DEALERS' SERVICE MANUAL

Section I

INTRODUCTORY

The information contained in this book will assist authorized Stromberg-Carlson dealers to render prompt and efficient service to their customers, in conjunction with article four of the Franchise Agreement, which reads as follows:

> "The dealer agrees to inspect all installations of the company's apparatus promptly after each installation; to satisfactorily service the company's apparatus; to furnish with the company's apparatus only high grade standard accessories and all accessories that are supplied as a part of the company's product, and to restore the finish on all of the company's cabinet work which has become marred in transit or in handling."

The value of a radio receiver installation to the owner is determined by its uninterrupted service, as well as its efficient operation, and fine tonal quality. Stromberg-Carlson receiving sets have been designed and built to give fine tonal qualities, as well as efficient operation, with the minimum of servicing.

Associated equipment, such as vacuum tubes and current supply units, require periodic inspection and a certain amount of replacement.

Minor troubles occasionally develop which the average receiving set user is unable to master and invariably his dealer is called upon for help.

A PROMPT RESPONSE TO A CUSTOMER'S APPEAL FOR SERVICE BUILDS GOOD WILL UPON WHICH INCREASED RETAIL BUSINESS WILL RESULT.

The dealer who renders courteous and efficient service will be assured of orders for Radiotron tubes, and other supplies, and he will also receive the benefit of the word-of-mouth advertising that his satisfied customers pass on to their friends.

Heretofore, service manuals have been built up around a set of general instructions that required expert radio knowledge on the part of the service man. These instructions have been so prepared as to simplify the location of troubles in the receiver, as well as the complete installation itself.

Stromberg-Carlson authorized dealer service man must take care of all the minor cases of troubles in receiving sets, as well as the trouble that shows up in the associated equipment. By minor troubles, we mean making minor repairs to cabinets, refinishing same as called for in franchise, changing fixed condensers, panel repairs such as changing voltmeter, rheostats, keys and jacks, external loose connections, etc. We have not endeavored to list every case of minor trouble, but to point out the class of troubles that a dealer's service man can readily and efficiently handle.

In order that the dealer's service man can promptly do a workmanlike job, the Stromberg-Carlson Company has provided a complete kit of tools, which contains the following:

1. Screw Driver.
2. Screw Driver (ground down).
3. Open End Wrench for $\frac{5}{8}''$ nuts.
4. Spintite Wrench for $\frac{1}{2}''$ nuts.
5. Spintite Wrench for $5/16''$ nuts.

6. Pointer Wrench.
7. Open-end Wrench for 1/2" nuts.
8. Open-end Wrench for 5/16" nuts.
9. Long Nose Pliers.
10. Cutting Pliers.
11. Socket Contact Gauge.
12. Socket Contact Adjuster.
13. Electric Soldering Iron with Small Tip and Holder.
14. Solder.
15. Circuit and Voltage Instrument.
16. Right Angle Screw Driver.
17. Hydrometer.
18. Seal
19. Sealing Wax.

This kit is being produced for the benefit of our dealers' service man.

Every dealer is required to carry at least one kit of these tools at all times. Dealers really should equip each service man with one of these tool kits, thus making it possible for their service men to avoid removing the receiving set from the customer's residence to make minor repairs.

You will note that this new kit of tools includes a sealing tool. We are giving our dealers' service men the right to remove shields, provided they will promptly seal same with the tool provided.

The dealer's service man, however, is not equipped with the special tools for rectifying major troubles, such as: neutralizing, alignment, changing of coils and adjustments of defective variable condensers. To save our dealers that investment and to assure the users of Stromberg-Carlson receiving sets of more uniform results, we are insisting on doing this work in our own service stations.

The rectification of major troubles which we prefer having handled by our own service men are as follows:

Neutralizing—This operation is done with special tools. It is only possible to obtain perfect results when these tools are used.

Aligning—The gang condensers must be in perfect alignment. This can be done only with special equipment.

Changing Coils—If a coil is defective the changing is a simple process, but involves re-neutralizing as mentioned above.

Changing Defective Variable Condensers—All adjustments made on these condensers will involve re-aligning as mentioned above.

Repairing Cabinet—Warped doors and panels, cracked woodwork.

These major troubles should be referred to one of the following offices:

Stromberg-Carlson Telephone Mfg. Co.,
1060 University Avenue,
Rochester, New York.

Gross-Brennan Inc.,
510 Canadian Pacific Bldg.,
342 Madison Avenue,
New York City.

Stromberg-Carlson Telephone Mfg. Co.,
17 South Jefferson Street,
Chicago, Illinois.

Stromberg-Carlson Telephone Mfg. Co.,
Coca Cola Building,
Kansas City, Missouri.

Stromberg-Carlson Telephone Mfg. Co. of Canada Ltd.,
211-219 Geary Avenue,
Toronto, Ontario, Canada.

Scoville Mercantile Company,
609 Rhodes Building,
Atlanta, Georgia.

Garnett Young & Company,
390 Fourth Street,
San Francisco, California.

Garnett Young & Company,
347-8 I. W. Hellman Building,
Los Angeles, California.

Garnett Young & Company,
401 Polson Building,
Seattle, Washington.

At these points, our service men are prepared to take care of these major troubles and such other troubles as the dealers' service men are unable to remedy. Write to the nearest office, giving the serial number of your set, and ask for instructions on shipping or how to correct the customer's complaint. A prompt reply will be given and prompt service rendered by the service department.

Section 2
INSTALLATION

Enough cannot be said of the importance of making the proper installation of a Stromberg-Carlson receiver. If the service man is thoroughly familiar with the type of installation and procedure, which is outlined at some length in the Reference Book that accompanies each set (Sec. 15-44), many calls and complaints can be eliminated. Half an hour extra time spent in going over the set and its operation with the buyer, giving instructions such as: how to tune to obtain the best results, how to detect detonated tubes, rundown "B" and "C" batteries, how to keep storage battery in best shape, explanation of effect of weather conditions (summer time local stations always available, while in winter time, greater distance can generally be had), use of log and calibration chart, what the owner can really expect in bringing in stations, effect of daylight and darkness on reception, local interference and static, will do more to cement the contact between dealer and customer, and establish confidence in the receiver, than any number of subsequent calls.

Section 3
LOCATING TROUBLE

It must be remembered that 9 out of 10 cases of trouble are not found in the receiver itself. We are justly proud of Stromberg-Carlson receiver which well deserves its reputation for rugged construction and permanence of performance. It is logical, therefore, that in locating trouble to first look at the accessories and installation, and to make a very careful

check on the possibility of error in the associated equipment. The batteries and tubes are the gasoline and tires of radio. Gasoline and eventually new tires are needed that a car may be kept in perfect running order and the best results obtained. The same line of reasoning must be used in connection with radio operation.

Trouble locating means, then, the application of 95% common sense and that the remainder can be acquired by use of the instructions found in this book and by actual radio experience.

The procedure should be much the same as a doctor calling on a case. Inquire as to the symptoms, turn on the set and put it through a test that will bring to light the cause of the customer's complaint. As an aid to locating these troubles, a condensed list of possible causes under the heading "Trouble Causes," has been supplied.

Section 4

TOOLS AND USE

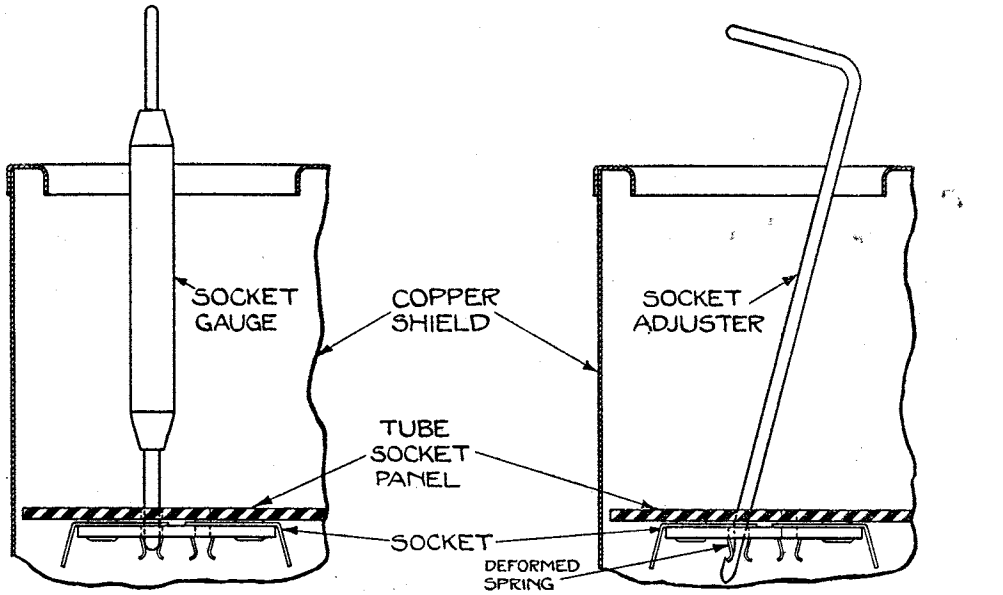
601-A and 602-A, 601-B and 602-B, and 501-A and 502-A

1. Seal. Pc. No. 16628.
2. Sealing Wax. List No. 2945.
3. Screw Driver. List No. 973.
4. Socket Contact Spring Gauge. P-16143.
5. Socket Contact Spring Adjuster. P-16142.
6. Circuit and Voltage Testing Instrument. Code 4 Test Set.
7. Open-end Wrench for 5/8" Nuts. Gar. Pc. No. 1629.
8. Open-end Wrench for 5/16" Nuts. List No. 2946.
9. Open-end Wrench for 1/2" Nuts. Code 47 Wrench.
10. Hydrometer. Pc. No. 16623.
11. Electric Soldering Iron with small tip and holder (110 Volt AC or DC). List No. 2862.
12. Solder (resin core). List No. 1500.
13. Spintite Wrench for 5/16" Nuts. Code 27.
14. Spintite Wrench for 1/2" Nuts. No. 8, List No. 2947.
15. Screw Driver (ground down to fit screws below surface). List No. 970, Pc. No. 16624.
16. Pointer Wrench. Pc. No. 16625.
17. Right Angle Screw Driver. Pc. No. 16626.
18. Long Nose Pliers. List No. 1671.
19. Cutting Pliers. List No. 994.

USE OF TOOLS

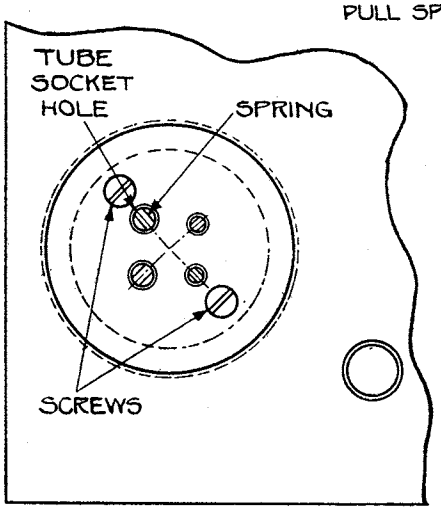
1. Seal—for resealing shields after repairs.
2. Sealing Wax—for making seals.
3. The long-handled screw driver is used on screws, except headless set screws. The length makes it easy to remove screws from shields. (If it is magnetized much time can be saved in replacing screws.)
4. Socket Contact Gauge—Special tool designed for testing the contact springs in each socket. If there is a question as to the contact of a certain tube or tubes, it is well to use this gauge. The large end of the gauge is placed in the larger of the socket holes. If the gauge drops through (not forced) the springs need adjusting (with tool No. 4) until the gauge will not fall through. (See diagram for details.)
5. Socket Spring Adjuster—(Note: "A" and "B" batteries should be disconnected from receiver in order not to cause a short circuit from socket to shield.) After the gauge has proved that the socket springs are out of place, this tool should be inserted so that

USE OF SOCKET TOOLS



SHOWING GAUGE IN GOOD SOCKET

SHOWING ADJUSTER READY TO PULL SPRING BACK TO NORMAL



POSITION OF SPRINGS IN RELATION TO TUBE SOCKET HOLES

the hook grasps firmly the end of the spring. When this is done, using the edge of the socket hole as a fulcrum, pry the spring back to its correct position. (Note: On all receiving sets with serial number above 66,000 and 601-A and 602-A the socket spring adjuster need not be used. The spring contacts on these sets are held in position by the use of a coil spring, therefore a good connection is insured at all times.) This should be done to all springs found out of place and a perfect socket contact is again assured. (See diagram for details.)

6. Voltage and Circuit Testing Instrument—The voltage and circuit testing instrument is simply a two range Weston voltmeter (low and high) with a multi-purpose (bi-polar) switch, to which is attached a cord and an U. X. socket plug. There are also two binding posts with leads to be used on circuits where plug is not applicable.

The operation of the switch is self-explanatory, the desired circuit being closed when the notation on the dial corresponding to that circuit is opposite the mark on the panel. The A, B, C and G notations are used with the plug only and the numerical notations only with the binding post leads. It should be remembered that when the binding posts are used, the instrument is nothing more than a two scale voltmeter, the switch changing the reading to the high or low scale as desired. (Care must be taken when using the 7.5 scale that the voltage to be measured does not exceed 7.5 volts, otherwise the meter may be damaged.) By inserting the plug in any tube socket in the set, the A, B, C and G voltages may be obtained by turning the switch to the desired notation without moving plug.

The following explanation must be fully understood in order that the proper readings may be obtained.

Reading "A" Battery Voltage (with Plug)

No "A" Battery reading will be obtained unless the battery switch on the front panel is turned on. The voltage rheostat should be adjusted to read 5 volts.

Note—When a tube is removed for insertion of the plug, a slight increase in voltage will be noticed on the voltmeter in tester and also on front panel. This is natural.

Reading "B" Battery (with Plug)

1. No "B" battery reading will be obtained in the second audio stage unless speaker or phones are connected.

2. A drop of several volts from the reading obtained at the "B" battery binding posts of the receiver must be expected in the first and second audio and detector stages due to the resistance of the transformers and speaker.

Reading "B" Socket Power (with Plug)

When the plug is inserted the current drain on the socket power is reduced, hence the voltage read will be many volts higher than is actually being delivered to the tube.

Allowing for the inaccuracy of the voltmeter itself it must be understood that only a picture of the actual conditions can be obtained.

Reading "C" Battery (with Plug)

A "C" Battery reading will be obtained only in the audio stages. Due to the resistance of the transformers, the reading will be very low, not much over $\frac{1}{2}$ volt in the first audio and not much over 1 volt in the second, when 9 volts of "C" battery are in the circuit. When 27 volts of "C" battery are used, the reading will not be over $\frac{3}{4}$ volt on the first stage, and not over $2\frac{1}{2}$ volts on the second stage.

7. Open-end wrench for use on jacks and panel keys.

8. Open-end wrench for use on nuts on rheostats.

9. Open-end wrench for use on nuts or panel screws.
10. Hydrometer to be used as a condition test for storage batteries.
11. 110 Volt A. C. or D. C. Soldering Iron with movable tip for making difficult wire connections in set, aerial or grounds.
12. Solder for making wire connections (resin core).
13. Spintite wrench for all small size nuts.
14. Spintite wrench to remove the two chassis bolts on bottom of 501 and 502 or rear of 601 and 602 cabinet. These must be removed before chassis can be slid out of cabinet. Also used on loop bracket nuts and bolts.
15. A narrow screw driver for headless set screws found on gears, shaft condensers and knobs.
16. A tool with two projections on end to fit into holes and remove or tighten station selector pointer arms.
17. Right angle screw driver to use on screw on end of rheostat shaft.
18. Long nose pliers—For use in installation of aerial and ground and for general wiring or soldering.
19. Cutting pliers—For use in installation of aerial and ground and general wiring.

SUPPLEMENT TO TOOL KIT

The following supplies should be carried by the service man in order to be prepared for emergency repairs. Batteries have been omitted because of their weight.

*1 Head Set.
*2 UX-201-A.
*1 UX-171.
*1 UX-112.
*1 Voltage Rheostat.
*1 Volume Rheostat.
*1 .01 M. F. Condenser
*1 .006 M. F. Condenser.
*1 1 M. F. Condenser.
*1 Knob.
*1 Grid leak.
* Extra 6–32 flat or round headed screws.
* Extra new large headed set screws.
50 or 60 feet of wire for trial aerial and counterpoise in noisy location.
1 Knife—for stripping wire.
1 Tube vaseline—for use on battery terminals.
1 Small bottle of furniture polish and cloth—for use on cabinet.
1 Small bottle of household ammonia.

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*Can be obtained from this Company.

Section 5

TROUBLE CAUSES

I—NO SIGNAL IN LOUD SPEAKER

1. Battery switch not turned on.
2. Station selectors not set correctly. (*Sec.* 8, 9, 10, 11; 5 *and* 6 *Tube Reference Book.*
3. Loop-Antenna switch not set correctly for type of pick-up used. (*Sec.* 37, 6 *Tube Reference Book.*)

4. Volume control not turned up. (*Sec.* 7; 5 *and* 6 *Tube Reference Book.*)
5. Tubes not in receiver. (*Sec.* 24; 5 *and* 6 *Tube Reference Book.*)
6. Tubes not making contact in socket. (*Sec.* 6, *No.* 6.)
7. Slipping station selector. (*Sec.* 6, *No.* 17.)
8. Loop (when used) in wrong position to receive station desired. (*Sec.* 37; 6 *Tube Reference Book.*)
9. Loud Speaker or head set not connected. (*Sec.* 47; 6 *Tube Reference Book. Sec.* 44; 5 *Tube Reference Book.*)
10. Loop (when used) or antenna and ground not connected properly. (*Sec.* 4; 5 *and* 6 *Tube Reference Book.*)
11. Fuse burnt out in house circuit.
12. House current supplying socket power units turned off.
13. Fuse burnt out on "A" Trickle charger. (*See Instructions accompanying Unit.*)
14. Incorrect battery connections. (*Sec.* 6, *No.* 1.)
15. Poor "A" or "B" battery connections. (*Sec.* 6, *No.* 2 *and* 3.)
16. Corroded battery terminals. (*Sec.* 6, *No.* 3.)
17. Socket Power unit not turned on. (*See Instructions accompanying Unit.*)
18. Antenna or ground leads open or not connected. (*Sec.* 6, *No.* 10.)
19. Antenna and ground leads reversed (on weak signal.) (*Sec.* 4; 5 *and* 6 *Tube Reference Book.*)
20. Antenna grounded. (*Sec.* 6, *No.* 8.)
21. Plug out of No. 301-A power switching relay. (*Sec.* 21; 5 *and* 6 *Tube Reference Book*).
22. Plugs inserted in No. 301-A power switching relay in wrong sockets. (*Sec.* 21; 5 *and* 6 *Tube Reference Book.*)
23. House current turned off. (Power Eqpt.) (*Sec.* 22; 5 *and* 6 *Tube Reference Book.*)
24. UX-213 Rectron tube in socket power unit defective or burnt out.
25. UX-213 Rectron tube not in socket power unit socket. (*See Instructions accompanying Unit.*)
26. Defective or run-down batteries. (*Sec.* 6, *No.* 14.)
27. Open or short circuit in head set or loud speaker cord or plug.
28. Defective loud speaker or head set. (*Sec.* 6, *No.* 15.)
29. Defective tube or tubes. (*Sec.* 6, *No.* 12.)
30. Socket power unit not delivering correct voltage. (*Sec.* 6, *No.* 14.)
31. Piece of wire lodged between panel and shields causing short circuit.
32. .01 mf. or .006 mf. condenser on first or second audio socket short circuited. (*Sec.* 6, *No.* 18.)
33. Leads from loop binding posts grounded to radio shield at bend where it enters first radio shield.
34. Antenna key springs not making proper contact.
35. Phone jack springs not making proper contact.
36. Audio panel jack springs not making proper contact. (*Sec.* 6, *No.* 20.)
37. Battery key springs not making proper contact.
38. Defective lightning arrester. (*Sec.* 6, *No.* 8.)
39. No station broadcasting.
40. Defective socket power unit. (*Sec.* 6, *No.* 14.)

41. Contacts in No. 301-A Power switching relay unit not making good contact. (*Sec.* 6, *No.* 20.)
42. Poor contacts in House 110 V AC Socket.
43. External power amplifier not connected properly. (*Sec.* 20; 5 *and* 6 *Tube Reference Book.*)
44. House 110 V AC Socket disconnected from light line. (*Sec.* 22; 5 *and* 6 *Tube Reference Book.*)
45. Tube in external power amplifier defective.
46. Defective external power amplifier.
47. Open circuit in loop.
48. Open circuit in battery cable.
49. Two receivers connected to one aerial.
50. Defective No. 10 audio filter.
51. Station selectors set near zero and antenna key set at position "2." (*Sec.* 7; 5 *and* 6 *Tube Reference Book.*)
52. Loose connection in chassis wiring. (*Sec.* 7.)
53. Open circuit in chassis wiring. (*Sec.* 7.)
54. Short circuit in chassis wiring. (*Sec.* 6, *No.* 19.)
55. Open in No. 5-A Audio output transformer.

II—WEAK SIGNAL IN LOUD SPEAKER.

1. Station selectors not set correctly. (*Sec.*8, 9, 10; 5 *and* 6 *Tube Reference Book.*)
2. Volume control not turned up. (*Sec.* 7; 5 *and* 6 *Tube Reference Book.*)
3. Loop-Antenna switch in wrong position. (*Sec.* 37; 6 *Tube Reference Book.*)
4. Loop pointed in wrong direction. (*Sec.* 39; 6 *Tube Reference Book.*)
5. Unit type speaker connections reversed. (For best quality use 5-A Cone Speaker.)
6. Tube not making contact in socket. (*Sec.* 6, *No.* 6.)
7. Antenna and ground connections reversed. (*Sec.* 4; 5 *and* 6 *Tube Reference Book.*)
8. Poor battery connections. (*Sec.* 6, *No.* 2-3.)
9. "A" battery discharged or defective so that voltmeter will not read 5 volts. (*Sec.* 6, *No.* 5.)
10. "A" battery connections reversed. (*Sec.* 6, *No.* 1.)
11. Corroded battery terminals. (*Sec.* 6, *No.* 3.)
12. "B" battery run-down to below 35 volts for 45 volt block. (*Sec.* 6, *No.* 14.)
13. "B" battery incorrectly connected. (*Sec.* 6, *No.* 1.)
14. "C" battery run down. (*Sec.* 6, *No.* 14.)
15. "C" battery connections reversed. (*Sec.*6, *No.* 1.)
16. Fading signals. (*See paragraph XL.*)
17. Poor circuit connection in antenna or ground circuits. (*Sec.* 6, *No.* 10.)
18. Antenna poorly insulated from supports, trees or buildings. (*Sec.* 6, *No.* 8.)
19. Antenna shielded by steel buildings, metal lathing, or damp walls. (*Sec.* 30; 5 *Tube Reference Book. Sec.* 29; 6 *Tube Reference Book.*)
20. Ground binding post on Socket Power not grounded. (*See instructions attached to Unit.*)
21. Loud speaker incorrectly adjusted. (*Sec.* 6, *No.* 15.)
22. Defective lightning arrester. (*Sec.* 6, *No.* 8.)
23. Certain stations shielded from receiving antenna. (*Sec.* 6, *No.* 7.)
24. No nearby or powerful broadcasting stations operating.

25. Poor atmospheric conditions.
26. Antenna key springs not making proper contact. (*Sec.* 6, *No.* 20.)
27. Phone jack springs not making proper contact. (*Sec.* 6, *No.* 20.)
28. Audio panel jack springs not making proper contact. (*Sec.* 6, *No.* 20.)
29. Tubes not up to full efficiency. (*Sec.* 6, *No.* 12.)
30. Defective tube or tubes.
31. Tubes other than R. C. A. Radiotrons. (*Sec.* 23; 5 *and* 6 *Tube Reference Book.*)
32. Station selectors set near zero and antenna key set on position "2" with a long antenna. (*Sec.* 7; 5 *and* 6 *Tube Reference Book.*)
33. Incorrect amount of "C" battery. Battery leads reversed on socket power unit. (*Sec.* 19; 5 *and* 6 *Tube Reference Book.*)
34. Open circuit in loop.
35. Ground clamp attached to pipe without scraping off coating of dirt or paint. (*Sec.* 6, *No.* 11.)
36. Ground connection made in sandy or dry earth. (*Sec.* 6, *No.* 11.)
37. Open "C" battery circuit. (*Sec.* 7.)
38. Slate-red wire connected to lug on bottom of a shielded unit loose or disconnected. (*Sec.* 7.)
39. Choke coil in audio unit open. (*Sec.* 7.)
40. 1 MF condenser in detector unit open, or blue-red wire connected to it loose at either end. (*Sec.* 7.)
41. Loose connection in chassis wiring. (*Sec.* 7.)
42. Open circuit in chassis wiring. (*Sec.* 7.)
43. Short circuit in chassis wiring. (*Sec.* 6, *No.* 19.)

