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. . . Official . . .

SHORT WAVE Radio Manual

FOR THE

EXPERIMENTER, SET-BUILDER and SERVICE MAN

Full Directory of all
SHORT WAVE RECEIVERS

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... Introduction ...

THIS is the second official short-wave radio manual, and we feel confident that it will meet an even greater success than the 1934 manual. We do not know of another branch of science that has grown and changed sa fast as the short-wave art in the past year.

Therefore, this 1935 manual will prove doubly welcome to every student of short-waves, as all of the most important developments in short-wave transmitters and receivers are covered in this new edition of the manual.

Service men will find this manual of inestimable help as it contains the wiring diagrams and the values of the various condensers, resistors, etc., of all the principal short-wave receivers.

Transmitters of the short-wave type have been included, and among the transmitters described, you will find the very latest "long lines" oscillators, with full constructional data given

We feel that no short-wave service man, student or general reader of the subject, can afford to be without a copy of this new manual, for the very good reason that the editors have endeavored to survey the whole field of short-waves for the past year, and have only included the most important set descriptions.

Five-meter waves have been growing rapidly in popularity in the past year and a considerable number of five-meter receiver and transmitter hook-ups are included in this manual.

The experimenter will find dozen of articles on small receivers and transmitters which he can build at a slight cost. All of the sets described and illustrated have been actually built and tested. Boosters, pre-amplifiers and beat oscillators are described; also how to obtain band-spread and the latest tube data.

New York, N. Y.

THE EDITORS.

S-W BEGINNER 1-Tube "Pocket Set" Gets Europe

● MANY of our readers have sent in requests for a simple short-wave receiver that could be used for portable work and small enough to fit in one's pocket. While it is nearly impossible to construct an elaborate set for this purpose, it is quite possible to make one that will work very nicely and one on which *foreign* stations can be received with surprising ease. In fact, stations in Europe were received with this set *without an antenna of any description*. In sets of this kind it is not practical to use more than one tube because of the heavy filament current requirement which would necessitate use of an A battery of considerable weight.

The main objective is to keep the battery element as light as possible and small enough to fit in another pocket. This little set will operate very nicely with a 22.5 volt block of batteries for the plate supply and two regular flashlight cells for the filament.

Many different ways of mounting and carrying the batteries will suggest themselves to the reader undoubtedly. However we show in the photographs of the set two methods of arranging the batteries. In both cases they are of the home-assembled style. Pen-flashlight cells are used in making up the "B" block. One method shows a very neat arrangement wherein they are all mounted on a strap which forms a belt that can be worn around the waist. This is an old stunt used in stage tricks. The other is more simple and does not require so much effort in construction. The cartridges are strapped together to make a flat affair which can be carried in the pocket.

The writer happened to have available a bakelite case which once contained a shaving set. This case measures 1¾" x 3" x 6½" and proved to be just the thing. However any other case having dimensions similar to it will serve.

Super-Regeneration Used

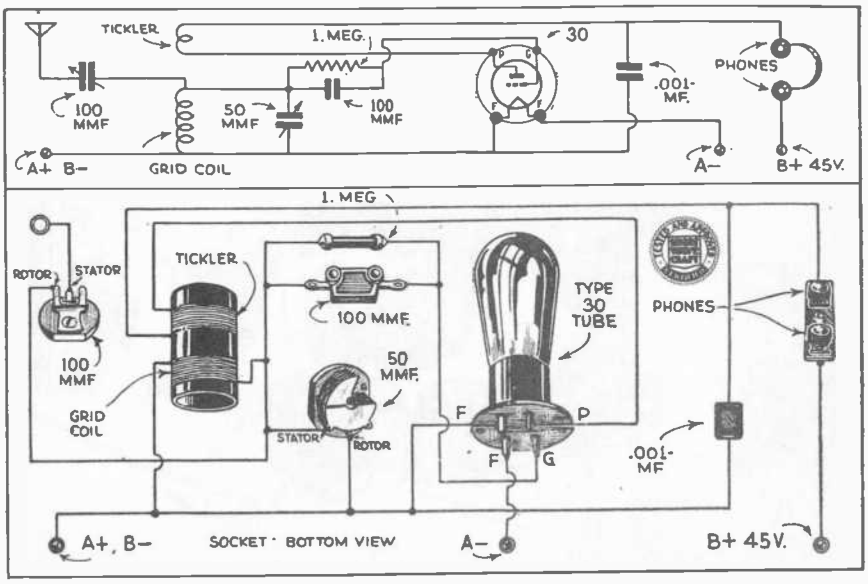
By referring to the circuit diagram we find that the circuit is straightforward in every respect. In order to obtain the tremendous amplification necessary in a set of this kind, the tube was made to *super-regenerate* by supplying its own quenching frequency. It is a well-known fact that if the number of tickler turns are increased over the usual amount necessary to obtain ordinary regeneration, the grid of the tube will "block" at intervals, the frequency of which is more or less controlled by the value of the grid-leak and grid-condenser. In this manner a very sensitive detector will result.

There is one serious drawback in super-regeneration—and that is the strong signal which is radiated from a set of this type. Therefore it is recommended that it be operated only in the less congested areas where there are few short-wave receivers and where the danger of interfering with others is nil. We have seen 5-meter super-regenerative receivers radiate a signal over a distance of 5 to 7 miles.

The tube used is a type 230 Radiotron and is the most convenient for a set of this kind, inasmuch as the filament requirements permit the economical use of very small batteries. The coils are not of the plug-in type as there was not enough room for the socket. The set was designed to cover only the 49 meter S-W broadcast band, as most of the stations can be heard in the evening on that wave-length. However data is given for coils that will cover the other S-W broadcast bands; this will be found at the end of the article.

These small condensers are equipped with a very short shaft, intended for screwdriver adjustment and it is necessary to extend it somewhat in order to use the dial. This was done by simply soldering to it a one half inch length of quarter inch shaft. The condenser is mounted slightly to one side of the case in order to leave room for the tube and coil. The wafer type tube socket is mounted in the case with two short angles; mount the socket so that there is space enough to insert and remove the tube easily.

There is no *regeneration control* provided, but the tickler coil is made just the right size to produce the right amount of feed-back. The size of the grid-leak should be just one megohm, no more or less. A .001 mf. plate by-pass condenser is necessary in order to keep the r.f. out of the phone cords and aid in obtaining smooth oscillation. Also be sure that the grid condenser is of the size indicated in the diagram. We had quite a bit of trouble in obtaining super-regeneration at the start until we found that this condenser was incorrectly marked; if in doubt, use one marked slightly larger than the one shown in order to be on the safe side.



It is a cinch to build the 1-tube pocket short-wave receiver by following the simplified wiring diagrams here presented. By using coils having different numbers of turns all the S.W. bands may be covered.

By GEORGE W. SHUART, W2AMN

● Astonishing indeed is the fact that this remarkably compact 1-tube short-wave pocket receiver actually picked up European stations without an aerial. The unusually high sensitivity of this set is due to careful design of the circuit. With a short aerial, this 1-tube pocket set picked up stations galore when tested by the editors inside a steel frame building in New York.

Only 1 Tuning Control

The antenna trimming condenser is mounted on the inside of the case and needs little adjustment. No external knob was found necessary. Merely adjust it for the particular antenna you are using and leave it there. This makes it a very simple set to tune, as there is only one control to adjust and that is the main tuning knob.

The adjustment of the antenna trimmer has quite an effect on smoothing up the regeneration so adjust it for best results. Best action of the detector is obtained when the antenna is adjusted to the point where tighter coupling will cause the tube to stop hissing. The usual hissing sound characteristic of super-regenerative receivers is present, although it will completely disappear when a moderately strong station is tuned in. Thus it is not the least bit annoying while listening to a station.

The antenna can be anywhere from 5 to 100 feet long. Best results were obtained with an antenna only several feet long and with the antenna condenser adjusted to maximum capacity. The filament battery has three volts and it is advisable to insert a resistor having approximately 16 ohms in series with it in order to insure long tube life. This can be either a fixed wire-wound affair or in the form of a 20-ohm variable rheostat mounted on the battery.

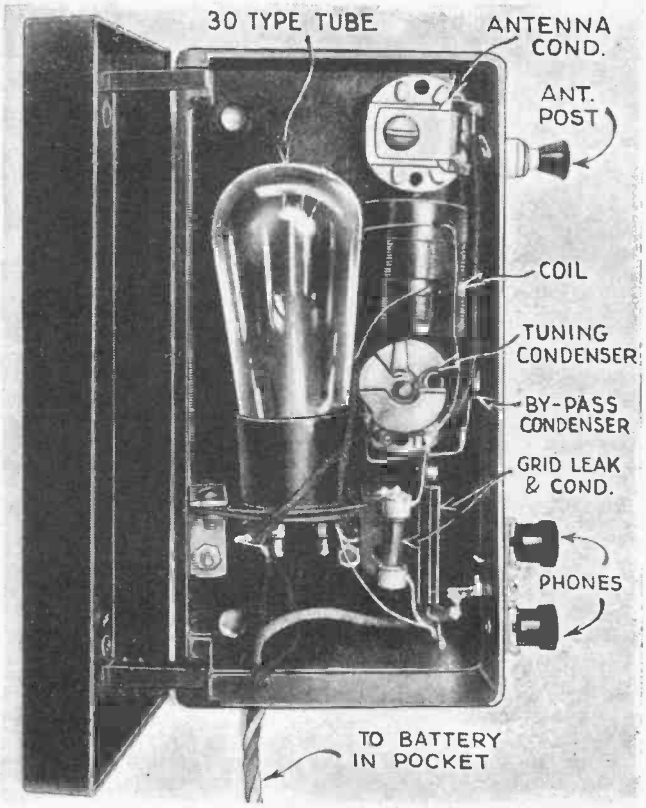
Coil Data

Band	Grid	Tickler
49 meter	18	18
25-31 meter	10	10
19 meter	5	5

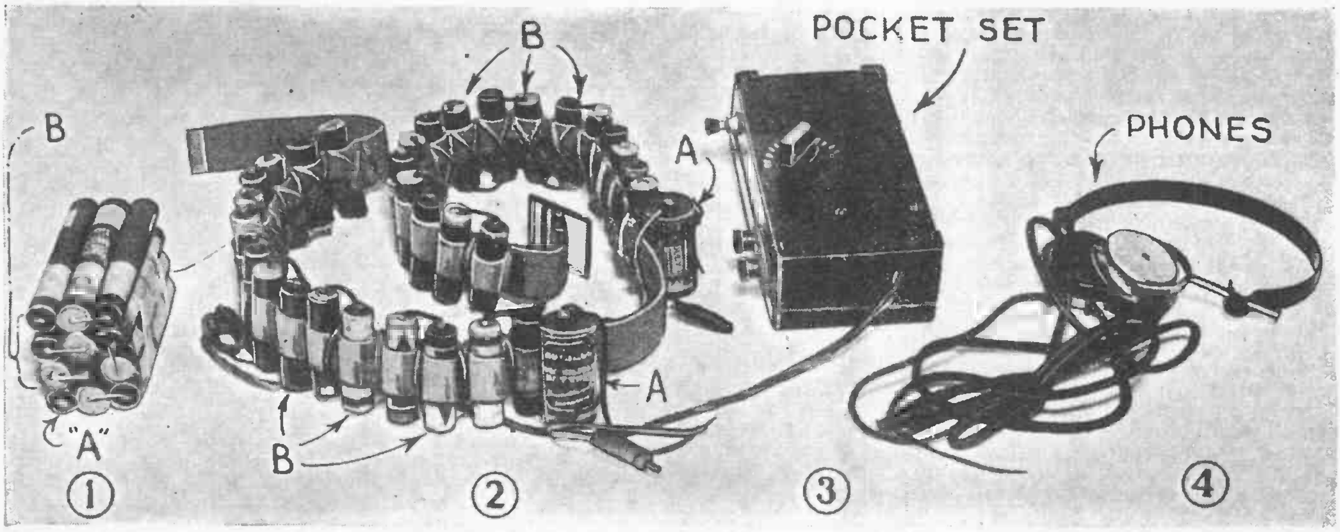
All coils close-wound with No. 26 D.S.C. wire on a 1-inch tube, spacing between tickler and grid coils 1/8 inch.

Parts List for Pocket Set

1—100 mmf. Antenna trimmer, Na-Ald.
1—50 mmf. tuning condenser (see text) Hammarlund.
1—100 mmf. mica condenser; Aerovox.
1—.001 mf. mica condenser; Aerovox.
1—1 meg. ½ watt resistor. Ohmite.
1—4 prong wafer socket, Na-Ald.
1—Phone binding post strip, Na-Ald.
1—Antenna binding post, Na-Ald.
1—Bakelite Case (see text).
1—RCA 30 Radiotron.



The "innards" of the remarkable 1-tube "Pocket Receiver" which proved to be astonishingly sensitive and selective. With only a short aerial, stations thousands of miles away were picked up and European programs were actually heard without any antenna at all!



Batteries for the pocket receiver may be arranged in a number of different ways. By using pen-light flashlight batteries, which measure about .5 inch in diameter, the "A" and "B" units can be arranged in a group as at 1, or in a home-made belt (2). 3 is the pocket receiver and 4 the 2,000 ohm head-phones.

