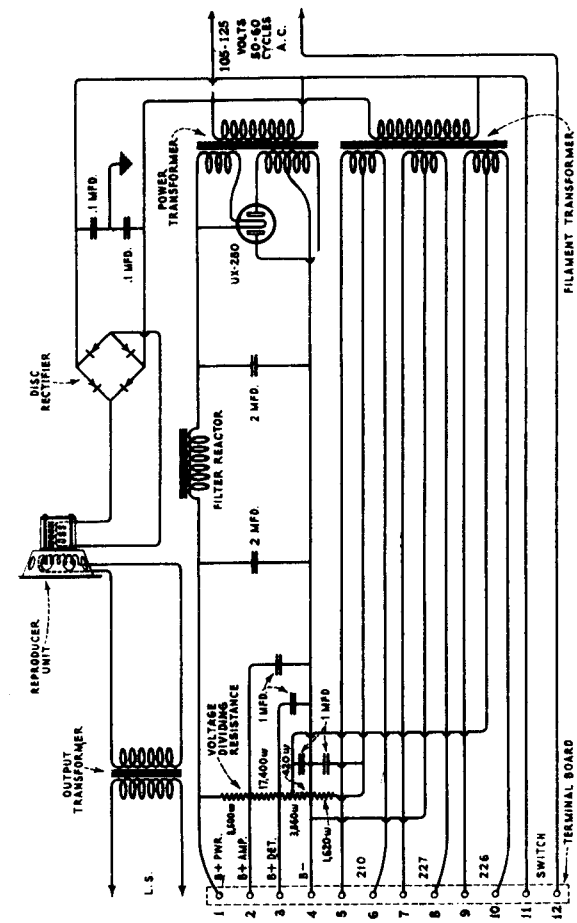


Schematic diagram of the Radiola 64. A. C. Super-Heterodyne Receiver.

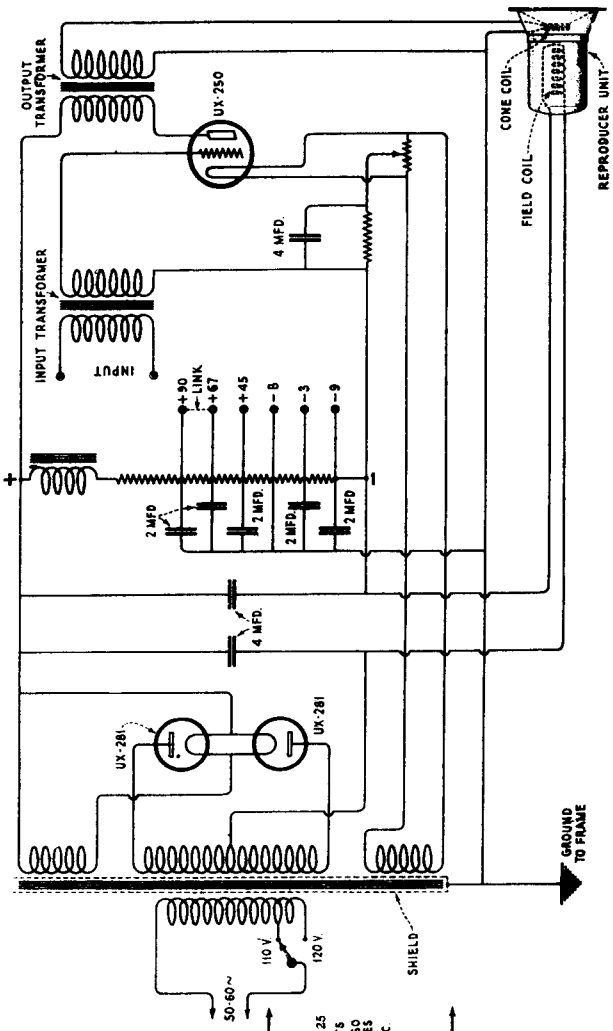




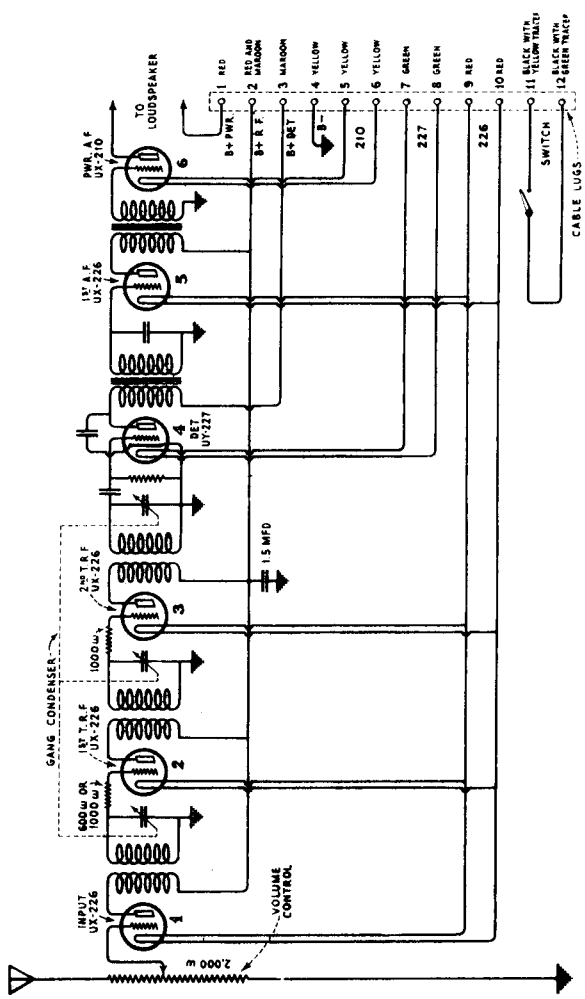
R.C.A.-VICTOR CO.



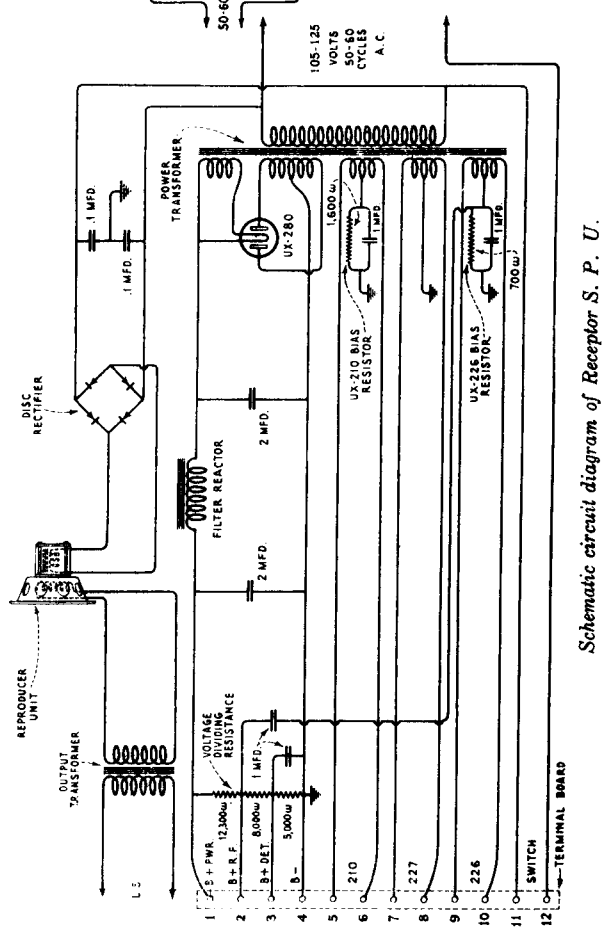
Schematic circuit diagram of Sterling S. P. U.



Schematic circuit diagram of RCA Loudspeaker 105.

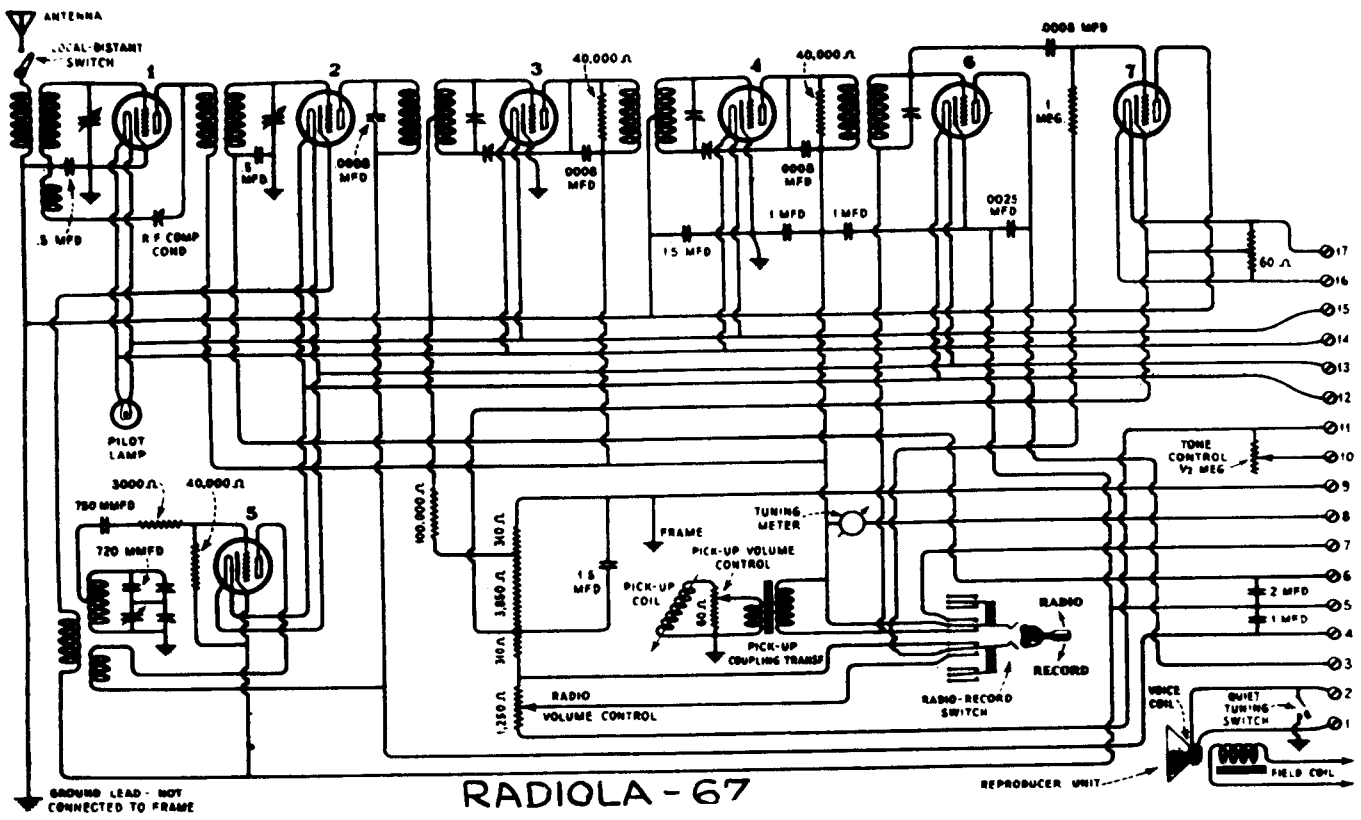


Schematic circuit diagram of the receiver assembly in Radiola 41

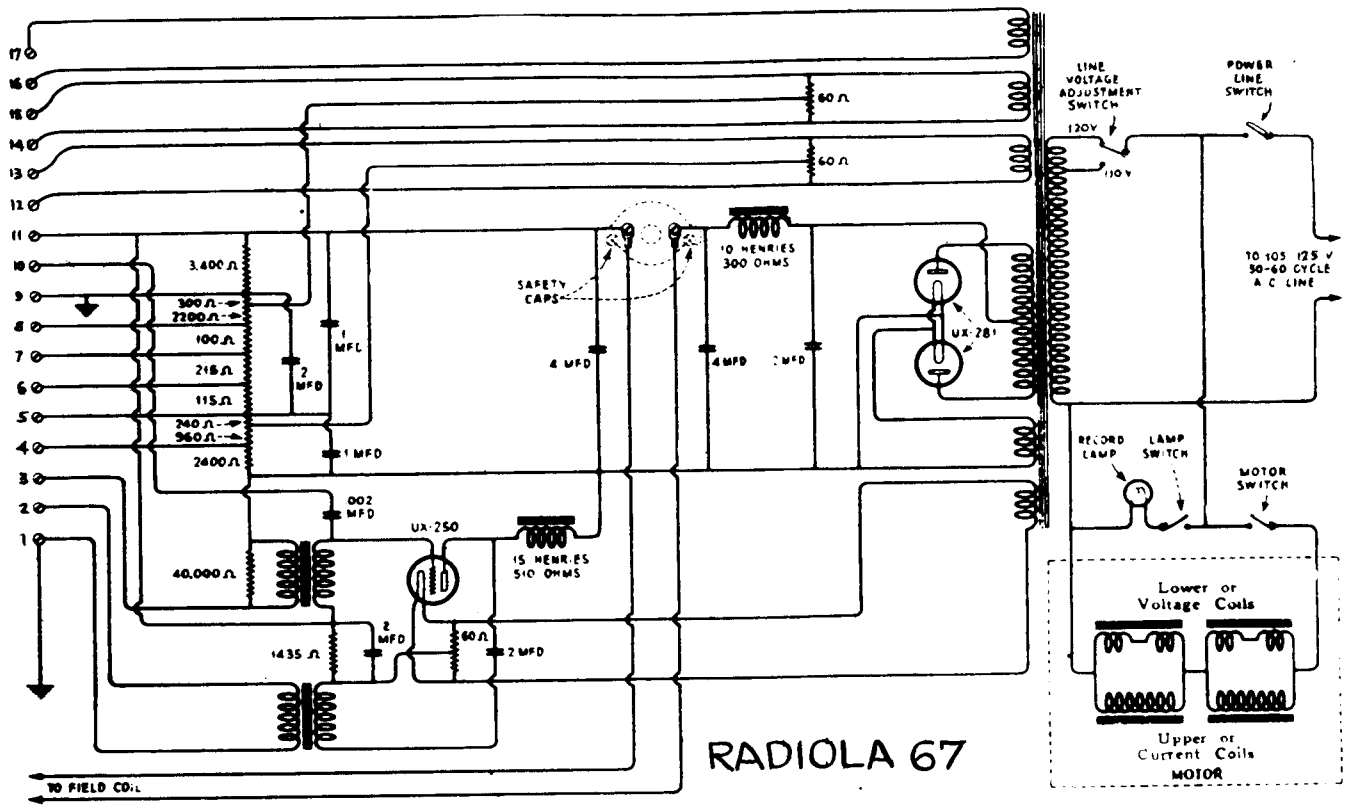


Schematic circuit diagram of Receptor S. P. U.

R.C.A.-VICTOR CO.

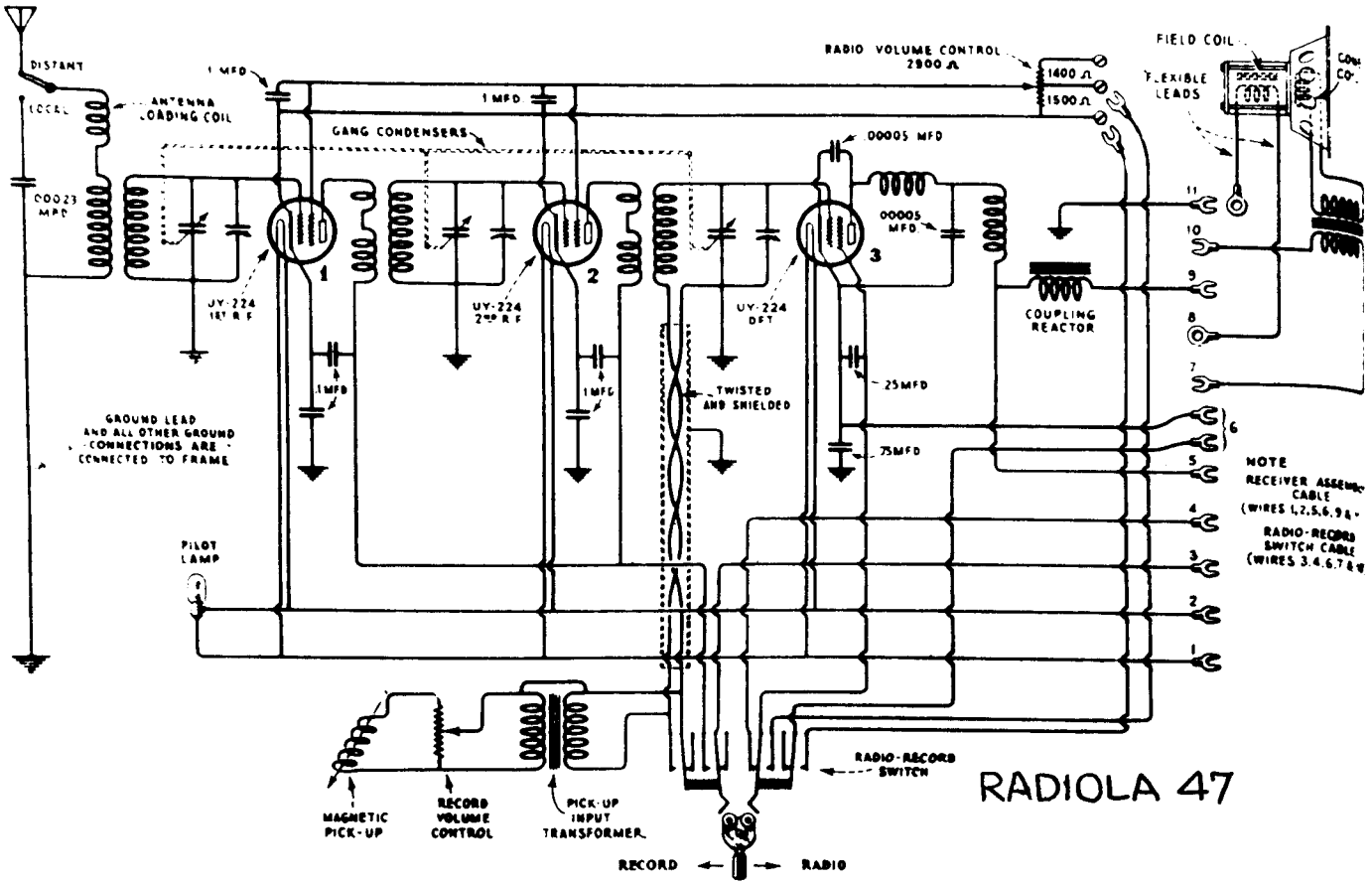


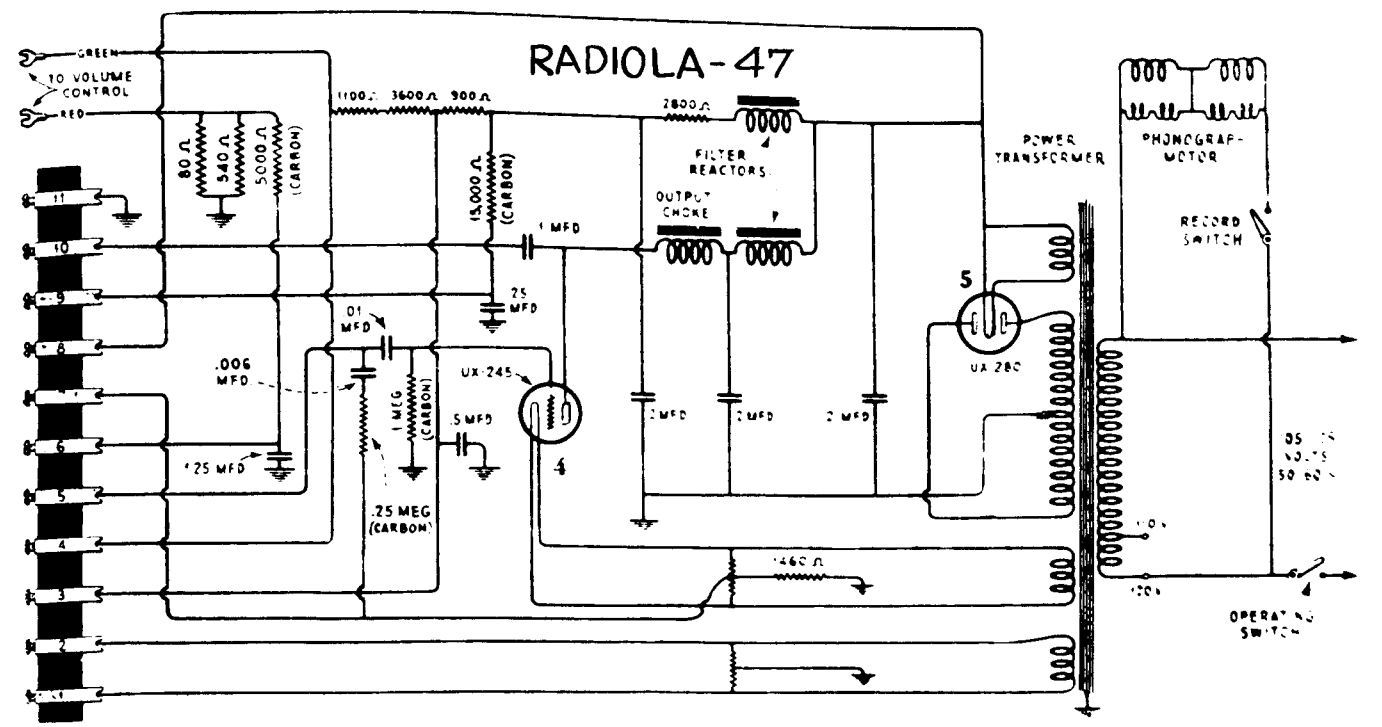
RADIOLA - 67



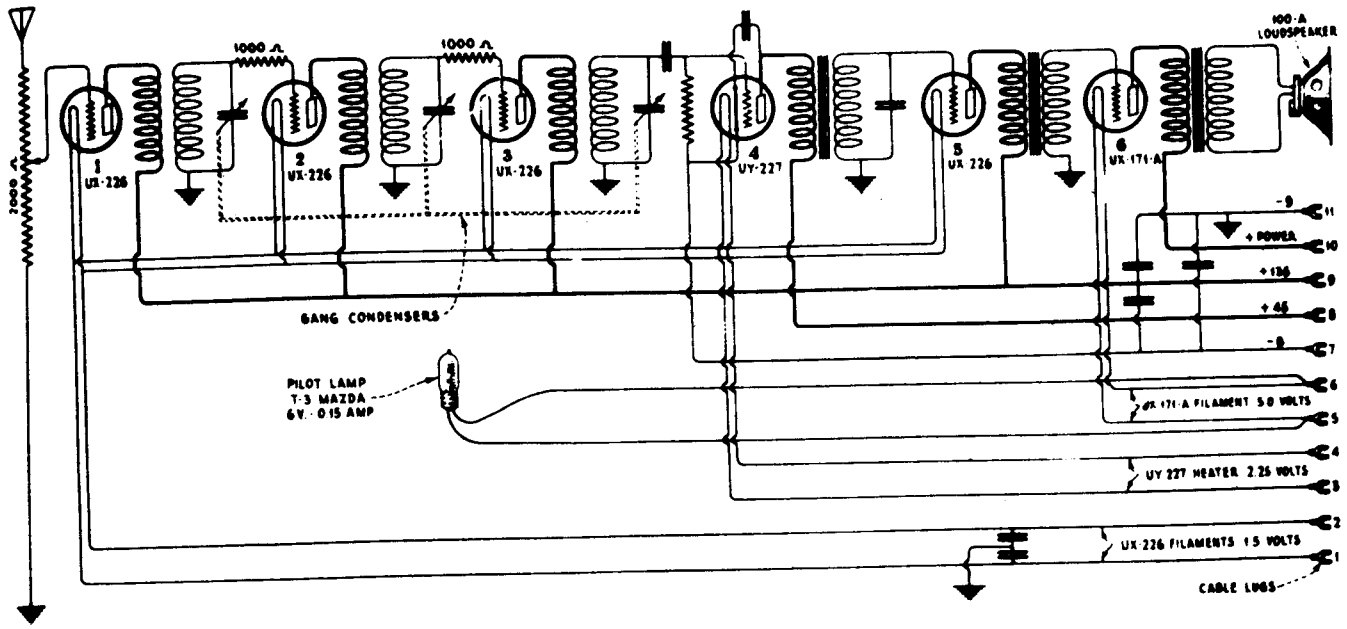
RADIOLA 67

R.C.A.-VICTOR CO.

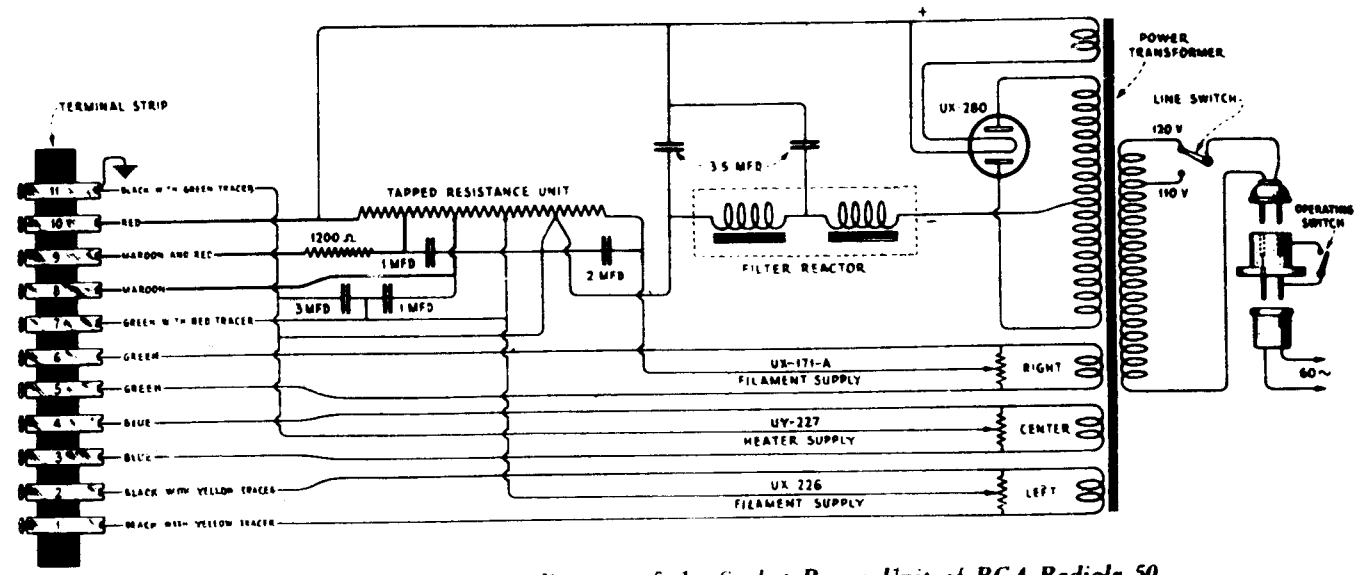




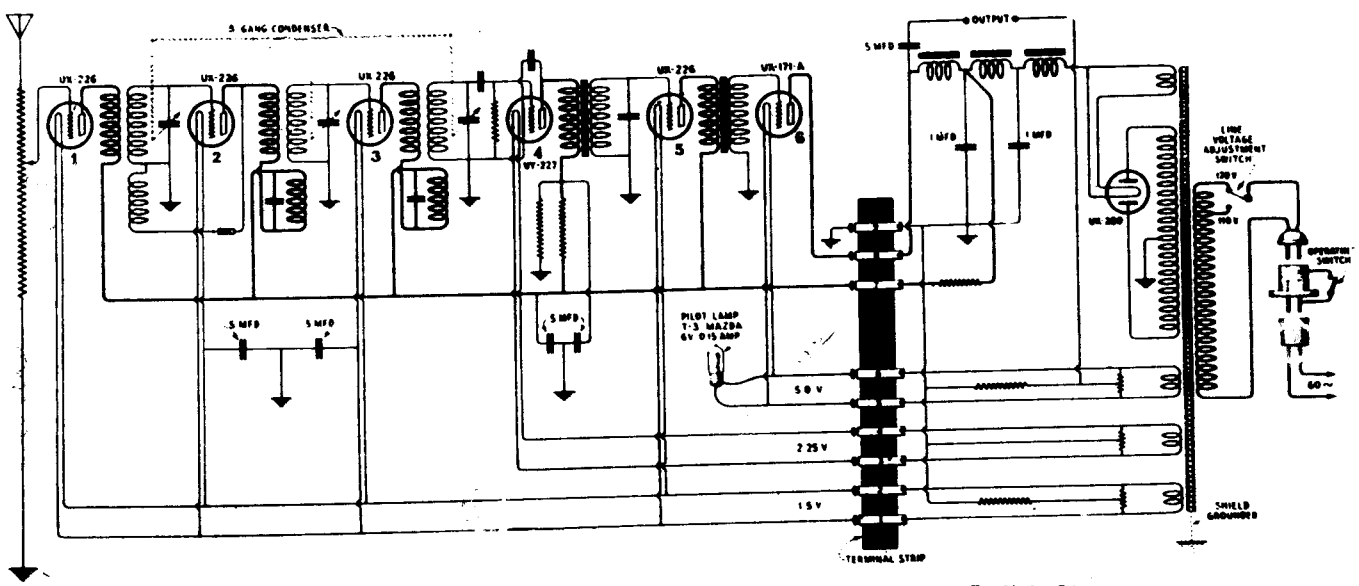
R.C.A.-VICTOR CO.



Schematic circuit diagram of the receiver assembly of RCA Radiola 50

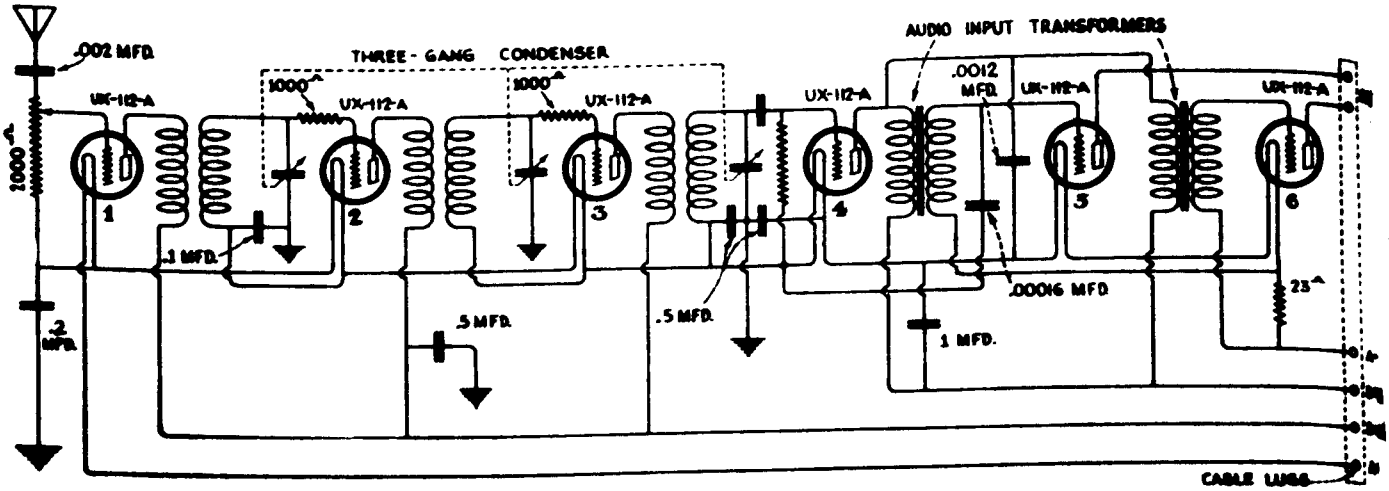


Schematic circuit diagram of the Socket Power Unit of RCA Radiola 50

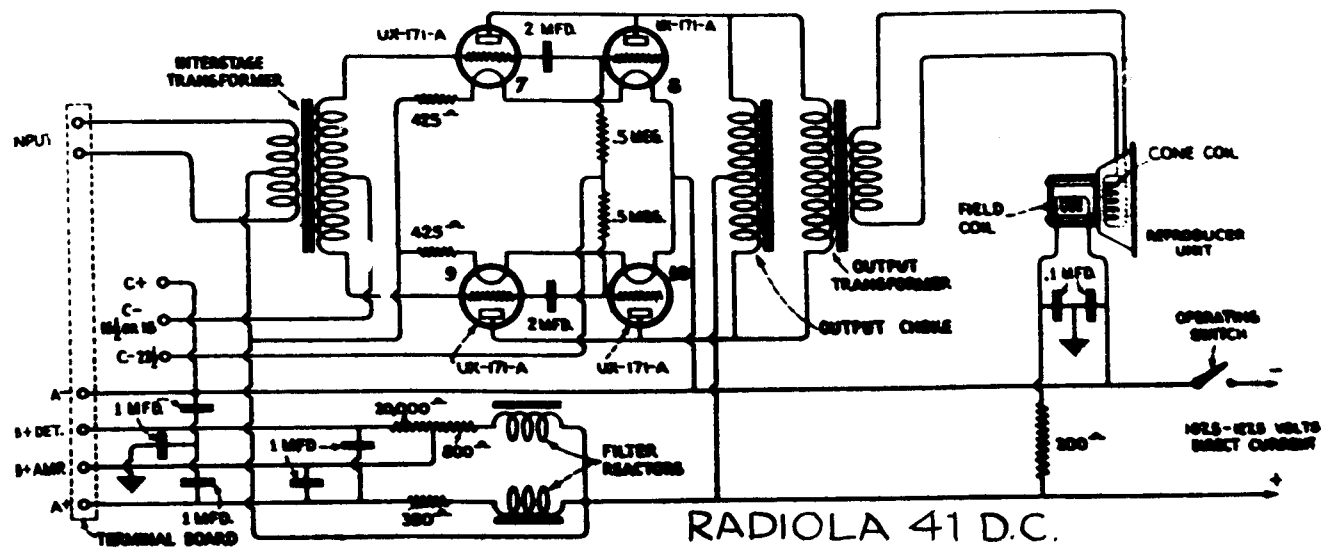


Schematic circuit diagram of the receiver and socket power unit of Radiola 51

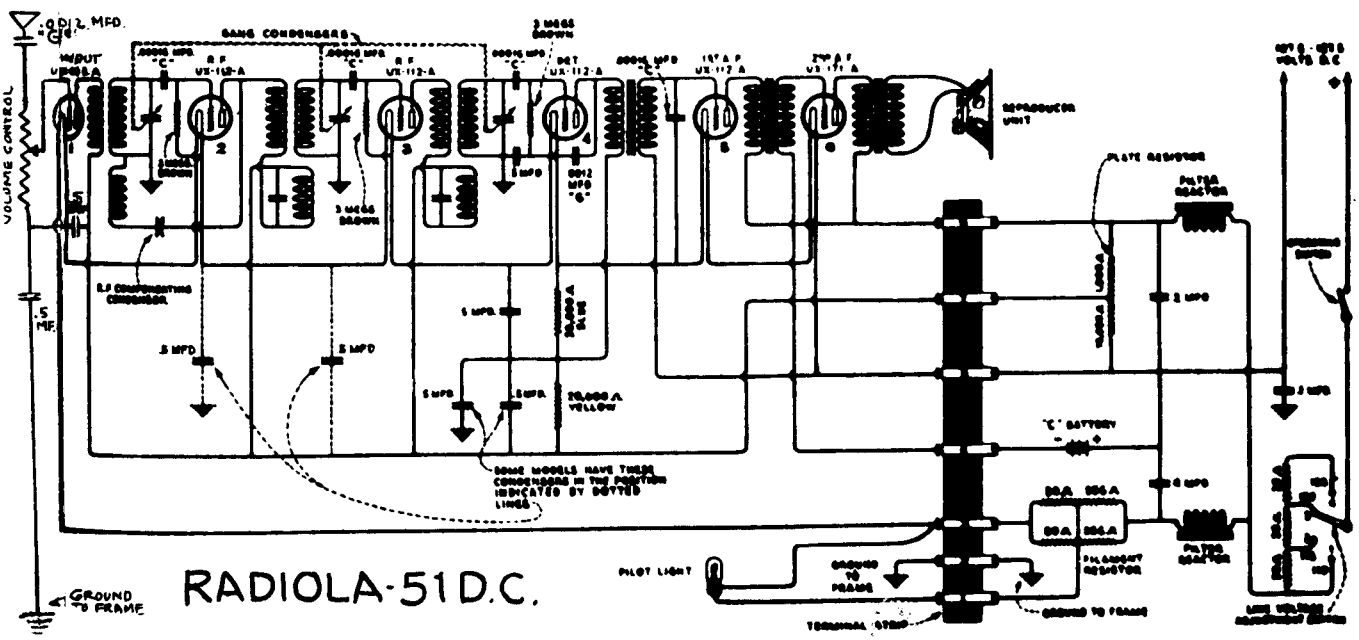
R.C.A.-VICTOR CO.



RADIOLA 41 D.C.

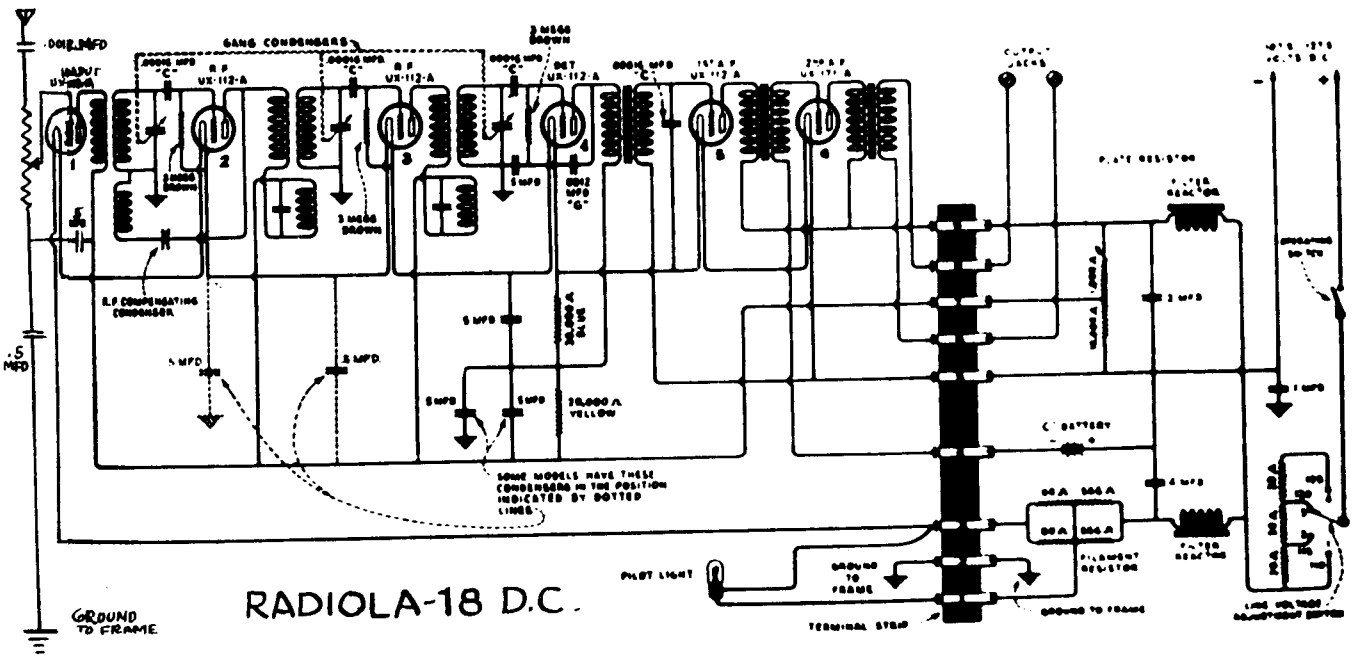


RADIOLA 41 D.C.

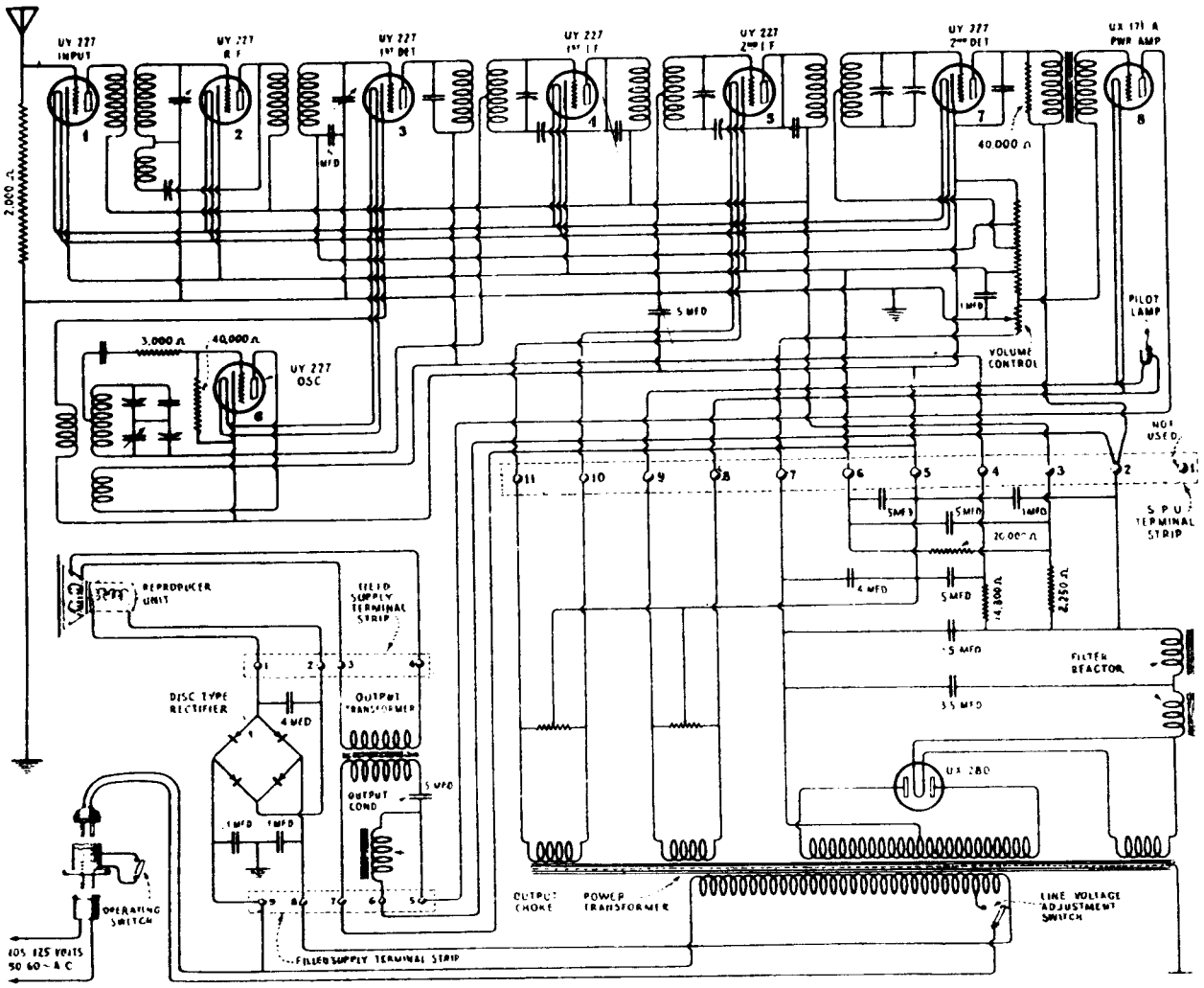


RADIOLA-51D.C.

R.C.A.-VICTOR CO.

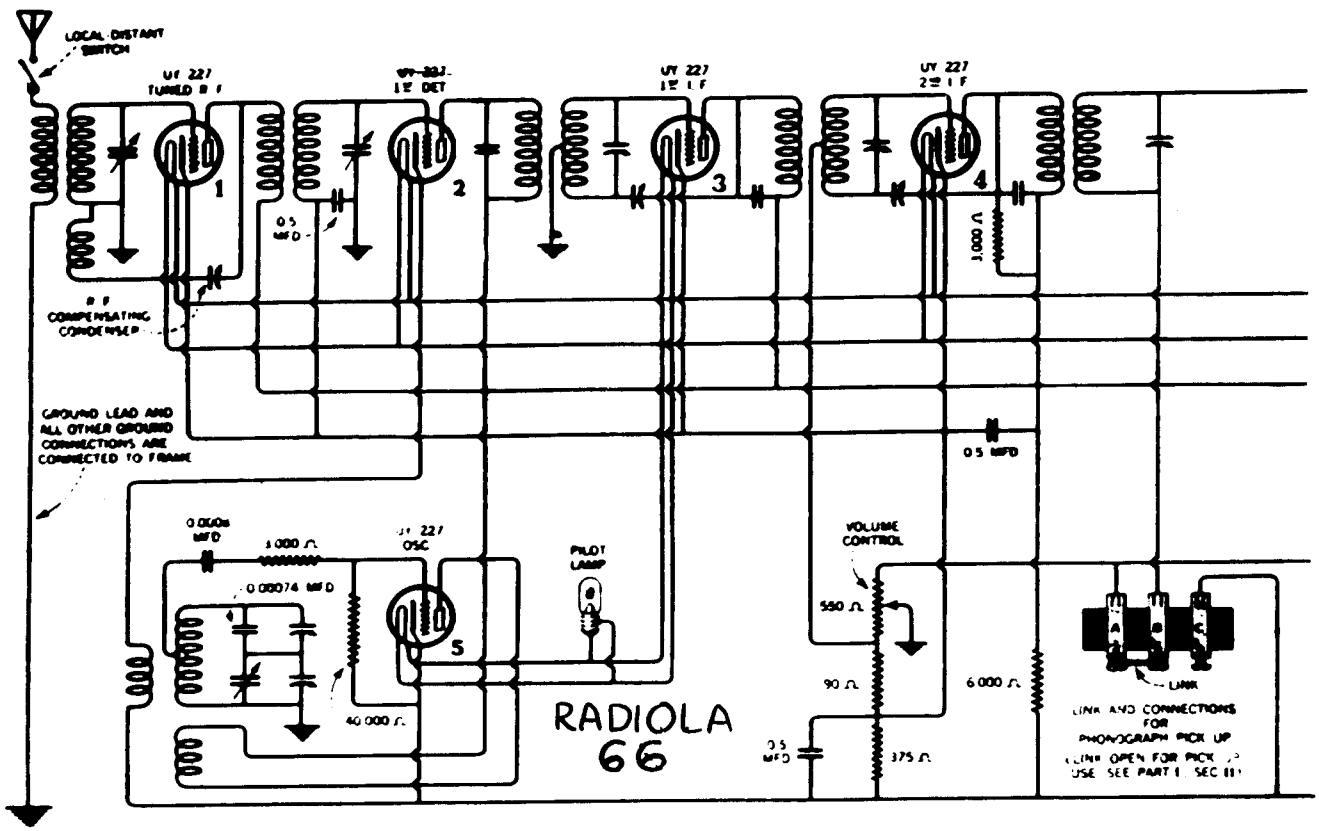


RADIOLA-18 D.C.

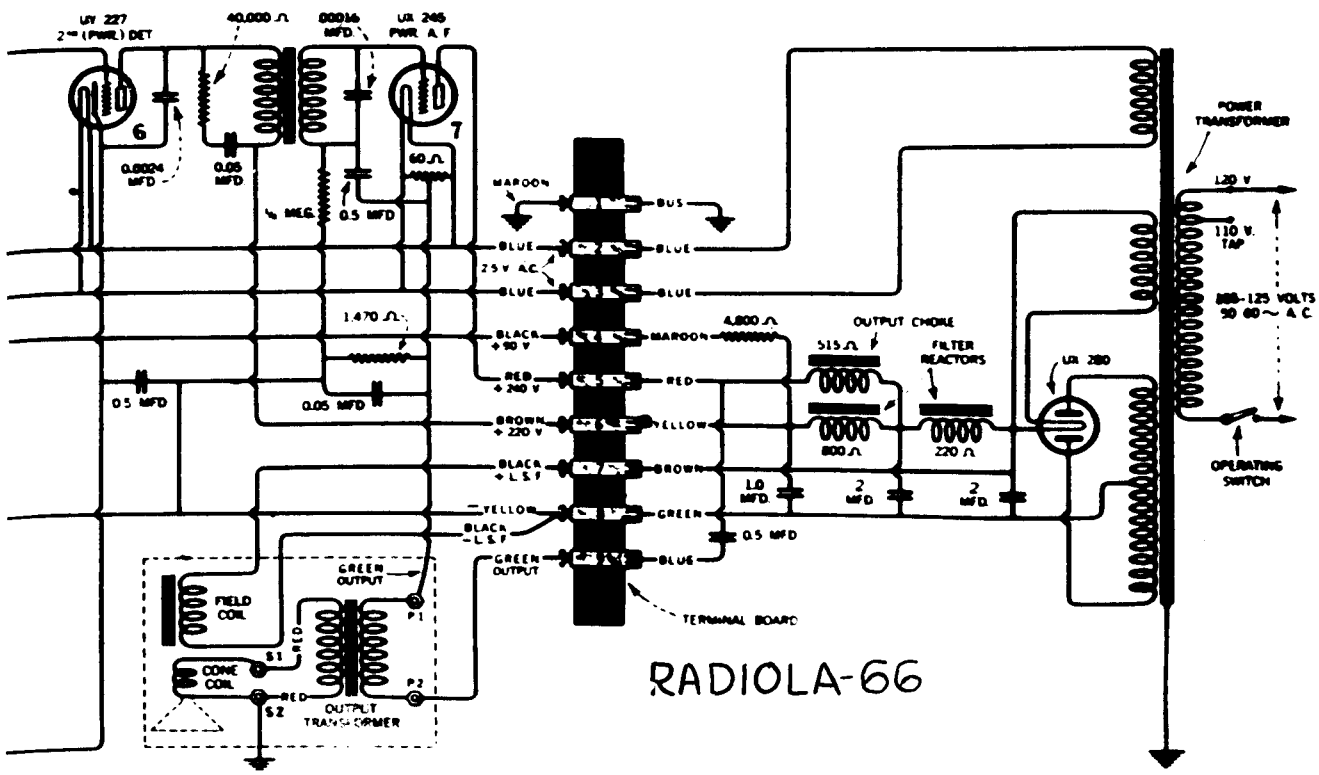


RADIOLA-62

R.C.A.-VICTOR CO.

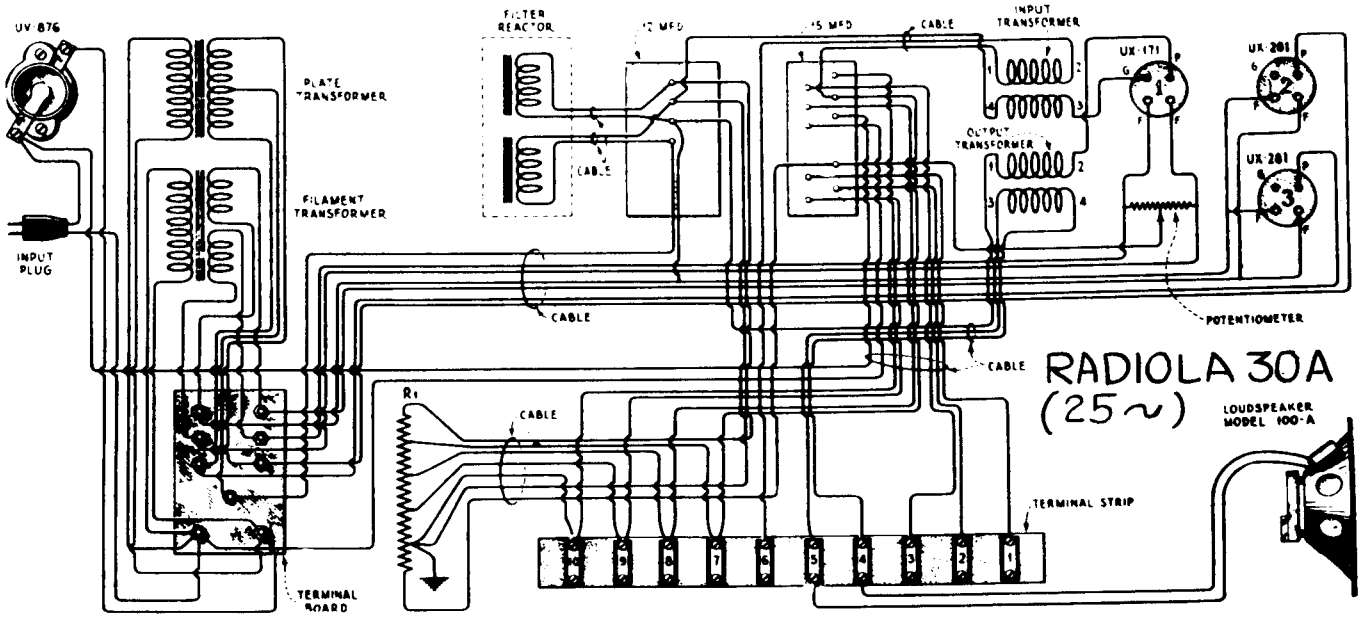


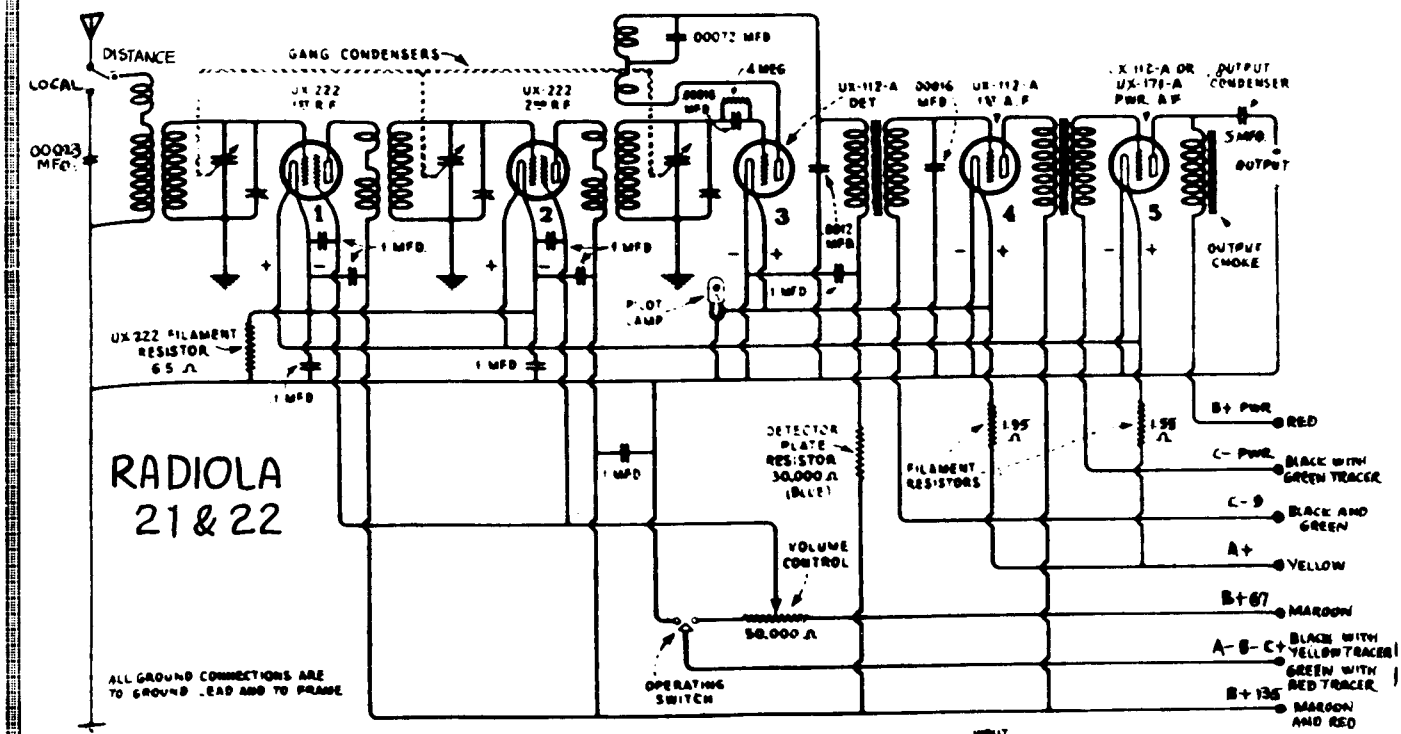
RADIOLA 66

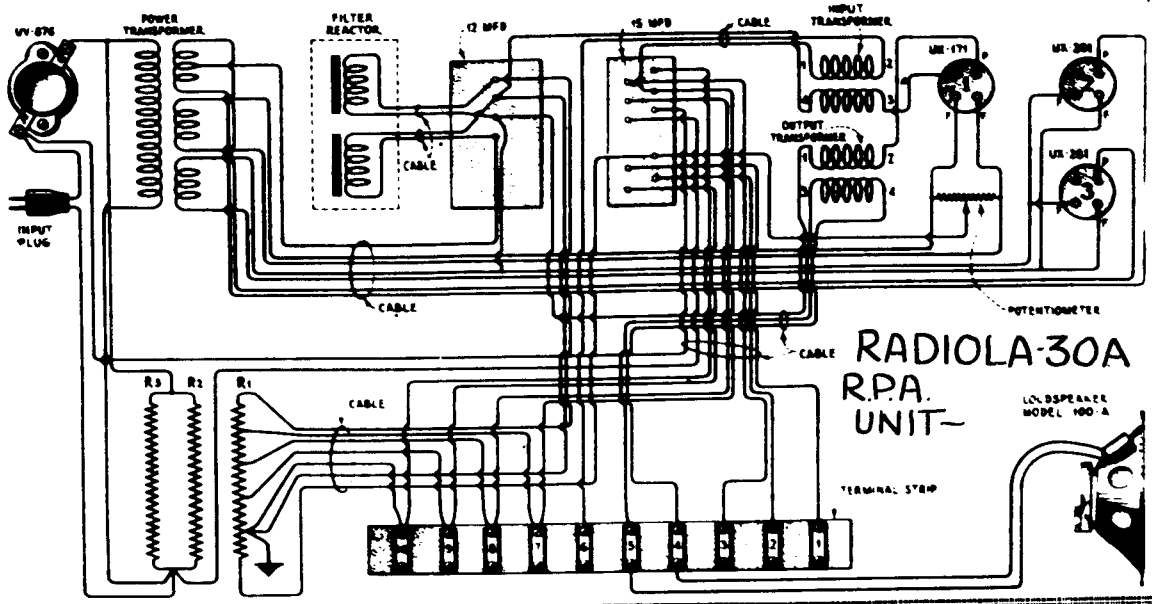


RADIOLA-66

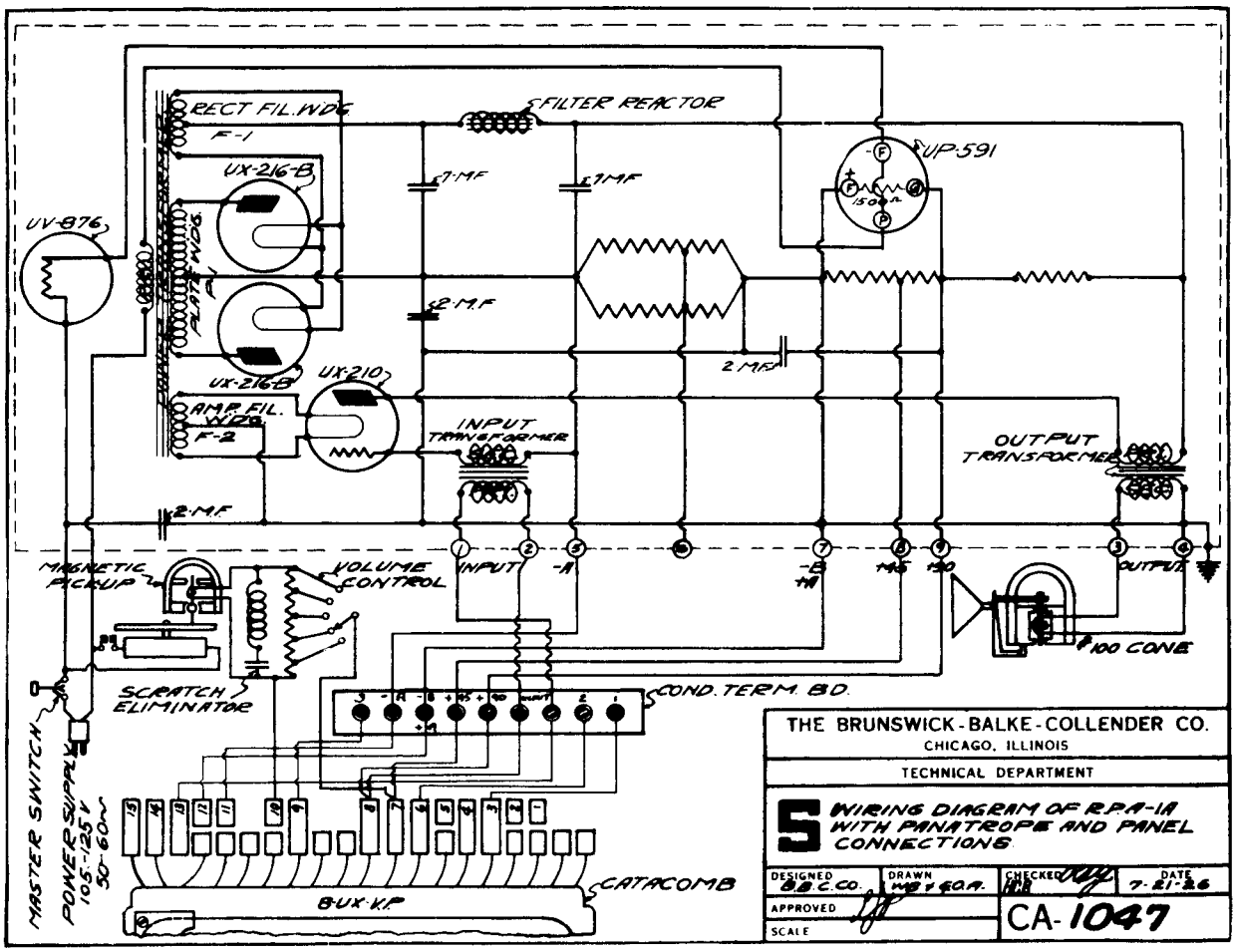
R.C.A.-VICTOR CO.

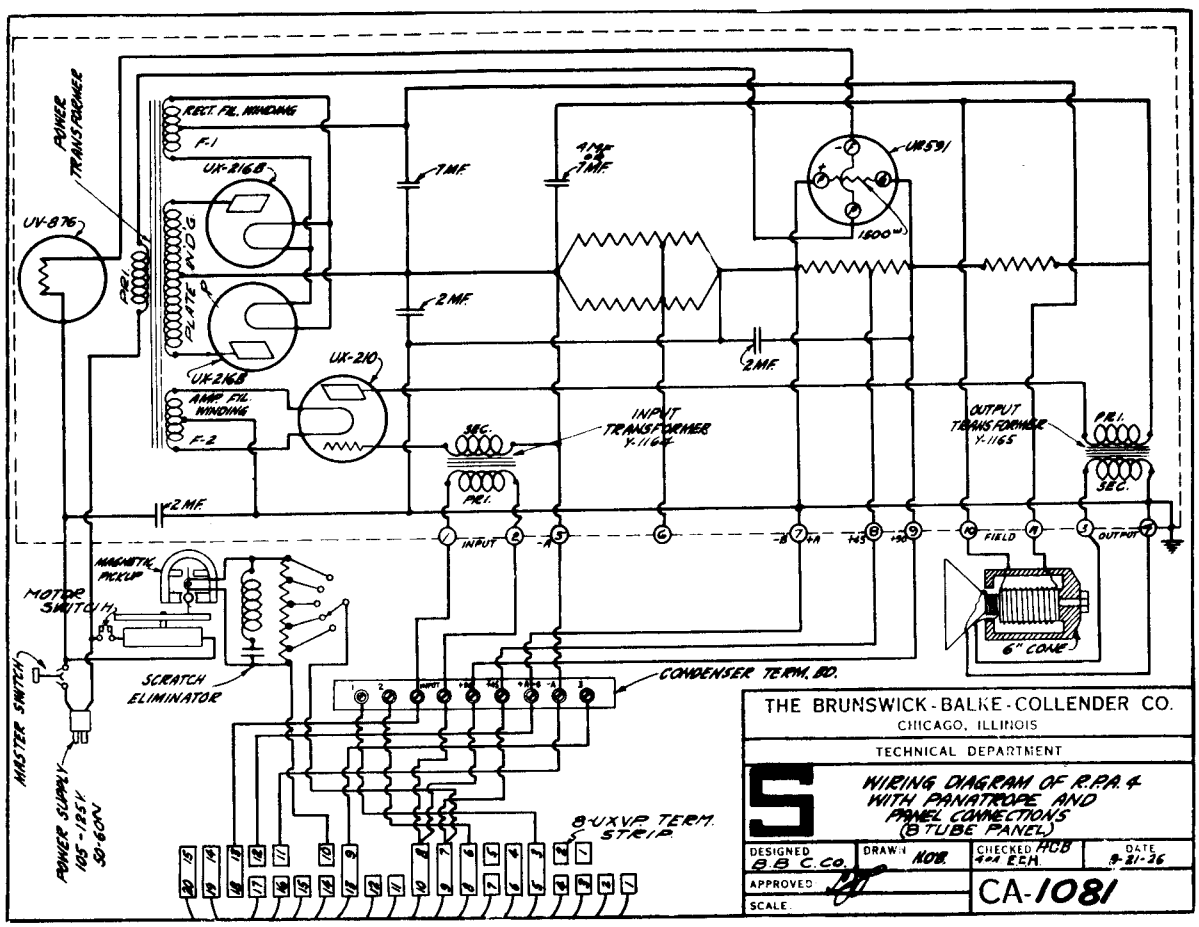




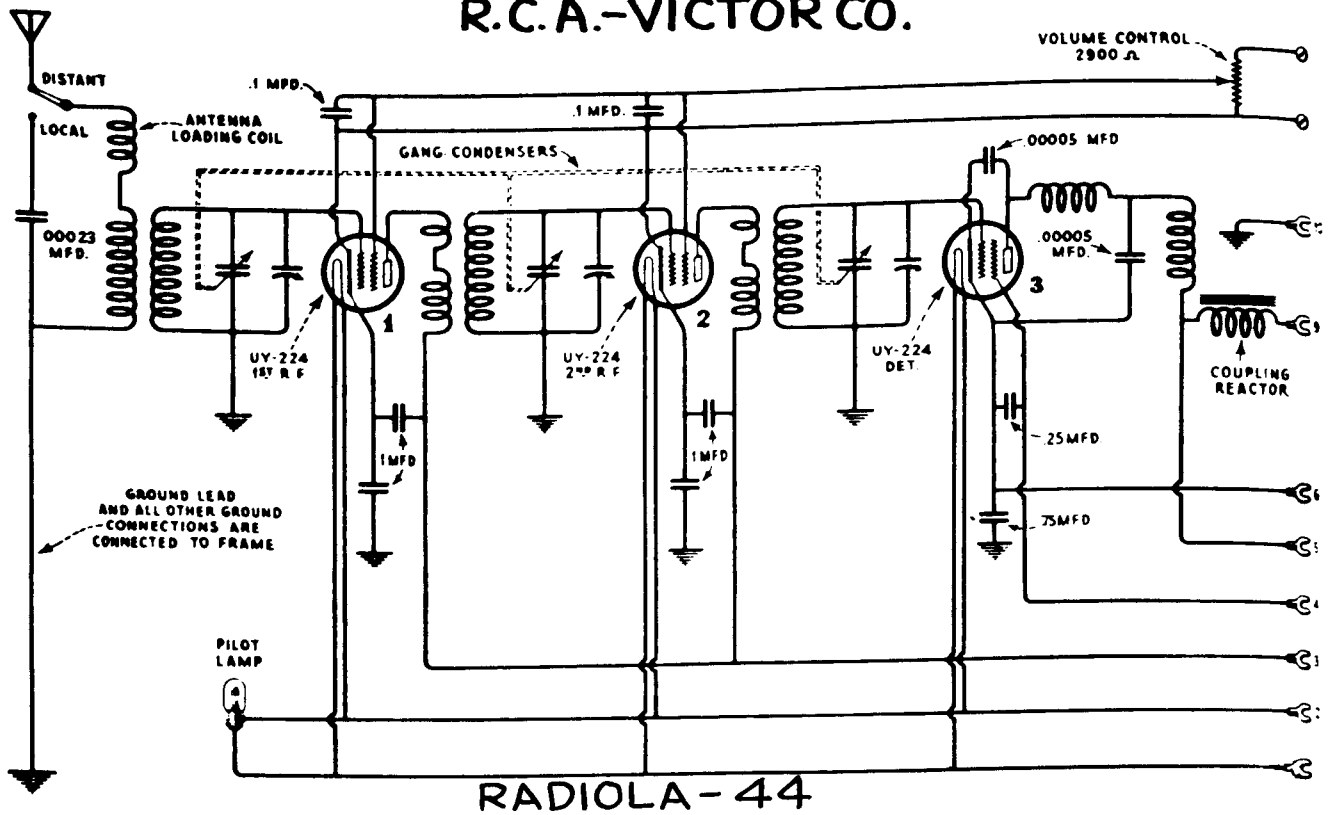


R.C.A.-VICTOR CO.

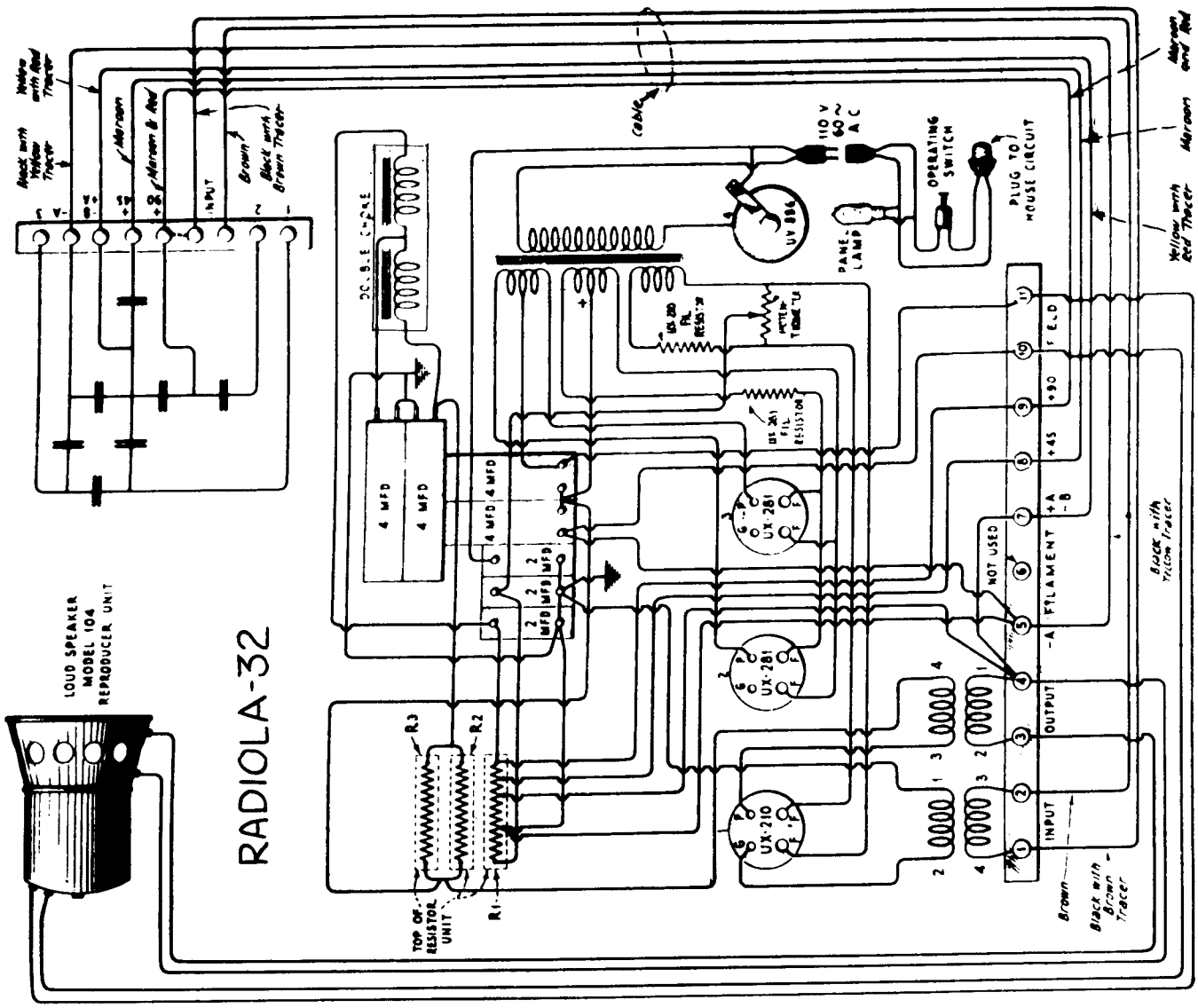




R.C.A.-VICTOR CO.



RADIOLA-44



RADIOLA-32

Radio Service Data Sheet

RADIOLA-VICTOR R 80—WESTINGHOUSE WR5—GRAYBAR 700—GENERAL ELECTRIC H-31

In the diagram is shown what might be termed the "foundation chassis" of a number of superheterodyne receivers of different trade names and external designs. This is the fundamental circuit plan recently released to all the Radiola-Victor licensees.

To the experienced Service Man it will be evident that extreme care must be taken in servicing these receivers, in order to maintain perfect circuit balance.

The figures in parentheses represent the resistance of each element of the circuit. The capacity values are as follows: C1, C2, C3, C4, 18 to 330 mmf.; C5, C6, C7, C8, C9, C10, 120 to 220 mmf.; C11, 745 mmf.; C12, 4.5 mmf.; C13, C15, C16, C19, 0.1-mf.; C14, 0.5-mf.; C17, 1.0 mf.; C18, .0024-mf.; C20, C21, 3 mf.; C22, 2 mf.; C23, .05-mf.; C24, 3 mf. (for 25 cycles only); C, 745-mmf.

Normal operating readings with volume control R2 at maximum and local-distant switch at "distant," are as follows:

Plate voltages, V1, V4, V5, 240; V2, 70; V3, 235; V6, 210; V7, V8, 200. Plate currents; V1, 4 ma.; V2, 6 ma.; V3, 0.25-ma.; V4, 5.5 ma.; V5, 2 ma.; V6, 0.5-ma.; V7, V8, 30 ma. Control-grid voltages; V1, V4, 2.2; V3, 8; V5, 5; V6, 23; V7, V8, 20. Screen-grid voltages; V1, 90; V3, 80; V4, V5, 85; Filament voltage (between 2 and 3 on the terminal strip), 2.5. Power-pack output voltage (between 4 and 5 on the strip), 250.

The antenna coupler L1 has a high-inductance primary coupled to the first of two tuned coils in slight inductive relation, thus forming a highly-selective link circuit preceding a stage of signal-frequency amplification, V1. The R.F. choke Ch1 in the plate circuit of the latter has a high inductance.

The color code for the main cable is: 1, red with yellow tracer; 2 and 3, brown; 4, yellow; 5, red.

By using the principle of the auto-transformer in the design of filter choke Ch3, a voltage 180 degrees out of phase with the ripple voltage is caused to cancel the latter; the field coil of the dynamic reproducer completes the filtering job (the current through this coil is 85 milliamperes and the drop across it is 110 volts).

Compensation for line voltage is obtained by changing the position of the fuse, which is of 5-amp. rating. A blown fuse may be due to a short in a pack condenser, the rectifier V9, the filament leads, or in the pilot-light socket.

Jerky action of the station selector may be corrected by adjustment of the condenser-drive cable spring or by placing a few drops of oil on the condenser bearing.

Remember that when this set is located close to a powerful station, better volume control may be obtained by removing R3.

Should a noisy volume control fail to respond to treatment with a pipe cleaner and cigarette-lighter fluid, it will probably be necessary to change the control.

Acoustic howl may be due to defective rubber cushions, wood shipping blocks not being removed, microphonic tube, or chassis not swinging freely in the rubber cushions.

Low volume may be caused by defective tubes, poor antenna system, or condensers out of balance (in either R.F., oscillator, or I.F. circuits), defective A.F.T's., shorted field coil (check current through coil), or opens, shorts or grounds in set or pack chasses.

This chassis is practically humless. Excessive hum, however, may be due to these defects: poor '80, open or shorted Ch3, defective condensers, shorted or open resistors.

Distorted reproduction not traceable to reproducer may be due to one of the following conditions: defective tubes, circuit oscillation (resulting in whistle on stations, where the whistle is not due to the heterodyne of two stations), defective A.F.T's., faulty alignment of tuned circuits, tuning slightly off the correct tuning point, strong local station, open or shorted condensers or resistors.

Audio howl often may be traced to defective tubes (particularly V6, V7, V8), open condensers, or circuit oscillation at R.F. causing heterodyne with station carrier.

Circuit oscillation and misalignment of the tuned circuits are probably the two foremost troublesome factors in this receiver. The former is fairly easy to locate and remedy by ordinary service procedure; the latter should not be attempted by anyone not experienced in superheterodyne repair, or anyone who has not made a careful and thorough study of the method of balancing the several circuits.

Circuit oscillation when localized will probably prove to be due to shielding not making proper contact, control-grid leads out of position or not making good contact, open by-pass condensers, defective screen-grid tubes, or separate grounding lead from by-pass condenser case not connected.

In addition to the five circuit-balancing condensers in shunt with the four tuning condensers and the fixed condenser C, there are five adjustable sectors on each of the four tuning condensers. These are adjusted by studs; as they were balanced carefully at the factory it is not likely that it will be necessary to touch them.

However, it may be noted that these sectors are adjusted for five positions of the test oscillator: 1120 kc., 840 kc., 700 kc., 600 kc., and 550 kc. (with the condenser so meshed that the slot of the sector under adjustment, and the next highest capacity, are level with the edge of the stator plate.)

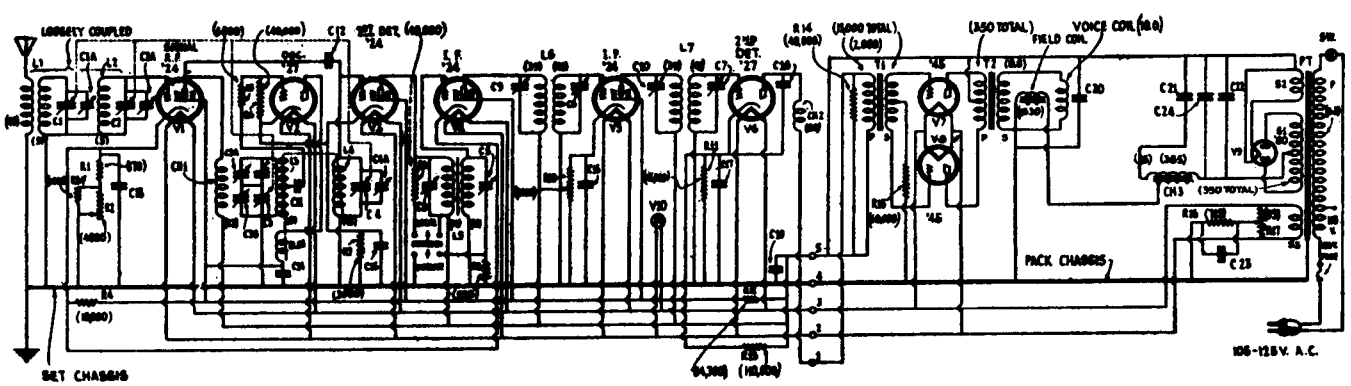
For this adjustment, there will be required a socket wrench, an audio modulated oscillator, and a 0-2-scale milliammeter connected in the plate circuit of the detector. (This connection may be obtained through an adapter that breaks the plate circuit, or by unsoldering the wire that is connected to the plate socket-contact and connecting the meter to this lead and the socket contact.) Then, remove the oscillator tube and connect a 20,000-ohm resistor from the socket plate connection of V2 to its cathode. These connections are to be made with the receiver out of the cabinet and a ground connected to the set.

This is a sketchy outline of the procedure (seldom necessary) in lining up the gang condenser; but to do this work correctly involves considerably more detail data than this space permits. Hence, these adjusting studs should not be touched until the complete service data is available; as it is necessary after this adjustment to check over the I.F. condensers, and the scale and oscillator readings.

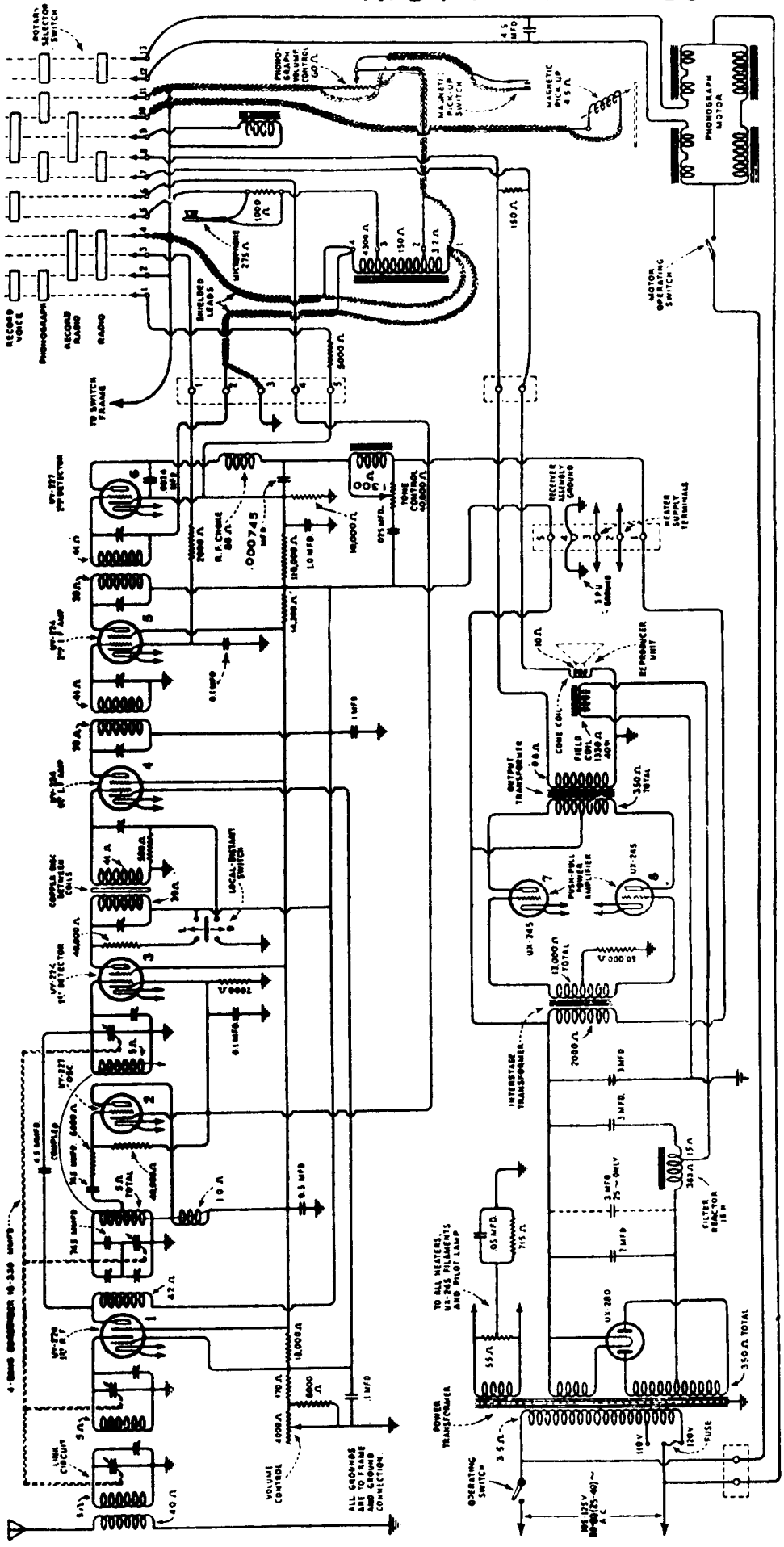
A modulated oscillator is required adjustable to exactly 600 kc. and to 1400 kc. for balancing the R.F. circuits. A suitable indicating device is a 0-5-scale milliammeter connected in the plate circuit of V6. Set the local-distant switch on "distant" and adjust the 600-kc. oscillator trimming condenser on the chassis, (between the second and third variable condensers), about three quarters of the way in. Now, set the oscillator in operation at exactly 1400 kc., turn the selector knob until the scale reads 1400 kc.; and adjust oscillator, first detector, R.F., and link-circuit trimming condensers, in the order given, for maximum output. Then, with the oscillator readjusted to 600 kc., adjust the 600 kc. trimming condenser while rocking the gang condenser back and forth. (The dial scale should now read 600 kc.) Readjust oscillator to 1400 kc. and set the selector scale at exactly 1400 kc.; then adjust the four trimming condensers, in the order C3, C4, C2 and C1, for maximum meter indication. Place the oscillator again in operation at 600 kc., tune in the signal, and the scale at maximum meter deflection should indicate 600 kc. Otherwise, repeat the former operations.

The I.F. transformers peak at 175 kc. and are so designed as to require a test oscillator variable from 171 kc. to 179 kc., for aligning them.

Making sure that there is a good ground connection, put the set in normal operation, place volume control at minimum, and remove V2. Connect a meter in the output circuit of set and connect the coupling lead of the oscillator to the control grid of V5 (oscillator set for 175 kc.). Adjust C7 and then C10 so that there is no appreciable drop in the meter reading between 172.5 and 177.5 kc., and an equal drop at 171 and 179 kc. After adjusting the tuning of L7, repeat the operation for L6, putting the test oscillator output lead on the control-grid connection of V4. Finally, shift the oscillator lead to the control-grid of V3 and balance the circuits of L5 (which will tune very sharply).



R.C.A.-VICTOR CO.



RCA RADIOLA 86 - WESTINGHOUSE WR7 - GRAYBAR 900 - GENERAL ELECTRIC H-71

This instrument is a combination radio receiver similar to Radiola 82, an electric phonograph employing an improved type of magnetic pick-up and tone arm and a home recording mechanism by which either a radio program or sound production in the home may be recorded on the Victor home recording record blanks. This set incorporates the tone control of the Radiola 82 and when the rotary switch is in the "radio" position, it is electrically the same as the Radiola 82.

SCHEMATIC AUDIO CIRCUIT DIAGRAMS

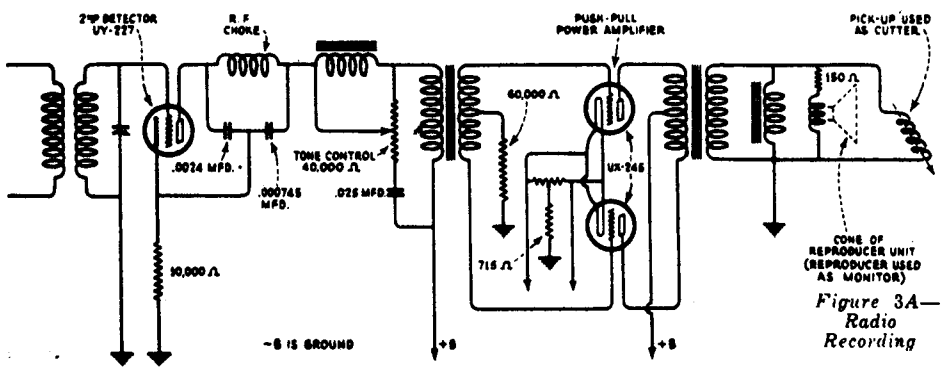


Figure 3A— Radio Recording

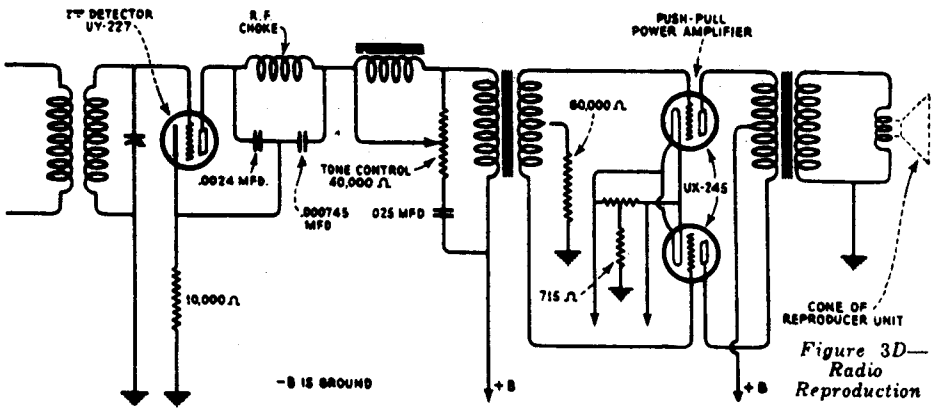


Figure 3D— Radio Reproduction

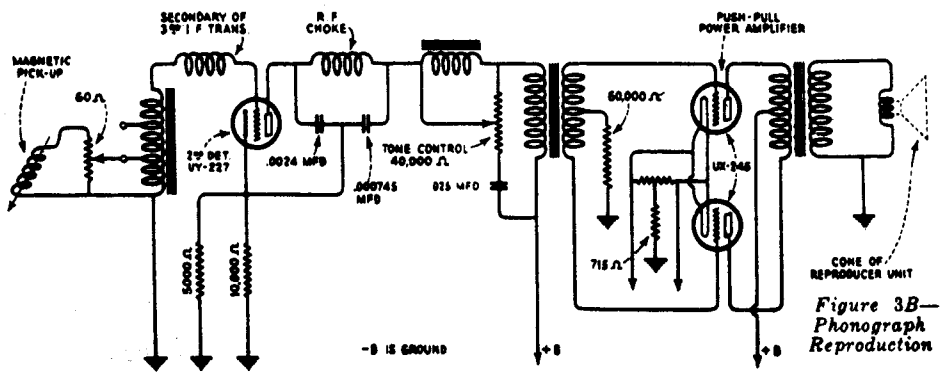


Figure 3B— Phonograph Reproduction

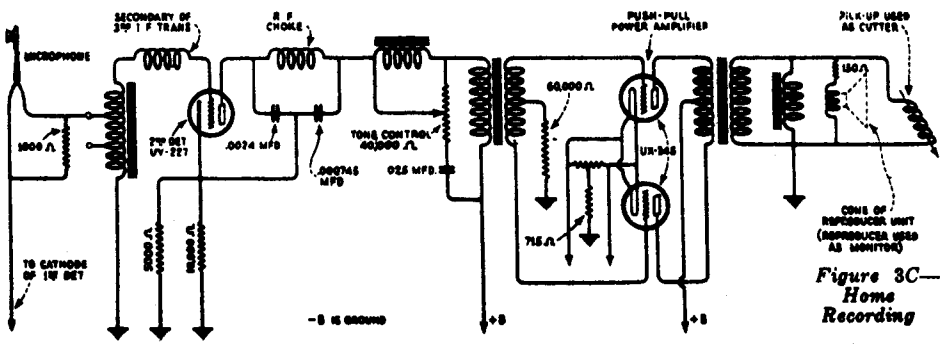
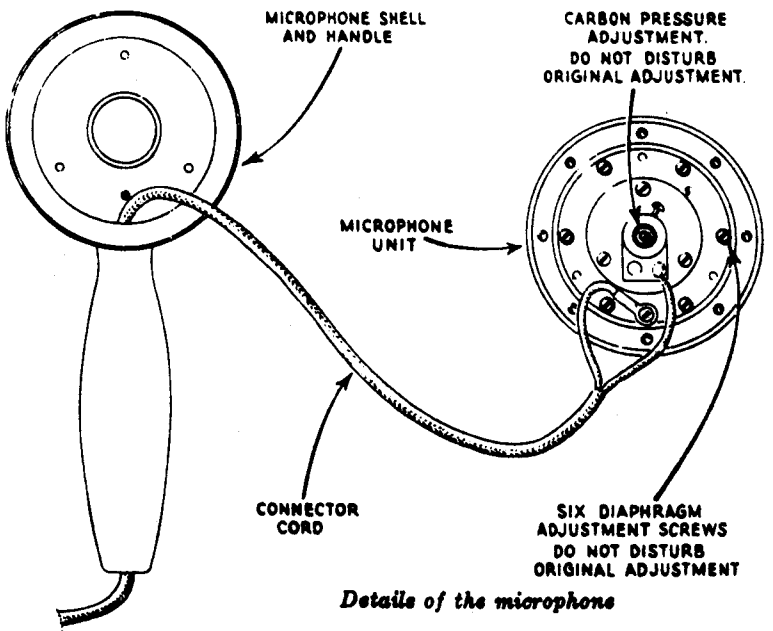


Figure 3C— Home Recording

RCA RADIOLA 86 - WESTINGHOUSE WR7
GRAYBAR 900 - GENERAL ELECTRIC H-71

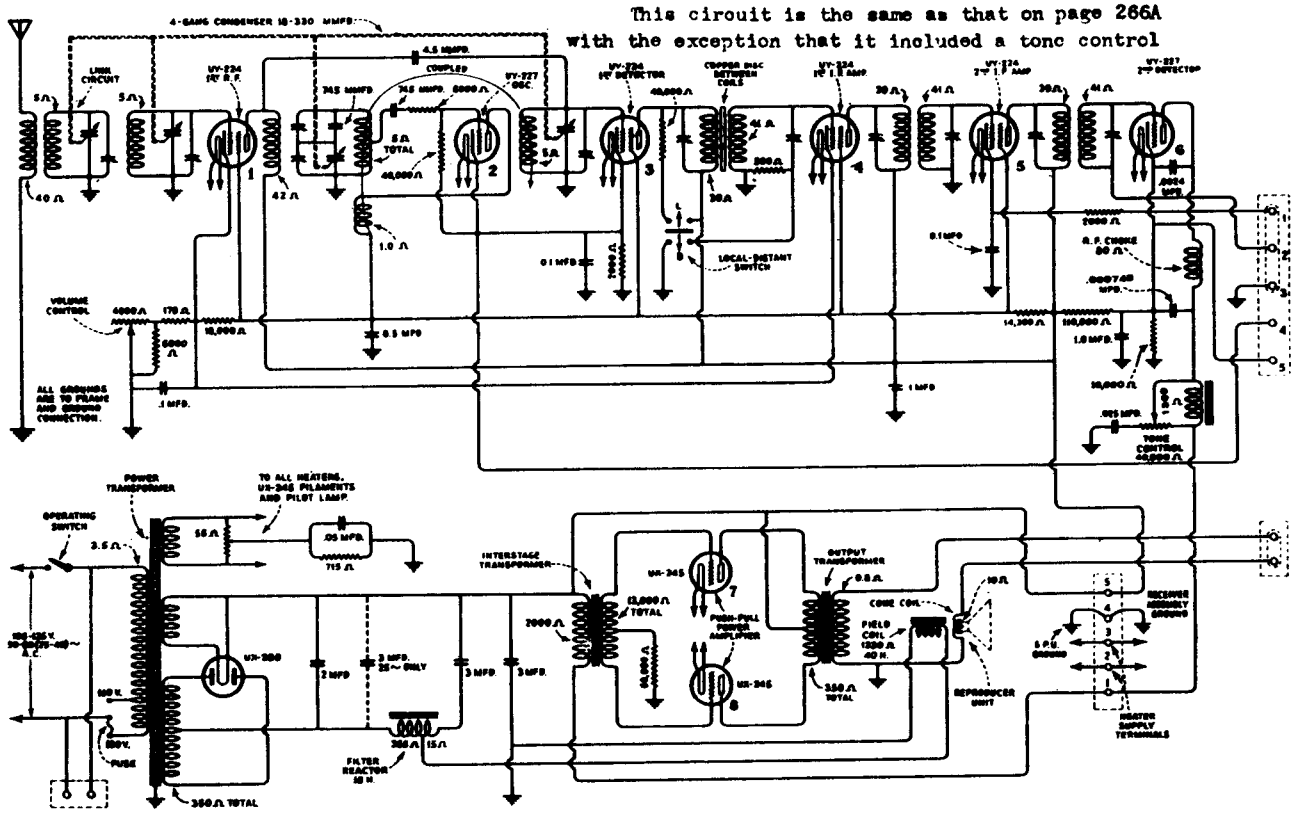


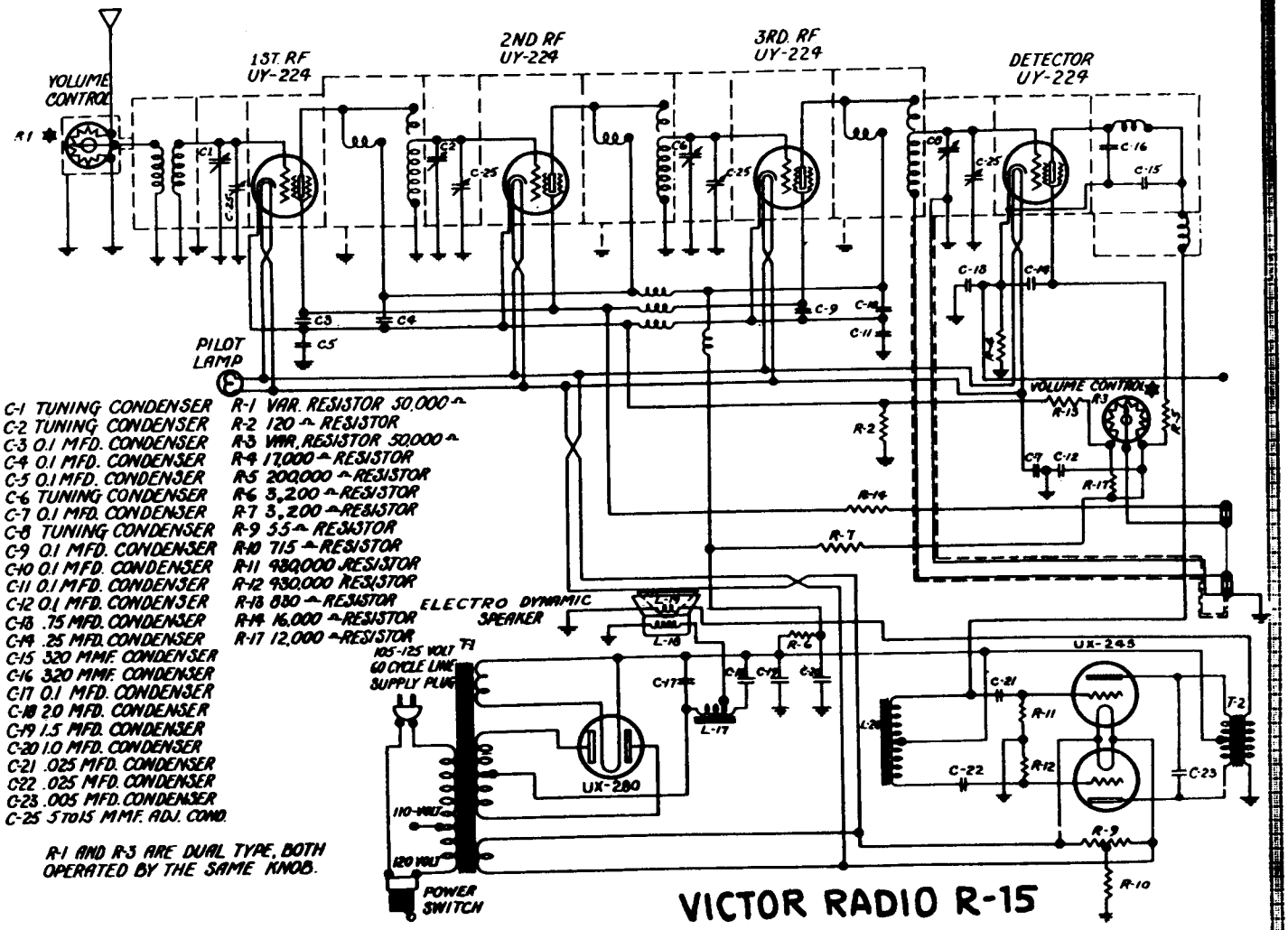
Details of the microphone

R.C.A.-VICTOR CO.

RCA 82 - WESTINGHOUSE WR6 - GRAYBAR 770 - GENERAL ELECTRIC H-51

This circuit is the same as that on page 266A with the exception that it included a tone control





C-1 TUNING CONDENSER
C-2 TUNING CONDENSER
C-3 0.1 MFD. CONDENSER
C-4 0.1 MFD. CONDENSER
C-5 0.1 MFD. CONDENSER
C-6 TUNING CONDENSER
C-7 0.1 MFD. CONDENSER
C-8 TUNING CONDENSER
C-9 0.1 MFD. CONDENSER
C-10 0.1 MFD. CONDENSER
C-11 0.1 MFD. CONDENSER
C-12 0.1 MFD. CONDENSER
C-13 .75 MFD. CONDENSER
C-14 .25 MFD. CONDENSER
C-15 320 MMF. CONDENSER
C-16 320 MMF. CONDENSER
C-17 0.1 MFD. CONDENSER
C-18 2.0 MFD. CONDENSER
C-19 1.5 MFD. CONDENSER
C-20 1.0 MFD. CONDENSER
C-21 .025 MFD. CONDENSER
C-22 .025 MFD. CONDENSER
C-23 .005 MFD. CONDENSER
C-25 5 TO 15 MMF. ADJ. COND.

R-1 VAR. RESISTOR 50,000 Ω
R-2 120 Ω RESISTOR
R-3 VAR. RESISTOR 50,000 Ω
R-4 17,000 Ω RESISTOR
R-5 200,000 Ω RESISTOR
R-6 3,200 Ω RESISTOR
R-7 3,200 Ω RESISTOR
R-8 55 Ω RESISTOR
R-9 715 Ω RESISTOR
R-10 980,000 RESISTOR
R-11 930,000 RESISTOR
R-12 880 Ω RESISTOR
R-13 16,000 Ω RESISTOR
R-14 12,000 Ω RESISTOR

R-1 AND R-3 ARE DUAL TYPE, BOTH OPERATED BY THE SAME KNOB.

VICTOR RADIO R-15

VICTOR "MICRO-SYNCHRONOUS" RADIO, MODELS "R-35," "R-39," "RE-57"

Radio Service Data Sheet

These T.R.F. receivers are manufactured by the Victor Division of RCA Victor Co., Inc., Camden, N. J. The schematic circuit shows the multiple-contact switch designed for changing the connections to "radio," "phonograph," "home-recording," or "radio-recording." The parts used in this Victor chassis are itemized below:

Condensers C2, C4, C12, each 5 mmf. (each capacity is formed by a single turn of wire); C5, C6, C7, C9, C13, C14, C15, 0.1-mf.; C10, 10 mmf.; C17, 0.25-mf.; C18, 0.75-mf.; C20, C21, 50 mmf.; C22, 100 mmf.; C24, 0.01-mf.; C25, C29, 1.0 mf.; C26, C27, C28, C30, C34, 2 mf.; C31, 0.2-mf.; C32, .0012-mf.; C33, 4.5 mf.

The resistors in these models have the following values: R1, 50,000 ohms; R2, 130 ohms; R3, 1,000 ohms; R4, 2 megohms; R5, 1.5 megohms; R6, 28,000 ohms; R7, 1.0 megohm, R8, R9, 0.5-megohm, R10, 2,800 ohms; R11, R15, 55 ohms; R12, R13, 8,000 ohms; R14, 70,000 ohms; R16, 730 ohms; R17, 9000 ohms; R18, 60 ohms; R20, 250 ohms; R21, 140 ohms. The two volume-control resistors R1 and R3 are operated by the same knob.

The hand microphone connects to the pin-jacks J. Unit L20 is the record microphone input transformer.

The portion enclosed by the dotted line DL is used only on the combination models. The links are to be closed, on radio models.

The strips in the enclosure DL, marked R, RR, PG, and RV are used to segregate the little rectangles which denote the contacts on the transfer switch. The four positions of these rectangles, and the wires they then connect, are thus clearly indicated.

Following are the voltage readings at the tube sockets of the receiver. Filament potentials: V1, V2, V3, V5, 2.1 volts; V4, 2.0; V6, V7, 2.25; V8, 4.9. Plate potentials: V1, V2, V3, 173 volts; V4, 50; V5, 67; V6, V7, 222. Plate currents: V1, V2, V3, 3.1 ma.; V4, 0.3; V5, 1.5; V8, each plate, 40 ma. Grid potentials: V1, V2, V3, 3.1 volts; V4, 1.5; V5, 0.2; V6, V7, 37. Screen-grid potentials: V1, V2, V3, 89 volts; V4, 3.4.

The power consumption of the "Models R-35" and "R-39" is 120 watts; the "RE-57," 170 watts for the combination.

Microphonic howl in a set of these types may be due to the reproducer's being not properly insulated from the cabinet front; adjust the felt. In home-recording, an open in R20 or R21 may cause a howl.

A good ground connection is essential, and must be used at all times.

If the line voltage is high, a "Type 9-V-10" Amperite may be used to limit the line supply.

Oscillation may be due to an ungrounded, or poorly-grounded chassis; or to shielding for condensers, coils, or tubes, being out of place; too much exposure of the green lead between control grid of a '24 and the coil (the unshielded portion of this wire should be as short as possible). An open circuit in any of the 0.1-mf. by-pass condensers, or poor grounding of one of these condensers (due to loose contact at the rivets), may cause this trouble. Faulty grounding of the shielding of a lead in the radio amplifier may cause the same effect.

Following is the color code of the main cable: 1, 2, light brown; 3, yellow (in most cases); 4, yellow-red tracer, in one cable, and red-yellow tracer, in the other; 5, green-red; 6, blue; 7, red; 8, green-red.

(Note: when replacing a coil, or tube-shield caps, always be sure that the slots are aligned with the green wire before the cap is forced into position. To avoid damage to the wire or coil, never turn the cap after it is once in place.)

Failure of the home-recording section of the receiver may be due to the following causes: poor contacts in microphone pin jack terminals; a loose or broken wire or connection; an open or a short in the microphone; a short in either of the resistors R20, R21, on reactor unit; a shorted or open record-microphone input transformer on motor board; faulty contact in control switch; an open coil L22, reactor unit; a weak magnet in the electric pick-up.

Faulty record reproduction with noticeable blasting, particularly on bass notes, may be caused by worn records or needles, or by improper centering of the pick-up armature. If such a condition is traced to the pick-up, center the armature in the following manner: remove pick-up from the pick-up arm, and remove the cover. (Note: It is highly important that the magnet be in contact with the pole pieces, or with a small iron or steel "keeper," at all times. Even a momentary break in the magnetic path of the pick-up magnet will produce a noticeable loss of magnetism, which is reflected in decreased efficiency of the pick-up, particularly in home recording.) Place a steel keeper, 1⅝ x ½ x ⅛-in. across the two ends of the magnet, and carefully slide the magnet from the pole pieces onto the keeper. Next, slide the magnet back onto the underside of the pole pieces. Then, loosen both round-head screws in the armature adjusting plate.

Insert a pick-up gauge between the armature and the pole pieces, and retighten the round-head screws in the adjusting plate. After properly centering the armature, replace all parts of the pick-up assembly.

In some models C33 has a capacity of 5.8 mf.; it is not in circuit for electric phonograph or radio reproduction, but serves to increase the power of the motor, during home-recording with either microphone or radio, to avoid increase of speed on playback. It is out of circuit for radio reproduction, to prevent the motor running at high speed and becoming excessively hot as it might if left running after moving the change-over switch from "recording" to "radio."

Following are the oscillator frequencies at which the variable condensers are to be aligned: 550, 710, 1000, 1300, 1500 kc.

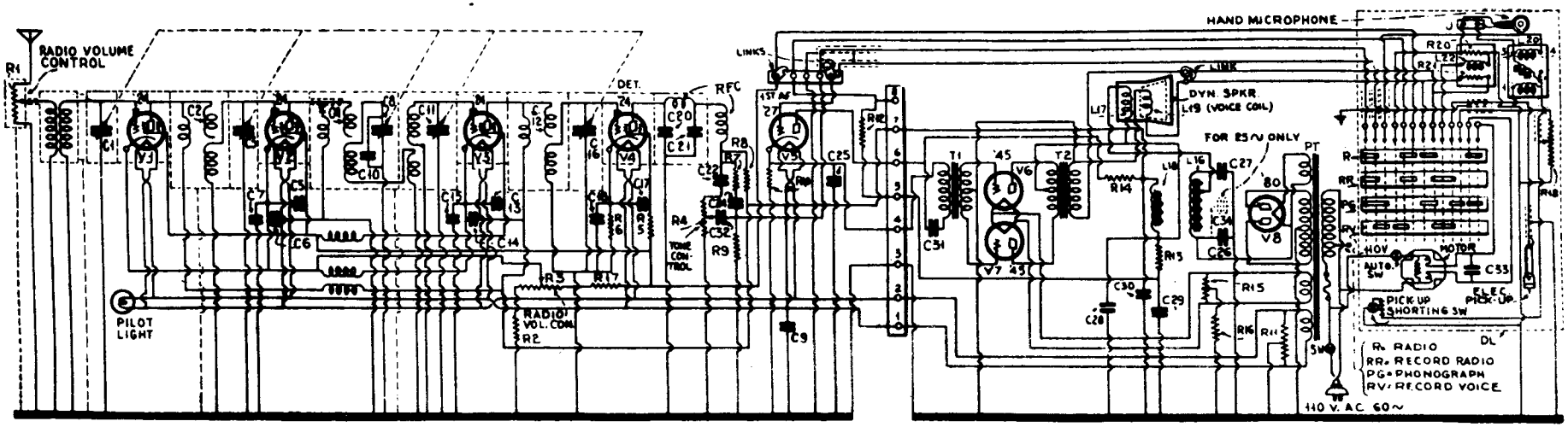
If it becomes necessary to re-center the cone of the dynamic reproducer, a strong 60-cycle hum may be obtained by removing one of the R.F. tubes and running a lead from its cathode to one of the filament terminals of a screen-grid tube's socket.

Should the tuning lever fail to operate freely, or should the vernier roller fail to track when turned, adjust the tension of the lever on its track, by means of the adjusting nut; which will be found on the lever midway between the cam wheel and the dial. A small amount of grease should be placed on both the top and the bottom of the roller track, to assure free movement of the lever.

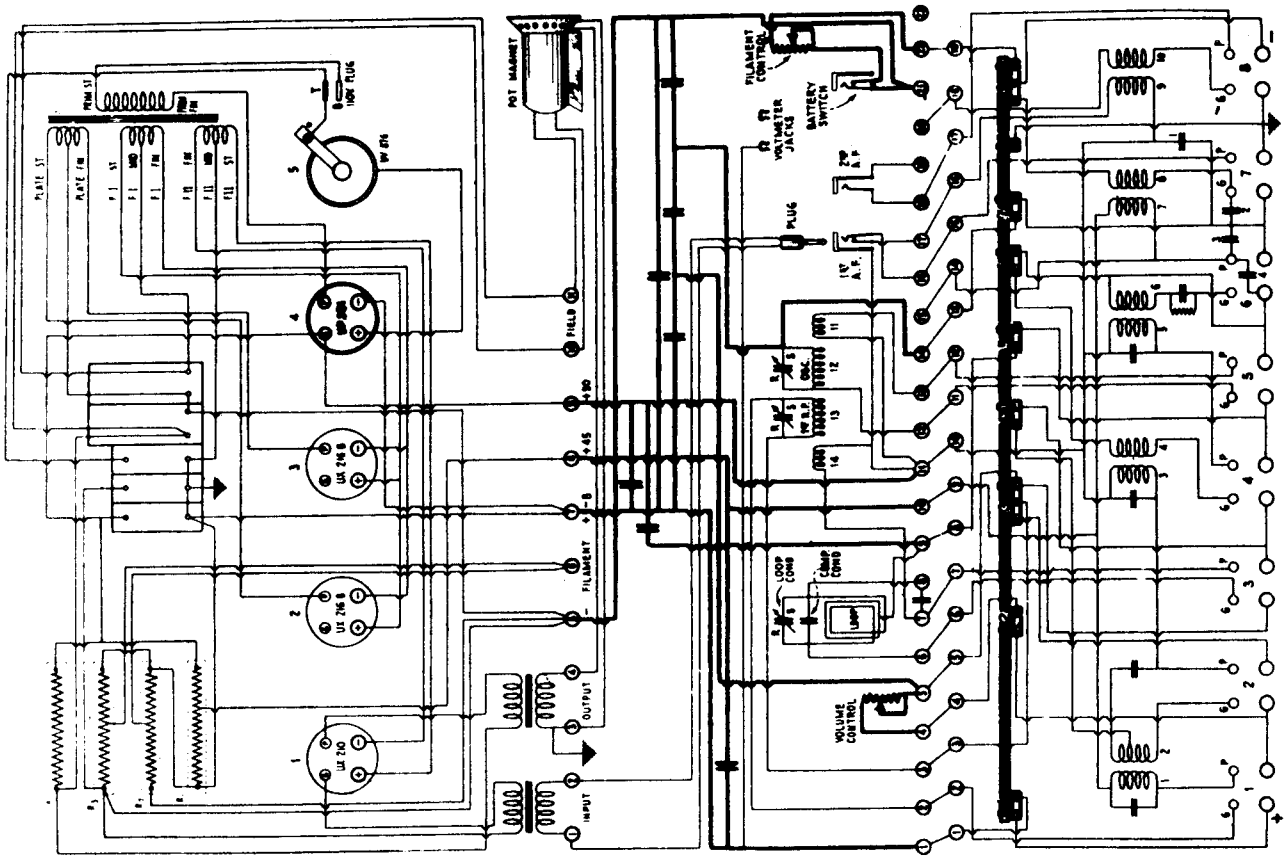
When replacing or repairing the selector scale, slide the scale to right and left until the indicator is in line with the frequency marking which is correct for a station then being received. Check this at several different points on the scale. If the pilot lamp is mounted off center, the dial readings at certain sections of the scale will be incorrect. Check the location of lamp, which should be exactly in the rear of the center of the dial; while the hair-line station indicator should be vertical at the center and at the extreme ends of the dial.

The tone control is effective on both radio and record reproduction.

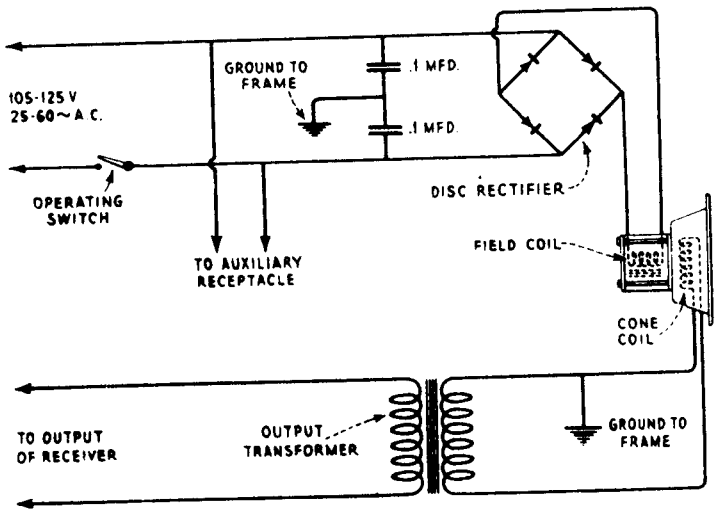
To prevent a twisting action the length of the pick-up during recording, the head is splayed. This weight on the sides serves by its inertia to maintain a "level keel."



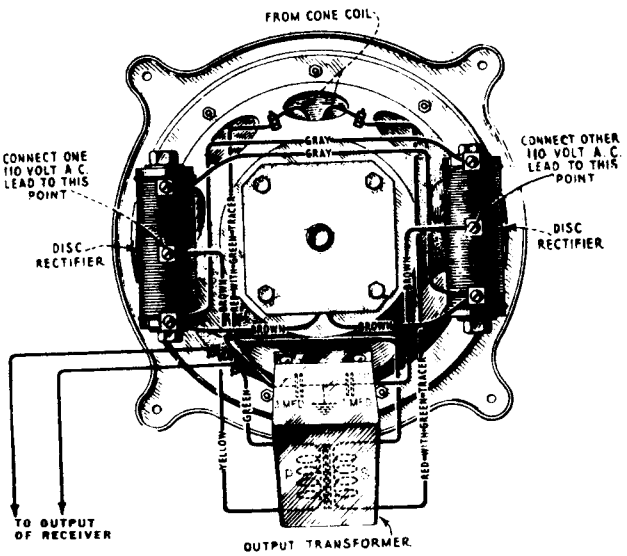
R.C.A. VICTOR CO.



RADIOLA 28 A.C.



Schematic wiring diagram of Loudspeaker 106



Wiring diagram of reproducer unit

RCA LOUDSPEAKER 106

Radio Service Data Sheet

RCA-VICTOR RADIOLA "SUPERETTE" MODEL R7 SUPERHETERODYNE

Graybar No. 8 Midget; Westinghouse No. WR-10 Columnette; and General Electric Models G. E. Jr. No. S-22, G. E. Jr., with clock, No. S-22X, and G. E. Jr. Console No. S-42.

The circuit of this receiver is of particular interest, as being the first of the mantel radio sets brought out by these companies. It is seen, by reference to the diagram below, that this superheterodyne uses a limited number of tubes, in the following manner: One stage of signal-frequency R.F., V1, using the new type '35 variable-mu tube; a type '27 as oscillator, V2; a '24 screen-grid first-detector V3; a type '35 variable-mu first stage of I.F. amplification, V4; a type '27 power second detector, V5; push-pull '45's, V6, V7, in the power A.F. circuit; and the usual '80 rectifier V8.

The resistance values of the choke coils and transformers in this model chassis are shown in parentheses in the diagram (Fig. 1); other constants are given below:

Tuning condensers C1, C2, C3, 18 to 325 mmf.; trimmer condensers C1A, C2A, C3A, 4 to 50 mmf.; oscillator padding condenser C4, 745 mmf.; padding trimmer C5, 15 to 75 mmf.; C6, 745 mmf.; C7, C14, C19, C21, 0.5-mf.; C8, 1 mf.; C9, 0.1-mf.; C10, C13, 10 to 70 mmf.; C11, C12, 20 to 220 mmf.; C15, .05-mf.; C16, C17, .0024-mf.; C18, 4 mf. (electrolytic); C20, 10 mf. (electrolytic).

Volume-control resistor R1, 3,800 ohms; R2, 150 ohms; R3, 14,300 ohms; R4, 8,000 ohms; R5, 6,000 ohms; R6, 10,000 ohms; R7, 1 meg.; R8, 30,000 ohms; R9, tone control, 0.5-meg.; R10, R11, 0.1-meg.; R12, 40,000 ohms.

Operating voltages in this chassis are as follows (volume control at minimum): All filament potentials except V8: 2.4 volts. Cathode potentials: V1, V2, V4, 40 volts; V3, 8 volts; V5, 25 volts. Control grid potentials: V1, V4, 40 volts; V2, 0 volts; V3, 7 volts; V5, 5 volts; V6, V7, 30 volts (note that the readings of V5, V6, V7 are taken through units of high resistance, and therefore are not the effective values). Screen-grid potentials: V1, V4, 55 volts; V2, 90 volts. Plate potentials: V1, V4, 200 volts; V2, 50 volts; V3, 240 volts: V5, 220 volts; V5, 220 volts; V6, V7, 245 volts. Plate currents: V1, V4, 0 ma.; V2, 4 ma.; V3, V5, 0.5-ma.; V6, V7, 30 ma. Screen-grid currents: V1, V4, 0 ma.; V3, 0.25 ma.

With the volume control in *maximum* position: Cathode potentials: V1, V4, 3.5 volts; V2, 2.5 volts; V5, 25 volts. Control-grid potentials: V1, V4, 3.5 volts; V2, 0 volts; V3, V5, 5 volts; V6, V7, 30 volts (indicated). Screen-grid potentials; V1, V3, V4, 70 volts. Plate potentials; V1, V4, 240 volts; V2, 65 volts; V3, 235 volts; V5, 220 volts; V6, V7, 245 volts. Plate currents: V1, V4, 5 ma.; V2, 5.5 ma. V3, V5, 0.5-ma. Screen-grid currents: V1, V4, 0.7-ma.; V3, 0.25-ma. (these last values may be higher or lower, depending upon the age of the tube).

The field coil is electrically center-tapped to obtain one-half the 100-volt drop across it as "C" bias for the power tubes. Note the following points of interest in the design of this chassis:

Phonograph operation is obtained by removing the strap (shown dotted) from lugs 1 and 2,

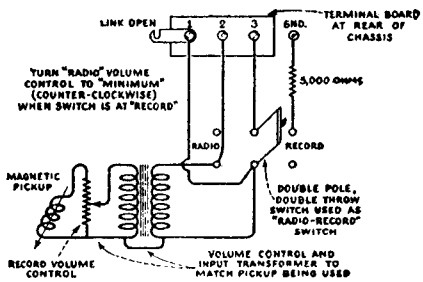


Fig. 3

and placing it across lugs 3 and 4; and connecting in a phonograph pickup at the terminals provided. The power transformer has a static shield," shown dotted. Volume is controlled by simultaneously varying the cathode biases of the two variable-mu tubes (which are used to prevent cross-modulation) and the '27 oscillator. The high-inductance primary of L1 prevents antenna variations from affecting the secondary tuning.

Observe that the I.F. transformers L4, L5, are reversed in their connection to the tubes; the high-resistance winding being the plate inductance in one instance, and the grid coil in the other. The I.F. transformers are not flat-topped, but are "peak-tuned" to the intermediate frequency of 175 kc. High selectivity is obtained by tuning both windings. The tone control serves partially to compensate for the lack of a large baffle; for, in the extreme bass response position, the condenser and A.F. transformer primary resonate at a very low frequency. Note that this is an efficient method of obtaining low-note response by resonance, and not by merely bypassing the high frequencies. In the former case low notes are actually amplified; in the latter, they are evident merely because the volume of the high notes has been reduced below the normal volume of the low notes.

The oscillator's output is inductively transferred to the remainder of the circuit by coupling between L2 and L3. The detector's grid-circuit filter, comprising R7 and C15, serves to reduce the hum level.

Since the electrolytic filter condensers are not efficient at radio frequencies, two paper-dielectric fixed condensers of 0.5-mf. capacity each, C19, C21, are included in the filter circuit as R.F. by-passes.

The electrolytic condensers may be tested by noting their leakage current; which at 400 volts D.C. should be 2.4 ma. for the 10-mf. unit and 1 ma. for the 4-mf. unit. The current through the reproducer field coil is 80 ma.

Three strips of "visiting card" bristol board may be dropped through the slits in the dynamic reproducer spider, to center the cone.

The positions of the condenser adjustments are shown in Fig. 2; connections which may be followed for phonograph operation are shown in Fig. 3.

The rubber friction-roller on the drum dial is provided with a means of adjustment, if the continued operation wears down the roller.

If it becomes necessary to open the case of the tone-control unit, to make repairs, a pin or sharp instrument is to be pushed into the small hole on the side of the case. This pushes down a spring, releasing the cover.

Acoustic howl may be due to hardening of the rubber chassis supports; replace these. Also, check the position of the chassis; if it does not swing freely, but touches the cabinet, a microphonic action may be produced.

Oscillation in the R.F. or I.F. circuits may be due to poor shielding contacts, open by-pass condensers, or an ungrounded light line. In the latter instance, try connecting the ground to both the chassis and the ground lead.

The R.F. circuits are adjusted first at 600 kc. and then at 1400 kc. A suitable output meter to indicate resonance may be a "current-squared" thermo-galvanometer, connected to the secondary of T2 instead of the voice coil of the reproducer; a low-range A.C. voltmeter may be connected across the voice coil; or an 0-5-scale milliammeter may be connected in series with the plate supply to the second detector.

The I.F. stages may be resonated by tuning to the output of an external oscillator connected to the control-grid cap of V3, with oscillator tube V2 removed and the chassis grounded; adjusting for maximum meter deflection.

It is best to align the I.F., R.F., and oscillator in this order; because of the interlocking of the controls.

The 3-gang condenser unit includes split end plates which are to be bent for stage alignment, only if tests indicate that this procedure is necessary.

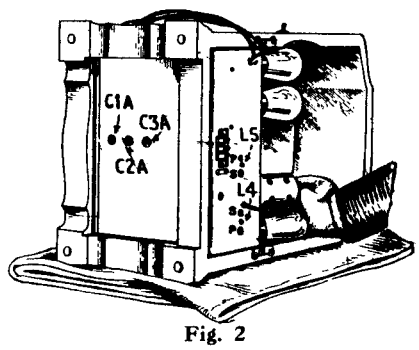


Fig. 2

Locations of the trimming capacities; C5 (underneath the dynamic reproducer) is being adjusted by the operator.

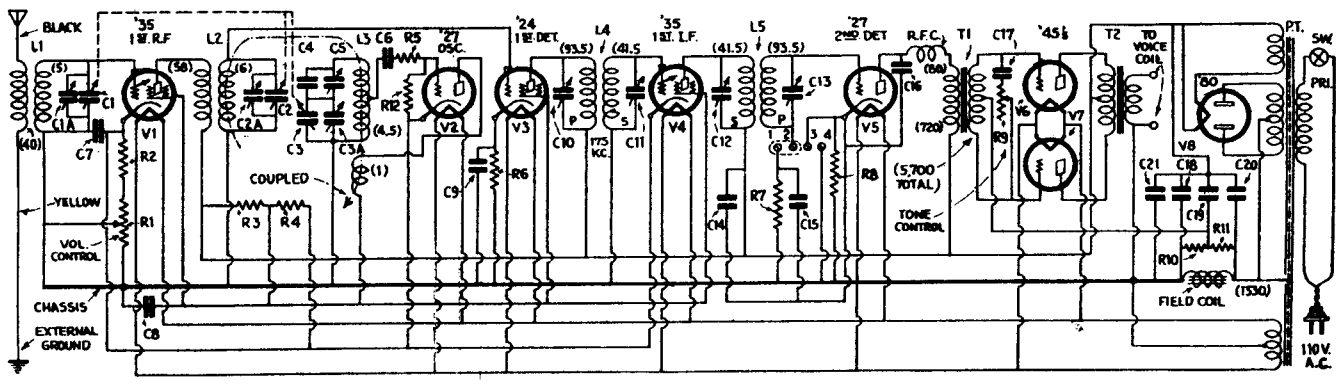


Fig. 1

Radio Service Data Sheet

WESTINGHOUSE "COLUMNAIRE" MODELS WR-8 AND WR-8-R (REMOTE CONTROL)

Also WR-5 (RCA Victor 80, G.E. H-31, Graybar 700); WR-6 (RCA Vic. 82, G.E. H-51, Graybar 770); WR-7 (RCA Vic. 86, G.E. H-71, Graybar 900); WR-6-R, and WR-7-R remote-control models

The fundamental circuit of these receivers is the WR-5 receiver chassis and power pack shown in Data Sheet No. 29. The model WR-6 is a highboy; its circuit is the same as used in the WR-5, except as modified for tone control. The Model WR-7 is similar to the Model WR-6, except as modified for an electric phonograph. Models WR-6-R and WR-7-R are the same as the respective WR-6 and WR-7 chasses, except as modified for remote control. The Model WR-8 uses the same chassis and power pack as the Model WR-6, only an electric clock and the cabinet distinguishing it as the "Columnaire;" the remote-control model being coded as the Model WR-8-R.

The resistance of each individual unit appears in Data Sheet No. 29. The values of only the resistors, capacities, and chokes follow:

Resistors R1, 4,000 ohms (potentiometer); R2, 170 ohms; R3, R6, 6,000 ohms; R4, 18,000 ohms; R5, R10, 2,000 ohms; R7, R8, 40,000 ohms; R9, 500 ohms; R11, 14,300 ohms; R12, 10,000 ohms; R13, 110,000 ohms; R14, 60,000 ohms, R15, 715 ohms; R16, 55 ohms.

Condensers C1, C2, C3, C4, 18 to 330 mmf.; C5, C7, C24, 0.1-mf.; C6, 0.5-mf.; C8, 4.5 mmf.; C9, C18, 745 mmf.; C10, C11, C12, C13, C14, C15 120 to 220 mmf.; C16, C23, 1.0 mf.; C17, .0024-mf.; C19, C21, 3 mf.; C20, 2 mf.; C22, .05-mf.

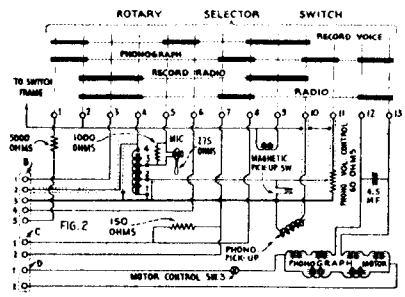
The tone-control units have the following values: C, .025-mf.; R, 40,000 ohms (potentiometer); Ch, 2 henries.

The phonograph attachment is shown in Fig. 2. The remote-control attachment is shown in Fig. 3. Variations in Fig. 1 are dotted.

The normal operating voltages of all these receivers, with volume control R1 at maximum and switch Swl at "distant," are given below:

Plate voltages, V1, V4, V5, 240; V2, 70; V3, 235; V6, 210; V7, V8, 200. Plate currents; V1, 4 ma.; V2, 6 ma.; V3, 0.25-ma.; V4, 5.5 ma.; V5, 2 ma.; V6, 0.5-ma.; V7, V8, 30 ma. Control-grid voltages; V1, V4, 2.2; V3, 8; V5, 5; V6, 23; V7, V8, 20. Screen-grid voltages; V1, 90; V3, 80; V4, V5, 85; Filament voltage (between 2 and 3 on the terminal strip A), 2.5. Power-pack output voltage (between 4 and 5 on the same strip), 250.

The color code of the push-pull A.F. transformer is as follows: T1 input, red and yellow; red with yellow tracer. Output, yellow (center-tap); and green. Transformer T2 input, red (center-tap); and blue; output, black. Power transformer PT, primary, black-with-red-tracer; black-and-red (110 volts); black (120 volts). Secondary, 2.5 volts, brown; 5 volts, black-with-green tracer; high voltage, yellow-with-red-tracer (center-tap), and black-with-blue-tracer.



The combination model (the Model WR-7) has substantially the same receiver and power pack chassis as the Model WR-6, except as modified for the special rotary switch which makes the necessary circuit changes for the following operations: personal home recordings; radio home recordings; radio reception; phonograph operation; (see Fig. 2.). See page 521, March, 1931 issue of RADIO-CRAFT for details of phonograph automatic switch. The turntable's speed is 78 r.p.m. In normal operation the motor develops considerable heat.

In the microphone-coupling auto-transformer (Fig. 2) read 3.2 ohms from 1 to 2; 2 to 3, 150 ohms; 3 to 4, 4,300 ohms.

In the remote-control receivers Models WR-6-R and WR-7-R, the control motor is part of the receiver chassis. Operation of the tone control or local-distant switch must be done at the receiver; but tuning and volume control may be effected at a distance of not more than 75 feet. The details of this external equipment are shown in Fig. 3. The 60-ohm resistors reduce the potential to 23 volts for station selection, and 18 volts for volume control, (special); the end thrust of the motor at the different speeds causing the proper gears to engage. The tapped phase-changing impedance and capacity change the phase-angle of the applied current, so that operation of the motor in either direction is obtained. The "on-off" operation of the set is relay-controlled; a series of drums and contactors start the motor in the right direction for station selection. In normal operation the pilot light dims, until a station has been tuned in (when the volume control is to be operated to suit). If trouble develops in the drum assembly, the entire unit must be replaced.

The "Columnaire" Model WR-8 is, except for the cabinet, the same as the Model WR-6; while the Model WR-8-R receiver chassis and power pack are almost identical with the Model WR-6-R. Leads for the synchronous electric clock are shown and, (in dots) the leads for the remote control attachment. The primary of T3 connects to the 110 V. line; the secondary output is 23 V.

Do not use the manual station selector with the chassis removed from the cabinet, unless the chassis is in a vertical position; otherwise, damage will result. Push either the "+" or the "−" button; the armature should *not* rise and engage the station-selector gear. Now push a station-selector button; if the armature does *not* rise and engage the station-selector gear, increase the tension of the spring. Next, increase the spring's tension until the armature just rises when a volume-control button is pressed; then decrease the tension until the armature just fails to rise when one of these buttons is pressed.

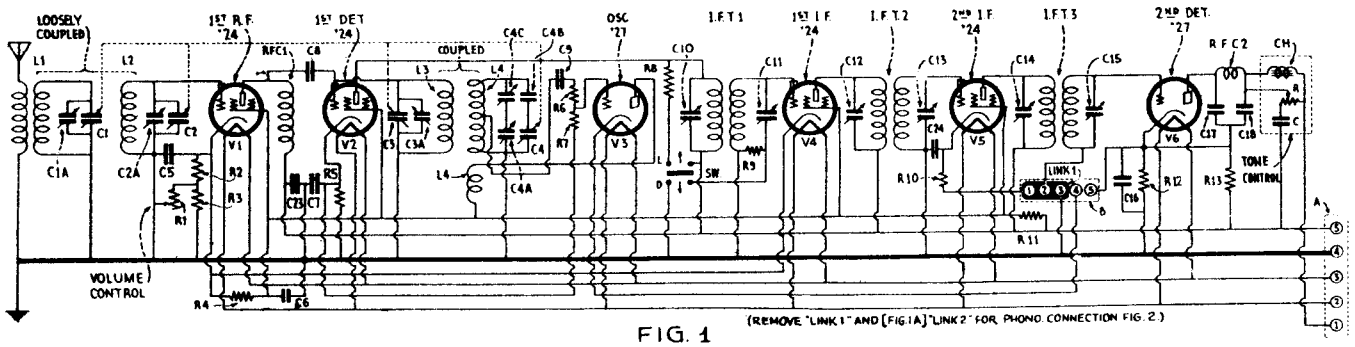


FIG. 1

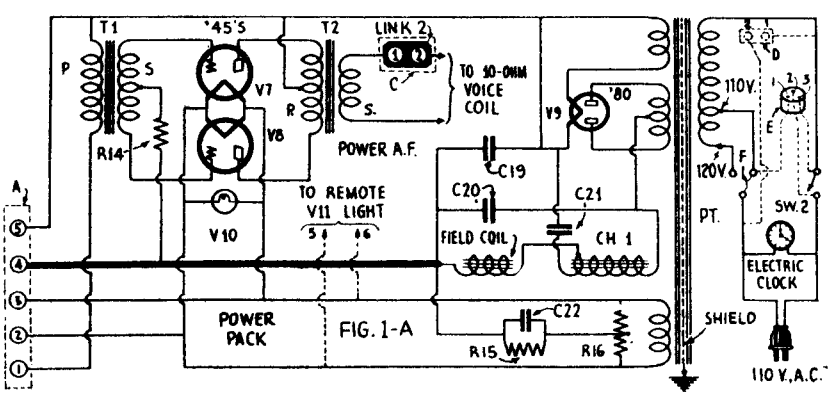


FIG. 1-A

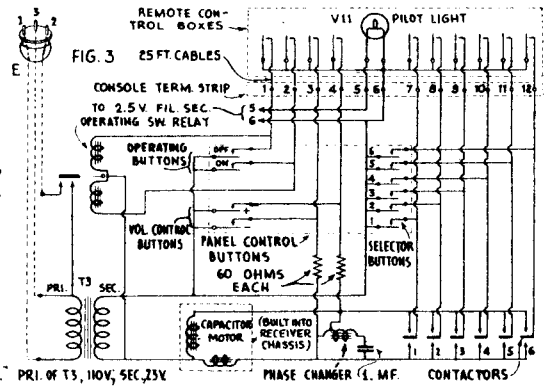
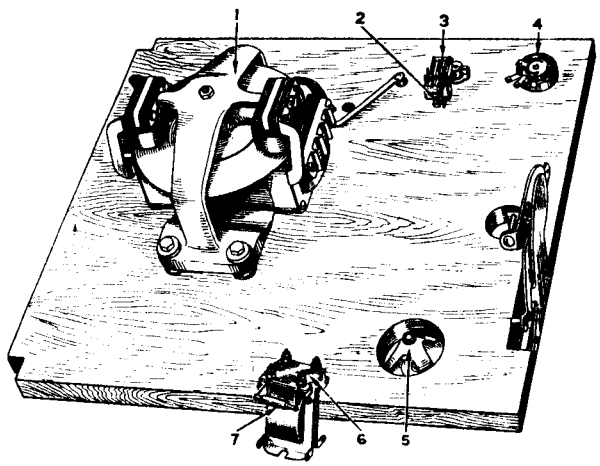


FIG. 3

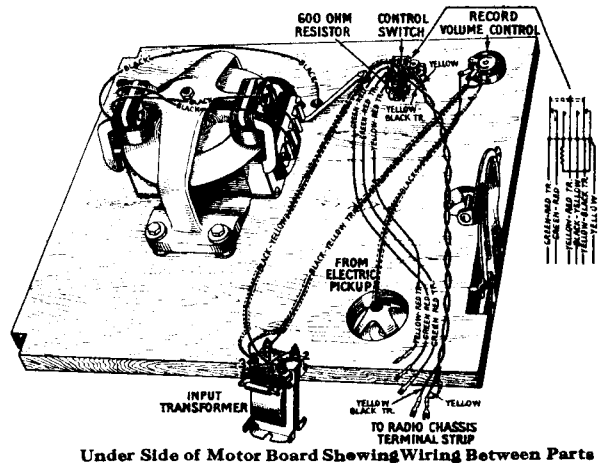
R.C.A. VICTOR CO.

Model RE-17

The Victor Radio with Electrola RE-17 is a combination of the four-circuit radio equipment in the R-15 with the Electrola equipment, less home recording, of the RE-57. A transfer switch controls the change-over from radio to record operation. When the switch is in the "Electrola" position, the power detector becomes a first stage audio amplifier, transformer coupled, by a change in the grid bias of this tube when a 600-ohm resistor is connected into the grid bias circuit. The screen grid voltage supply to the R.F. tubes is opened to prevent the possibility of obtaining both radio and record reproduction simultaneously.



Under Side of Motor Board Showing Parts



Under Side of Motor Board Showing Wiring Between Parts

No.	Name of Parts	Stock No.
1.	Motor (60 Cycles)	A-9054
	Motor (25 Cycles)	A-9053
	Motor Capacitor (25 Cycles)	A-241
	Motor Resistor (25 Cycles)	A-359
2.	600 Ohm Resistor (Green, White, Green)	A-358
3.	Radio-Record Control Switch (Complete less knob)	A-425
4.	Electrola Volume Control (Complete less knob)	A-336
5.	Electric Pickup Arm and Base	A-1454
6.	Input Transformer	A-24
7.	Input Transformer Capacitor)	A-257

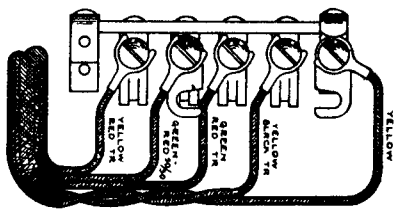
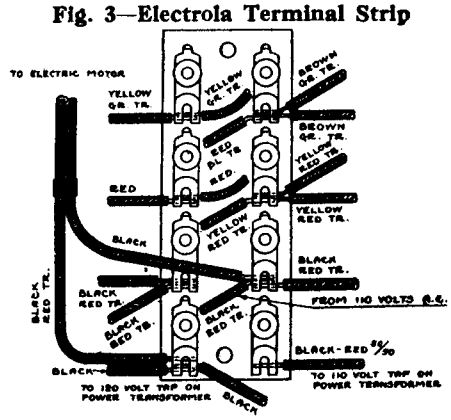


Fig. 3—Electrola Terminal Strip



Radio Chassis Terminal Board, showing Additional Connections for Motor

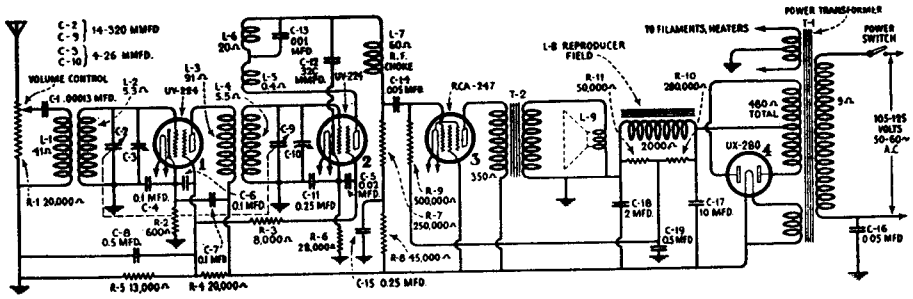
Voltmeter Continuity Test of Electrola Parts

Using 10 volt scale of Weston 547 Test Box and 4½ volt "C" battery.

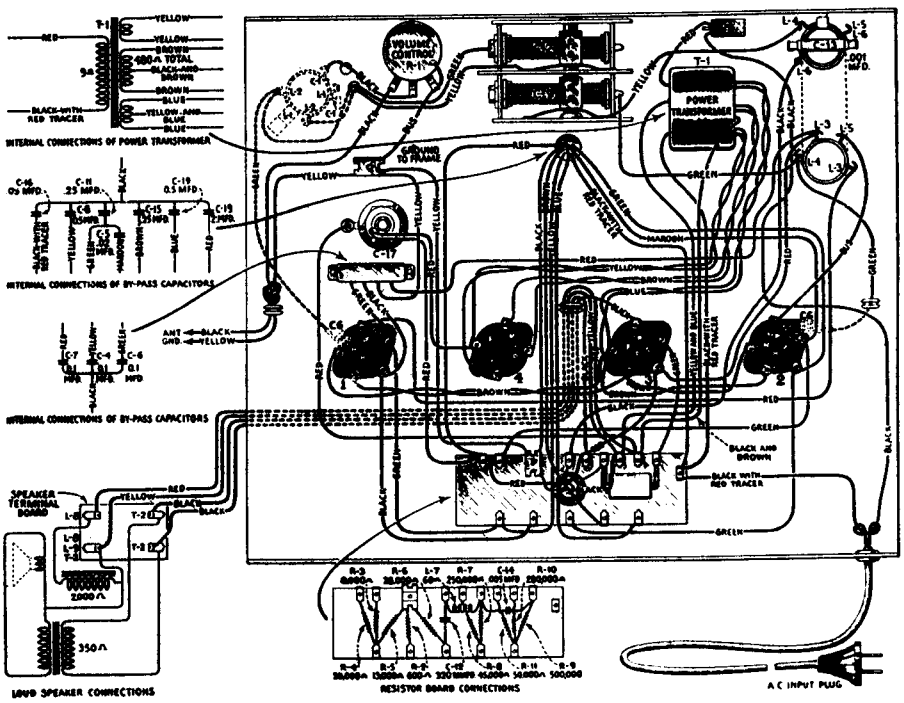
TEST	TERMINALS	APPROX. VOLTAGE (10 Volt Scale)
Electric Pickup	On P. U. Connector Block	9.0 Volts
Record Volume Control	Two End Terminals	8.6 Volts
Input Transformer	1 and 2 3 and 4	9.0 Volts 7.2 Volts

R.C.A. VICTOR CO.

MODEL R-5



Schematic Circuit Diagram of Model R-5



SOCKET VOLTAGE READINGS

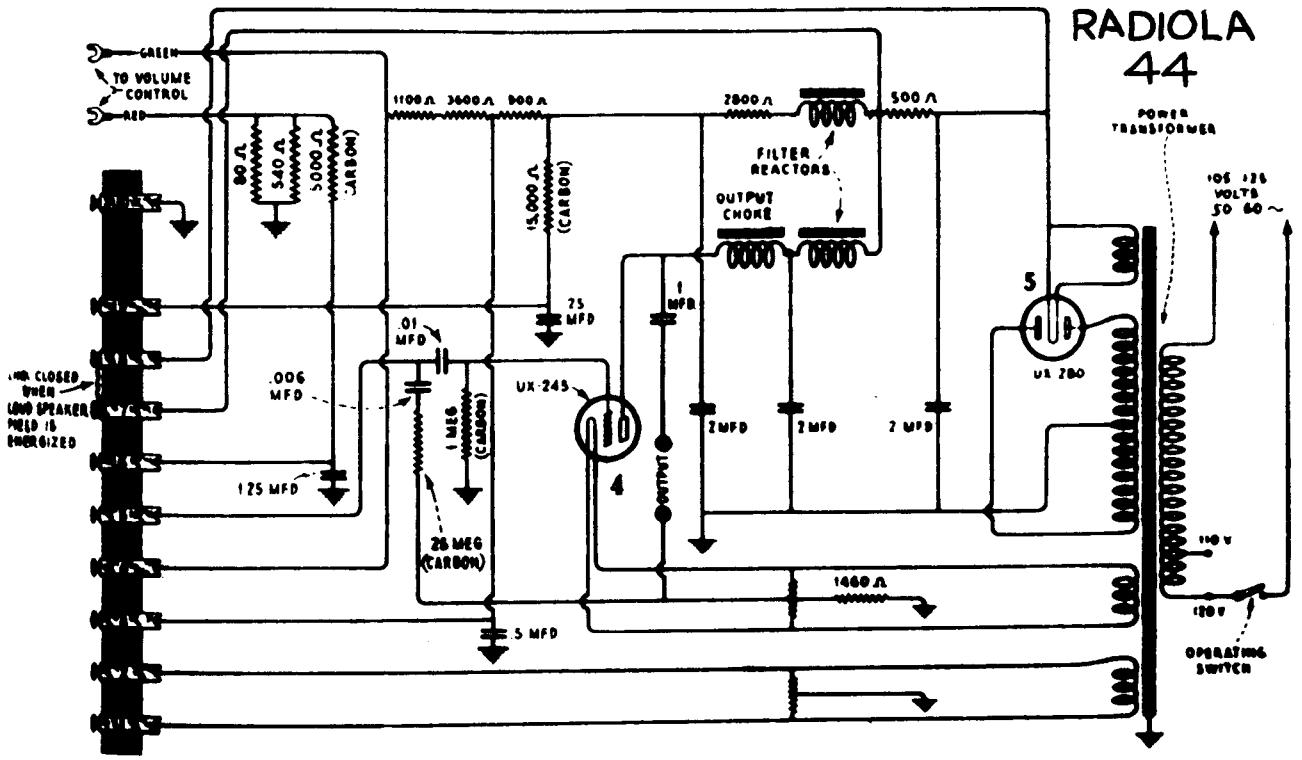
110-VOLT LINE

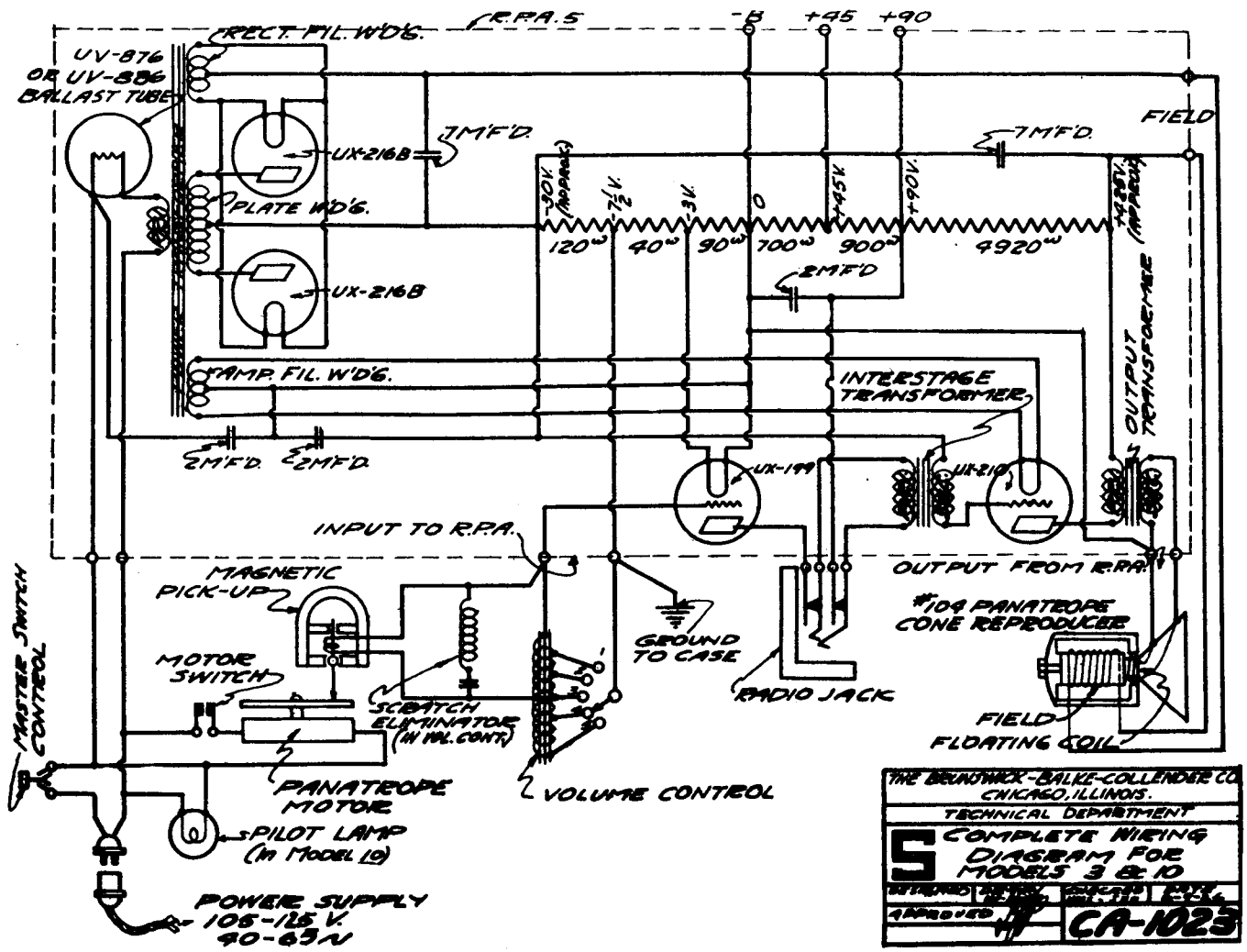
These are readings obtained with the usual Set Analyzers and are not true readings of the voltages at which the Radiotrons operate.

Radiotron No.	Heater to Cathode Volts	Cathode or Filament to Control Grid Volts	Cathode or Filament to Screen Grid Volts	Cathode or Filament to Plate Volts	Plate Current M. A.	Heater Volts
1	3.0	3.0	85	225	4.0	2.2
2	7.0	7.0	65	100	0.25	2.2
3	——	2.0	225	215	30.0	2.2

R.C.A.-VICTOR CO.

RADIOLA 44





THE BRUNSWICK-BALKE-COLLENDER CO.
CHICAGO, ILLINOIS.
TECHNICAL DEPARTMENT

5 COMPLETE WIRING DIAGRAM FOR MODELS 3 & 10

CA-1023

Radio Service Data Sheet

SILVER RADIO MODELS 30 (CHASSIS), 60 LOWBOY, 95 HIGHBOY AND 75 CONCERT GRAND

This chassis utilizes '24 type screen-grid tubes in the first four stages: an aperiodic antenna coupler feeds V1, which is connected to V2 through the band selector L2-L3-L4. V3 is the third R.F. stage, and V4 a power detector which is followed, however, by a '27-type first audio stage V5. In the push-pull power stage, V6 and V7 are '45s.

The volume control in this receiver is the 10,000-ohm potentiometer P1; while the low resistance instrument P2 is the hum balancer. P1 is a metal-frame component ("PP No. 4477" —Yaxley "Type 510,000") and must not, under any circumstances, be replaced with one of the earlier bakelite frame type. When inserting a new unit, drop a fiber washer over the shaft bushing; the lock-nut should be removed and a fiber spacing washer used to insulate the potentiometer shaft from the metal chassis. After replacing the front panel, which is fastened by the lock-nuts of the power switch SW1 and the "overtone switch" Sw2, a second fiber spacing washer is dropped over the shaft of P1, and its nut tightened. A test for a ground to the chassis should be made before soldering the connecting leads of P1.

While the low-note amplification of this receiver is high, and the normal operating hum faintly discernable, if this becomes excessive try other tubes in the detector and audio sockets. The power tubes should be selected for matched characteristics.

In the earlier models of this receiver, the cathode resistor R8 was connected to the white lead of the condenser bank C13, and thus bypassed by 1 mf. capacity; while both red leads of C12 ran to the cathode of V4. In these receivers, produced before July 8, 1929, it will be found desirable, for the reduction of hum, to rearrange the connections as shown in the diagram below.

The receivers with a serial number above 12,907 contain the "Type 30 filter"—comprising L12 and C14; in the 25-cycle models, C14 is connected as indicated in dotted lines; in 60-cycle receivers, as shown by full lines.

In receivers of a lower number, it may be desirable to add this unit to reduce hum. Without it, plate potential readings taken from these sets will be found about 10 volts higher than the figures shown below; in later models, the resistance of the choke coil L12 ("No. 339U") causes this drop.

The following figures represent the average readings obtained on a Jewell "Model 199" set analyzer, with the line-voltage at 114 and the volume control set at maximum:

Tube	*Screen*	*"A"*	*"B"*	*"C"*	*K*	*Plate Ma.*
V1	60	2.25	142	1.0	1.0	2.6
V2	58	2.25	140	1.4	1.4	2.3
V3	58	2.25	140	1.2	1.2	3.2
V4	40	2.25	55	5.4	10	0.2
V5	—	2.30	176	—	12	6.5
V6	—	2.30	205	40	—	28
V7	—	2.30	205	40	—	28

In normal operation, this receiver may be tested for noise by shorting the antenna and ground posts, and turning P1 to the full "on" position. Practically no background noise should then be heard at 550 kc.; no appreciable hiss becoming evident until the "Selector" drum has been turned to 1500 kc. Excessive noise may be due to tubes, wiring, or parts. Interchange the '24s until a quiet one has been obtained for V4, and another for V1 (the right-hand or first R.F. socket). V2 is the least critical '24 position.

Inability to receive stations between 200 and 214 meters (1400 and 1500 Kc.), or crystal-controlled transmissions below 230 meters (above 1300 Kc.), at their designated positions on the "Selector" drum, indicates the need for realignment of the tuning condensers. The correct procedure is: first, remove the chassis from the cabinet, and put it in operation with the shield-can cover resting over only the first three (R.F.) compartments. Next, tune in a weak signal between 240 and 230 meters (1250 and 1300 Kc.), and start with the aligning condenser in shunt with C4; then, in succession, align C3, C2, C1. To align C2 for loudest signal, it will be necessary to unsolder the red wire from the rear stator soldering lug of C1. Then re-solder the red wire to the stator lug of C1 and unsolder both wires (*but leave them connected to each other*) from the stator lug of C2; and align C1 for loudest signal. Re-solder the wires to stator lug of C2. When they are properly adjusted, the aligning screw of C4 will be practically all the way in; those of C3 and C2 nearly all in; while that of C1 will be nearly all out and with frame and spring separated about ⅛-in. It is absolutely essential that the drum dial and volume control settings remain unchanged during the above operations, which must be carried out in the order specified. If the receiver will not tune down to 200 meters (1500 Kc.), the aligning process has been carried out with the aligning condensers screwed too tight.

If the loud-speaker frame becomes ungrounded and "floats," the receiver will usually oscillate; as, also, if the ground lead is unconnected, poor tubes are in use, the R.F. plate leads incorrectly located, or tube shields not firmly in position. It is vitally important that the three red R.F. plate leads (leading from lugs of sockets of V1, V2, V3, through and under chassis partition to their respective inductors) be pushed down carefully into the angle between the chassis and the partitions, where they run from the socket lug up to the slot in the partition. If, during previous servicing, these leads have been allowed to straggle through the set, and are not placed exactly as specified, the circuits will invariably oscillate. An infrequent cause of circuit oscillation is a short of L10; or a defective C5 or C8.

If the "overtone" switch SW1 fails to change the timbre of programs, carefully check the values of C5, C7 and C8.

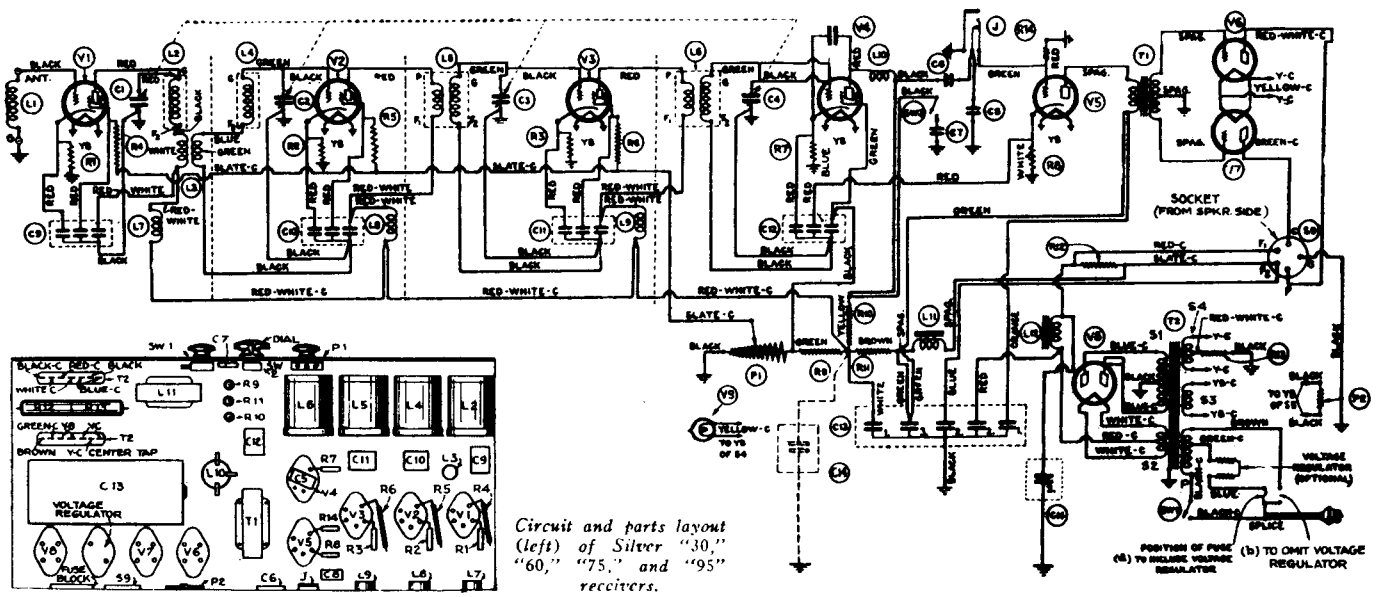
A tension screw on the hub of the dial, which is held by a lock-nut, permits the drive cord to be tightened when necessary.

If it becomes necessary to replace an R.F. coil, the replacement coil *must* have upon its end the same crayon identifying number as the defective coil.

The following values are used in the Silver "Model 30" chassis: C5, C7, .00015-mf.; C6, .006-mf.; C8, .001-mf.; C9, C10, C11, C12, 0.1-mf.; P1, 10,000 ohms; R1, R2, R3, 400 ohms; R4, R5, R6, 2600 ohms; R7, 60,000 ohms (blue); R8, 2,000 ohms (white); R9, 10,000 ohms (green); R10, 300,000 ohms (yellow); R11, 3500 ohms (brown); R12, R13, one 800-1500-ohm tapped resistor; R14, 2 megs. (red); C14, 2 mf. L1, L7, L8, L9, L10 are "Type 274U" R.F. chokes.

A screen antenna is contained inside the cabinet top.

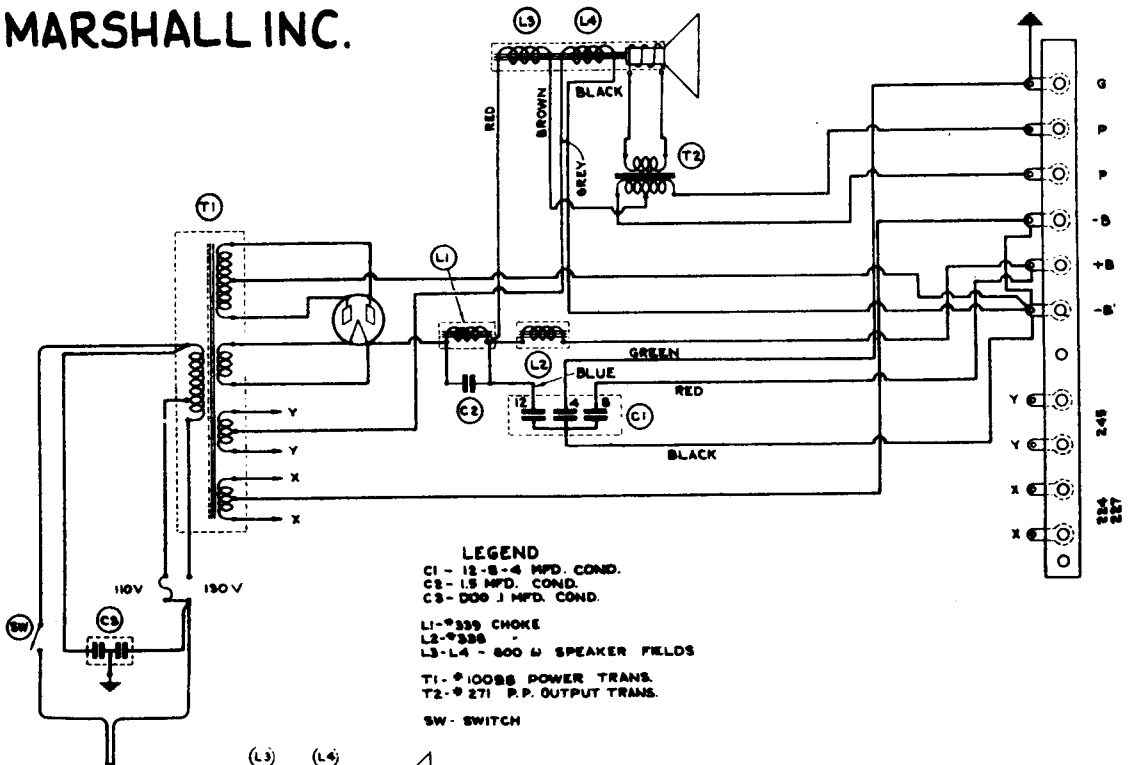
To readjust the gang condenser bearings, if they are too tight, loosen the dial set screws sufficiently to free the dial, after removing the chassis. Adjust the condenser so that the rotor turns freely. First release all rotor spring tension screws. If the condenser is still tight, or if end-play exists, the thrust screw must be carefully adjusted. The rotor spring bearings should be adjusted one by one, so they do not press the rotor shaft upward. Otherwise, the screw should be completely removed and the upper spring so bent as to bear down upon the rotor shaft (as the screw is tightened) before the lower rotor spring forces the shaft upward. The proper adjustment of the rotor springs is when they are not loose enough to cause vertical play, but permit side play.



Circuit and parts layout (left) of Silver "30," "60," "75," and "95" receivers.

SILVER MARSHALL INC.

33-A POWER SUPPLY 25 ~



LEGEND
C1 - 12-8-4 MFD. COND.
C2 - 1.5 MFD. COND.
C3 - 000 J MFD. COND.

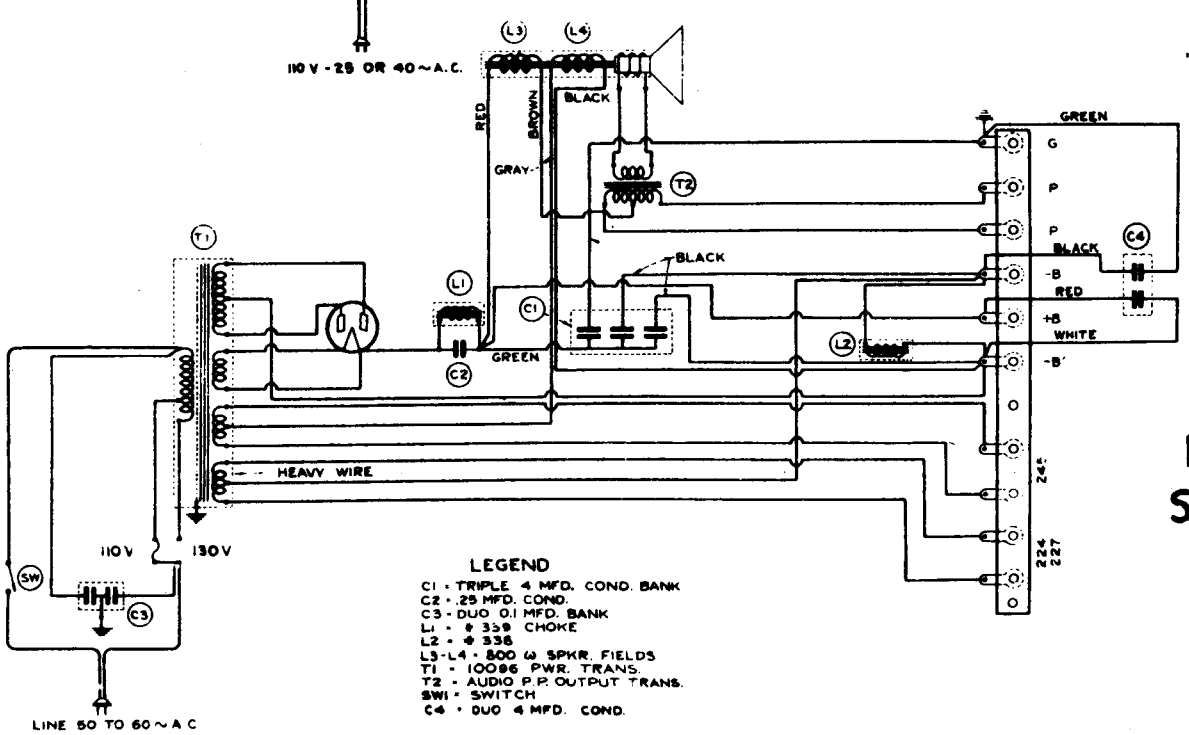
L1-#339 CHOKE
L2-#338 "
L3-L4 - 800 Ω SPEAKER FIELDS

T1 - #10088 POWER TRANS.
T2 - #271 P.P. OUTPUT TRANS.