III—NOISY RECEPTION IN LOUD SPEAKER

1. Unavoidable noise pick-up by antenna. (*See Sec.* 8.)
2. Ground binding post not connected to "B" socket power unit. (*See instructions attached to unit.*)
3. Volume control set too high. (*Sec.* 47; 6 *Tube Reference Book, Par. A. Sec.* 44; 5 *Tube Reference Book, Par. A.*)
4. Station selectors not set at maximum signal response for desired station. (*Sec.* 4; 5 *and* 6 *Tube Reference Book.*)
5. Loose or corroded joints in battery connection. (*Sec.* 6, *No.* 2 *and* 3.)
6. "C" battery connections open or loose or run-down "C" battery. (*Sec.* 6, *No.* 14.)
7. Loose connections of battery cable to terminal board in receiver. (*Sec.* 6, *No.* 4.)
8. Run-down or defective "B" battery. (*Sec.* 6, *No.* 14.)
9. Antenna and ground connections reversed which is apt to make set oscillate or cause a state of oscillation. (*Sec.* 4; 5 *and* 6 *Tube Reference Book.*)
10. Stations on nearly the same wave-length causing whistle. (*Sec.* 8.)
11. Loose spring clips on fuse holder of Gould AC 6 HD Socket Power unit.
12. Poorly soldered antenna or ground connections. (*Sec.* 6, *No.* 10.)
13. Socket power unit not connected properly. (*See instructions attached to unit.*)
14. "B" battery not connected properly. (*Sec.* 18; 5 *and* 6 *Tube Reference Book.*)
15. Loose connections in sockets or plugs on relay, or at connections to house current.
16. Trouble at broadcasting station.
17. Microphonic detector tube. (*Sec.* 25; 5 *and* 6 *Tube Reference Book.*)

18. Acoustic coupling between loud speaker and receiver. (*Sec.* 25; 5 *and* 6 *Tube Reference Book.*)
19. Poor contact of tube in socket. (*Sec.* 6, *No.* 6.)
20. Antenna poorly insulated. (*Sec.* 6, *No.* 8.)
21. Loose connections of loop connecting cable to binding posts in receiver. (*Sec.* 36; 6 *Tube Reference Book.*)
22. Incorrectly adjusted loud speaker. (*Sec.* 6, *No.* 15.)
23. Poor combination of tubes in receiver. (*Sec.* 25; 5 *and* 6 *Tube Reference Book.*)
24. Set oscillating. (*Sec.* 6, *No.* 16.)
25. Overloaded loud speaker or tubes. (*Sec.* 47; 6 *Tube Reference Book. Sec.* 44; 5 *Tube Reference Book.*
26. Water pipe or good earth ground not used. (*Sec.* 6, *No.* 11.)
27. External amplifier plugged in front panel phone jack. (*Sec.* 20; 5 *and* 6 *Tube Reference Book.*)
28. Defective external amplifiers.
29. Defective external amplifier tubes.
30. Defective tube or tubes. (*Sec.* 6, *No.* 12.)
31. Broken or defective loud speaker cord or connections. (*Sec.* 47; 6 *Tube Reference Book. Sec.* 44; 5 *Tube Reference Book.*)
32. Defective socket power unit. (*Sec.* 6, *No.* 14.)
33. Piece of solder between variable condenser plates.
34. Defective "A" battery. (*Sec.* 17; 5 *and* 6 *Tube Reference Book.*)
35. Loose connection in chassis wiring. (*Sec.* 7.)
36. Short circuit in chassis wiring. (*Sec.* 6, *No.* 19.)
37. Station selector gear rubbing against wires connected to antenna key or phone jack.
38. Another receiver radiation whistles. (*Sec.* 8.)

IV—SIGNALS NOT CLEAR

1. Station selector not set at maximum response for desired station. (*Sec.* 5; 5 *and* 6 *Tube Reference Book.*)
2. Volume control set too high, thus overloading tubes or loud speaker. (*Sec.* 47; 6 *Tube Reference Book. Sec.* 44; 5 *Tube Reference Book.*)
3. Heterodyning or squealing of two stations or radiating receivers. (*Sec.* 8.)
4. Acoustic coupling of loud speaker to receiver, shown by one or more musical notes unduly accented or prolonged. (*Sec.* 6, *No.* 13.)
5. Unit type speaker connection reversed.
6. Run-down "A" battery. (*Sec.* 17; 5 *and* 6 *Tube Reference Book.*)
7. Run-down "B" battery. (*Sec.* 6, *No.* 14.)
8. Run-down "C" battery. (*Sec.* 6, *No.* 14.)
9. Insufficient "C" battery for amount of "B" battery used. (*Sec.* 3; 5 *and* 6 *Tube Reference Book.*)
10. Ground not attached to "B" socket power unit. (*See instructions attached to Unit.*)
11. Connections reversed on "B" socket power unit. (*See instructions attached to Unit.*)
12. Socket power unit not delivering correct voltages. (*Sec.* 6, *No.* 14.)
13. Defective "B" battery. (*Sec.* 6, *No.* 14.)
14. Socket power unit that produces a hum. (*Sec.* 6, *No.* 14.)
15. Defective tube or tubes. (*Sec.* 6, *No.* 12.)
16. Loud speaker of poor construction. (Our 5-A Cone Speaker is recommended.)
17. Defective loud speaker, or speaker incorrectly adjusted. (*Sec.* 6, *No.* 15.)
18. Received signals of poor quality.
19. Loose connection. (*Sec.* 7.)
20. Batteries incorrectly connected. (*Sec.* 6, *No.* 1.)

V—INABILITY TO TUNE OUT UNDESIRED STATIONS

1. Transmission from nearby powerful broadcast station broadly tuned.
2. Defective tube or tubes.
3. Two stations on nearly the same wave length and signals overlapping. (*Sec.* 8.)
4. Poor combination of tubes. (*Sec.* 26; 5 *and* 6 *Tube Reference Book.*)
5. Volume control turned up too high. (*Sec.* 4; 5 *and* 6 *Tube Reference Book.*)
6. Antenna too long, including lead-in wire. (*Sec.* 30-34; 5 *Tube Reference Book. Sec.* 29-39; 6 *Tube Reference Book.*)
7. Antenna grounded. (*See Sec.* 6, *No.* 8.)
8. Station selectors not tuned to maximum response for desired station.
9. The antenna key on No. 2 position. (*Sec.* 4; 5 *and* 6 *Tube Ref. Book.*)
10. Long ground connections. (*Sec.* 6, *No.* 11.)
11. Loop when used not pointed for maximum response from desired station. (*Sec.* 37; 6 *Tube Reference Book.*)
12. Defective lightning arrester. (*Sec.* 6, *No.* 8.)

VI—INABILITY TO TUNE IN DISTANCE

1. Unfavorable atmospheric conditions.
2. Antenna shielded by tall buildings, heavy voltage, high hills, etc. (*Sec.* 29; 6 *Tube Reference Book. Sec.* 30; 5 *Tube Reference Book.*)
3. A nearby station operating on the same wave length as the distant station that is desired.
4. Too much noise. (*Sec.* 8.)
5. Antenna grounded.
6. Run-down batteries. (*Sec.* 6, *No.* 14.)
7. Corroded battery terminals. (*Sec.* 6, *No.* 3.)
8. Defective tube or tubes. (*Sec.* 6, *No.* 12.)
9. Socket power not delivering correct voltage. (*Sec.* 6, *No.* 14.)
10. Dead spot.
11. Poor installation. (*Sec.* 4; 5 *and* 6 *Tube Reference Book.*)

VII—STEADY HOWL

1. Acoustic coupling between loud speaker and detector tube. (*Sec.* 6, *No.* 13.)
2. Microphonic detector tube. (*Sec.* 25; 5 *and* 6 *Tube Reference Book.*)
3. Loud speaker too near receiver. (*Sec.* 25; 5 *and* 6 *Tube Reference Book.*)
4. More than 45 volts on detector tube. (*Sec.* 3; 5 *and* 6 *Tube Reference Book. Sec.* 6, *No.* 14.)
5. Felt lined cap not on detector unit. (*Sec.* 25; 5 *and* 6 *Tube Reference Book.*)

VIII—MICROPHONIC SOUND WHEN PANEL, CABINET OR TABLE IS TAPPED (SEE No. VII ABOVE)

IX—HUM

1. Electric radiation of electrical apparatus picked up by antenna. (*Sec.* 8.)
2. Defective socket power unit. (*Sec.* 6, *No.* 14.)
3. Ground not attached to "B" Socket Power unit. (*See instructions attached to unit.*)
4. Generator hum coming from broadcasting station.
5. Ground connection not attached to external power amplifier post. (*See instructions attached to unit.*)

X—WHISTLES, SQUAWKS, GROANS, VARYING IN PITCH WITHOUT MANIPULATION OF RECEIVER CONTROLS. SEC. 8

1. A receiver in vicinity improperly operated or adjusted. (*Sec.* 8.)
2. The overlapping of signals of two stations on nearly the same wave length. (*Sec.* 8.)

XI—WHISTLE, THE PITCH OF WHICH CAN BE VARIED BY TURNING STATION SELECTORS

1. Receiver out of balance and oscillating. (*Sec.* 6, *No.* 16.)
2. Tubes not R. C. A. Radiotrons. (*Sec.* 23; 5 *and* 6 *Tube Reference Book.*)
3. Loose bearing in 3rd radio frequency unit and embossing on shield not in contact with bearing. (*Sec.* 6, *No.* 16.)

XII—STATION SELECTORS SLIP

1. Loose set screws in large gear. (*Sec.* 6, *No.* 17.)
2. Knob loose.

XIII—STATION SELECTORS BIND

1. Large gear rubbing against shield. (*Sec.* 6, *No.* 17.)
2. Knob rubbing against panel.
3. Gear on knob shaft end not adjusted correctly.

XIV—PROGRAM BREAKS OFF AND ON AS STATION SELECTORS ARE TURNED

1. Large gear rubbing against wires which connect to antenna key or phone jack. (*Sec.* 6, *No.* 17.)
2. Defective tube or tubes.
3. Black wire in a shielded unit rubbing against variable condensor rotor.
4. Loose connection in the installation. (*Sec.* 6, *No.* 2.)
5. Piece of solder between variable condenser plates.
6. Tube making poor contact in socket. (*Sec.* 6, *No.* 6.)

XV—PROGRAM BREAKS OFF AND ON WITHOUT TURNING STATION SELECTORS

1. Antenna swinging and rubbing against tree, building, etc. (*Sec.* 6, *No.* 9.)
2. Defective tube or tubes.
3. Loose battery or loud speaker connections. (*Sec.* 6, *No.* 2.)
4. Loose connections in the installation. (*Sec.* 6, *No.* 2.)
5. Tube making poor contact in socket. (*Sec.* 6, *No.* 6.)
6. Corroded battery terminals. (*Sec.* 6, *No.* 3.)
7. Trouble at broadcasting station.
8. Fluctuation in 110 volt AC line if socket power is used.

XVI—RUSHING OR HISSING NOISE

1. Defective grid leak.
2. Microphonic noise at broadcasting station.
3. Power tube not in 2nd audio socket. (*Sec.* 23; 5 *and* 6 *Tube Reference Book.*)
4. "B" battery connections reversed. (*Sec.* 6, *No.* 1.)
5. Tube noise. (*Sec.* 6, *No.* 6.)
6. Poor combination of tubes. (*Sec.* 23; 5 *and* 6 *Tube Reference Book.*)
7. Defective tubes.

XVII—GRATING NOISE WHEN VOLUME OR VOLTAGE CONTROLS ARE VARIED

1. Dirt on rheostat slider or resistance wire.
2. Receiver in oscillating condition. (*Sec.* 6, *No.* 16.)

XVIII—LESS DISTANCE IN CERTAIN DIRECTIONS

1. Antenna shielded by building, large metallic object, etc. (*Sec.* 29; 6 *Tube Reference Book. Sec.* 30; 5 *Tube Reference Book.*)
2. Local disturbances overpowering station. (*Sec.* 8.)

XIX—SETTING OF TWO STATION SELECTORS NOT THE SAME

The difference in the setting of the antenna selectors depends upon the length and location of the antenna and ground connection.

XX—MORE VOLUME WITH FIRST RADIO FREQUENCY TUBE REMOVED

1. This is natural with volume control turned down.
2. Dirt on the rheostat.
3. With volume control turned up, open in first radio frequency unit wiring. (*Sec.* 7.)
4. Arm not making proper contact with rheostat.
5. Defective tube or tubes.

XXI—POOR QUALITY OF MUSIC AND SPEECH FROM CERTAIN STATIONS

1. Trouble at broadcasting station.
2. Interference by another station on nearly the same wave length. (*Sec.* 8.)
3. Regenerative set in vicinity not tuned correctly.

XXII—REPLACEMENT OF TUBES CHANGES LOG SETTINGS

Natural with some tubes.

XXIII—RATTLE IN SPEAKER

1. Loud speaker defective or not adjusted properly. (*Sec.* 6, *No.* 15.)
2. Loose connection in the loud speaker cord or binding posts on set.
3. Overloaded loud speaker. (*Sec.* 47; 6 *Tube Reference Book. Sec.* 44; 5 *Tube Reference Book.*)
4. Overloaded tube. (*Sec.* 47; 6 *Tube Reference Book. Sec.* 44; 5 *Tube Reference Book.*)
5. Defective power tube.

XXIV—ANTENNA KEY INOPERATIVE

1. Springs in key not adjusted for correct make and break. (*Sec.* 6, *No.* 20.)
2. Open primary of 1st stage. (*Sec.* 7.)
3. Wire loose on key. (*Sec.* 6, *No.* 20.)
4. Loose wire on primary coil in 1st radio stage. (*Sec.* 7.)
5. Antenna grounded. (*Sec.* 6, *No.* 8.)

XXV—VOLUME AND CLARITY BEST WITH VOLUME CONTROL TURNED BELOW NORMAL ROOM VOLUME

1. Low "B" battery voltage. (*Sec.* 6, *No.* 14.)
2. Insufficient "C" battery. (*Sec.* 19; 5 *and* 6 *Tube Reference Book.*)
3. Poor combination of tubes. (*Sec.* 26; 5 *and* 6 *Tube Reference Book.*)
4. Power tube not used in 2nd audio stage. (*Sec.* 25; 5 *and* 6 *Tube Reference Book.*)
5. Socket power unit not supplying proper voltage. *Sec.* 6, *No.* 14.)
6. Loud speaker not adjusted properly or over-loading. (*Sec.* 6, *No.* 15.)
7. Set oscillating. (*Sec.* 6, *No.* 16.)

XXVI—SQUEALING OR "KNOCKING"

1. "C" battery disconnected or loosely connected. (*Sec.* 6, *No.* 2.)
2. Defective grid leak.
3. Open grid circuit probably in audio or detector units. (*Sec.* 7.)
4. Open transformer. (*Sec.* 6, *No.* 21.)

XXVII—WARM VOLTAGE CONTROL ESCUTCHEON

Natural when receiver is in operation.

XXVIII—VOLTMETER POINTER JUMPS BACK AND FORTH AS VOLTAGE CONTROL IS ADJUSTED

1. Dirt on rheostat slider or wire.
2. Loose connection in the installation.
3. Slider not making good contact.
4. Defective tube or tubes.
5. Corroded "A" Battery terminals.

XXIX—VOLTAGE CONTROL DOES NOT BRING VOLTMETER POINTER BELOW 3 VOLTS

Natural.

XXX—VARYING VOLUME CONTROL CHANGES VOLTMETER READING

Natural

XXXI—BATTERY KEY DOES NOT TURN ON CURRENT TO TUBE FILAMENTS

1. Battery key springs not adjusted for good contact. (*Sec.* 6, *No.* 20. *Sec.* 7.)
2. Fuse burnt out on Trickle Charger. (*See instructions with unit.*)
3. Loose battery connection. (*Sec.* 6, *No.* 2.)
4. Corroded battery terminal. (*Sec.* 6, *No.* 3.)
5. Loose wire on key or rheostat. (*Sec.* 7.)
6. Loose wires on "A" battery binding posts. (*Sec.* 6, *No.* 2.)
7. Short circuit. (*Sec.* 6, *No.* 19.)

XXXII—BATTERY KEY DOES NOT TURN OFF CURRENT TO TUBE FILAMENTS

1. Key springs not properly adjusted. (*Sec* 6, *No.* 20.)
2. Connections to key bent and short-circuiting key.

XXXIII—ONE TUBE DOES NOT LIGHT

1. If second audio tube, loose wire on Audio panel jack or springs not adjusted for good contact. (*Sec.* 7.)
2. If 1st radio frequency tube, volume rheostat not turned up.
3. Coating on wall of tube too heavy to allow the filament to be seen when lighted.
4. Loose wire on a socket. (*Sec.* 7.)
5. Voltage control knobs not turned high enough. (*Sec.* 4; 5 *and* 6 *Tube Reference Book.*)
6. Tube burnt out. (*Sec.* 6, *No.* 12.)
7. Tube not making good contact in socket. S*ec.* 6, *No.* 6.)

XXXIV—TWO AUDIO TUBES DO NOT LIGHT

1. Black or blue-orange wire on first audio socket loose. (*Sec.* 7.)
2. Voltage control knob not turned up. (*Sec.* 4; 5 *and* 6 *Tube Reference Book.*)
3. Black wire on "A" battery binding post loose. (*Sec.* 7.)
4. Coating on walls too heavy to allow the filament to be seen when lighted.
5. Defective socket.

XXXV—THREE RADIO FREQUENCY AND DETECTOR TUBES DO NOT LIGHT

1. Black wire on filament of 1st radio frequency socket loose. (*Sec.* 7.)
2. Voltage and volume control knobs not turned up.
3. Black wire on "A" Battery Binding Post loose. (*Sec.* 7.)
4. Coating on walls of tubes too heavy to allow the filaments to be seen when lighted.

XXXVI—"A" BATTERY RUNS DOWN QUICKLY

1. Receiver operated often and for long periods.
2. Battery key left on unintentionally while receiver was not in use.
3. Battery key not functioning properly. (*Sec.* 6, *No.* 20.)
4. Storage battery of small capacity. (*Sec.* 17; 5 *and* 6 *Tube Reference Book.*)
5. Defective storage battery. (*Sec.* 17; 5 *and* 6 *Tube Reference Book.*)
6. Short circuit. (*Sec.* 6, *No.* 19.)
7. Charger not connected to 110 AC house current.
8. Plugs in wrong sockets on relay. (*Sec.* 21; 5 *and* 6 *Tube Reference Book.*)
9. Plug not in 110 volt AC socket.

XXXVII—"B" BATTERY RUNS DOWN QUICKLY

1. Small capacity batteries. (*Sec.* 3; 5 *and* 6 *Tube Reference Book.*)
2. Defective tube or tubes.
3. Receiver used often and for a long period.
4. Defective battery. (*Sec.* 6, *No.* 14.)
5. Short circuit. (*Sec.* 6, *No.* 19.)

XXXVIII—SMOKING VOLUME RHEOSTAT

1. Blue-orange wire from volume rheostat to 1st radio frequency socket cut by shield.
2. Bottom 1 Mf. condenser (6 tube set) in 1st radio frequency unit short circuited or leaky. (*Sec.* 6, *No.* 18.)
3. Piece of solder between 1 Mf. Condenser terminal and condenser case.
4. Condenser terminal to which is connected spaghetti covered wire touching shield.

XXXIX—SMOKING VOLTAGE RHEOSTAT

1. Orange wire on " 'A' battery +" binding post squeezed between Audio Panel and lug of " 'A' battery —" post.
2. Blue-Orange wire cut somewhere by shields. (6 *Tube Set.*)
3. 1 Mf. condenser in one of shielded units short-circuited. (*Sec.* 6, *No.* 18.)
4. Piece of solder between terminal of 1 Mf. condenser and condenser case.
5. 1 Mf. condenser terminal to which is connected spaghetti covered wire touching shield.

XL—FADING SIGNALS

1. Defective tube or tubes. (*Sec.* 6, *No.* 12.)
2. Broadcasting station fading due to atmospheric conditions.
3. Defective batteries. (*Sec.* 6, *No.* 14.)
4. Loose connection in the installation. (*Sec.* 6, *No.* 2.)
5. Antenna rubbing against tree, building, etc. (*Sec.* 6, *No.* 9.)
6. Defective lightning arrester. (*Sec.* 6, *No.* 8.)
7. Loose connection in antenna or ground wires. (*Sec.* 6, *No.* 10.)
8. Antenna allowed to swing freely by the wind. (*Sec.* 6, *No.* 9.)
9. Fluctuating house current on "B" Socket Power or External Power Amplifier.
10. Regenerative receiver in vicinity incorrectly tuned. (*Sec.* 8.)
11. Corroded battery terminals. (*Sec.* 6, *No.* 3.)
12. Loose connections anywhere in the installation. (*Sec.* 6, *No.* 2.)
13. Run-down battery or batteries.

XLI—LOOP DOES NOT POINT IN DIRECTION OF BROADCASTING STATION

Will happen if loop is in or near steel building or metallic objects. (*Sec.* 37, *Reference Book.*)

XLII—STATIONS WEAK IN DAYTIME

Stations are always much weaker in the daytime with the exception of locals and with the exception of poor atmospheric conditions which sometime prevail at night.

XLIII—RECEPTION BETTER OR WORSE FROM DAY TO DAY

Reception from a distant station varies with atmospheric conditions and local interferences.

XLIV—VOLTMETER NOT REGISTERING CORRECT VOLTAGE

1. Discharged "A" battery.
2. "A" battery short circuited. (*Sec.* 6, *No.* 19.)
3. Voltage rheostat not turned on sufficiently. (*Sec.* 4; 5 *and* 6 *Tube Reference Book.*)
4. Defective voltmeter.
5. "A" battery leads too long or wire used is too small.
6. Leaky 1 M. F. condenser in "A" battery side.

XLV—BATTERY KEY DOES NOT OPERATE RELAY

1. Blue wire on voltage rheostat loose.
2. Fuse blown on Trickle Charger. (*See Instructions attached to unit.*)
3. Wires on binding posts R-1 and R-2 loose or not connected. (*Sec.* 6, *No.* 2.)
4. Defective "A" battery.
5. Poor connections on relay.
6. Discharged "A" battery.

XLVI—BATTERY KEY DOES NOT TURN ON "A" SOCKET POWER UNIT

1. Loose connection on units or relay.
2. Fuse blown on Trickle Charger. (*See Instructions attached to unit.*)
3. Defective "A" battery.
4. Run-down "A" battery.
5. Open in a battery cable.
6. Corroded "A" battery terminals.

XLVII—BATTERY KEY DOES NOT TURN ON "B" SOCKET POWER UNIT

See No. XLVI.

XLVIII—BATTERY KEY DOES NOT TURN ON EXTERNAL POWER AMPLIFIER

External power amplifier connected to "A" socket power unit socket on relay. (*See XLVII*)

XLIX—NO SIGNAL WITH CERTAIN SETTINGS OF VOLUME OR VOLTAGE RHEOSTATS

1. Volume and voltage set too near minimum on weak signals.
2. Insufficient pressure of rheostat slider on resistance wire.

L—SOCKET POWER UNIT SMOKES AND SIZZLES AT TIME OF INSTALLATION

1. Defective unit.
2. House current not type required by unit.

LI—STATION CAN BE HEARD AT SEVERAL DIAL SETTINGS

1. Harmonics.
2. One station modulating the carrier wave of another station.

Section 6

SERVICE REMEDIES

1. *Incorrect Connections:* Care should be taken that the batteries or Socket-Power connections are all according to the correct circuit diagrams in the Reference Book. The receiver will not operate correctly unless the leads are connected to their correct voltage and polarity. Check carefully with testing instrument at binding post and sockets. (*See Figs.* 3 *to* 8 *inclusive, Section* 15, *Reference Books.*)

   (a) If the "A" battery leads are reversed, signals will be considerably weakened and the voltmeter on the front of the receiver will not indicate correctly (will point in the wrong direction). These connections should also be checked carefully with the wiring diagrams (*Figs.* 3 *to* 8 *inclusive, Section* 15, *Reference Books.*)

   (b) If the "B" battery leads are reversed, so as to give voltages at the receiving set terminals that are different from that specified on the binding posts, see Figs. 3 to 8 inclusive, Section 15, Reference Books, the reproduction may be weak, distorted or unstable. Follow the color code and indicating tags in the circuit diagrams and check the connections at both ends of the battery cable. Socket readings should correspond to binding posts minus resistance of transformers. Refer to Section 15, Reference Books.

   (c) If the polarity of the "C" battery is reversed, the signals will be very weak. These connections should be carefully checked with the wiring diagrams (*Figs.* 3 *to* 8 *inclusive, Section* 15, *Reference Books.*)

2. *Loose Connections:* All connections should be carefully checked to make sure that they are tight. Connections between two wires should be soldered wherever possible, and the bare conductor completely covered with insulating tape.

3. *Corroded or Dirty Terminals:* The storage battery terminals sometimes become corroded and this corrosion may extend to the connecting wires, so that poor contact is made. These terminals and the wire should be cleaned off. "Household Ammonia" may be used in cleaning the terminals. Vaseline should be put on the terminal to prevent recurrence. Poor connections are sometimes caused on any battery by dirt or some foreign material getting between the terminal of wire and binding post. Clean carefully.

4. *Battery Cable Terminals:* The terminals of the battery cable should be tightly held under the thumb nuts of the binding post of the terminal board of the receiver. Tighten these connections by using a silver 25 cent coin as a screw driver, inserted in the slot in the thumb nut.

5. *Voltmeter Reading Low:* If the "A" battery is not charged high enough to operate the radio receiver efficiently, the voltmeter pointer will not indicate 5 volts when the *voltage control* knob is turned as far in the direction of the arrow as possible. If the "A" battery leads are made longer than the connecting cable furnished with the receiver, or if made of too small a size of wire, the voltage drop in them, when the set is turned on, will be so great as to prevent the full 5 volts across the filaments of the tubes. This is indicated by the impossibility of obtaining a reading of 5 volts on the voltmeter even though the battery is fully charged and the *voltage control* knob is turned to the maximum (direction of arrow).

6. *Poor Contact in Tube Sockets:* If the prongs of the vacuum tubes are corroded or dirty, they will not make good contacts with the springs of the tube sockets. Remove the tubes and scrape the tube prongs clean. If this does not help, the socket springs must be readjusted (*see "Use of Tools," Sec.* 4, *par.* 4 *and* 5).

7. *Inefficient Aerial:* It is sometimes found beneficial, when a receiver has been properly installed and is lacking distance getting power, or is inclined to pick up a disagreeable amount of local interference, to change the direction of the aerial; that is, at right angles to the old one. Very often the so-called perfect aerial installation is impossible but there can be no hard and set rule, and it often happens that excellent results can be obtained from aerials which seem to be inefficient. It is a matter of cut and try and it is for this reason that the above recommendation is made (*see Sec. 29, Reference Books*).

8. *Grounded Antenna:* If the antenna is accidentally grounded, indicated by broad tuning on the left hand station selector and the weakness of the received signals, trace out the antenna lead and make sure that its installation is perfect where it runs along walls and through partitions and at its supports. If the trouble is not located, disconnect the antenna lead-in from the arrester and connect through directly to the receiver "ANT" post, so as to omit any connection of the antenna to the arrester, and re-test the receiver. If it now works correctly, the lightning arrester is defective and should be replaced by a new one.

9. *Swinging Antenna:* The antenna installation should be carefully inspected, making sure that the antenna or lead-in does not swing against trees, buildings, etc.

10. *Poor Connections in Antenna-Ground* System: Antenna or ground wires when spliced or connected to ground clamps, etc., should be soldered whenever possible. In any case, a good firm, clean contact is necessary.

11. *Inefficient Ground Connections:* The ground connection should be as short as possible to a cold water pipe or other good ground (*Section 34, 6 tube Ref. Bk.; Section 35, 5 tube Ref. Bk.*). If the ground lead is long or is connected to a system of steam or similar pipes, it is liable to be of a high resistance. Noisy reception will generally result. Try using a wire as a "counterpoise" as suggested in section 35, 6 tube Ref. Bk., section 36, 5 tube Ref. Bk. Inspect the ground clamp (if used) for tightness and for presence of dirt or paint between clamp and pipe.