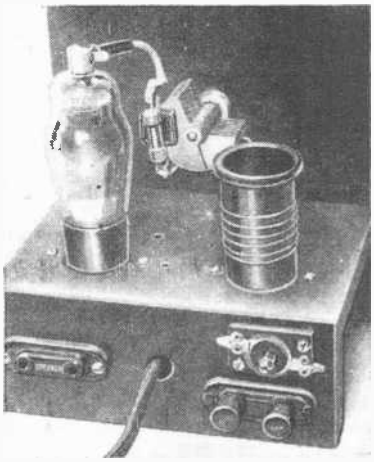
1-Tube All-Electric OSCILLODYNE

By ART GREGOR

Thanks to the use of the single 12A7 tube, the famous Oscillodyne receiver has been brought up to date; in the new model here described, the 12A7 rectifies its own plate current. This set works on 110 volts A.C. or D.C.

The 1-Tube All Electric Oscillodyne will find hundreds of everyday applications—it is ideal for travelers.

● BELIEVE it or not, this is really an *all-electric* short-wave receiver that employs but ONE tube! So far, we have had three tubes do the work of six, two tubes that work as well as four, but—this is the first *1-tube all-electric* receiver that we have seen. Of course, the many novel sets described in this magazine could not have been built if it were not for the accomplishments of the tube engineers—they have done a remarkable job. And this set, too, owes it success to the newer tube developments.



Rear view of the 1-tube Oscillodyne which has been made "all electric," thanks to the 12A7-type tube used, one element of which serves as the regenerative detector and the other element as a half-wave rectifier. This is essentially a headphone job.

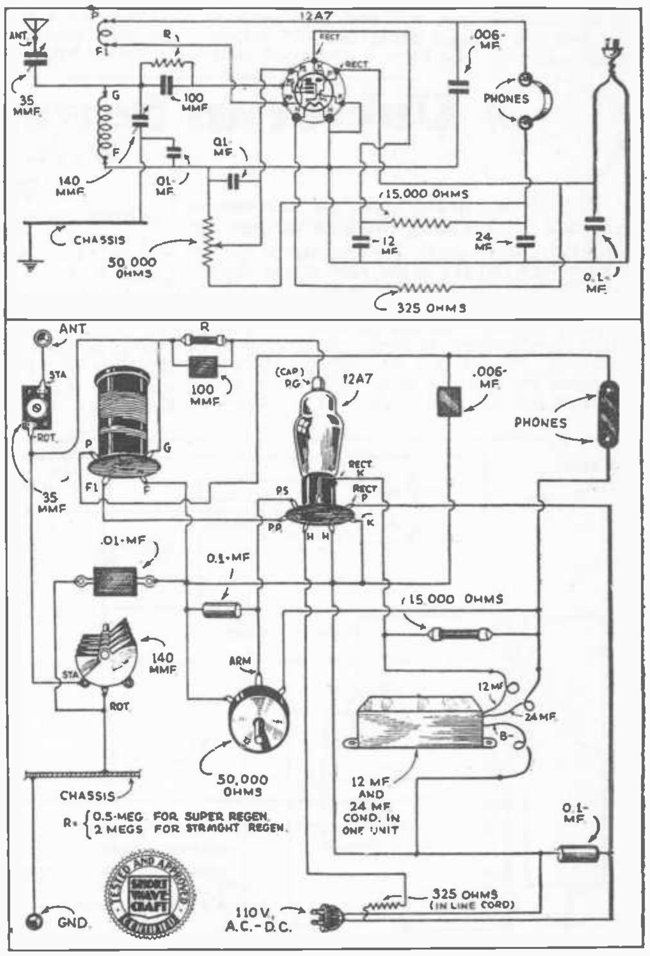
Uses 12A7 Tube As Det. and Rectifier

The tube used in this receiver is known as the 12A7. It consists of a *pentode* and a *half-wave rectifier* all inclosed in a single glass envelope! The pentode portion is intended for audio frequency amplification; however we have still to see a tube that could only be used for a single purpose! After many tests and experiments it was found that this tube will do a great many things its inventors never thought of and you can look forward to seeing this tube in other rôles. As we started to say, the pentode section can be used as a *regenerative detector* and will perform as well as any other type. The great question in building a 1-tube set is—what circuit shall we use in order to obtain the utmost efficiency. This question I think can best be left for the reader to answer. How are we going to work that? Easy enough, we'll give all the dope and some pointers as to what may be expected and let the reader choose for himself.

Why the sudden burst of generosity? Hi—as this is being written it's only a few day to Christmas—probably that explains it. Anyway, let's get started. The option left to the reader is whether he wants to use a straight regenerative circuit or make the set a "self-quenching" super-regenerator; both have their advantages and they will be clearly explained.

Many will ask "What about *hum* in such a receiver, wherein only half-wave rectification is used and the two parts of the circuit placed so close together?" Well, the truth of the matter is that in one instance we are troubled with *hum* of a peculiar sort, and in the other we have no hum! When the receiver is a straight regenerative one, we have no hum, insofar as the *power supply* is concerned, but we have a slight modulation of signals as the detector is brought right on the edge of oscillation. When the regeneration control is *backed off* slightly, the voice or music comes in very clearly and no objectionable hum or modulation exists! This hum or modulation is caused by pick-up on the grid of the detector due to its close proximity to the rectifier. It can be eliminated entirely by reducing the value of the grid-leak, but this reduces our sensitivity.

When used as a super-regenerator the detector is *humless;* the overall volume is far greater, but we have that characteristic hiss present in all super-regenerators. And it is because of the above-mentioned facts that we give the reader his choice of circuits. With either of the two methods mentioned all the "foreign" stations heard on any short-wave receiver were pulled in very easily, the super-regenerative circuit providing about *four times the audio volume* of the regular regenerative method of detection.



Anyone with the slightest mechanical skill can easily build the 1-tube All-Electric set here described, which can be plugged into any 110-volt A.C. or D.C. lamp socket. It needs no batteries or eliminators.

1-Tube Oscillodyne

A glance at the circuit will reveal that it is of the A.C-D.C. variety, making it very simple to build and its constructional cost quite nominal. The filter consists of a 15,000-ohm 1-watt resistor and two electrolytic condensers having a capacity of 24 mf in one section and 12 in the other. These condensers are both mounted in a small cardboard container and have a working voltage of 200 volts. A .1 mf. by-pass condenser is needed across the line to reduce noise to a minimum. The heater voltage is obtained with a line cord having incorporated in it a 325-ohm voltage dropping resistor. The entire receiver is mounted on a metal chassis, the dimensions of which are given in the drawing; this is necessary if we are to be rid of the hum.

There are only two changes in the circuit in order to change from one to the other is in the size of the grid-leak and the number of tickler turns of the coils, the values of the remaining components remaining the same. The circuit shown is for super-regeneration and the values are correct for either method of reception. With super-regeneration the grid-leak value is one half megohm. The tickler coils should be changed according to the data given in the coil table. For the straight regenerative circuit any of the standard plug-in coils on the market will give satisfactory results. One thing is really very important in constructing the receiver, and that is the wires of the A.C. line and those of the rectifier and filter should be kept a good distance from all other parts of the circuit and the rest of the wiring, in order that there be a minimum of induction hum. Carelessly placed wires will produce so much hum that the set will be just about useless. Then another important thing to remember is not to attach an *external* ground to the "B" negative part of the circuit; otherwise the house fuses will be blown. In connecting up the receiver you will find that we have isolated the chassis from the "B" minus. In this way we can have a grounded chassis and condenser rotor which help to eliminate body capacity effects. In order to bring the "B" minus circuit to ground R.F. potential, we have by-passed it to the chassis with a large condenser. This condenser should be able to stand the 110-volts A.C. or D.C. without breaking down. It is advisable to use a condenser rated at 200 or 300 volts A.C.

Operation of the receiver is so very smooth and the construction so simple, that the reader should have no trouble and the set should work "right off the bat." When first connecting the set to the power line try reversing the line plug, because inserting it in one direction will give less hum than the other. Attach a good antenna and ground; the antenna should be at least 75 feet long and high above the ground. Don't run the antenna near any power lines or considerable induction hum may be encountered due to the A.C-D.C. circuit. If you have made it a super-regenerative set, turn the regeneration control full on, and you will notice a strong hissing sound. This will disappear when a station is tuned in. The set should hiss all over the dial and if it does not, then reduce the capacity of the antenna trimmer. If you have made it a regular regenerator, then the regeneration control will be quite critical and will have to be adjusted in the usual manner. As stated before, if the tube is operated too near the oscillation point, the signal will be modulated at 60 cycles; back off the regeneration control slightly after the station is tuned in. During tests with this receiver, all the foreign stations in Europe and South America were tuned in with ease and with surprising volume; the volume, as mentioned before, was greatest with *super-regeneration!* If the reader tries both methods, he will soon be able to decide for himself which is best.

PARTS LIST FOR 1-TUBE A.C. SET

1—½ or 2 meg. grid-leak, see text. Lynch.
1—50,000-ohm potentiometer; Electrad.
1—15,000-ohm, 1 watt, resistor; Lynch.
1—line cord with 325-ohm voltage dropping resistor.
1—100 mmf. mica condenser; Aerovox.
1—.01 mf. mica condenser; Aerovox.
1—.006 mf. mica condenser; Aerovox.
—.1 mf. condenser, 300-volt rating.
1—Dual electrolytic condenser, 12 and 24 mmf. working voltage, 200.
1—35 mmf. antenna trimmer, I.C.A.
1—140 mmf. tuning condenser, Bud.
1—7-prong (small) wafer socket.
1—4-prong (small) wafer socket.
1—antenna ground terminal strip. I.C.A.
1—phone terminal strip. I.C.A.
1—small chassis; Blan.
1—12A7 tube; Sylvania.
1—pair of earphones; Trimm.

Parts List for 1-Tube A.C. Set
Na-ald Plug-in Coil Data

Meters Wave-length	Grid coil turns	Tickler turns	Distance between 2 coils
200-80	52 T. No. 28 En. Wound 32 T. per inch.	19 T. No. 30 En. Close wound (CW)	1/8"
80-40	23 T. No. 28 En. Wound 16 T. per inch.	11 T. No. 30 En. C. W.	1/8"
40-20	11 T. No. 28 En. 3-32" between turns	9 T. No. 30 En. C. W.	1/8"
20-10	5 T. No. 28 En. 3-16" between turns	7 T. No. 30 En. C. W.	1/8"

Coilform—2 1/8" long by 1 1/8" dia. 4-pin base.

The above coil data is correct when using a straight regenerative circuit. When using a super-regenerative circuit, the following tickler coils will be necessary:

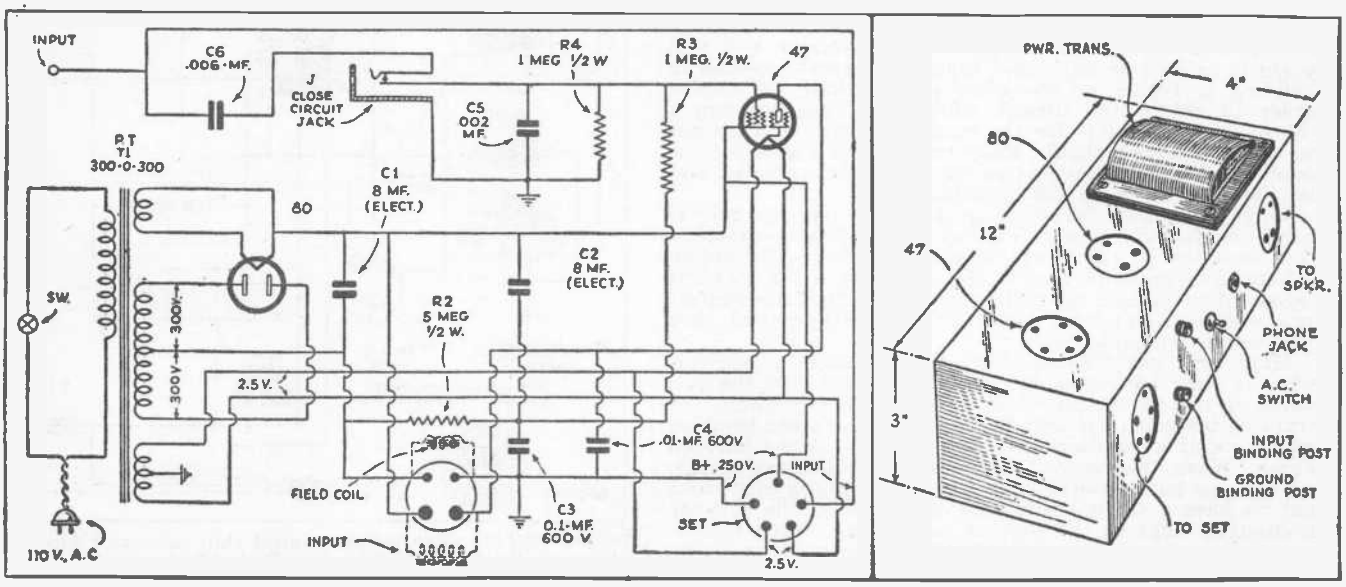
Coil	Tickler
200-80	25 turns
80-40	15 turns
40-20	12 turns
20-10	10 turns

A Universal Power-Pack and Amplifier

W. H. Balderston
W9CKV

It will be noted that an uncommon method of obtaining the bias voltage for the 47 tube is used. By the use of the resistors R2 and R3 to the grid, of the capacities shown, the bias voltage will be 1/7 the voltage drop across the speaker field RI, which in most cases will be correct if a 2,500 ohm speaker field is used. A condenser of .002, C5, is used as a tone control and interference eliminator; this capacity is about correct for a type 47 tube. It helps cut off the highs but does not bring out the lows to any great extent; its main purpose is to help cut out interference. By the use of the phone jack a head set can be used and by hooking it as shown in the diagram if a head set is plugged in the speaker will be cut out, but the bias voltage of the 47 will still be on the tube; this is very necessary on this type of tube as cutting off the bias voltage with plate voltage on will greatly harm the tube.