SW - SWITCH

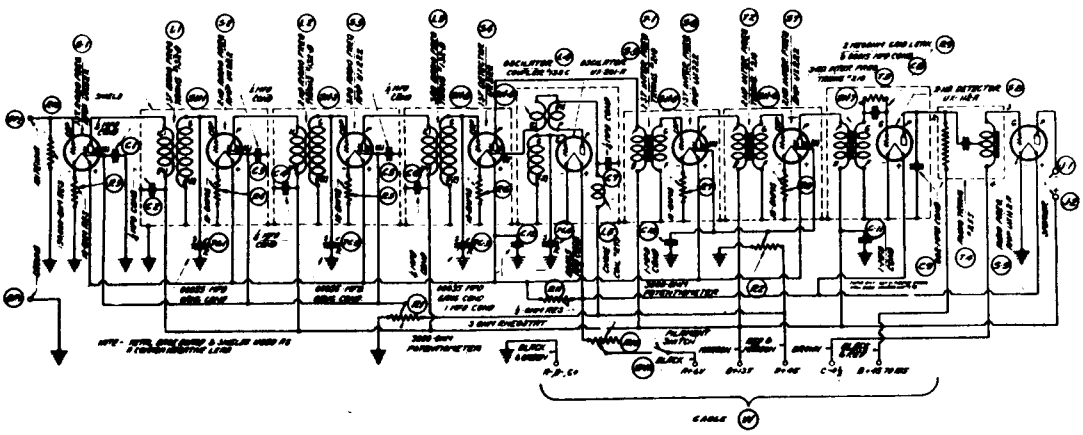
110 V - 25 OR 40 ~ A.C.

33-A POWER SUPPLY 60 ~



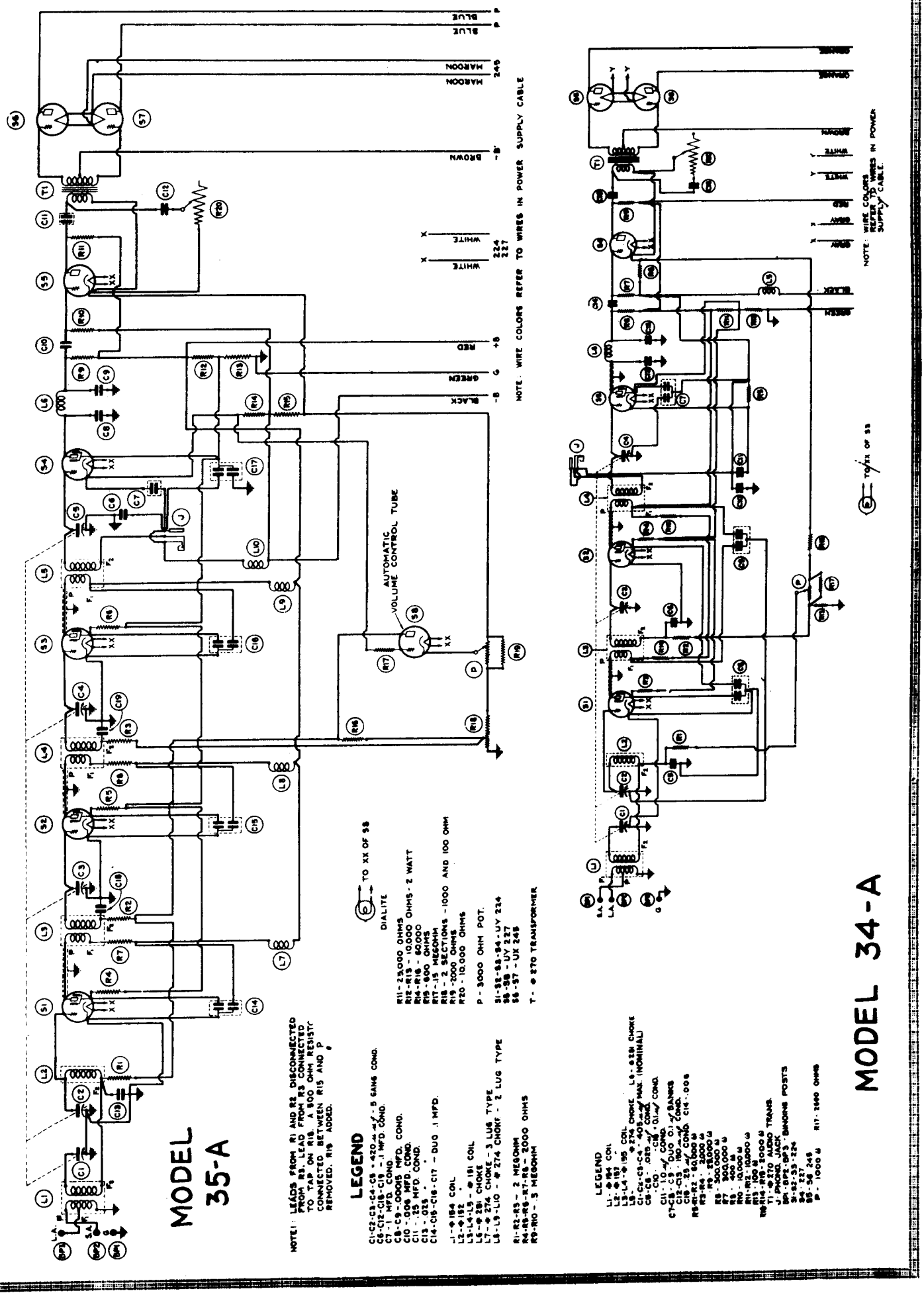
LEGEND
C1 - TRIPLE 4 MFD. COND. BANK
C2 - .25 MFD. COND.
C3 - DUO 0.1 MFD. BANK
L1 - # 339 CHOKE
L2 - # 338
L3-L4 - 800 Ω SPKR. FIELDS
T1 - 10086 PWR. TRANS.
T2 - AUDIO P.P. OUTPUT TRANS.
SW1 - SWITCH
C4 - DUO 4 MFD. COND.

LINE 50 TO 60 ~ A C



1929 - 9-TUBE S-G. SUPER.

SILVER MARSHALL INC.



Radio Service Data Sheet

SILVER-MARSHALL SUPERHETERODYNE, WITH "MODEL 36A" CHASSIS AND "32A" POWER PACK

This late model superheterodyne, a product of Silver-Marshall, Inc., Chicago, Ill., operates on an intermediate frequency of 175 kc. The single stage of signal-frequency amplification is preceded by a band-selector. The power consumption is only 100 watts, and it is so sensitive that an antenna longer than 25 feet will seldom be required.

The load for the power pack is the receiver chassis; and the pack must never be operated without the receiver chassis being attached. This is important.

Following is a list of replacement-part values: Condensers C1, C2, C3, C4, 407 mmf.; C5, 750 mmf.; C6, 250 to 600 mmf.; C7, C8, C9, triple 0.1-mf. bank (C7, C8, 200 volts rating; C9, 300 volts); C10, C14, C16, C20, 0.25-mf.; C11, C17, C21, 0.1-mf.; C12, C15, C18, 1.0 mf.; C13, .001-mf.; C19, 4 mf. electrolytic condenser bank.

Resistors R1, R5, 25,000 ohms; R2, 500 ohms; R3, 750 ohms; R4, 2,000 ohms; R6, 300,000 ohms; R7, 400 ohms; R8-R9, 100 to 1000 ohms on one strip, wire-wound; R10, 375 ohms; Rv, 3,000 ohms; R11, 3500 ohms, R12, 4,000 ohms; R13, R15, 10,000 ohms, R14, 20,000 ohms. Resistors R2, R3, R7, and R10 are wire-wound. Note that resistors R12 and R13 are of 2-watt rating; while R11 is rated at 3 watts.

The inductances in this receiver have the following catalog designations: L1, L2, "No. 161" coil; L3, "No. 160" coil; L4, L5, "No. 162" coil; L6, L11, "No. 281" choke; L7, L8, L9, "No. 163" oscillator coil; L10, "No. 339" choke. The speaker field SP has a resistance of 800 ohms per section. The transformers are listed as follows: T1, "No. 272"; T2, "No. 271A" or special; PT, "No. 346"; IT1, "No. 212"; IT2, IT3, "No. 213."

Average tube-supply values for this receiver are as follows. Filament potentials: V1, V2 V3, V4, V5, V6, 2.27 volts; V7, V8, 2.4. Screen-grid potentials: V2, 85 volts; V3, 80; V4, V5, 110; V6, 162. Grid potentials; V7, 22.5 volts (depending upon meter); V8, 42.5. Cathode potentials: V1, V3, 37.5 volts; V2, V6, 7; V4, 42.5; V5, 45.0. Plate potentials: V1, 82 volts; V2, 162; V3, 76 (depending upon meter); V4, V5, 160; V6, 245; V7, V8, 255. Plate currents: V1, 11 ma.; V2, V4, V5, V6, 4; V3, 3.

One 800-ohm section of the field coil supplies "C" bias for the power tube. Switch Sw2, the "local-distance" control unit, controls both selectivity and amplification at the same time. One power tube is impedance-coupled, and the other transformer-coupled, to the detector tube. The undistorted power ouput of this combination is rated at 4 watts.

It may be found desirable to arrange a line filter, consisting of two 1-mf. condensers in series; the center tap being grounded, and the two ends being connected across the light line, at the receiver. In some localities, it may be necessary to use a shielded lead-in, the antenna length being increased to compensate for the by-pass effect of the shield.

When placing the tubes in the sockets, note that the little metal disc should be placed on top of the '24 tube shield located third from the left, with the grid wire passing through the slot.

Perhaps the most important comment, in connection with this receiver, is the suggestion that extreme care and attention be given to the selection of tubes of satisfactory characteristics for the different positions in the set.

The first detector (V3) may be selected by tuning in a weak station, and tapping the tube in the second-detector (V6) socket; least noise being the desired quality. When a non-microphonic tube is located, it is to be taken out of socket V6 and put in socket V3. The tube for regular use as V6 may be selected by turning the volume control for medium volume (on a local station) and selecting the tube which gives best tone quality.

A noisy volume control may often be repaired by simply turning the control knob rapidly to remove oxidization.

If an exceptional hum develops, check for defective power or rectifier tubes. The power tubes, and each plate of the rectifier tube, should read within 5% of each other. Also, hum may be due to the pilot light V10 becoming grounded.

Granting that good tubes have been selected, a microphonic howl may be due to non-removal of shipping blocks; or to the receiver chassis not being entirely supported by the rubber cushions.

Many radio service stations have a workbench with a metal top. The manufacturers of this set point out that it should be aligned only on a table with a wooden top.

If the set lacks sensitivity and selectivity, even though all tubes check perfect, it is probable that the circuits should be aligned. Start with the I.F. circuit, then check up the R.F. and oscillator circuits.

The I.F. transformer trimmers are accessible through the tops of their shield cans, adjustment for 175-kc. frequency being made with an *insulated* screwdriver.

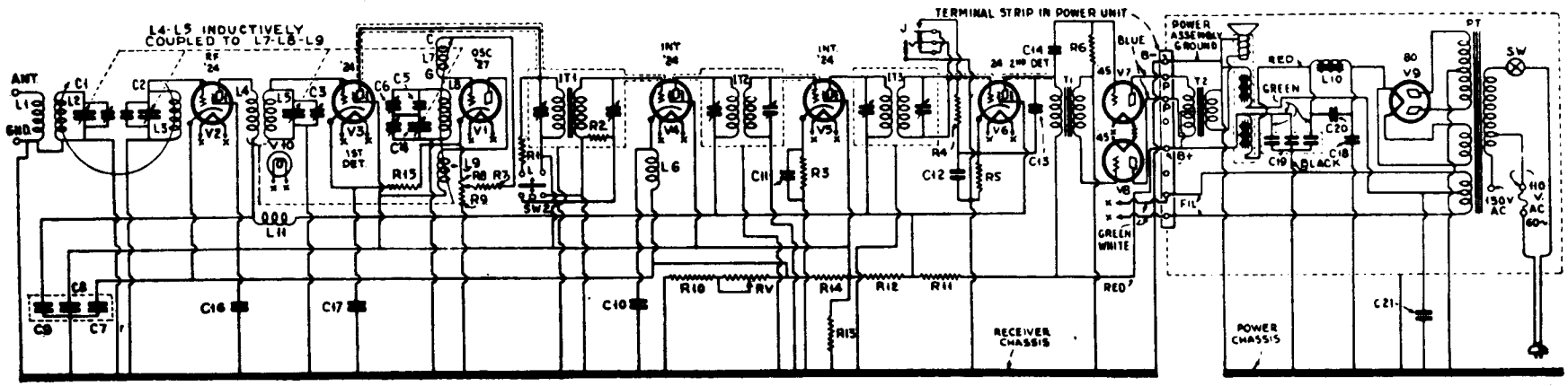
Before proceeding with this alignment process, it will be necessary to provide a temporary pointer, on the dial scale, against which alignment may be made (the chassis being out of its cabinet). Arrange the pointer so that (with the setscrew stop on the drive shaft released and the variable condenser against its own stop in the minimum position) the temporary pointer will line up exactly with the line marked "stop" on the dial. The dial should then be rotated until the 1400-kc. marking is directly opposite the temporary dial pointer. Both of these operations must be performed accurately.

The R.F. circuits are to be balanced at 1400 kc. and the oscillator at 600 kc. To balance the oscillator, it is necessary to locate accurately the point at which 600 kc. is passed by the R.F. amplifier.

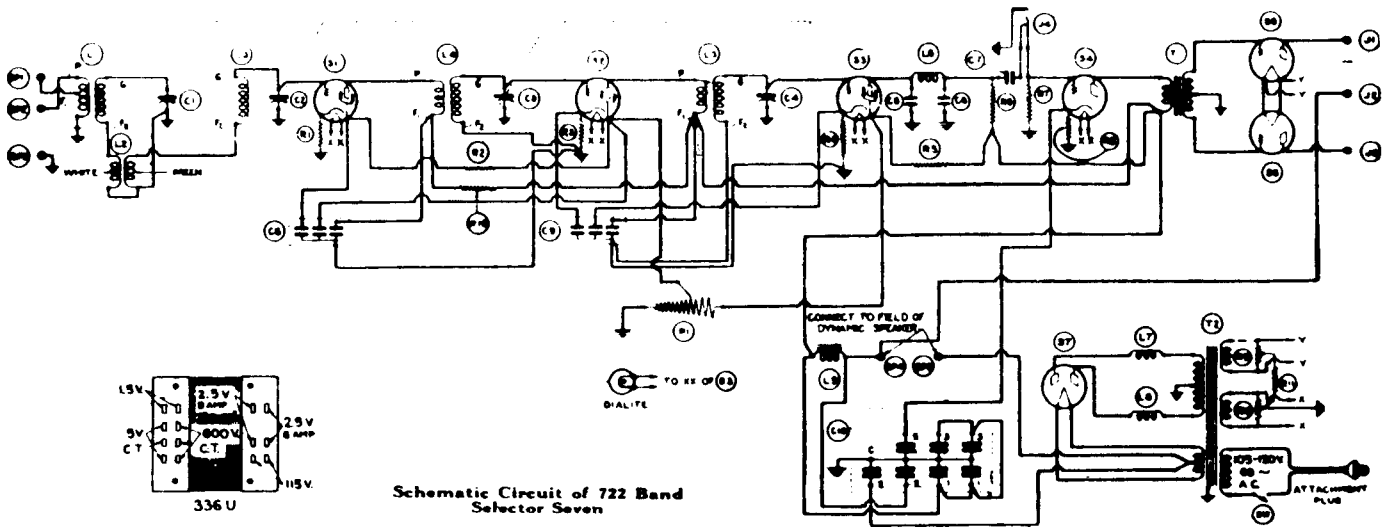
To do this, the wire connecting C6 (on the centrally-located micarta strip) to C4, is disconnected from C4. The free end of this wire now should be connected to a separate 350- or 500-mmf. condenser; the other side being grounded to the chassis. The test oscillator should now be re-adjusted to 600 kc., and the receiver dial turned to that reading as well. The external condenser, which has been added to the oscillator, is now rotated until the signal is heard; and the input to the receiver from the oscillator is adjusted to give a convenient value on the output meter connected to the output of the receiver. The dial of the receiver should now be rotated, turning the gang condenser, until the reading in the output meter is a maximum. From this point on, both the setting of the receiver dial and the adjustment of the *four* trimming condensers on the gang condenser should remain undisturbed.

The external condenser should now be removed; and the wire between the oscillator section of the gang condenser and the second oscillator trimmer should be replaced and soldered. Now, with a bakelite screwdriver, adjust this oscillator low frequency trimmer, by means of the adjusting screw in the back of the micarta mounting strip, until the output meter reads maximum. This completes the alignment procedure on the receiver. If, after the chassis is replaced in the cabinet, the dial does not read exactly true, it may be shifted slightly on the shaft.

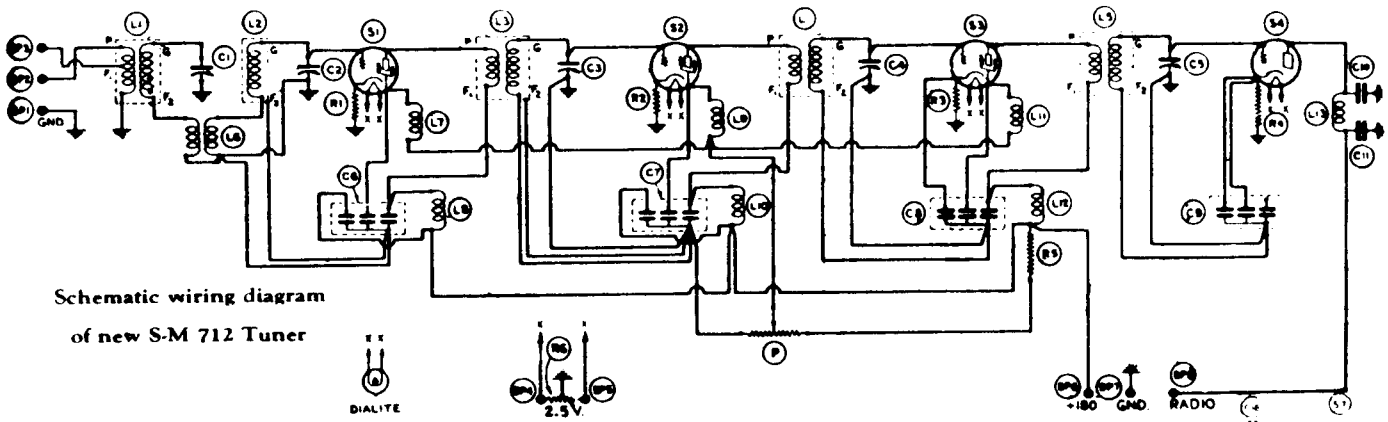
A new cord may be installed on the drum dial without removing the dial from the set; a 21½-in. length of "SM 3913" Heavy Dial Cord is required. If the drum dial turns stiffly, the gang condenser bearing may be too tight.



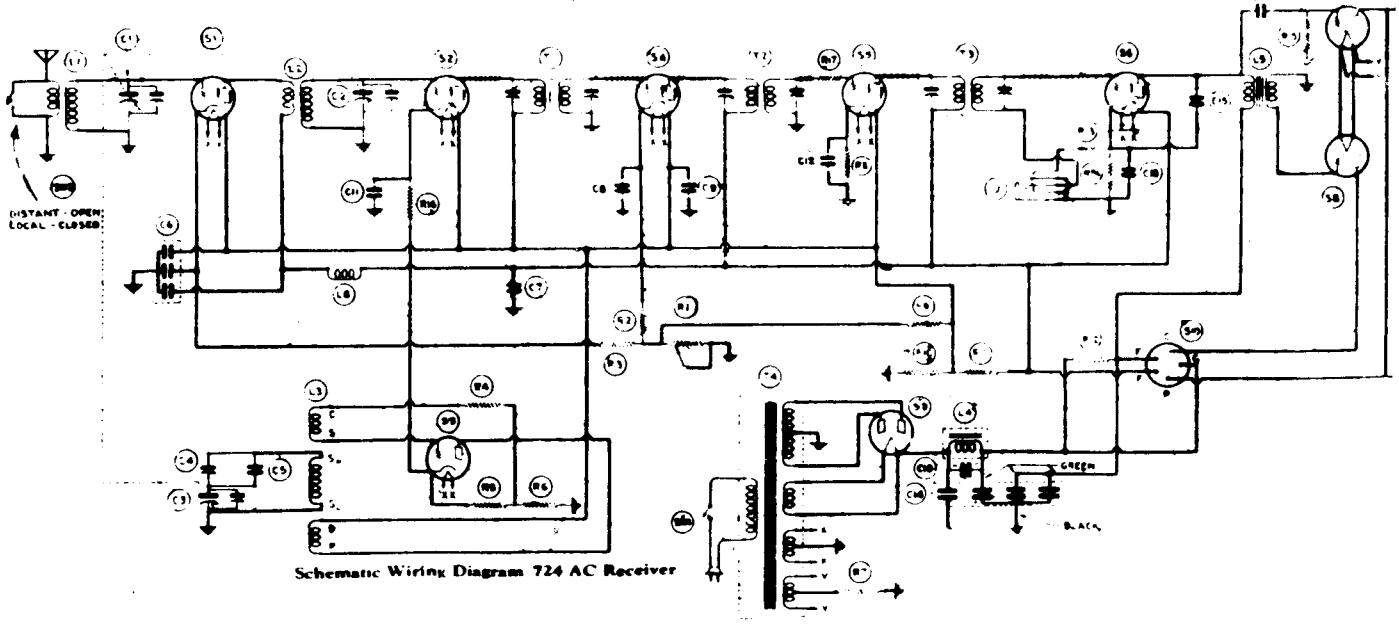
SILVER MARSHALL, INC.



Schematic Circuit of 722 Band Selector Seven



Schematic wiring diagram of new S-M 712 Tuner



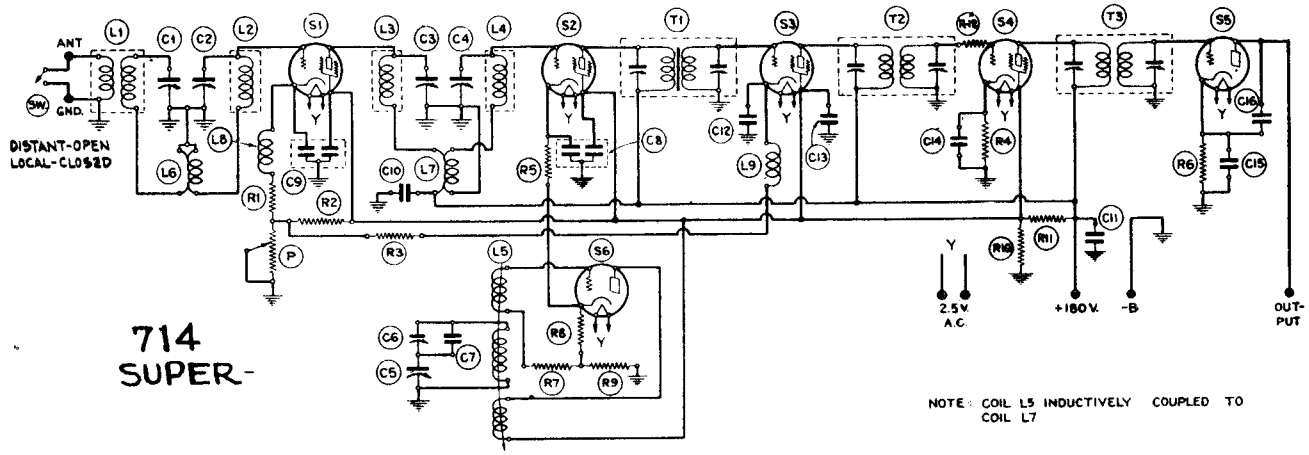
Schematic Wiring Diagram 724 AC Receiver

REPLACEMENT PARTS LIST FOR 724AC

C7, C8, C9, C10, C16 5—Polymet .25 Cond. Cased
C13 1—Potter 1 mfd. Cond
C6 1—Potter 30B Triple .1 mfd. Cond.
C14 1—Elkton #7044 (or Potter #6258B) Condenser bank (4-4 mfd.
1—S-M 6171 Oscillator-Detector Coil Assembly (Includes) L2 1—162 r.f. Coil
L3 1—163 Osc. Coil
R3, R4 2—Carter RU400 ohm Res.
R2 1—Yaxley 1000 ohm Res.
1—Bakelite strip
Hardware
C1, C2, C3 1—S-M 6369 Condenser & Dial Assembly (SM325 & SM#11)
C4, C5 1—S-M 6362 Oscillator Trimmer Assembly

R12 1—Carbon 600 Ohm 2-watt Resistor
R11 1—Carbon 2360 Ohm 4-watt Resistor
R10 1—Carbon 3750 Ohm 3-watt Resistor
R7 1—Carbon 900 Ohm 3-watt Resistor
R17 1—Carbon 150,000 Ohm Grid Supressor Resistor
R14 1—Durham 25,000 Ohm 1-watt Resistor
R9 1—Durham 20,000 Ohm 1-watt Resistor
R13 1—Durham 2,000 ohm 1-watt Resistor
R15 1—Durham 300,000 ohm 1-watt Resistor
R16 1—Durham 10,000 Ohm 1-watt Resistor
R18 1—Durham 3500 ohms 2-watt Resistor
R8 1—Yaxley 1000 Ohm Resistor
R1 1—Yaxley 3000 Ohm Variable Resistor with Milled Shaft
R5, R6 1—Yaxley 1100 Ohm Tapped Resistor
J 1—Yaxley #704A 5-prong Jack
SW1 1—H & H #5174 Rotary Switch with Milled Shaft
SW2 1—H & H #5192 On-Off Toggle Switch Long Shank
C15 1—Polymet .001 Fixed Condenser
C11, C12 2—Sprague .1 mfd. Condenser

SILVER-MARSHALL INC.



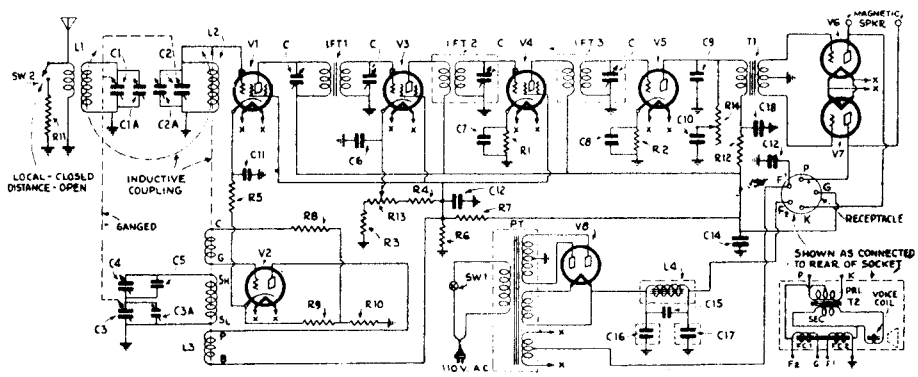
714 SUPER-

714 PARTS LIST FOR REPLACEMENT

1--S-M 714 Chassis assembly.....		$43.45
(Includes) 1--Chassis complete with shields @ 10.50		
T1	1--212-41 Transformer @ 5.50	
T2	1--213-42 Transformer @ 5.50	
T3	1--213-43 Transformer @ 5.50	
C8, C9	2--Potter dual .1 mfd. cond. @ $1.10 ea.	
C12, C13	2--Polymet .25 mfd. cond. @ $1.00 ea.	
C11	1--Potter .1 mfd. cond. @ 1.25	
S1, S2, S3, S4	4--CR 224 Sockets @ .50 ea.	
S5, S6	2--CR 227 Sockets @ .50 ea.	
L1	1--SM 167 antenna coil @ 2.00	
L2, L3, L4	3--SM 166 r.f. Coils @ 2.00 ea.	
C1, C2, C3, C4, C5,	1--SM 6384 Condenser and Dial Assembly.....	19.00
(Includes SM 316 condenser and SM811 dial)		
C6, C7	1--S-M 6350 Oscillator Trimmer Assembly.....	3.50
R1, R3	1--S-M 6408 Volume Control Resistor Assembly for 714 (1--RU400, 1--1000 ohm).....	1.25
L5	1--S-M 163 Oscillator Coil...	1.75
L8, L9	2--S-M 281U Choke Coils @ .75	1.50
	3--S-M 637 Tube Shields @ .40	1.20
	1--S-M 814 Escutcheon.....	.50
	1--S-M 819 Knob.....	.30
	2--S-M 820 knobs @ .30.....	.60
	1--S-M 818 Hookup Wire.....	.50
L6, L7	2--S-M 30X Couplers @ .60	1.20
R8, R9	1--Yaxley 1100 ohm. Resistor Tapped at 100 ohms.....	.65
R4	1--Yaxley 1000 ohm Resistor..	.50
P	1--Yaxley 3000 ohm Variable Resistor.....	1.50
R2	1--Durham 20,000 ohm 1-watt Resistor.....	.75
R5	1--Durham 10,000 ohm 1-watt Resistor.....	.75
R6	1--Durham 60,000 ohm 1-watt Resistor.....	.75
R12	1--Durham 300,000 ohm 1-watt Resistor.....	.50
R10	1--Carbon 3750 ohm 3-watt Resistor.....	.75
R11	1--Carbon 2360 ohm 5-watt Resistor.....	1.10
C10, C14	2--Sprague .1 mfd. Condensers @ .90.....	1.80
C16	1--Polymet .002 Fixed Condenser.....	.75
C15	1--Potter .1 mfd. Condenser..	1.25
R7	1--Carter RU 400 ohm Resistor	.20
	1-- H & H 5174 On-Off Switch.	.85
SW	1--H & H 5192 On-Off Toggle Switch, Long Shank.....	1.00
	7--Binding Posts @ .15.....	1.05
	1--Set of Hardware.....	1.20

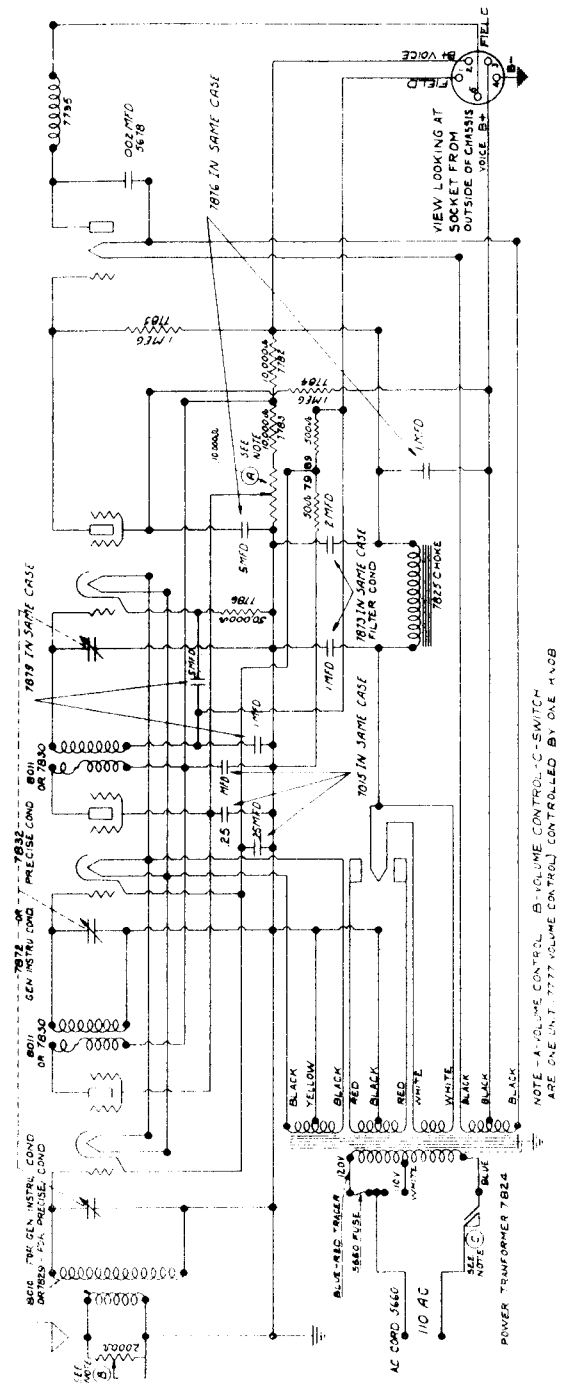
HARDWARE

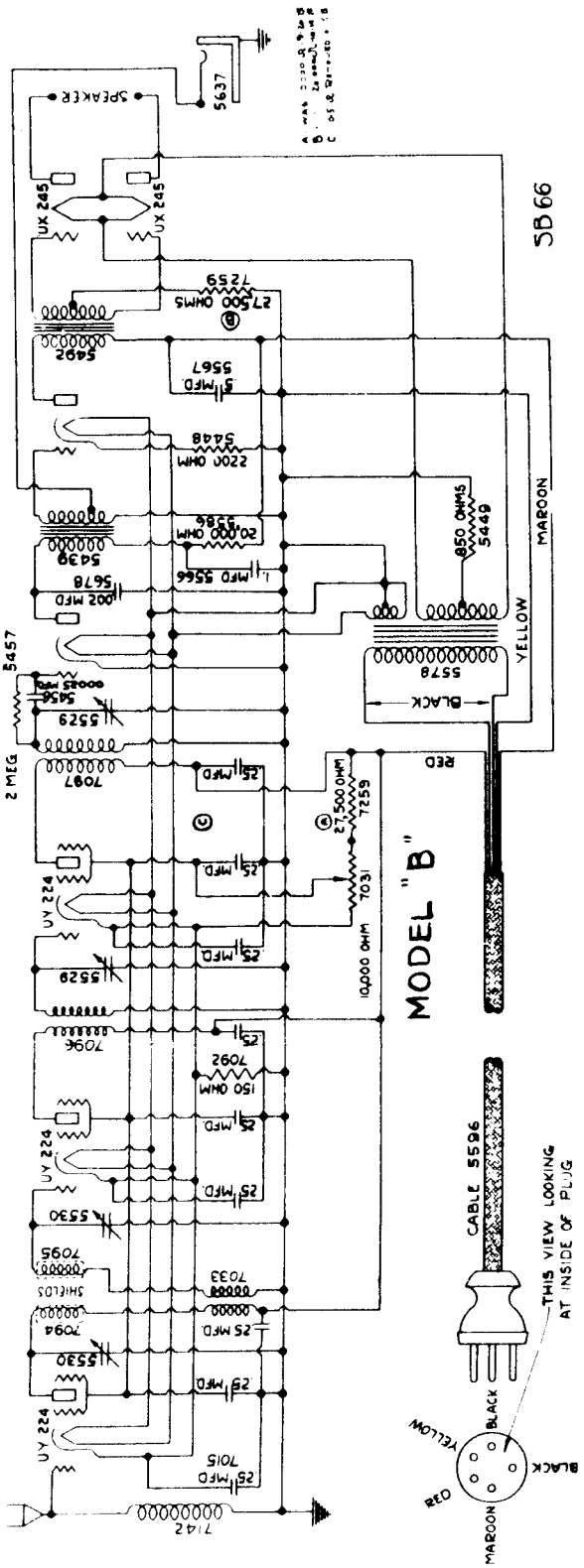
10--3898 L60 Lugs
36--5701 #6 Shakeproof Washers
29--4113 6/32 x 1/4 Hex Nuts
41--4980 6/32 x 1/2 RH CP MS
2--5697 #4 Shakeproof Washers
2--4110 2/56 Hex Nuts
2--4976 2/56 x 3/8 RH OX MS
1--3034 714-304 Coil Mtg. Bracket
7--Feet #14 Yellow Wire
1--5716 1/4" Hex Brass Stud
3--5713 3/4" Fibre Washers
2--4994 6/32" x 1 7/8" RH CP MS
2--4989 6/32" x 1" RH CP MS
5--5705 Ext. BP Washers
5--5706 Plain BP Washers
2--5031 6/32" x 1 1/8" RH CP MS
2--5049 11/16" x 1/4" Spacer



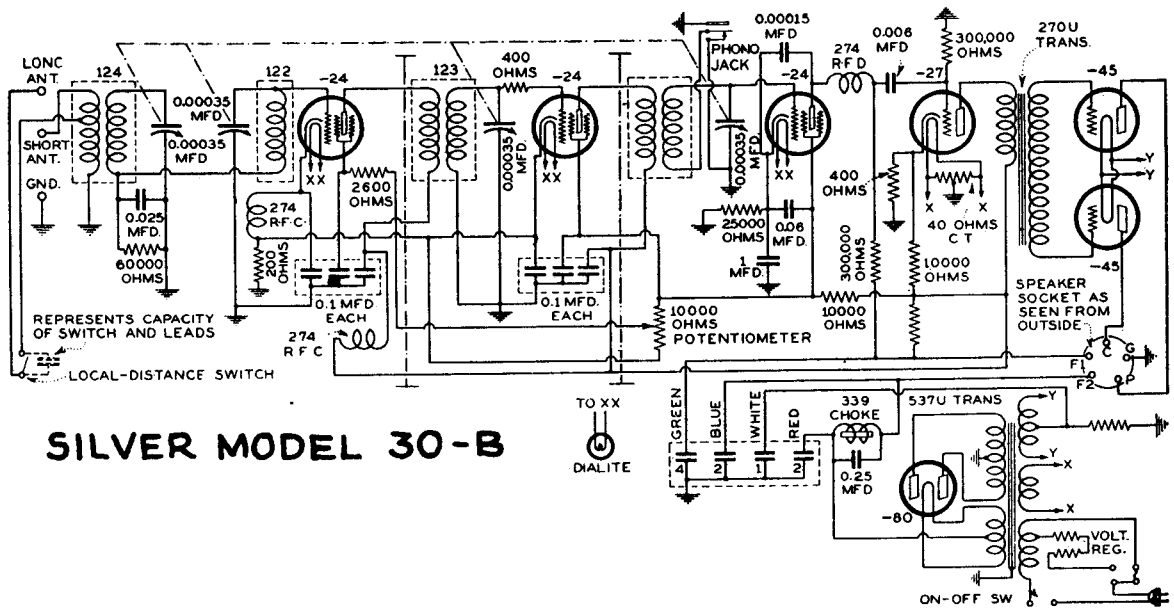
The new "37, 38 and 39" Silver-Marshall super circuit, for midget chasses. Resistances (ohms): R1, 750; R3, 200; R5, R6, R7, 10,000; R8, 400; R9, R11, 100; R10, 1,000; R12, 4,000; R13, 10,000; R14, 500,000. Capacities (mmf.): C1, C2, C3, 425 max.; C4, 250-600; C5, 750: (mf.) C6, C7, C11, C13, 0.1; C8, C12, C14, 1.0; C9; .001; C10, C15, 0.25; C16, C17, 8 (electrolytic). R2 and R4 are 25,000-ohm resistors of one-watt rating.

STERLING MFG. CO.

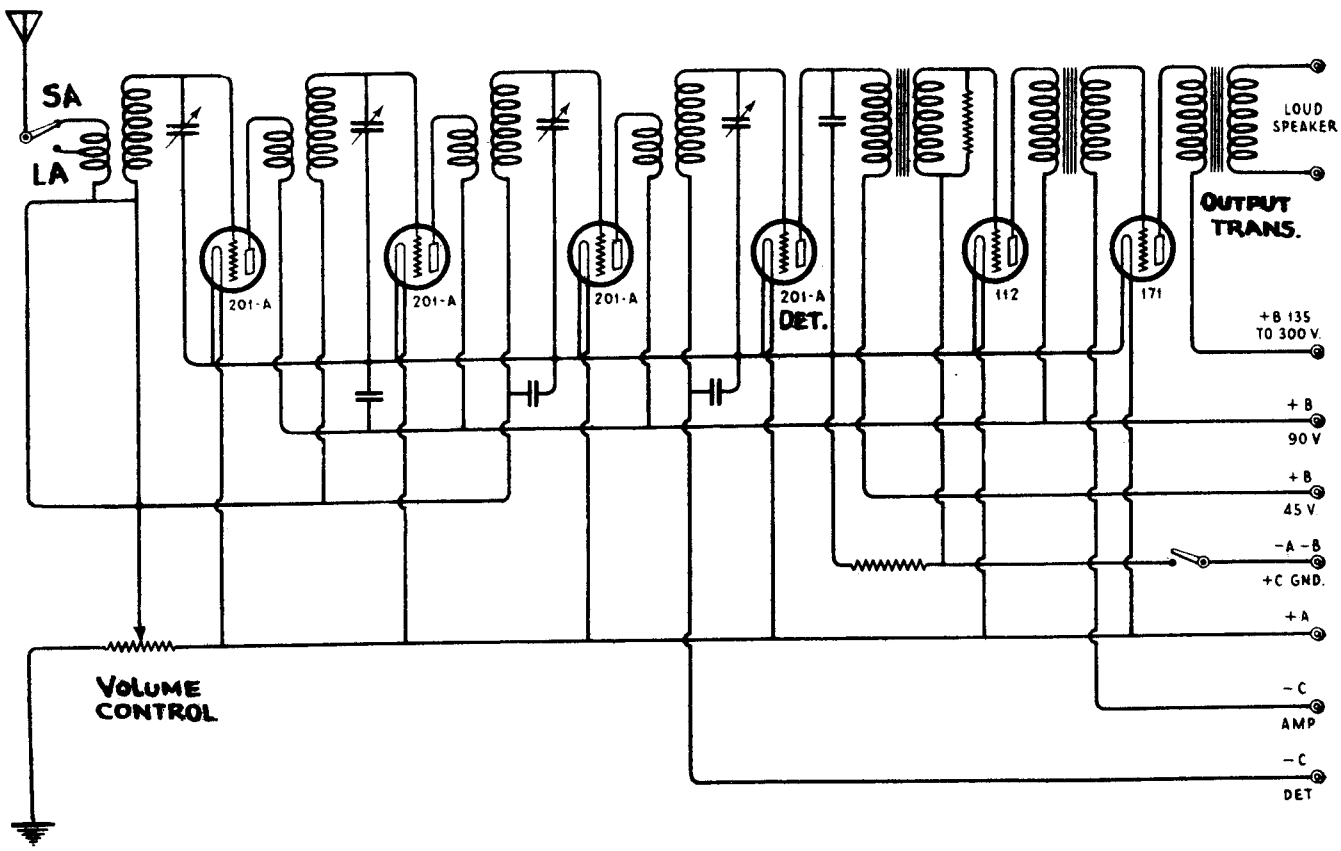




SILVER-MARSHALL, INC.



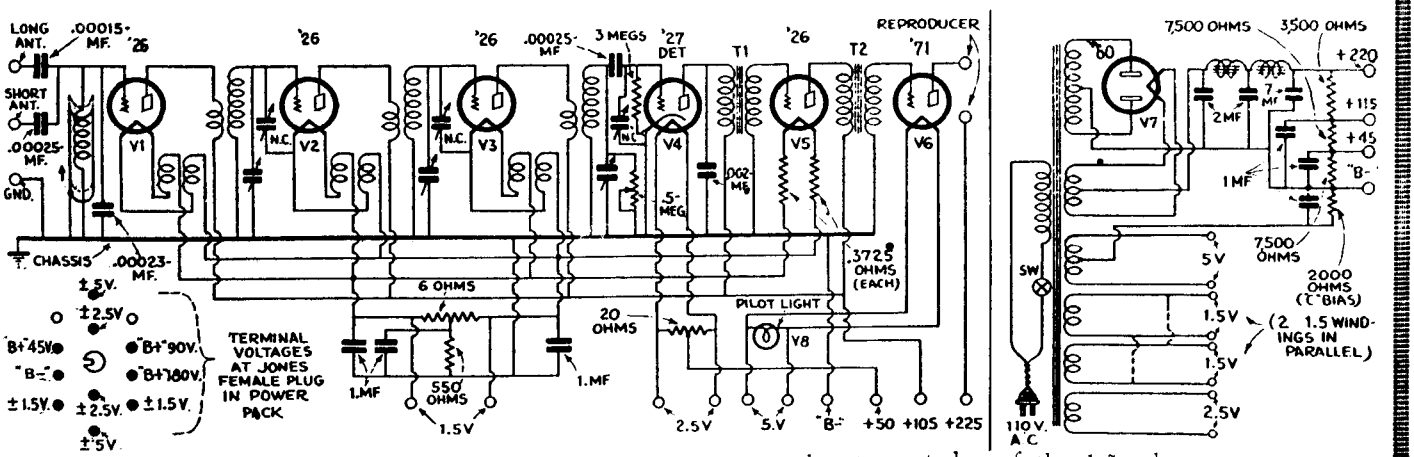
SILVER MODEL 30-B



SILVER MODEL 630

SONORA PHONOGRAPH CO., INC.

SONORA MODEL E-A.C.



The circuit of the Sonora Model E-AC is the conventional one used in conversion jobs on 1927 circuits; a neutralizing circuit of tfhe modified Rice type is used.

The neutralizing condensers are mounted on their respective R.F. sockets, while a detector alignment condenser is found on the first A.F. tube socket.

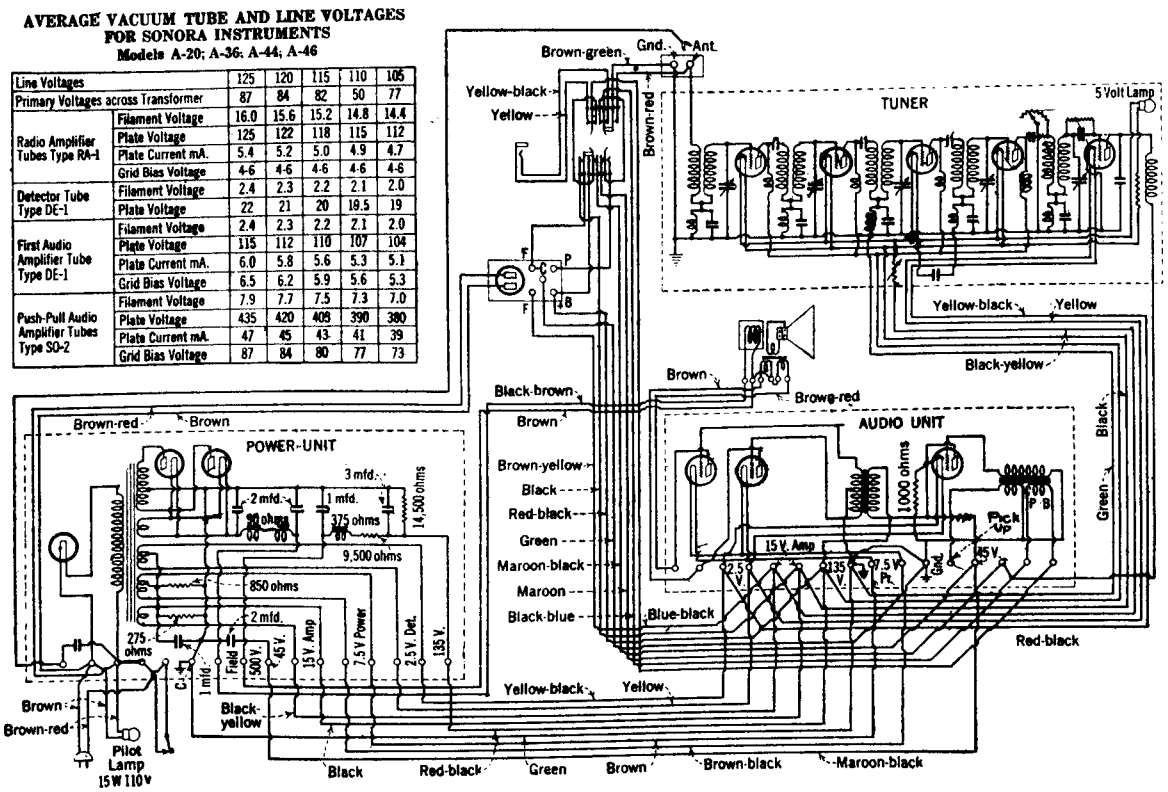
A trombone-shaped copper shield slides over the antenna coil, which is a 160-turn unit, shunted by a .00023-mf. condenser. It is essential that perfect 1-mf. condensers be used in the connection to each leg of the 1.5-volt filament. Note that the pilot light must be insulated from the chassis.

The power for this receiver is obtained from a special pack, either Majestic or Acme, shown at the right. A Jones 13-wire plug-in cable connects the two units. Because of the resistance of the neutralizing windings in the R.F. filament leads the pack is made to provide a 2.4-volt potential at its terminals; this voltage is lowered to 1.5 at the R.F. tube socket by the drop across these windings. Nichrome-wire leads take care of this drop in the '26-type A.F. stage.

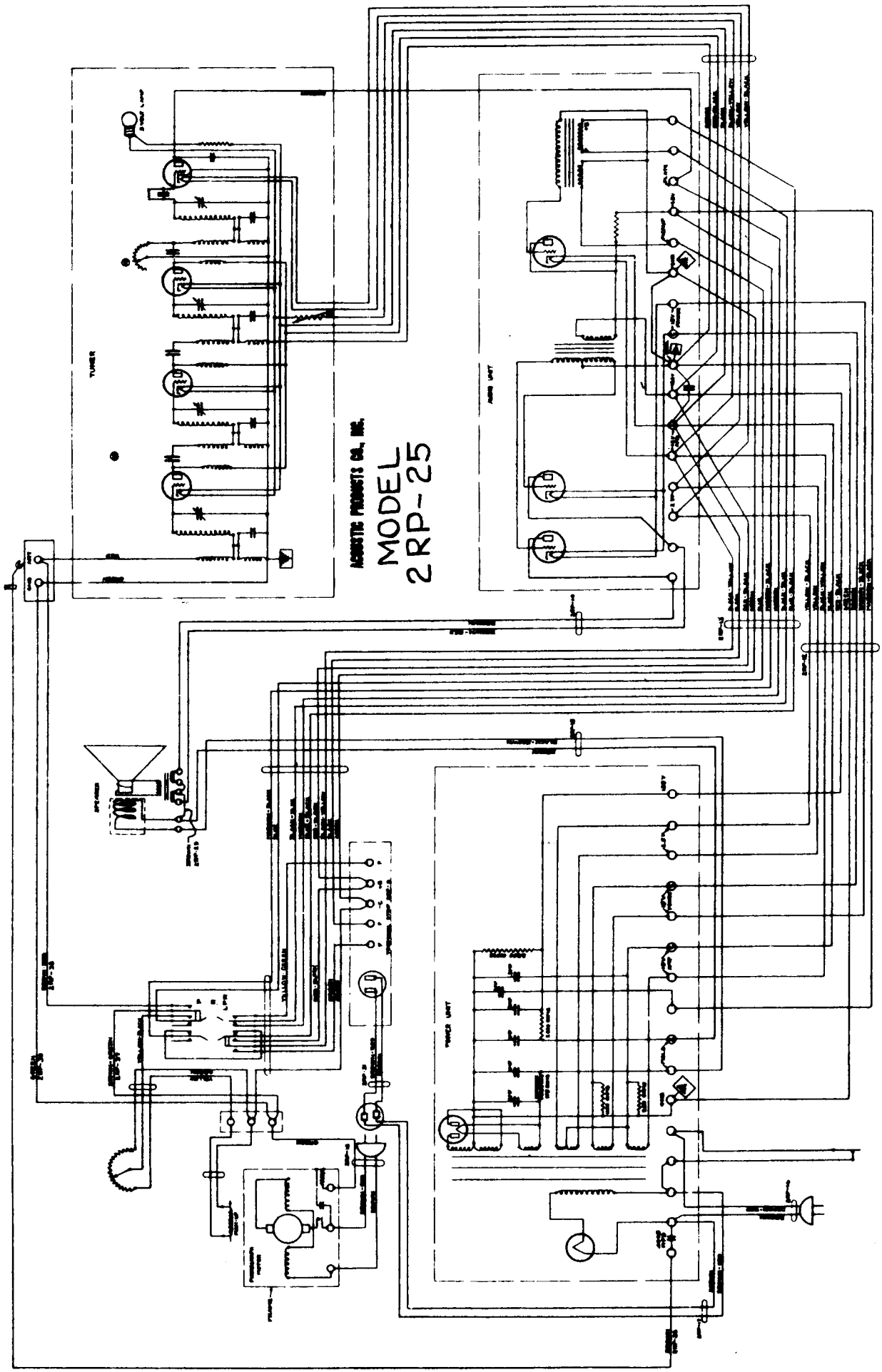
MODEL - A - 36

AVERAGE VACUUM TUBE AND LINE VOLTAGES FOR SONORA INSTRUMENTS
Models A-20; A-36; A-44; A-46

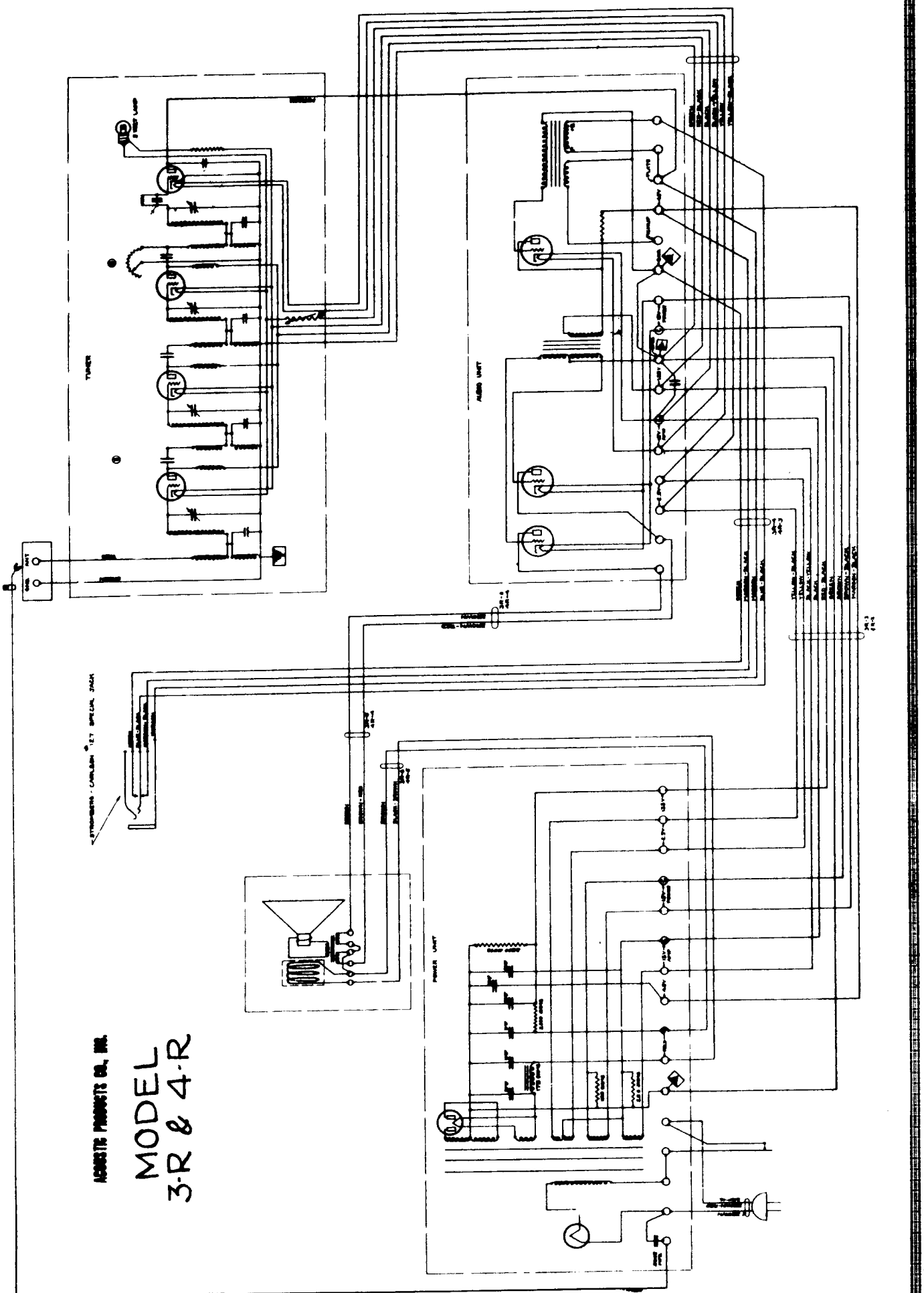
Line Voltages		125	120	115	110	105
Primary Voltages across Transformer		87	84	82	50	77
Radio Amplifier Tubes Type RA-1	Filament Voltage	16.0	15.6	15.2	14.8	14.4
	Plate Voltage	125	122	118	115	112
	Plate Current mA.	5.4	5.2	5.0	4.9	4.7
	Grid Bias Voltage	4.6	4.6	4.6	4.6	4.6
Detector Tube Type DE-1	Filament Voltage	2.4	2.3	2.2	2.1	2.0
	Plate Voltage	22	21	20	19.5	19
First Audio Amplifier Tube Type DE-1	Filament Voltage	2.4	2.3	2.2	2.1	2.0
	Plate Voltage	115	112	110	107	104
	Plate Current mA.	6.0	5.8	5.6	5.3	5.1
	Grid Bias Voltage	6.5	6.2	5.9	5.6	5.3
Push-Pull Audio Amplifier Tubes Type SO-2	Filament Voltage	7.9	7.7	7.5	7.3	7.0
	Plate Voltage	435	420	405	390	380
	Plate Current mA.	47	45	43	41	39
	Grid Bias Voltage	87	84	80	77	73



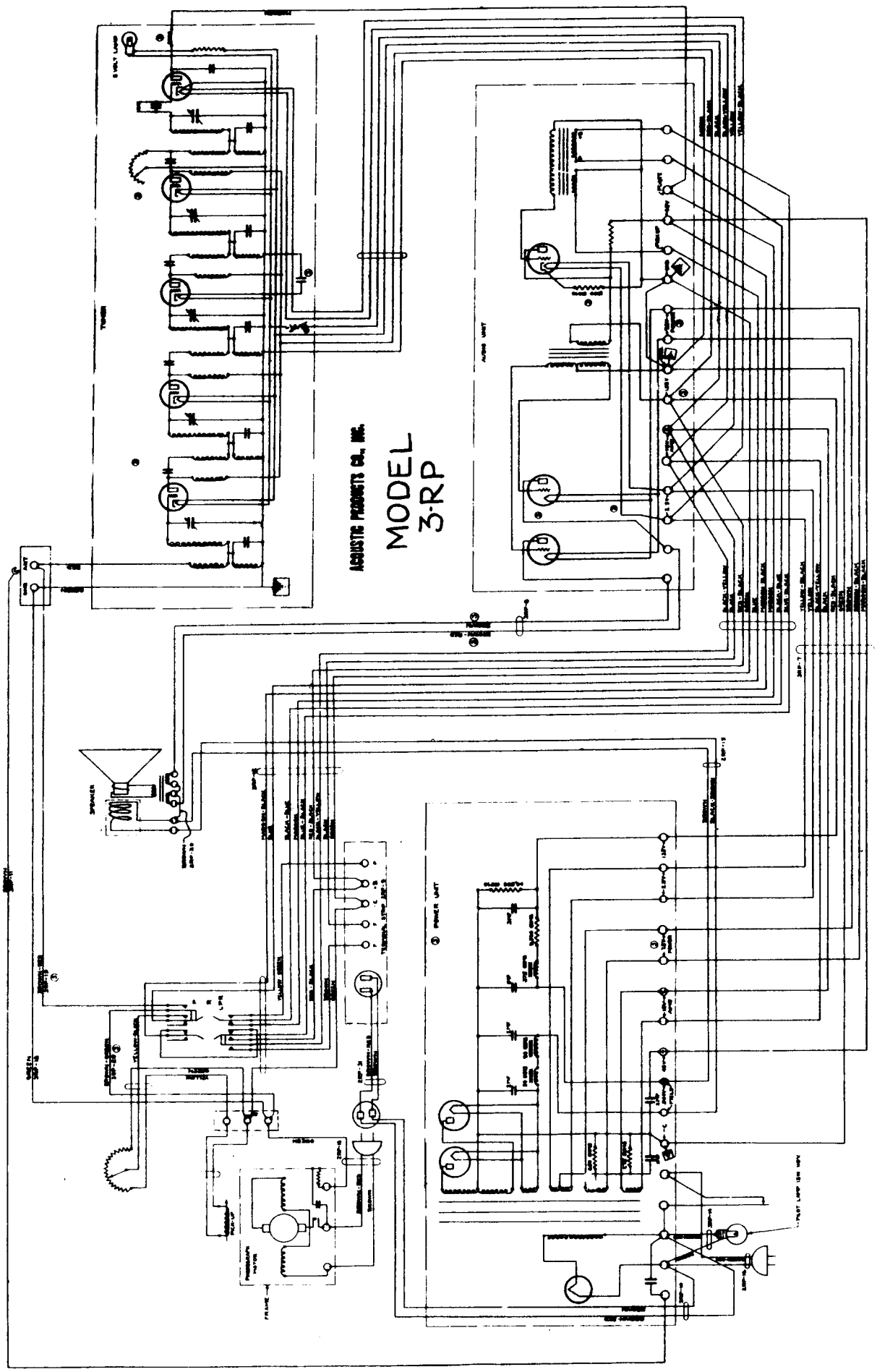
SONORA PHONOGRAPH CO., Inc.



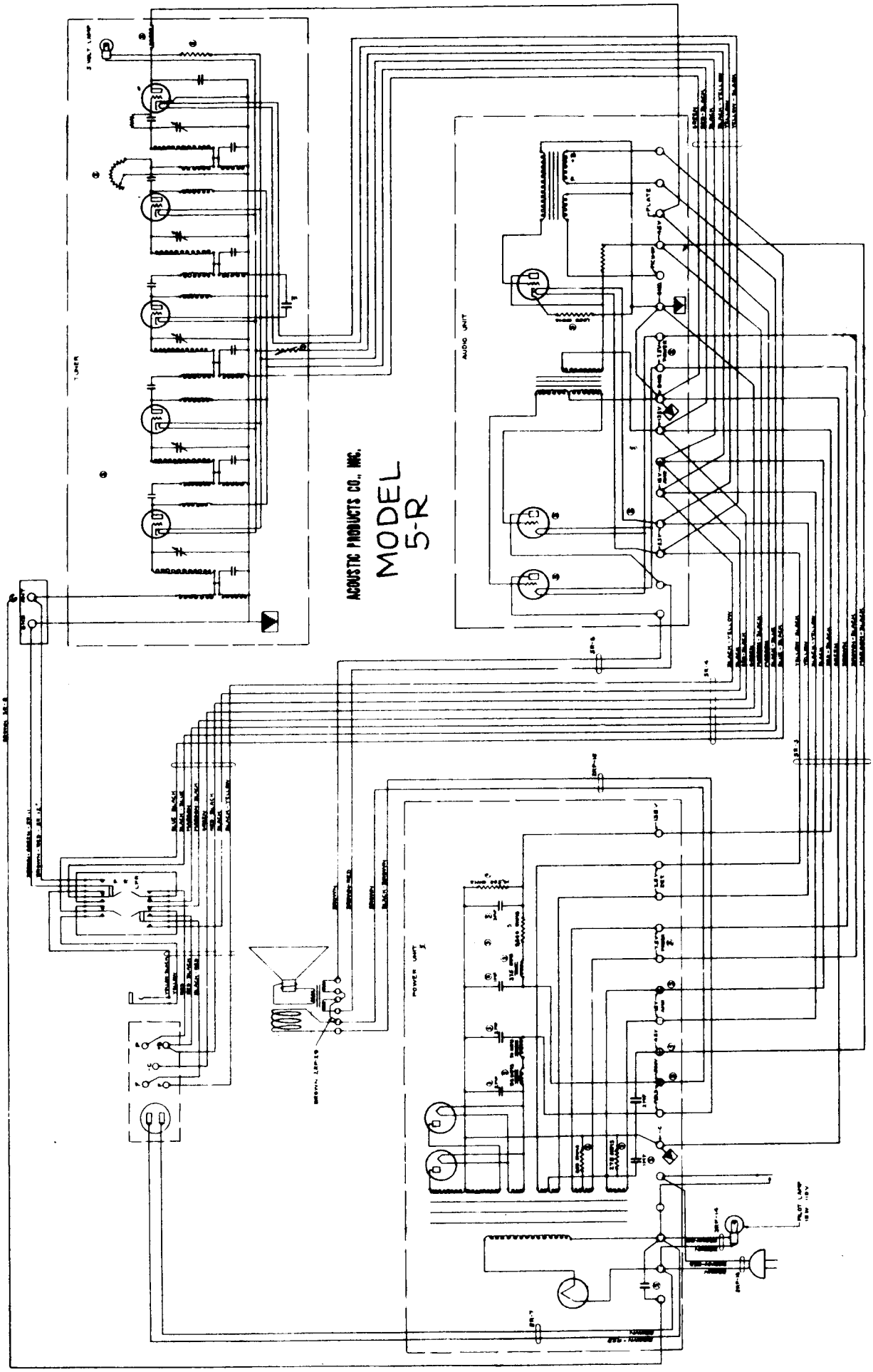
SONORA PHONOGRAPH CO., Inc.



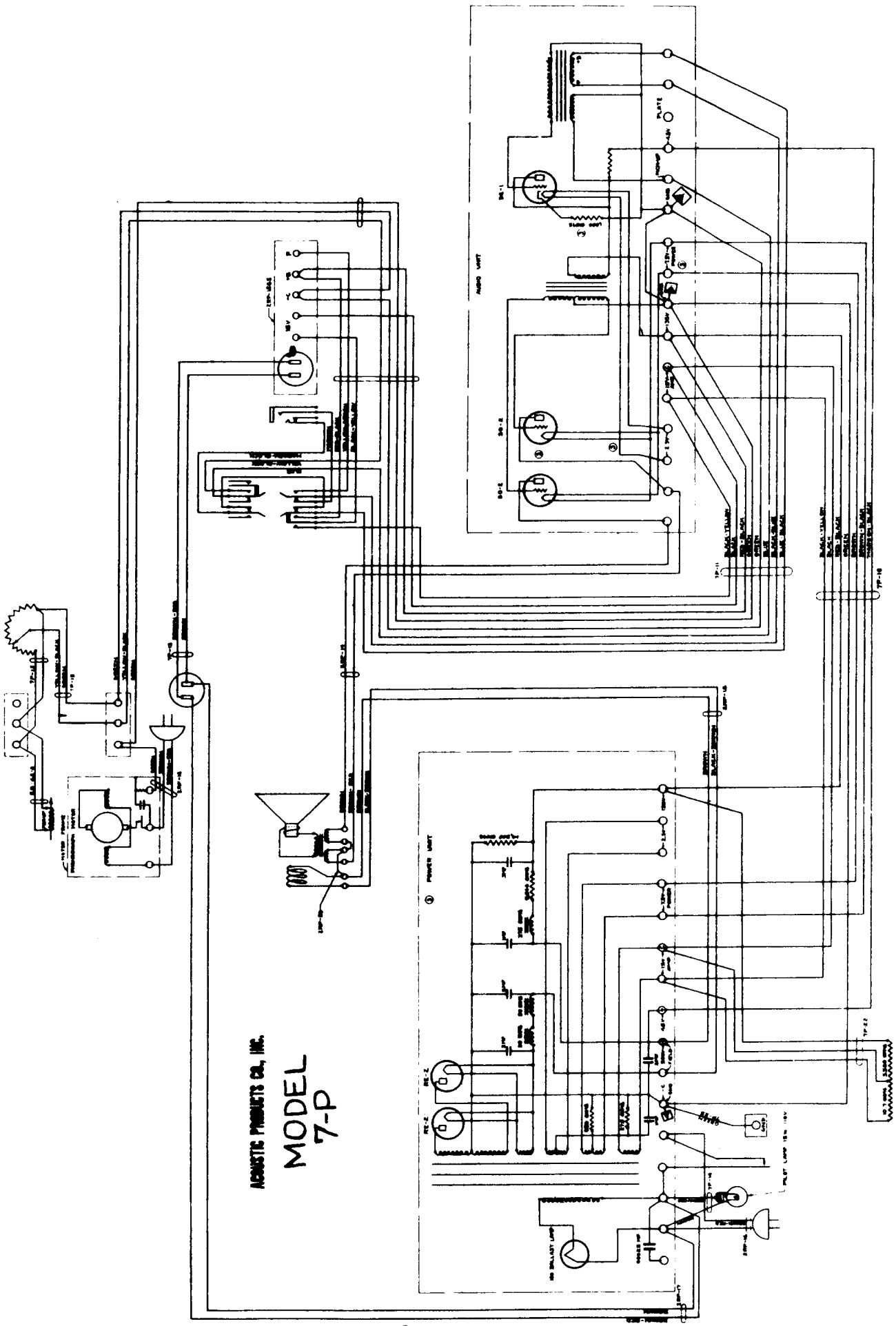
SONORA PHONOGRAPH CO., Inc.

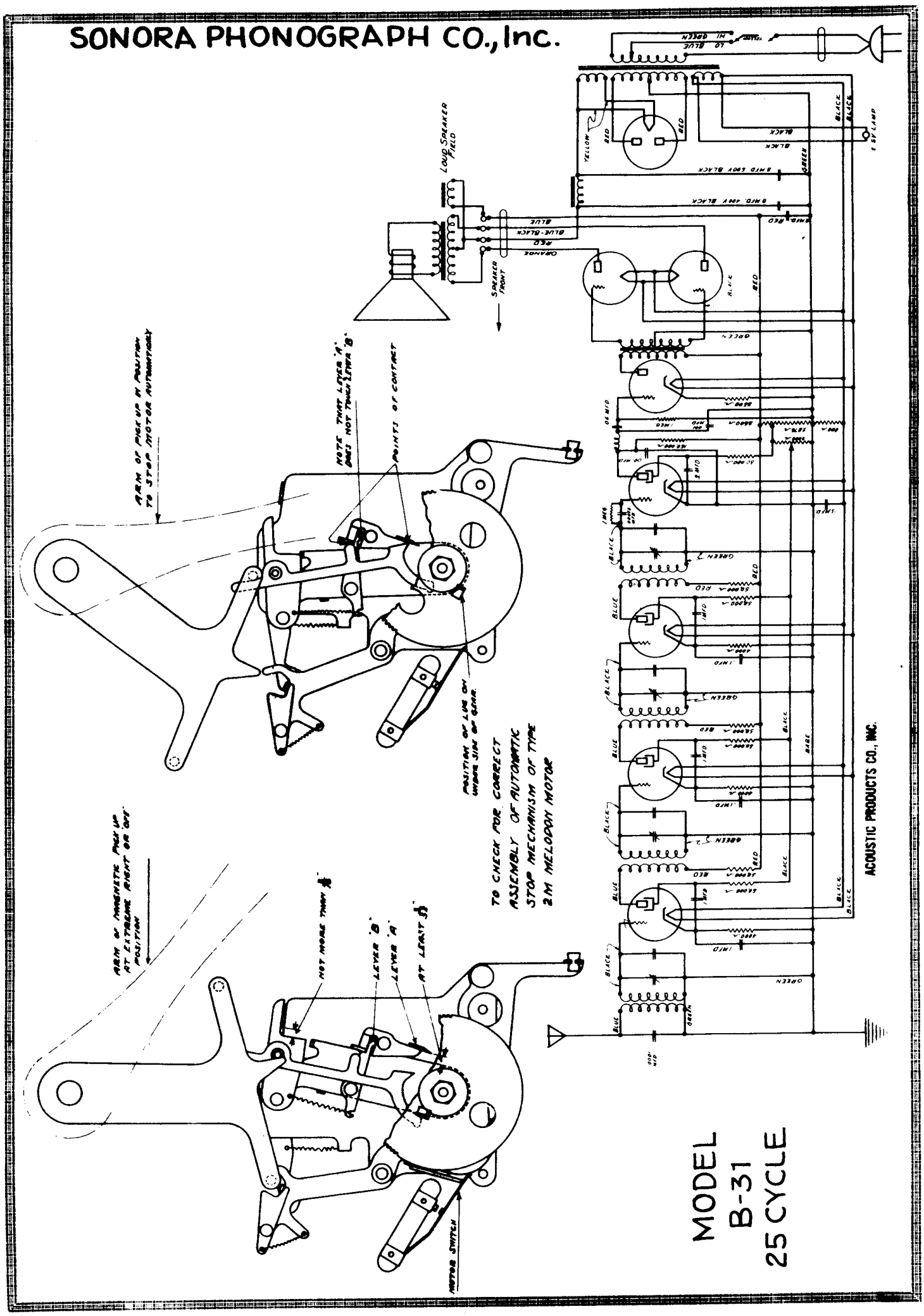


SONORA PHONOGRAPH CO., Inc.



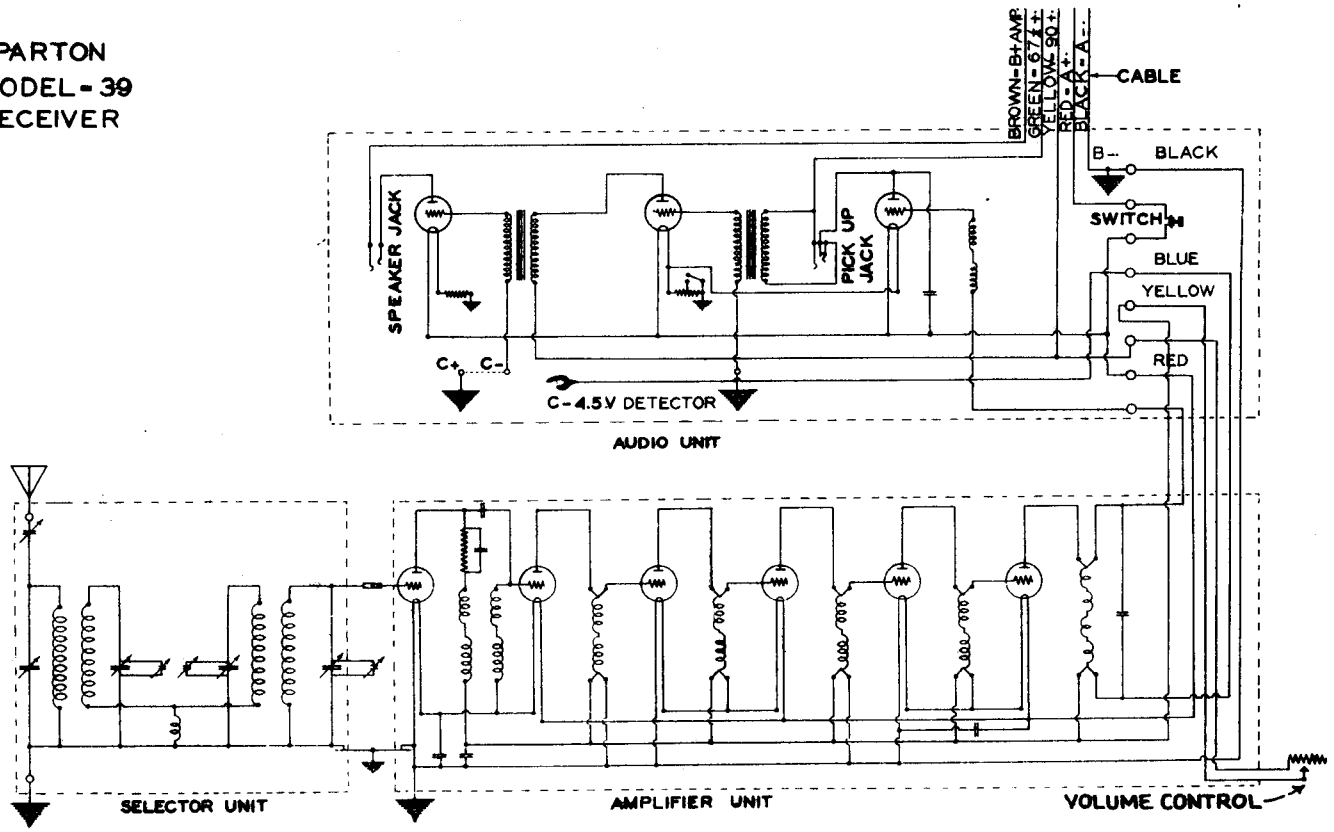
SONORA PHONOGRAPH CO., Inc.




SONORA PHONOGRAPH CO., Inc.
LOUD SPEAKER FIELD
SPEAKER FRONT
ARM OF PICK UP IN POSITION TO STOP MOTOR AUTOMATICALLY
NOTE THAT LEVER 'A' DOES NOT TOUCH LEVER 'B'
POINTS OF CONTACT
POSITION OF LUG ON UNDER SIDE OF GEAR
TO CHECK FOR CORRECT ASSEMBLY OF AUTOMATIC STOP MECHANISM OF TYPE 2M MELODAY MOTOR
ARM OF MAGNETIC PICK UP AT EXTREME RIGHT OR OFF POSITION
NOT MORE THAN
LEVER 'B'
LEVER 'A'
AT LEAST
MOTOR SWITCH
ACOUSTIC PRODUCTS CO., INC.
MODEL B-31 25 CYCLE

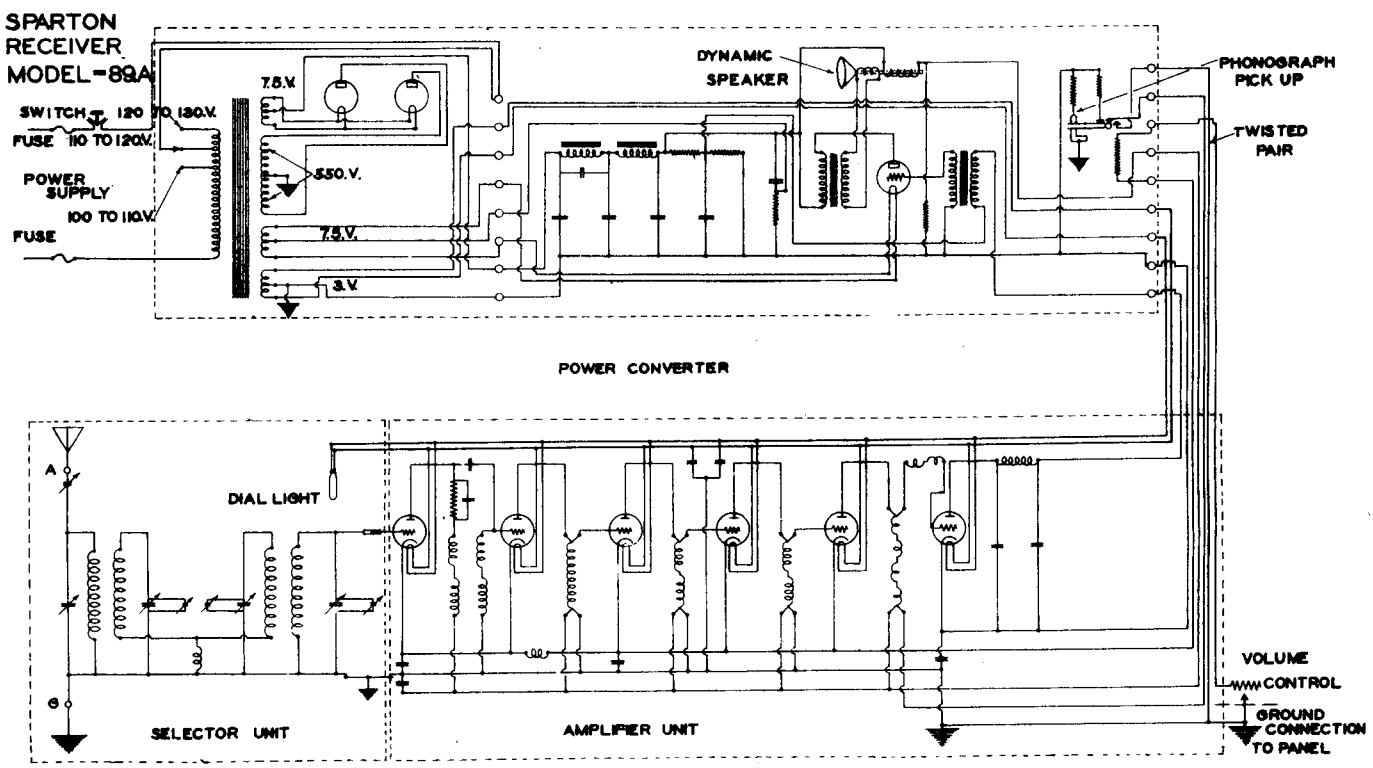
SPARKS-WITHINGTON CO.

SPARTON
MODEL-39
RECEIVER



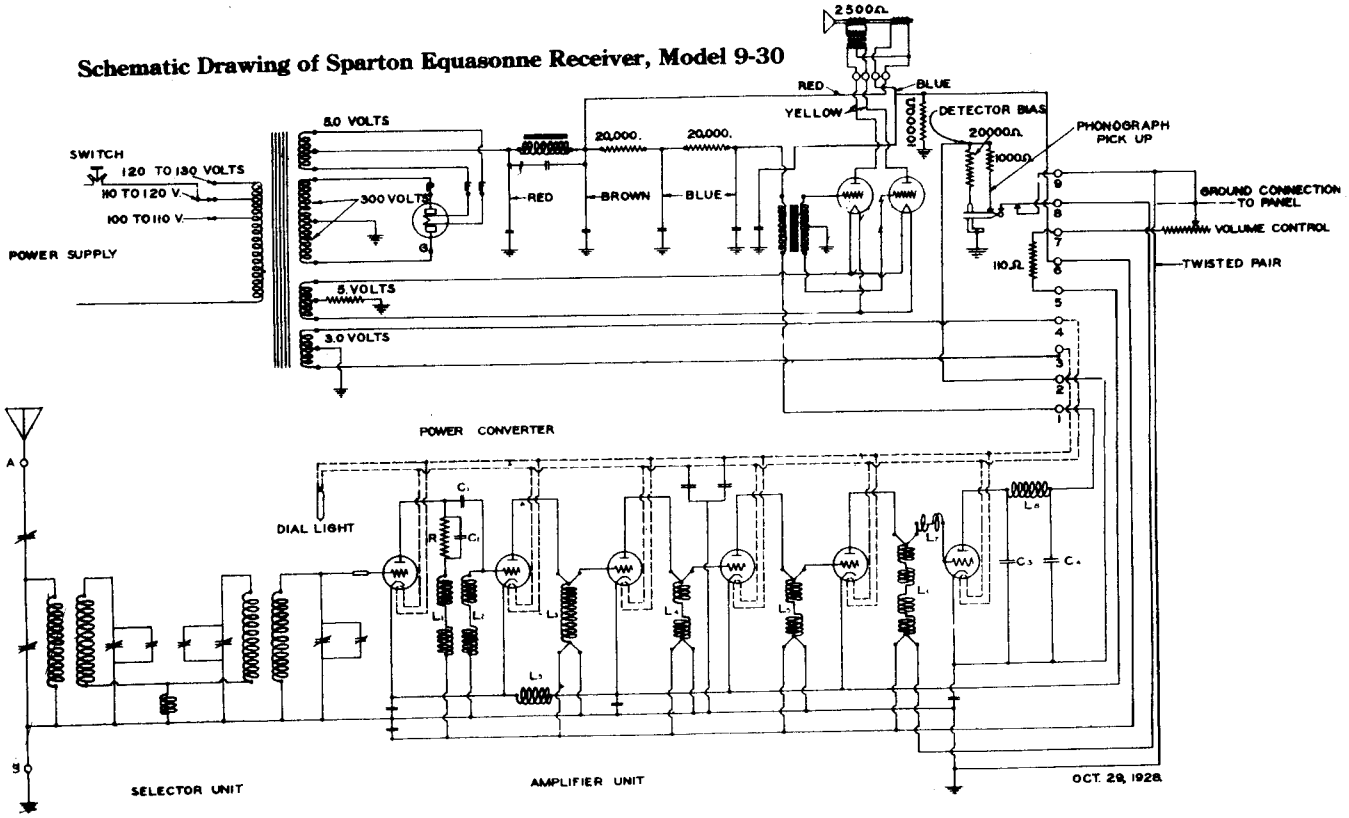
Schematic Drawing of the Sparton Equasonne Circuit

SPARTON
RECEIVER
MODEL-89A

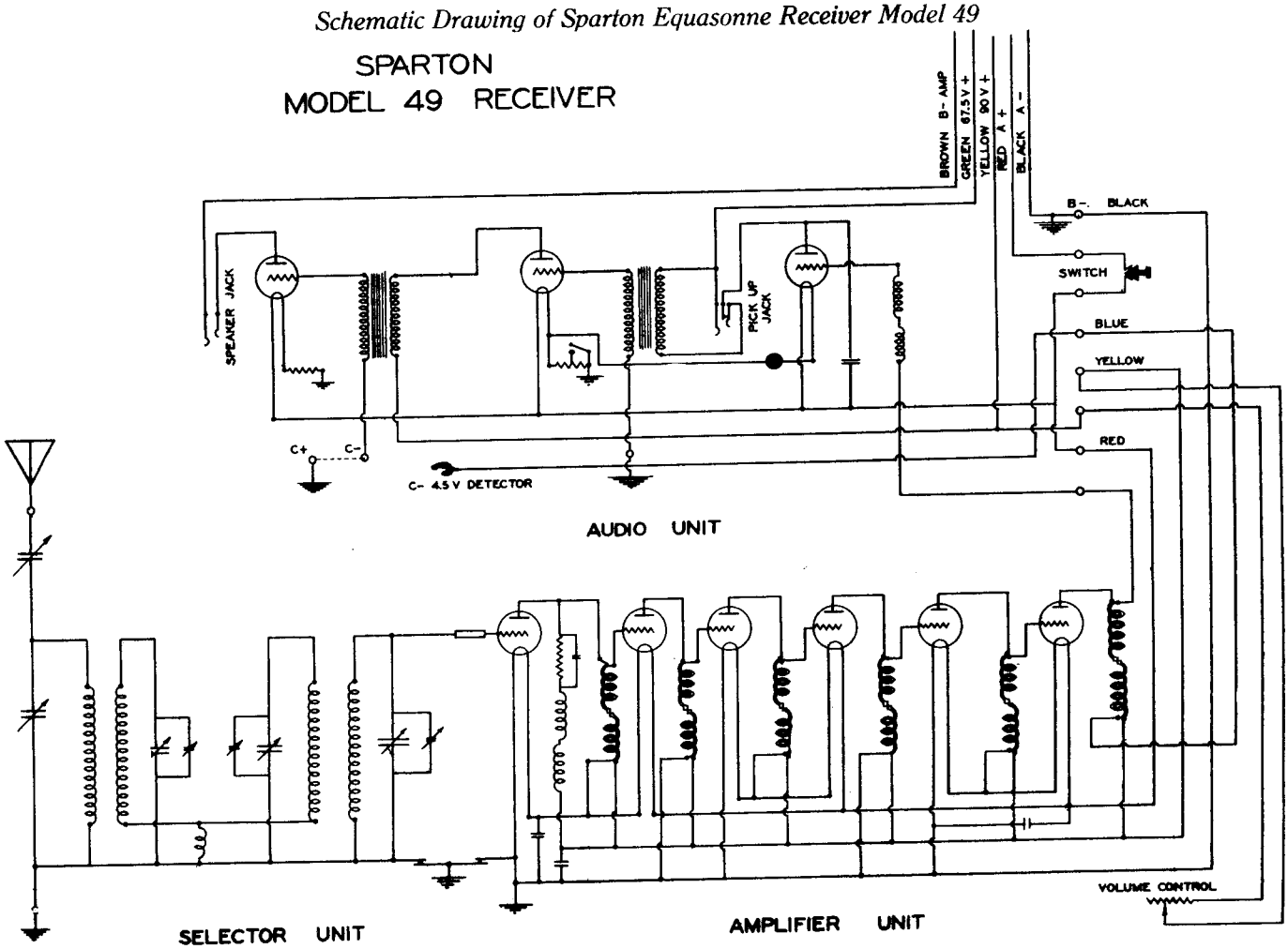


SPARKS-WITHINGTON CO.

Schematic Drawing of Sparton Equasonne Receiver, Model 9-30



Schematic Drawing of Sparton Equasonne Receiver Model 49



Radio Service Data Sheet

SPARTON "EQUASONNE" MODELS 931 AND 301 D.C.

Although grounds are shown in the schematic circuit of this set, no ground should be connected to this set. The reason is that one side of the D.C. line is grounded at the power house; consequently, if, for example, with the line-plug connections reversed the set should be connected to an external ground in any manner a short-circuit would result. In some D.C. sets fixed condensers will be found in both ground and antenna leads; in this receiver accidental grounding of the antenna (which usually results, when the lead-in insulation of a poorly installed aerial is rubbed, through permitting the lead to touch metal on the building) is prevented by the antenna condenser shown. An additional safety factor in the D.C. "Equasonne" is a 3-amp. fuse in the negative side of the line.

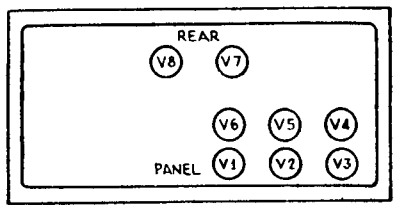
All tuning is obtained before the input of V1, a band-selector circuit being used to secure the desired selectivity. The signal is then amplified successively by V1, V2, V3, V4 and V5 (V6 is the "power" detector); the signal transfer being made through "aperiodic" (broadly-resonant) R.F. transformers. In series with a special R.F. coil arrangement in the plate circuit of V1 is a 2,800-ohm resistor, shunted by a fixed condenser of very small capacity.

The bank of three 15-ohm resistors in series with the reproducer's field coil limits the current consumption to approximately the correct amount; more accurate adjustment for high- or low-line supply is obtained through the 7-ohm resistor which is controlled by the shorting switch marked "Hi-Lo." ("Lo." below 115 volts; "Hi," 115-125 volts.) It has been found that the "110-volt" D.C. supply in some districts may rise to a value of 135 volts; and the remedy in this case is to add to the three-resistor bank a fourth resistor, also of 15 ohms.

The Service Man is recommended to check first the 15-ohm resistors in the 45-ohm bank. There is no other outstanding point for test, in the event of trouble, in this set; the dynamic reproducer requires usually no attention.

The volume control in this receiver has a resistance of 50,000 ohms.

A few cautions must be observed with regard to the filament circuit of this receiver. If the pilot light should burn out, replace it at once;



Tube arrangement of the "Equasonne" D.C. models.

this will bring back to normal the increased voltage across the filaments of the Type-182 (Sparks-Withington Co's.) power tubes V7-V8 (equivalent to the standard '71A). The dial light, with a 63-ohm resistor in series, is shunted across the filaments of the R.F. amplifiers and the power detector V6. Therefore, if the filament of one of the type "484" tubes should burn out, V9 will act as a fuse and also burn out; this should be to the Service Man an indication of the trouble. For this reason, too, tubes should be removed from their sockets only when the set is disconnected from the line, to prevent burning out V9. (If the heater [filament] of one of the 484s should burn out, the remaining tubes in the series will not light until the circuit is completed through a replacement tube or an equivalent resistor.)

As the Sparton tubes carry a 90-day guarantee, the Service Man should acquaint himself with the limitations of this guarantee. The specifications set by the manufacturer for tubes subject to replacement and bearing the proper sticker, dated, are as follows: low amplification; low emission; loose bases; defective welds; unsoldered terminals; gassy; open heaters; one element shorted to another; loose pins; low mutual conductance; no plate current; loose elements; open filament. Tubes having loose tops; broken glass; broken stems; broken bases, or dated outside the time limit cannot be replaced.

An external "C" battery supplies the bias for the power tubes.

V9 may be a 3.8-volt Mazda T3, type G3.

The current in the filament-heater-resistor circuit is approximately 1.5 amperes under correct conditions. All continuity tests of the apparatus should be made with the set off the line.

Absence of plate voltage on the detector V6 may be due to: lack of line voltage; an open R.F. choke CH; open push-pull-input A.F.-transformer primary; or a ground in the R.F. amplifier.

Operating voltages for this set are as follows:

Plate voltage, V7 and V8, 115; V6 (volume "on"), 100-108; V1, V2, V3, V4 and V5, (volume "on"), 112.

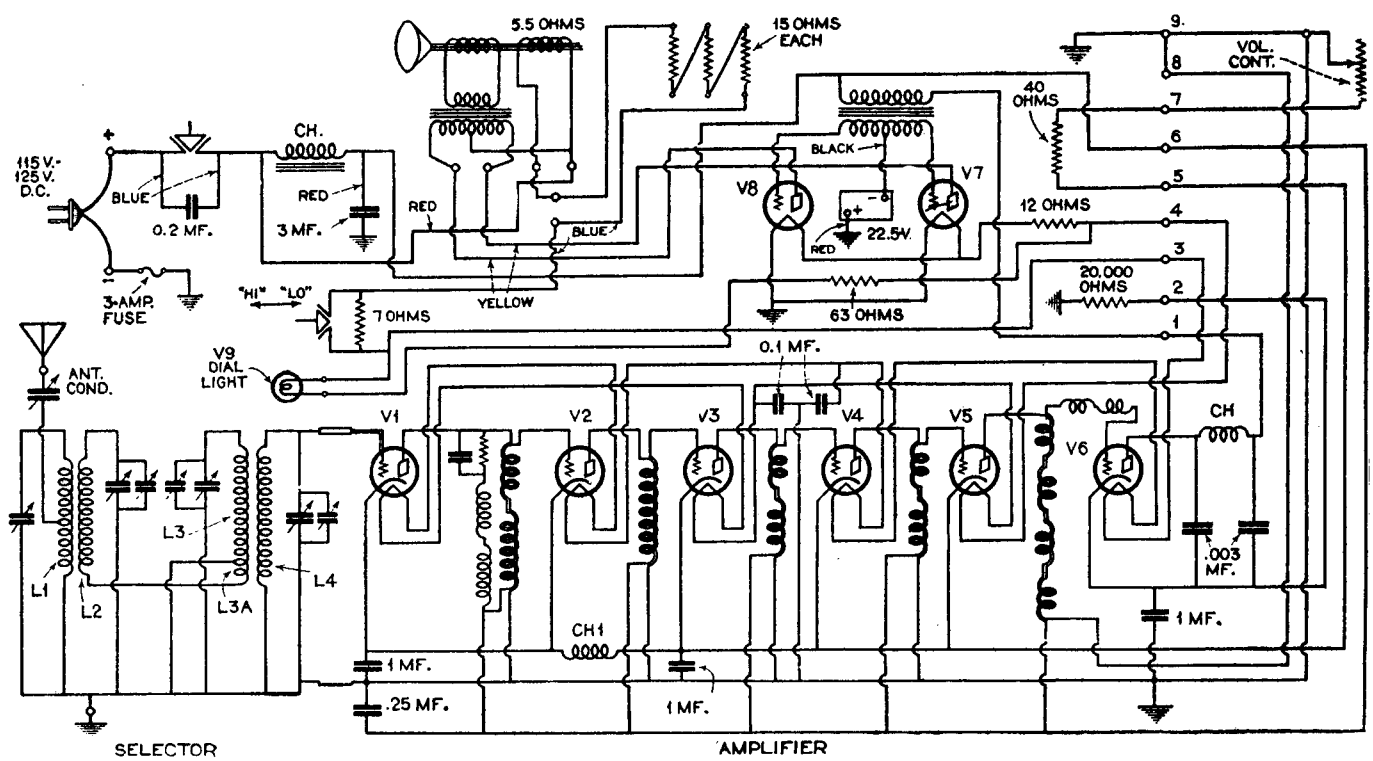
Grid voltage, V1, V2, V3, V4 and V5 (volume "on"), 2 to 3; V6, 8 to 10; V7 and V8, 22½;

Filament voltage, V1, V2, V3, V4, V5 and V6, (across the six tubes in series) 18; V7 and V8 (across the two tubes in parallel), 4 to 4.5.

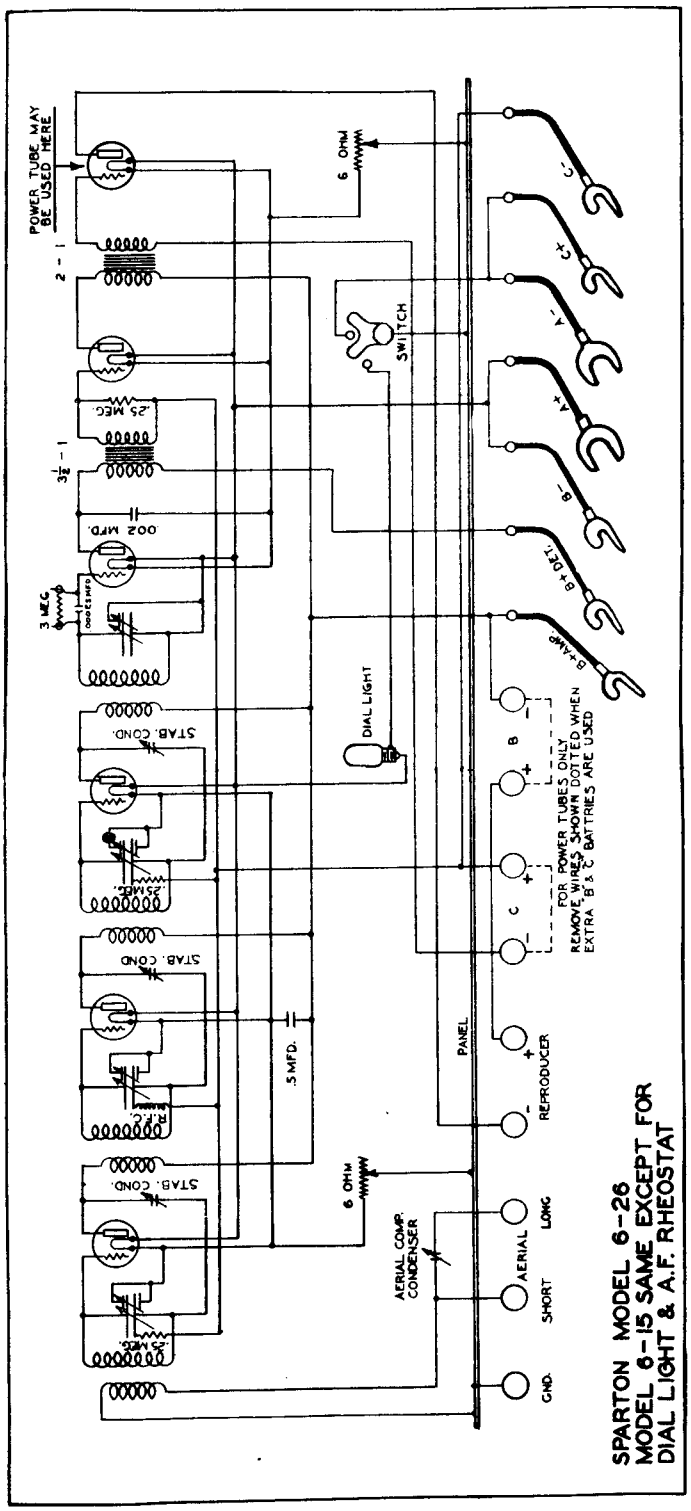
For reference, the characteristics of Sparton tubes are given in the accompanying table: in which SN is the Sparton tube-type designation: FV, filament volts; FA, filament amps.; GV, grid volts; PV, plate volts; PMa, plate milliamps.; PR, plate resistance; Mu, amplification factor.

SN	FV	FA	GV	PV	PMa	PR	Mu
484	3.0	1.25	3	90	6.0	16,000	12.5
585	7.5	1.25	45	250	55.0	2,000	3.8
182B	5.0	1.25	29	200	18.0	2,400	
181	3.0	1.40	29	200	12.0	1,500	
401	3.0	1.40	3	90	6.0	7,000	
226	1.5	1.05	3	90	6.0	7,000	
227	2.5	1.75	9	135	6.0	9,000	.0
686	3.0	1.25	3	90	....	2,000	3.8
182	5.0	0.90	45	200	18.0	2,000	3.0

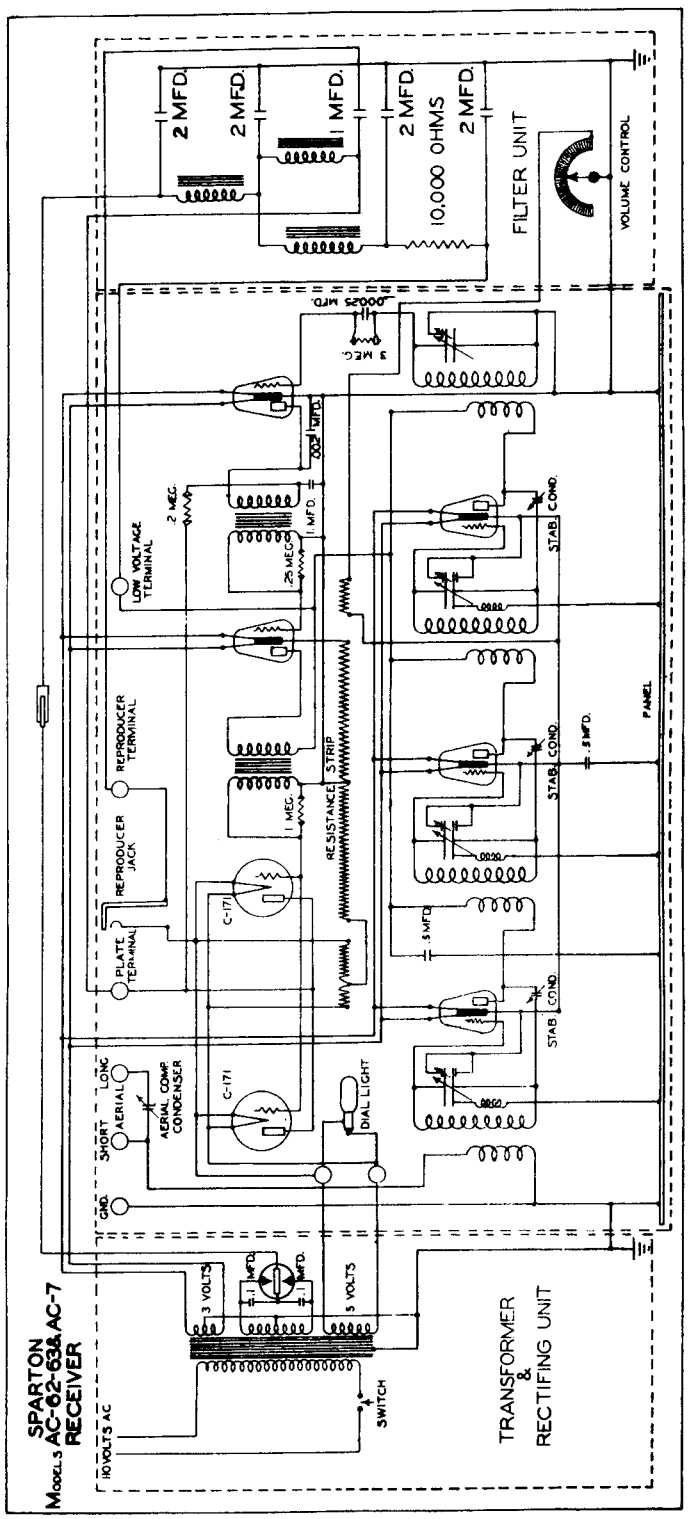
The Sparton tubes numbered 171, 373, and 201A have been discontinued. The 401 is a "side-heater" tube similar to the Kellogg tube of the same characteristics. The 585 has a wire mesh plate, the 686, also a high-power tube, has a solid plate. The 182 has a slightly larger output than the standard '71A. The 484 is a hi-mu tube with a 3-volt filament. The 182B is a special 5-volt tube with slightly higher output than the standard '45. Type 280 and 281 tubes are similar to the standard '80 and 81.



SPARKS-WITHINGTON CO.



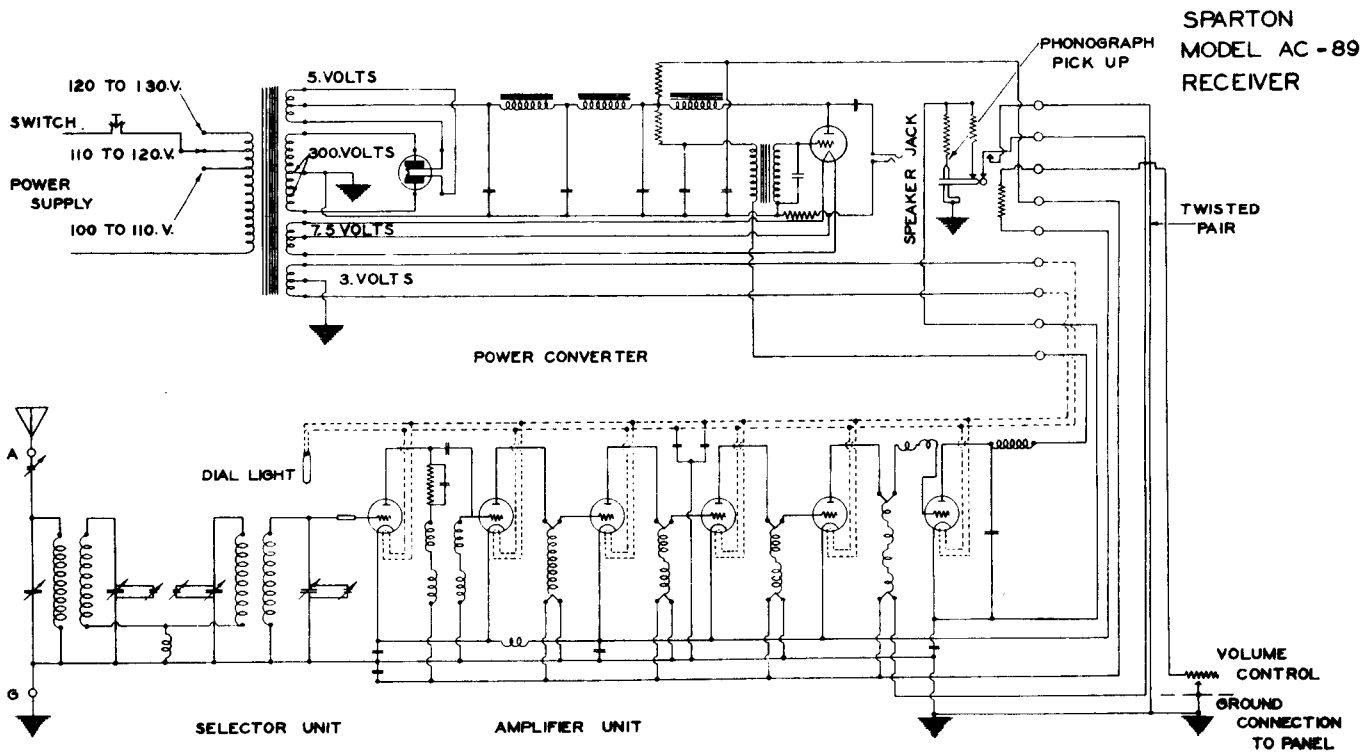
SPARTON MODEL 6-26
MODEL 6-15 SAME EXCEPT FOR
DIAL LIGHT & A.F. RHEOSTAT

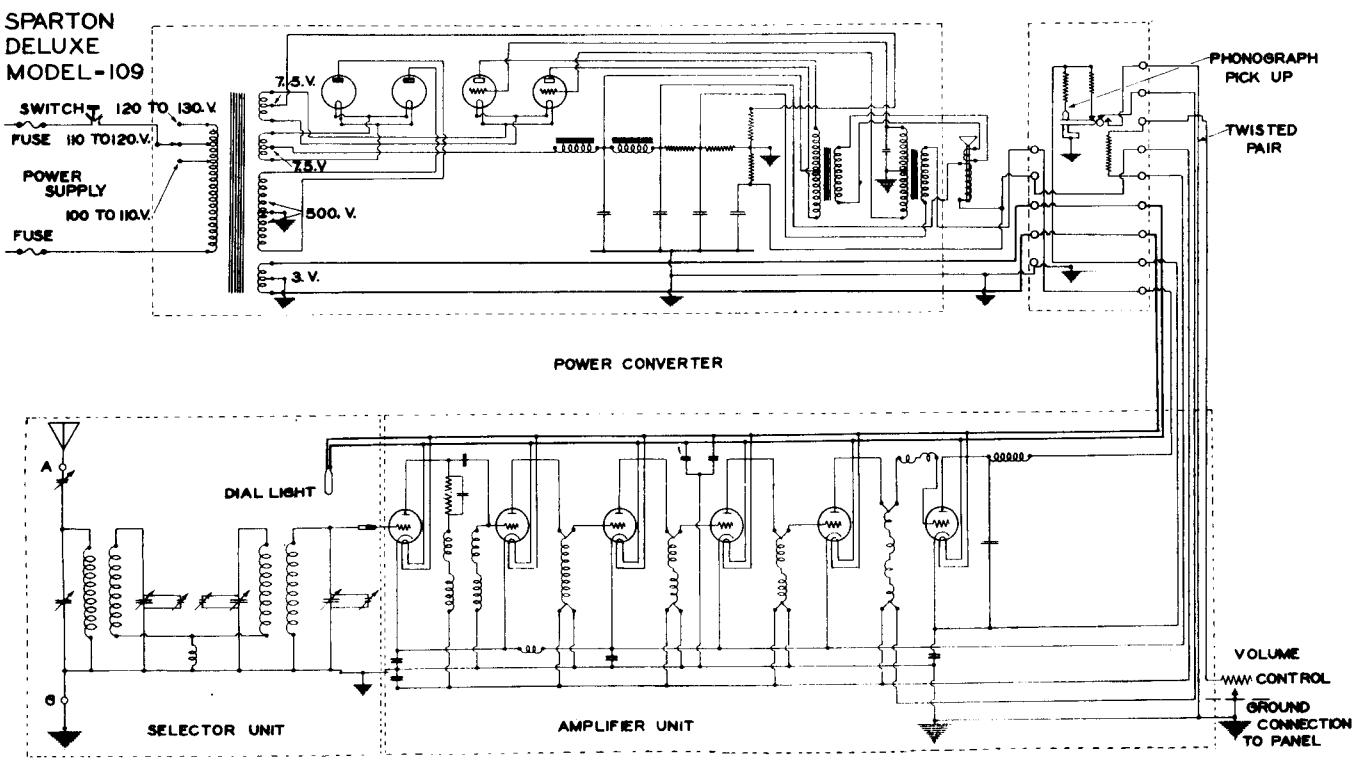


SPARTON
MODELS AC-62-63 & AC-7
RECEIVER

SPARKS-WITHINGTON CO.

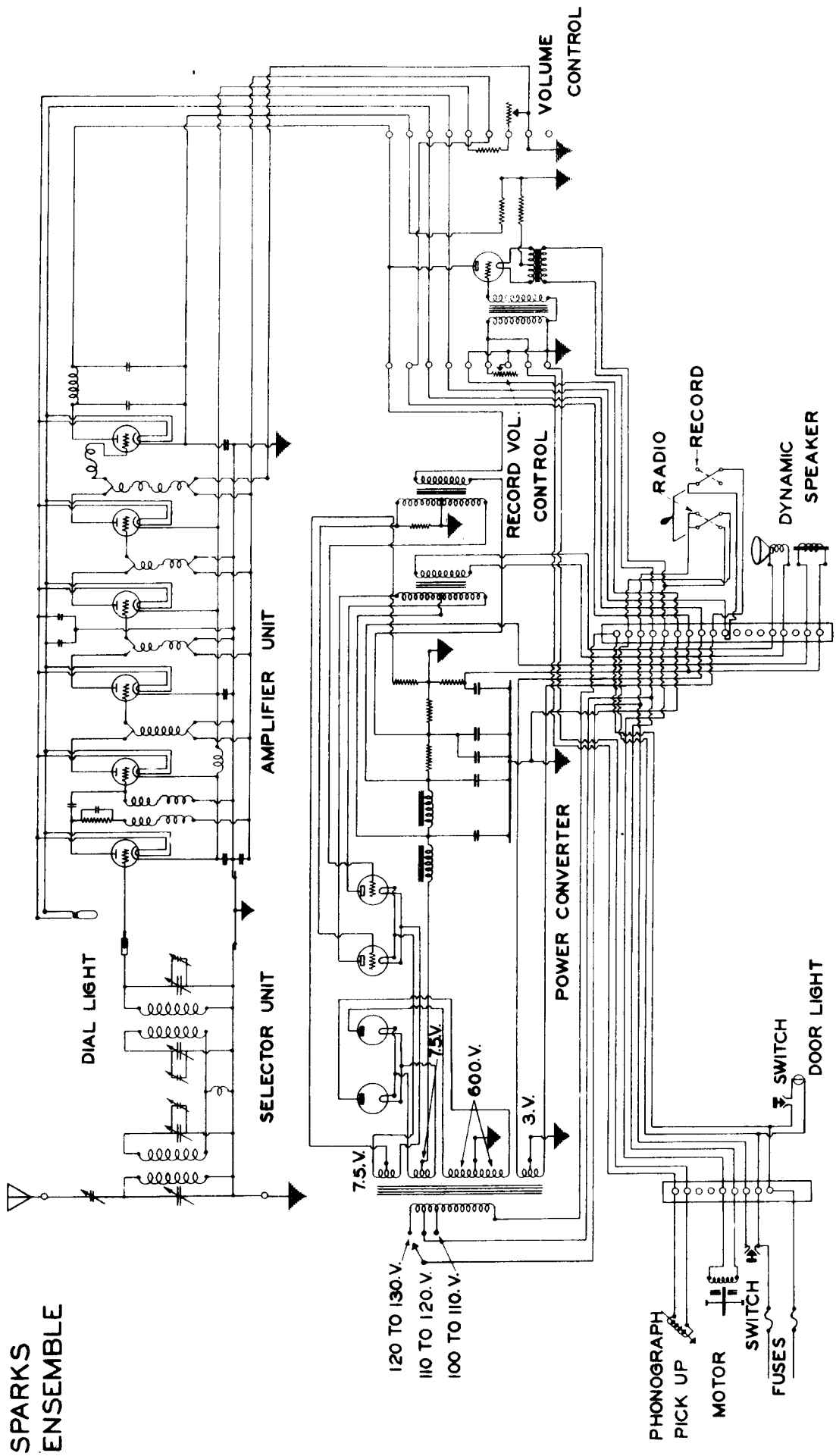
Schematic Drawing of the Sparton Equasonne Circuit



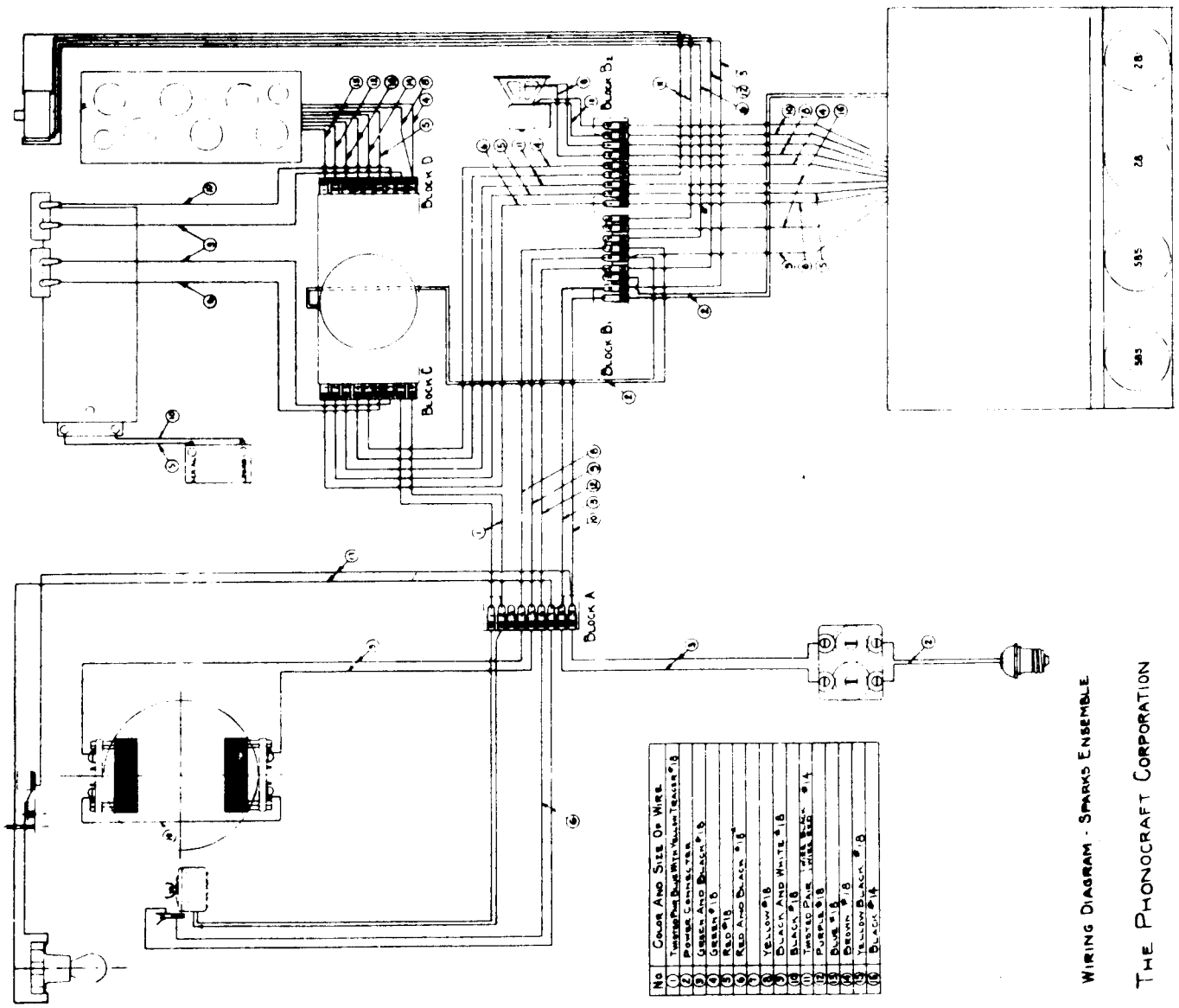


SPARKS-WITHINGTON CO.

Schematic Drawing of the Sparks Ensemble

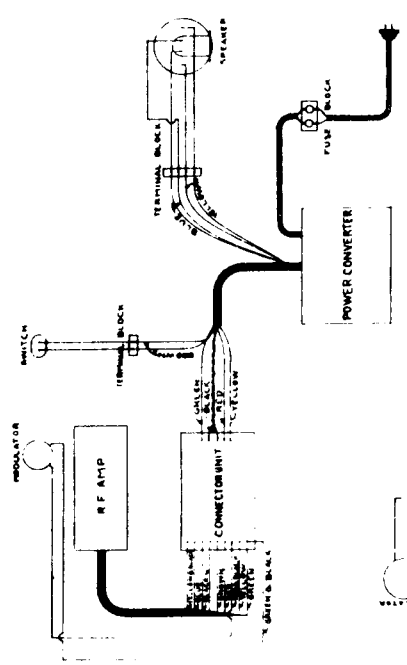


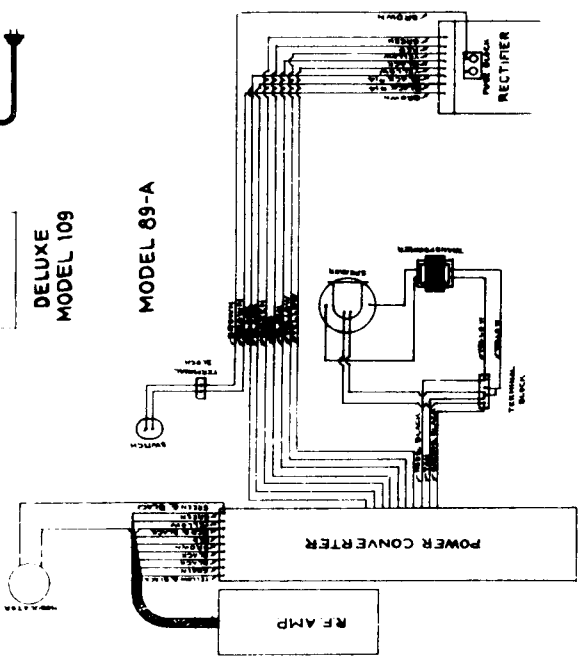
SPARKS-WITHINGTON CO.



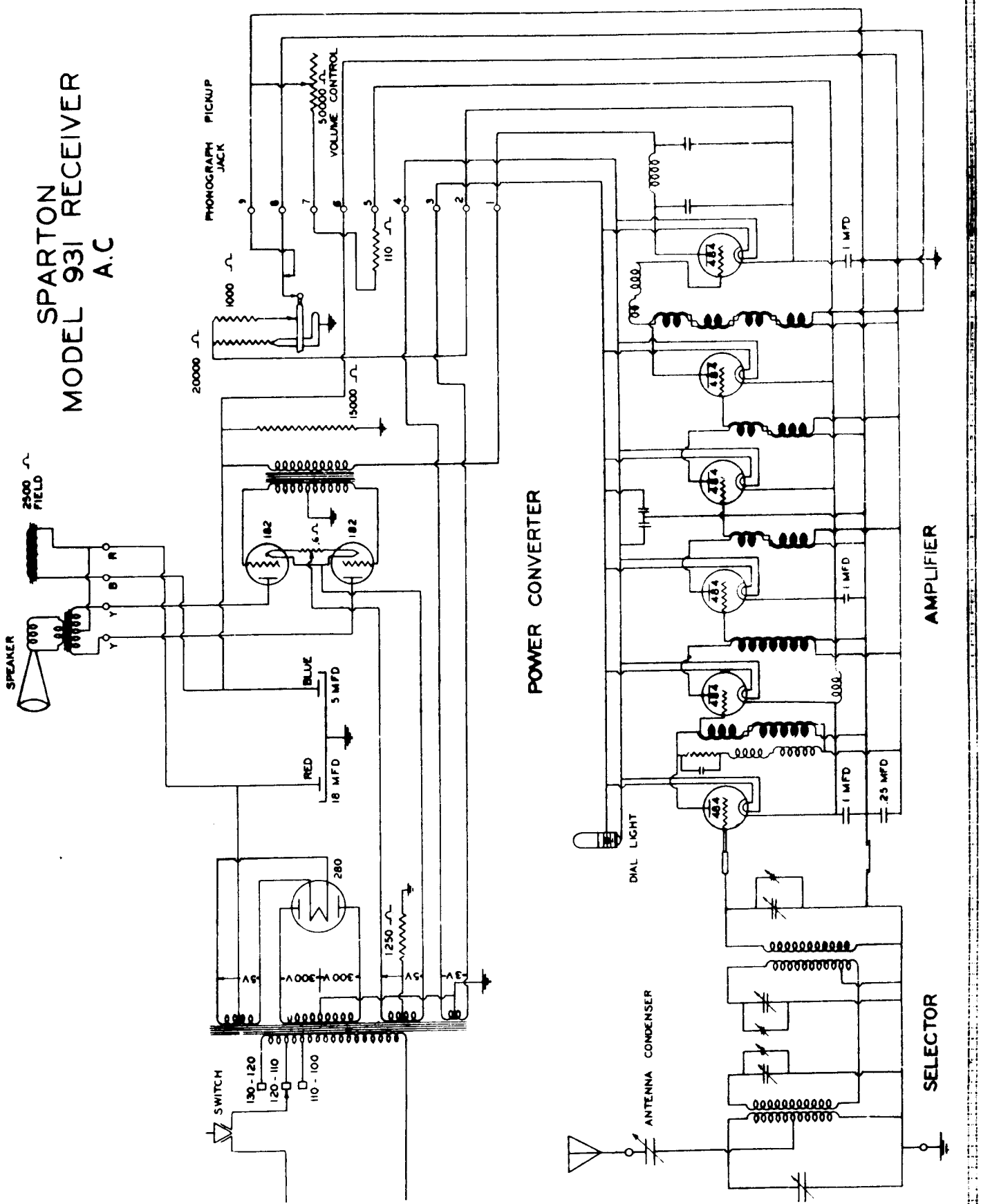
WIRING DIAGRAM - SPARKS ENSEMBLE

THE PHONOCRAFT CORPORATION

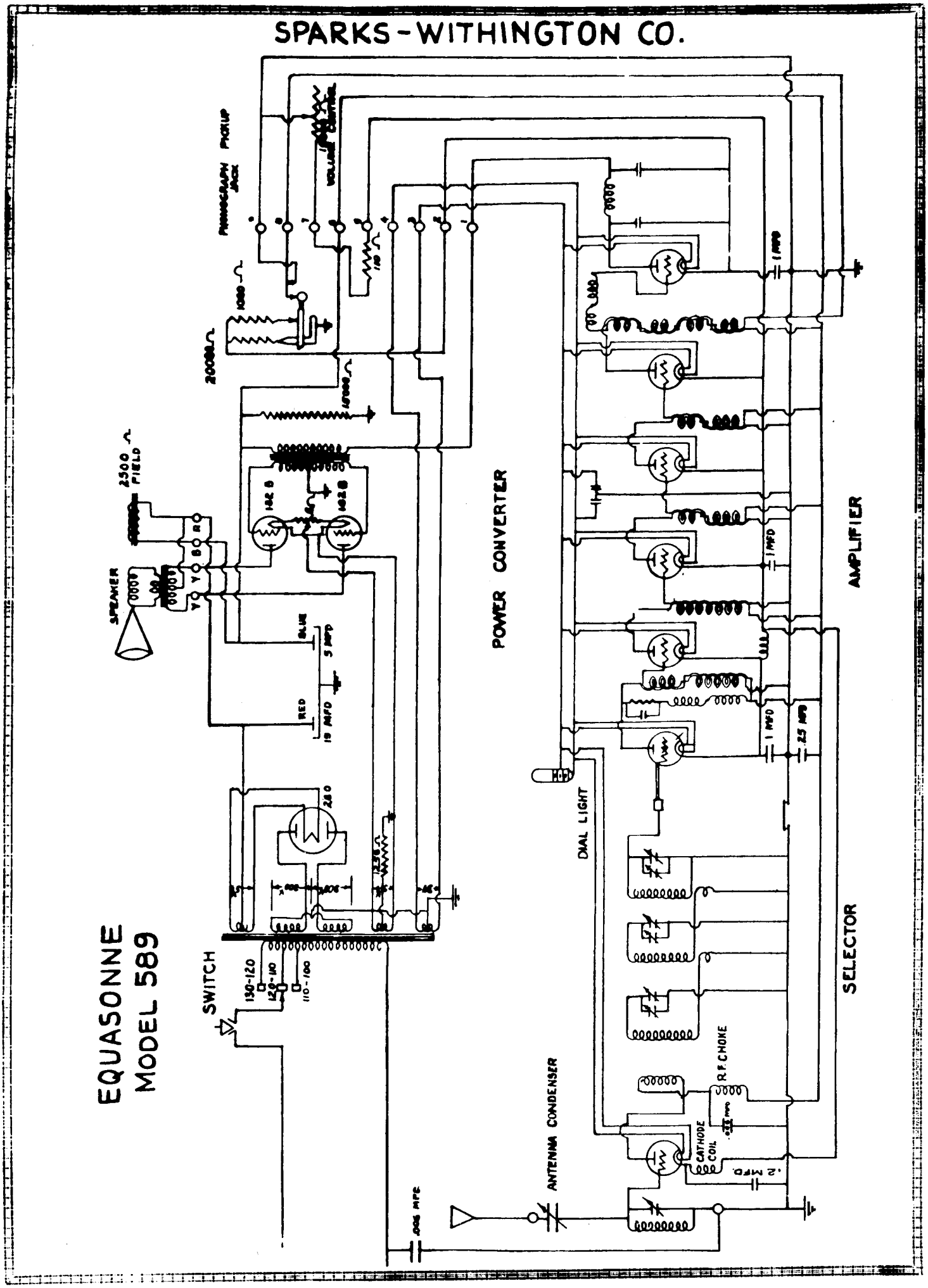




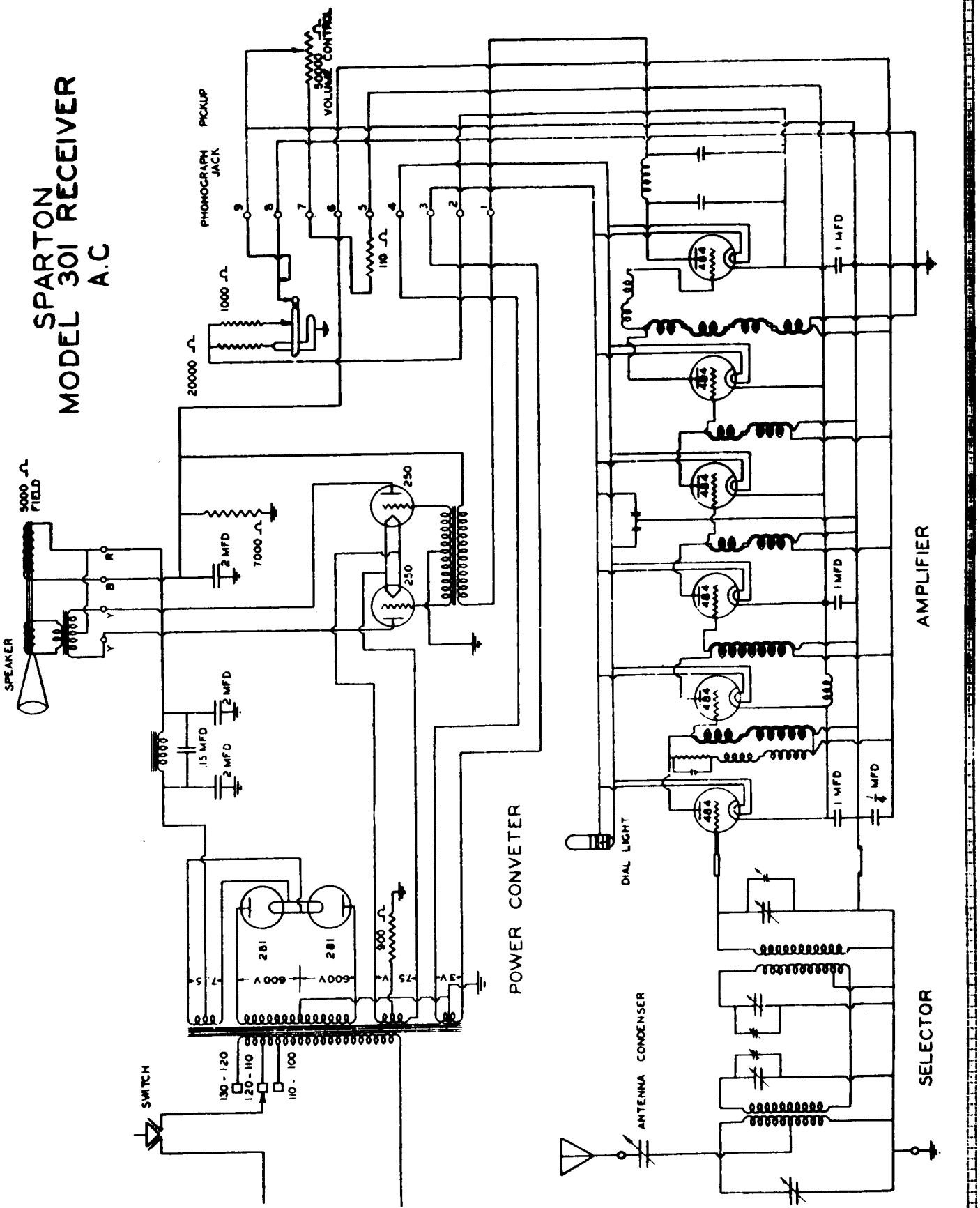
SPARKS-WITHINGTON CO.



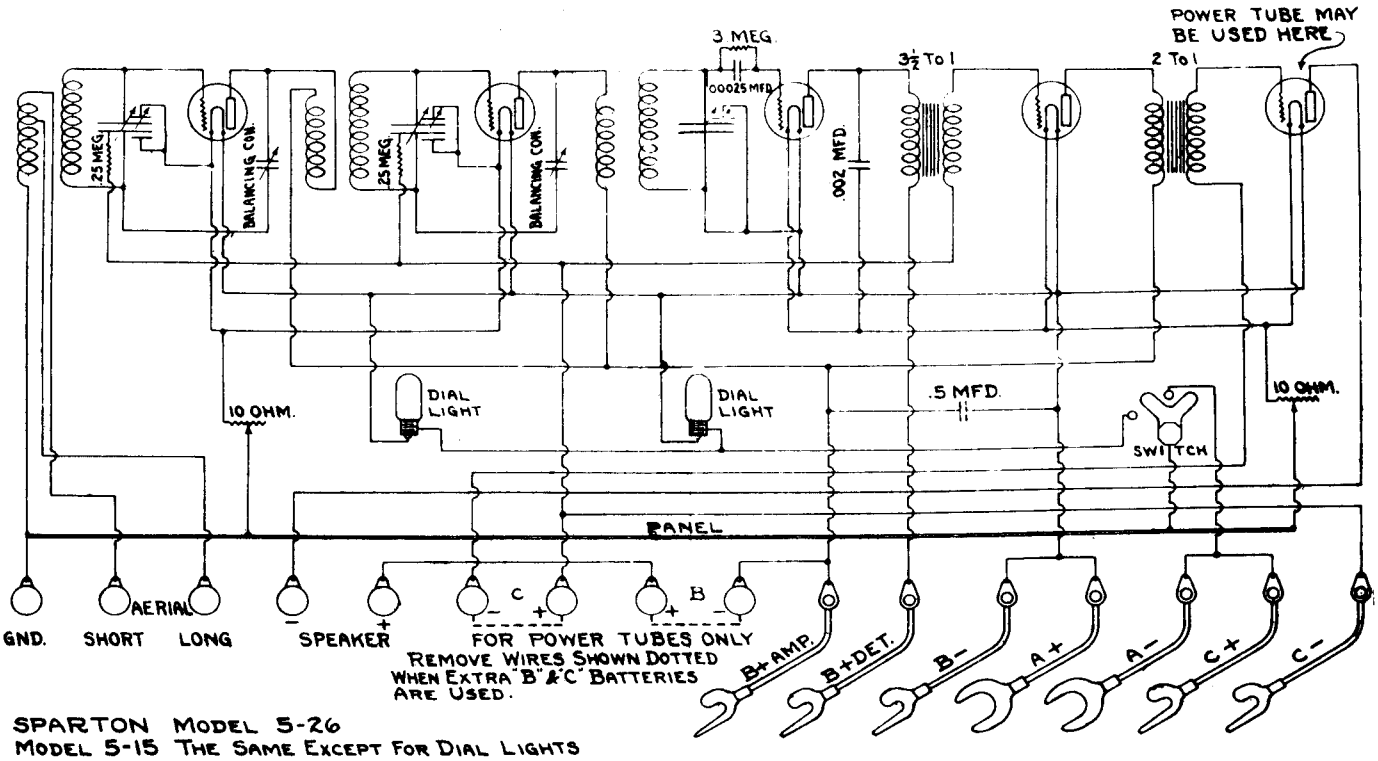
SPARKS-WITHINGTON CO.



SPARKS-WITHINGTON CO.

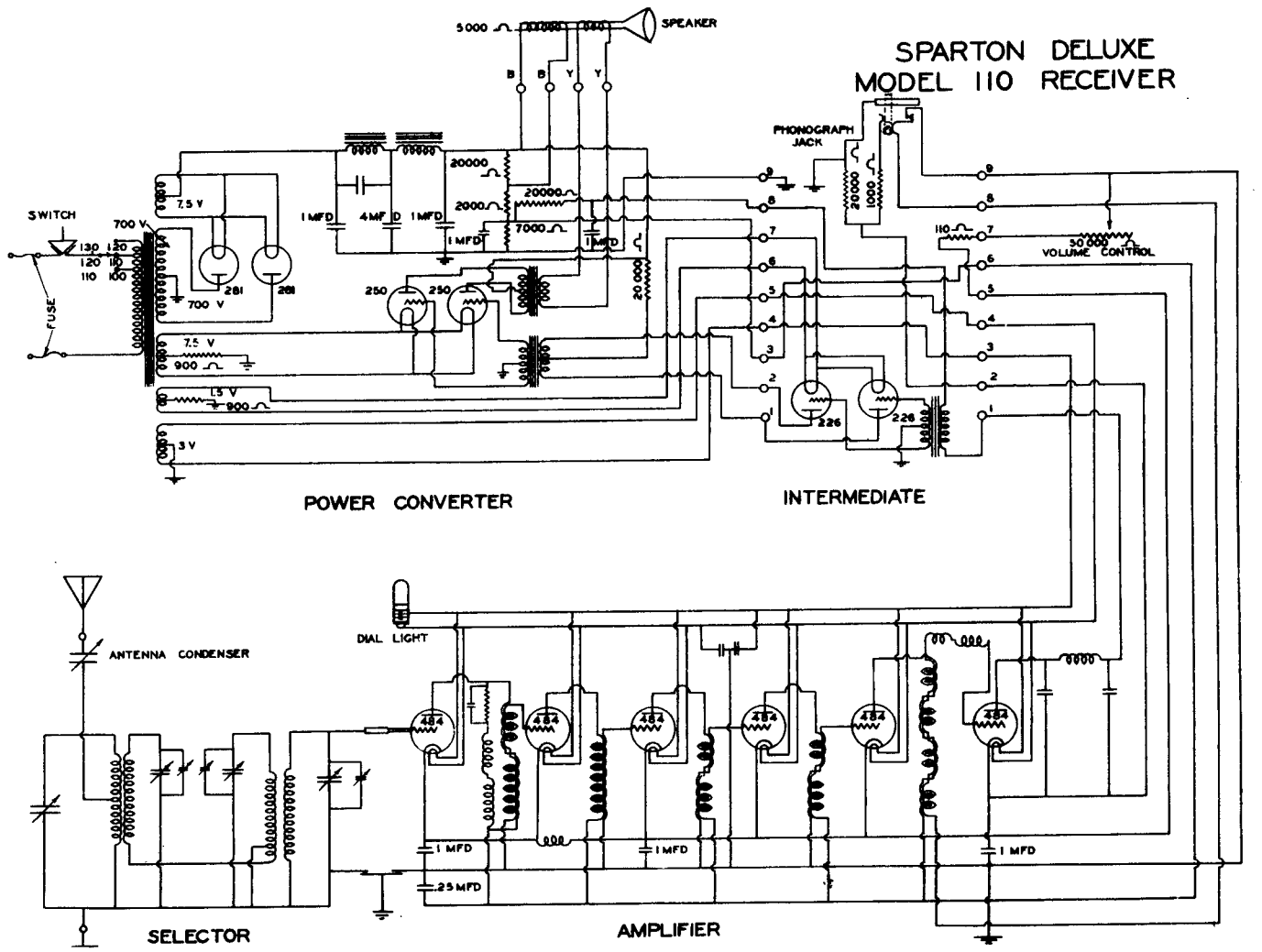


SPARKS-WITHINGTON CO.



SPARTON MODEL 5-26
MODEL 5-15 THE SAME EXCEPT FOR DIAL LIGHTS

Schematic Drawing Sparton Equasonne Receivers Model 110



Radio Service Data Sheet

STEINITE 50-A AND 102-A

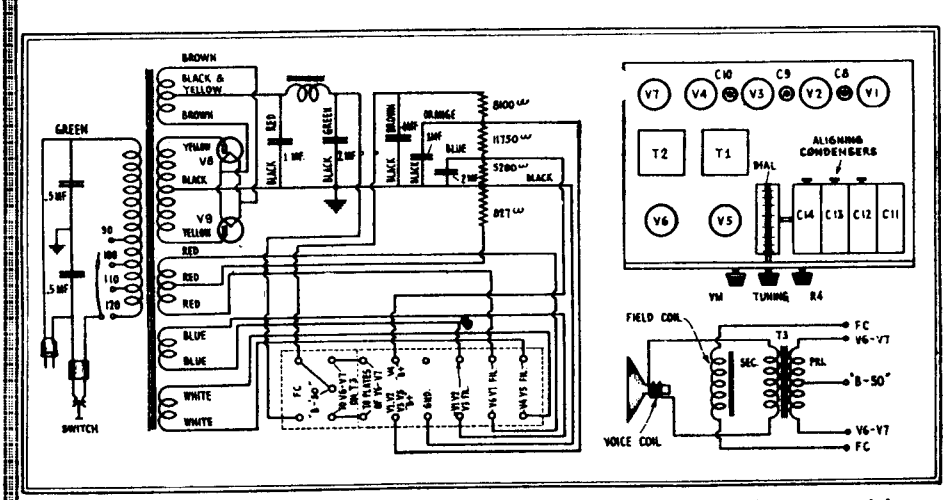
On the terminal strip of this receiver are mounted: the power-cable lugs; the grid leak and condenser; the detector-plate by-pass condenser; the two center-tap resistors; and the 600-ohm and 2500-ohm "C-bias" resistors.

A special input circuit is used on the Steinite receivers, for the purpose of obtaining sensitivity. The circuit acts as an autotransformer when the antenna lead is connected at the junction between L1 and C1. The purpose of R1 is to complete the D.C. path for the grid bias.

clockwise position cuts in 75,000 ohms additional. The resulting biasing potential is sufficient to reduce the plate current to nil; and even powerful local signals are cut out.

The output transformer matching V6 and V7 to the moving coil of the dynamic reproducer is built into the reproducer. The primary winding has a resistance of 285 ohms between center tap and each end. The secondary winding matches the low-resistance voice-coil.

The power pack of this receiver is built on the



Power-pack parts layout and reproducer connections of the Steinite "50-A" and "102-A."

Each unit of the four-gang condenser has a capacity of 380 mmf., maximum, and 30 mmf., minimum. The secondaries L3, L6, L9 consist each of 87¼ turns of No. 30 enameled wire on a tube 1¼-inch in diameter. They are connected in series with the balancing coils (L4, L7, L10) which are wound with 32 turns of the same size wire; they are placed at the low-potential ends of the secondary coils, and in non-inductive relation. The primary coil, placed inside the main secondary, consists of 24 turns of space-wound No. 38 advance wire.

When the volume control R4 is turned entirely "on" in a clockwise direction the bias on the R.F. stages is normal (600 ohms in the cathode leads); turning this control to its maximum counter-

unit plan; whereby, if one unit is defective, it can be easily removed and another substituted in its place. Some difficulty may be experienced in removing the chassis from the Model 102 unless the following procedure is followed. First, remove the two screws with which the "Radio-Phono" escutcheon is held in place. Sufficient slack has been provided in the leads so that it is possible to raise the escutcheon assembly, turn it on edge and pass it down through the hole into which it fits, permitting its removal as an integral part of the receiver chassis. Second, no attempt should be made to remove the receiver chassis from the shelf to which it is attached until the shelf has been removed from the cabinet. The shelf with chassis attached can be readily removed by with-

drawing the four screws which secure it to the cabinet, permitting the entire assembly to be pulled out from the back of the cabinet and making easy access to the six bolts which secure the chassis to its supporting-shelf.

If the volume control does not function, consideration of the schematic circuit indicates that the trouble may be due to a shorted C2 or C3.

If the transformer's filament windings for V4-V5 V8-V9 are making contact or flashing over, resistor R2 (situated under the terminal strip and colored red) will be burnt out and consequently show an open circuit, or no "C" voltage on the grid of V5. The remedy for this condition is to remove the transformer from the power pack and substitute another. Only early models should require this repair.

The phonograph turntable should rotate at the standard speed of 78 r.p.m.

Any hum which may develop is ordinarily traceable to the detector; particular care taken in the selection of a detector tube when first setting up the receiver will result in best operation over an extended period.

Variation from the standard circuit to include connections for the phonograph-radio switching arrangement on the 102-A is illustrated; the schematic is laid out to correspond with the view of the switch escutcheon, which is a rear one.

The aligning condensers of this receiver, shown in the parts layout, are not shown in the schematic circuit.

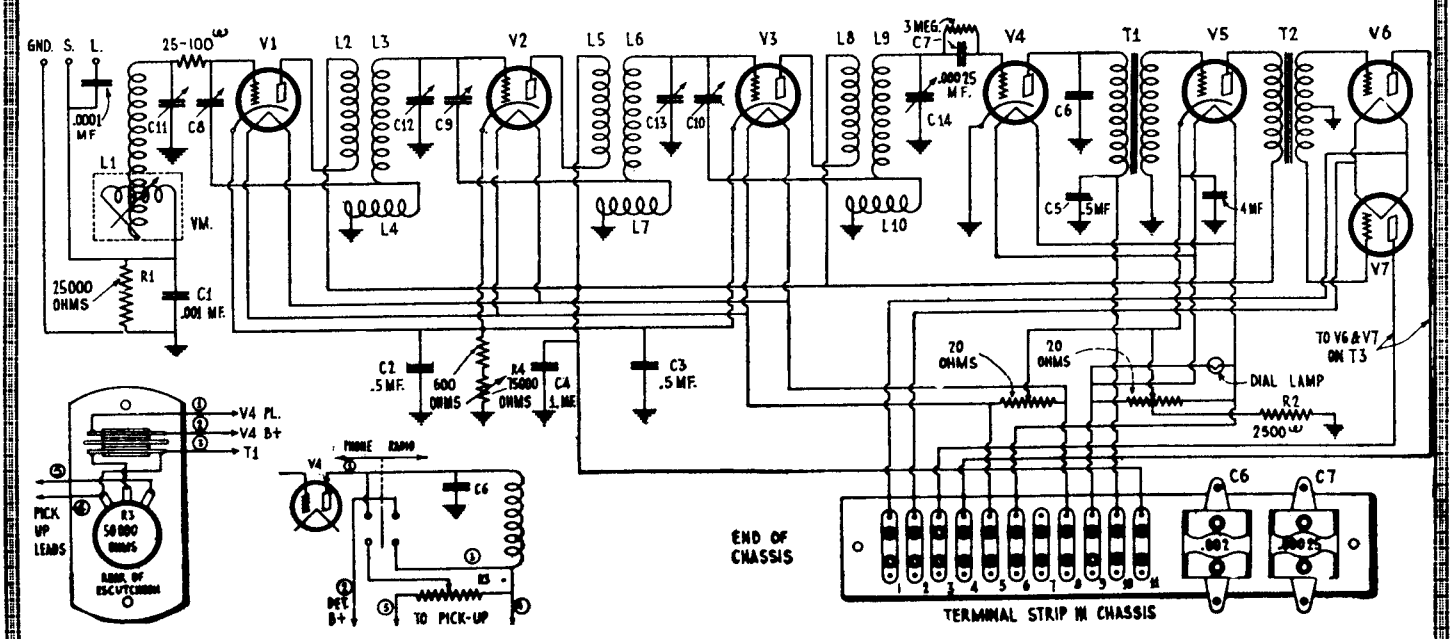
Line voltage tap colors of pack are: red, 90; white, 100; blue, 110; green, 120.

The average voltage readings (as shown by a standard set analyzer) for the 50-A and 102-A are given in the table which follows:

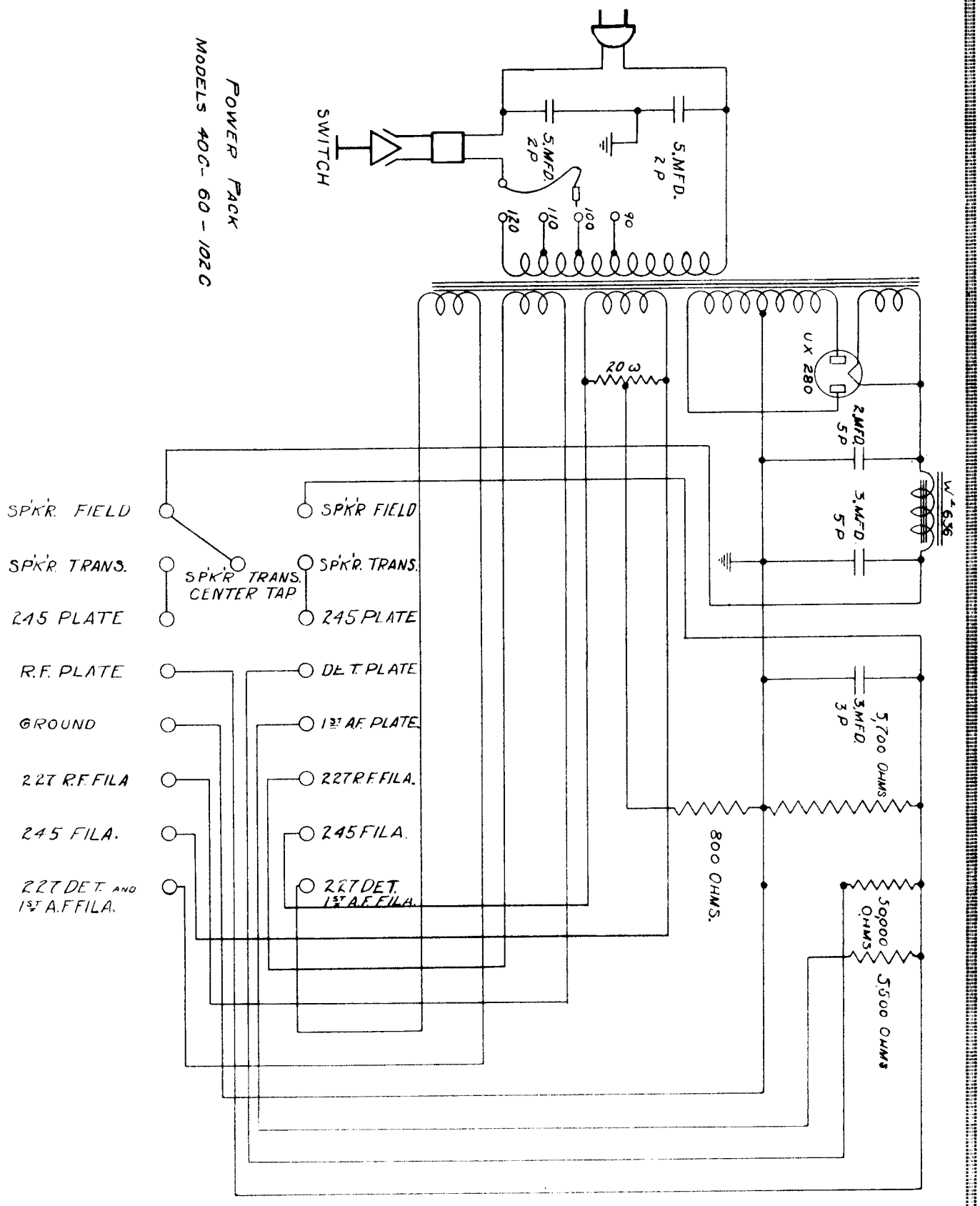
Readings of Tester with Test Plug in Socket of Set

Tube No.	Tube Type	Tube out of Tester (Volts) "A"	"B"	Tube in Tester (Volts) "A"	"B"	"C"	Normal	Grid Test Milliamperes
V1	'27	2.75	134	2.45	125	6.5	4.25	13.0
V2	'27	2.75	134	2.45	125	8.7	5.0	14.0
V3	'27	2.75	134	2.45	125	8.7	4.8	13.6
V4	'27	2.65	92	2.40	32	....	2.5	.....
V5	'27	2.65	144	2.40	118	8.2	3.6	9.0
V6	'50	7.7	355	7.40	310	51.0	36.0	98.0
V7	'50	7.7	355	7.40	310	51.0	36.0	98.0

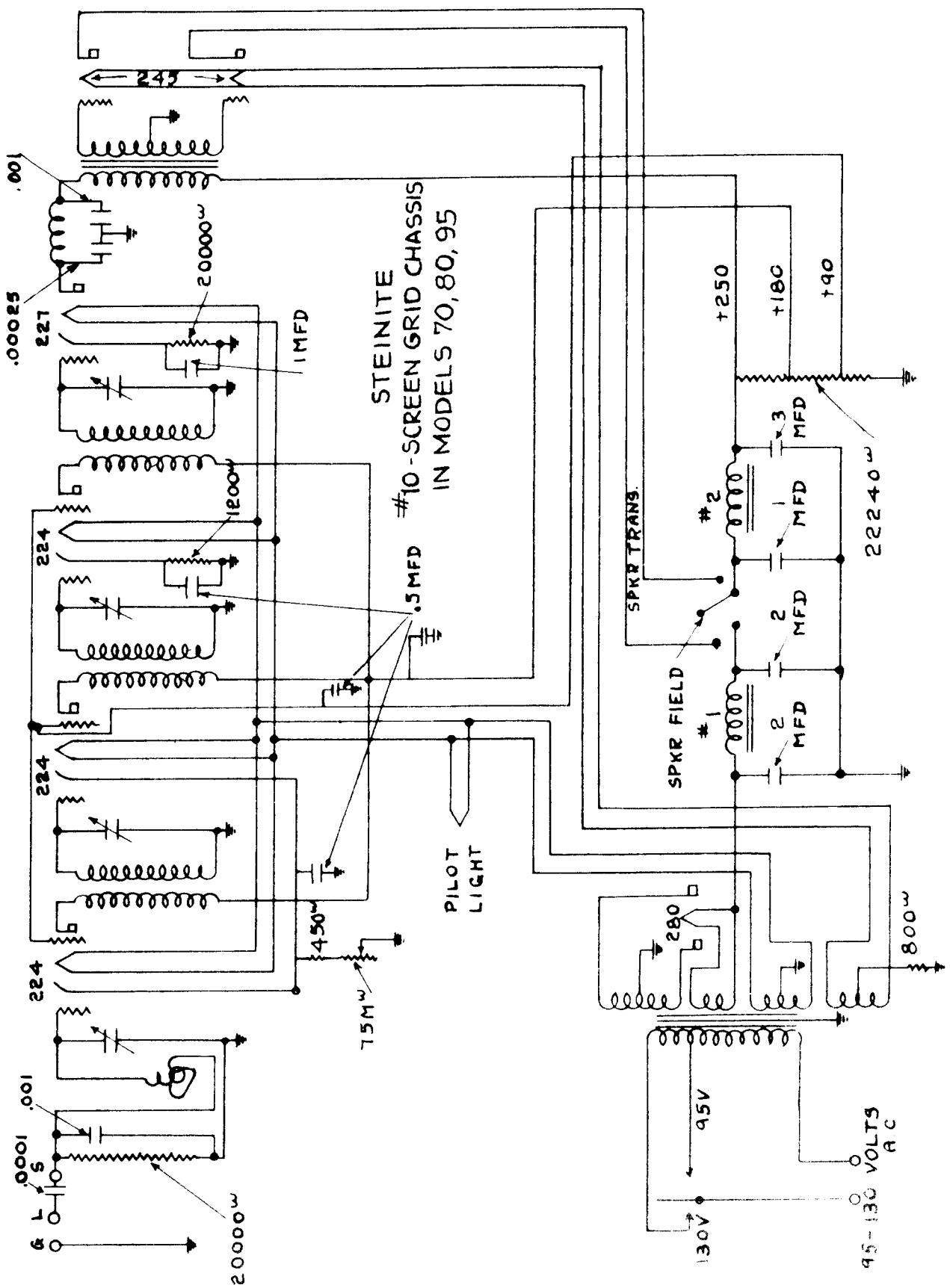
These values were determined with a line-voltage of 110 and with the line-voltage tap on the power transformer set at 110 V. (Volume Control position "Max.")



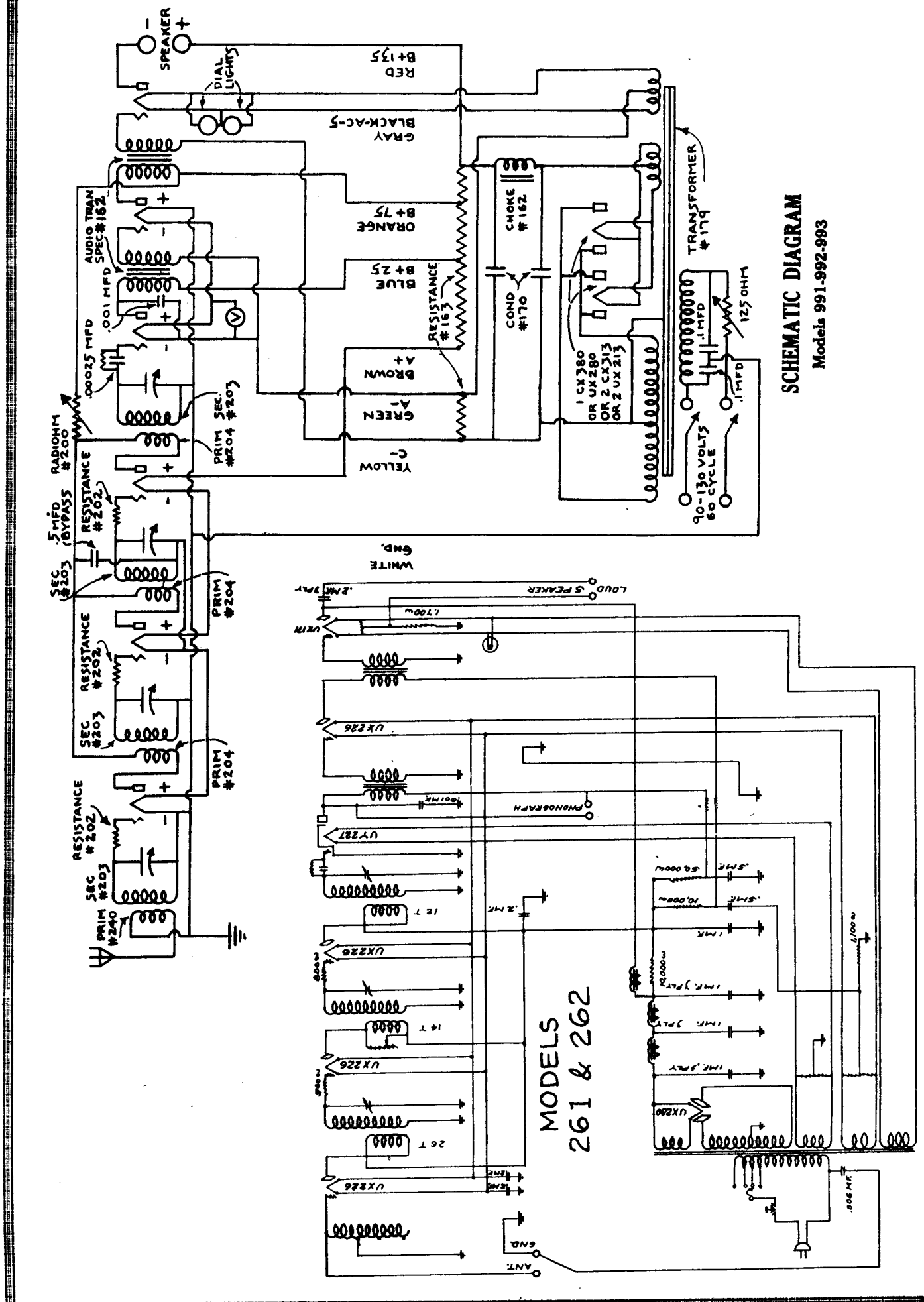
STEINITE RADIO CO.



STEINITE RADIO CO.

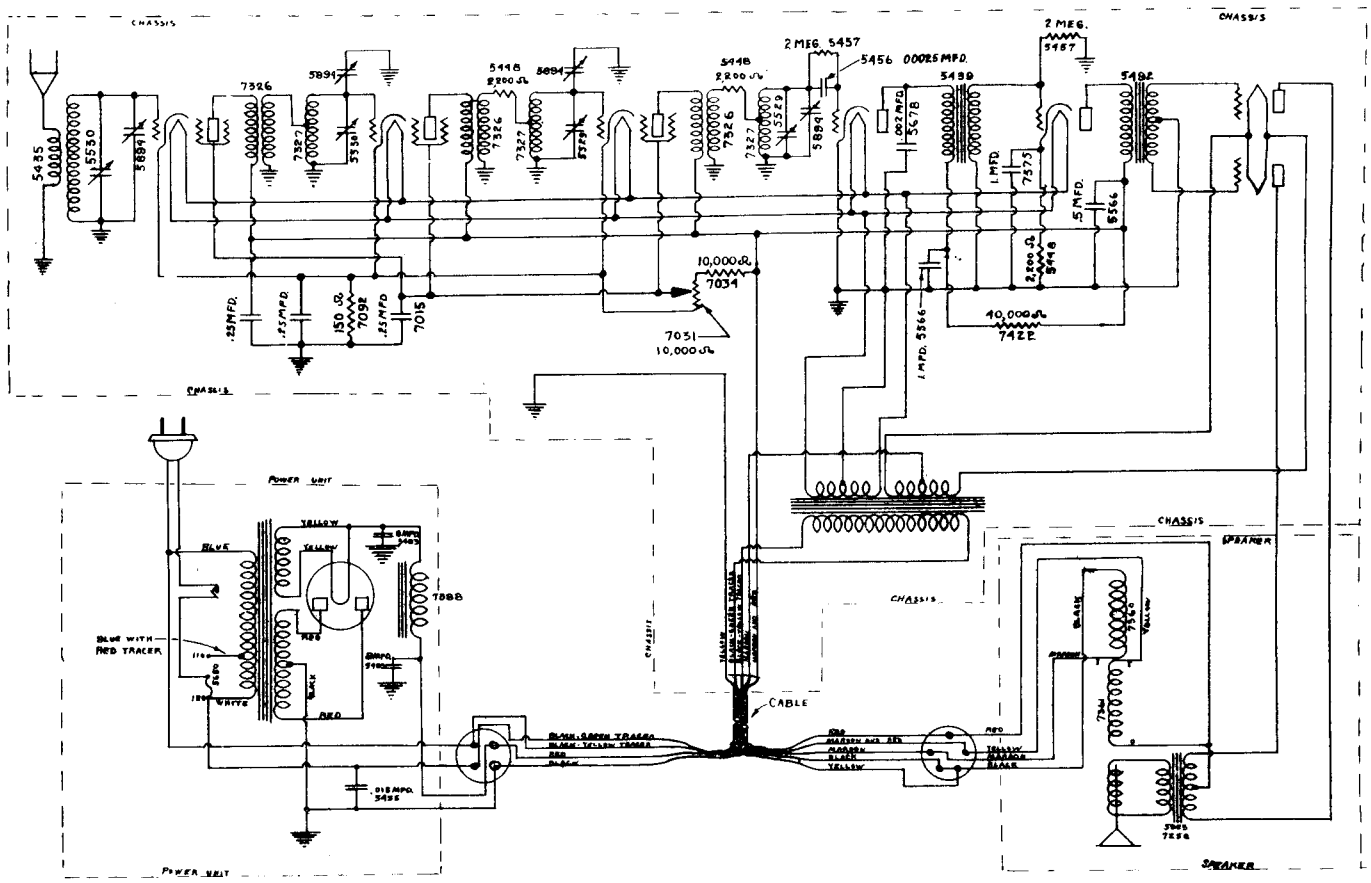


STEINITE RADIO CO.

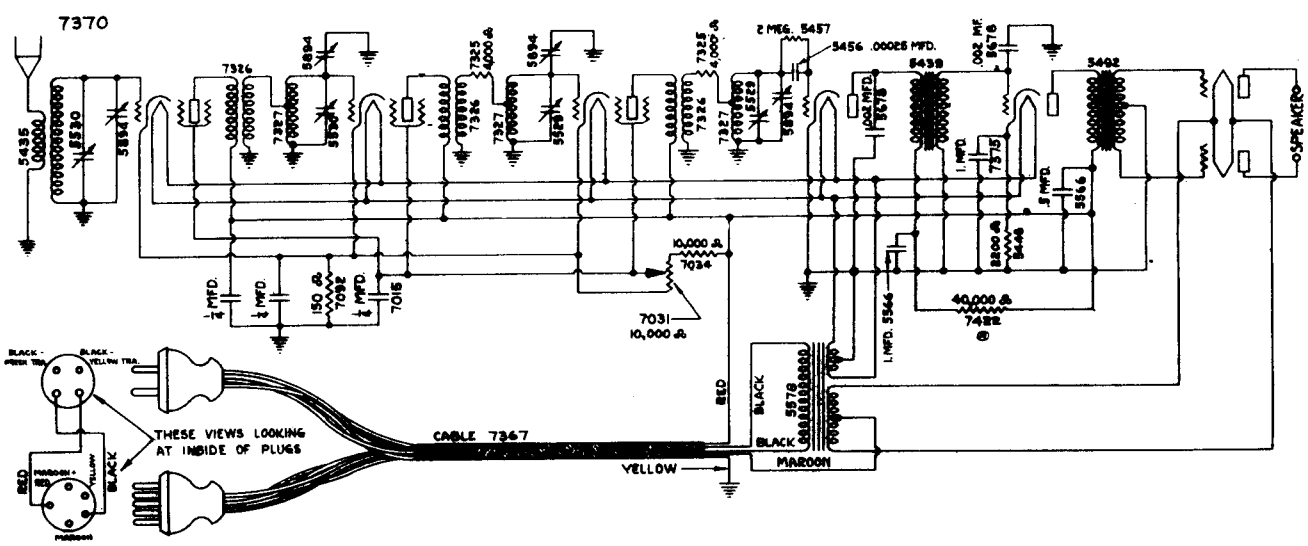


STERLING MFG. CO.

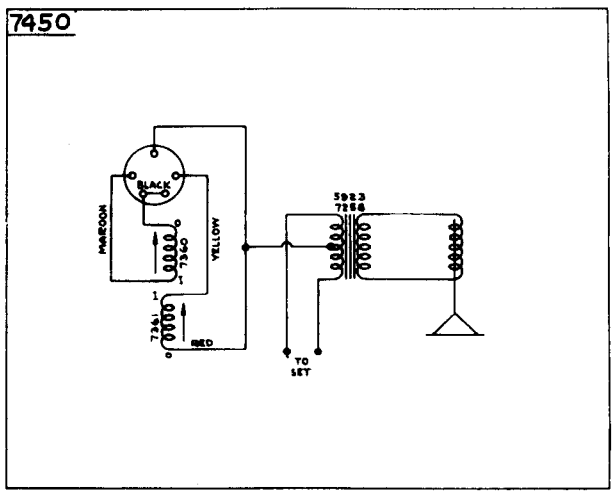
Complete Schematic Diagram of the No. 4 Circuit



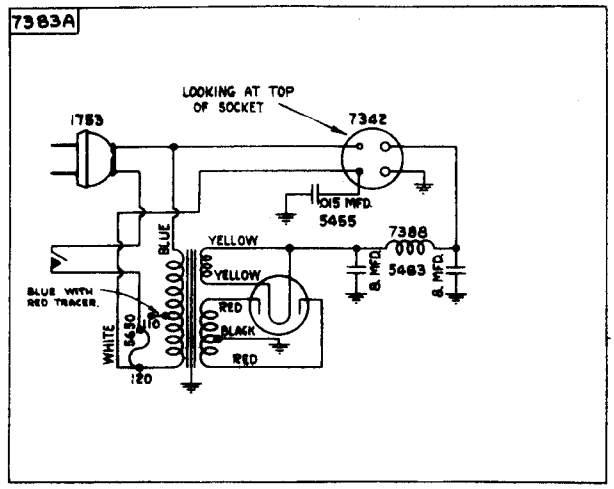
Circuit Diagrams---No. 4 Chassis, Power Unit and Speaker



STERLING MFG., CO.