12. *Defective Tubes:* Tubes may be defective in several ways. There may be an inter-element short-circuit or the filament emission may be low. Check tubes by exchanging them, one at a time, with a tube that is known to be good. If one tube is found to be poor or defective, check the rest carefully again so as to be sure that there are no more. Sometimes the vacuum tubes can be damaged by rough handling so that the filament becomes broken or the elements of the tube short-circuited. (*See Section 23 and 24 in five and six tube Reference Book.*)

13. *Acoustic Coupling:* If a steady howl is given by the loud speaker, but not by a head set when plugged in, try moving the loud speaker in various positions in the room, keeping it well away from the receiver, also follow the directions concerning microphonic detector tubes. (*Section 25 in five and six tube Reference Book.*)

14. *Defective Current Supply:* (Dry and Socket Power.)

    1. *Dry "B" Battery:* It sometimes happens that new "B" battery may be defective and have very low or zero voltage. This will make the signals very weak, lacking entirely, or cause the cone speaker to rattle. To determine whether this condition exists, each block should be tested with a voltmeter when installed, or checked; a test made of batteries that have been in operation. If the voltage for any block drops below 34 volts when the set is turned on, it should be replaced with a fresh one. (*Make this test with the batteries hooked up to set and the set in operation for at least 5 minutes.*)

2. (a) *Socket Power "B" Supply:* The "B" socket power unit must meet two requirements in order that the receiver may enjoy perfect results from this type of supply.

The filter system employed in the "B" Socket Power unit must be suitable to prevent the 60 cycle hum from being heard in a high quality Cone Speaker. This condition can be detected by ear.

The "B" socket power unit must have ample current capacity at the 135 volt, 90 volt and 45 volt taps to properly operate the receiver. This cannot be determined with any degree of accuracy unless a high quality voltmeter is used (1000 *ohms per volt*).

3. *Defective "C" Battery:* A worn out or defective "C" battery usually is indicated by the failure of the loud speaker to give a good clear tone on a medium volume of signal when listening to local broadcasting.

The "C" battery should be changed if voltmeter reads less than 3½ volts for 4½ volt battery, 18 volts for 22½ volt battery.

4. *Defective "A" Battery:* (*See Section* 17, *Reference Book.*)

15. *Adjusting Cone:* It may happen that due to weather conditions or shipment, the cone has pulled slightly off center, so that the driving rod is not running free. To test this, turn the volume up on a local signal and loosen the adjusting nut on the center of cone. If only the rasping noise results the speaker is well centered. On the other hand, if a noticeable amount of music can be heard, it may be touching the side of the cone which throws the tones off quality.

Loosen the three screws on the three ends of the spider at the rear of the speaker. (*It may be necessary to pull the spider away from cone due to sticking of finish.*) Then move the cone slightly in one direction and then the other until only the rasping sound is heard. The rod will then be centered and running free. Tighten the three screws and the adjusting screw on the cone and the quality balance of the speaker will again be appreciated.

Before any adjustment work is done on the cone speaker, it must be clearly understood that on receivers not using 135 volts and a power tube, the clear quality of the speaker may not be enjoyed. This does not prohibit the sale of the cone for these sets but the following adjustment is necessary.

(1) In such cases, it will be found beneficial and advantageous to use our No. 10-A audio filter. A further description and use can be found elsewhere.

(2) A .01 M. F. condenser hooked up across the two terminals of the speaker will also clear up this condition to a large degree. The terminals are located on the top of the unit in back of the cone. One side of the condenser goes to one post and one to the other.

16. *Oscillation:* There are several possible causes for oscillation in a Neutrodyne Circuit.

They will be explained in order of their importance:

Worn out or defective tubes, or tube in 5 and 6 tube receiving sets is probably the principal cause of this condition. A tube that is O. K. should be substituted for each tube in turn until the defective tube is located. It sometimes is possible to change the tubes around in the various sockets until the oscillation is eliminated.

If, by turning the right hand selector knob on the 6 tube receiving set, the pitch of the oscillation is changed, the trouble might very possibly be in the third radio or middle shield on right-hand side of set. Grasp this shield firmly and shove it back and forth. If oscillation disappears or is intermittent with the pushing, the trouble is that the embossed place on the side of the shield is not making contact with the condenser.

By taking the shield off and being in at the point of embossing a good contact may be assured when the shield is replaced. Also tighten the bearing nearest the front on the condenser shaft in this stage to assure a good electrical contact there as well.

If the receiver oscillates when the loop is used—check the contact spring between the third radio and detector stage. It should be making a good contact on the collar fastened to shaft.

Check ground strap that ties the top of third radio to the detector stage, for good contact.

Be sure tube covers are on tight, especially detector, and first radio covers.

If, after the above tests on 5 and 6 tube receiving sets have been made, and the oscillation still remains, it is probably a factory case. Communicate with the Stromberg-Carlson Telephone Mfg. Co. branch and the necessary repairs will be made.

17. *Station Selector Slips:* In case it is found that one of the station selector slips, the procedure is as follows: Remove the two bolts at the rear or bottom (501 *and* 502) of the cabinet and pull the chassis forward about 2 or 3 inches. It will then be noticed that the set screws holding the large gear to the shaft have loosened. If these set screws are tightened, the slipping will disappear. No other adjustment is necessary.

If there is any doubt as to the ability of these screws to hold, which has occurred in some cases, send for some of the large headed steel set screws that we are now using. The trouble will be permanently cured.

18. *Replacing Condensers:* Short circuit in "A" battery circuit due to breaking down of a 1 M. F. condenser. Symptoms: Voltage rheostat will smoke and voltmeter will read about 1 volt on 6 tube receiving sets.

The trouble will be located in the 1 M. F. condensers on the bottom of the group of two found in each stage, on the 6 tube receiving set. Unsolder the wires from the bottom condenser and turn on the battery key on front panel. If the voltage is normal again, then that is the defective condenser. If not, solder up the wires and proceed to the next stage until the proper one is found. It must then be removed by loosening the bracket that holds the two condensers and slipping it out, replacing it with a new one, resolder the wires and the trouble is cleared.

Breaking down of .01 M. F. in 601-A and 602-A or .006 M. F. in (601-*B*, 602-*B*, 501-*A* *and* 502-*A*) condensers in second audio beneath tube socket. If it is open, the reception will be disagreeable, husky and noisy in the second audio stage, but when plugged in at the first audio jack, it will be clear and pleasing, as it should be.

If shorted in 5 or 6 tube receiving sets there will be no signal in second audio and it will heat up loud speaker and perhaps burn out the coils in the speaker. To replace—remove chassis from cabinet completely and turn set on end with audio end up. With screwdriver, loosen two screws that hold socket near tube holes of second audio. The condenser is also held by these screws. Remove condenser and replace with another, tighten up the screws and the job is done.

Weak signal or batteries running down is due to a top 1 M. F. in these groups of two on the 6 tube receiving set. If the signal is weak, take a spare 1 M. F. condenser and hold it under the Detector Stage, one terminal touching shield and the other on the lug that protrudes from bottom of shield. If volume increases then top 1 M. F. condenser is defective and should be replaced.

If batteries run down on 6 tube receiving set, it may be condenser is shorted. Remove slate-red wire from terminal of top 1 M. F. condenser and if the reading returns, change the condenser.

19. *Short Circuits:* When a set is being installed, or after the circuit tester has been inserted in a socket and no "B" battery reading is obtained and short circuit is suspected, the following test and procedure will be of assistance.

Remove the "B" battery lead from the binding post of receiver, insert the two voltmeter leads of the circuit tester into circuit at this point—one lead being fastened to the "—B" binding post and the other to the "+B" battery lead that has just been removed. *Make sure that battery switch on the front panel is off.* If no reading is obtained there is no short circuit in the line. If a reading is obtained the reading in number of volts will determine the circuit that is shorted.

45 *Volt Short.* If the reading is around 45 volts, remove the tube in the detector; if it still remains the tube is O. K. and the trouble will probably be found in:

(a) Wires squeezed between binding post lugs and audio panel in 6 tube receiving set.

(b) Spaghetti cover on lug on bottom of detector unit cut by shield on 6 tube receiving set.

(c) Dare wire from bottom of neutrodon to bottom of coil hitting nut, which holds lug passing through bottom of detector unit on 6 tube receiving set.

(d) Top 1 M. F. condenser in detector unit short-circuited on 6 tube receiving set. (*Section* 6, *No.* 18.)

(e) Terminal to which is connected slate-red wire touching shield on 6 tube receiving set.

(f) Piece of solder between 1 M. F. condenser terminal and condenser case on 6 tube receiving set.

90 *Volt Short.* If the voltage is around 90 volts, it will be found in one of the three radio stages. Remove each tube separately and if the short disappears it will be the last tube removed and it should be replaced. If it still remains the trouble is in the circuit.

(a) Wire squeezed between binding post lugs and audio panels.

(b) Spaghetti cover on lugs through bottom of radio frequency units cut by edge of shield.

(c) Shielded cable connecting 1st and 2nd radio frequency unit cut by edge of unit shield.

(d) Wires in short cables connecting other units cut by cable or unit shields.

Note: If the set is a 501-A, 502-A, 601-B (601-*A*, 602-*A that are changed over for the UX*-171 *tube*) and the voltage reading at "—B" is about 10 volts less than across the terminals, the trouble is in the 1st audio stage.

(a) In first audio of 501-A, 502-A, 601-B, 602-B (601-*A*, 602-*A that are changed over for the UX*-171 *tube*) receivers, Sangamo condenser on socket may be short.

(b) Springs on audio panel jack may be shorted from solder, etc.

(c) Wires squeezed between binding post lugs and bottom of audio panel.

135 *Volt Short.* If the reading is over 100 volts it may be located in the second audio stage or in the first audio, also, of the 601-A and 602-A. Remove the tube and if this does not clear it, look for the following:

(a) Wires squeezed between binding post lugs and audio panel.

(b) Sangamo condenser on audio sockets short (*Sec.* 6, *No.* 18) but only the second audio condenser on the 501-A, 502-A, 601-B, 602-B (601-*A*, 602-*A that are changed over for the UX*-171 *tube*).

(c) Check wiring and on audio panel jack for solder between springs, etc.

(d) Be sure wires are away from big gear on front panel.

20. *Adjust Spring Contacts:* It sometimes happens that the springs do not make the proper contact due to dirt forming on contact points and being jarred out of place. Remove the chassis bolts from the rear of cabinet and pull out chassis about two or three inches. If, by inspection and manipulation of key or plug, the springs look to be in order, insert a piece of paper between the spring contact when the contact is open, then close the contact and pull the paper out, thus cleaning the contact points.

If it is noticed that a very poor or no contact is being made, use the long screwdriver and insert point at base of springs close to point where they are fastened together, turn the screwdriver in the direction desired, until a good contact is made.

In the case of the audio jack, the chassis must be completely removed from cabinet but because of the little use of this jack, trouble should not be anticipated from this source.

21. *Defective Transformers and Choke:* If, by the nature of the symptoms a defective transformer is suspected, the following tests will settle the trouble:

(a) Primary of 1st audio transformer open may be detected by having no detector "B" battery voltage when plug of circuit tester is inserted. Put one lead of voltmeter on a shield and the other on B plus of transformer and then on P of transformer. If a reading is obtained on B plus, but not on P, the transformer is open.

(b) Secondary of 1st audio transformer. No "C" reading will be obtained in 1st audio socket. To check transformer, put one lead of voltmeter on plus B and if reading is obtained at F, but not at G, the secondary of transformer is open.

(c) Primary of 2nd audio transformer. No "B" battery reading will be obtained in 1st audio socket. To check transformer, put one lead of voltmeter on one of shields and other on B plus of transformer and then on P of transformer. If a reading is obtained at B plus, but not on P, the transformer is open.

(d) Secondary of 2nd audio transformer. No "C" reading in 2nd audio socket. To check transformer, put one lead of voltmeter on B plus, and the other on F, and then on G. If a reading is obtained at F, but not at G, the transformer is open.

(e) The audio choke coil. No reading is obtained on detector "B" battery voltage when circuit tester plug is inserted. To check choke coil, place one lead of voltmeter on a shield and the other on F of choke coil and then on G. If a reading is obtained on one terminal and not on the other, the choke coil is open.

Section 7

CIRCUIT CONTINUITY TESTS

601-A, 602-A, 601-B and 602-B Sets

(For use of Circuit Testing Instrument, Sec. 4, No. 15)

Note: When it is found that no reading is obtained from any tube socket with the tester, the first move should be to test the socket contacts with the gauge (*Tool No. 5*). If the contacts are in order, the following procedure for checking the circuit may be used.

No "B" battery reading will be obtained in any stage if it is shorted (*see Sec. 6, No. 20*). "G" circuit reading is the "A" battery voltage read through the grid.

1. *1st Radio Socket (Plug Inserted)*
   - (a) No "A" battery reading. Open or loose connection. Check: black, orange, and orange-blue wires at socket, rheostat, battery switch, voltmeter, binding posts of set and "A" battery terminals.
   - (b) No "B" battery reading. Open or loose connection on wires in 1st radio stage black, slate-red wire on inside coil in second radio stage, both terminals on lug at bottom of 1st radio shield, all bottom lugs in other stages and binding post connections.
   - (c) No reading on "G" circuit. Loose or open connection. Check socket, bare wire on neutrodon, all loop antenna switch connections, loop binding posts, check all connections on outside coil, check grounding connection on inside bottom of shield.

2. *2nd Radio Socket (Plug Inserted)*
   - (a) No "A" battery reading. Check socket wires, other wires as in stage above.
   - (b) No "B" battery reading. Check wires on socket, black and slate-red wires on inside coil of 3rd radio stage, both ends of lug at bottom of 2nd radio shield, and all other lugs.
   - (c) No reading on "G" circuit. Check bare wires on socket, neutrodon, outside coil connections and grounding tap on inside bottom of shield.

3. *3rd Radio Socket (Plug Inserted)*
   - (a) No "A" battery reading. Check socket connections and R. F. choke coil beneath shield. Check orange-blue wire on 2nd radio socket. (***R. F.** coils only on* 601-***B*** *and* 602-B *set.*)
   - (b) No "B" battery reading. Check black and red-slate wire on inside coil of Detector unit, red-slate wire on both ends of lug beneath shield and all lugs on other stages and check wires on socket.
   - (c) No reading on "G" circuit. Check bare wire on socket, all other wires same as "2 (c)" above.

4. *Detector Socket (Plug Inserted)*
   - (a) No "A" battery reading. Same as 3rd stage but check both R. F. choke coils instead of orange-blue wire as in preceding stage. (***R. F.** coils only on* 601-***B*** *and* 602-***B*** *sets.*)
   - (b) No "B" battery reading. Check connections on battery and binding posts. Check wires on audio choke and red-blue wire on bottom of shield, connections on 1st audio transformer and slate wire on Detector socket.

(c) No "G" test possible unless terminals of .00025 condenser in tube shielding is shorted with a small wire.

5. *1st Audio Socket (Plug Inserted)*

(a) No "A" battery reading. Check socket connections. Black wire on "A" binding posts, orange-blue wire on choke coil beneath detector unit.

(b) No "B" battery reading. Check slate wire on socket, wires on audio panel jack, connections on 2nd audio transformers, wires on 90 V. binding post on 601-B and 602-B, and 135 V. binding post on 601-A and 602-A.

(c) No "C" battery reading. Check wire on socket, connections on 1st audio.

6. *2nd Audio Socket (Plug Inserted)*

(a) No "A" battery reading. Check wires on socket, black and orange-blue on 1st audio socket, check wires on audio panel jack.

(b) No "B" battery reading. Check wires on socket and front panel phone jack. Check wire on 2nd audio or 135 V. binding post.

(c) No "C" battery reading. Check bare wire on socket connections on 2nd audio transformer—wires on "C" battery binding posts.

CIRCUIT CONTINUITY TEST

501-A and 502-A Sets

(For use of Circuit Testing Instrument, Sec. 4, No. 15)

Note: When it is found that no reading is obtained from any tube socket with the tester, the first move should be to test the socket contacts with the gauge (*Tool No. 5*). If the contacts are in order, the following procedure for checking the circuit may be used.

No "B" battery reading will be obtained in any stage if it is shorted (*see Sec. 6, No. 20*).
"G" Circuit reading is the "A" battery voltage read through grid.

To follow wiring, lift chassis up directly as it leaves cabinet, exposing wiring on bottom.

1st Radio Socket (Plug Inserted)

(a) No "A" battery reading—open or loose connections. Check orange and orange-blue wires at socket rheostat, battery switch, voltmeter binding posts of receiver and "A" battery terminals.

(b) No "B" battery reading—open or loose connections. Check wires on 1st radio socket, wires on 1st and 2nd coil (*from left*), 1st neutralizing condenser (*from left*), all slate-red wires including binding post terminals.

(c) No reading on "G" circuit—loose or open connections. Check 1st radio socket, wires on neutralizing condenser, all connections on outside coil (*1st from left*), grounding connection at 1st coil.

2nd Radio Socket (Plug Inserted)

(a) No "A" battery reading—open or loose connections. Check 2nd radio socket; other wires as in 1st radio.

(b) No "B" battery reading—open or loose connections. Check wires on 2nd radio socket, wires on 2nd and 3rd coils (*from left*) and 2nd reneutralizing condenser and variable condenser.

(c) No reading on "G" circuit. Check wires on neutralizing condenser, coil connections, 2nd coil (*from left*), 2nd variable condenser (*from left*).

Detector Socket (Plug Inserted)

(a) No. "A" battery reading. Check detector socket, grid leak connections, other wires as in 2nd radio.

(b) No "B" battery reading. Check wires on detector socket, wires on 3rd 1 MFd. Condenser (*in back of 2nd*) and 3rd coil (*from left*), also 3rd variable condenser wires on 1st audio transformer, wires on 45 volt binding post.

(c) No reading on "G" circuit (*none is possible unless .00025 condenser beneath grid leak is shorted out*) with condenser shorted out, no reading. Check grid leak, variable condenser and 3rd 1 Mfd. condenser in back of 2nd.

1st Audio Socket (Plug Inserted)

(a) No "A" battery reading—loose or open connection. Check wires on socket and orange-blue wires on other sockets, black wire on "A" battery binding posts, other wires as in detector.

(b) No "B" battery reading. Check wires on socket, wires on audio panel jack, connections on 2nd audio transformer, wires on 90 volt binding post.

(c) No "C" battery reading. Check wires on socket and 1st audio transformer, also "C" battery binding posts and "C" battery terminals. Speaker or phones must be in circuit at front panel jack "A" on speaker binding posts but not in audio panel jack.

2nd Audio Socket (Plug Inserted)

(a) No "A" battery reading—loose or open connection. Check wires on socket, black and orange-blue wires on terminal binding posts, wires on audio panel jack, others as in 1st audio (*be sure plug is not in audio panel jack.*)

(b) No "B" battery reading—loose or open connection. Check wires on socket, front panel jack and audio panel jack, also wires on 2nd audio binding post (*be sure plug is not in audio panel jack*).

(c) No "C" battery reading (*plug inserted*). Check wires on socket, connections on 2nd audio transformer, wires on "C" battery binding posts and "C" battery terminals (*be sure plug is not in audio panel jack.*)

Section 8
INTERFERENCES AND DISTURBANCES

Disturbances that interfere with the clear reception of broadcast programs can be due to two causes:

First—Noises that are generated in the radio receiver circuit.

Second—Noises that are generated outside of the radio receiver and that are picked up by the antenna and amplified, along with the desired broadcast signals.

The Stromberg-Carlson Nos. 501-A, 502-A, 601-A, 602-A, 601-B and 602-B Radio Receivers completely avoid all noises usually generated in the receiver itself by the special balancing of the circuits and the use of shielding over the tuning coils. Incorrect operation of the receiver, in no case, will generate noises that will radiate from the antenna and interfere with neighboring receivers.

However, noises that are caused by natural "static," locally used electrical appliances and neighbors' radiating receivers, and collected by the antenna, naturally are magnified or amplified by the radio receiver, along with the desired signals, and are heard in the loud speaker. The sole function of any radio receiver is to amplify, without distortion, all of the signals that are tuned-in at any particular wave length or frequency. It is not possible to "sift" out these "noise" frequencies as most of them are of the same character as the frequencies of the desired signal.

It is obvious that the eliminating of these disturbances must be by either one or both of the following methods:

(a) Eliminate or reduce the disturbance at its source.

(b) Locate or arrange the antenna of the radio receiver so as to be in a favorable position for picking up broadcast station signal and in an unfavorable position to collect local disturbing noises. (*Preceding section.*) Unfortunately, it is not possible to remedy all of the disturbances at the source, but care in the installation of the pick-up usually will give a satisfactory installation for local stations and for most distant stations. The following is a list of disturbances and suggested remedies:

(a) *Interference Between Broadcasting Station Programs:* The selectivity of the No. 501-A, 502-A, 601-B, 602-B, 601-A and 602-A Radio Receivers is ample to prevent this kind of interference, provided the antenna is not too long, and the station signals do not overlap. (*See Section* 29, 6 *tube Reference Book, and Section* 30, 5 *tube Reference Book, covering "Choice of Antenna and Location."*)

(b) *Interference Due to Broadcasting Stations on Close Wavelengths:* When the broadcasting stations are operating on wave lengths that are so close together that the inaudible radio-frequency carrier waves combine to cause audible beat notes, the result is a steady squeal or howl of unvarying pitch. This seldom occurs unless one or both of the broadcasting stations are operating on an incorrect wave length, or when a very distant broadcasting station has an assigned wave length the same as or close to that of a local broadcasting station.

There is no remedy in the hands of the broadcast listener to entirely overcome this kind of disturbance, other than to listen to the station that comes in with the loudest signal and reduce the amplification by turning the *"volume control"* knob counter-clock-wise or to the point where the interfering note is practically eliminated. If both stations come in with the same volume, there is no way to mitigate this type of interference, although the programs may be partially separated by careful setting of both *"station selectors"* (*also "vernier" to "maximum response" for the station desired on the* 501-*A and* 502-A *receiving sets.*)

(c) *Radiation from Local Receiving Sets:* Practically all receiving sets, using the "regenerative" principle, and sets not provided with means to prevent "oscillation" act as miniature broadcast stations and radiate tuning and receiving noises, when incorrectly operated. These noises usually vary in pitch and sound like chirping of birds, howling and low pitched groans and can be picked up from a receiving set located many miles away. However, the louder noises of this character come from a neighboring receiving set. A correctly balanced "neutrodyne" type of receiver will not radiate this kind of disturbance, regardless of how the *"station selectors"* are tuned, so that when all of the receiving sets in use are of the "Neutrodyne" or balanced type, no disturbance of this kind will be possible. The Stromberg-Carlson 5 and 6 tube Radio Receivers do not oscillate or radiate when installed in accordance with these instructions, therefore will not cause disturbance to the nearest neighboring receiving set. The only remedy for this kind of disturbance is to suppress it at the source. A campaign of education has been inaugurated by radio clubs and various national radio associations to minimize and eventually eliminate this receiving set radiating disturbance.

(d) *Interference Due to Telegraph Code Signals:* Telegraph code signals, sounding like continuous dots and dashes, usually come from so-called "spark sets" and can be local amateur stations or local or distant commercial stations. Nearly all of the commercial stations are without the broadcast range and the amateur stations are gradually eliminating the "spark sets" or are working these sets on a schedule that avoids interference with evening broadcast programs.

The great selectivity of the Stromberg-Carlson 5 and 6 tube Radio Receivers reduces this kind of disturbance to a minimum.

(e) *Interference Due to Static:* All noises due to atmospheric electricity and local man-controlled electricity is commonly called "static." This disturbance sounds like a continuous roaring noise with occasional crashes and other varying or steady superimposed noises.

The atmospheric static is greater in summer than in winter and usually is more noticeable at night than in daytime. When the volume of the "static" exceeds that of the signal from the desired broadcast station, it is impossible for any radio receiver to bring in the programs satisfactorily. Devices for eliminating "static" also eliminate signal frequencies that are absolutely necessary for high quality audio reception. The only remedy is to be content with programs that come in with greater volume than that of the "static." Always keep the *volume control* turned down when the static level is high.

Other noises included under the heading of "Static" are caused by one or more of the following:

1. Switching on and off of lamps and other electrical devices.
2. Electric flatirons with thermostatic heat control or loose plug.
3. Electric heating pad with thermostatic heat control.
4. Door bells and buzzers while being operated.
5. Electric vacuum cleaners.
6. Sewing machine motors.
7. Furnace thermostat motors.
8. Oil burners that use spark ignition (some types).
9. Oil burners operating motors.
10. Refrigerator motors or electric control.
11. Violet ray machines.
12. Ozonators.
13. Motors with sparking brushes.

14. Battery chargers of vibrating type and some electrolytic types.
15. Ignition systems on private home lighting plants.
16. Electric elevators using commutators.
17. Hum caused by some types of "B" Socket Power Units having unsatisfactory filter system, or with magnetic coupling to audio apparatus of the receiver.
18. Bad contact in electric house lighting system switch, lamp socket, fuse or other connected device.
19. Electric sign flashers.
20. Electric street cars and electric railroads.
21. Electric smoke and dust precipitators.
22. Telephone exchange pole changers and ringing converters, if not protected by suitable shunting devices.
23. Induction from telephone and telegraph lines.
24. Some ark light systems.
25. Electric welding apparatus.
26. X-ray machines.
27. Static electricity produced by running belts.
28. Static electrical machines.
29. Stock tickers.
30. Electric furnaces of some types.
31. Motion picture projectors using arc lamps.
32. High voltage testing equipment.
33. Defective electrical power circuits and apparatus.

Fortunately practically none of the above listed disturbances (*steady disturbances*) are picked up by a receiving set located in a residence building, although they may be encountered to a more or less extent in steel frame apartment houses, stores and factory buildings. Thus a satisfactory demonstration of a sensitive and powerful radio receiving set is best made in the ultimate location rather than in a store or other salesroom. If the 5 or 6 tube Radio Receiver is to be installed in a steel framed building, where the disturbing "static" is generated inside this metal framework, the use of an outside antenna with a short length of lead-in wire between the radio receiver and the outside wall of the building usually will greatly reduce the effect of this locally generated noise.

(f) Interference Due to Battery Noises: Any noise that continues after the antenna and ground is disconnected from the receiver binding posts and the left hand *station selector* is set at "0" and the right hand *station selector* is set at "100," usually is due to loose battery connections, to run down "B" or "C" batteries or to "noisy" tubes. First, see that all battery wires are securely fastened at the battery binding posts or spring clips of the various batteries (*A, B and C batteries*) and at the radio receiver battery binding posts. Then if the noise continues when the "A" battery is fully charged, replace the "B" and "C" batteries with fresh, new batteries.