Two binding posts are shown in the diagram, one for connecting to separate ground and another for input from the set. This extra input connection to the binding post was found very useful when using a battery set or one with its own power supply in which case the five-prong socket connection is not used. In the diagram an input connection is also shown on the five-prong socket and when using a set which derives its power and filament supply from the pack this connection can be included in the connections from the set.



Useful circuit diagram is that given above, which shows how to wire up a Universal Power-Pack and Amplifier.

The 2-Tube "CHAMP" In Which 2 Tubes=3

By JACK WARING and HAROLD MITCHELL

Left—here we see the 2-tube "Champ" in action! Thanks to the new two-element tubes, this set actually lives up to its name and gives the same results as though 3 tubes had been used.

● INVARIABLY the Short Wave fan or Beginner prefers to "Break the ice," with a one tube or two tube short wave set, and it is because of this that the "2-Tube CHAMP" was designed.

In this compact little two tube short wave receiver we use only two tubes and yet we really get the results of three, and still better than that, many of the major foreign, and practically all of the local and domestic stations operate a speaker.

One of the many features of this set is that it uses one of the new tubes, the 6F7, in conjunction with a '37 type tube. The six volt tubes have been selected in preference to the conventional 2.5 volt tubes since all of us do not have 110 volt A.C. available. We may have to content ourselves with 110 volt D.C., or then again we may want to make it a portable affair. Therefore the power supply must be constructed to meet with your requirements or preference.

The 6F7 Tube

The new type 6F7 tube is a Pentode-Triode (really two tubes with a common filament), in one bulb. One of the many advantages in using this type tube is that you not only save the cost of additional parts, but valuable space as well. And you actually do get the result of two tubes.

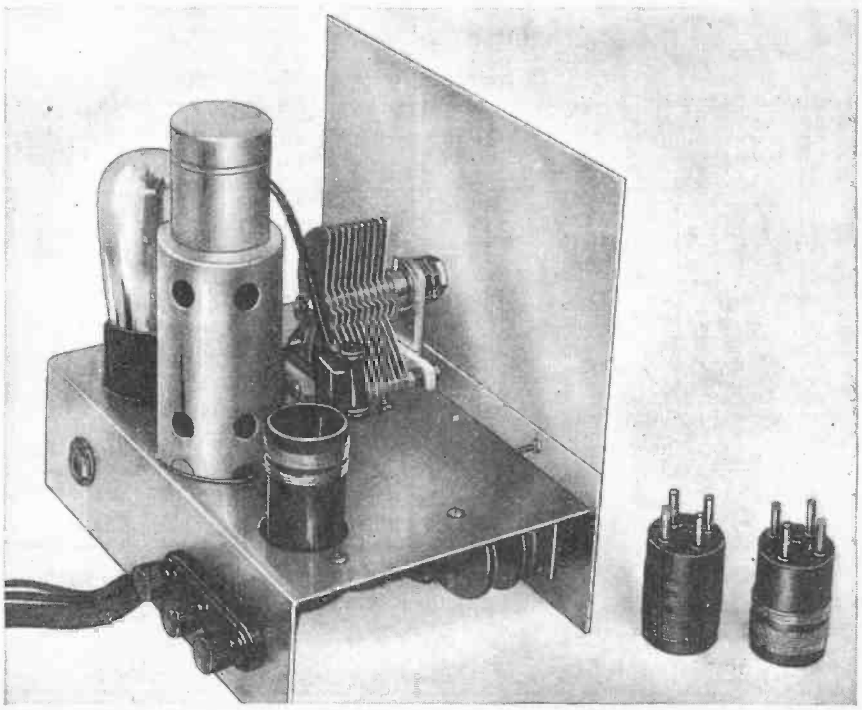
Description of Set

The set is built up of mostly National parts. The *pentode* portion of the 6F7 operates as the detector, and the *triode* portion as the first audio amplifier. Beginning with the high frequency end of the set we connect a lead from the antenna or aerial post to the stator plates of the antenna trimming condenser. This condenser has a capacity of .000025 microfarad, and its function is to adjust, or permit adjustment of the antenna circuit. From the rotor plates of this condenser, which incidentally is insulated from the chassis, we bring a lead to the grid side of the plug-in coil socket and to the stator plates of the main tuning condenser, which has a capacity of .00015 microfarad. From this point also we bring a lead to a .0001 mf. mica grid condenser which is shunted by a two megohm leak, or resistor. To the other side of this grid condenser and leak is connected the lead which goes to the control grid of the pentode portion of the 6F7 tube which is the terminal on the top of the tube.

The rotor plates of the main tuning condenser and the other side of the plug-in coil connects to ground. The screen-grid of the detector goes directly to the arm of the regeneration control at which point it is by-passed to ground with a half microfarad condenser. One side of the regeneration control which is a 100,000 ohm potentiometer, goes to ground and the other side goes to a 150,000 ohm resistor which in turn connects with the high voltage or "B" positive.

The cathode of the 6F7 tube is connected to ground through a five hundred ohm resistor which is by-passed with a tenth microfarad condenser. The grid of the triode portion of the "Six-F-Seven" tube goes to a one megohm resistor to ground and to a .01 mf. condenser. The other end of this condenser goes to the "B" positive terminal of the tickler winding of the coil socket through an R.F. choke.

The tickler coil end of the radio frequency choke is by-passed to ground



Rear view of the 2-Tube "Champ" which actually gives the same results as any ordinary 3-tube set; phones or loud speaker may be used.

through a .00025 mfd. condenser, and to the other end of the choke is connected a 250,000 ohm resistor the other side of which goes to "B" positive. The other side of the tickler winding, or the plate terminal of the coil we connect to the plate of the pentode section of the 6F7 tube.

The plate of the Triode portion is connected to a coupling condenser of .01 mf. and to "B" positive through a 250,000 ohm resistor. The other side of this coupling condenser goes to the grid of the '37 type tube socket and to a one megohm resistor to ground.

The cathode of the '37 type tube is now connected to a one thousand five hundred ohm bias resistor the other side of which is connected to ground.

To the plate of the '37 type tube we run a lead to one of the output terminals. The other output terminal goes to "B" positive.

"B" minus naturally goes to ground or chassis.

There is nothing very complicated about this set however, careful wiring is recommended for the success of this delightful little receiver, which is very easy to operate and it makes one of the dandiest little stand-by receivers you ever saw or heard, and is therefore ideally suited to the "Ham" that is particular.

There are no special adjustments to be made. After the wiring is completed, it should be carefully checked, and if correct, you are ready to tune in short wave stations, after having connected a suitable power supply.

The coils are wound on the National small type forms which are made of the new "low-loss" insulating material for high frequencies known as R-39.

The physical dimensions are: panel 7 x 6½, and the chassis 7 x 4 x 2. Both panel and chassis are made of aluminum.

Everyone is interested in obtaining the greatest output from a radio set using the least number of tubes. Here we have an ultra modern 2-tube receiver which has actually brought in European stations on a loud speaker. This set uses two of the latest style tubes and it makes an ideal "low-cost" set for the beginner, while the few parts used render its construction very simple.

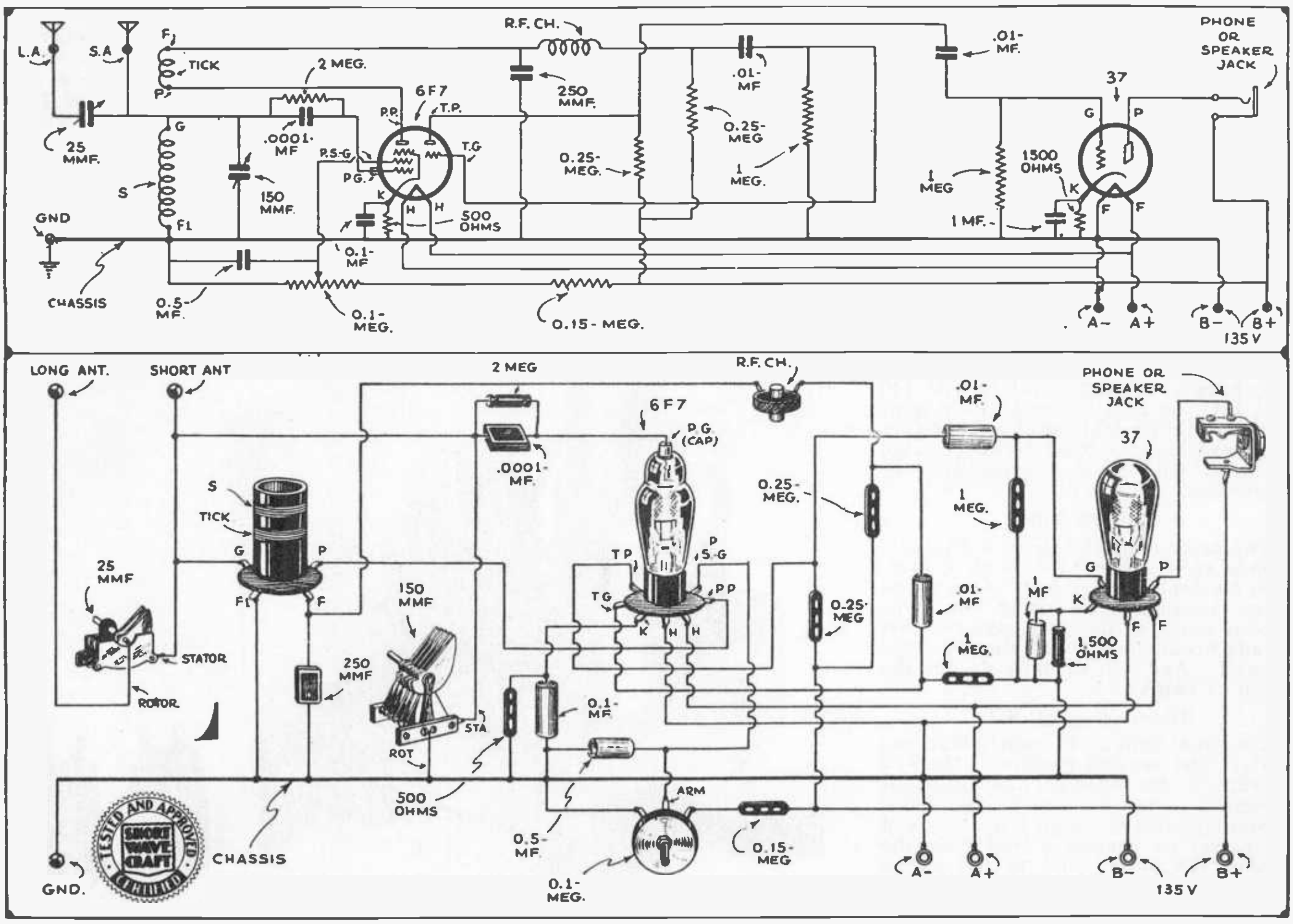
Parts List

1 National Dial type B
1 National R.F. Choke 2.5 M.H.
1 National Tuning condenser type SE-100 (100 mmf.)
1 National .000025 mf. Variable condenser
1 .0001 mf. condenser
1 .00025 mf. condenser
2 .01 mf. condenser
1 .1 mf. condenser
1 .5 mf. condenser
1 2 megohm resistor Lynch
2 1 megohm resistor Lynch
1 150,000 ohm resistor Lynch
1 100,000 ohm resistor Lynch
1 250,000 ohm resistor Lynch
1 1,500 ohm resistor Lynch
1 '37 type socket
1 6F7 type socket
1 UX blank socket
1 500 ohm resistor Lynch
1 100,000 ohm potentiometer; Acratest
1 chassis 7 x 4 x 2
1 panel 7 x 6½

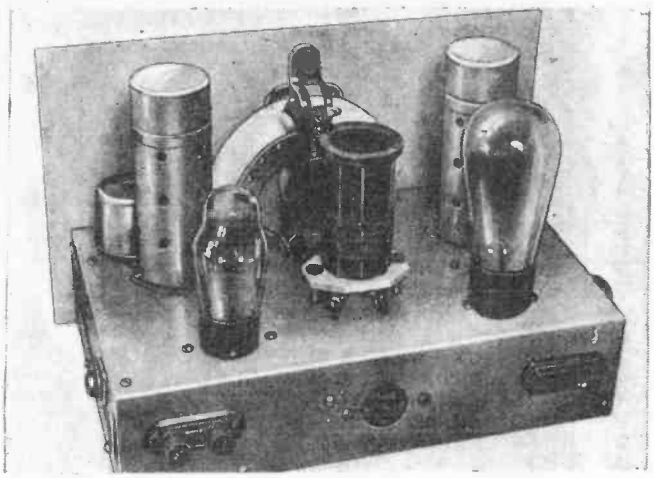
Data for Winding Coils

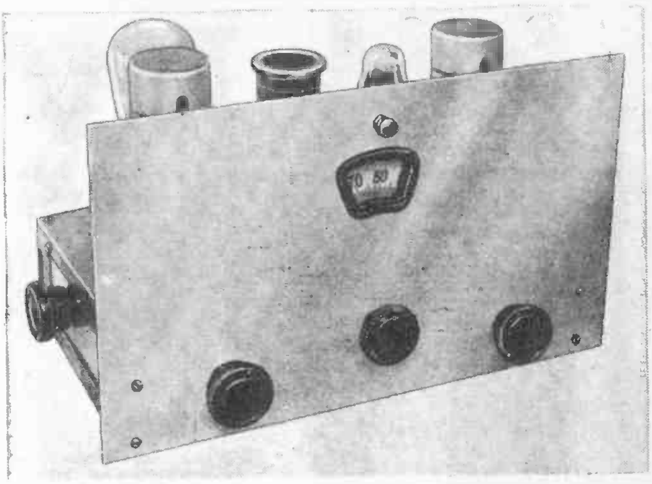
Range in meters	Grid—size wire	Plate—size wire
14 to 22	6 turns 26 D.C.C.	6 turns 26 D.C.C.
20 to 40	12 turns 26 D.C.C.	8 turns 26 D.C.C.
40 to 80	25 turns 26 D.C.C.	12 turns 26 D.C.C.
80 to 200	45 turns 30 D.S.C.	15 turns 30 D.S.C.