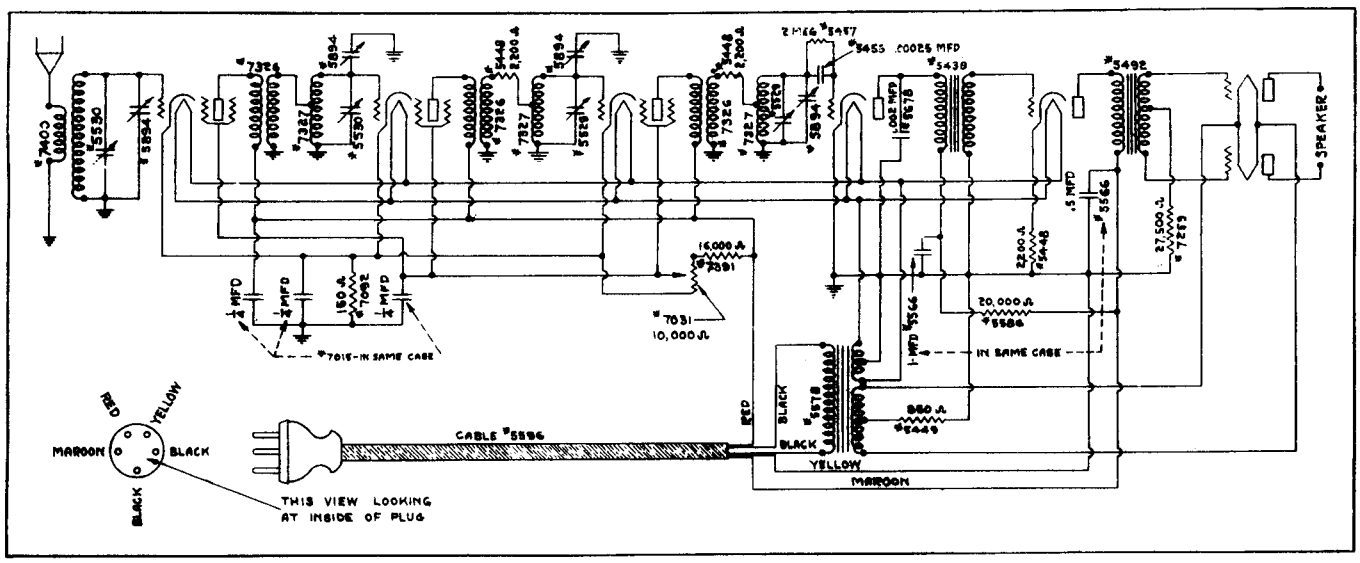


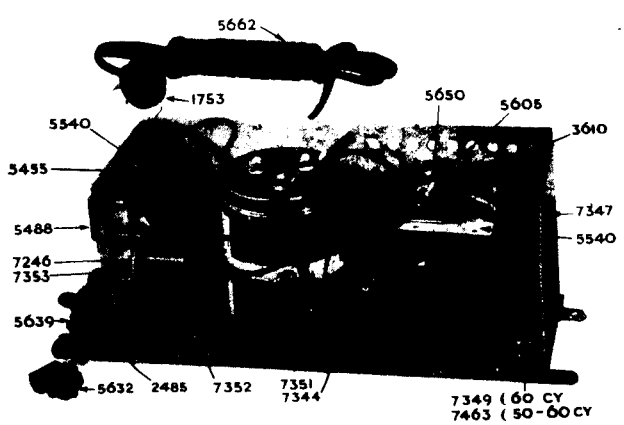
No. 4 Speaker (Part No. 7450)



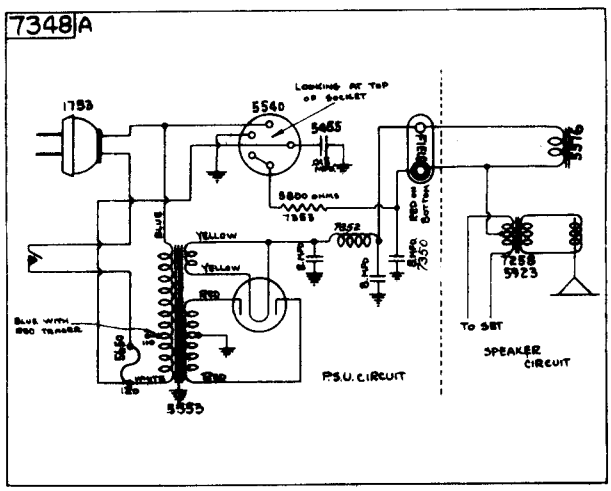
No. 4 Power Unit (Part No. 7383A)

Circuit Diagrams---No. 3A Chassis, Power Unit and Speaker



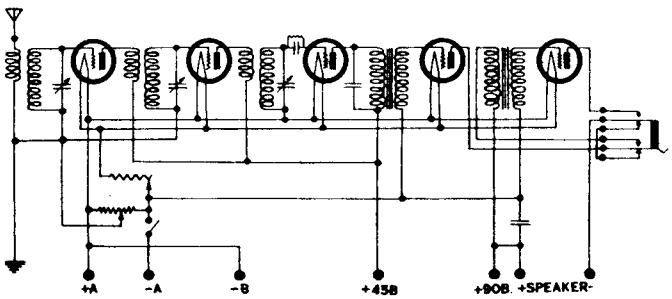


No. 3 Power Unit (Part No. 7348A)

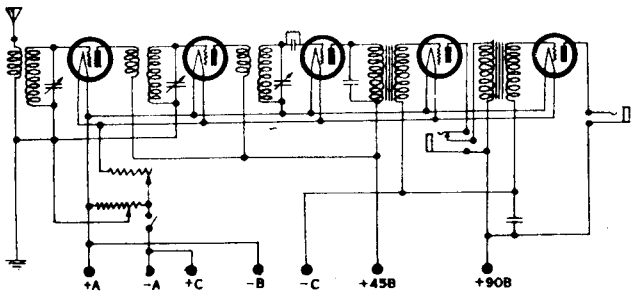


STEWART-WARNER CORP.

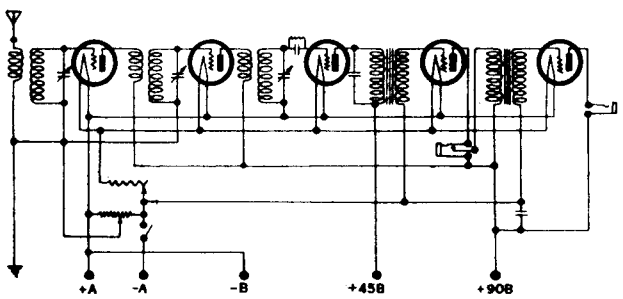
Schematic Diagram of Connections for Stewart-Warner One-Dial Control



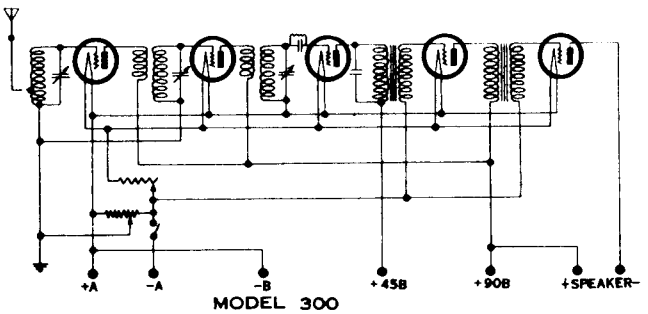
MODEL 305-315-320 WITH "45 VOLT B" ON R.F



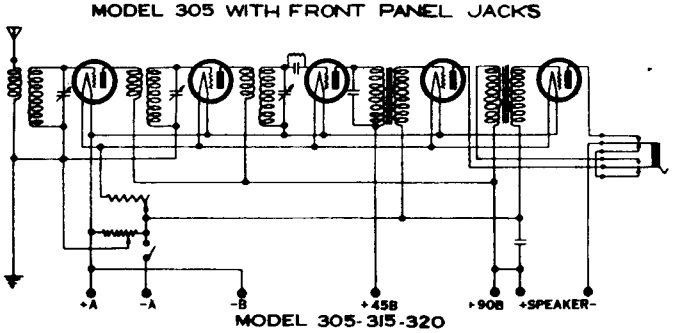
A TYPICAL TUNED RF CIRCUIT WITH "C" BATT. CONNECTIONS



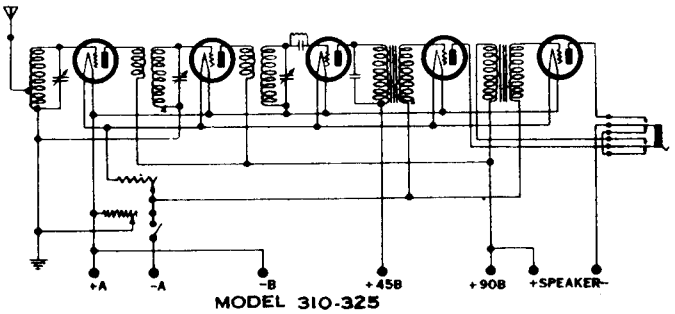
MODEL 305 WITH FRONT PANEL JACKS



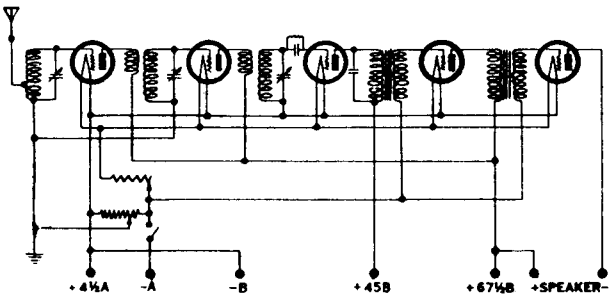
MODEL 300



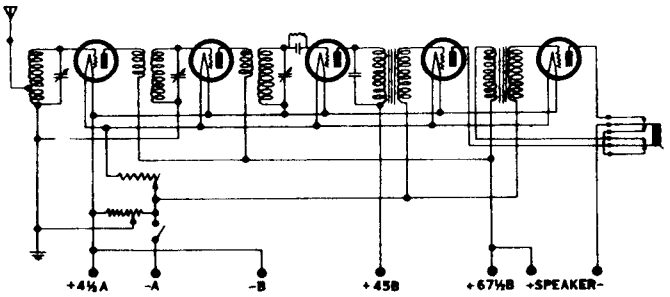
MODEL 305-315-320



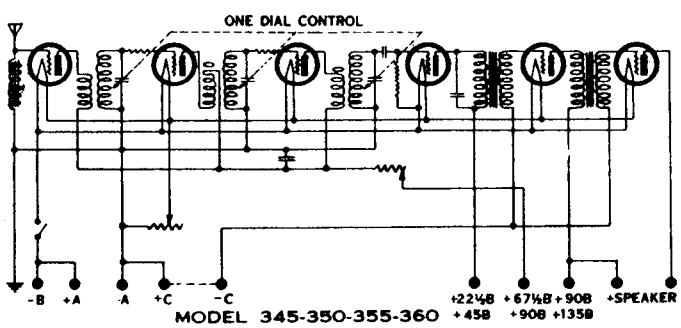
MODEL 310-325



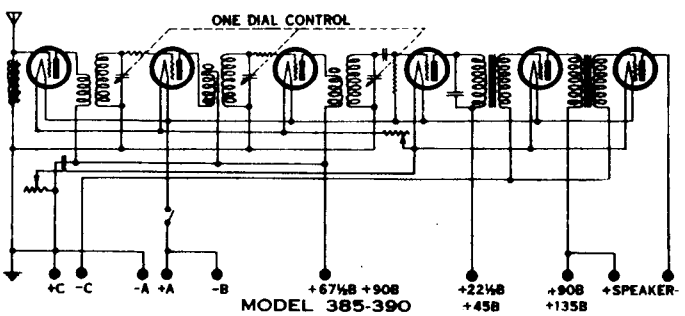
MODEL 330



MODEL 335-340

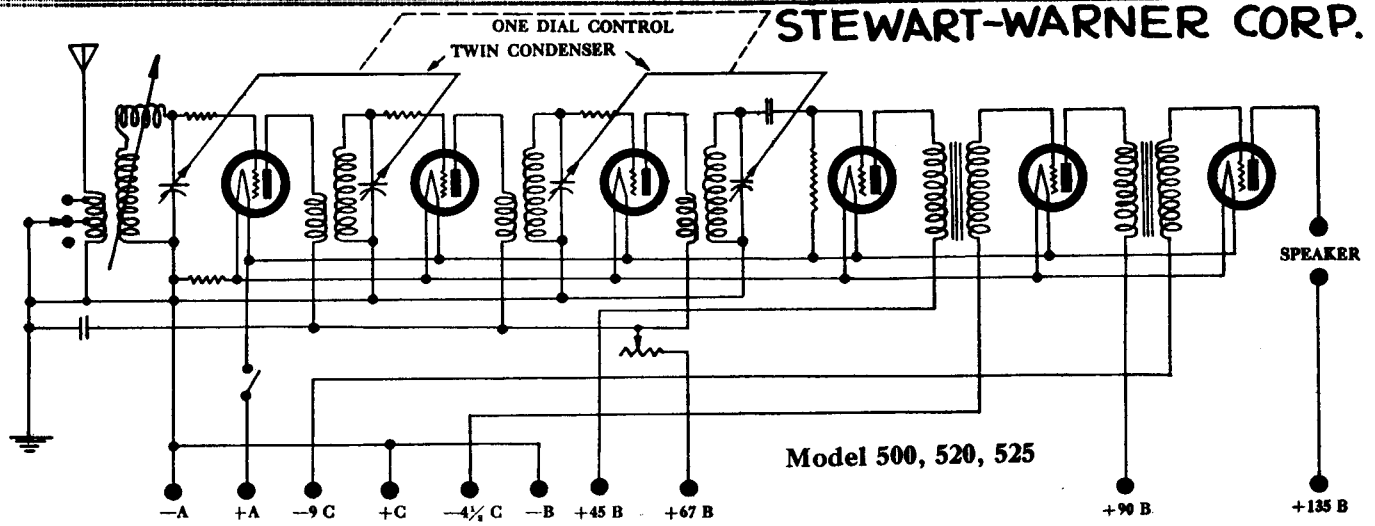


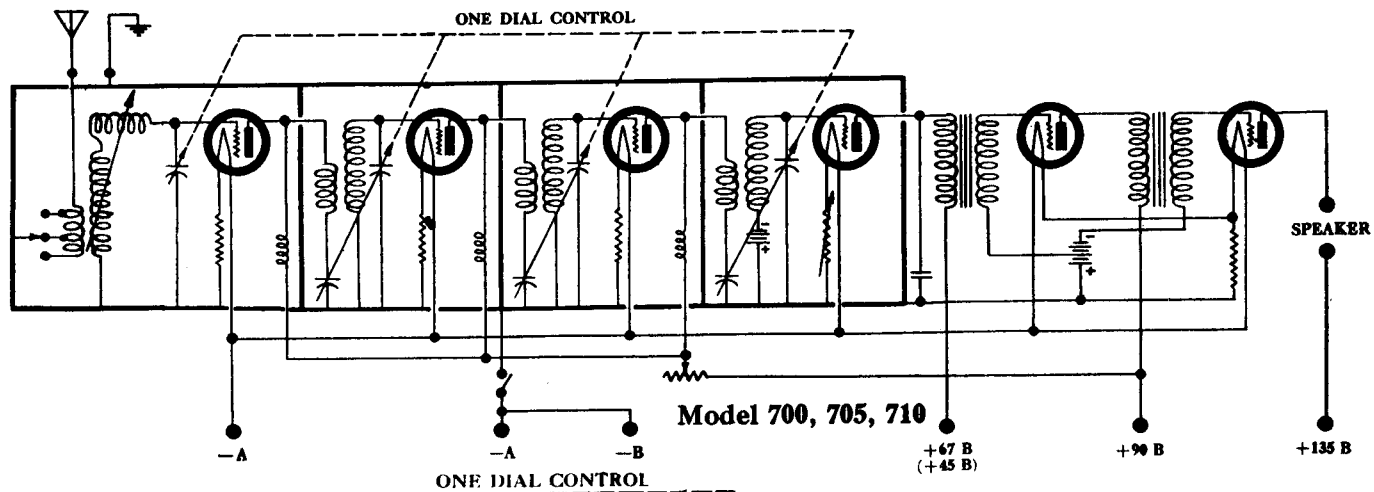
MODEL 345-350-355-360

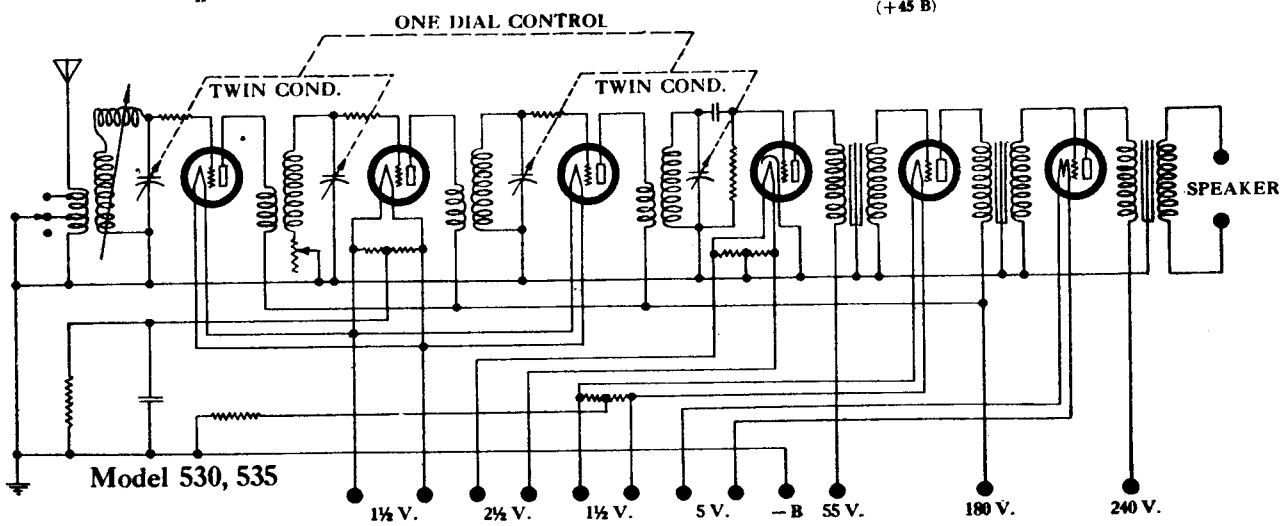


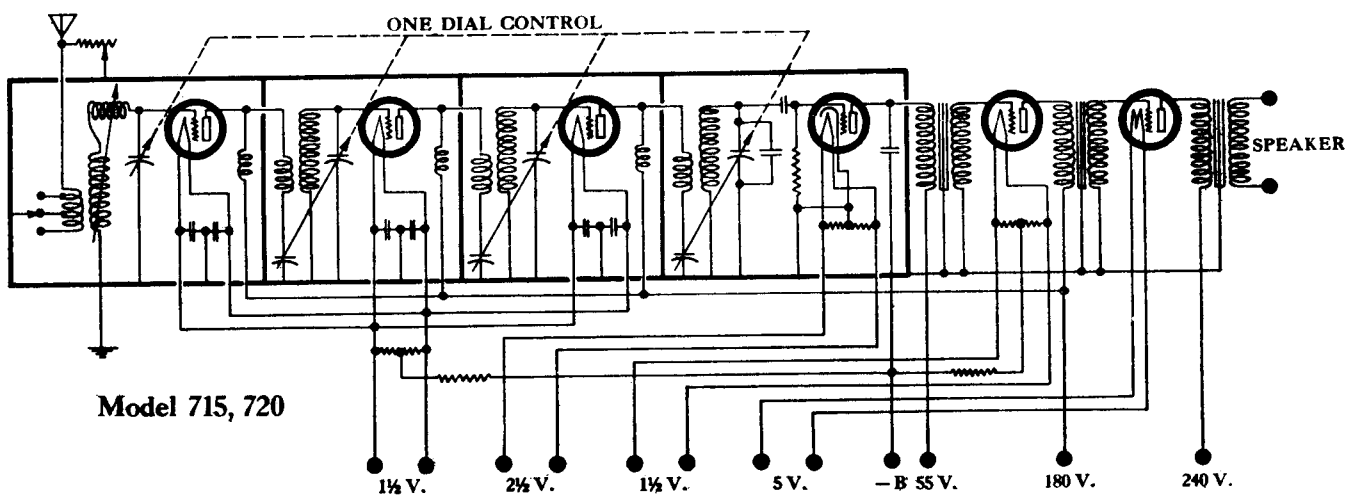
MODEL 385-390

STEWART-WARNER CORP.



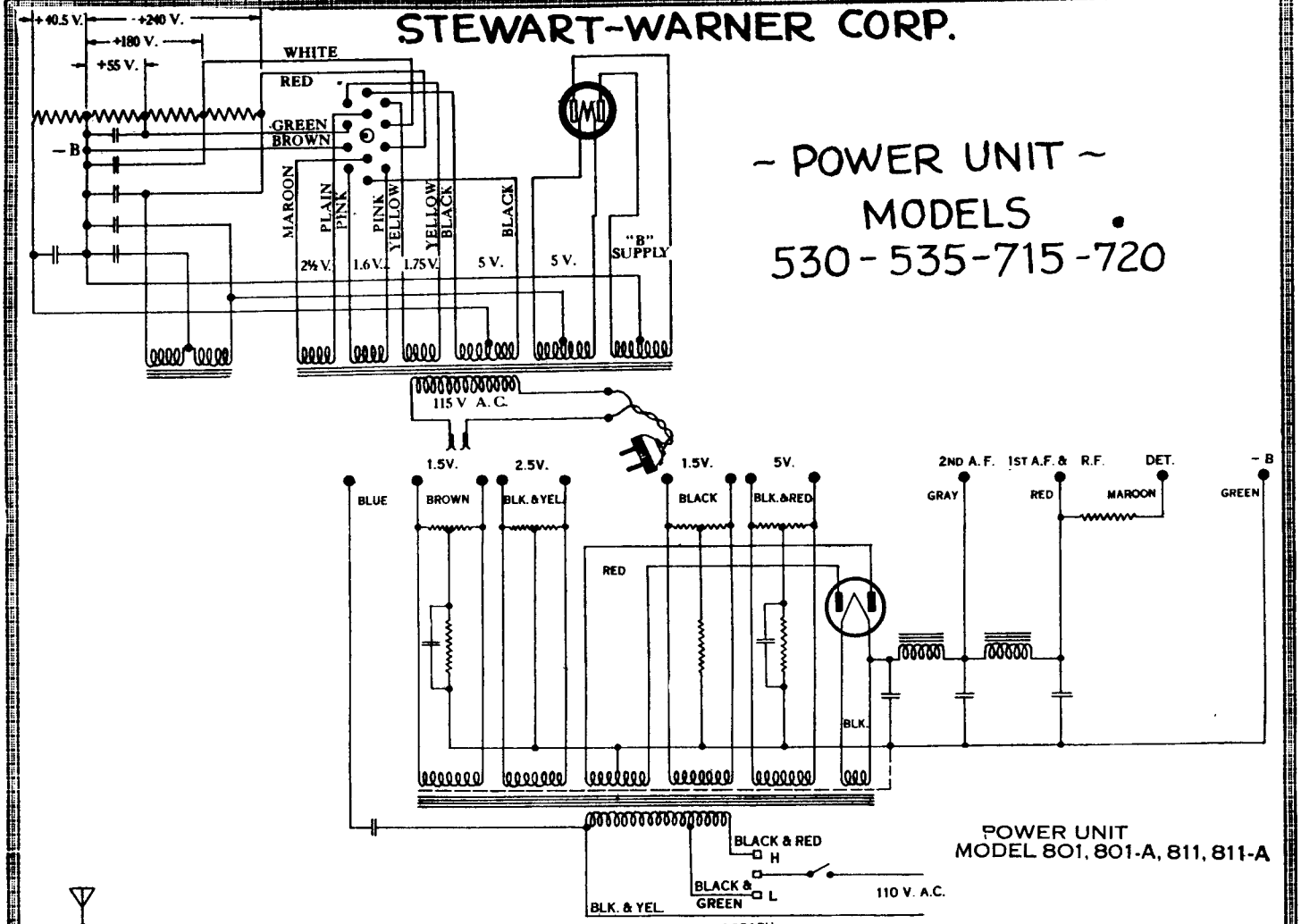




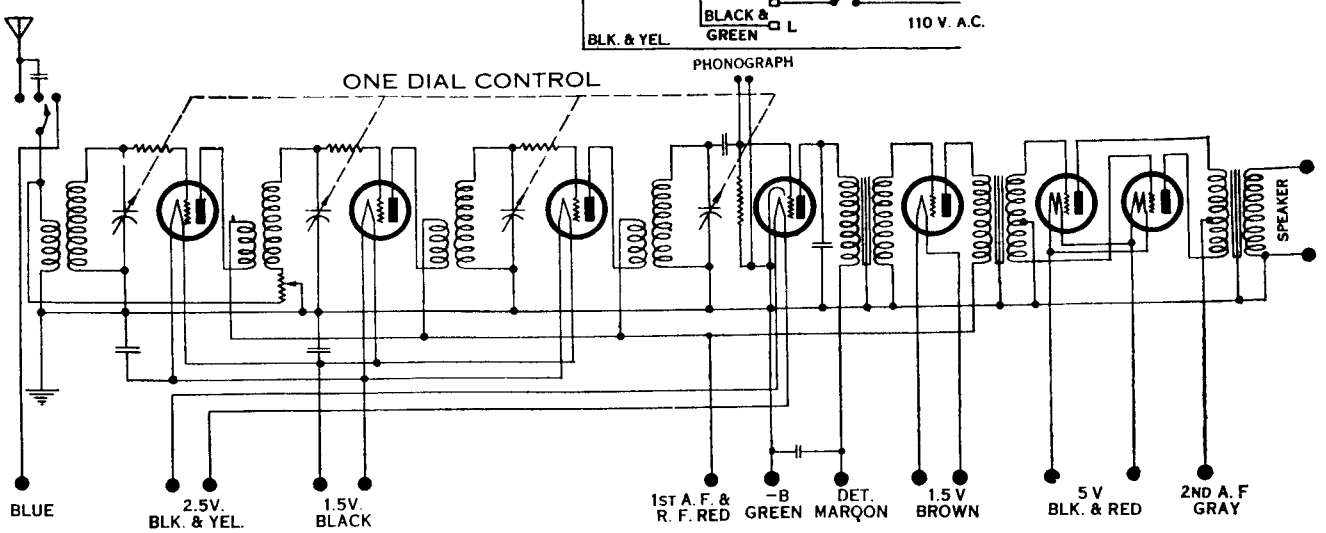


STEWART-WARNER CORP.

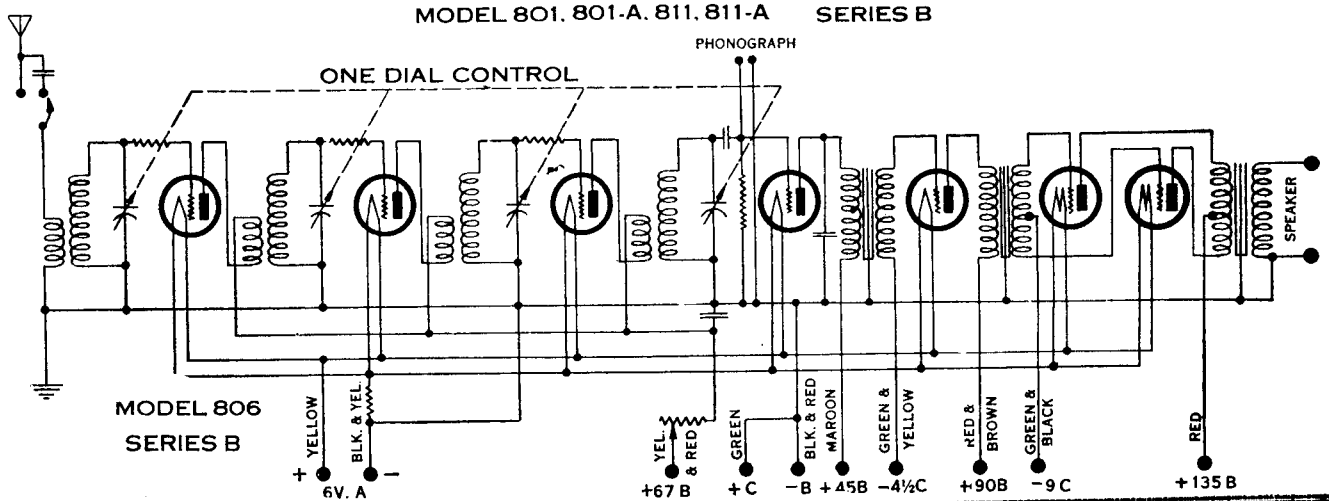
- POWER UNIT -
MODELS
530 - 535 - 715 - 720



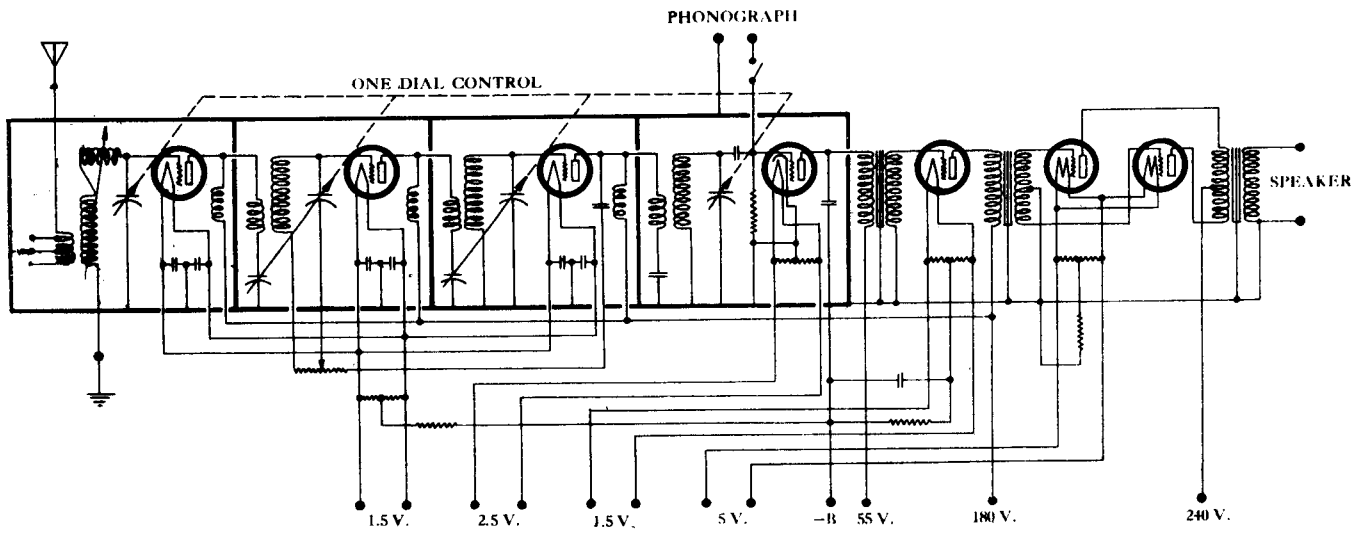
POWER UNIT
MODEL 801, 801-A, 811, 811-A



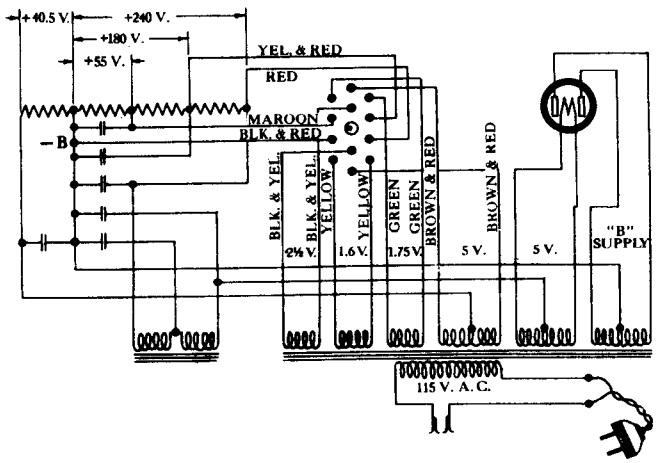
MODEL 801, 801-A, 811, 811-A SERIES B

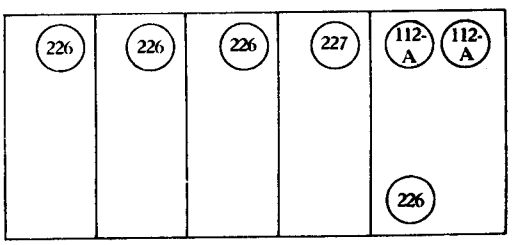


STEWART-WARNER CORP.

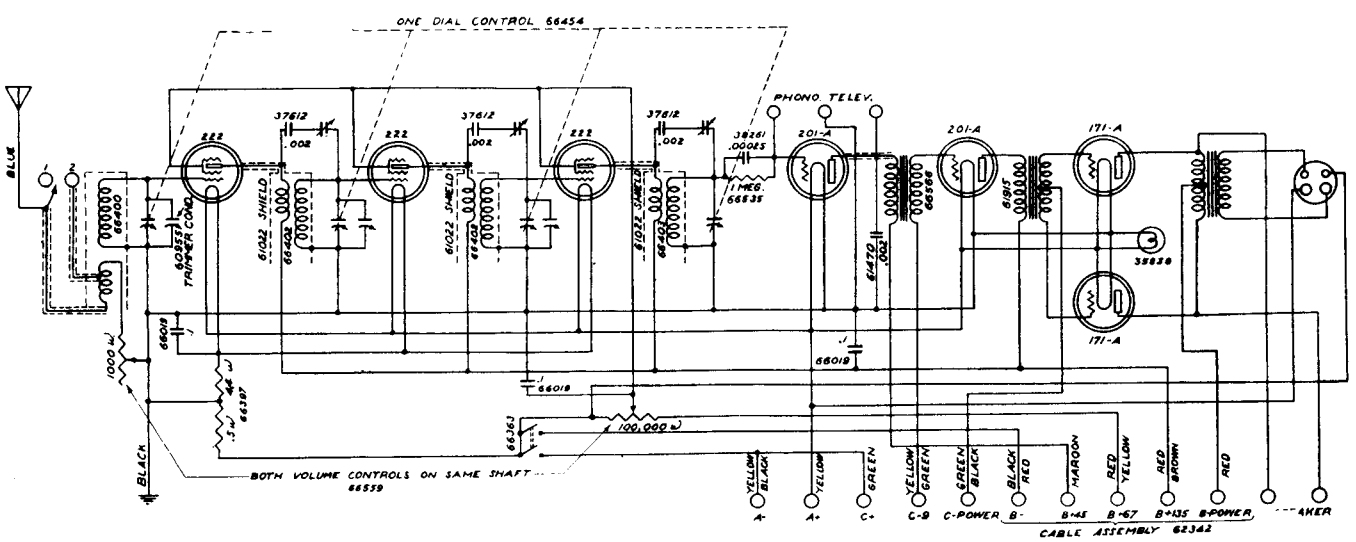


Model 750



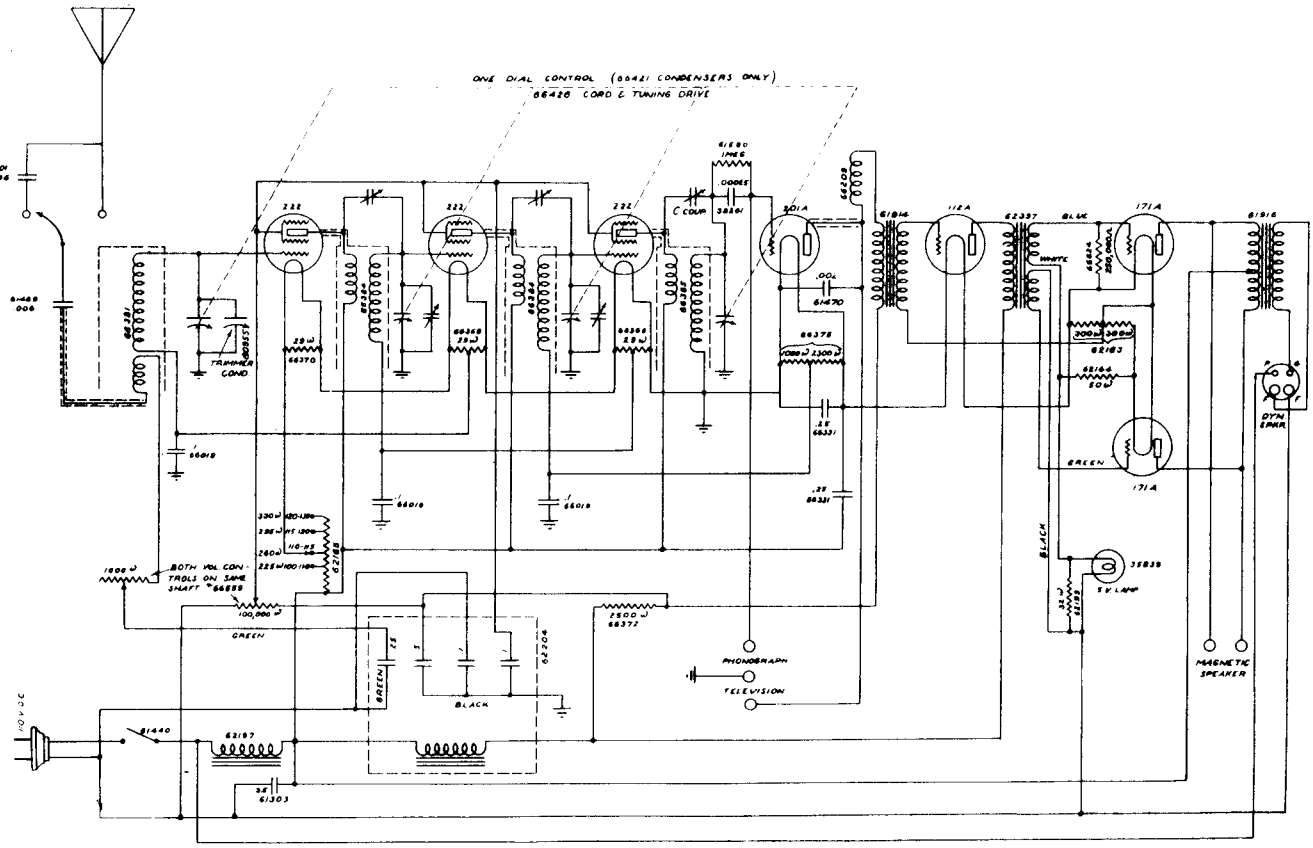


LOCATION OF VARIOUS TUBES
MODEL 750



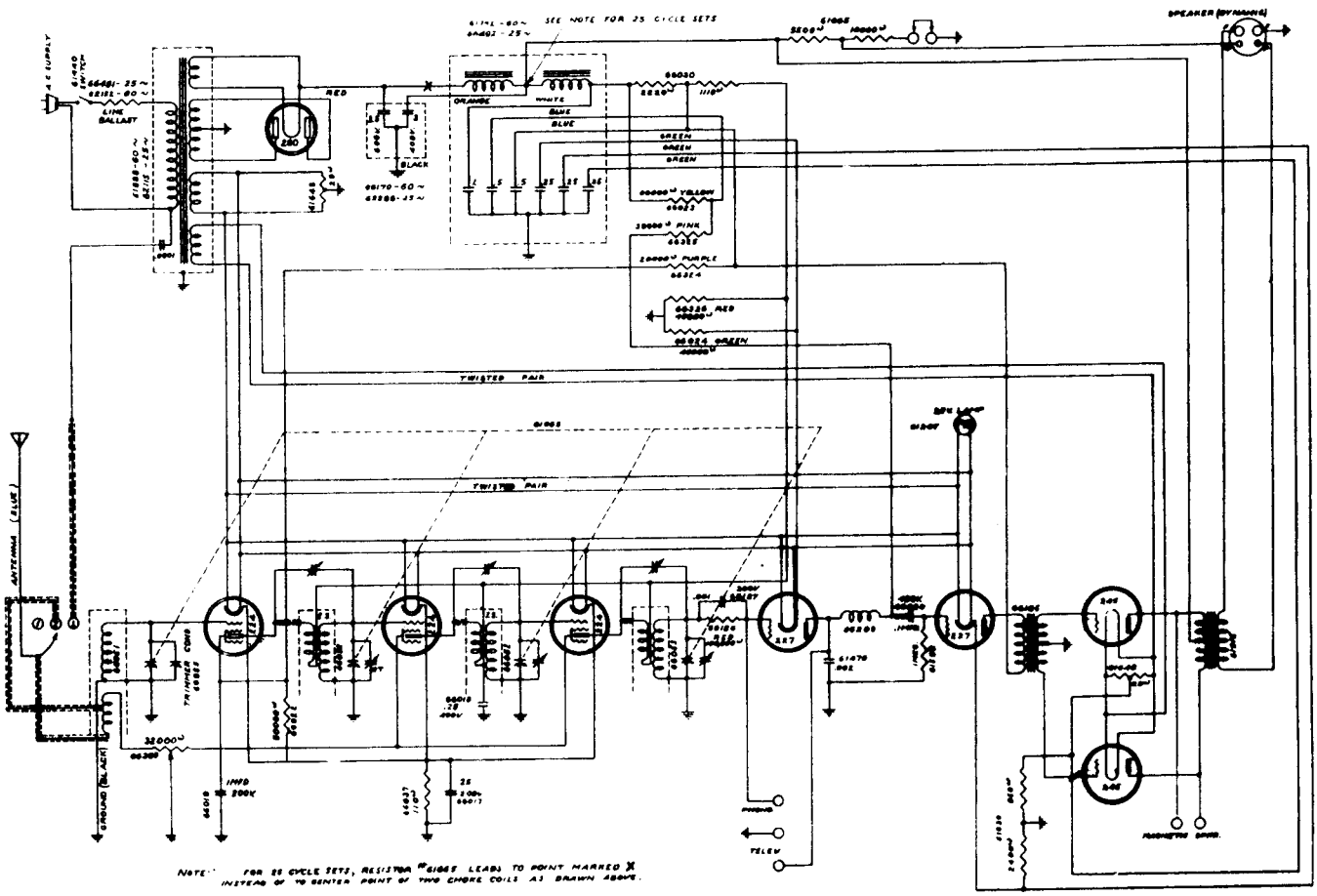
CIRCUIT DIAGRAM OF 950 SERIES BATTERY SCREEN-GRID RECEIVER

STEWART-WARNER CORP.



Circuit Diagram of Stewart-Warner 950 Series D. C. Receiver

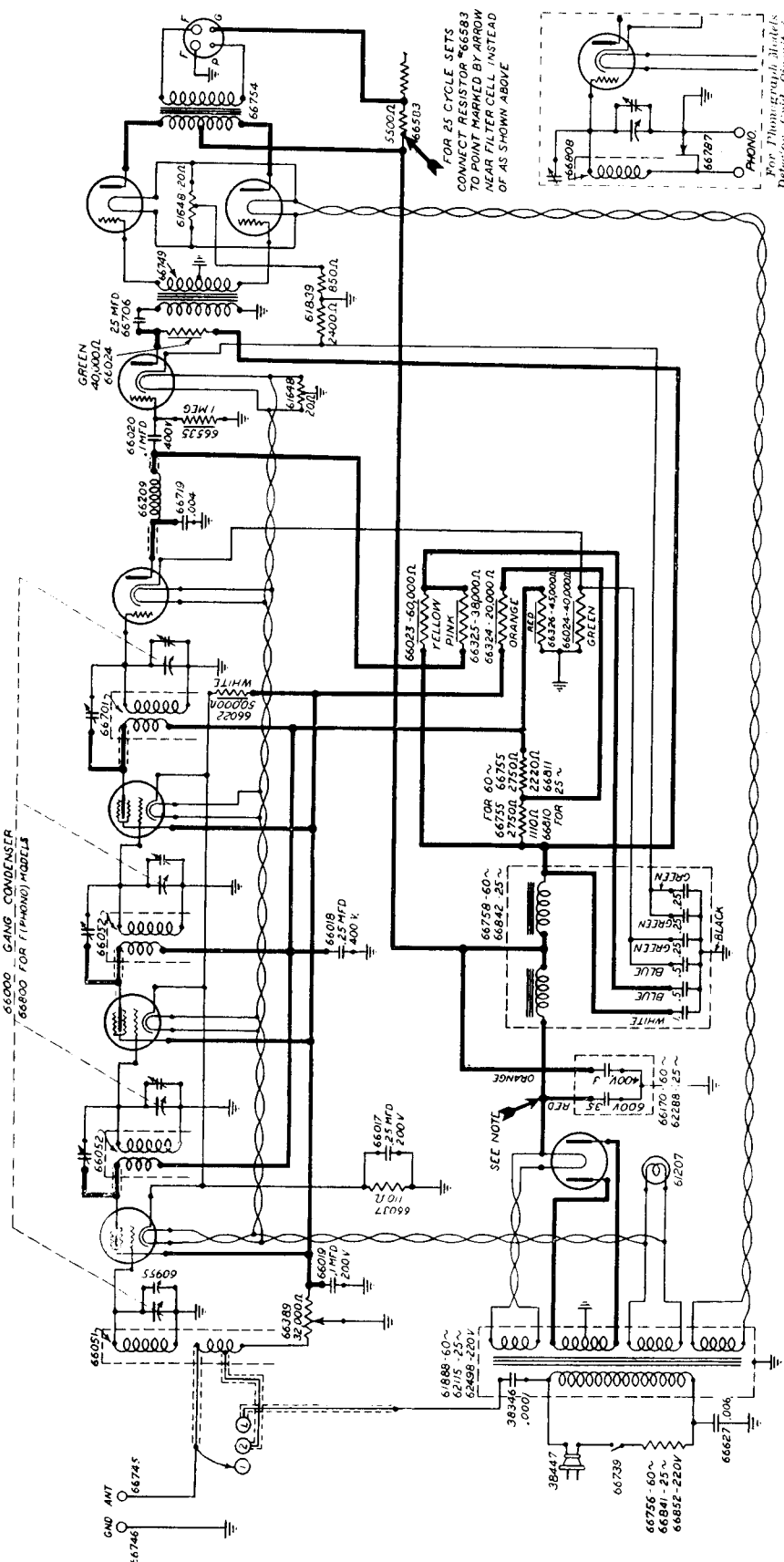
950 Series 25 and 60 Cycle A. C. Radio Receivers



NOTE: FOR 25 CYCLE SETS, RESISTOR LEADS TO POINT MARKED X INSTEAD OF TO CENTER POINT OF TWO CHOKE COILS AS SHOWN ABOVE.

STEWART-WARNER CORP.

Models R-100A, AF, B, BF, E, and EF

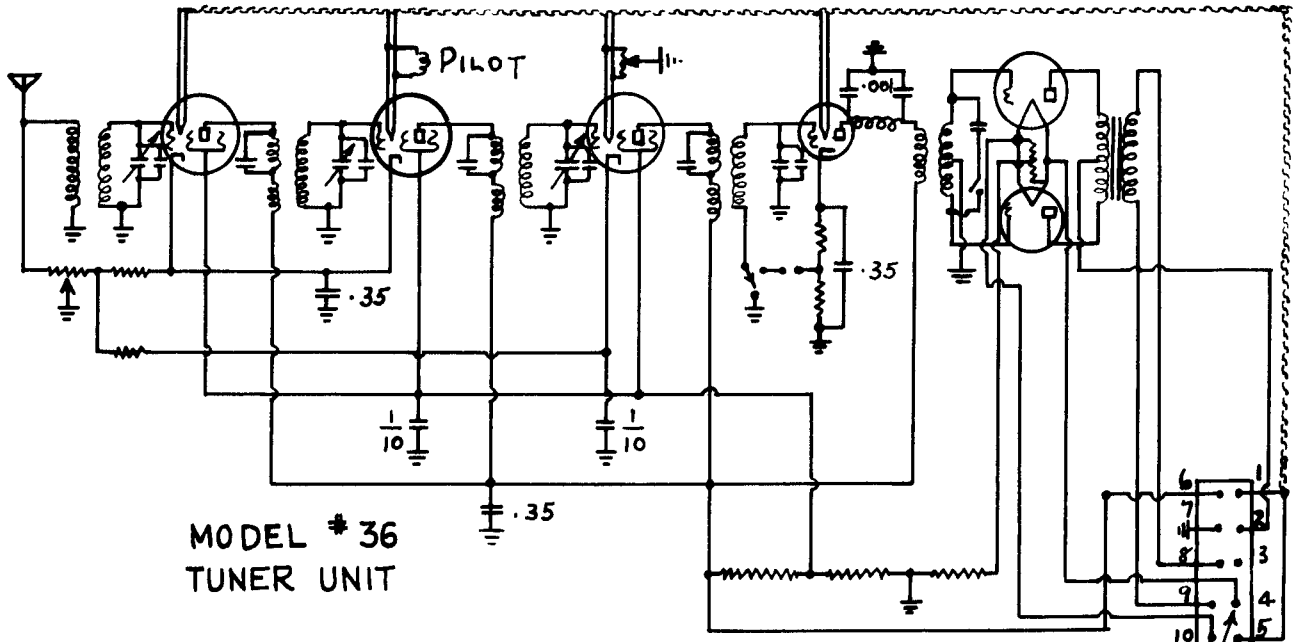


AVERAGE VOLTAGE READINGS FOR MODEL R-100A

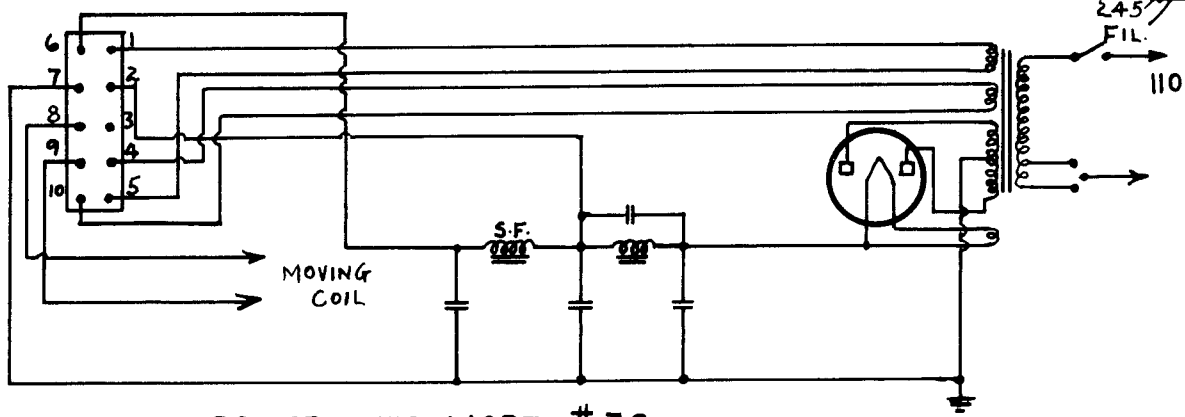
Line Voltage 115 **Volume Control Full On**

Position of Tube in Set	Type of Tube	Filament Voltage	Effective Plate Voltage (Plate to Cathode)	Plate to Ground	Screen-Grid Voltage	Bias Voltage
1 R. F.	'24	2.16	160	165	79	1.7
2 R. F.	'24	2.18	160	165	79	1.7
3 R. F.	'24	2.2	160	165	79	1.7
Det.	'27	2.18	175	170	...	23
1 A. F.	'27	2.18	125	130	...	9
2 A. F.	'45	2.25	250	300	...	50
2 A. F.	'45	2.25	250	300	...	50
Rectifier	'80	4.7	...	...	...	...

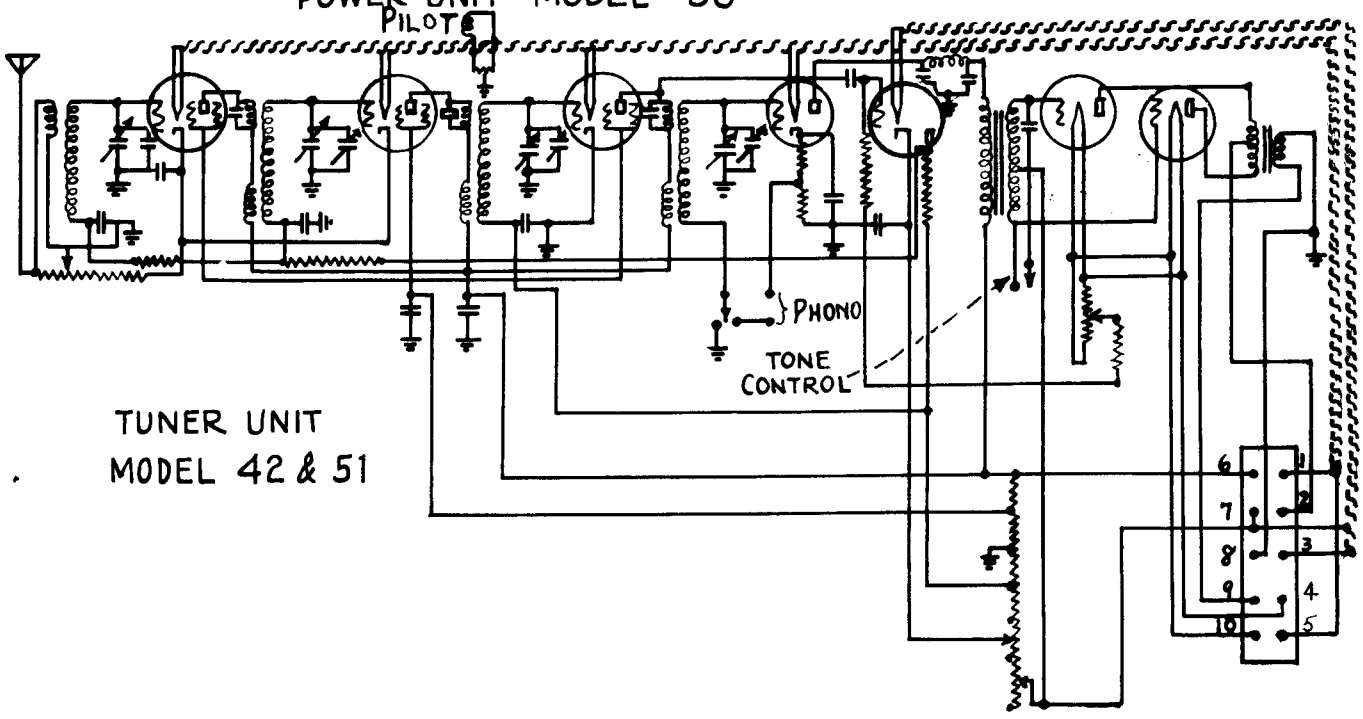
STORY AND CLARK RADIO CORP.



MODEL # 36
TUNER UNIT



POWER UNIT MODEL # 36



TUNER UNIT
MODEL 42 & 51

Radio Service Data Sheet

STEWART-WARNER SERIES 900

This receiver is so designed as to permit the use of aerials of widely differing characteristics. In addition to being adaptable to aerials of the usual type, it makes provision for use of the light-line, if satisfactory operation results when the R.F. input is taken from the light-line through C13. (Sw. 1 on tap L.). If the light-line is being used as the aerial, reversing the line plug may improve reception.

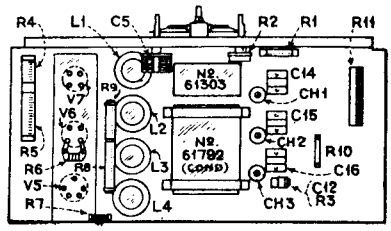
Volume control is effected by varying R2. This varies the grid-bias potential on tubes V1, V2 and V3. The first tube V1 has a tuned input and its synchronism in relation to the other tuned circuits, is accomplished through a trimming condenser, C5, controlled from the panel.

The detector output of this receiver may be tapped to any external equipment, by connection to posts provided on the rear of the receiver. Specifically, it is intended to make convenient the operation of television equipment by connecting to binding posts BP1 and BP3. Also, the detector input may be tapped for operation of a phonograph pickup, by connection to posts BP1 and BP2. There is no switching device for disconnecting the pick-up; for its leads would introduce a capacity that would impair the "phase" conditions, (resonance of the stages) of the set; consequently, the pick-up connections must be removed from the receiver when only radio reception is desired. The amplification of the detector tube is obtained when the pick-up is connected to posts BP1 and BP2.

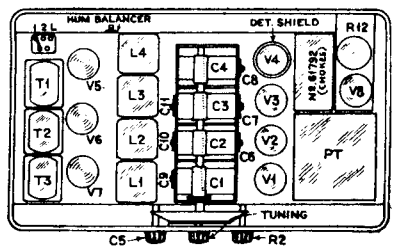
The circuit used in this receiver is of a neutralized type, and is specifically called a "balanced-bridge" connection. (Changing tubes of the same type does not disturb the circuit balance.) Before attempting to re-balance the R.F. circuits, in the event of circuit oscillation, it is advisable to make certain that the ground is a satisfactory one. It is convenient to do this by connecting a voltmeter between the ground wire and one side of the 110-volt light-line. The maximum voltage reading obtained in this manner should be practically the same as the reading obtained by connecting the meter across the light-lines. Connection to aerial and ground is obtained through two leads; one black, for ground, and one blue, for aerial. Compensation for aerial variation is obtained by adjustment of switch Sw.1; which taps the primary of the input R.F. transformer L1.

In the earlier sets of this series, condenser C26 (next R9) was omitted, and a fixed center-tap resistor used instead of the variable R7. These two changes were made to reduce hum. Should one of the earlier receivers produce an objectionable hum, the set may be brought up-to-date by installing the variable resistor and condenser. (A "No. 66058" bracket is used for holding this unit.)

This receiver is designed to use either a magnetic or a dynamic reproducer; the field winding of the Stewart-Warner dynamic has a D.C. resistance of approximately 1,800 ohms. There is no transformer in this dynamic reproducer; the secondary of the output unit T3 matches the constants of the (12-ohm) speaker voice coil. A 4-connection



receptacle is provided for the dynamic reproducer; but magnetic reproducers connect instead to tip-jacks. The "B" voltages, which are disturbed when the dynamic reproducer field coil is removed from the circuit are equalized by load resistor R8; which is placed in shunt with the high voltage D.C. when the "link" is connected to the two binding posts shown at the upper right of the



schematic circuit. Magnetic, and other makes of dynamic, reproducers connect, as shown, from plate to plate of the power tubes.

At a line voltage of 110, the primary of PT should receive about 88 volts. When making any changes in the receiver connections or parts, it is well to watch the regulator R12. If it heats to a visible red, the plug should be pulled and circuit checked.

The parts of this receiver may be duplicated for service replacements by using the code numbers included in the following data: Units C1, C2, C3, C4, C6, C7, C8, C9, C10 and C11 constitute a complete assembly, No. 61,055—complete with bracket, No. 61,933; C5 is No. 60,955; C12, 38,261; C13 of .0001-mf. capacity is included in the shield can of PT; C14, C15 and C16, of .006-mf., are each 61,469; C17, .002-mf., 61,470; C18, 1.5 mf., 600-volt rating and C19, 2 mf., 400-volt rating are 61,303; C20, 0.5-mf., 400-volt; C21, 1.0-mf., 400-volt; C22, 0.5-mf., 400-volt, C23, C24 and C25, 0.25-mf., 200 volt, constitute, with two choke coils, filter bank 61,729; C26, 1.5-mf., 66,059. The resistors are. R1, 800 ohms, 61,830; R2, 60,000 ohms (max.), 61,557; R3, 1 meg. 61,590; R4, 2,400 ohms—R5, 850 ohms—constituting unit 61,839; R6, 20 ohms, 61,648; R7, 20 ohms, 66,060; R8, 10,000 ohms and R9, 5,500 ohms constitute unit 61,665; R10, 75,000 ohms, 61,559; R11, 7,000 ohms, 61,833; R12, line ballast, 61,868. Power transformer PT is 61,888; L1, 61,803; L2, 61,804; L3, 61,805; L4, 61,806; Ch1, Ch2, and Ch3, 61,405; T1, 61,914; T2, 61,915; T3, 61,916. For the pilot light V9, a 2.5-volt lamp is used.

All connections in this receiver are gold-plated; copper is used for shielding. The line-voltage ballast R12 is designed to equalize line voltages between the limits of 100 and 130 volts. The R.F. transformers are checked at three wavelengths from the output of a crystal-controlled oscillator at the factory; little likelihood that they are not in exact balance with each other, should the tuning circuits not "phase" exactly.

In this receiver the plate D.C. supply for the set is fed through R.F. chokes, Ch1 Ch2 and Ch3. Resistors R4 and R5 are wound on one form.

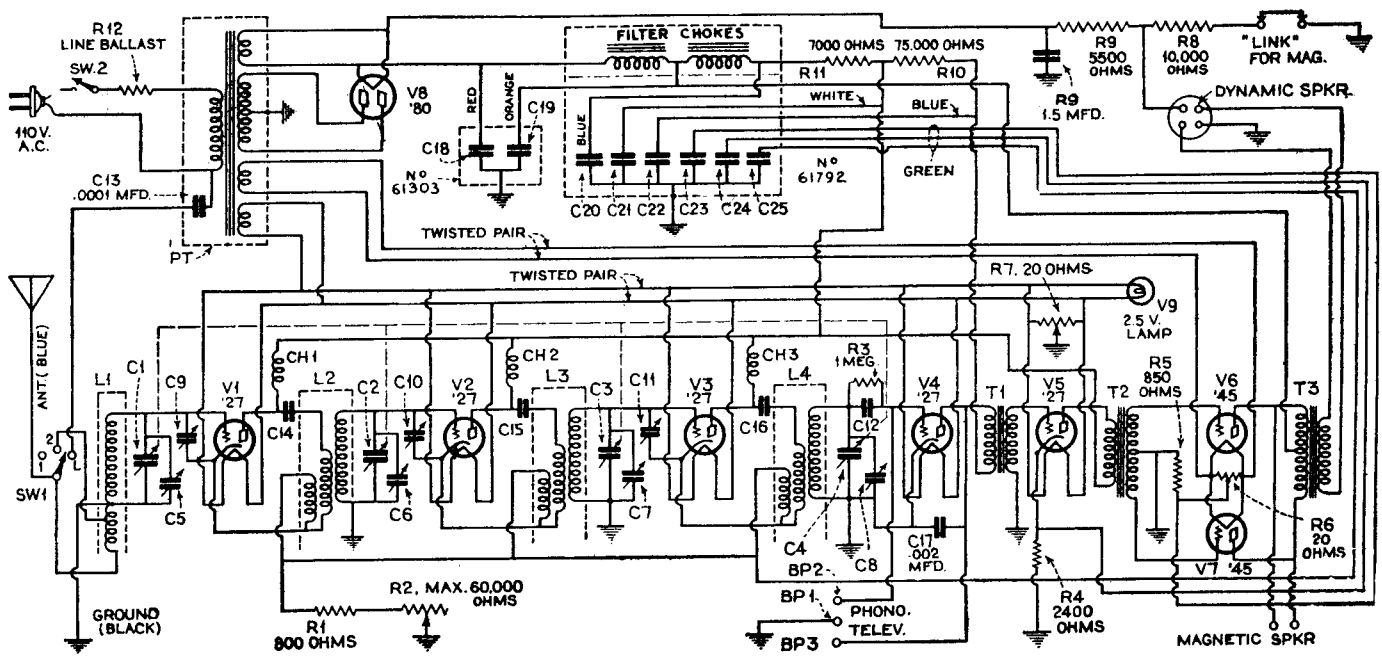
Units which might be subject to occasional replacement are easily removable from the set chassis. Filament leads are twisted pairs.

The grid bias on the '27s is limited to a minimum value by R1; but R2 makes possible a maximum bias which is sufficient to give full control of the amplification obtainable from the receiver.

TABLE 1

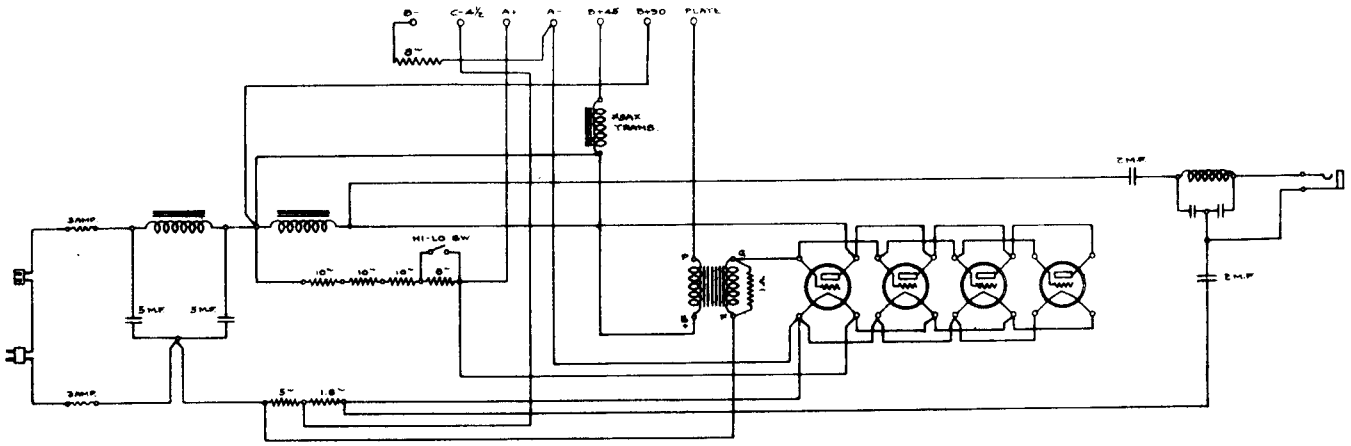
(*Readings with Jewell "Pattern 199"*)

Tubes	Volts "A"	Volts "B"	Volts "C"	Milliamps. Plate Normal	Milliamps. Grid Test
V1	2.2	132	8.5	3,8	7,0
V2	2.2	138	8.5	3.2	5.8
V3	2.15	132	8.5	3.9	6.8
V4	2.10	32	0.0	2.8	2.8
V5	2.2	132	7.5	5.4	6.5
V6	2.25	226	47.5	26.0	30.0
V7	2.25	226	47.5	26.0	30.0
V8	4.7	.....	.....	.....	.....

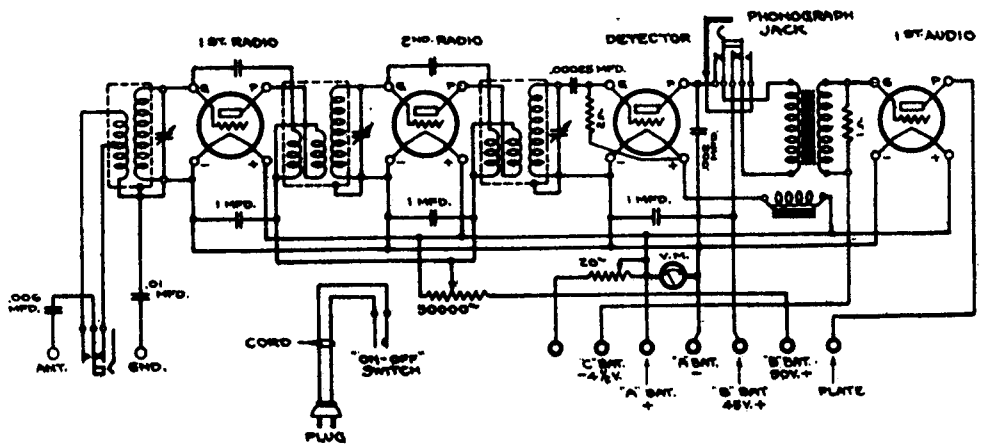


STROMBERG-CARLSON MFG., CO.

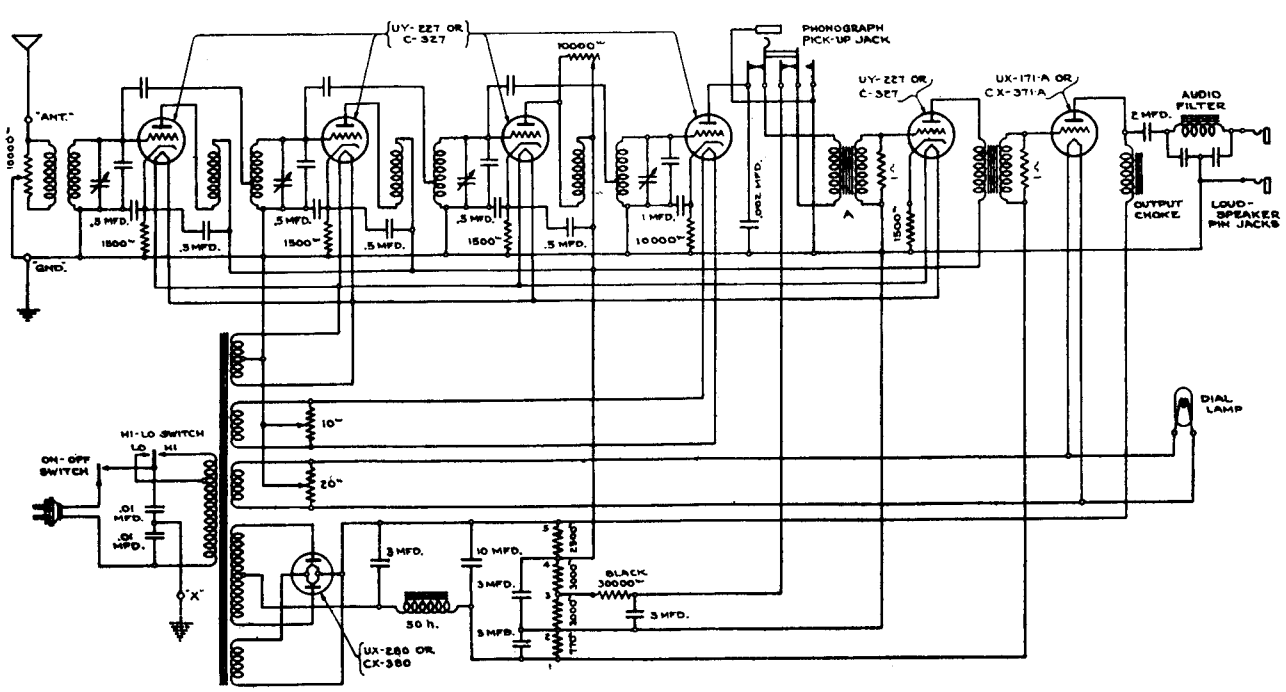
CIRCUIT D-968
(AUDIO POWER UNIT D-957)
FOR #523-524 D.C. RADIO REC.



#523 & #524 D.C. RADIO RECEIVER CIRCUIT



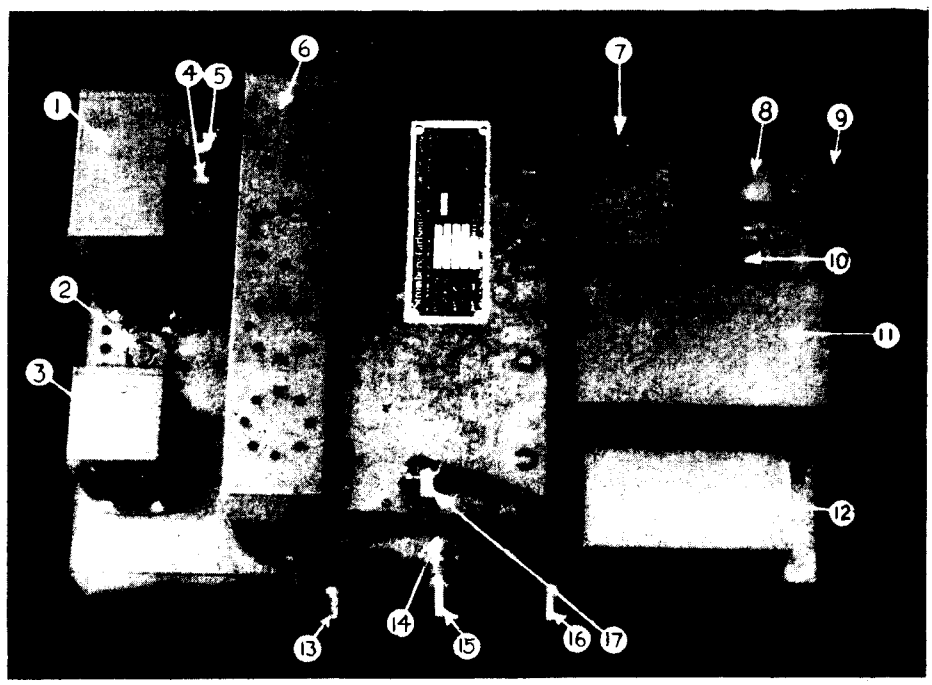
Schematic Circuit Diagram of Stromberg-Carlson Receivers Nos. 635 & 636.

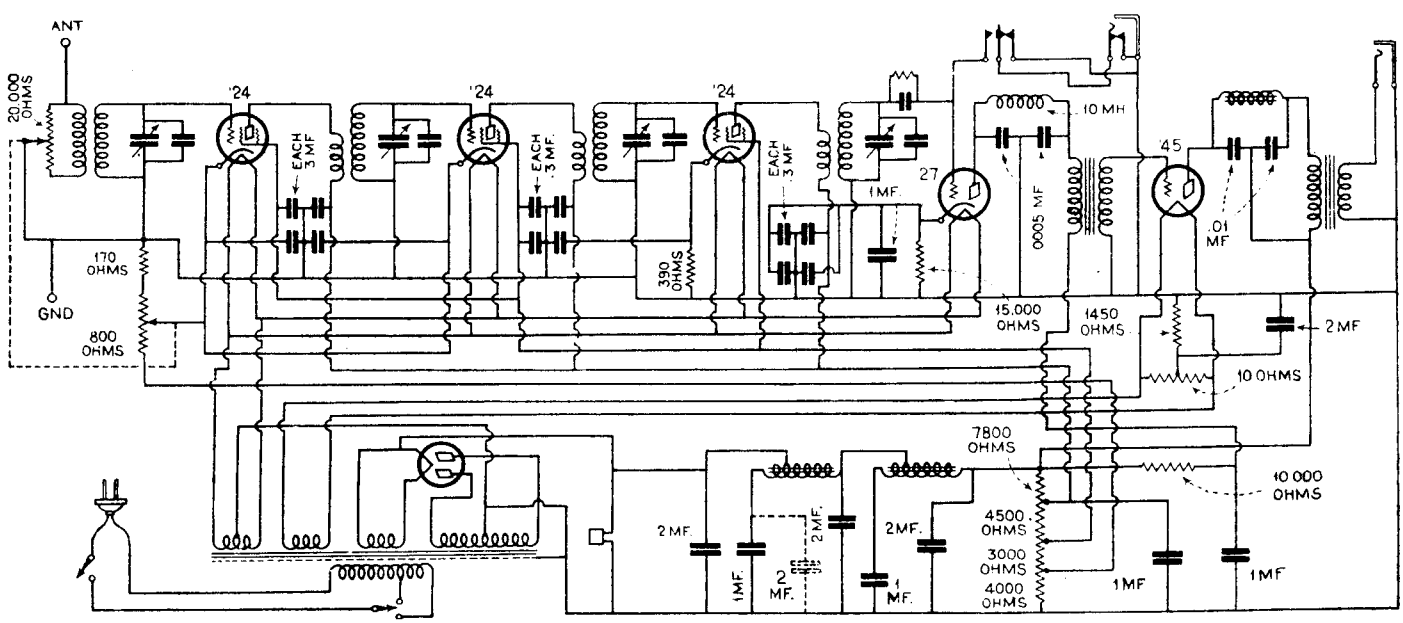


Radio Service Data Sheets

STROMBERG-CARLSON Nos. 641 & 642

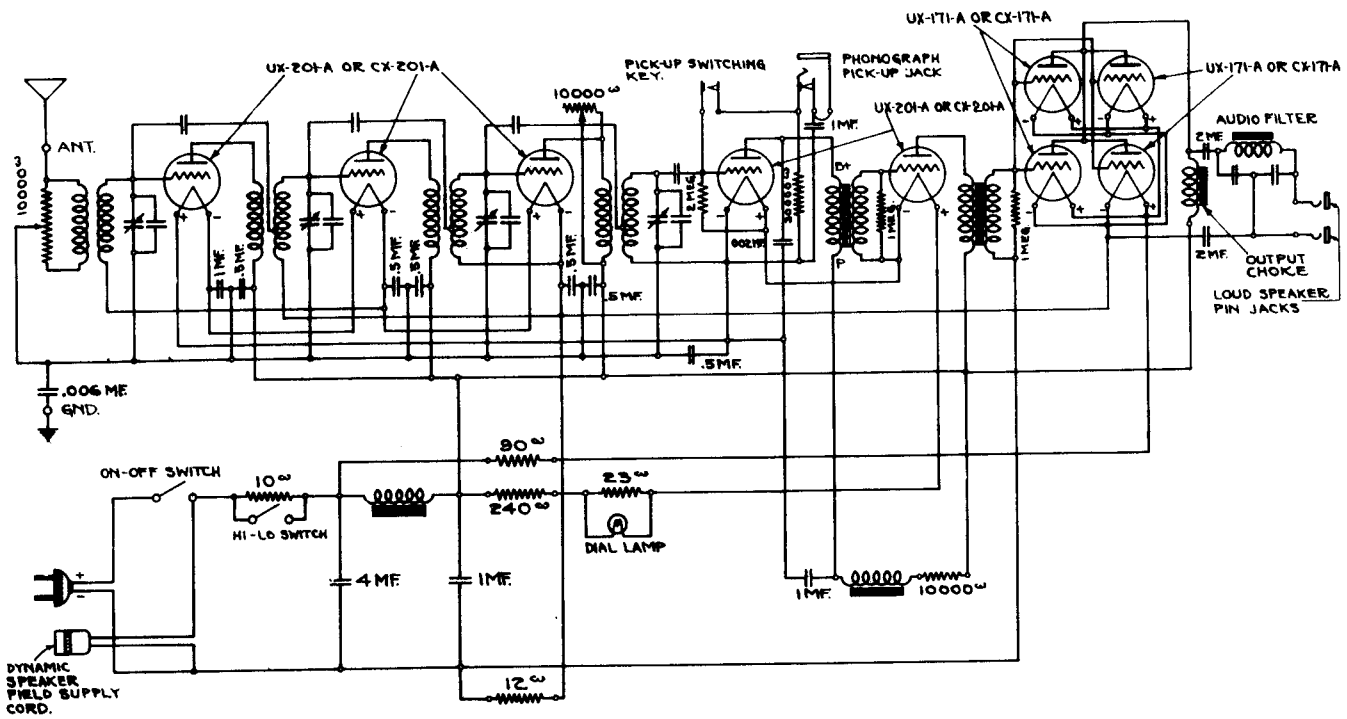
As will be seen in the photograph of the assembled units, all operating parts are enclosed. All transformers, inductances and capacities are mounted in metal boxes; and filled with moisture proof compound. The power transformer leads are laced to the main cable. To insure good connection for the grounding leads, the chassis of steel has been copper plated. The 641 is a small model in a cabinet known as the "Treasure Chest." The 642 is the same chassis, nearly, in an art console. A removable panel is provided on the cabinet bottom to allow ready access to the apparatus and wiring on the under side of chassis base without dismantling the cabinet. (In the case of the 641.) The receiver chassis and reproducer are bolted to a removable structure; as is also the front panel. This renders servicing easy. The items shown in the photograph are numbered as follows: 1, Output transformer assembly; 2, audio amplifier socket ('45); 3, A.F.T.; 4, "gnd." post; 5, "ant." post; 6, cover over tubes (one nearest dial, '27; next three, '24's); 7, filter condenser bank; 8, cover over high-low switch; 9, power supply cord; 10, rectifier tube ('80) socket; 11, power transformer; 12, choke coil assembly; 13, volume control and switch; 14, dial; 15, selector control; 16, on-off switch; 17, pilot lamp socket and bracket. Pin jacks for loud speaker cord are at rear, left, (and consequently not visible); while the pickup jack, power outlet, and power supply cord are grouped at rear right. The volume control is double and operates by varying the biasing potentials on the control grids of the first and second radio amplifier tubes as well as the voltage supplied to radio amplifier from the antenna. The two controls are simultaneously operated from one knob. The grid bias control does not begin to operate until the volume is partially reduced by the antenna control; this prevents distortion due to overloading the radio amplifier when the volume is turned down on very strong local signals. This type of volume control does not cause detuning when it is varied. A '27 is used as a "linear" power detector with automatic bias. This detector operates at high radio frequency voltages provided by the R.F. amplifier and is not subject to the ordinary distortion to which the "square law" detector is heir. The grid bias is automatically adjusted to the proper value for the strength of signal received to obtain this linear characteristic. The value of the R.F. input to the detector is so high that the output may be fed directly into the single stage of amplification shown in the diagram. The output transformer secondary connects to pin jacks, in the model 42 receiver; in the 41, a fixed condenser connects one pin jack capacitatively to the primary of the output transformer, while the other pin jack is then connected to the center tap on the 10 ohm resistor which shunts the power tube filament. A jack has been placed in the rear of the chassis for plugging in a pickup. By turning the volume control completely "Off" (counter-clockwise) the pickup is connected in the grid circuit of the detector tube. This tube then acts as an amplifier, making a two stage amplifier for the pickup energy. To energize an A.C. type dynamic reproducer an outlet has been supplied in the model 41; it is automatically cut off when the set is disconnected at the panel. In the 42 this outlet is used to supply the A.C. needed for the built-in dynamic reproducer. Hum due to this circuit arrangement of the reproducer is nullified by careful design; including the use of a "shading ring." Rust flakes and filings in the air gap will result in distorted reception. To reduce as much as possible this cause of poor operation, the pole pieces have been heavily zinc plated. Very complete shielding is necessitated by the high amplification obtained through use of type '24 tubes. (These receivers give an amplification from antenna to the grid of detector tube of approximately 255 000 and an overall amplification from antenna to output of approximately 2,350,000. Comparing this with a good receiver using the same number of tuning stages with '27 tubes and employing the customary detector and two A.F. stages which gives an amplification from the antenna to the detector grid of approximately 12,500, and from the antenna to the output of approximately 575 000, it will be observed that the Nos. 641 and 642 receivers have approximately 20 times more amplification between the antenna and the detector. This allows the use of a linear power detector, the omitting of the first audio stage and still gives an overall amplification of approximately four times that of the other receiver. Instead of the dynamic reproducer field, a floor lamp may be connected to the A.C. output jack mentioned above.



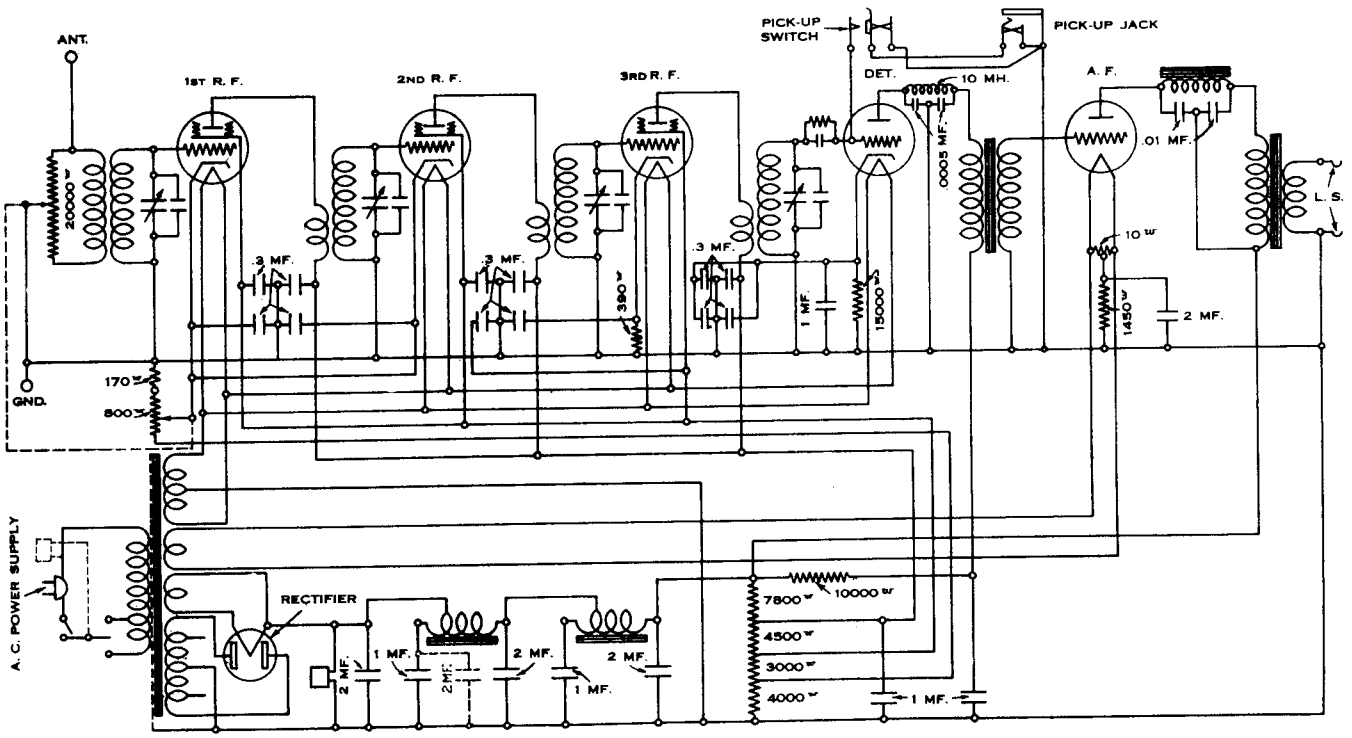


STROMBERG CARLSON MFG.,CO.

NO. 638 D.C. RADIO RECEIVER SCHEMATIC DIAGRAM

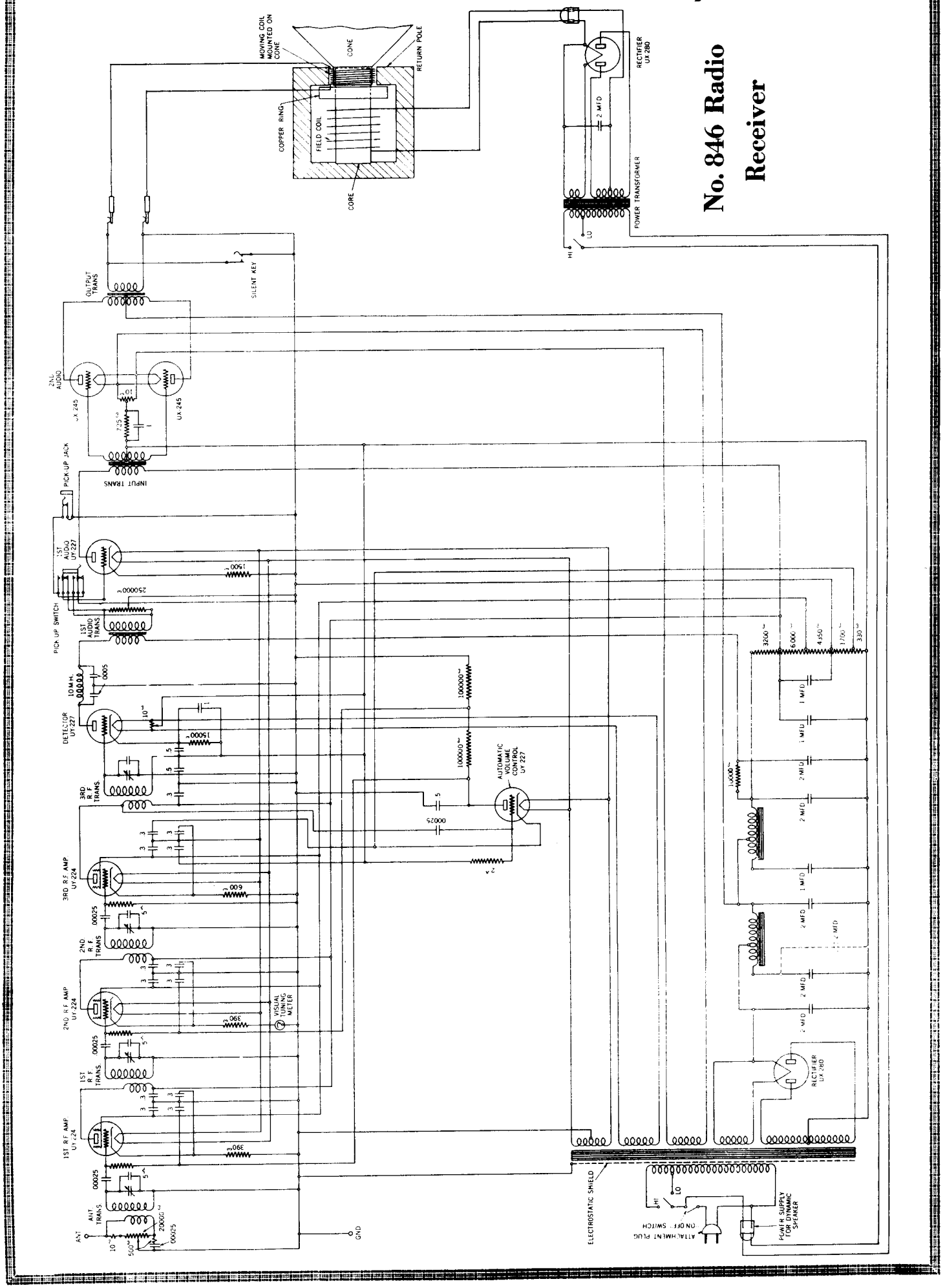


Nos. 652 and 654 Receivers



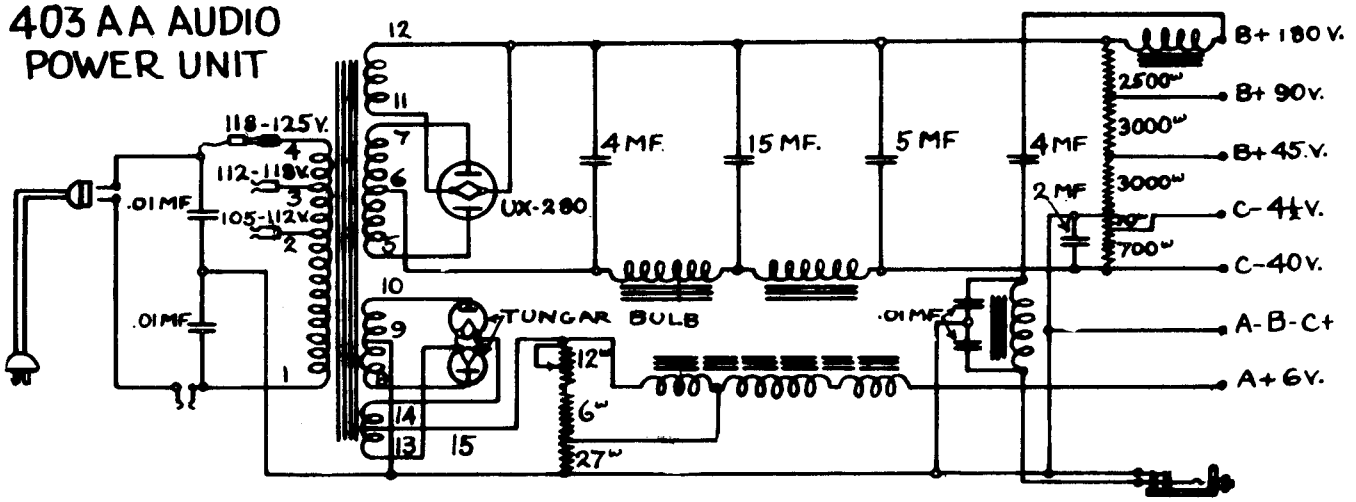
STROMBERG-CARLSON MFG., CO.

No. 846 Radio Receiver

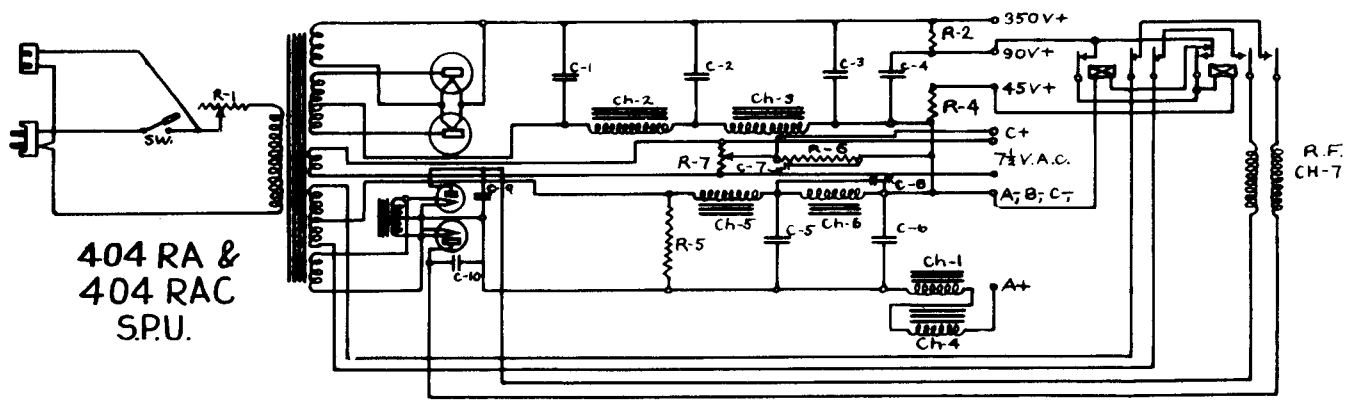


STROMBERG-CARLSON MFG.,CO.

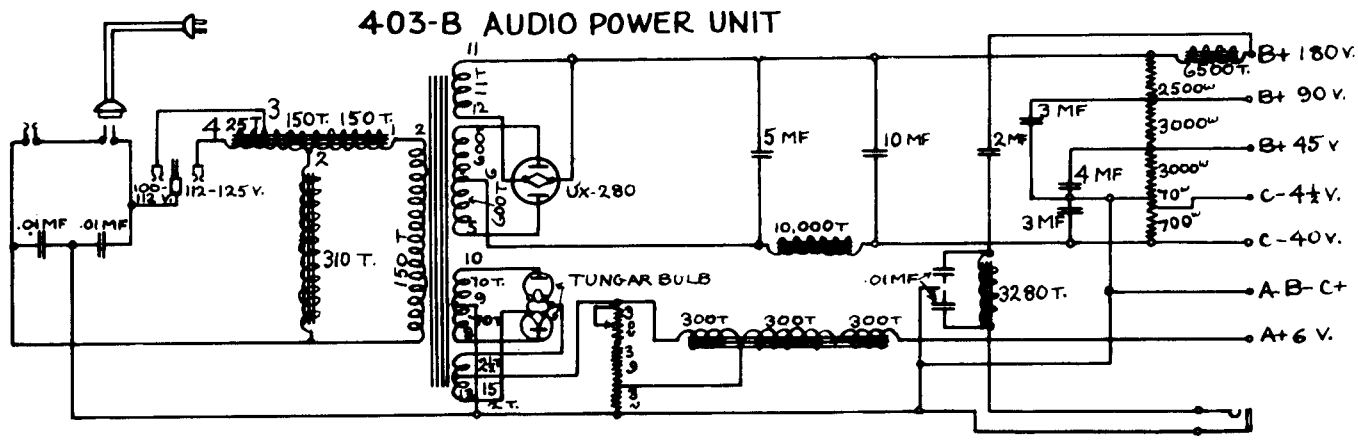
403 AA AUDIO POWER UNIT



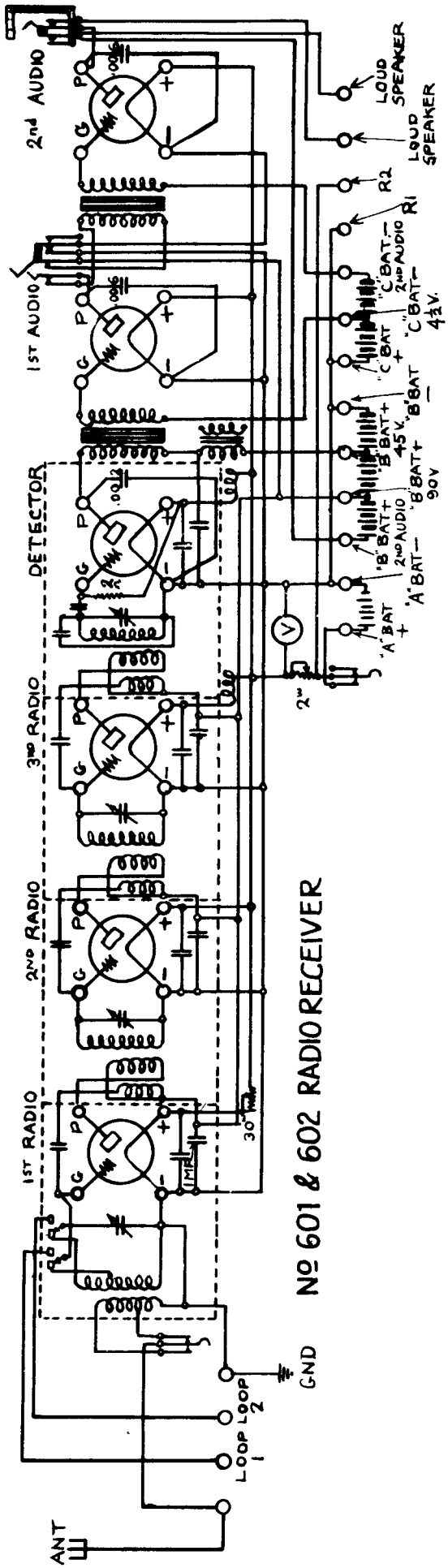
404 RA & 404 RAC S.P.U.

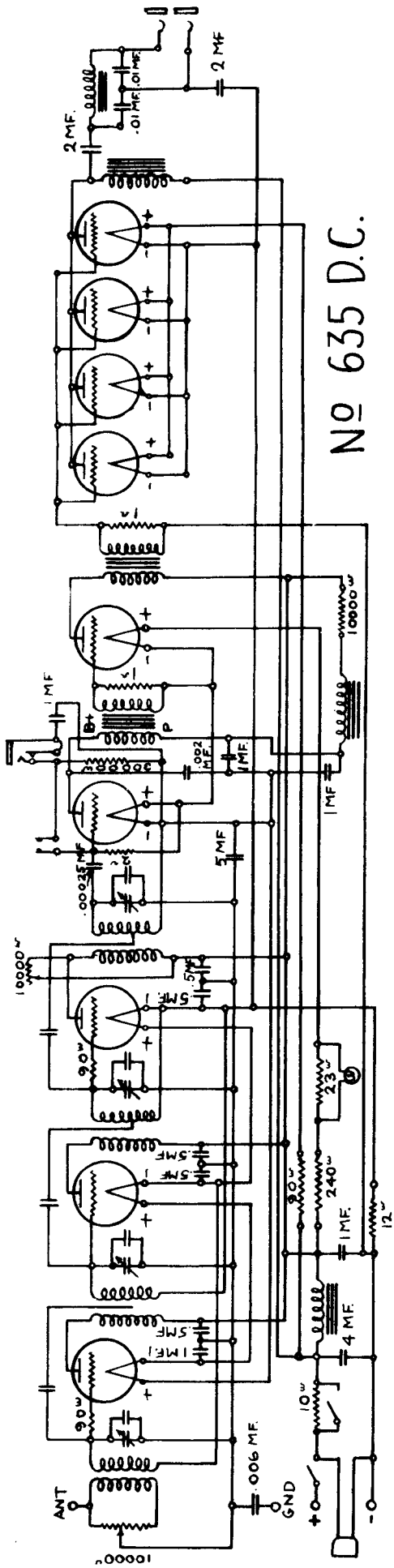


403-B AUDIO POWER UNIT

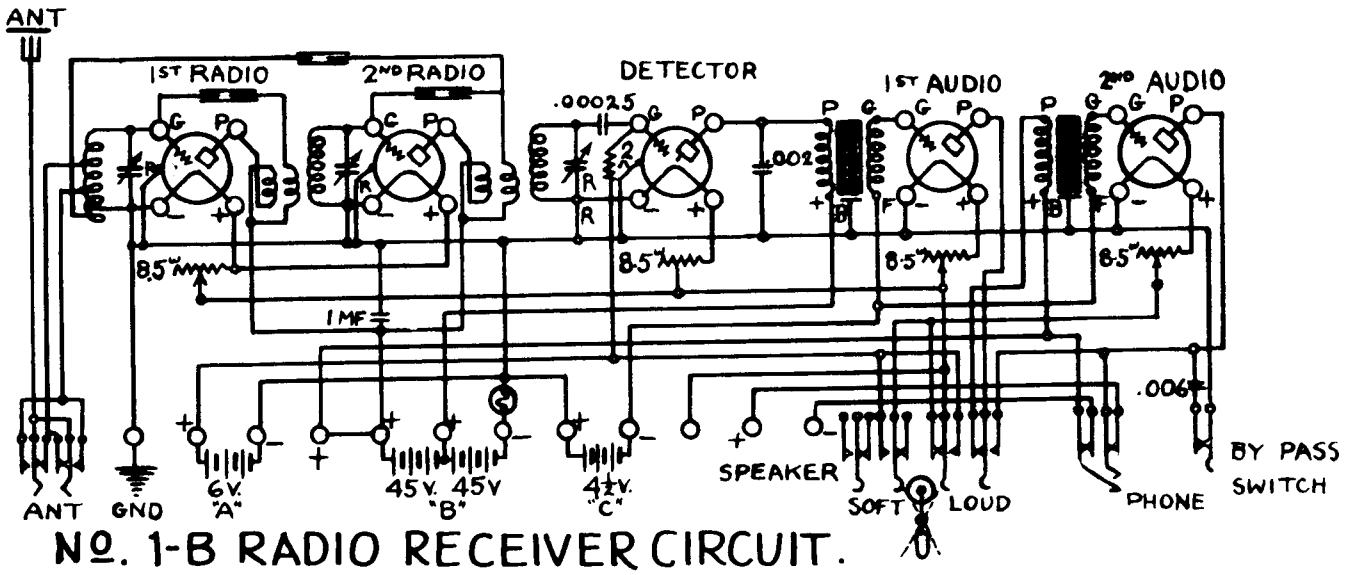


STROMBERG-CARLSON MFG., CO.

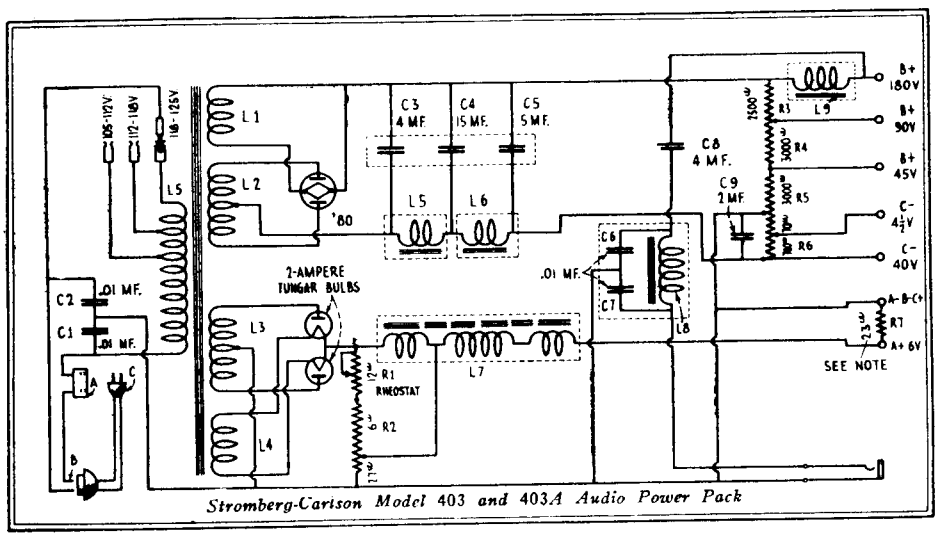




STROMBERG-CARLSON MFG., CO.

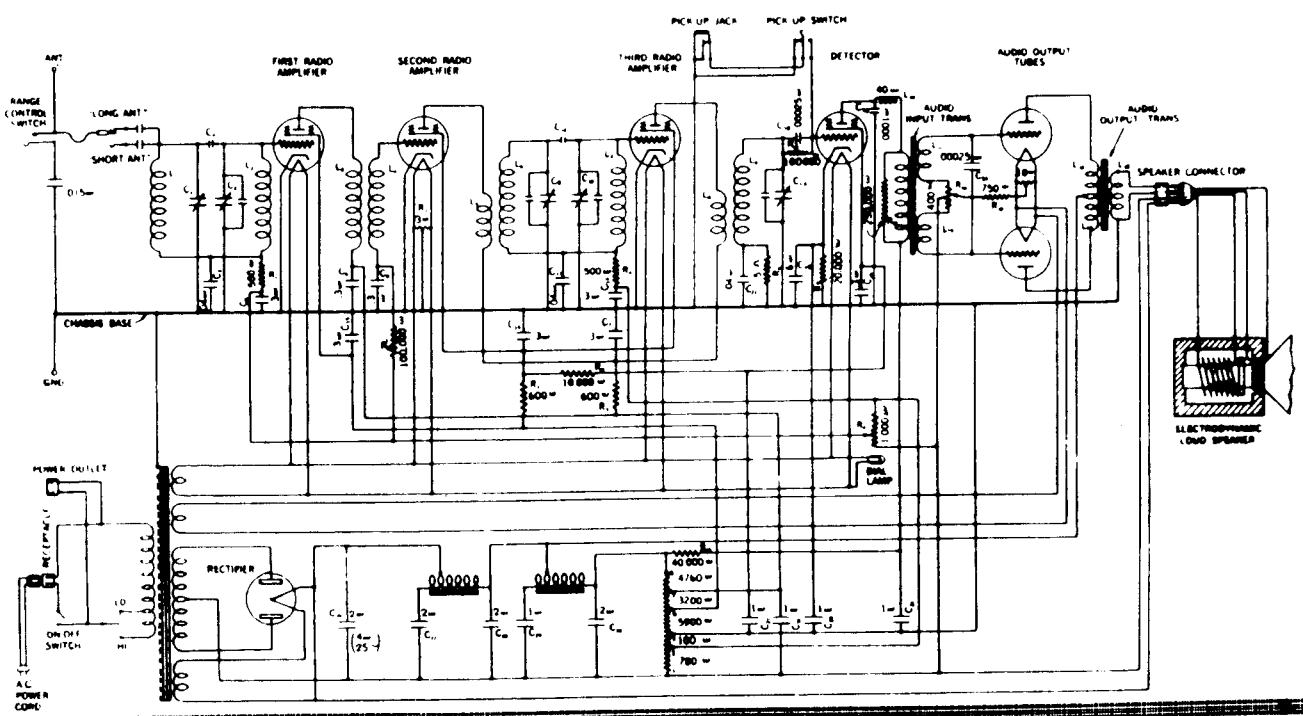


No. 1-B RADIO RECEIVER CIRCUIT.

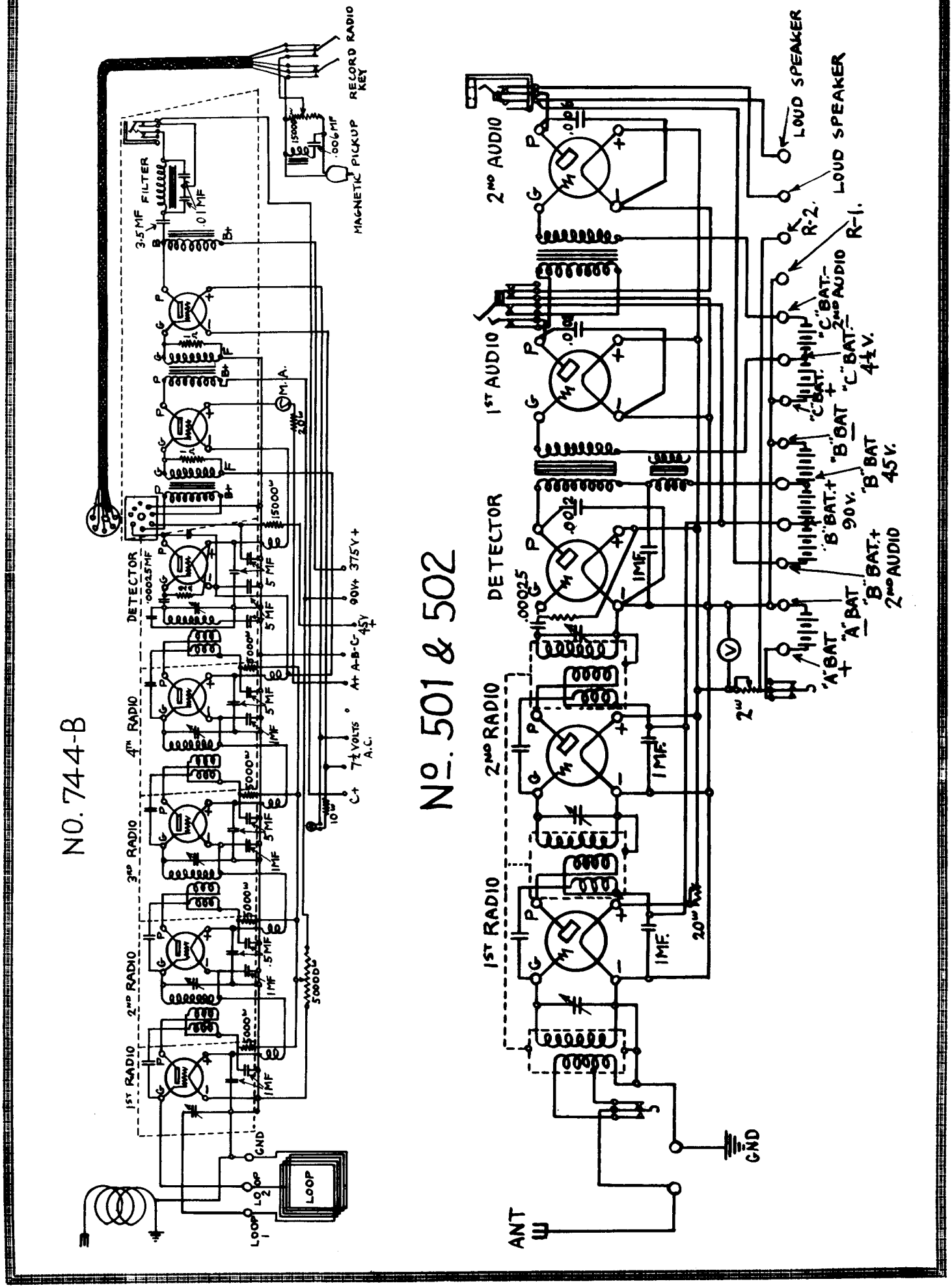


Stromberg-Carlson Model 403 and 403A Audio Power Pack

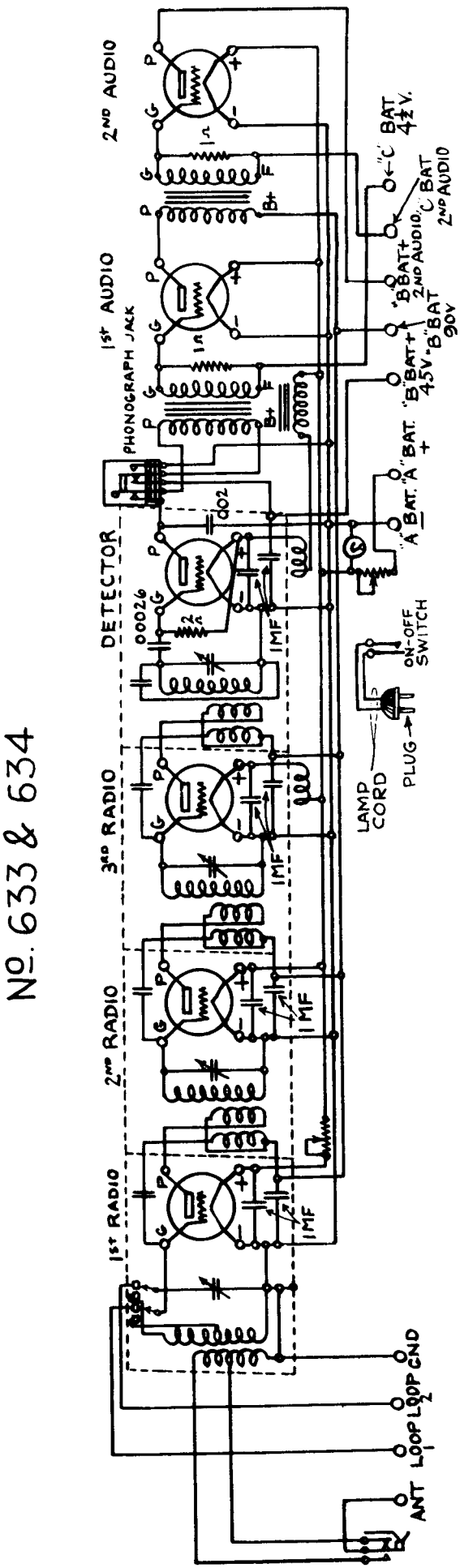
Schematic Circuit of Chassis for Nos. 10 and 11 Receivers

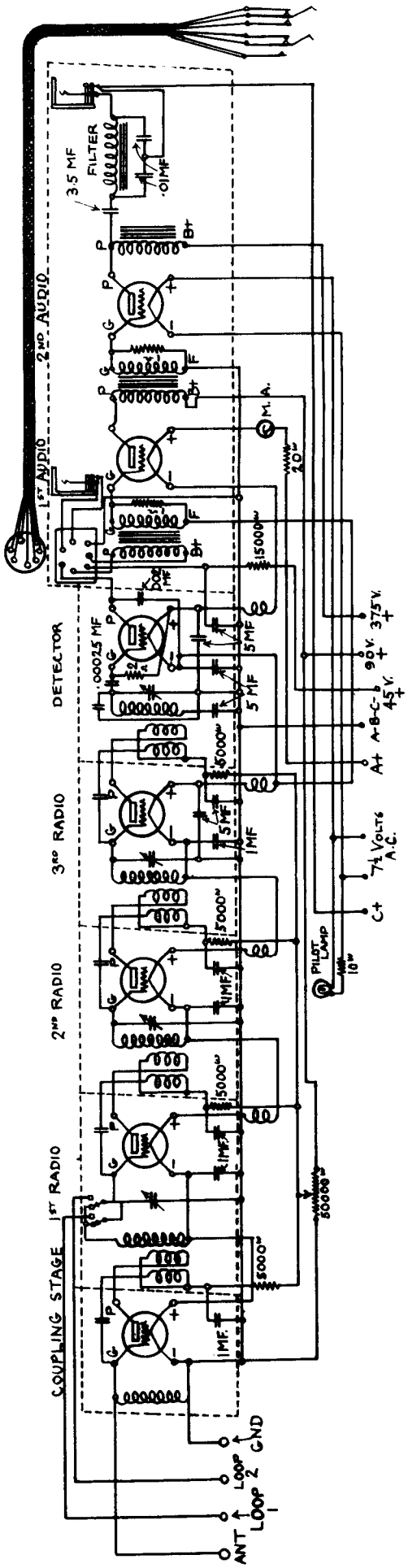


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STROMBERG-CARLSON MFG. CO.





STROMBERG-CARLSON MFG. CO.

Schematic Circuit of Multiple Record Phonograph.

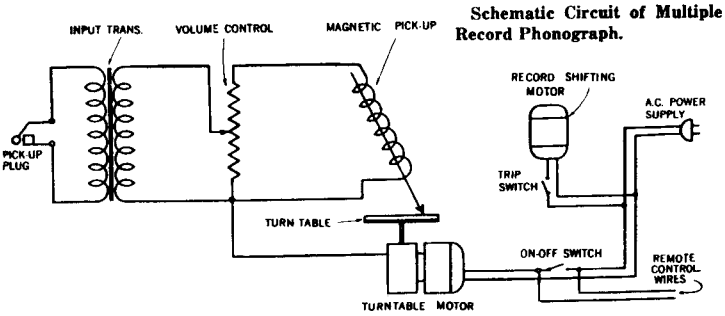
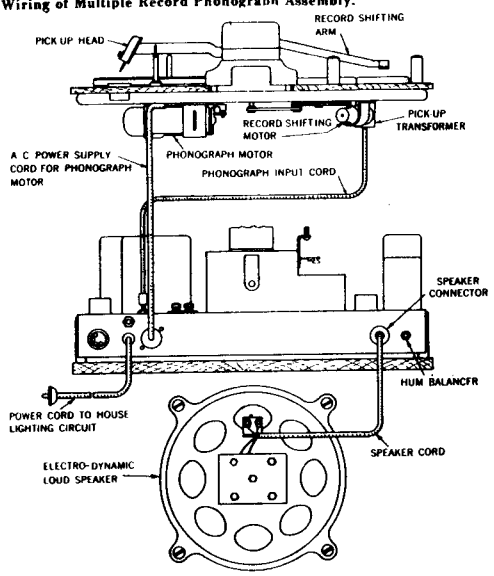
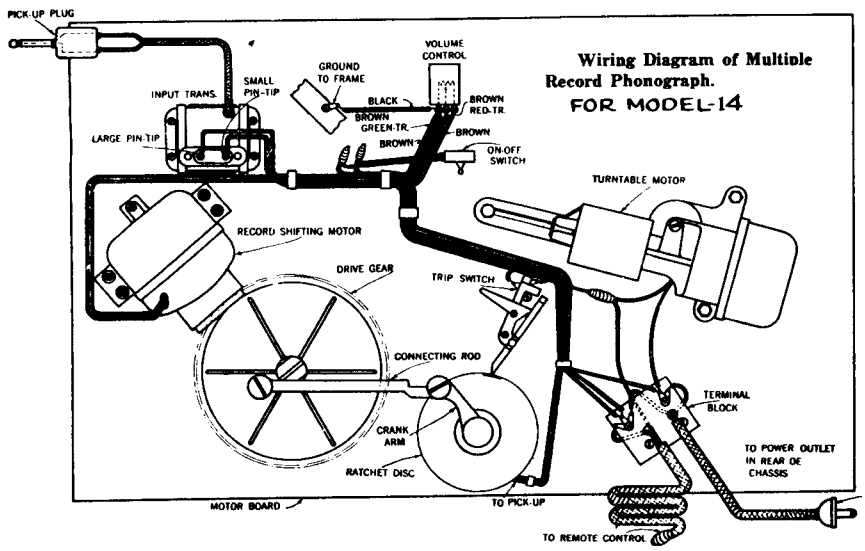
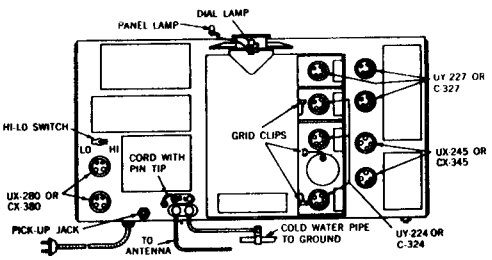


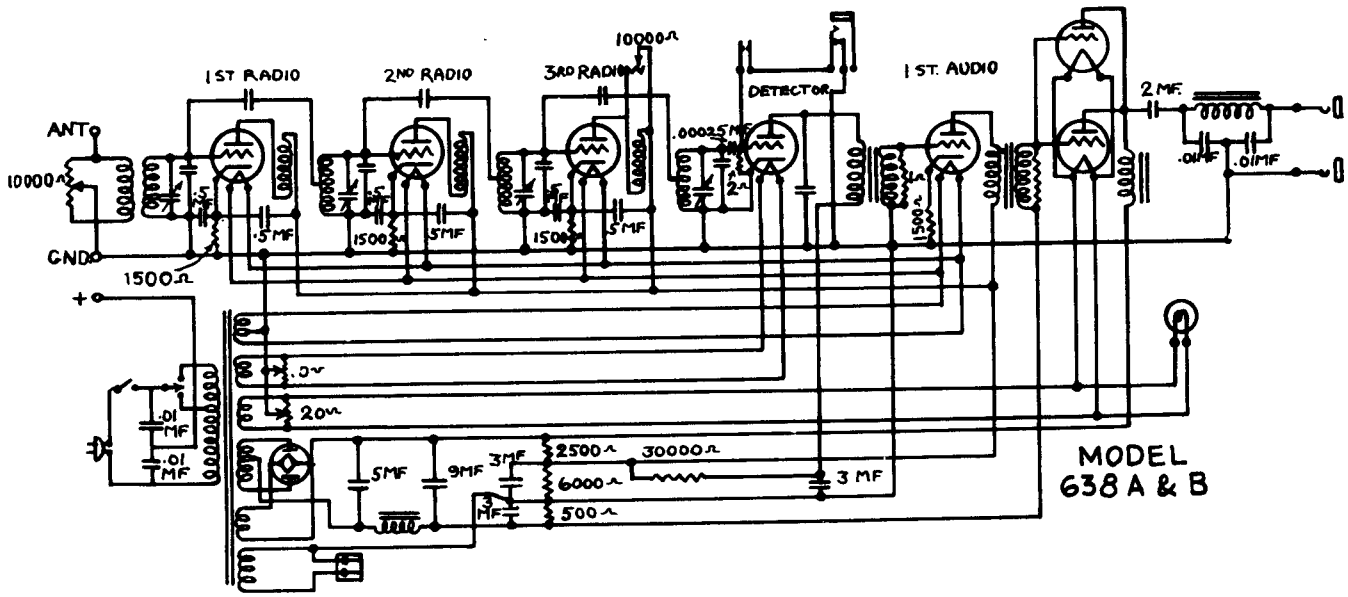
Diagram Showing Location of Tube Sockets and Proper Connections of Wiring of Multiple Record Phonograph Assembly.



Wiring Diagram of Multiple Record Phonograph. FOR MODEL-14

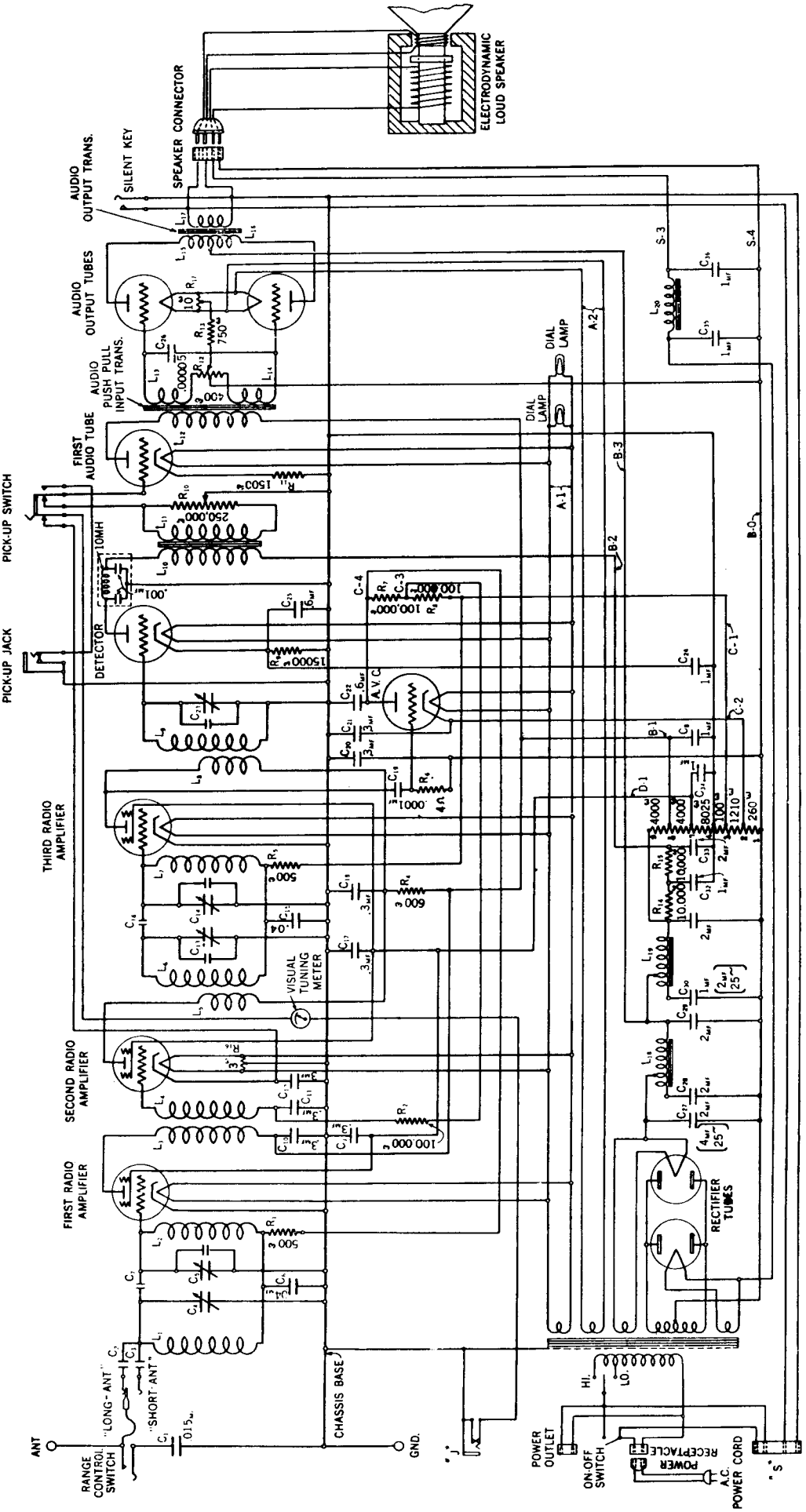






STROMBERG-CARLSON MFG. CO.

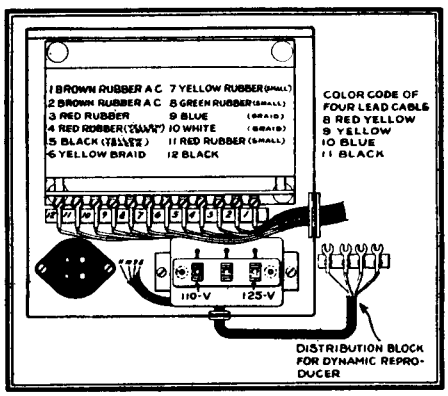
Nos. 12 and 14 Receivers



Radio Service Data Sheets

TEMPLE—Models 8-60—8-80—8-90

In this receiver A.F. transformer TR1 has a ratio of 4-to-1; TR2, 3-to-1. Cases are occasionally reported where, when a loud signal is tuned into the set, the receiver will suddenly go dead but immediately start again if it has been retuned. This condition is due to fine metallic dust which collects between the condenser plates and causes an electrostatic short at irregular intervals. Every precaution to overcome this difficulty has been taken and it is not found in receivers bearing serial numbers over 8000. (Pipe cleaners make excellent condenser plate cleaners.) The small carbon resistors on the bottom of the chassis have been color coded (to prevent substitution of wrong values), as follows: 750,000 ohm resistor, either all red or natural color with a blue dot. The 2 meg. leak is natural with a yellow dot and the 43,000-ohm resistor (detector plate lead and also in phonograph pickup lead), all black or black with dark green dot or all black with red end. In case a carbon resistor is substituted in place of the wirewound grid suppressor these will be light green in color. The voltages indicated in the table, "Set Analysis," for 112 volts; any other than this requiring due allowance for the different values which will be indicated. Wide plate voltage variance denotes poor rectifier tube or defective power pack; great milliammeter variation, unsatisfactory tubes. No reading on the filaments shows that either there is no A.C. input, that a fuse has blown, or there is an open primary in the power transformer. Before making further test be sure that the A.C. line to which the set has been connected is alive. (To test your A.C. line the easiest way is to simply insert any 110 volt lamp in the socket to be used for the radio line connection.) No "C" voltage on the '27's denotes either defective resistors in the cathode return or shorted resistor by-pass condensers. No "C" voltage on the '45 indicates a defective resistor in the filament-to-ground circuit of the '45's or a shorted by-pass condenser across the 900 ohm portion of the large resistor. The UX280 or the CX380 is recommended by the manufacturers for the reason that some makes of tubes pass 200 milliamperes instead of the required 125 milliamps, at 350 volts. This would cause (a) the A.C. input fuse to blow; (b) rectifier tube burnout; or, (c) power transformer to heat to a dangerous point. In instances of excessive hum (a rare condition, as unusual precautions have been taken to prevent this, as a study of the schematic will, in part, show), check the characteristics of the detector and first audio tube. All receivers bearing serial numbers under 7,500 have the pilot light in parallel with the '27 filaments. Beginning with serial numbers approximately 7,600 the pilot light light is parallel with the filaments of the '45 tubes. This change was made due to the fact that many of the 2½-volt pilot lights supplied by the lamp maker would show a decided flicker when their source of power was from the '27 filament line. Changing pilot lights usually remedied this trouble but it was found far more satisfactory to make the change of filament wiring and thereby entirely do away with the flicker. It is suggested that service men working on sets having serial numbers below 7,500 make this filament wiring change while the chassis is out of the cabinet, as a matter of standard practice toward increased customer satisfaction. In spite of the fact that most A.C. sets apparently work almost as well without a ground as they do with, the installer should in no case make an installation where the set is not connected to a good ground. This can be either a cold water pipe or if necessary a steam radiator. In installations where neither are available a six-foot iron pipe driven in the ground outside of the house, preferably in a position where the soil is moist, will be satisfactory. In some instances high resistance in the water meter where sets are grounded to the water pipe will cause oscillation or impaired reception due, often, to excessive regeneration. Cases of this kind are easily remedied. Simply fasten a ground clamp on each side of the water meter and connect a No. 14 wire "jumper" across the meter, attaching to the two ground clamps. The 14 inch dynamic reproducer is designed particularly for this receiver. Tuning is of the single-control type. With every stage balanced at the factory extreme sensitivity and selectivity result. This excellent operation is obtained through proper use of 1000 ohm grid suppressors; and volume is adequately governed by the 6000 ohm unit. Under exceptional conditions it may be desirable to shunt the low resistance R.F. transformer in the plate circuit primary of the second stage (second tube), with a 10 ohm resistance. This unit has been provided; and is controlled by the switch indicated in the schematic circuit. As the field coil of the dynamic reproducer constitutes part of the main filter, any defect in this winding will become manifest in the receiver performance, and plate potentials will not be obtainable; with the exception of the supply to the '45 tubes, which does not go through the reproducer field coil. The first choke coil is contained in the power pack carrying on top of it fuse connections for the 110 volt primary. This winding is tapped for 110 and 125 volt supplies and change is made by reversing the position of the 2 ampere protective fuse. Both the first audio transformer and the input transformer of the '45 push pull stage are mounted in the metal can located nearest to the condenser drive. In case of open A.F.T. windings, replace both transformers (the entire can) thus insuring a perfectly matched audio amplifier at all times.

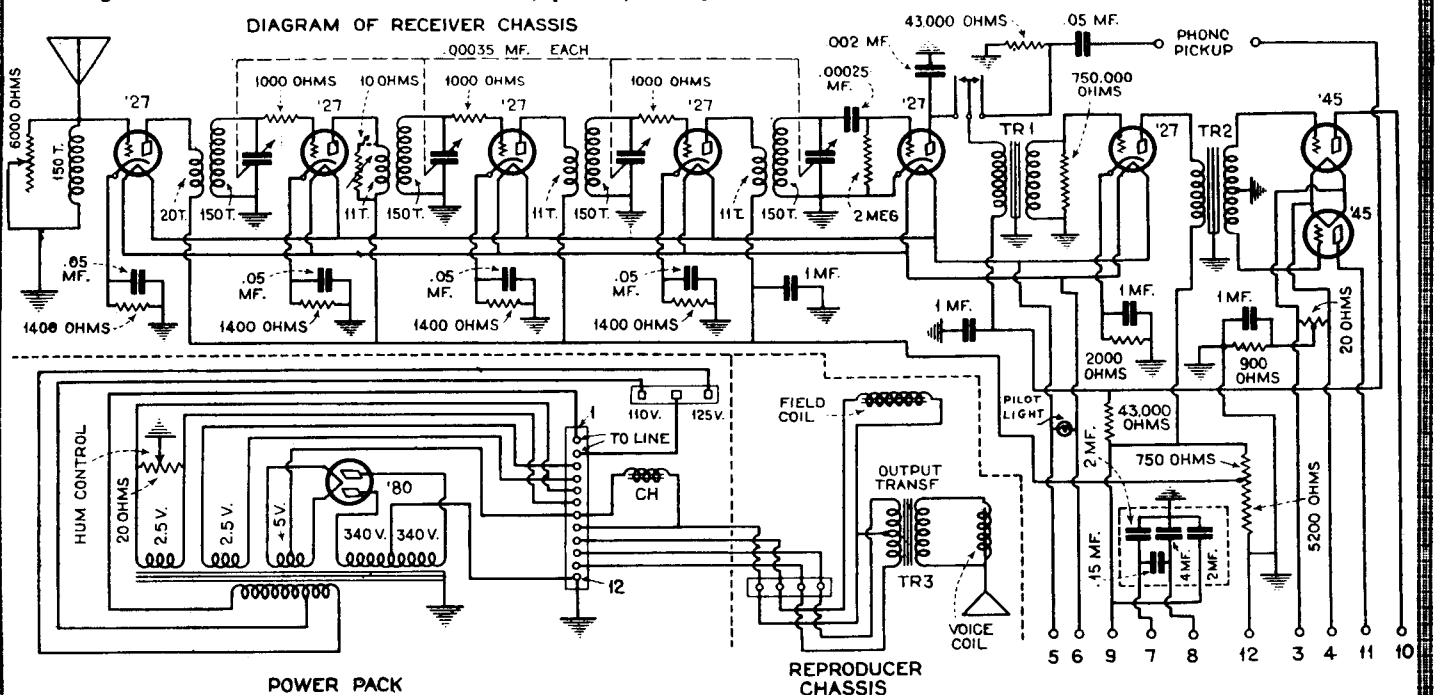


TYPICAL SET ANALYSIS

Tubes		Tubes Out		Tubes In					
		Voltage		Voltage			Normal	Plate M. A. Grid	Plate M. A.
Type	Use	"A"	"B"	"A"	"B"	"C"	Plate M. A.	Test	Change
'27	R.F.1	2.10	136	2.05	124	7	4.8	6.9	2.1
'27	R.F.2	2.10	136	2.00	122	6	4.6	6.8	2.2
'27	R.F.3	2.15	136	2.00	122	7	4.7	6.8	2.1
'27	R.F.4	2.15	136	2.05	121	7	5.0	7.2	2.2
'27	Det.	2.15	140	2.10	48	0	2.5	3.0	0.5
'27	1st A.F.1	2.15	164	2.10	140	8	4.2	5.8	1.6
'45	Out.	2.45	260	2.25	240	43	26.0	32.0	6.0
'45	Out.	2.45	260	2.25	240	44	22.0	28.0	6.0
'80	Rect.	5.40	AC	4.80	AC	0	*50.0	0.0	0.0

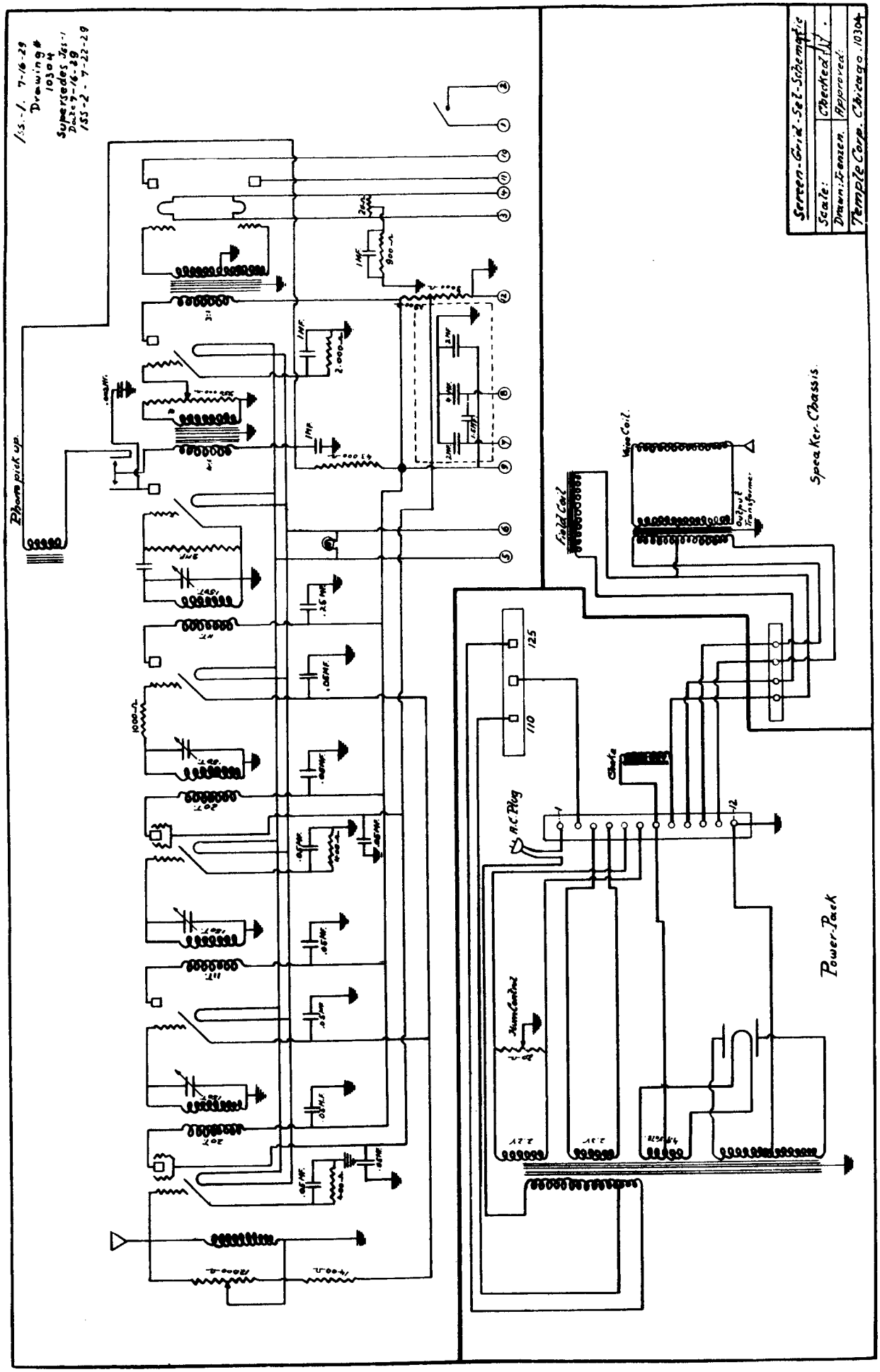
Line Voltage 112. Volume Control Position Full On. *Reading on meter, one anode only; actual current twice this value. Note: Cathode voltages show a reversed reading.

DIAGRAM OF RECEIVER CHASSIS



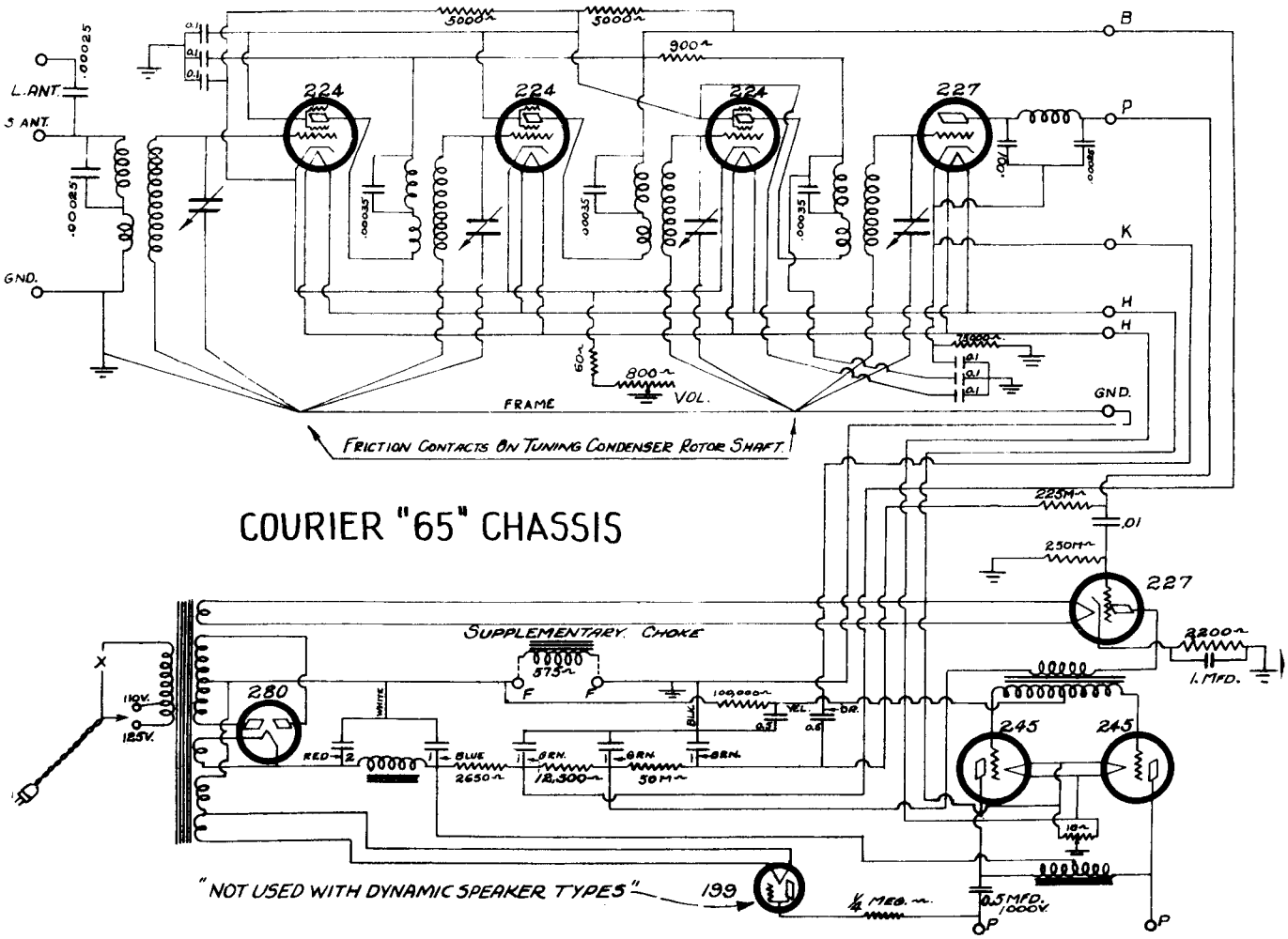
TEMPLE CORPORATION

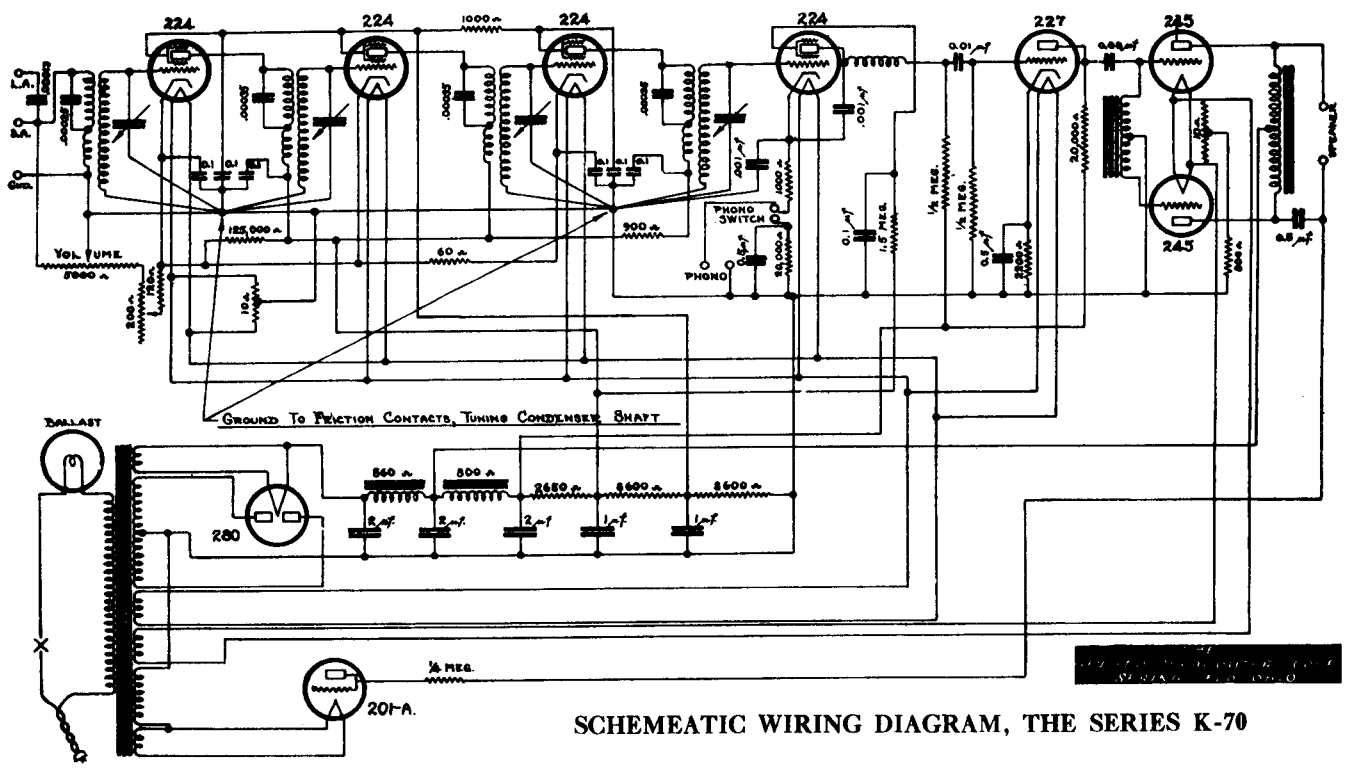
Models 8-61—8-81—8-91 Temple Receivers



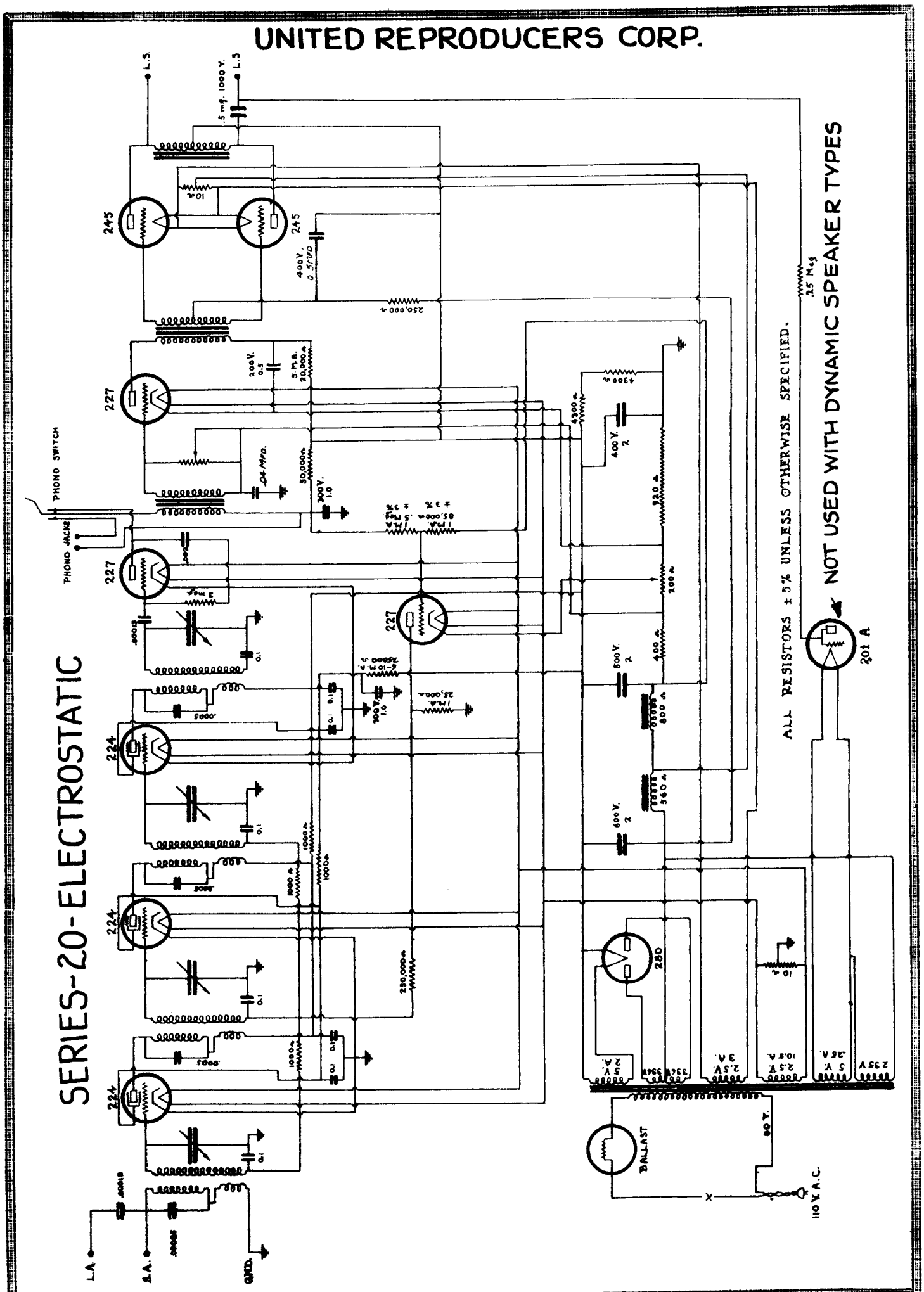
UNITED REPRODUCERS CORP.

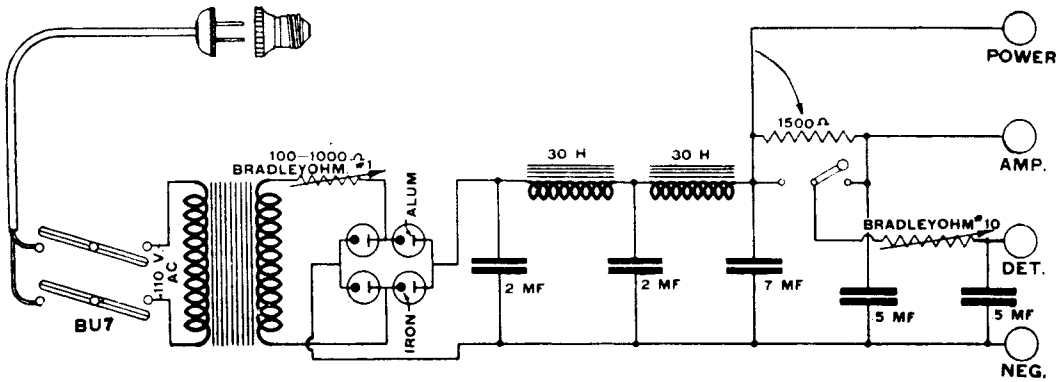
COURIER "65" CHASSIS



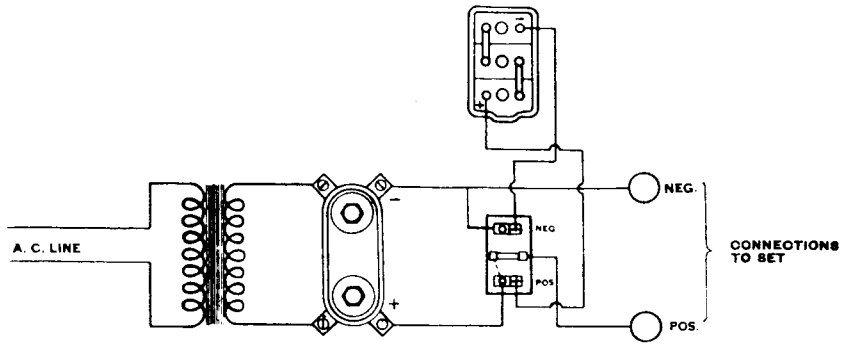


SCHEMEATIC WIRING DIAGRAM, THE SERIES K-70

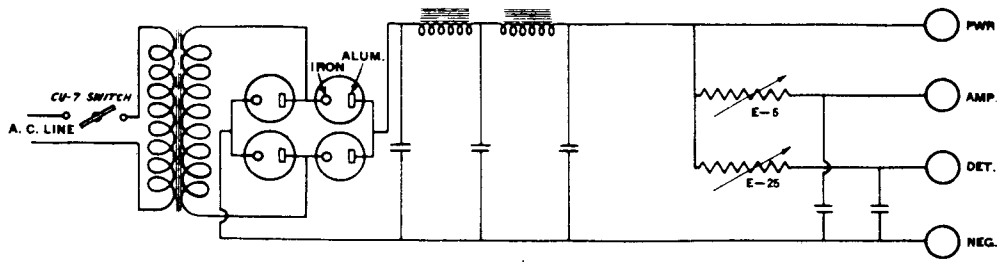

UNITED REPRODUCERS CORP.
SERIES-20-ELECTROSTATIC
NOT USED WITH DYNAMIC SPEAKER TYPES
ALL RESISTORS ± 5% UNLESS OTHERWISE SPECIFIED.
PHONO SWITCH
PHONO JACKS
L.S.
L.A.
B.A.
GND.
BALLAST
110 V. A.C.
201 A
245
227
224
280



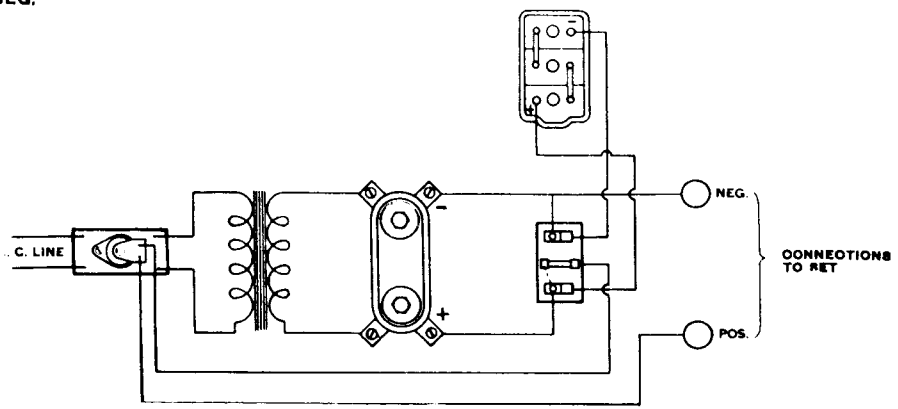
Standard "B" Power Unit, Part No. 3095, 50-60 Cycle



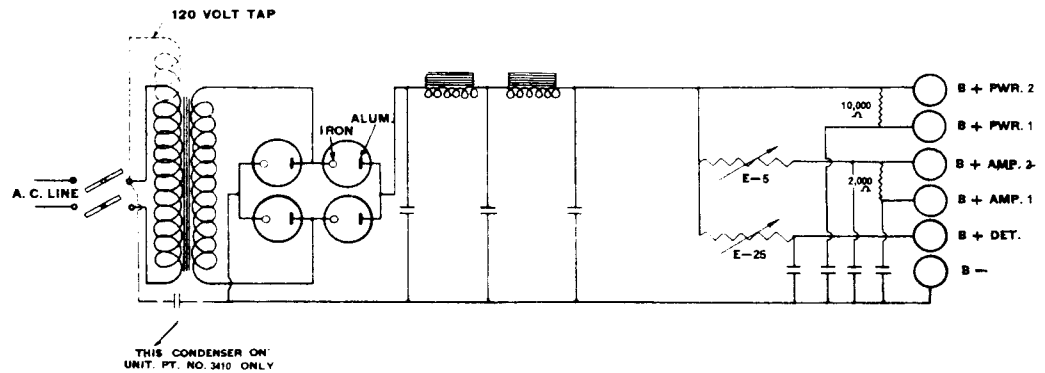
Standard "A" Power Unit, Part No. 3280, 6 Volt, 50-60 Cycle (Without Relay)



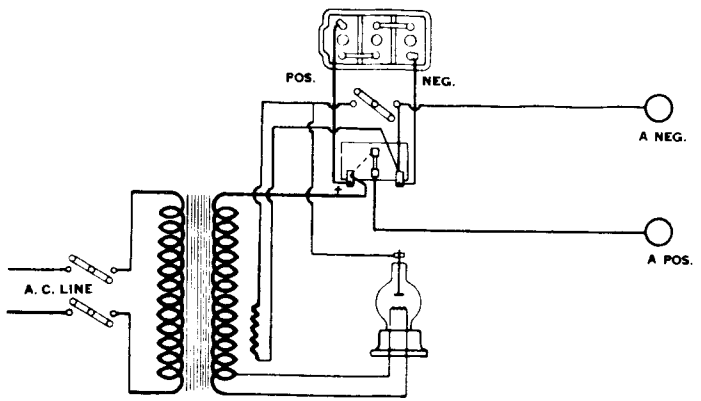
Standard "B" Power Unit, Part No. 4095, 50-60 Cycle



Standard "A" Power Unit, Part No. 3262, 6 Volt, 50-60 Cycle (with Relay)



Super "B" Power Units, Part Nos. 3310 and 4310, 25-40 and 50-60 Cycle

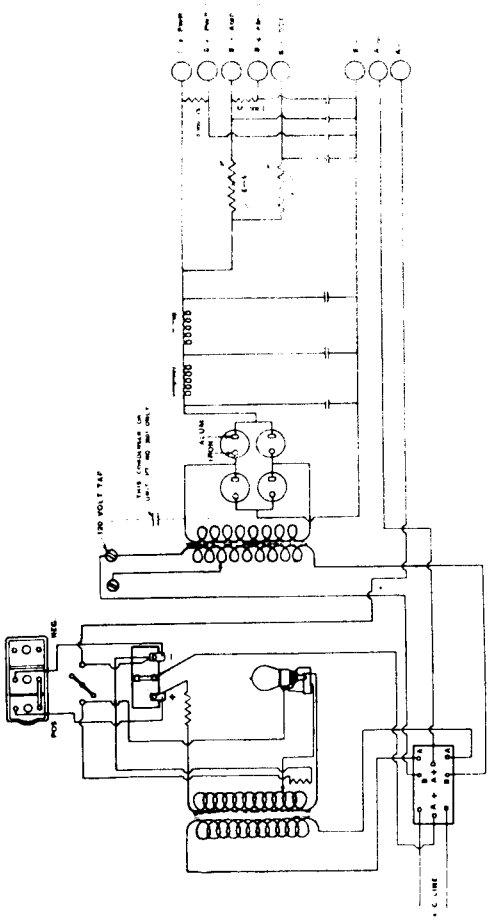


Super "A" Power Units, Part Nos. 3290 and 3390, 4 and 6 Volt, 50-60 Cycle

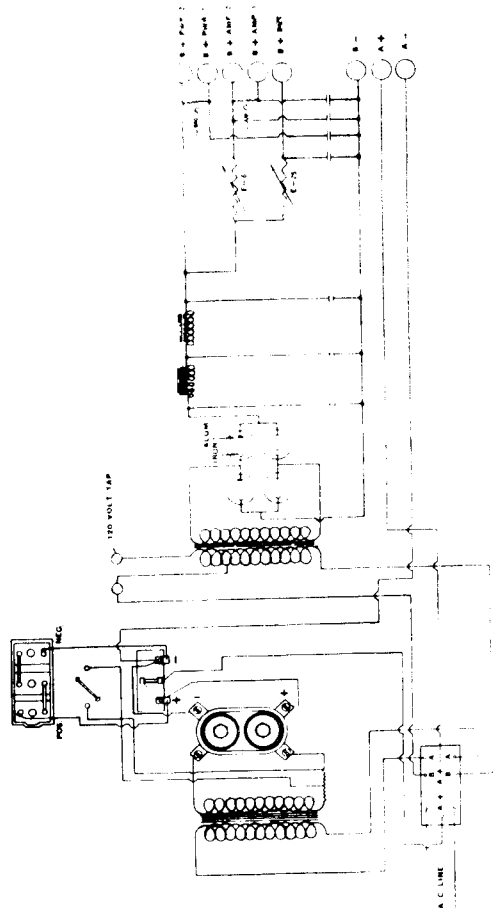
Super "A"—4 volt is schematically the same as the Super "A"—6 volt, except for increased resistance in the charge circuit and a battery using 2 cells instead of 4 cells.

WILLARD STORAGE BATT. CO.

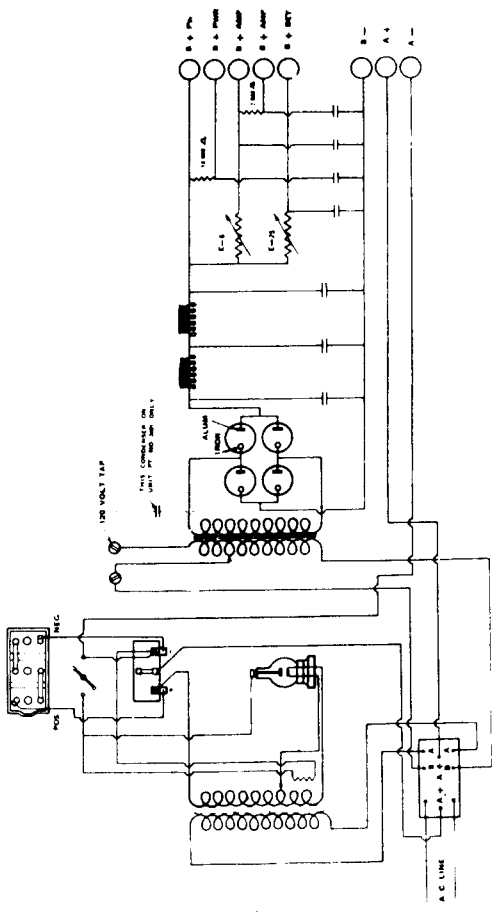
WILLARD STORAGE BATT. CO.



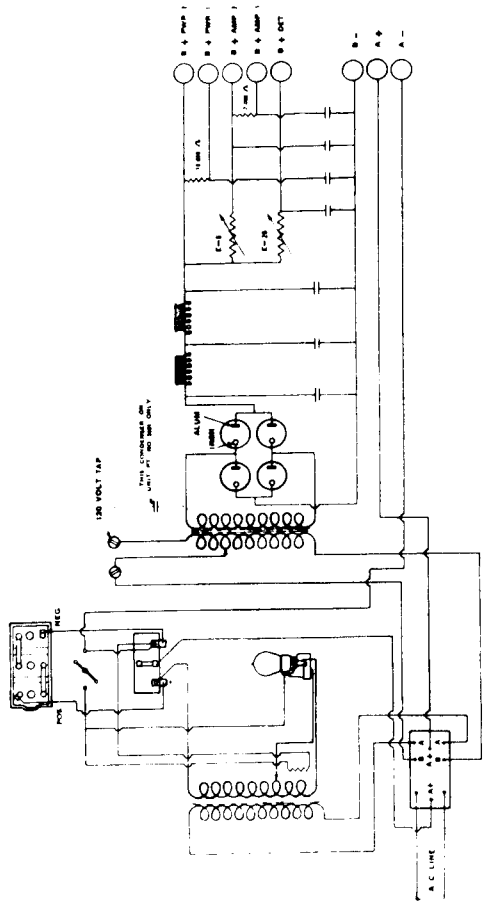
Combination "A-B" Power Unit, Part No. 6301, 4 Volt, 50-60 Cycle



Combination "A-B" Power Unit, Part No. 4301, 6 Volt, 25-40 Cycle

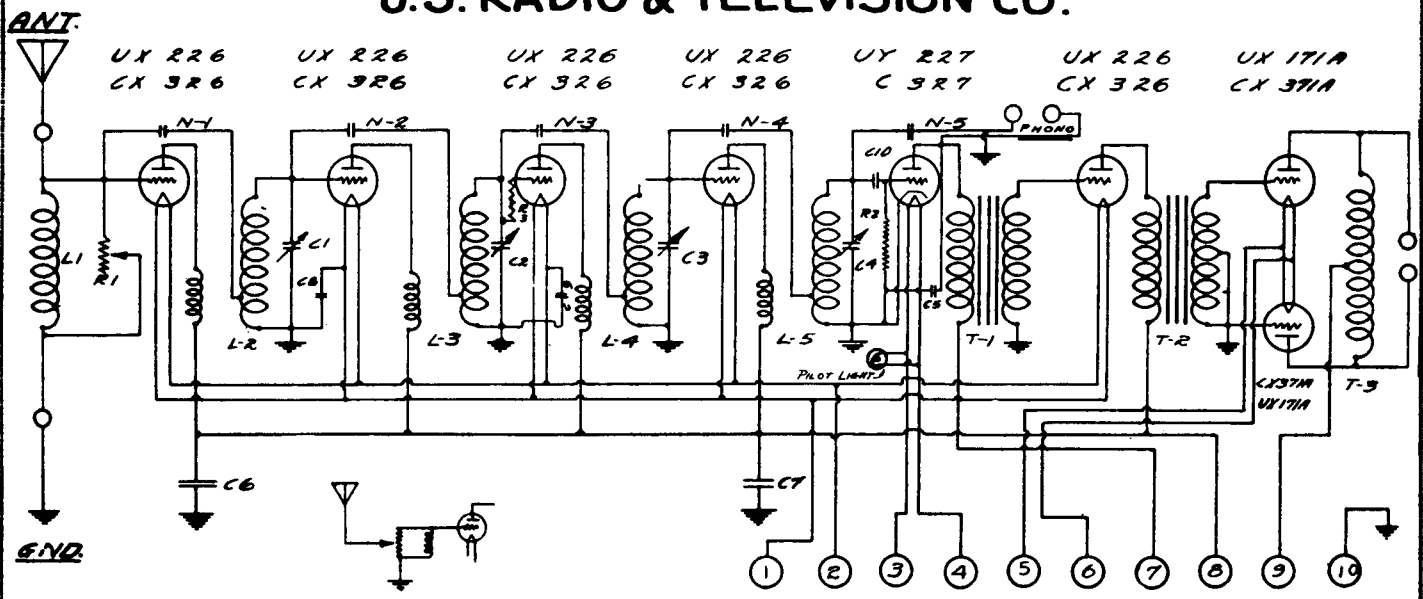


Combination "A-B" Power Unit, Part No. 3301 (Westinghouse Charger), 6 Volt, 50-60 Cycle



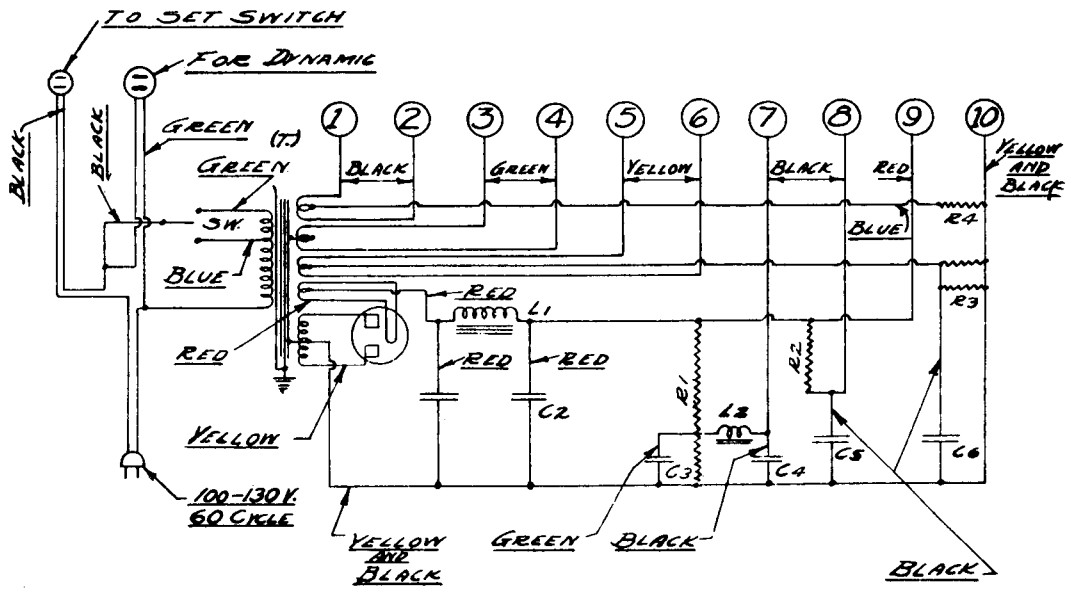
Combination "A-B" Power Unit, Part No. 3301 (General Electric Charger), 6 Volt, 50-60 Cycle

U.S. RADIO & TELEVISION CO.