HOW TO AVOID DISTURBING NOISES

It is a simple matter to check whether disturbing noises heard in the loud speaker are generated in the radio receiver or whether these noises are picked up by the antenna and simply amplified in the receiver along with the desired broadcast signal.

Disconnecting the antenna wire or ground connection and then tuning the receiver to resonance is not a safe check, for there is always a short length of pick-up conductor (*tuned by the left hand station selector*) between the antenna binding post and first shielded coil of the 5 and 6 tube Radio Receivers to act as an antenna for nearby electrical noises or for local powerful broadcast signals.

The correct test for internal generated noises is to detune the receiver by setting the left hand *station selector* at the "0" division and the right hand *station selector* at the "100" division and then turning the volume control to maximum (*clock-wise direction as far as the knob will go*). The voltmeter pointer should be at the red line (*5 volts*) when this test is made and the A, B and C batteries should be fresh and all battery wires tightly held at the binding posts in radio receiver, as well as at the batteries.

Absence of noise, when making this test, is proof that any noise heard in the loud speaker when tuning-in a desired broadcast signal is due to a local electrical disturbance or to atmospheric static and not to faulty operation of the receiver.

If the antenna and ground are correctly installed, all batteries O. K., and battery connections tight, then careful tuning of the receiver will cut-down the outside noise to a considerable extent. A good rule to follow is:

> Rule 1—Always keep the "Volume Control" knob turned down (*counter-clockwise*) to the point where both "Station Selectors" tune sharply or to a point on the scale where a definite maximum loudness of signal is heard.

Now if greater volume of loud speaker signal is desired, the volume control can be slightly advanced, so long as the disturbing noise does not become objectionable. Keeping the volume control turned too high also overloads the detector and audio tubes, resulting in poor quality (*rattling and hissing*) of the signals.

The 5 and 6 tube Receivers always tune more sharply on the left hand *station selector* when the *antenna* key is set at position marked "1" thereby avoiding pick-up of undesirable frequencies. Thus another good rule to follow is:

> Rule 2—Always set the *antenna* key at "1" for receiving local broadcast signals and only use at position "2" for distant weak signals, and then only when conditions are favorable and local noise is not too great.

When the noise heard in the loud speaker is due to a local electrical disturbance, it is best to determine the source and make corrections at that source.

In many cases this is not possible, therefore the next best remedy is to so locate the antenna as to avoid picking up the disturbance. Follow this rule to avoid noise pick-up:

> Rule 3—Always locate the antenna so that it will be more exposed to the desired broadcast signal than to the local disturbing electrical "noise."

If the receiver is located in a steel frame building or in a building with metal lathing, and electrical "noises" are generated inside the building by motors or other electrical devices, then it is obvious that an inside antenna would be very unsatisfactory, due to its free exposure to the local "noises" and to the fact that it is shielded against the outside signals from the desired broadcasting station. Thus two more rules can be formulated:

> Rule 4—Always locate the antenna as far away from local generated electrical "noises" as possible.

> Rule 5—Always locate the antenna outside of a shielded building when inside "noises" are present, so that as much of the pick-up wire as possible will be in a favorable position for collecting the desired broadcasting signals and so that this wire will be in an unfavorable position to collect the inside "noise."

When following the latter ruling to its limit, there should be no long stretches of lead-in wire between the outside antenna and the receiving set, as this wire will act as a pick-up for the inside "noises." Also the outside antenna wire is best located when its open end is at the greatest distance from the building or from the source of electrical noise.

In many cases the ground connection acts as a collector of "noise." This is particularly true when the ground wire is long or is attached to a heating system pipe with high resistance rusted joints between the point of attachment and moist earth. Thus a good rule to follow is:

Rule 6—Always make the ground connection to a cold water pipe where possible.

When a good ground connection, free from "noise" pick-up, is not possible, then the next best scheme is to use what is known as a "counterpoise." (*See Section* 36, 5 *tube Reference Book, and Section* 35, 6 *tube Reference Book.*) This is merely a length of insulated wire, connected to the ground binding post of the receiver and stretched along the floor or down a hallway for 30 feet or longer. It should not be connected to any metallic objects and the antenna should be as favorably located as possible to pick up the desired broadcast signal and so as not to pick up the local "noise." With a counterpoise in place of a ground connection, the receiver will tune sharp and the key marked *"antenna"* may have to be set in position "2" for increased sensitivity.

Rule 7—A counterpoise "ground" should be used when a short length, low resistance connection to earth, that is free from "noise" pick-up, is not possible.

No doubt, the greatest cause for excessive noise pick-up is in the use of an antenna that is too long for the receiver. It must be remembered that the antenna is a part of the amplifying system of a receiving set installation, and the longer the antenna the greater the amplification possible. When the receiver has a great amplifying power within its circuits, the antenna need not be as long as when the receiver is of less amplifying power.

In general, the total length of antenna, including the lead-in, should not exceed 100 feet of single wire for the Nos. 501-A and 502-A Receivers, and not over 60 feet for the 601-A, 602-A, 601-B and 602-B Receivers. With powerful local broadcast signals, the total length of antenna might be cut down to less than 30 feet if it is located in a position to efficiently pick up the desired signals. Thus the following rule should be observed:

Rule 8—A short antenna (*less than* 50 *feet long for the* 5 *tube sets and* 30 *feet for the* 6 *tube sets*) should be used only when it can be located in a position to efficiently pick up broadcast signals and when there are no local disturbing noises to interfere with the reception.

Reducing the length of antenna will not always act favorably to prevent the picking up of "noise," for if the noise is local and confined to the building, then the shorter the antenna length the greater the amplification necessary (increase of volume control in the receiver) to make up for loss in amplification due to the shorter antenna if the loud speaker volume for the desired broadcast signal be kept the same for each condition.

The turning up of the volume control, to compensate for decreased antenna length, naturally will increase the amplification of the local noise to a greater extent than that of the desired broadcast signal as the portion of the antenna exposed to the local disturbance remains practically the same whether the antenna is of a long or a short length. Thus the following rule should be observed:

Rule 9—Use a long antenna (*keeping in mind Rules* 2 *and* 10) for reducing the noise background in the loud speaker when the disturbing "noise" is local and close to the receiver.

When it is possible to get away from local "noise" conditions with the use of a fairly long antenna (*not to exceed* 100 *feet, including lead-in wire for the six tube sets and* 60 *feet including the lead-in wire for the five tube sets*) then it is preferable to use this longer antenna for the extra pick-up that is required for daylight reception. This longer antenna also is preferable for use in the country, as usually there are no local or powerful broadcasting stations to interfere (*see* ***Rule*** 10).

The length of antenna also is dependent on whether it is possible to have complete control of the loud speaker volume by means of the *volume control* on the receiver without resorting to detuning the station selectors or unduly cutting down the tube voltage *voltage control* for reducing loud speaker volume when listening to the most powerful local broadcast station signals. Therefore, this gives another good rule to follow:

> Rule 10—The size of antenna should be limited to the length that will allow the most powerful broadcast signal to be tuned sharply to resonance (*maximum response*) on both station selectors and so as not to give too great a volume on the loud speaker when the volume control is turned fully down (*counter-clockwise*).

The reason for this ruling is that detuning the station selectors, in order to cut down volume, always results in impairment of quality and promotes interference and noise pick-up. Also reducing the voltage on the audio tube filaments to less than 4.6 volts (*reading on voltmeter*) for reducing of volume may result in poor quality of loud speaker reproduction.

In unfavorable locations, the use of short antenna for local reception and a long antenna for distant with a switch to cut-in one or the other will satisfy the radio fan who is after the maximum range that is possible with the five and six tube Receivers and at the same time give full control of the amount of noise background that might be encountered, due to atmospheric changes throughout the year.

Due to the shielding of the five and six tube Radio Receivers, and to the careful design of the receiver circuits, practically the only "noise" that can reach the loud speaker is that actually picked up by the antenna and amplified along with the desired signal. The powerful radio amplification provided in these receivers allows for many installation precautions against "noise" pick-up that could not be used with receivers of less amplification or with receivers having no shielding.

> Rule 11—There are locations where it is difficult to install a satisfactory horizontal type of out-door or in-door antenna wire and avoid the picking up of locally generated noises, such as disturbances from street car circuits, high voltage power circuits, etc. In general, an antenna wire arranged to be at right angles (*not parallel*) to the disturbing wire, such as a trolley wire, power wire, etc., will give the minimum pick-up from these disturbing sources.

Also, it has been found that these disturbances often are picked up through the usual ground connections between the receiving set and a cold water pipe in the building. In such cases, the water pipe usually runs under or adjacent to the car tracks or circuits of disturbing electrical devices are also connected to the water pipes, so that there is a direct electrical connection to the circuit of the radio receiver. In such cases, one of the following two remedies usually overcome the trouble:

1. The use of a counterpoise instead of a ground connection to the "GND" binding post of the radio receiver. This counterpoise is nothing more than an insulated wire arranged below the level of the receiving set.
2. The use of a 6 ft. telephone type of ground rod driven into moist earth at a location near the location of the receiver, so that the ground wire connection will be very short and as near as possible in a vertical line. This type of ground is described in

Section 35 of the five tube reference book and Section 34 of the six tube reference book.

If the noise pick-up still continues to be objectionable, then a vertical type of antenna usually will provide a remedy, unless the disturbance is caused by some vertical wires located inside the building. This vertical antenna is nothing more than a wire that is carried in a vertical line from the antenna binding post of the receiver to as great a height as possible. There should be no horizontal run of wire anywhere between the binding posts and the top end of this vertical type antenna. The wire itself can terminate at the top of a pole, and the greater the length of wire extending into the air, the greater the efficiency of this type of antenna for picking up desired broadcast signals.

Often, it is impossible to get a sufficient length of vertical wire to make an efficient type of pick-up for distant broadcast signals. This would indicate that a radio receiver with maximum amplification in the radio end should be employed and in such cases the Stromberg-Carlson No. 601-B or No. 602-B Receivers are recommended in preference to the No. 501-A or the No. 502-A Receivers.

When it is not possible to extend the single wire directly upward a sufficient distance to get the desirable pick-up for distant signals, then the so-called "umbrella type" of antenna may be used to advantage. This type of antenna is nothing more than 12 or more antenna wires that are soldered together at the top end and fastened by an insulator to the top of a pole at least 10 feet in height. This pole should be erected on the roof of a building, so as to be as high as possible from the ground. The lower ends of these wires are spread so as to form a small circle about 3 feet in diameter around the bottom of the pole and each wire attached to the roof with an insulator. This arrangement gives the appearance of the ribs of an umbrella that has been partially opened up, the supporting pole representing the handle and center rod of the umbrella. These spreading wires serve as guide wires for bracing the pole, as well as for wires to pick up the desired broadcast signal. A lead-in wire for connecting to the "ANT" binding post of the receiving set to this umbrella type of antenna can be connected to any one of the several wires of the umbrella and it should extend to the receiving set in as vertical a path as possible, avoiding any horizonal stretches of wire.

I-A RADIO RECEIVER MODIFICATION CIRCUIT

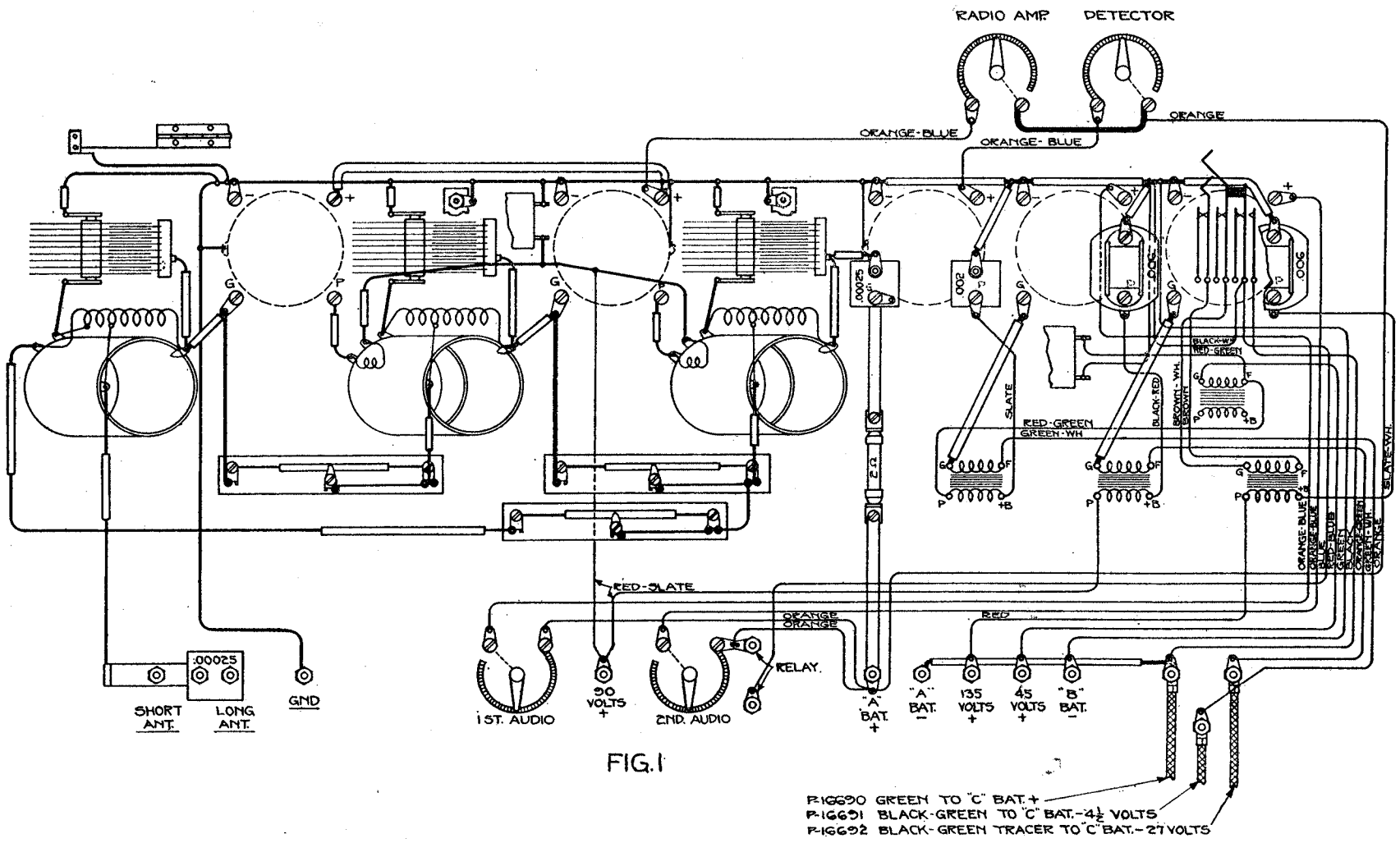
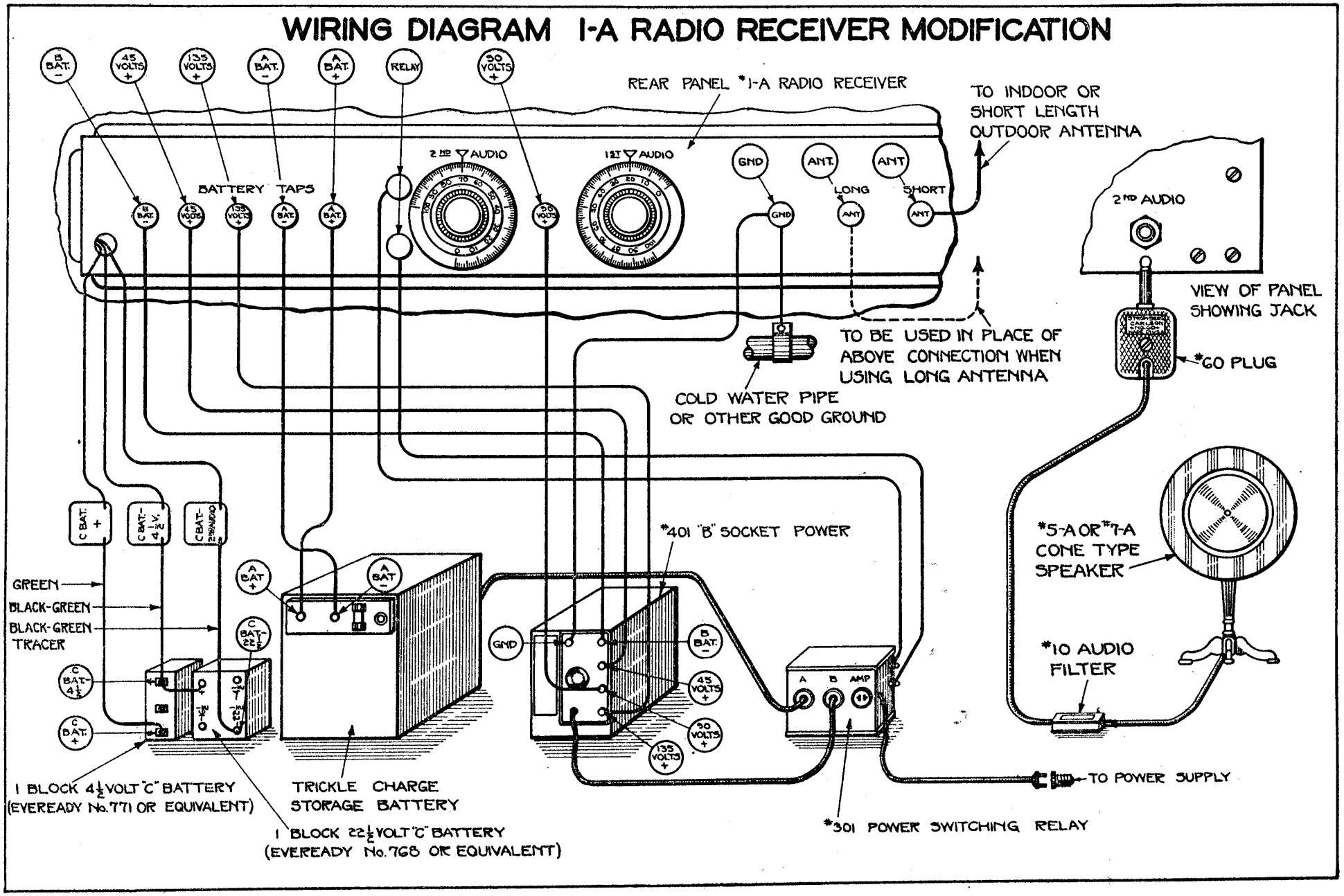


FIG. I

WIRING DIAGRAM 1-A RADIO RECEIVER MODIFICATION



I-B RADIO RECEIVER MODIFICATION CIRCUIT

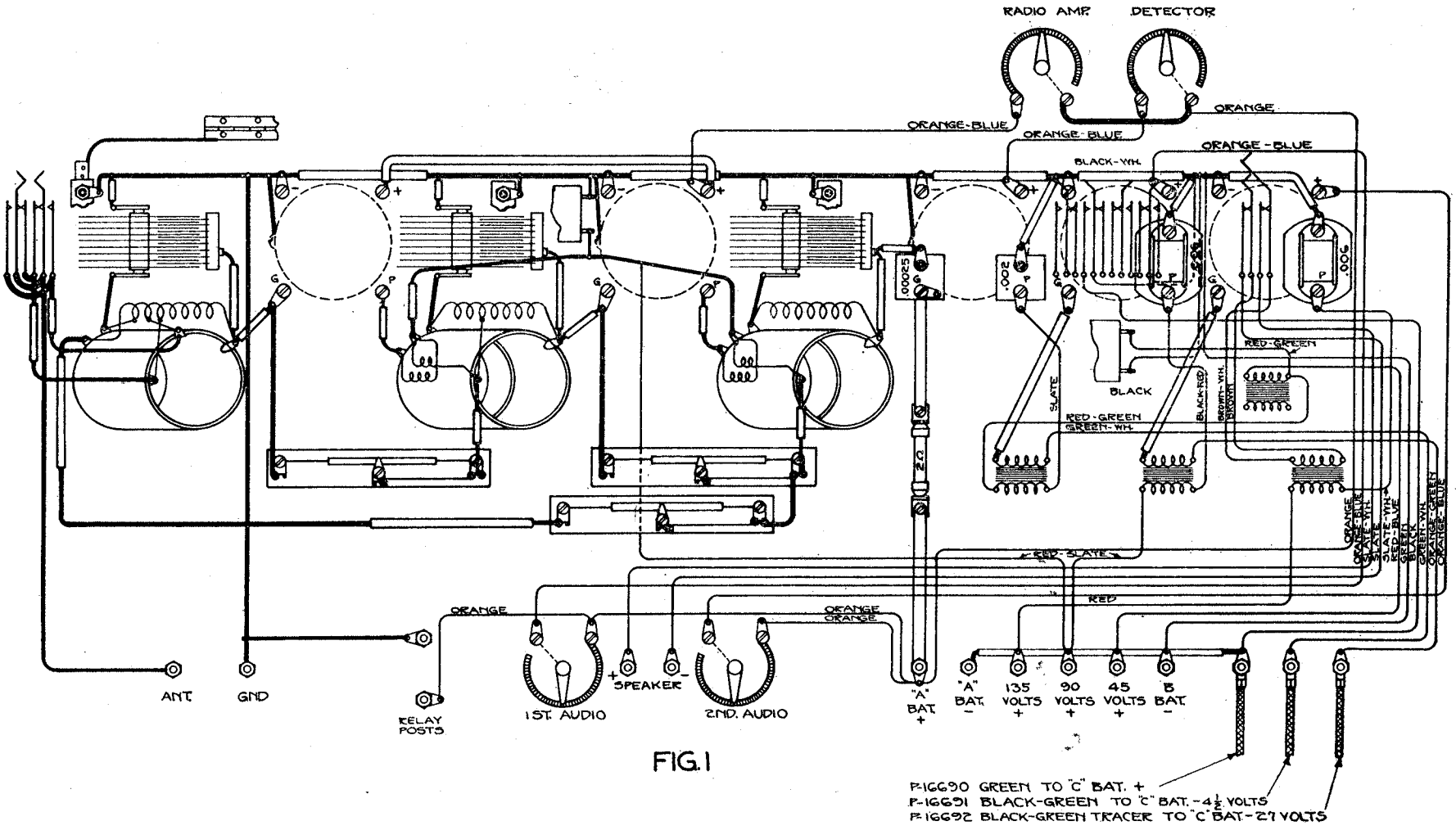
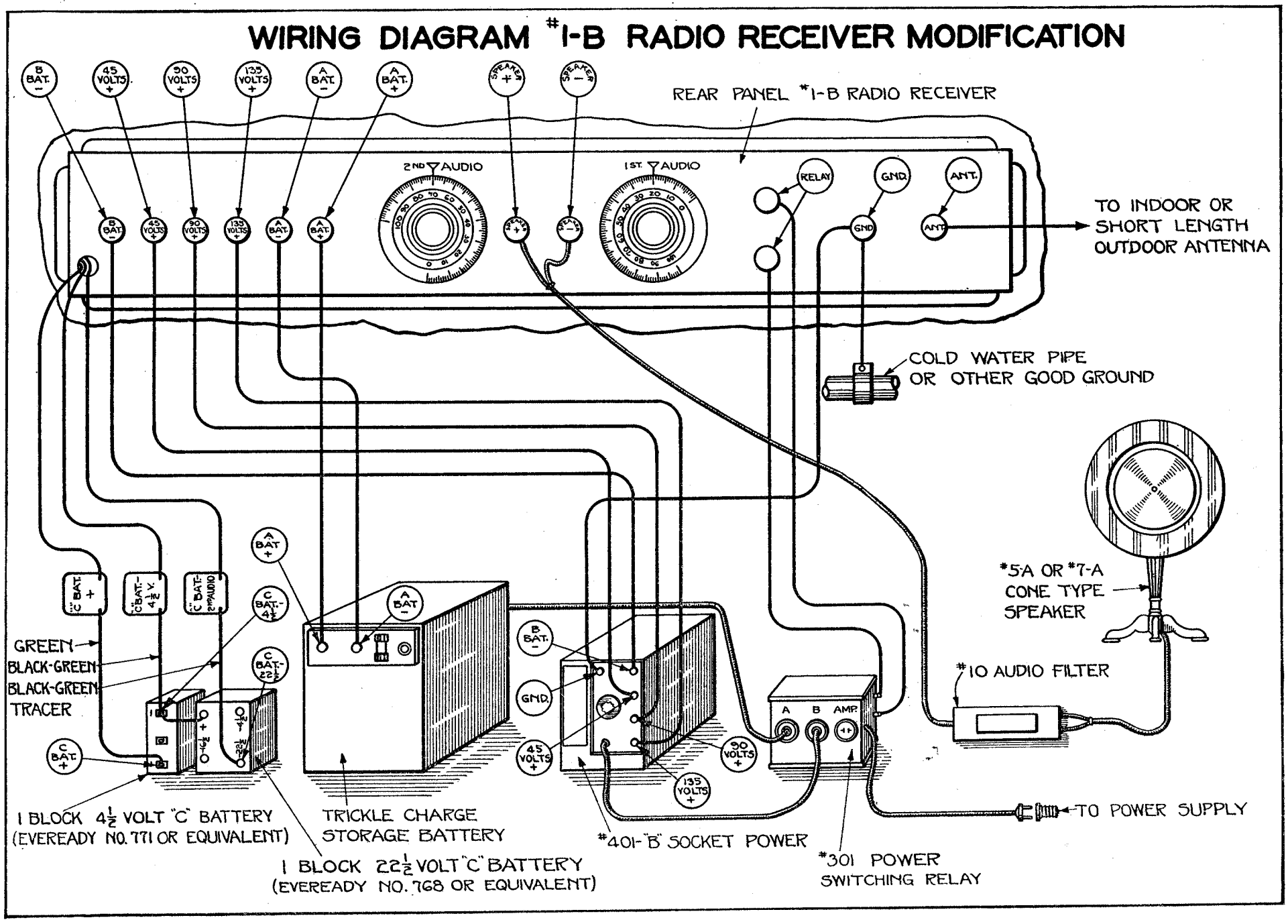
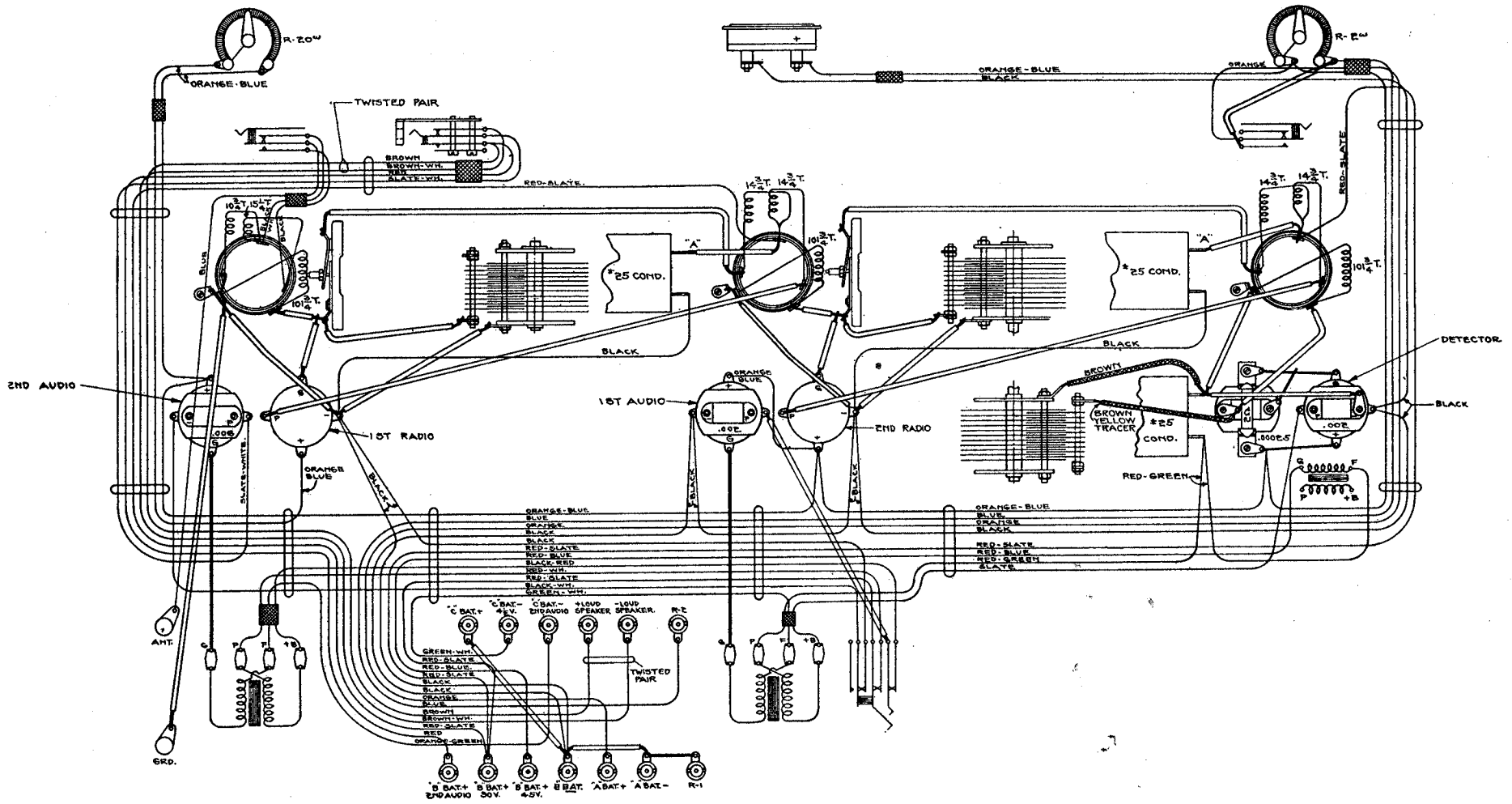