Leave 3-16 inch space between grid and tickler coils. Dimensions of coil forms—1½ inch long by 1 inch in diameter; National 4-pin, special low-loss R-39 insulation forms.



After all, most of us go into the short-wave game for the "fun" we get out of it. The 2-tube "Champ" is so simple to build and wire, with the aid of the picture diagram above, that it is really fun to build the set. And wait till you hear the distant stations roll in like a charm! Oh Boy!





B-S4 Works Loud-Speaker Has Band-Spread Tuning

By ALBERT FRIESE, Jr.

The type of detector used is extremely stable in spite of large variations in plate voltage. A type 58 tube was also used as a detector tube as it seemed to perform better than the 57, which was designed for the purpose. *Band-spread* tuning, which makes the tuning much easier, is used. The *band-spread* method makes the tuning of amateur stations much easier, as they are spread over the dial instead of "bunched" all together. Variation of the screen-grid voltage is used to control regeneration as it does not detune the signal received and is noiseless in operation. The output of the detector is well-filtered by a choke and two condensers and prevents the radio frequencies from getting into the audio section of the receiver.

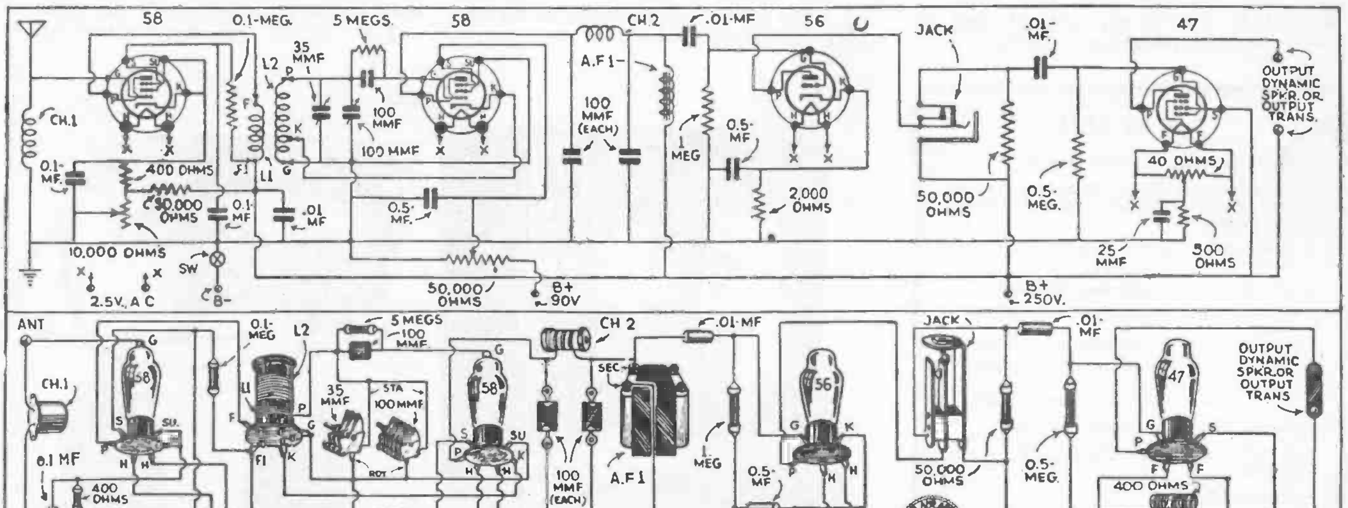
The *output* of the detector is fed into a 56 triode which is the *first audio stage.* The coupling is an audio transformer with its secondary and primary coils connected in series to form an A.F. choke for the plate voltage of the detector with a condenser and a resistor for the grid of the 56. The output of the 56 is fed either into earphones or the last audio tube, which is a 47 pentode. The 56 is resistance-coupled to the 47 which feeds into a dynamic speaker. The 47 operates efficiently and drives the dynamic speaker on all signals.

Parts List

1—.000035 mf. midget variable condenser, C12, Hammarlund.
1—.0001 mf. midget var. condenser C13, Hammarlund.
2—.1 mf. fixed by-pass condenser C, C2, Aerovox.
3—.001 mf. fixed condenser, C6,C7, C5, Aerovox.
2—.5 mf. fixed by-pass condensers, C4, C10, Aerovox.
3—.01 mf. fixed condensers, C8, C9, C3, Aerovox.
1—25 mf. 25 volt fixed by-pass condenser (Electrolytic) C11, Aerovox.

Resistors:
1—40 ohm center-tapped resistor, R8, Aerovox (Electrad).
1—400 ohm 5 watt resister, R1, Aerovox.
1—500 ohm 10 watt resistor, R7, Aerovox.
1—2,000 ohm 2 watt resistor, R9, Aerovox.
1—10,000 ohm tapered wire-wound potentiometer with S.W., R10, Electrad.
1—50,000 ohm potentiometer, R11, Electrad.
1—100,000 ohm 2 watt resistor, R2, Aerovox.
1—500,000 ohm 2 watt resistor, R6, Aerovox.
1—1 megohm, 2 watt resistor, R4, Aerovox.
1—5 megohm, 2 watt resistor, R3, Aerovox.

Chokes:
1—Hammarlund shielded R.F. choke Code CH-10-S, CH1.
1—Hammarlund Isolantite R.F. Choke, Code CH-8, CH2.
1—Audio Transformer with primary and secondary connected in series, A.F.1.



Schematic and picture wiring diagrams showing how simple it is to build the "B-S4" short-wave receiver, which features "band-spread" tuning—so desirable for European reception.

DUO-AMPLI-

Ideal 1-Tube Set for the

The "Duo-Amplidyne" impressed the editors as a crackerjack 1-tuber; on test, "Europeans" came in strong!

● THE receiver shown in the photographs is a combination of the Twinplex and the Oscillodyne. It makes use of the type 19 twin tube One set of elements is used as a *super-regenerative detector* and the other set as a *resistance-coupled audio amplifier.* This combination results in a very sensitive "one-tube" receiver.

For the beginner it is an ideal set inasmuch as it is very economical to build and extremely easy to operate. If the instructions are followed carefully, no trouble will be had in making it work right off. Tuning with this type of receiver is not at all critical, due to the super-regenerative detector; the regeneration control does not need to be adjusted as critically as an ordinary regenerative receiver. There is only one draw-back with a set of this kind and that is the slight hissing sound which is present in the earphones when a station is not tuned in. However when a moderately strong signal is being received the hiss completely disappears. As the station gets weaker the hiss will increase in proportion to the decrease in signal level. It will be noticed when comparing this set with another of the regular type, that there is decidedly less *fading* and *swinging* of the short-wave stations. This is due to the set being rather broad in response and also to the automatic action of the detector tube which tends to hold the signal at a more or less constant level. During a fade the station will remain at a nearly constant level and the hiss will increase and decrease in amount. Stations which are effected with very rapid fading can be copied "solid" on this set where on other sets it is almost impossible to get their call letters. So even though it has that bothersome hiss it has several advantages which outweigh its disadvantages.

Foreign Stations on 10 Foot Aerial

It will work on the smallest type of antenna. Foreign stations can be brought in on a ten-foot wire with nearly the same volume as on a long out-door antenna. With a large antenna the small antenna coupling condenser can be loosened to a point where no trace of a "dead-spot" can be found. When this condenser is once adjusted it needs no further attention. Loose coupling does not decrease the sensitivity and it allows greater selectivity with greater tuning ease, due to lack of "dead-spots".

After reading this far the reader will gather that this set as is the case with all super-regenerative receivers is no good for CW (code) reception and is only good for phone or modulated signals. Well that is not the case for with the regeneration turned below the point where the set breaks over into irregular oscillations, it will work as a regular regenerative detector and one stage of audio. Regeneration is controllable from nothing right up to super-regeneration.

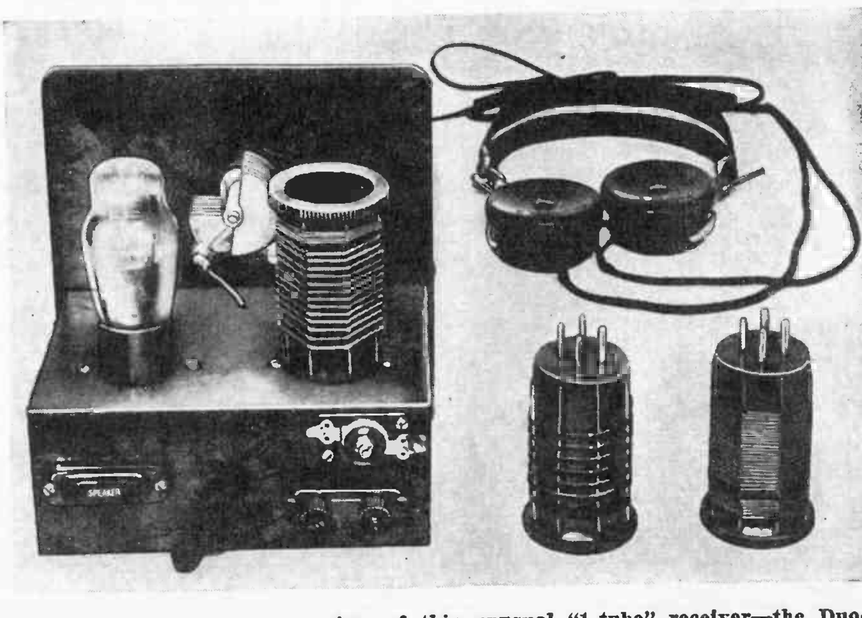
Set Built On Wood or Metal Chassis

The set as shown in the photographs is built up on a metal chassis, however, it could easily be built on a wood baseboard with a metal panel. The three controls on the panel are, the filament control rheostat, main tuning condenser and the potentiometer which controls the regeneration. In order to obtain smooth action from the set it is advised that the parts values specified be used. The two most important values are the one megohm grid-leak and the .002 mf. fixed plate by-pass condenser. If either of these are changed it will be impossible to obtain smooth super-regeneration over the entire dial on all the coils.

The plug-in coils can be any number

PARTS LIST

1 Metal Chassis. Try-Mo Radio.
1 set of Plug-in Coils, 15 to 200 meters. (See data.) Na-Ald (I.C.A.; Bruno; Gen.-Win.).
1 .00014 mf. Variable Condenser. (Hammarlund; I.C.A.).
1 .01 m.f Fixed Condenser. Polymet.
1 .1 mf. Fixed Condenser. Polymet.
1 .0001 mf. Fixed Condenser. Polymet.
1 .002 mf. Fixed Condenser. Polymet.
2 50,000 ohm 1-watt Resistors. Lynch.
2 1-meg. Fixed Resistors. Lynch.
1 50,000 ohm Potentiometer, with switch. Acratest.
1 10 ohm Rheostat.
1 6-prong Wafer Socket. Na-Ald.
1 4-prong Wafer Socket. Na-Ald..
1 Antenna Trimmer Condenser (low minimum capacity); 35 mmf. max.); Hammarlund.
1 Antenna Ground Terminal Strip. I.C.A.
1 Type 19 Tube, R.C.A. Radiotron (Arco.)
For Coil Data see page 89.



This picture shows a rear view of this unusual "1-tube" receiver—the Duo-Amplidyne, developed especially and exclusively for SHORT WAVE CRAFT readers by the author.