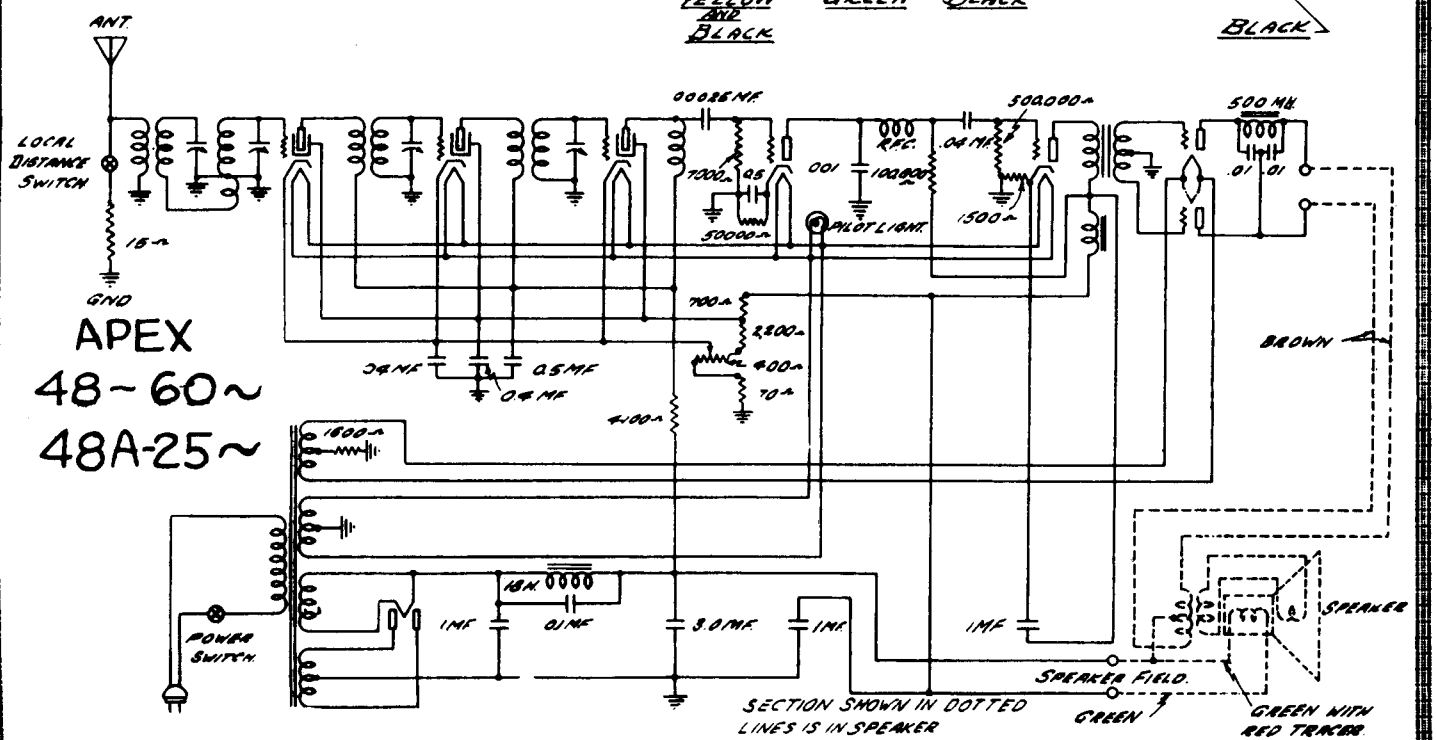


ALL MODELS WITH SERIAL NUMBERS ABOVE 5050 WILL HAVE THIS VOLUME CONTROL. - NOTE ROTATES ONLY TO 80R

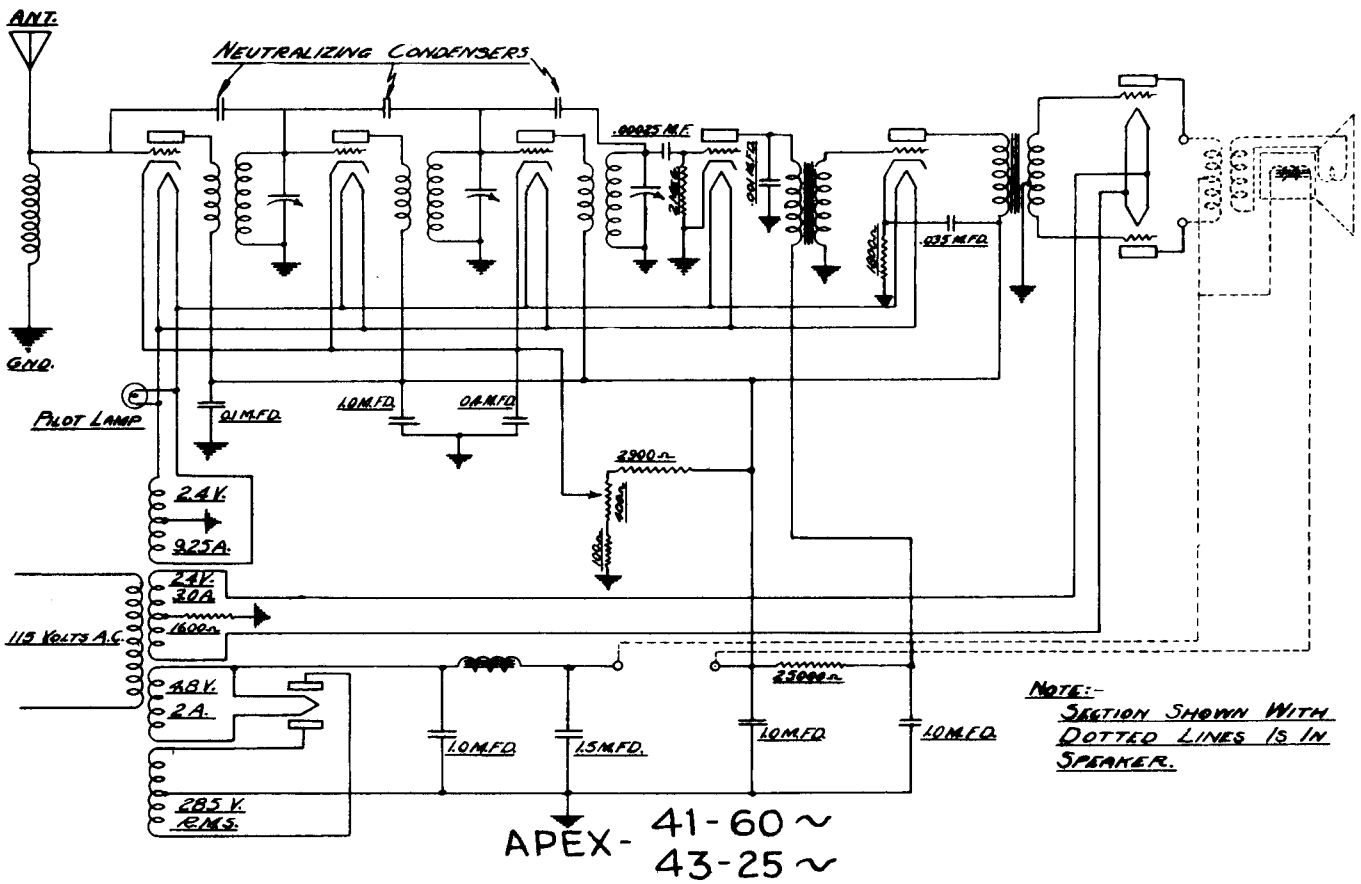
MODEL 80



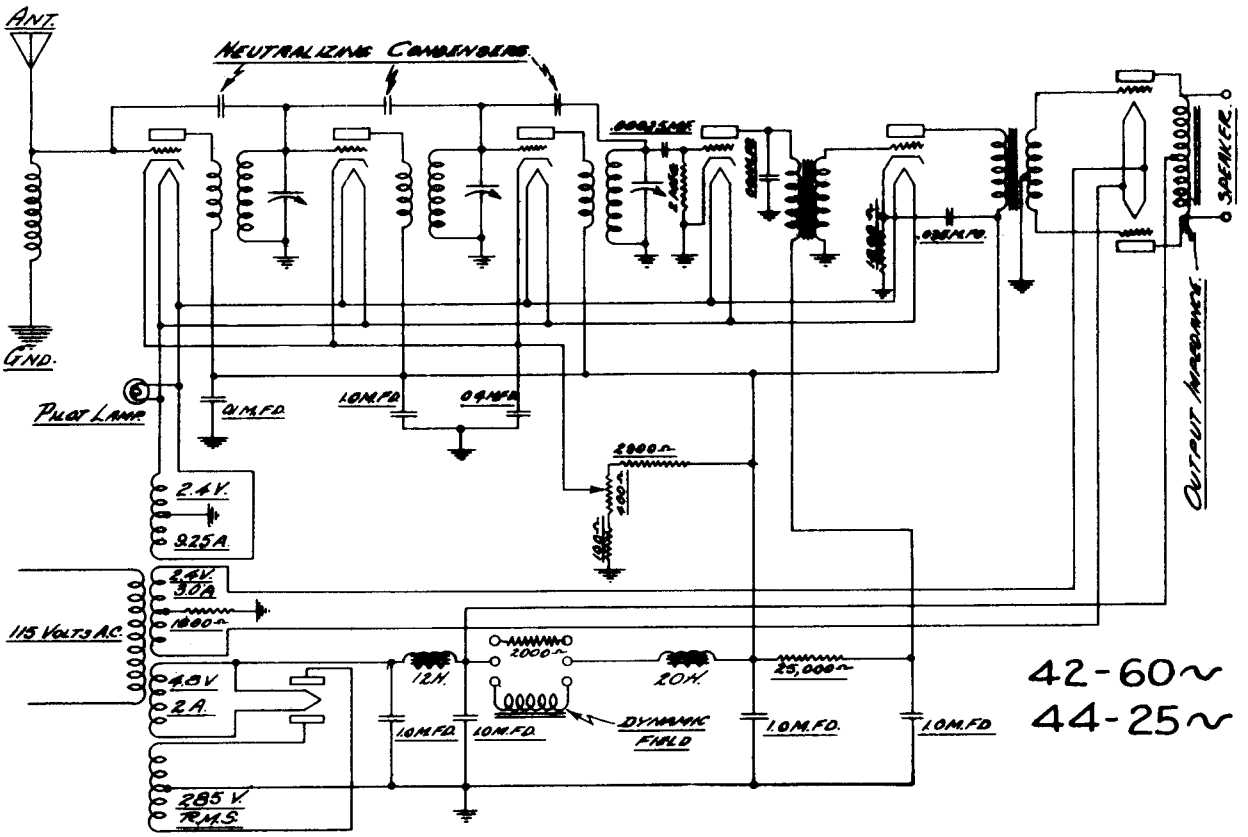
APEX 48-60~ 48A-25~



U.S. RADIO & TELEVISION CO.

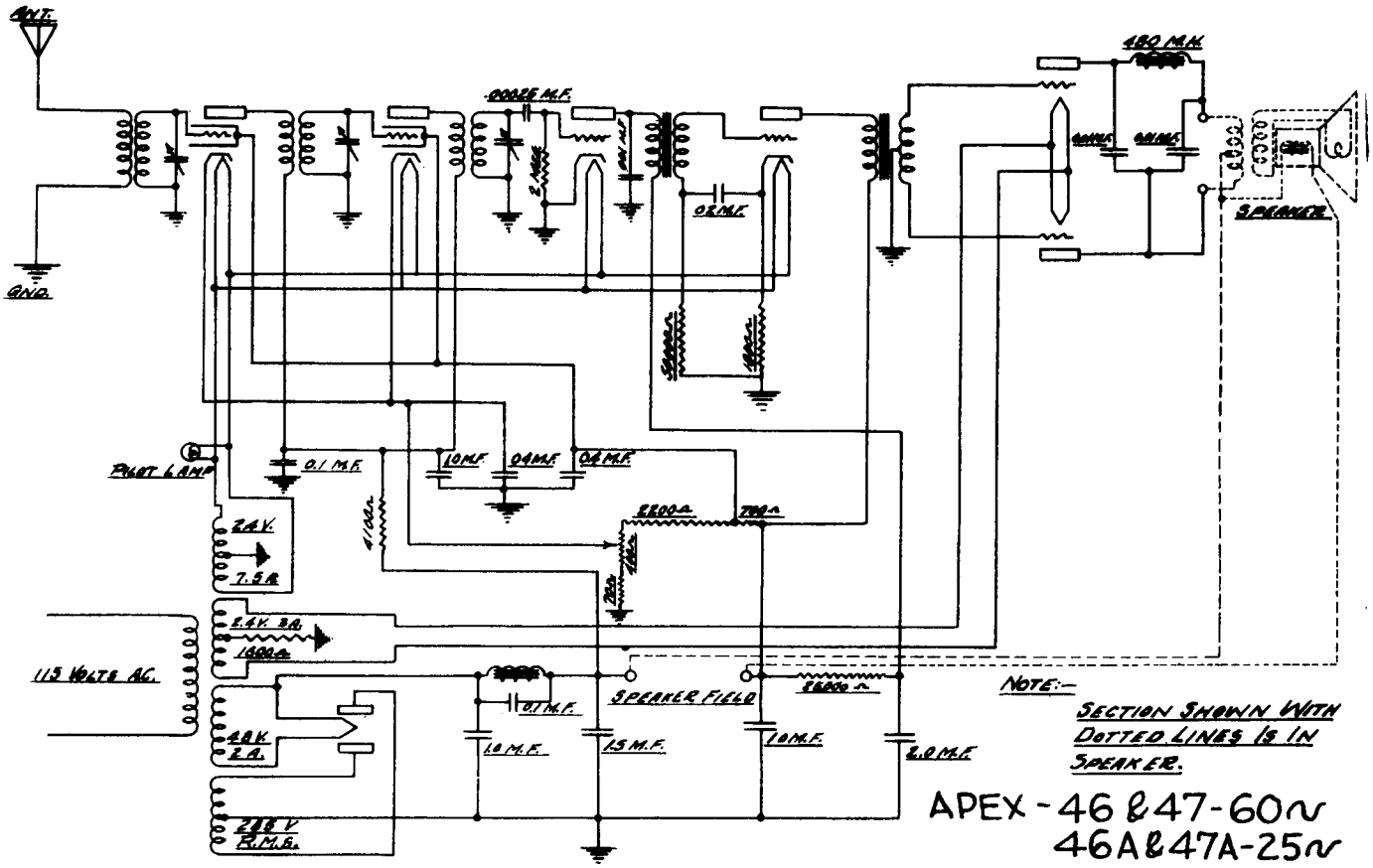


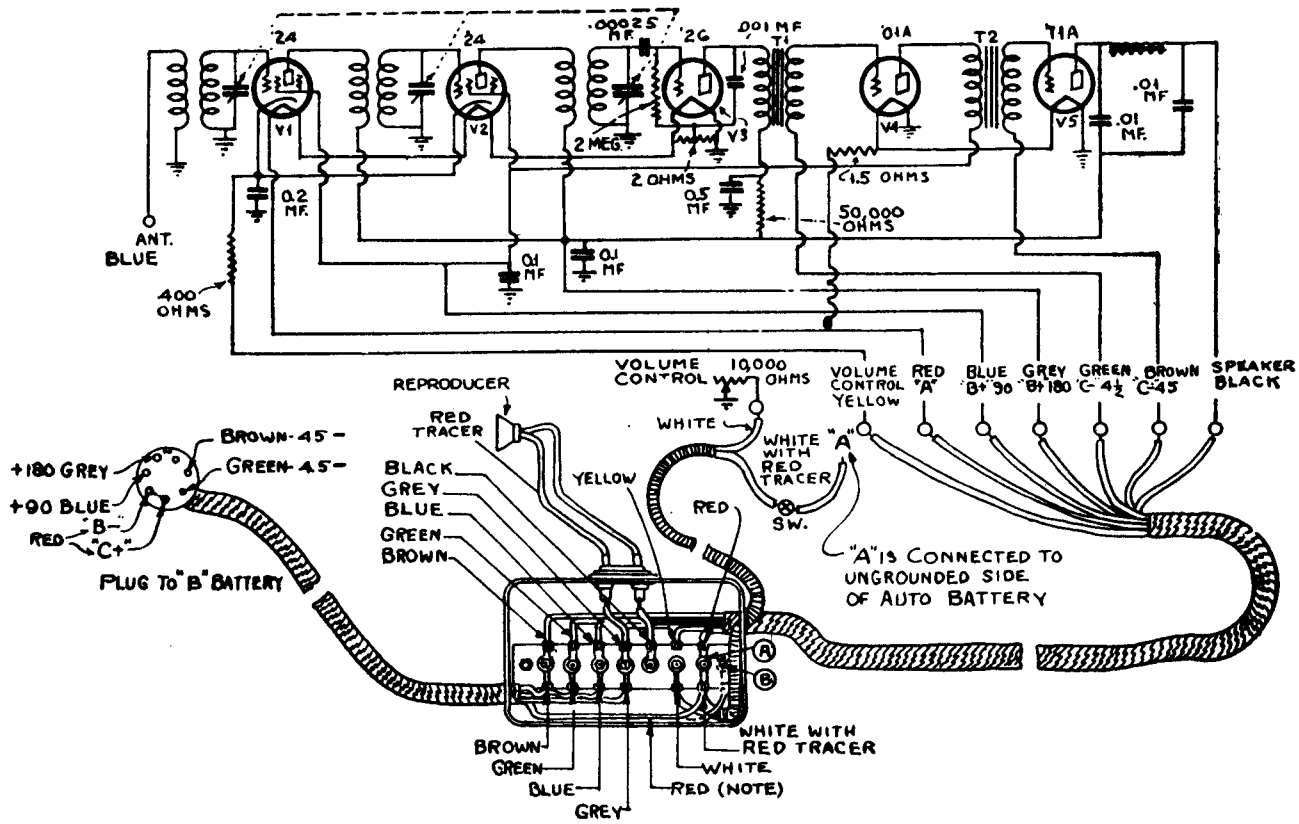
APEX- 41-60 ~
43-25 ~



42-60 ~
44-25 ~

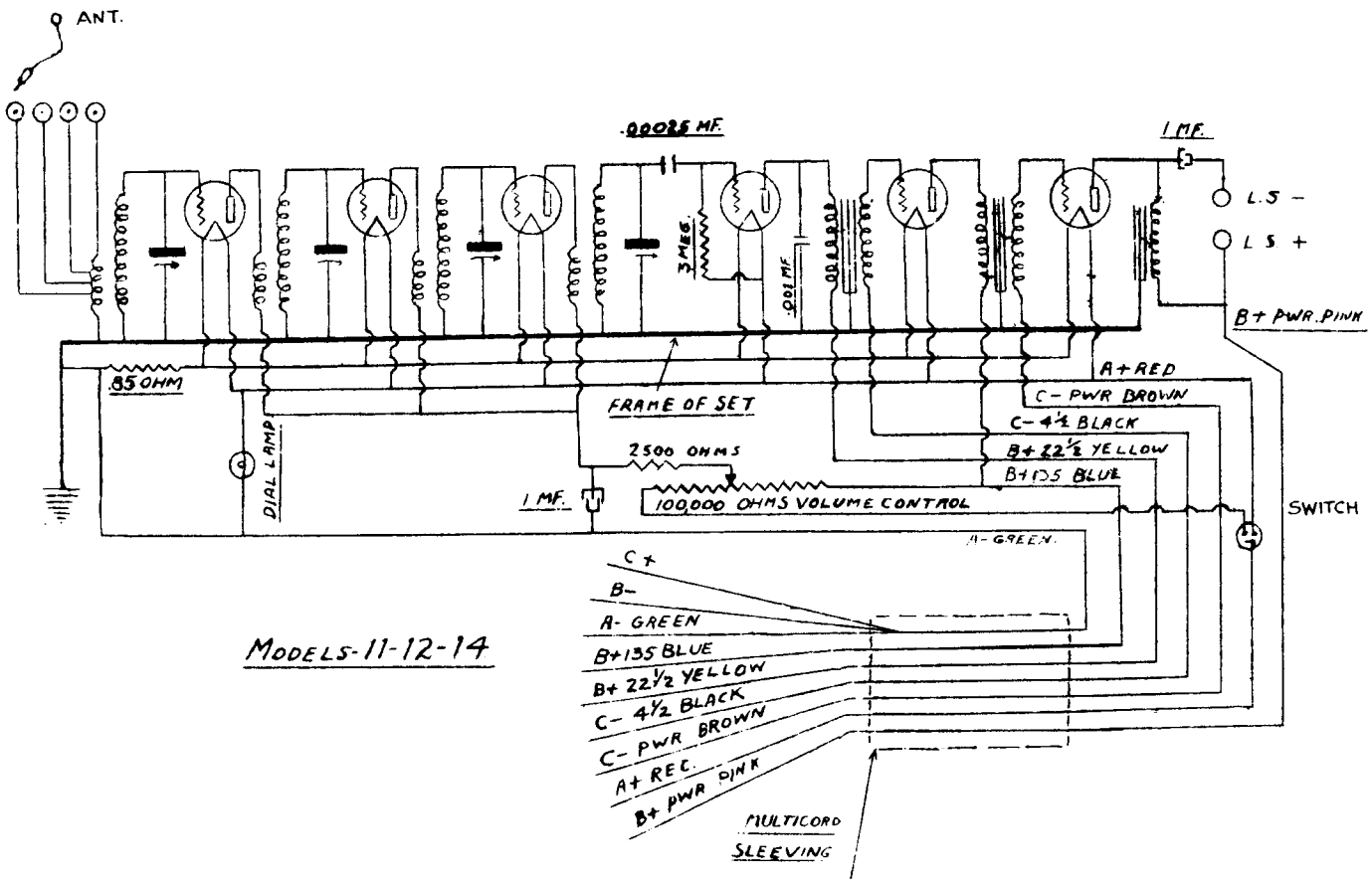
U.S. RADIO & TELEVISION CO.





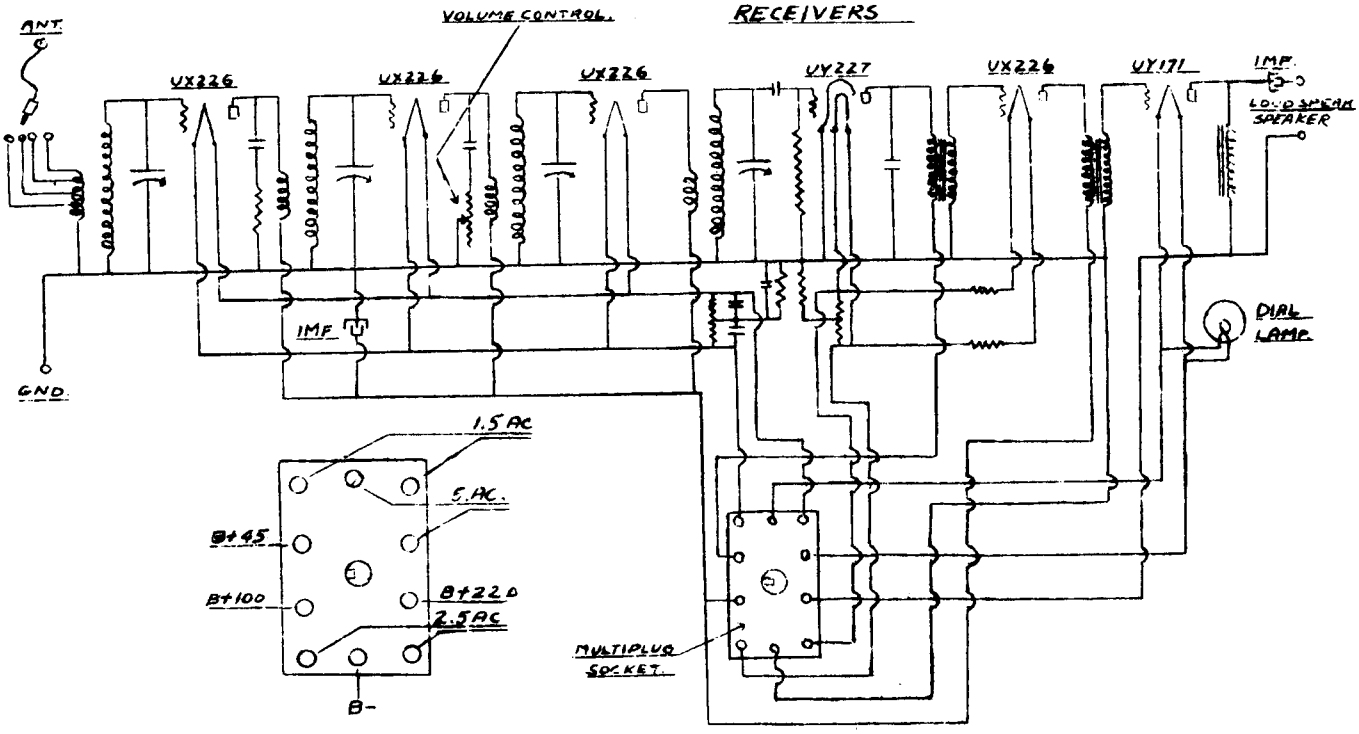
The schematic circuit and wiring connections of the U. S. Radio "Model 30" screen-grid automotive receiver. When the positive side of the car's storage battery is grounded, the red lead connects to terminal "A" of the junction box, from which one side of all voltage readings is then taken. If the battery's negative is grounded, the red lead connects to "ground" on the screw "B" which mounts the junction box.

ZENITH RADIO CORP.



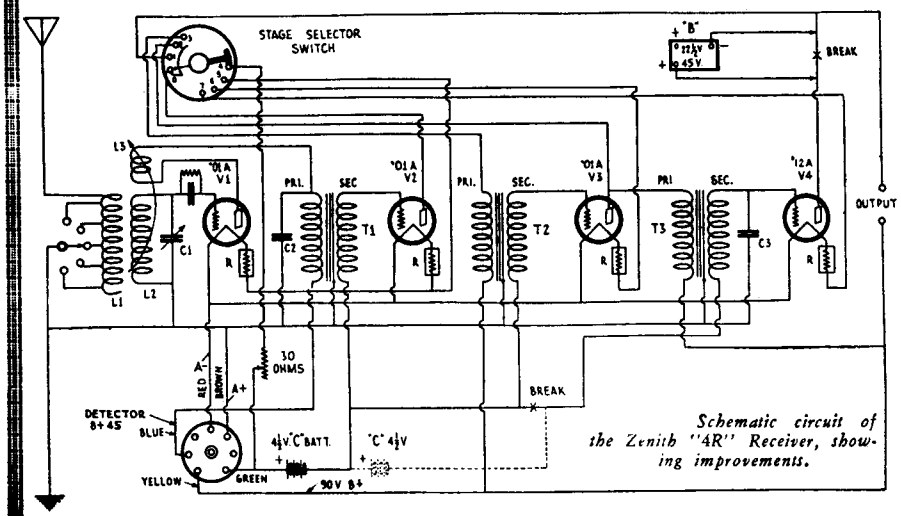
MODELS-11-12-14

MODEL 11E AND 14E ELECTRIC RECEIVERS

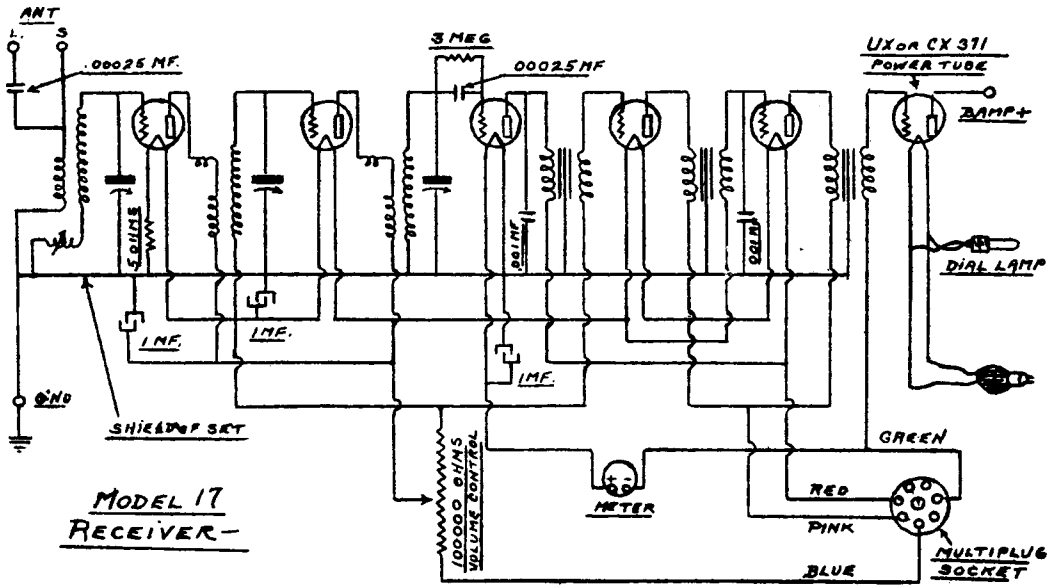


11E FROM 48657 TO 51050

14E FROM 605420 TO 607147.

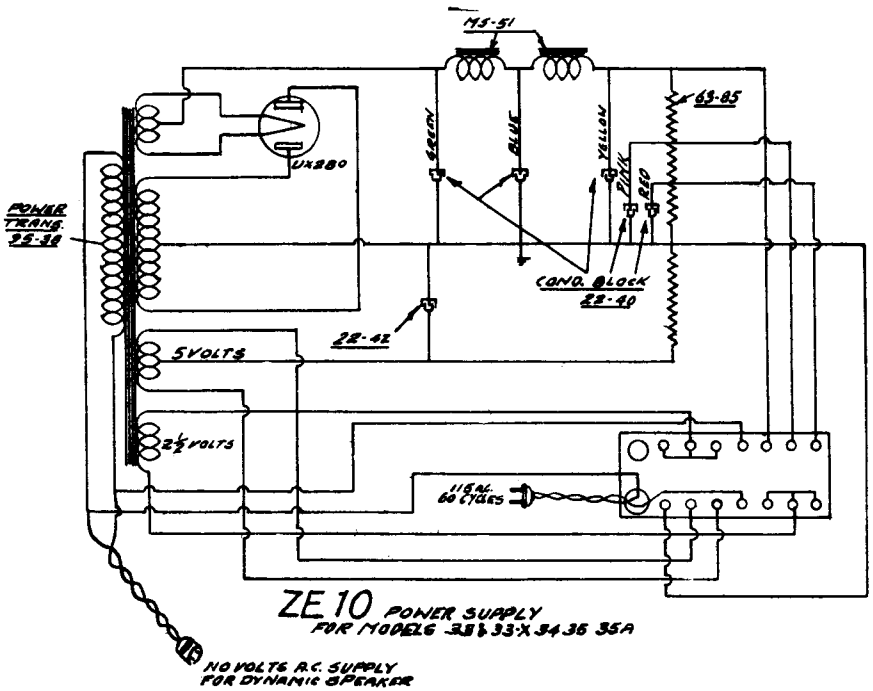


Schematic circuit of the Zenith "4R" Receiver, showing improvements.

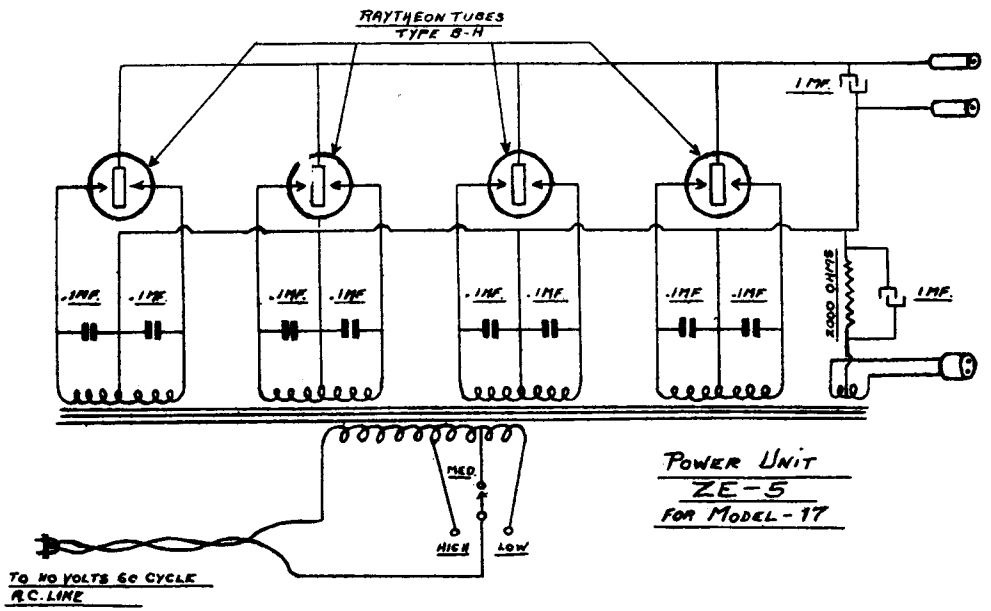


MODEL 17 RECEIVER—

Circuit Diagram of Zenith Model 17



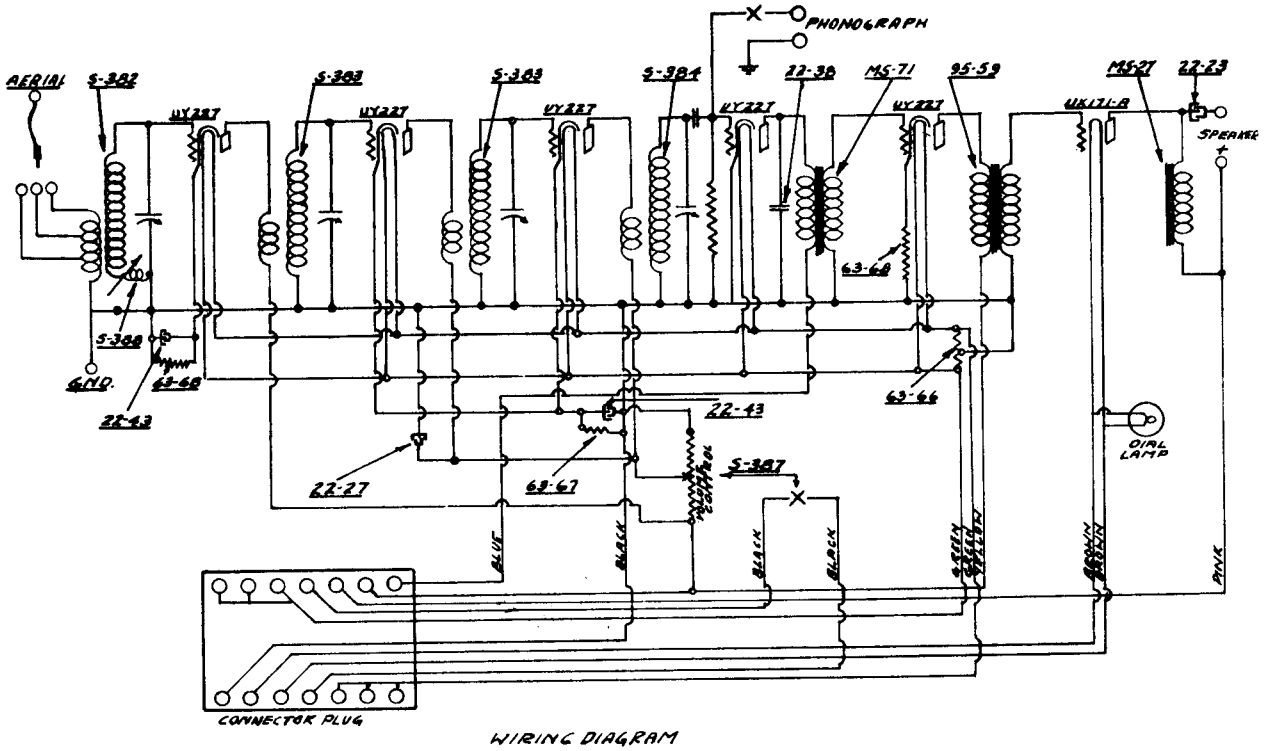
ZE 10 POWER SUPPLY
FOR MODELS 32 & 33-X 34 36 35A



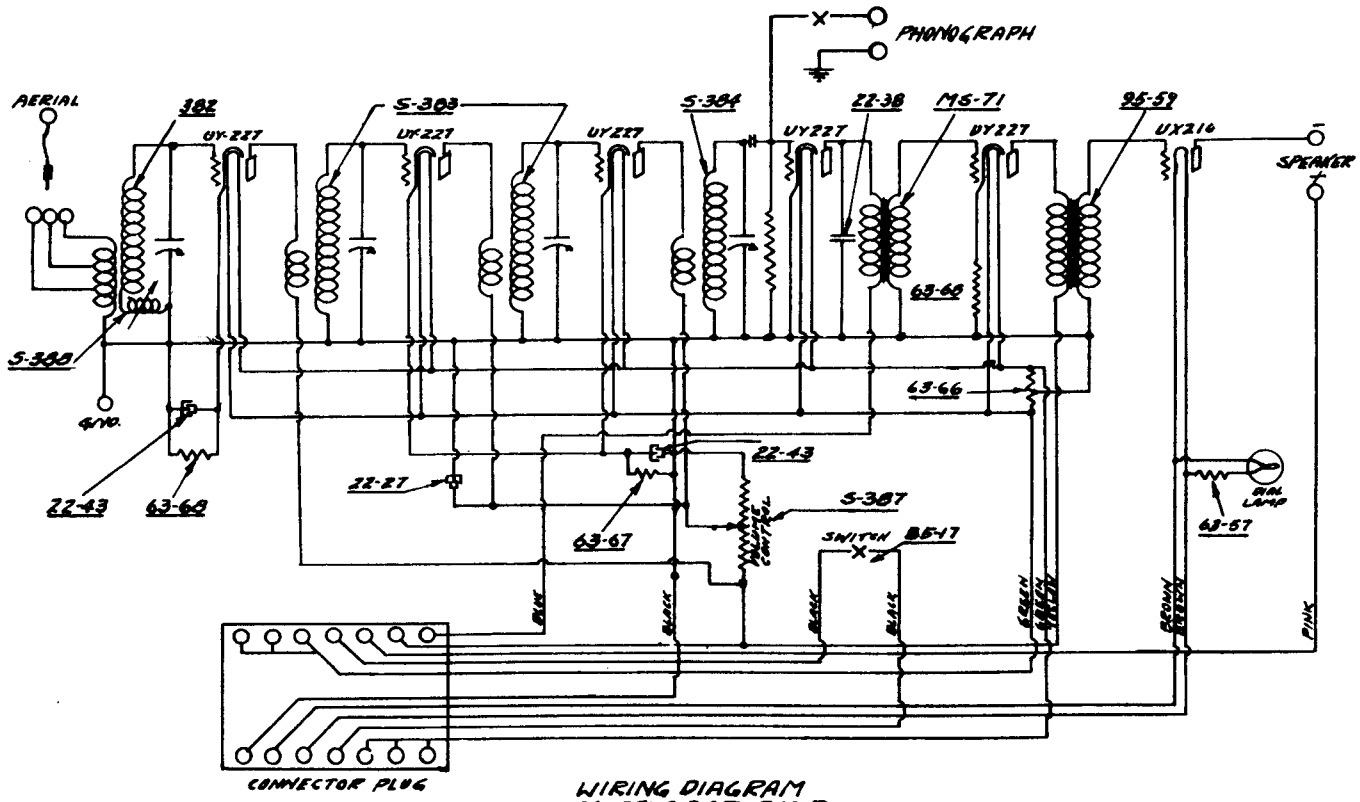
POWER UNIT
ZE-5
FOR MODEL-17

ZENITH RADIO CORP.

ZENITH RADIO CORP.

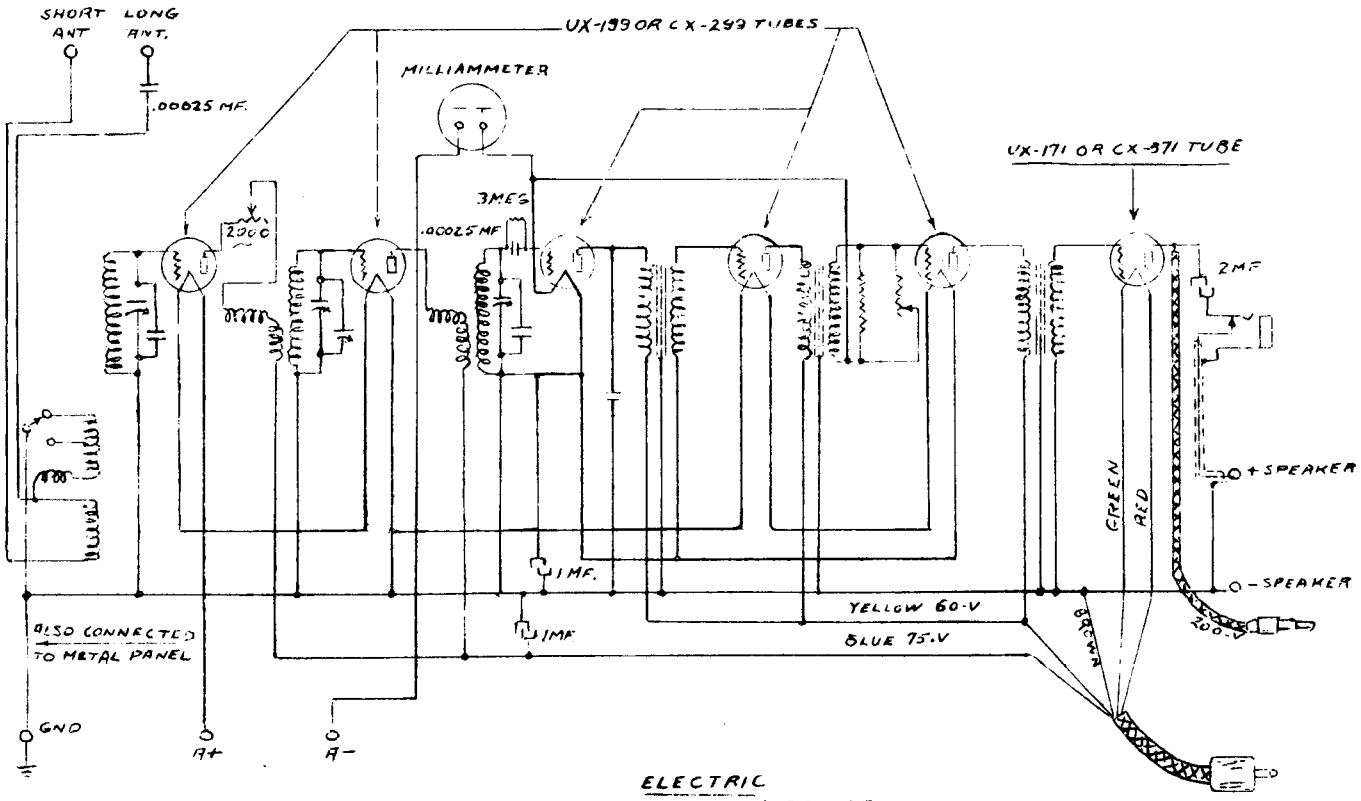


WIRING DIAGRAM
MODELS 33X362X
6 TUBE ELECTRIC SET

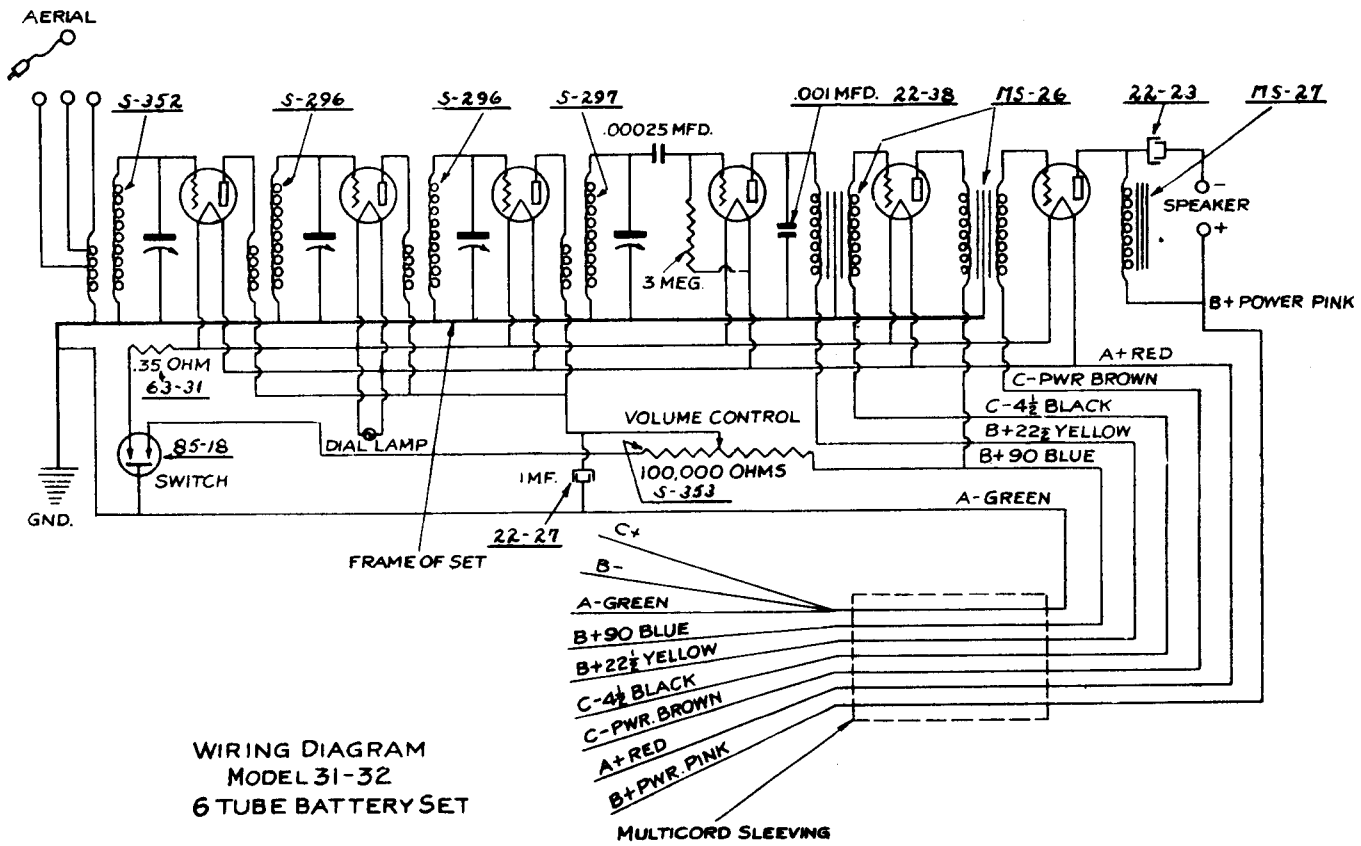


WIRING DIAGRAM
MODELS 34P-342P
6 TUBE ELECTRIC SET

ZENITH RADIO CORP.

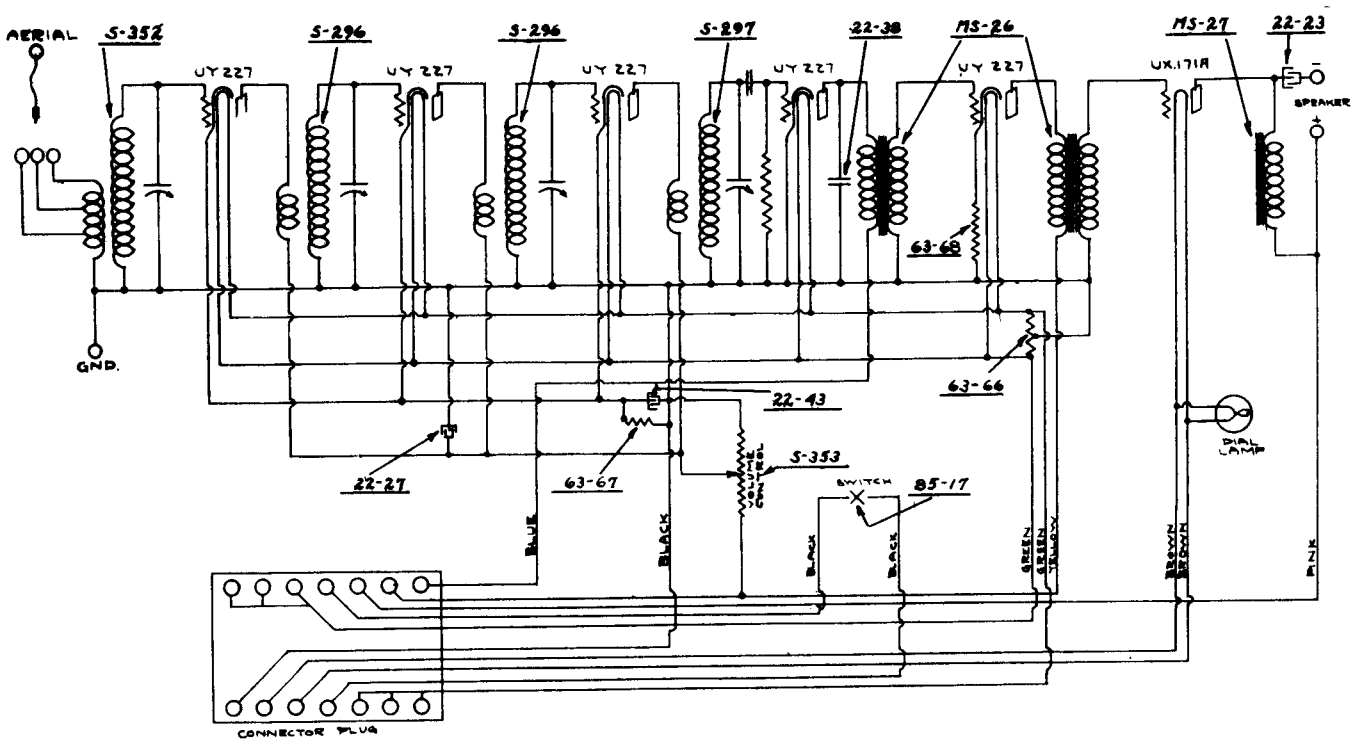


ELECTRIC
SUPER-ZENITH MODEL 27

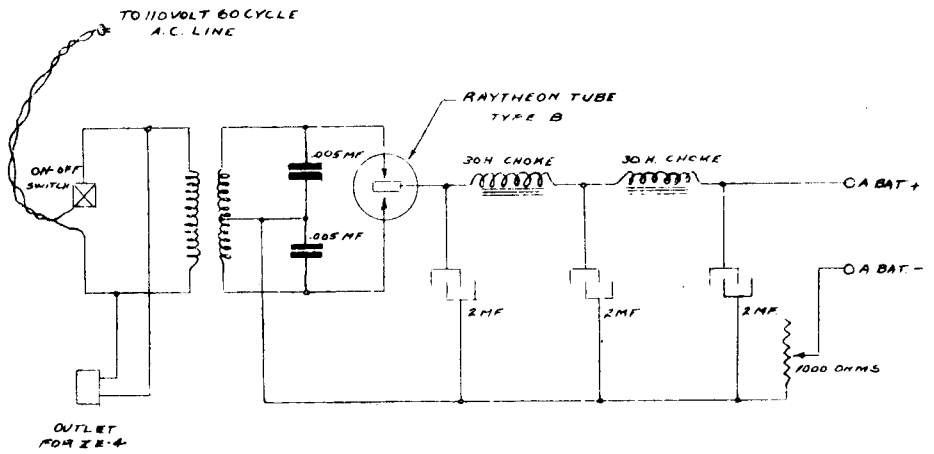


WIRING DIAGRAM
MODEL 31-32
6 TUBE BATTERY SET

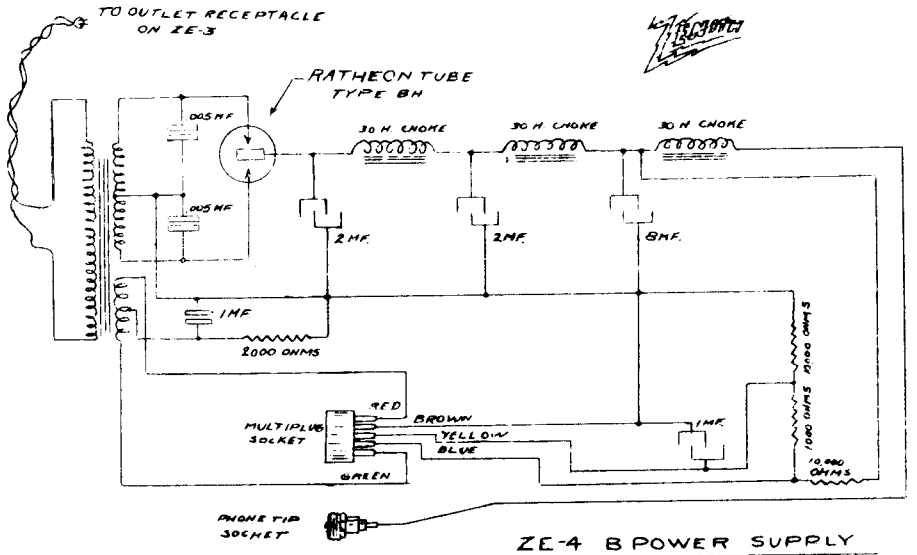
ZENITH RADIO CORP.



WIRING DIAGRAM
MODELS 33-34-35-35A-342-352-352A-362
6 TUBE ELECTRIC SET

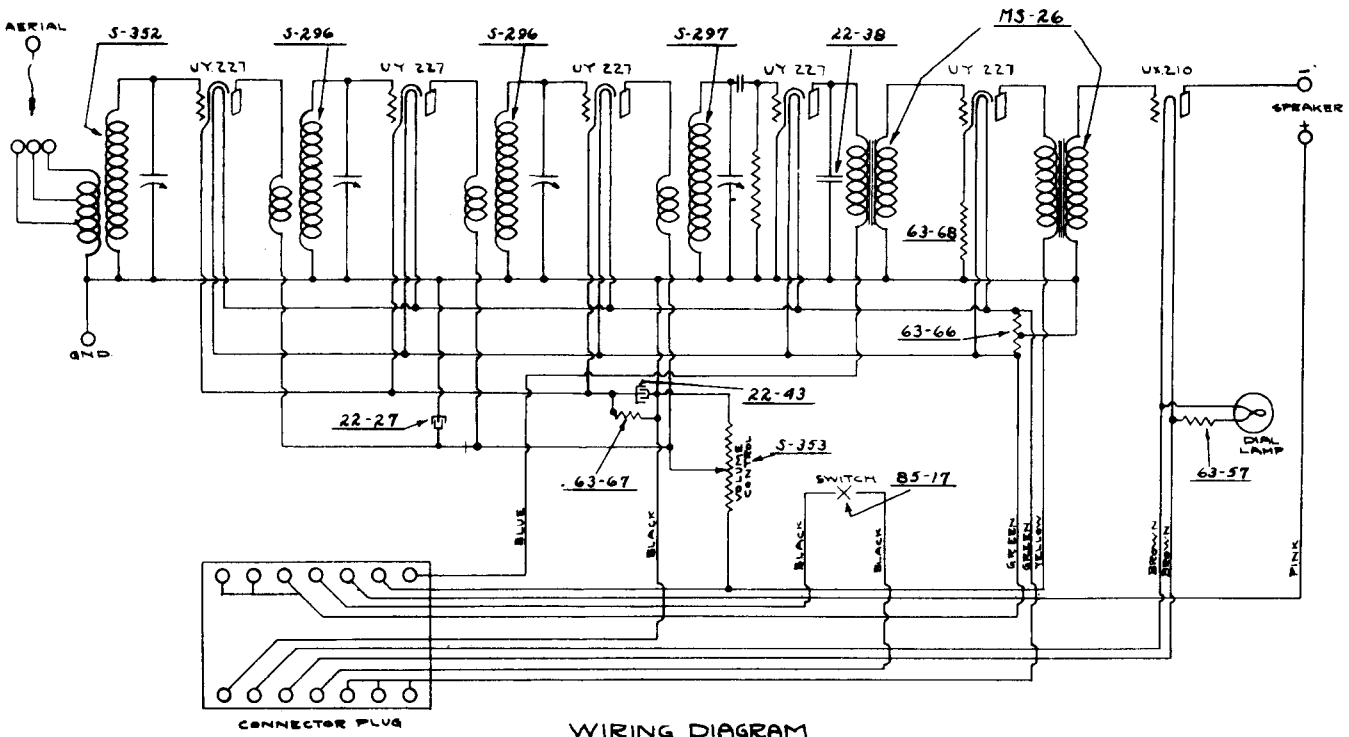


ZE-3 A-POWER SUPPLY

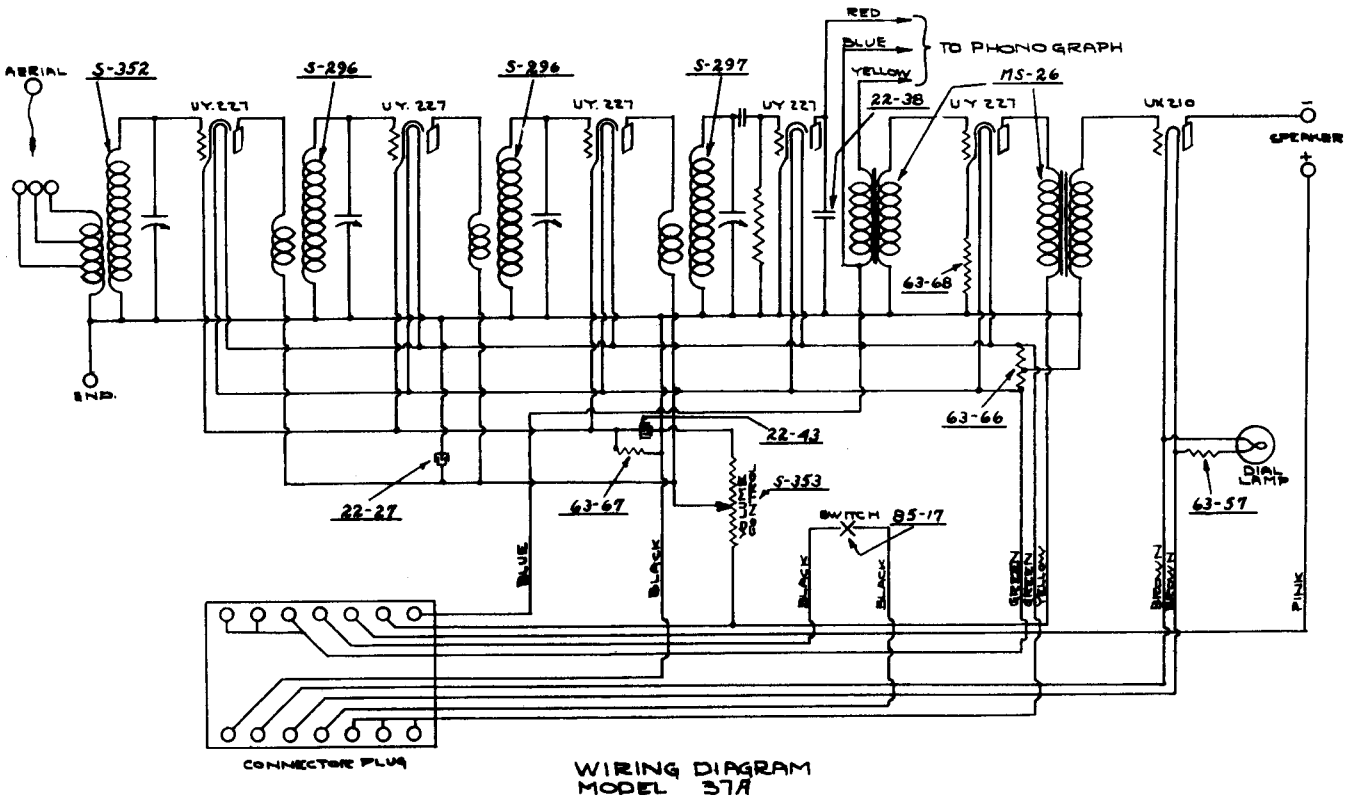


ZE-4 B POWER SUPPLY

ZENITH RADIO CORP.

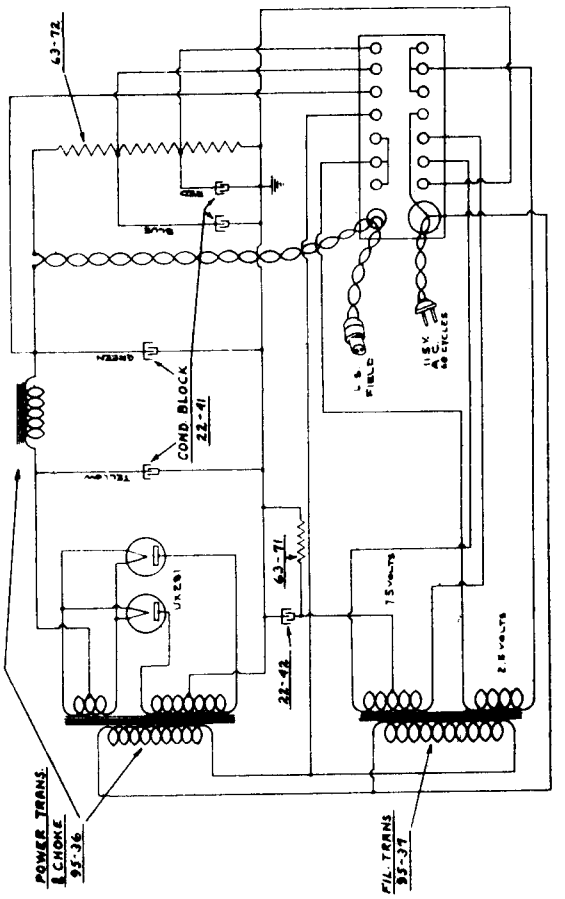


WIRING DIAGRAM
MODELS 35P-35AP-352P-352AP
6 TUBE ELECTRIC SET

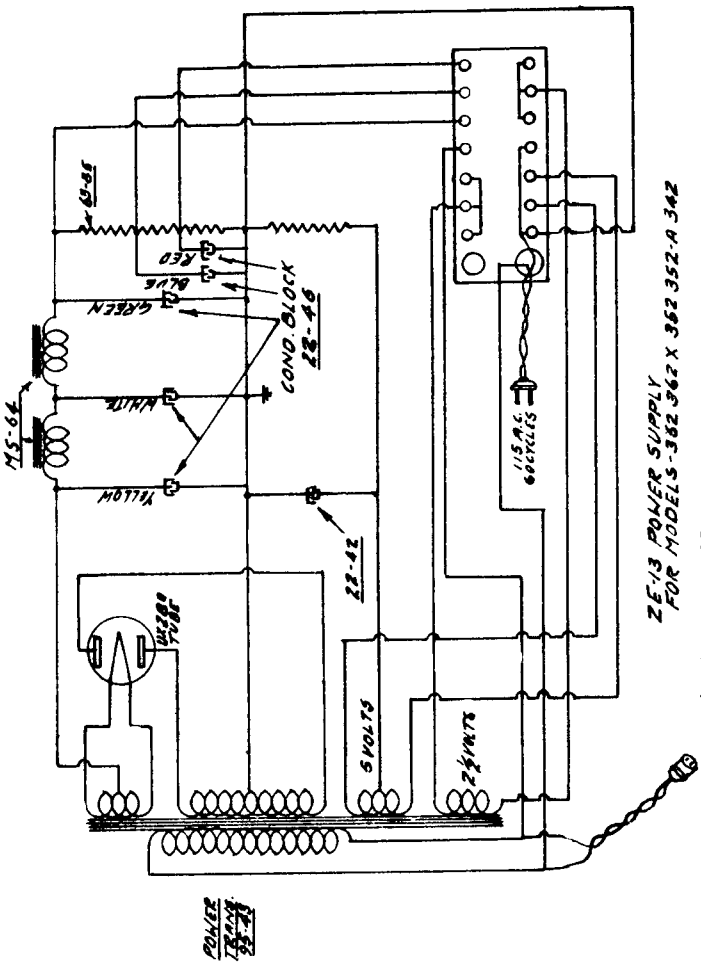


WIRING DIAGRAM
MODEL 37A
6 TUBE ELECTRIC SET

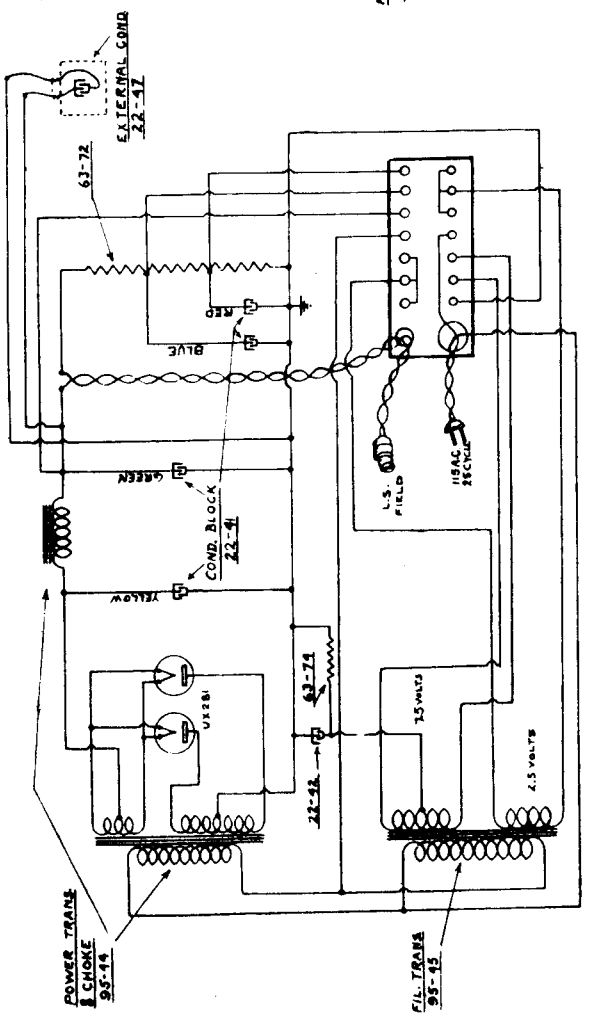
ZENITH RADIO CORP.



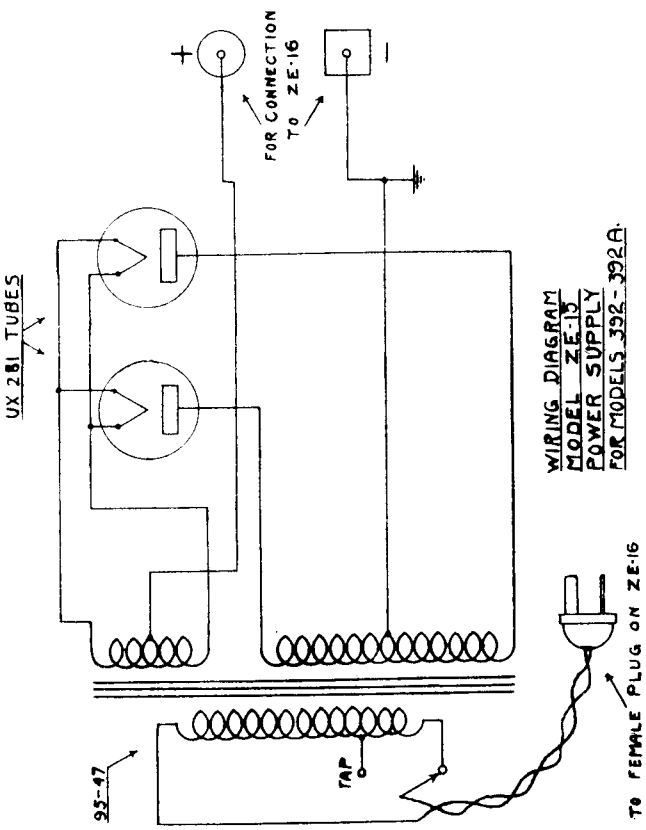
ZE 11 POWER SUPPLY
FOR MODELS 35SP-35 AP-37A



ZE-13 POWER SUPPLY
FOR MODELS-362 362 X 362 352-A 342
110 VOLTS A.C. SUPPLY
FOR DYNAMIC SPEAKER

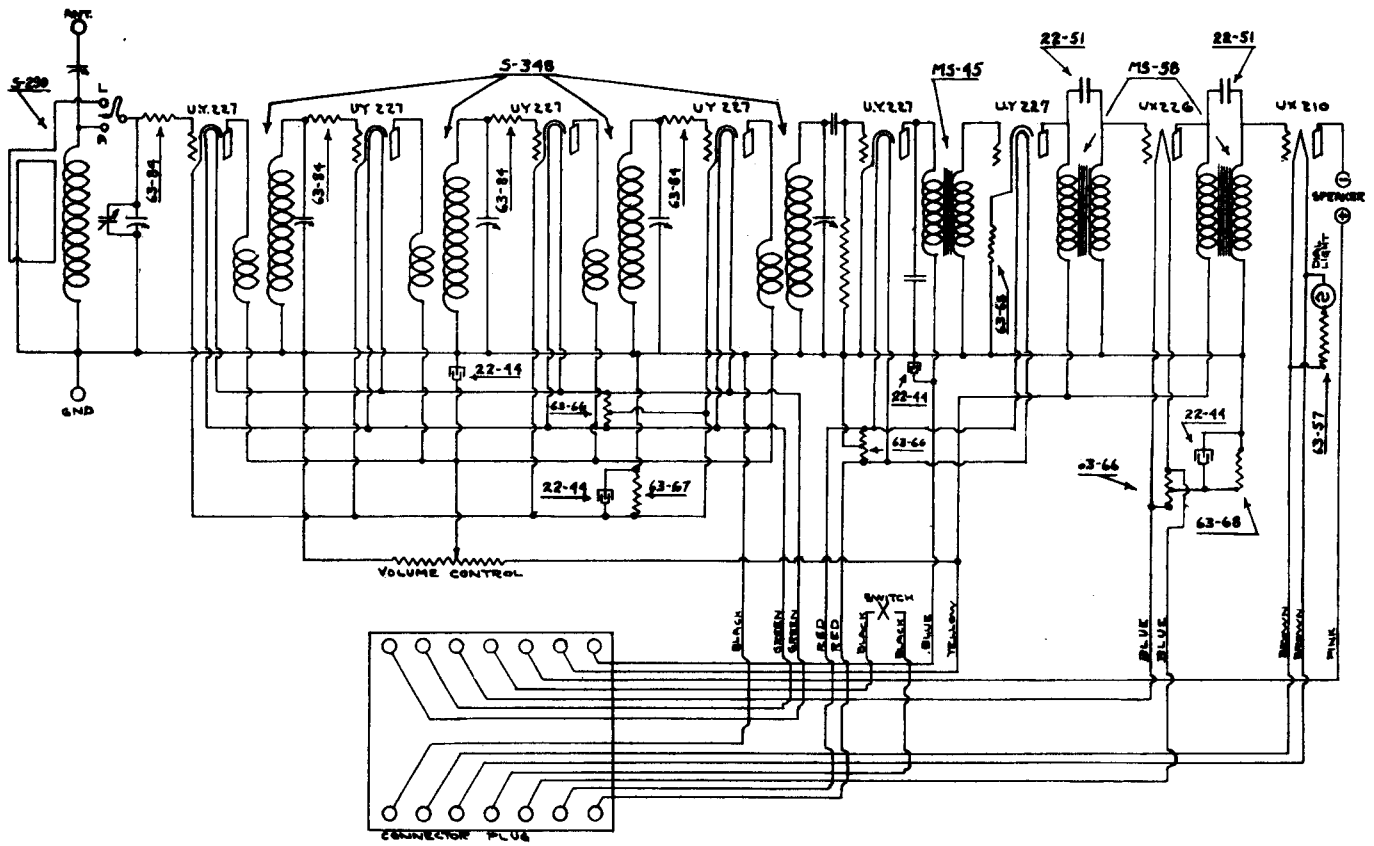


ZE 14 POWER SUPPLY
FOR MODELS 352P-352AP

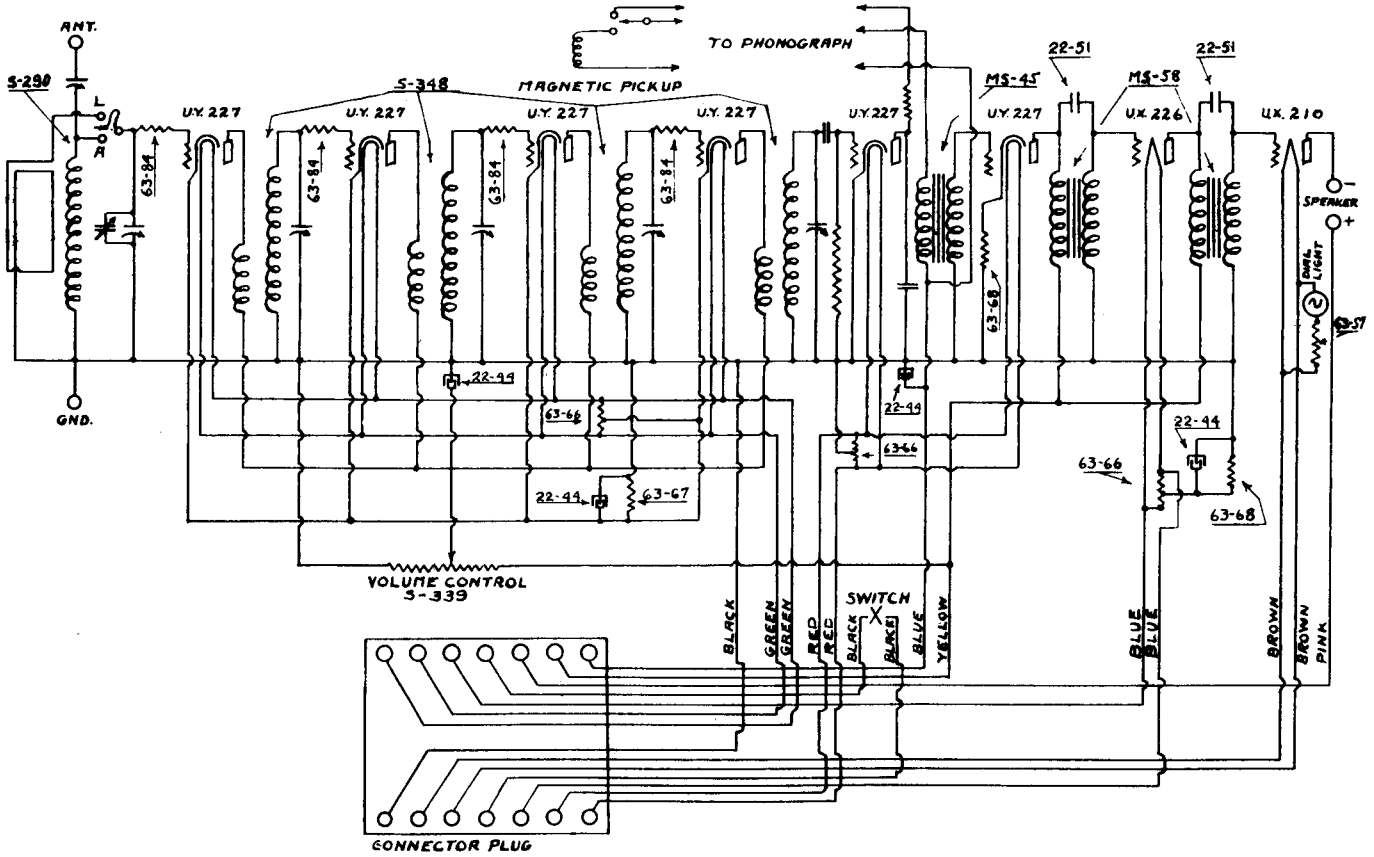


WIRING DIAGRAM
MODEL ZE-13
POWER SUPPLY
FOR MODELS 392-392A

ZENITH RADIO CORP.

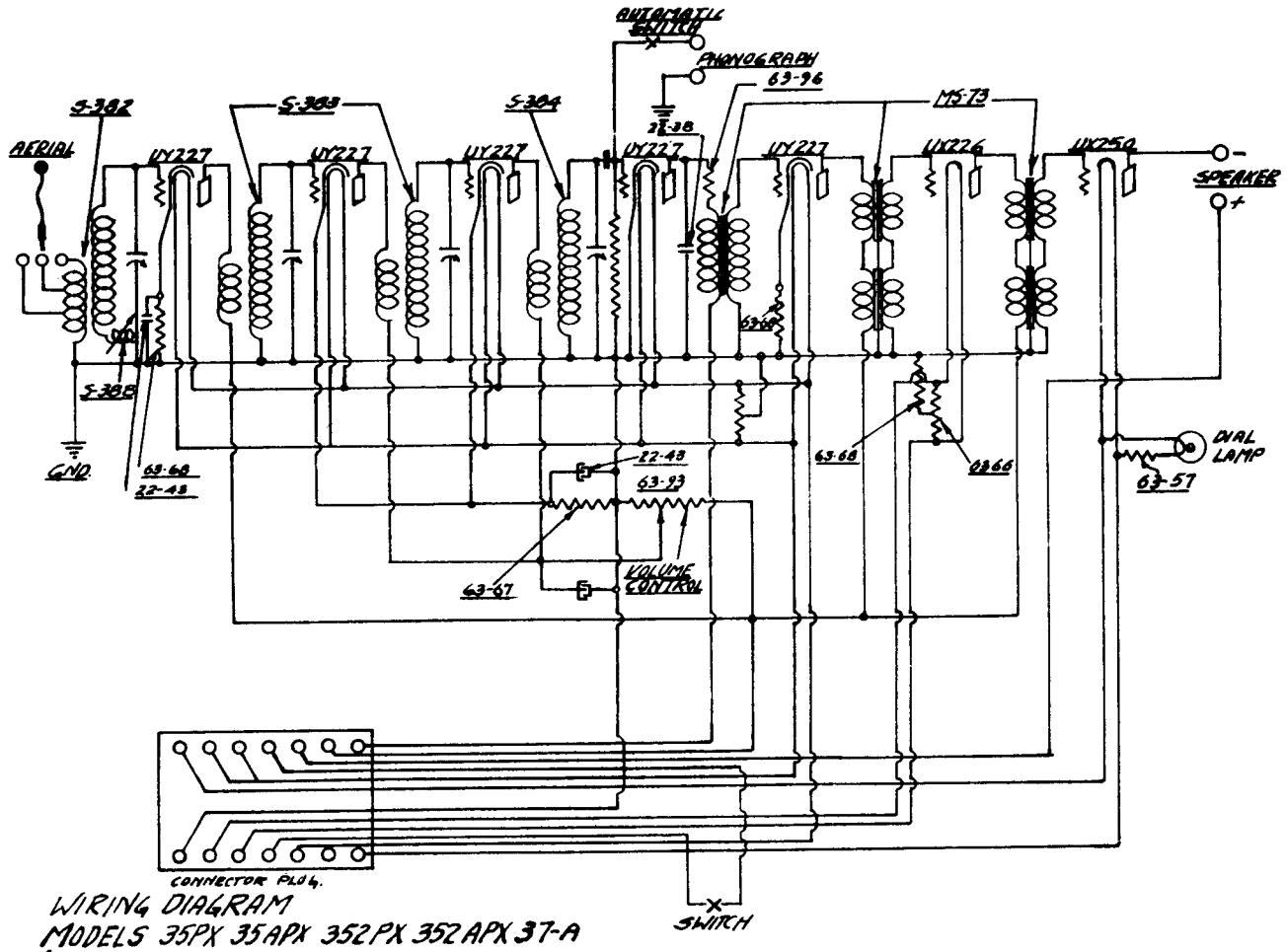


WIRING DIAGRAM
MODELS 39-39A-392-392A

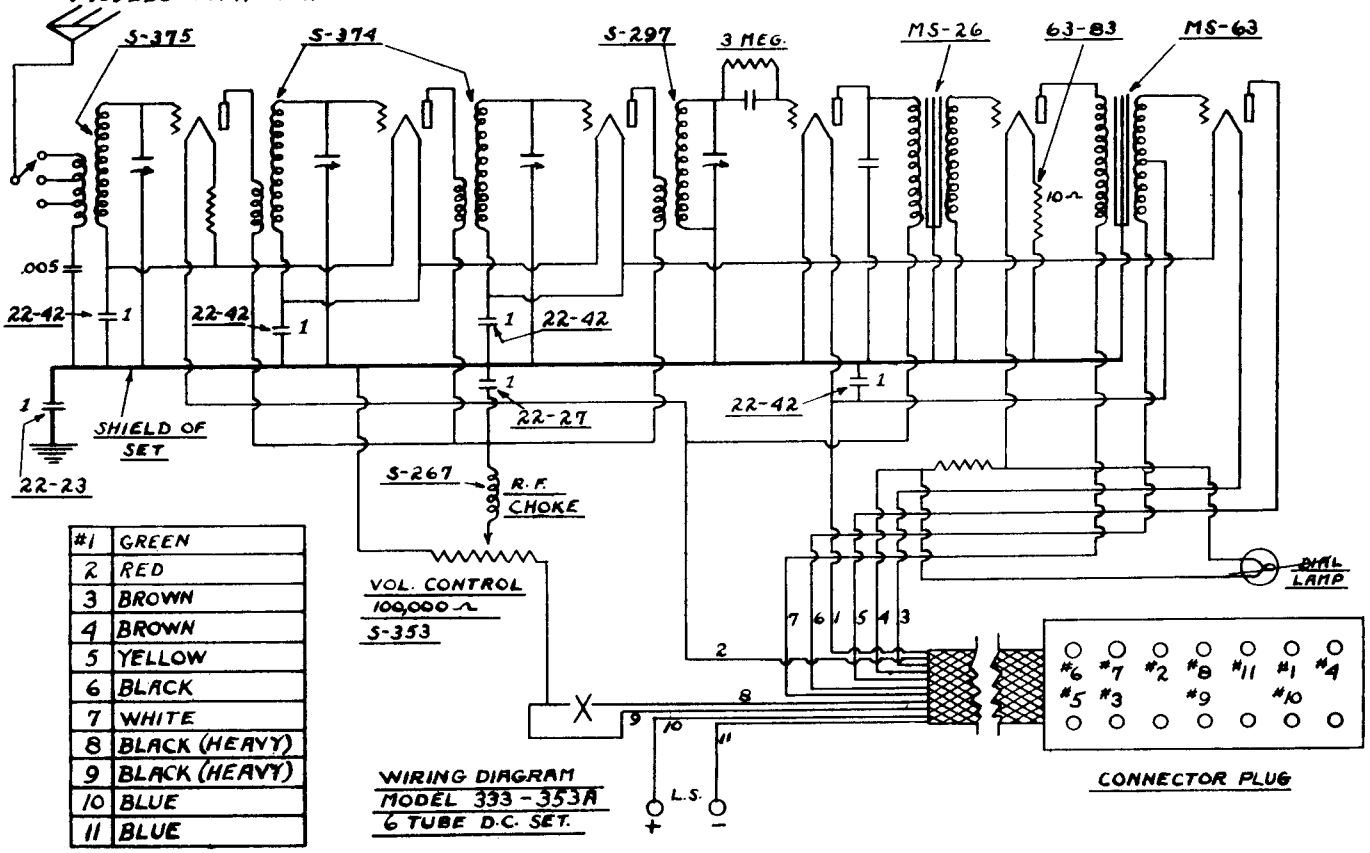


WIRING DIAGRAM
MODEL 40A

ZENITH RADIO CORP.



WIRING DIAGRAM
MODELS 35PX 35APX 352PX 352APX 37-A

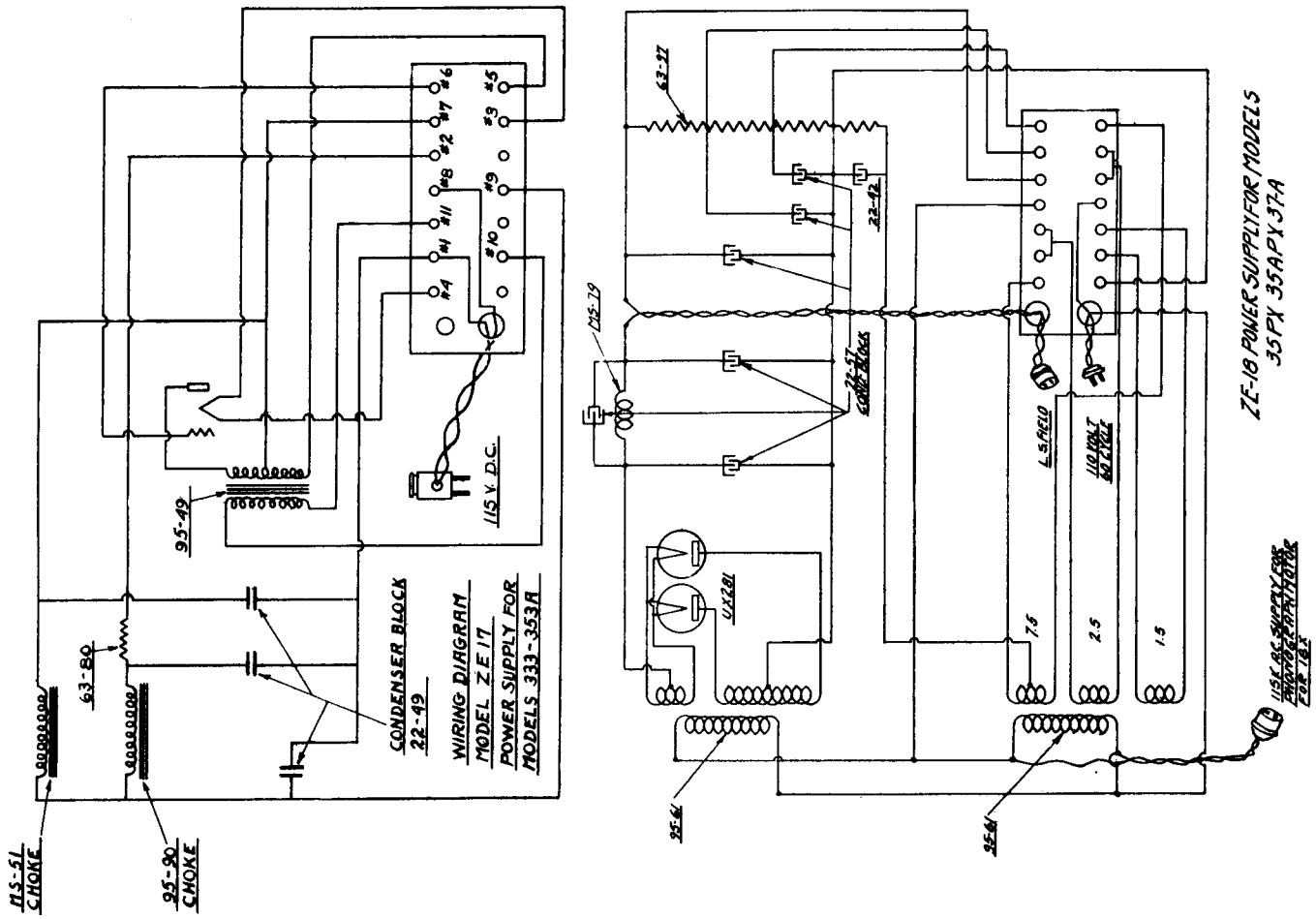


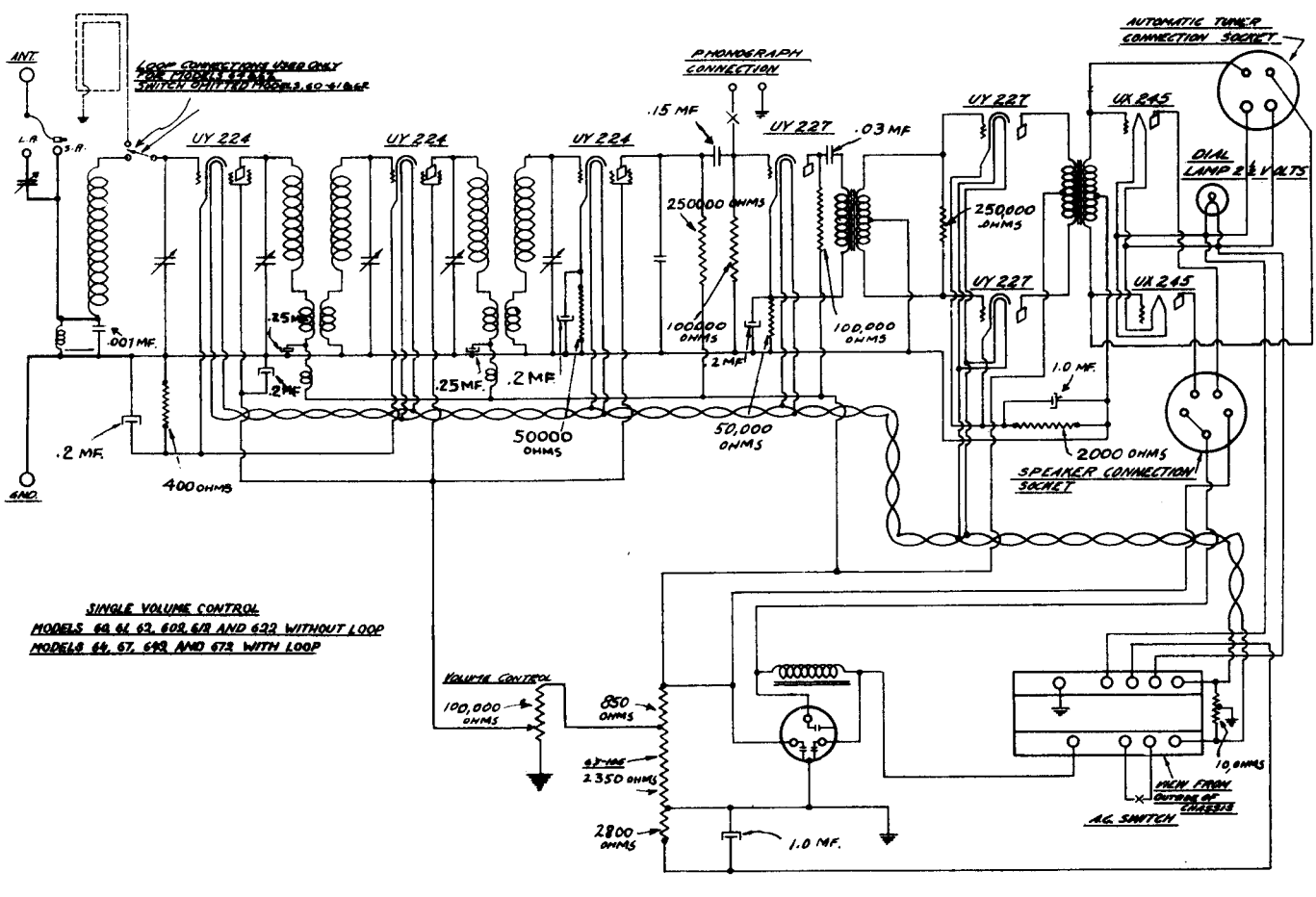
#1	GREEN
2	RED
3	BROWN
4	BROWN
5	YELLOW
6	BLACK
7	WHITE
8	BLACK (HEAVY)
9	BLACK (HEAVY)
10	BLUE
11	BLUE

WIRING DIAGRAM
MODEL 333-353A
6 TUBE D.C. SET.

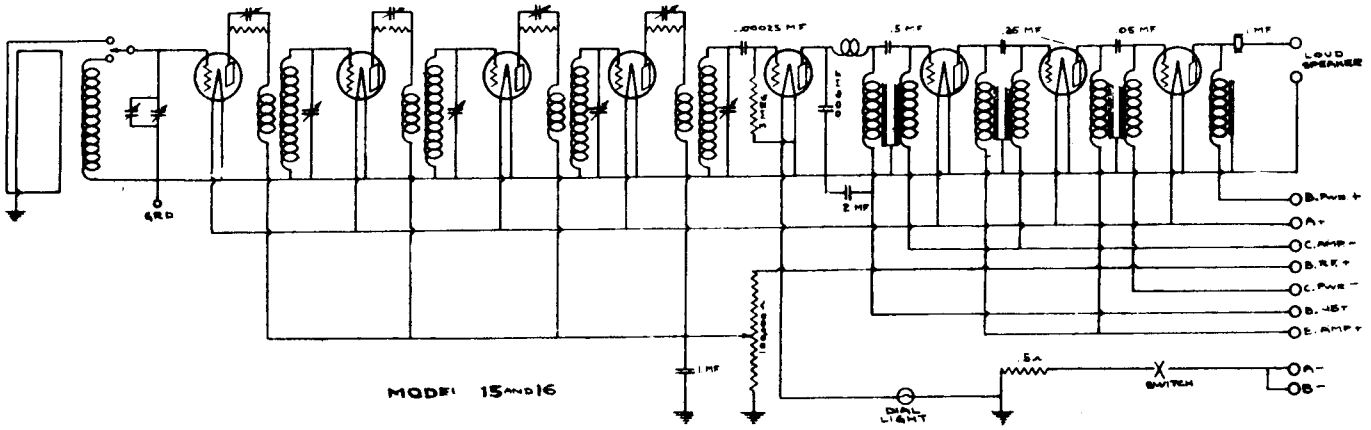
CONNECTOR PLUG

ZENITH RADIO CORP.

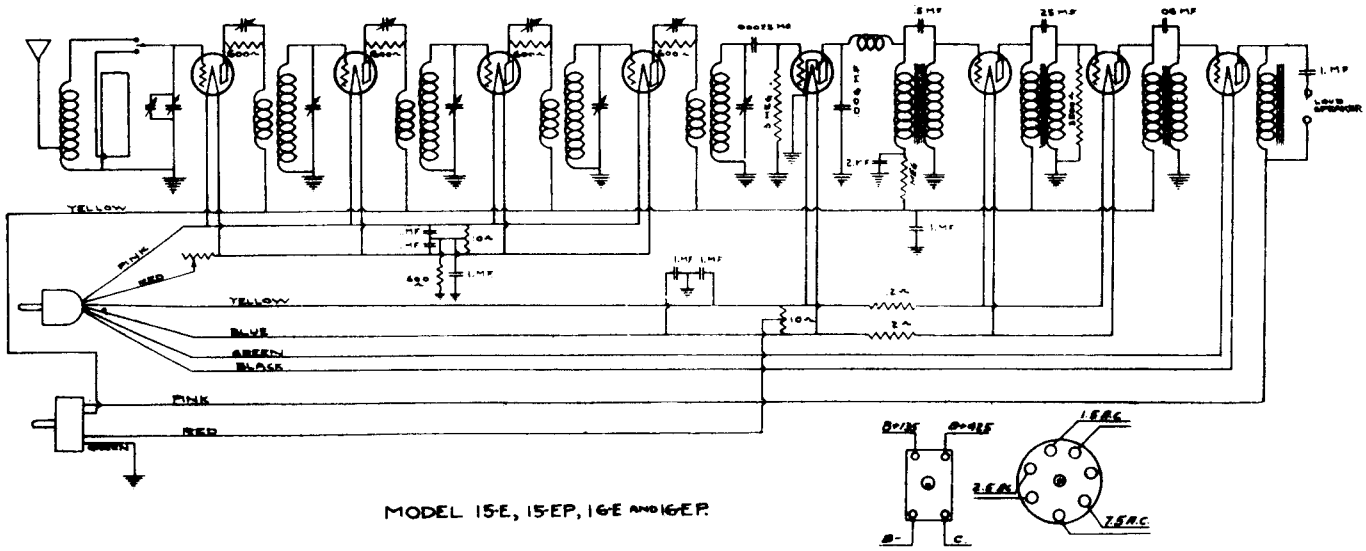




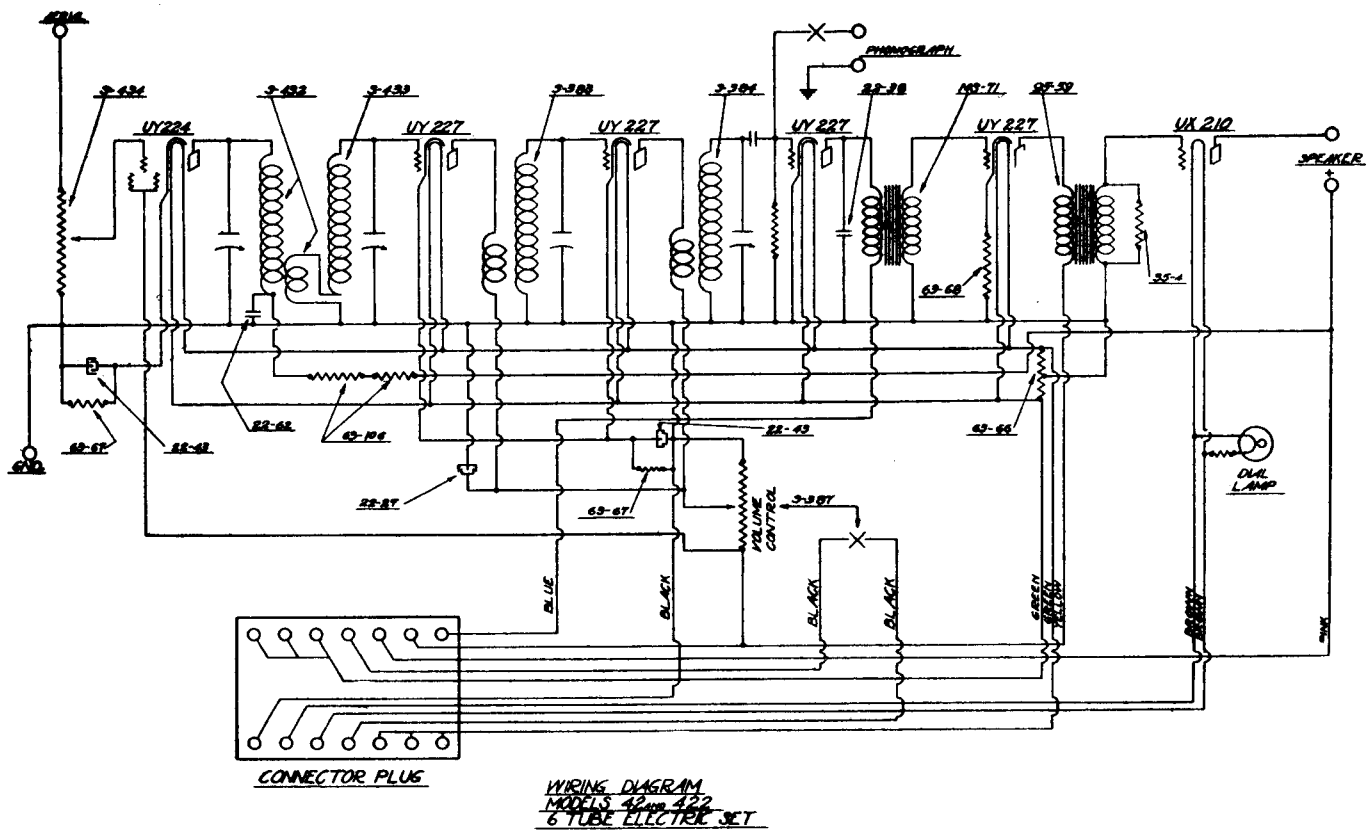
ZENITH RADIO CORP.



MODEL 15 AND 16



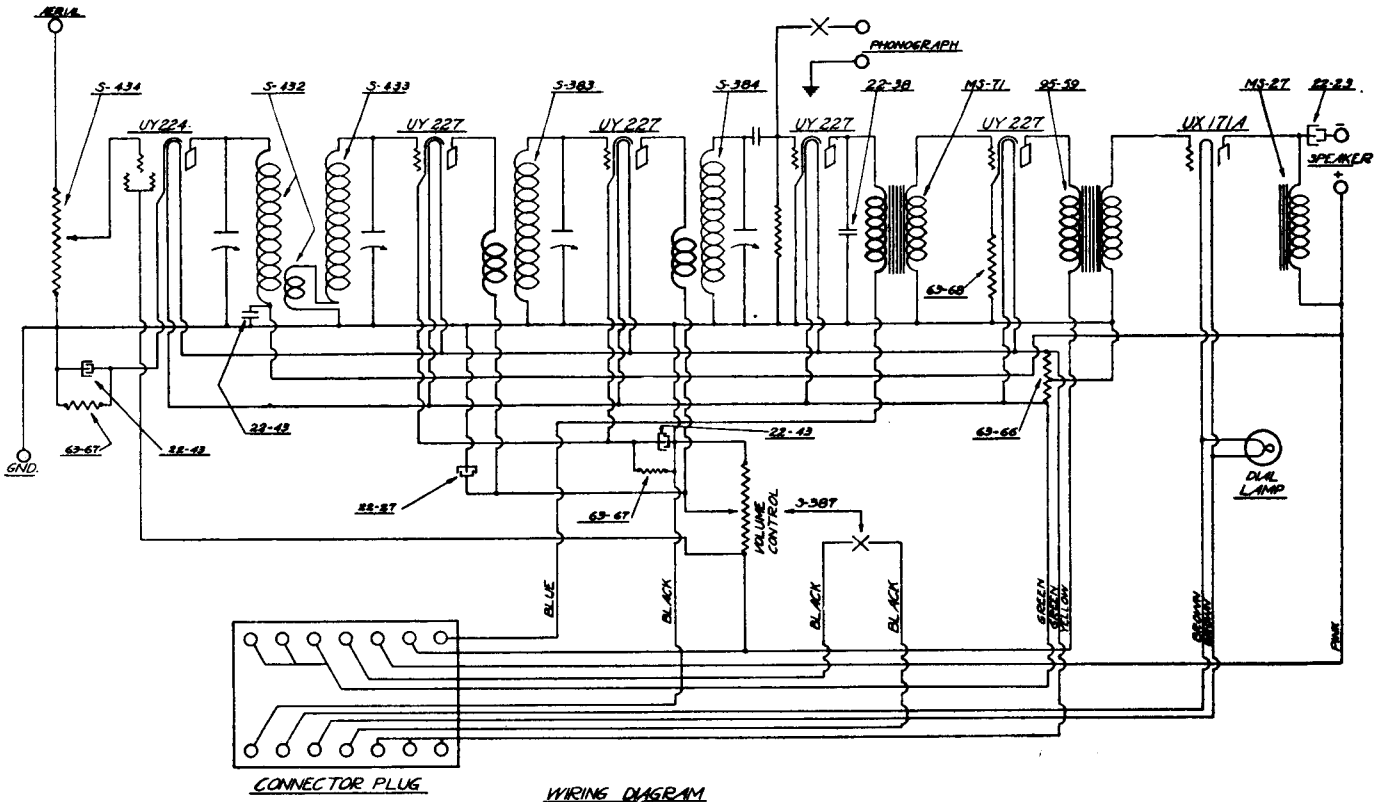
MODEL 15-E, 15-EP, 16-E AND 16-EP



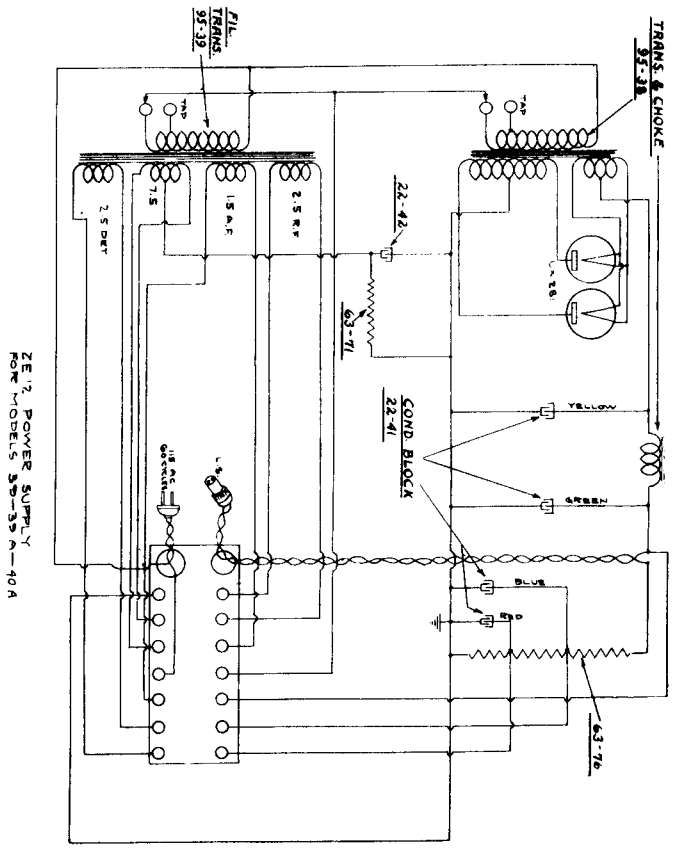
CONNECTOR PLUG

WIRING DIAGRAM
MODELS 42 AND 422
6 TUBE ELECTRIC SET

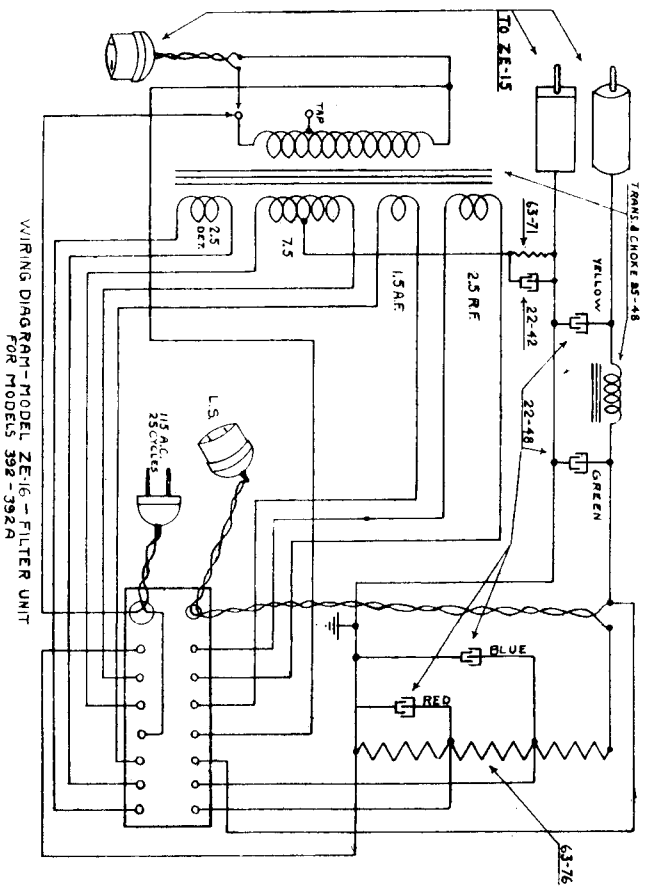
ZENITH RADIO CORP.



WIRING DIAGRAM
MODELS 41 AND 42
6 TUBE ELECTRIC SET

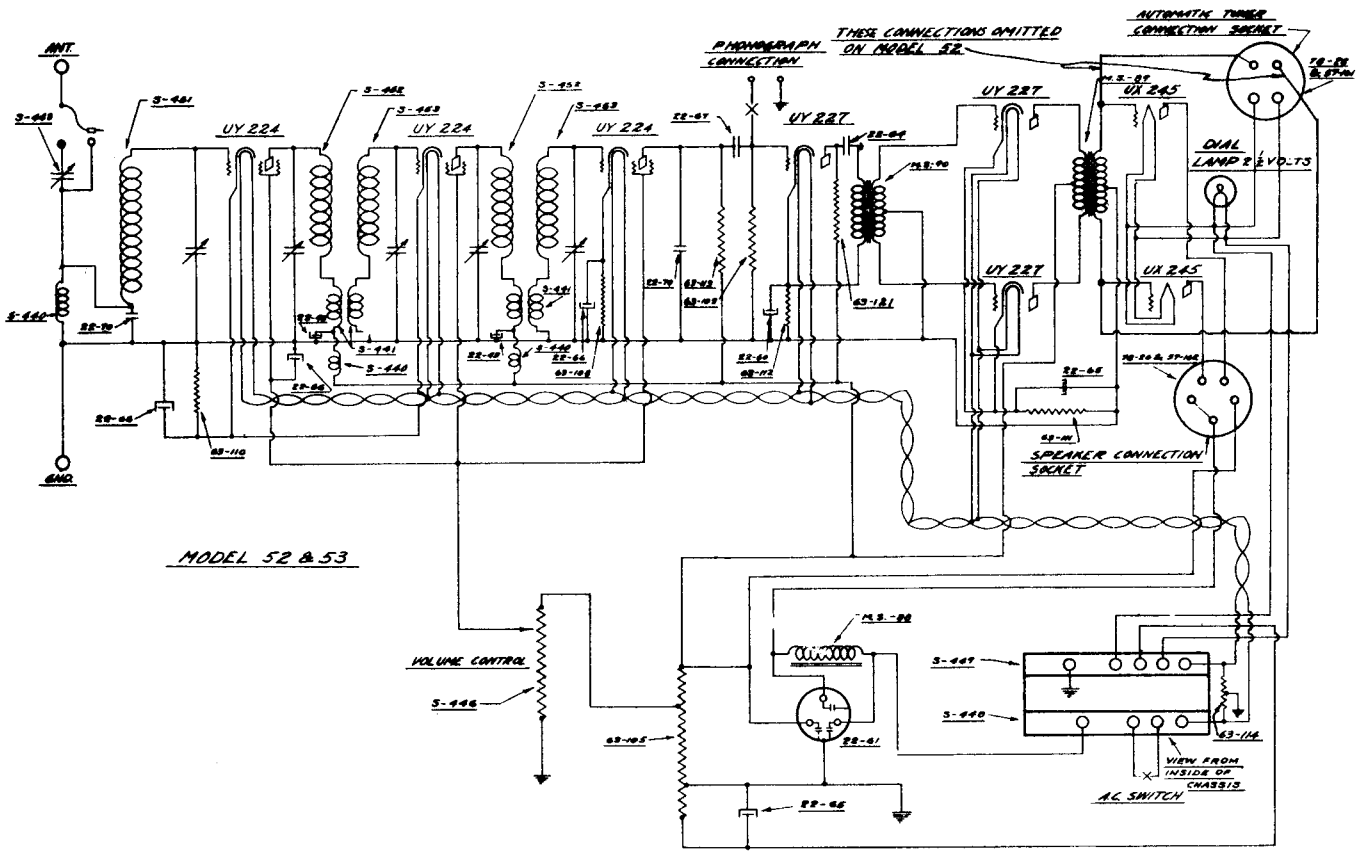


ZE-12 POWER SUPPLY
FOR MODELS 390-390A-40A

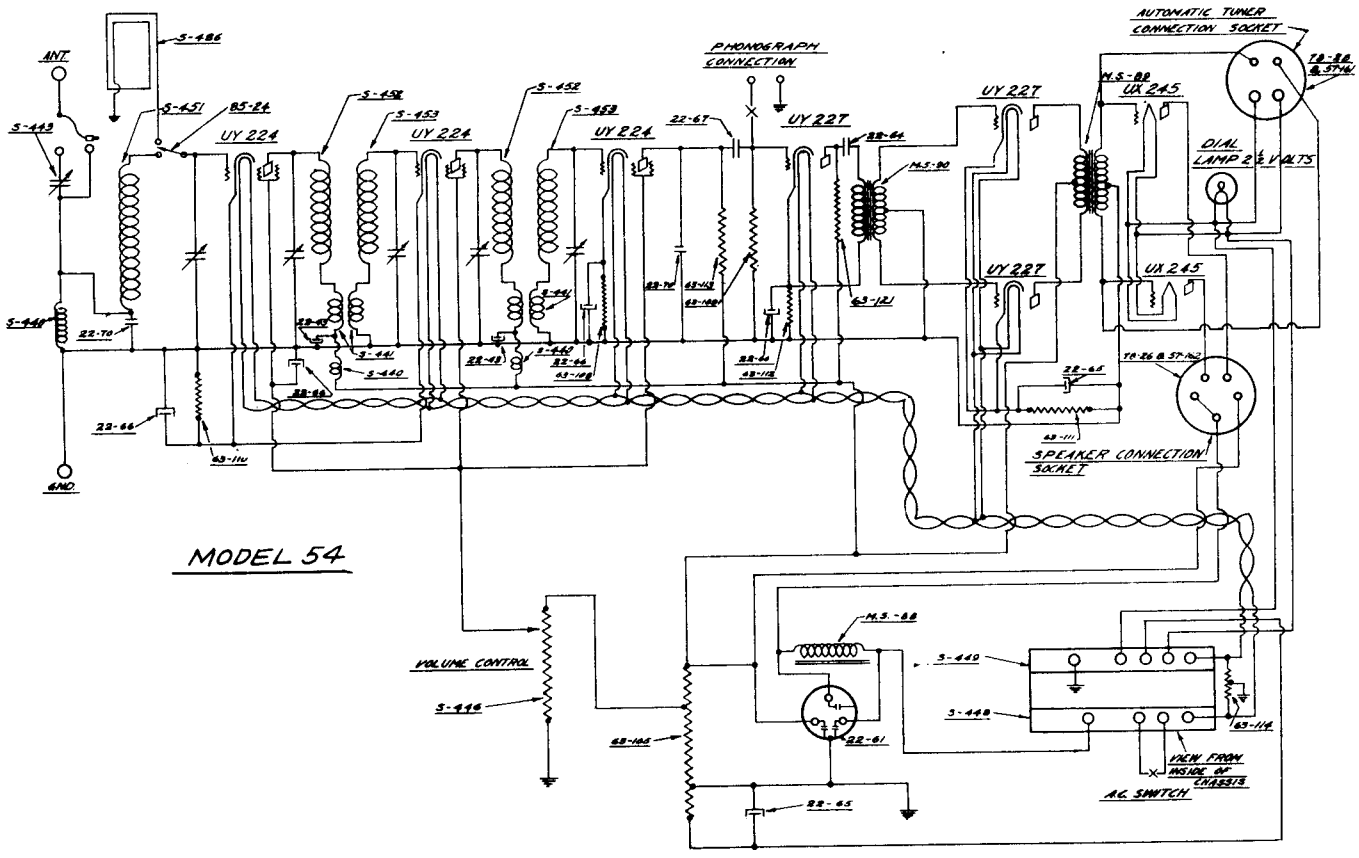


WIRING DIAGRAM - MODEL ZE-16 - FILTER UNIT
FOR MODELS 392-392A

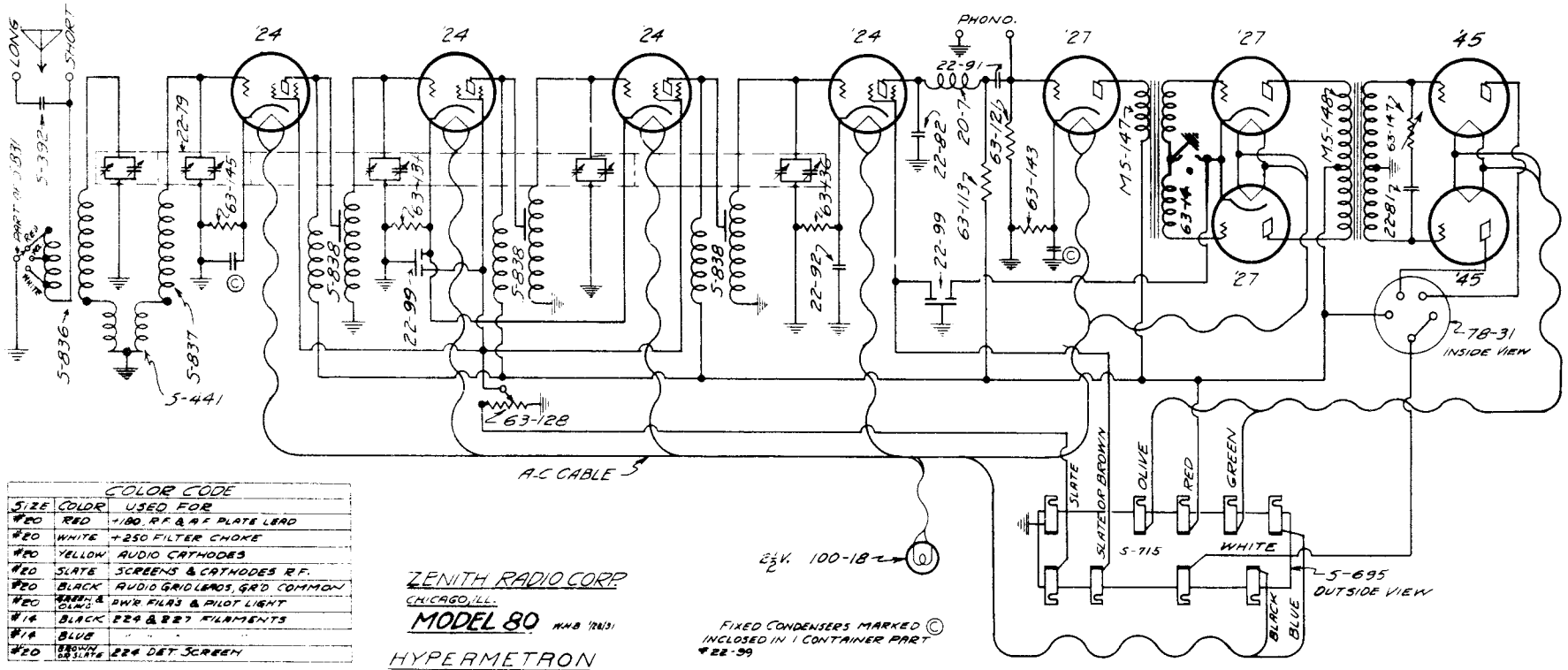
ZENITH RADIO CORP.



MODEL 52 & 53



MODEL 54



COLOR CODE

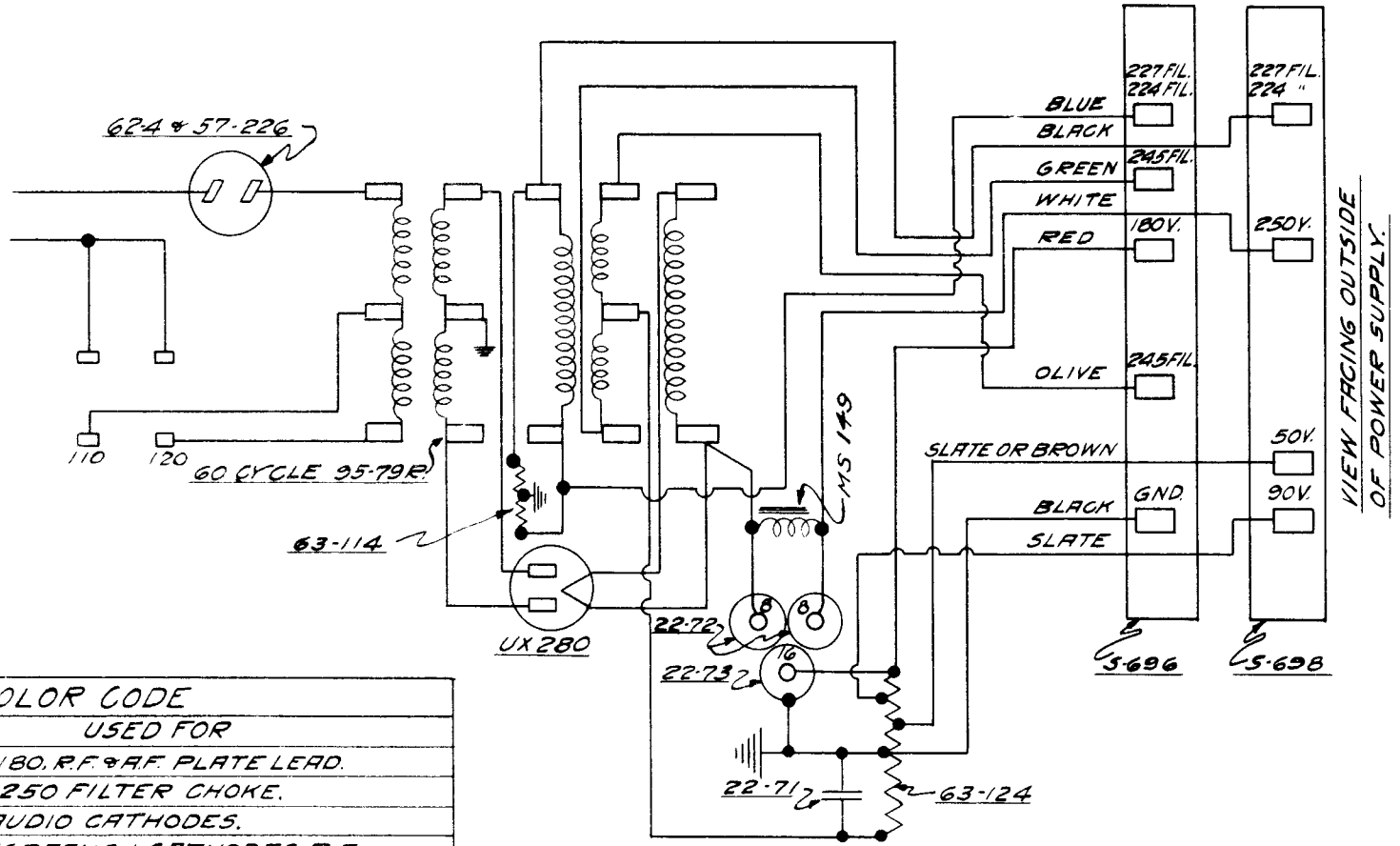
SIZE	COLOR	USED FOR
#20	RED	+180 R.F. & A.F. PLATE LEAD
#20	WHITE	+250 FILTER CHOKE
#20	YELLOW	AUDIO CATHODES
#20	SLATE	SCREENS & CATHODES R.F.
#20	BLACK	AUDIO GRID LEADS, GR'D COMMON
#20	BROWN OR OLIVE	PWR. FILAS & PILOT LIGHT
#14	BLACK	224 & 227 FILAMENTS
#14	BLUE	
#20	BROWN OR SLATE	224 DET. SCREEN

Fixed Condensers

22-81	Single .01 mf Condenser	(Tone Control Cond.).
22-82	Single .001 " "	(Detector Plate).....
22-91	Single .03 " "	(Audio Coupling).....
22-92	Single .5 " "	(Det. Cathode Bypass)
22-99	Dual .1 " "	(2nd RF & Det.Bypass)
S-392	Antenna Series Condenser	

Resistors

63-113	250M Ohm Resistor	(Red,Green End,Yellow Dot)...
63-121	100M " "	(Pink).....
63-131	400 " "	(Yellow,Black End, Brown Dot)
63-136	50M " "	(Green, Black End, Orange Dot)
63-143	4M " "	(Yellow, Black End, Red Dot)
63-145	800 " "	(Gray, Black End, Brown Dot)
63-146	2000 " "	(Red, Black End, Red Dot)



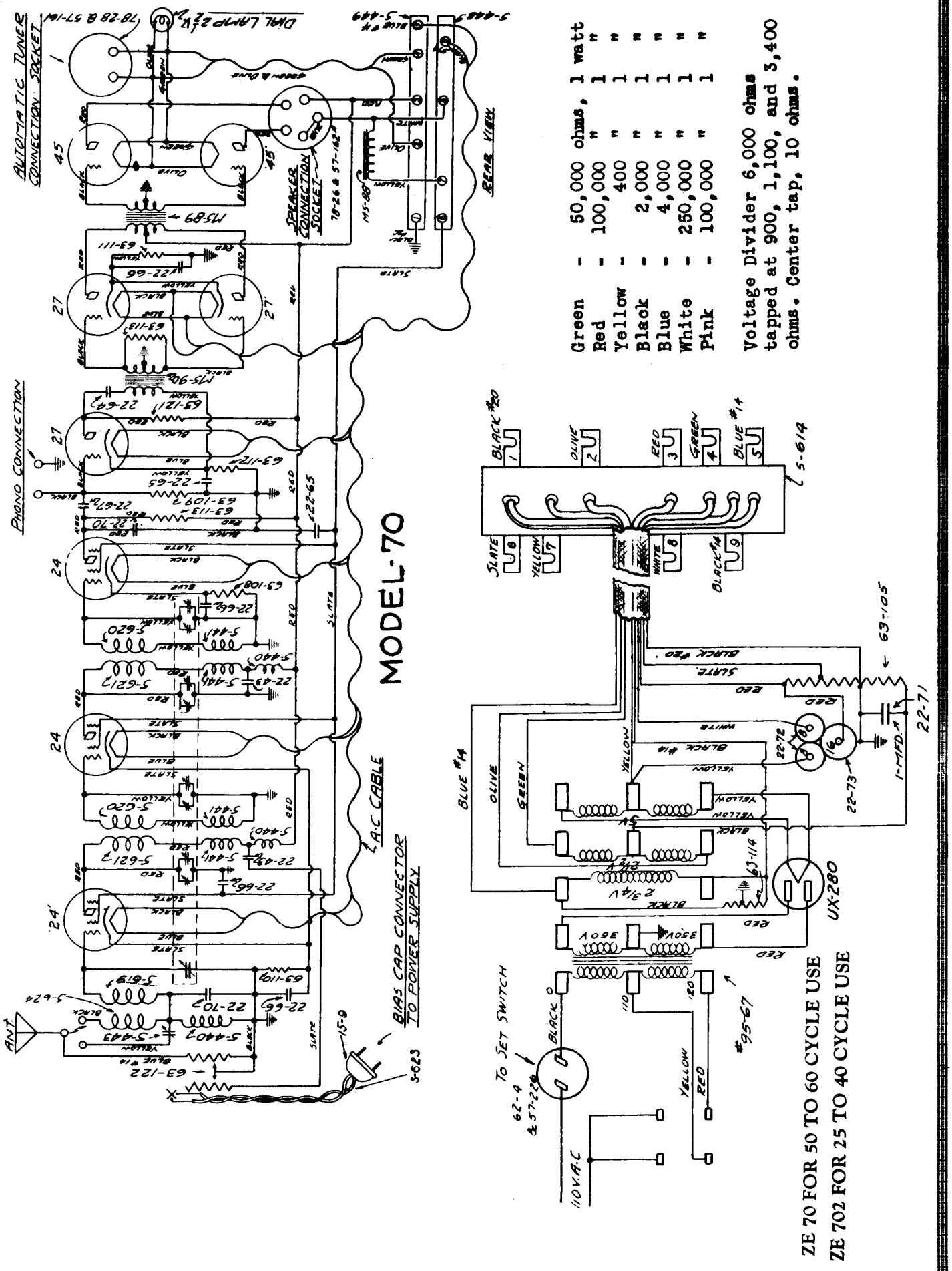
COLOR CODE		
SIZE	COLOR	USED FOR
#20	RED	+180. R.F. & A.F. PLATE LEAD.
#20	WHITE	+250 FILTER CHOKE.
#20	YELLOW	AUDIO CATHODES.
#20	SLATE	SCREENS & CATHODES R.F.
#20	BLACK	AUDIO GRID LEADS, GR'D COMMON.
#20	GREEN & OLIVE	POWER FILA'S. & PILOT LIGHT.
#14	BLACK	224 & 227 FILAMENTS.
#14	BLUE	" " "
#20	BROWN OR SLATE	224 DET. SCREEN.

ZENITH RADIO CORP.
CHICAGO, ILL.
MODEL 80

22-71	1. mf	Condenser.....(Power Bias)..
22-72	8. " "	.....(Electrolytic)
22-73	16. " "	.....(Electrolytic)
Note: 16 mf Condenser can be identified by Blue marking		
63-114	10 Ohm	Center Tap Resistor.....
63-124	10,450 "	Voltage Divider.....
57-226		Bias Plate.....
57-242		Bias Socket & Guide Plate.....
78-32		Four Prong Socket for Rectifier.....
95-79		Power Transformer.....(60 Cycle)
95-93		Power Transformer.....(25 Cycle)
136-2		2 Amp Fuse.....
S-696		Terminal Strip Assem.....(Five)
S-698		Terminal Strip Assem.....(Four)
S-700		Fuse Receptacle & A.C. Outlet Plate
MS-149		Power Choke

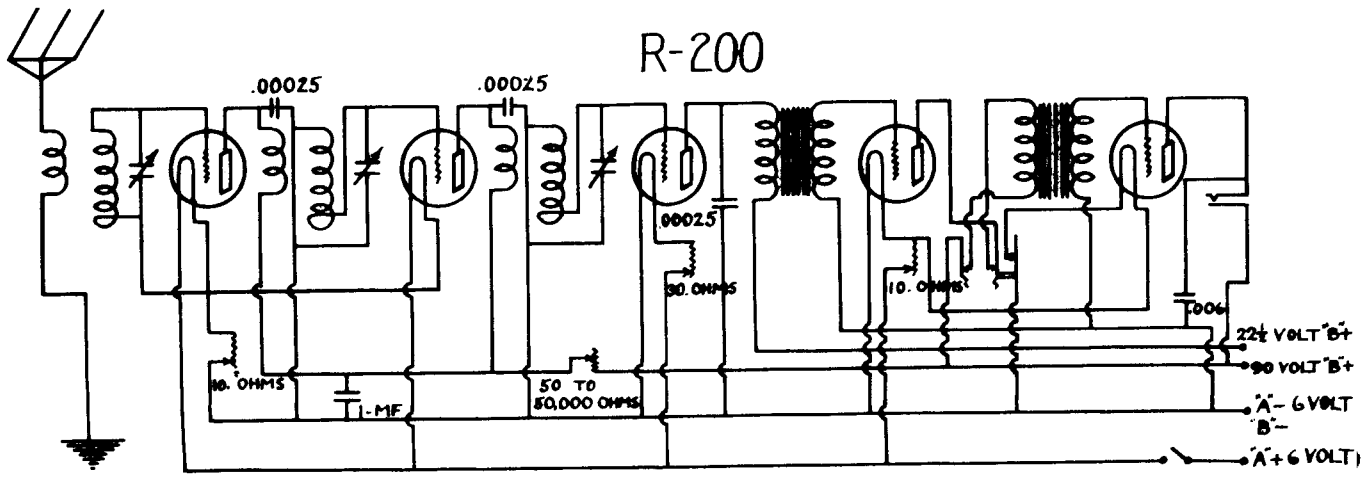
ZENITH RADIO CORP.

ZENITH RADIO CORP.

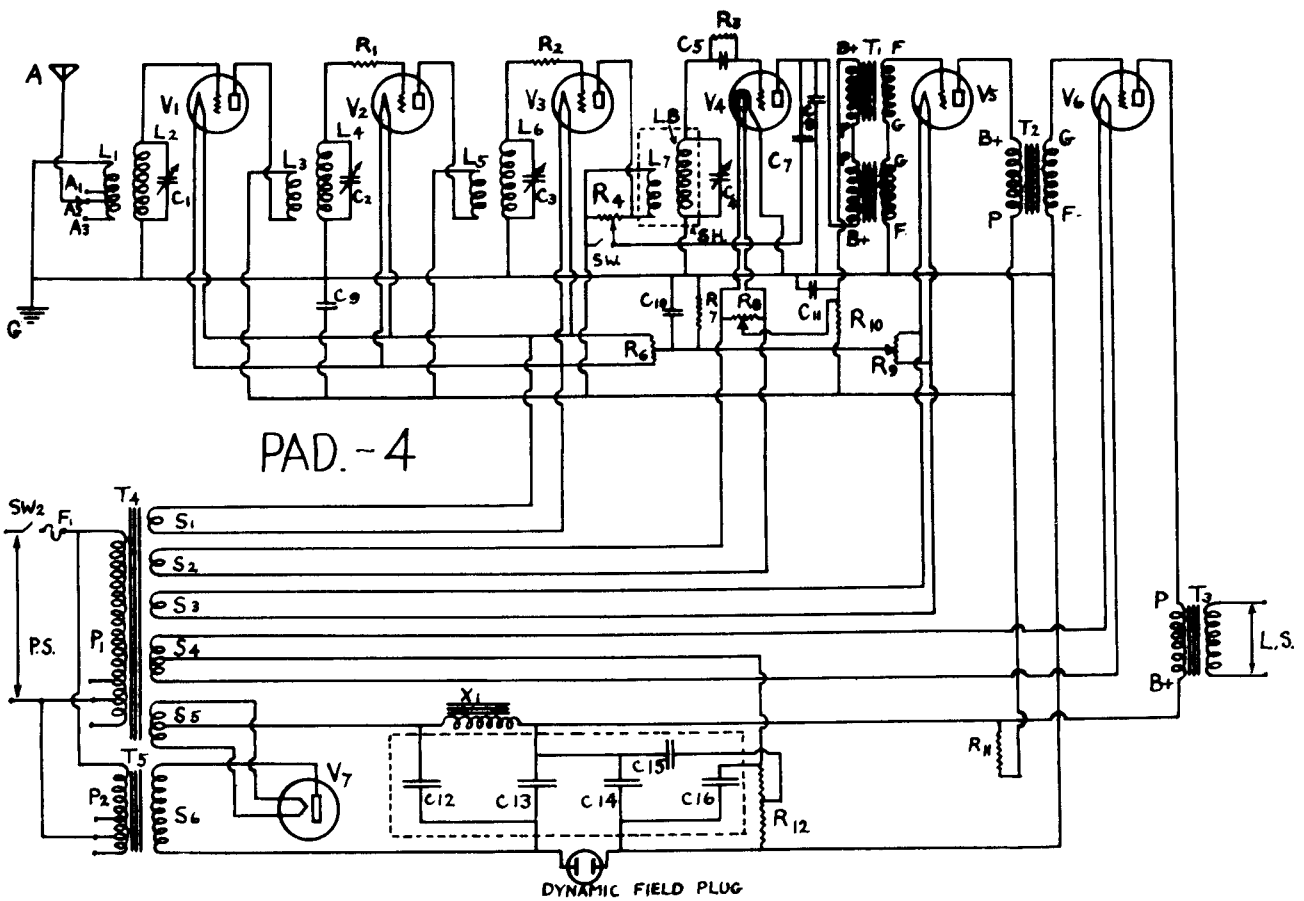


SPLITDORF ELEC., MFG., CO.

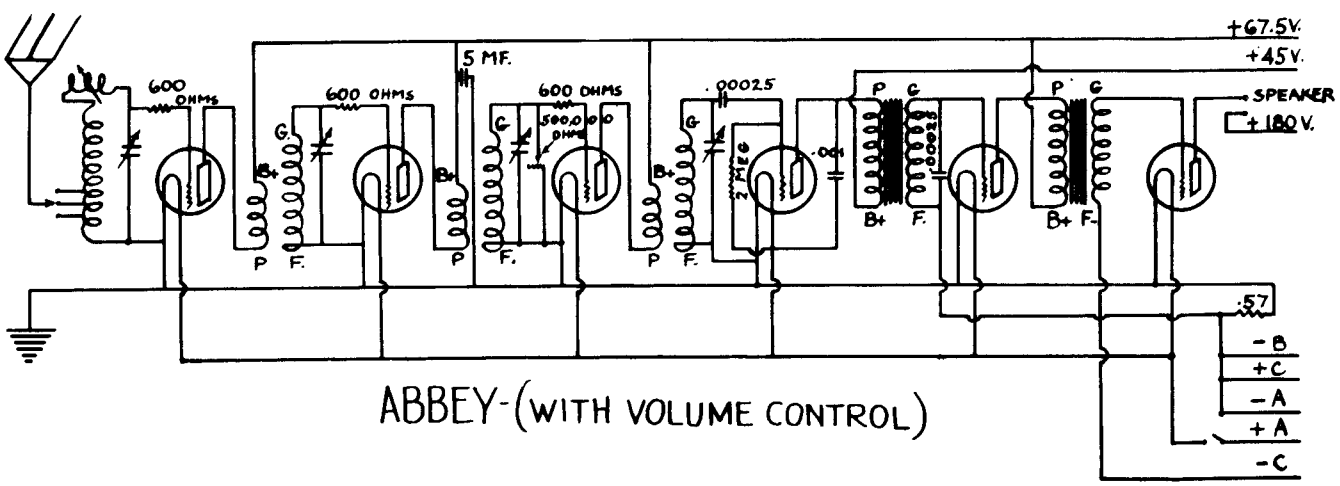
R-200



PAD.-4

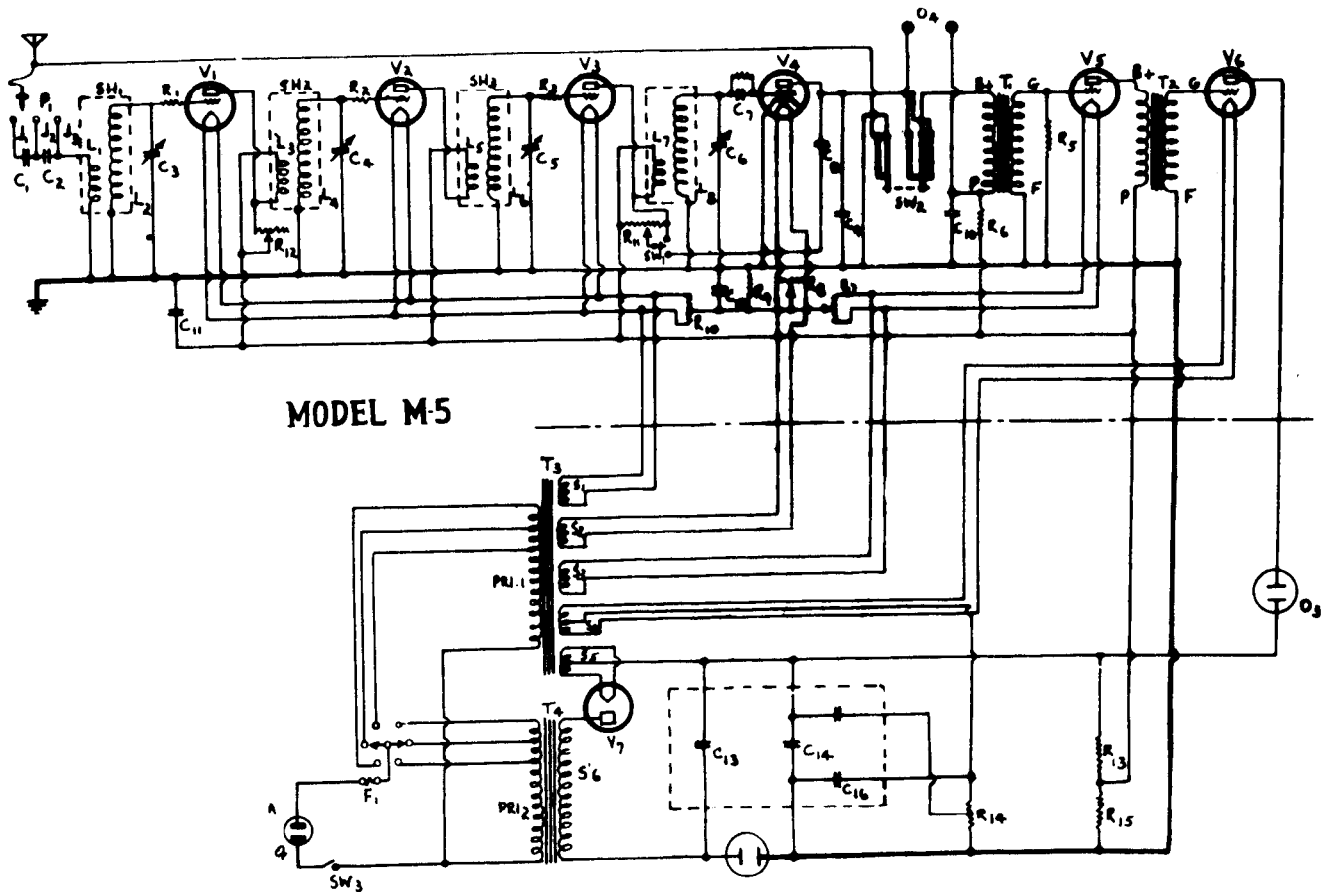


ABBEY-(WITH VOLUME CONTROL)



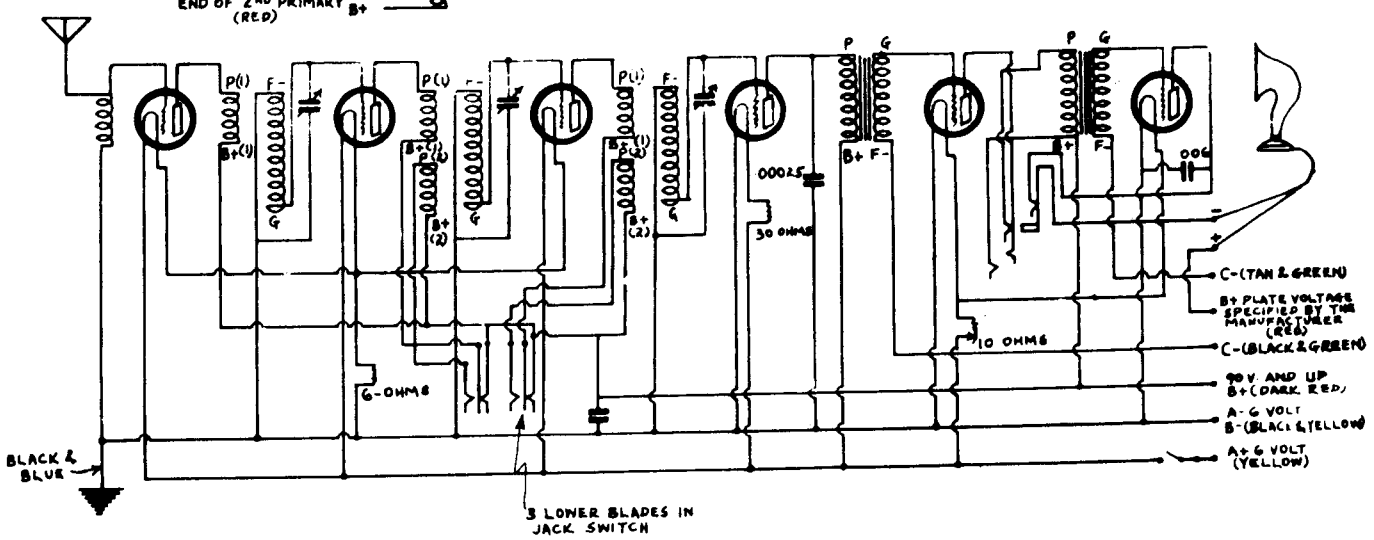
SPLITDORF ELECTRIC MFG. CO.

MODEL M-5

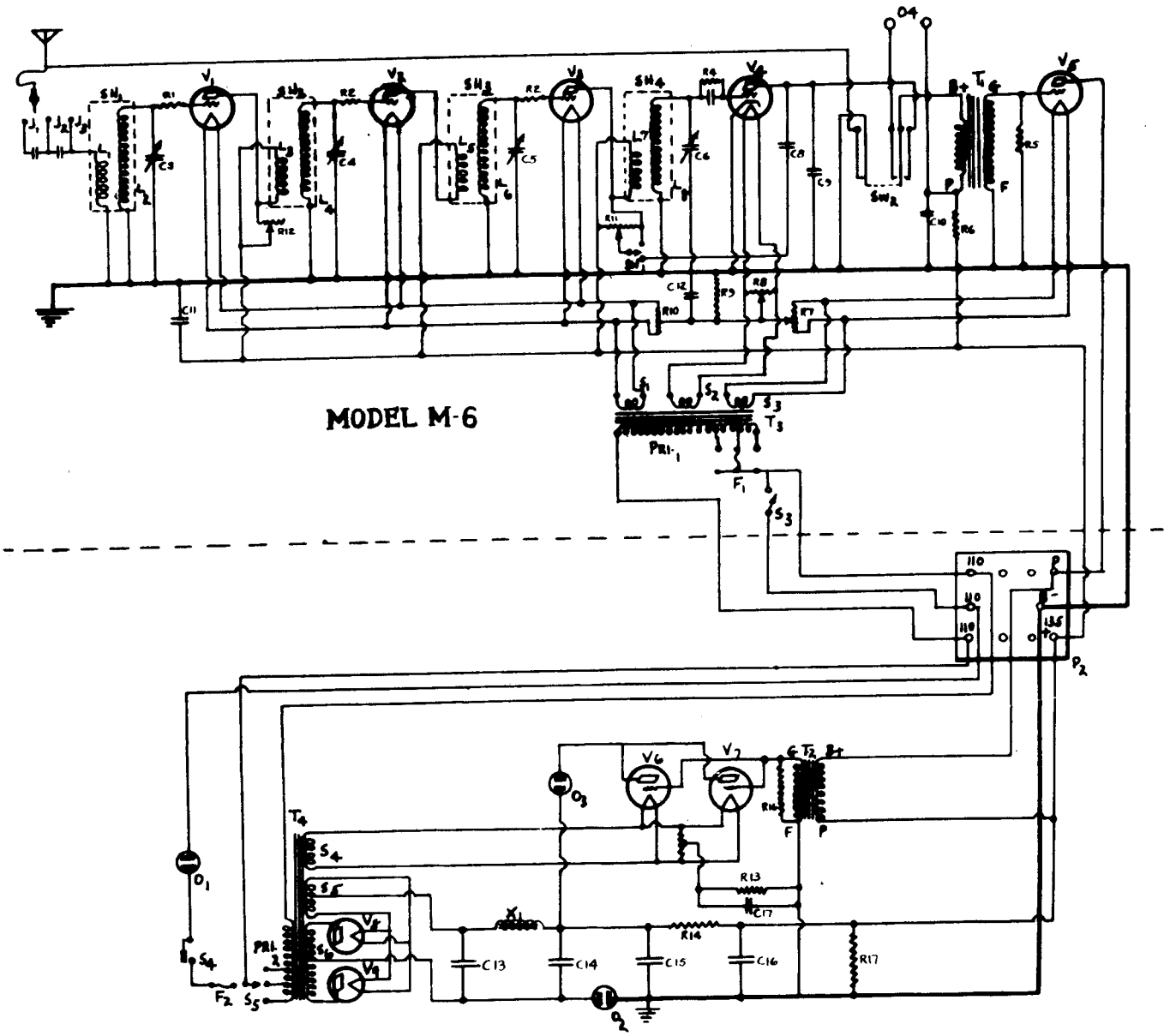


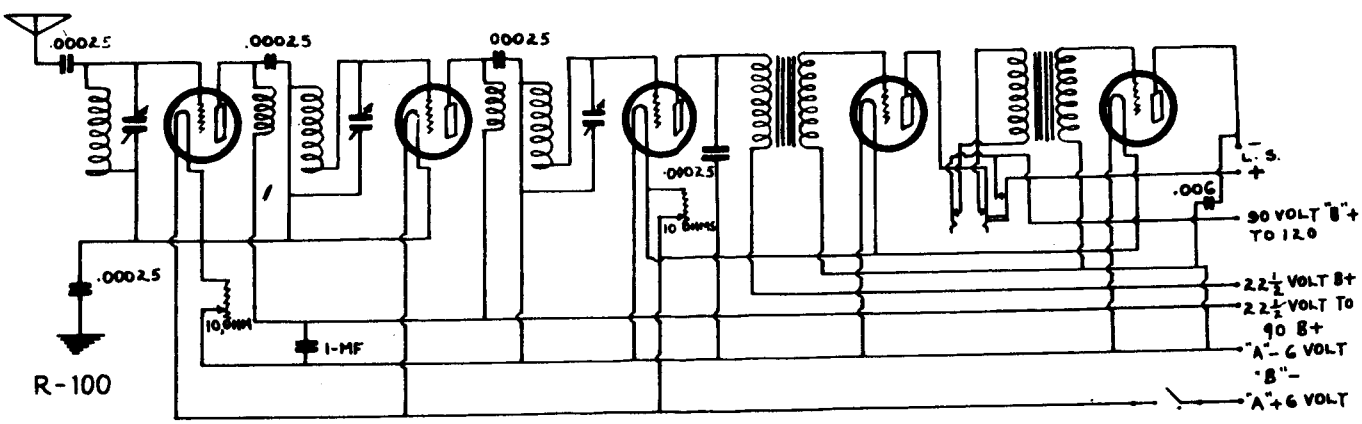
INSIDE LEAD OR START OF 1ST PRIMARY (RED) P(1)
END OF 1ST PRIMARY (RED) B+(1)
BEGINNING OR START OF 2ND PRIMARY (RED) P(2)
END OF 2ND PRIMARY (RED) B+
START OF SECONDARY (GREEN) F-
OUTSIDE LEAD OR END OF SECONDARY (GREEN) G

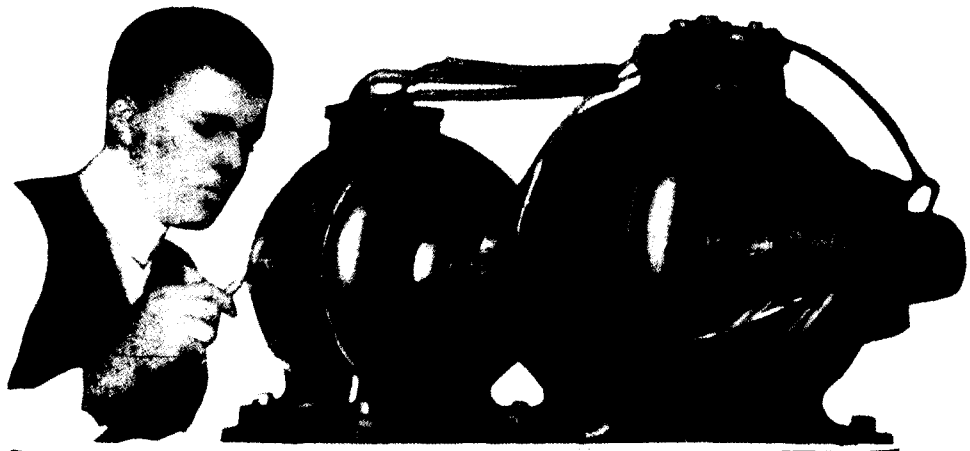
R-V-695



SPLITDORF ELECTRIC MFG. CO.







Amazingly Easy Way to get into ELECTRICITY

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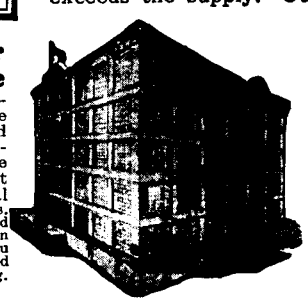
No books, no baffling charts . . . all real actual work . . . right here in the great Coyne school . . . building real batteries . . . winding real armatures, operating real motors, dynamos and generators, wiring houses, etc., etc. That's a glimpse of how we make you a master practical electrician in 90 days, teaching you far more than the average ordinary electrician ever knows and fitting you to step into jobs leading to big pay immediately after graduation. Here, in this world-famous *Parent school*—and nowhere else in the world—can you get this training!

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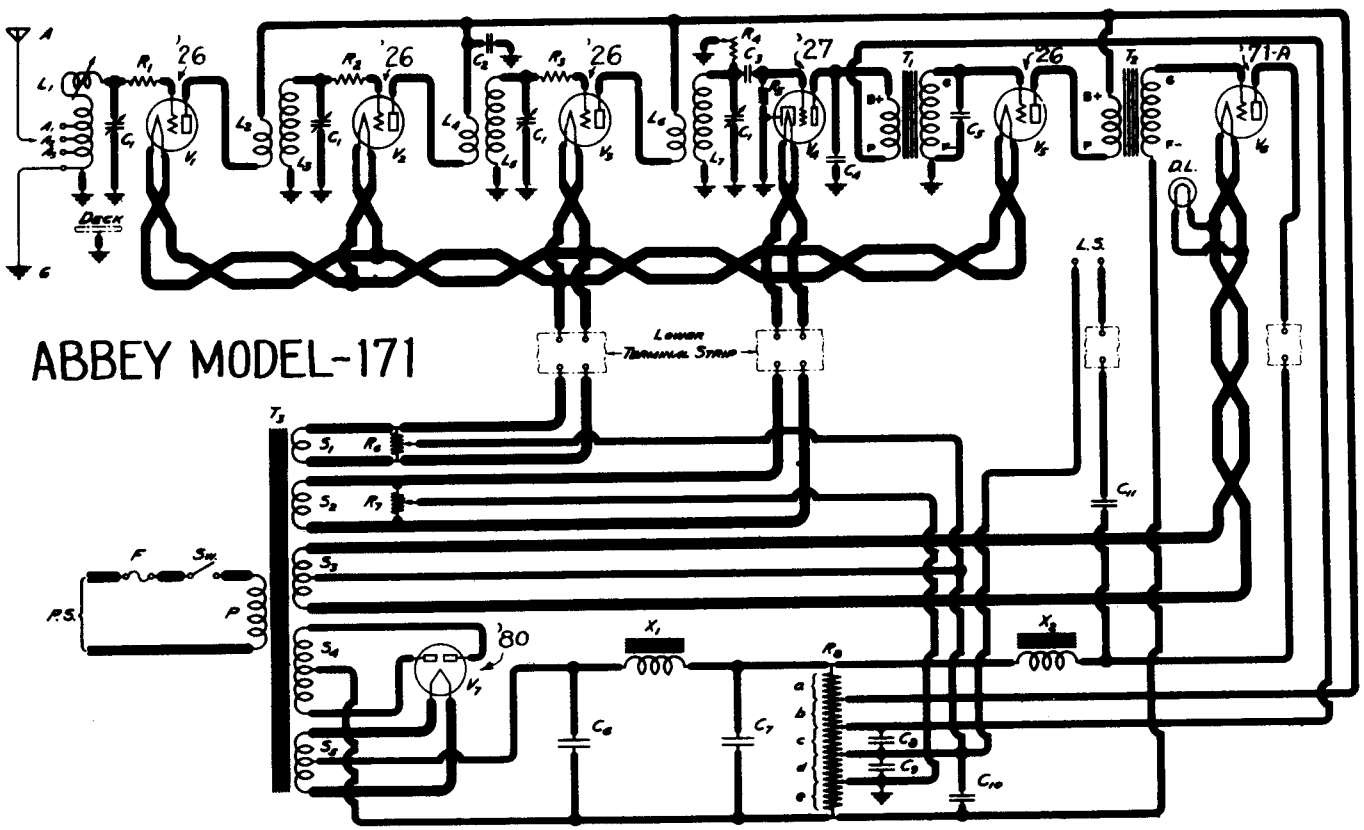
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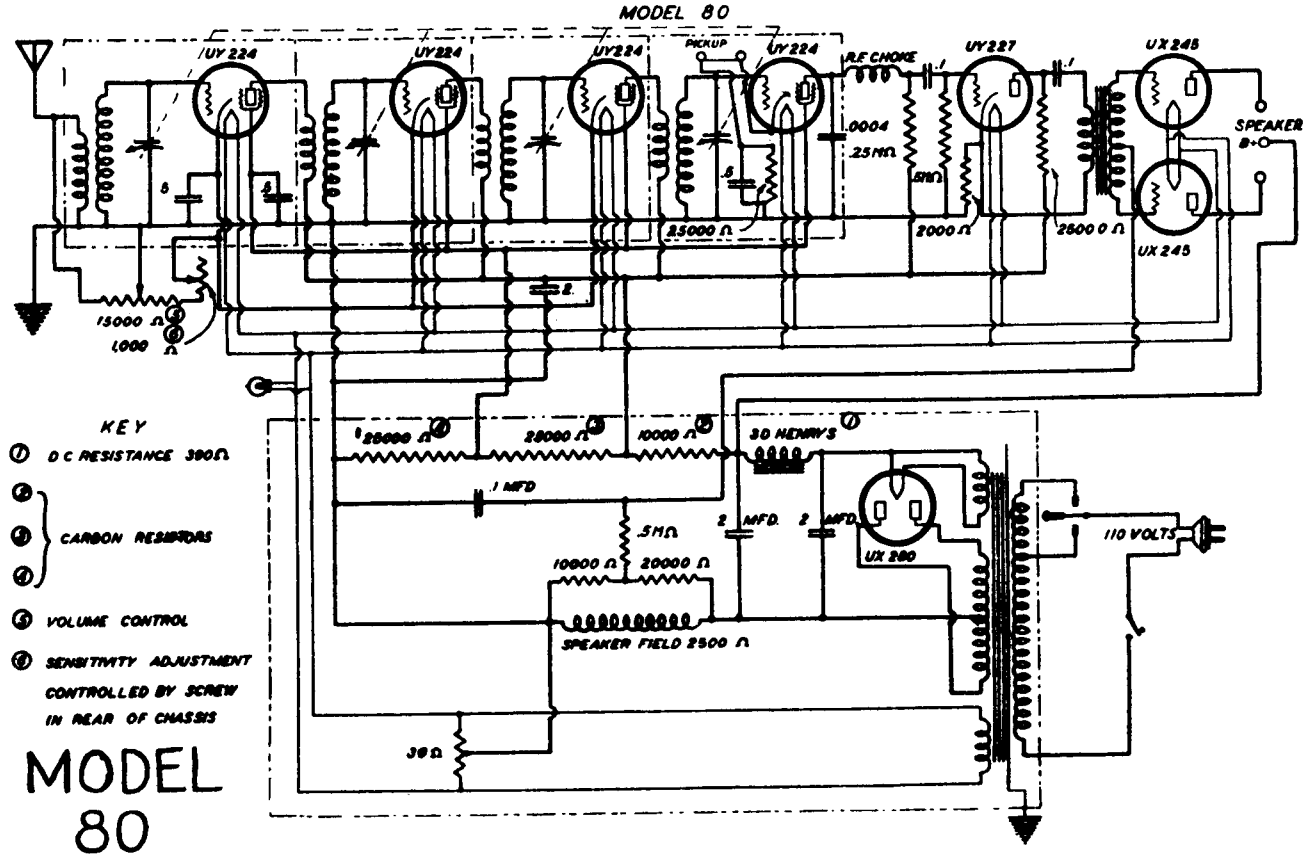
SPLITDORF ELEC., MFG., CO.



NATHANIEL BALDWIN CO.

SCHEMATIC DIAGRAM OF BALDWIN SCREEN GRID RECEIVING SET

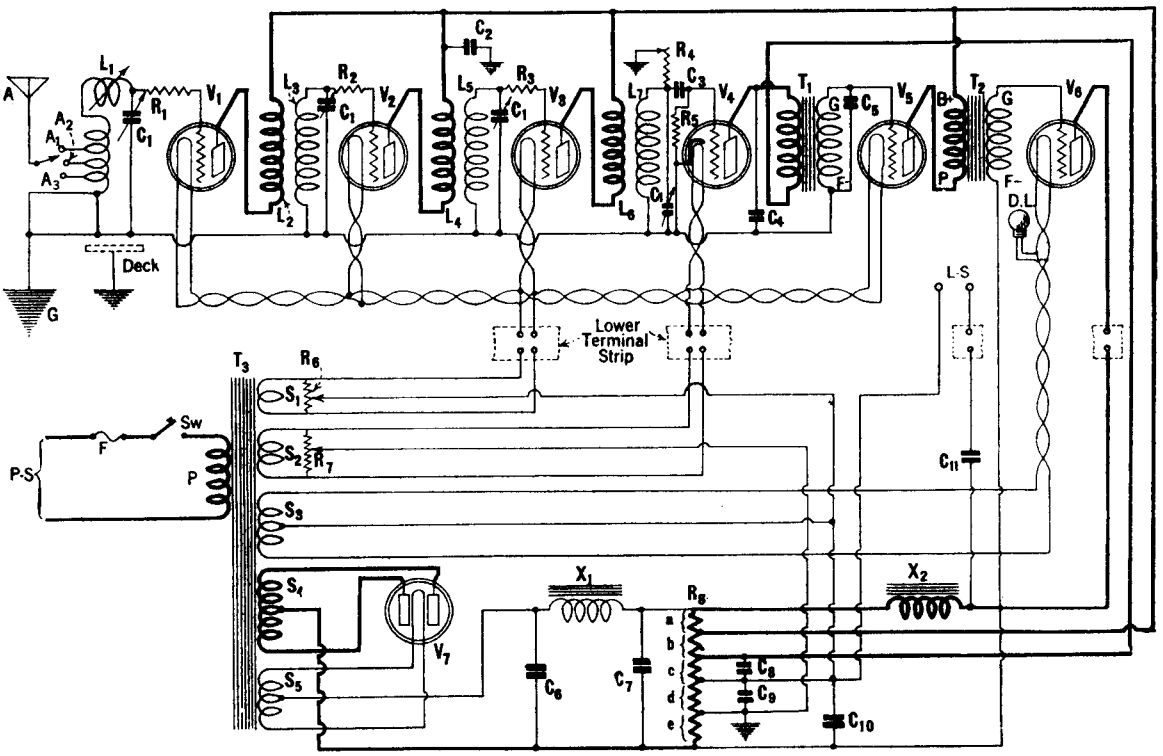
MODEL 80



MODEL 80

SPLITDORF ELECTRIC MFG. CO.

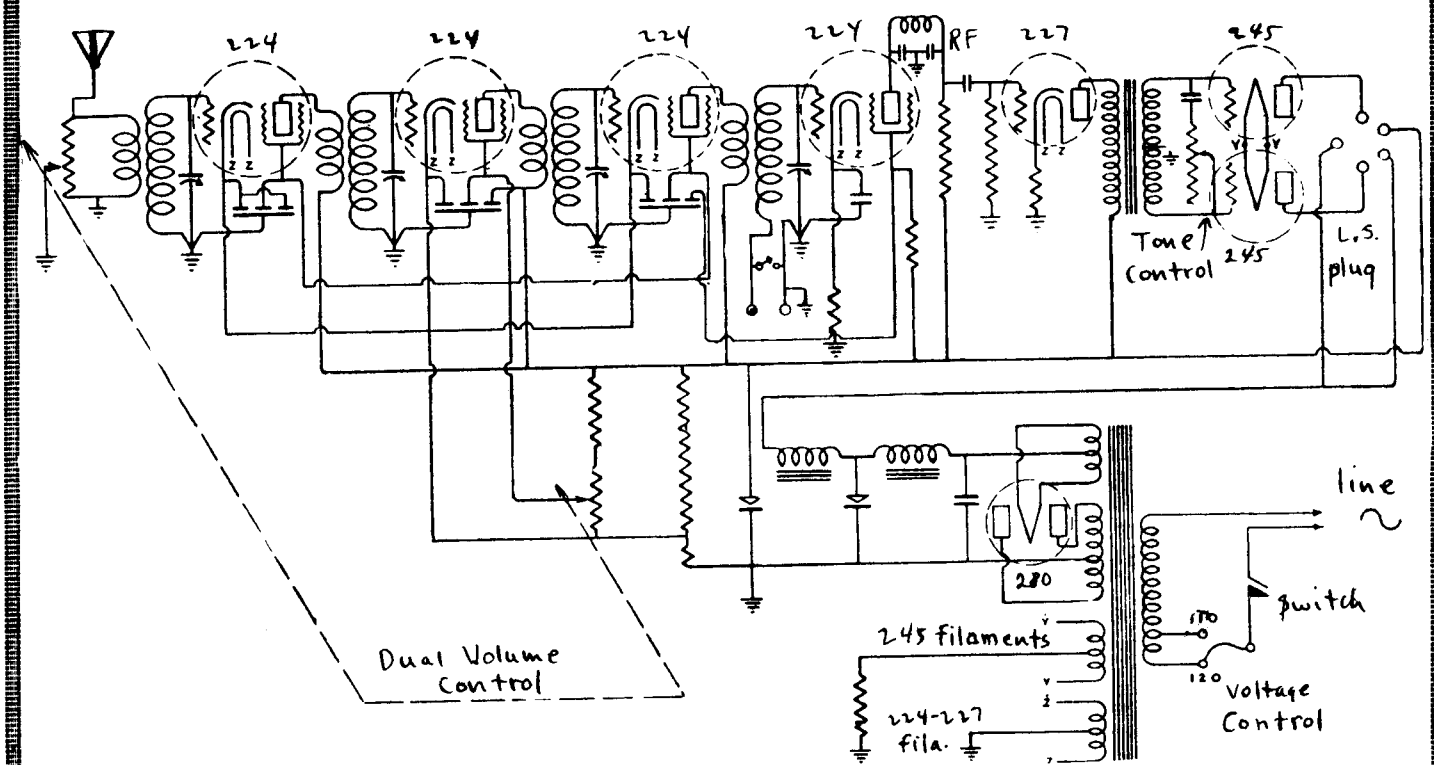
"INHERENTLY ELECTRIC" MODEL



C1—Four-gang variable, .00035 mf. per section.
R1, R2, R3—600-ohm grid resistors.
C3, R5— .00025 mf. and 2 megohms.
C2—0.5 mf.
C8, C10—1.0 mf.
C9—2.0 mf.
R8—13,200 ohms.
C6—4.0 mf.
C7—6.0 mf.
C4— .0001 mf.
C5— .00025 mf.
C11—1.0 mf.
R4—500,000 ohms.
T3—Power transformer.
R6, R7—30 ohms.