FIG. 1

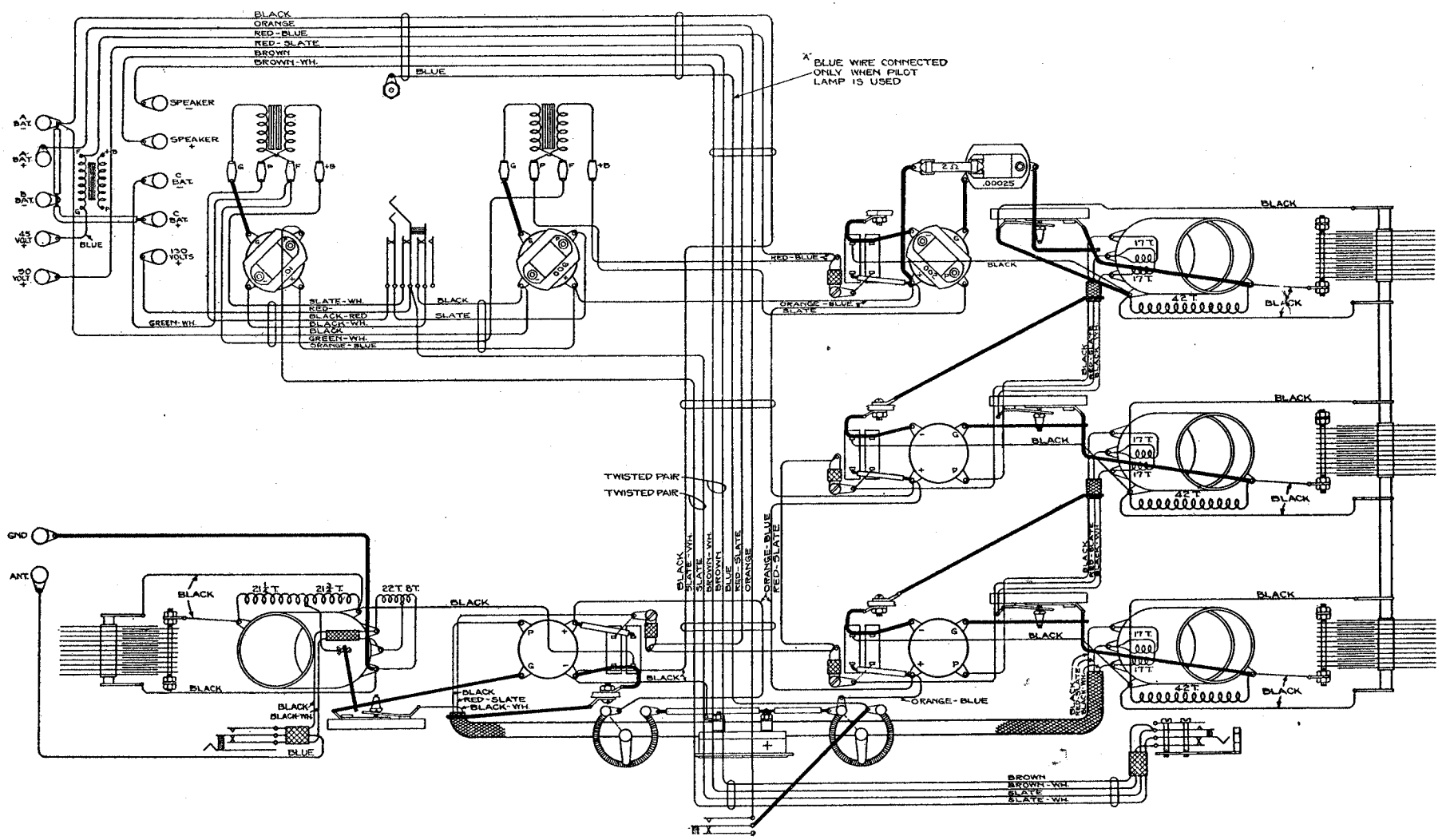
WIRING DIAGRAM #1-B RADIO RECEIVER MODIFICATION



501-A & 502-A RADIO RECEIVER CIRCUIT

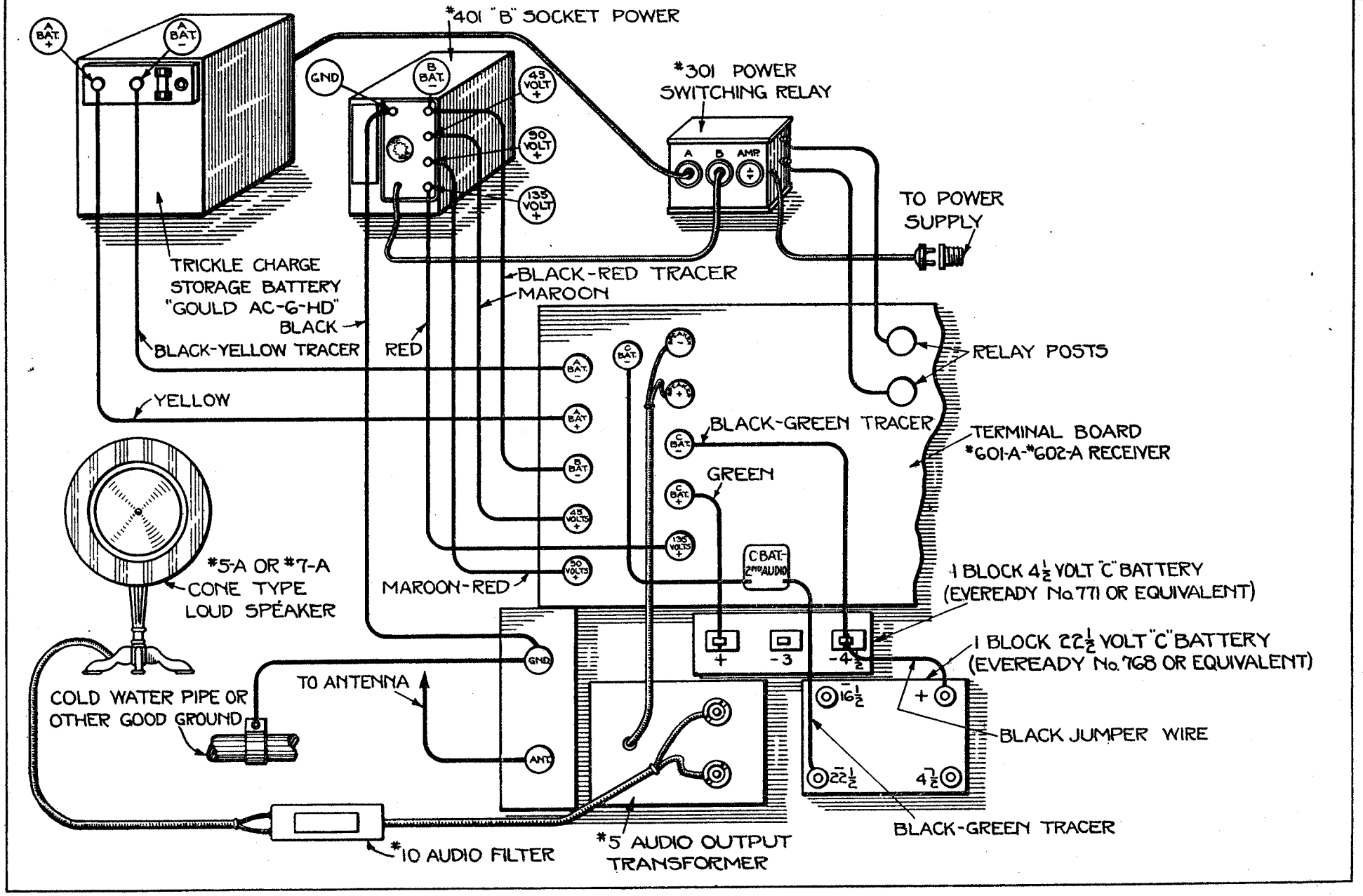


601-A & 602-A RADIO RECEIVER CIRCUIT

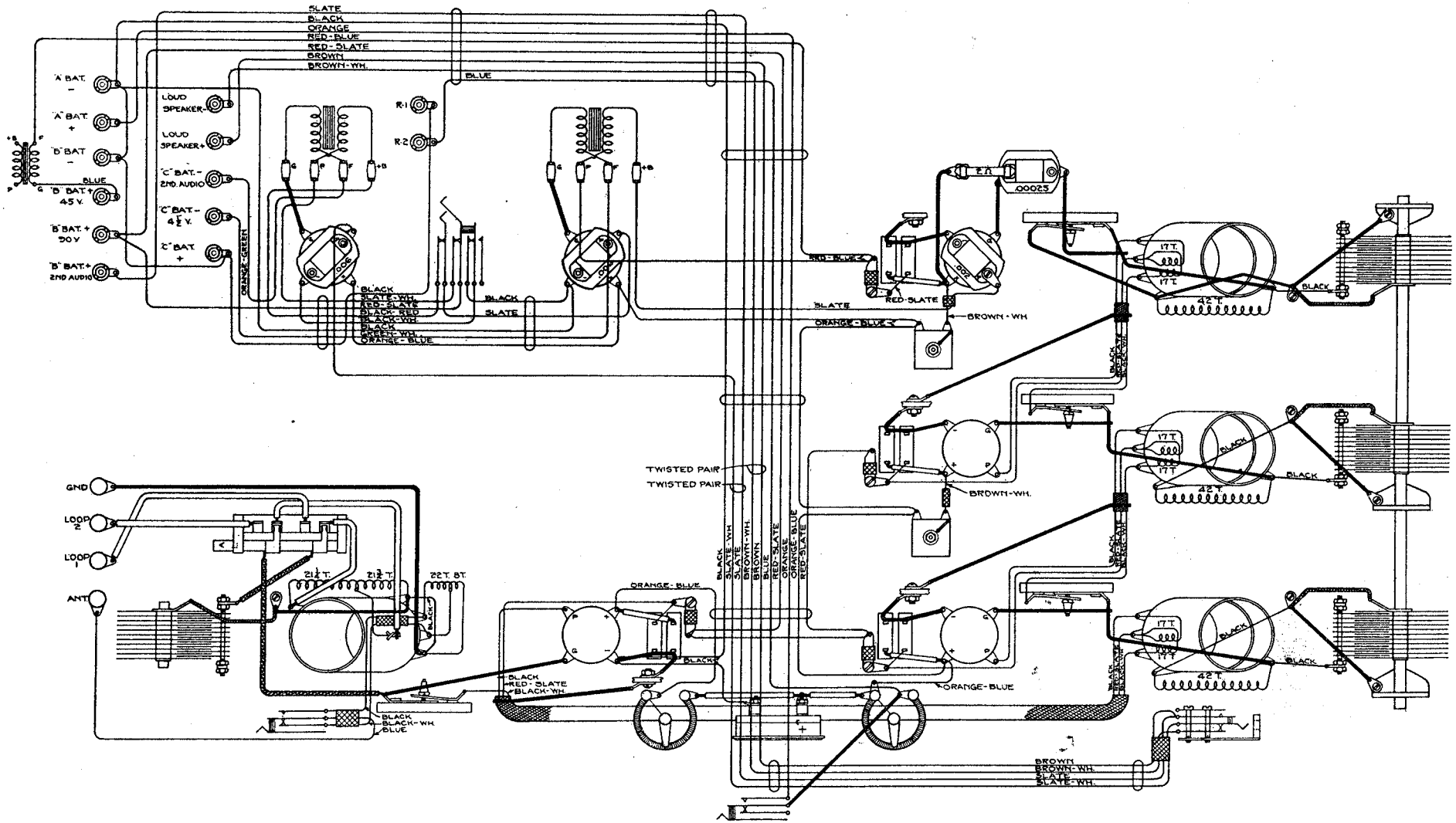


WIRING DIAGRAM #601-A & #602-A RADIO RECEIVER MODIFICATION

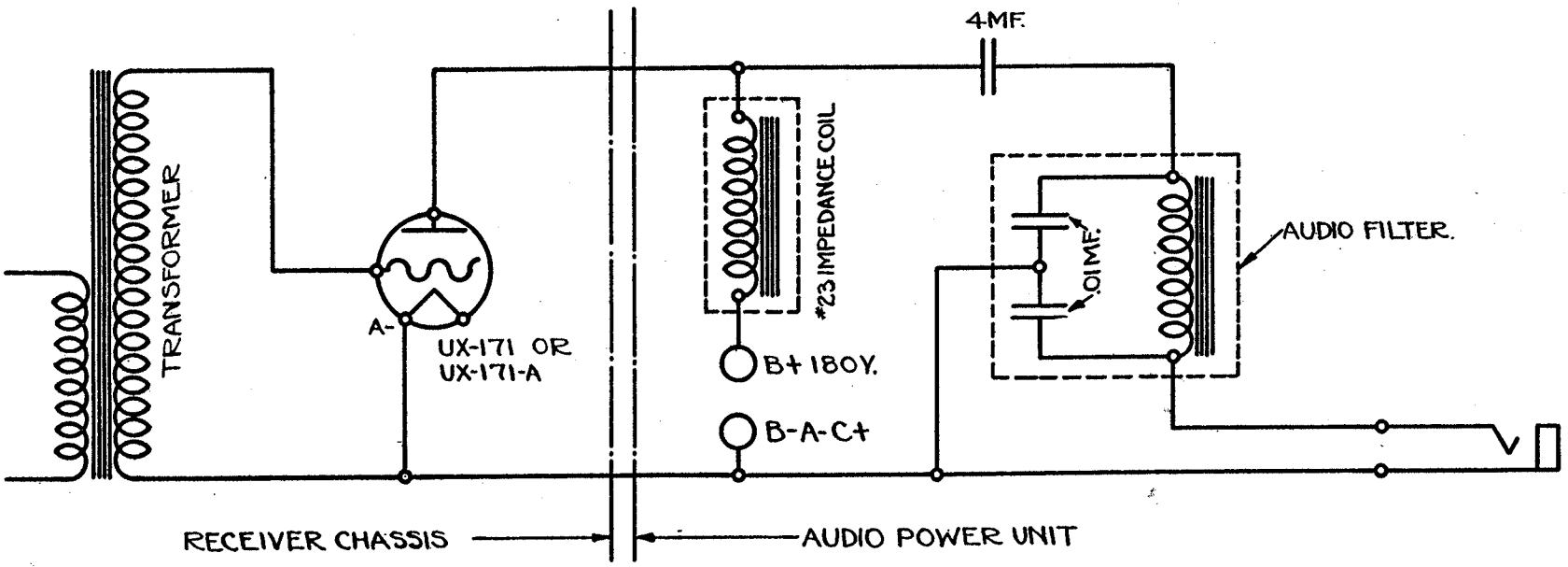
ADAPTED FOR UX-171 TUBE & POWER SWITCHING RELAY



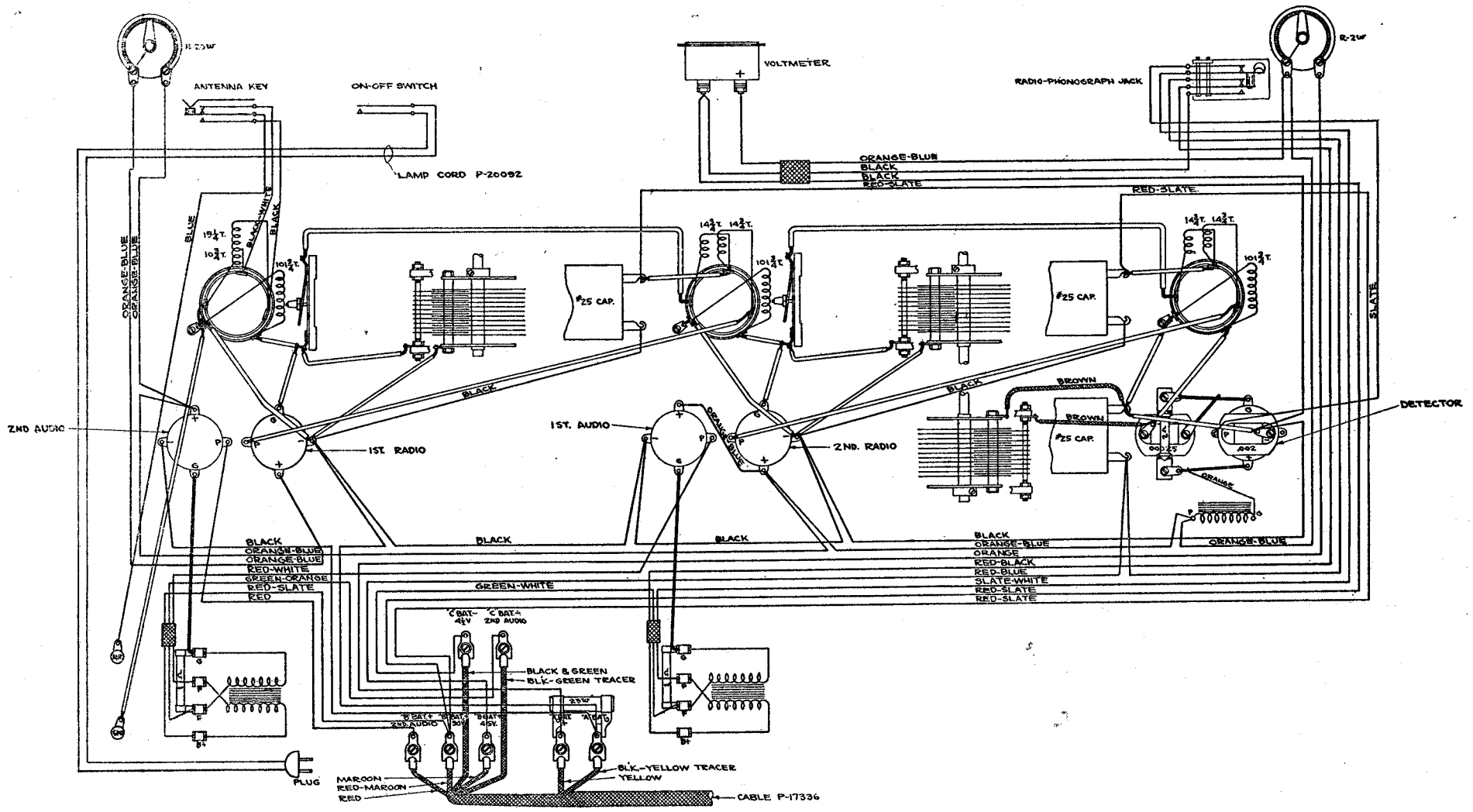
601-B & 602-B RADIO RECEIVER CIRCUIT



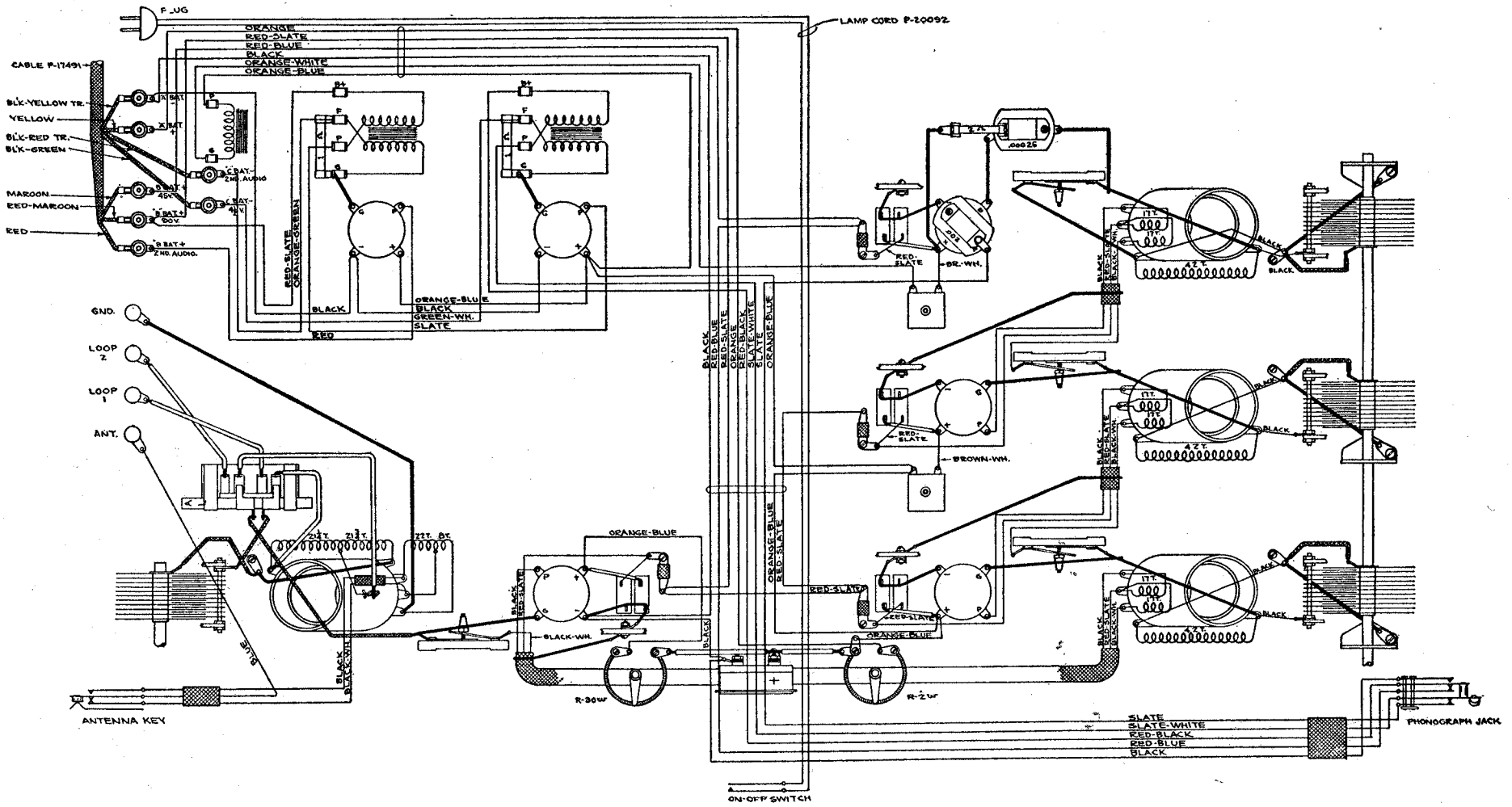
520 AND 630 SERIES RECEIVERS
AUDIO OUTPUT CIRCUIT



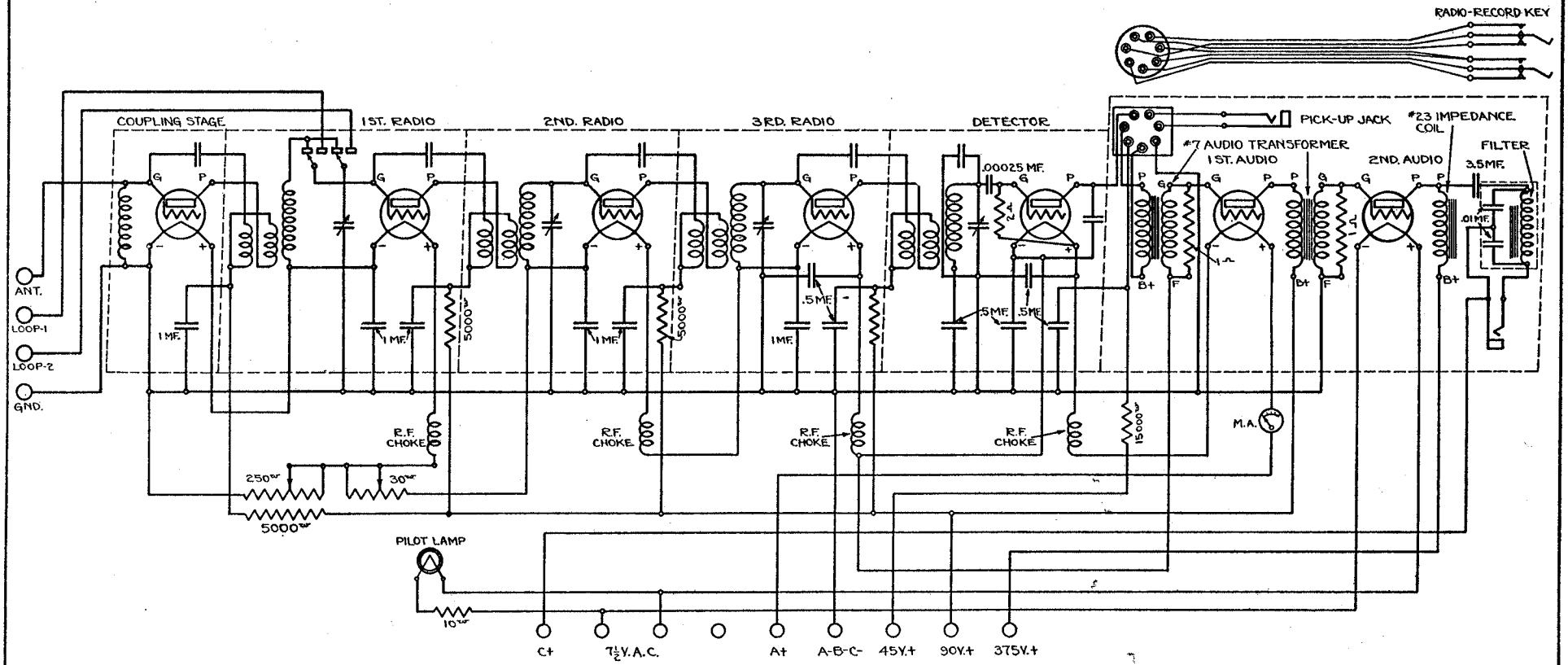
523 & 524 RADIO RECEIVER CIRCUIT.