DYNE

Beginner

By GEORGE W. SHUART W2AMN

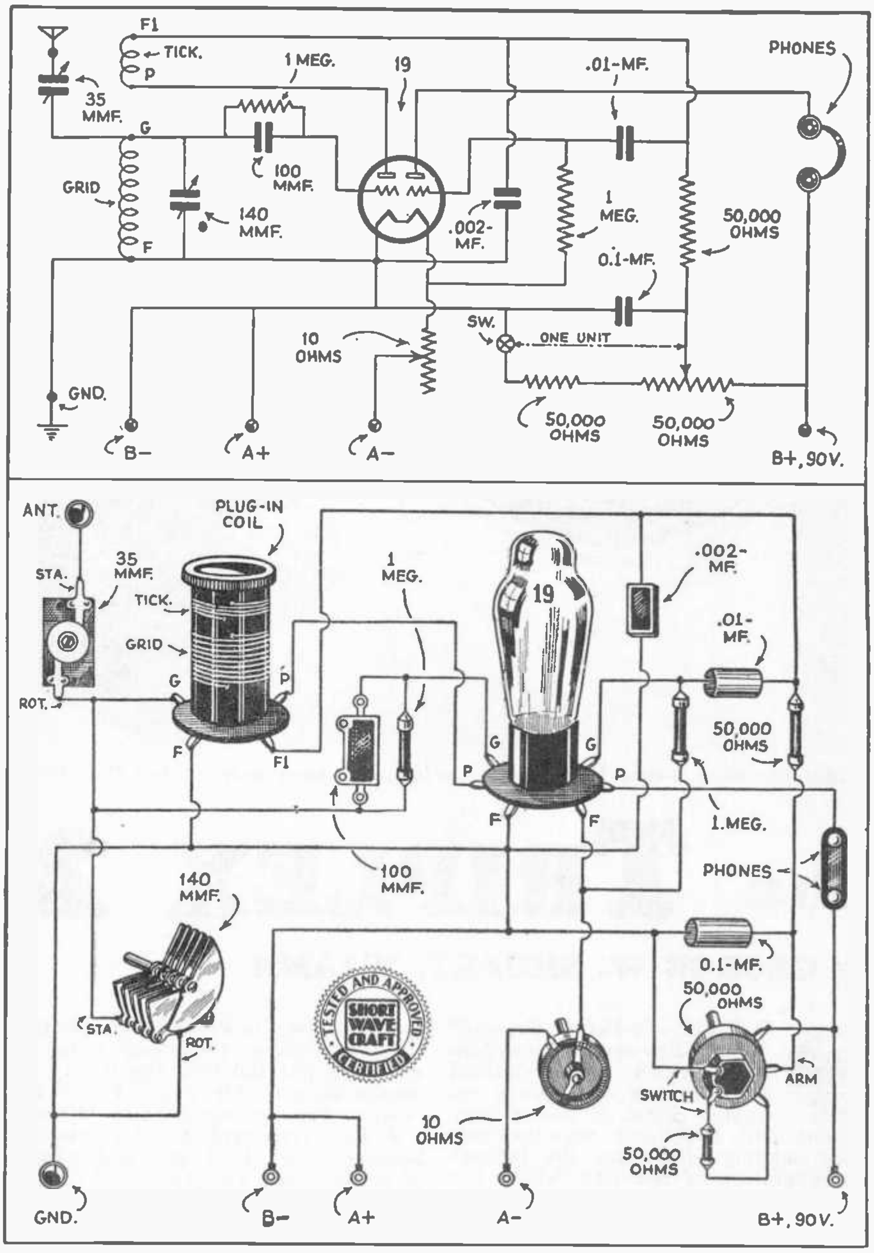
of the standard manufactured variety which have large tickler windings. For manufactured coils having less turns on the tickler than specified in the coil table, it will be necessary to add a few turns. In order to obtain either straight or super-regeneration without changing the plate voltage on the detector tube, a 50,000 ohm fixed resistor is connected between one side of the potentiometer and the B negative. Unless the rheostat or the potentiometer is provided with a switch it will be necessary to disconnect the B negative battery lead in order that the 50,000 ohm resistor will not run the B battery down when the set is not in use. It is advisable to use a potentiometer which has a switch attached in order to break the B circuit when the set is turned off. The .1 mf. by-pass condenser connects from the rotor of the regeneration control to B— and reduces any noise caused by the control. Some units will require more than .1 mf. to render them quiet in operation; as high as 1 mf. may be found necessary in some cases.

Wiring Details

The builder should have no difficulty in constructing this set. After all the parts are mounted, wire the filament circuit first. Then proceed to wire the rest of the set, making sure that the grid return of the detector is connected to the filament positive and the grid return of the audio part of the circuit to the negative. The connections for the plug-in coil used may differ from those shown in the diagrams. In any case *make sure that the out-side winding of the grid coil is connected to the grid-leak and condenser with the end nearest the tickler connected to the filament positive. The outside connection of the tickler will be connected to the plate of the tube, with the end next to the grid coil going to the 50,000 ohm plate resistor and the .01 mf. audio coupling condenser.* If these rules are followed carefully there will be no trouble with the set not working, due to improper coil connections.

After the set is wired, connect the A battery and if the circuit is correct, the filament will glow a dull red when the rheostat is turned up. Needless to say the entire circuit should be checked before any batteries are connected. With all batteries connected and the phones inserted, adjust the antenna coupling condenser to minimum capacity; insert the largest coil and connect the antenna. Rotate the regeneration control until a decided hissing sound is heard in the phones; we are now ready to tune in either amateurs or police calls. It will be noticed after the set is in operation a while, that there is one definite point of feed-back which gives best results, and this point is where the carrier wave of the station being received will kill the hiss entirely and as the station is tuned out the hiss will reappear. The adjustment of the antenna condenser is not critical and when an optimum setting is found it can be left alone.

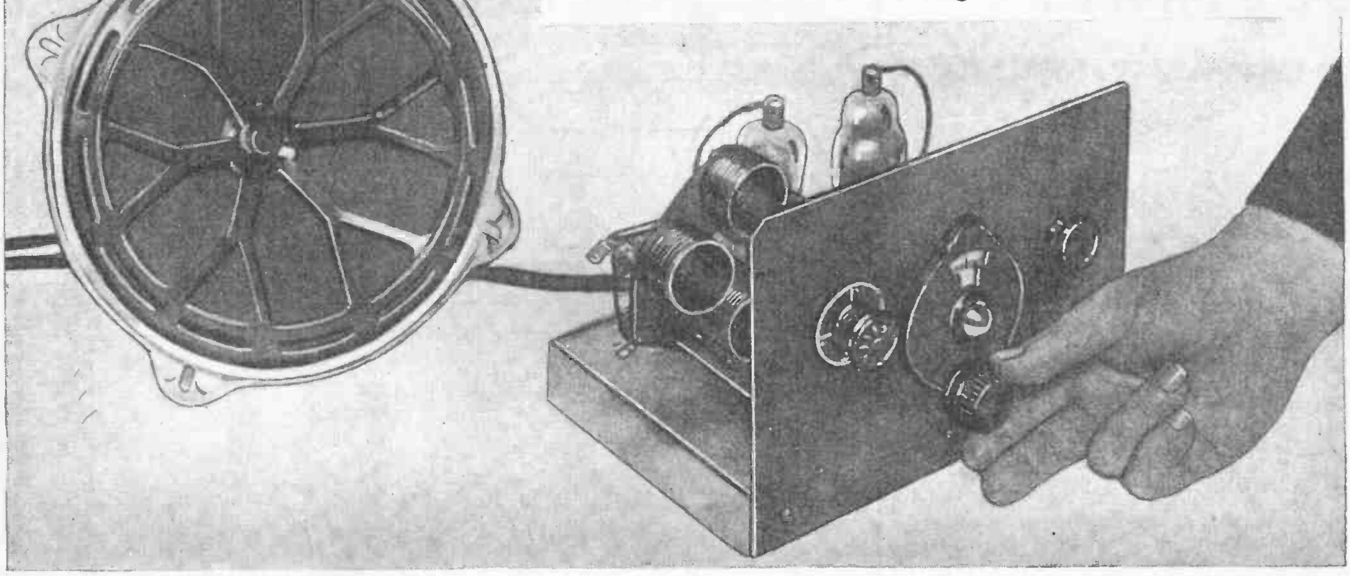
As for results actually obtained during tests made with this receiver, we can safely say that all of the "foreign" stations can be brought in with good earphone volume, and without any real fussy adjustments to make or hold. This little receiver brought in German stations right in the heart of the congested down-town district in New York City—and that is more than lots of multitube receivers have been able to do for the author. Anyone building this set will be more than pleased with its smooth performance and simplicity.



Practically anyone can follow the extremely simple wiring diagrams given above, both in schematic and picture style, so that they can enjoy the really surprising performance afforded by this ideal 1-tube set, which employs a single 19-tube. The set works on a 2 volt "A" battery.

● The circuit of the DUO-AMPLIDYNE represents a considerable amount of research and what this one tube receiving set can do, even on a 10-foot antenna, will certainly surprise you! It may seem a little hard to believe, but extensive tests repeatedly showed that the "foreign" broadcast short-wave stations, such as German, British, and others, could be picked up in fine shape, using only a 10-foot wire as an antenna. The high efficiency of this circuit is partly due to the use of the type 19 "twin-triode" tube, coupled to the fact that the circuit also operates in "super-regenerative" fashion, with a consequent tremendous increase in the signal amplification. ●

This is not a trick circuit but a very logical development worked out to provide the greatest gain possible from two standard type tubes. The detector stage utilizes a type 36 screen-grid tube, with regeneration; two stages of resistance-coupled audio are afforded by the use of a single 79 Class-B "twin" tube. 2 tubes thus give actual 3 tube performance.



Besides providing 3-tube loud-speaker performance from only 2 tubes, the "Triplex-2" includes a new wave-band change switch.

The TRIPLEX 2 — It Works Loud Speaker

By GEORGE W. SHUART, W2AMN

● THE *"2-Tube Triplex"* embodies several new features which are a decided asset to any short-wave receiver. First, it has a very efficient coil switching arrangement, which entirely eliminates the bothersome operation of reaching behind the panel to plug in the various coils. The second new feature lies in the audio channel, where a single 79 class "B"-twin tube, is made to function as a two stage class "A" audio amplifier; the two triodes in this tube are operated in cascade. This permits good loud speaker operation on two tubes as actual tests have demonstrated.

Automobile type tubes were used in this set for the benefit of those living in the rural districts, where 110 volt A.C. service is not available. These tubes permit the use of a six volt storage battery and 180 volts of "B" batteries for the plate supply. Operating a short-wave receiver in this manner gives the lowest possible background noise and even the weakest stations can be tuned in with perfect clarity. The 2.5 volt A.C. tubes can be used in this set with no change in wiring except to the pin connections on the sockets. A good line-up would be a 57 detector and a 53 as the two-stage audio tube; this of course would necessitate the use of sockets to fit these tubes.

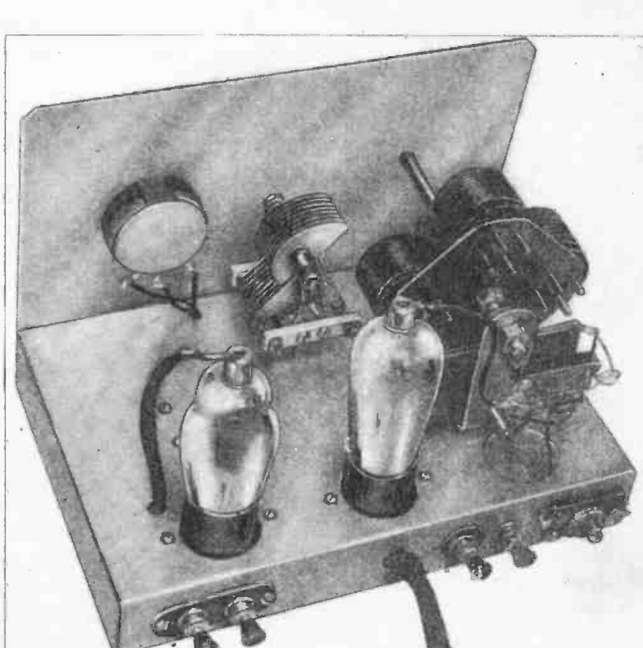
No Trick Circuits

There are no tricks about this circuit, it is a straight regenerative set-up with two stages of resistance coupled audio; and the most inexperienced short-wave "fan" can build it without difficulty. No band-spread arrangement is shown in the diagram; however, if a 35 mmf. midget variable condenser were connected in parallel with the tuning condenser shown, this would be an ideal receiver for the Amateur or "Ham."