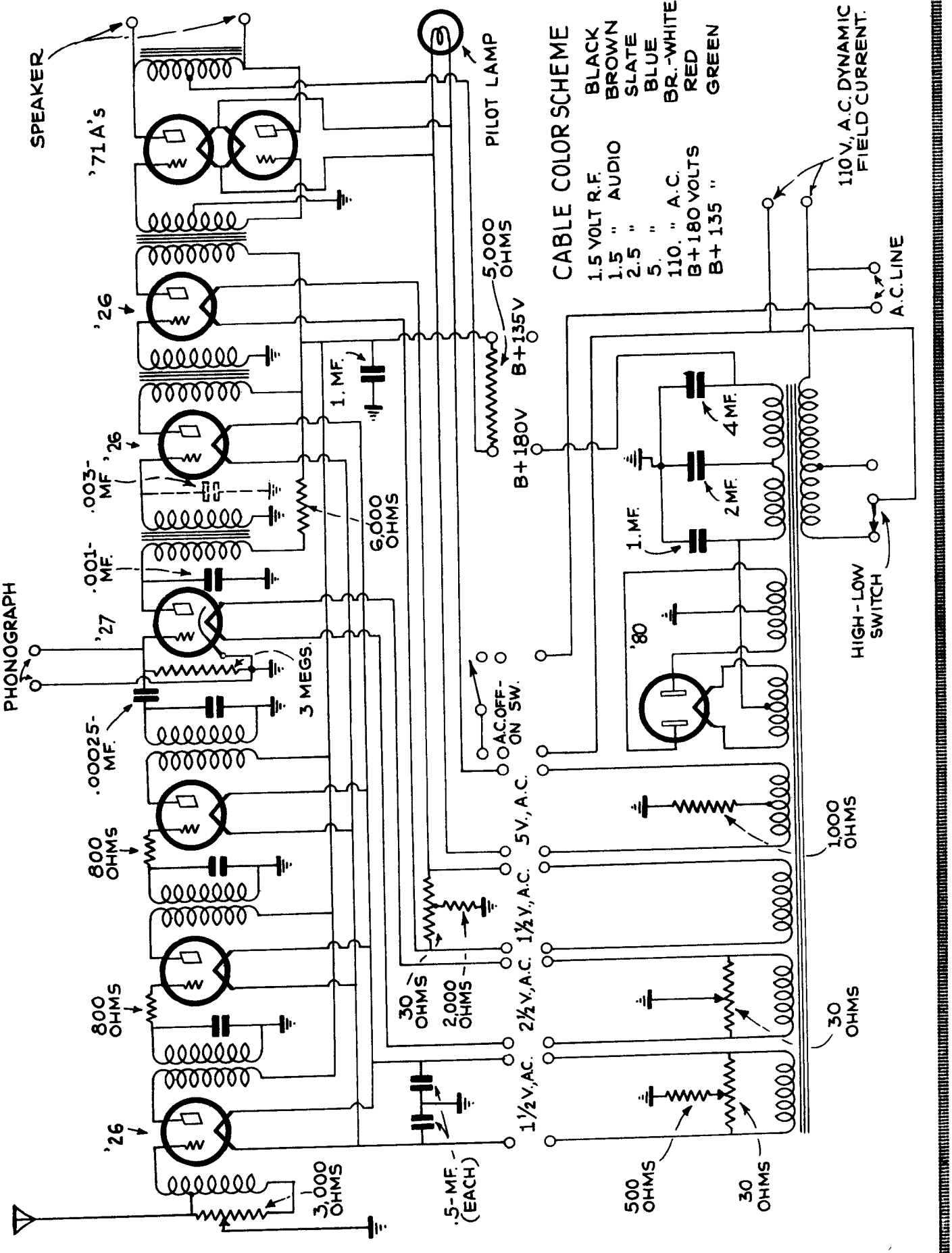
UNITED AIR CLEANER CO.

MODEL 50

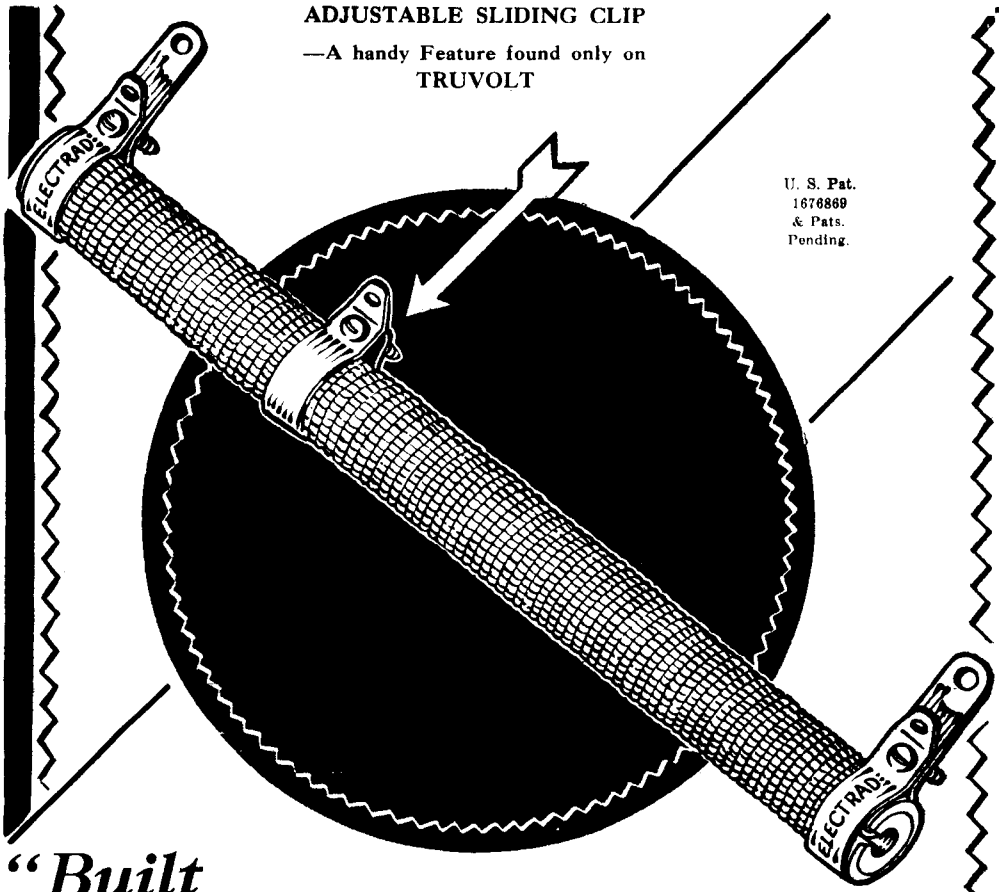


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ADJUSTABLE SLIDING CLIP
—A handy Feature found only on TRUVOLT



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Built to PERFORM!

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The radio service man is doing an important work in insuring radio owners satisfaction and the ELECTRAD organization welcomes the opportunity to be service men to service men.

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(Illustrated)

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The resistance wire is wound first around an asbestos core, having a flexible, enamelled copper center.

This winding is then in turn wound around a grooved fireclay base and firmly anchored at each terminal.

TRUVOLTS are made in all usual sizes and values and are ideal for eliminator and power-pack use.

TRUVOLT ADJUSTABLE has the same basic construction as the fixed types, but the resistance can be conveniently varied by knob control. There is a protective ventilating shield around the unit and provision is made for baseboard or panel mounting. The resistance element has unusually long life and gives smoother variation, as the contact travels *endwise* over the wire. 22 stock sizes, $2.50.

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A Great Convenience in Repair Work

The fixed type TRUVOLTS are really *semi-variable*, on account of one or more sliding adjustable clips in between the main terminals (*see illustration*). This is an *exclusive* feature of great value in experimental work, or in making repairs where exact resistance values are desired.

No other type resistance affords this convenience.

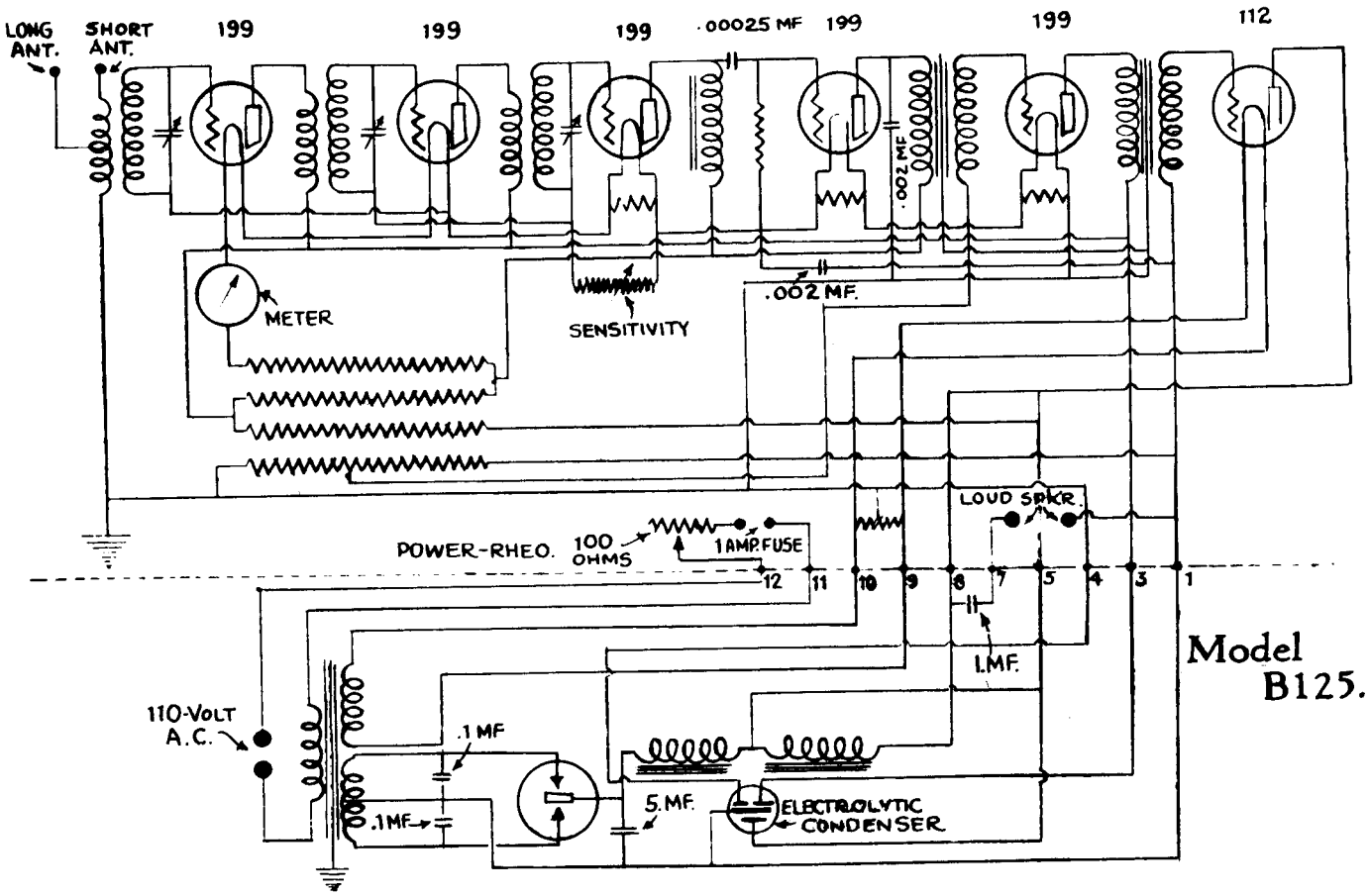
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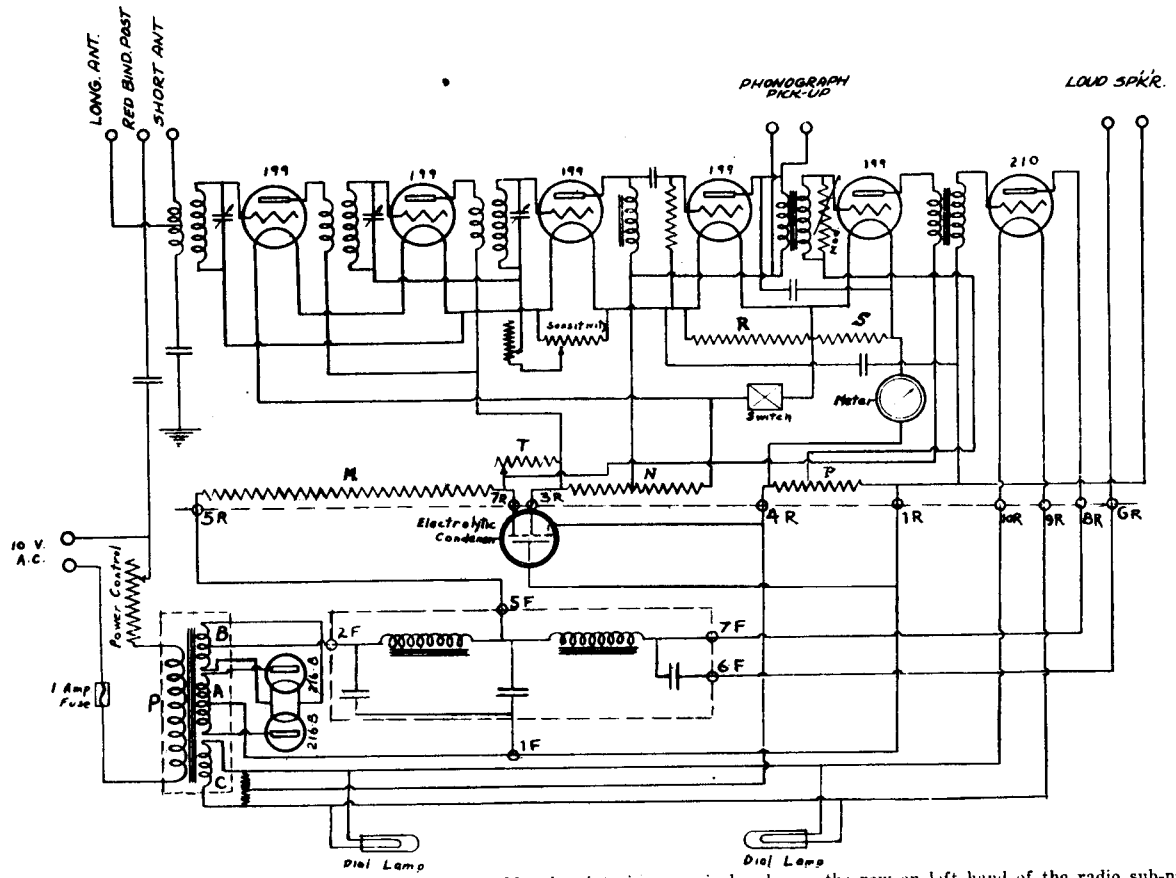
Address.....

ARGUS RADIO CORP.



Model B125.

DIAGRAM OF TYPE B-195 ARGUS ELECTRIC RADIO RECEIVER



The numerals followed by letter "R" indicate soldered points in numerical order on the row on left hand of the radio sub-panel (when facing the receiver) and counting from front towards rear.

The numerals followed by letter "F" indicate the leads from the filter box counting from front towards rear (count also the "blank" holes.)

KEEP STEP WITH RADIO PROGRESS!



RADIO is one of the real marvels of this modern age. Its development has been phenomenal. It is growing, changing, evolving new principles which require constant study. The demand is for technically trained men—men who keep pace with the unfolding revelations of this mighty and promising industry.

The International Correspondence Schools Course in Radio, prepared and constantly supplemented by outstanding authorities in the field, is specifically designed to meet the requirements of the radio industry for technically trained radio men. The manufacturer, the distributor, the dealer, Communication and Steamship Companies, the U. S. Government, all insist upon up-to-date, expert training. Recognized for its completeness and practicability, an I.C.S. Radio Course provides this training.

Authorities responsible for the preparation of the I.C.S. Radio Course include: H. H. Beverage, Radio Corporation of America; George C. Crom, American Transformer Company; Keith Henney, author of "Principles of Radio;" Malcom E. Gager, instructor at the Massachusetts Institute of Technology; E. V. Amy, consulting radio engineer, formerly with R.C.A.; H. F. Dart, authority on radio tubes; Julius C. Aceves, consulting radio engineer, formerly of Columbia University, and others.

The I.C.S. Radio Course is complete, from the foundational principles of radio to the most advanced stages, thoroughly and scientifically covering every department of this vast industry. It is a modern education in radio, a valuable guide of advancement for men engaged professionally in the radio business. It also outlines the principles and possibilities of television.

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ATWATER KENT MFG. CO.

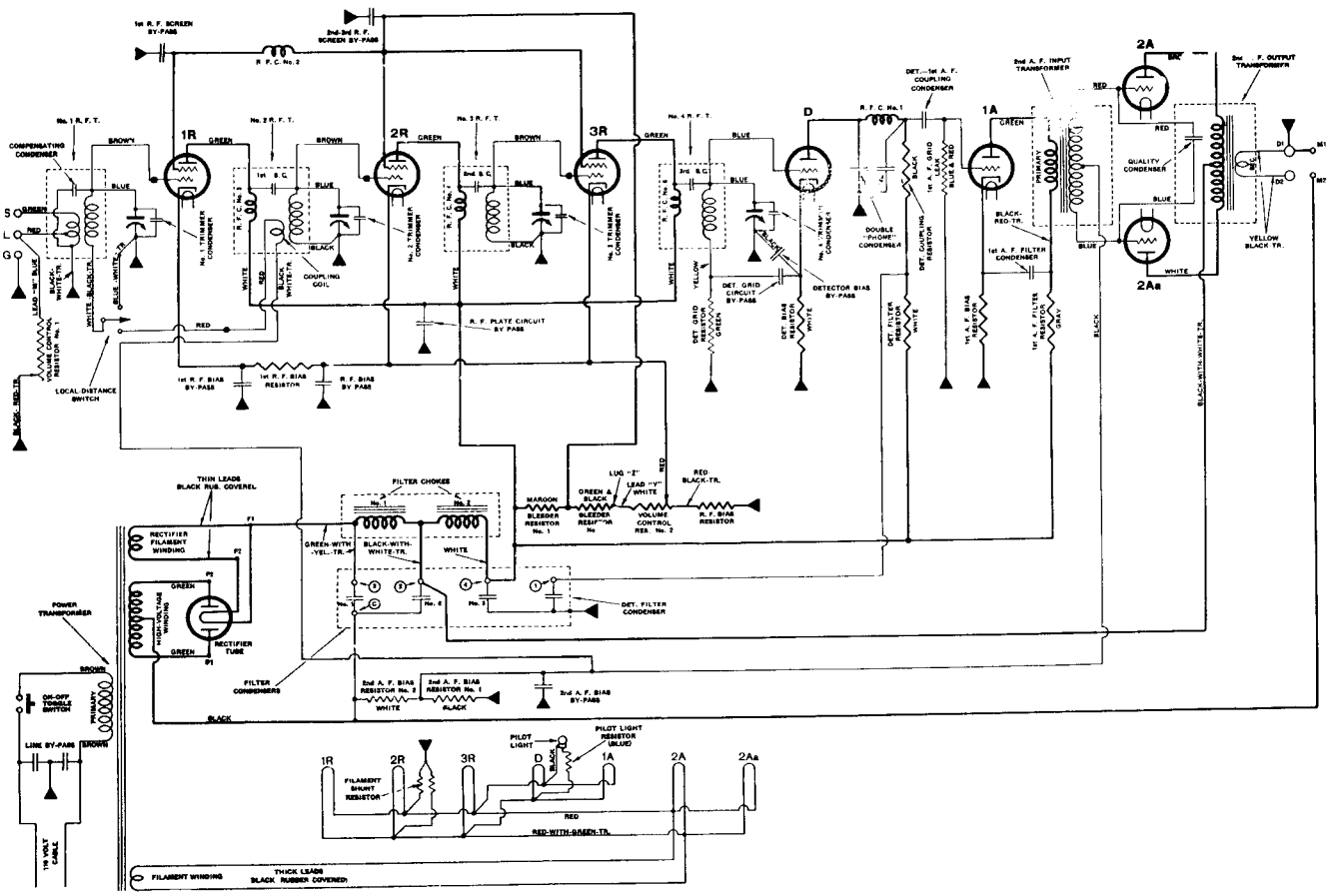
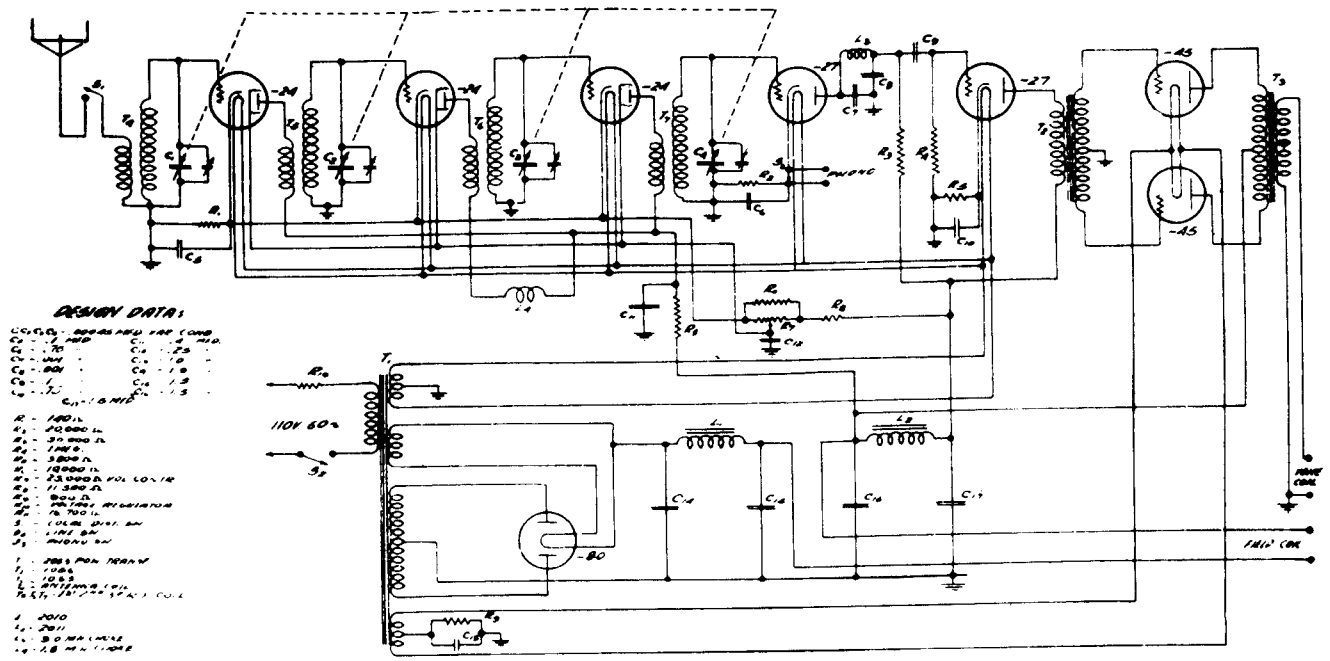


FIG. 202. SCHEMATIC DIAGRAM OF 3RD TYPE OF MODEL 60-C.

In the above diagram, "S.C." means stopping condenser.
In later types of this model, the leads from the filament winding are covered with light gray rubber or black sleeving, and the grid-return of No. 4 R.F.T. is yellow-with-black-tracer instead of yellow.
In a few of these models, the quality condenser is connected across the primary of the output transformer, the connections being made inside the unit:
In these sets, the output transformer has five leads instead of seven.

TRANS. CORP. OF AMERICA



Schematic Diagram of Chassis and Power Pack

A.C.-51, AC.-53, A.C.-55, 25,51 - 25,53 - 25,55.

Radio Service Data Sheet

CLARION "SERIES 90" SUPERHETERODYNES (MODELS AC-90, AC-91, AC-91A, 25-90, AND 25-91)

The latest Clarion receiver, manufactured by the Transformer Corp. of America, Chicago, Ill., incorporates the newest advances in set design. Among the features with which the Service Man must familiarize himself are the following: a superheterodyne circuit with variable-mu tubes; a screen-grid first detector; a power screen-grid second detector; a pentode power stage; together with tone control, tuned hum filter, and automatic volume control; as the circuit illustrates.

Models "AC-90" and "AC-91" operate on 110 volts 60 cycles; and the "25-90" and "25-91," on 25 cycles. Model "90" is mantel-type; Model "91," a console, and Model "91-A," a phonograph combination.

The volume control, in its extreme left position, operates a phonograph switch, in the Model "90A" receiver; the phonograph pick-up circuit being shown dotted in the diagram; and the switch at X. The pick-up impedance should be between 2000 and 5000 ohms; and the volume controlled at the unit.

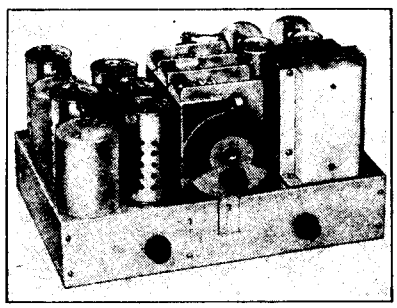
All available constants are as follows: condensers C1, C2, C3, tuning units; C1A, C2A, C3A, shunt trimmers; C5, C21, .0008-mf.; C6, C7, C8, C9, I.F. circuit trimmers; C10, C15, C16, C18, C20, C22, C23, .05-mf.; C11, 0.25-mf.; C12, 1.0-mf.; C14, C24, C27, C28, 0.1-mf.; C17, .00005-mf.; C19, 0.35-mf.; C25, C26, 8 mf. (electrolytic).

Resistors R1, R3, R6, 1,000 ohms; R2, 230 ohms; R4, 2,000 ohms; R5, R9, 100,000 ohms; R7, 40,000 ohms; R8, ½-meg.; R10, 1.0-meg.; R11, 12,000 ohms; R12, 3,800 ohms; R13, 4,300 ohms; R14, 1,800 ohms; R15, 1,300 ohms; R16, 435 ohms; R17, 400 ohms; R18, 65,000 ohms; R19, 20,000 ohms; R20, 210 ohms.

Operating voltages (with volume control in position "full" and line potential 115 volts) are as follows: Filaments V1, V2, V3, V4, V5, V6, V7, 2.2 volts; V8, 4.6 volts. Plate potentials, V1, 160 volts; V2, 168 volts; V3, 125 volts; V4, 163 volts; V5, 178 volts; V6, 25 volts; V7, 260 volts; V8, 350 volts. Control-grid potentials, V1, 0.9-volt; V2, 7.6 volts; V3, none; V4, 0.6-volt; V5, 6.8 volts; V6, 4.6 volts; V7, 16.5 volts. Cathode potentials, V1, V4, 2 volts; V2, 4.9 volts; V3, none; V5, 9 volts; V6, 4.5 volts. Plate currents (normal), V1, 2.8 ma.; V2, V4, 2. ma.; V3, 9.5 ma.; V5, 0.25-ma.; V6, none; V7, 36 ma.; V8, 72 ma. Screen-grid potentials, V1, V2, V4, 77 volts; V5, 90 volts; V6, 40 volts; V7, 260 volts.

Removal of the tube shields will cause circuit instability. Use of the variable-mu tube eliminates the hissing sound usually associated with high-gain superheterodynes. The manufacturer's (T.C.A.) code for the tubes is as follows: V1, V2, V4, CL-51; V3, CL-27; V5, V6, CL-24; V7, CL-PZ or CL-47; V8, CL-80.

The above readings on the pentode were taken in the following manner: the plate potential is read between plate and filament prongs, on the 250-volt scale. The control-grid is checked between the black common lead (on the reproducer's voice coil) and ground. The space-charge-grid is tested between this prong and filament. Connections to the UY base of the 'PZ resemble those of a '27—except that the cathode prong becomes the space-charge-grid lead. An adapter which exposes these five connections will be of assistance to Service Men not yet provided with modern analyzers designed to test pentodes.



Chassis of Series "90" Clarion: compare this illustration with the coded layout at the lower right.

Lack of sensitivity may be due to an open circuit, a high resistance, or a short circuit; seldom to trimmers out of adjustment. Exceptional care is taken to align these circuits accurately; after which they will retain their adjustment in nearly all instances.

Poor selectivity is seldom due to mis-alignment of the tuned circuits; but, more often, to a high-resistance joint in an R.F. circuit. An ohmic test may not indicate the faulty connection; but the application of a soldering iron to suspected joints may clear the trouble.

To align the I.F. circuits, (if the procedure is imperative), use a bakelite screwdriver to adjust C6, C7, C8, C9 for maximum output meter reading; with a 175-kc. (exact) oscillator output wired to the cap of V2, all tubes in their respective sockets; and all cap leads connected.

The R.F. circuits are to be aligned at 1400 kc. and 600 kc.

The oscillator low-frequency "padding" trimmer C4 is next adjusted, with the R.F. oscillator (connected to the antenna and ground posts) operating at exactly 600 kc.; at the same time, the receiver's dial is to be swung back and forth over the 600-kc. setting—adjusting for maximum output. Repeat the operation at 1400 kc.; except that C3 (the high-frequency tuning condenser) remains fixed, only C3A being adjusted, if necessary. Check also C1A and C2A.

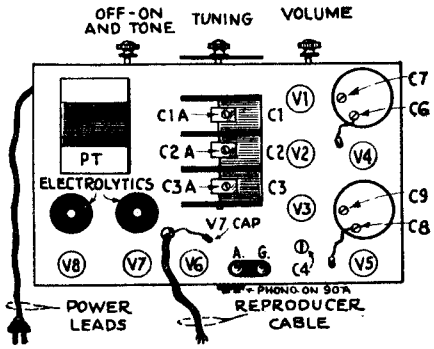
High-percentage modulation at the transmitter will result in increased signal strength at the receiver, as compared to other stations for which the automatic volume control has been adjusted.

Poor tone quality may be due to off-resonance tuning by the listener. Check by using a short-wire antenna, with volume control full on; the automatic volume control circuit will then cease to level the signal strength, and a tuning peak can be obtained. A poor '24 second-detector may mar the tonal reproduction; check also V6. A "fluttering" signal may be due to a poor ground.

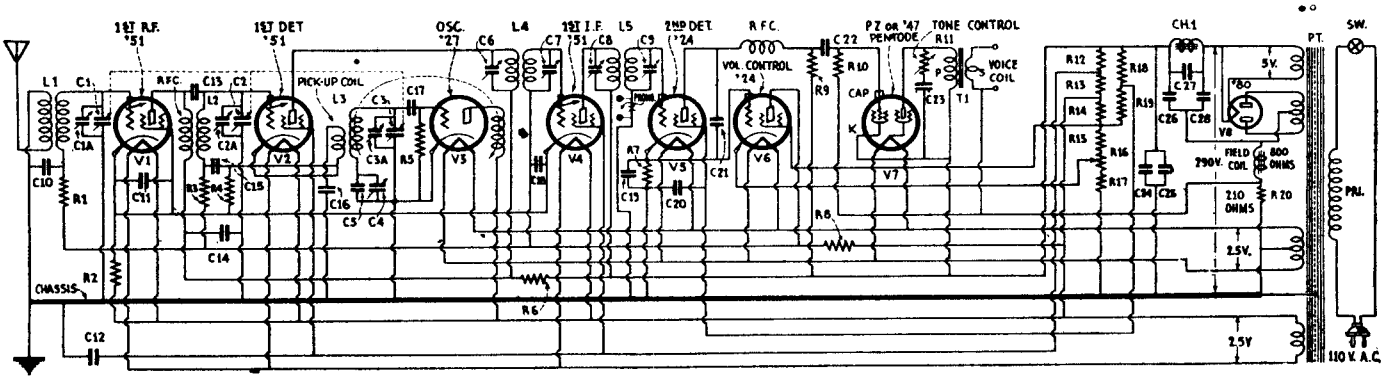
A 100-watt lamp should light brilliantly when connected between ground and one side of the light-line. A dim light indicates a poor ground connection; and no light, an ungrounded light-line. If the power company corrects the latter condition, hum, fluttering, circuit oscillation, and back-ground noise may be eliminated.

Although the intermediate frequency of 175 kc. has been selected by most manufacturers as the most satisfactory it is to be noted that a weak fourth harmonic, 700 kc., may heterodyne a broadcast station carrier and cause a whistle. Another cause of circuit oscillation is high line voltage; look also for open by-pass condensers.

Note that one side of the filament secondary which supplies V1, V2 and V4 connects also to other parts of the circuit, including the cathodes of V1 and V4, and the plate of the oscillator V3; and that, with respect to ground, this lead has a positive voltage of 95.

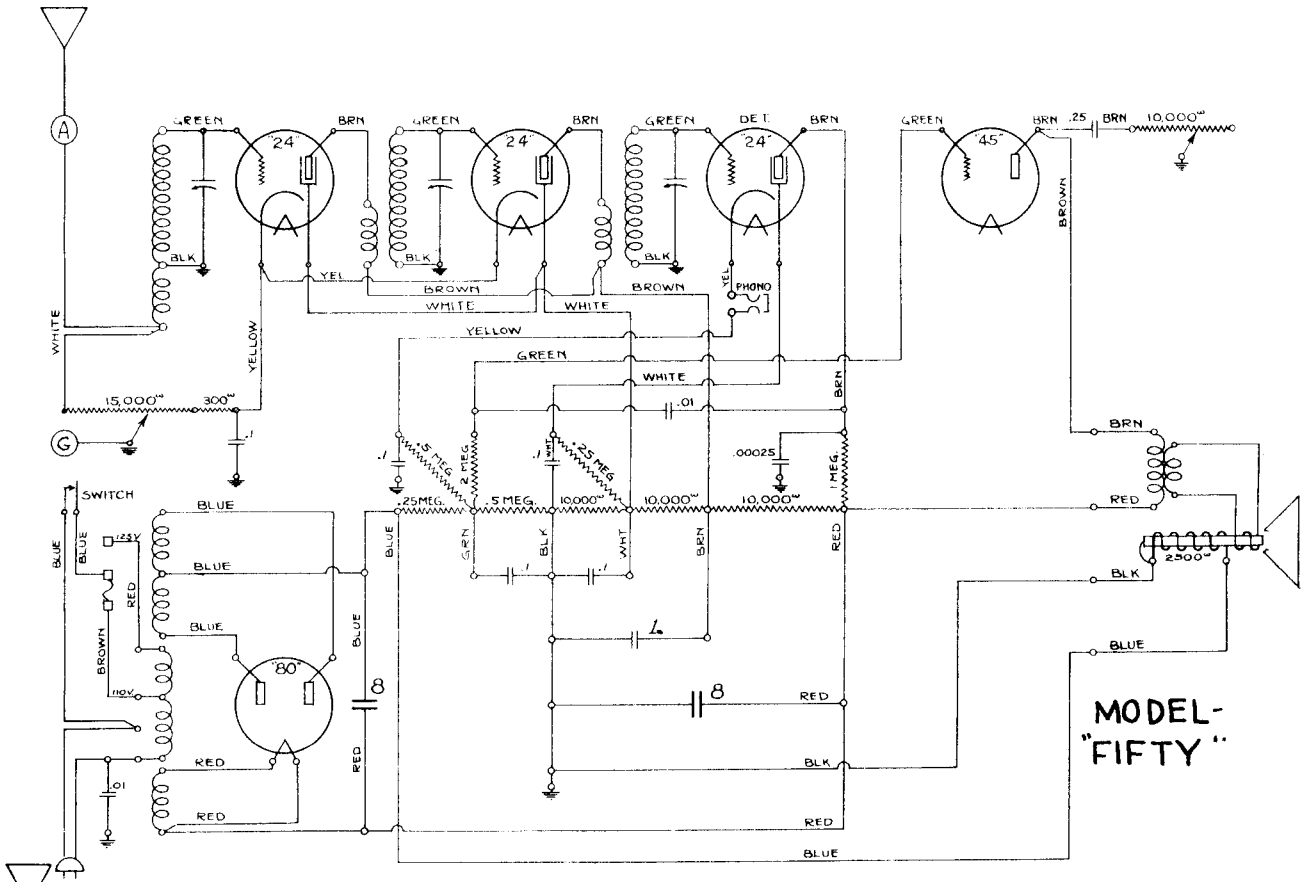


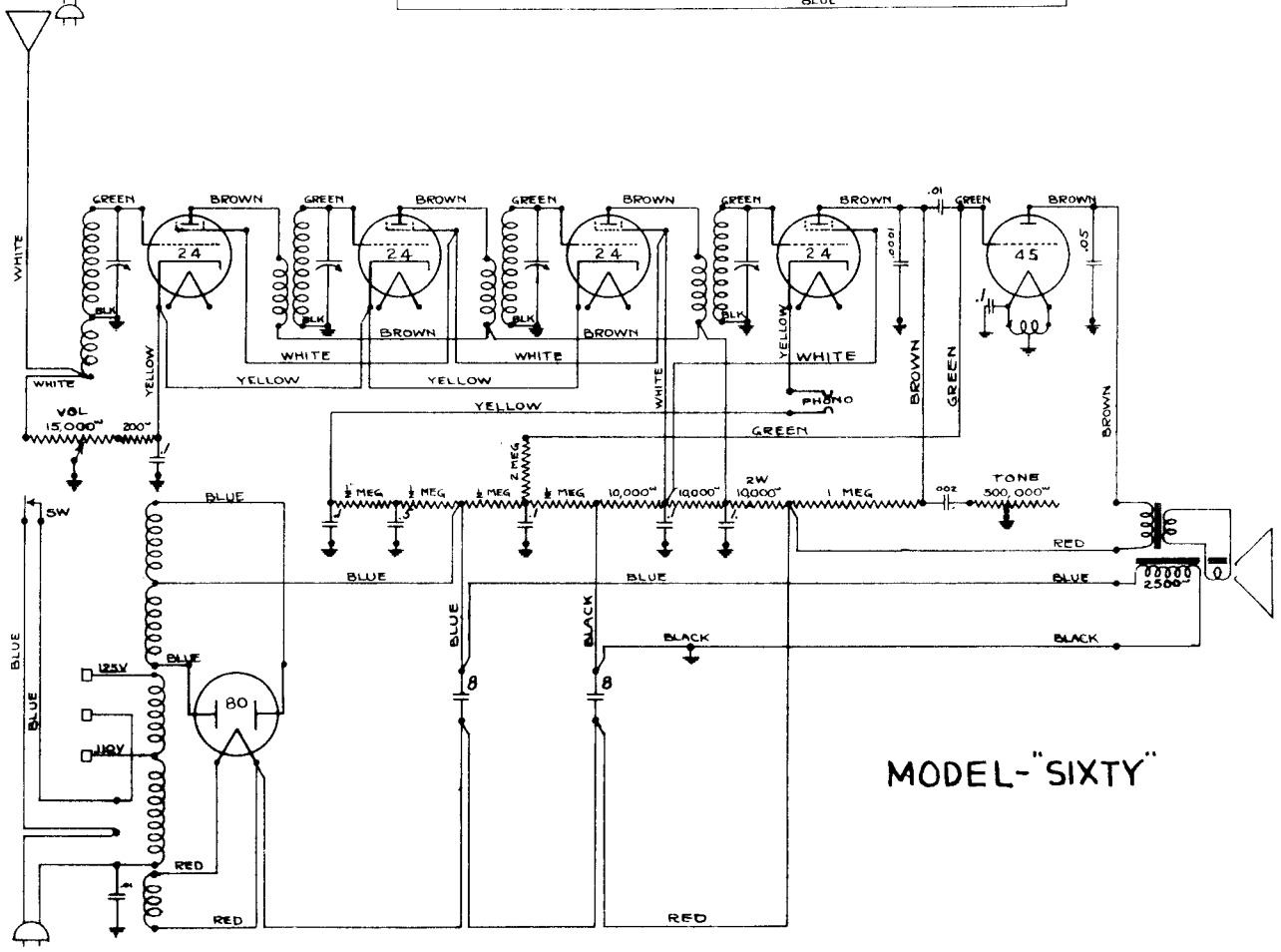
Top view of a Clarion superheterodyne chassis showing the positions of the trimmer condensers. The phonograph connection appears only on the "Model 90-A" chassis.



Schematic circuit of the highly-developed midget and console Clarion "Series 90" superheterodyne receivers; these utilize both variable-mu and pentode tubes, with automatic volume control. (Note: in the manufacturer's "breakdown analysis" illustration of this receiver, condensers C24 and C25 return to the juncture of R10 and R20, instead of to the chassis.)

KELLER FULLER MFG. CO. LTD.





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Radio Service Work gives you the basic experience you need to qualify for the big $8,000, $10,000 to $25,000 a year Radio positions. Once you get this experience, the whole range of rich opportunities in Radio lies open before you. Training in the Association, starting as a Radio Service Man, is one of the quickest, most profitable ways of qualifying for rapid advancement.

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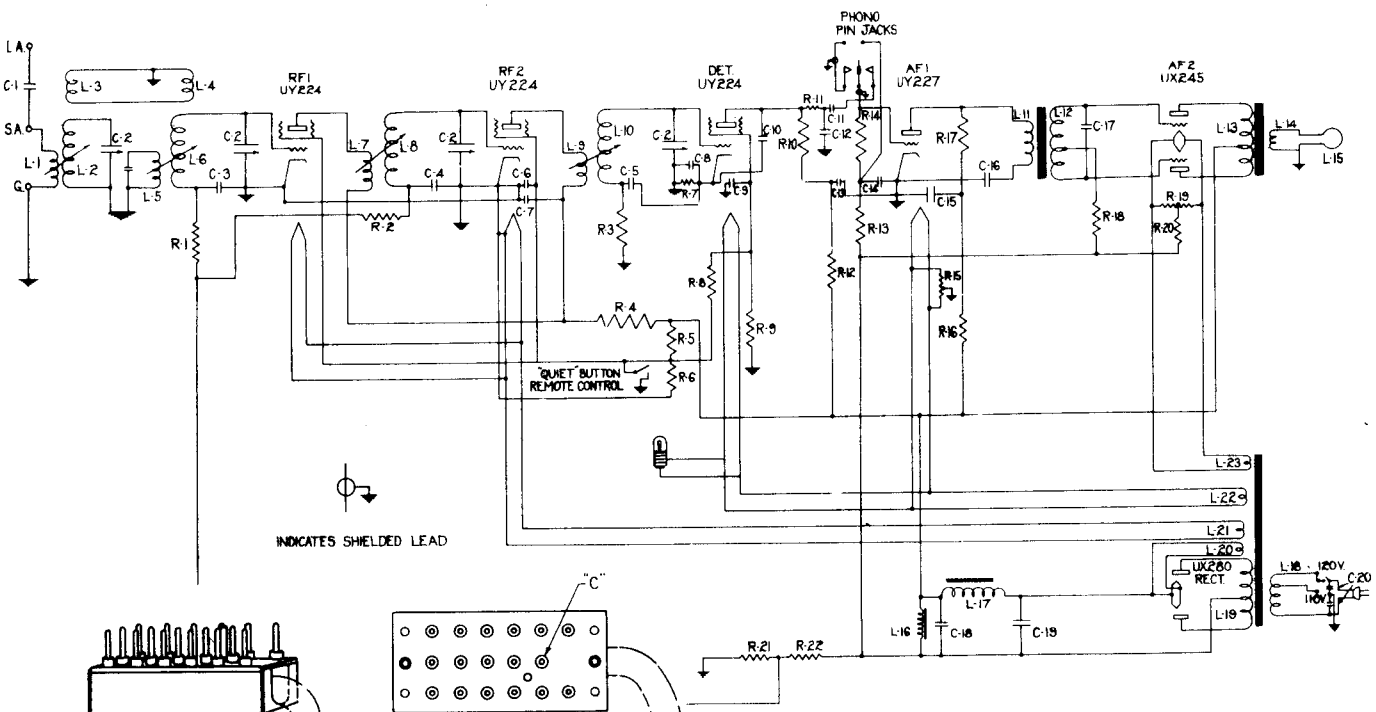
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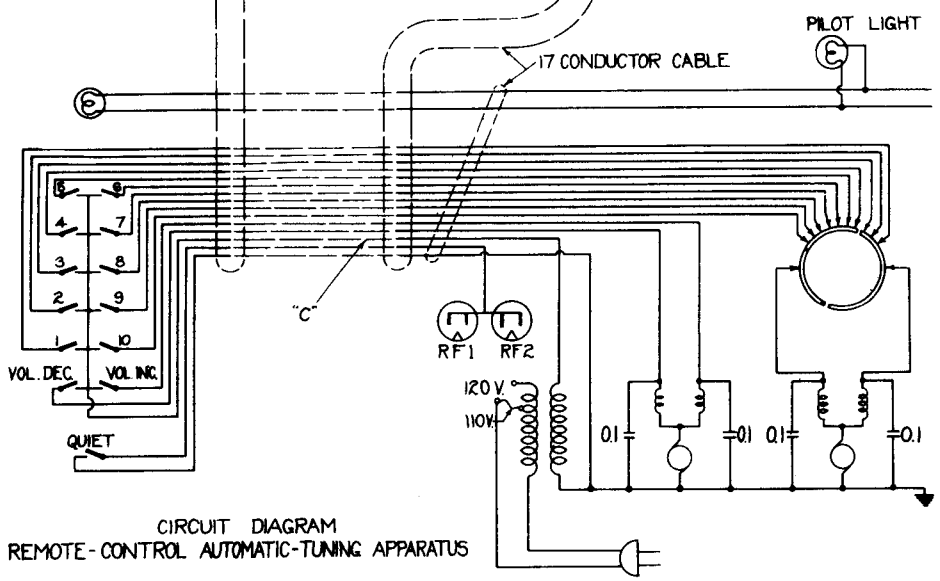
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City.....*State*.....

COLONIAL RADIO CORP.

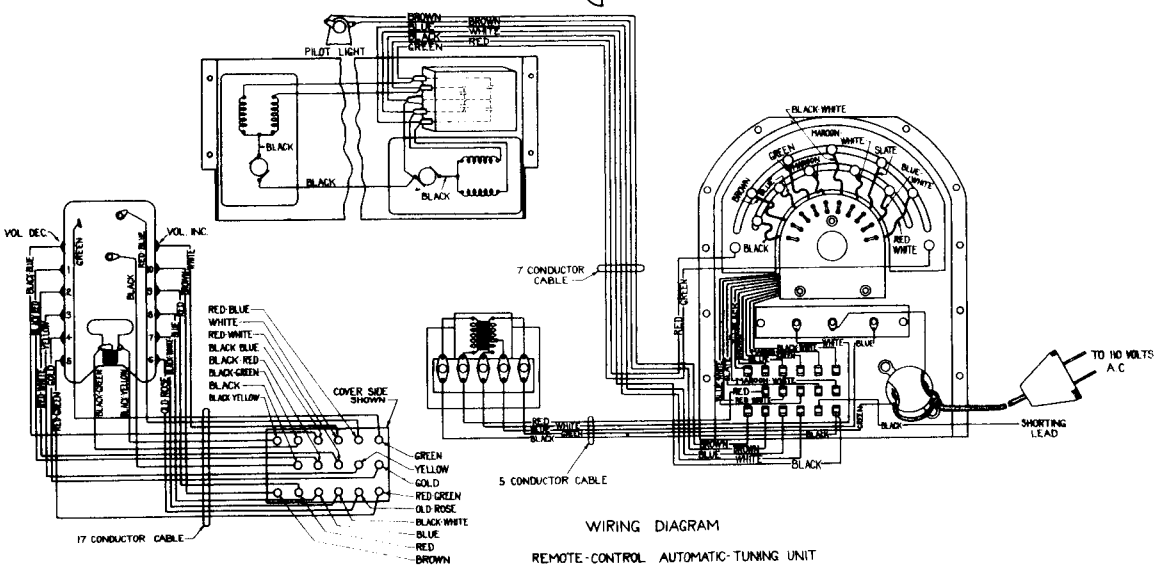


NOTE—In the 25 cycle models, R_3 is shorted out and there is an additional 1 mfd. condenser connected from the R.F. screen-grids to ground.



CIRCUIT DIAGRAM
REMOTE-CONTROL AUTOMATIC-TUNING APPARATUS

MODEL 33 & 34 A.C.



WIRING DIAGRAM
REMOTE-CONTROL AUTOMATIC-TUNING UNIT

I will train you at home to fill a BIG PAY Radio Job!



Here's Proof



If you are earning a penny less than $50 a week, send for my book of information on the opportunities in Radio. It is free. Clip the coupon NOW. Why be satisfied with $25, $30 or $40 a week for longer than the short time it takes to get ready for Radio.

Radio's growth opening hundreds of $50, $75, $100 a week jobs every year

In about ten years Radio has grown from a $2,000,000 to a $1,000,000,000 industry. Over 300,000 jobs have been created. Hundreds more are being opened every year by its continued growth. Men and young men with the right training—the kind of training I give you—are needed continually.

You have many jobs to choose from

Broadcasting stations use engineers, operators, station managers and pay $1,800 to $5,000 a year. Manufacturers continually need testers, inspectors, foremen, engineers, service men, buyers, for jobs paying up to $15,000 a year. Shipping companies use hundreds of Radio operators, give them world wide travel at practically no expense and a salary of $85 to $200 a month. Dealers and jobbers employ service men, salesmen, buyers, managers, and pay $30 to $100 a week. There are many other opportunities too. My book tells you about them.

So many opportunities many N. R. I. men make $5 to $25 a week while learning

The day you enroll with me I'll show you how to do 10 jobs, common in most every neighborhood, for spare time money. Throughout your course I send you information on servicing popular makes of sets; I give you the plans and ideas that are making $200 to $1,000 for hundreds of N. R. I. students in their spare time while studying.

Talking Movies, Television, Wired Radio included

Radio principles as used in Talking Movies, Television and home Television experiments, Wired Radio, Radio's use in Aviation, are all given. I am so sure that I can train you satisfactorily that I will agree in writing to refund every penny of your tuition if you are not satisfied with my Lessons and Instruction Service upon completing.

64-page book of information FREE

Get your copy today. It tells you where Radio's good jobs are, what they pay, tells you about my course, what others who have taken it are doing and making. Find out what Radio offers you, without the slightest obligation. ACT NOW.

J. E. SMITH, President
National Radio Institute Dept., OG-92
Washington, D. C.



$100 a week

"My earnings in Radio are many times greater than I ever expected they would be when I enrolled. They seldom fall under $100 a week. If your course cost four or five times more I would still consider it a good investment."

E. E. WINBORNE
1414 W. 48th St.,
Norfolk, Va.



Jumped from $35 to $100 a week

"Before I entered Radio I was making $35 a week. Last week I earned $110 servicing and selling Radios. I owe my success to N. R. I. You started me off on the right foot."

J. A. VAUGHN
8715 S. Kingshighway,
St. Louis, Mo.



$500 extra in 6 months

"In looking over my records I find I made $500 from January to May in my spare time. My best week brought me $107. I have only one regret regarding your course—I should have taken it long ago."

HOYT MOORE
R. R. 3, Box 919,
Indianapolis, Ind.



Our Own Home

Pioneer and World's Largest Home-Study Radio training organization devoted entirely to training men and young men for good jobs in the Radio industry. Our growth has paralleled Radio's growth. We occupy three hundred times as much floor space now as we did when organized in 1914.

I will give You my new 8 OUTFITS of RADIO PARTS for a home Experimental Laboratory

You can build over 100 circuits with these outfits. You build and experiment with the circuits used in Crosley, Atwater - Kent, Eveready, Majestic, Zenith, and other popular sets. You learn how these sets work, why they work, how to make them work. This makes learning at home easy, fascinating, practical.



Back view of 5 tube Screen Grid A. C. tuned Radio frequency set—only one of many circuits you can build with my outfits.



I am doubling and tripling the salaries of many in one year and less Find out about this quick way to BIGGER PAY



Radio Needs Trained Men

FILL OUT AND MAIL THIS COUPON TODAY

J. E. SMITH, President,
National Radio Institute, Dept. OG-92
Washington, D. C.

Dear Mr. Smith: Send me your book. This request does not obligate me.

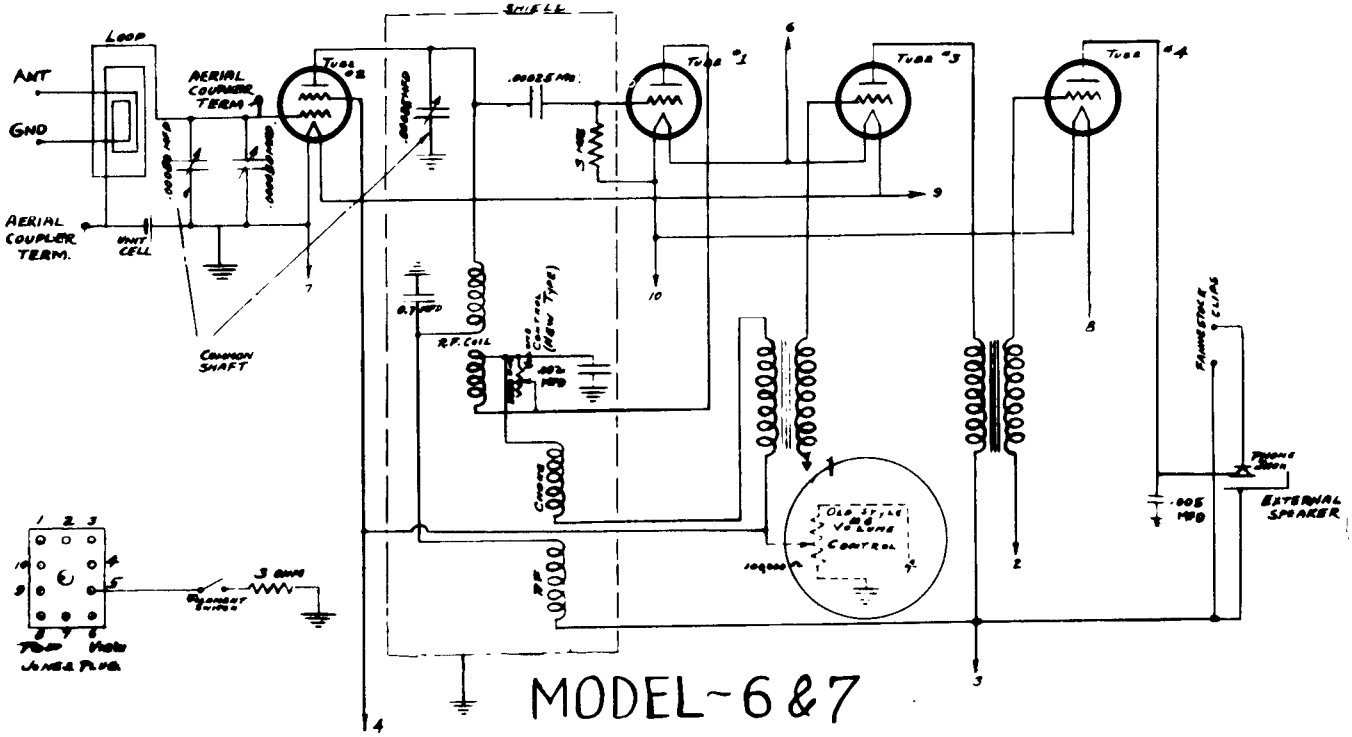
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Address .....

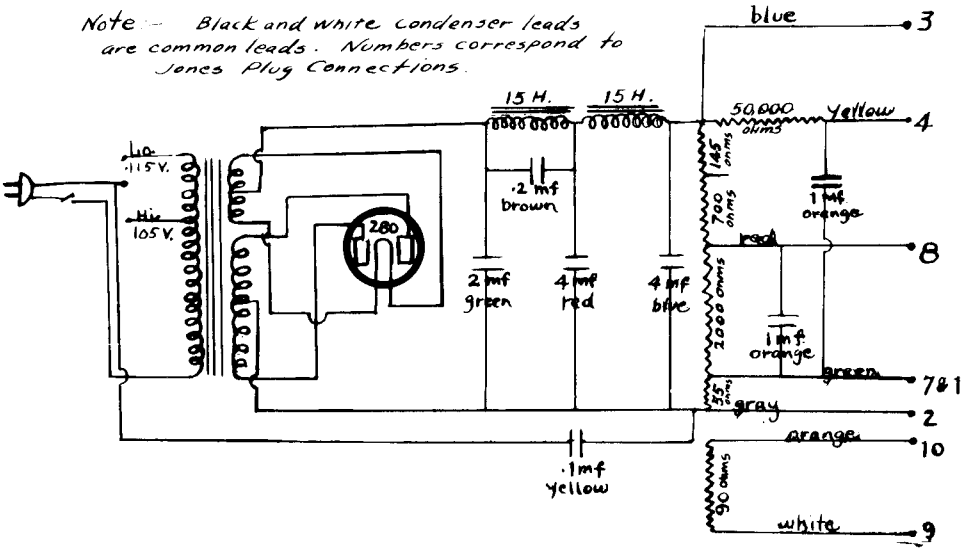
City .....State .....

Lifetime Employment Service to all Graduates

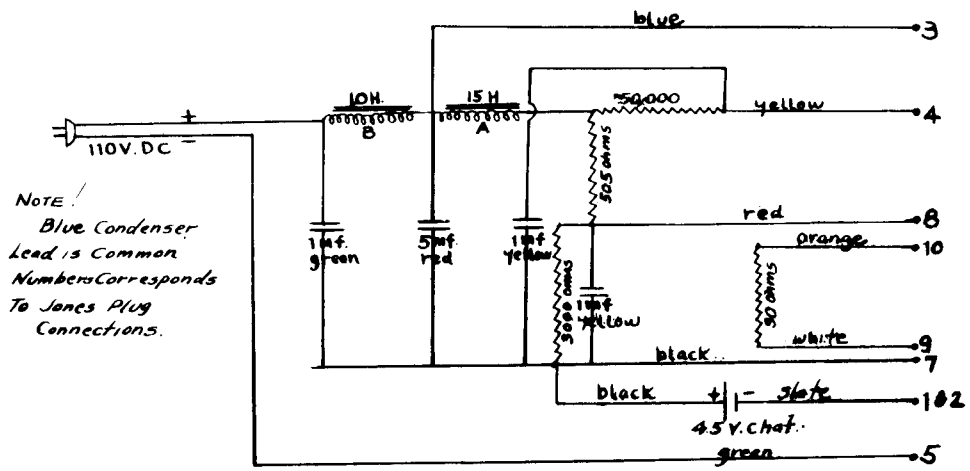
TRAV-LER MFG. CO.



A.C. POWER PACK



D.C. POWER PACK



LET RCA INSTITUTES START YOU ON THE ROAD TO . . . .

SUCCESS IN RADIO

Radio needs you . . . That's why the entire Radio industry is calling for trained men . . . That's why thousands of men who answered these advertisements are now earning from $2,000 and up a year. Radio is highly interesting work . . . with opportunities that are yet unlimited. Manufacturers and broadcasting stations are now eagerly seeking trained RCA Institute men . . . Aviation and radio in the movies also provide innumerable opportunities . . . Millions of sets need servicing . . . thousands of ships require experienced operators . . . Never before was there an opportunity like this in Radio.



Radio Mechanic and Inspector $1800 to $4,000 a Year.



Broadcast Station Mechanic $1800 to $3600 a Year.



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This is the Only Course Sponsored by Radio Corporation of America

RCA sets the standards for practically the entire Radio industry . . . The RCA Institutes' Home Laboratory Training Course enables you to learn more than the mere ABC's of Radio . . . In your spare time, in only an hour or so a day, you can obtain a thorough, practical education in Radio . . . You get the inside information, too, because you study right at the source of all the latest, up-to-the-minute developments. RCA, the world's largest Radio organization, sponsors every single detail in this course.

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RCA Institutes offers four different courses . . . certainly instruction that you need. A complete serviceman's and repairman's technical course . . . advanced course . . . complete course without code . . . and a complete course including code. And practical instruction with each course. Courses that teach construction, repairing, service, broadcasting and ship operating.

Graduates of RCA Institutes Find It Easier to Get Good Jobs

They are closest to the source of Radio's greatest achievements because so much of the progress of Radio is measured by the accomplishments of the great engineers in the huge research laboratories of the Radio Corporation of America.

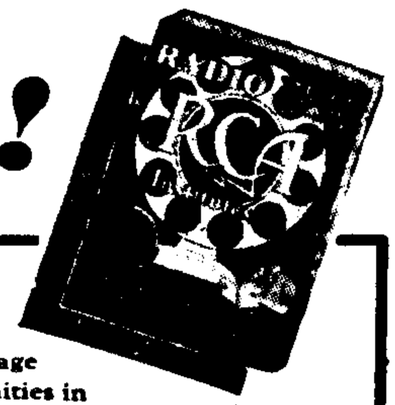
Students of RCA Institutes get first-hand knowledge, get it quickly and get it complete. Success in radio depends upon training and that's the training you get with RCA Institutes. That's why every graduate who desired a position has been able to get one . . . That's why graduates are always in big demand.

Study Radio at the Oldest and Largest Commercial Training Organization in the World

Send for our Free Book . . . it will explain our practical methods of training that has prepared hundreds of men for success in Radio. Remember that you, too, can be succes ful . . . can speed up your earning capacity . . . can earn more money in Radio than you ever earned before. The man who trains today will hold down the worthwhile Radio job of the future. Come in and get our free book or send for it by mail. Everything you want to know about the opportunities in Radio. Forty fascinating pages, packed with pictures and descriptions of brilliant opportunities in this gigantic, world-wide profession.

See for yourself why graduates of RCA Institutes now occupy thousands of well-paid positions. These positions are usually available in from 3 to 10 days after graduation for men who can qualify. RCA Institutes will back you up to the limit. Our catalogue is yours free . . . SEND FOR IT TODAY!

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Gentlemen: Please send me your FREE 40-page book which illustrates the brilliant opportunities in Radio and describes your laboratory-method of instruction at home!

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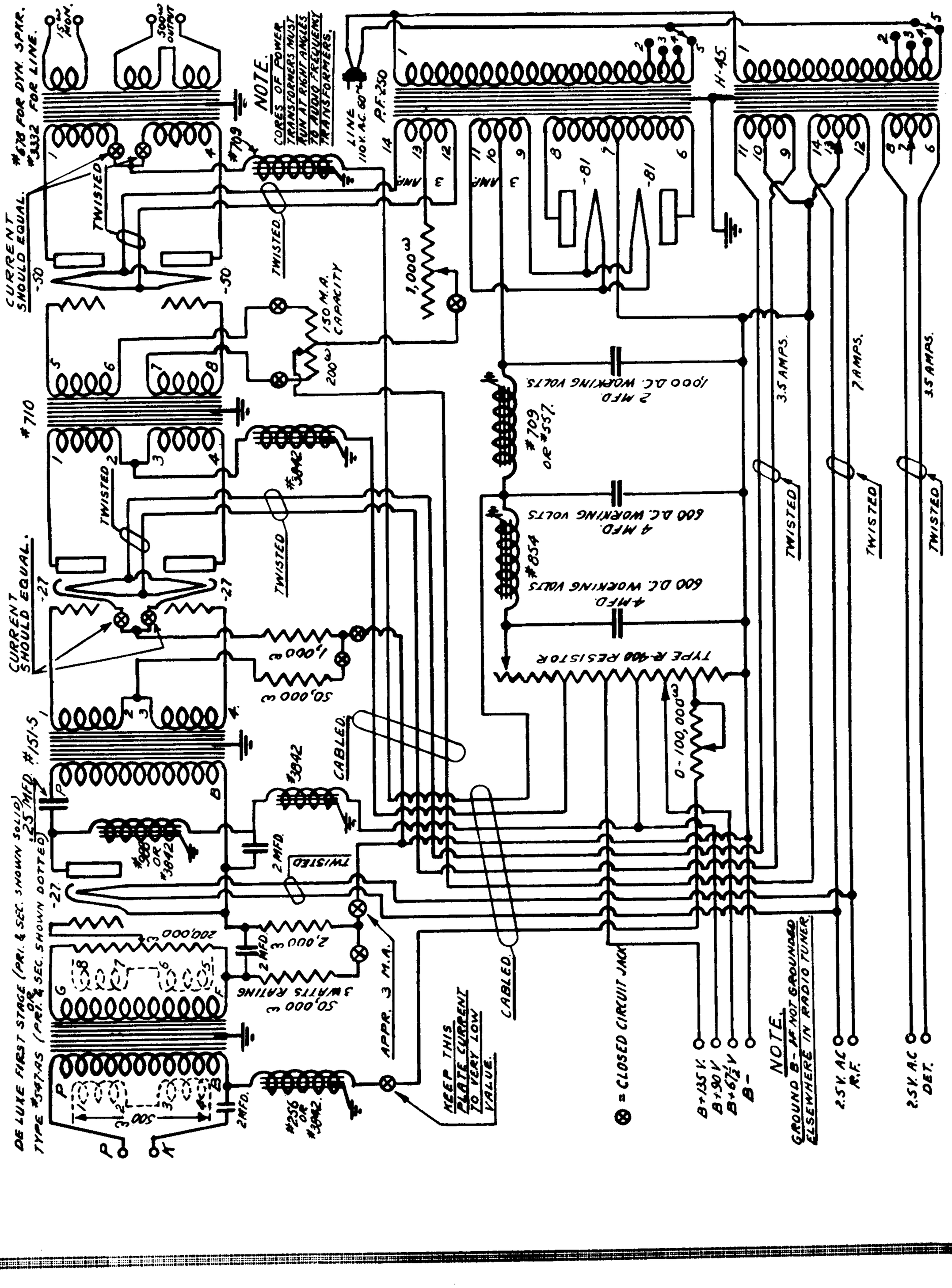
RCA INSTITUTES, INC.

A Division of the
Radio Corporation of America

RCA

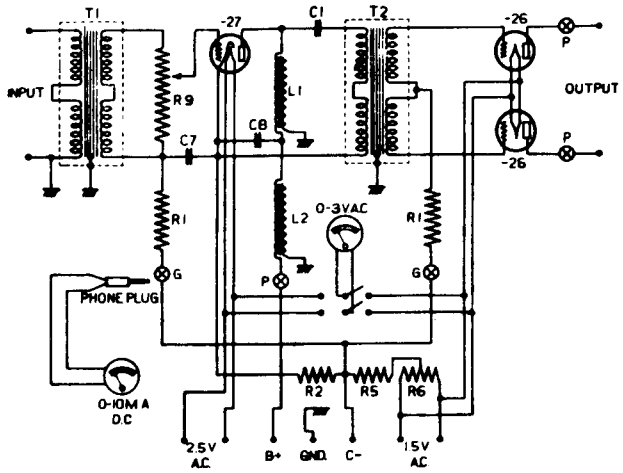
AMERICAN TRANSFORMER CO.

(P.F. 250 POWER AMPLIFIER)

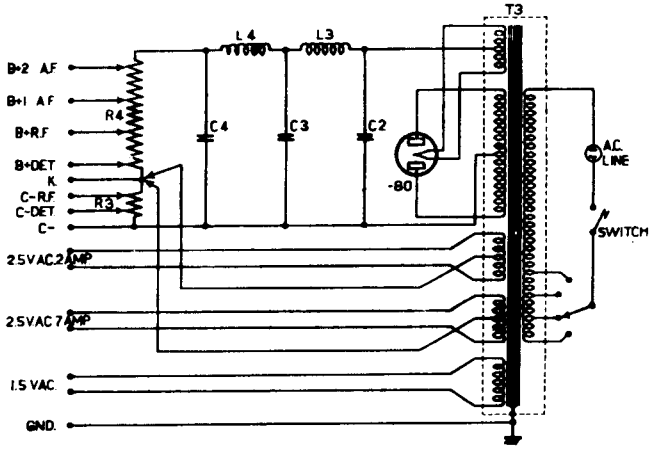


AMERICAN TRANSFORMER CO.

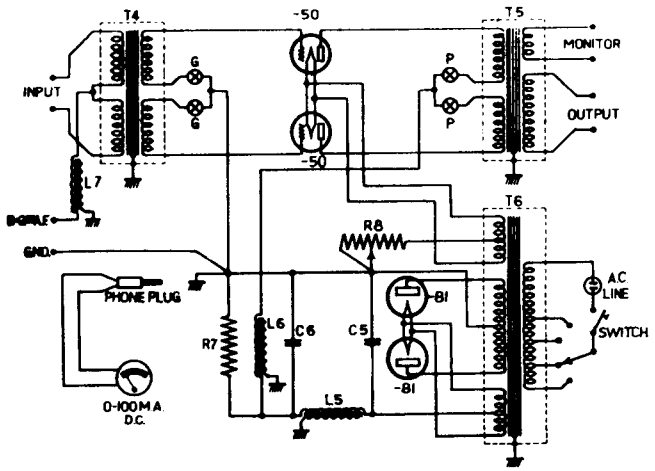
CONCERT-HALL AMPLIFIER—TYPE 25A



Panel A—Two-stage input audio-frequency amplifier. First stage: one 227-type tube. Second stage: two 226-type tubes.



Panel P—Power-supply unit. Provides all d.c. plate voltages and a.c. filament currents required for operation of panel A, also for radio tuner if equipped with 2½-volt a.c. tubes. Type 280 rectifier tube used.



Panel PA—Power output stage. This unit includes input and output transformers and a self-contained power supply for two 250-type tubes which are connected in push-pull. Two 281-type tubes are used as rectifiers.

The standard Type 25A amplifier comprises three panel sections, employs three stages of power audio-frequency amplification, and may be operated directly from the standard 115-volt, 60-cycle power line. The first stage uses a single 227-type tube, the second stage employs two 226-type tubes in a push-pull circuit, and in the output stage two 250-type tubes are connected in push-pull. The undistorted output of the last stage is 12.6 watts, and, in cases where greater power is required, twice this value may be obtained by connecting two output panels in parallel.

Two power-supply circuits are utilized to provide plate and filament voltages for the various tubes of the amplifier; the output stage is equipped with an individual power circuit and the first two stages are supplied with power from another power panel, which also furnishes plate current for the radio tuner and filament current for 2.5-volt, heater-type tubes.

APPROVED AMERTRAN AUDIO CIRCUITS

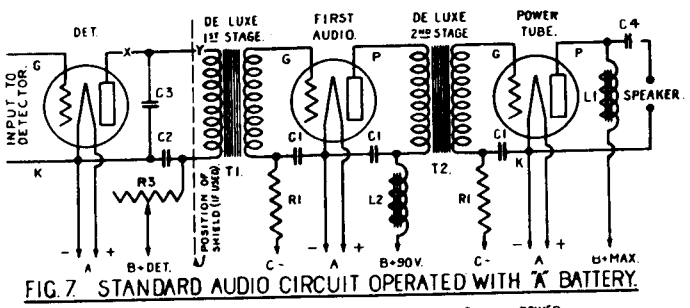


FIG. 7. STANDARD AUDIO CIRCUIT OPERATED WITH "A" BATTERY.

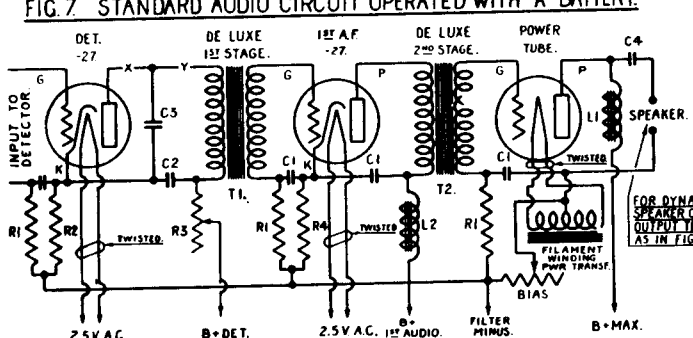


FIG. 9. STANDARD AUDIO CIRCUIT USING -27 A.C. TUBES FOR DETECTOR AND 1ST AUDIO, BOTH SELF BIASED.

FOR DYNAMIC SPEAKER CONNECT OUTPUT TRANSFORMER AS IN FIG. 8 ABOVE.

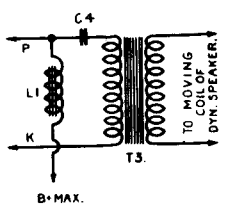


FIG. 8. SAME AS FIG. 7 EXCEPT OUTPUT ARRANGED FOR DYNAMIC SPEAKER.

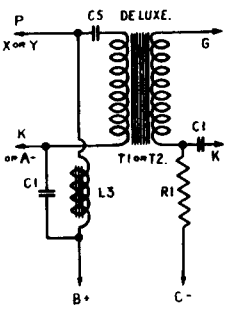
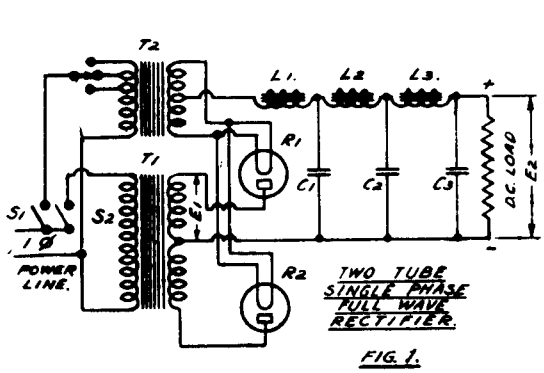


FIG. 10. PARALLEL FEED ANY AUDIO STAGE.

C_1—Non-inductive by-pass condenser, 2-mfd.
C_2—Non-inductive by-pass condenser, 1- or 2-mfd.
C_3—Non-inductive by-pass condenser, 0.0005- to 0.001-mfd.
C_4—Non-inductive (high-voltage) condenser, 4-mfd.
C_5—Non-inductive by-pass condenser, 0.25-mfd.
K—Cathode or —A.
L_1—AmerChoke (output), type 101.
L_2—AmerChoke, type 3482.
L_3—AmerChoke, type 3482 or 988.
R_1—50,000-ohm resistor, Elmenco, or Ward Leonard.
R_2—10,000- to 15,000-ohm adjustable potentiometer for biasing detector.
R_3—100,000-ohm variable resistor for detector plate control.
R_4—1800- to 2000-ohm wire-wound resistor for biasing.
Bias—Wire-wound resistor for power tube bias (Res. ohms = —C volts ÷ plate current amps.
T_1—AmerTran audio transformer, First Stage De Luxe or type AF-8.
T_2—AmerTran audio transformer, Second Stage De Luxe or type AF-8.
T_3—10- to 15-ohm AmerTran output transformer, type 115.
X—Location of tickler, if regenerative.
Y—Location of r.f. choke coil, if used.

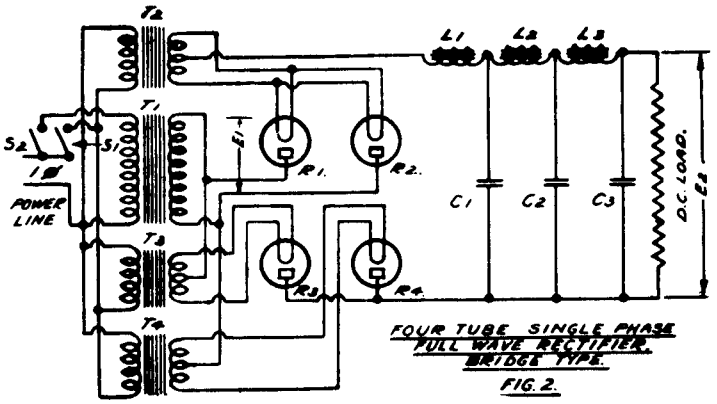
AMERICAN TRANSFORMER CO.

PLATE SUPPLY TRANSFORMER CONNECTIONS



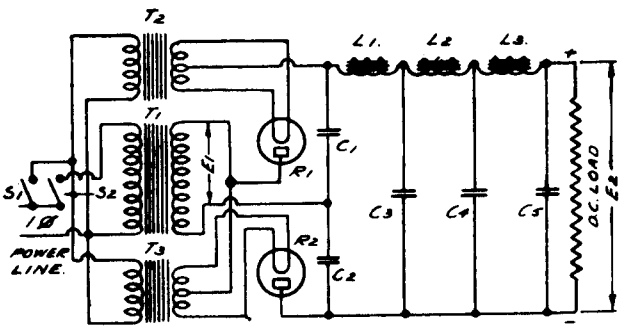
TWO TUBE SINGLE PHASE FULL WAVE RECTIFIER.

FIG. 1.



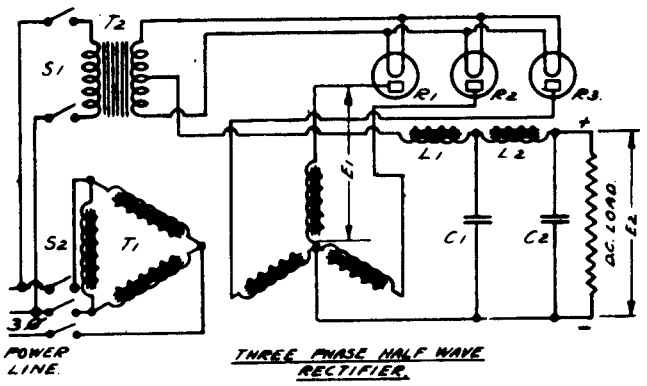
FOUR TUBE SINGLE PHASE FULL WAVE RECTIFIER. BRIDGE TYPE.

FIG. 2.



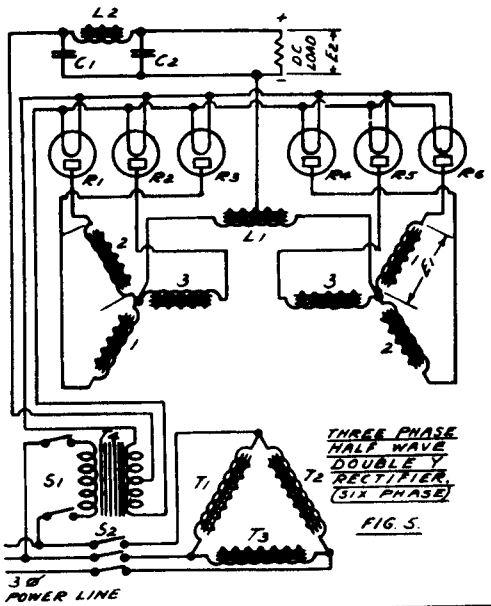
TWO TUBE HALF WAVE VOLTAGE DOUBLER RECTIFIER.

FIG. 3.



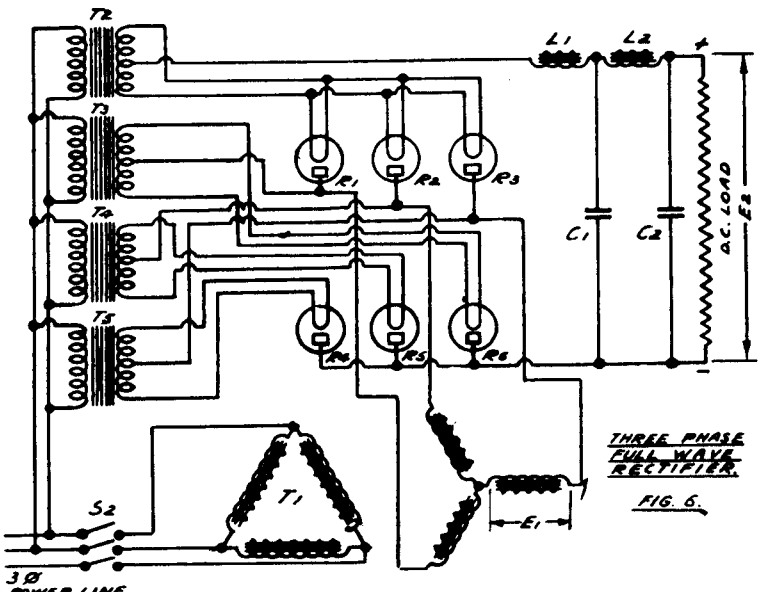
THREE PHASE HALF WAVE RECTIFIER.

FIG. 4.



THREE PHASE HALF WAVE DOUBLE Y RECTIFIER. (SIX PHASE)

FIG. 5.



THREE PHASE FULL WAVE RECTIFIER.

FIG. 6.

CIRCUIT.	NO. TUBES.	MAX. INPUT VOLTS E1 R.M.S.	D.C. OUTPUT VOLTS E2 LESS DROP IN FILTER.	MAX. D.C. OUTPUT CURRENT.
FIG. 1	2	353 % M.P.I.V.	63% E1	66% M.P.P.C.
IF L1 IS OMITTED			113% E1	27.5% M.P.P.C. OF 1 TUBE.
FIG. 2.	4	70 % M.P.I.V.		66% M.P.P.C.
IF L1 IS OMITTED			113% E1	27.5% M.P.P.C. OF 1 TUBE.
FIG. 3.	2	114% M.P.I.V.	170% E1 *)	33% M.P.P.C.
FIG. 4	3	41% M.P.I.V.	117% E1	84% M.P.P.C.
FIG. 5.	6	41% M.P.I.V.	117% E1	200% M.P.P.C.
FIG. 6.	6	41% M.P.I.V.	234% E1	100% M.P.P.C.

*) DEPENDS ALSO ON SIZE OF C1 & C2

FOR 3-PHASE OPERATION ONLY.

M.P.I.V. - IS MAXIMUM PEAK INVERSE VOLTAGE RATING OF RECTIFIER TUBE.
M.P.P.C. - IS MAXIMUM PEAK PLATE CURRENT RATING OF RECTIFIER TUBE.

MUST BE USED WITH T TYPE FILTERS WHOSE PARTS CAN HAVE SMALLER VALUES THAN THOSE OF FILTERS FOR 1 PHASE.
INTERPHASE REACTOR ACTS AS FIRST CHOKE.
TRANSFORMERS CAN BE EITHER THREE-PHASE WITH DELTA PRIMARY & STAR SECONDARY OR PREFERABLY THREE SINGLE PHASE TRANSFORMERS WITH DELTA PRIMARIES & STAR SECONDARIES.
SWITCH S1 SHOULD BE CLOSED FIRST. S2 CLOSED 40 SECONDS AFTER S1.

A. T. Co. Drawing C-12985

SM SILVER-MARSHALL



Statement by McMurdo Silver
President, Silver-Marshall, Inc.

It has always been our policy to publish the full technical details of all Silver-Marshall Receivers, for we fully realize that the success of our sets depends not only on careful, painstaking manufacturing, but on the ability of the ultimate consumer to obtain satisfactory service.

We maintain a technical service information department and will be happy to give any legitimate service men or organization complete technical information on any Silver-Marshall Receiver they may be called on to service.

SILVER-MARSHALL, Inc.

6401 West 65th Street - - Chicago, U. S. A.

S-M Radiobuilder

The RADIOBUILDER, Silver-Marshall's official publication, is edited by McMurdo Silver with the thought in mind of giving the service man detailed news from the great S-M laboratories before it is given to the world.

Mr. Silver has earned a reputation of knowing what the public wants, and by regularly reading the RADIOBUILDER, thousands of service men keep IN ADVANCE of the industry. This is proven by the many "scoops" that Silver-Marshall has to its credit: screen-grid circuits, power detection, tuned audio transformers, A.C. screen-grid short-wave receivers, the utilization of FOUR A.C. screen-grid tubes, high-frequency cut-off transformers, and a dozen others. The subscription rate is 50 cents for twelve issues. Don't miss the July issue!

S-M Data Sheets

A Silver-Marshall Data Sheet, giving complete, detailed information, is published on all S-M parts equipment. They are freely supplied to service men and accredited service organizations for a small part of the handling costs—2 cents each. Recent Data Sheets are listed below:

No. 16—712 Tuner (Development from the Sargent-Rayment)

No. 18—722DC Band-Selector Six Receiver

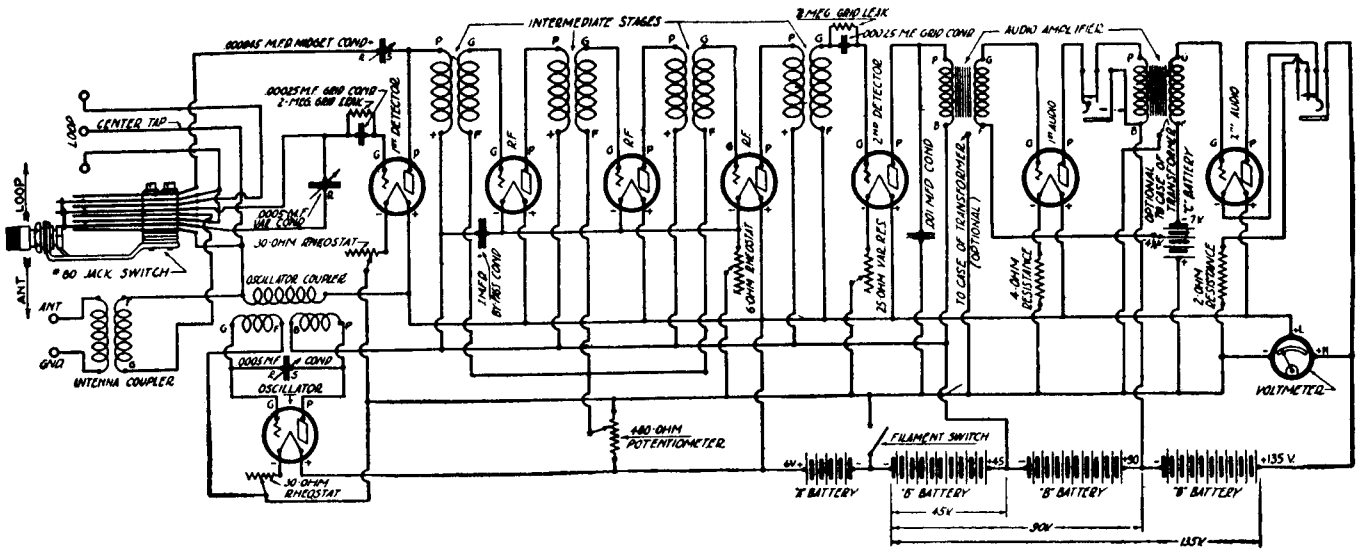
No. 19—692 Power Amplifier ('50 Push-Pull)

No. 20—677B Power Amplifier ('45 Push-Pull)

No. 21—737 Short-Wave Bearcat

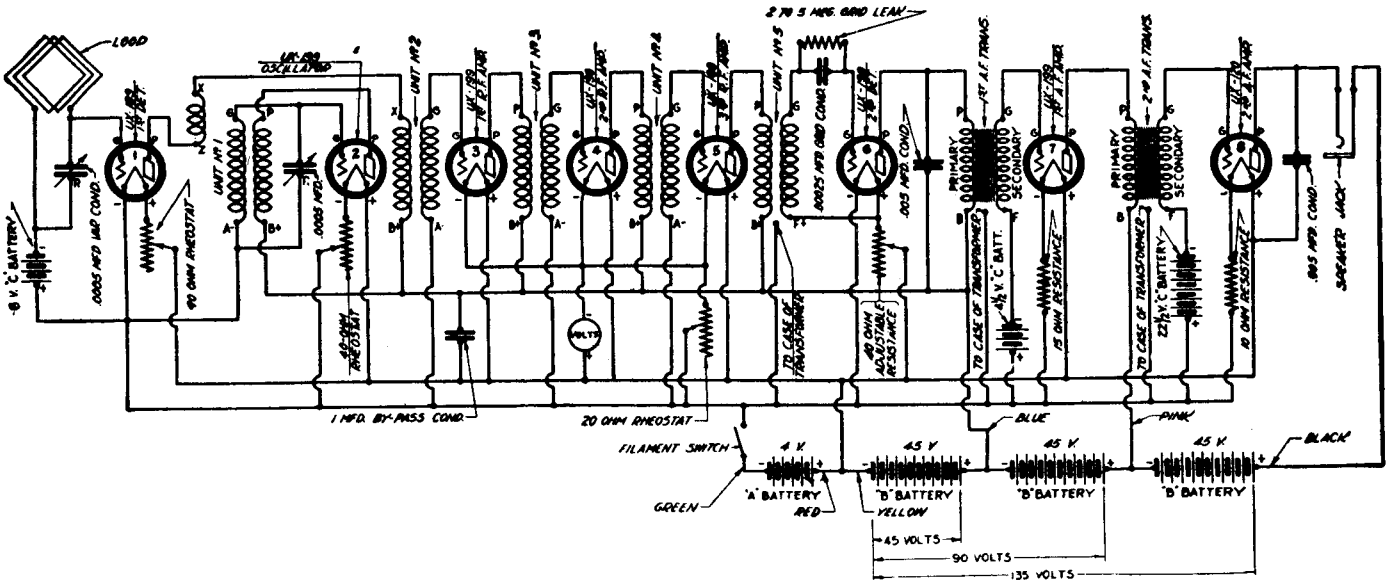
No. 22—770 Screen-Grid Auto-Set

VICTOREEN SUPERHETERODYNE



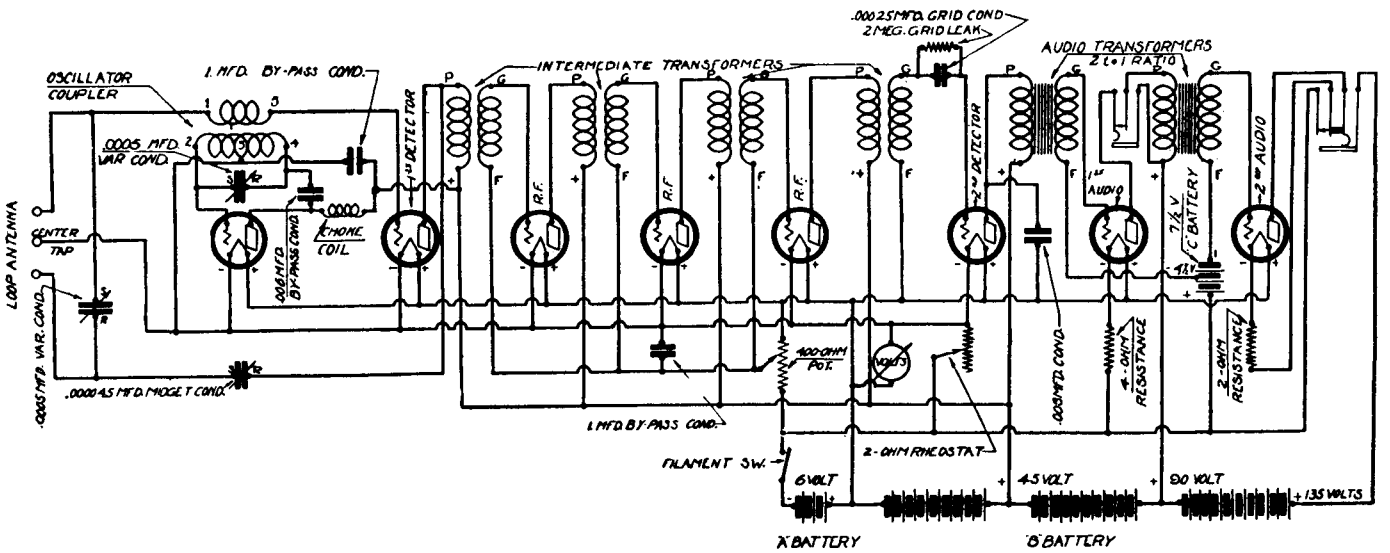
Victoreen Superheterodyne circuit. The double scale volt meter shown in the diagram is used to ascertain the "A" and "B" voltages at all times.

MADISON-MOORE SUPERHETERODYNE



Madison-Moore Superheterodyne circuit. UX-199 tubes are used throughout this receiver with the exception of the last stage of audio, which is a UX-120 power tube.

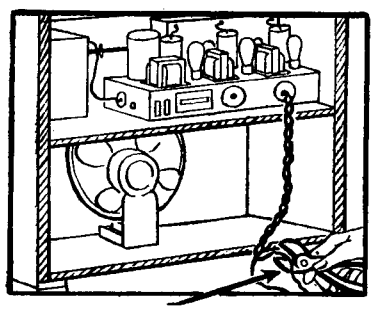
ST. JAMES SUPERHETERODYNE



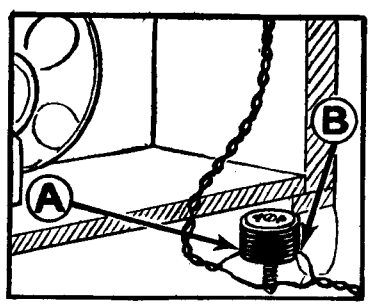
St. James Superheterodyne circuit. A filament control jack is used in the last stage of audio. The filament circuit of the last tube is completed only when a loud speaker is plugged in.

Now

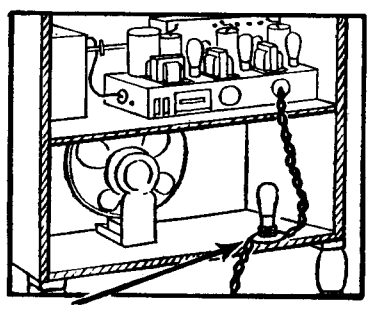
AMPERITE
Self-Adjusting
LINE VOLTAGE CONTROL
Can Be Installed in ANY Standard Radio



To install the new AMPERITE Line Voltage Control cut one lead of the power supply line or cable at any place between the set and the house socket plug.

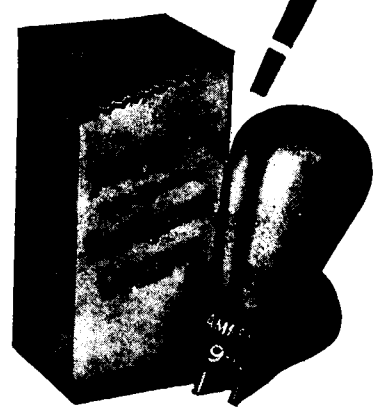


Connect these two cut ends to the terminals of an AMPERITE adapter socket as shown by line "A & B" or to any standard UX tube socket. If a tube socket is used, make connections to either two opposite terminals, leaving the remaining two terminals blank.



Mount the adapter or socket at any convenient place inside the cabinet. Insert the proper AMPERITE Line Voltage Control tube and the receiver is ready for operation. When making the above connections, first disconnect the house line plug.

Insures Perfect Operation of A. C. Receivers Regardless of Line Variations



THE finest designed receiver and the best tubes can function properly only within a voltage range of plus or minus 5 per cent. of rated specifications.

And yet, nationally sold radio sets are subjected to line voltages varying as much as 30 per cent.

The AMPERITE Self-Adjusting Line Voltage Control *automatically* regulates the voltage from the A.C. power main. It assures the right voltage for most efficient operation, regardless of line variations, over a 30-volt range between 95 and 145 volts.

AMPERITE operates to a degree of accuracy unobtainable by any other means. It prevents fluctuating line voltage from damaging tubes and filter equipment. It is trouble free and long-lasting.

Many of the newer makes of receivers are equipped for AMPERITE. A new development now makes it possible to install AMPERITE in *any* A.C. receiver, regardless of standard equipment, in only a few minutes and at very small cost.

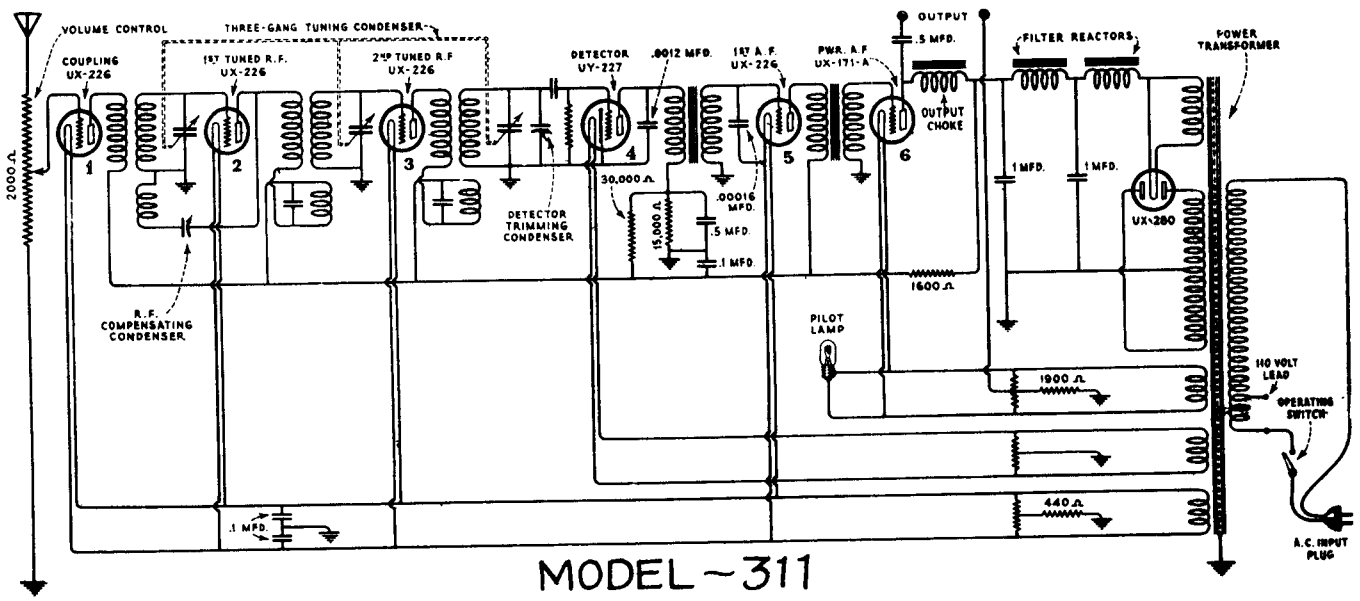
There is an AMPERITE available for any popular electric set. The Amperite Line Control Guide shows the proper type AMPERITE for every popular make of electric radio set. Ask your jobber for it or write direct to us. AMPERITE is an ideal product for the service man as it assures improvement to any make of radio.

AMPERITE is manufactured and guaranteed by the world's largest makers of automatic voltage controls—exclusively.

AMPERITE Corporation
561 Broadway, New York, N. Y.

AMPERITE
Self-Adjusting
LINE VOLTAGE CONTROL

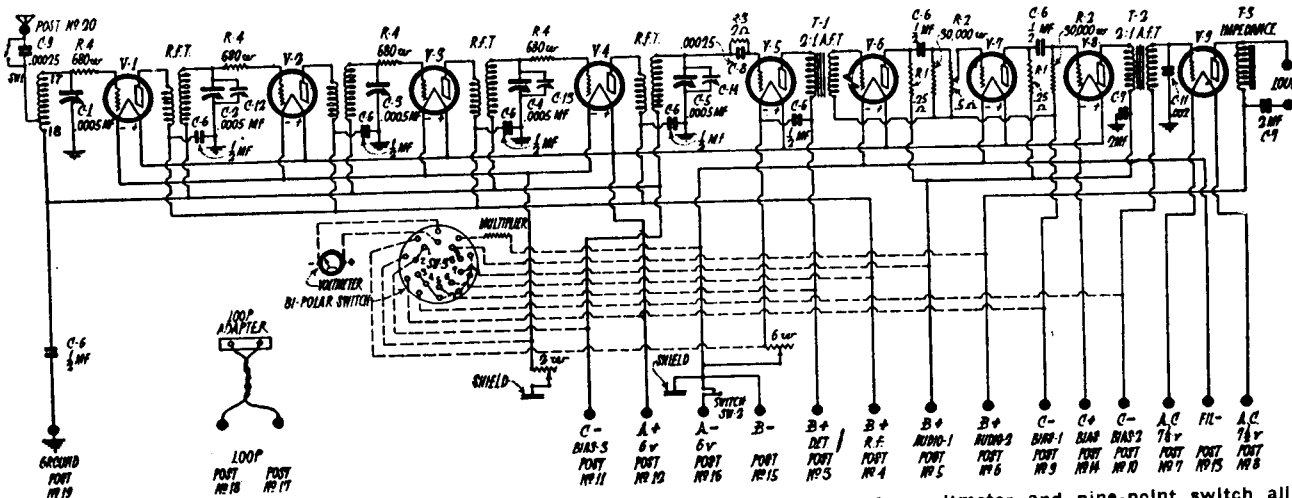
GRAYBAR ELECTRIC CO.



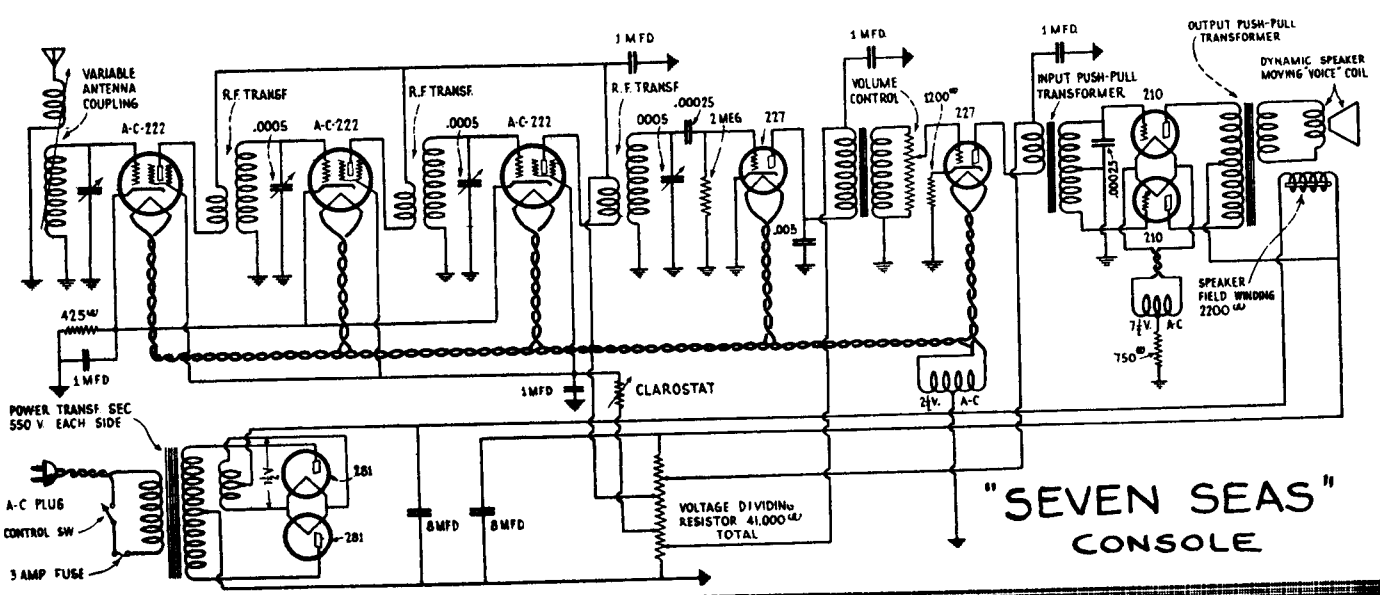
MODEL ~ 311

Schematic circuit diagram of receiver and socket power unit—all grounds are connected to frame and metal cabinet

C.R.LEUTZ INC.



Circuit diagram of the Leutz Universal Trans-Oceanic receiver. By means of a voltmeter and nine-point switch all A, B and C voltages from 0 to 500 are read directly



"SEVEN SEAS" CONSOLE

Guard your Reputation

in service work . .

use DURHAM

Metallized RESISTORS

and insure satisfied customers

8 POINTS OF SUPERIORITY

- Metallized Resistors are conservatively rated as to power.
- May be safely loaded to full capacity continuously and will carry a considerable overload.
- Accurately rated . . . units vary less than 10% plus or minus rated value.
- Metallized Resistors will not exceed their original tolerance even after years of use.
- Ratio of AC to DC resistance is practically 1 to 1, making them ideal for filter systems.
- Offered in all types . . . all carefully designed to provide maximum compactness, ease of assembly and rugged strength.
- Metallized Resistors are notably quiet, even after years of service.
- Metallized Resistors insure a lower change of resistance due to the homogenous metal coating.



Write for Guide "G. B." today

Shows how to locate faulty reception and gives proper resistor values for nearly every make of radio . . . the most complete guide ever offered radio service men.

Durham Metallized Resistors are supplied in *any intermediate values* from 50 to 10,000,000 ohms. Complete stocks assure prompt deliveries for your service requirements.

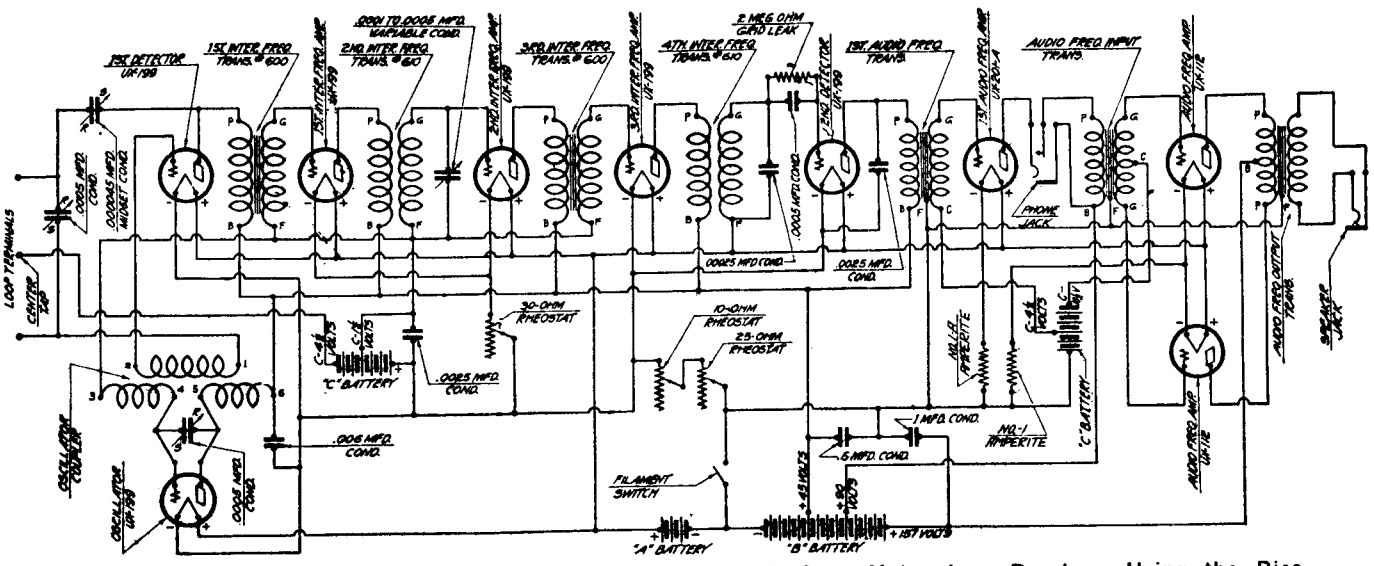
Metallized



RESISTORS

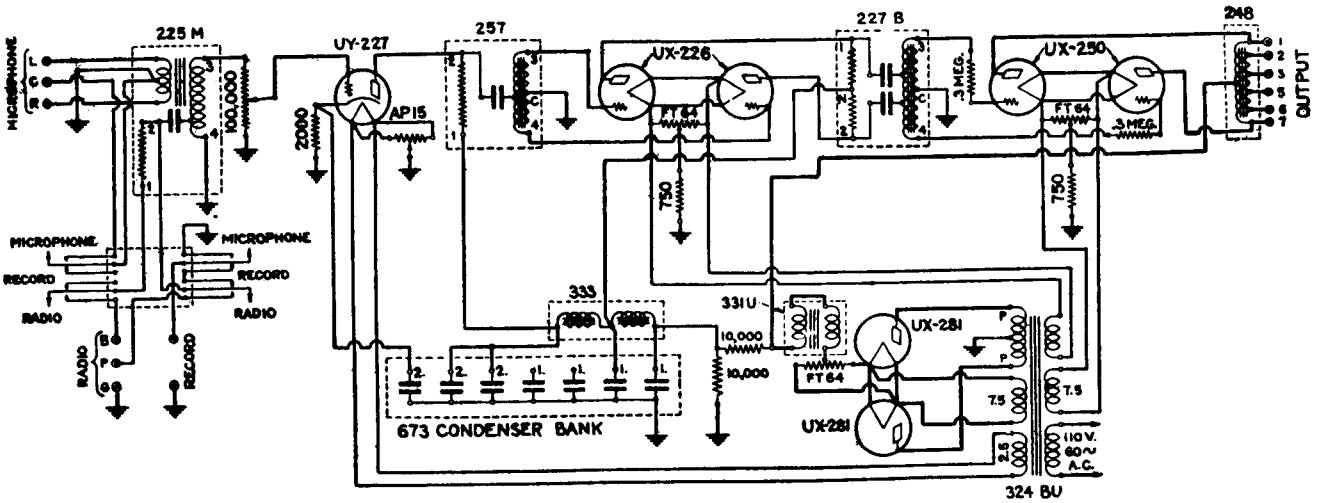
INTERNATIONAL RESISTANCE CO., 2006 CHESTNUT ST., PHILA., PA.

REMLER RADIO CORP.



Schematic Wiring Diagram of the Remler 45 K. C. Super-Heterodyne Receiver, Using the Rice Split-Loop to Obtain Regeneration.

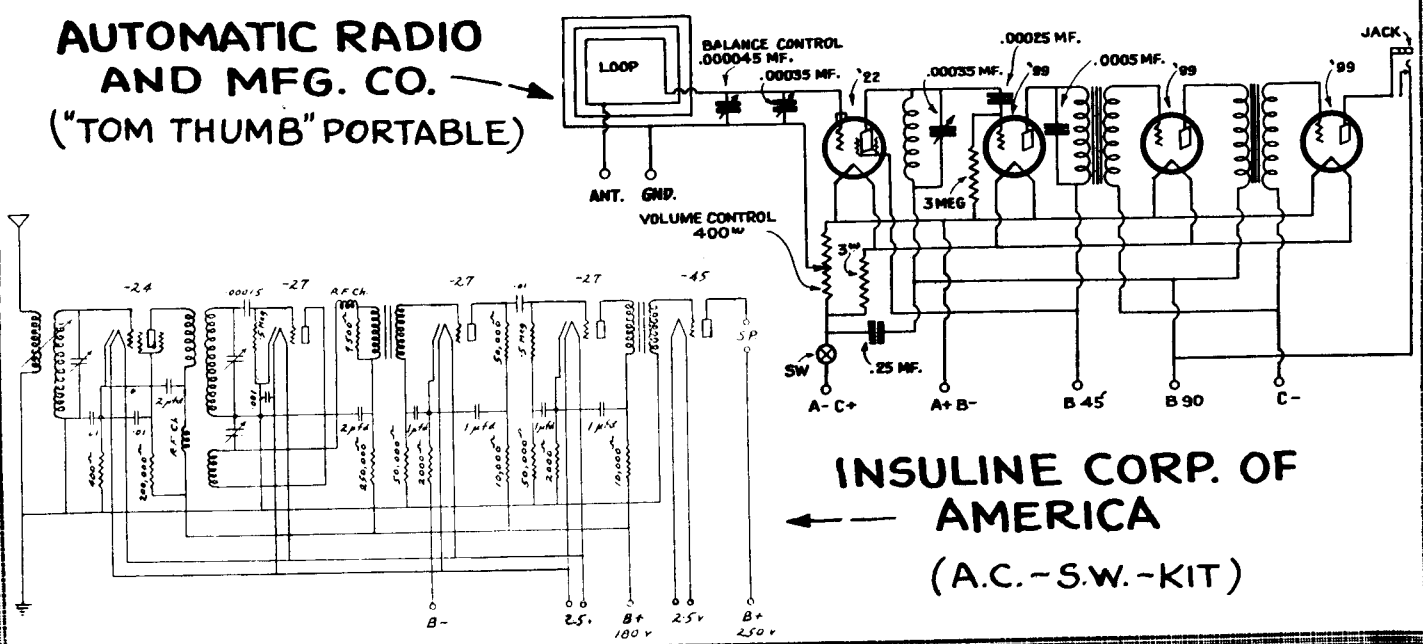
SILVER MARSHALL, Inc.



Schematic Diagram of the SM 690 Public Address Amplifier.

AUTOMATIC RADIO AND MFG. CO.

("TOM THUMB" PORTABLE)



INSULINE CORP. OF AMERICA

(A.C.-S.W.-KIT)



Here's the Solution *of Your* Condenser Troubles!

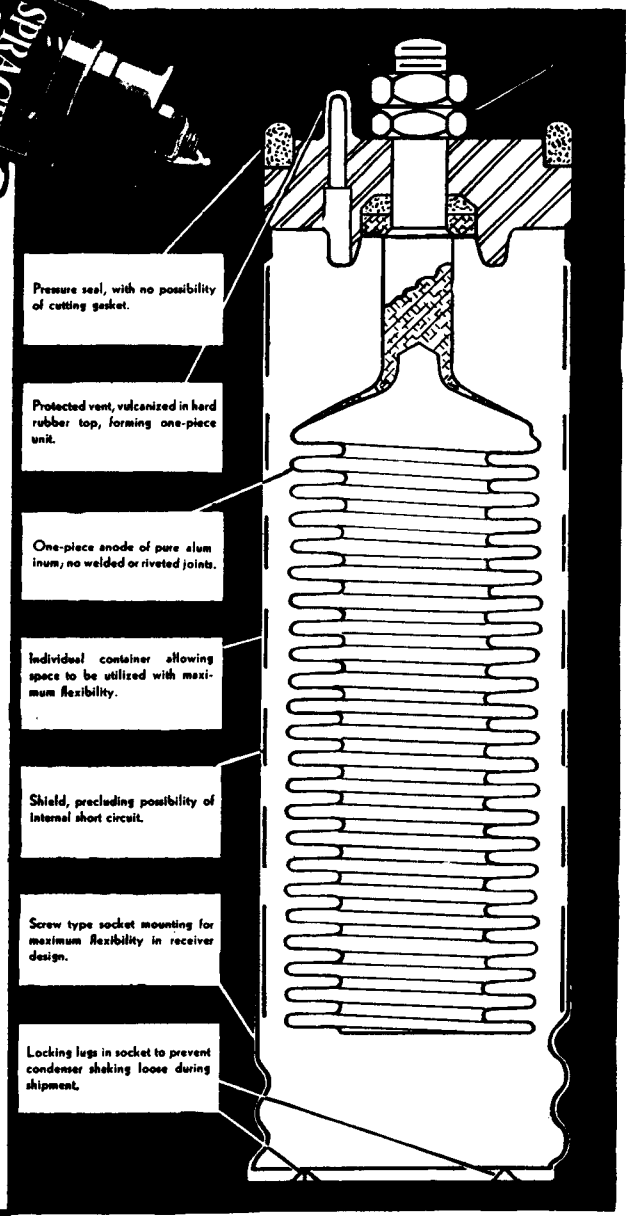
DON'T worry about condenser problems. If they involve 8 MFD or more —let the Sprague electrolytic condenser take care of them. For this new, perfected condenser is the most adaptable and efficient unit you ever saw. Only 1⅜" in diameter and only 5" height overall. Yet it rates 8 MFD capacity with peak voltage of 430 DC.

It has an exclusive, one-piece, round-edged anode without a single soldered or welded joint anywhere. The individual screw socket mounting makes it easily adaptable to use in any set.

And because of the Sprague standardized unit construction—you buy just the amount of capacity you require, without paying a premium for useless excess or for "special built" jobs.

Write for illustrated folder on the Sprague electrolytic condenser.

SPRAGUE SPECIALTIES COMPANY
QUINCY, MASS.
Manufacturers also of the well-known
SPRAGUE PAPER CONDENSER

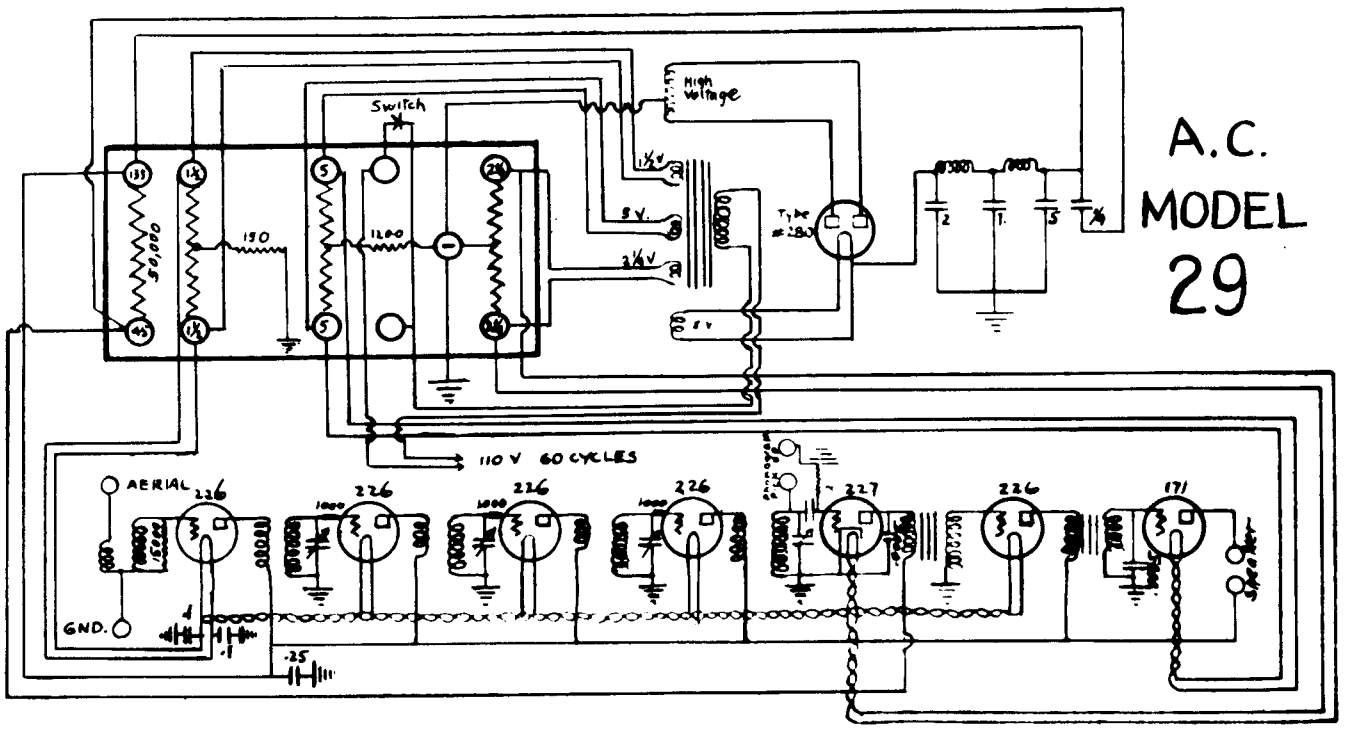


SPRAGUE *Electrolytic* CONDENSER

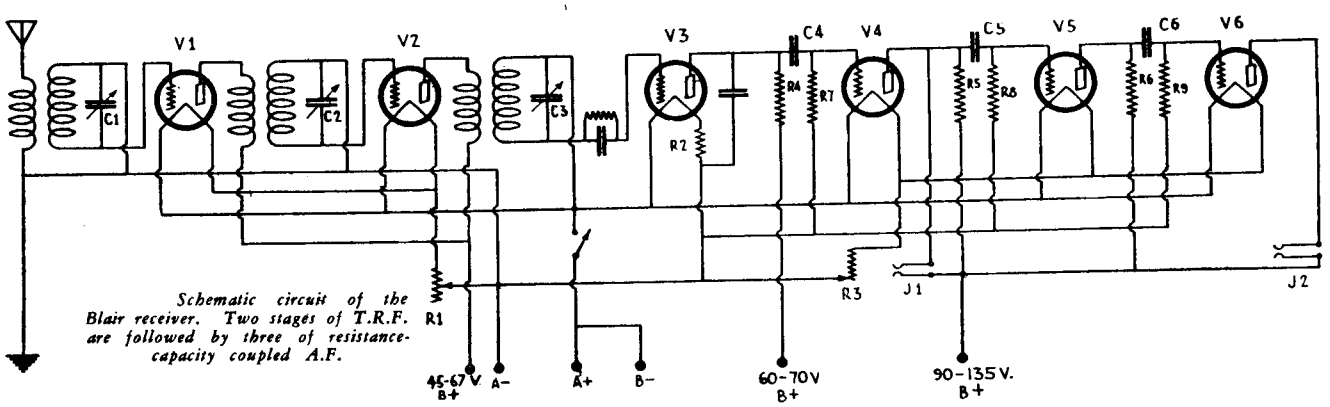
Capacity 8 MFD
Peak Voltage 430 DC
Can Negative

STANDARD RADIO CORP.

A.C. MODEL 29



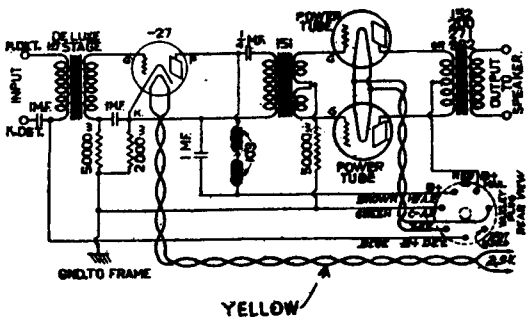
BLAIR RADIO CO.

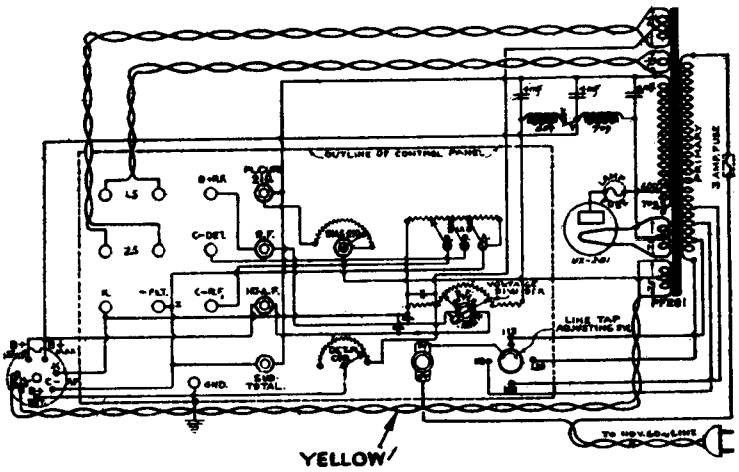


Schematic circuit of the Blair receiver. Two stages of T.R.F. are followed by three of resistance-capacity coupled A.F.

AMERICAN TRANSFORMER CO.

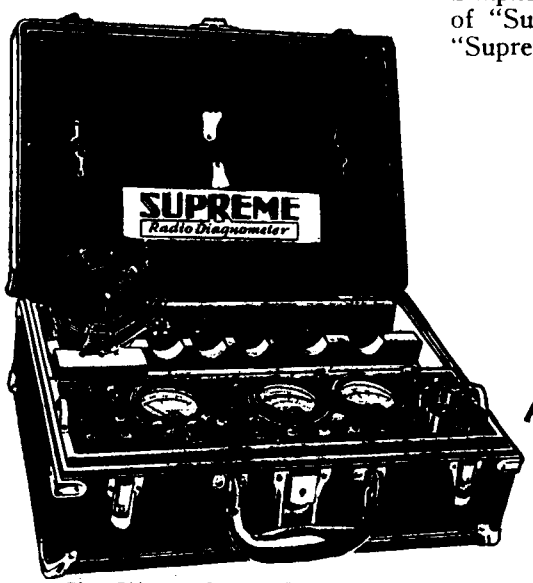
The Amertran Type 2-AP Audio Amplifier and Type 21-D "Hi-Power Box."





"Supreme by Comparison"

Simplify your choice of testing instruments . . . enjoy the profits and prestige of "Supreme" standards . . . standardize on Supreme Testing Instruments . . . "Supreme by Comparison."



Size 7½ x 12 3/16 x 18 7/16
Dealers' Net Price, F.O.B. Greenwood, Miss. **$139.50**

Also available in smaller case for the radio man who does not care to carry spare parts, tubes, etc., in the same unit.

SUPREME Radio Diagnometer

MODEL 400-B

conceivable

Makes every test on any Radio Set-

In every competition and comparison Model 400-B Supreme Diagnometer is acknowledged "Supreme by Comparison"—without a rival in its field. Amazingly complete in its testing facilities . . . providing analysis of Pentode, Screen Grid and Auto Receivers in addition to its countless circuit combinations, Model 400-B is admittedly the marvel of the radio servicing industry. Endorsed and recommended by practically every servicing authority.

Put your service on a par with 1930 proficiency . . . Modernize with the Supreme Diagnometer. It pays for itself in a few months . . . Faster and more accurate servicing means greater profits. So far ahead in its field that it will be modern years from now!

SUPREME TUBE CHECKER

MODEL 19

Size 3¼ x 9⅞ x 6 1/16. Weight 6 lbs.

Dealers' Net Price, F.O.B. Greenwood, Miss.

Counter Type $26.95 **Portable Type $29.95**

A sensational value in a counter or portable Tube Checker. Tests all tubes, including Pentode, Screen Grid, Second plate 280 and 2-volt '30 series, all without adapters. 8 mil. scale provides easy and accurate reading. Simple in operation—sturdy in construction, Model 19 provides accuracy and speed in tube testing at an exceptionally low price. Large 3½" D'Arsonval meters — all readings plainly marked on panel. Line switch.

SUPREME TUBE TESTER

MODEL 50

Size 5⅛ x 10 9/16 x 7 5/16. Weight 11¾ lbs.

Dealers' Net Price, F. O. B. Greenwood, Miss. $98.50

A super efficiency instrument invaluable to technicians, laboratories, public address systems, sound picture equipment. Equipped with automatic voltage regulator. Manufactured under license from Ward-Leonard Electric Co. The finest in tube-testing equipment.

SUPREME OHMMETER

MODEL 10

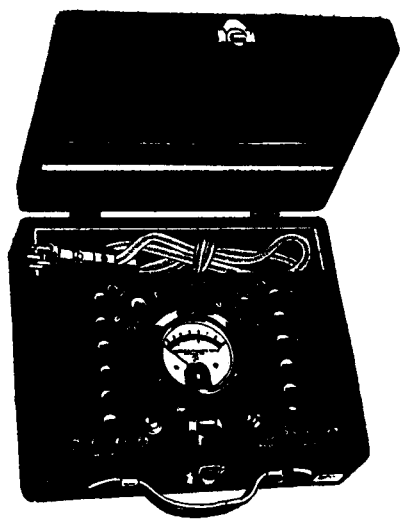
Size 2 x 2 5/16 x 4¾.
Shipping Weight 12 oz.

Dealers' Net Price, F. O. B. Greenwood, Miss. $18.50

Embodying most advanced fentures in Ohmmeter design. Directly calibrated in ohms. Equipped with zero adjustor. Scale 0 to 10,000 ohms. Pocket size for portability. Extremely handy and useful for continuity checking.

SUPREME
Testing Instruments
"SUPREME BY COMPARISON"

A REVOLUTIONARY SET ANALYZER



25 TESTING INSTRUMENTS IN ONE

All Readings on One Meter
Only One Meter to Read

SUPREME SET ANALYZER

MODEL 90

Dealers' Net Price, F.O.B. Greenwood, Miss. Size 4¼ x 9¼ x 11¼, Shipping weight 6 lbs. $78.50

It provides 79 possible analytical readings
It furnishes A.C. and D.C. Voltage and Current readings on ONE METER
Voltage readings up to 900 volts
Current readings to 300 Milliamperes
Resistance 1000 Ohms per volt A.C. or D.C.
External pin jack connections
High and low resistance measurements
Polarity indication
Pentode Testing — Auto Receiver Testing
IT DOES MORE THAN ANY THREE OR FOUR-METER Set Analyzer on the Market
QUICKER, SIMPLER and with a higher degree of accuracy — plus the advantage of ONLY ONE METER TO READ!

"SUPREME BY COMPARISON"

Most good distributors carry the complete line of Supreme Instruments in stock. If yours cannot supply you, write direct to

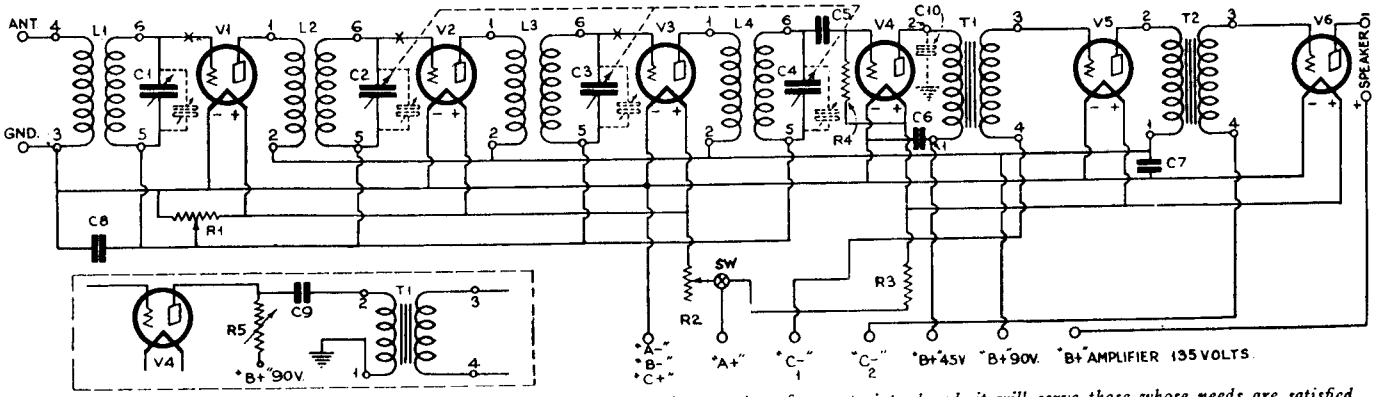
Supreme Instruments Corp.

373 Supreme Building :: Greenwood, Miss.

Distributors in All Principal Cities

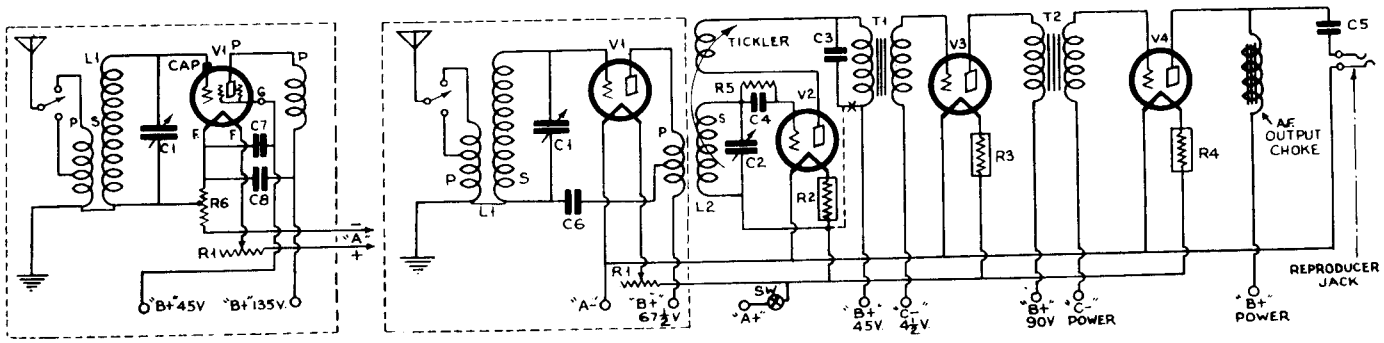
Service Depots in New York, Philadelphia, Pittsburgh, Chicago, Kansas City, Seattle, Toronto, San Francisco

AERODYNE SIX



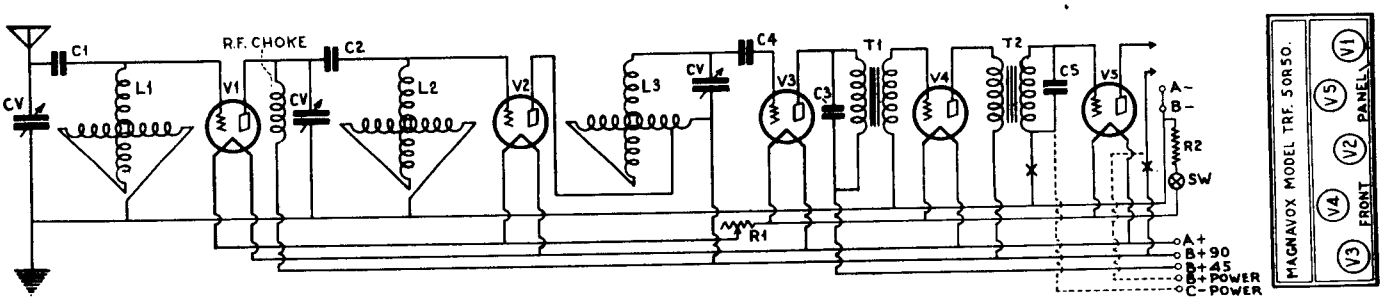
The "Aerodyne Six" was in its day a very good receiver; with certain refinements introduced, it will serve those whose needs are satisfied by a battery-operated set. A few simple changes are shown by the dotted lines and Xs in the original circuit, above; and the recommended "parallel-plate feed" detector circuit is given at the lower left; the plate should be by-passed to ground by C10 in either case.

AMBASSADOR FOUR



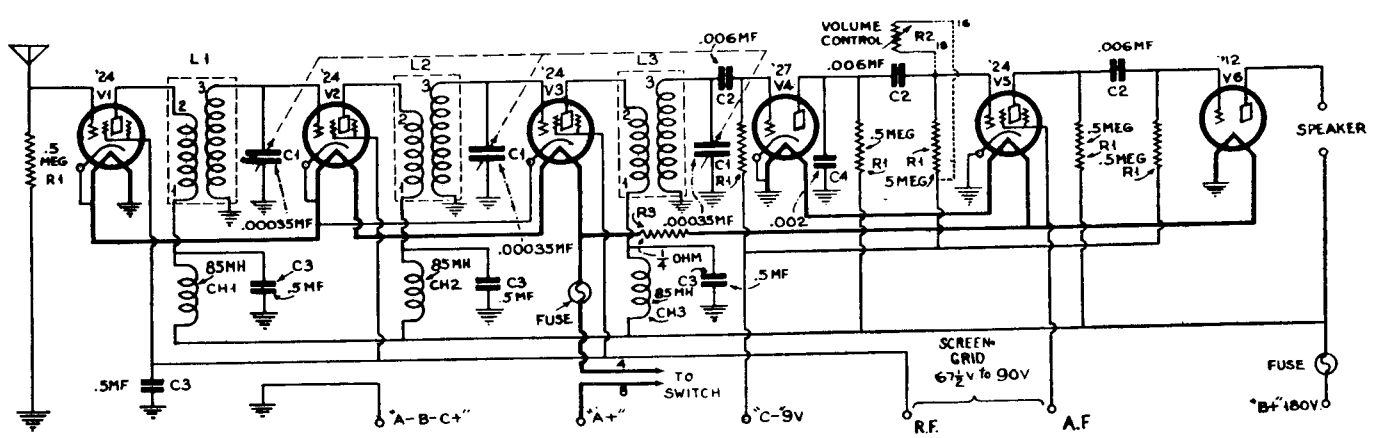
At the right, the "Ambassador Four" receiver as originally designed. Its first R.F. stage, indicated by a dotted square, may be replaced by the screen-grid stage shown in the dotted panel at the left.

MAGNAVOX CO.

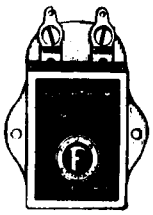


Circuit arrangement of the Magnavox Types TRF-5 and TRF-50 receivers; Note that this single-dial set is tuned by variable inductances (variometers) instead of the more usual variable condensers. Servicing one of these receivers requires treatment different from that which would obtain when the more usual type of receiver is being serviced.

CONTINENTAL WIRELESS & SUPPLY CO.



Latest circuit of "The Voice of the Road" automobile receiver. The amplification provided is high in both radio and audio channels, giving sensitivity with the small aerial system which can be accommodated in a car. Note the series filament connections and the separate connection for A.F. screen-grid bias.



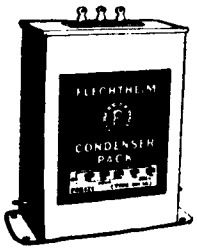
By-Pass
250-v. D.C.

AN EVER INCREASING NUMBER

of



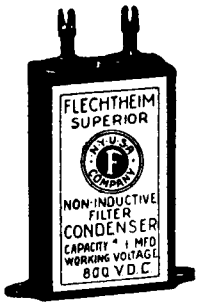
Filter
450-v. D.C.



Blocks
450 to 1000-v.
D.C.

RADIO SERVICE MEN,
CUSTOM SET BUILDERS,
EXPERIMENTAL LABS.,
BROADCAST STATIONS,
SCHOOLS, COLLEGES,
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ARE USING
FLECHTHEIM
SUPERIOR CONDENSERS
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High
Voltage
800-v. D.C.



High Tension
1000-v. D.C.

3 VERY REASONS IMPORTANT *Why:*

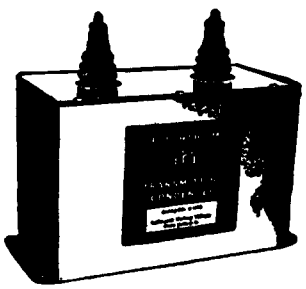
1—Highest Quality Materials and Workmanship

2—Thoroughly Dependable and Reliable

3—Priced Very Reasonably

— IMMEDIATE SHIPMENT OF ALL ORDERS —

Write for Catalog No. 22 and name of nearest Dealer

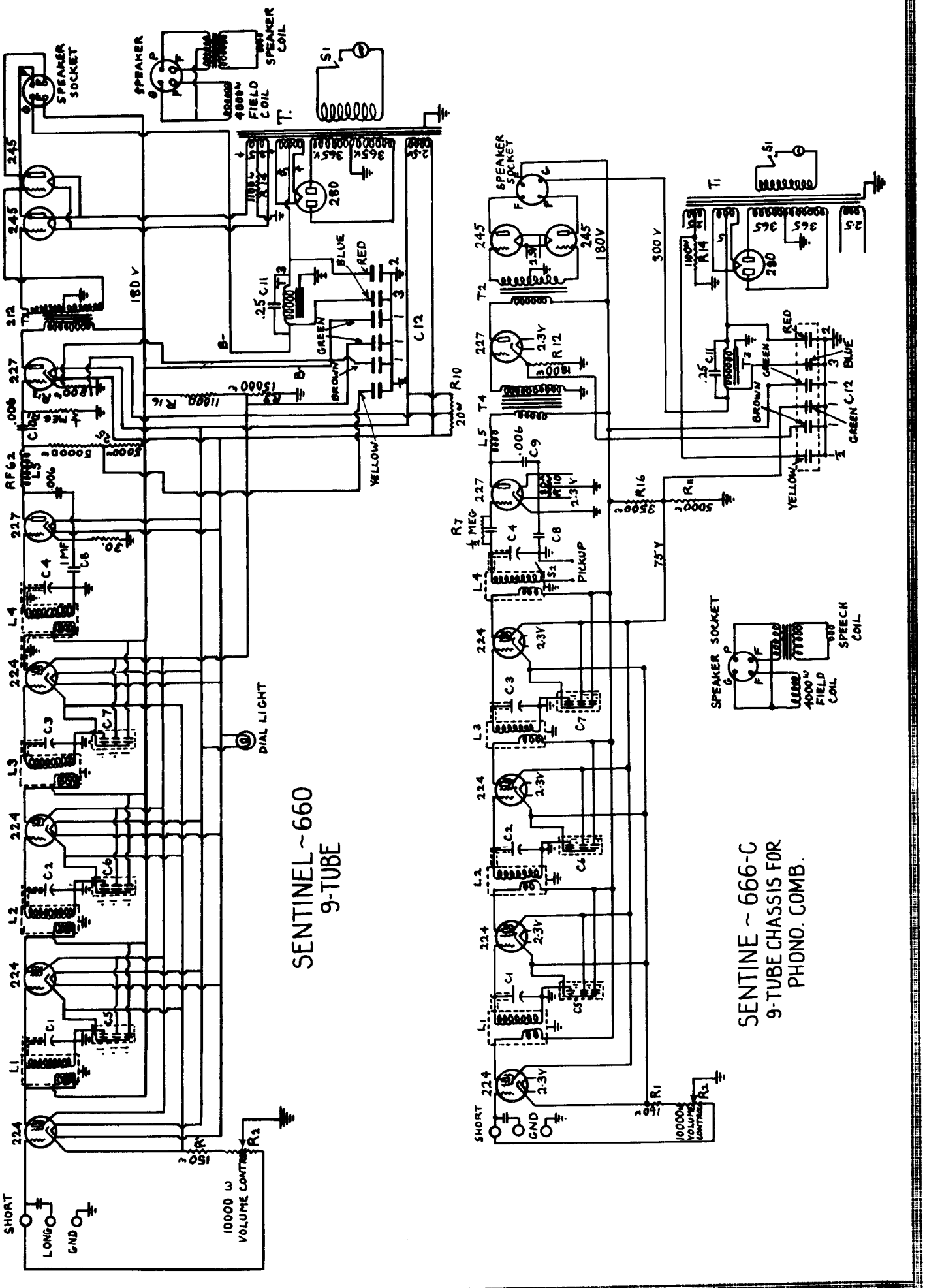


Transmitting
1500 to 5000-v. D.C.

A. M. FLECHTHEIM & CO., Inc.

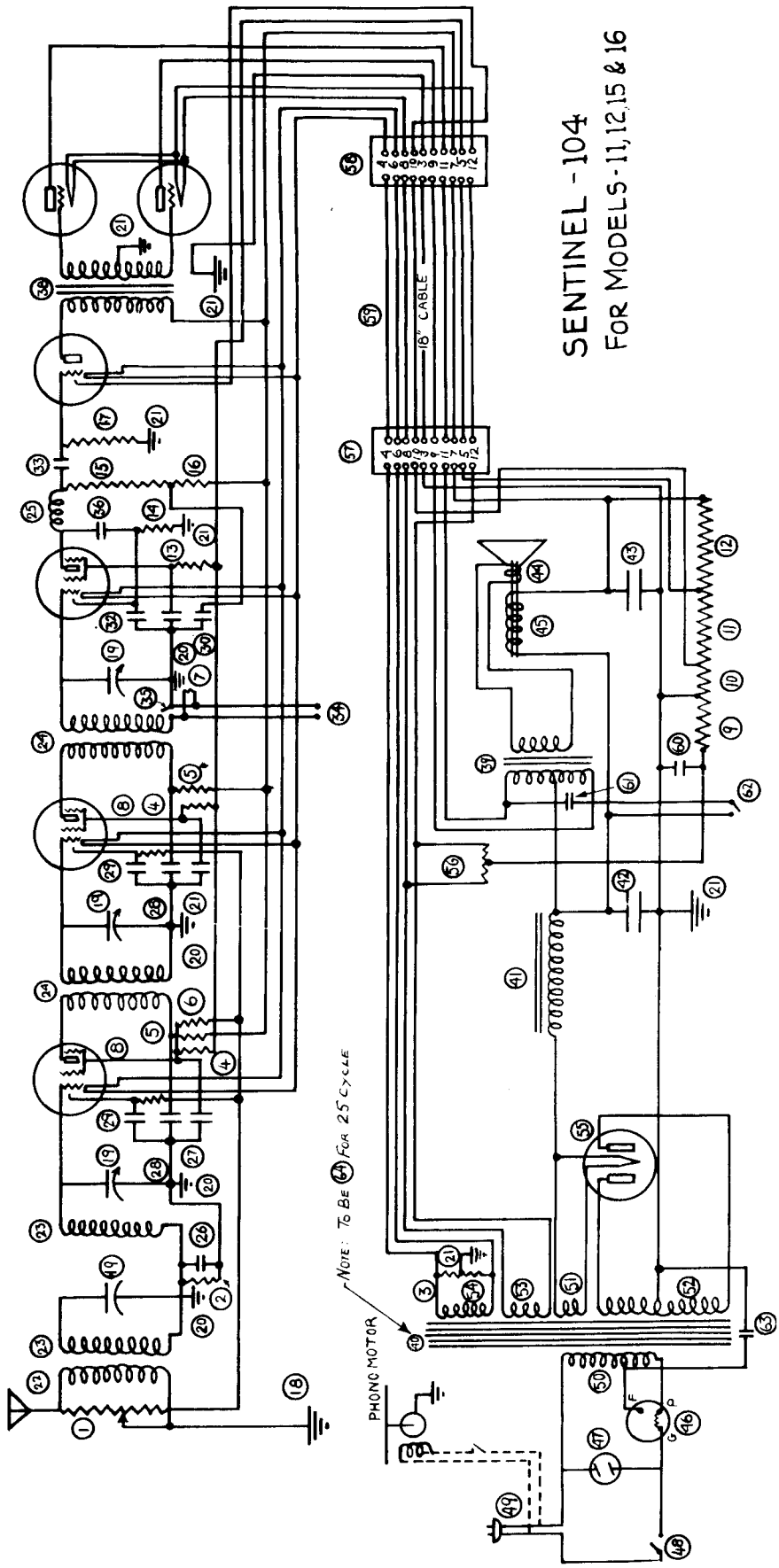
134 Liberty Street, New York, N. Y.

UNITED AIR CLEANER CO.



UNITED AIR CLEANER CO.

SENTINEL - 104
FOR MODELS - 11, 12, 15 & 16

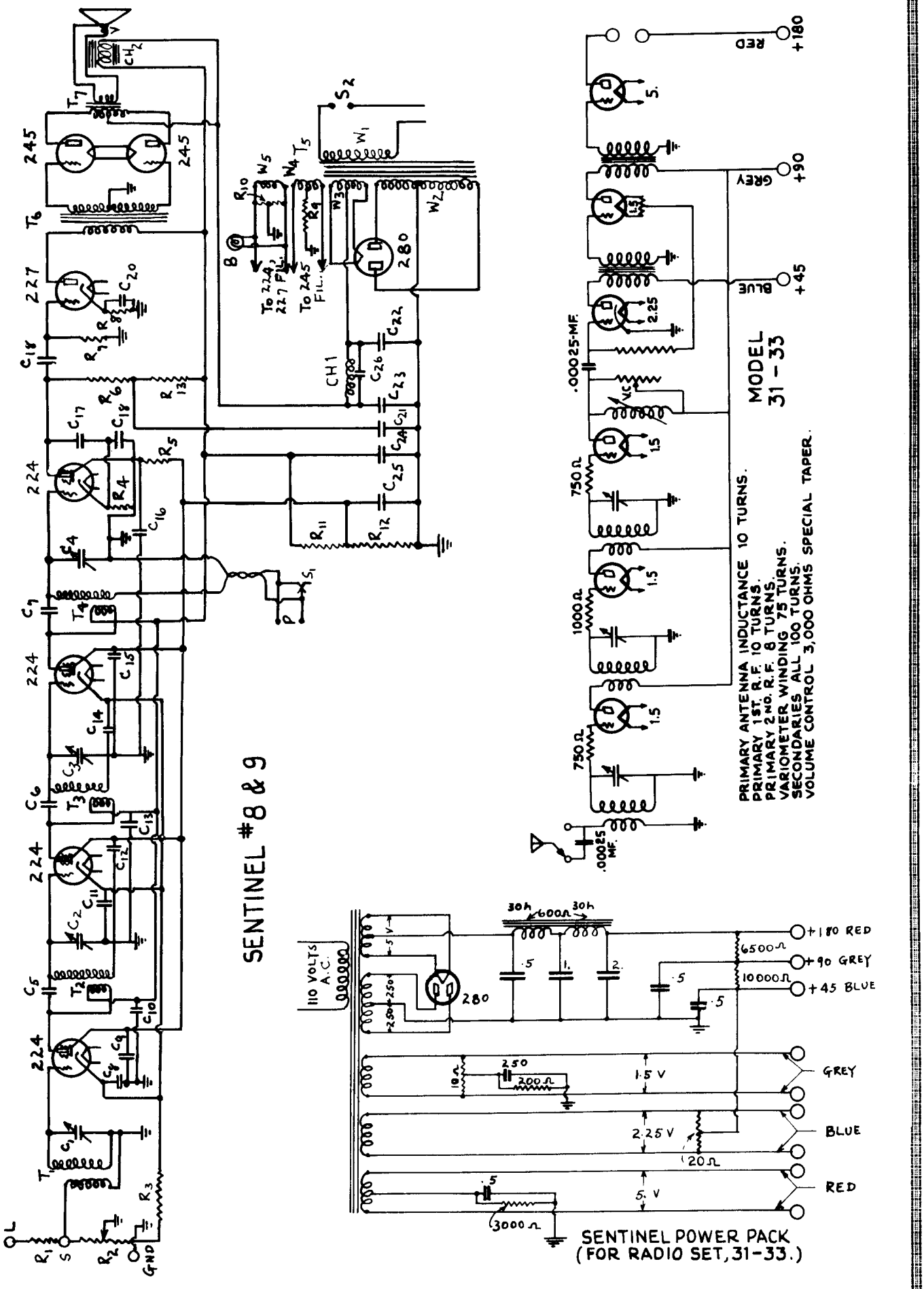


Nº	DESCRIPTION	R	I	E	W	Nº
1	VOLUME CONTROL	1.0M	18 MA	∝	0-001	18
2	COUPLING RESISTOR	740	0	0	0	20
3	CENTER TAP RESISTOR	20	125	25	315	21
4	SCREEN FILTER RESIS	750	1	75	.0009	19
5	PLATE FILTER RESIS	750	4	3	012	22
6	BIAS RESISTOR	100M	1	93	09	23
7	PICKUP LOAD RESIS	2500	0	0	0	24
8	CATHODE BIAS RESIS	750	4	3	012	25
9	245 BIAS RESISTANCE	775	62	50	31	26
10	AUDIO BIAS RESIS	295	44	12.5	55	27
11	SCREEN RESISTANCE	1850	46	80.5	36	28
12	FIELD LOAD RESIS	2100	46	93	43	29
13	SCREEN BLEEDER RESI	1.5MM	055	110	006	30
14	DETECTOR BIAS RESIS	5M	30	1.9	0007	31
15	PLATE LOAD RESIS.	300M	32	96.	03	32
16	DETECTOR FILTER RESIS	50M	32	16	005	33
17	GRID RESISTANCE	1MM	0	0	0	34

Nº	DESCRIPTION
35	PHONOGRAPH SWITCH
36	DETECTOR R.F. BY PASS .001 mf mica
37	245 BIAS BY PASS COND. .025 mf 900
38	INPUT PUSH-PULL TRANS. THORD 2118-B
39	OUTPUT PUSH-PULL TRANS. THORD 0382-A K=122
40	POWER TRANSFORMER Y-4218-D
41	POWER CHOKE THORD. 3646 200 ma
42	15 MFD. MERSHON COND. 300 V.
43	5 MFD. MERSHON COND. 300 V.
44	VOICE COIL
45	FIELD 2000Ω ± 5%
46	BALLAST LAMP SOCKET
47	PHONO. MOTOR OUTLET
48	LINE SWITCH
49	PLUG AND 8' CORD BELDEN
50	POWER PRIMARY 82 amp @ 115 V.
51	280 FIL 2.4 amp 5 V

Nº	DESCRIPTION
52	HIGH VOLTAGE WINDING
53	245 FILAMENT WINDING
54	224 FILAMENT WINDING
55	RECTIFIER TUBE TYPE 280
56	CENTER TAP 245 FILAMENT
57	JONES PLUG and RECEPTACLE
58	CABLE TERMINAL STRIP
59	18½ CABLE 10 CONDUCTOR
60	.025 PAPER CONDENSER 300 V
61	.1 MFD PAPER CONDENSER 10000 V
62	TONE CONTROL SWITCH
63	.005 BY PASS COND
64	POWER TRANS 4296-A FOR 25 CYCLE

UNITED AIR CLEANER CO.





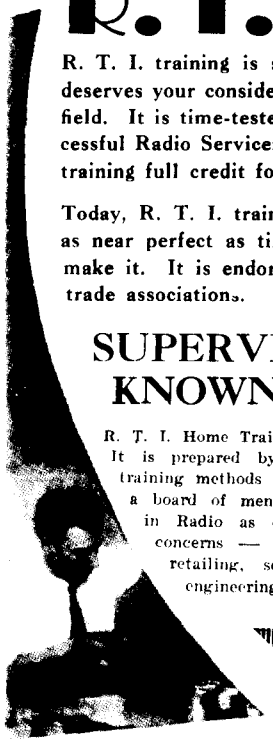
R. T. I. ANSWERS THE CALL

R. T. I. training is so closely linked with the development of Radio—past, present and future—that it deserves your consideration for what it can do for you or someone you know who wants to step up in the field. It is time-tested (being founded upon a course of training started early in 1922) and hundreds of successful Radio Servicemen, dealers, salesmen, broadcast station operators, special set builders, etc., give the training full credit fo- their success.

Today, R. T. I. training constantly revised and amplified, is as near perfect as time, money, brains and experience can make it. It is endorsed by leading radio men and radio trade associations.

SUPERVISED BY WELL KNOWN RADIO MEN

R. T. I. Home Training is practical and up-to-date. It is prepared by experts. Both lessons and training methods are continually supervised by a board of men who are actively engaged in Radio as executives with prominent concerns — manufacturing, jobbing, retailing, servicing, broadcasting, engineering, etc.



The Booklet tells how R. T. I. gives practical home training.

Complete Training for "SERVICE MEN"

The problem of training men for Radio servicing is solved by R. T. I. Everything that comes up in a service man's daily work is covered from the minute he rings the customer's door bell until he leaves her (or him) with a satisfied smile. It's the training that the radio industry wants men to have. It is practical, thorough and complete. An R. T. I. service man also receives a pocket size loose-leaf Radio Service Manual covering the sets of 25 prominent manufacturers—pictures—wiring diagrams—installation—"trouble-shooting"—repair, etc. It goes along with the course and is very valuable being kept up-to-date.

ALL BRANCHES COVERED

Television and Talking Pictures, Too

R. T. I. training is so complete there is hardly a subject that is not well covered. It includes the latest in Television, Talking Pictures, Public Address Systems, Short-Wave, etc. The R. T. I booklet gives complete information.

LIFETIME CONSULTATION

Free of Extra Cost to Everyone Who Enrolls

In addition to the regular training Work Sheets which are constantly revised, every R. T. I. student is kept up-to-the-minute with bulletins of latest information right out of the world's laboratories, work shops, factories, etc.

Consultation Service is also supplied on problems of engineering, installation, etc. Answers promptly given by letter, wire or air mail by the R. T. I. engineering staff out of their own experience, their library or by outside personal investigation.

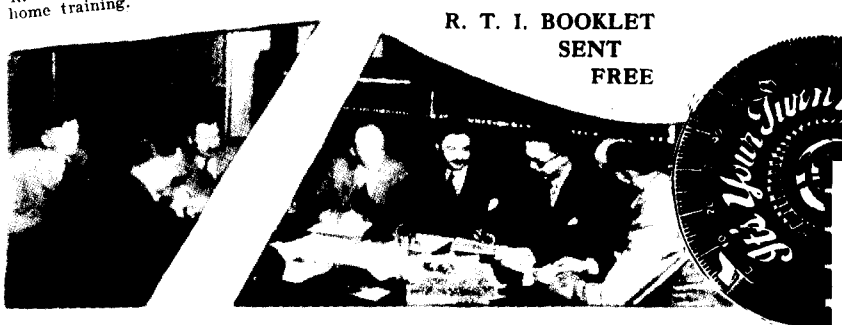


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Mr. Schnell, Chief of the R. T. I. Staff, is one of the ablest and best known radio men in America. He has twenty years of Radio experience. First to establish two-way amateur communication with Europe.

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We shall be glad to send you our booklet and answer any inquiries about the value of R. T. I. training for you.

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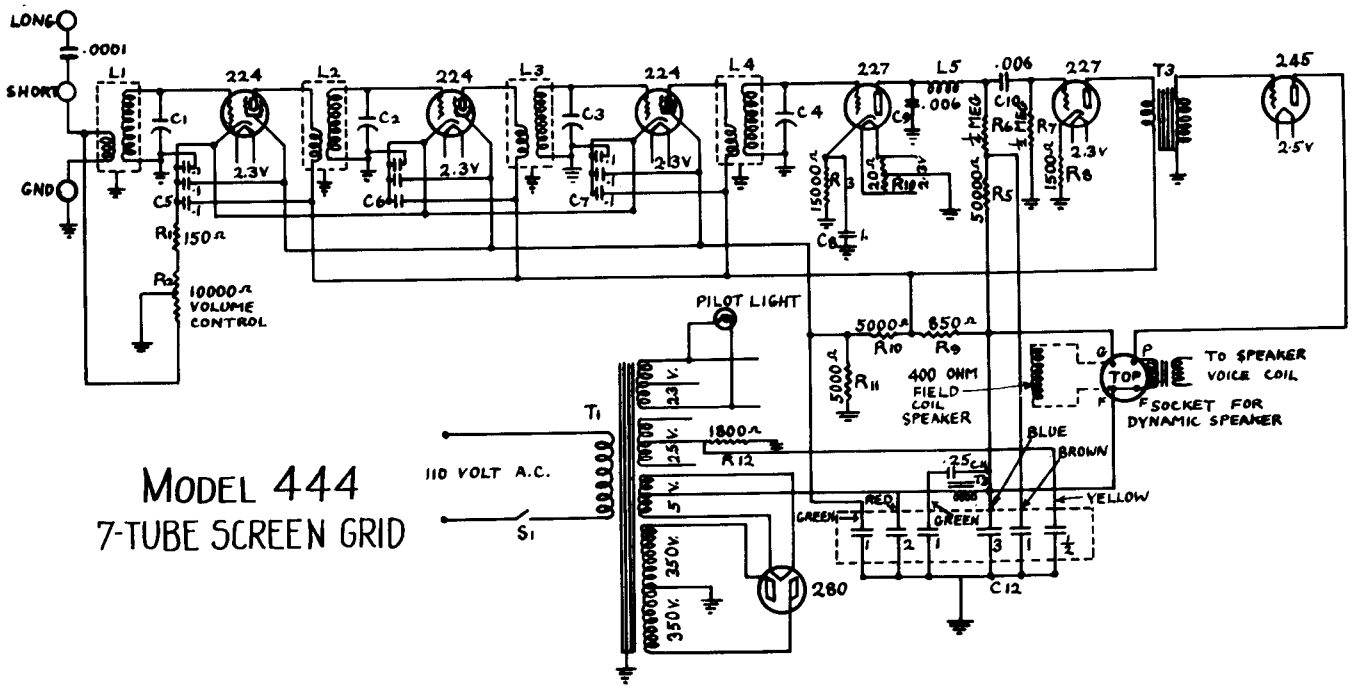
Send me Free and prepaid your booklet and full details of your three-in-one Home Training (without obligating me in any way).

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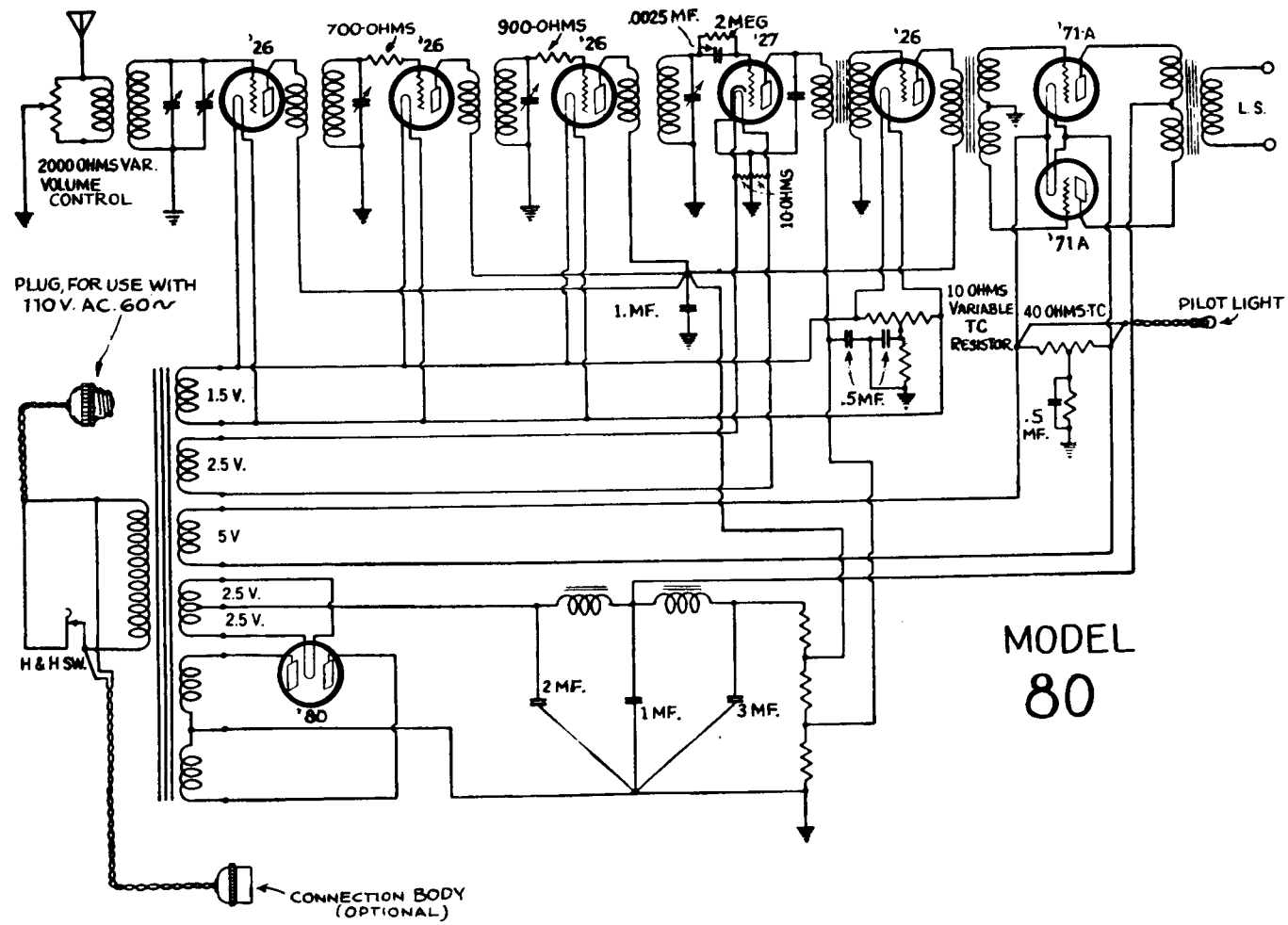
City ..... State .....

UNITED AIR CLEANER CO



MODEL 444
7-TUBE SCREEN GRID

BUCKINGHAM RADIO CORP.



MODEL 80

ANY RADIO SERVICE MAN WILL MAKE MORE MONEY

FOR HIMSELF OR HIS EMPLOYEES

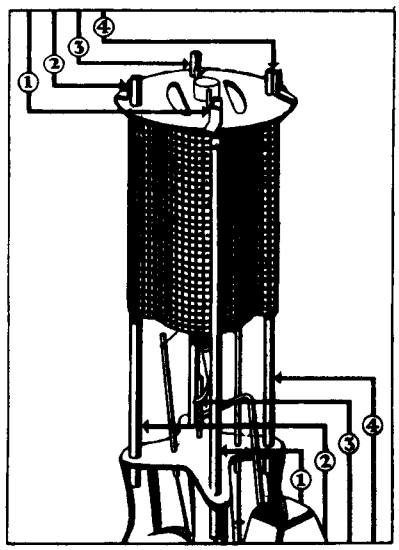


as soon as he realizes that a thoroughly satisfied radio set owner is his best advertisement and endorsement.

Successful service men are always carefully building up an ever-increasing patronage of thoroughly satisfied set owners, thereby securing a continually growing all-the-year-'round income.

Thousands of successful service men have already discovered that a home demonstration with a set of EVEREADY RAYTHEONS helps them make more money because these tubes completely satisfy the most critical set owner.

Everyready Raytheon 4-Pillar Tubes incorporate ALL of the latest developments in the tube art. In addition to their superior electrical design, they have a patented 4-Pillar type of mechanical construction and die spacing which insures that the uniformly excellent characteristics built into the tubes at the factory will be unimpaired by shipping or handling.



EVEREADY RAYTHEON 4-PILLAR TUBES ARE

QUICK ACTING

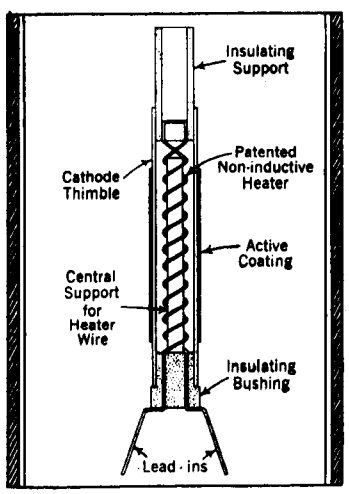
The listener hears the program in a few seconds because of the perfected space insulated heater and high emission cathode.

HUMLESS

because of the patented non-inductive heater and electrostatic shielding system.

NOISELESS

because all metallic joints in the structure and shielding system are spot welded.



LONG LIVED

because of careful selection of materials, rigid inspection in manufacturing and the use of a patented continuously active "getter" for maintaining a high vacuum throughout the life of the tube.

VERY UNIFORM

because of the patented 4-pillar construction and die spacing of the heater, cathode, grid and plate elements.

GUARANTEED TO GIVE COMPLETE SATISFACTION

All Eveready dealers are authorized to replace defective tubes.
A very complete chart showing the electrical characteristics and required operating voltages of all receiving tubes will be sent free of charge to all service men upon request.