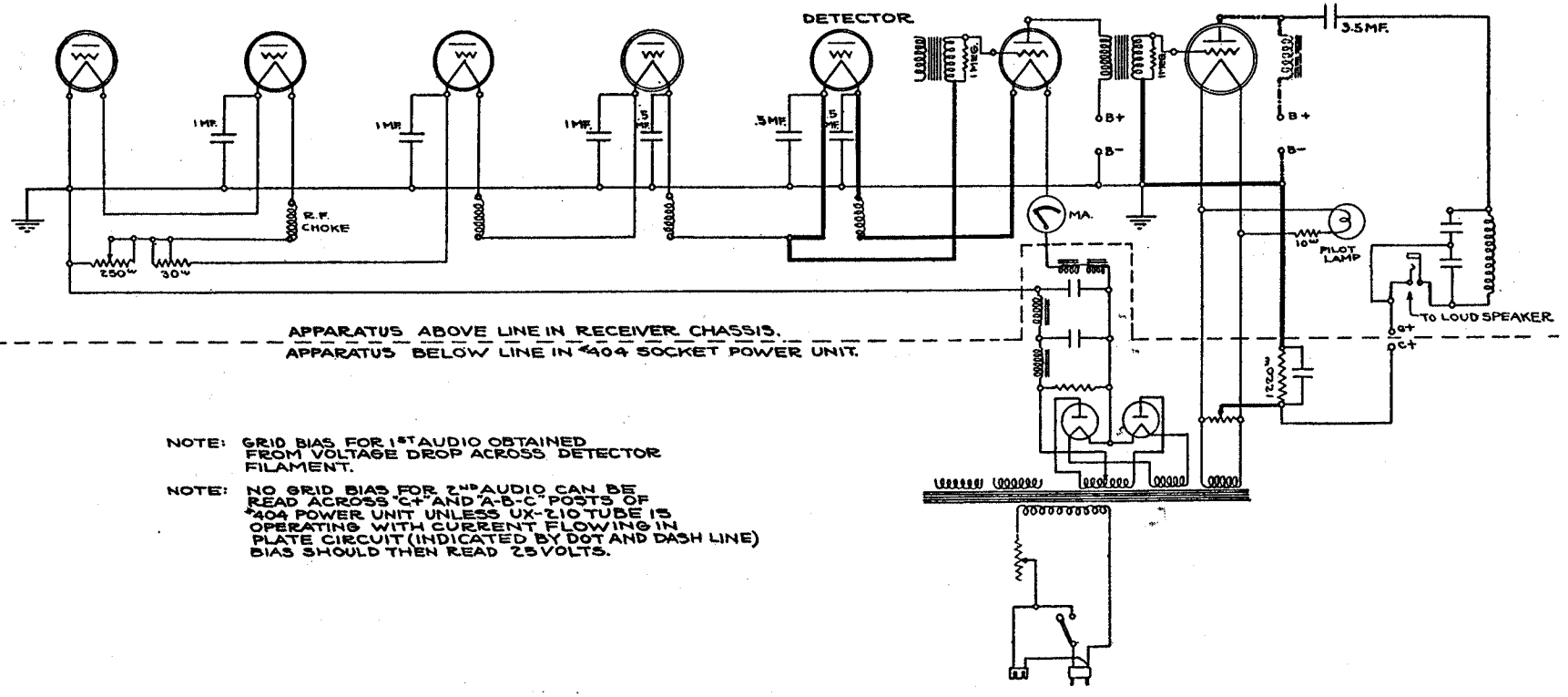
633 & 634 RADIO RECEIVER CIRCUIT.



734 RADIO RECEIVER CIRCUIT



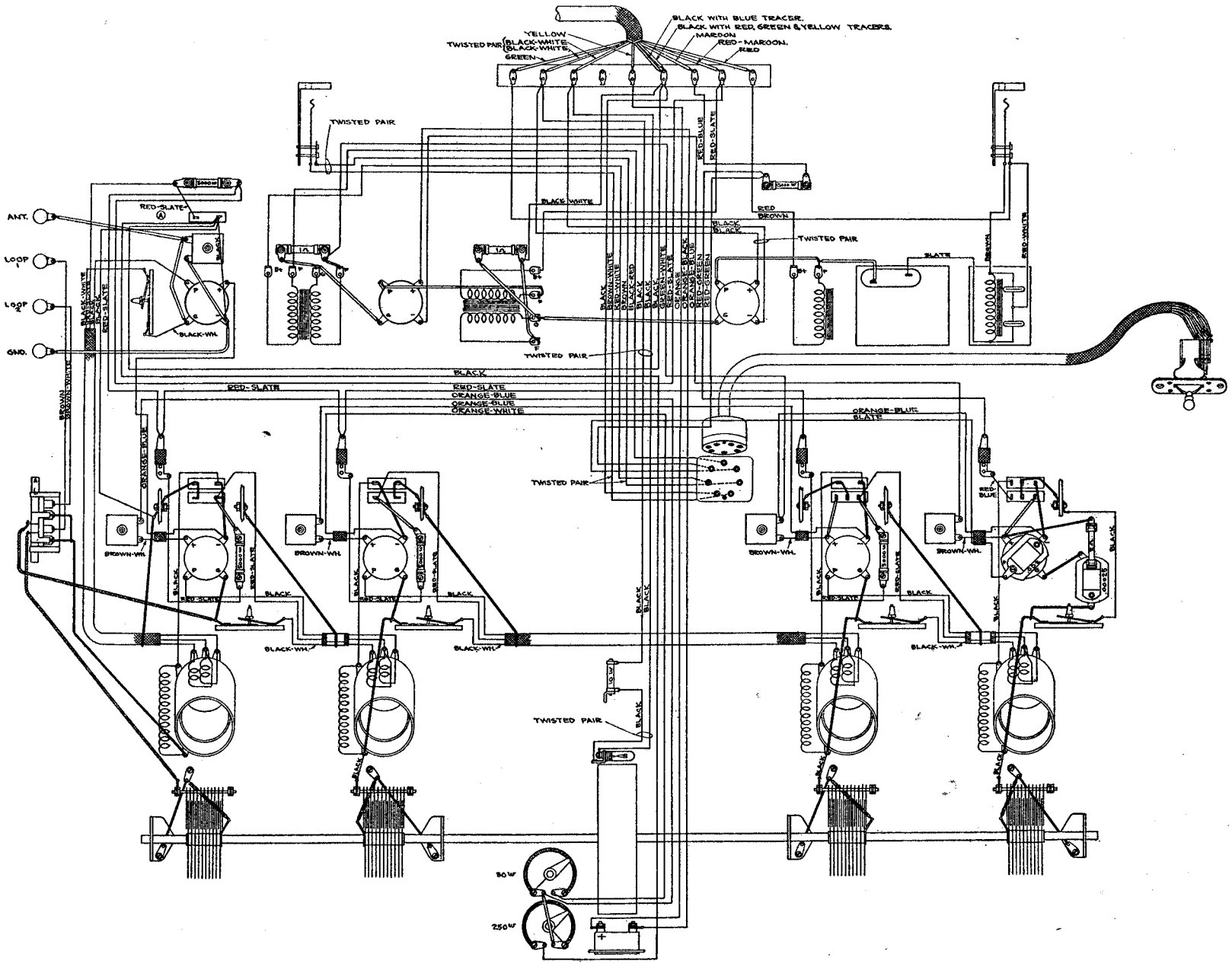
NO. 734 AND 744 RECEIVERS
FILAMENT AND GRID BIAS CIRCUIT



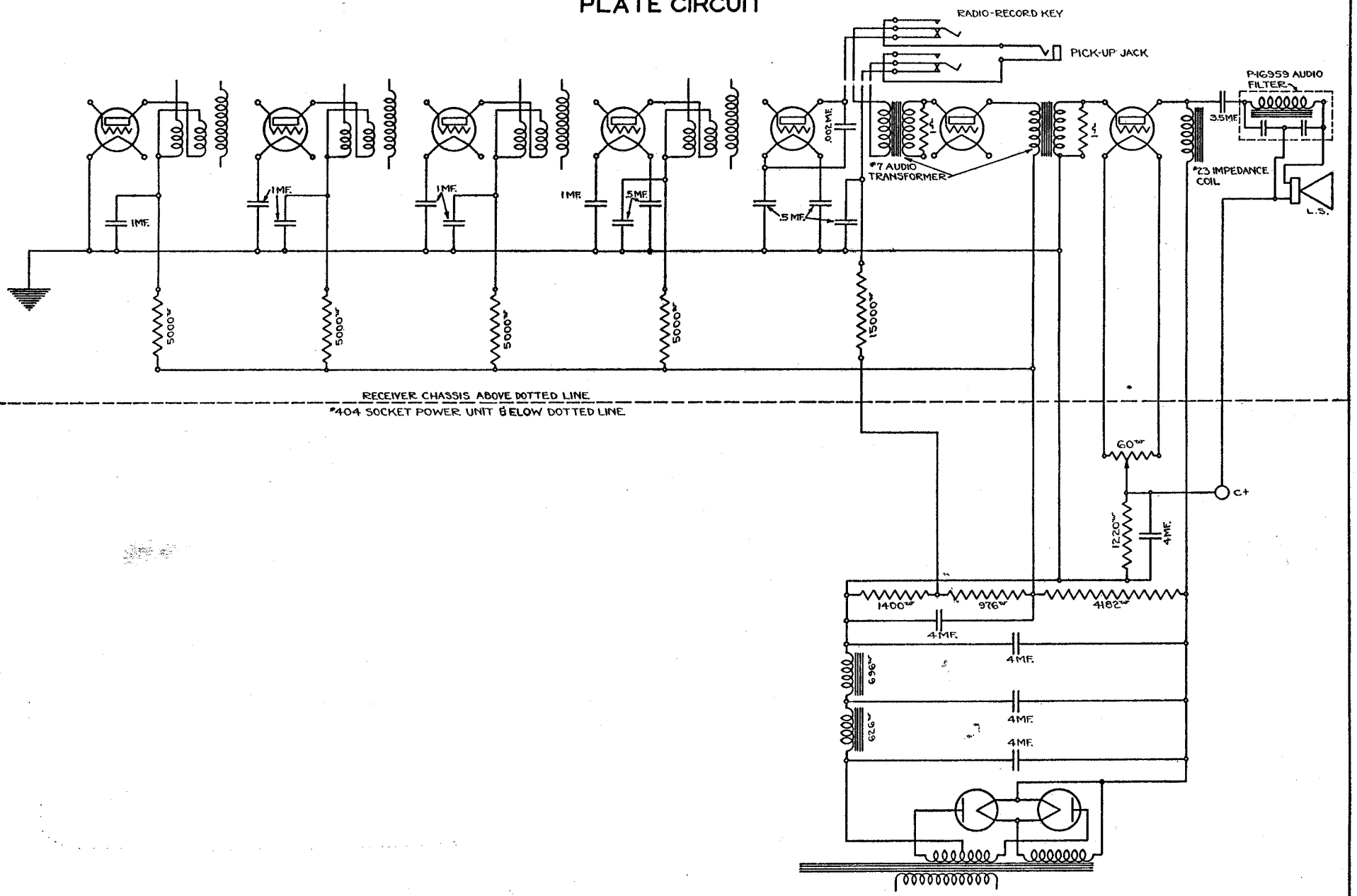
NOTE: GRID BIAS FOR 1ST AUDIO OBTAINED FROM VOLTAGE DROP ACROSS DETECTOR FILAMENT.

NOTE: NO GRID BIAS FOR 2ND AUDIO CAN BE READ ACROSS "C+" AND "A-B-C" POSTS OF 404 POWER UNIT UNLESS UX-210 TUBE IS OPERATING WITH CURRENT FLOWING IN PLATE CIRCUIT (INDICATED BY DOT AND DASH LINE) BIAS SHOULD THEN READ 25 VOLTS.

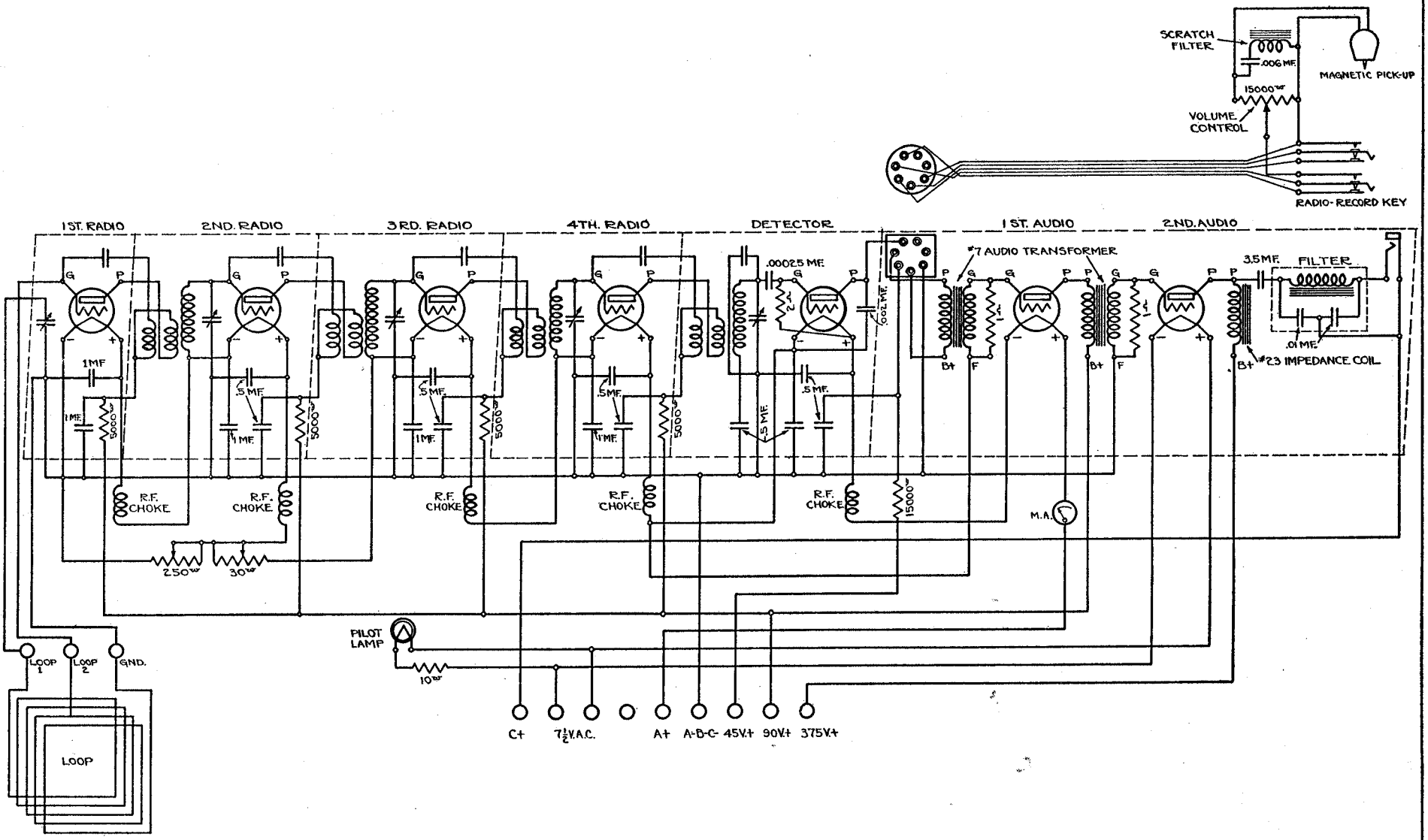
734 RADIO RECEIVER CIRCUIT.



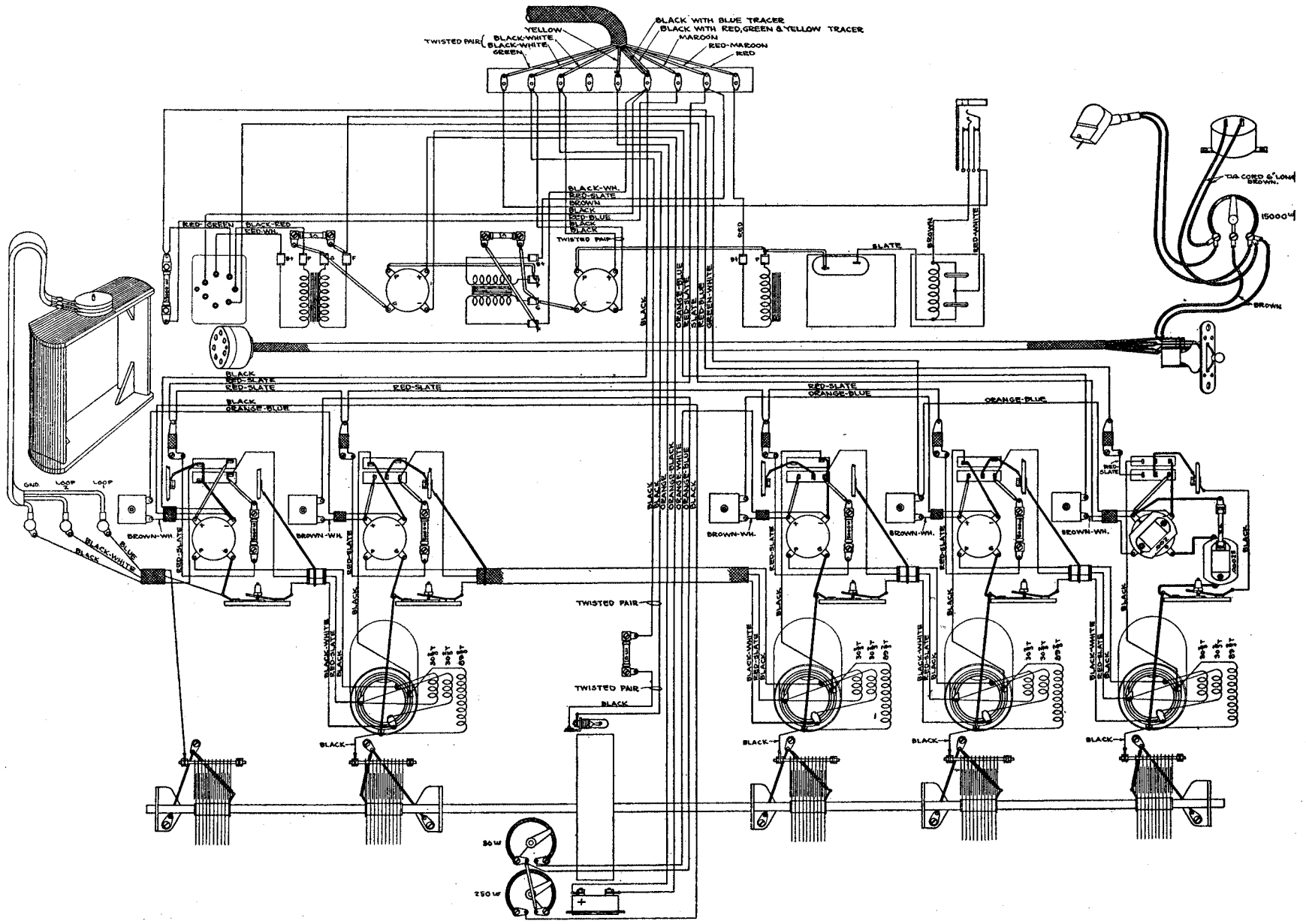
734 & 744 RADIO RECEIVERS
PLATE CIRCUIT



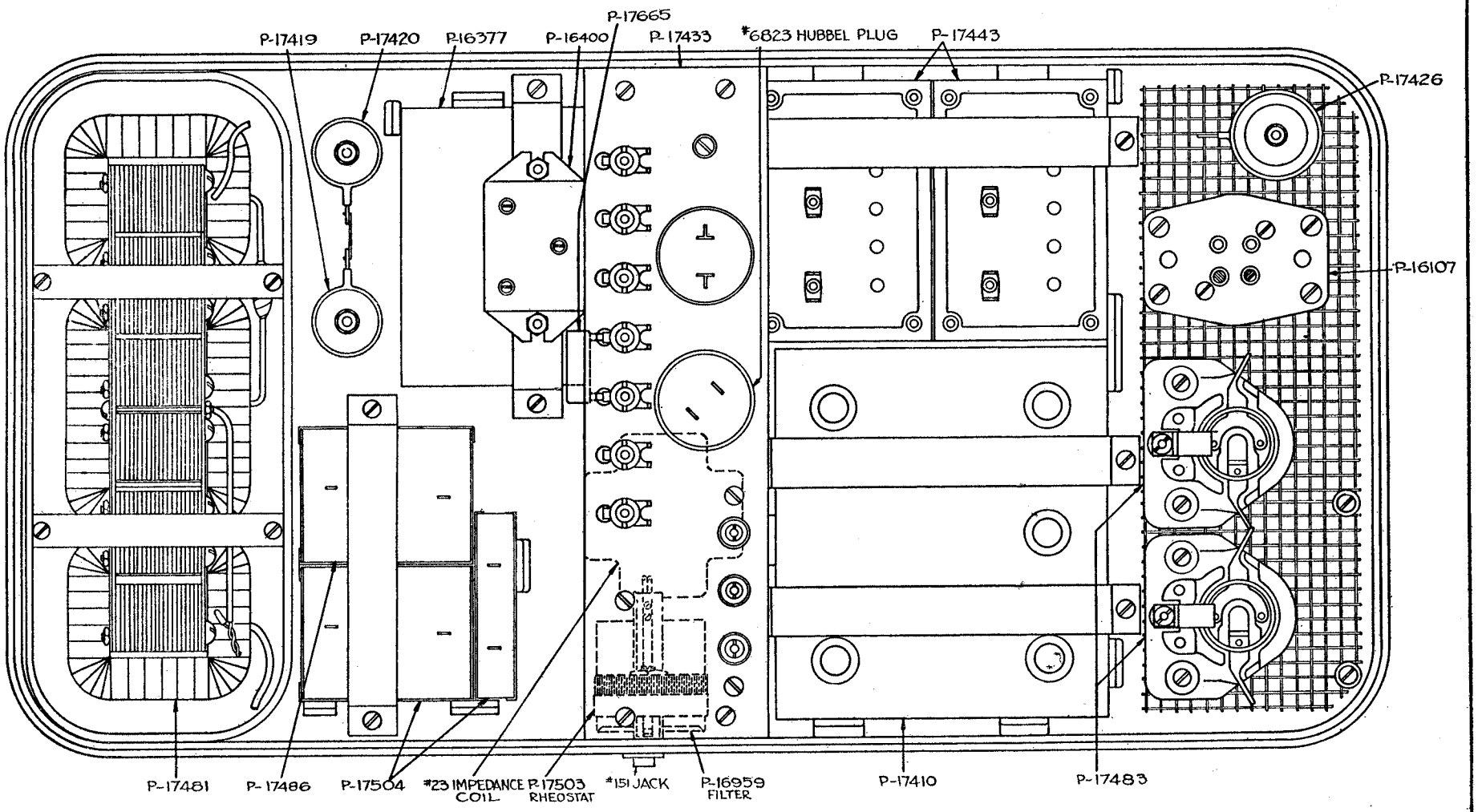
744 RADIO RECEIVER CIRCUIT



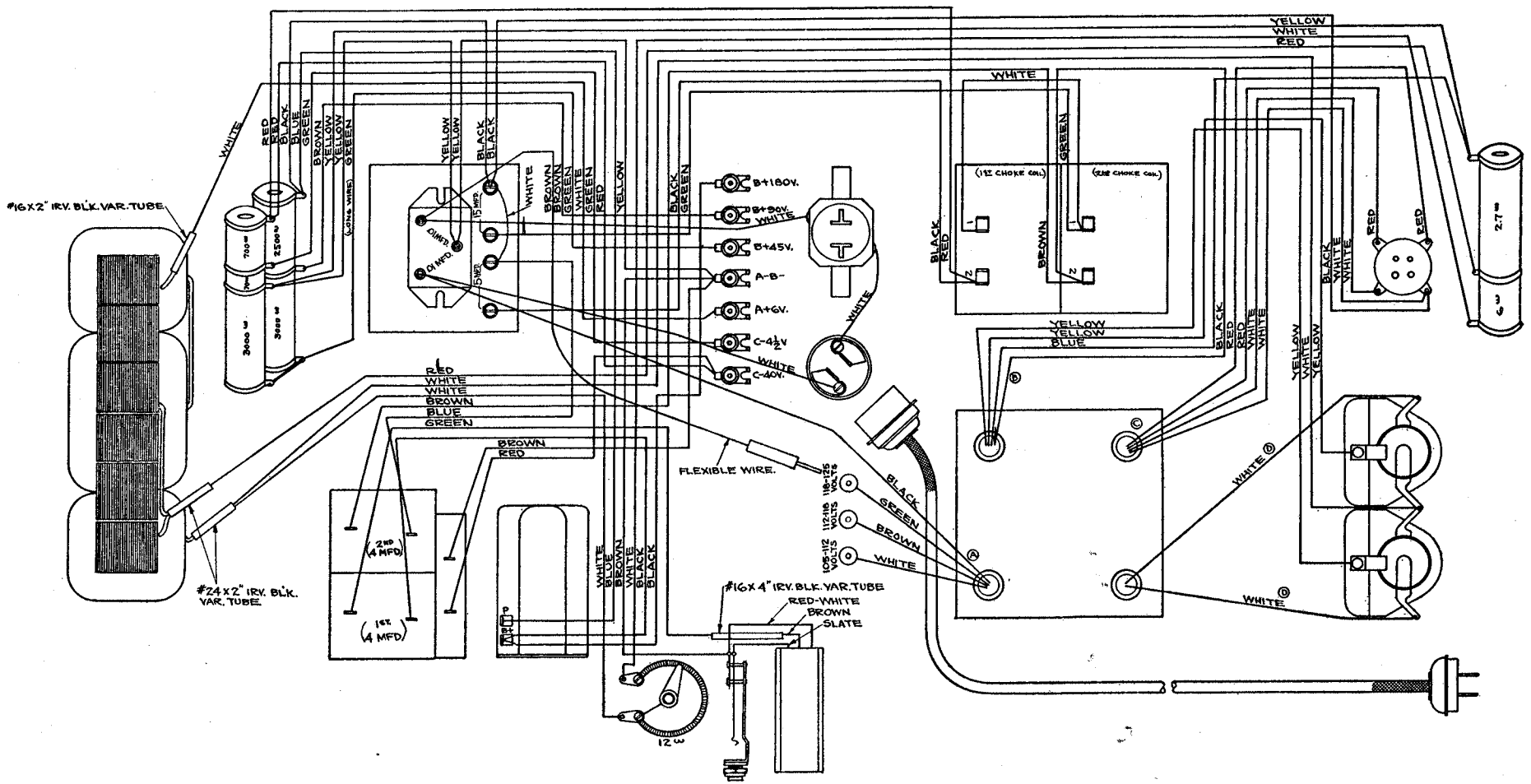
744 RADIO RECEIVER CIRCUIT.