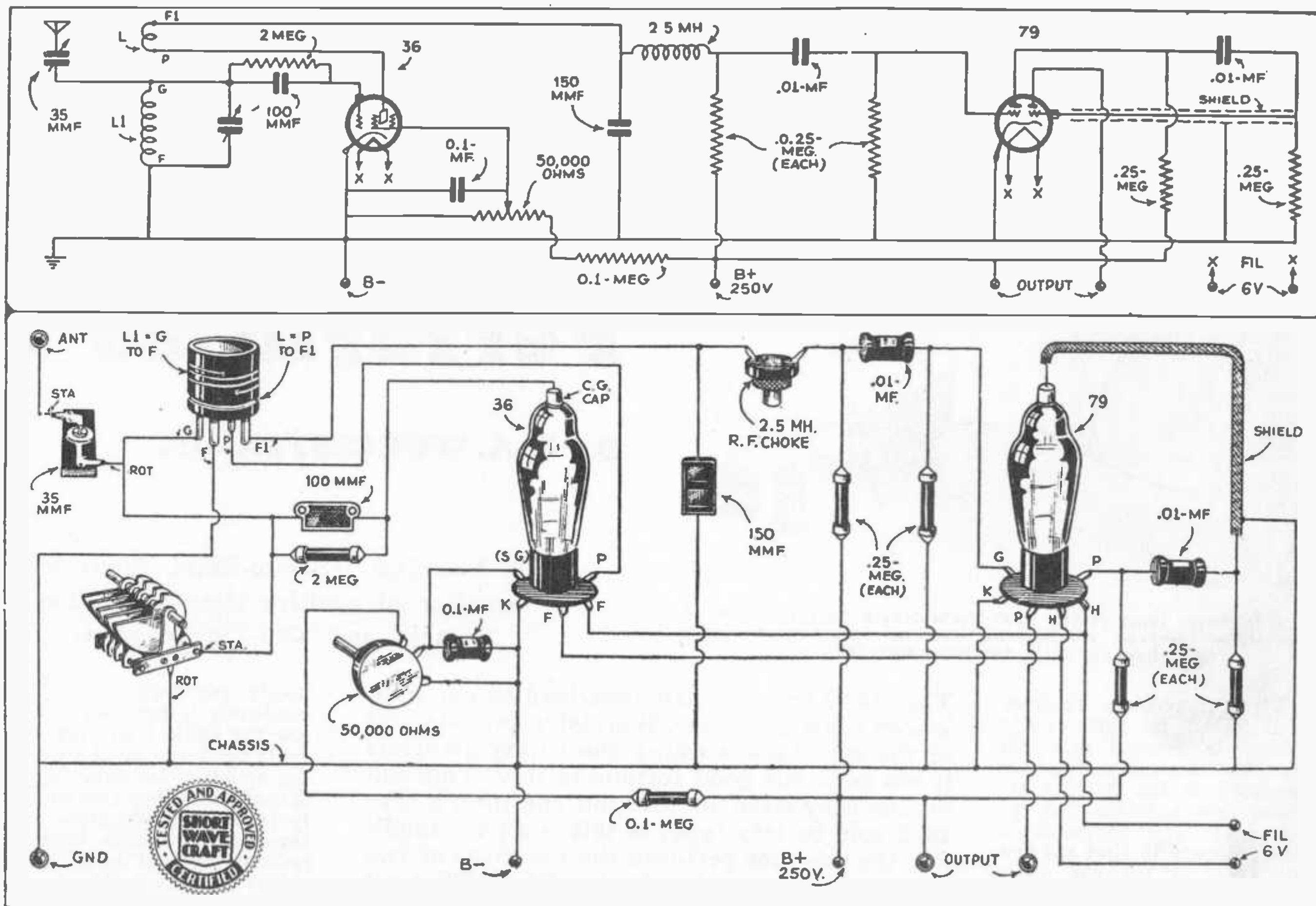
A 36 screen-grid detector was used because it is about the best detector of the 6.3 volt variety. Grid-leak detection is used with regular tickler feed-back for regeneration. Regeneration is controlled by a 50,000 ohm potentiometer which regulates the screen-grid voltage. This method has stood the "acid test" insofar as regeneration controls are concerned. A 100,000 ohm one-watt resistor connected between the potentiometer and the "B" plus 180, serves to reduce the voltage to a point where a 50,000 ohm potentiometer provides a not too critical control of feed-back.

How Detector is Coupled

The output of the 36 works into a 250,000 ohm load resistor (a high impedance choke could be used here to provide higher audio output) and is coupled to the audio stage through a .01 mf. condenser. The first audio tube is the triode of the 79, having its grid



Rear view of the "Triplex-2" receiver, which employs a 36 tube as detector and a single 79 Class-B "twin" tube for the two audio stages, together with a switch to change the wave-bands.



By the aid of the clearly drawn diagrams above, anyone can easily build the "Triplex-2," an extremely efficient and low cost S-W receiver.

at the base of the tube; the triode with its grid at the top of the envolope is the second stage.

A 250,000 ohm resistor is used for the grid leak of the first audio tube, and proved to be the optimum value; higher values gave greater gain but resulted in less stable operation, which resulted in inferior tone quality. The plate load resistor for the first audio stage which gave the best results was 250,000 ohms. A lower value in this position gave no greater gain and again instability was the result. The grid coupling condenser and grid resistor for the second audio stage are the same as in the first and again proved to be the optimum values.

Grid Lead Needs Shielding

At this point it must be stressed that it is necessary to shield the grid lead of the second stage as this lead comes out at the top of the tube and necessitates a rather long connection. With no shield on this lead there was considerable feed-back which rendered the two stages useless. No cathode bias resistor was found necessary; many values were tried without the slightest improvement.

Operated under the conditions outlined above the amplifier worked very nicely into a magnetic type loud-speaker. A dynamic speaker however, gave much better tone reproduction and slightly greater volume. With the D.C. tubes it would be necessary to use a dynamic speaker having a field coil wound for 6 volt battery operation, unless a power supply were used where the field coil could take the place of one of the filter chokes.

Layout of Parts

The lay-out of parts as shown in the photographs proved to be the most convenient and best as far as short leads are concerned. Looking at the front of the panel the control on the left operates the coil-changing device. The National vernier dial in the center controls the .00014 mf. tuning condenser and that on the right is the 50,000 ohm volume control. The chassis and front panel are of the variety used for S-W set construction and marketed by practically all the various mail-order houses.

At this point it might be well to say that standard short-wave plug-in coils such as described in former issues of SHORT WAVE CRAFT can be used if the builder does not wish to make use of the switching device used in the Triplex. Equal signal results of course can be expected from the regular plug-in coils such as National, Alden, Gen-Win, or Octocoil.

Tuning and operation of this set is exactly the same as any other short-wave set using a screen grid detector and the builder should obtain excellent results and spend many happy hours exploring the short-wave spectrum.

Care should be exercised in following the wiring diagram and *all connections should be made firm with rosin core solder, using a hot and well-tinned iron.*

Careful measurement in various radio laboratories and commercial short-wave receiving stations, have proven that the vertical type of antenna is definitely superior to any other type heretofore used, for general short-wave reception. The idea, of course, is to get it as high as possible and keep it in the clear. A good length for an antenna of this type would be about 40 feet long. If it is impossible to run the antenna directly into the receiving location either a twisted-pair, or better still a Lynch transposition block lead-in, can be used to link the antenna with the receiver. If the coupling device were used on this receiver, the best plan would be to mount a 10 turn coil directly in back of the grid coils so that as each coil was brought around into position, it would be directly in line with the antenna coil.

Parts List For Triplex

1—.00014 or .00015 mf. tuning condenser. National (Hammarlund; Cardwell).
1—50,000 ohm potentiometer. Acratest.
1—15 to 200 meter coil and switch assembly.
1—6-prong wafer socket. Na-ald.
1—5-prong wafer socket. Na-ald.
4—binding posts.
1—35 mmf. antenna trimmer condenser. National (Hammarlund).
1—.0001 mf. mica condenser.
3—.01 mf. by-pass condensers.
1—.00015 mf. mica condenser.
1—100,000 ohm (1 watt) resistor. Lynch
2—250,000 ohm (1 watt) resistor. Lynch.
2—250,000 ohm (½ watt) resistor. Lynch.
1—2 meg. (½ watt) resistor. Lynch.
1—drilled metal chassis. Try-Mo Radio.
1—National Vernier dial (small).
1—36 tube RCA Radiotron Co. (Arco).
1—79 tube RCA Radiotron Co. (Arco).

Alden 4-Pin Plug-In Coil Data

Meters Wave-length	Grid coil turns	Tickler turns	Distance between 2 coils
200-80	52 T. No. 28 En. Wound 32 T. per inch	19 T. No. 30 En. Close wound (CW)	⅛"
80-40	23 T. No. 28 En. Wound 16 T. per inch	11 T. No. 30 En. C. W.	⅛"
40-20	11 T. No. 28 En. 3-32" between turns	9 T. No. 30 En. C. W.	⅛"
20-10	5 T. No. 28 En. 3-16" between turns	7 T. No. 30 En. C. W.	⅛"

Coil form—2⅛" long by 1¼" dia. 4-pin base.

Name and address of "Switch-Coil" Assembly manufacturer furnished upon receipt of stamped and addressed envelope.

At the first trial of the "19" Twinplex, a battery-operated one-tube receiver, foreign, as well as American stations, rolled in with amazing smoothness.

The "19" TWINPLEX Makes 1-Tube Perform as 2

By J. A. WORCESTER, Jr.

A Low-Cost, Easy-to-Build, Short-Wave Receiver of positive interest to "Beginners" and "Old-Timers" alike.

The "19" Twinplex, here described by our well-known contributor, Mr. Worcester, provides one of the *smoothest-working* short-wave receivers it has been our good fortune to try. This ambitious baby-sized set uses but one tube, a type 19, 2 volt, battery type; as this is a twin amplifier, the one tube performs the functions of two stages—detector and audio amplifier. This set is extremely easy, as well as economical, to build and is a dandy for those just breaking into the short-wave game.

● THE short-wave receiver described in this article follows in general principle the "53" Twinplex receiver described in the October issue of this magazine, but requires a less pretentious power supply in that the dry cell type 19 tube is used. This tube consumes .26 ampere at 2 volts and hence requires only two dry cells in a series connection for satisfactory results. The 53 tube previously employed, required 2.0 amperes at 2½ volts, thus making the use of dry cells uneconomical. The plate voltage for the 19 tube can vary between 90 and 135 volts and may be supplied by dry batteries or a well-filtered "B" eliminator.

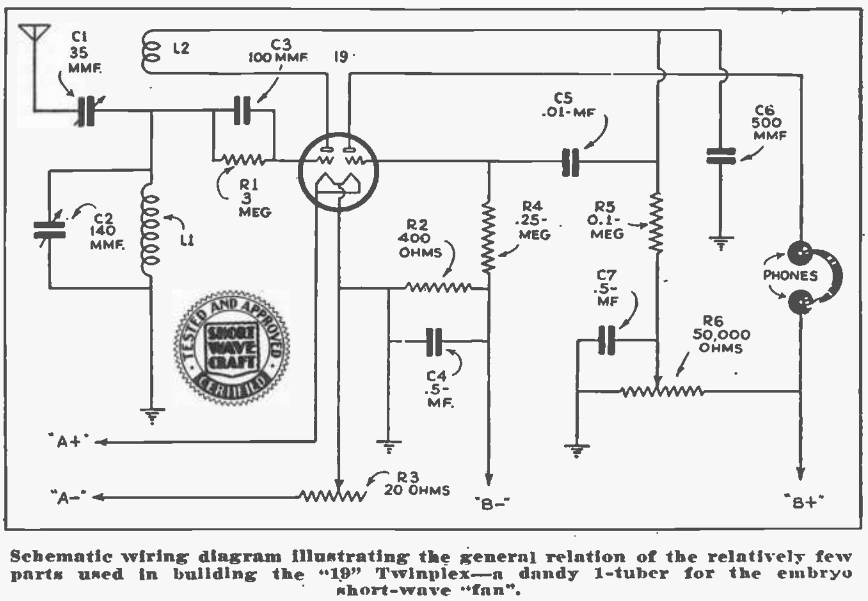
As is well known, this tube was designed as a class "B" twin amplifier and when used in this manner is capable of supplying approximately 2 watts of audio power. Due to the rather large static plate current drawn by this tube, however, it is entirely feasible to employ it for detection and class "A" amplification. The mechanical construction of this tube is similar to that of the 53, in that it effectively comprises two triodes enclosed within a single envelope; only the filament circuit being common.

Diagram Easy to Follow

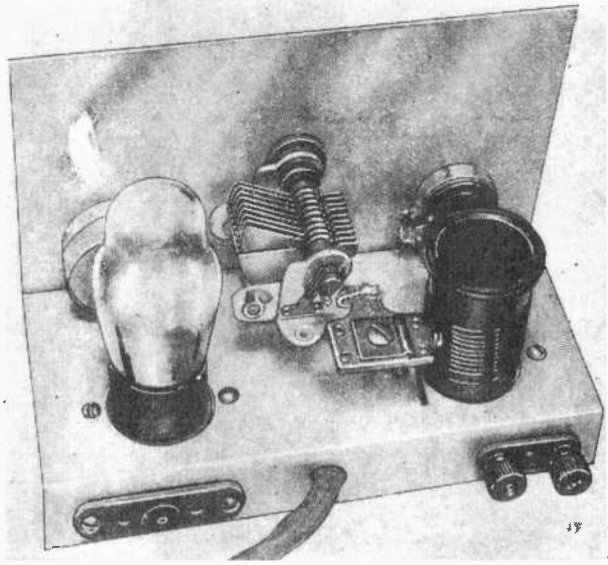
An inspection of the circuit diagram will reveal the simplicity of the layout and the small number of parts required. It will also be noted that the input circuit is entirely conventional. The antenna is coupled to the tuned circuit by means of the small equalizing condenser, C1. Detection is produced by virtue of the grid condenser, C3, and grid-leak, R1. These components have the proper values to automatically bias the tube sufficiently for proper detecting action. The plug-in tuning coils, L1, L2, are of the conventional manufactured variety although data are furnished for constructing same, if the reader wishes to "roll his own." The winding, L2, is employed to feed a portion of the radio frequency current flowing in the plate circuit back to the grid circuit; thus making it possible by suitable adjustment of the feed-back to largely compensate for losses in the tuned circuit. The feed-back is controlled by varying the plate voltage applied to the detector tube by means of the potentiometer, R6. Decreasing the plate voltage increases the internal plate resistance of the tube, causing a corresponding decrease in mutual conductance with a consequent reduction in feed-back. The radio frequency currents flowing in the plate circuit are by-passed to ground by the small capacity condenser, C6. This condenser is too small to allow the audio frequency currents produced by the detecting action of the tube to pass through and they consequently take the alternative path through the plate coupling resistor, R5, and the large capacity condenser, C7.