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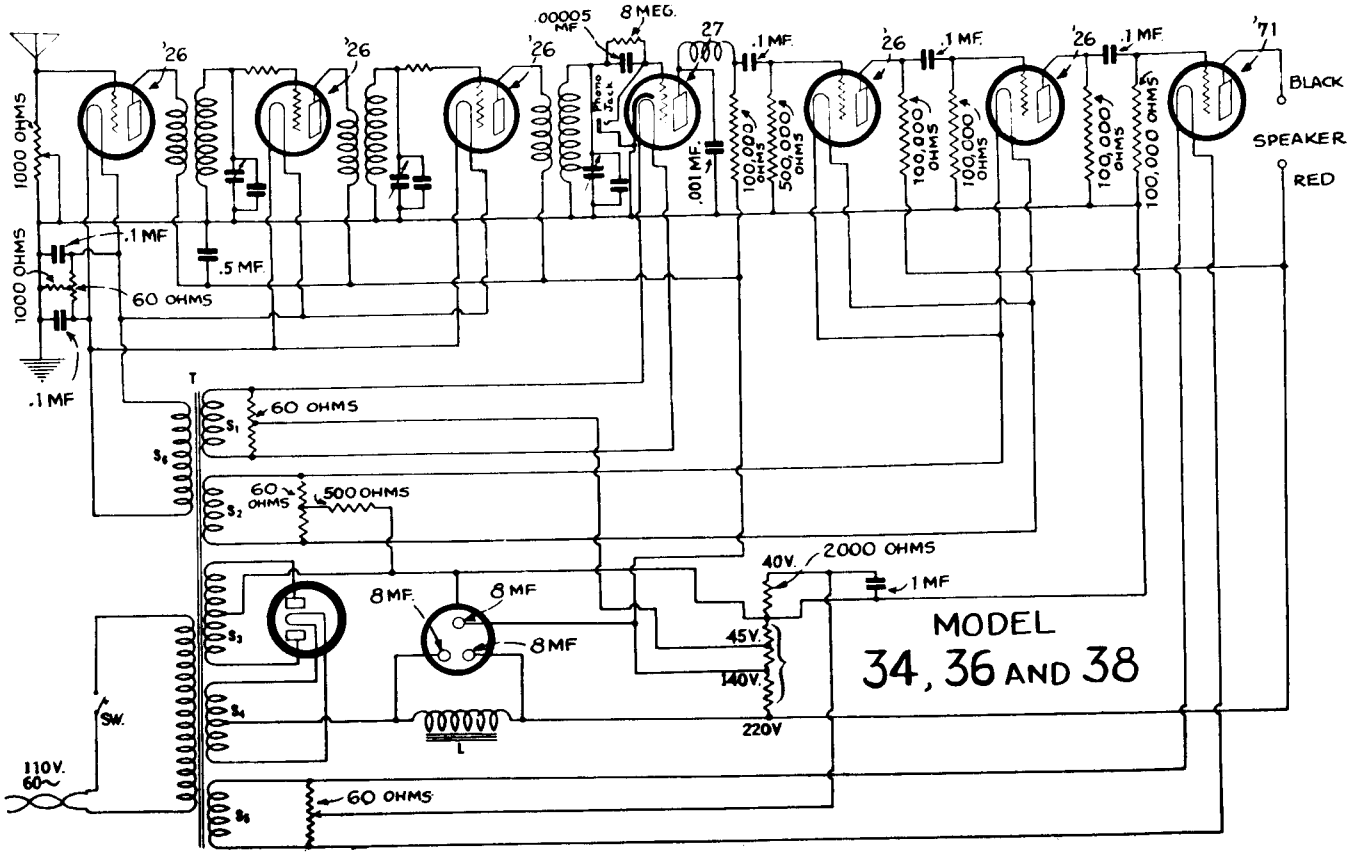
General Offices: New York, N. Y.

Branches:

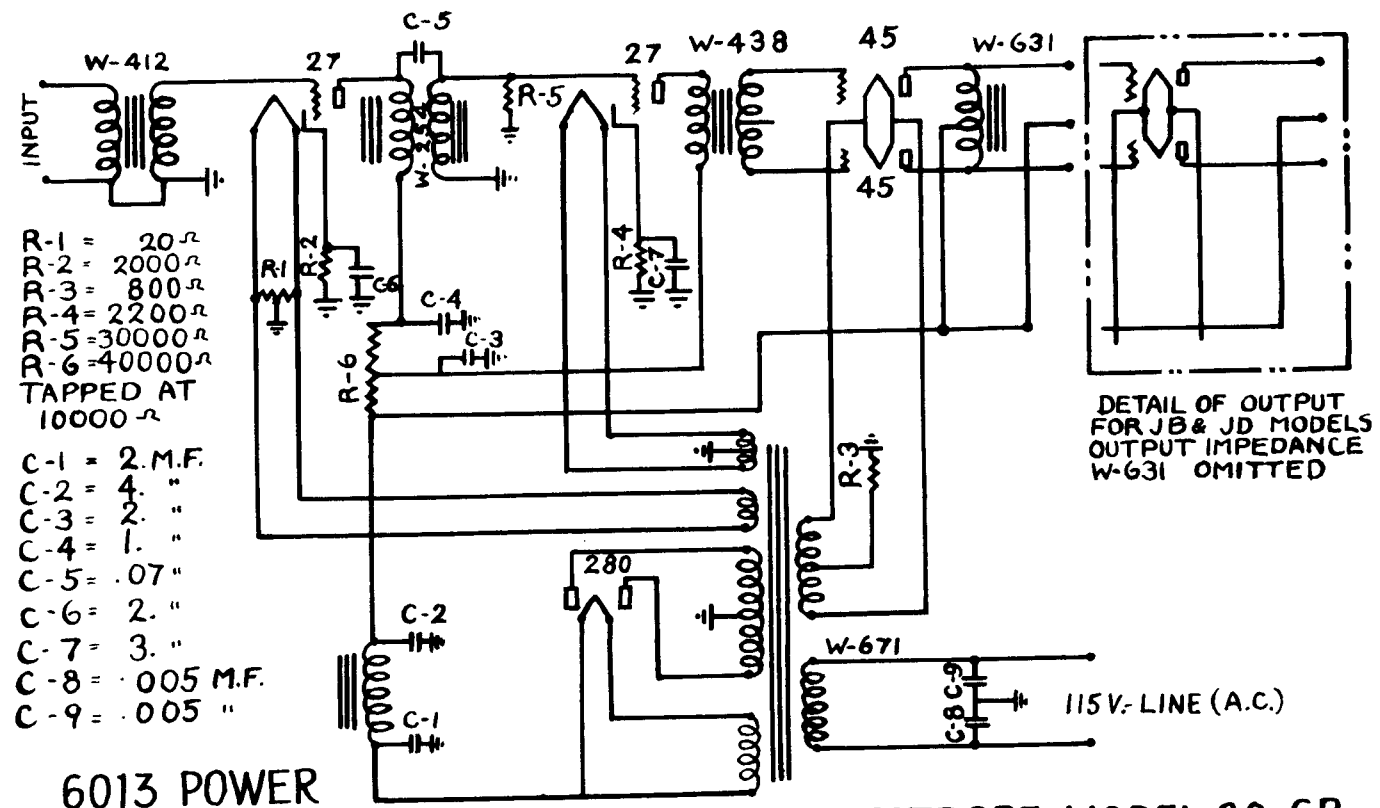
Chicago - Kansas City - New York - San Francisco

Unit of Union Carbide UCC *and Carbon Corporation*

BROWNING DRAKE CORP.

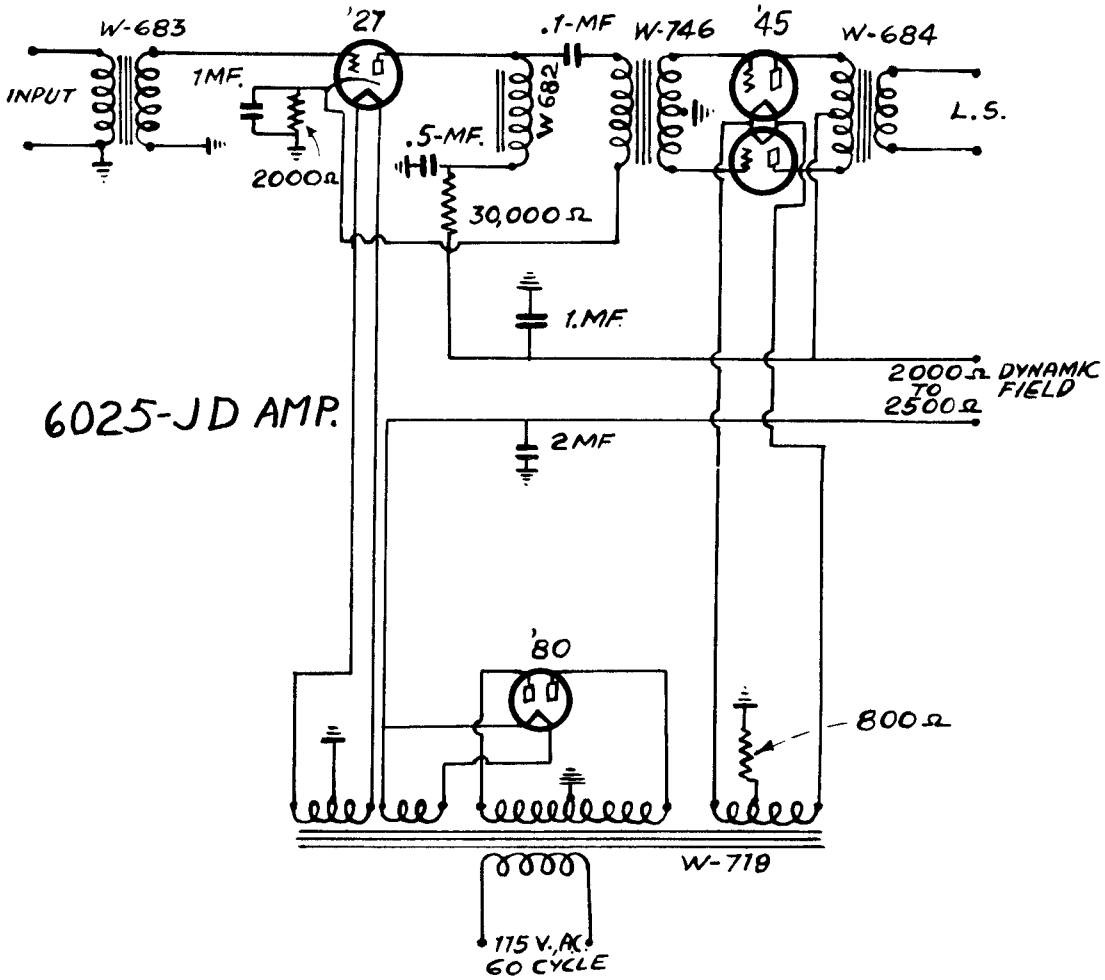


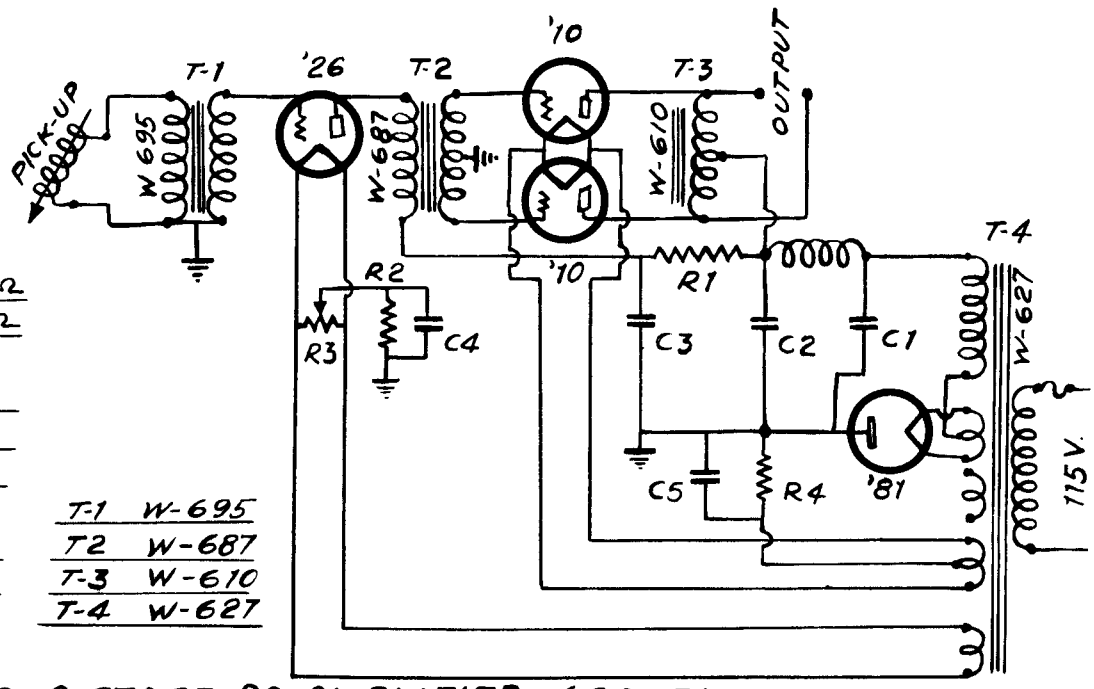
WEBSTER ELECTRIC CO.



6013 POWER AMPLIFIER USED IN CAPEHART ORCHESTROPE MODEL-28-GB.

WEBSTER ELECTRIC CO.



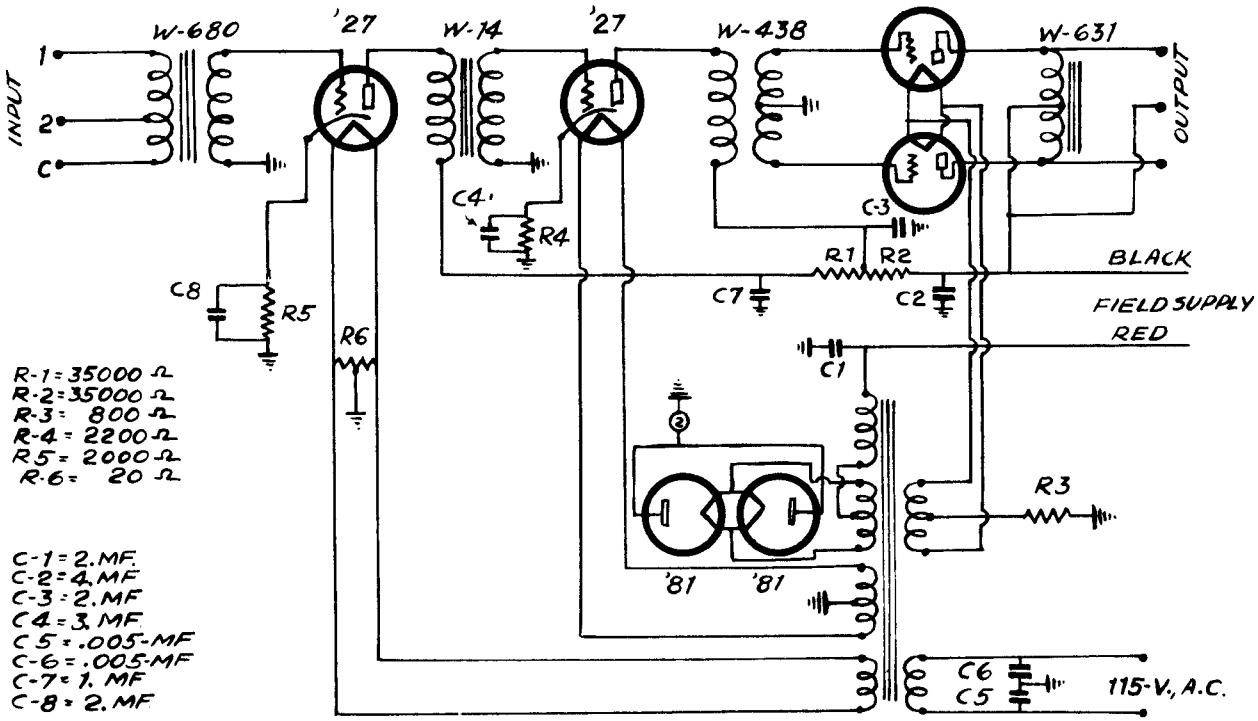


R-1	85000 Ω
R-2	5200 Ω
R-3	10 Ω
R-4	800 Ω
C-1	2. MF
C-2	4. MF
C-3	2. MF
C-4	3. MF
C-5	1. MF

T-1	W-695
T-2	W-687
T-3	W-610
T-4	W-627

WEBSTER 2 STAGE P.O. AMPLIFIER (6005)

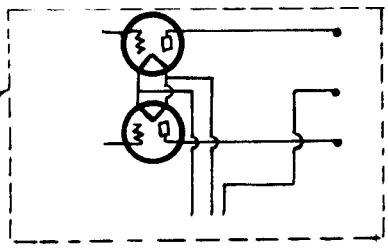
WEBSTER ELECTRIC CO.



R-1 = 35000 Ω
R-2 = 35000 Ω
R-3 = 800 Ω
R-4 = 2200 Ω
R-5 = 2000 Ω
R-6 = 20 Ω

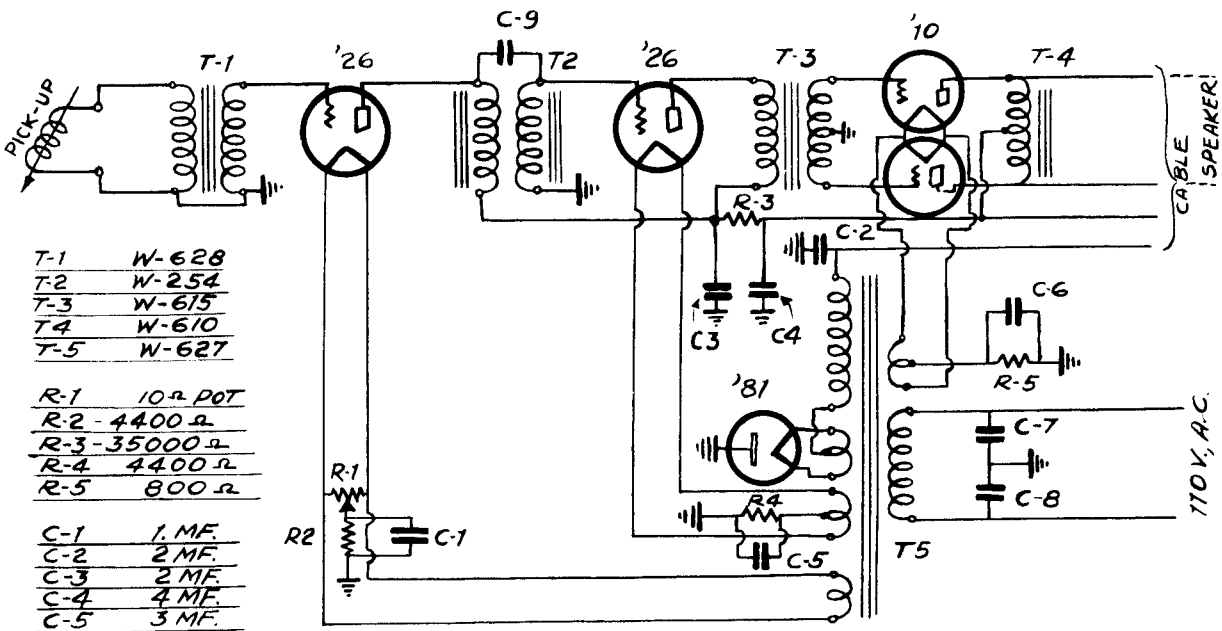
C-1 = 2. MF.
C-2 = 4. MF
C-3 = 2. MF
C-4 = 3. MF
C-5 = .005-MF
C-6 = .005-MF
C-7 = 1. MF
C-8 = 2. MF

L = 3-CP 12-16 VOLT S.C. BULB



DETAIL OF OUTPUT FOR JB&JD MODELS. OUTPUT IMPEDENCE OMITTED (W-631)

6030-JE & B-37-50 AMP.



T-1	W-628
T-2	W-254
T-3	W-615
T-4	W-610
T-5	W-627

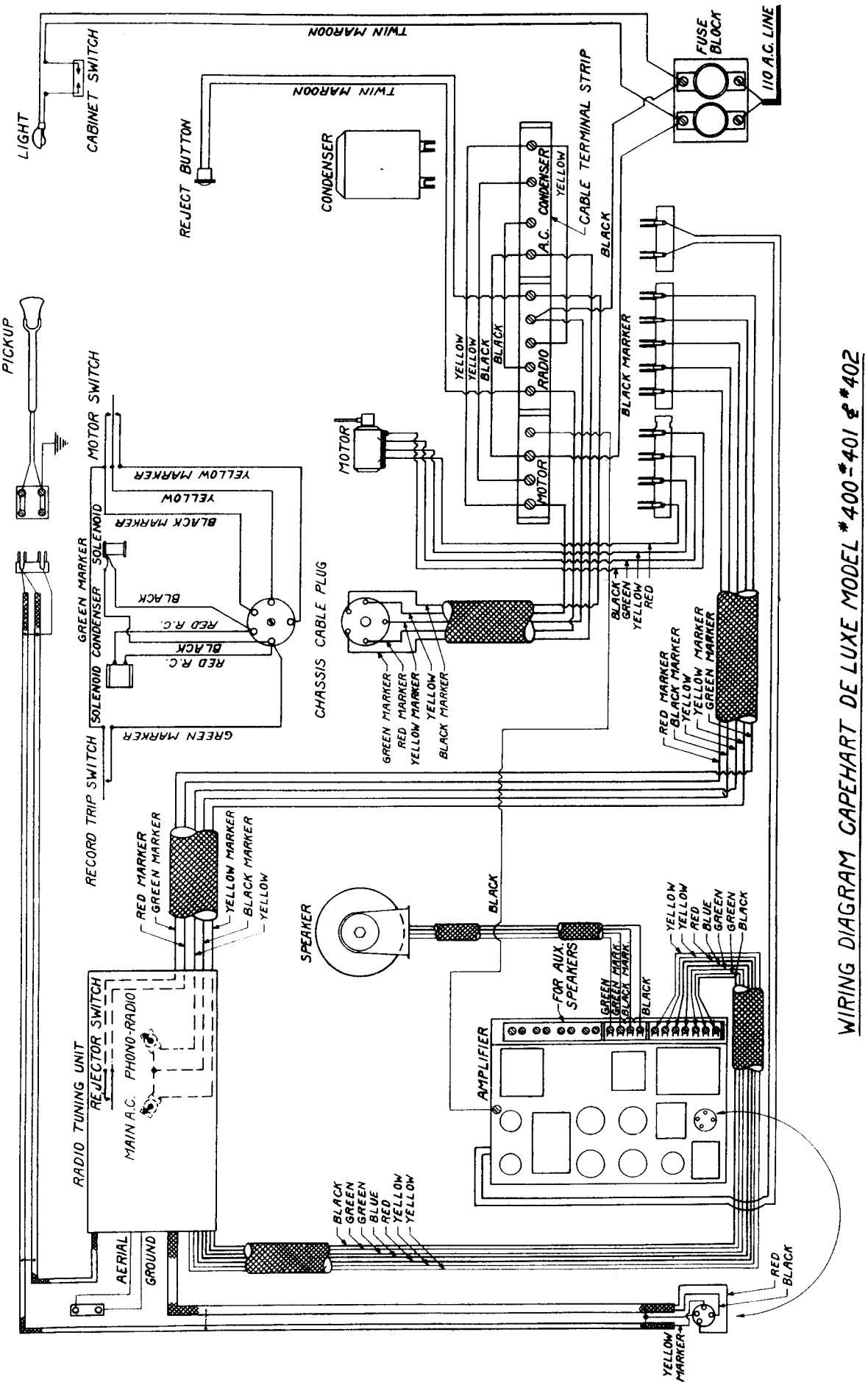
R-1	10 Ω POT
R-2	4400 Ω
R-3	35000 Ω
R-4	4400 Ω
R-5	800 Ω

C-1	1. MF.
C-2	2 MF.
C-3	2 MF.
C-4	4 MF.
C-5	3 MF.
C-6	1 MF.
C-7	.005 MF.
C-8	.005 MF.

C-9 .07-MF.

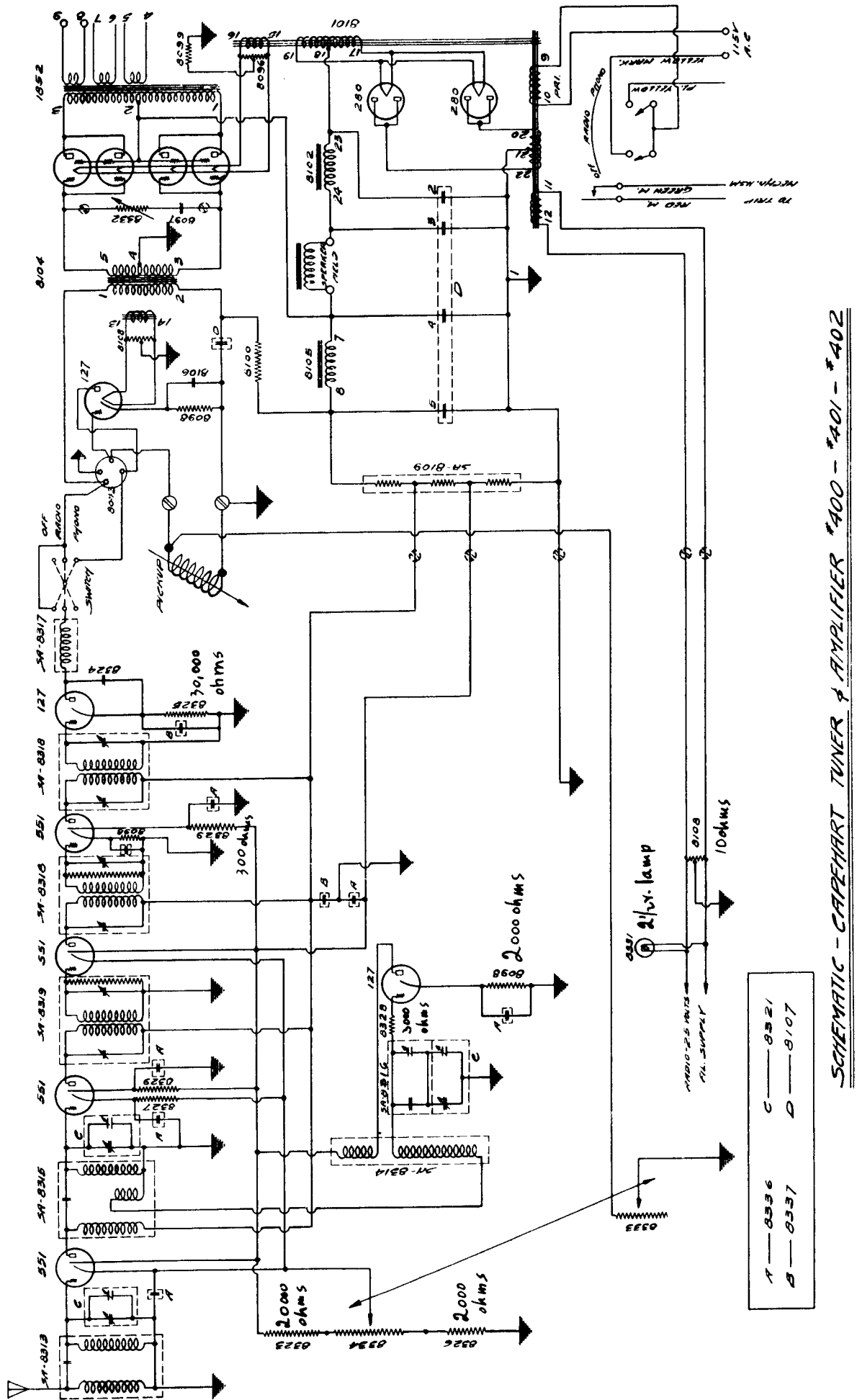
WEBSTER 3 STAGE P.O. AMPLIFIER (6009)

CAPEHART CORPORATION



WIRING DIAGRAM CAPEHART DE LUXE MODEL #400-#401 & #402

CAPEHART CORPORATION



Discriminating Service Men Follow the Choice of Well-known Engineers and Specify

Polymet Products

These finely built parts are used by practically all leading radio receiver manufacturers, following thorough and successful laboratory tests.

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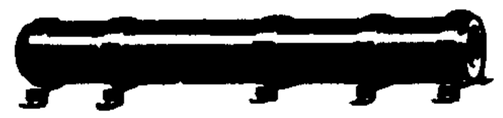


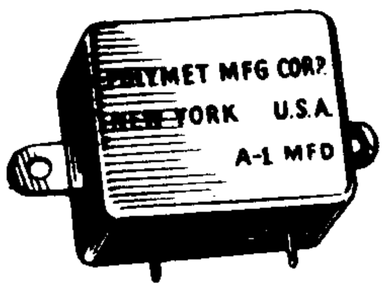
FILTER BLOCKS

The Standard
of the Industry
Built to specification

FIXED RESISTORS

Wire-wound Tubular
Flat Strip—Flexible
Grid Leaks



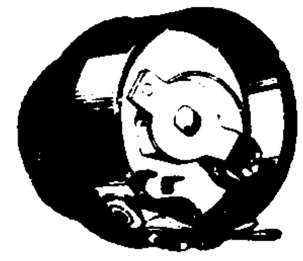


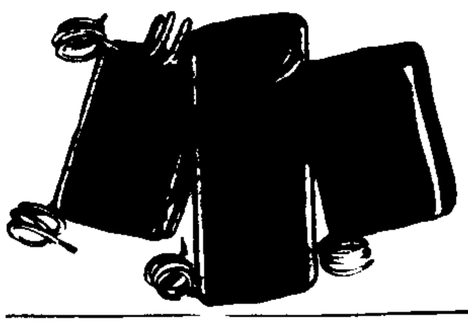
BY-PASS CONDENSERS

In stock in all usual
capacities

VARIABLE RESISTORS

Carbon Volume Controls
Wire-wound Volume Controls
Rheostats—Potentiometers



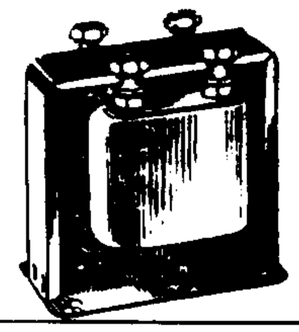


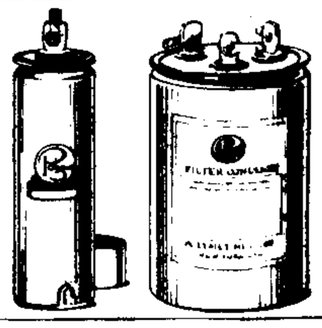
UNCASED PAPER CONDENSER SECTIONS

For repair work

TRANSFORMERS

Audio Transformers
Power Transformers
Standard Choke Units



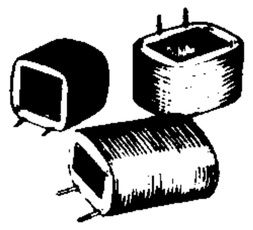


ELECTROLYTIC CONDENSERS

In single, double and
triple units

COIL WINDINGS

All types of coils,
except radio frequency,
built to specification



MICA CONDENSERS

Postage Stamp Type
Large Molded
Small Molded



MAGNET WIRE

Enameled Wire
Sizes, 18 to 42—in case lots



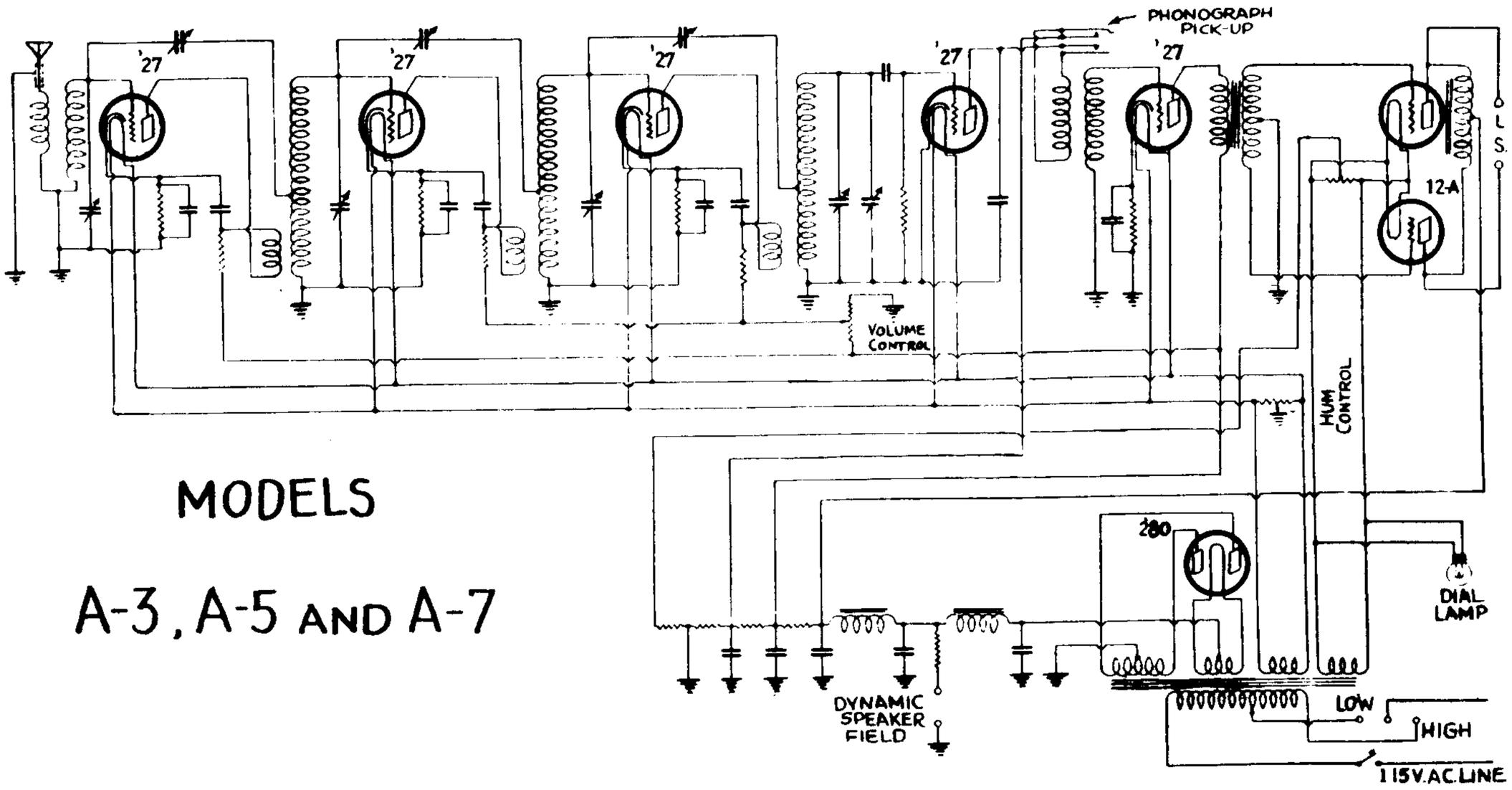
A copy of Special Service Men's Catalog of
POLYMET RADIO ESSENTIALS
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World's Largest Manufacturers of Radio Essentials

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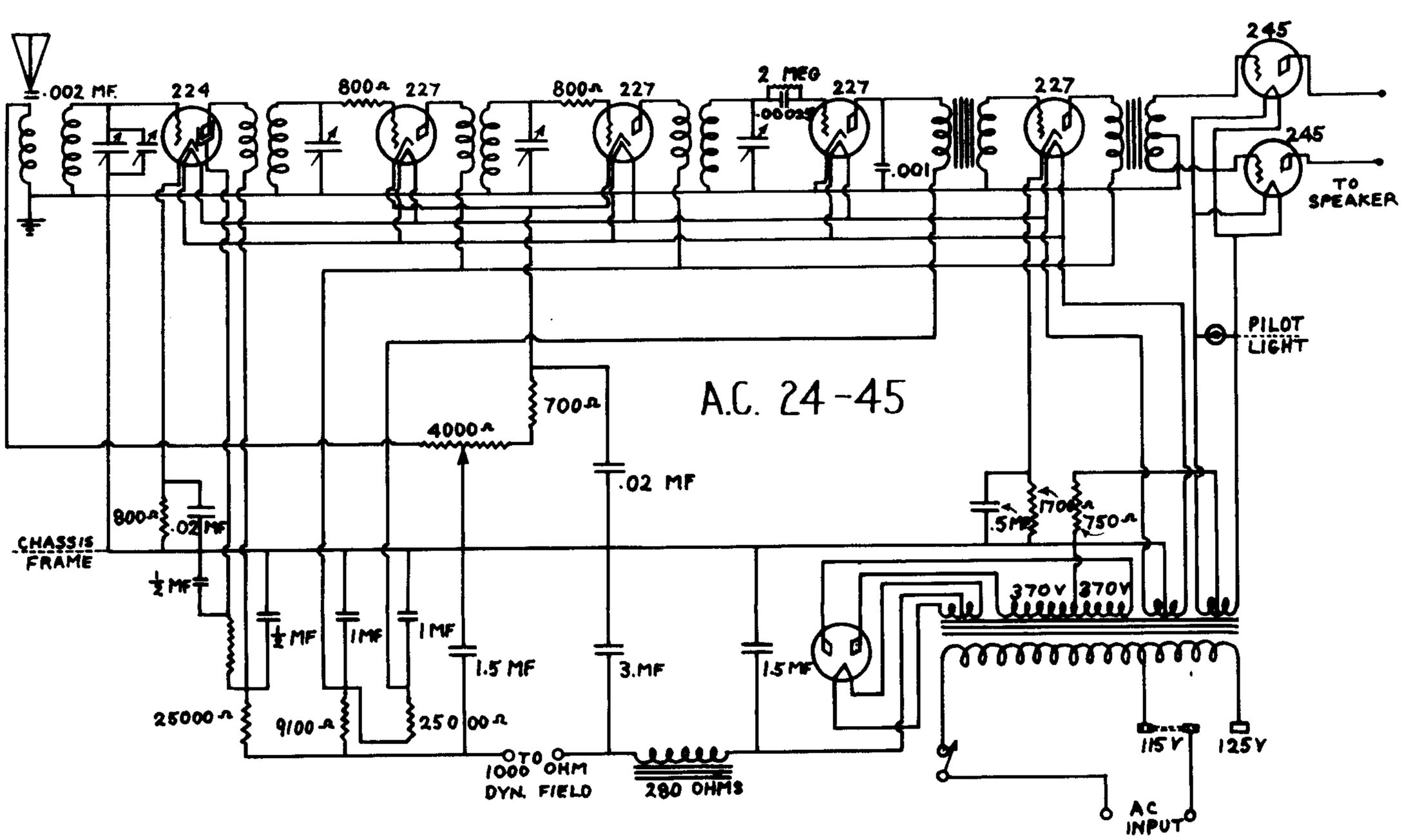
BALKITE PRODUCTS CO.

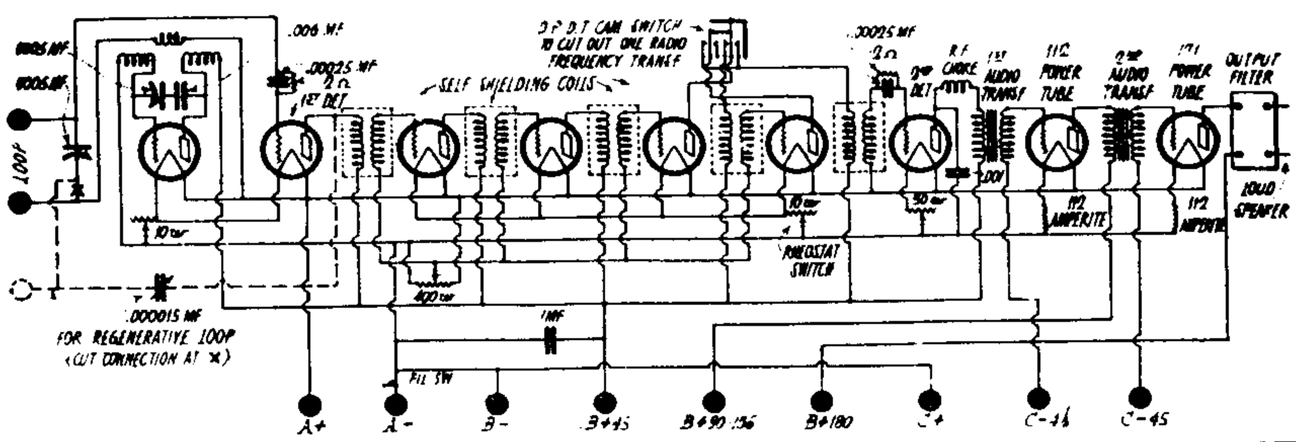


MODELS

A-3, A-5 AND A-7

PIERCE AIRO INC.



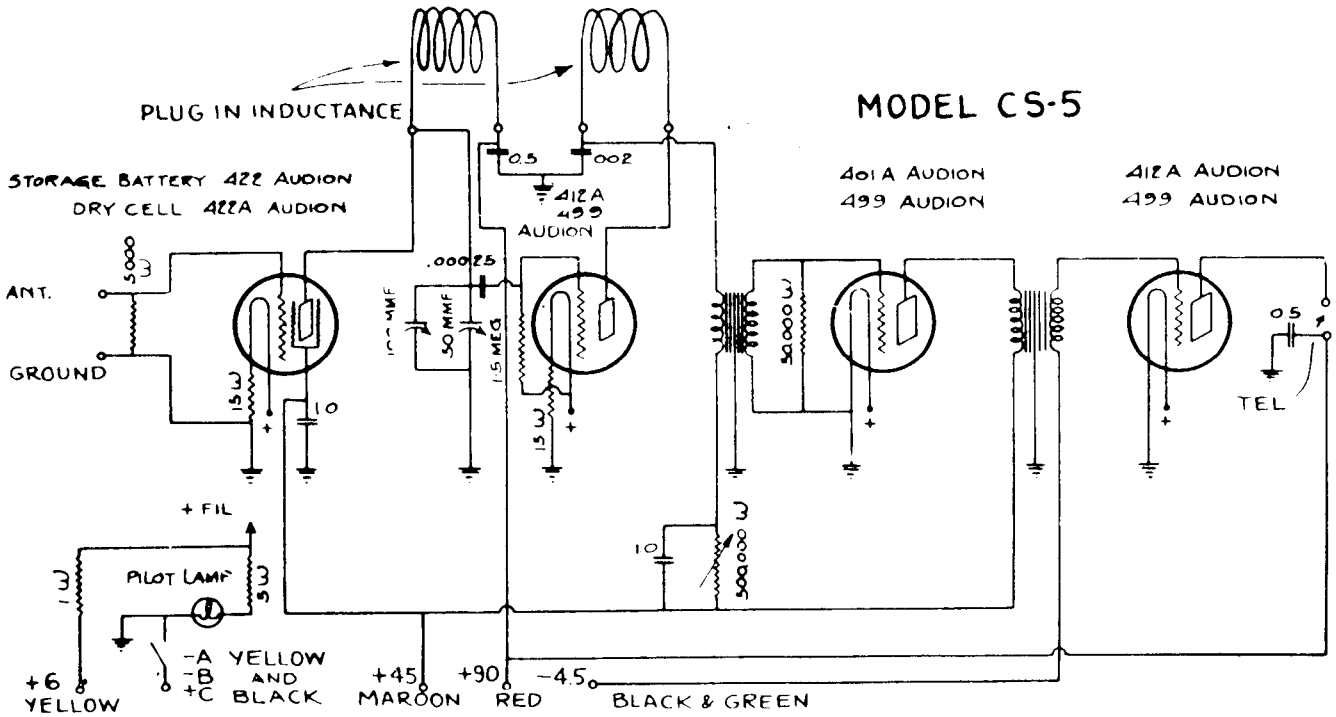


MAGNAFORMER

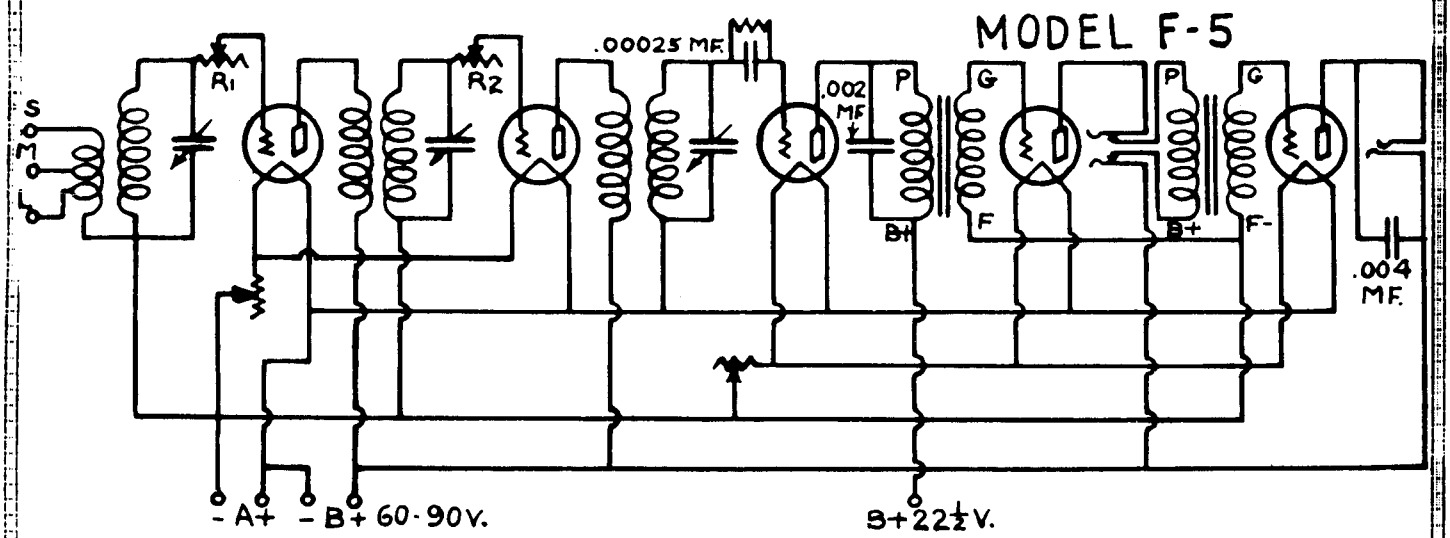
9-8 SUPER-HETERODYNE

DE FOREST RADIO CO.

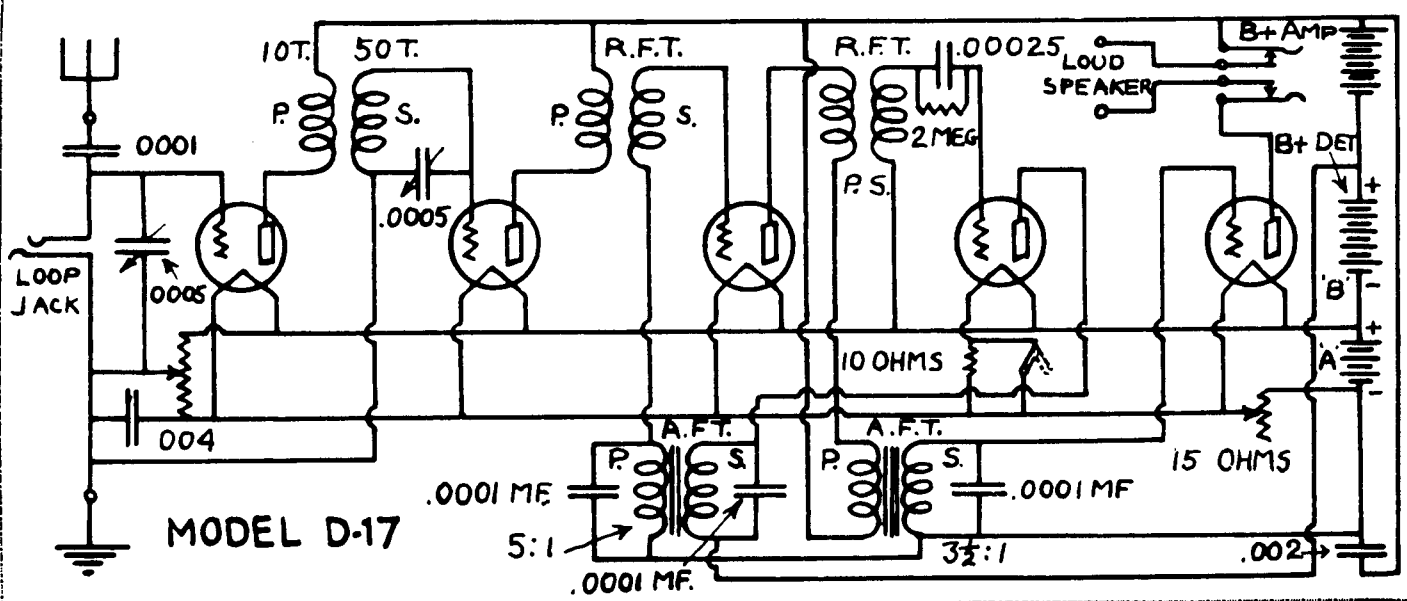
MODEL CS-5



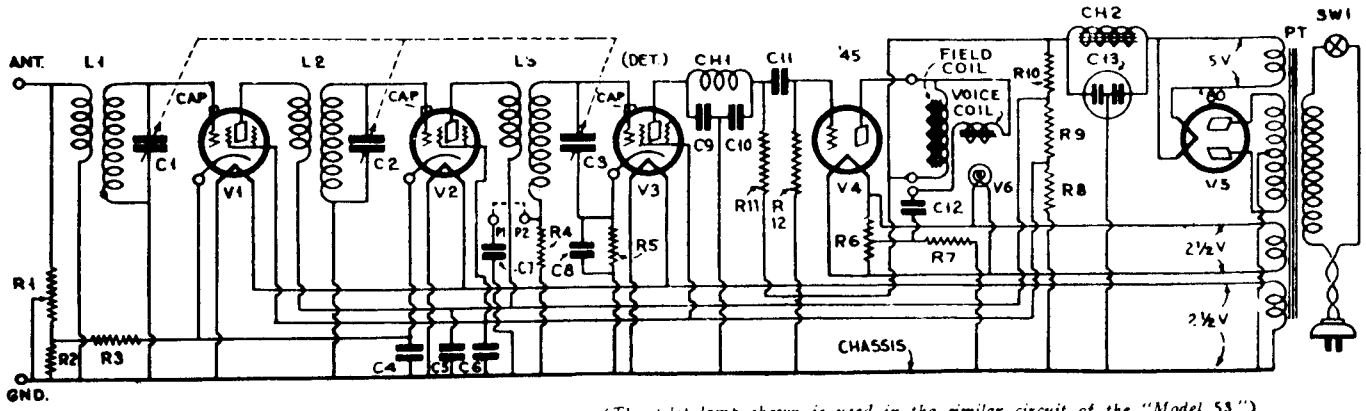
MODEL F-5



MODEL D-17



MIDGET RECEIVERS



Circuit of the Crosley "Model 54—New Buddy." (The pilot lamp shown is used in the similar circuit of the "Model 53.")

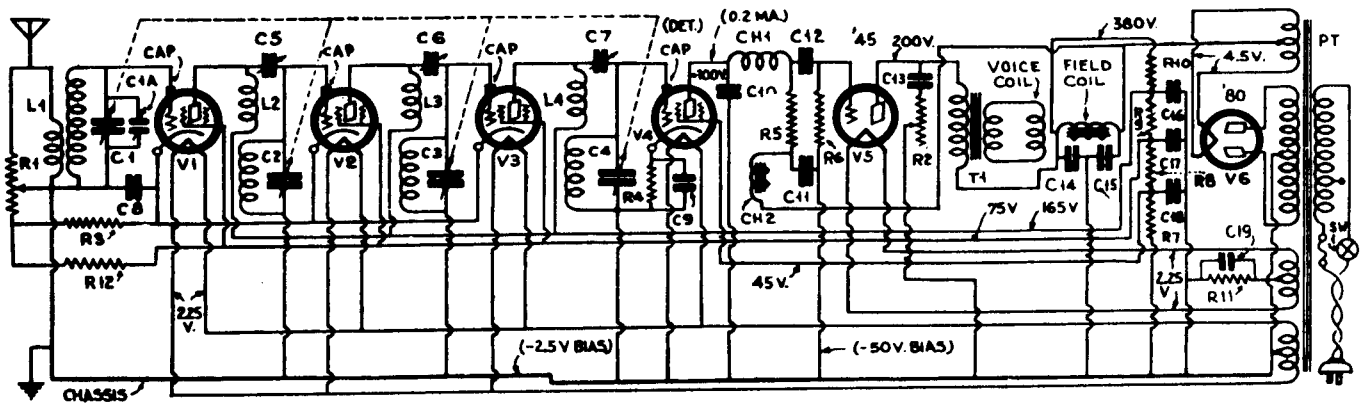
In the Crosley 54 ("New Buddy") a conventional circuit is used, with provision for a phonograph pickup (P1, P2) Resistor R1 is the volume control, and the reproducer (though in the diagram it seems like a dynamic) is a special magnetic unit, with an electromagnetic field replacing the more usual permanent magnets. (This circuit is the diagram of the latest "New Buddy" and hence it varies a little from previous releases dated July, 1930.)

As a matter of reference, the following values are given for the components:

Type '24 tubes are used at V1, V2, V3, and a type '45 tube for the power amplifier V4; V5 is an '80. Resistor R1 is a 25,000-ohm potentiometer; R2, 20,000 ohms; R3, 440 ohms; R4, 1 megohm; R5, 10,000 ohms; R6, 25 ohms on each side of the center tap; R7, 1650 ohms; R8, R9, R10, 10,000 ohms; R11, 150,000 ohms; R12, 1 megohm.

The condenser capacities are as follows: C4, C6, C7, C11, 0.1-mf., C5, C8, C12, 0.5-mf.; C9, C10, .00025-mf., C13, a "twin-8" electrolytic condenser.

(The pilot light, V6, is not used in the "Model 54" set.) The R.F. choke Ch1 and the condensers C9, C10, form a carefully-designed R.F. filter system. The receiver is illustrated at the upper right on page 274.

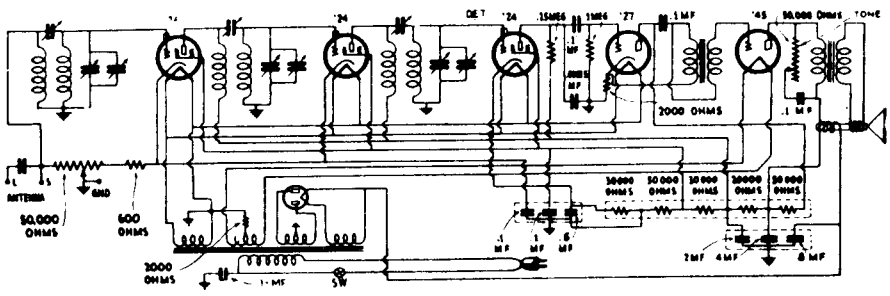


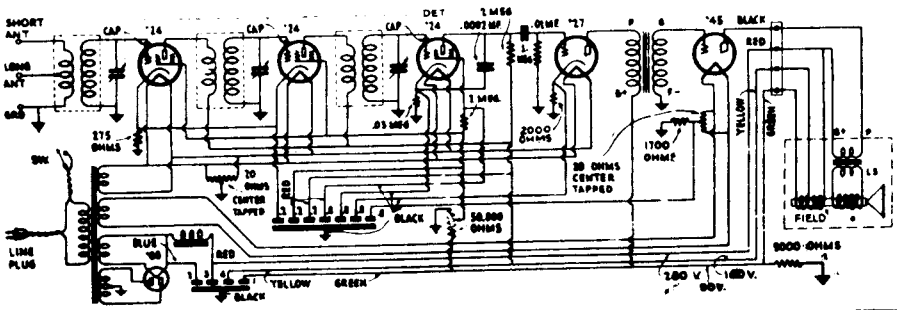
The schematic circuit of the Jackson-Bell "Model 62" The large filter capacities are provided by dry electrolytic condensers.

Following are the values used in this set: Volume-control resistor R1, 3,000 ohms; R2, 10,000 ohms; R3, 250 ohms; R4, 30,000 ohms; R5, 0.5-megohms; R6, 2 megohms; R7, R8, R9, 10,000 ohms; R10, 5,000 ohms; R11, 2,200 ohms; R12, 30,000 ohms.

Condensers C5, C6, C7, 7 mmf.; C8, C16, C17, C18, 0.1-mf.; C9, C19, 1.0 mf.; C10, .00025-mf.; C11, 8 mf.; C12, .02-mf.; C13, .25-mf.; C14, 2 mf.; C15, 4 mf.

Remler Division,
Gray & Danielson Mfg. Co.
CAMEO MODEL 14



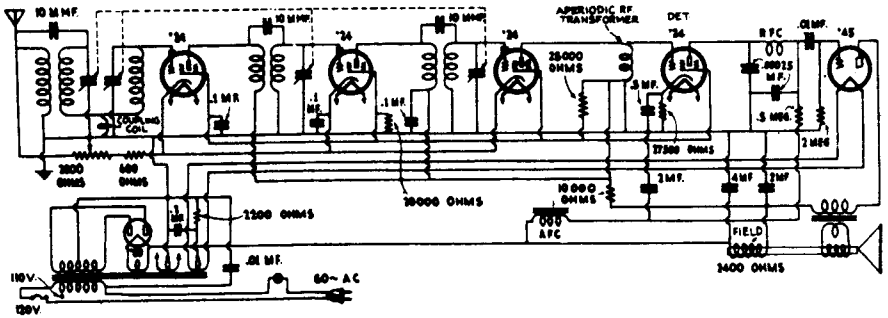


Pilot Radio & Tube Corp.

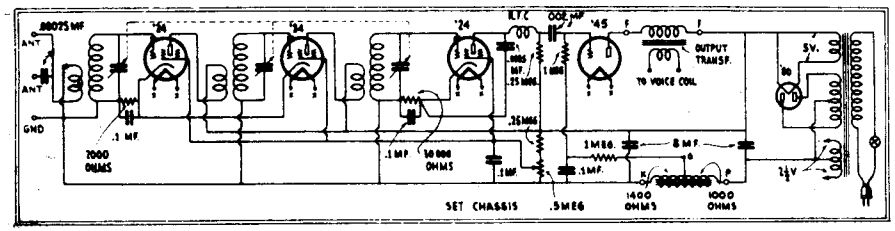
"PILOT MIDGET"

MIDGET RECEIVERS

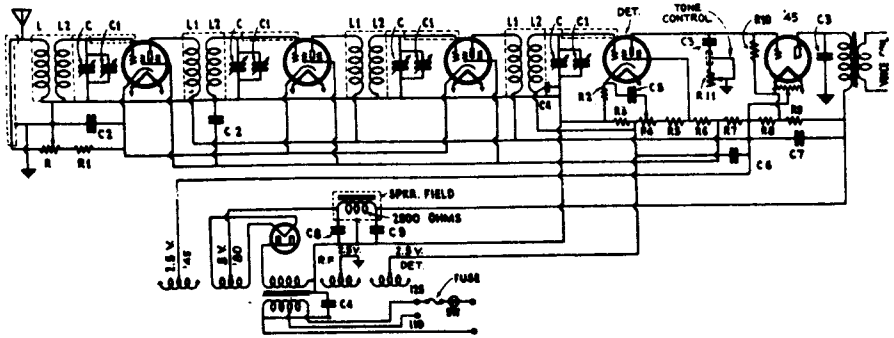
Keller-Fuller Mfg. Co. Ltd.
RADIETTE MODEL 14F



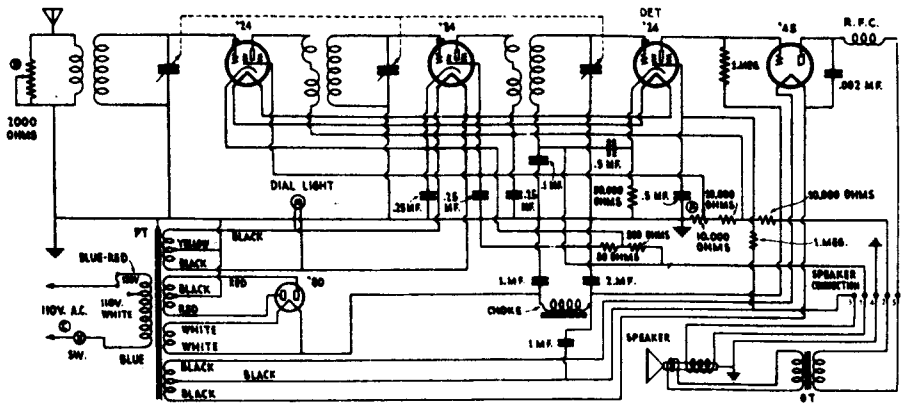
Federated Purchaser
MELORAD "CATHEDRAL TONE"



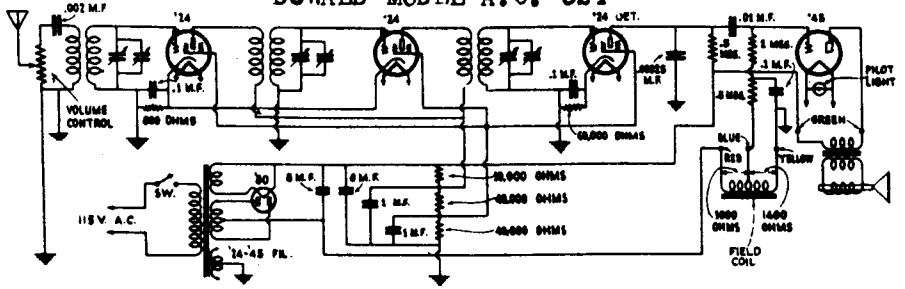
Master Radio Mfg. Co. Ltd.
MASTER MODEL 424



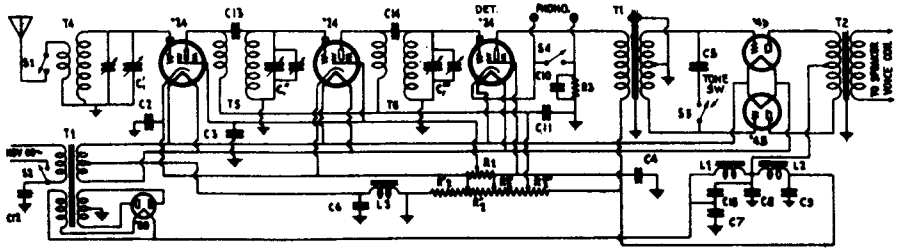
Jesse French & Sons Piano Co.
JUNIOR MODEL "G"



Pierce-Airo, Inc.
DeWALD MODEL A.C. 524



Transformer Corp. of America
CLARION JR. MODEL 60

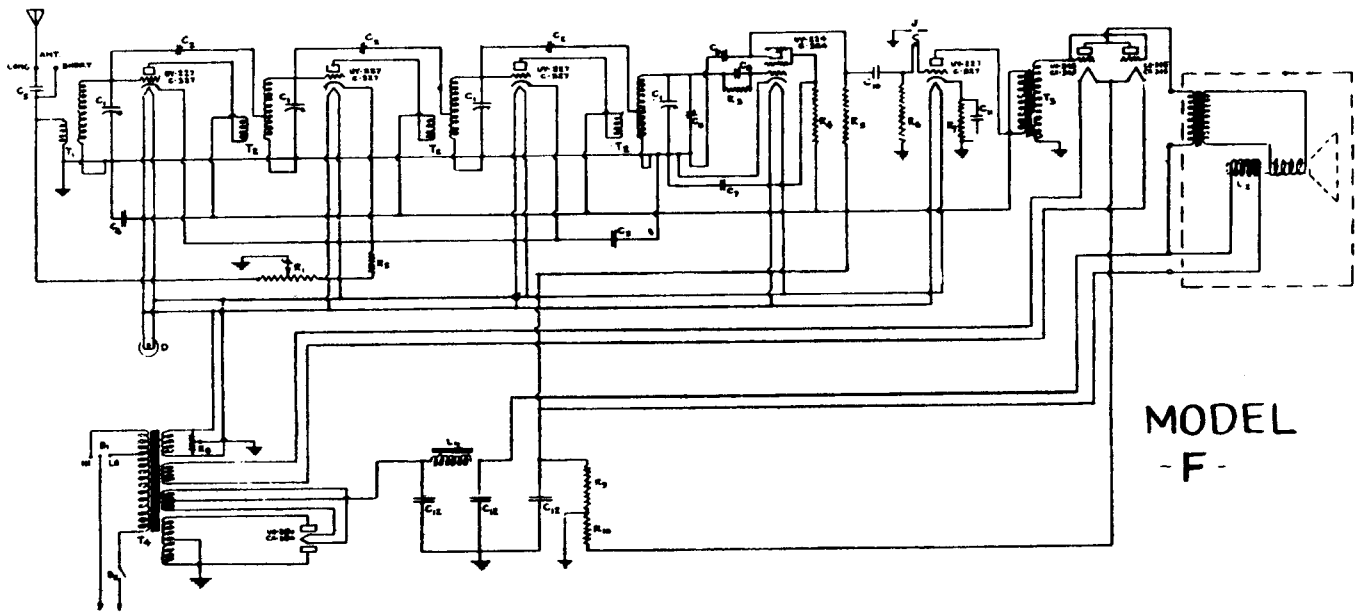


The technical details are as follows: R (volume control), 6,050 ohms; R1, 500; R2, R8, 50,000; R3, 425; R4 (hum control) 200; R5, 1584; R6, 1,800; R7, 2515; R9, 100,000; R10, R11, 500,000 (tone selector). The voltage divider comprises R3, R5, R6, R7. The condensers have the following values: C, 350 mmf.; (C1, trimmer condenser); C2, C4, 0.1-mf.; C3, .002-mf.; C5, 0.5-mf.; C6, C7, 1.0 mf. (600 V.); C8, C9, 2 mf. (1,000 V.); Condensers C4, C5, C6, C7, C8, C9 are in filter bank. In some cases it is necessary to use .004-mf. for C3, to overcome feedback from the R.F. stages.

Following are the values of the components: tuning condensers C1, 420 mmf.; C2, C12, 0.1-mf.; C3, C15, 0.24-mf.; C4, C9, 0.5-mf.; C5 (tone control), .0005-mf.; C6, C10, 1.0 mf.; C7, C9, 1.5 mf.; C11, 0.4-mf.; C13, C14, 12 mmf.

The resistors have the following values: R1 (volume control), 25,000 ohms; R2-1, 167; R2-2, 13,400; R2-3, 8,200; R2-4, 4,600; R3, 40,000.

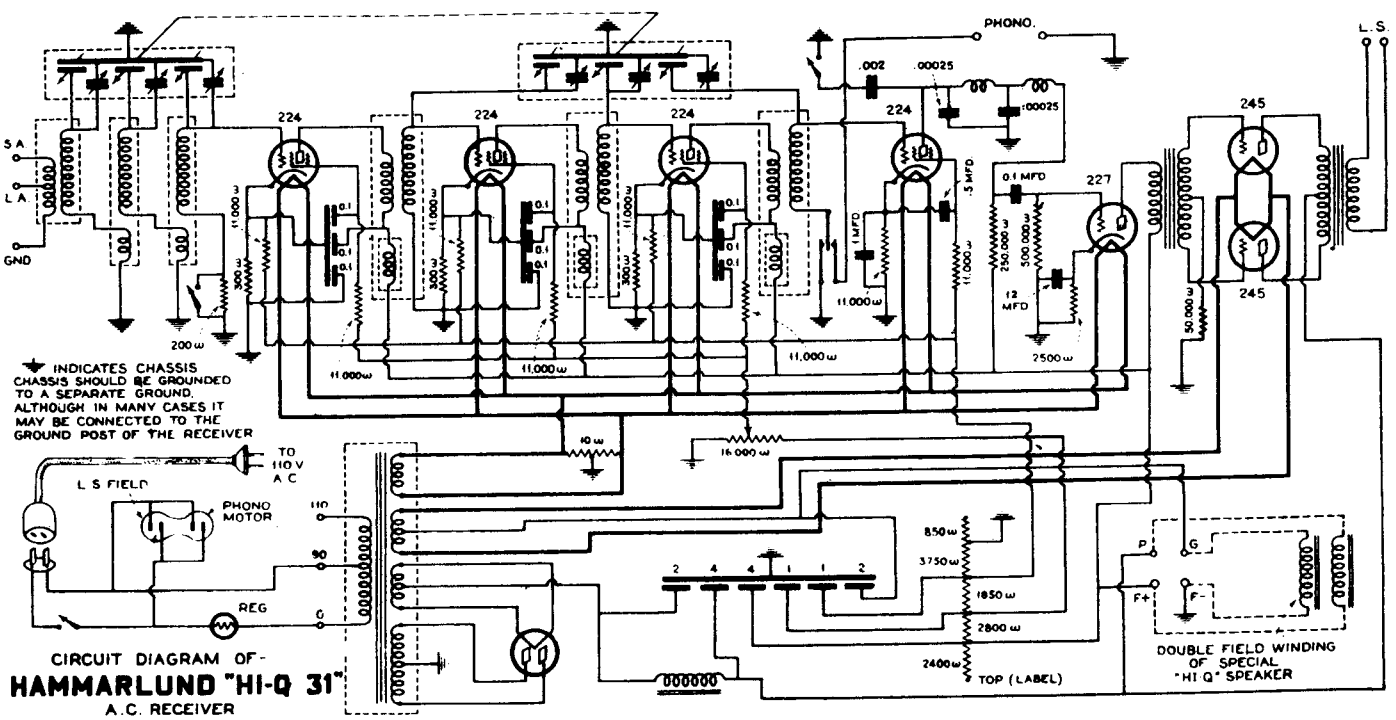
EMERSON RADIO & PHONOGRAPH CORP.



MODEL
-F-

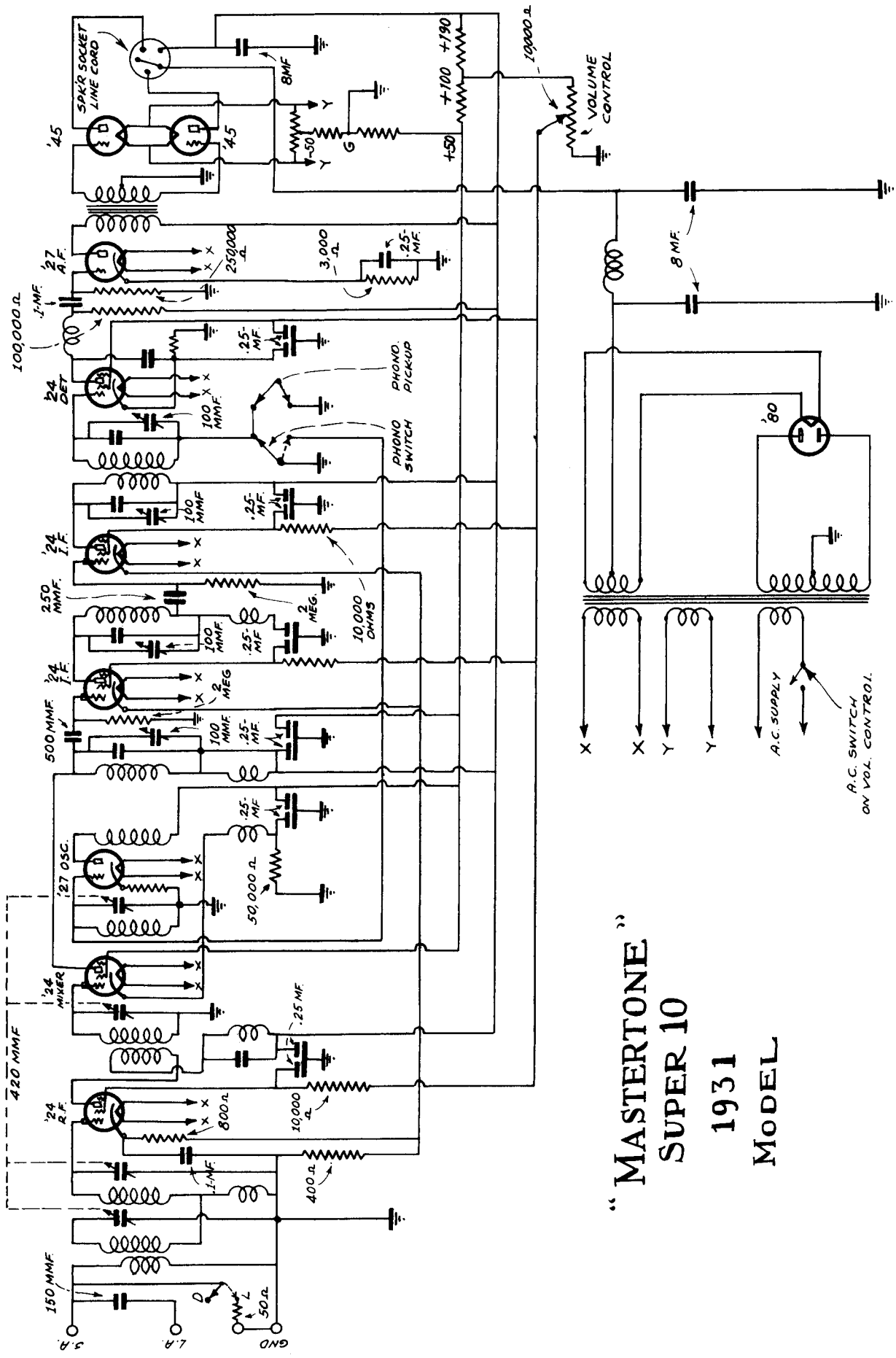
C_1 Tuning Condenser.
C_2 Neutralizing Condenser.
C_3 R.F. Grid Bias Condenser .25 MF.
C_4 R.F. Plate By-Pass Condenser .25 MF.
C_5 Antenna Condenser .00025 MF.
C_6 Det. Padding Condenser.
C_7 Det. Screen Grid Bias Condenser .25 MF.
C_8 Det. Control Grid Condenser .0001 MF.
C_9 Det. Plate Condenser .0005 MF.
C_{10} 1st Audio Coupling Condenser 0.1 MF.
C_{11} 1st Audio Grid Condenser 0.5 MF.
C_{12} Filter Condensers 8.0 MF Each.
L_1 Filter Choke.
L_2 Speaker Field 2500 Ohms.
J Phonograph Jack.
D Dial Lamp.
R_1 Volume Control 15,000 Ohms.
R_2 R.F. Grid Bias Resistance 620 Ohms.
R_3 Det. Control Grid Resistance .5 Megohm.
R_4 Det. Screen Grid Resistance .5 Megohm.
R_5 1st Audio Coupling Resistance .1 Megohm.
R_6 1st Audio Grid Resistance .5 Megohm.
R_7 1st Audio Grid Bias Resistance 1750 Ohms.
R_8 Hum Control 20 Ohms.
R_9 Loss Current Resistance 4500 Ohms.
R_{10} 245 Grid Bias Resistance 650 Ohms.
T_1 Antenna Transformer.
T_2 R.F. Inter stage Transformer.
T_3 Input Audio Transformer.
T_4 Power Transformer.
B_1 Hi-Lo S.P.D.T. Toggle Switch.
B_2 S.P.S.T. Toggle Switch.

HAMMARLUND MFG. CO.



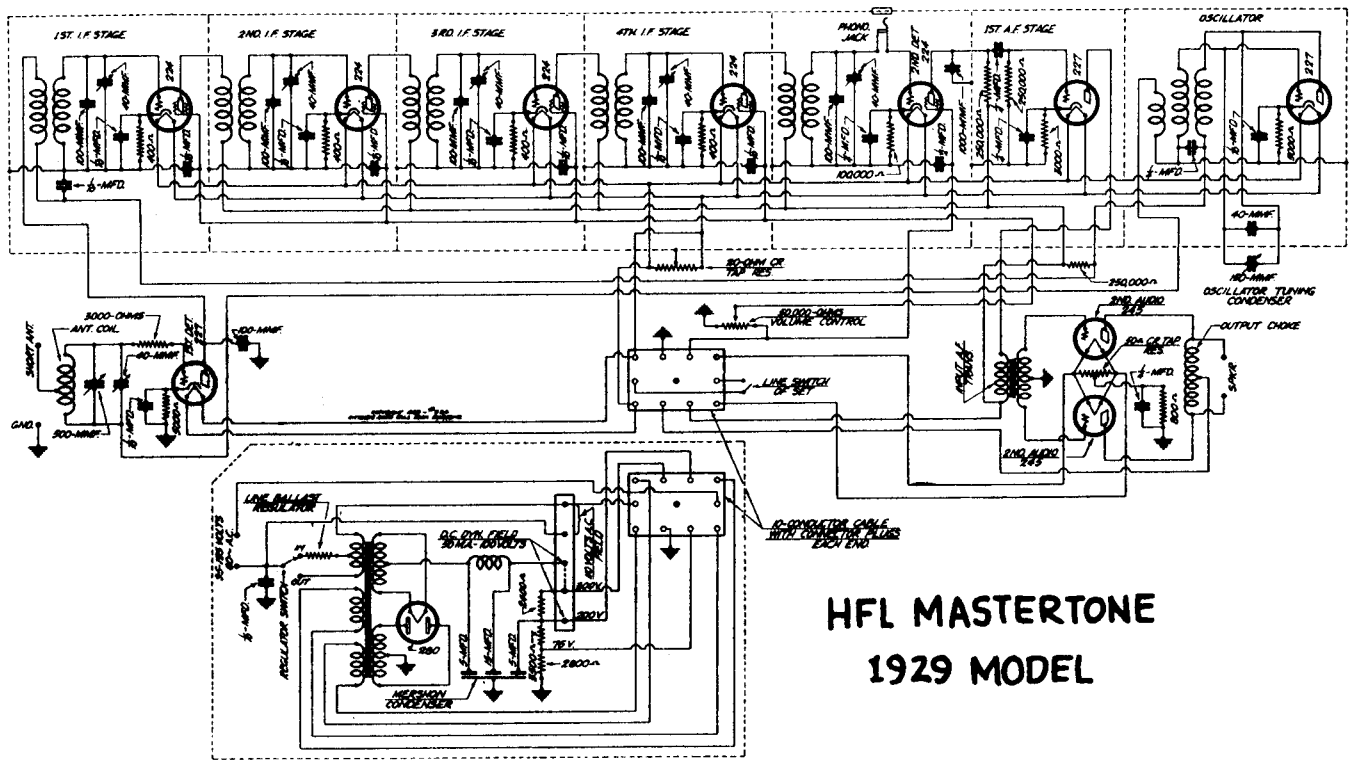
CIRCUIT DIAGRAM OF-
HAMMARLUND "HI-Q 31"
A.C. RECEIVER

HIGH FREQUENCY LABORATORIES

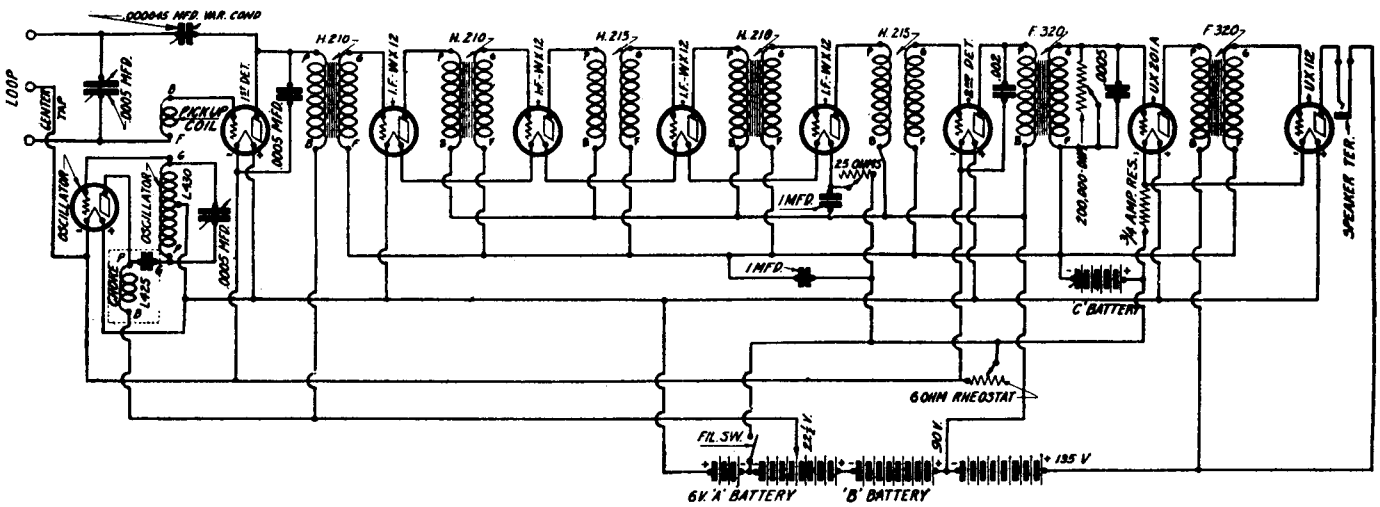


"MASTERTONE"
SUPER 10
1931
MODEL

HIGH FREQUENCY LABORATORIES

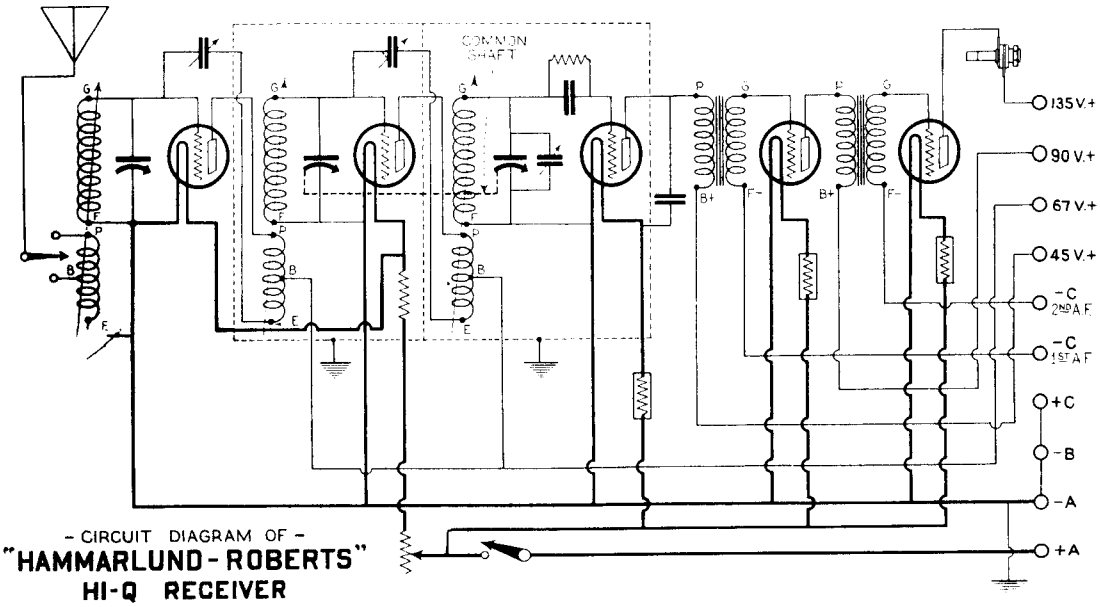


HFL MASTERTONE
1929 MODEL

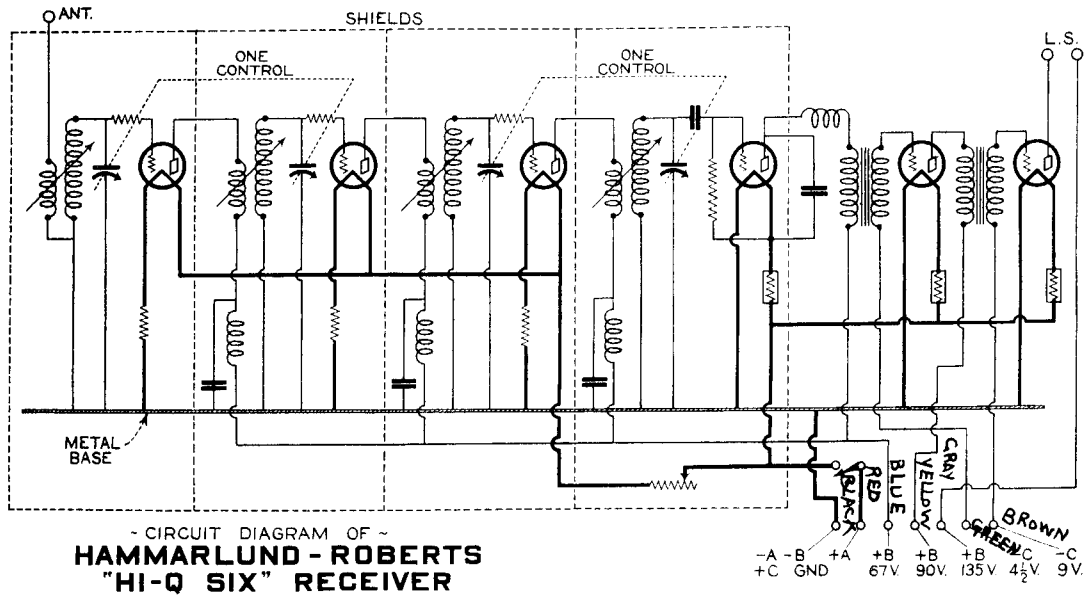


Nine-in-Line Superheterodyne circuit. A common "C" battery of 4.5 to 6 volts is used for all grid returns. It will be noted that this "C" battery will provide the necessary bias also for the second detector tube, so that rectification will be accomplished on the negative side of the static characteristic curve of this tube.

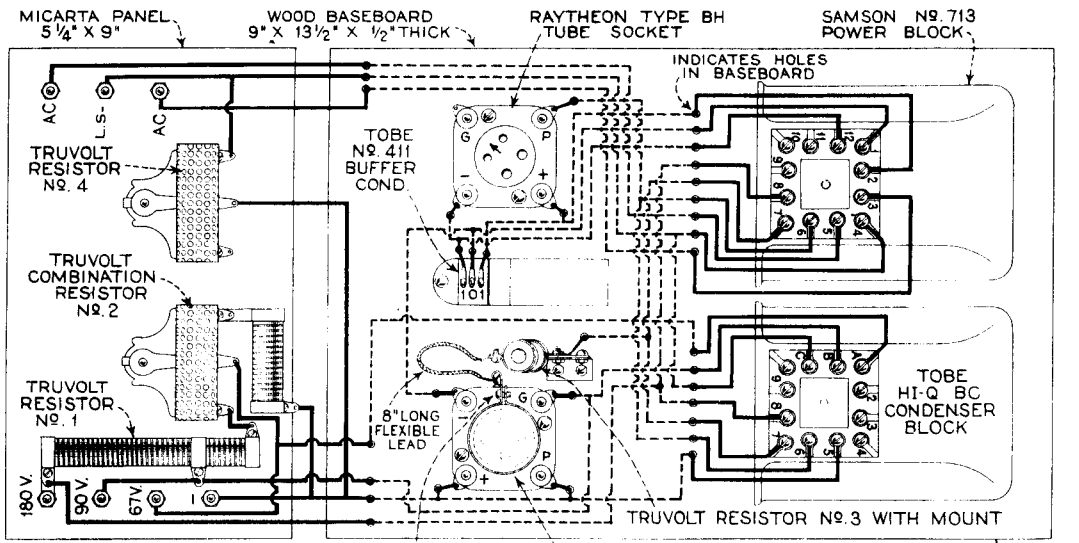
HAMMARLUND MFG. CO.



- CIRCUIT DIAGRAM OF -
"HAMMARLUND-ROBERTS"
HI-Q RECEIVER



- CIRCUIT DIAGRAM OF -
HAMMARLUND-ROBERTS
"HI-Q SIX" RECEIVER



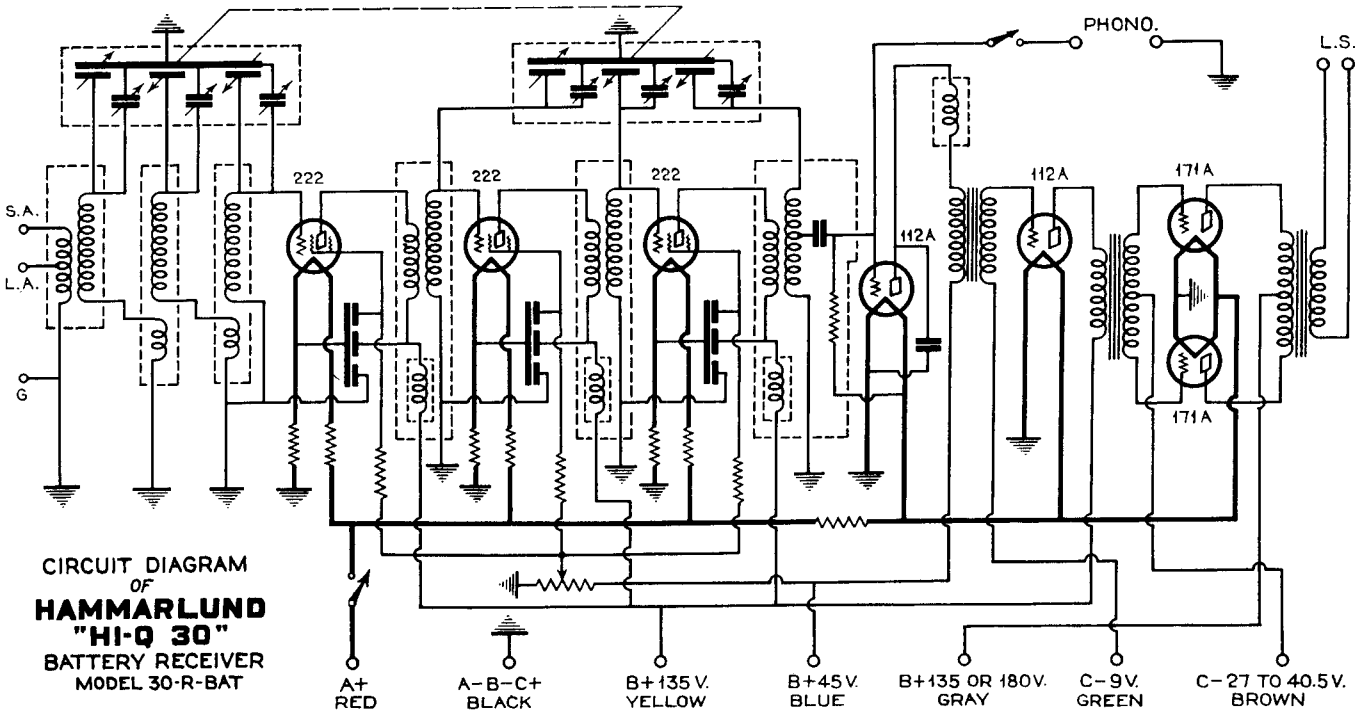
WIRING DIAGRAM OF -
HAMMARLUND ROBERTS
"HI-Q SIX" POWER SUPPLY
- FOR USE WITH 171 POWER TUBE -

FAHNESTOCK TYPE R CONNECTING CLAMP

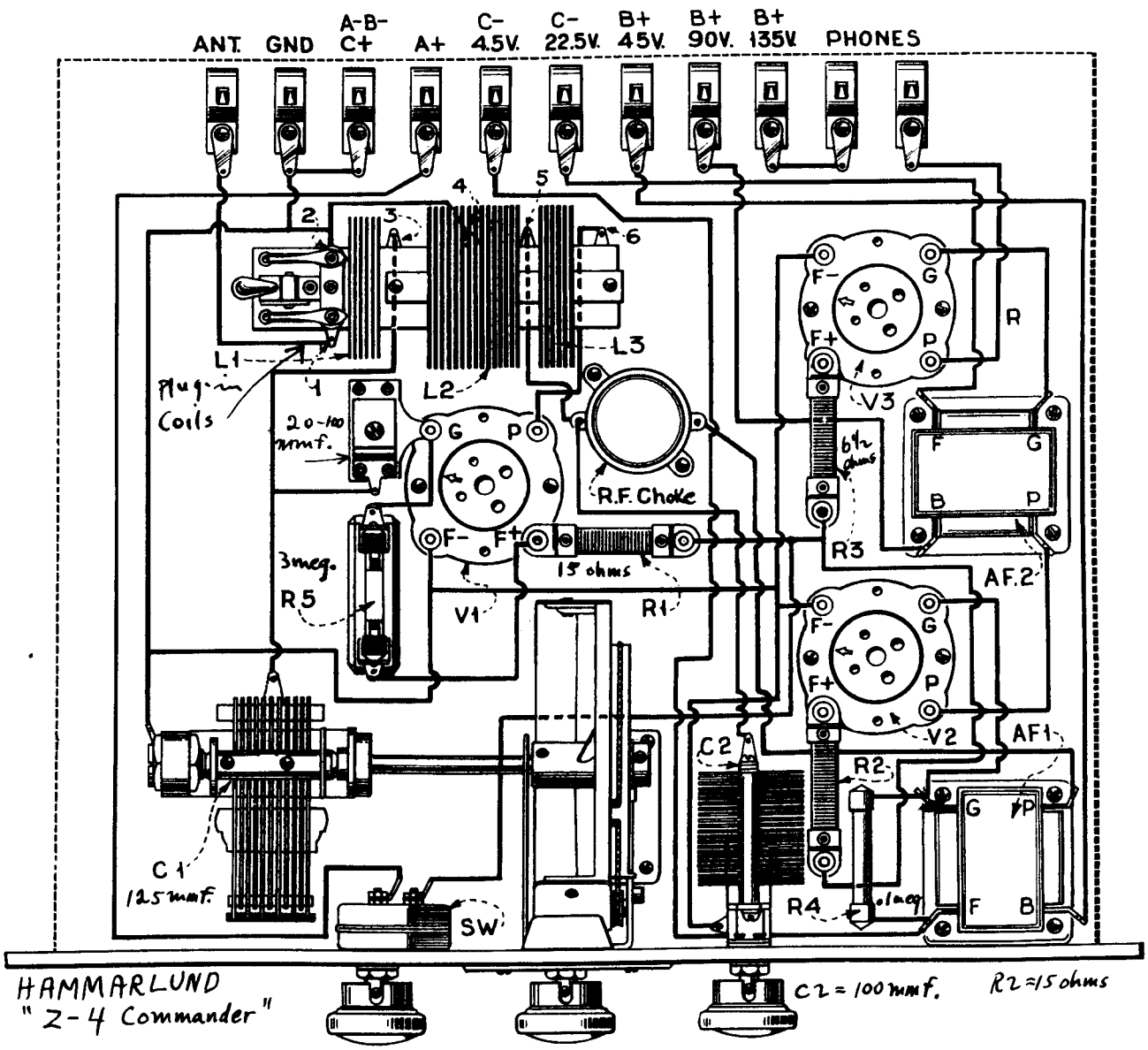
RAYTHEON TYPE R REGULATOR TUBE SOCKET

HEAVY BLACK LINES INDICATE CONNECTIONS TO BE MADE ABOVE BASEBOARD. DOTTED LINES SHOW CONNECTIONS TO BE MADE UNDER BASEBOARD.

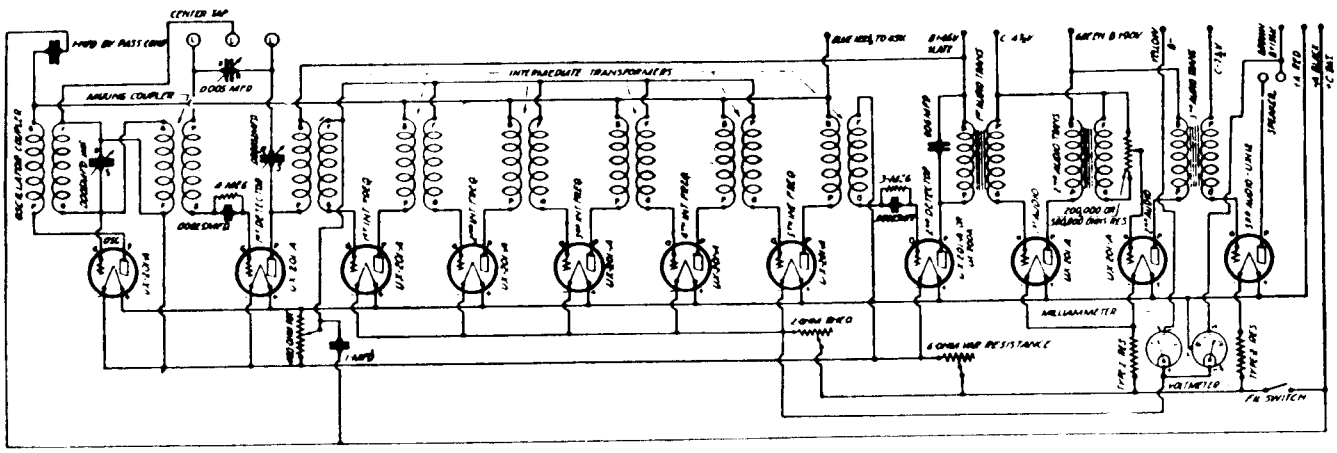
HAMMARLUND MFG. CO.



CIRCUIT DIAGRAM
OF
HAMMARLUND
"HI-Q 30"
BATTERY RECEIVER
MODEL 30-R-BAT



ROBERTSON-DAVIS CO.

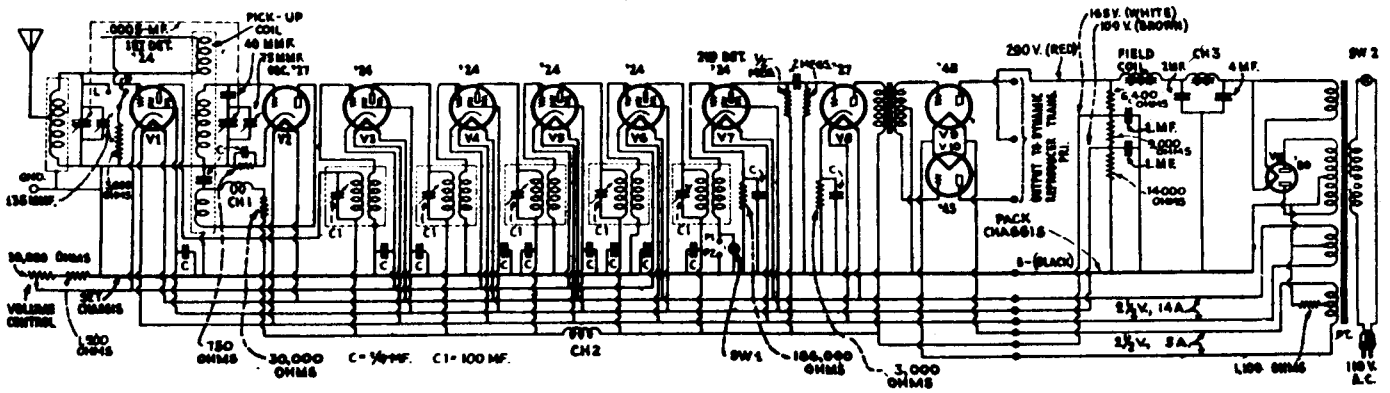


MELO-HEALD 11-TUBE SUPER-HETERODYNE

LIST OF PARTS

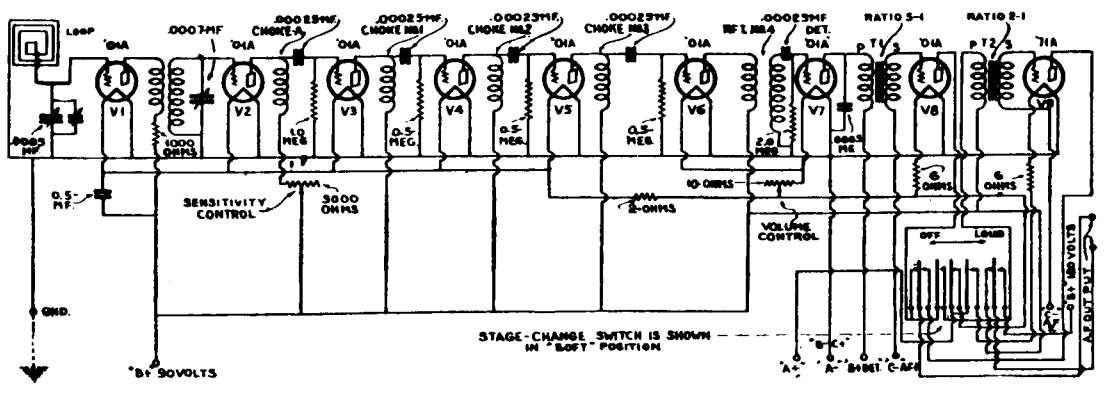
1—160 Oscillating Robertson-Davis Certified Melocoupler.
1—120 Mixing Robertson-Davis Certified Melocoupler.
6—135 Long Wave Robertson-Davis Certified Melocouplers.
3—Multistage Robertson-Davis Certified Meloformers.
11—Na-Ald UX Cushion Sockets.
3—Dubilier 601G .00025 MF Condensers.
1—Dubilier 601 .006 MF Condenser.
2—Dubilier 907 1 MF Condensers.
1—Dubilier 3 Meg. Grid Leak.
1—Dubilier 4 Meg. Grid Leak.
8—Eby Binding Posts.
1—Yaxley 400 Ohm Potentiometer.
1—Yaxley No. 10 Filament Switch.
1—Yaxley 2-Ohm Rheostat.
1—Yaxley 6-Ohm Fixed Variable Resistance.
1—Yaxley 060 Cable Connector.
2—Hammarlund .0005 MF Midline Variable Condensers.
1—Hammarlund .000032 MF MCS Midget Condenser.
1—Jewell 135 0-100 Milliameter.
1—Jewell 135B Double Scale Voltmeter.
2—Elkay Type 2 Equalizers.
1—Frost No. 882 200,000 Ohm Variable Resistance.
10—UX 201A Radiotrons.
1—UX 112 or UX 171 Radiotron.
1—Lignole 7x28 Drilled and Engraved Panel.
1—10x27-inch Baseboard.
3—Formica Terminal Strips.
2—Kurz-Kasch No. 502 Walnut Dials.
50—Feet Belden No. 12 Wire.
100—Kellogg Soldering Lugs.
1—Package Kester Solder.

LINCOLN RADIO CORP.



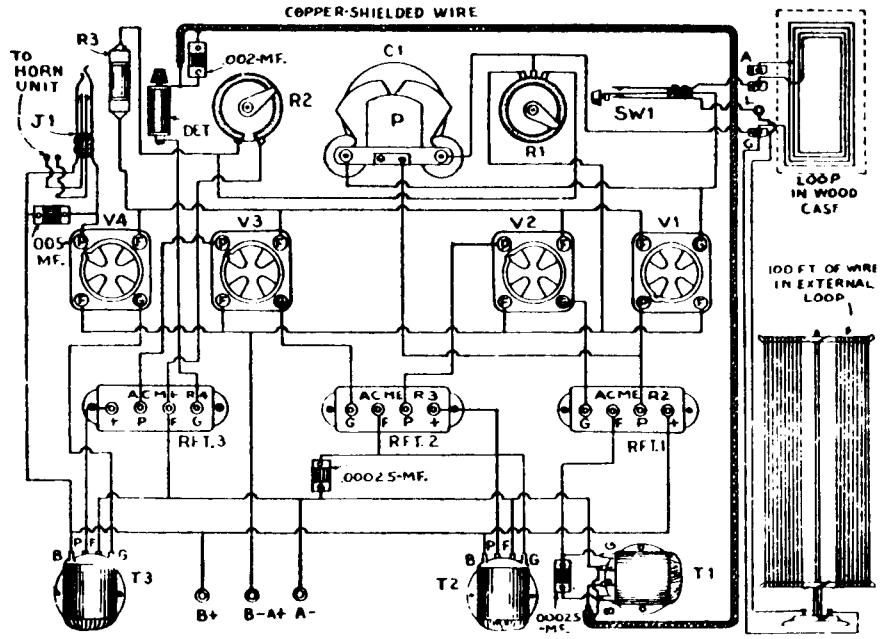
The heart of every superheterodyne is its intermediate amplifier. The "Model 31" has four screen-grid I.F. stages, with plate windings tuned by the 100-mmf. midget condensers C1. The bypass condensers C are 0.25-mf. P1-P2 are phonograph pickup jacks; and L-D the "local-distance" switch.

PRIESS RADIO CO.



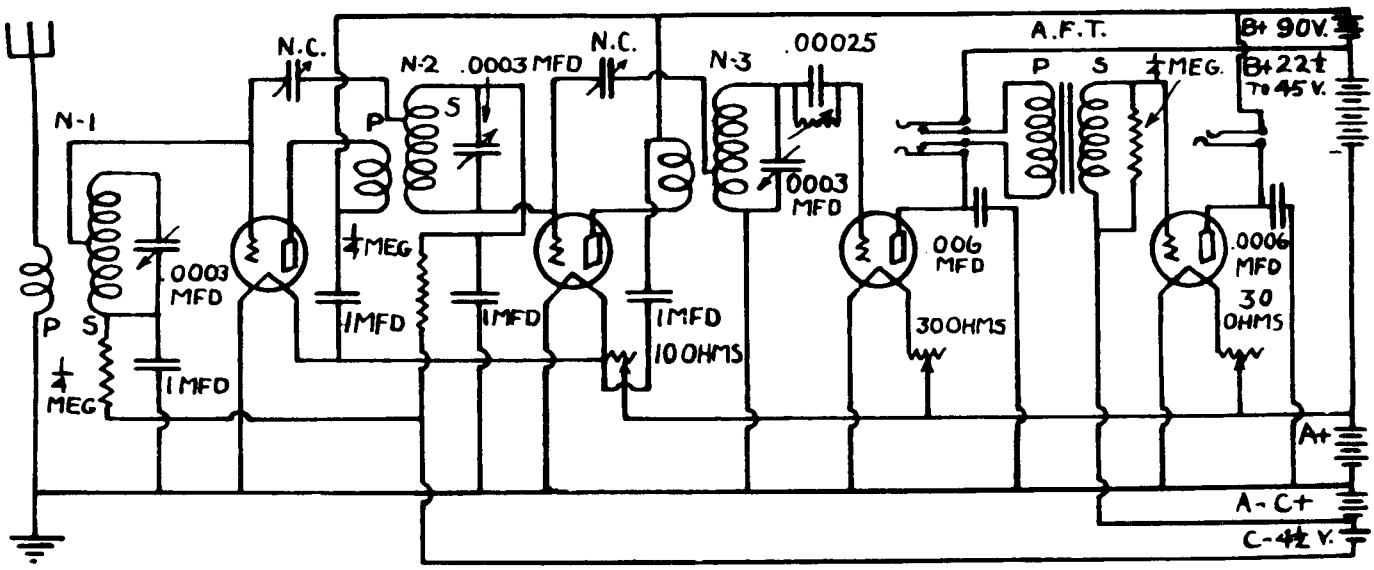
The circuit at the left is that of the Priess "Nine-in-Line," one of the most powerful and efficient receivers of its day. This is the "Model R"; the "Model C" added another tuning circuit, to increase selectivity in congested district. Many inquiries for this circuit have been received; but it has only now become available. In some receivers, slightly different connections to the audio-stage switch will be found.

TELEPHONE MAINTENANCE CO.

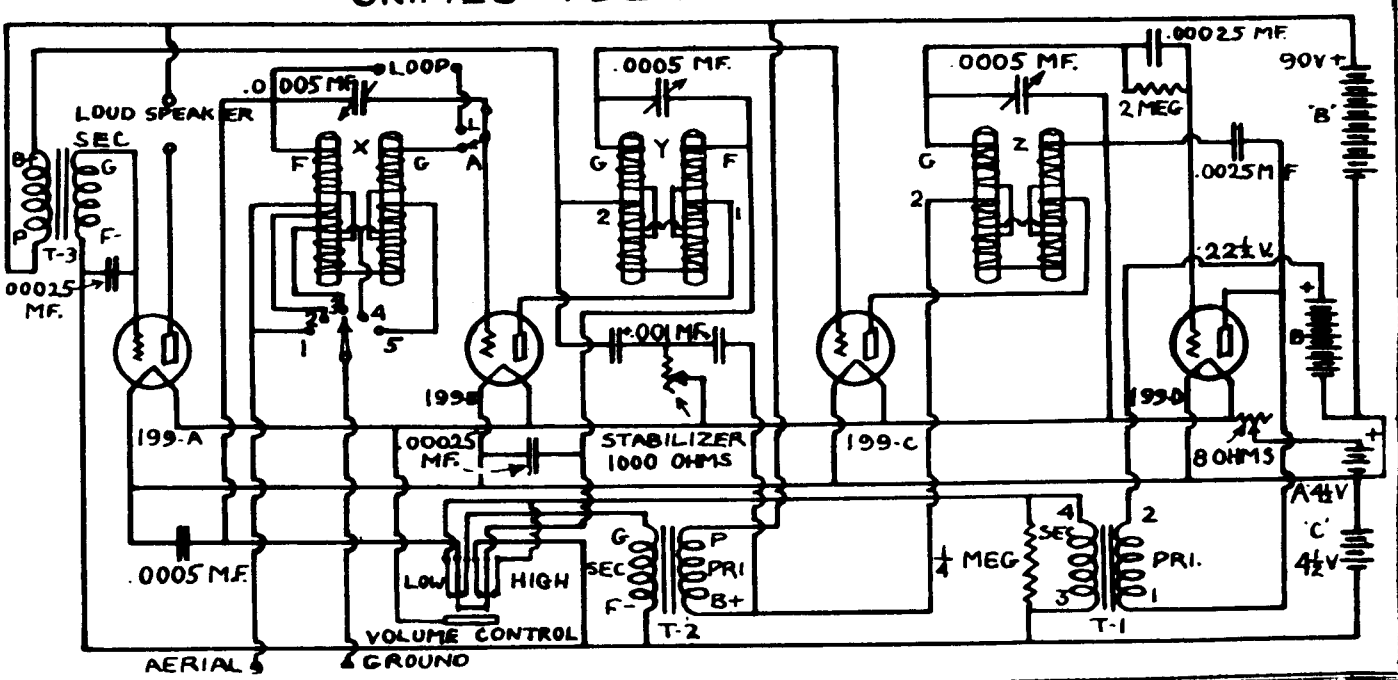


The "Telmaco P-1" portable receiver, with optional loop and aerial and ground connections. The set, with its reflex circuit, gives three R.F. and three A.F. stages with four V'99 tubes. The battery consumption is very slight.

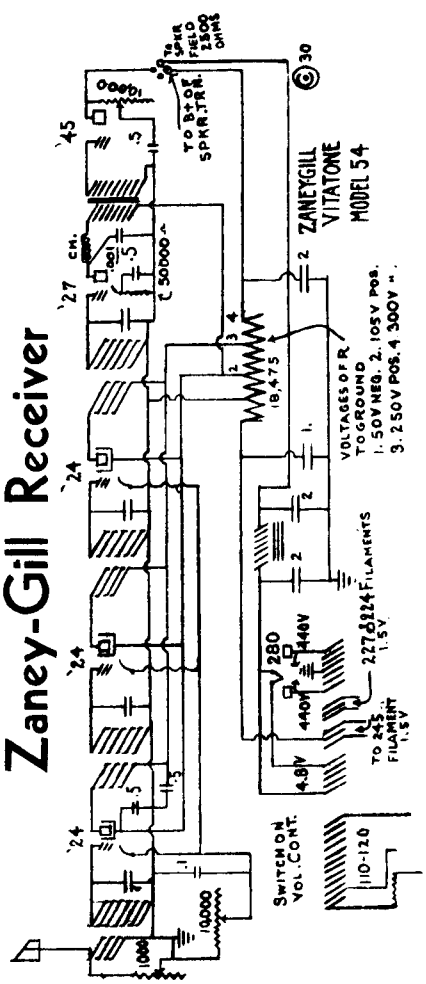
~GAROD~ NEUTRODYNE

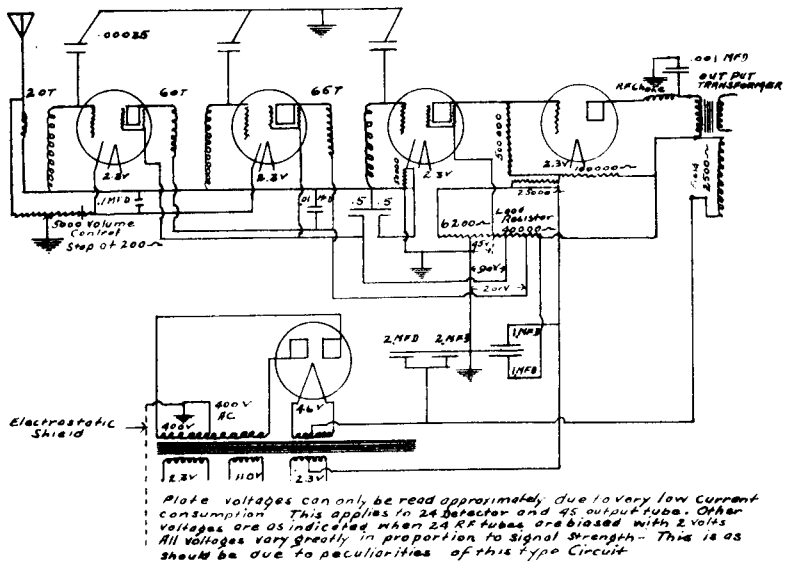


GRIMES 4-DL INVERSE DUPLEX.

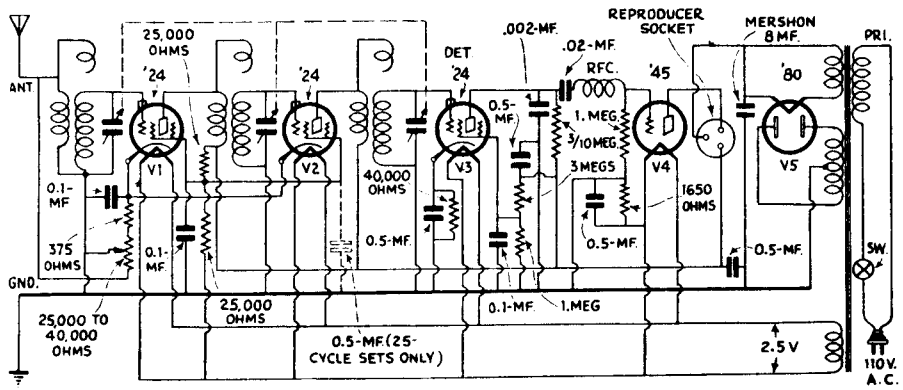


Zaney-Gill Receiver

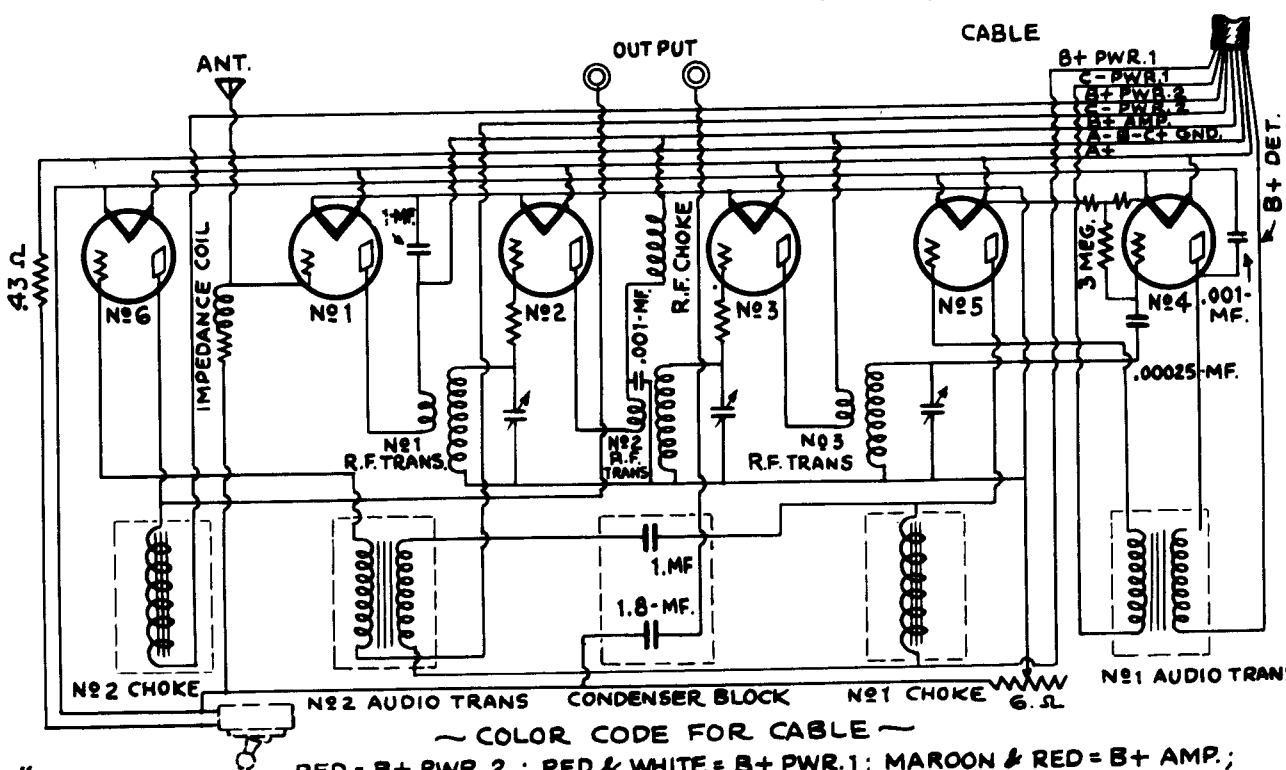




This is the circuit used for the famous Mission Bell chassis which has been used in some of the best known midget sets. It was used exclusively in the Royale until recently, and is still being offered by many distributors under different "brand" names.



Circuit of the Crosley "Model 48" or "Wiait"



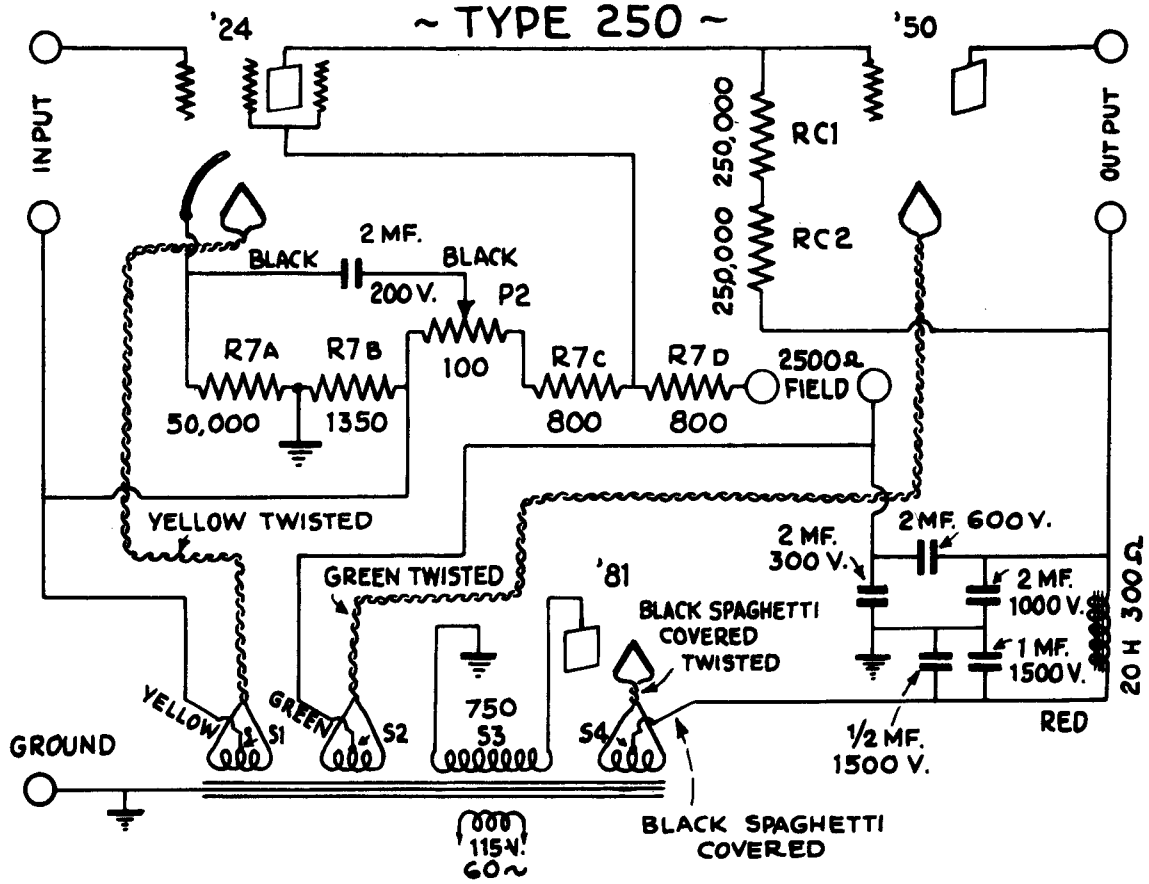
"DAY-FAN" MODEL-5055

~ COLOR CODE FOR CABLE ~

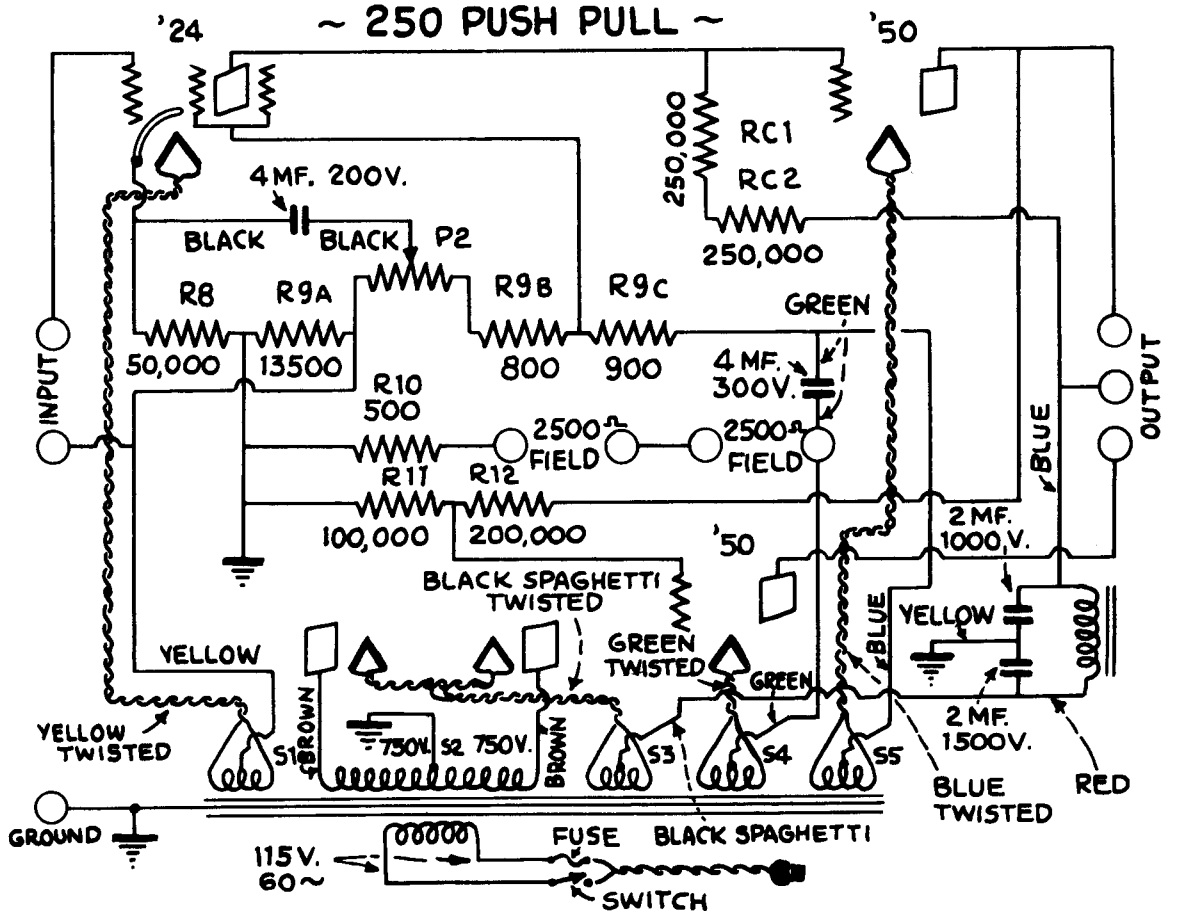
RED = B+ PWR. 2 ; RED & WHITE = B+ PWR.1; MAROON & RED = B+ AMP.; MAROON = B+ DET.; GREEN WITH RED & YELLOW TRACER = A-B-C+ GND. YELLOW = A+; BLACK WITH GREEN TRACER = C- PWR.1; BLACK WITH WHITE TRACER = C- PWR. 2

ELECTRAD-LOFTIN-WHITE

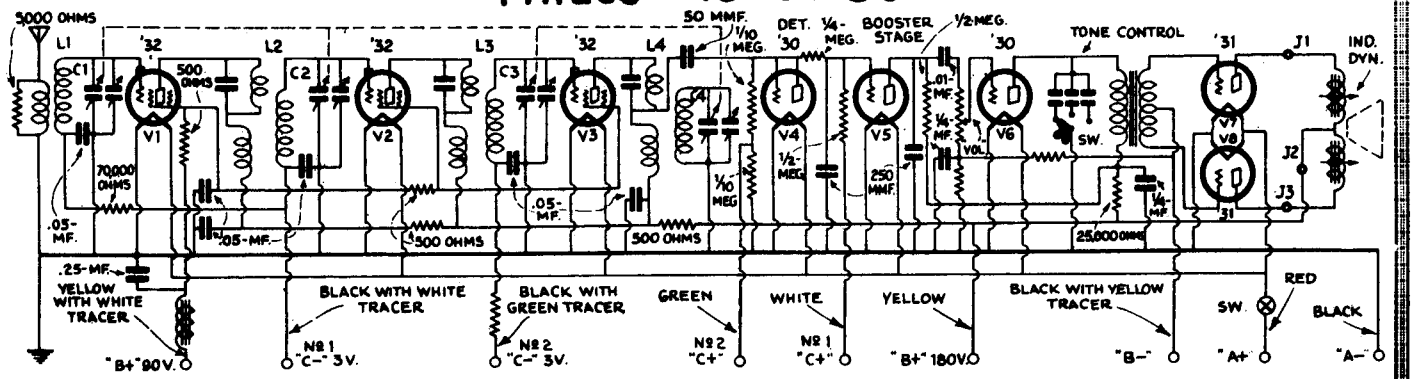
~ TYPE 250 ~



~ 250 PUSH PULL ~

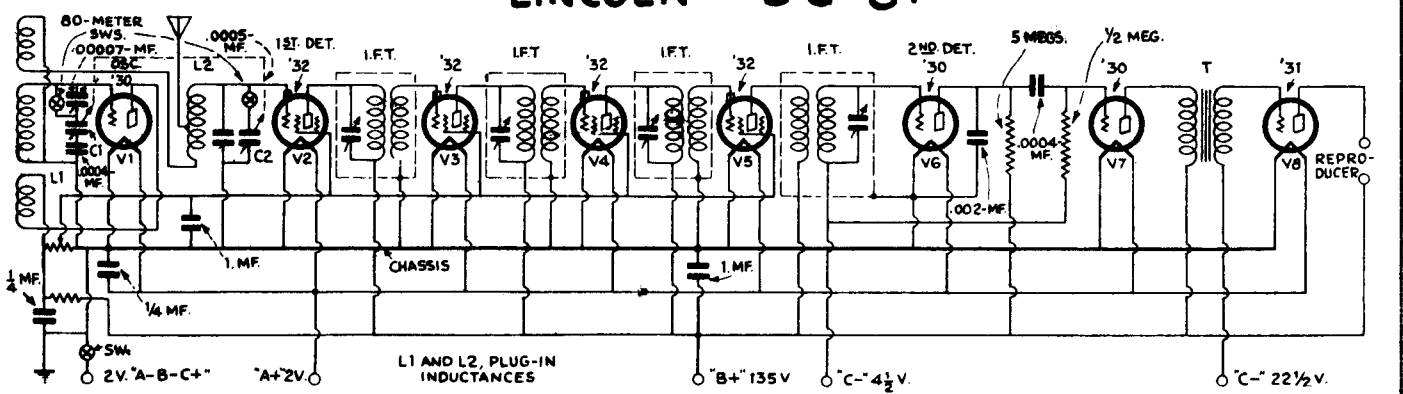


PHILCO "MODEL 30."



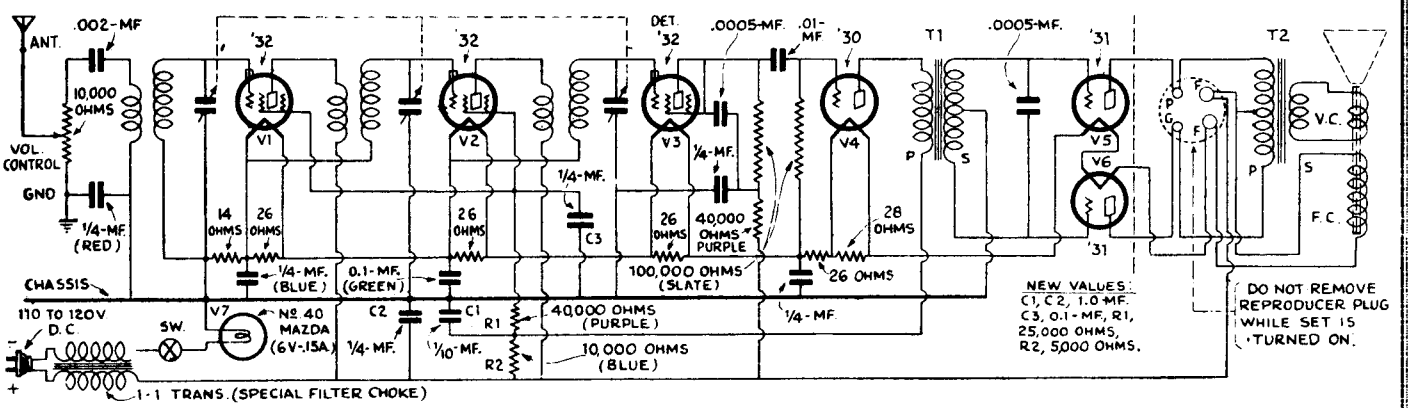
The circuit of the Philco "Model 30" receiver, which is designed for operation from a two-volt source. It incorporates automatic volume control and tone control; and operates an inductor dynamic which requires no field current

LINCOLN "DC-8."



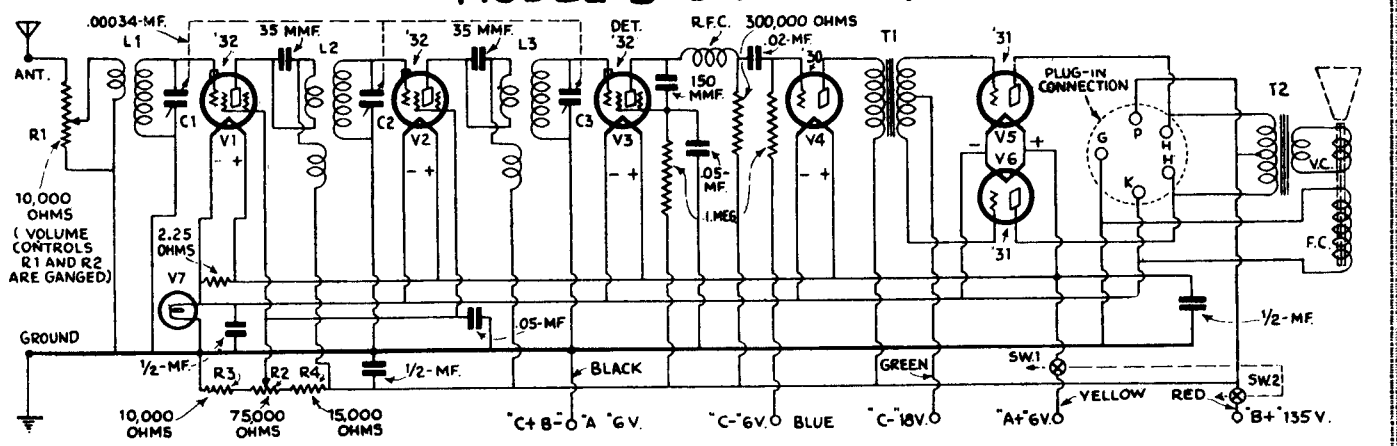
The Lincoln "DC-8" superheterodyne not only works on two volts, but gives a choice of two wavebands which may be extended by the use of plug-in coils. This specially powerful set may be operated from an air-cell battery, or a storage battery may be used. The filament-voltage control is external to the circuit shown

PIERCE-AIRO "DeWALD MODEL DC 632."



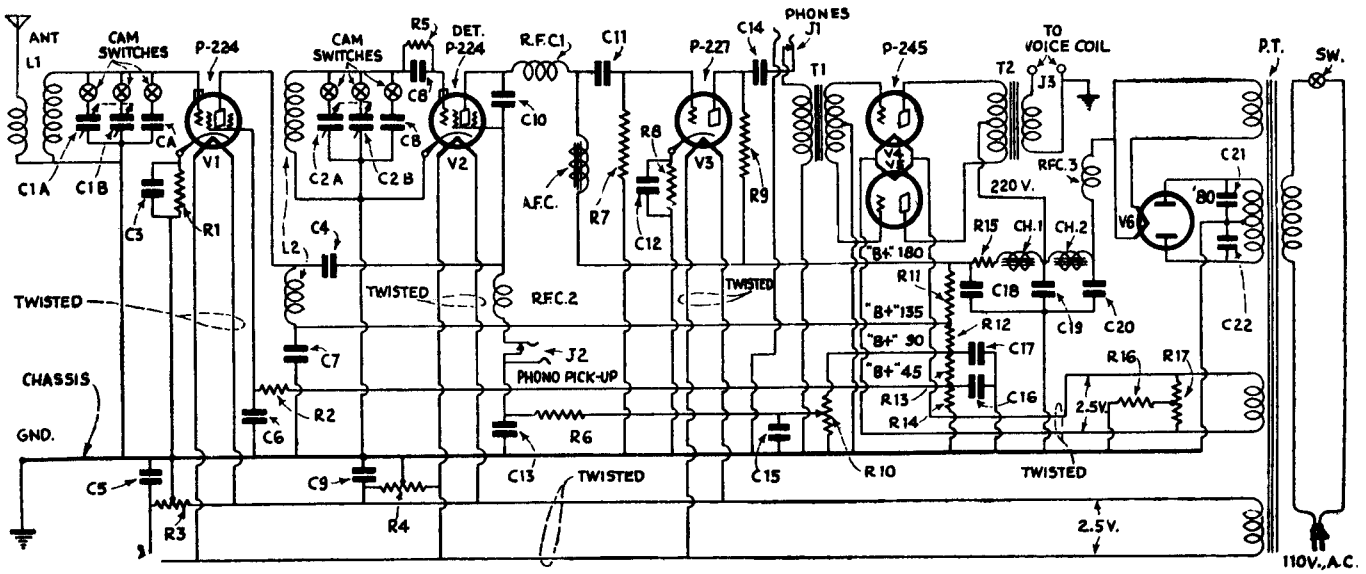
The schematic circuit of the Pierce-Airo "DeWald Model DC 632" midget illustrated above. It is designed for 110 volt D.C. operation; but may be connected to a 220-volt line through a series resistor the Mazda lamp ballasts the circuit. Note the dynamic's field coil is in series with the filaments.

"MODEL B-94" LYRIC.

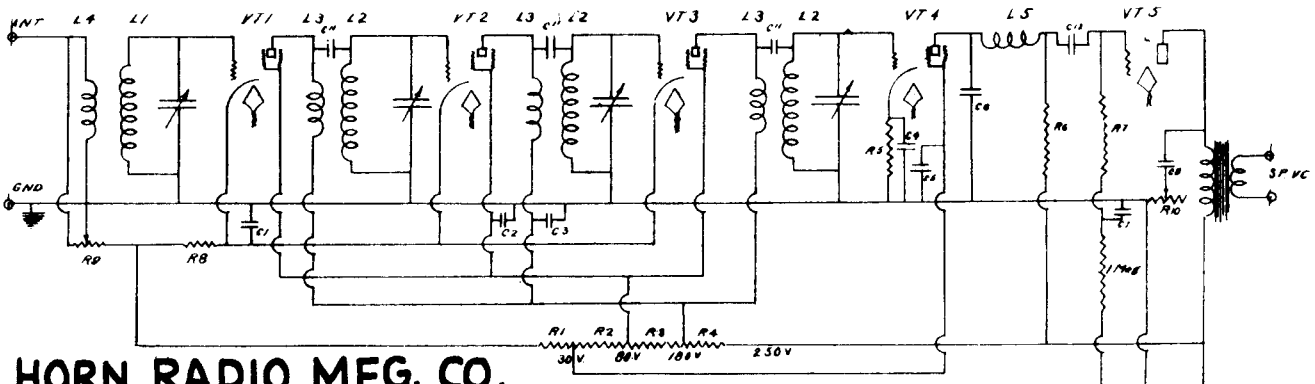


The schematic circuit of the All-American Mohawk "Model B-94" Lyric.

PILOT "UNIVERSAL SUPER-WASP."

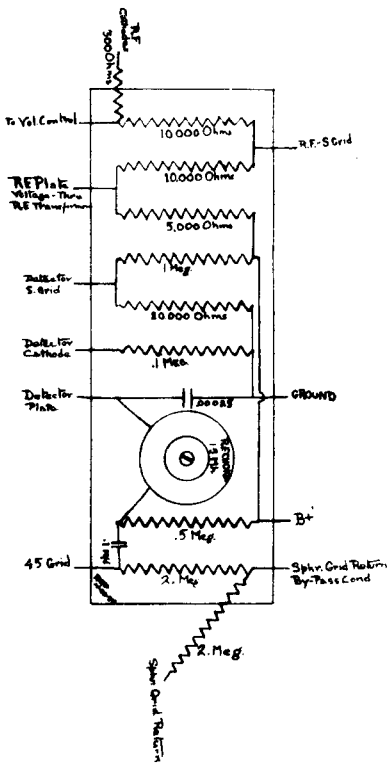


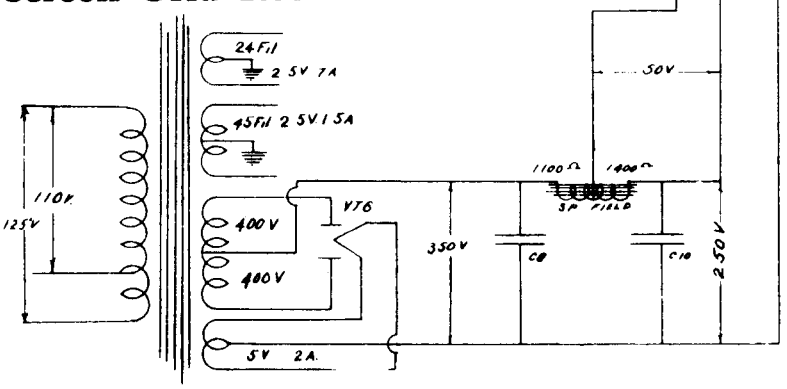
The circuit of the "Universal Super-Wasp," somewhat simplified by the representation of the four sets of R.F. transformers as one. The capacities CA and CB are fixed .0004-mf. condensers used only to tune the highest waveband, above 470 meters. Note the unusual regeneration method.

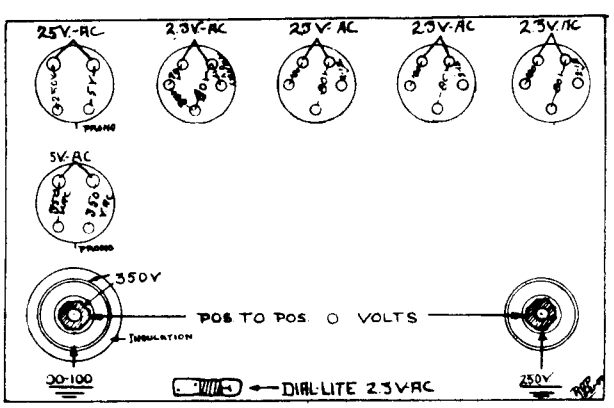


HORN RADIO MFG. CO.

MODEL No. 15 -- Four Screen Grid Receiver



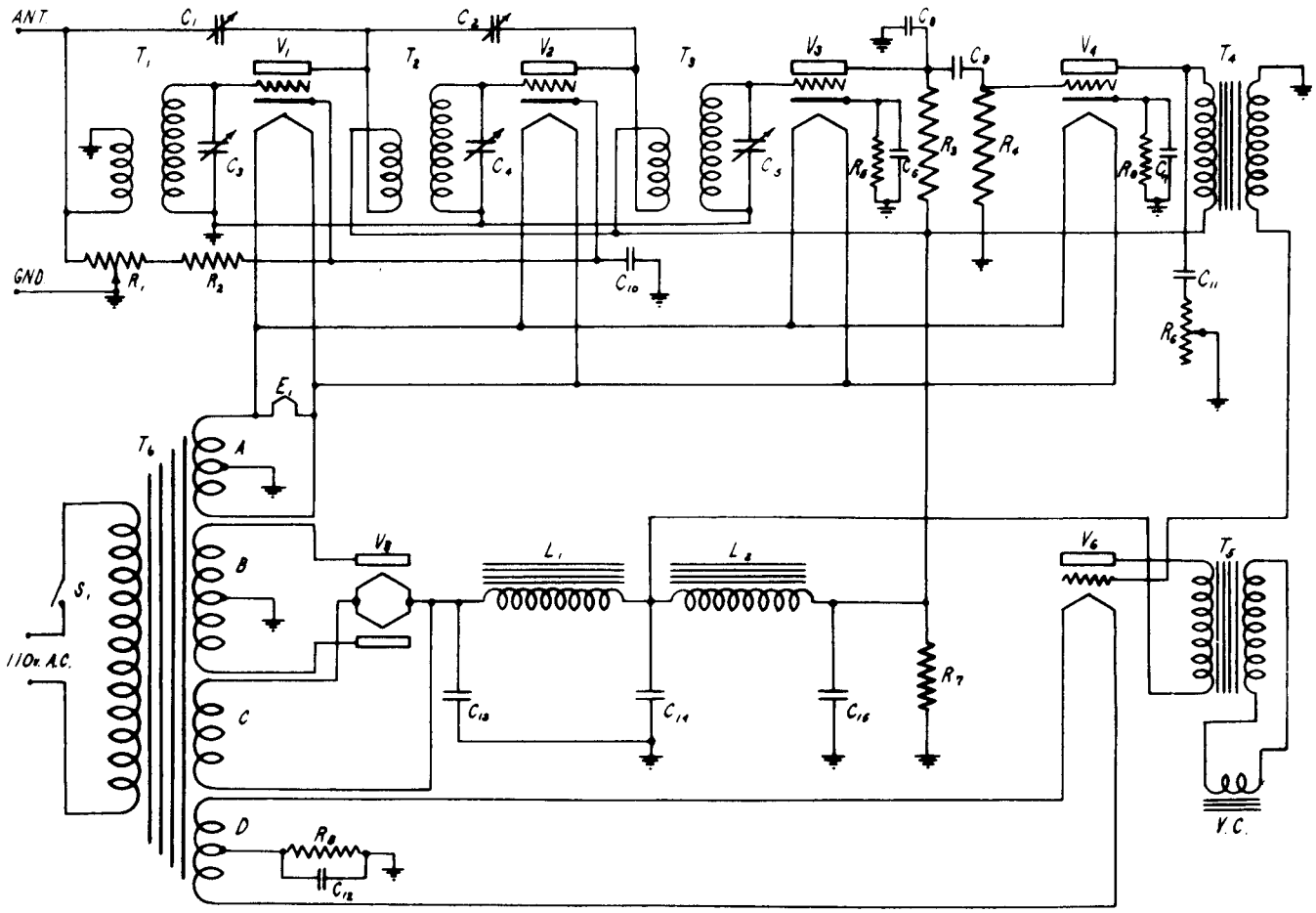




ALL VOLTAGES ARE DIRECT CURRENT - UNLESS MARKED OTHERWISE

NATIONAL TRANSFORMER CO.

MIDGET SIX

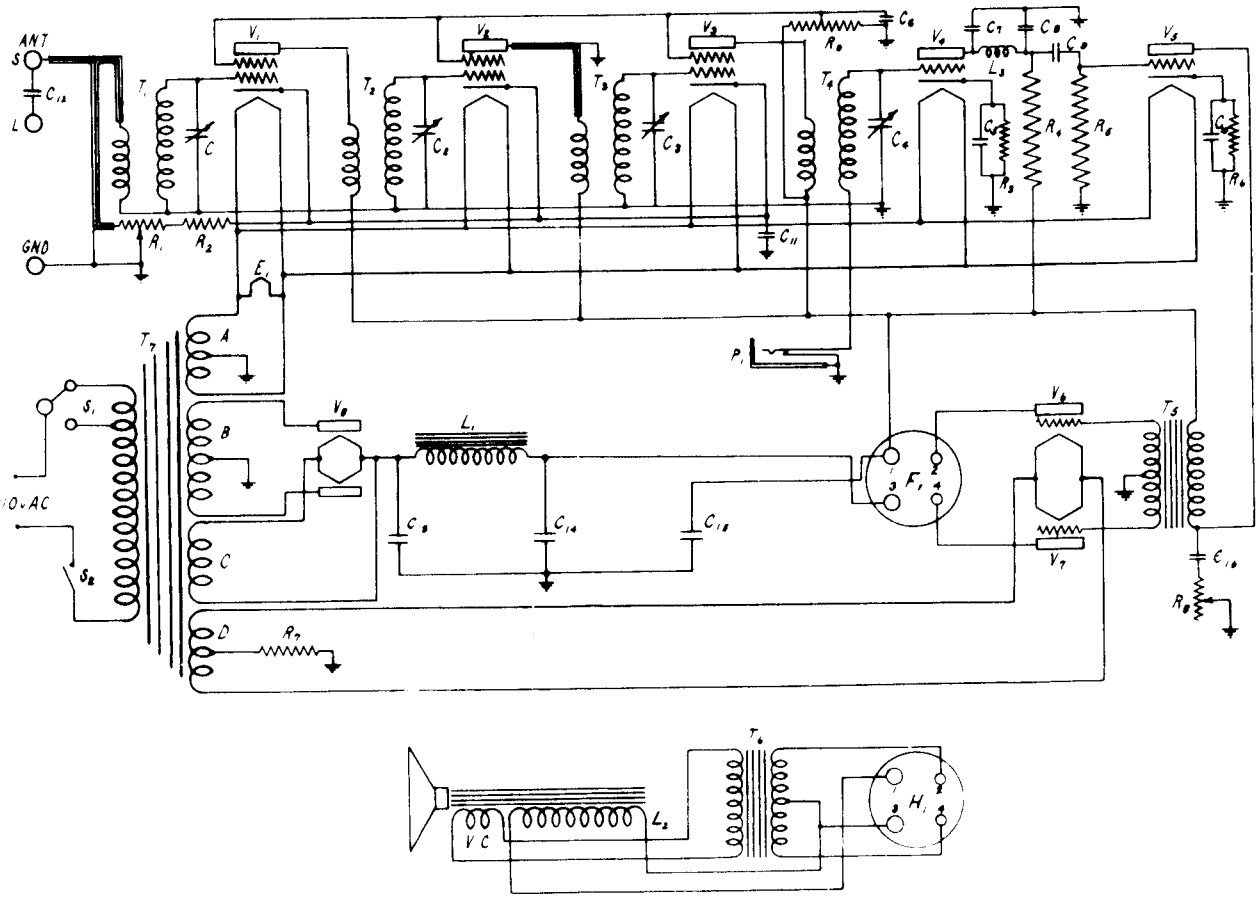


MIDGET SIX
LIST OF PARTS.

A	Fil.- 2.5 Volts - 227		
B	High Voltage		
C	Fil. 5.0 Volts - 280		
D	Fil. 2.5 " - 245		
E1	Dial Light 2.5 Volts		
C1	Neutralizing Cond.		
C2	" "		
C3	1st R.F. Cond. Var.	.00035	M.P.
C4	2nd " " " "	"	" "
C5	3rd " " " "	"	" "
C6	Det. Bypass Cond.	0.25	" "
C7	1 A.F. " "	0.25	" "
C8	Det. Plate Bypass Cond.	0.001	" "
C9	R.F. Coupling Cond.	0.1	" "
C10	R.F. Bypass Cond.	0.25	" "
C11	Tone Var. Cond.	0.1	" "
C12	245 Bypass Cond.	0.25	" "
C13	Filter Cond.	8.0	" "
C14	" "	"	" "
C15	" "	0.25	" "
R1	Volume Control	15,000	Ohms
R2	R.F. Bias Res.	625	"
R3	Det. Plate Res.	100,000	OHMS
R4	1 A.F. Grid Res.	500,000	"
R5	Det. Bias Res.	25,000	"
R6	Tone Control	7,500	"
R7	Bleeder Res.	5,150	"
R8	245.Bias Res.	1,500	"
R9	1 A.F. Bias Res.	1,750	"
V1	1 R.F. Tube	227	
V2	2 R.F. "	"	
V3	Det. "	"	
V4	1 A.F. "	"	
V5	Rec. "	280	
V6	2 A.F. "	245	
T1	Ant. Trans.		
T2	1 R.F. "		
T3	2 R.F. "		
T4	2 A.F. "		
T5	Output "	(On Speaker)	
T6	Power Tran.		
S.	Switch on Volume Control		
VC	Speaker Voice Coil		
L1	Choke Coil		
L2	Speaker Field		

NATIONAL TRNSFORMER CO.

SCREEN GRID EIGHT

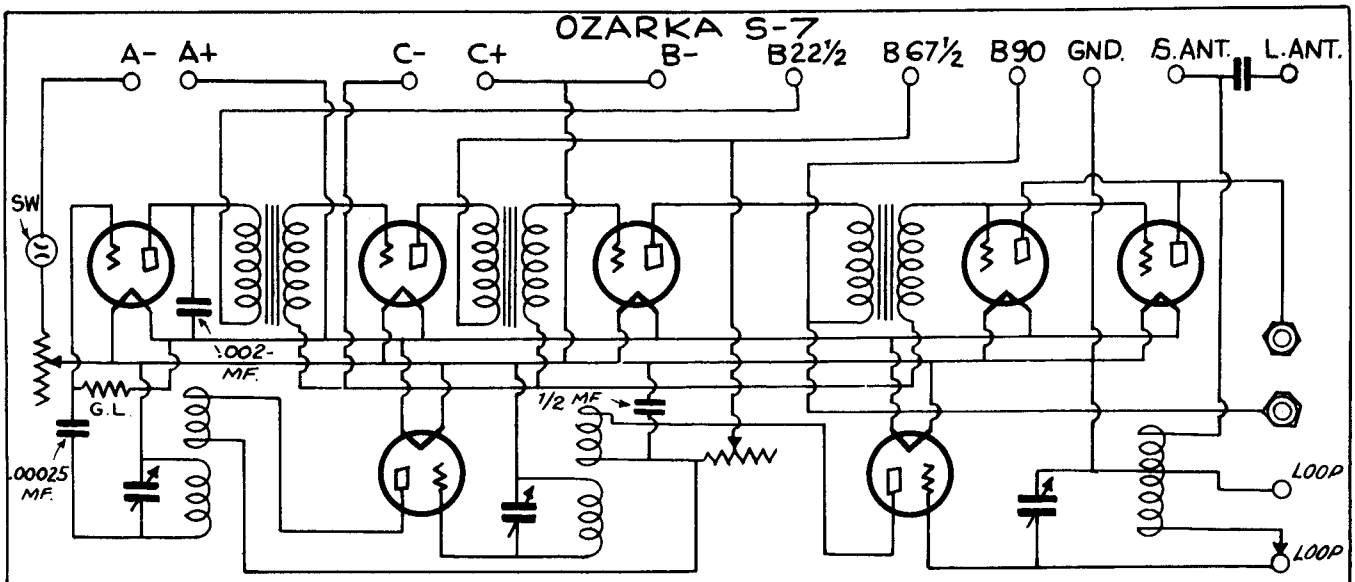


SCREEN GRID EIGHT
LIST OF PARTS

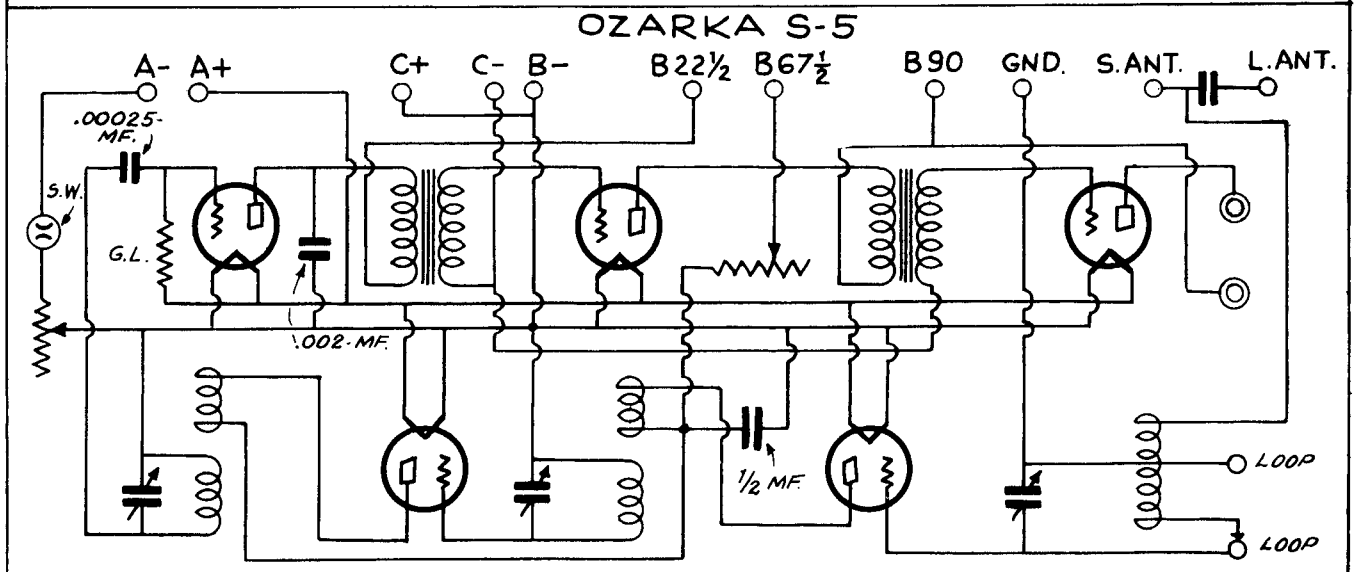
A	Fil. 2.5 Volts - 227	
B	High Voltage	
C	Fil. 5.0 Volts - 280	
D	Fil. 2.5 " - 245 Push Pull	
El	Dial Light 2.5 Volts	
Fl	Speaker Socket (Front View)	
Hl	Speaker Plug	
Cl	1st R.F. Cond. Var.	.00035 M.F.
C2	2nd R.F. " "	" " "
C3	3rd " " " "	" " "
C4	4th " " " "	" " "
C5	Det. Bypass Cond.	.25
C6	Screen Grid Bypass	.25
C7	Det. Plate Bypass	.001 M.F.
C8	" " "	" " "
C9	1 A.F. Coupling Cond.	.25 " "
C10	1 A.F. Bypass Cond.	.25 " "
C11	R.F. Bypass Cond.	.25 " "
C12	Ant. Cond.	.00025 " "
C13	Filter Cond.	8.0 " "
C14	" "	" " "
C15	" "	" " "
C16	Tone Var. Cond.	0.1 " "
Rl	Volume Control	15000 Ohms
R2	R.F. Bias Res.	150 "
R3	Det. Bias Res.	75000 "
R4	Det. Plate Res.	200000 "
R5	1 A.F. Grid Res.	100000 "
R6	1 A.F. Bias Res.	4000 "
R7	245 Bias Res.	900 "
R8	Tone Control	7500 Ohms
R9	Bleeder Res.	8500 "
V1	1 R.F. Tube - 224	
V2	2 R.F. " "	
V3	3 R.F. " "	
V4	Det. " 227	
V5	1 A.F. " "	
V6	Push Pull Tube 245	
V7	" " " "	
V8	Rec. Tube - 280	
Tl	Ant. Trans.	
T2	1 R.F. "	
T3	2 R.F. "	
T4	3 R.F. "	
T5	2 A.F. " (Input Push Pull)	
T6	2 A.F. " (Output Push Pull on Speaker)	
T7	Power "	
Ll	Choke Coil	
L2	Speaker Field	
Sl	Hl - Lo Switch	
S2	Switch on Volume Control	
VC	Speaker Voice Coil	
Pl	Phonograph Jack	

OZARKA, INC.

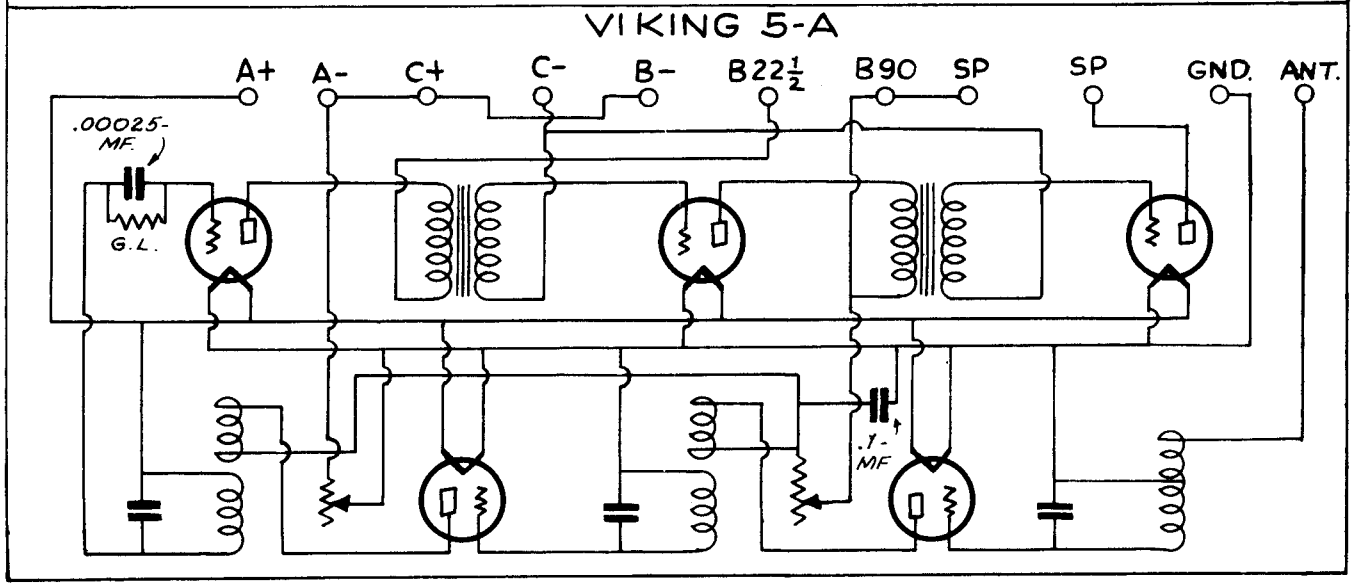
OZARKA S-7



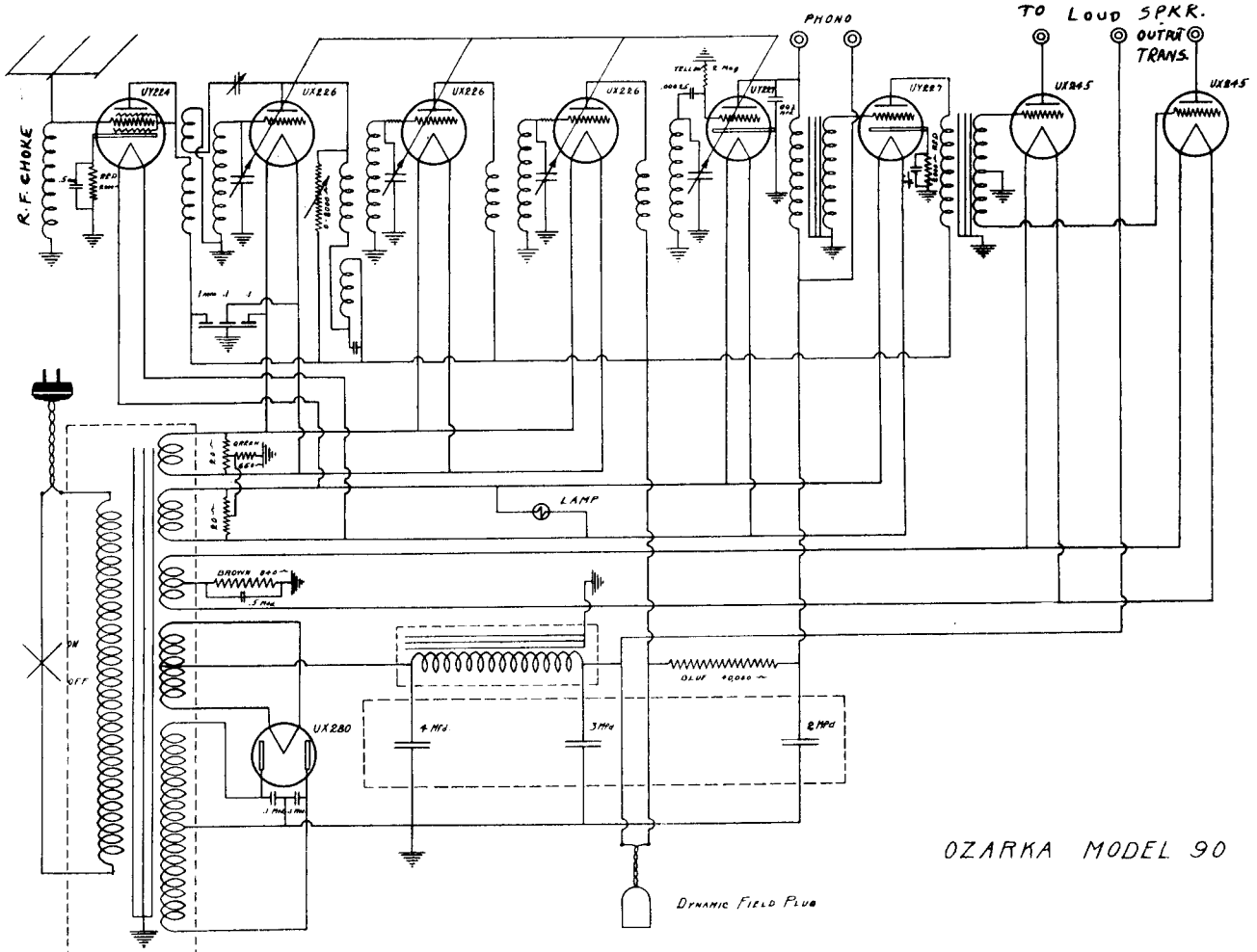
OZARKA S-5



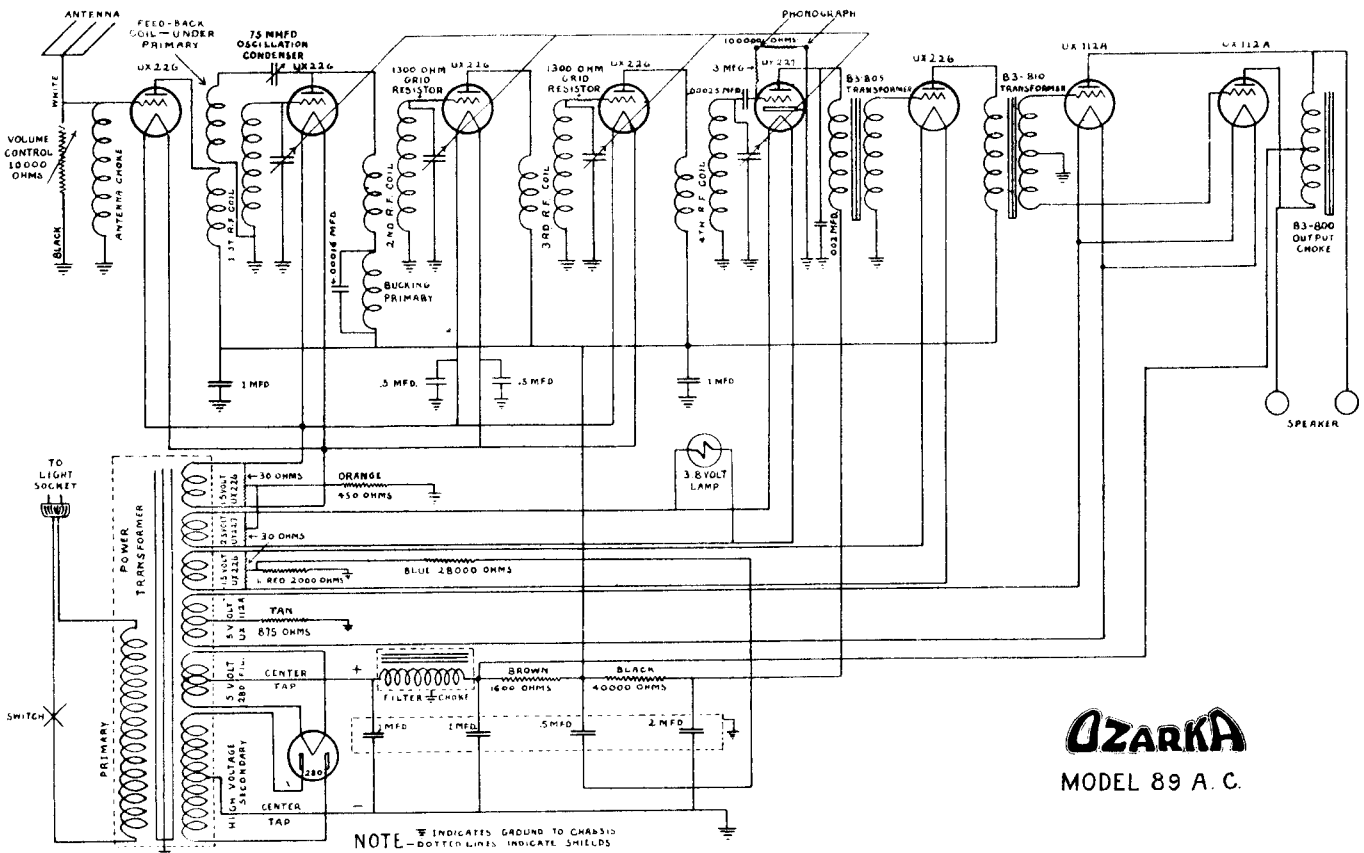
VIKING 5-A



OZARKA, INC.