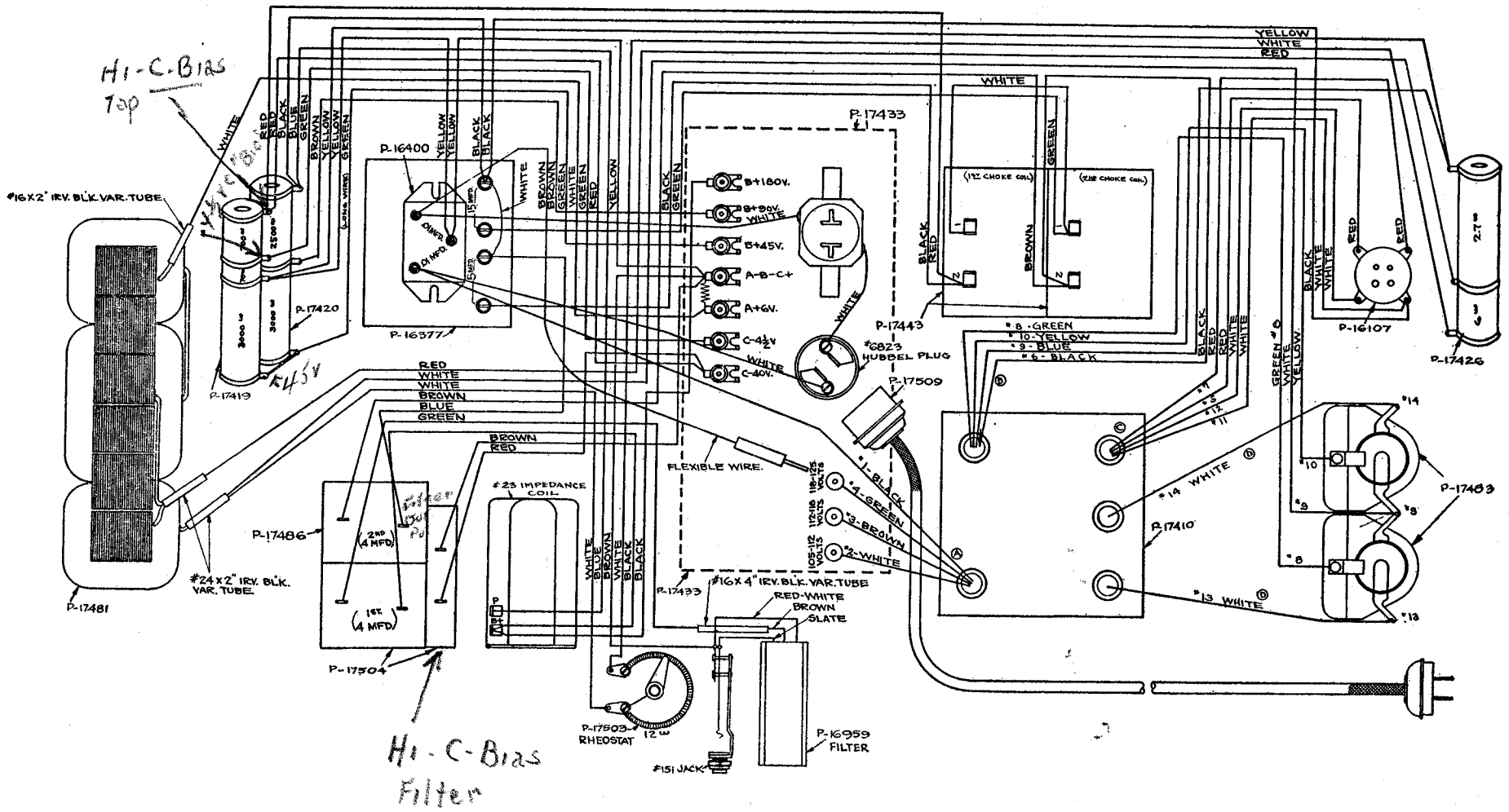
403-A AUDIO POWER UNIT



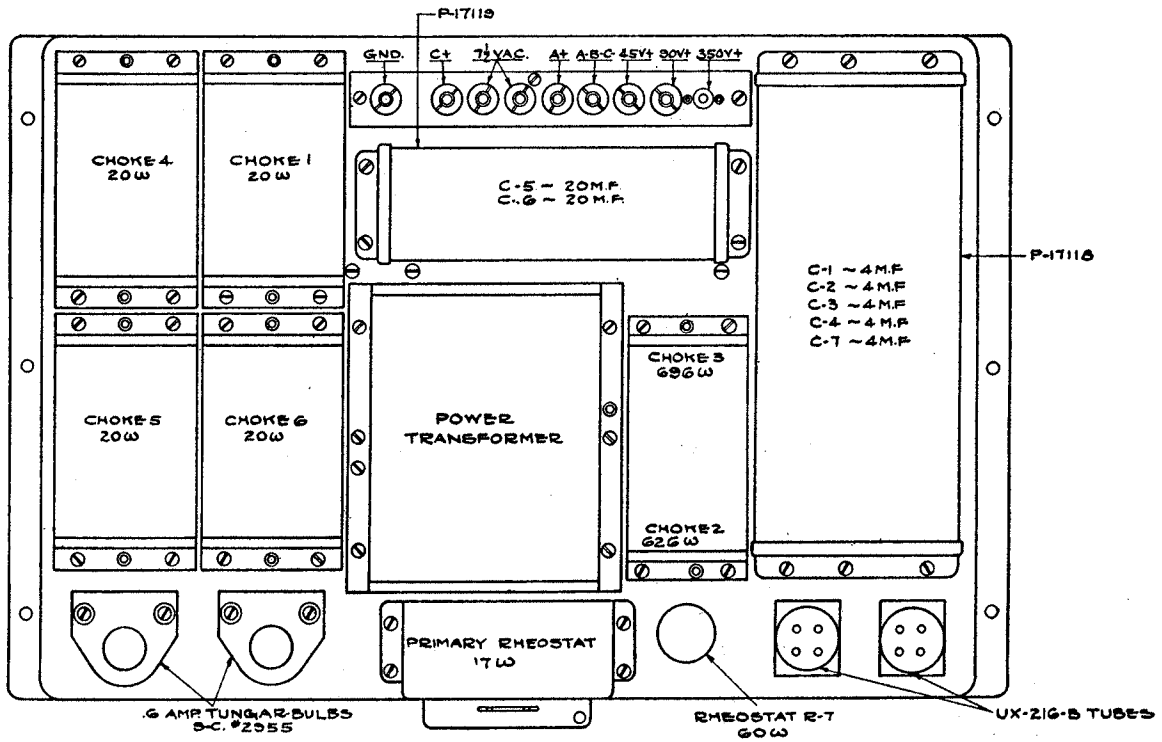
403 AUDIO POWER UNIT CIRCUIT.

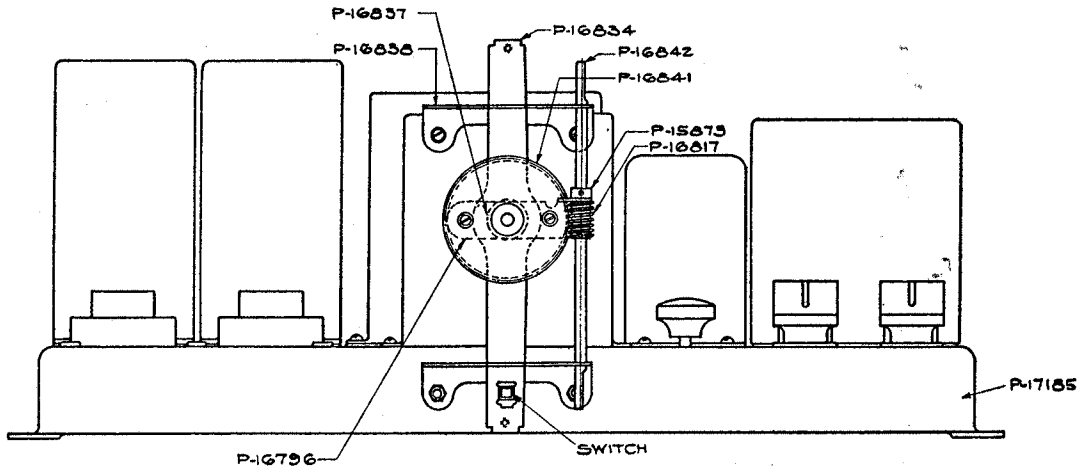


403-A AUDIO POWER UNIT CIRCUIT.

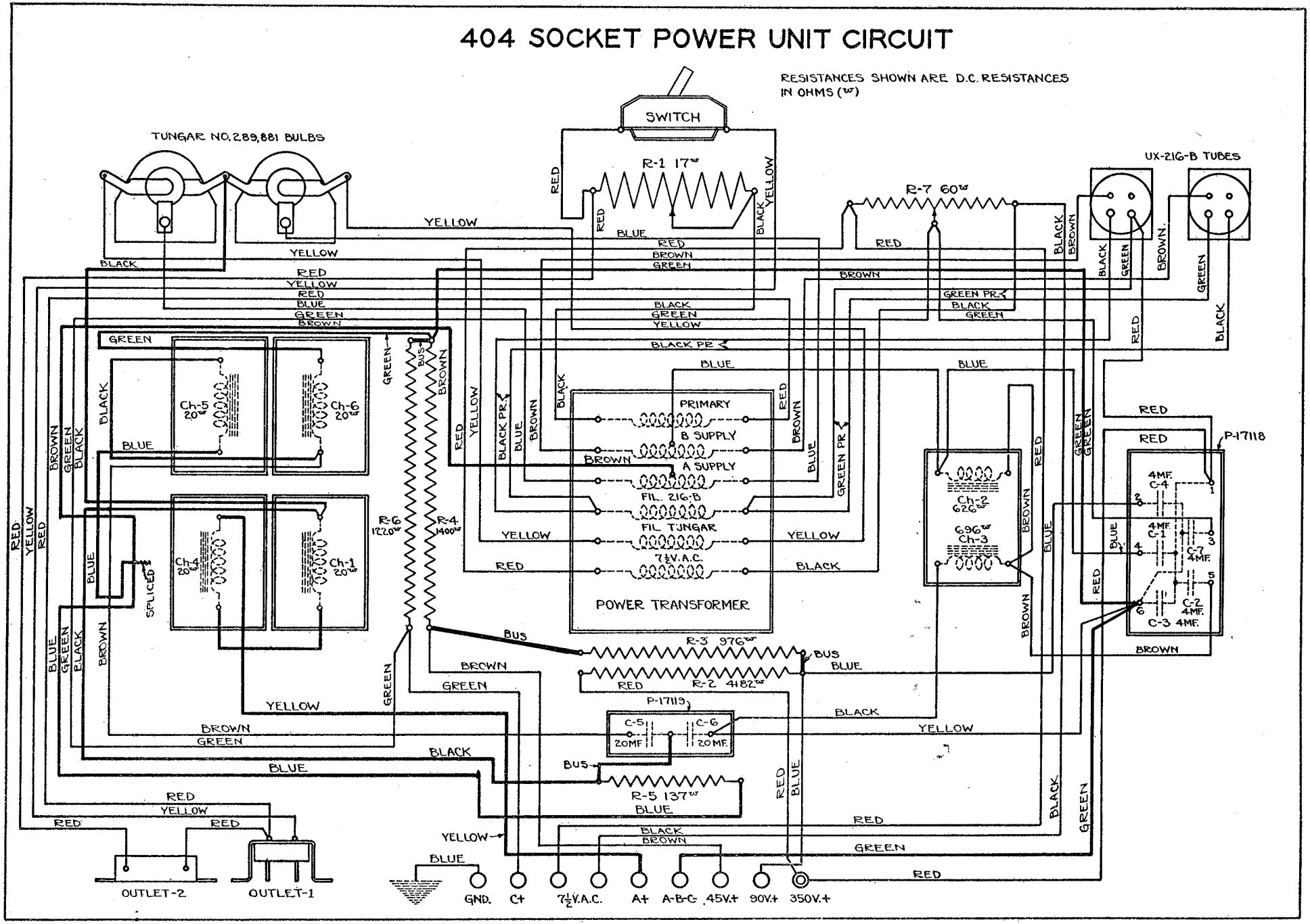


SOCKET POWER UNIT CODE 404

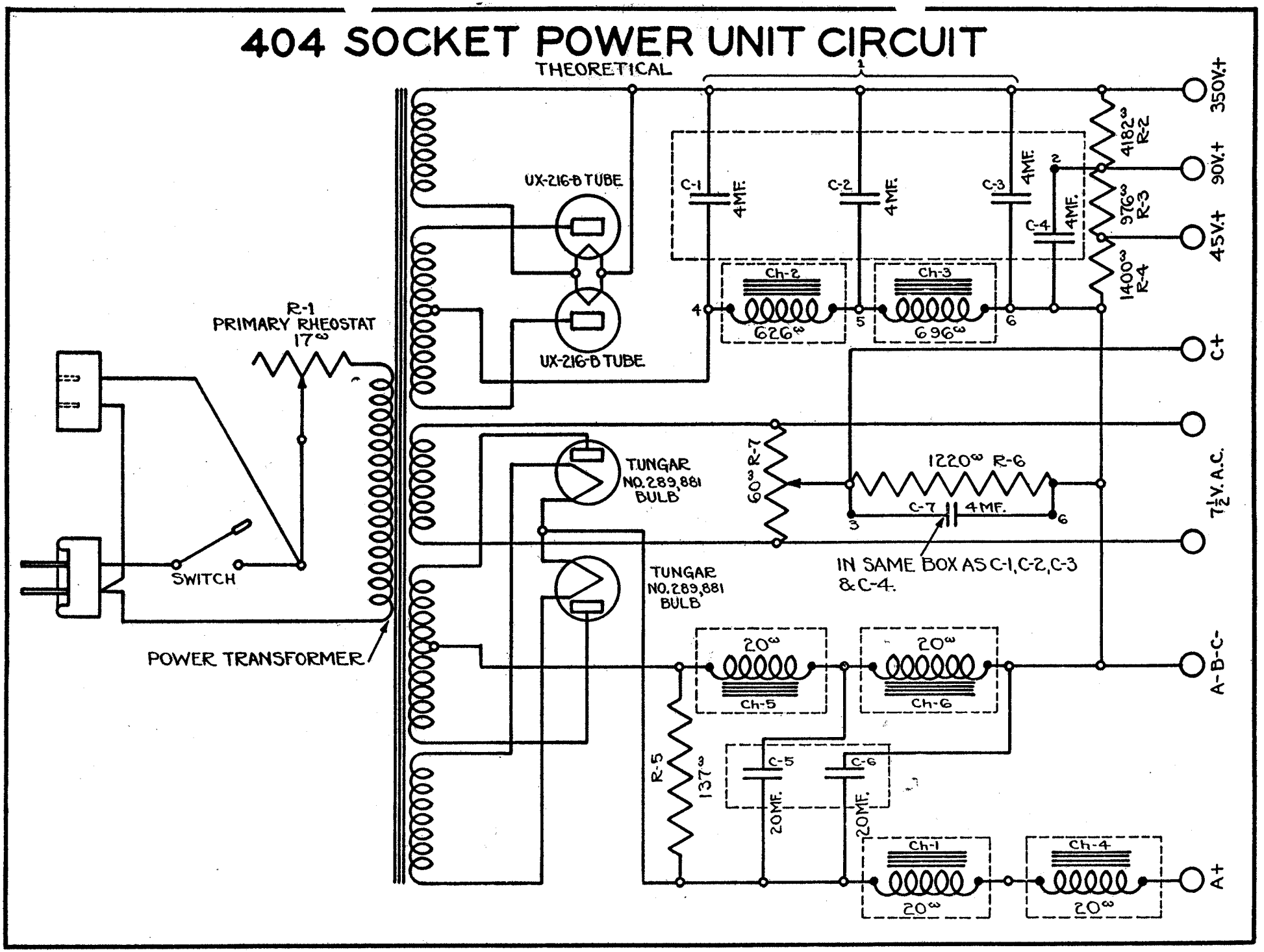




404 SOCKET POWER UNIT CIRCUIT



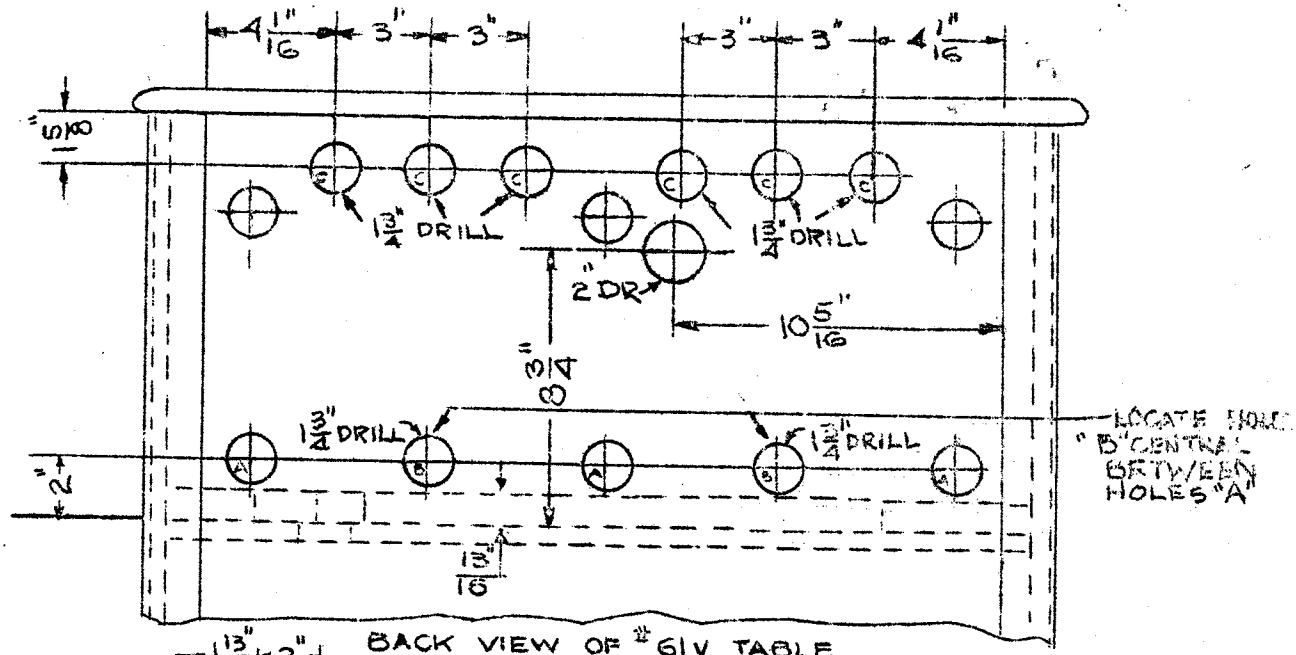
404 SOCKET POWER UNIT CIRCUIT



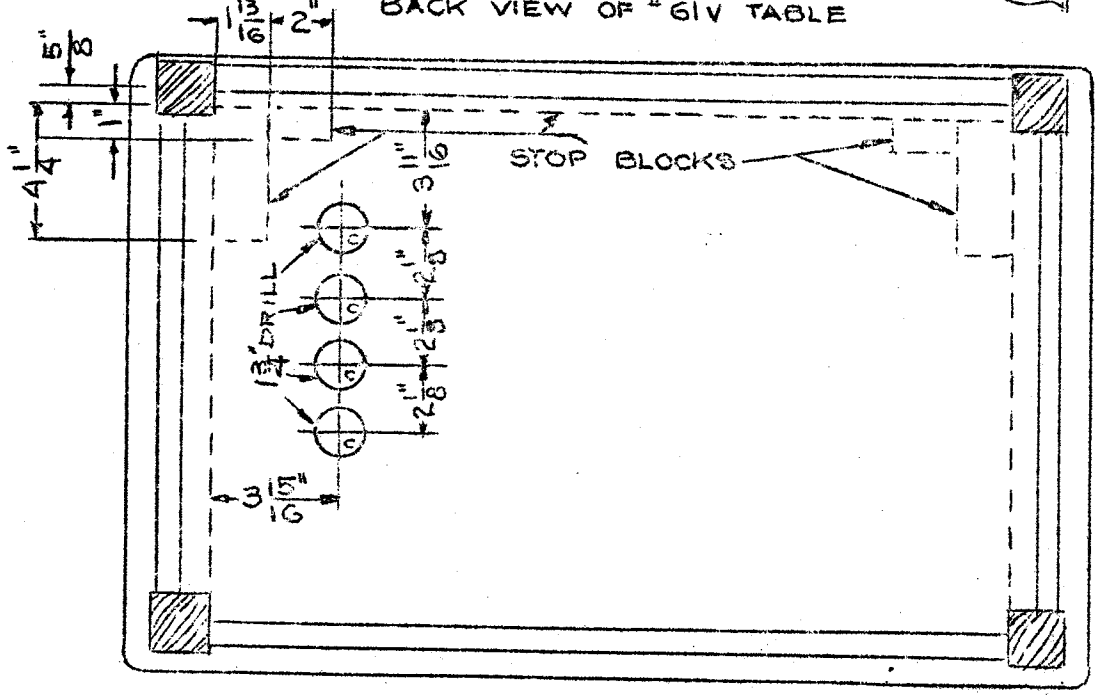
X 2744

METHOD OF CONVERTING #51 AND #61 TABLES FOR USE WITH #523 AND #633 RADIO RECEIVERS

ADD HOLES "B" AND "C" AND STOP BLOCKS AS SHOWN



BACK VIEW OF #61V TABLE

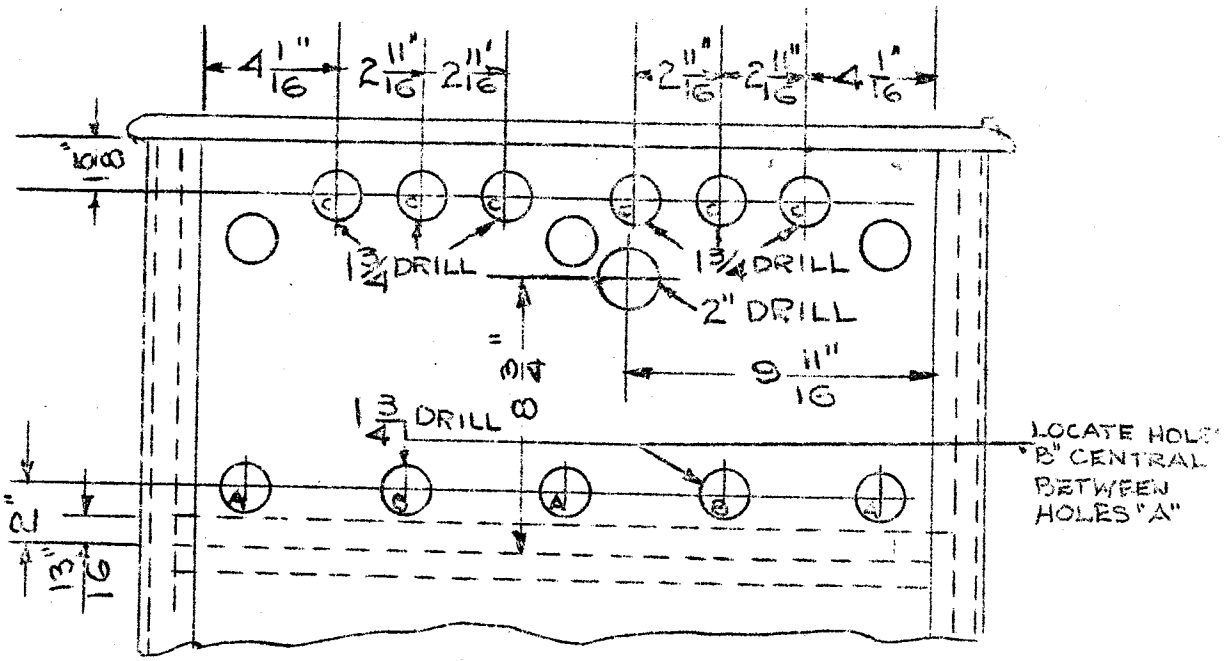


BOTTOM VIEW OF TABLE

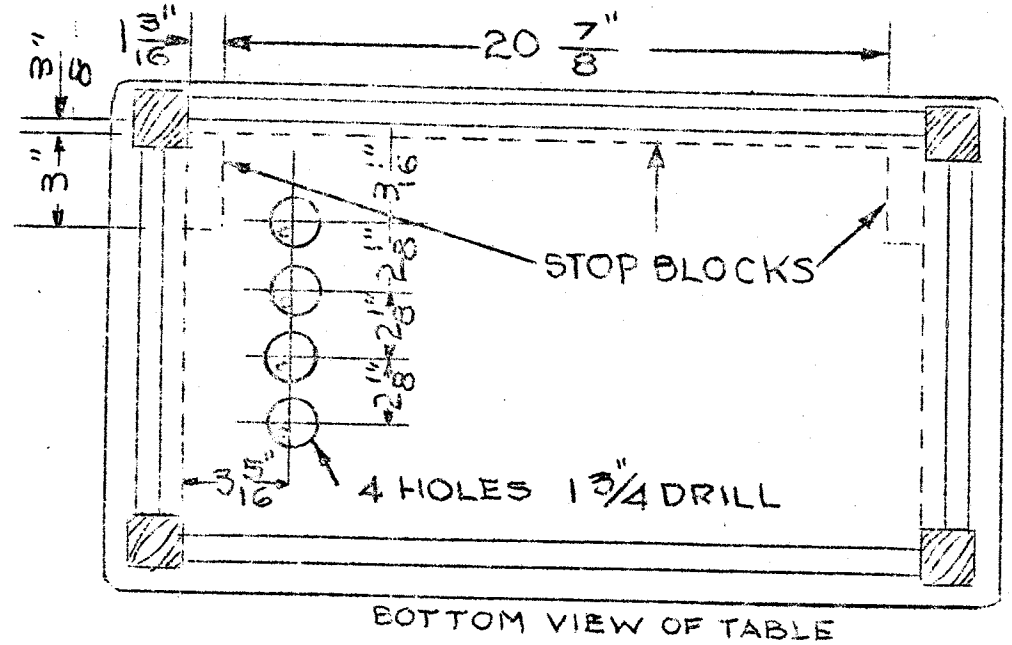
X 2744

METHOD OF CONVERTING #51 AND #61 TABLES FOR USE WITH #523 AND #633 RADIO RECEIVERS

ADD HOLES "B" AND "C" AND STOP BLOCKS AS SHOWN



BACK VIEW OF 51 V. TABLE



BOTTOM VIEW OF TABLE

NO. 403 AUDIO-POWER UNIT

SPECIAL SERVICE INSTRUCTIONS

I. Use only General Electric 2-ampere Tungar Bulbs with the Stromberg-Carlson inspection label on the carton. The 2-ampere bulbs which we are purchasing have low gas pressure so as to give better operation in our No. 403 Audio Power Unit than other No. 277465 Tungar Bulbs which have a high gas pressure to meet requirements for high-voltage charging of storage "B" batteries in Tungar rectifiers. Our bulbs are specially made and specially selected for use in this unit.