Audio Frequency Function

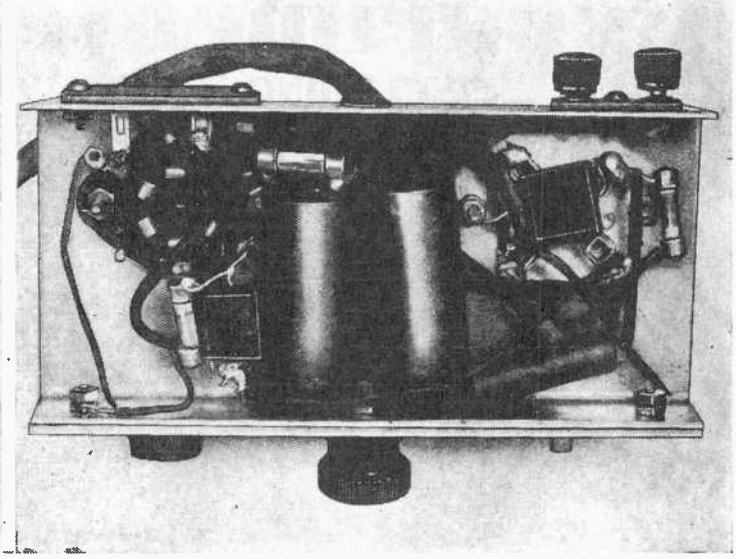
The audio frequency plate current flowing through the resistor, R5, produces corresponding voltage variations across it and these are impressed across the grid of the audio amplifier tube element. The condenser, C5, is employed to prevent the plate voltage of the detector from being impressed on the grid. This necessitates the use of the resistor, R4, to prevent a negative charge from accumulating on the tube and blocking it by reducing the plate current to a negligible value. A negative bias is provided for this tube by the total "B" current flow through the resistor, R2. C4 is employed for by-pass purposes.



Schematic wiring diagram illustrating the general relation of the relatively few parts used in building the "19" Twinplex—a dandy 1-tuber for the embryo short-wave "fan".



Bottom view of the remarkable 1-tube receiver.



Rear view of the "19" Twinplex Receiver.

The amplified audio frequency currents flowing in the plate circuit of the amplifier tube pass through the headphones as shown. The rheostat, R3, is employed to reduce the 3 volt "A" supply, furnished by two dry cells in series, to 2 volts at the tube terminals.

The location of the various parts will be noted from the photographs. The first step in constructing the receiver is to provide the chassis. This consists of a 14 gauge aluminum panel 5"x7" and an aluminum subpanel 7"x3¼"x1". The above subpanel is formed by bending a 5¼"x7" sheet to the above dimensions. On the front panel are mounted the 140 mmf. tuning condenser, C2, the 50,000 ohm potentiometer, R6, and the 20 ohm rheostat, R3. The antenna equalizing condenser, C1, is mounted directly on the tuning condenser as shown.

At the rear of the subpanel are mounted the twin binding post and phone-jack assemblies. A centrally located hole is also drilled to accommodate the battery cable.

Underneath the chassis are mounted the 6-prong tube socket and the isolantite coil socket. The various mica and paper condensers as well as the resistors are mounted directly by their pigtails as shown. Battery connections are made by connecting the cable directly to the proper points.

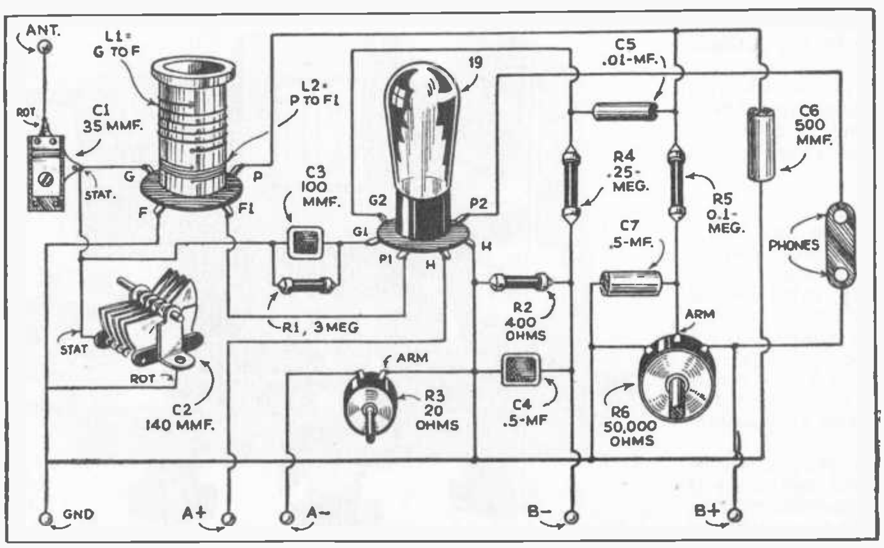
Parts List

L1, L2—Alden (Na-Ald) Short Wave Coils, 15-200 meters.
C1—Equalizing condenser 3-35 mmf. EC-35; Hammarlund (National, Cardwell).
C2—Isolantite midget condenser, 140 mmf., MC-140-M; Hammarlund (National; Cardwell).
C3—.0001 mf. moulded mica condenser.
C4, C7—.5 mf. tubular by-pass condenser, 200 DCWV.
C5—.01 mf. tubular by-pass condenser, 200 DCWV.
C6—.0005 mf. moulded mica condenser.
R1—3 meg. metallized resistor; Lynch.
R2—400 ohm metallized resistor; Lynch.
R3—20 ohm rheostat.
R4—0.25 meg. metallized resistor; Lynch.
R5—100,000 ohm resistor; Lynch.
R6—50,000 ohm potentiometer; Acratest.
1—Aluminum panel, 7"x5"x1/16"; Blan.
1—Aluminum subpanel 14 ga., 7"x3¼"x1"; Blan.
1—3" vernier dial; National.
1—4-prong isolantite socket; Hammarlund (National).
1—6-prong wafer socket; Alden.
1—Ant.-ground binding-post strip.
1—Twin speaker jack assembly.
1—Type "19" tube RCA (Arco.).

Operating Hints

When putting the set into operation the rheostat should be adjusted until the filament voltage is two volts. The potentiometer should be adjusted until the circuit goes into oscillation. When oscillation starts a pronounced thud generally occurs and pronounced clicks will occur when the ungrounded terminal of the tuning condenser is touched with the finger. It will generally be found advisable to readjust the antenna condenser each time a coil is changed. For the smallest coil, best results will usually be obtained with the condenser plate "all out," while for the largest coil the plate should be nearly "all in" for most satisfactory results. This adjustment should be loose enough so that "dead-spots" in the tuning range, caused by antenna resonance, do not occupy more than five or ten degrees on the tuning scale.

This little receiver will pull in signals from all over the world without the slightest difficulty. Even the weakest foreign stations can be pulled in with perfect clarity, under fair receiving conditions, as there is practically no back-ground noise from the receiver itself. Anyone building this set will surely be surprised at the volume it will produce. There are no tricks in tuning the 19 Twinplex; the regeneration control operates very smoothly and causes only an inappreciable detuning effect. As in all short-wave receivers, extreme care must be exercised in operating, otherwise a great number of the weaker stations will be passed up. *So Tune S-l-o-w-l-y!*



Picturized wiring diagram which even the most inexperienced short-wave fan can follow, in order to build this excellent one-tube receiver which gives 2-tube results.

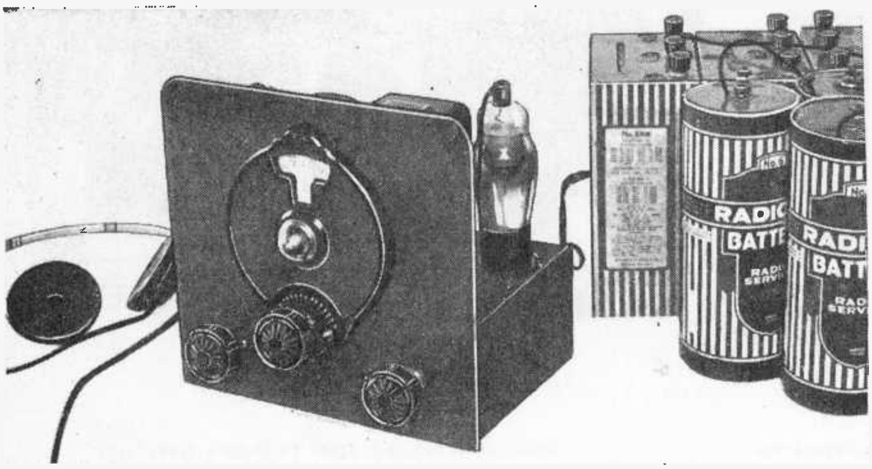
PLUG-IN COIL DATA

Meters Wave-length	Grid coil turns	Tickler turns	Distance between 2 coils
200-80	52 T. No. 28 En. Wound 32 T. per inch	19 T. No. 30 En. Close Wound (CW)	⅛"
80-40	23 T. No. 28 En. Wound 16 T. per inch	11 T. No. 30 En. C. W.	⅛"
40-20	11 T. No. 28 En. 3-32" between turns	9 T. No. 30 En. C. W.	⅛"
20-10	5 T. No. 28 En. 3-16" between turns	7 T. No. 30 En. C. W.	⅛"

Coil form—2⅛" long by 1¼" dia. 4-pin base.

Experimenter's Section

INCLUDING BATTERY-TYPE RECEIVERS



Above—is the general view showing the "Economy-2" together with the necessary batteries. Note the extremely neat appearance of this set.

Economy 2 Battery Receiver

● THE fellows in the rural districts where there is no electric power supply, at last have an excellent chance to construct a receiving set with all the "earmarks" of an *electrified* 110 volt outfit. This is made possible by the introduction of the new Sylvania type 15 screen-grid pentode. It is a modern tube, designed to work from a two volt battery supply with moderately low current drain (.22 ampere). Its greatest feature of course is the *indirectly heated cathode*. This makes possible the construction of a set that has *no microphonic tube noises!* The tube has an amplification factor of 600 with 135 volts on the plate!

As a regenerative detector or oscillator the tube performs equally as good as most of the others which work on higher heater voltages. The input (grid to cathode) capacity is only 2.35 mmf. rendering it better suited for high and ultra high frequency work than many other types of screen-grid tubes. The set herein described uses two of these tubes, one as a *regenerative detector* and the other as a *triode audio amplifier*.

The detector is connected up in the usual manner, but the audio differs somewhat from the usual run of circuits. The 15 type tube could not be used satisfactorily in the audio stage as a pentode, because of its high plate impedance and the fact that we must connect the earphones in its plate circuit in this particular receiver. To get around this we have connected it up as a triode by connecting the screen-grid directly to the plate. The suppressor of course cannot be connected to the plate because it is already connected to the cathode inside the tube. Bias is obtained, in the usual manner, by inserting a resistor in the cathode circuit.

With this new tube we can use some of the well-known electron-coupled circuits in a much simpler manner. There is a wonderful opportunity for the "battery set" constructor and many new ideas will undoubtedly be presented in the near future.

3 Dry Cells Run 2 Tubes

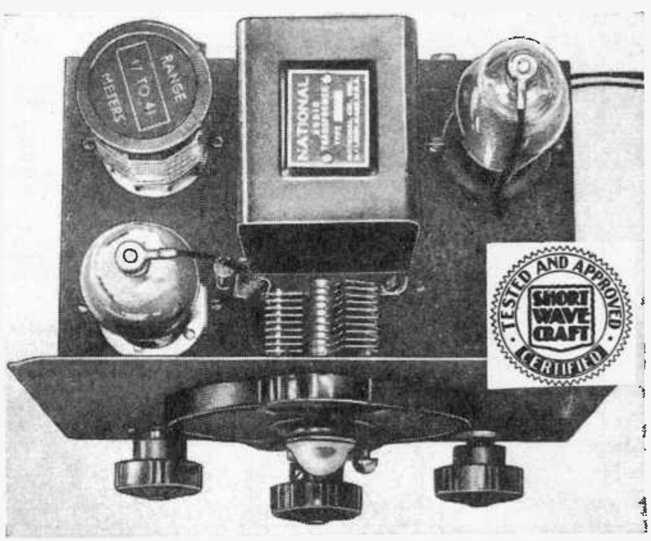
The heater current of the 15 is .22 ampere and while this is considerably higher than the average battery-operated tube, it can be worked out very nicely by simply connecting the heaters in series. In using dry batteries we find that they will give better and more economical service when the current drain is low. When we connect these tubes in series, we have to increase the voltage; however the current requirements remain the same. (.22 ampere.) For two tubes the voltage required is 4 and for three tubes the voltage is 6. A three tube set could be run very economically with four dry cells.

The various values used in the detector circuit are nearly the same as in any regenerative set. The grid condenser is a .0001 mf. affair and best results were obtained with a three megohm resistor for the grid-leak. Plug-in coils are used for convenience and are the new Hammarlund type wound on ribbed "XP-53" forms and cover a range of from 17 to 270 meters. Only two windings are used, one for the *tickler* and one for the *grid coil*. The tuning condenser has a capacity of 140 mmf.; for band-spread another small condenser having a capacity of 35 mmf. can be shunted in parallel with the larger condenser and serves to effect *band-spread;* the large condenser will then be used to adjust the range of the smaller one.