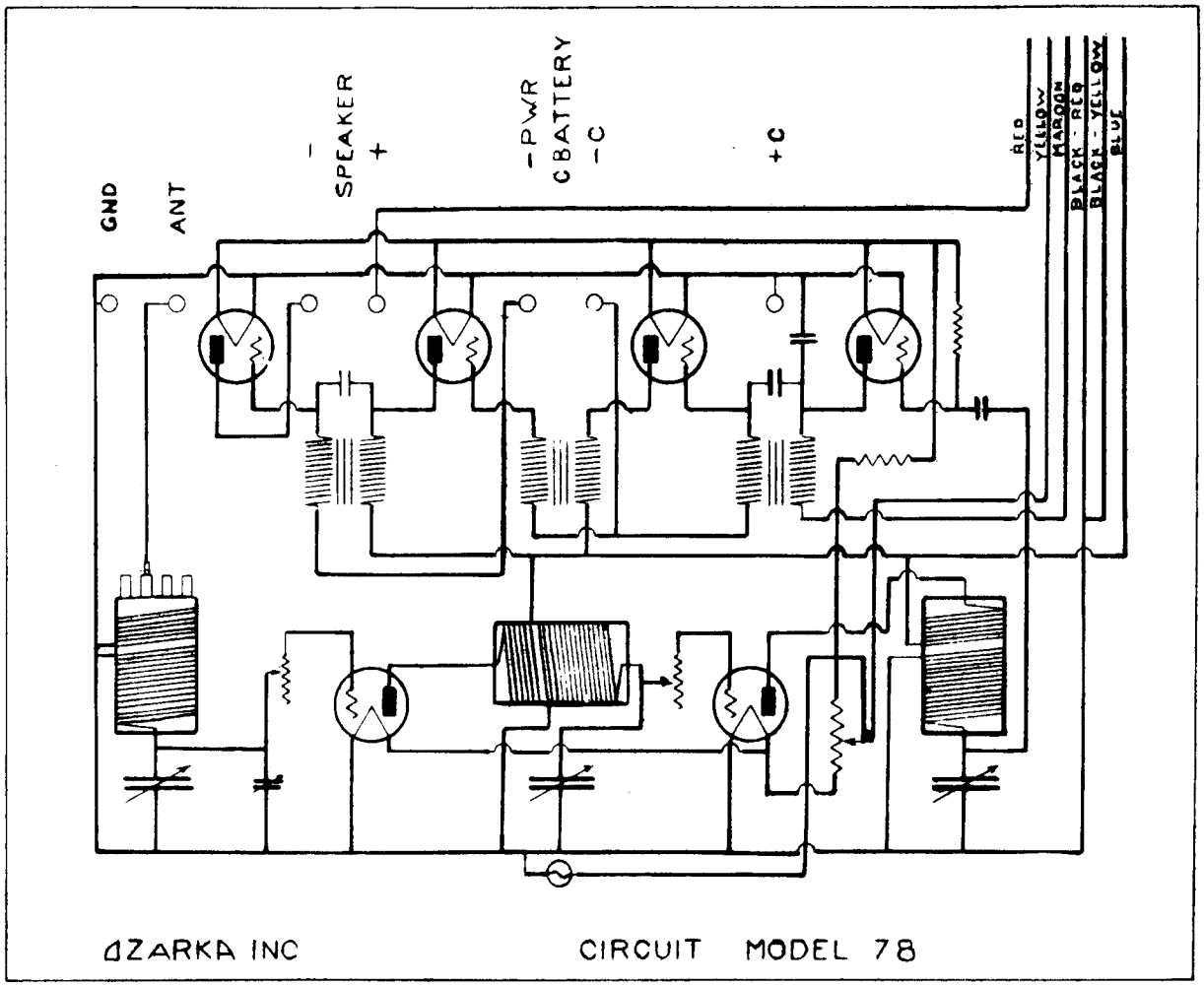
OZARKA MODEL 90

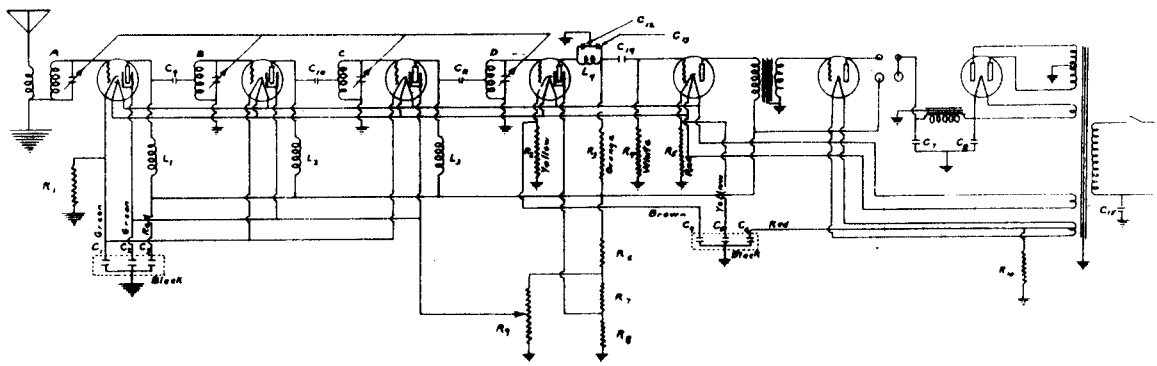


NOTE – ⏚ INDICATES GROUND TO CHASSIS
DOTTED LINES INDICATE SHIELDS

OZARKA
MODEL 89 A. C.

OZARKA, INC.



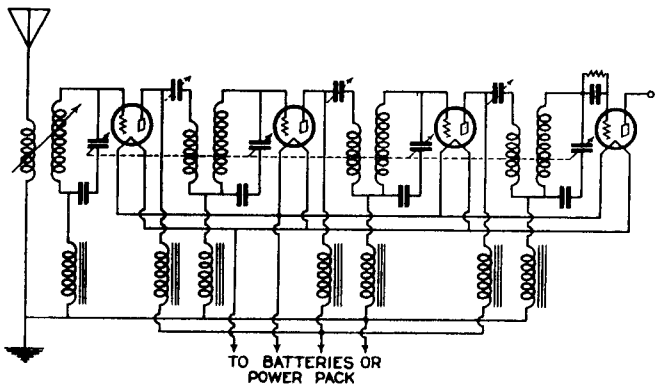


C1- .25 } R.F. By Pass
C2- .25
C3- 1.0
C4- .25 } A.F. By Pass
C5- .1
C6- .5
C7- 8.0
C8- 8.0
C9- .0001
C10- .0001
C11- .0001
C12- .001
C13- .001
C14- .005
C15- .005

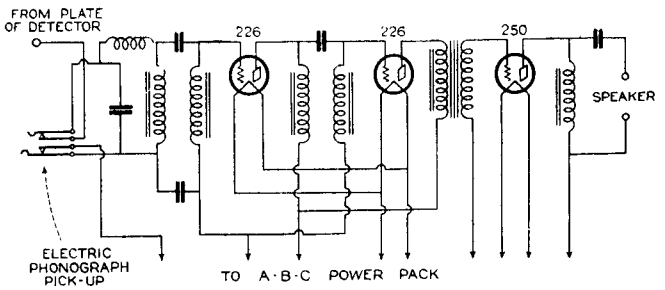
R1- .225 ~
R2- 110,000 ~
R3- 350,000 ~
R4- 1 Meg ~
R5- 2000 ~
R6- 5000 ~
R7- 5000 ~
R8- 5000 ~
R9- 10,000 ~
R10- 1600 ~

THE VIKING
MODEL 92-AC

RADIO PRODUCTS LABORATORY

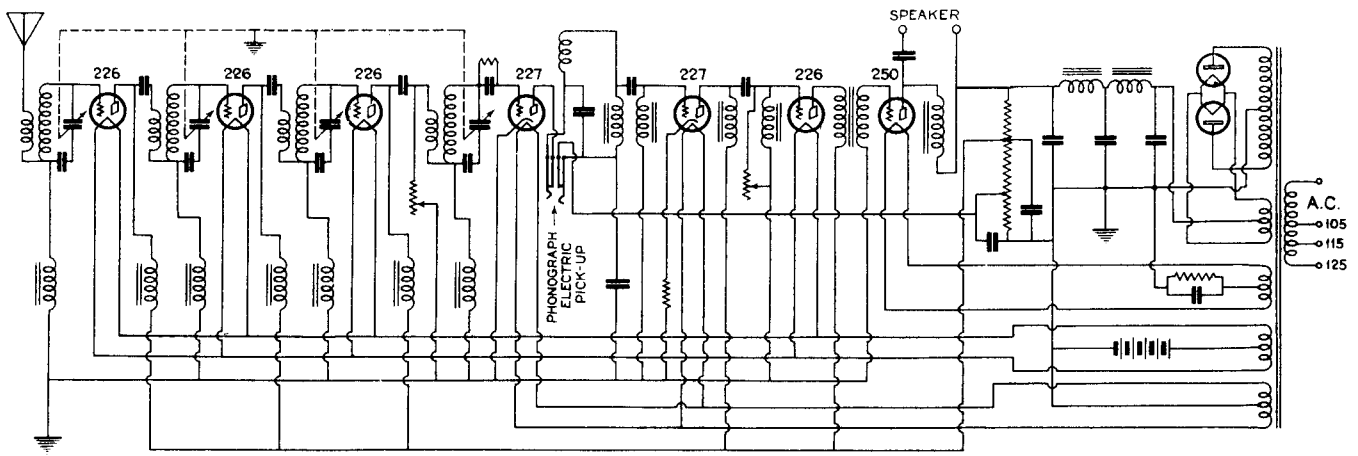


"LOFTIN-WHITE TUNER"

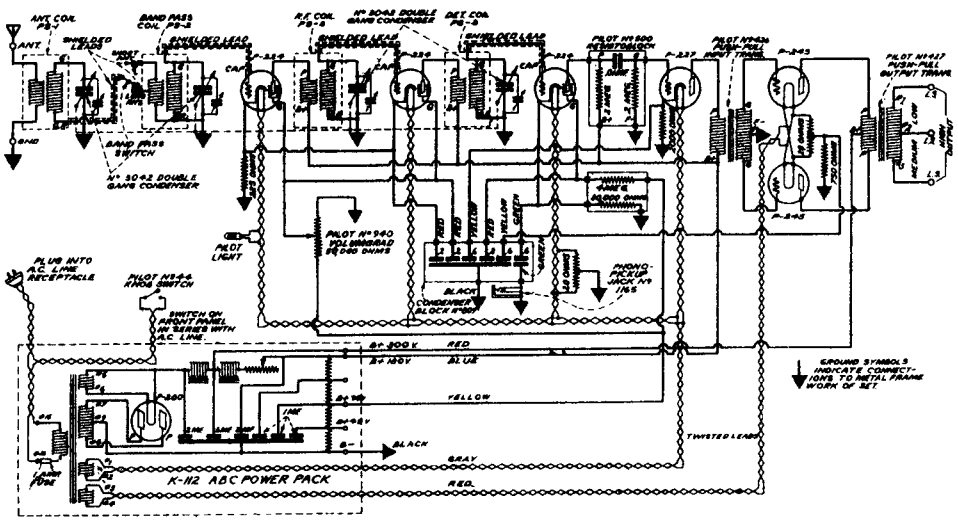


"AUDIO AMPLIFIER"

COMPLETE SET



PILOT RADIO & TUBE CORP.



PRE-SELECTOR

HOW TO OBTAIN CORRECT FILAMENT VOLTAGE

The purpose of the special eight-point switch is to enable one to obtain the proper "A" voltage for any receiving set up to eight tubes. When the arrow on the switch knob points to A, the lowest available voltage is obtained; when the knob points to H, maximum output results. For best performance, a reliable voltmeter should be connected across the "A" terminals of your receiver. The switch knob should then be rotated until the voltmeter reads 6 with all tube filaments lit. A 6-volt supply is correct for all sets using 201-A, 112, 112-A, 171 and 171-A type tubes. Once the voltage adjustment has been made, no further voltmeter readings are necessary, nor is any other attention required by the Knapp "A" Power Unit.

For small sets, such as those using three or four tubes, it may be necessary to install a 6 or a 10 ohm rheostat in the "A" minus lead wire, so as to reduce the output voltage to 6. Under no circumstances should the tubes be operated above the rated voltage specified by their manufacturers.

IN CASE HUM IS EXPERIENCED

The Knapp "A" Power Unit is designed to operate without the slightest trace of hum. Some sets and circuits are super-sensitive and critical, and in case any hum is experienced, one of the following suggestions will undoubtedly eliminate the trouble:

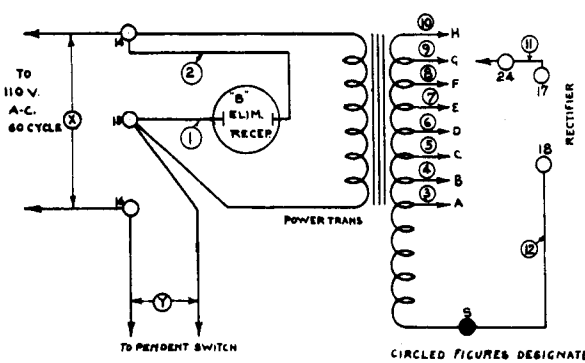
1st. Hum may be caused by the AC line supply. Pull out the AC plug, turn it 180 degrees and put it back.

2nd. Ground the negative "A" lead through a condenser of .1 mfd. or higher.

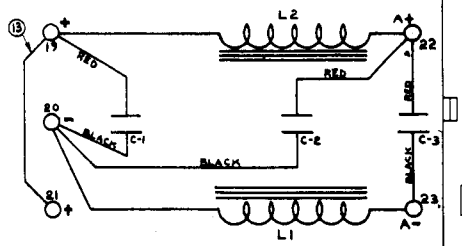
3rd. Place a .1 mfd. (or higher) by-pass condenser between the grounded side of the AC input and the negative side of the DC output.

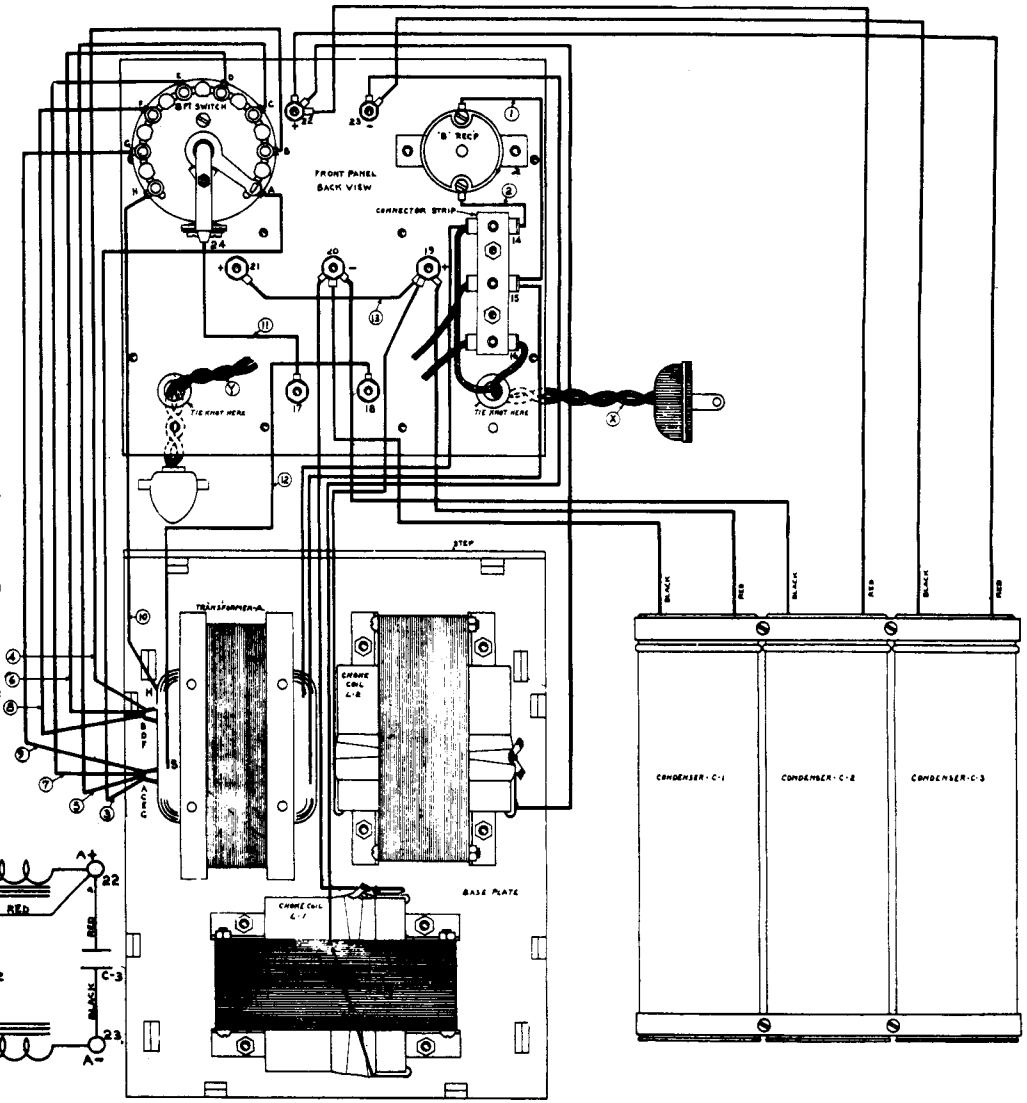
4th. Move "A" Power away from super-sensitive set.

5th. Investigate the "B" eliminator, as defective "B" eliminators often cause hum.



Schematic Wiring Diagram of Knapp "A" Power Unit

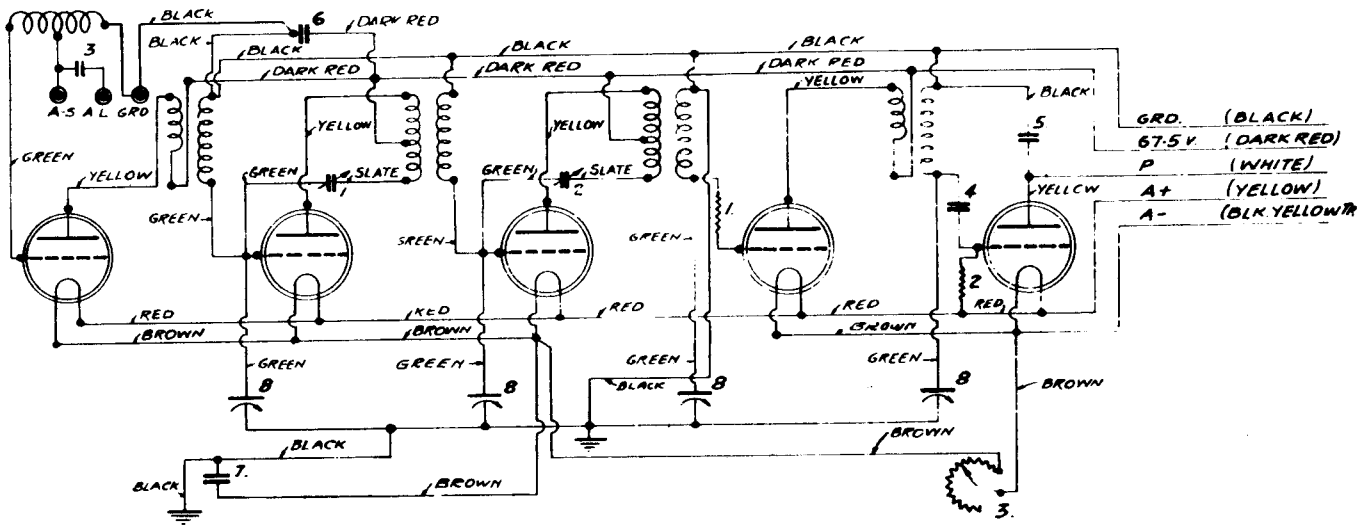




Picture Wiring Diagram of Knapp "A" Power Unit, showing rear of Panel and Transformer and Chokes mounted on Base Plate

KNAPP "A" POWER UNIT.

CANADIAN MARCONI CO.



TYPE XIV D.C.

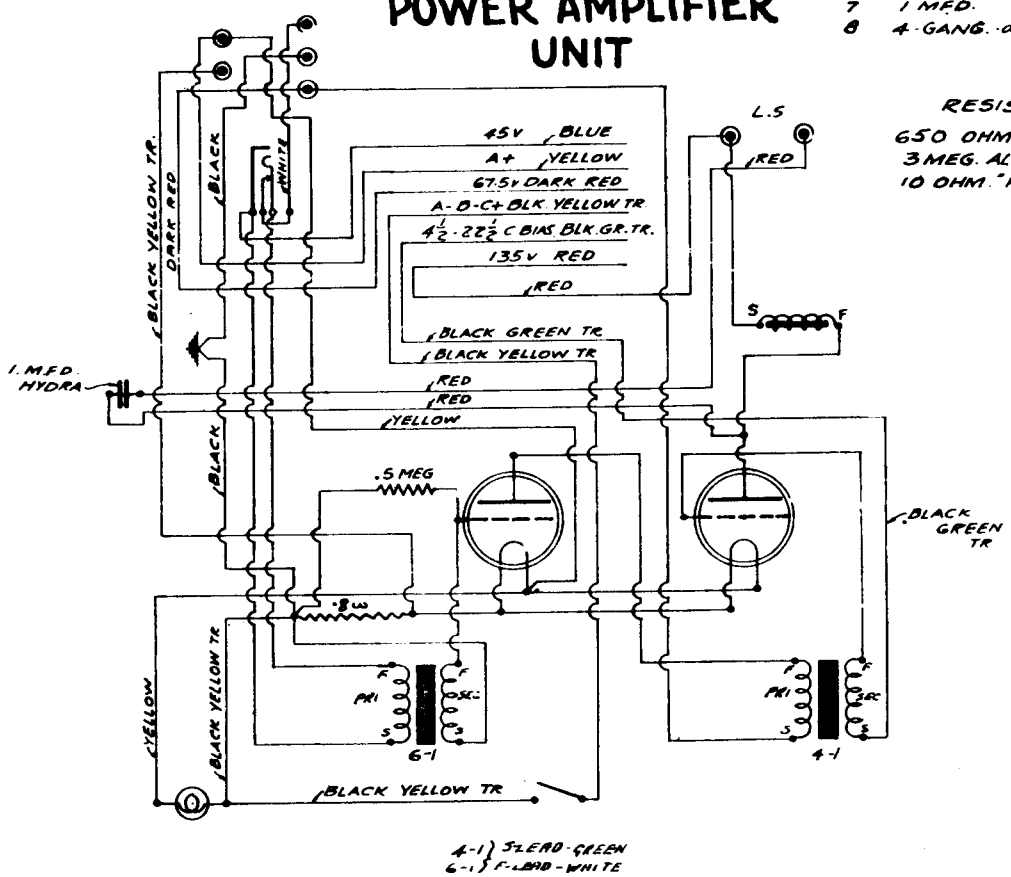
CONDENSERS

1	NEUT CONDENSER	1
2	NEUT. CONDENSER	2
3	.001 M.F.D. AEROVOX.	3
4	.00025 "AEROVOX"	4
5	.002 "AEROVOX"	5
6	1 M.F.D. "HYDRA"	6
7	1 M.F.D. "HYDRA"	7
8	4-GANG. .00035 "TALLMAN.	8

RESISTANCES

650 OHM "ELECTRAD
3 MEG. ALLEN BRAD. GRIDLEAK
10 OHM. "FROST." RHEOSTAT

POWER AMPLIFIER UNIT



4-1 } 3 LEAD - GREEN
6-1 } F - LEAD - WHITE

CANADIAN MARCONI CO.

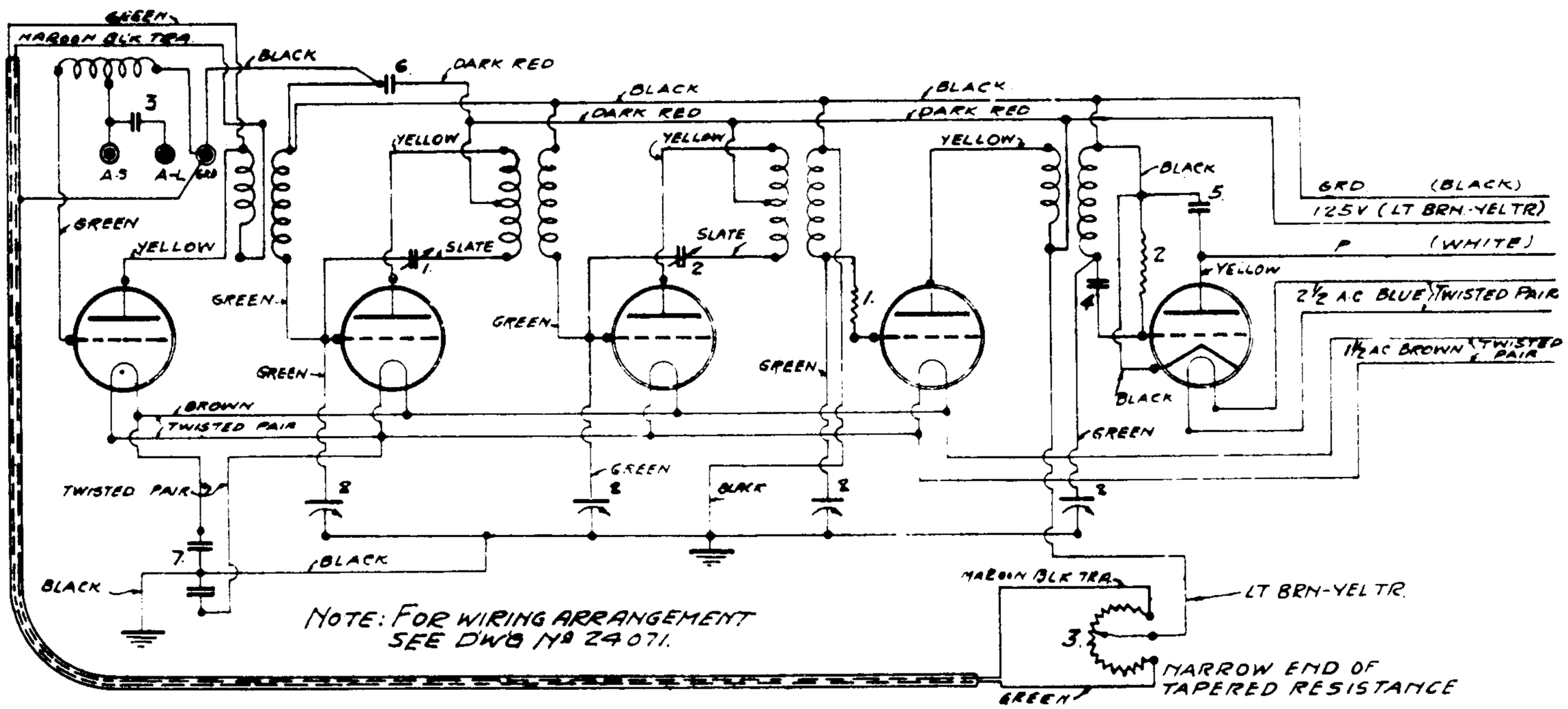
CONDENSERS

1	NEUT. CONDENSER
2	NEUT. CONDENSER
3	·001 M.F.D AEROVOX.
4	·00025 MFD. AEROVOX.
5	·002 MFD. AEROVOX.
6	1 MFD HYDRA
7	2 × ½ MFD. HYDRA
8	4-GANG. ·00035 TALLMAN.

RESISTANCES.

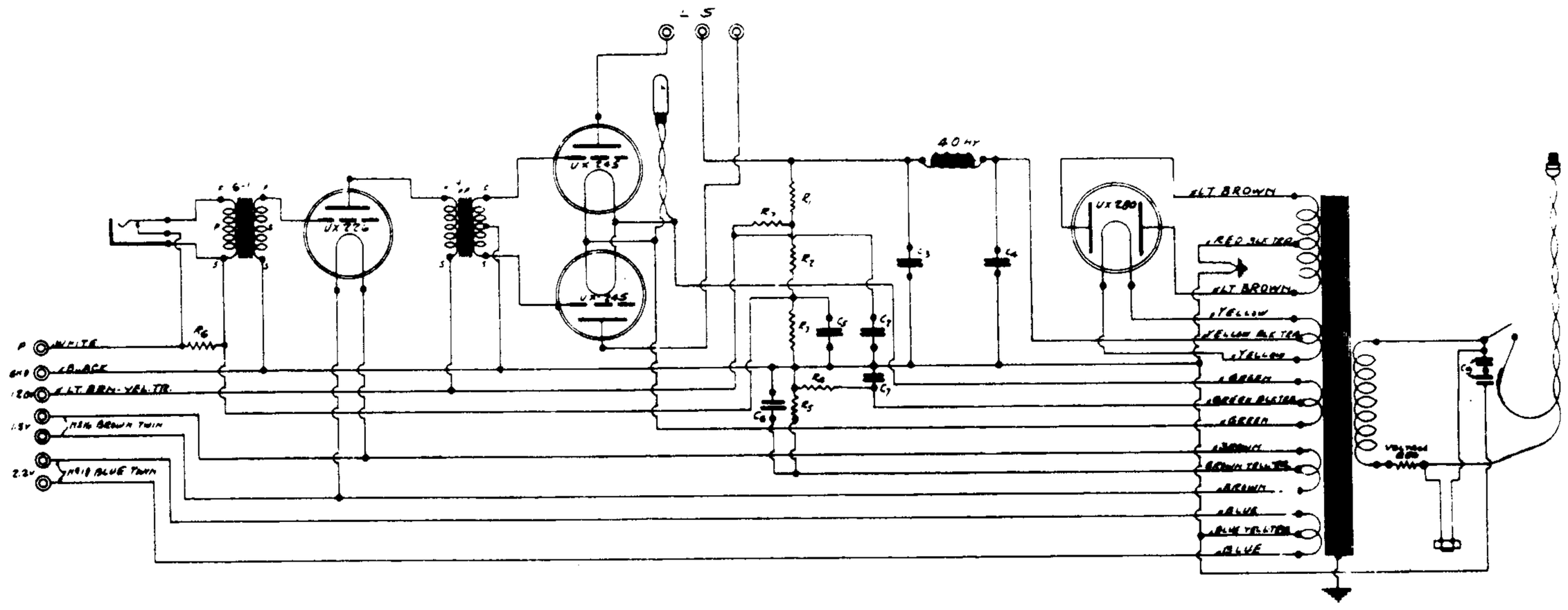
900 OHM. ELECTRAD
3 MEG. ALLEN. BRD GRID LEAK.
1000 OHM. CARTER POTENTR.

TUNER UNIT TYPES XV, XVI, XVII, XVIII A.C.



NOTE: FOR WIRING ARRANGEMENT SEE DWG Nº 24071.

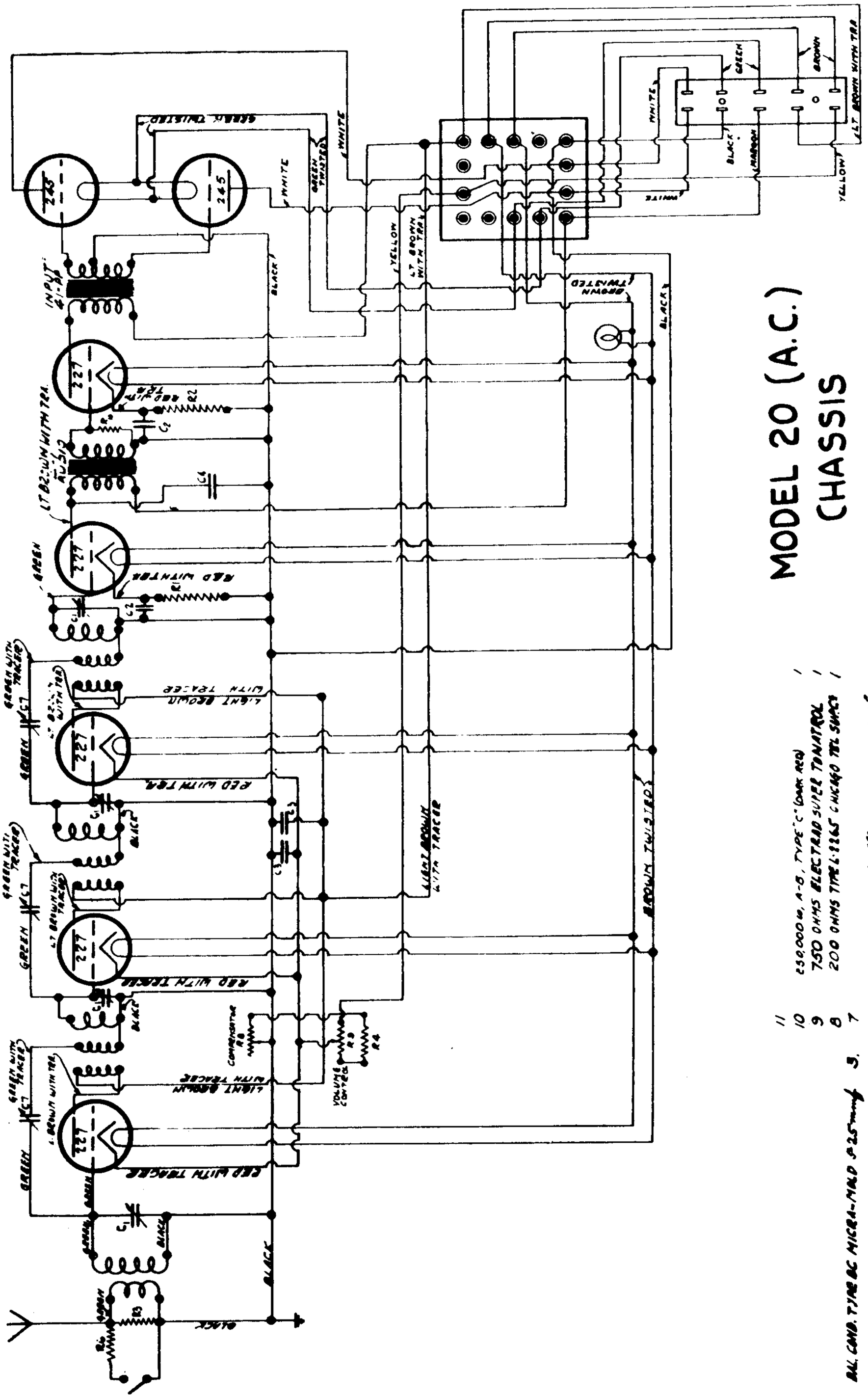
POWER UNIT TYPE XVI



8		
7	800 OHMS ELECTRAD	
6	8000 OHMS GRIDLEAK ALLEN BRADLEY	
5	350 OHMS	POTENTIAL DIVIDER ALLEN BRADLEY
4	640 OHMS	
3	9000 OHMS	
2	10600 OHMS	
1	3275 OHMS	
Nº	RESISTORS	

10		
9	2×.1 MFD HYDRA	
8		
7	1 MFD	16 MFD CONDENSER BLOCK "HYDRA"
6	1 MFD	
5	2 MFD	
4	8 MFD	
3	2 MFD	
2	2 MFD	
Nº	CONDENSERS	

CANADIAN MARCONI CO.



MODEL 20 (A.C.) CHASSIS

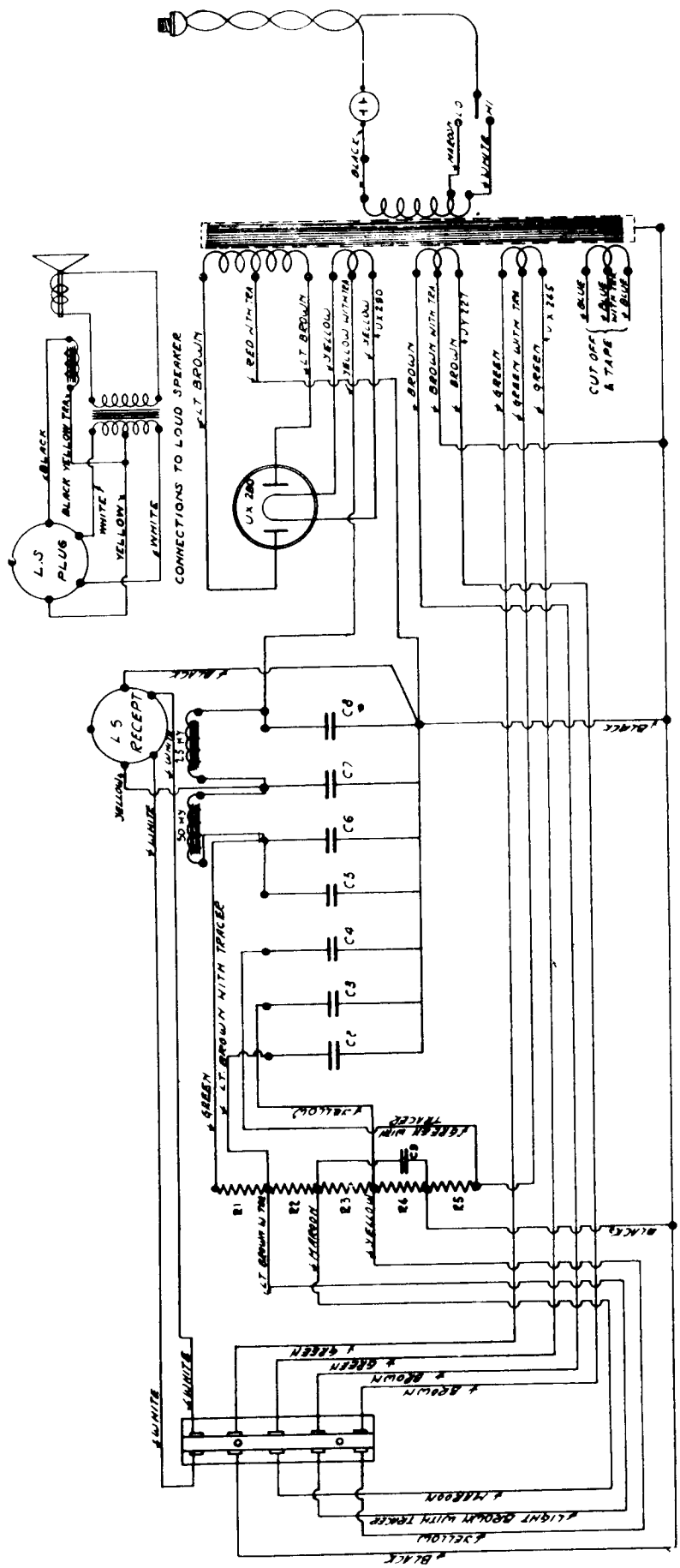
RESISTANCES

REQ.		
11		
10	250,000 ω, A-B, TYPE "C" (DARK RED)	1
9	750 OHMS ELECTRAD SUPER TONATROL	1
8	200 OHMS TYPE L-1165 CHICAGO TEL SWITCH	1
7		
6	15 OHMS N-350R ADVANCE WIRE WOUND	1
5		
4	120 OHMS 4 WATT TYPE WIRE WOUND	1
3	10000 OHMS 3/4 WATT "CLAROSTAT"	1
2	1500 OHMS 75 WATT "CLAROSTAT"	1
1	15000 OHMS .4 WATT "CLAROSTAT"	1

CONDENSERS

REQ.		
11		
10		
9		
8		
7	ALL COND. TYPE BC MICA-MOLD ASSEMBLY	3
6		
5		
4	.002 MFD. AEROVOX	1
3	1 MFD. "HYDRA"	2
2	5 MFD "HYDRA"	2
1	360 MFD 4 GANG SCOVILL	1

CANADIAN MARCONI CO.



MODEL 20 (A.C.) POWER UNIT

NOTE 1 FOR WIRING ARRANGEMENT SEE DWG. # 28743

NOTE 2 DIAGRAM SHOWS 10 POINT RECEPTACLE AND L.S RECEPTACLE AS SEEN WHEN LOOKING UNDER POWER UNIT

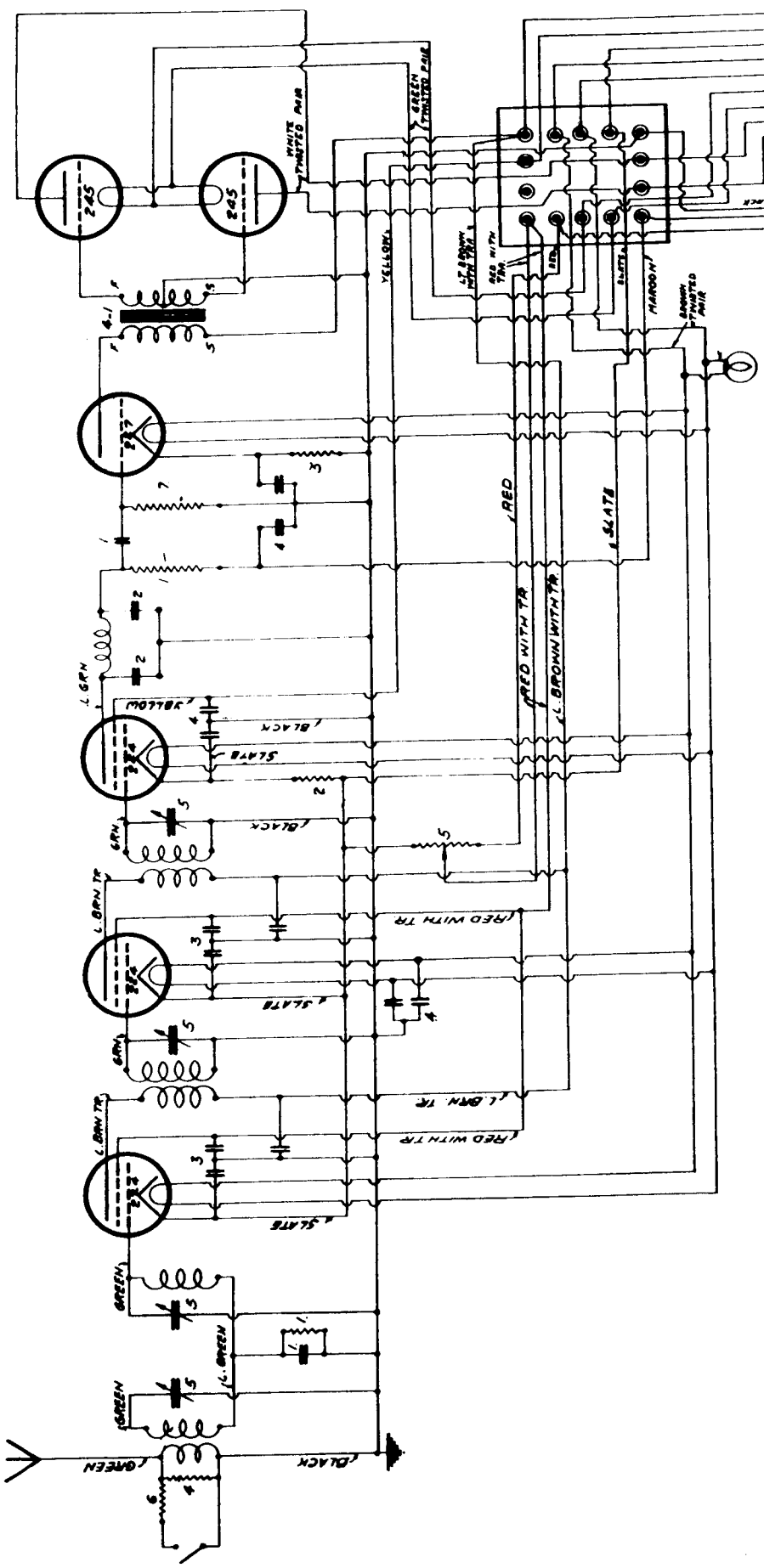
CONDENSERS

11			
10			
9	1 MFD. "HYDRA"		
8	6 MFD.	16 MFD "HYDRA"	
7	3 MFD.		
6	2 MFD.		
5	2 MFD.		
4	1 MFD.		
3	1 MFD.		
2	1 MFD.		
1			

RESISTANCES

6		
5	760 OHMS	VOLTAGE DIVIDER
4	25000 OHMS	
3	1100 OHMS	
2	3375 OHMS	
1	3750 OHMS	

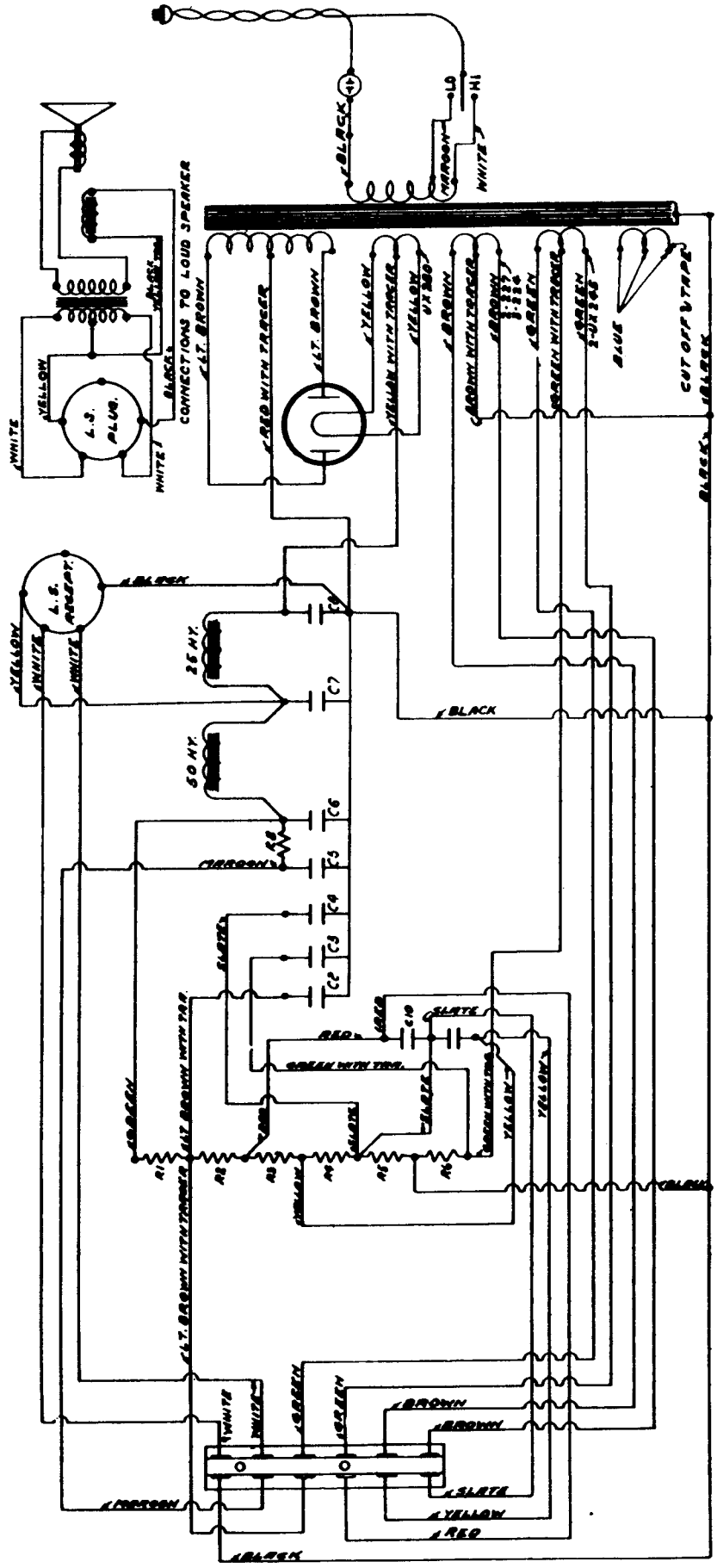
CANADIAN MARCONI CO



MODEL 21 (A.C.)
CHASSIS

11					
10					
9					
8					
7			1 MEG ½ WATT "A.B. TYPE 'C'"		1
6			8 OHM N°1336 ADVANCE RES-ST-ANCE 8½" LG		1
5	5	5	5000 ω POTENT. ELECTRAD SUPERTONATROL		1
4	4	4	10,000 ω ¾ WATT A.B TYPE B		1
3	3	3	1500 ω ¾ WATT A.B TYPE B		1
2	2	2	5000 ω ½ WATT A.B. TYPE C		1
1	1	1	.25 MEG ½ WATT A.B. TYPE B		1
	QTY.		RESISTORS		QTY.
6	1	5	4-GANG 360 MMFD "SCOVILL"		1
5	3	4	2×.5 MFD "HYDRA"		3
4	2	3	3×.3 MFD "HYDRA"		2
3	2	2	.00025 MFD AEROVOX		2
2	1	1	.02 MFD "AEROVOX"		1
	QTY.		CONDENSERS		QTY.

CANADIAN MARCONI CO.

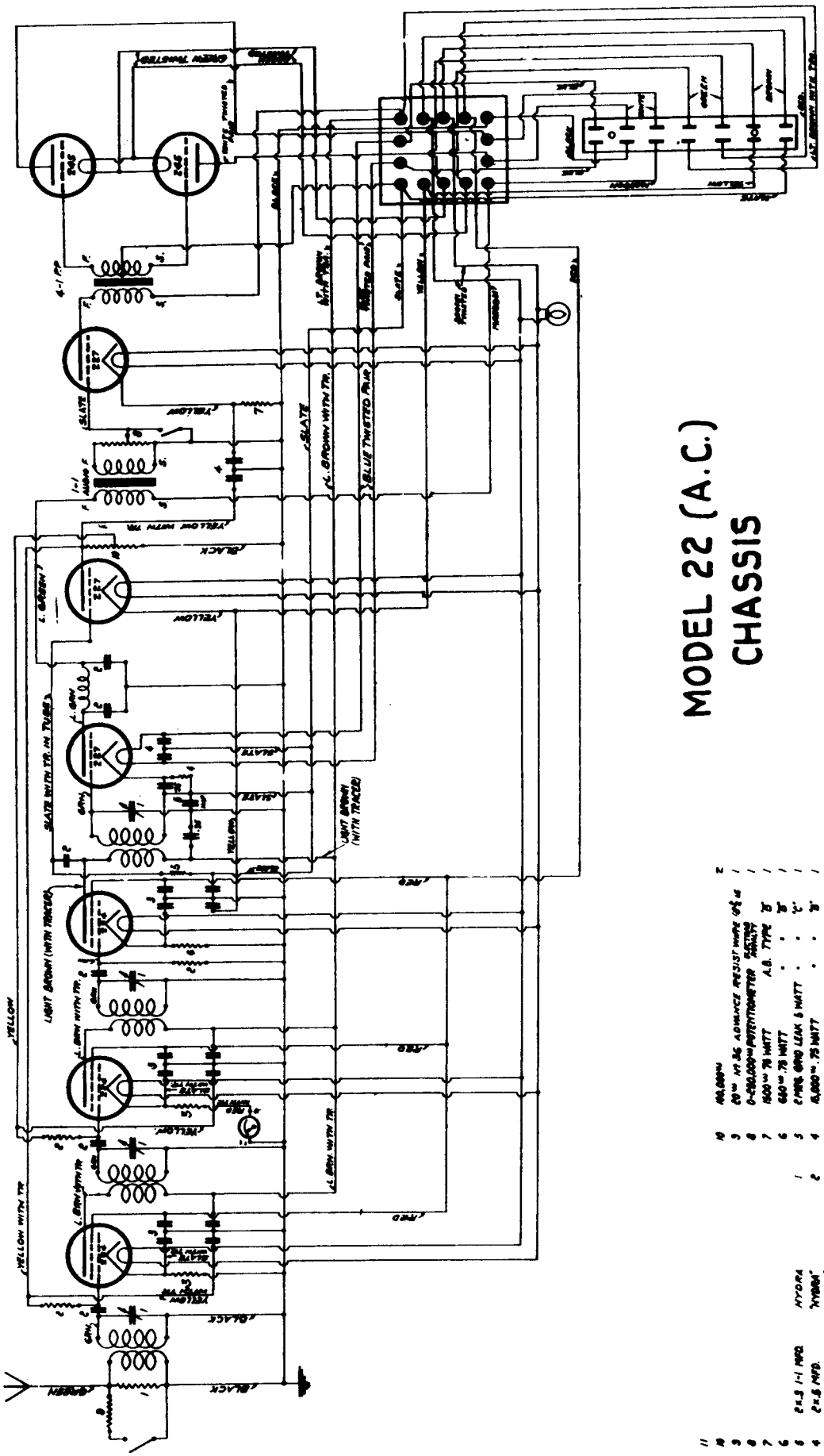


NOTE:- FOR WIRING ARRANGEMENT SEE Dwg. E6742
DIAGRAM SHOWS 12 POINT RECEPTACLE & L.S. RECEPTACLE
AS SEEN WHEN LOOKING UNDER POWER UNIT

MODEL 21 (A.C.)
POWER UNIT

11				
10		10		
9		9		
8	8 MFD. "HYDAE"	8	10,000 OHMS RESISTANCE; 25 WATT, A & T TYPE 8	
7	1 MFD.	7		
6	2 MFD.	6	760 OHMS	
5	2 MFD.	5	60 OHMS	VOLTAGE DIVIDER
4	1 MFD.	4	25,000 OHMS	
3	1 MFD.	3	25,000 OHMS	
2	1 MFD.	2	4,400 OHMS	
1		1	2650 OHMS	
	CONDENSERS		RESISTANCES	

CANADIAN MARCONI CO.



MODEL 22 (A.C.) CHASSIS

RESISTORS

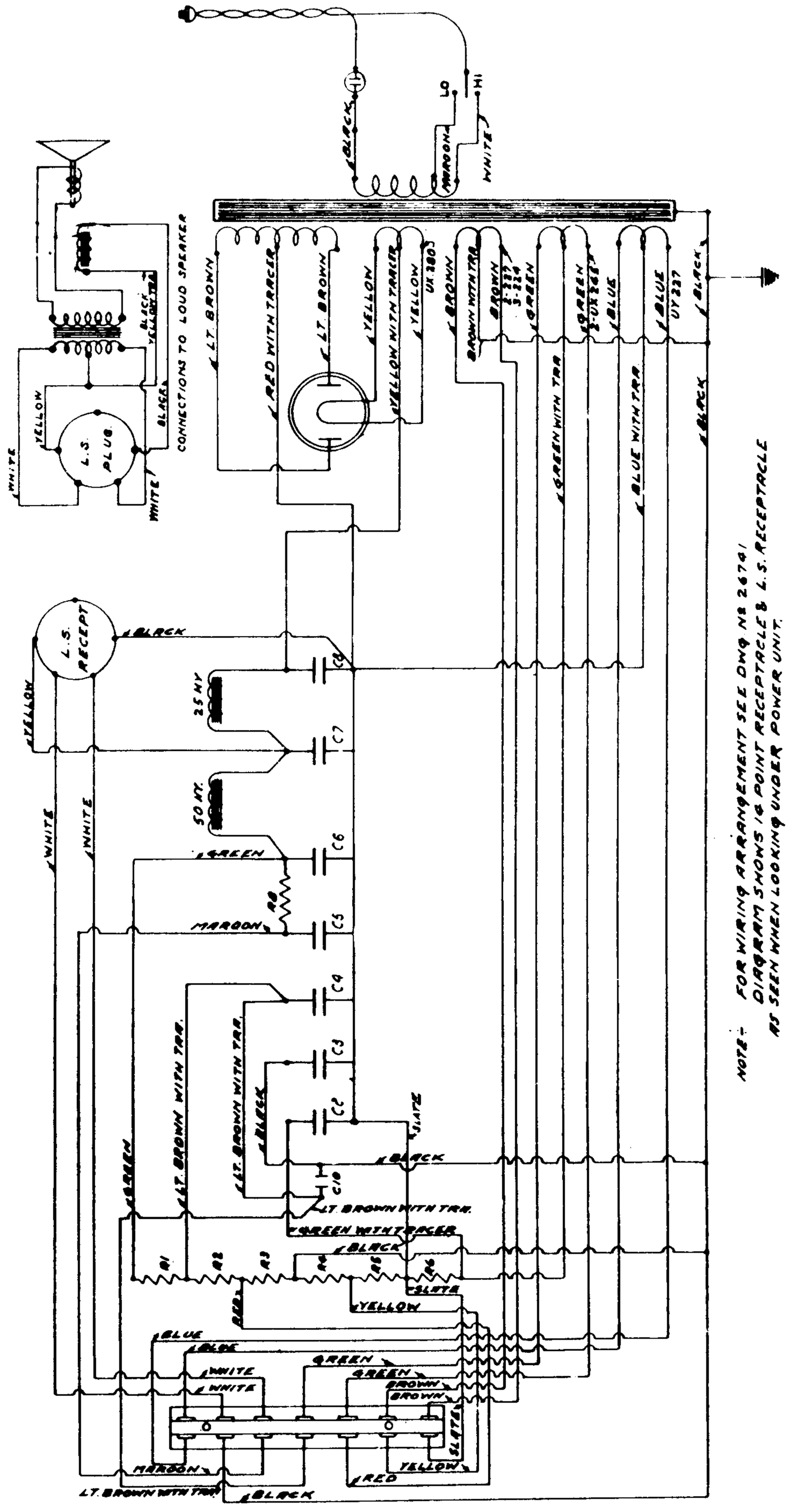
NO.	
1	MEGOHM
3	50 "WIRE WOUND" ADJUSTABLE RESISTANCE
8	0-250,000 OHM POTENTIOMETER
7	1500 OHM .75 WATT A.B. TYPE
6	680 OHM .75 WATT " "
5	2 MEG GRID LEAK .5 WATT " "
4	5,000 OHM .75 WATT " "
3	400 OHM .75 WATT " "
2	5 MEG GRID LEAK .5 WATT " "
1	10,000 OHM .75 WATT " "

CONDENSERS

2	.01 MFD.	HYDRA	
4	.1 MFD.	"HYDRA"	
3	.01 MFD.	"HYDRA"	
6	.0005 MFD.	"HERMAX"	
1	BROADCAST 4 GANG	SCOVILL	

CANADIAN MARCONI CO.

MODEL 22 (A.C.) POWER UNIT

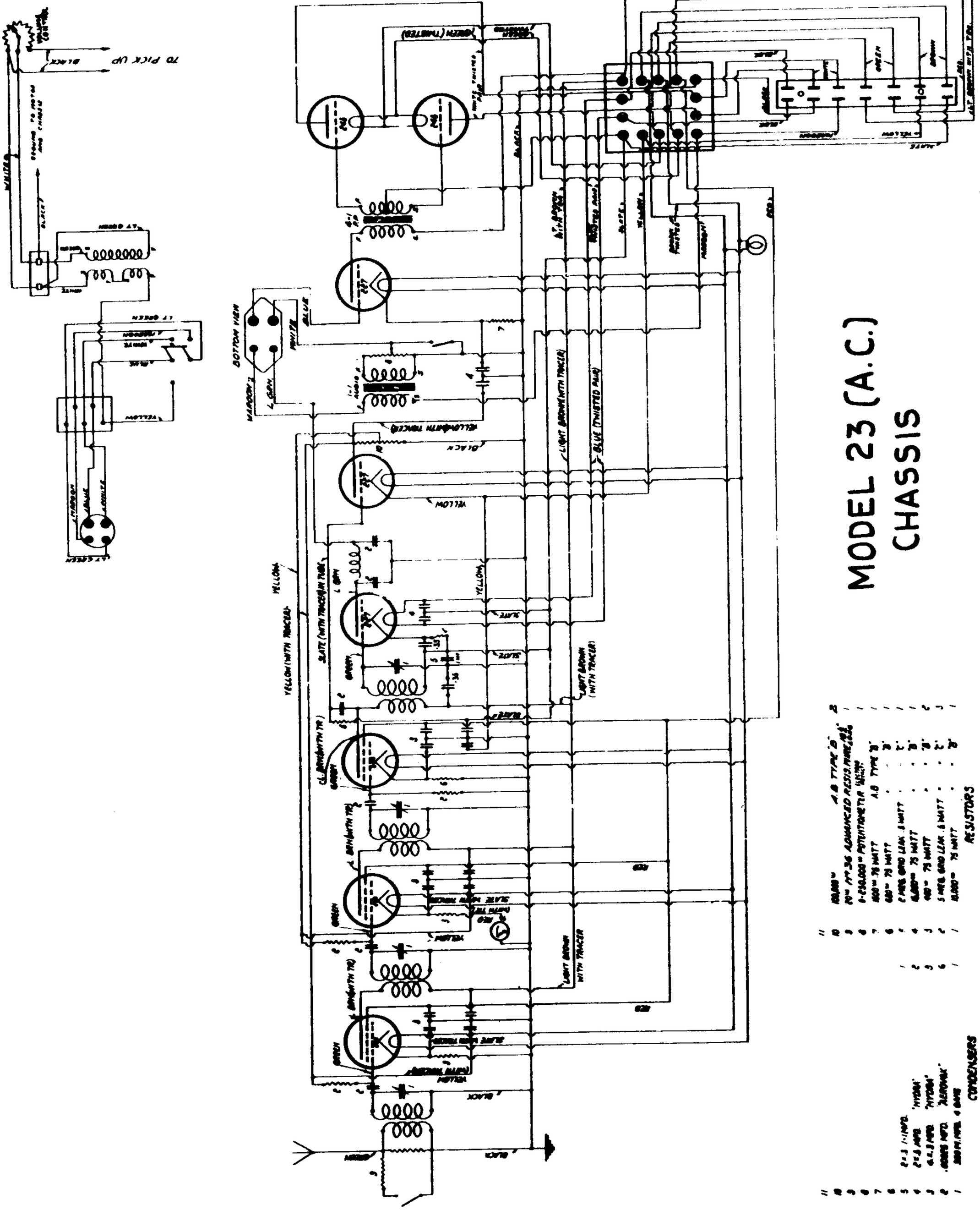


NOTE:- FOR WIRING ARRANGEMENT SEE DWG. NO. 26791
DIAGRAM SHOWS 16 POINT RECEPTACLE & L.S. RECEPTACLE
AS SEEN WHEN LOOKING UNDER POWER UNIT.

			RESISTANCES
		1	1050 OHMS
		2	4550 OHMS
		3	3500 OHMS
		4	1425 OHMS VOLTAGE DIVIDER
		5	285 OHMS
		6	760 OHMS
11		7	
10		8	10,000 OHMS RESISTOR. 75 WATT AB TYPE "A"
9			
			CONDENSERS
11	1 MFD. "HYDRA"		
10			
9			
8	6 MFD.		
7	3 MFD.		
6	2 MFD.		
5	2 MFD.		16 MFD. "HYDRA"
4	1 MFD.		
3	1 MFD.		
2	1 MFD.		
1			

CANADIAN MARCONI CO.

MODEL 23 (A.C.) CHASSIS



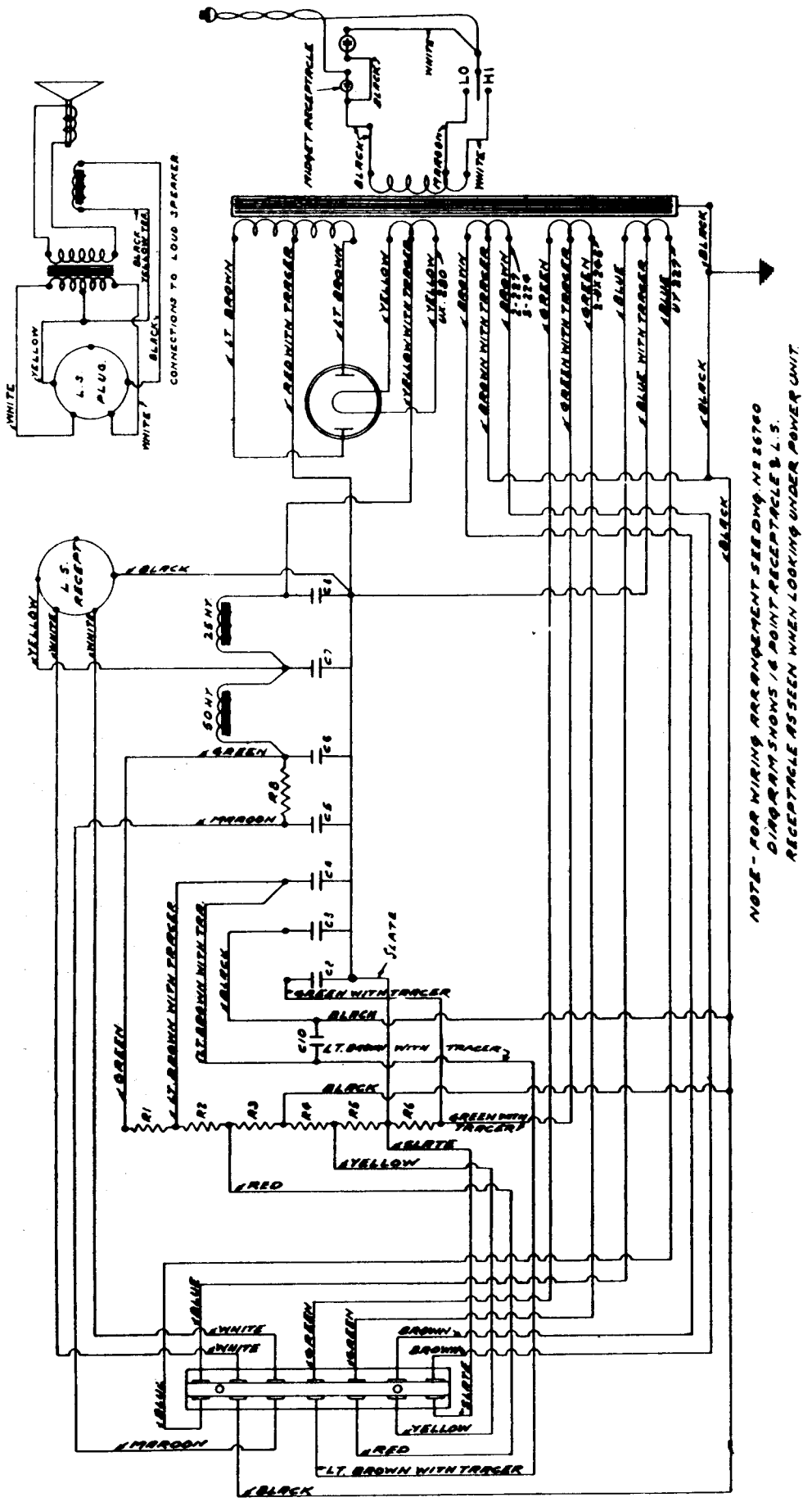
RESISTORS

2	10,000 ohms	1.0 Type "D"
1	20,000 ohms	AA-36 Advanced Resistance
1	1,250,000 ohms	Potentiometer
1	800 ohms	7½ Watt 1.0 Type "D"
1	60 ohms	7½ Watt " "
2	2,000 ohms	Grid Leak 5 Watt " "
2	5,000 ohms	7½ Watt " "
2	90 ohms	7½ Watt " "
1	5,000 ohms	Grid Leak 5 Watt " "
1	8,000 ohms	7½ Watt " "

CONDENSERS

5	.1 mfd.	"Hydak"
4	.2 mfd.	"Hydak"
3	.4, .5 mfd.	"Hydak"
2	.006 mfd.	"Mikanite"
1	.004 mfd.	"

CANADIAN MARCONI CO.

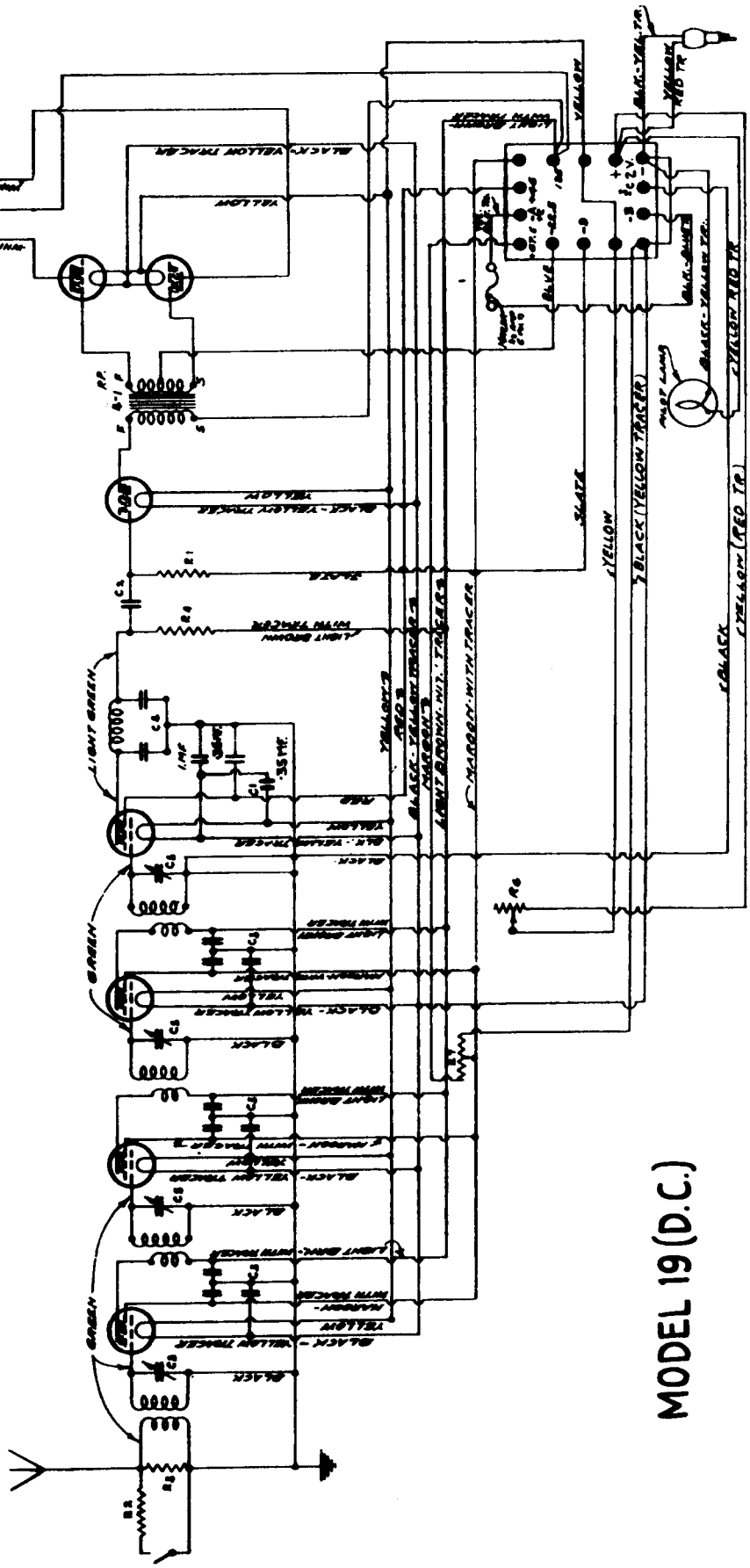


NOTE - FOR WIRING ARRANGEMENT SEE DWG. NO 26760
DIAGRAM SHOWS 16 POINT RECEPTACLE & L.S.
RECEPTACLE AS SEEN WHEN LOOKING UNDER POWER UNIT

MODEL 23 (A.C.)
POWER UNIT

11				
10	1 MFD. "N1DRA"	10		
9		9		
8	1 MFD	8	1000 OHMS RESISTOR 25 WATT A.B. TYPE	
7	2 MFD.	7		
6	2 MFD.	6	200 OHMS	
5	2 MFD.	5	285 OHMS	
4	1 MFD.	4	1438 OHMS	VOLTAGE DIVIDER
3	1 MFD.	3	3500 OHMS	
2	1 MFD.	2	4550 OHMS	
1		1	1150 OHMS	
	CONDENSERS		RESISTANCES	

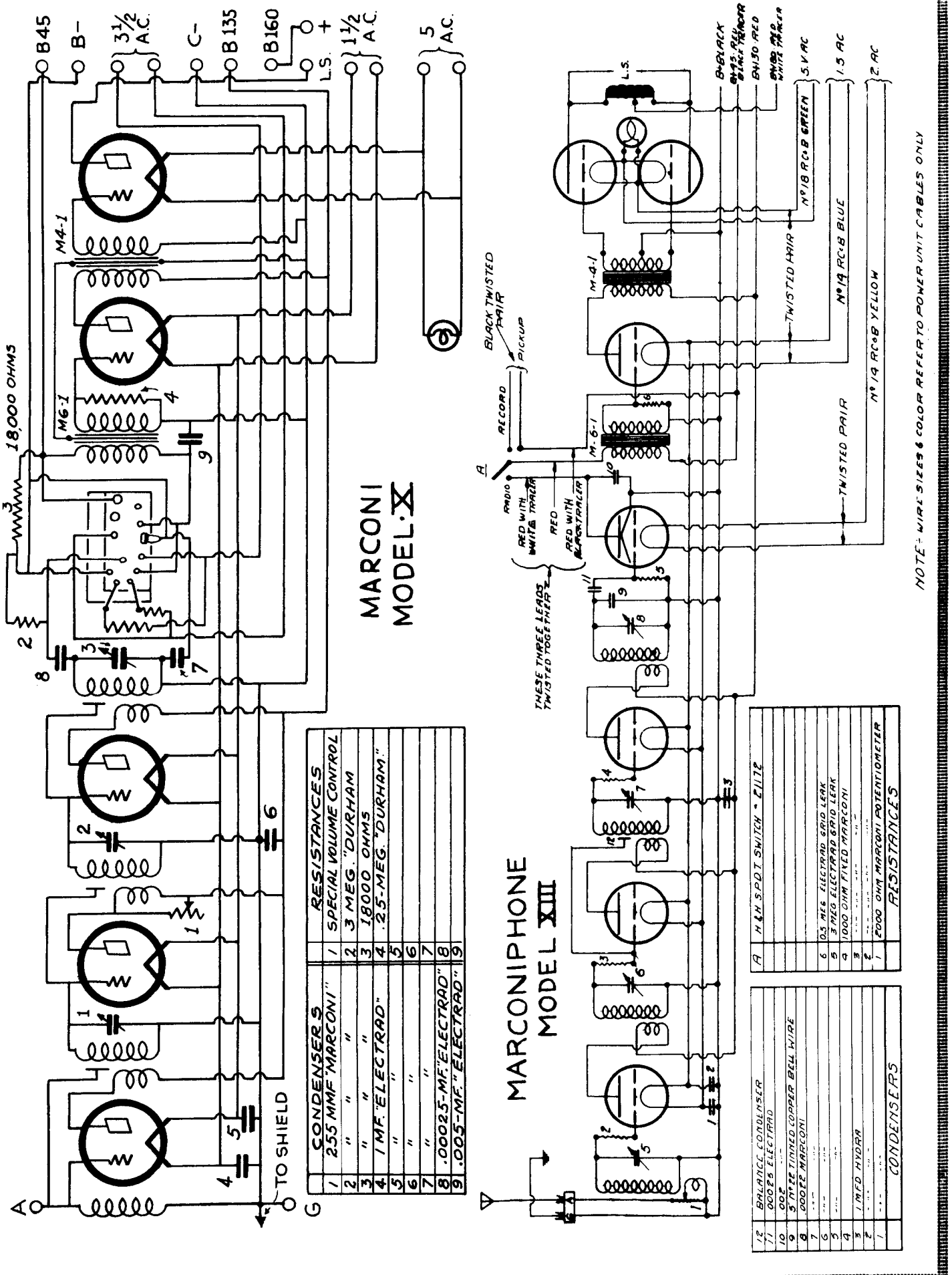
CANADIAN MARCONI CO.



MODEL 19 (D.C.)

7			7	50,000 ᵂ POTENTIOMETER ELECTRAD 3½ STRATONATROL	1
6			6	2 ᵂ RHEOSTAT EROST	1
5	380 M MFD 4 GANG CONDENSER SCOVILL	1	5		
4	.00025 CONDENSER AEROVOX	2	4	100,000 ᵂ RESISTOR ½ WATT A-B TYPE B	1
3	3x.3 MFD "HYDRA"	3	3	10,000 ᵂ RESISTOR A-B TYPE B	1
2	.02 MFD "AEROVOX"	1	2	5 ᵂ RESISTOR, Nº 30 Ga. ADVANCE ADJUST. WIRE 20½ LG	1
1	.35MF.-1MF. SPECIAL "HYDRA"	1	1	2 MEG. ½ WATT RESISTOR A-B TYPE C	1
	CONDENSERS			RESISTORS	

CANADIAN MARCONI CO., LTD.



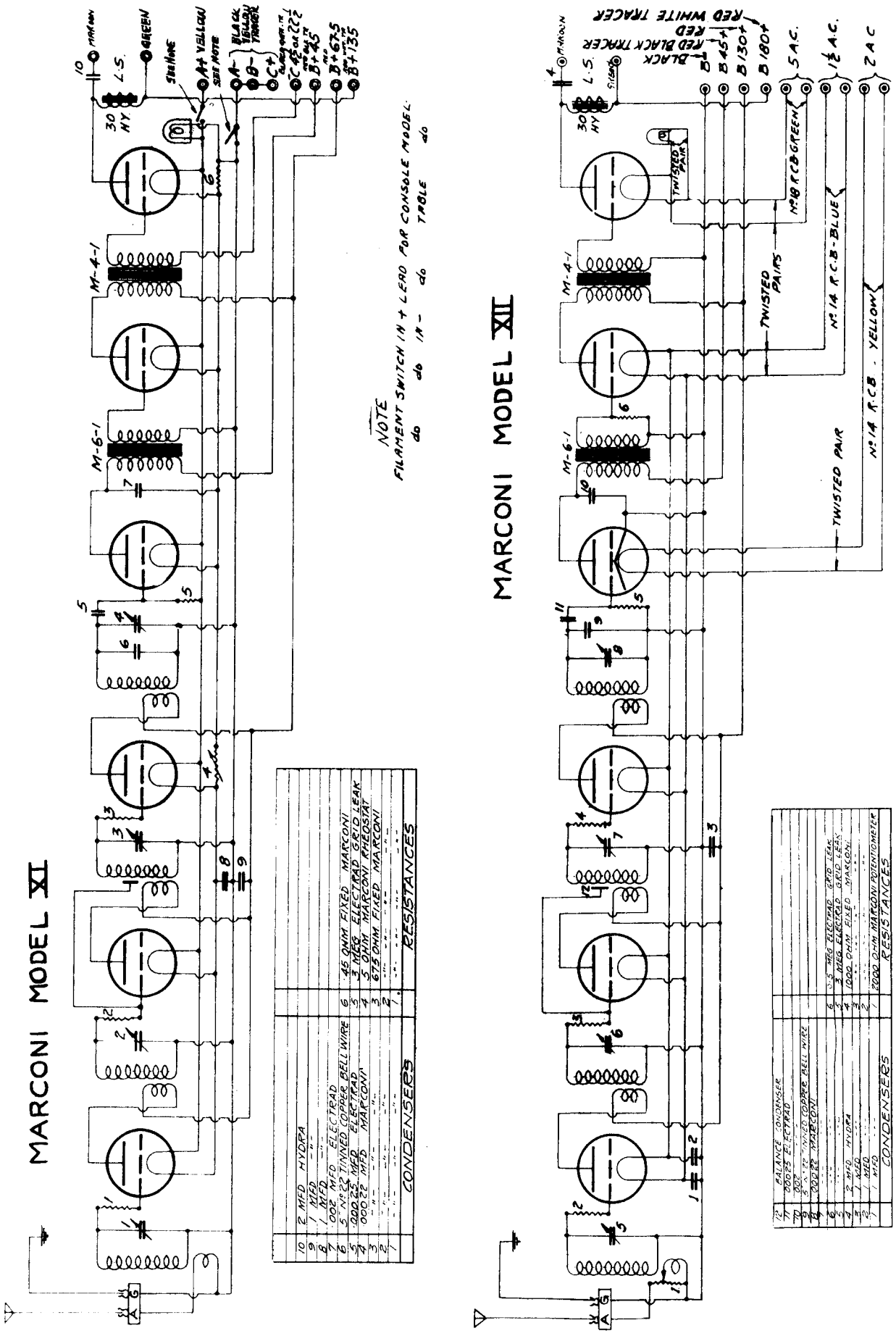
	CONDENSERS
1	255 MMF "MARCONI"
2	" " "
3	" " "
4	1 MF. "ELECTRAD"
5	" "
6	" "
7	" "
8	.00025-MF. "ELECTRAD"
9	.005-MF. "ELECTRAD"

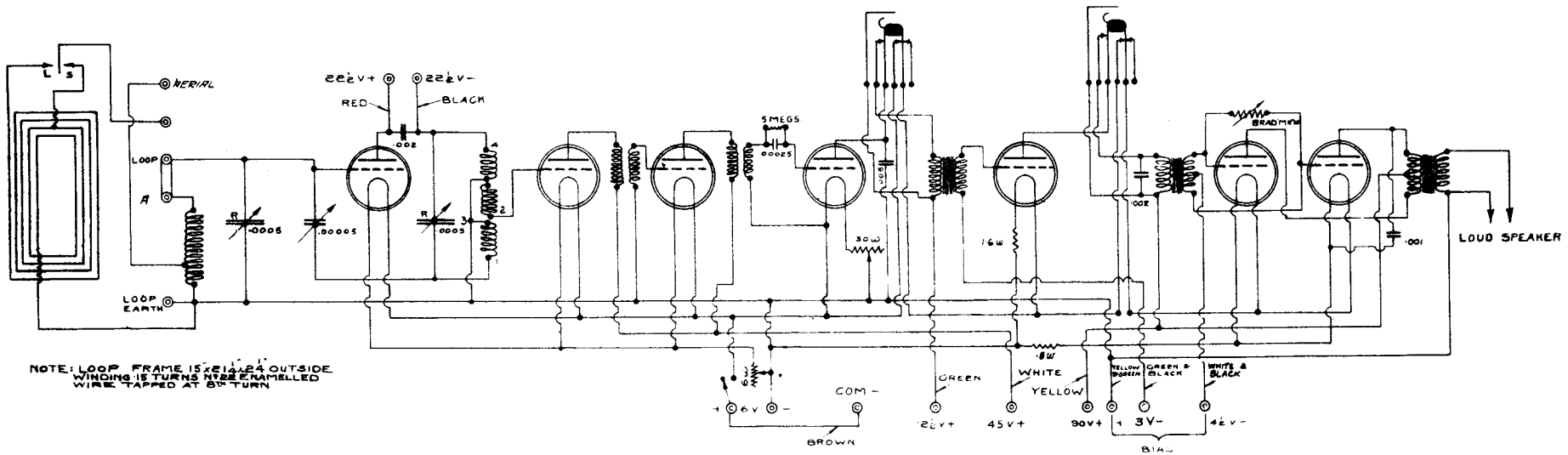
	RESISTANCES
1	SPECIAL VOLUME CONTROL
2	3 MEG. "DURHAM
3	18000 OHMS
4	.25-MEG. "DURHAM."
5	
6	
7	
8	
9	

	CONDENSERS
12	BALANCE CONDENSER
11	.0025 ELECTRAD
10	.002 " "
9	5 FEET TINNED COPPER BELL WIRE
8	.0002 MARCONI
7	" "
6	" "
5	" "
4	" "
3	1 MFD HYDRA
2	" "
1	" "

	RESISTANCES
A	H & H SPOT SWITCH - 2 1/2
6	0.5 MEG ELECTRAD GRID LEAK
5	3 MEG ELECTRAD GRID LEAK
4	1000 OHM FIXED MARCONI
3	" " " "
2	" " " "
1	2000 OHM MARCONI POTENTIOMETER

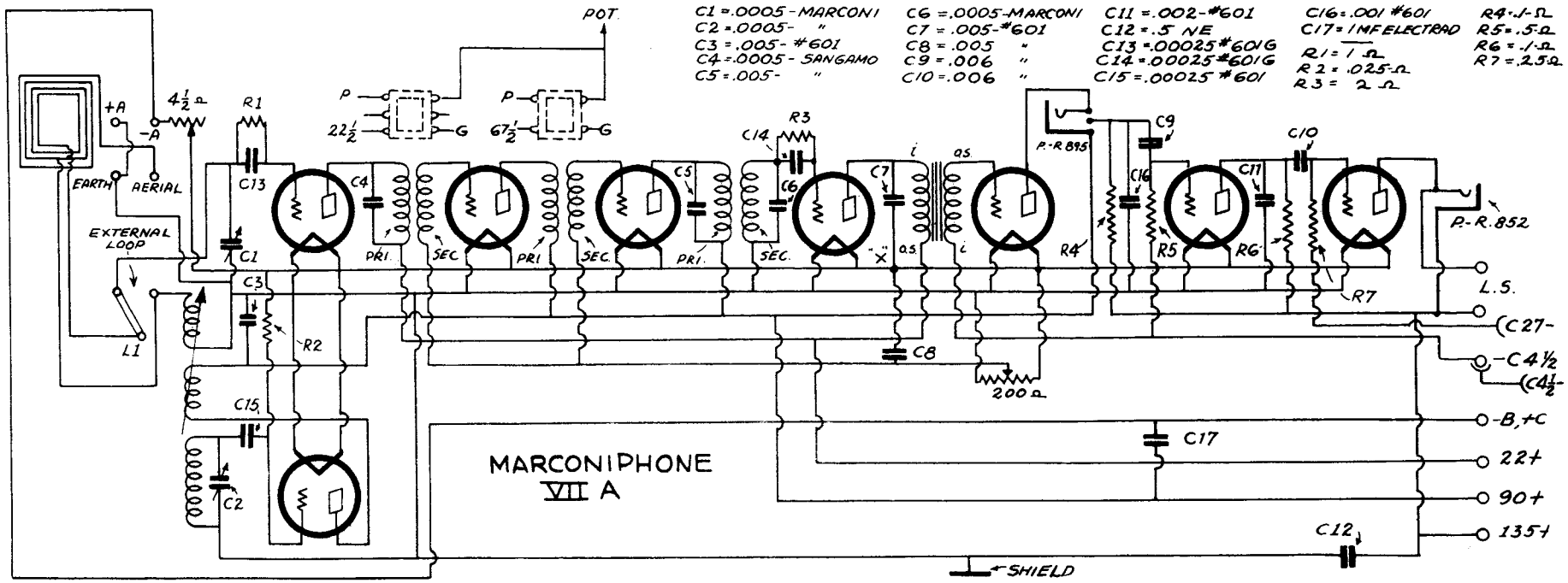
CANADIAN MARCONI CO., LTD.





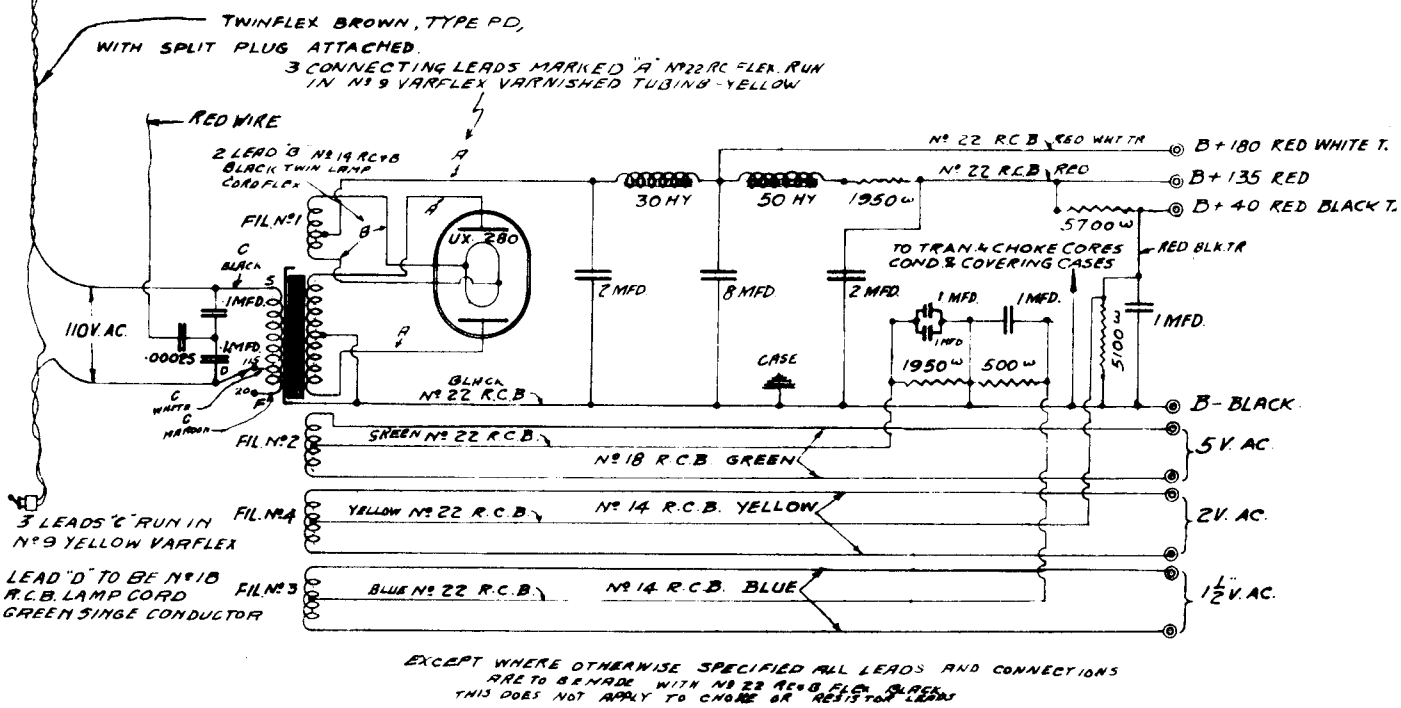
MARCONIPHONE V

C1 = .0005 - MARCONI
C2 = .0005 - "
C3 = .005 - #601
C4 = .0005 - SANGAMO
C5 = .005 - "
C6 = .0005 - MARCONI
C7 = .005 - #601
C8 = .005 "
C9 = .006 "
C10 = .006 "
C11 = .002 - #601
C12 = .5 NE
C13 = .00025 #601G
C14 = .00025 #601G
C15 = .00025 #601
C16 = .001 #601
C17 = 1 MF ELECTRAD
R1 = 1 Ω
R2 = .025 Ω
R3 = 2 Ω
R4 = .1 Ω
R5 = .5 Ω
R6 = .1 Ω
R7 = 2.5 Ω



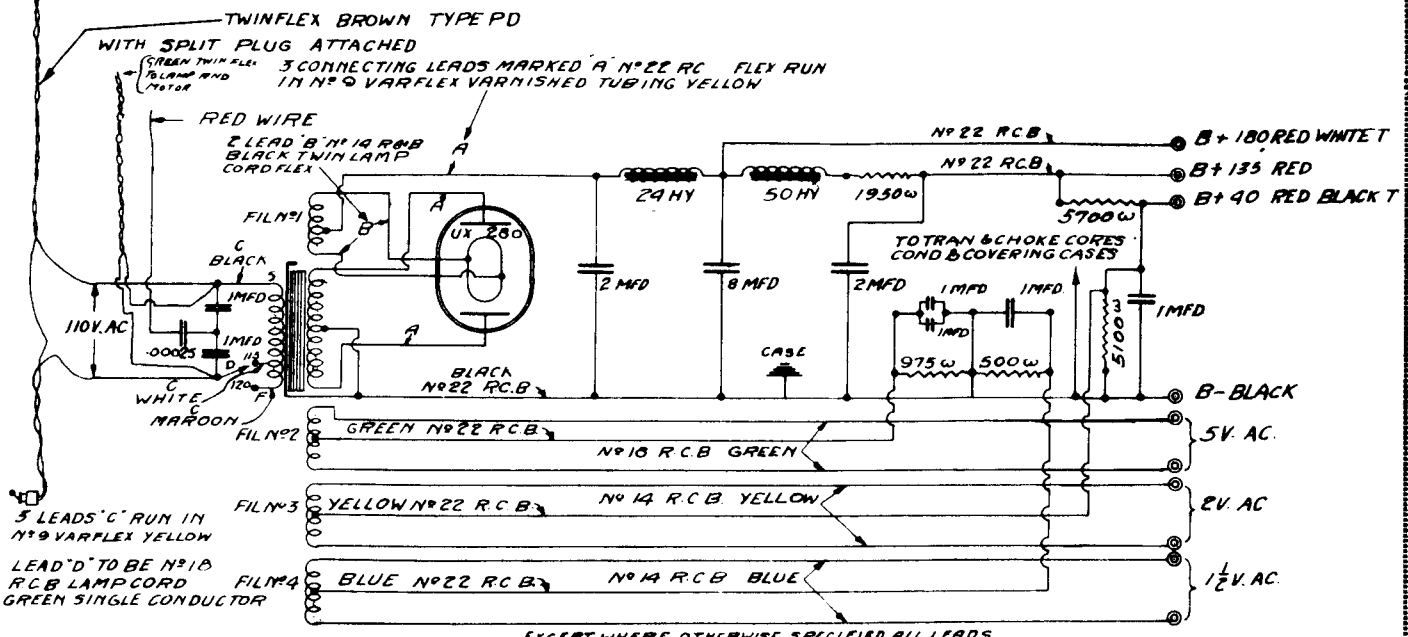
CANADIAN MARCONI CO., LTD.

MARCONI MODEL XII POWER UNIT



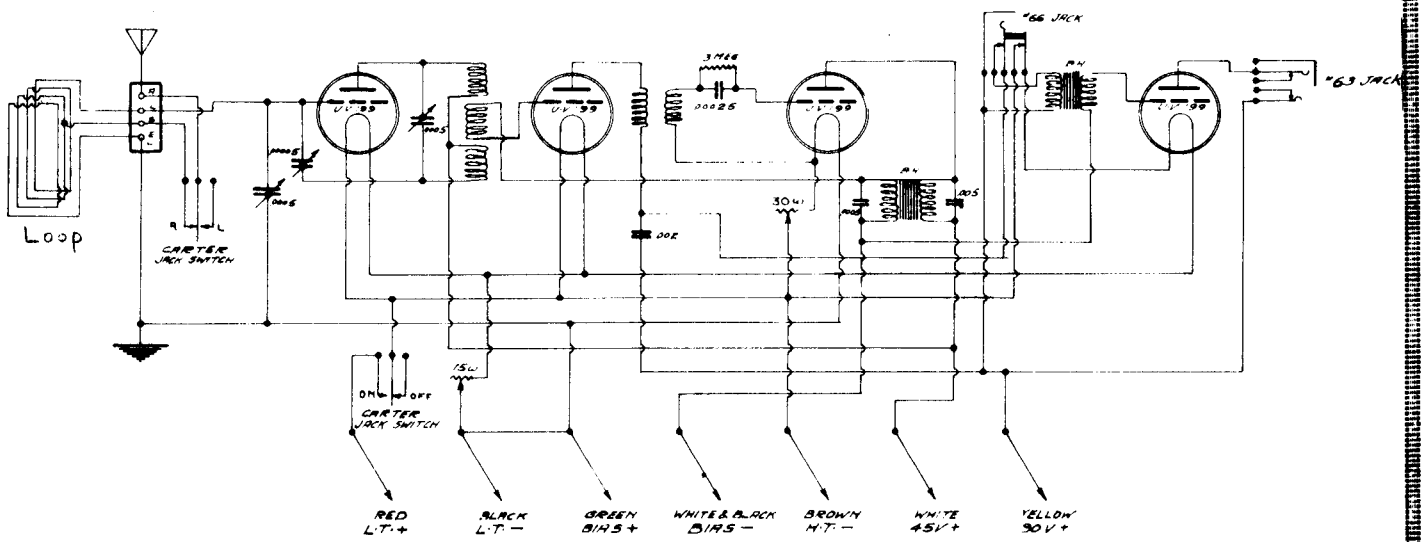
EXCEPT WHERE OTHERWISE SPECIFIED ALL LEADS AND CONNECTIONS ARE TO BE MADE WITH Nº 22 R.C.B FLEX. BLACK. THIS DOES NOT APPLY TO CHOKE OR RESISTOR LEADS

MARCONI MODEL XIII POWER UNIT



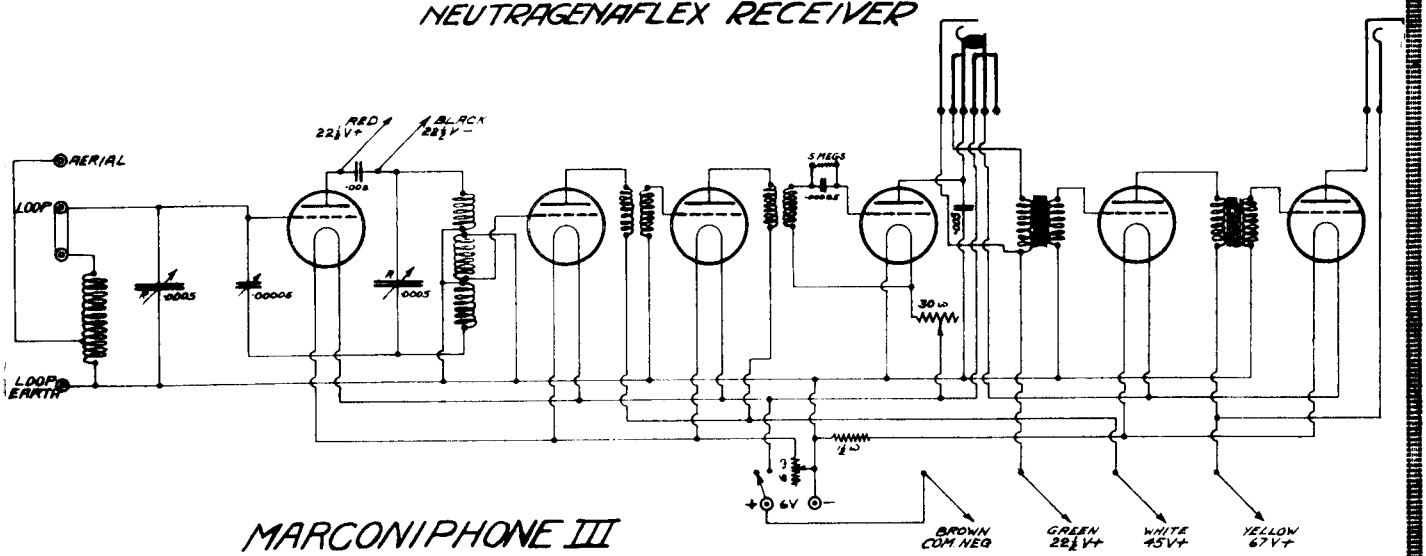
EXCEPT WHERE OTHERWISE SPECIFIED ALL LEADS AND CONNECTIONS ARE TO BE MADE WITH Nº 22 R.C.B FLEX BLACK. THIS DOES NOT APPLY TO CHOKE OR RESISTOR LEADS

CANADIAN MARCONI CO., LTD.



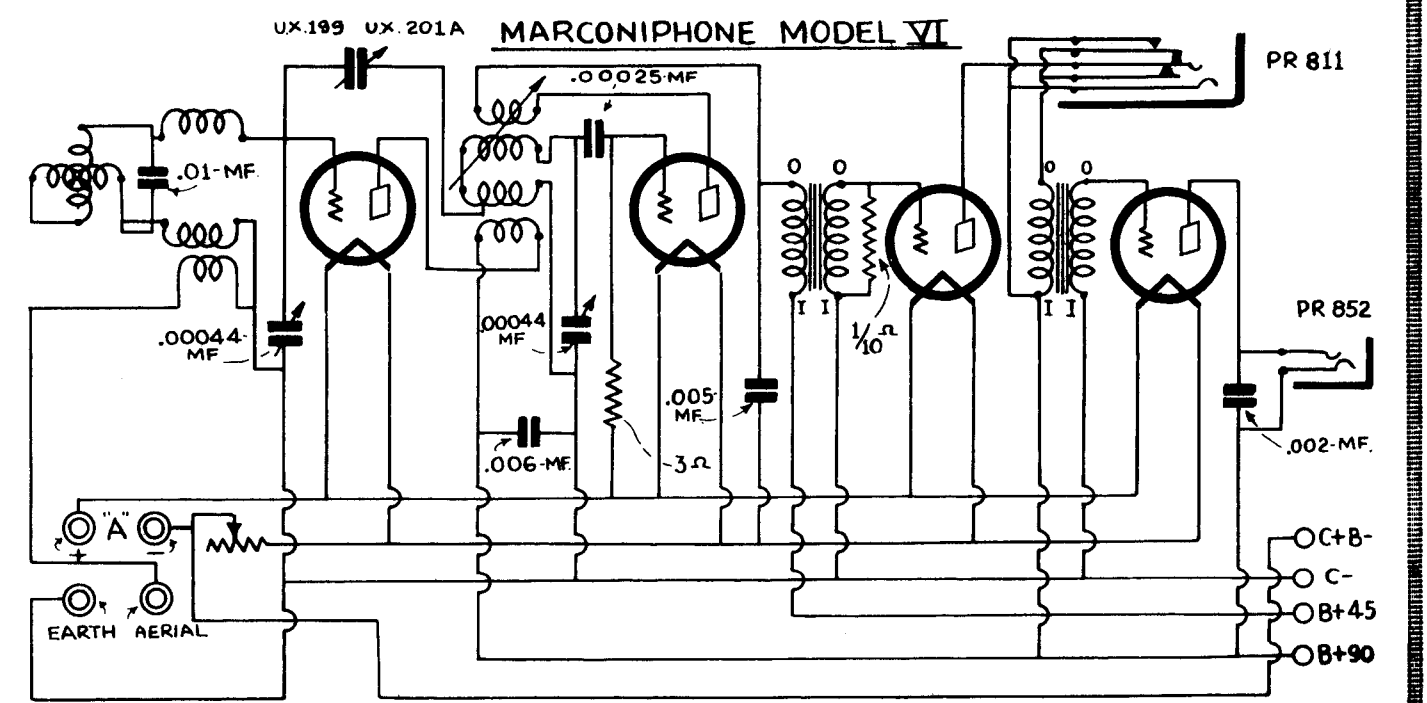
MODEL IV

NEUTRAGENAFLEX RECEIVER



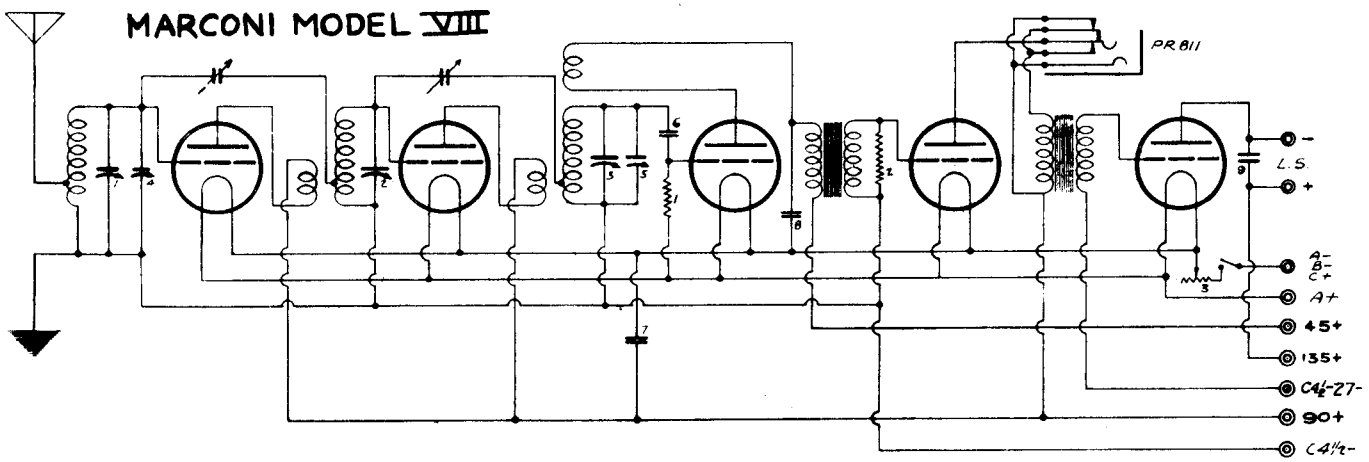
MARCONIPHONE III

MARCONIPHONE MODEL VI

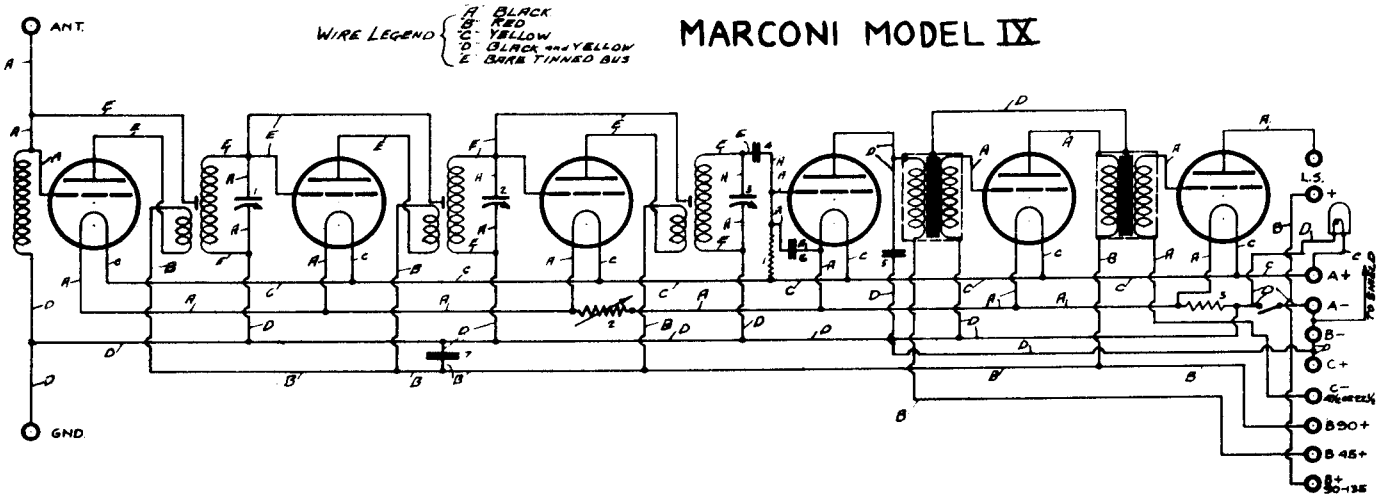


CANADIAN MARCONI CO., LTD.

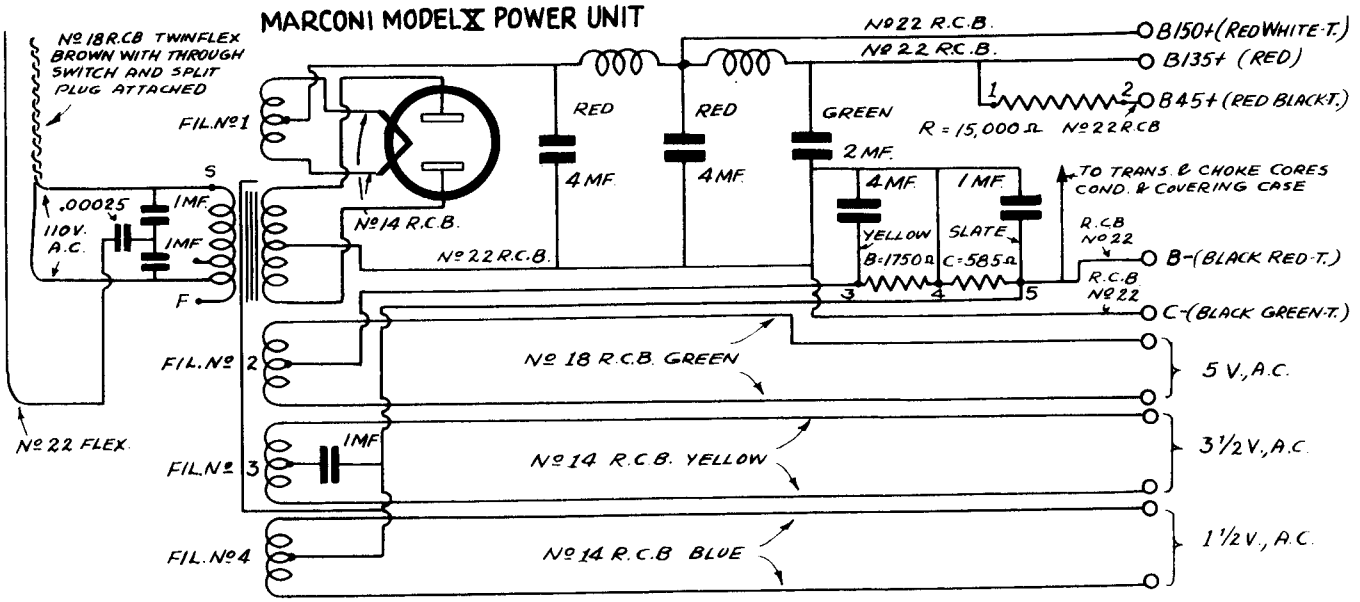
MARCONI MODEL VIII



MARCONI MODEL IX



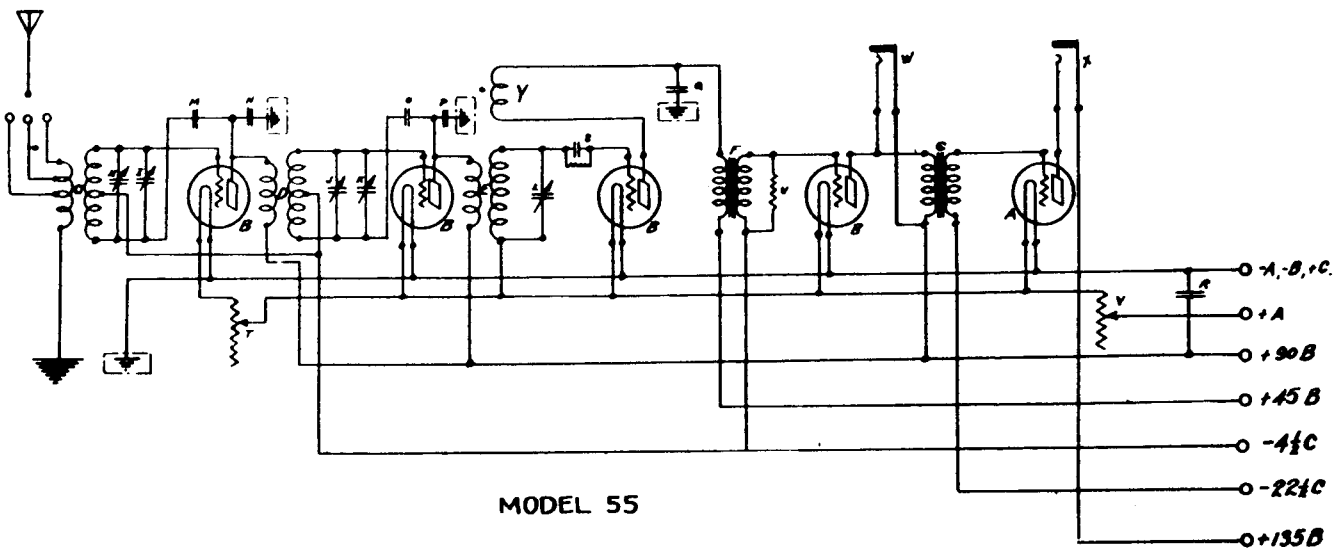
MARCONI MODEL X POWER UNIT



	CONDENSERS		RESISTANCES
1	440 MMF. MARCONI	1	3 MEG. "DURHAM"
2	220 MMF. "	2	5 MEG. "
3	220 MMF. "	3	2 OHMS "MARCONI"
4	30 MMF. "	4	
5	30 MMF. "	5	MODEL VIII
6	.00025 MFD. "SPLITDORF"		
7	.1 MFD. " "		
8	.005 MFD. "SPLITDORF"		
9	.002 MFD. " "		
10			

	CONDENSERS		RESISTANCES
1	255 MMF. "MARCONI"	1	3 MEG "DURHAM"
2	" " "	2	5 OHMS "MARCONI"
3	" " "	3	.45 " "
4	.00025 MFD. "ELECTRAD"	4	
5	.005 " " "	5	
6	COMPENSATING "MARCONI"		MODEL IX
7	.1 MFD. "TOBE"		
8			
9			

CANADIAN WESTINGHOUSE CO. LTD.



MODEL 55

PARTS

A Radiotrons UX120.
B Radiotrons UX199.
C Antenna Coil Assembly.
D First Stage R.F. Transformer Assembly.
E Second Stage R.F. Transformer Assembly.
F First Stage Audio Transformer.
G Second Stage Audio Transformer.
H J and L Gang Condensers.
I First Stage Vernier Condenser.
K Second Stage Vernier Condenser.
M First R.F. Stage Neutralizing Condenser.
N First R.F. Stage Compensating Condenser.
O Second R.F. Stage Neutralizing Condenser.
P Second R.F. Stage Compensating Condenser.
Q Phone Condenser.
R By Pass Condenser.
S Grid Leak and Condenser.
T Volume Control.
U Audio Resistor.
V Battery Setting Control.
W Phone Jack.
X Loud Speaker Jack.
Y Tickler Coil.

−A−B+C Green, Yellow and Red.
+A Yellow.
+90B Maroon and Red.
+45B (or +22½B) Maroon.
−4½C Black and Green Bands.
−22½C Black with Green Tracer.
+135B Red.

WIRING DIAGRAMS OF W55A, W57, W60, W58

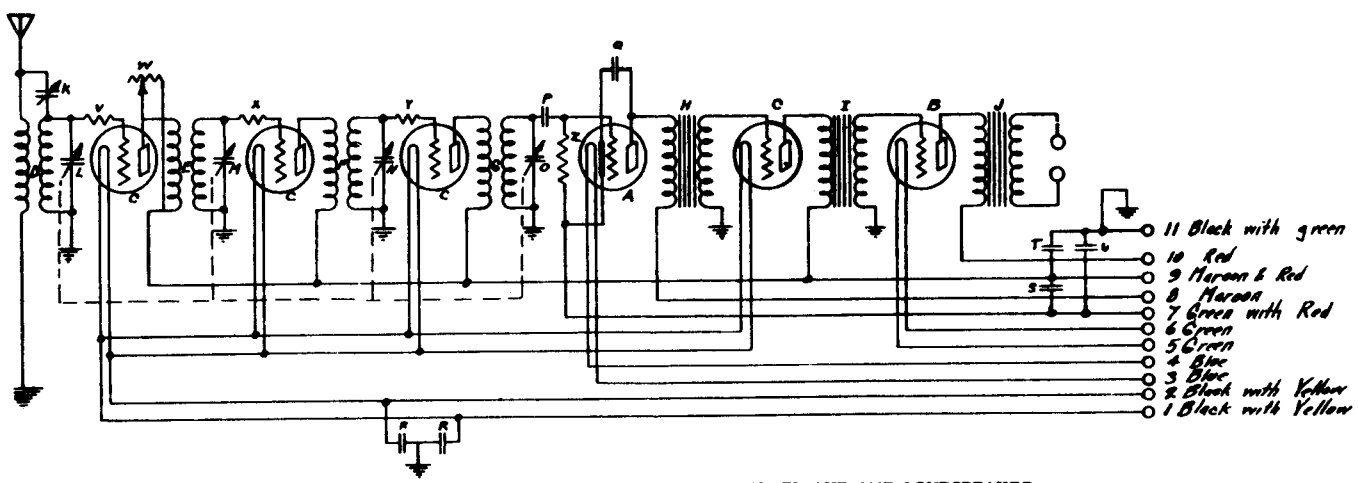
Wiring Diagrams of W55A and W60 are similar to that of W55 with necessary modifications for use with UX201A and UX201B Radiotrons respectively.

Wiring Diagram of W57 is similar to that of W55 with necessary modifications for use with 201A or 201B tubes, for use of a fixed tickler coil controlled by a shunt resistance and with phone and loud speaker jacks omitted.

Wiring Diagram of W58 Chassis is similar to W55 diagram with necessary modifications for use with A.C. Radiotrons.

Wiring Diagram of W58 Power Unit is identical with that of Socket Power Unit No. 18 as used with Westinghouse Six Tube Batteryless Sets.

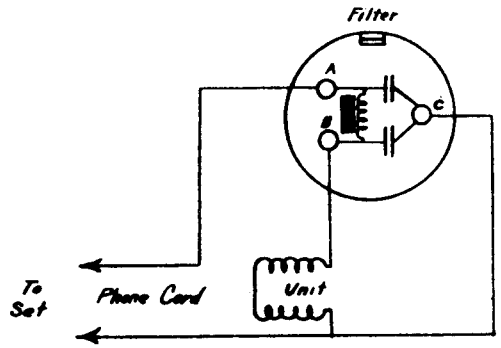
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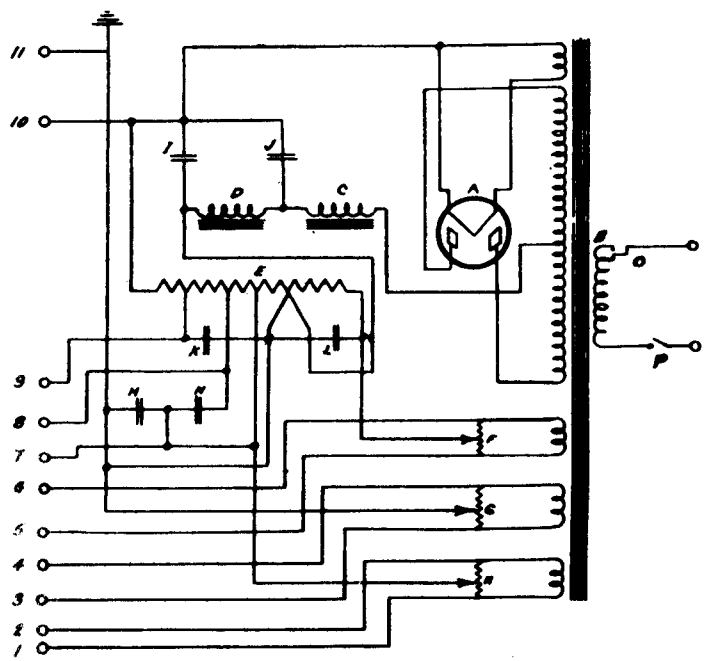


WESTINGHOUSE SIX TUBE A. C. CHASSIS 1928 MODEL AND 200B LOUDSPEAKER

PARTS

A—Radiotron UY227.
B—Radiotron UX171A
C—Radiotron UX226.
D—Antenna Coil Assembly.
E, F, and G—First, Second and Third R.F. Transformer Assembly.
H and I—Audio Transformer Assembly.
J—Output Transformer.
K—Selectivity Control.
L, M, N, and O—Four Gang Condenser.
P—Grid Condenser.
Q—Phone Condenser.
R—By Pass Condenser (tapped).
S and T—By Pass Condenser (tapped).
U—By Pass Condenser.
V—First R.F. Stage Grid Resistor.
W—Volume Control.
X—Second R.F. Stage Grid Resistor.
Y—Third R.F. Stage Grid Resistor.
Z—Grid Leak.





SOCKET POWER UNIT No. 18 WIRING DIAGRAM

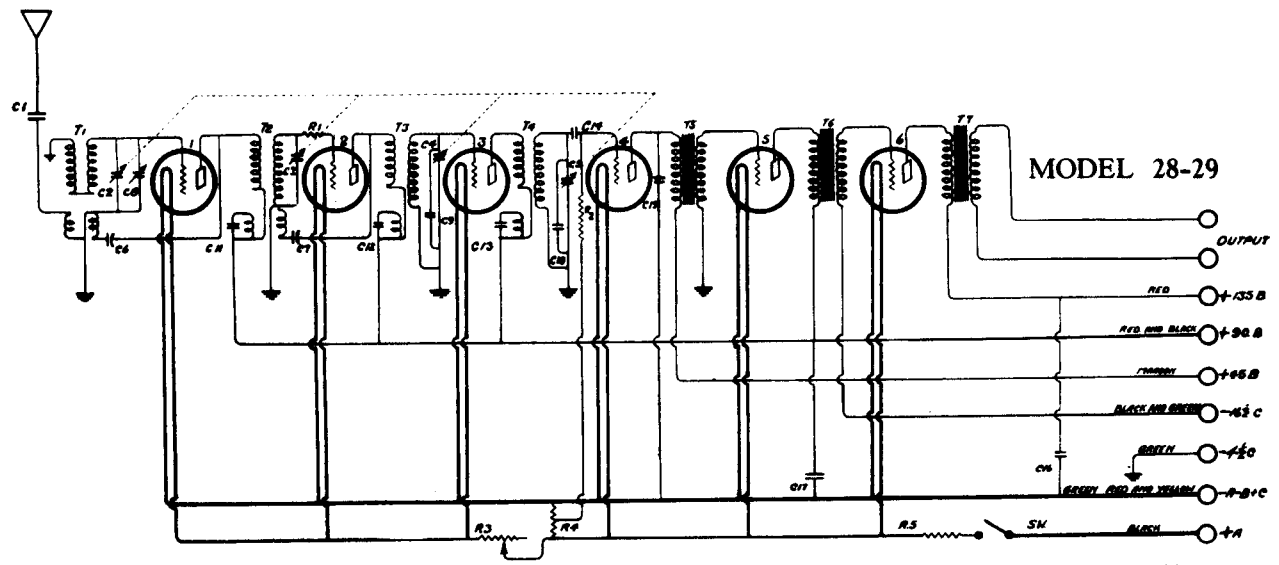
PARTS

A—Rectron UX280.
B—Line Transformer.
C and D—Filter Choke Assembly.
E—Voltage Dividing Resistor.
F—Potentiometer.
G—Potentiometer.
H—Potentiometer.
I, J, K, L, M, and N—Filter Condenser Assembly.
O—Line Voltage Compensating Switch.
P—Line Switch.

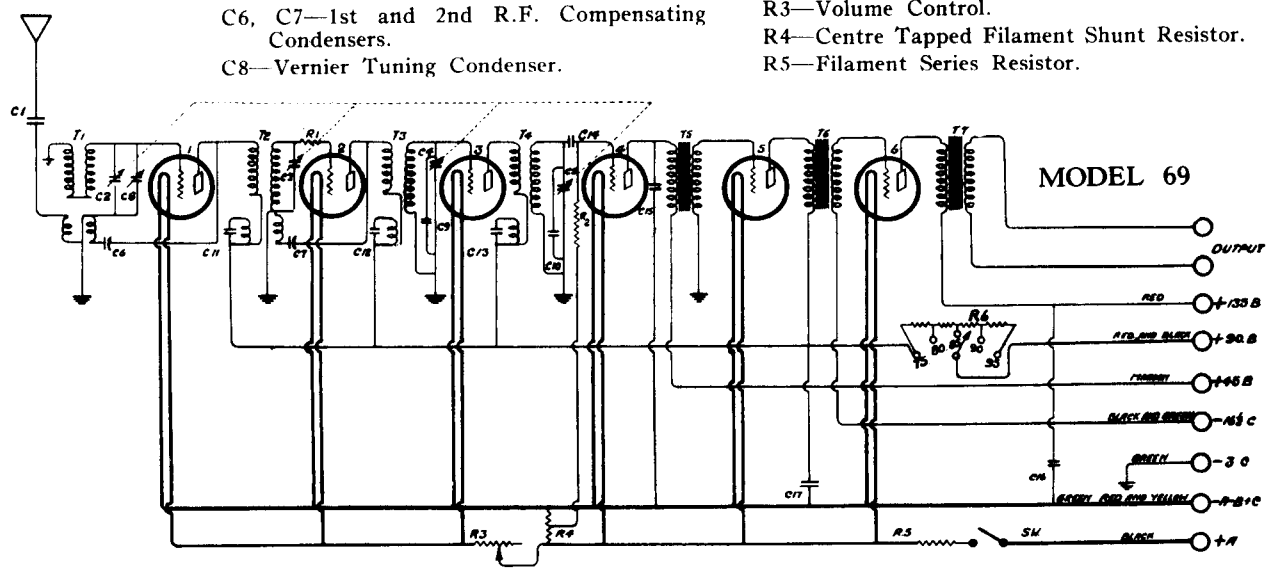
TERMINALS

1 and 2	—Black and Yellow	1.5 Volts A.C.
3 and 4	—Blue.	2.5 Volts A.C.
5 and 6	—Green.	5.0 Volts A.C.
7	—Green and Red.	—B
8	—Maroon	+45 Volts Detector.
9	—Maroon and Red	+135 Volt Amplifier.
10	—Red.	+B Power Amplifier.
11	—Black and Green	- 9C and Ground.

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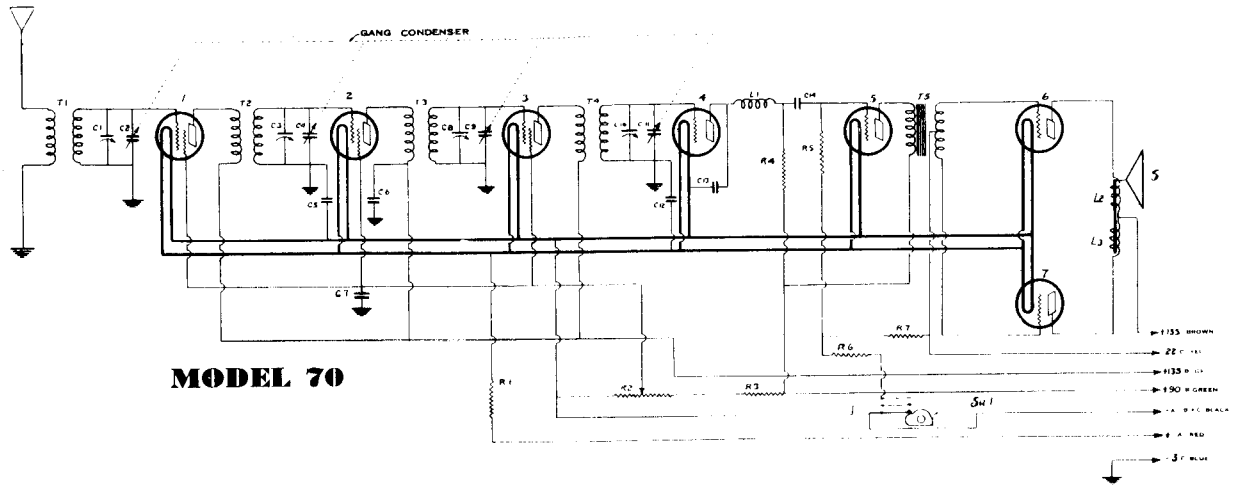


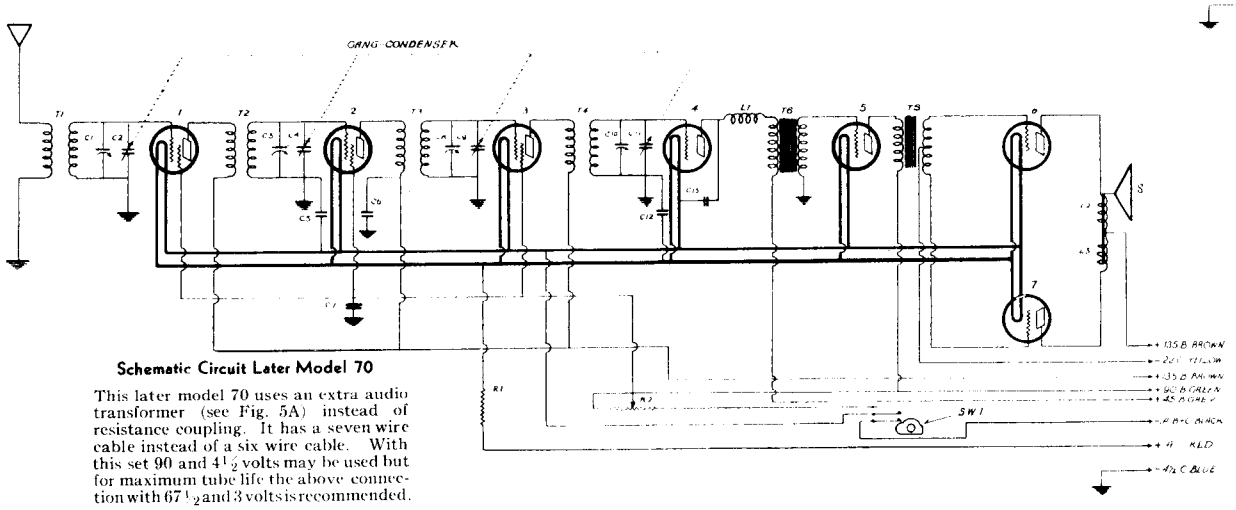
S.W.—Operating Switch.
T1—Antenna R.F. Transformer.
T2—1st R.F. Stage Transformer.
T3—2nd R.F. Stage Transformer.
T4—3rd R.F. Stage Transformer.
T5—1st Audio Transformer.
T6—2nd Audio Transformer.
T7—Output Transformer.
C1—Antenna Series Condenser (Marked III; m.m.f.).
C2, C3, C4, and C5—Four Gang Condenser.
C6, C7—1st and 2nd R.F. Compensating Condensers.
C8—Vernier Tuning Condenser.
C9, C10—Gang Condenser Trimming Capacities.
C11—Fixed Condenser (Marked III; 160m.m.f.
C12—Fixed Condenser (Marked IIII; 320 m.m.f.).
C13—Fixed Condenser (Marked IIIII; 880 m.m.f.).
C14—Grid Condenser (Marked III; 160m.m.f.).
C15—Phone Condenser (Marked IIIIII; 1200 m.m.f.).
C16, C17—By-Pass Condensers (.5 m.f.d.).
R1—Grid Resistor (800 ohms.).
R2—Grid Leak (Red.; 4 meg.).
R3—Volume Control.
R4—Centre Tapped Filament Shunt Resistor.
R5—Filament Series Resistor.



S.W —Operating Switch.
T1—Antenna R.F. Transformer.
T2—1st R.F. Stage Transformer.
T3—2nd R.F. Stage Transformer.
T4—3rd R.F. Stage Transformer.
T5—1st Audio Transformer.
T6—2nd Audio Transformer.
T7—Output Transformer.
C1—Antenna Series Condenser (Marked III; 160 m.m.f.).
C2, C3, C4 and C5—Four Gang Condenser.
C6, C7—1st and 2nd R.F. Compensating Condensers.
C8—Vernier Tuning Condenser.
C9, C19—Gang Condenser Trimming Capacities.
C11—Fixed Condenser (Marked III; 160m.m.f.
C12—Fixed Condenser (Marked IIII; 320 m.m.f.).
C13—Fixed Condenser (Marked IIIII; 480 m.m.f.).
C14—Grid Condenser (Marked III; 160m.m.f.)
C15—Phone Condenser (Marked IIIIII; 1200 m.m.f.).
C16, C17—By-Pass Condensers (.5 m.f.d.).
R1—Grid Resistor (800 ohms.).
R2—Grid Leak (Red.; 4 meg.).
R3—Volume Control.
R4—Centre Tapped Filament Shunt Resistor.
R5—Filament Series Resistor.
R6—Battery Voltage Compensating Resistor.

CANADIAN WESTINGHOUSE CO. LTD.





Schematic Circuit Later Model 70

This later model 70 uses an extra audio transformer (see Fig. 5A) instead of resistance coupling. It has a seven wire cable instead of a six wire cable. With this set 90 and 4½ volts may be used but for maximum tube life the above connection with 67½ and 3 volts is recommended.

RESISTORS, COLOUR AND VALUE (OHMS)

R1 Filament Series Resistor—Wire Wound—.56
R2 Volume Control—500,000.
R3 Screen Grid Series Resistor—50,000 Green.
R4 Audio Coupling Resistor—2 Meg. Yellow.
R5 Audio Grid Leak—2 Meg. Yellow.
R6 "C" Voltage Divider Resistor—500,000 Blue.
R7 "C" Voltage Divider Resistor—2 Meg. Yellow.

TRANSFORMERS

T1 Antenna R.F. Transformer.
T2 1st Stage R.F. Transformer.
T3 2nd Stage R.F. Transformer.
T4 Detector R.F. Transformer.
T5 Input Transformer.
T6 Audio Transformer.

REACTOR COILS

L1 R.F. Choke—(40 ohms.)
L2 & L3 Louspeaker Coils—(425 ohms each).

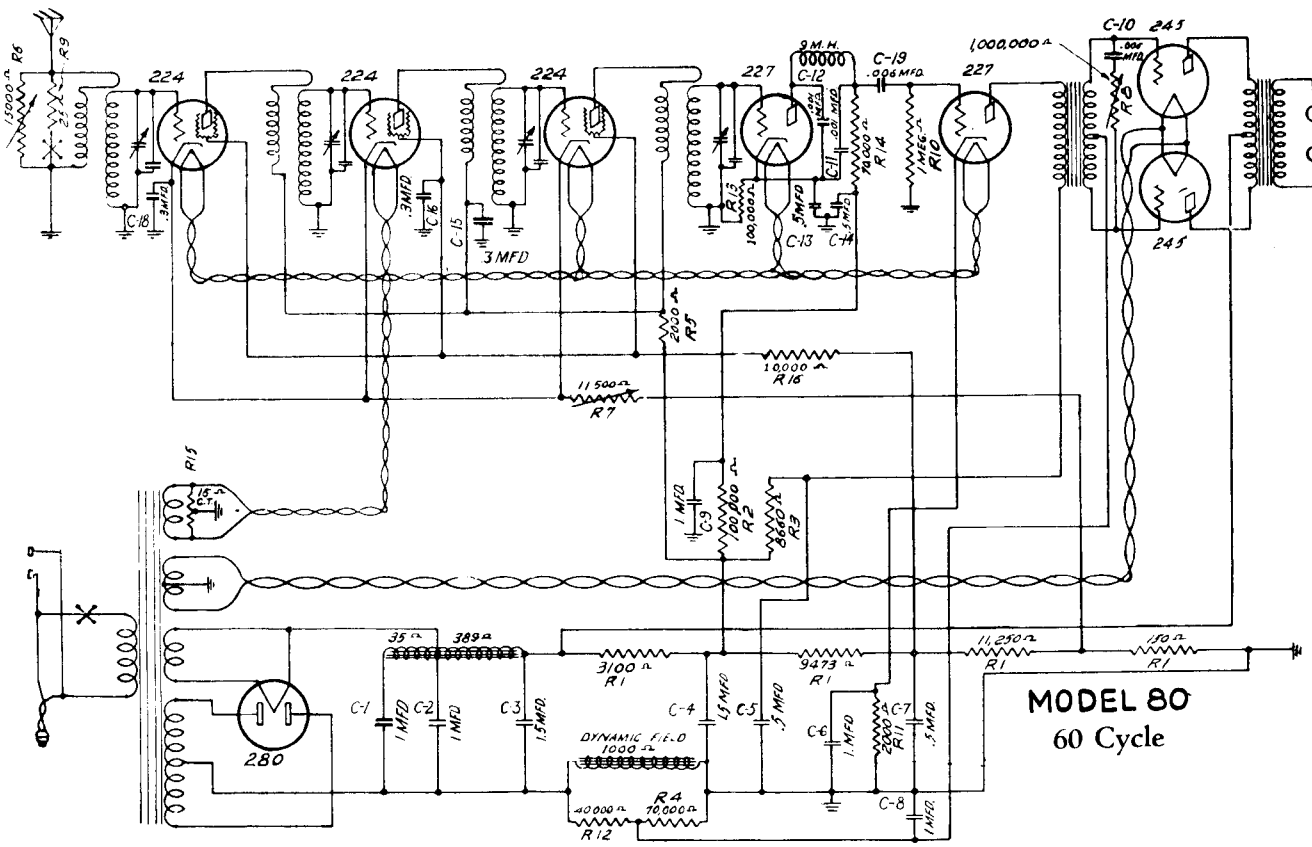
CONDENSER

C1 1st Gang Condenser Trimmer.
C2 1st Gang Condenser Section.
C3 2nd Gang Condenser Trimmer.
C4 2nd Gang Condenser Section.
C5 R.F. By-pass .5MFD. (Type 1268).
C6 R.F. By-pass .5MFD. (Type 1268)
C7 R.F. By-pass .5MFD. (Type 1268)
C8 3rd Gang Condenser Trimmer.
C9 3rd Gang Condenser Section.
C10 4th Gang Condenser Trimmer.
C11 4th Gang Condenser Section.
C12 R.F. By-pass Condenser .5MFD. (Type 1268)
C13 R.F. By-pass Condenser .0005.
C14 Audio Coupling Condenser .01 MFD.

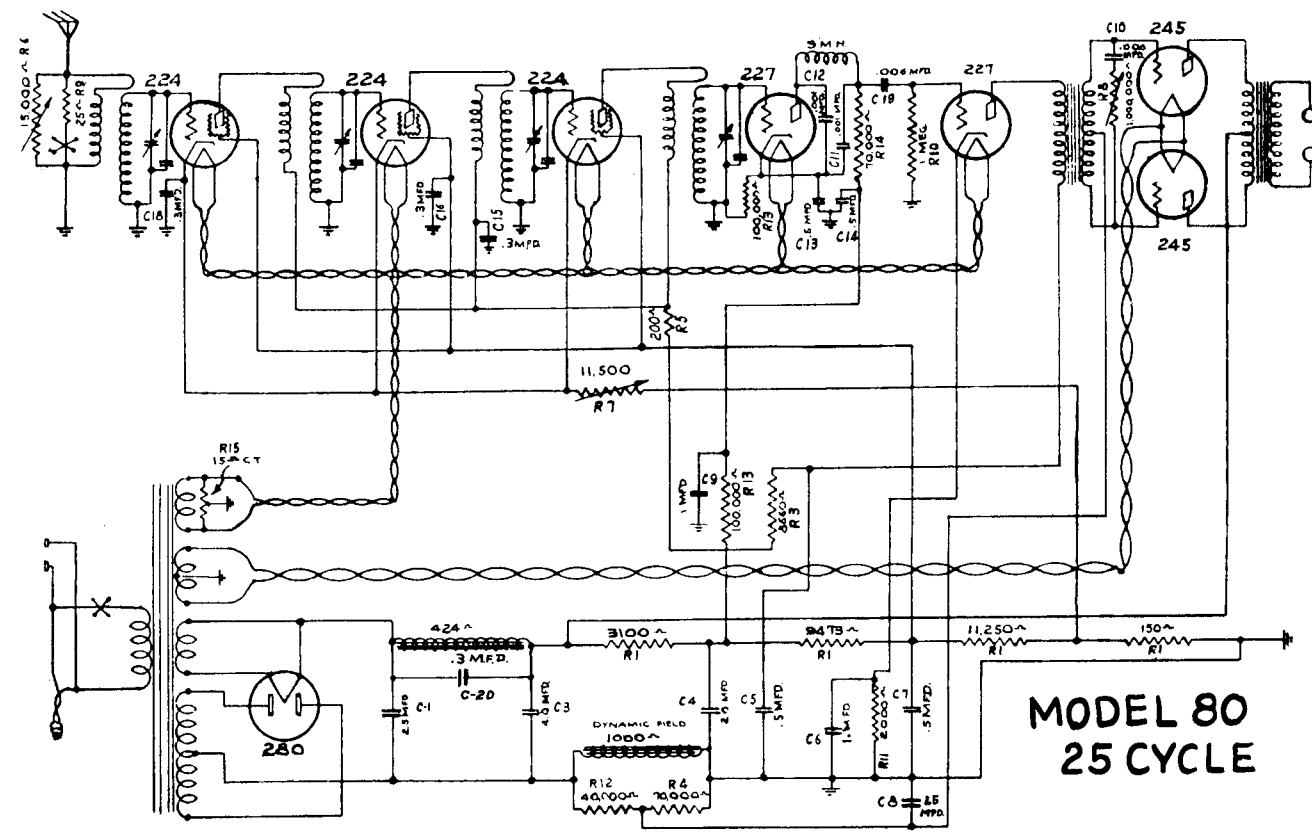
The following voltages are correct for 90 volts on the green cable lead and 4½ on the blue lead.

Socket No.	Filament Volts	Filament to Control Grid Volts	Filament to Screen Grid Volts		Filament to Plate Volts	Plate Current Milliamps.	
1. Ant. Stage	2.1	4.5	60*	0	145	1	0
2. 2nd R. F.	2.1	4.5	60*	0	145	1	0
3. 3rd R. F.	2.1	4.5	60*	0	145	1	0
4. Det.	2.1	4.5			10*	0	0
5. 1st Audio	2.1	0*			90	3	3
6. Push Pull	2.1	22			145	7.4	7.4
7. Push Pull	2.1	22			145	7.4	7.4
Socket Reading Later Model 70 (See Note under Figure 6A)							
1. Ant. Stage	2.1	4.5	90	0	145	1	0
2. 2nd R. F.	2.1	4.5	90	0	145	1	0
3. 3rd R. F.	2.1	4.5	90	0	145	1	0
4. Det.	2.1	4.5			46	0.6	0.6
5. 1st Audio	2.1	2.8*			96	1.8	1.8
6. Push Pull	2.1	22			145	7.4	7.4
7. Push Pull	2.1	22			145	7.4	7.4

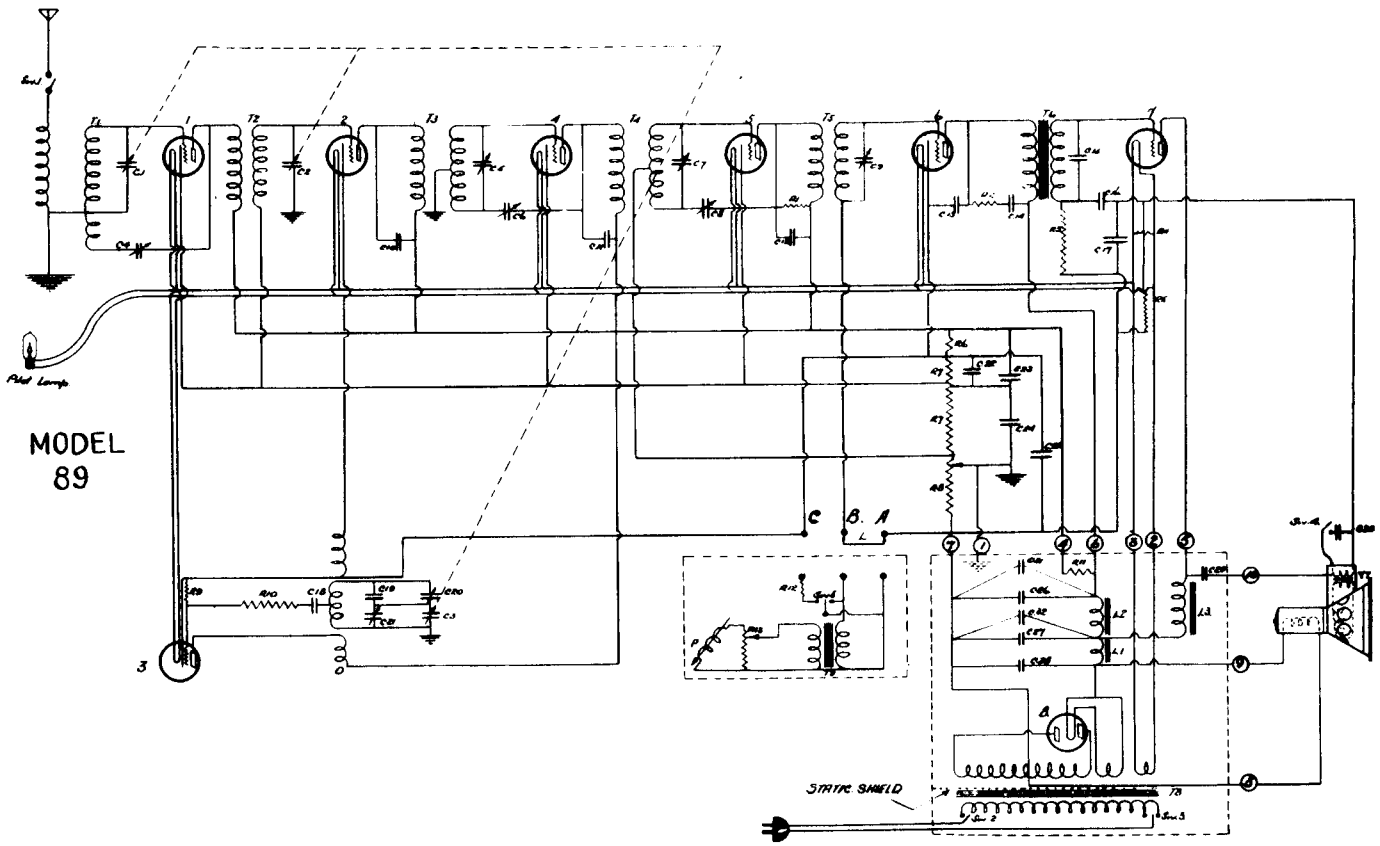
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Note: The 25 ohm resistor R9 and local distance switch are not used in the present Model 80 Receiver.



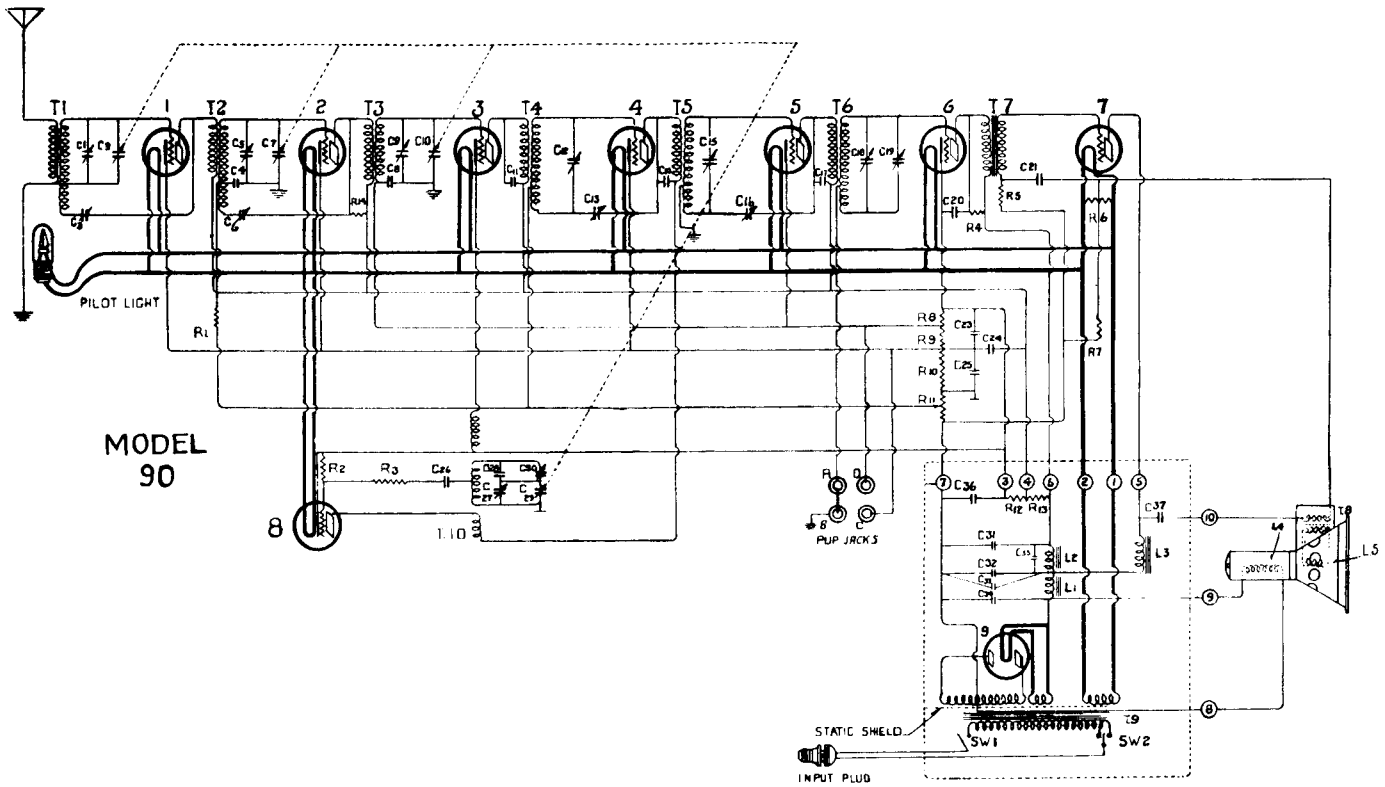
CANADIAN WESTINGHOUSE CO. LTD.



MODEL 89—"KEY" TO SCHEMATIC WIRING DIAGRAM

S.W. 1—Local-Distant Switch
S.W. 2—Line Switch
S.W. 3—110-120 Volt Switch
S.W. 4—Tone Control Switch
S.W. 5—Phonograph Switch (if pick-up is used)
T1—Antenna R.F. Transformer
T2—First Stage R.F. Transformer
T3—First Inter. Freq. Transformer (assembled with C.10, C. 5 and C. 6
T4—Second Inter. Freq. Transformer (assembled with C. 11, C. 7 and C. 8
T5—Third Inter. Freq. Transformer (assembled with R. 1, C. 12 and C. 9)
T6—Audio Freq. Transformer (assembled with C. 14, C. 16, C. 17, C. 22, C. 23, C. 24 and C. 25)
T7—Output Transformer
T8—Line Transformer
T9—Input Transformer (for Phono. Pick-up if used)
O—Oscillator Coil Assembly (assembled with C. 18)
P—Phonograph Pick-up (if used)
L—Short Circuiting Link on Chassis Terminal Board. (This link to be removed if Phono. Pick-up is used)
R1—Oscillation Suppressing Resistor (7000 ohm. Red and Yellow; was Brown and Yellow)
R2—Audio Resistor (40,000 ohm. Black with Black dot)
R3—Power Stage Grid Resistor, (¼ Meg. Brown)
R4—Filament Centre Tapped Resistor (60 ohm. wire-wound)
R5—Grid Bias Resistor, (1460 ohm. Blue with Red tip or 1500 ohm. Blue)
R6—Voltage Divider Resistance (Carbon 5000 ohm. Blue with Yellow Tip)
R7—Voltage Divider Resistance (wire-wound, tapped) (375 and 90 ohms.)
R8—Volume Control 650 ohms. (approx.)
R9—Oscillator Grid Leak, (Black with Black dot, 40,000 ohms.)
R10—Oscillator Grid Resistor (3,000 ohm. Green with Blue tip; was Green)
R11—Voltage Divider Resistor (Vitrohm 4800 ohms.)
R12—Phono. Pick-up Bias Resistor (if used, 2000 ohms.)
R13—Phono. Pick-up Volume Control (if used)
C1, C2, C3—Three Gang Condenser
C4—R. F. Compensating Condenser
C5, C7, C9—Inter. Freq. Tuning Adjustable Condenser
C6, C8—Inter. Freq. Compensating Condensers.
C10, C11, C12—Inter. Freq. Primary Tuning Condensers (fixed 800 m.m.f.)
C13—Phono. Condenser, (2400 m.m.f.)
C14—Audio Condenser (.05 mfd. assembled with T. 6)
C15—Audio Condenser (160 m.m.f.)
C16—Audio By-Pass Condenser (.5 mfd. assembled with T. 6)
C17—Audio By-Pass Condenser (.05 mfd. assembled with T. 6)
C18—Oscillator Grid Condenser (720 m.m.f.)
C19—Fixed Oscillator Trimming Condenser (720 m.m.f.)
C20, C21—Oscillator Trimming Condensers (Series and Shunt)
C22—By-Pass Condenser (.5 mfd. assembled with T. 6)
C23—By-Pass Condenser (.5 mfd. assembled with T. 6)
C24—By-Pass Condenser (.5 mfd. assembled with T. 6)
C25—By-Pass Condenser (.5 mfd. assembled with T. 6)
C26—Filter Condenser (1 m.f.d.) } Filter Condenser assembly
C27—Filter Condenser (2 m.f.d.) }
C28—Filter Condenser (2 m.f.d.) }
C29—Output Filter Condenser (.5 m.f.d. assembled with C. 26, C. 27, C. 28)
C30—Tone Control Condenser (.05 m.f.d.)
C31—Filter Condenser (External 2 m.f.d.)
C32—Filter Condenser (External two 2 m.f.d. condensers in parallel)
L1, L2—Filter Choke Coils (assembled together)
L3—Output Filter Choke (assembled with C26, C27, C28)

CANADIAN WESTINGHOUSE CO. LTD.



MODEL 90—KEY TO CIRCUIT DIAGRAM

RESISTORS, COLOUR AND VALUE (OHMS)

R1. Suppressor—Green with Blue—3,000.
R2. Oscillator Grid Leak—Black—40,000.
R3. Oscillator Grid Suppressor—Green with Blue—3,000.
R4. Audio Resistor—Black—40,000.
R5. Power Stage Grid Resistor—Brown—250,000.
R6. Filament Centre-tapped Resistor—Wire-wound—60.
R7. Grid Bias Resistor—Blue or Blue with Red—1,500.
R8. Voltage Divider 425.
R9. Resistors wire- 875.
R10. wound. 130.
R11. Volume Control—500.
R12. Voltage Divider Resistor—Red and Yellow—7,000.
R13. Voltage Divider Resistor—Vitrohm—4,800.
R14. Stabilizer—Black with Grey—8,570.

CONDENSERS

C1. 1st Gang Condenser Trimmer.
C2. 1st Gang Condenser Section.
C3. 1st R.F. Compensator.
C4. R.F. By-pass—.1 MFD. WG-44.
C5. 2nd Gang Condenser Trimmer.
C6. 2nd R.F. Compensator.
C7. 2nd Gang Condenser Section.
C8. R.F. By-pass—.1 MFD. WG-44.
C9. 3rd Gang Condenser Trimmer.
C10. 3rd Gang Condenser Section.
C11. I.F. Primary Condenser—800 MMF.
C12. I F. Tuning Condenser.
C13. I.F. Neutralizing Condenser.
C14. I.F. Primary Condenser—800 MMF.
C15. I.F. Tuning Condenser.
C16. I.F. Neutralizing Condenser.
C17. I.F. Primary Condenser—800 MMF.
C18. & C19. I.F. Tuning Condensers.
C20. I.F. By-pass Condenser—2,500 MMF.
C21. Audio By-pass .5 MFD.
C23. Condensers in .5 MFD.
C24. Container WG-41 .5 MFD.
C25. .5 MFD.
C26. Oscillator Grid Condenser—720 MMF.
C27. Oscillator Shunt Trimming Condenser.
C28. Oscillator Fixed Series Trimming Condenser—720 MMF.
C29. 4th Gang Condenser Section.
C30. Oscillator Series Trimming Condenser.
C31. Filter 1 MFD.
C32 Condenser 2 MFD.
C33. Assembly S No. 652360 2 MFD.
C34. External Filter Condenser—2 MFD. WG-23.
C35. Tuned Filter Condenser—.4 MFD.
C36. Voltage Divider By-pass—.5 MFD. (Assembled
C37. Output Filter Condenser—.5 MFD. with C31&c

TRANSFORMERS

T1. Antenna R.F. Transformer.
T2. 1st Stage R.F. Transformer.
T3. 2nd Stage R.F. Transformer.
T4. 1st I.F. Transformer.
T5. 2nd I.F Transformer.
T6. 3rd I.F Transformer.
T7. Audio Transformer
T8. Output Transformer.
T9. Line Transformer
T10. Oscillator Coil Assembly.

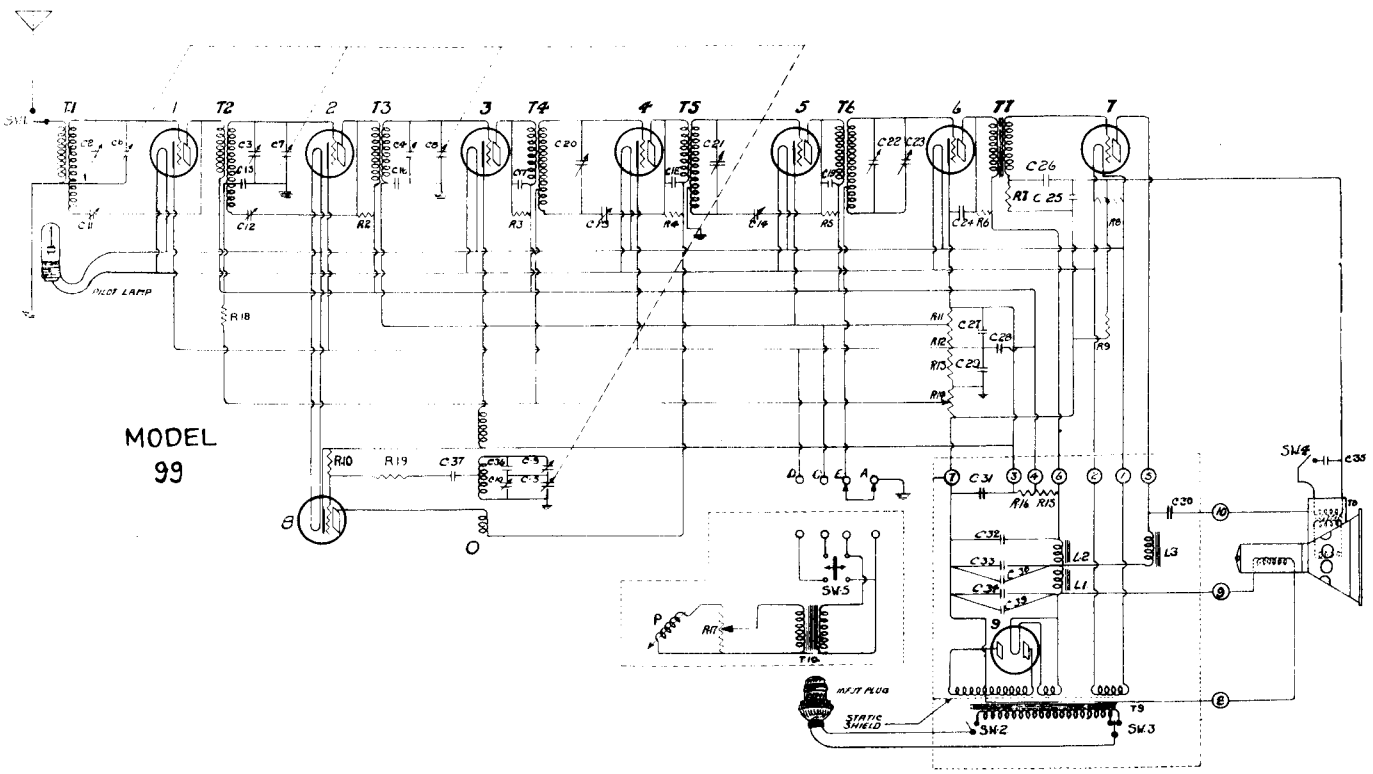
REACTOR COILS

L1. Filter Reactor—25 henries, 330 ohms.
L2. Filter Reactor—35 henries, 800 ohms.
L3. Output Choke—15 henries, 500 ohms.
L4. Reproducer Field Coil—7,000 ohms.
L5. Reproducer Cone Coil—10 ohms.

MISCELLANEOUS

SW1. Line Switch.
SW2. 110/120 Volt Switch.

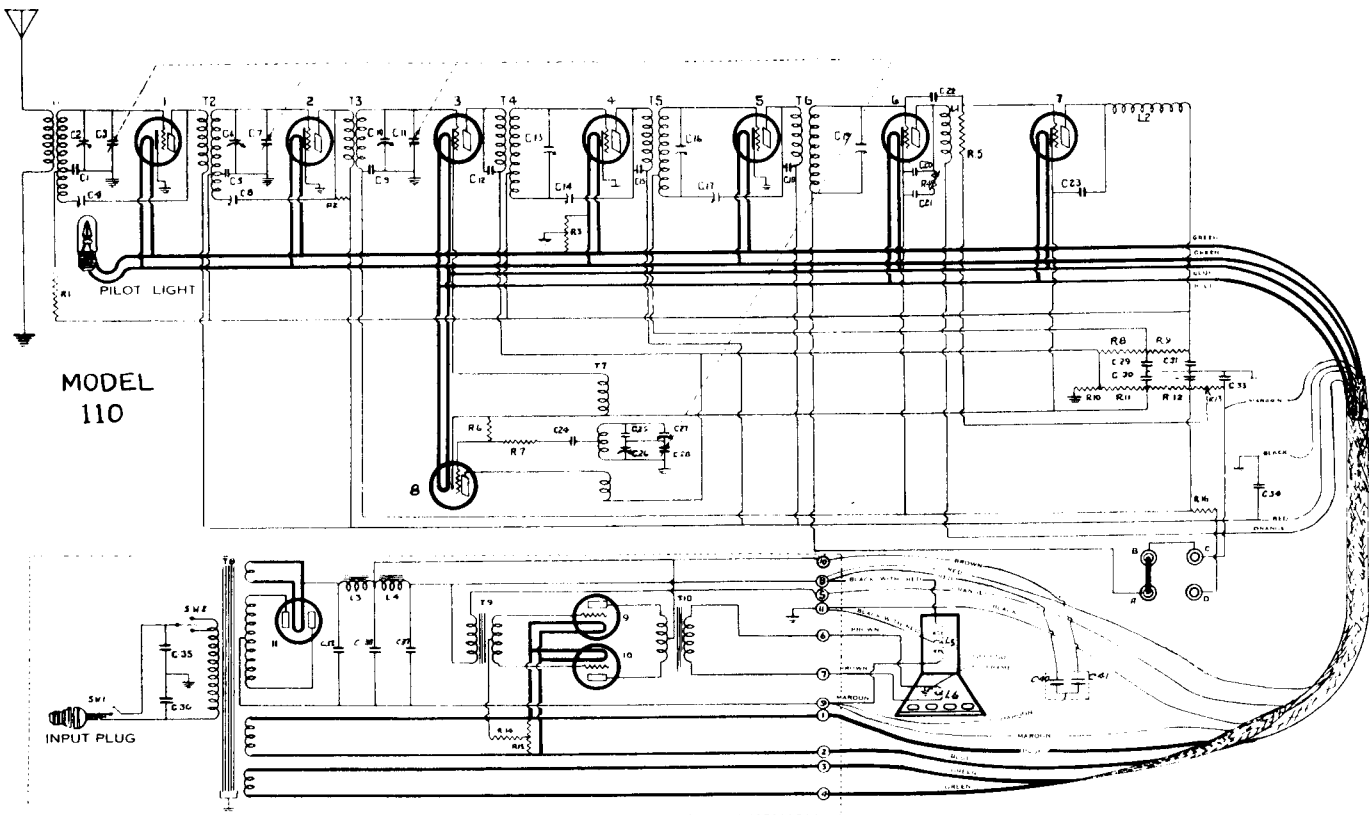
CANADIAN WESTINGHOUSE CO. LTD.



KEY TO MODEL "99" WIRING DIAGRAM

SW. 1—Distant-Local Switch
SW. 2—Line Switch
SW. 3—110-120 Volt Switch
SW. 4—Tone Control Switch
SW. 5—Phonograph Pick-up Switch (if used)
C2, C3, C4 and C5—Four Gang Condenser
C6, C7 and C8—Radio Frequency Trimming Condensers (assembled with C1, C2, C3, and C4)
C9—Oscillator Series Trimming Condenser
C10—Oscillator Shunt Trimming Condenser (assembled with C1, C2, C3, and C4)
C11, C12 } Radio Frequency Compensating Condensers
C13, C14 } Inter. Frequency Compensating Condensers (Assembled with T4 and T5)
C15 Radio Frequency By-pass Condensers (.1 mfd.)
C16 (Marked WG 44)
C17, C18, C19—Inter. Frequency Primary Tuning Condensers, (800 m.m.f. fixed—assembled with T4, T5, and T6)
C20, C21 } Inter Frequency Secondary Tuning
C22, C23 } Condensers (assembled with T4, T5, and T6)
C24—Phone Condenser (2500 m.m.f.)
C25—Audio Frequency By-pass Condenser (.1 m.f.d.)
C26—Audio Frequency By-pass Condenser (.5 m.f.d.)
C27—Voltage Divider By-pass Condenser (.5 m.f.d.)
C28—Voltage Divider By-pass Condenser (.5 m.f.d.)
C29—Voltage Divider By-pass Condenser (.5 m.f.d.)
} By-pass Condenser Assembly W.G. 41 or W.G. 53
C30—Audio Frequency By-pass Condenser (.5 m.f.d.)
C31—Voltage Divider By-pass Condenser (.5 m.f.d.) (C30 and C31 assembled with C32, C33, and C34)
C32—1 m.f.d. }
C33—2 m.f.d. } Filter Condenser Assembly S No. 652360
C34—2 m.f.d. }
C35—Tone Control Condenser (.05 m.f.d.)
C36—Fixed Oscillator Trimming Condenser (720 m.m.f.)
C37—Oscillator Grid Condenser (720 m.m.f.)
C38—External Filter Condenser (two of 2 m.f.d. WG. 23)
C39—External Filter Condenser (two of 1 m.f.d 579651)
O—Oscillator Coil Assembly
P—Phonograph Pick-up (optional)
T1—Antenna R.F. Coil Assembly
T2—First Stage R.F. Coil Assembly
T3—Second Stage R.F. Coil Assembly
T4—First Intermediate Freq. Transformer
T5—Second Intermediate Freq. Transformer
T6—Third Intermediate Freq. Transformer
T7—Audio Transformer
T8—Output Transformer
T9—Line Transformer
T10—Phono. Pick-up Input Transformer
R2 } R.F. Oscillation Suppressor Resistor (Black and Grey 8750 ohms.; was Red and Yellow)
R3, R4, and R5—(Assembled with T4, T5, and T6, 40000 ohms. Black with Black dot) (omitted on later production).
R6—Audio Resistor (40000 ohms. Black with Black dot)
R7—Power Stage Grid Resistor (¼ Meg. Brown)
R8—Filament Centre-tapped Resistor (60 ohm. wire-wound)
R9—Grid Bias Resistor, (1500 ohm. Blue or 1460 ohm. Blue with Red End)
R10—Oscillator Grid Leak, (40000 ohm. Black with Black dot)
R11—425 Ohms. }
R12—875 Ohms. } Voltage Divider Resistor (wire-wound)
R13—130 Ohms. }
R14—Volume Control 500 ohms
R15—Voltage Divider Resistor (4800 ohm. Vitrohm)
R16—Voltage Divider Resistor (7000 ohms. Red and Yellow; was Brown and Yellow)
R17—Phono. Pick-up Volume Control (if used)
R18—R.F. Grid Resistor (3,000 ohm Green with Blue Tip; was Green).
R19—Oscillator Grid Resistor (3,000 ohm Green with Blue Tip; was Green).
L—Link (to be removed if Phono. Pick-up is used)
L1, L2 } Filter Reactor Coil Assembly
L3—Output Filter Choke Coil, (assembled with C32, C33, and C34.)

CANADIAN WESTINGHOUSE CO. LTD.