A supply of these special Tungar bulbs should be ordered by each dealer shortly for replacement purposes.

II. The "Siamese" Choke Coil is located inside the heavy iron shell at the left-hand end of the unit. This is an inductor made up of three windings on two U-frame cores with cross pieces in the U openings which only partially close the magnetic circuit and leave large gaps. Around the middle or double leg of the core (the one supporting the large winding) there is a heavy copper band or short-circuited turn.

The copper band on this inductor acts as a hum balance auxiliary to the rheostat on the front of the unit. Before leaving the factory this band is adjusted to the proper position for use on our local lighting system. However, it may and probably will have to be readjusted for use in other localities.

If a No. 403 Audio-Power Unit produces a bad hum in a high quality Stromberg-Carlson No. 10 or No. 11 Cone Speaker, try to balance it out with the rheostat as instructed in the Reference Book accompanying each receiver. Bear in mind the instructions in the book for locating the unit with respect to the receiver to avoid magnetic coupling. If the hum still persists, set the unit on the floor or a stool in approximately the same position with respect to the receiver that it will occupy in the cabinet and proceed as follows:

1. Remove cover of Audio-Power Unit

2. Remove collar clamping light circuit female plug to cover. Use this plug and cord to connect unit to light socket or outlet, with cover removed from unit.

3. With your Open End Wrench for 5/16" nuts, loosen slightly the nut clamping band.

4. Move the band a short distance up or down. Note: Normal position of band is close to top of coil winding. If hum remaining, after rheostat is in balance, has a predominant low note, push the band down about one sixteenth inch; if a high note, force band upward.

5. Readjust rheostat each time position of band is changed.

6. When a good quiet balance is found tighten nuts to clamp band. Replace cover on unit, reclamping plug in opening in cover with collar before you do so. Do not fail to replace this clamp.

A good Service Man will quickly learn the knack of adjusting this unit for balance.

III. It must be borne in mind that absolute uniformity in a product such as the Tungar bulb is practically impossible. Tungar Bulbs #277465 bearing the Stromberg-Carlson label on the carton are made to meet the special requirements of this Audio-Power Unit, are tested for operating characteristics in the General Electric factory and rechecked in our factory and should give satisfactory operation, unless damaged in shipment. However, it is impossible to determine the probable life of the bulb by preliminary tests.

One advantage in using this type of rectifier is that any defect or weakness in the bulbs will become quickly apparent. Thus, it may be possible that a few bulbs will fail in the first few hours of operation. All bulbs that will withstand the first few days of service should give a life at least equivalent to the average life of the UX-201-A type. Therefore, it is recommended that the Installer leave the receiver turned on for as long a period as possible while he is making his installation, so that any Tungar Bulbs that may show defects in the initial operation can be removed and replaced with new Tungar Bulbs. In order that this process may be carried out, each Dealer should see that the Installer has at least one extra Tungar bulb in his installing kit, and preferably two or more extra bulbs.

A defective Tungar bulb is easily located by observing the reading on the voltmeter of the Radio Receiver. If the initial voltage registers about 5 volts when the voltage control rheostat is correctly adjusted and later on the voltage drops below 4 volts, say about 3 volts, even with the voltage control rheostat set to its maximum voltage position,

then it is an indication that one of the Tungar bulbs is operating incorrectly. In order to determine which bulb is in trouble, one of the bulbs should be removed and replaced with a fresh bulb and the Receiver left on for five or ten minutes. If the voltage is maintained at 5 volts after this substitution of Tungar bulbs, then it can be assumed that the defective bulb has been replaced. On the other hand, if the replacing of one bulb does not improve conditions materially; that is, the voltage still stays down to or below 4 volts when the voltage rheostat is turned to maximum voltage position, it can be assumed that the bulb just replaced is O.K. and that the other Tungar bulb is the defective one.

Attention is called to the article in our Instruction Book entitled "Determining Correct Line Voltage Jack By Trial" for information regarding correct setting for the line voltage. This voltage should not be changed while making the above tests, unless the initial setting of this line voltage adjustment has been incorrectly made at the start.

The Installer or Service Man should switch the receiver on and off a few times after placing new Tungar Bulbs in the Unit, since this will hasten the appearance of defects or weakness in the bulbs. When switched on, the bulbs should bring the receiver up to normal voltage within a few seconds.

Full credit will be given for Tungar bulbs which prove defective within a short time after they are put in service. The defective bulbs should be returned to us with disposition instructions, which should include the approximate number of hours the tubes have been in use.

STROMBERG-CARLSON INSTALLERS' INSTRUCTIONS FOR THE Nos. 523, 524, 633, 634, 734 and 744 Receivers Released 11/1/27

IV. The No. 403 Audio Power Unit

Before placing the No. 403 Audio Power Unit in the cabinet of a No. 524 or No. 634 Receiver or in a No. 51-V, No. 61-V or other table adjust it as follows for the elimination of A.C. hum.

Connect the Antenna and Ground to the correct binding posts. Place the Receiver vacuum tubes in the proper sockets and (if a Console Model) push the chassis back into the cabinet. Be sure that the "Antenna Loop" switch of the 633 or 634 Receivers is in the position desired.

Now set the packing case in which the 403 Audio Power Unit was received on end in front of the Receiver and mount the Audio Power Unit on it in such a way that it is parallel to the Receiver chassis, and as you face the front panel of the Receiver you also face the loud speaker jack and name plate of the unit.

Remove the top cover of the Audio Power Unit, following directions on the tag. Place the two 2-Ampere Tungar Bulbs and the UX-280 Tube in their sockets in the unit. Connect the two cables from the receiver chassis to the power unit. Now free the plug on the unit end of the A.C. supply cord from the cover of the unit by removing the small collar. Place the pin plug in the jack which you estimate to be correct. (We recommend that Installers carry A.C. voltmeters of 0-150 volts for this purpose). Connect the power unit, with cover removed, to the house lighting system, and turn on the Receiver. You can now proceed to unpack the Cone Speaker, and the Receiver will be "warming up" while you do so.

Plug the Loud speaker cord into the jack on the Audio Power Unit. Place the Cone Speaker where it is conveniently close to your ear, yet out of danger from accidental upsets. Adjust the pin plug in pin jacks and the Voltage Control until the Voltmeter reads five volts. Set the Volume Control a little less than half-way up to full volume. Now, with a screw-driver, adjust the rheostat above the loud speaker jack for a balanced condition of quiet operation.

If an objectionable volume of hum remains after the rheostat has been balanced, (Note: the range of travel of the contact or "wiper" on the rheostat should be the same as for the Volume and Voltage controls. Sometimes one of the asbestos-covered wires gets in the way and stops it) there are two operations, the first a minor and the second a major adjustment, to correct this, as follows:

Note: Installer should remove his watch or wrist-watch and place it at some distance from the Unit before adjusting the "Siamese" choke. The strong magnetic field will magnetize a watch and require a trip to the jewelers.

1. Loosen the screws at the outer or left end of the two brass cross-pieces which clamp the "Siamese" Choke Coil in the large iron shell at the left end of the unit. Then readjust the rheostat.

   Note: It is a good idea to remove these cross-pieces altogether, unless the customer expects subsequently to reship the unit by freight or express. The choke is adequately anchored in place by a sealing compound and the removal of these cross-pieces will insure against over-voltaging the Tungar Bulbs if the coils of the choke should become accidentally grounded to the core in the second or major adjustment:

   Note: Audio Power Units shipped on or after October 27, 1927, have these cross-pieces insulated from the core of the Siamese choke. It is, therefore, not necessary to remove them, but it may help in reducing hum to loosen the left-hand screws and relieve tension.

2. With a 5/16" open-end wrench, loosen the nut clamping in place the copper band or short-circuited turn around the middle leg of the UU core of the choke. Now, with the screw-driver held in your right hand constantly balancing the rheostat, grasp this band with the fingers of your left hand and move it up or down until the desired position of quiet operation is found. This position will normally be found to be quite close to the top of the coil, and at a slight angle to the horizontal. DO NOT BE AFRAID TO GRASP THIS BAND WITH THE BARE HAND. IT IS IMPOSSIBLE TO GET A SHOCK FROM ANYTHING INSIDE THE SHELL. Now hold the band in place and take up on the clamp nut until the band is quite tight but barely moveable, and rebalance the rheostat. It will generally be found that a slight readjustment of the band is then necessary, because the squeezing effect of the clamp screw has thrown the circuit out of balance. This readjustment can generally be accomplished by canting (moving) the band at a greater or less angle to the horizontal.

V No. 10 and No. 11 Cone Speakers

Cut off the extra length of driving rod provided for protection in shipment. The edges of this cone are free, and if a short rod were provided, the cone might spring so far in shipment that the rod would come out of its hole. This would result in a damaged driver mechanism, a pierced cone, or both.

This excess of rod should be cut off as the projecting length of rod may whip into sidewise vibration or resonance at certain frequencies and have a "sing" all its own, which will spoil the reproduction.

The customer should be advised, however, that after the rod has been shortened in packing for shipment or transportation of the speaker, the fibre core should be removed from the aluminum frame and shipped separately.

Do not slip the yellow Instruction Card down between the cone and the baffle board. In that position it is free to vibrate and will not only sing by itself but will beat against the cone and cause a "muffled" sound of distortion.

If this sort of distortion is encountered look also for nuts, washers, etc. lodged between the cone and the baffle board. Then look for unglued joints, vibrating members, etc. as instructed in Manual of Helpful Information for Dealers' Service Men.

Occasionally a cone speaker will be encountered which will "blast" at low frequencies for a signal of great volume. This is an indication that the armature is more limber than in other No. 10 and No. 11 speakers which do not blast.

Speakers with limber armatures which will blast at great volume are really more desirable than stiffer speakers which will not blast, when installed in a small room where great volume is not desired nor necessary. Such speakers are slightly more sensitive, and more responsive to low notes. This fact can readily be demonstrated with an oscillator and recording apparatus.

But if your cone speaker is to be installed in a large room, it must have a stiff armature. There is no adjustment possible. Speakers which prove too limber for the acoustical conditions prevailing and volume desired where installed can only be serviced by returning the driver to the factory with instructions describing the conditions under which the speaker is to be used. In returning loud speaker drivers to the factory, unsolder the driving rod from the bronze reed. This will facilitate packing and protect the rest of the driver somewhat from damage in transit.

VI No. 60 Radio Plug

Use the Stromberg-Carlson No. 60 Radio Plug in connecting loud speakers to these new A.C. Receivers. This plug is so designed that it is impossible for the fingers to come in contact with metal which is connected in any circuit, when inserting the plug in a jack. Most other plugs on the market have exposed metal devices which grasp the pin tips of a speaker cord and are, naturally, connected to the pin tips and the contacts on the plug. The output circuit of the new Stromberg-Carlson receivers is such that the customer or installer may receive a disagreeable shock due to a condenser discharge when inserting such an unprotected plug.

VII No. 404 Socket Power Unit

No. 404 Power Units shipped prior to November 4, 1927, were equipped with molded composition binding nuts which have been found in the field to loosen up in some installations and allow a poor or open contact with the spade terminals on the cable connecting shoe. No. 404 Power Units shipped subsequent to that date have been equipped with metal nuts. Dealers who have experienced trouble with the No. 734 and No. 744 Receivers shutting off due to the opening up of these contacts may receive a set of metal binding nuts by addressing a request for same to Stromberg-Carlson Tel. Mfg. Co., 1060 University Avenue, Rochester, N.Y.

Another method of insuring more positive contact at the binding posts is as follows:

> As you face the shoe with the contacts pointing toward you, insert a screw driver or other handy piece of metal in the slot of each forked spade terminal (one at a time), and bend the right-hand tine of the fork upward. The fork will then exert a pressure on the binding nut and then the sharp edge of the tines will tend to prevent the binding nut from loosening, giving an effect equivalent to that of a lock washer.

In order to facilitate adjustment of the hum balance potentiometer on the base of the No. 404 Unit (located next to the Rectron sockets) we recommend that this balance be made with the "Record - Radio" key set at "Record" position. A balance so obtained also should be satisfactory when the key is set at "Radio" position, for radio reception, and it is easier to adjust the potentiometer when there is no radio frequency or detector tube noise present in the loud speaker. When this balance is made on a No. 734 Receiver, be sure that a No. 1 Magnetic Pickup, or a regular Radio Head Set, is plugged into the jack marked "Magnetic Pickup."

No. 404 Power Units shipped subsequent to October 22, 1927, have all been modified in the "A" rectifier circuit for a more complete suppression of AC hum. These units are marked for identification by the letter "R" stamped in red ink on the name plate and on the packing case. Some of the No. 404 Units shipped prior to that date allowed a greater amount of ripple (hum) to reach the filaments of the vacuum tubes. Many of these units were very quiet, but others can be improved by applying this modification, which may be easily done (in about ten minutes time) by the dealer's service man in the store or in the field. This modification is not an adjustment or balance, therefore, is positive in effect, reducing any objectionable AC hum to a nearly imperceptible minimum.

Reference to Figure 1, which shows the underneath-the-base arrangement of the four choke coils of an "A" rectifier circuit of an unmodified receiver, will tell you whether or not your unit has been changed.

Figure 2 shows the Schematic Circuit Diagram of the "A" circuit for the unmodified unit.

To modify a No. 404 Power Unit, refer to Fig. 4 and perform these operations:

(1) Unsolder the wires attached to the contact terminals of choke No. 4 (2 blue wires to one terminal; 1 brown wire to the other terminal). Twist all three wires together, solder, tape the joint well, and tape or tie it back to the cable where it is out of the way.

(2) Remove Outlet No. 2 so that you can get at the nuts holding choke No. 4 to the base.

(3) Remove choke No. 4 from base. Turn it around 180° (end for end) from former position and bolt it back on to base again in the same holes. Replace Outlet No. 2 on base.

(4) Unsolder yellow wire from rear contact terminal of choke No. 1. Solder it to forward (diagonally opposite) contact of reversed choke No. 4. (You may have to bend the contact terminal of the choke coil a little to make this reach. If so, be careful that the terminal does not "ground" by touching the iron base). Now solder a short piece of wire (No. 18 bell wire will do)from the rear or open contact of Choke No. 1 to the rear or open contact of Choke No. 4, and the modification is complete.

Your modified Power Unit should now look like the Sketch in Figure 4, and the "A" circuit diagram is given in Figure 3.

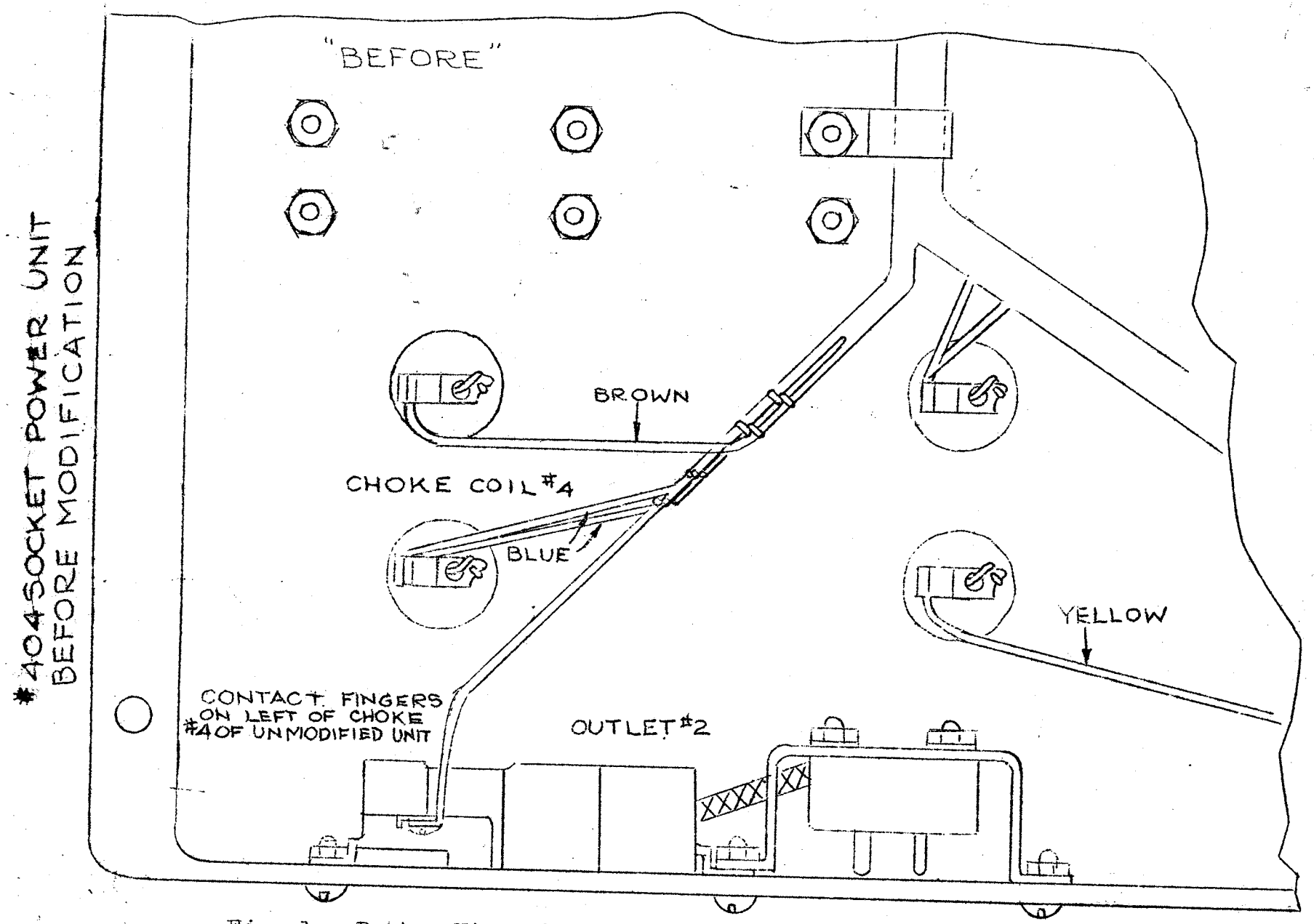


Fig. 1 - Bottom View of Rear Left-hand Corner of #404 Socket Power Unit Before Modification.

#404 SOCKET POWER UNIT "A" CIRCUIT

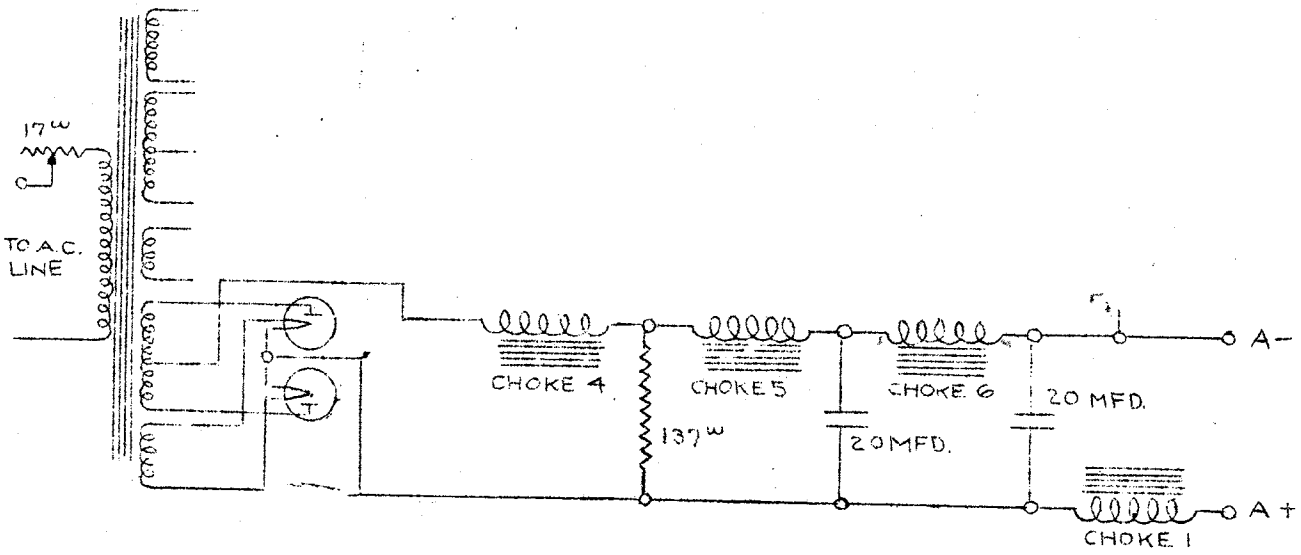


Fig. 2: "A" Circuit Diagram of #404 Socket-Power Unit before modification.

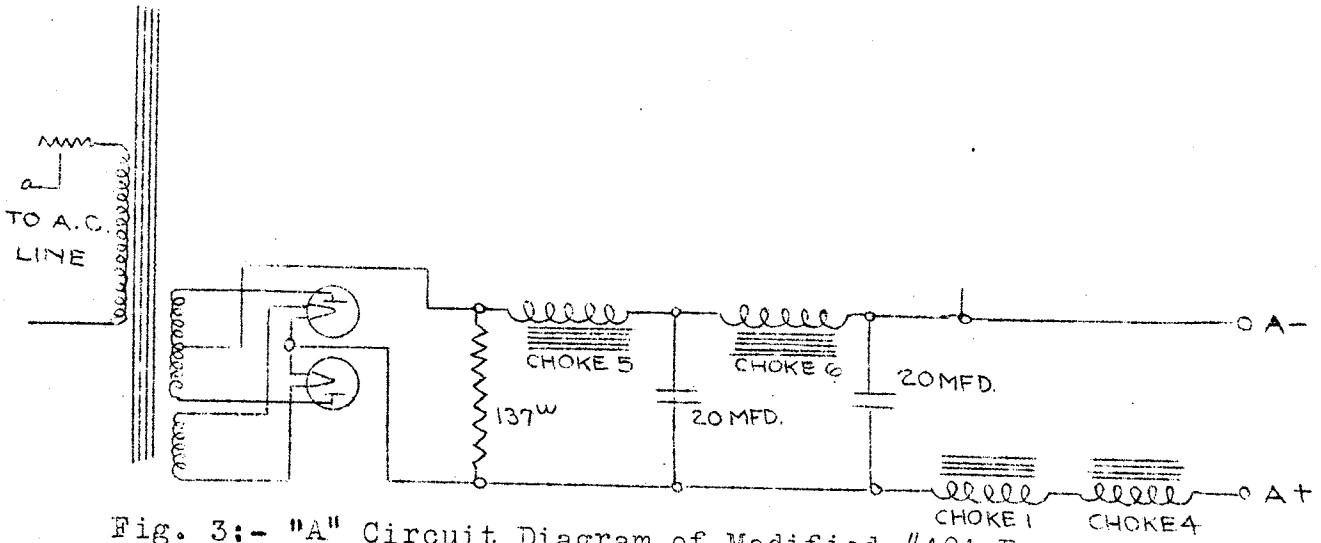


Fig. 3:- "A" Circuit Diagram of Modified #404 Power Unit.

Fig. 4 - Bottom View of Rear Left-hand Corner of Modified #404 Power Unit

SK 2813