MODEL 110—KEY TO CIRCUIT DIAGRAM

RESISTORS, COLOUR AND VALUE (OHMS)

R1. Suppressor—Blue with Maroon—7,700.
R2. Stabilizer—Black with Grey—8,570.
R3. Filament Center-tapped Resistor Wire-wound—60.
R4. Variable Tone Control—0-50,000.
R5. Automatic Volume Control Grid Leak—Green with Grey 2,000,000.
R6. Oscillator Grid Leak—Black—40,000.
R7. Oscillator Grid Suppressor—Green and Blue—3,000.
R8. & R9. Automatic Bias Resistors—Red—100,000.
R10. Voltage Divider Resistors—mounted together. Wire-wound—485.
R11 Maroon with Green—8,000.
R12. Wire-wound—395.
R13. Volume Control—1,600.
R14. Grid Bias Resistor—Yellow with Black—740.
R15. Filament Centre-tapped Resistor—Wire-wound—60.
R16. Extra Bias Resistor—Blue with Maroon—7,700.

CONDENSERS

C1. R.F. By-pass—.1 MFD. WG-44.
C2. 1st Gang Condenser Trimmer.
C3. 1st Gang Condenser Section
C4. 1st R.F. Compensator.
C5. R.F. By-pass—.1 MFD. WG-44.
C6. 2nd Gang Condenser Trimmer.
C7. 2nd Gang Condenser Section.
C8. 2nd R.F. Compensator.
C9. R.F. By-pass—.1 MFD. WG-44.
C10. 3rd Gang Condenser Trimmer
C11. 3rd Gang Condenser Section.
C12. I.F. Primary Condenser—800 MMF.
C13. I.F. Tuning Condenser.
C14. I.F. Neutralizing Condenser.
C15. I.F. Primary Condenser.
C16. I.F. Tuning Condenser.
C17. I.F. Neutralizing Condenser.
C18. I.F. Primary Condenser—800 MMF.
C19. I.F. Tuning Condenser.
C20. I.F. By-pass Condenser—2,500 MMF.
C21. Tone Control .05 MFD. WG-106.
C22. Coupling Condenser 800 MMF.
C23. I.F. By-pass Condenser 2,500 MMF.
C24. Oscillator Grid Condenser 720 MMF.
C25. Oscillator Fixed Trimming Condenser 800 MMF
C26. 4th Gang Condenser Trimmer.
C27. Oscillator Series Trimming Condenser
C28. 4th Gang Condenser Section.
C29. By-pass Condensers Assembled in two Containers Marked WG-41 .5 MFD.
C30. .5 MFD.
C31. 1.0 MFD.
C32. .5 MFD.
C33. 1.0 MFD.
C34. .5 MFD.
C35. Line Filter Condenser—Centre Tapped.
C36. 1 MFD. each half. S No. 700759
C37. Filter Condensers 2 MFD.
C38. 4 MFD.
C39. Assembled with T10 4 MFD.
C40. External Filter Condensers 4 MFD.(2 of S No.552844)
C41. 2 MFD.(2 of S No.579651)

TRANSFORMERS

T1. Antenna R.F. Transformer.
T2. 1st Stage R.F. Transformer.
T3. 2nd Stage R.F. Transformer.
T4. 1st I.F. Transformer.
T5. 2nd I.F. Transformer.
T6. 3rd I.F. Transformer.
T7. Oscillator Coil.
T8. Line Transformer.
T9. Input Transformer.
T10. Output Transformer.

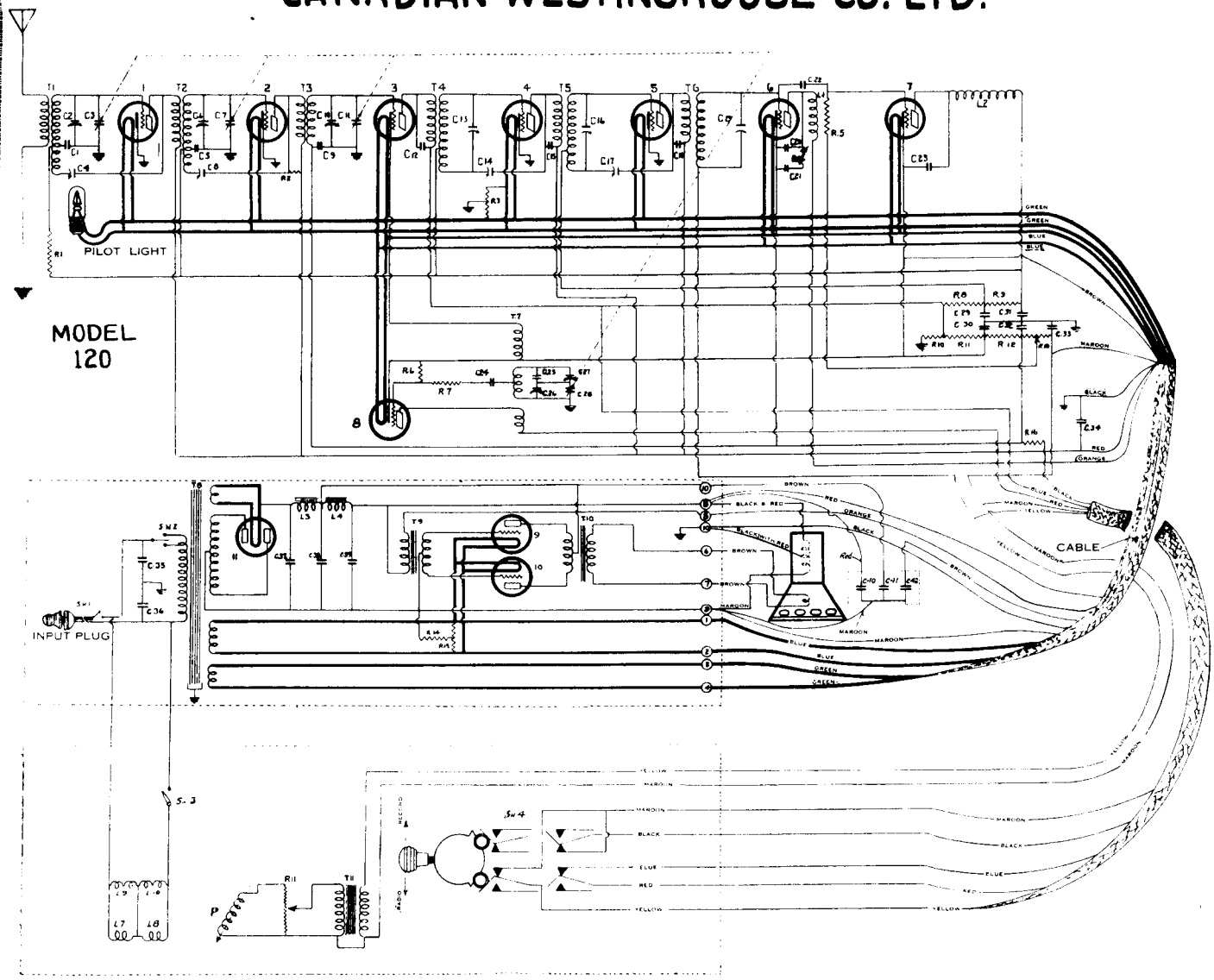
REACTOR COILS

L1. I.F. Choke Coil (large)—85 ohms.
L2. I.F. Choke Coil (small)—35 ohms.
L3. Filter Reactor—10 henries, 300 ohms.
L4. Filter Reactor—10 henries, 300 ohms.
L5. Reproducer Field Coil—3,250 ohms. each side of tap.
L6. Reproducer Moving Coil—10 ohms.

MISCELLANEOUS

SW1. Operating Switch.
SW2. 110-120 Volt Switch.

CANADIAN WESTINGHOUSE CO. LTD.



MODEL 120---KEY TO CIRCUIT DIAGRAM

RESISTORS, COLOUR AND VALUE (OHMS)

R1. Suppressor—Blue with Maroon—7,700.
R2. Stabilizer—Black with Grey—8,570.
R3. Filament Center-tapped Resistor Wire-wound—60.
R4. Variable Tone Control—0-50,000.
R5. Automatic Volume Control Grid Leak—Green with Grey 2,000,000.
R6. Oscillator Grid Leak—Black—40,000.
R7. Oscillator Grid Suppressor—Green and Blue—3,000.
R8. & R9. Automatic Bias Resistors—Red—100,000.
R10. Voltage Divider — Wire-wound—485.
R11. Resistors—mounted together. — Maroon with Green—8,000.
R12. Wire-wound—395.
R13. Volume Control—1,600.
R14. Grid Bias Resistor—Yellow with Black—740.
R15. Filament Centre-tapped Resistor—Wire-wound—60.
R19. Extra Bias Resistor—Blue with Maroon—7,700.
R17. Record Volume Control—0-60.

CONDENSERS

C1. R.F. By-Pass—.1 MFD. WG-44.
C2. 1st Gang Condenser Trimmer.
C3. 1st Gang Condenser Section.
C4. 1st R.F. Compensator.
C5. R.F. By-pass—.1 MFD. WG-44.
C6. 2nd Gang Condenser Trimmer.
C7. 2nd Gang Condenser Section.
C8. 2nd R.F. Compensator.
C9. R.F. By-pass. 1 MFD. WG-44.
C10. 3rd Gang Condenser Trimmer.
C11. 3rd Gang Condenser Section.
C12. I.F. Primary Condenser—800 MMF.
C13. I.F. Tuning Condenser.
C14. I.F. Neutralizing Condenser.
C15. I.F. Primary Condenser.
C16. I.F. Tuning Condenser.
C17. I.F. Neutralizing Condenser.
C18. I.F. Primary Condenser—800 MMF.
C19. I.F. Tuning Condenser.
C20. I.F. By-pass Condenser—2,500 MMF.
C21. Tone Control .05 MFD. WG-106.
C22. Coupling Condenser 800 MMF.
C23. I.F. By-pass Condenser 2,500 MMF.
C24. Oscillator Grid Condenser 720 MMF.
C25. Oscillator Fixed Trimming Condenser 800 MMF.
C26. 4th Gang Condenser Trimmer.
C27. Oscillator Series Trimming Condenser.
C28. 4th Gang Condenser Section.
C29. .5 MFD.
C30. By-pass Condensers — .5 MFD.
C31. 1.0 MFD.
C32. Assembled in two Containers — .5 MFD.
C33. 1.0 MFD.
C34. Marked WG-41 — .5 MFD.
C35. Line Filter Condenser—Centre Tapped.
C36. 1 MFD. each half. S. No. 700759.
C37. Filter Condensers — 2 MFD.
C38. 4 MFD.
C39. Assembled with T10 — 4 MFD.
C40. External Filter — 4 MFD. (2 of S No. 552844)
C41. 1 MFD. (S No. 579651).
C42. Condensers — 1 MFD. (S No. 579651).

TRANSFORMERS

T1. Antenna R.F. Transformer.
T2. 1st Stage R.F. Transformer.
T3. 2nd Stage R.F. Transformer.
T4. 1st I.F. Transformer.
T5. 2nd I.F. Transformer.
T6. 3rd I.F. Transformer.
T7. Oscillator Coil.
T8. Line Transformer.
T9. Input Transformer.
T10. Output Transformer.
T11. Phonograph Input Transformer.

REACTOR COILS

L1. I.F. Choke Coil (large)—85 ohms.
L2. I.F. Choke Coil (small)—35 ohms.
L3. Filter Reactor—10 henries, 300 ohms.
L4. Filter Reactor—10 henries, 300 ohms.
L5. Reproducer Field Coil—3,250 ohms, each side of tap.
L6. Reproducer Moving Coil—10 ohms.
L7. & L8. Motor Series Coils.
L9. & L10. Motor Shunt Coils.

MISCELLANEOUS

SW1. Operating Switch.
SW2. 110-120 Volt Switch
SW3. Motor Switch.
SW4. Radio-Record Switch.
P. Phonograph Pick-up.

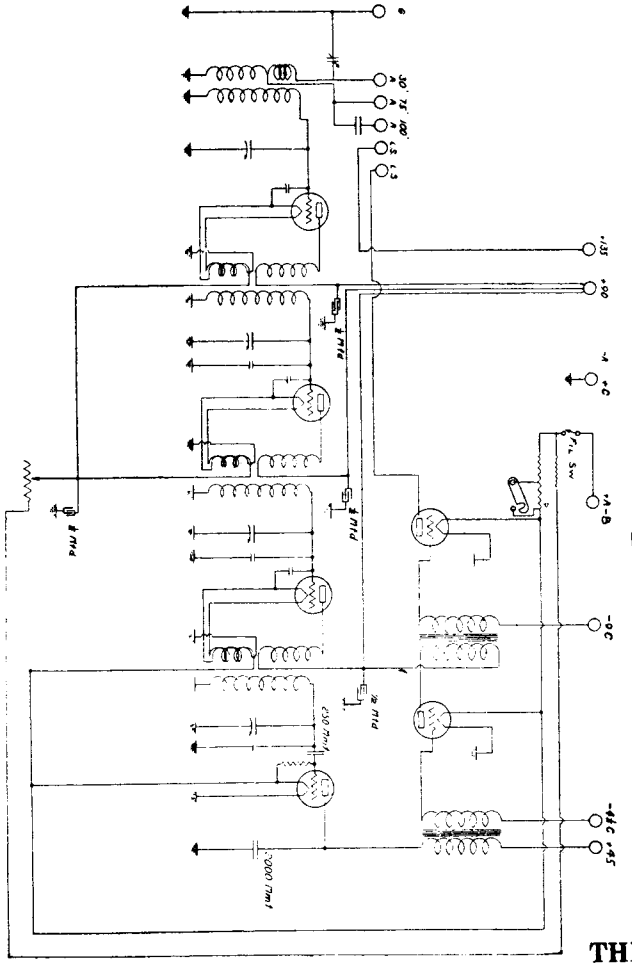


Figure 10

THE C6 COMPACT AND CONSOLE—1926-27

Figure 10 shows the circuit diagram of the C6 Compact and Console. The chasses in both of the above models are identical with the exception of the cable, which is longer in the Compact model than in the Console. The "ground" symbols indicate that the circuit is grounded to the chassis at those points.

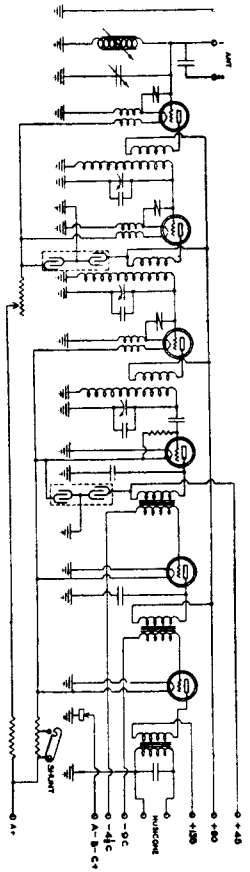


Figure 12

THE CONWAY AND HASTINGS (1927-28)

The circuit diagram of the Conway and Hastings Models is illustrated at Figure 11. The chasses of both models are identical with the exception of the cable, which is longer on the Conway than on the Hastings.

THE WARWICK AND WINDSOR (1927-28)

Figure 12 shows the circuit diagram of the Warwick and Windsor Models. The chasses in both models are identical with the exception of the battery cable, which is longer on the Warwick than on the Windsor. The "ground" symbols indicate that the circuit is grounded to the chassis at these points.

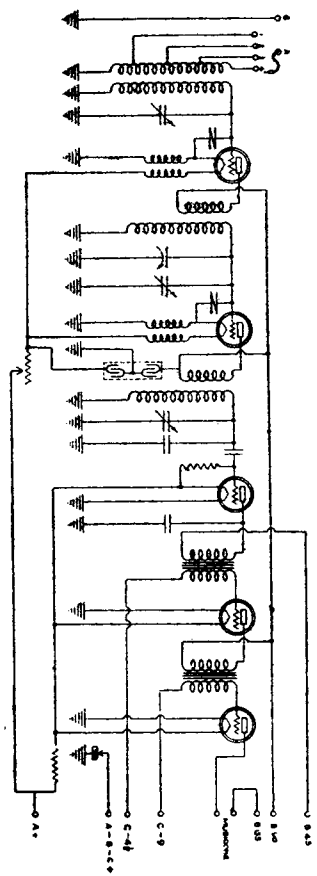


Figure 11

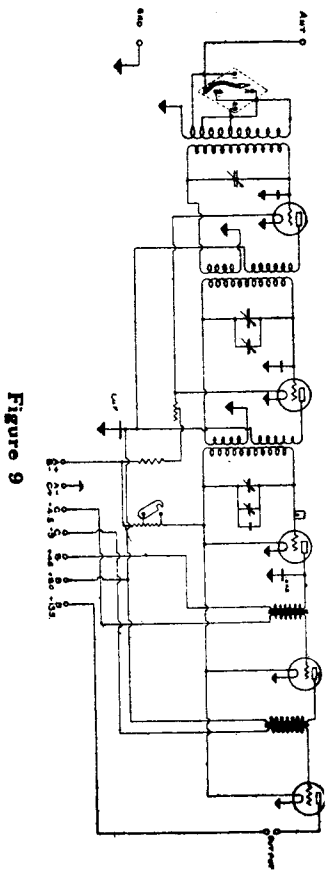


Figure 9

THE DC5 COMPACT AND CONSOLE (1926-27)

Figure 9 shows the circuit diagram of the DC5 Compact and Console. The chasses in both of the above models are identical with the exception of the cable which is longer in the compact model. The "ground" symbols indicate that the circuit is grounded to the chassis at those points.

While the diagram shows the order of the tubes in their natural progressive sequence for the purpose of simplicity, their actual order in the chassis, counting from left to right, is as follows:—1st R.F. Amplifier, 2nd Audio Amplifier, 2nd R.F. Amplifier, 1st Audio Amplifier and Detector.

DE FOREST CROSLEY LTD.

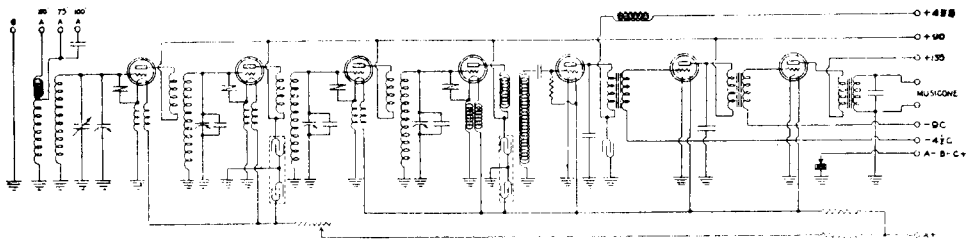


Figure 13

THE BALMORAL AND BERWICK (1927-28) Battery Operated

Figure 13 shows the circuit diagram of the Balmoral and Berwick. The chasses of both Models are identical with the exception of the cable which is longer in the Balmoral than in the Berwick. The "ground" symbols indicate that the circuit is grounded to the chassis at these points.

THE BANDBOX JUNIOR (1928)

Figure 14 is the schematic circuit diagram of the Bandbox Junior, which is made in two models, namely, for use with WX 199 Radiotrons and for use with UX 201B Radiotrons. The WX 199 Model has a finer wound volume control rheostat than the UX 201B type. The R.F. coils are also different. The Bandbox

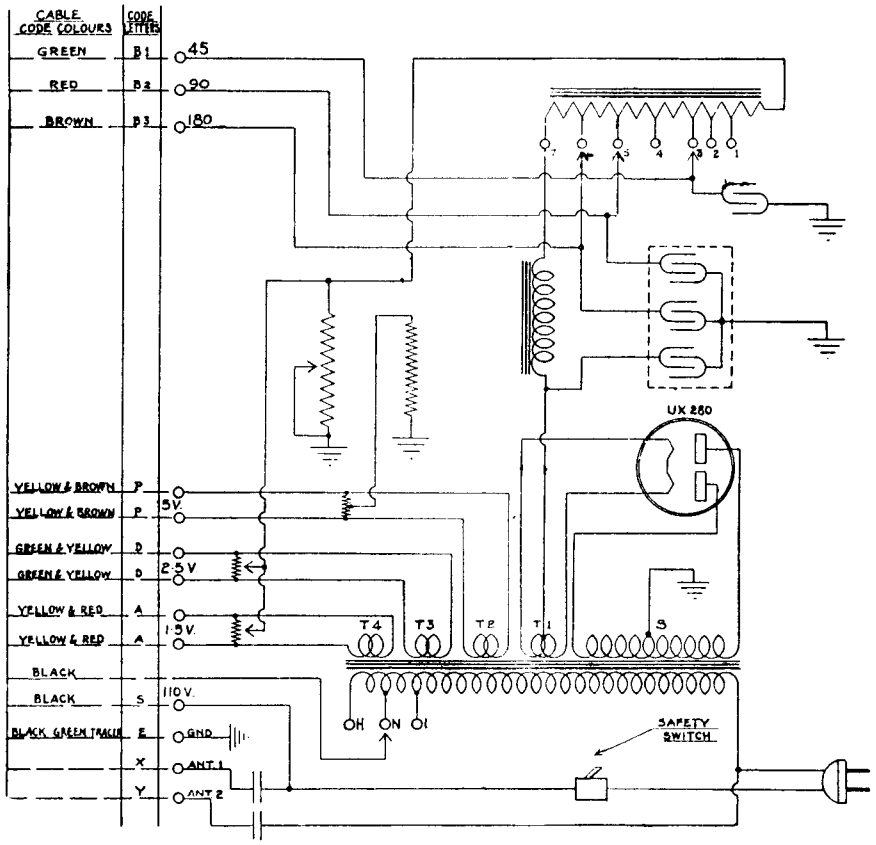


Figure 17
Schematic diagram of the A.B.C. Power Unit Circuit.

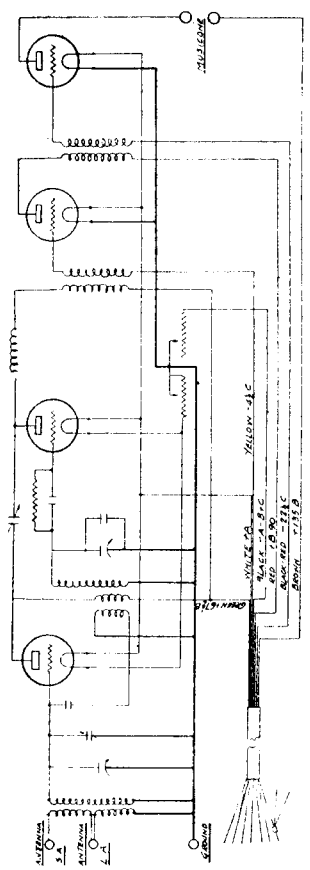


Figure 14

THE DE FOREST CROSLEY POWER UNIT FOR ELECTRIC HASTINGS, BERWICK AND FIRST SERIES SYMPHONY MODEL (1927-28)

Figure 17 illustrates the circuit of the Power Unit used in the above electric models. The transformer is shown at the bottom with its separate windings for the filaments of the UX 226, UY 227, UX 171A, and UX 280 Radiotrons respectively. The Mershon condenser is illustrated at the left upper centre, while choke coils are indicated at the centre and top. The 2 M.F. fixed condenser connected between the green lead and the chassis is illustrated just above the Mershon condenser. The variable resistance shown at the left centre is the rheostat indicated as "E" in Figure 17. The winding to the right of the rheostat is the UX 171 bias resistor wound on a flat bakelite form. The potentiometers placed at the lower right of the power unit are shown at the left, connected across the filament windings of the UX 226 and UY 227.

The mid top resistor connected across the UX 171A filament terminals is the narrow fine winding on the bakelite strip and the ground symbols represent connections to the chassis.

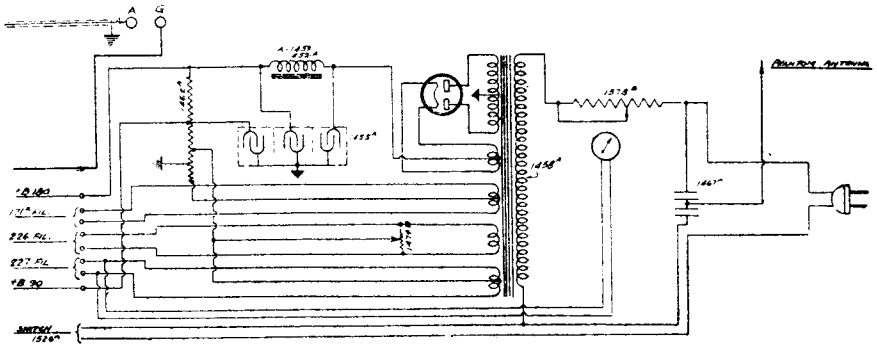


Figure 18
Schematic diagram of the Etude and Symphony Power Unit.

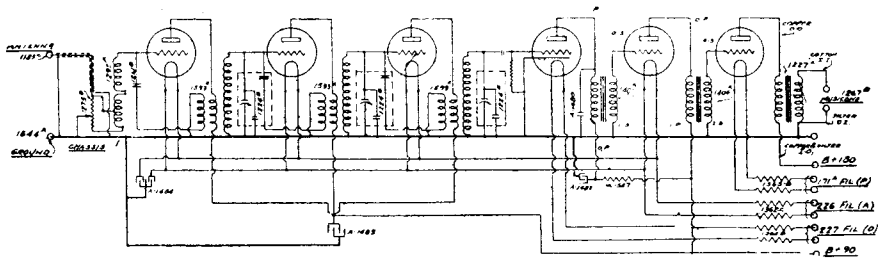


Figure 21
Circuit diagram of the First Series Symphony Chassis.

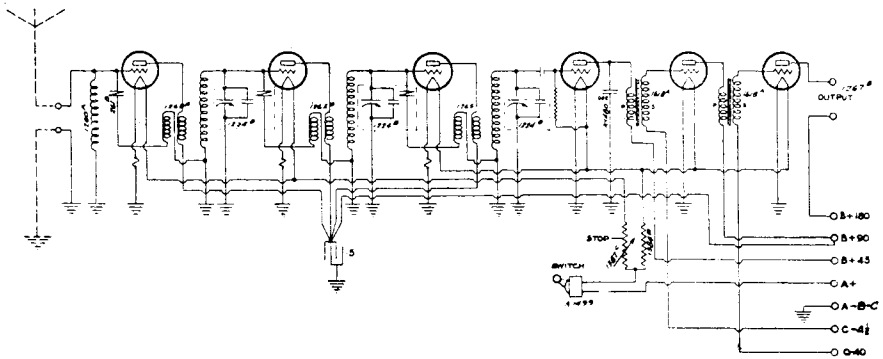


Figure 15

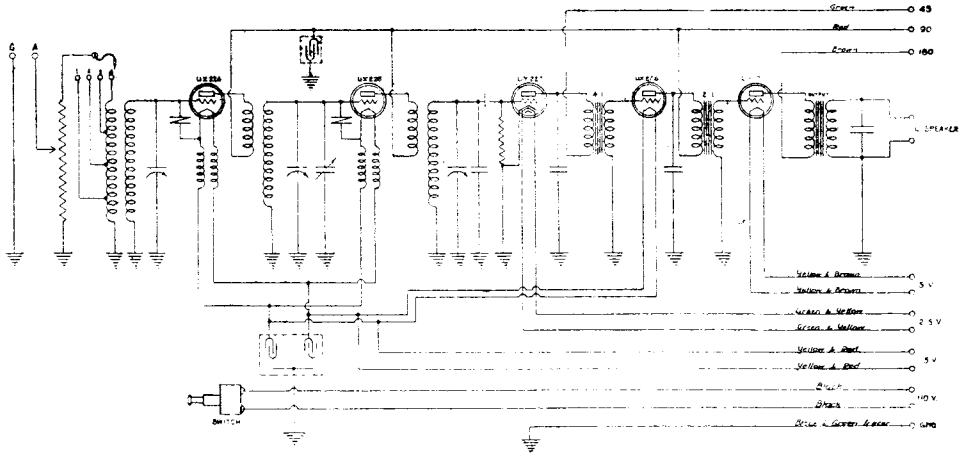


Figure 19
Schematic diagram of the Electric Hastings Chassis Circuit.

THE BARCAROLLE AND MINUET (Battery Type—1928-9)

Figure 15 is the circuit diagram of the above Receivers. The ground symbols indicate connections to the chassis at these points.

While the diagram shows the order of the tubes to be in their natural progressive sequence for the purpose of simplicity, their actual order in the chassis is as follows:—

Row parallel to rear edge—From left to right, 1st R.F. amplifier, 2nd R.F. amplifier, 3rd R.F. amplifier, Detector.

Remaining two Tubes—Front tube, 2nd A. F. amplifier, middle tube, 1st A.F. amplifier. The points between which series tests may be made are obvious but one or two examples are illustrated below.

THE ELECTRIC HASTINGS CHASSIS (1927-28)

Figure 19 is the circuit diagram of the Electric Hastings chassis. While the position of the tubes are shown in their natural progressive order of sequence for the purpose of simplicity, their actual order in the chassis is as follows, counting from the left to right:—1st R.F. Amplifier, 2nd A.F. Amplifier, 1st A.F. Amplifier, 2nd R.F. Amplifier and Detector.

THE SYMPHONY CHASSIS (First Series—Power Unit Separate) (1928-29)

Figure 21 is the circuit diagram of the Symphony Model, first series. The heavy horizontal line near the centre represents the steel chassis. It will be noticed that several connections are made to it.

THE DE FOREST CROSLEY POWER UNIT FOR ETUDE AND SECOND SYMPHONY SERIES (1928-29)

Figure 18 illustrates the circuit diagram of the power unit of the Etude and Symphony Models. The "ground" symbols indicate connections to the chassis. The Mershon Condenser is shown at the upper left while the tapped resistor mounted vertically in the power unit is placed to the left of the Mershon. The transformer is located near the centre of the drawing. It will be noticed that the filament windings for each type of tube are placed to the left of the primary.

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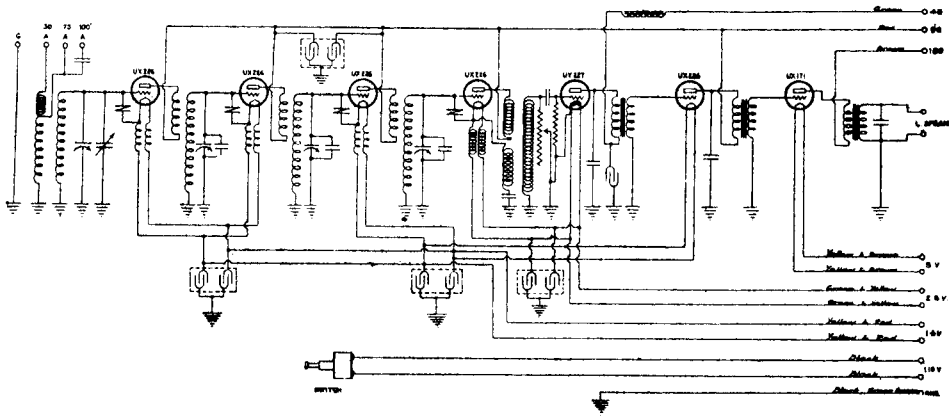


Figure 20
Schematic diagram of the Electric Berwick Chassis Circuit.

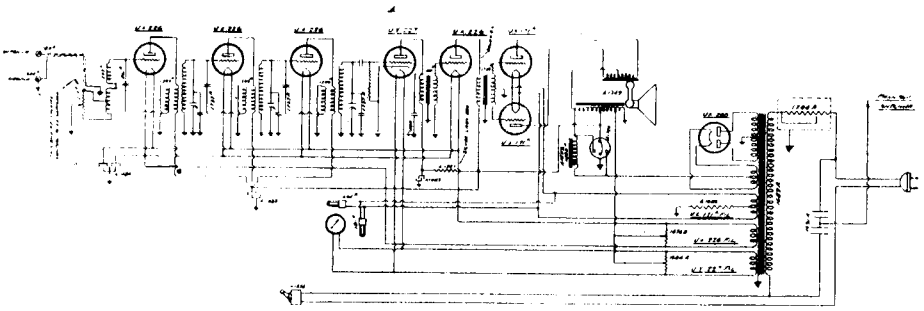


Figure 23
Schematic diagram of the Nocturne Circuit.

THE NOCTURNE (AC. 1928)

Figure 23 shows the circuit of the Nocturne chassis and power unit. The chassis occupies the left portion, while the power unit is shown at the right. The chassis is placed on the upper shelf and the power unit is located on the bottom shelf.

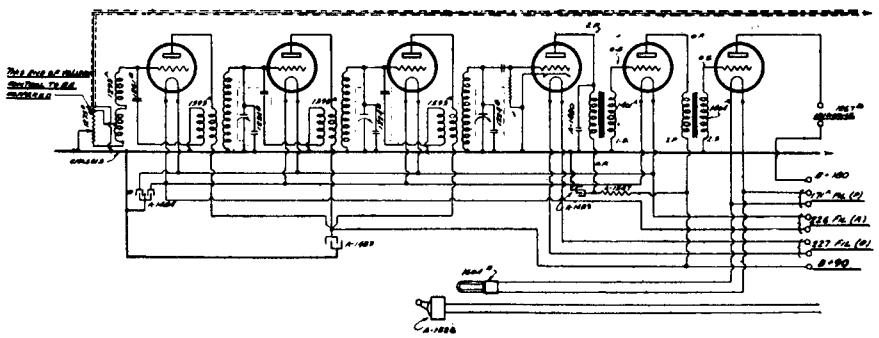


Figure 22
Circuit diagram of the Second Series Symphony.

THE SYMPHONY (Second Series) AND THE ETUDE (AC. 1928)

Figure 22 is the circuit diagram of the second series Symphony and Etude chasses. The heavy horizontal line near the centre represents the steel chassis. It will be noticed that several connections are made to it.

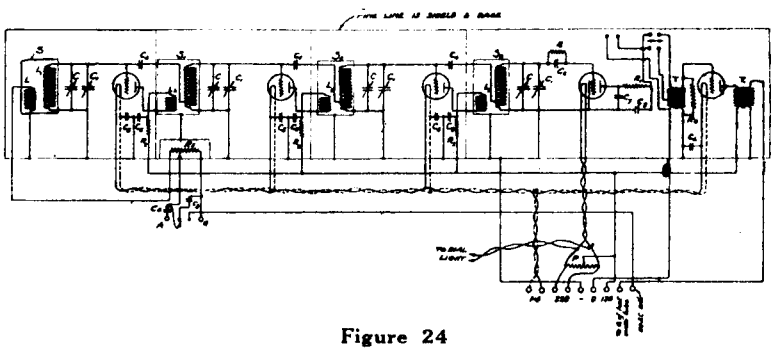


Figure 24
Schematic diagram of the Concerto, Sonata and Opera Models.

THE CONCERTO, SONATA AND OPERA MODELS (1928-29)

Figure 24 is the circuit diagram of the chassis contained in the above models. It will be noted that the R.F. coils are slightly different from other types as the balance winding is a portion of the secondary winding.

Figure 25 represents the circuit of the power unit used in the above models. The power transformer, with its several windings, is shown at the right, the Mershon Condenser is located near the centre and the adjacent rectifier tubes are the UX 281 Radiotrons. The UX 250 power amplifier is indicated near the left.

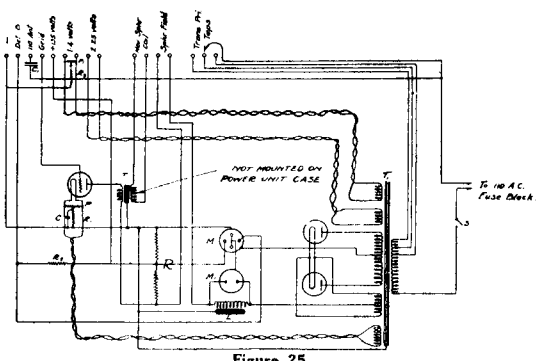
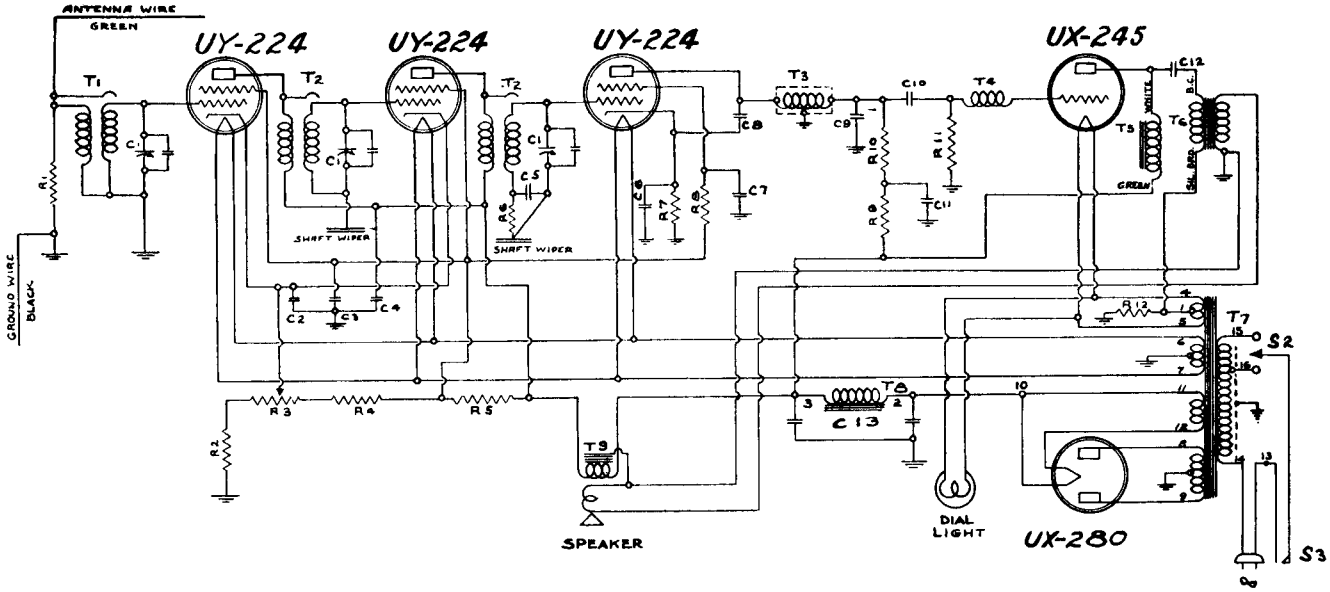


Figure 25
Circuit diagram of the Concerto, Sonata and Opera Power Unit.

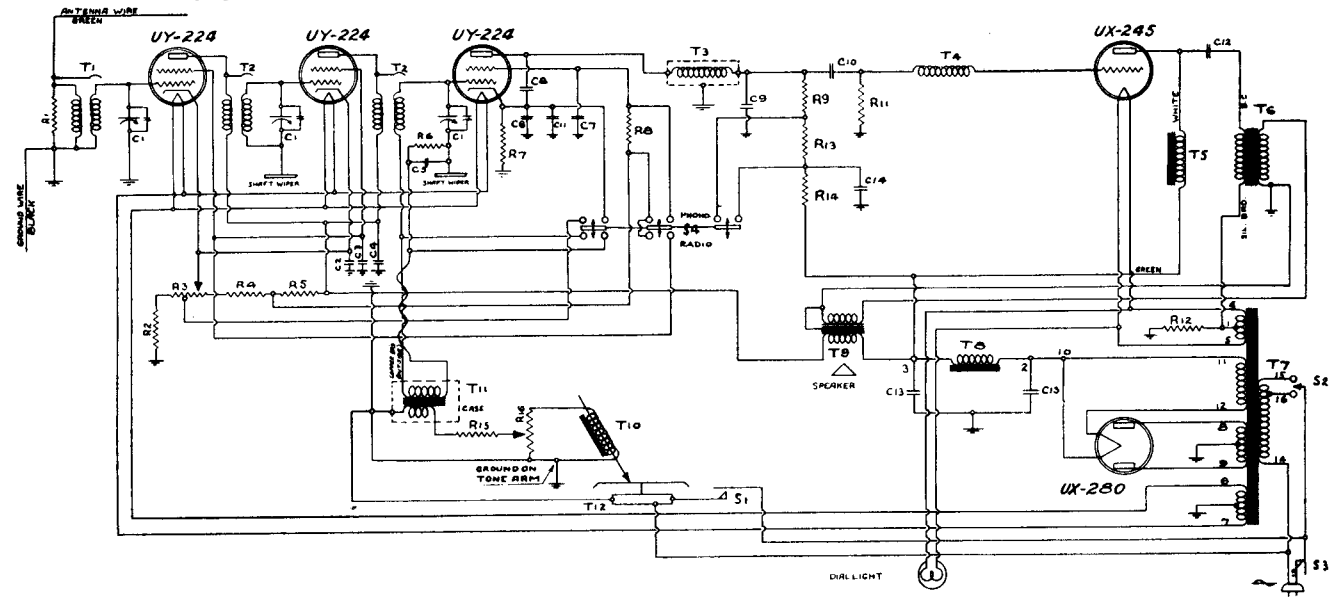
DE FOREST CROSLEY LTD.



TYPES 400-420 CHASSIS

("Brock" and "Rideau" Models)

Symbol	Description	Part No.
C1	Tuning condenser gang	A3394A
C2	.25 Mfd. cathode R.F. by-pass condenser	A3819
C3	.25 Mfd. screen R.F. by-pass condenser	
C4	.30 Mfd. plate R.F. by-pass condenser	
C5	.10 Mfd. Det. automatic bias by-pass condenser	A3820
C6	1.0 Mfd. R.F. cathode by-pass condenser	
C7	.10 Mfd. R.F. screen by-pass condenser	
C8	.0001 Mfd. R.F. plate by-pass condenser	A3815
C9	.0001 Mfd. R.F. plate by-pass condenser	A3861
C10	.02 Mfd. A.F. coupling condenser	A3821
C11	.10 Mfd. hum filter condenser	A3820
C12	1.0 Mfd. output coupling condenser	
C13	8 Mfd. Mershon power filter condenser	A3845
R1	5,500 ohm antenna resistance	A3791
R2	75 ohm UY 224 bias resistance	A3792
R3	300 ohm vol. control (bias) resistance	S3773
R4	2,500 ohm voltage divider resistance	A3794
R5	3,050 ohm voltage divider resistance	
R6	550,000 ohm Det. automatic bias resistance	A3796
R7	24,000 ohm cathode bias resistance	A3797
R8	250,000 ohm screen voltage reducing resistance	A3798
R9	100,000 ohm hum filter resistance	A3799
R10	800,000 ohm Det. plate resistance	A3802
R11	900,000 ohm A.F. grid leak resistance	A3800
R12	1,650 ohm UX 245 bias resistance	A3801
S2	"Hi-lo" switch (voltage control)	C3393B
S3	"On-off" switch (power control)	S3774
T1	Antenna coupling transformer	A3826A
T2	R.F. Interstage transformers	A3909A
T3	R.F. choke	A3840A
T4	R.F. choke	A3841A
T5	A.F. output choke	A3779
T6	A.F. output transformer	A3780
T7	Power transformer	A3781
T8	Power filter choke	A1692
T9	Speaker field	A3529A



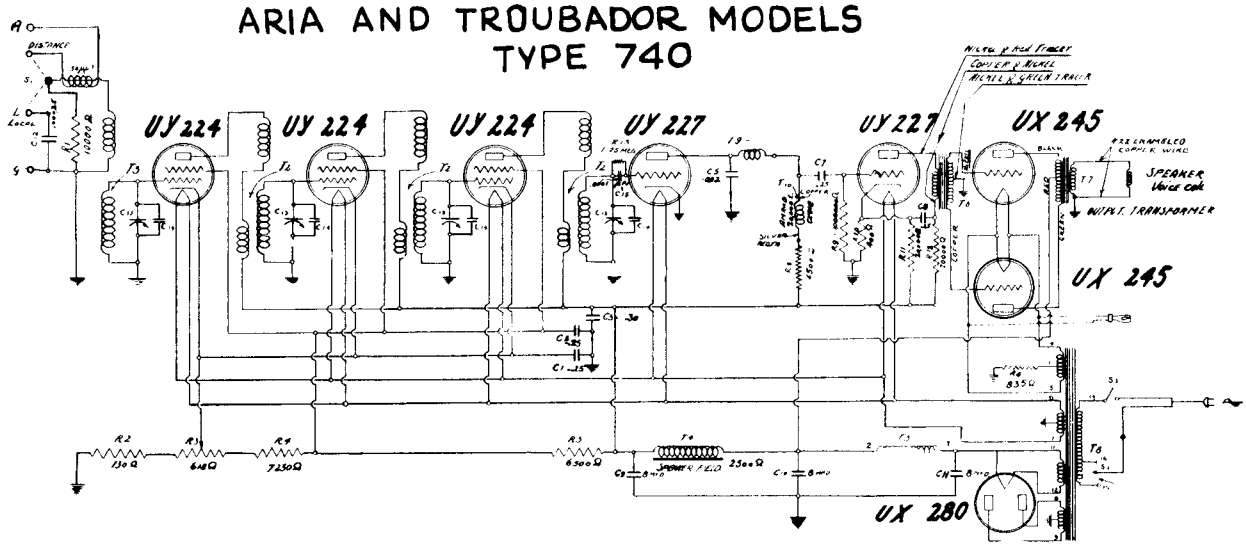
TYPE 410 CHASSIS

("Elgin" Model)

Symbol	Description	Part No
C1	Tuning condenser gang	A3394A
C2	.25 Mfd. cathode R.F. by-pass condenser	A3819
C3	.25 Mfd. screen R.F. by-pass condenser	
C4	.30 Mfd. plate R.F. by-pass condenser	
C5	.10 Mfd. Det. automatic bias by-pass condenser	A3820
C6	1.0 Mfd. R.F. cathode by-pass condenser	
C7	.10 Mfd. R.F. screen by-pass condenser	
C8	.0001 Mfd. R.F. plate by-pass condenser	A3815
C9	.0001 Mfd. R.F. plate by-pass condenser	A3861
C10	.02 Mfd. A.F. coupling condenser	A3821
C11	.10 Mfd. R.F. cathode by-pass condenser	A3820
C12	1.0 Mfd. output coupling condenser	
C13	(2) 8 Mfd. Mershon power filter condenser	A3845
C14	.5 Mfd. hum filter condenser	A2263
R1	5,500 ohm antenna resistance	A3791
R2	75 ohm UY 224 bias resistance	A3792
R3	300 ohm vol. control resistance	A4047
R4	2,500 ohm voltage divider resistance	A3794
R5	3,050 ohm voltage divider resistance	
R6	550,000 ohm Det. automatic bias resistance	A3796
R7	24,000 ohm cathode bias resistance	A3797
R8	250,000 ohm screen voltage reducing resistance	A3798
R9	90,000 ohm Det. plate resistance	A4048
R11	900,000 ohm A.F. grid leak resistance	A3800
R12	1,650 ohm UX 245 bias resistance	A3801
R13	280,000 ohm Det. plate resistance	A4050
R14	20,000 ohm hum filter resistance	A4049
R15	31 ohm phono. vol. limit resistance	A3686
R16	60 ohm phono. vol. control resistance	A3687
S1	Motor "on-off" switch	A4076
S2	"Hi-lo" switch (voltage control)	C3393B
S3	"On-off" switch (power control)	S3774
S4	"Radio-record" switch (3 gang)	A4051
T1	Antenna coupling transformer	A3826A
T2	R.F. Interstage transformers	A3909A
T3	R.F. choke	A3840A
T4	R.F. choke	A3841A
T5	A.F. output choke	A3779
T6	A.F. output transformer	A3780
T7	Power transformer	A3781
T8	Power filter choke	A1692
T9	Speaker field	A3529A
T10	Pickup (record)	D2283B
T11	Pickup transformer	A4055A
T12	Motor (25 cycle)	A3698
T12	Motor (60 cycle)	A3699

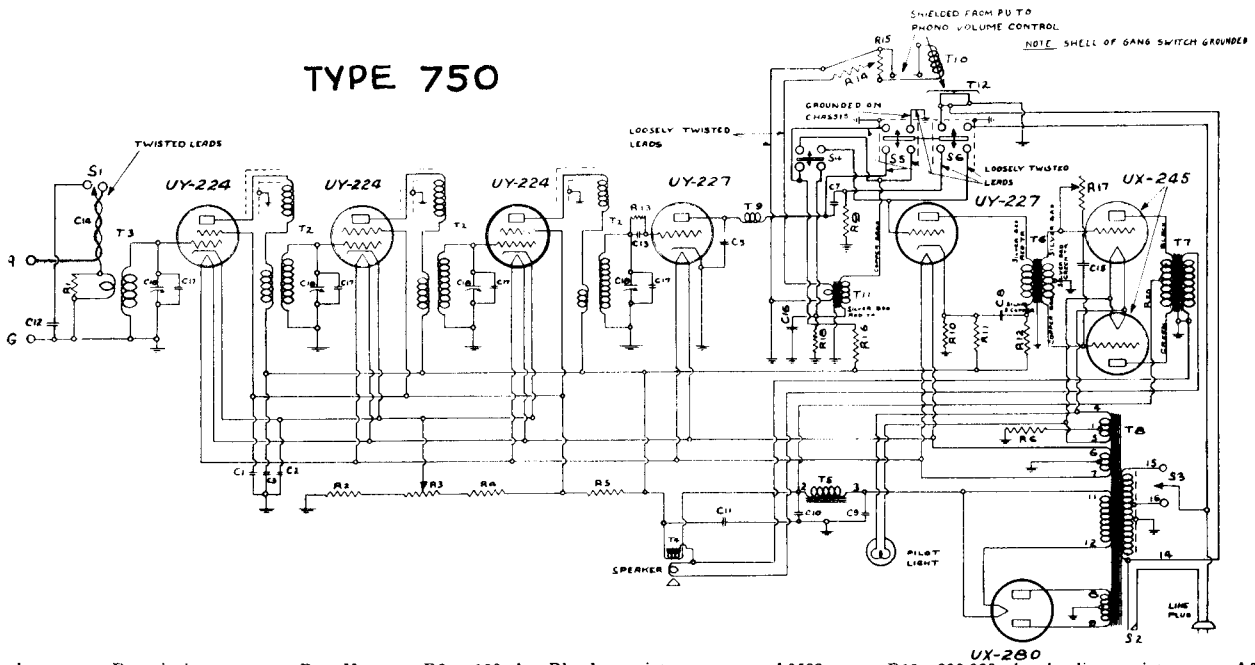
DE FOREST CROSLEY LTD.

ARIA AND TROUBADOR MODELS
TYPE 740



Symbol	Description	Part No.
C1	.25 Mfd. by-pass condenser }	
C2	.25 Mfd. by-pass condenser } Block	A3565
C3	.30 Mfd. by-pass condenser }	
C5	.002 Mfd. by-pass condenser	B3676
C7	.25 Mfd. by-pass condenser }	
C8	.25 Mfd. by-pass condenser } Block	A3564
C9	8 Mfd. filter condenser }	
C10	8 Mfd. filter condenser } Mershon	A1456
C11	8 Mfd. filter condenser }	
C12	.00025 Mfd. by-pass condenser	A1496
C13	Gang condenser }	
C14	Aligning condenser }	B3530B
C15	.0001 Mfd. grid condenser	A3669
R1	10,000 ohm Attenuator resistance	A3595
R2	130 ohm Bleeder resistance	A3589
R3	615 ohm vol. control (Potentio) resistance	A3602
R4	7,330 ohm voltage divider	A3596
R5	6,500 ohm voltage divider resistance	A3594
R6	835 ohm 245 bias resistance	A3572
R8	4,500 ohm Detector plate resistance	A3670
R9	1 megohm grid leak resistance	A3597
R10	400 ohm 227 bias resistance	A3590
R11	20,000 ohm 227 bias bleeder resistance	A3671
R12	20,000 ohm 1st audio filter resistance	A3598
R13	1.25 megohm grid leak resistance	B3668
S1	Local-distance (range control) switch	A3581
S2	Hi-lo (volt. control) switch	A3393B
S3	On-off switch	A2647
T2	Radio frequency transformers	3578A
T3	Antenna transformers	A3575A
T4	Speaker field coil	A3496
T5	Filter choke	D3567B
T6	Push-pull audio transformer }	
T7	Output audio transformer }	F3544B
T8	Power transformer	D3567B
T9	Radio frequency choke	B3677A
T10	Audio frequency choke	B3673B

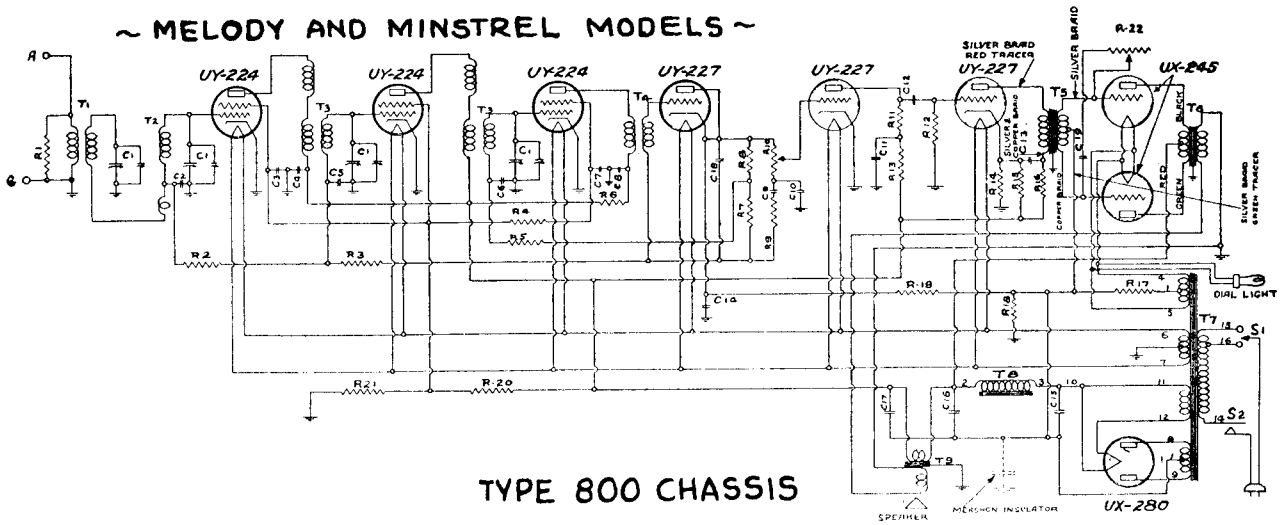
TYPE 750



Symbol	Description	Part No.
C1	.25 Mfd. by-pass condenser }	
C2	.25 Mfd. by-pass condenser } Block	A3565
C3	.30 Mfd. by-pass condenser }	
C5	.002 Mfd. by-pass condenser	B3676
C7	.25 Mfd. by-pass condenser } Block	
C8	.25 Mfd. by-pass condenser } (also C16)	A3564
C9	8 Mfd. filter condenser }	
C10	8 Mfd. filter condenser } Mershon	A1456
C11	8 Mfd. filter condenser }	
C12	.00025 Mfd. by-pass condenser	A1496
C13	.0001 Mfd. grid condenser	A3669
C14	.00003 Mfd. antenna condenser (Twisted wire)	A3723
C15	.002 Mfd. by-pass condenser (Tone control)	B3676
C16	.5 Mfd. by-pass condenser	A3564
C17	Aligning condenser }	
C18	Gang condenser }	B3530B
R1	10,000 ohm Attenuator resistance	A3595
R2	130 ohm Bleeder resistance	A3589
R3	615 ohm voltage control resistance (Potentio)	A3782
R4	7230 ohm voltage divider resistance	A3596
R5	6,500 ohm voltage divider resistance	A3594
R6	835 ohm 245 bias resistance	A3572
R9	1 megohm grid leak resistance	A3597
R10	400 ohm 227 bias resistance	A3590
R11	20,000 ohm 227 bias bleeder resistance	A3671
R12	20,000 ohm 1st audio filter resistance	A3598
R13	1.25 megohm grid leak resistance	A3703
R14	31 ohm limiting resistance	A3686
R15	60 ohm phono volume control resistance (Potentio)	A3687
R16	10,000 ohm det. plate resistance	A3948
R17	1 megohm tone control resistance (Potentio)	A3777
R18	200,000 ohm loading resistance	A3947
S1	Local-distance (range control) switch	A3581
S2	On-off switch	A2647
S3	Hi-lo (volt. control) switch	A3393B
S4	Radio-record (on volume control) switch	A3782
S5	Radio-record } Gang switch	A3945
S6	Radio-record }	
T2	Radio frequency transformers	3578A
T3	Antenna switch	A3575A
T4	Speaker field (Pot) coil	A3496
T5	Filter choke	D3567B
T6	Push-pull audio transformer }	
T7	Output audio transformer }	F3544B
T8	Power transformer	D3567B
T9	Radio frequency choke	B3677A
T10	Phono pickup	A2283
T11	Phono pickup transformer	B3684
T12	Phono motor 25 cycle	A3698
	Phono motor 60 cycle	A3699

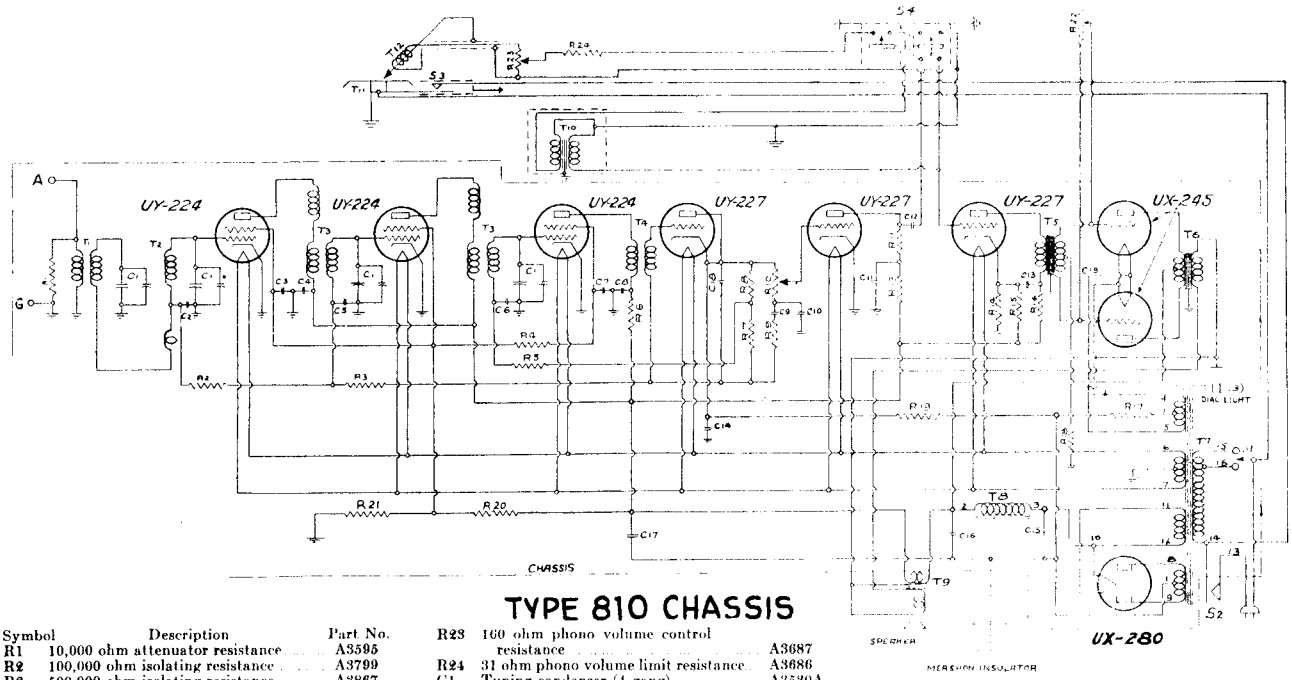
DE FOREST CROSLEY LTD.

~ MELODY AND MINSTREL MODELS ~



TYPE 800 CHASSIS

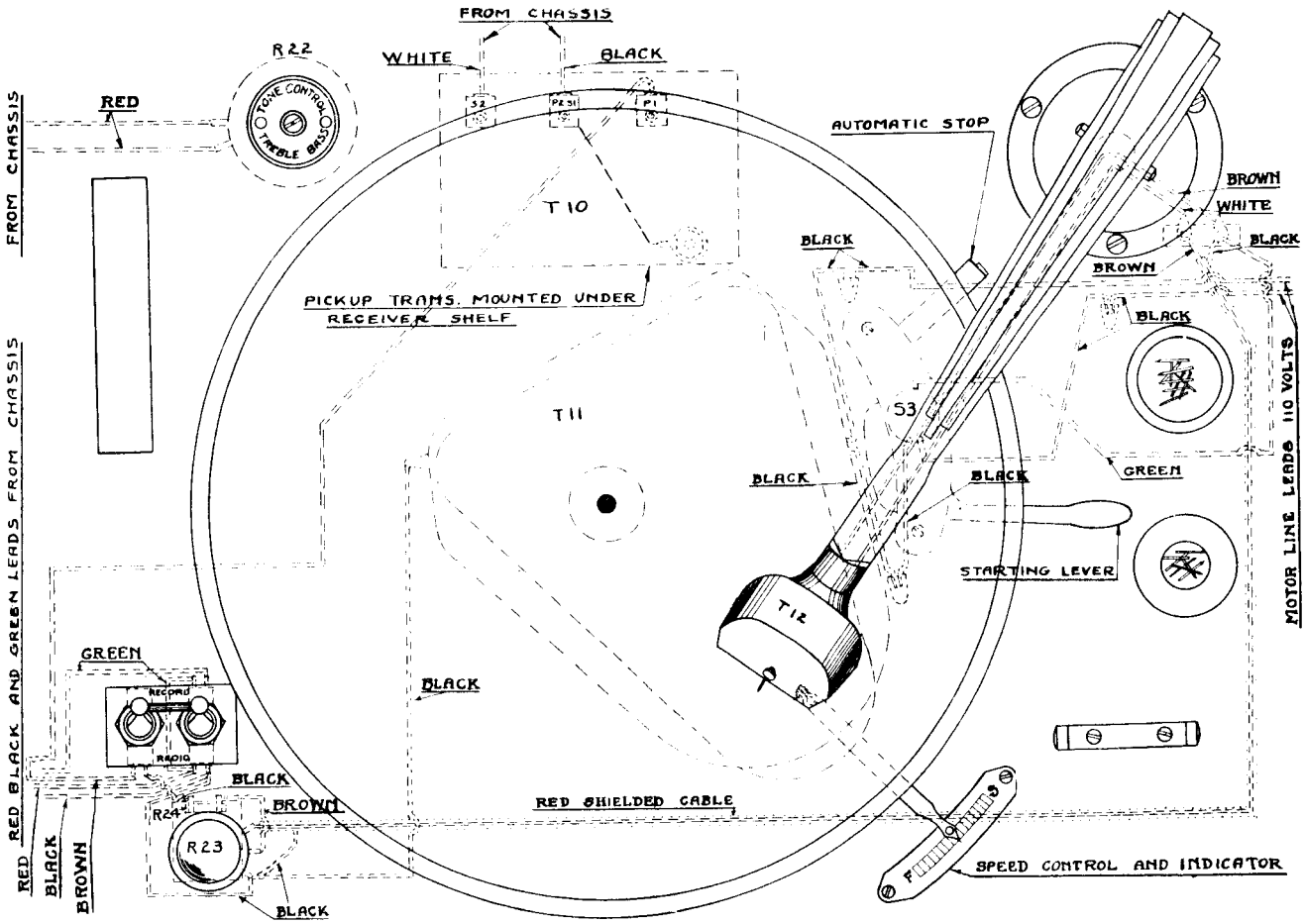
Symbol	Description	Part No.
R1	10,000 ohm attenuator resistance	A3595
R2	100,000 ohm isolating resistance	A3799
R3	500,000 ohm isolating resistance	A3867
R4	1,000 ohm isolating resistance	A3869
R5	500,000 ohm isolating resistance	A3867
R6	1,000 ohm isolating resistance	A3869
R7	25,000 ohm voltage dividing resistance	A3600
R8	25,000 ohm voltage dividing resistance	A3600
R9	250,000 ohm plate resistance	A3798
R10	1,000,000 ohm level control resistance	C3904
R11	250,000 ohm plate resistance	A3798
R12	500,000 ohm grid leak resistance	A3867
R13	100,000 ohm isolating resistance	A3799
R14	400 ohm bias resistance	A3590
R15	20,000 ohm A.F. bias bleeder resistance	A3671
R16	18,000 ohm isolating resistance	A3598
R17	835 ohm UX 245 bias resistance	A3868
R18	67 ohm R.F. bias (constant) resistance	
R19	250,000 ohm isolating resistance	A3907
R20	4,700 ohm voltage divider resistance	A3865
R21	5,600 ohm bleeder resistance	A3866
R22	1,000,000 ohm tone control resistance	C3922
C1	Tuning condenser (4 gang)	A3530A
C2	.05 Mfd. by-pass condenser	B3873
C3	.1 Mfd.	B3872
C4	.1 Mfd.	R.F. by-pass condenser
C5	.05 Mfd. by-pass condenser	B3873
C6	.05 Mfd. by-pass condenser	B3873
C7	.1 Mfd.	B3874
C8	.1 Mfd.	R.F. by-pass condenser
C9	.005 Mfd. grid condenser	B3891
C10	.0001 Mfd. R.F. by-pass condenser	B3861
C11	.1 Mfd. by-pass condenser	B3871
C12	.1 Mfd. grid condenser	B3875
C13	25 Mfd. by-pass condenser	B3871
C14	1.0 Mfd. R.F. by-pass condenser	
C15	9 Mfd.	
C16	18 Mfd.	A3932
C17	9 Mfd.	Mershon filter condenser
C18	.00025 Mfd. R.F. by-pass condenser	B1496
C19	.002 Mfd. tone control condenser	B3676
S1	Voltage control switch	A3393A
S2	"On-off" power switch	A2647
T1	R. F. Antenna transformer	
T2	R. F. pre-selection transformer	3886A
T3	R. F. inter-stage transformer	
T4	R. F. fixed-tune transformer	A3889A
T5	A. F. intermediate transformer	A3903A
T6	A. F. output transformer	
T7	Power transformer	A3884A
T8	Filter choke	
T9	Speaker (field)	A3913A



TYPE 810 CHASSIS

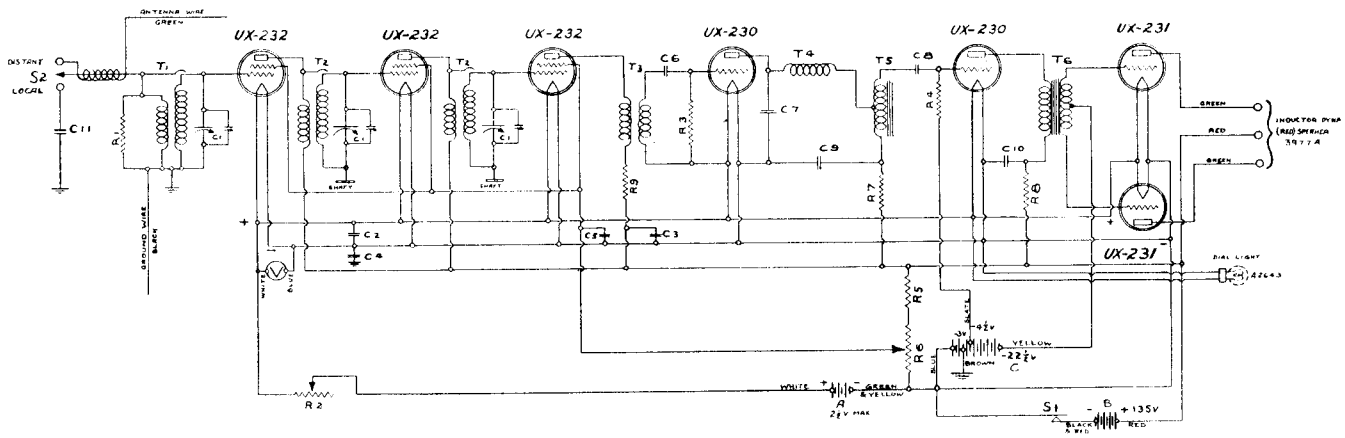
Symbol	Description	Part No.
R1	10,000 ohm attenuator resistance	A3595
R2	100,000 ohm isolating resistance	A3799
R3	500,000 ohm isolating resistance	A3867
R4	1,000 ohm isolating resistance	A3869
R5	500,000 ohm isolating resistance	A3867
R6	1,000 ohm isolating resistance	A3869
R7	25,000 ohm voltage dividing resistance	A3600
R8	25,000 ohm voltage dividing resistance	A3600
R9	250,000 ohm plate resistance	A3798
R10	1,000,000 ohm level control resistance	C3904
R11	250,000 ohm plate resistance	A3798
R13	100,000 ohm isolating resistance	A3799
R14	400 ohm bias resistance	A3590
R15	20,000 ohm A.F. bias bleeder resistance	A3671
R16	18,000 ohm isolating resistance	A3598
R17	835 ohm UX 245 bias resistance	A3868
R18	67 ohm R.F. bias (constant) resistance	
R19	250,000 ohm isolating resistance	A3907
R20	4,700 ohm voltage divider resistance	A3865
R21	5,600 ohm bleeder resistance	A3866
R22	1,000,000 ohm tone control resistance	A4034A
R23	160 ohm phono volume control resistance	A3687
R24	31 ohm phono volume limit resistance	A3686
C1	Tuning condenser (4 gang)	A3530A
C2	.05 Mfd. by-pass condenser	B3873
C3	.1 Mfd.	B3872
C4	.1 Mfd.	R.F. by-pass condenser
C5	.05 Mfd. by-pass condenser	B3873
C6	.05 Mfd. by-pass condenser	B3873
C7	.1 Mfd.	B3874
C8	.1 Mfd.	R.F. by-pass condenser
C9	.005 Mfd. grid condenser	B3891
C10	.0001 Mfd. R.F. by-pass condenser	B3861
C11	.1 Mfd. by-pass condenser	B3871
C12	.1 Mfd. grid condenser	B3875
C13	.25 Mfd. by-pass condenser	B3871
C14	1.0 Mfd. R.F. by-pass condenser	
C15	9 Mfd.	
C16	18 Mfd.	A3932
C17	9 Mfd.	Mershon filter condenser
C18	.00025 Mfd. R.F. by-pass condenser	B1496
C19	.002 Mfd. tone control condenser	B3676
S1	Voltage control switch	A3393A
S2	"On-off" power switch	A2647
S3	Automatic stop switch	A3812
S4	"Radio-record" change-over switch	A3955
T1	R. F. Antenna transformer	
T2	R. F. pre-selection transformer	3886A
T3	R. F. inter-stage transformer	
T4	R. F. fixed-tune transformer	A3889A
T5	A. F. intermediate transformer	A3903A
T6	A. F. output transformer	
T7	Power transformer	A3884A
T8	Filter choke	
T9	Speaker (field)	A3913A
T10	Pickup transformer	A3684
T11	Motor (25 cycle)	A3810
	Motor (60 cycle)	A3811
T12	Pickup	A3697A

DE FOREST CROSLEY LTD.



TYPE 810 CHASSIS

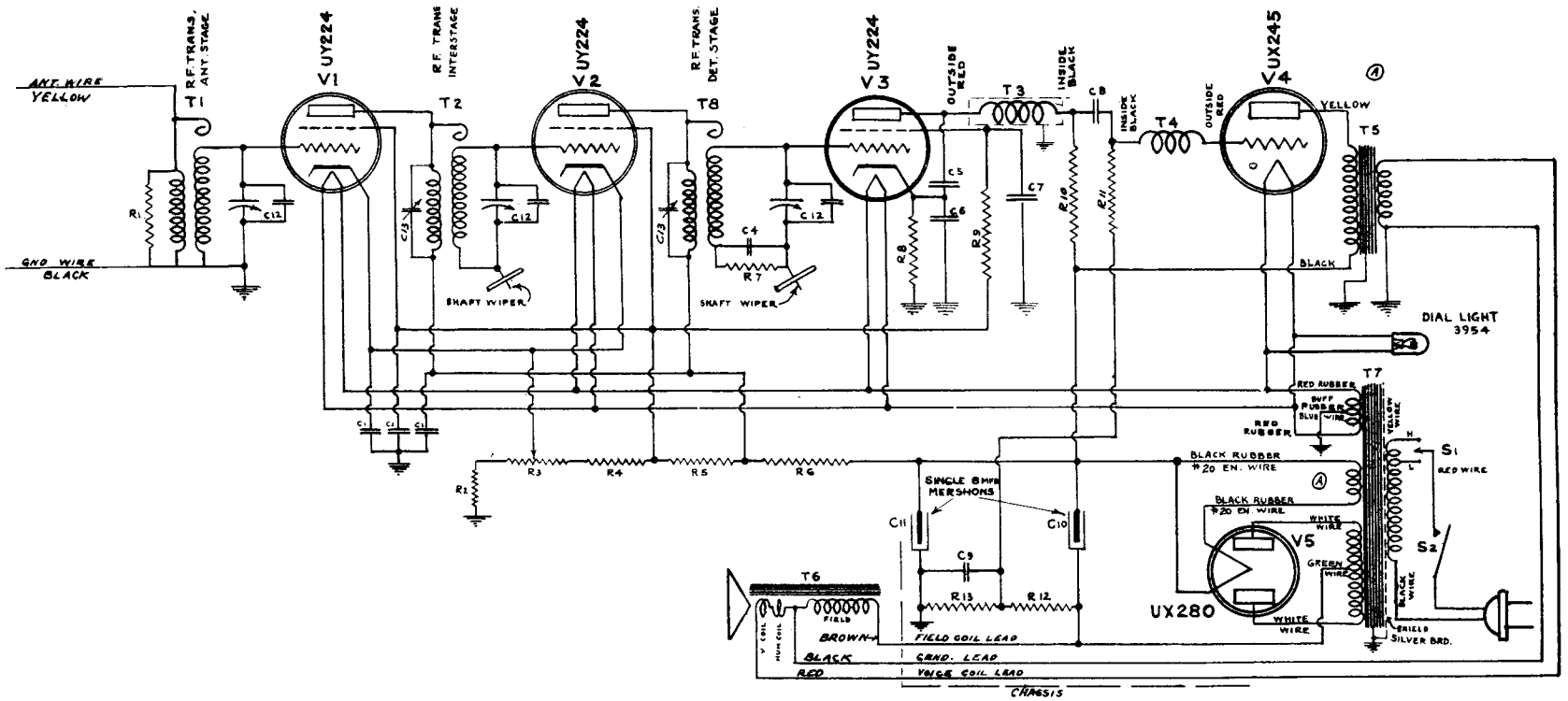
Motor Board Wiring



TYPE 700 CHASSIS

("Serenata" Model)

Symbol	Description	Part No.
C1	Tuning condenser (3 gang)	A3394B
C2	.5 Mfd. filament by-pass condenser	A3972
C3	.5 Mfd. plate by-pass condenser	
C4	.5 Mfd. filament by-pass condenser	
C5	.5 Mfd. screen by-pass condenser	
C6	.00025 Mfd. grid condenser	A3993
C7	.00025 Mfd. plate by-pass condenser	A3993
C8	.002 Mfd. grid condenser	A3992
C9	.25 Mfd. plate by-pass condenser	A3973
C10	.25 Mfd. plate by-pass condenser	
C11	.00025 Mfd. antenna by-pass condenser	A1496
R1	5,500 ohm Antenna resistance	A3791
R2	2 ohm filament resistance	A3978
R3	3 megohm grid leak resistance	A3987
R4	900,000 ohm grid leak resistance	A3800
R5	25,000 ohm bleeder resistance	A3990
R6	35,000 ohm volume control resistance	A3994
R7	45,000 ohm voltage divider resistance	A3988
R8	20,000 ohm voltage divider resistance	A3989
R9	5,500 ohm isolating resistance	A3927
S1	B supply "on-off" switch	A3978
S2	"Local-Distance" switch	B3581
T1	Antenna transformer	A4090A
T2	R. F. Interstage transformers	A4089A
T3	R. F. Untuned transformer	A3889A
T4	Radio frequency choke	A3841A
T5	Audio frequency transformer	A2095
T6	Audio frequency transformer	A2096
V	Filament Voltmeter	A3979



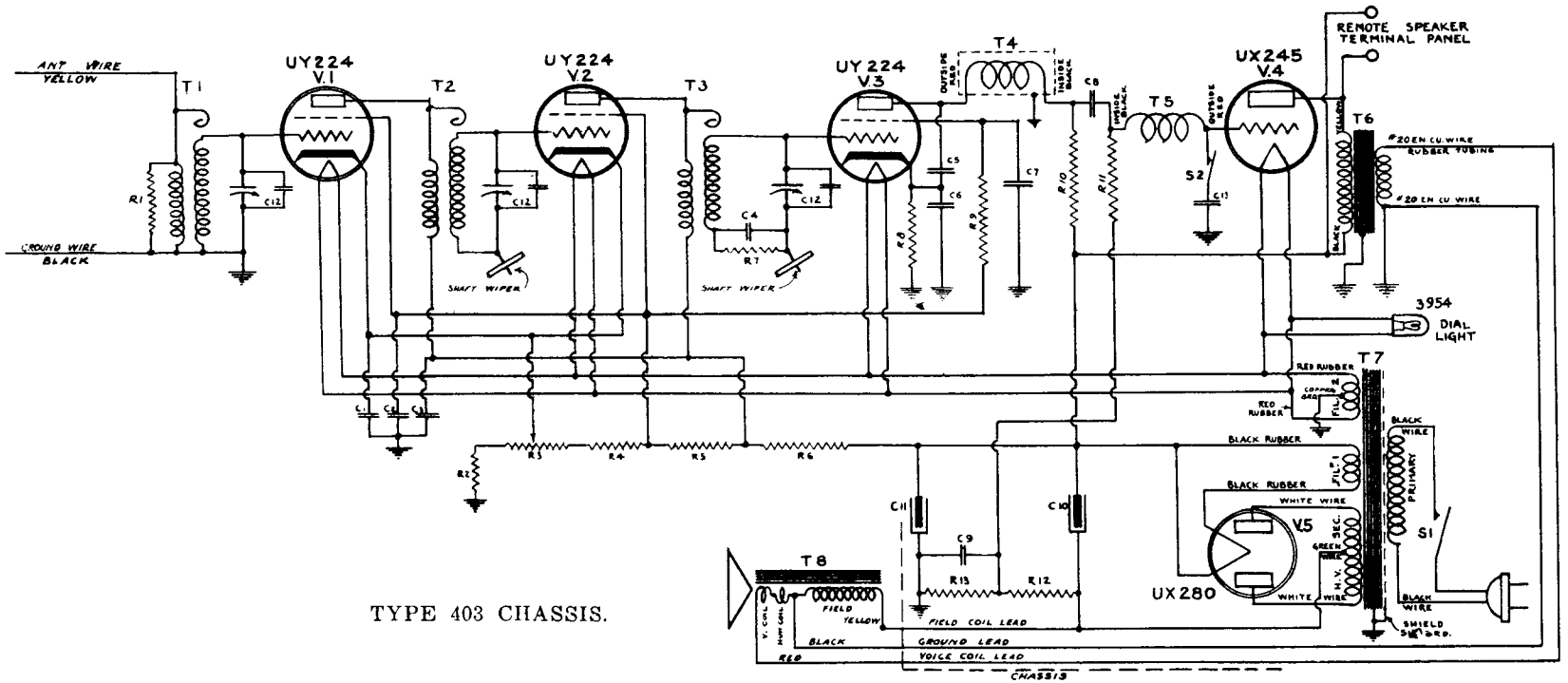
TYPE 402 CHASSIS
CIRCUIT DIAGRAM
("Drake" and "Nelson" Models)

Symbol	Description	Part No.
C1	.25 Mfd. cathod R.F. by-pass condenser	A4231
C2	.1 Mfd. screen R.F. by-pass condenser. }	B4230
C3	.1 Mfd. plate R.F. by-pass condenser.. }	
C4	.018 Mfd. Det. auto-bias by-pass condenser	C4229
C5	.0001 Mfd. Det. plate by-pass condenser	A3815
C6	1 Mfd. Det. cathode bias by-pass condenser	C4229
C7	.1 Mfd. Det. screen by-pass condenser	B4230
C8	.02 Mfd. A. F. coupling condenser	A4220
C9	.05 Mfd. output bias by-pass condenser	(See note
C10	8 Mfd. Mershon filter condenser	A4173
C11	8 Mfd. Mershon filter condenser	A4173
C12	3 gang tuning condenser	A4207A
C13	R.F. resonating condenser	A4314

R1	5,500 ohm antenna resistance	B3791
R2	120 ohm R.F. bias resistance	A4205
R3	615 ohm (vol. cont.) bias resistance	A4242
R4	5,000 ohm voltage divider resistance... }	
R5	5,140 ohm voltage divider resistance... }	A4205
R6	3,080 ohm voltage divider resistance... }	
R7	550,000 ohm Det. auto-bias resistance	A3796
R8	35,000 ohm Det. cathode bias resistance	A4226
R9	250,000 ohm screen voltage drop resistance	A4225
R10	400,000 ohm Det. plate resistance	A4224
R11	900,000 ohm A. F. grid leak resistance	A3800
R12	800,000 ohm resistance	A4223
R13	1,000,000 ohm	A4222

T1	Antenna coupling transformer	4297A
T2	R. F. interstage transformer	4298A
T3	Detector R. F. choke	A4293A
T4	Output R. F. choke	A4296A
T5	A. F. output transformer	A4245A
T6	Speaker field (used as filter choke)	4261
T7	Power transformer	A4243A
T8	R. F. interstage transformer	4311A
S1	Hi-lo switch	A4219A
S2	On-off switch	A4242

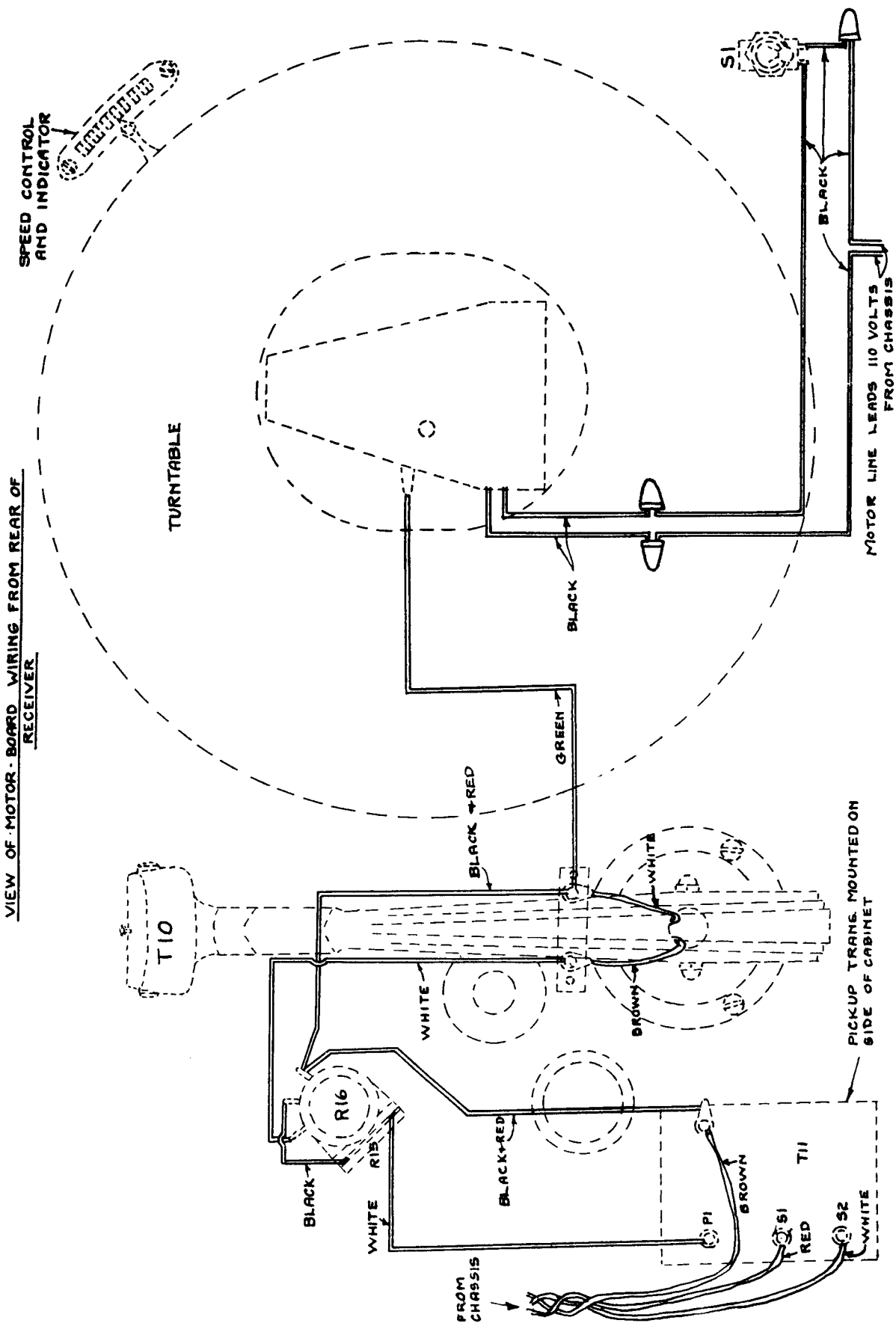
NOTE:—First releases use two capacities of .1 Mfd. in series, parts B4230 and A4458. Later releases use only .05 section of block B4230.



TYPE 403 CHASSIS.

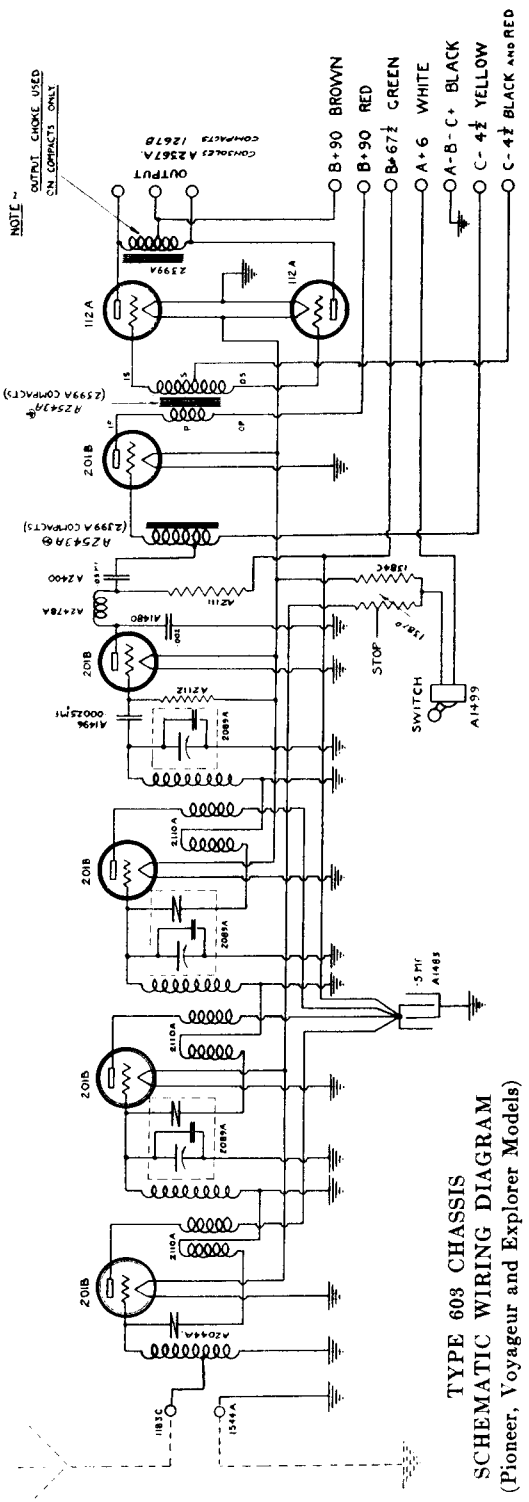
Symbol	DESCRIPTION	Part No.
C1	R. F. cathode by-pass condenser, .25 Mfd.	4772
C2	R. F. screen by-pass condenser, .1 Mfd.	4810(B)
C3	R. F. plate by-pass condenser, .1 Mfd.	4810(B)
C4	Det. grid by-pass condenser, .018 Mfd.	4229(C)
C5	Det. plate by-pass condenser, .0001 Mfd.	3815
C6	Det. cathode by-pass condenser, 1.0 Mfd.	4229(C)
C7	Det. screen by-pass condenser, .1 Mfd.	4810(B)
C8	A. F. coupling by-pass condenser, .02 Mfd.	4220
C9	245 bleeder by-pass condenser, .03 Mfd.	4810(B)
C10	Filter condenser, (electrolytic) 8 Mfd.	4560
C11	Filter condenser, (electrolytic) 8 Mfd.	4560
C12	R. F. tuning condenser (3 gang)	4728
C13	Tone control condenser, .001 Mfd.	3588
R1	Ant. resistance, 5,500 Ohms	3791
R2	R. F. minimum bias resistor, 120 Ohms	4205(A)
R3	Volume control resistor, 615 Ohms	4534
R4	Voltage reducing resistor, 5,000 Ohms	4205(A)
R5	Voltage reducing resistor, 5,140 Ohms	4205(A)
R6	Voltage reducing resistor, 3,080 Ohms	4205(A)
R7	Det. automatic bias resistor, 550,000 Ohms	3796
R8	Det. cathode bias resistor, 35,000 Ohms	4226
R9	Det. screen filter resistor, 250,000 Ohms	4225
R10	Det. plate resistor, 400,000 Ohms	4224
R11	245 grid leak resistor, 900,000 Ohms	3800
R12	245 grid bias resistor, 800,000 Ohms	4223
R13	245 grid bias bleeder resistor, 1,000,000 Ohms	4681
S1	"On-off" power switch	4534(D)
S2	Tone control switch	4784
T1	R. F. transformer, antenna stage	4729
T2	R. F. transformer, second stage	4730
T3	R. F. transformer, detector stage	4731
T4	R. F. choke, detector stage	4293
T5	R. F. choke, output stage	4296
T6	A. F. output transformer	4715
T7	Power transformer	4725
T8	Speaker (Type D6)	4580
(A)	Part of candohm resistor strip	4205
(B)	Part of block condenser	4810
(C)	Part of block condenser	4229
(D)	Part of volume control assembly	4534

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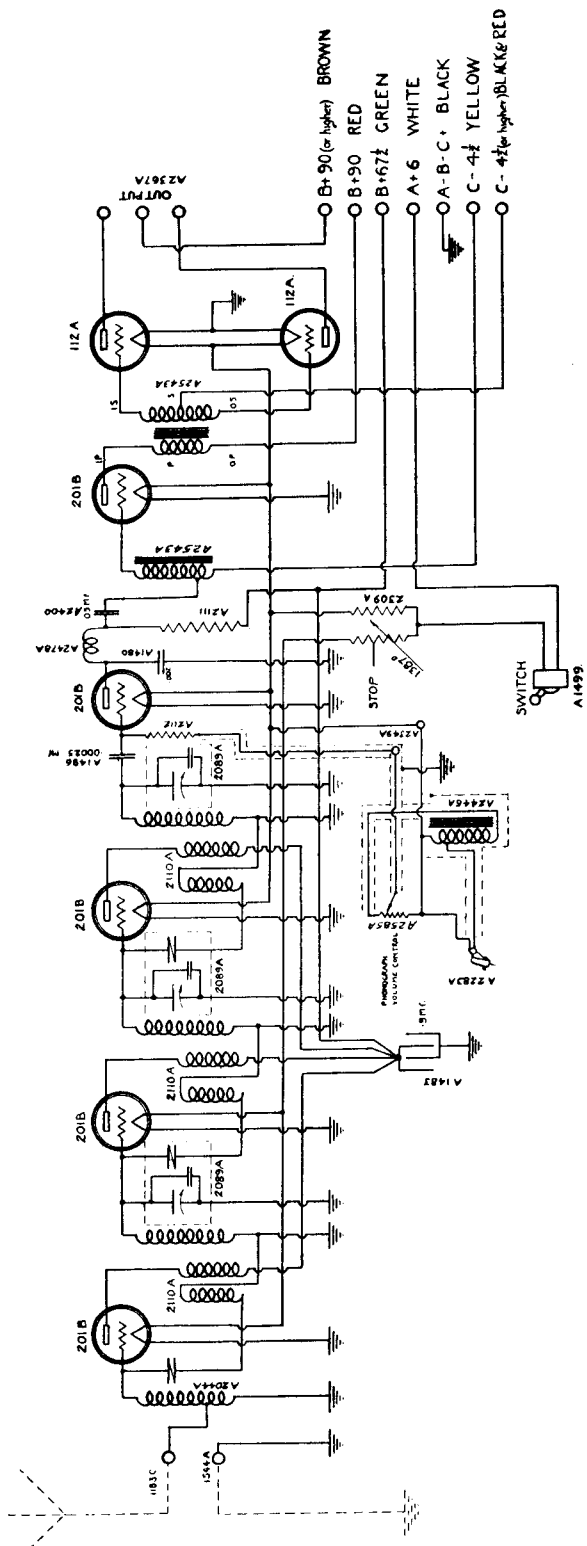


PICTURE DIAGRAM—TYPE 410 CHASSIS
("Elgin" Model—Motor Board Wiring)

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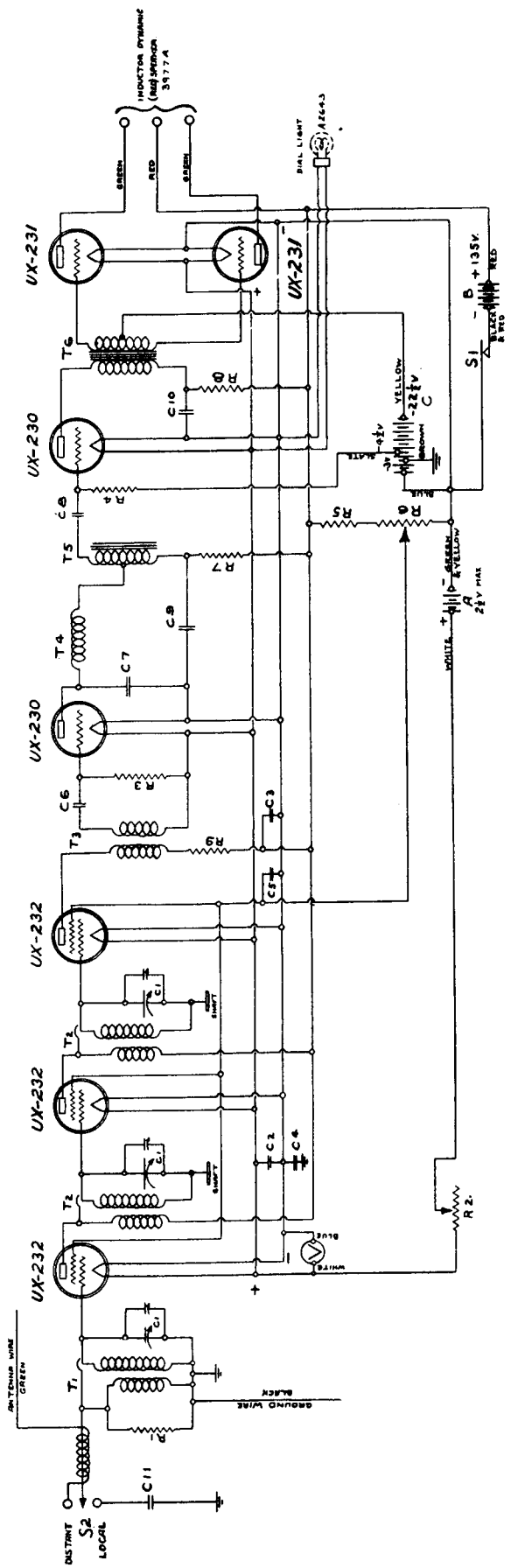


TYPE 603 CHASSIS
SCHEMATIC WIRING DIAGRAM
(Pioneer, Voyageur and Explorer Models)



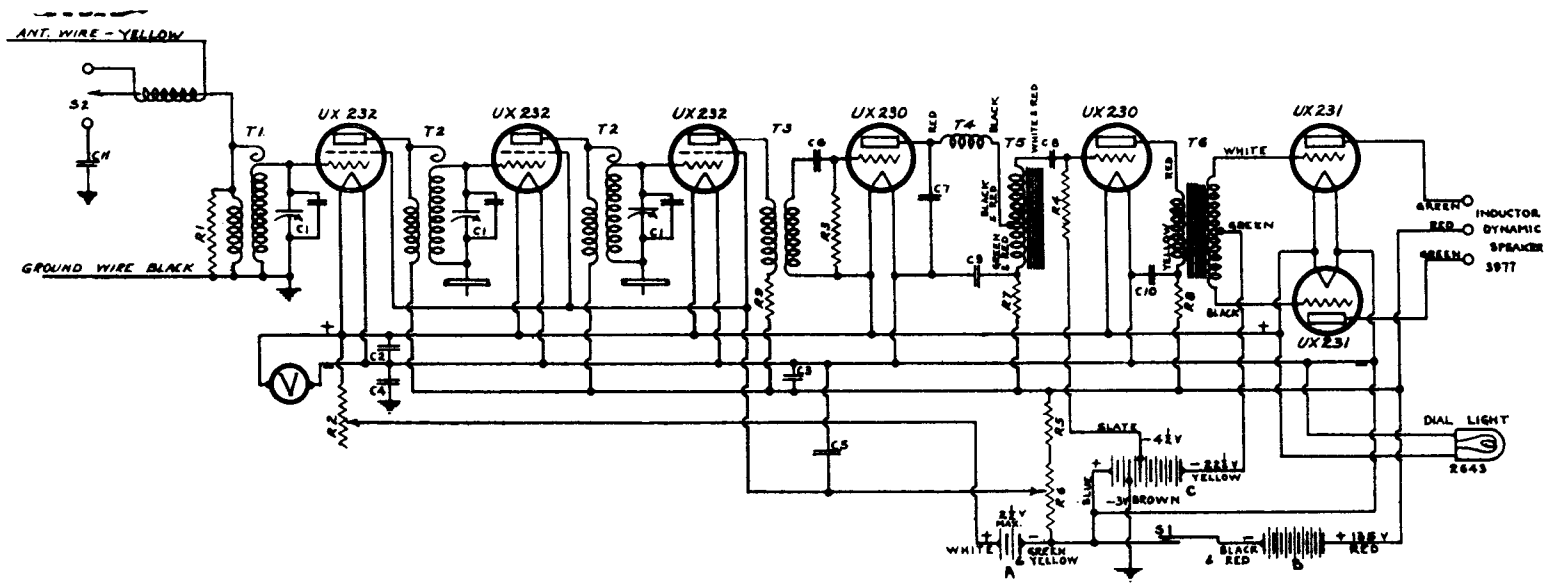
TYPE 605 CHASSIS
SCHEMATIC WIRING DIAGRAM
(Adventurer Model)

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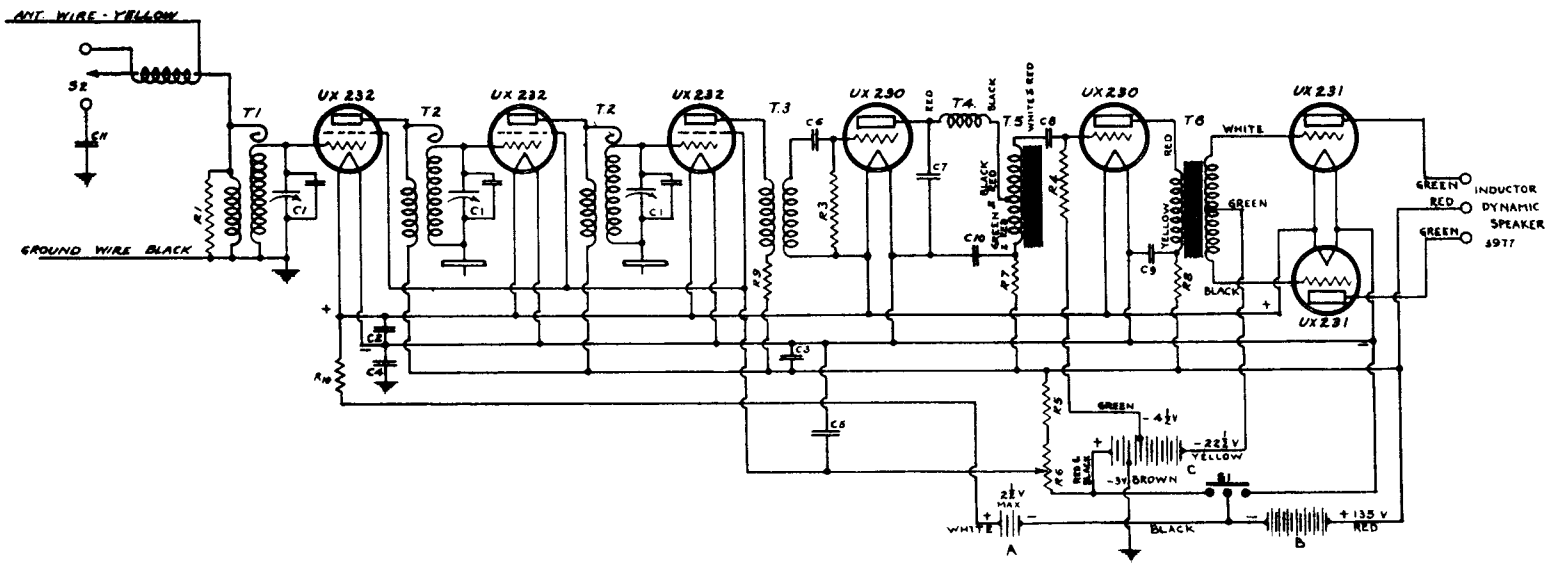
CIRCUIT DIAGRAM—TYPE 700 CHASSIS
("Serenata" Model)

Symbol	Description	Part No.
C1	Tuning condenser (3 gang)	A3394B
C2	.5 Mfd. filament by-pass condenser	A3972
C3	.5 Mfd. plate by-pass condenser	
C4	.5 Mfd. filament by-pass condenser	
C5	.5 Mfd. screen by-pass condenser	
C6	.00025 Mfd. grid condenser	A3993
C7	.00025 Mfd. plate by-pass condenser	A3993
C8	.002 Mfd. grid condenser	A3992
C9	.25 Mfd. plate by-pass condenser	A3973
C10	.25 Mfd. plate by-pass condenser	
C11	.00025 Mfd. antenna by-pass condenser	A1496
R1	5,500 ohm Antenna resistance	A3791
R2	2 ohm filament resistance	A3978
R3	3 megohm grid leak resistance	A3987
R4	900,000 ohm grid leak resistance	A3800
R5	25,000 ohm bleeder resistance	A3990
R6	35,000 ohm volume control resistance	A3994
R7	45,000 ohm voltage divider resistance	A3988
R8	20,000 ohm voltage divider resistance	A3989
R9	5,500 ohm isolating resistance	A3927
S1	B supply "on-off" switch	A3978
S2	"Local-Distance" switch	B3581
T1	Antenna transformer	A4090A
T2	R. F. Interstage transformers	A4089A
T3	R. F. Untuned transformer	A3889A
T4	Radio frequency choke	A3841A
T5	Audio frequency transformer	A2095
T6	Audio frequency transformer	A2096
V	Filament Voltmeter	A3979



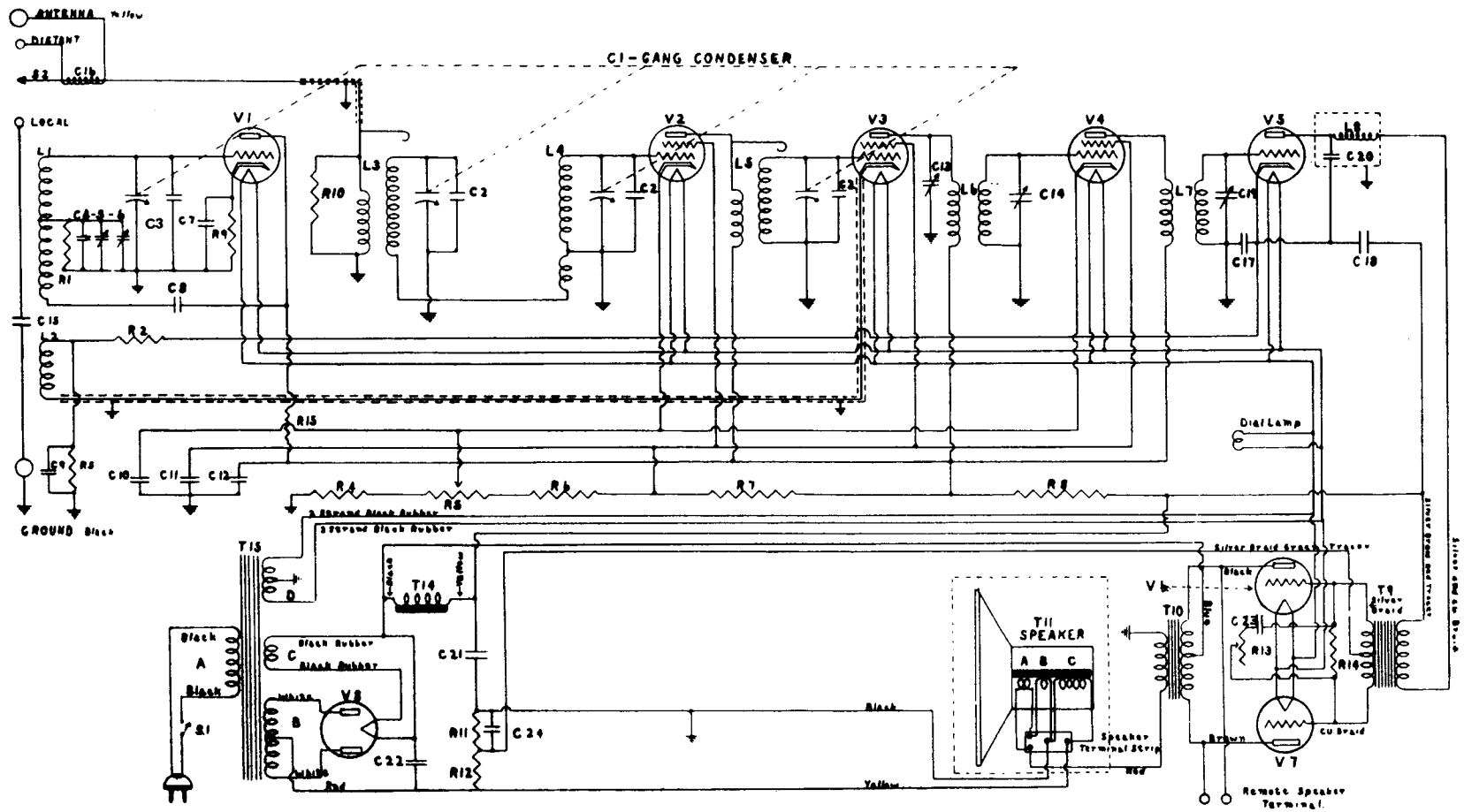
TYPE 701 CHASSIS—CIRCUIT DIAGRAM

Symbol	DESCRIPTION	Part No.
C1	Tuning Condenser (3 gang)	4811
C2	Filament by-pass condenser, .5 Mfd.	4803
C3	R. F. Plate by-pass condenser, .5 Mfd.	4803
C4	Filament by-pass condenser, .5 Mfd.	4803
C5	R. F. Screen by-pass condenser, .5 Mfd.	4803
C6	Det. Grid condenser, .00025 Mfd.	3993
C7	Det. Plate by-pass condenser, .00025 Mfd.	3993
C8	A. F. coupling condenser, .002 Mfd.	3992
C9	A. F. filter condenser, .25 Mfd.	4804
C10	A. F. filter condenser, .25 Mfd.	4804
C11	Antenna condenser, .00025 Mfd.	1496
R1	Antenna resistance, 5500 Ohms	3791
R2	Voltage control resistance, 2 Ohms	3978
R3	Det. grid leak resistance, 3,000,000 Ohms	3987
R4	A. F. grid leak resistance, 900,000 Ohms	3800
R5	Bleeder resistance, 25,000 Ohms	3990
R6	Volume control resistance, 35,000 Ohms	3994
R7	Voltage divider resistance, 45,000 Ohms	3988
R8	Voltage divider resistance, 22,000 Ohms	3989
R9	R. F. isolating resistance, 6,100 Ohms	4827
S1	On-off switch (part of R2)	3978
S2	Local-distance switch	3581
T1	Antenna coupling transformer	4815
T2	R. F. interstage transformer	4816
T3	R. F. untuned transformer	3889
T4	Detector R. F. choke	4826
T5	A. F. (1st stage) transformer	4860
T6	A. F. (input) transformer	4860



TYPE 702 CHASSIS—CIRCUIT DIAGRAM

Symbol	DESCRIPTION	Part No.
C1	Tuning condenser (3 gang)	4811
C2	Filament by-pass condenser, .5 Mfd.	4803
C3	R. F. plate by-pass condenser, .5 Mfd.	4803
C4	Filament by-pass condenser, .5 Mfd.	4803
C5	R. F. screen by-pass condenser, .5 Mfd.	4803
C6	Det. grid condenser, .00025 Mfd.	3993
C7	Det. plate by-pass condenser, .00025 Mfd.	3993
C8	A. F. coupling condenser, .002 Mfd.	3992
C9	A. F. filter condenser, .25 Mfd.	4804
C10	A. F. filter condenser, .25 Mfd.	4804
C11	Antenna condenser, .00025 Mfd.	1496
R1	Antenna resistance, 5,500 Ohms	3791
R3	Det. grid leak resistance, 3,000,000 Ohms	3987
R4	A. F. grid leak resistance, 900,000 Ohms	3800
R5	Bleeder resistance, 25,000 Ohms	3990
R6	Volume control resistance, 35,000 Ohms	3994
R7	Voltage divider resistance, 45,000 Ohms	3988
R8	Voltage divider resistance, 22,000 Ohms	3989
R9	R. F. isolating resistance, 6,100 Ohms	4827
R10	Fixed filament resistance, .6 Ohms	5243
S1	On-off switch	4986
S2	Local-distance switch	3581
T1	Antenna coupling transformer	4815
T2	R. F. interstage transformer	4816
T3	R. F. untuned transformer	3889
T4	Detector R. F. choke	4826
T5	A. F. (1st stage) transformer	4860
T6	A. F. (input) transformer	4860

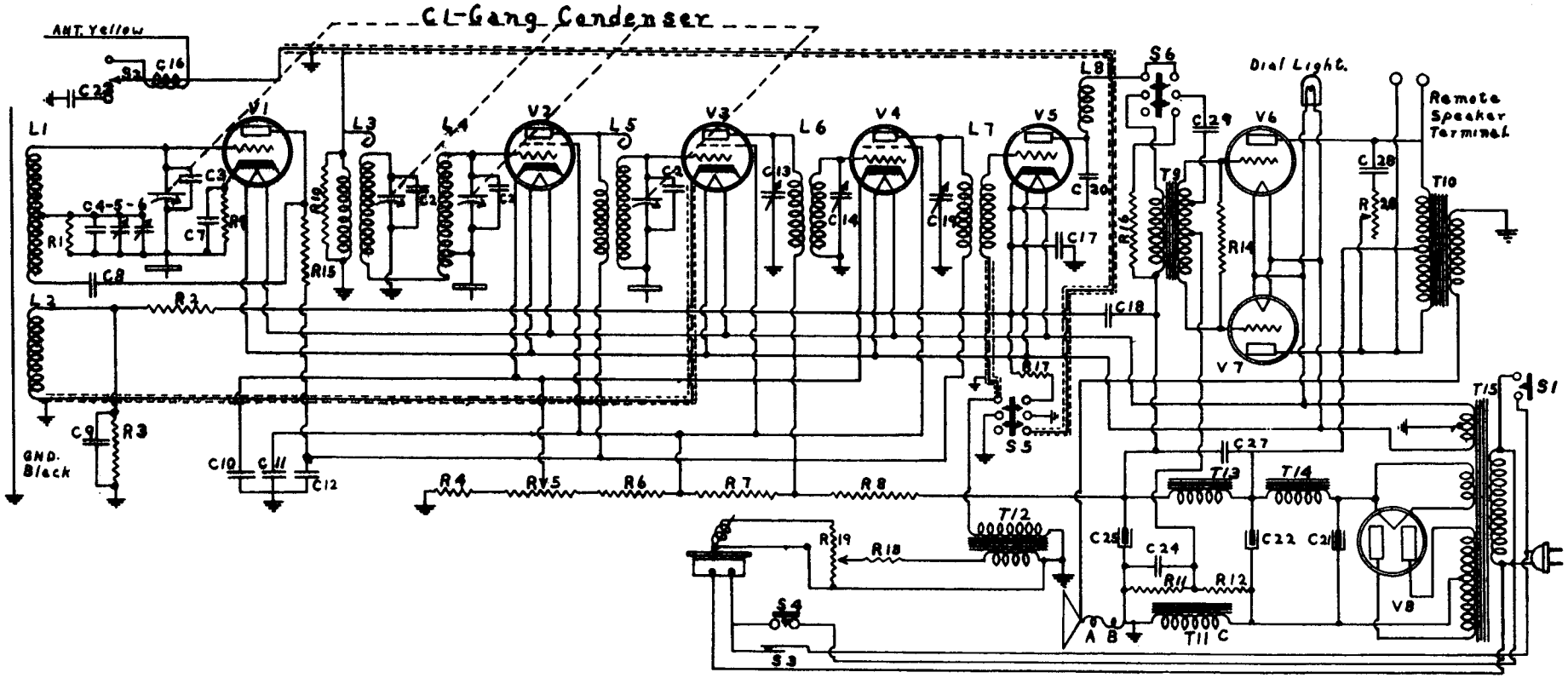


Circuit Diagram—Type 705 Chassis

Symbol	DESCRIPTION	Part No.
C. 1	Gang Condenser, 4 unit	4558
C. 2	R.F. Aligning Condensers	
C. 3	Osc. Aligning Condenser	
C. 4	Osc. Padding Condenser ..... .0005 mfd.	4554
C. 5	Osc. Aligning Condenser	4673
C. 6	Osc. Aligning Condenser ..... 380 mmfd.	
C. 7	Osc. Cathode Bypass Condenser .... .05 mfd.	4513
C. 8	Osc. Plate Coupling Condenser.. .0001 mfd.	3815
C. 9	Det. Cathode Bypass Condenser .... .05 mfd.	4679
C.10	R.F. & I.F. Cathode Bypass Condenser ..... .25 mfd.	4550 (A)
C.11	R.F. & I.F. Screen Bypass Condenser ..... .3 mfd.	4802
C.12	Osc. R. F. & I.F. Plate Bypass Condenser ..... .3 mfd.	4550 (A)
C.13	I.F. Aligning Condenser	(B)
C.14	I.F. Aligning Condenser	(B)
C.15	Antenna Bypass Condenser..... .00025 mfd.	1496
C.16	Antenna Series Condenser ..... 30 mmfd.	(C)
C.17	Det. Cathode Bypass Condenser ..... 1 mfd.	4487
C.18	A.F. Filter Condenser ..... .12 mfd.	4553
C.19	I.F. Aligning Condenser	(B)
C.20	Det. Plate R.F. Bypass Condenser .002 mfd.	4548
C.21	Power Filter (Mershon) Condenser 8 mfd.	4560
C.22	Power Filter (Mershon) Condenser 8 mfd.	4560

Symbol	DESCRIPTION	Part No.
C.23	A.F. Tone Control Condenser..... .001 mfd.	4514
C.24	245 Bias Bypass Condenser..... .5 mfd.	4801
(A)	Two sections in one unit (B) Part of Assemblies L6 and 7 (C) Twisted leads of S2	
R. 1	Osc. Voltage Equalizing Resistance .....25000 ohms	4591
R. 2	Mixer, Det. Bias Resistance .....30,000 ohms	4608
R. 3	Mixer, Det. Bias Resistance.....6600 ohms	4545
R. 4	R.F. Minimum Bias Resistance.. 140 ohms	4861 (E)
R. 5	R.F. Variable Bias (Vol. Cont.) Resistance ..... 725 ohms	4891
R. 6	Voltage Dividing Resistance.....6225 ohms	4676
R. 7	Voltage Dividing Resistance.....6400 ohms	4622
R. 8	Voltage Dividing Resistance.....2200 ohms	4622
R. 9	Osc. Bias (Cathode) Resistance..5000 ohms	4546
R.10	Antenna Resistance .....7000 ohms	4378
R.11	245 Bias Resistance .....1000000 ohms	4681
R.12	245 Bias Resistance .....400,000 ohms	4680
R.13	A.F. Tone Control Resistance....6 megohms	4611
R.14	A.F. Shunt Resistance .....3.5 megohms	4892
R.15	Osc. Plate Resistance .....30000 ohms	4631
(E)	In two sections in first releases	

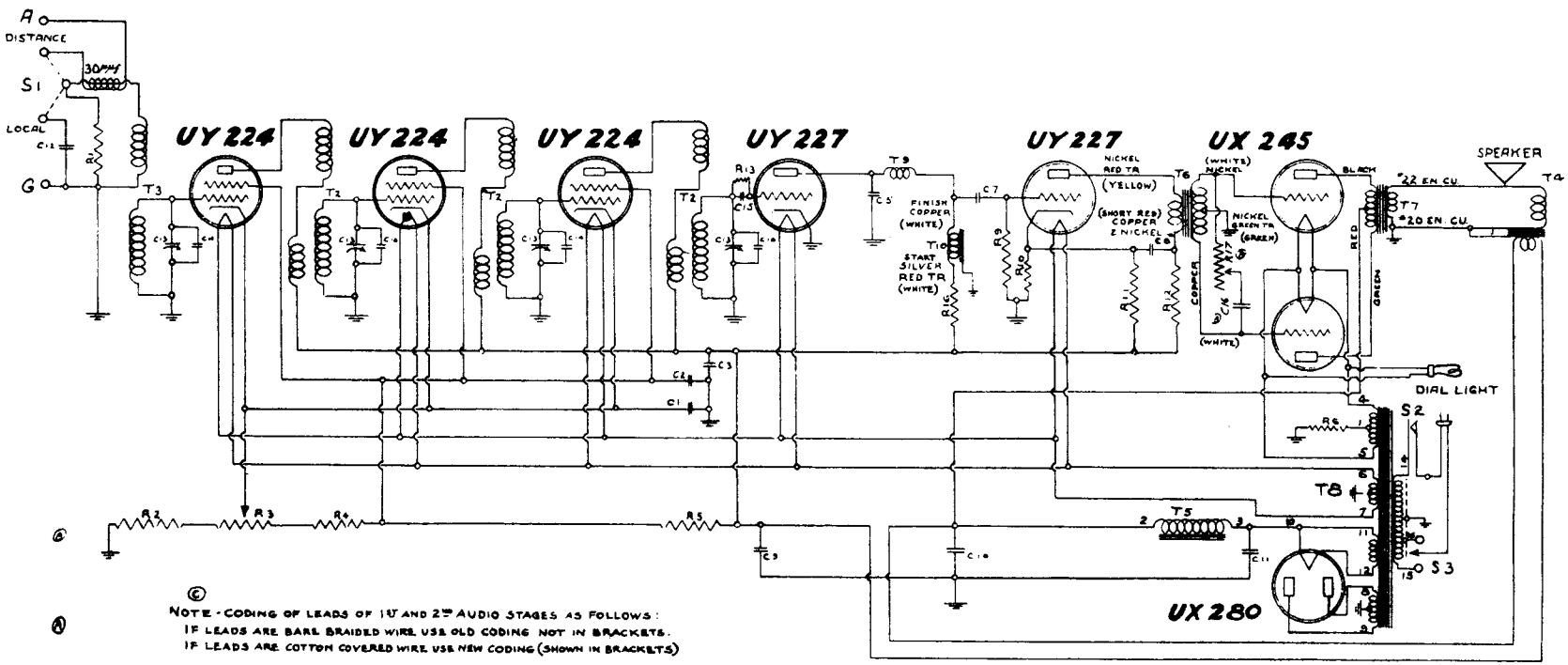
Symbol	DESCRIPTION	Part No.
L. 1	Oscillator Tuning Coil	4597
L. 2	Oscillator Coupling Coil	
L. 3	R.F. Transformer (pre-selection)	4683
L. 4	R.F. Transformer (R.F. stage)	4595
L. 5	R.F. Transformer (Mixer stage)	4684
L. 6	I.F. Transformer (I.F. stage)	4662
L. 7	I.F. Transformer (Det. stage)	4669
L. 8	R.F. Choke	(D)
(D)	Part of L7	
T. 9	Push-pull, Input Transformer	4592
T.10	Push-pull, Output Transformer	
T.11-A	Speaker, voice coil	4625
T.11-B	Speaker, hum coil	
T.11-C	Speaker, field coil	
T.14	Power Filter Choke	4593
T.15-A	Power Transformer, primary winding	
T.15-B	Power Transformer, H.V. secondary wind.	
T.15-C	Power Transformer, 280 Fil. secondary winding	4544
T.15-D	Power Transformer, 227, 224, 245 Fil. winding	
S. 1	"On-off" Switch	(G)
S. 2	"Loc-Dist." Switch	3581
(G)	Part of Vol. Control R5	



TYPE 707 CHASSIS—CIRCUIT DIAGRAM

NOTE—Unless shown below parts and symbols are the same as for Type 705 Chassis.

C17	Audio Cathode By-pass Condenser 1 Mfd.	4978A
C18	Audio Blocking Condenser .12 Mfd.	4978A
C25	Power Filter (Mershon) 8 Mfd.	4560
C27	Audio By-pass Condenser .5 Mfd.	4959
C28	Tone Control Condenser .12 Mfd.	4978A
C29	Audio Coupling Condenser .1 Mfd.	4978A
R5	Radio Vol. Control and Phono-Radio Switch, 725 ohms	4971
R16	Phono Coupling Resistor, 26,000 ohms	4974
R17	Cathode Bias Resistor, 2,000 ohms	4957
R18	Phono Volume Control Fixed Resistor, 31 ohms	3686
R19	Phono Volume Control, 80 ohms	4985
R20	Tone Control Rheostat, 45,000 ohms	4975
S3	Automatic Switch on Record Changer	.....
S4	"On-off" Motor Switch	5018
S5	Phono-Radio Switch	(F)
S6	Phono-Radio Gang Switch on Motor Board	4986
T12	Phono Pickup Transformer	4894
T13-14	Filter Choke Assembly	4965A
(F)	Part of Volume Control Assembly R5.	

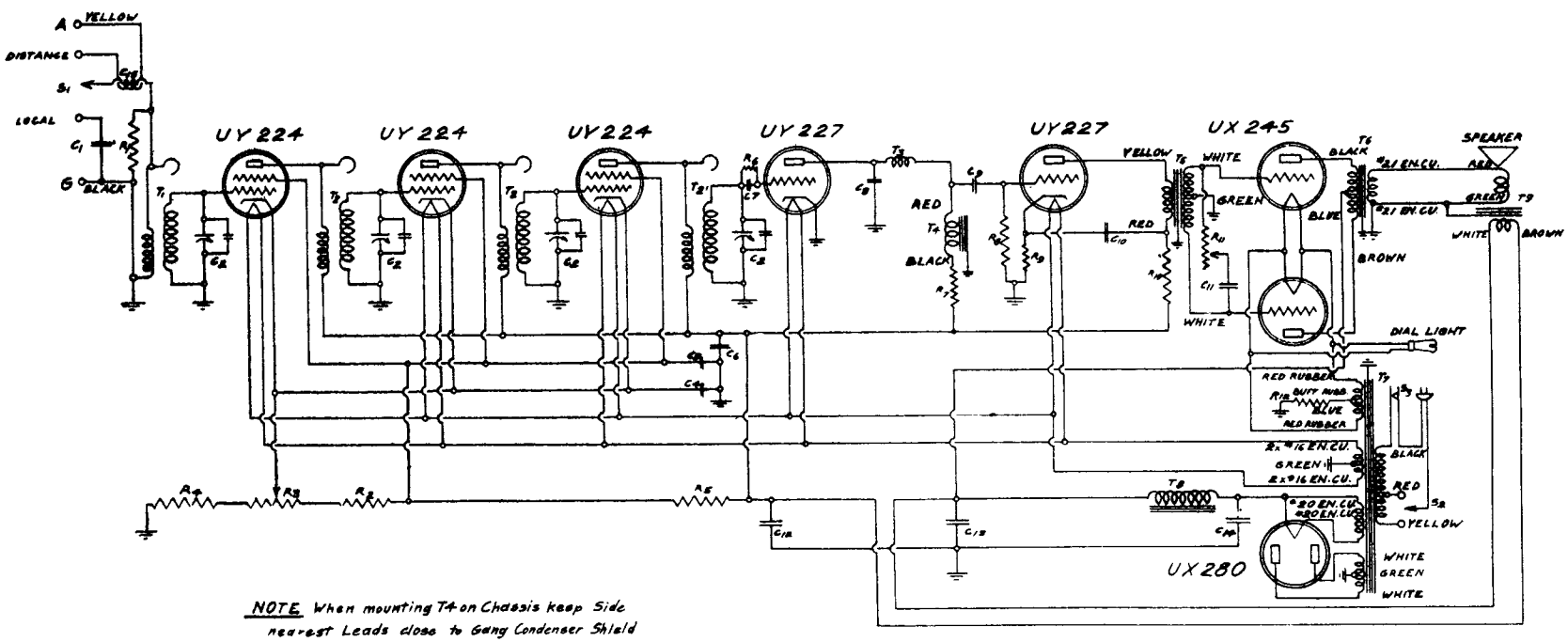


TYPE 740-B CHASSIS
CIRCUIT DIAGRAM

Symbol	Description	Part No.
C1	.25 Mfd. by-pass condenser	Block A3565
C2	.25 Mfd. by-pass condenser	
C3	.30 Mfd. by-pass condenser	
C5	.002 Mfd. by-pass condenser	B3676
C7	.25 Mfd. by-pass condenser	Block A4019
C8	.25 Mfd. by-pass condenser	
C9	8 Mfd. filter condenser	Mershon A1456
C10	8 Mfd. filter condenser	
C11	8 Mfd. filter condenser	
C12	.00025 Mfd. by-pass condenser	A1496
C13	Gang condenser	B3530B
C14	Aligning condenser	
C15	.0001 Mfd. grid condenser	A3669
C16	.002 Mfd. tone control condenser	A3676

R1	10,000 ohm antenna resistance	A3595
R2	130 ohm Bleeder resistance	A3589
R3	615 ohm vol. control (Potentio) resistance	A3602
R4	7,230 ohm voltage divider	A3596
R5	6,500 ohm voltage divider resistance	A3594
R6	835 ohm, 245 bias resistance	A3572
R9	1 megohm grid leak resistance	A3597
R10	400 ohm 227 bias resistance	A3590
R11	20,000 ohm 227 bias bleeder resistance	A3671
R12	20,000 ohm 1st audio filter resistance	A3598
R13	1.25 megohm grid leak resistance	A3703
R16	4,500 ohm Detector plate resistance (was R8)	A3670
R17	1 megohm tone control resistance	A4024

S1	Local-distance (range control) switch	A3581
S2	On-off switch	A2647
S3	Hi-lo (volt. control) switch	A3393B
T2	Radio frequency transformer	3578A
T3	Antenna transformer	A3575A
T4	Speaker field coil	A3496
T5	Filter choke	D3567B
T6	Push-pull audio transformer	F3544B
T7	Output audio transformer	
T8	Power transformer	D3567B
T9	Radio frequency choke	B3677A
T10	Audio frequency choke	B3684



CIRCUIT DIAGRAM TYPE 741 CHASSIS

(Note:—Coding of primary of T5 should be reversed—Red to plate and yellow to plate supply)

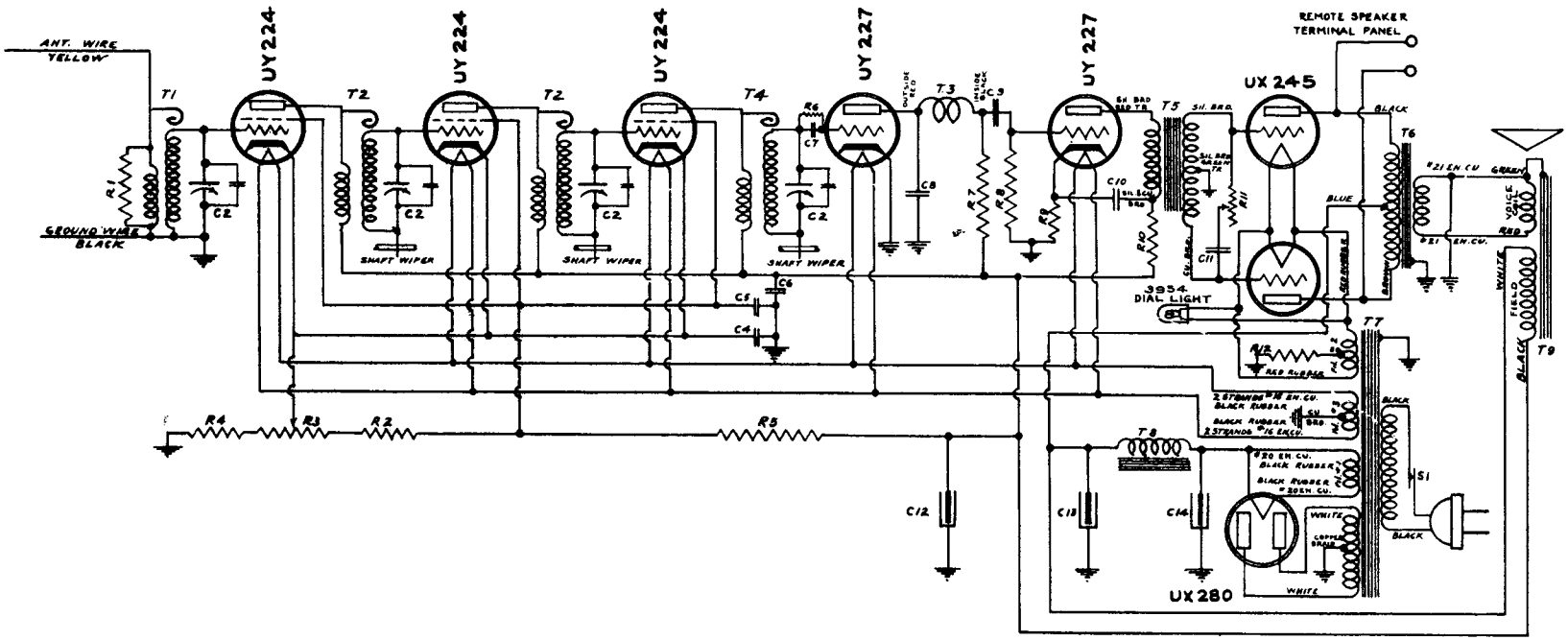
Symbol	Description	Part No.
R1	7,000 ohm antenna resistance	A4378
R2	4,725 ohm voltage divider resistance	*
R3	415 ohm volume control resistance	A4372
R4	98 ohm minimum R.F. bias resistance	*
R5	4,200 ohm voltage divider resistance	*
R6	1,250,000 ohm. Det. grid leak res.	B3703
R7	4,500 ohm Det. voltage reducing resistance	*
R8	500,000 ohm Audio Grid leak resistance	A4379
R9	1,250 ohm A.F. bias resistance	A4353
R10	18,000 ohm A.F. filter resistance	B3598
R11	1,500,000 ohm tone control resistance	A4382
R12	835 ohm Output bias resistance	A3572
*	Tapped sections of the same unit	A4352

Symbol	Description	Part No.
C1	.00025 mfd. antenna condenser	B3993
C2	4 gang tuning condenser	A4389
C4	.25 mfd. cathode bias bypass condenser	A4339
C5	.25 mfd. R.F. screen bypass condenser	A4339
C6	.25 mfd. R.F. plate bypass condenser	A4339
C7	.0001 mfd. Det. grid condenser	A3669
C8	.002 Mfd. Det. plate bypass cond's'r	B3676
C9	.1 mfd. Audio coupling condenser	A4483
C10	1 mfd. Audio filter condenser	B4340
C11	.002 mfd. tone control condenser	B3992
C12	8 mfd. power filter condenser	A1456
C13	8 mfd. power filter condenser	A1456
C14	8 mfd. power filter condenser	A1456
C15	30 mmfd. antenna condenser	A4376**

**Twisted leads between S1 and Chassis

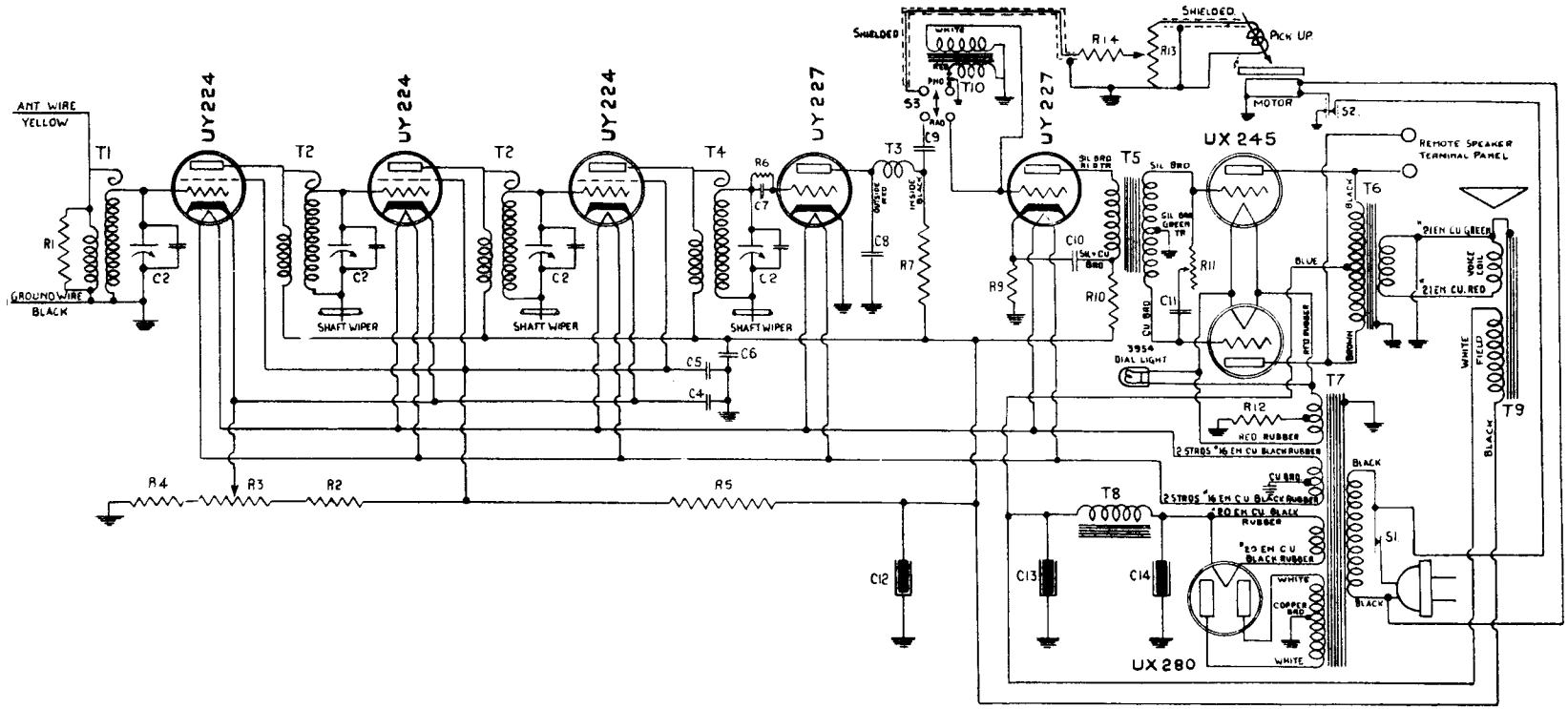
Symbol	Description	Part No.
T1	Antenna R.F. transformer	A4310
T2	Interstage R.F. transformers	A4317
T2(1)	Detector R.F. transformer	A4426
T3	Detector R.F. plate choke	A4293
T4	A.F. choke	B4401
T5	Pushpull input transformer	B4398
T6	Pushpull output transformer	B4398
T7	Power transformer	A4407
T8	Power filter choke	A4404
T9	D3 dynamic speaker	D3529
S1	Local—distance switch	B3581
S2	Hi-lo switch	A3393
S3	On—off switch	A4372***

***A part of volume control resistance.



TYPE 742 CHASSIS—CIRCUIT DIAGRAM

Symbol	DESCRIPTION	Part No.
C2	R. F. tuning condenser (4 gang)	4882
C4	R. F. cathode by-pass condenser, .25 Mfd.	4851(A)
C5	R. F. screen by-pass condenser, .1 Mfd.	4851(A)
C6	R. F. plate by-pass condenser, .1 Mfd.	4851(A)
C7	Det. grid by-pass condenser, .0001 Mfd.	3669
C8	Det. plate by-pass condenser, .002 Mfd.	3676
C9	A. F. coupling condenser, .1 Mfd.	4866(A)
C10	A. F. filter condenser, .4 Mfd.	4866(A)
C11	Tone control condenser, .002 Mfd.	3992
C12	Filter condenser (electrolytic), 8 Mfd.	4560
C13	Filter condenser (electrolytic), 8 Mfd.	4560
C14	Filter condenser (electrolytic), 8 Mfd.	4560
R1	Antenna resistance, 7,000 Ohms	4378
R2	Voltage reducing resistor, 4,640 Ohms	4864(B)
R3	Volume control resistor, 500 Ohms	4865
R4	R. F. minimum bias resistor, 98 Ohms	4864(B)
R5	Voltage reducing resistor, 4,200 Ohms	4864(B)
R6	Det. grid leak resistor, 1,250,000 Ohms	3703
R7	Det. plate resistor, 20,000 Ohms	4854
R8	A. F. grid leak resistor, 500,000 Ohms	4379
R9	A. F. cathode bias resistor, 1,250 Ohms	4353
R10	A. F. filter resistor, 18,000 Ohms	3598
R11	Tone control resistor, 1,500,000 Ohms	4887
R12	245 bias resistor, 835 Ohms	3572
S1	"On-off" power switch	4865(C)
T1	R. F. transformer, antenna stage	4884
T2	R. F. transformer, 2nd and 3rd stage	4885
T3	Det. R.F. plate choke	4293
T4	R. F. transformer, detector stage	4883
T5	A. F. input transformer	4871(D)
T6	A. F. output transformer	4871(D)
T7	Power transformer	4870
T8	Power filter choke	4874
T9	Speaker (Type D)	4889
(A)	Part of block condenser	4851
(B)	Part of candohm resistor	4864
(C)	Part of volume control assembly	4865
(D)	Part of audio block assembly	4871



TYPE 743 CHASSIS—CIRCUIT DIAGRAM

Symbol	DESCRIPTION	Part No.
C2	R. F. tuning condenser (4 gang)	4882
C4	R. F. cathode by-pass condenser, .25 Mfd.	4851(A)
C5	R. F. screen by-pass condenser, .1 Mfd.	4851(A)
C6	R. F. plate by-pass condenser, .1 Mfd.	4851(A)
C7	Det. grid condenser, .0001 Mfd.	3669
C8	Det. plate by-pass condenser, .002 Mfd.	3676
*C9	A. F. coupling condenser, .1 Mfd.	4863(A)
*C10	A. F. filter by-pass, .4 Mfd.	4863(A)
C11	Tone control condenser, .002 Mfd.	3992
C12	Filter condenser (electrolytic), 8 Mfd.	4560
C13	Filter condenser (electrolytic), 8 Mfd.	4560
C14	Filter condenser (electrolytic), 8 Mfd.	4560
R1	Antenna resistance, 7,000 Ohms	4378

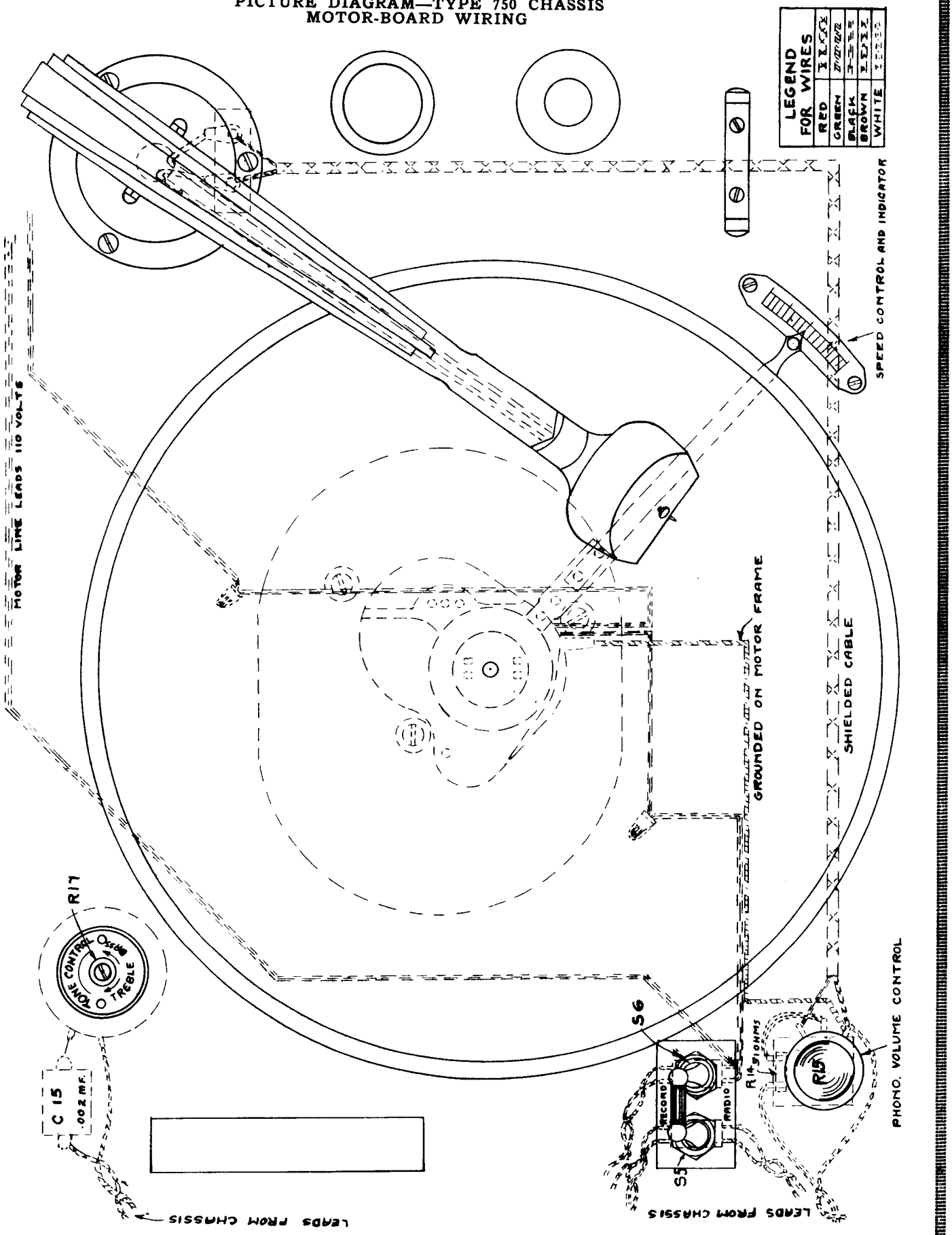
Symbol	DESCRIPTION	Part No.
R2	Voltage reducing resistor, 4,640 Ohms	4864(B)
*R3	Volume control resistance, 500 Ohms	4862
R4	R. F. Minimum bias resistance, 98 Ohms	4864(B)
R5	Voltage reducing resistance, 4,200 Ohms	4864(B)
R6	Det. grid leak resistance, 1,-250,000 Ohms	3703
R7	Det. plate resistance, 20,000 Ohms	4854
R8	A. F. grid leak resistance, 500,000 Ohms	4379
R9	A. F. cathode bias resistance, 1,250 Ohms	4353
R10	A. F. filter resistance, 18,000 Ohms	3598
R11	Tone control resistance, 1,-500,000 Ohms	4887
R12	245 bias resistance, 835 Ohms	3572
*R13	Record volume control resistance, 80 Ohms	4985

Symbol	DESCRIPTION	Part No.
*R14	Record volume limit resistance, 31 Ohms	3686
*S1	"On-off" power switch	2647
*S2	Motor auto-stop switch	3812
*S3	"Radio-record" switch	4862(C)
T1	R. F. transformer, antenna stage	4884
T2	R. F. transformer, 2nd and 3rd stage	4885
T4	R. F. transformer, detector stage	4883
T5	A. F. input transformer	4871(D)
T6	A. F. output transformer	4871(D)
T7	Power transformer	4870
T8	Power filter choke	4874
T9	Speaker (Type D)	4889
*T10	Pick-up transformer	4894
	*Motor, 25 cycle, 120 volt	3698
	*Motor, 60 cycle, 120 volt	3699
	*Pick-up	2283
(A)	Part of block condenser	4863
(B)	Part of candohm resistor	4864
(C)	Part of volume control assembly	4862
(D)	Part of audio block assembly	4871

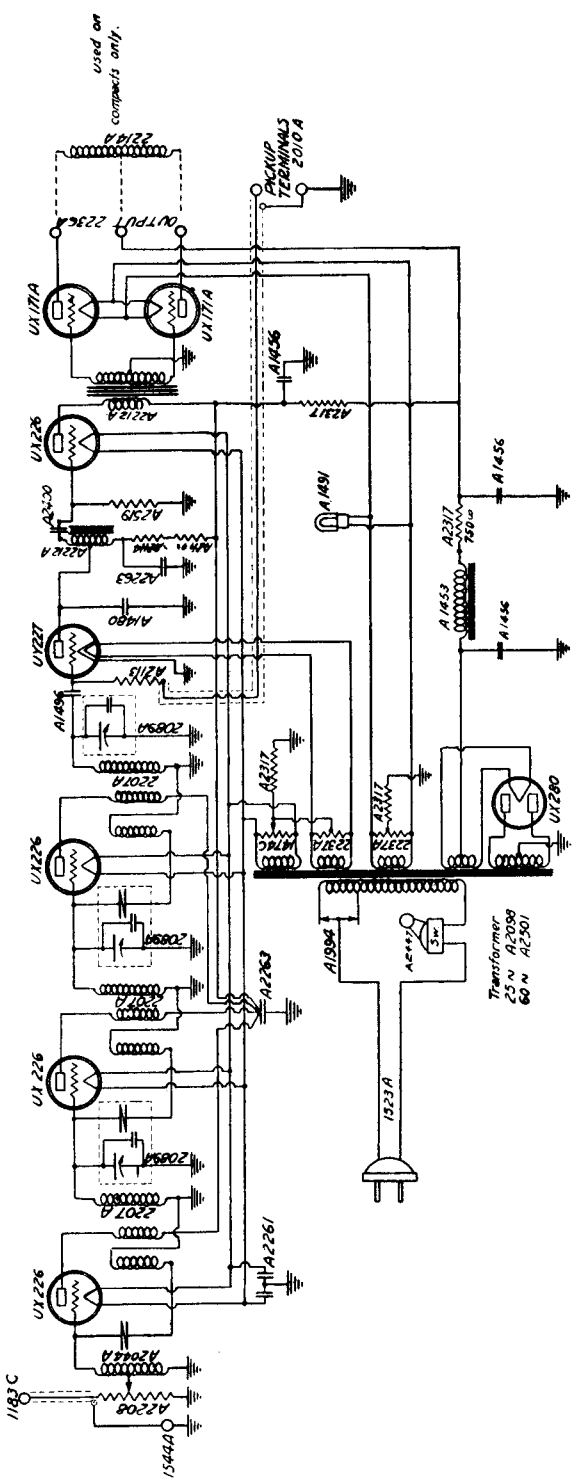
*** Parts marked by asterisk are in addition to or slightly different from assemblies used in the type 742 chassis.**

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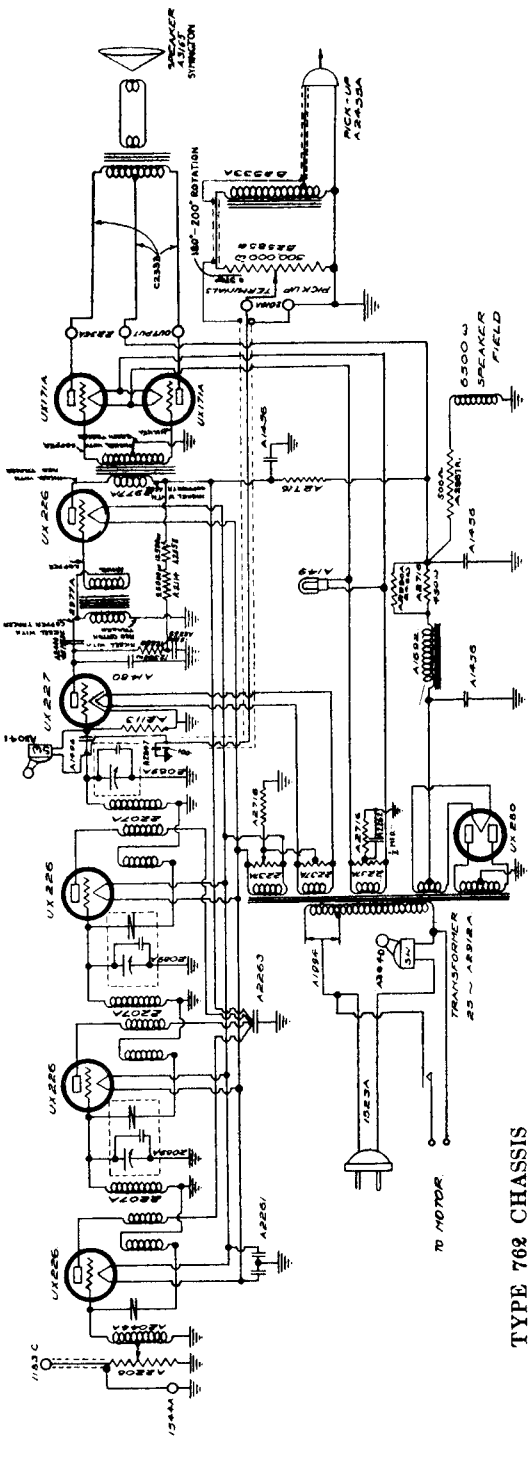
PICTURE DIAGRAM—TYPE 750 CHASSIS MOTOR-BOARD WIRING



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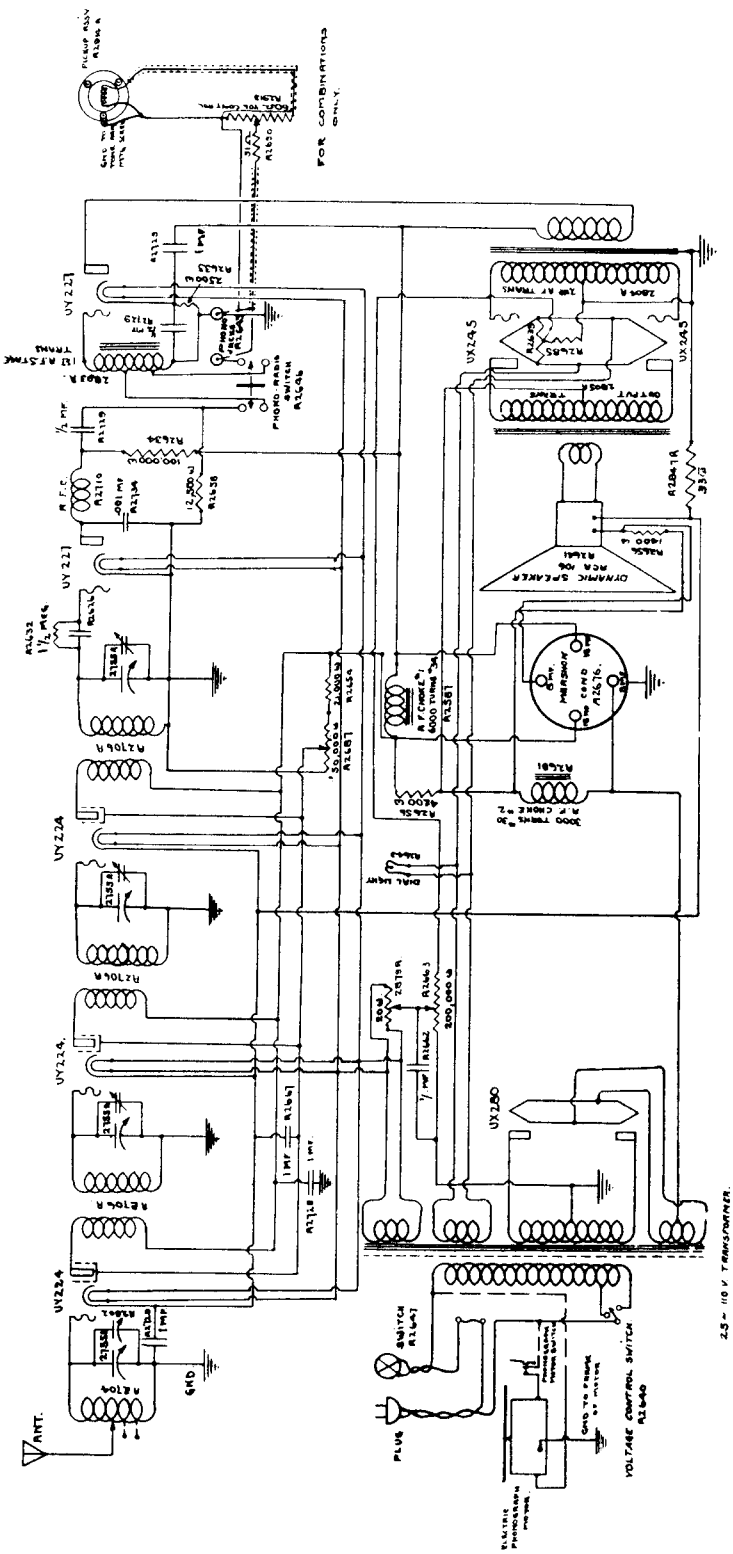


TYPE 762 CHASSIS
SCHEMATIC WIRING DIAGRAM
Dauntless, Invader A and B, and Renown Models)



TYPE 762 CHASSIS
SCHEMATIC WIRING DIAGRAM
(Conqueror Model)

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TYPE 766 CHASSIS
SCHEMATIC WIRING DIAGRAM
(Renown B, Tudor, Royal York, Norman, Norman B, Stuart and Lancaster Models)

Power Transformer Connections

T 1—To Line Cord.

T 2—To Hi-lo Switch.

T 3—To Hi-lo Switch.

T 4 } —To UY 224 and UY 227 Filaments.
T 5 }

T 6 } —To UX 245 Filaments.
T 7 }

T 8—To Plate of UX 280.

T 9—Center Tap of High Voltage Secondary grounded.

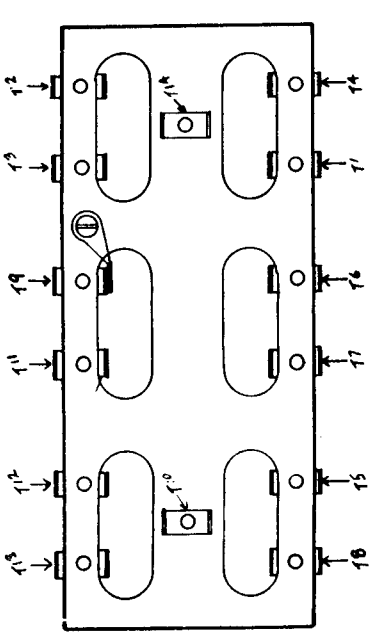
T 10—To Plate of UX 280.

T 11—To Filament of UX 280.

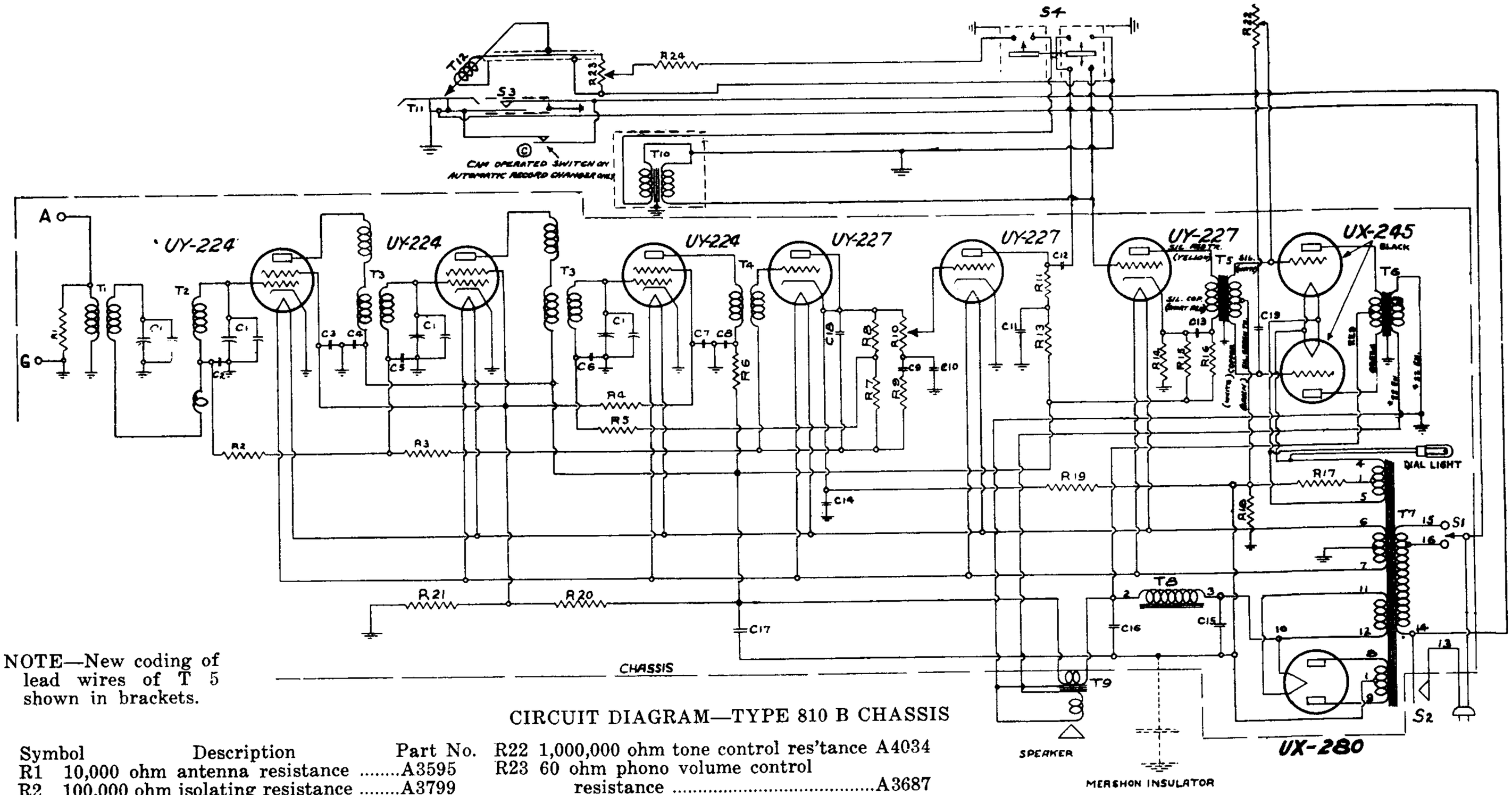
T 12—Center Tap UX 280 Filament (Pos. B supply).

T 13—To Filament of UX 280.

T 14—Dummy Connection for Line Cord and Hi-lo Switch.



POWER TRANSFORMER
Showing Connections.



NOTE—New coding of lead wires of T 5 shown in brackets.

CIRCUIT DIAGRAM—TYPE 810 B CHASSIS

Symbol	Description	Part No.
R1	10,000 ohm antenna resistance	A3595
R2	100,000 ohm isolating resistance	A3799
R3	500,000 ohm isolating resistance	A3867
R4	1,000 ohm isolating resistance	A3869
R5	500,000 ohm isolating resistance	A3867
R6	1,000 ohm isolating resistance	A3869
R7	25,000 ohm voltage div'g resistance	A3600
R8	25,000 ohm voltage div'g resistance	A3600
R9	250,000 ohm plate resistance	A3798
R10	1,000,000 ohm level control res'ance	C3904
R11	250,000 ohm plate resistance	A3798
R13	100,000 ohm isolating resistance	A3799
R14	400 ohm bias resistance	A3590
R15	20,000 ohm A.F.bias bleeder resistance	A3671
R16	18,000 ohm isolating resistance	A3598
R17	835 ohm UX 245 bias resistance	A3868
R18	67 ohm R.F. bias (constant) resistance	A3868
R19	250,000 ohm isolating resistance	A3907
R20	4,700 ohm voltage divider resistance	A3865
R21	5,600 ohm bleeder resistance	A3866
R22	1,000,000 ohm tone control res'tance	A4034
R23	60 ohm phono volume control resistance	A3687
R24	31 ohm phono volume limit resistance	A3686
C1	Tuning condenser (4 gang)	A3530 A
C2	.05 Mfd. by-pass condenser	B3873
C3	.1 Mfd. R.F. by-pass condenser	B3872
C4	.1 Mfd. R.F. by-pass condenser	B3872
C5	.05 Mfd. by-pass condenser	B3873
C6	.05 Mfd. by-pass condenser	B3873
C7	.1 Mfd. R.F. by-pass condenser	B3874
C8	.1 Mfd. R.F. by-pass condenser	B3874
C9	.005 Mfd. grid condenser	B3891
C10	.0001 Mfd. R.F. by-pass condenser	B3861
C11	.1 Mfd. by-pass condenser	B3871
C12	.1 Mfd. grid condenser	B3875
C13	.25 Mfd. by-pass condenser	B3871
C14	1.0 Mfd. R.F. by-pass condenser	B3871
C15	9 Mfd. Mershon filter condenser	A3932
C16	18 Mfd. Mershon filter condenser	A3932
C17	9 Mfd. Mershon filter condenser	A3932
C18	.00025 Mfd. R.F. by-pass condenser	B1496
C19	.002 Mfd. tone control condenser	B3676
S1	"Hi-lo" switch	A3393A
S2	"On-off" power switch	A2647
S3	Automatic stop switch	A3812
S4	"Radio-record" change-over switch	A3955 and A3949
T1	R. F. Antenna transformer	3886A
T2	R. F. pre-selection transformer	3886A
T3	R. F. inter-stage transformer	3886A
T4	R. F. fixed-tune transformer	A3889A
T5	A. F. intermediate transformer	A3903A
T6	A. F. output transformer	A3903A
T7	Power transformer	A3884A
78	Filter choke	A3884A
T9	Speaker (field)	A3913A
T10	Pickup transformer	A3684
T11	Motor, 25 cycle	A3810
	Motor, 60 cycle	A3811
T12	Pickup	A4500

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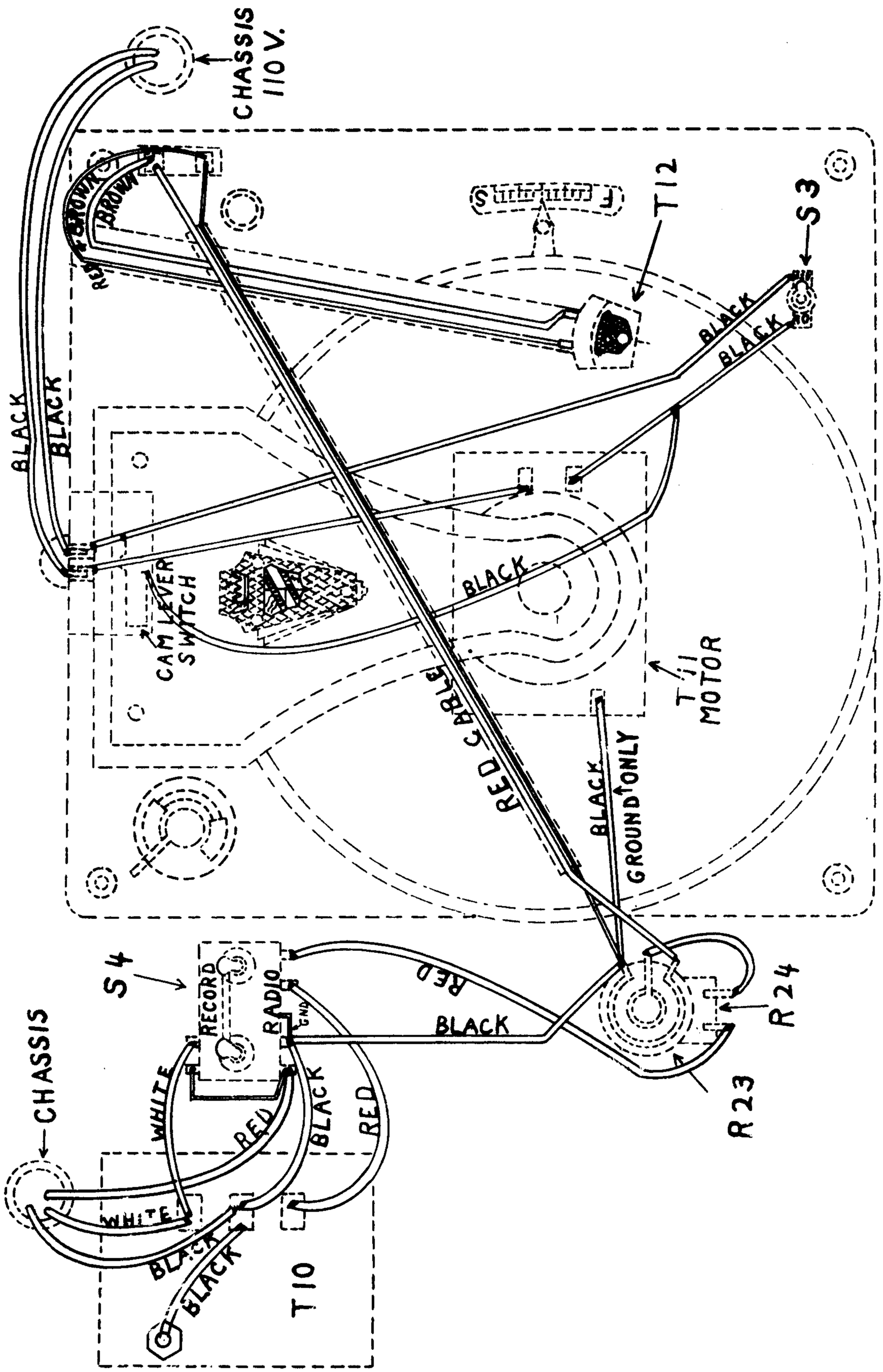


ILLUSTRATION 6
MOTOR BOARD WIRING "MARLBOROUGH" MODEL
(Type 810 B Chassis)