Regeneration Control

The antenna is connected directly to the grid of the detector through a small Hammarlund variable padding condenser, having a capacity of 25 mmf. This condenser is mounted directly on the front panel for convenience and after once set for a given antenna needs little attention. Regeneration is controlled by a potentiometer connected in the screen-grid circuit of the 15 detector and gives very smooth control of feed-back. If the builder does not wish to use this method it can be arranged so that the plate condenser is variable instead of a fixed affair and regeneration controlled by varying the capacity. In this case the potentiometer is not necessary. The screen-grid lead is connected directly to the 22.5 volt terminal of the "B" battery.

Having a very high plate impedance the 15 tube when used as a detector requires either resistance or impedance coupling to the audio stage. In this set we use a National *impediformer*. However a 250,000 ohm resistor could be used but with considerably less volume.

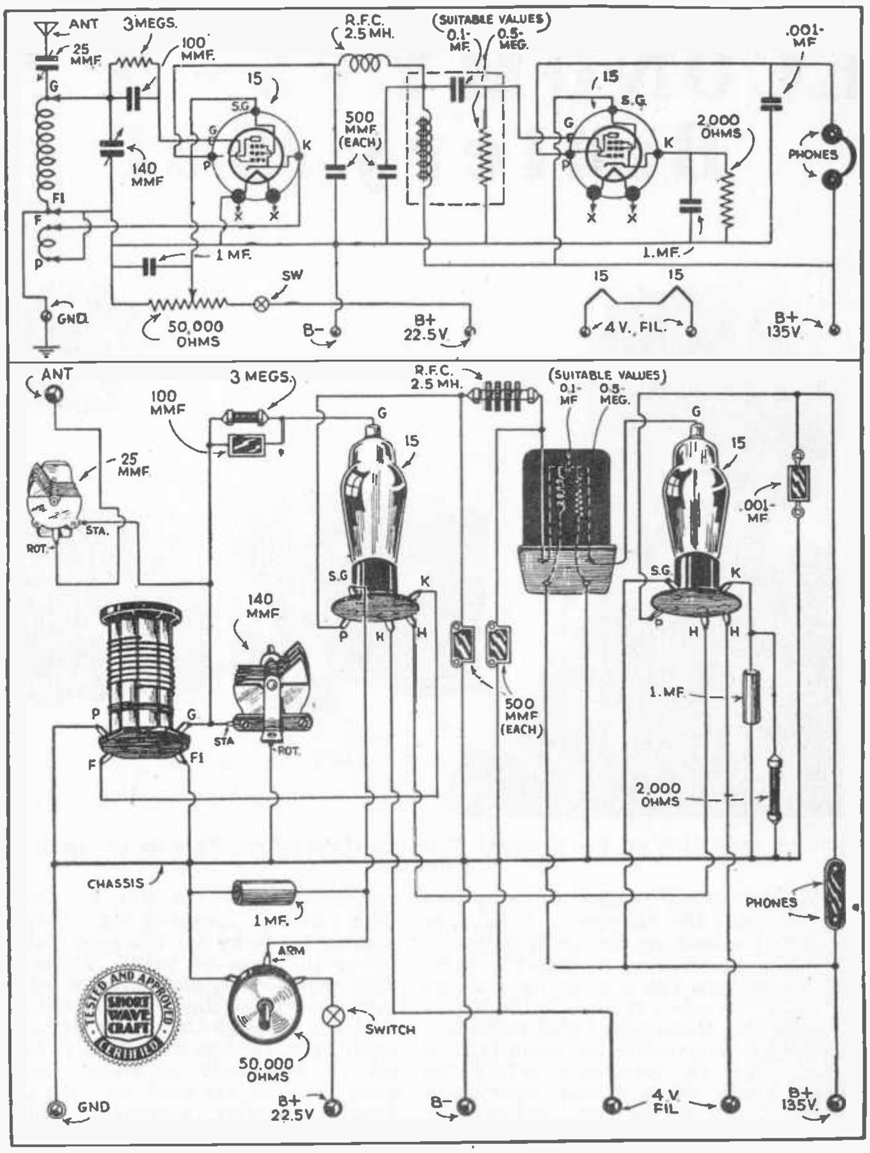


Above we have the top view, showing the arrangement of parts used in the battery operated "Economy-2."

In the plate circuit of the 15 detector we have a radio frequency filter consisting of two fixed condensers and an r.f. choke. Two .0005 mf. condensers and a 2.5 mh. choke are used. This eliminates considerable trouble in that the R.F. currents are kept out of the audio system and a more stable set will be the result.

The audio component in the plate of the detector is fed into the audio amplifier through the .1 mf. audio coupling condenser. The grid of the audio amplifier is returned to the "B" negative through the one-half megohm grid-leak.

This set requires 4 volts for the heater supply and is run off three dry cells. This gives 4.5 volts for the two tubes or 2.25 volts for each. This, while higher than recommended, seems to have no ill effects on the life of the tube. If the reader wishes to be more exact it is recommended that he use a 6 ohm variable rheostat in order that proper voltage may be obtained.



Right—We have the diagrams, both schematic and physical, of the "Economy-2," using type 15 tubes.

Placement of Controls

Looking at the front of the receiver we find that the main tuning dial is in the center of the panel and the antenna trimmer is located on the left-hand side. On the right-hand side is the *regeneration-control* potentiometer. In the rear view the tube nearest the coil is the detector tube. The coupling choke is located between the two tubes. If one wishes to operate the heaters of the tubes with A.C. it can be easily done as the tubes are designed to work on either current. However make sure that the voltage is correct! For the plate supply, "B" batteries are used although the set could be well operated with a good "B" eliminator. The batteries afford absolutely quiet operation and they are recommended. Three 45 volt units furnish the 135 volts and should last a very long time as the plate current drain of the set is very low, around 4 or 5 milliamperes.

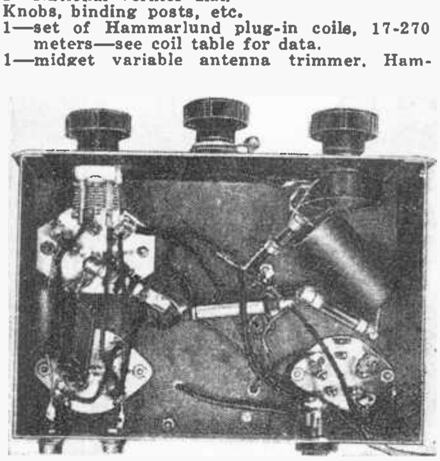
When using small receivers a *good* antenna system should be used in order to obtain proper performance. The antenna should be at least 75 feet long and mounted as high in the air as possible and well out in the clear, away from surrounding objects. In the October issue there appeared a very complete article on antennas and it is recommended that some of the practical important hints there set forth be put into practice.

Operation

Tuning and operation of this two tube set is very simple and even the most inexperienced "Fan" should have no difficulty. Set the regeneration control so that the detector is oscillating—tune in a station—then "back-off" the regeneration control until the whistle disappears and the voice comes in clearly. For receiving code, of course, the detector will remain in oscillation at all times. Use a *good ground* connection on the set and when making connections do not use too much solder but make sure that every connection is firmly made. The values of all the parts are given together with a table showing the correct sizes of the plug-in coils; follow the diagram carefully and you will have a nifty little set.

Parts List for "Economy 2"

1—140 mmf. tuning condenser, Hammarlund.
1—100 mmf. mica condenser, Aerovox.
2—.0005 mf. mica condenser, Aerovox.
1—.001 mf. mica condenser, Aerovox.
2—1 mf. by-pass condenser, Aerovox.
1—.1 mf. by-pass condenser, Aerovox.
1—2 meg. half watt grid leak.
1—½ meg. half watt grid-leak.
1—50,000 ohm potentiometer, Electrad.
1—R.F. choke 2.5 mh. (approx.) Hammarlund.
1—National Impedaformer (type, S-101).
1—4-prong Isolantite socket, Hammarlund.
1—5 prong Isolantite socket, Hammarlund.
1—5 prong wafer socket, Na-Ald.
1—National vernier dial.
Knobs, binding posts, etc.
1—set of Hammarlund plug-in coils, 17-270 meters—see coil table for data.
1—midget variable antenna trimmer, Hammarlund, 25 mmf. (air dielectric) type APC.
2—type 15 tubes, Sylvania.
3—45 volt "B" batteries, Burgess.
3—No. 6 dry cells, Burgess.



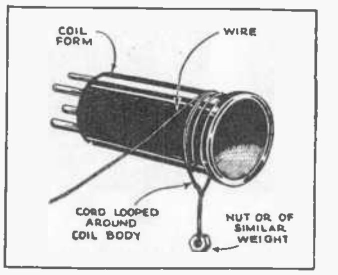
Bottom View of Receiver.

Coil Data "Economy 2"

GRID COIL			TICKLER		
Band	Turns	Wire No.	Length of Winding	Turns	Wire No.
17-41	9	14 tinned	1¼ in.	4	28 DSC
33-75	18	18 tinned	1½ in.	6	28 DSC
66-150	38	22 tinned	1⅜ in.	11	28 DSC
135-270	80	28 enameled	1⅞ in.	16	28 DSC

SPACE WOUND COILS

Here is a simple method for correctly spacing the winding on coils. All that is needed is a small weight such as a bolt and a short piece of cord or wire, the size of the cord or wire determining the spacing. Make a loop of the cord and slip over coil form. Start winding wire which is fastened at one end to hold taut and the cord will follow along and space each one the same. When the end is reached simply lift loop of cord off and a professional looking job will be the result.—Harold Bergquist.



ECONOMY - 3 - A "High Gain" Battery Set

By GEORGE W. SHUART, W2AMN

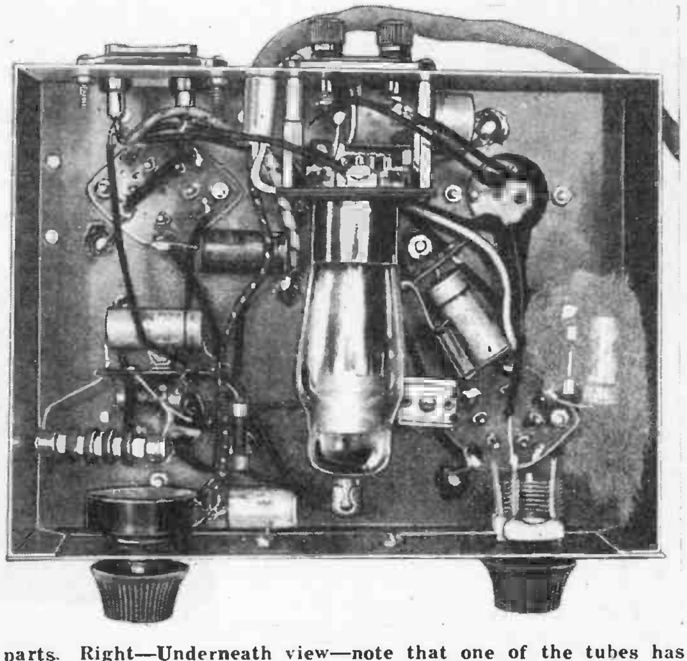
Here's a front view of the "Economy 3" in actual operation. Note its extremely neat appearance.

● MANY of our readers have by this time built the "Economy 2" because it offered something distinctly better in the line of "battery-operated" short-wave receivers. The fine results obtained with the two tube set induced the writer to build this three tube tuned radio frequency receiver using the same type of tubes. As we have said before the type 15 tube offers a real opportunity to the "battery" set constructor.

Advantages of Battery Sets

Battery-operated short wave receivers, if they can be built efficiently, offer something that can not be obtained with an A.C. operated set. First the battery set is by far the most *quiet* receiver that can be built. There is no hum whatsoever, and there is no noise such as is sometimes introduced in an A.C. set, through the power lines. Then again, the voltage supply in a battery set in absolutely constant, provided good batteries are used, and this is just about impossible to obtain in an A.C. operated outfit. The above features alone should convince the most critical fan. However there are advantages in an A.C. operated set, and far be it from this author's intention to condemn them. This battery set is offered for those who want an efficient battery-operated receiver.

The advantages of this set rest entirely in the type of tube used. It is a *screen-grid pentode* tube having an *indirectly heated cathode* and its characteristics make it particularly well suited to short-wave reception. The "Economy 3," so named because it is really economical to run and offers high efficiency, has a stage of tuned R.F., a regenerative detector and one stage of audio amplification. The set is intended for earphone operation and will not operate a loud speaker. The volume on the phones is so great that some of the stations actually hurt the ears! Even those "hard to get" stations can be brought in with full earphone volume. The R.F. stage uses five prong coils of the two-winding variety; one winding is for antenna coupling and the other for the grid coil. These are the new Na-Ald band-spread coils and permit the "crowded" bands to be spread over a goodly portion of the dial, making tuning very simple. The R.F. stage is equipped with a small condenser, having 50 mmf. capacity, for trimming the circuit and keeping it in alignment with the detector stage. This is necessary because the two circuits of the detector and the R.F. stages are "ganged" in order to have what amounts to *single-dial* tuning. The coils are made in three varieties, namely—short-wave broadcast band-spread, short-wave amateur band-spread, and "general coverage" coils which cover the entire range of from 15 to 200 meters. This makes the set adaptable to "Fan" or "Ham" requirements.



Left—Rear view of the "Economy 3" showing the placement of parts. Right—Underneath view—note that one of the tubes has been mounted under the chassis in order to simplify wiring and make the receiver more compact.

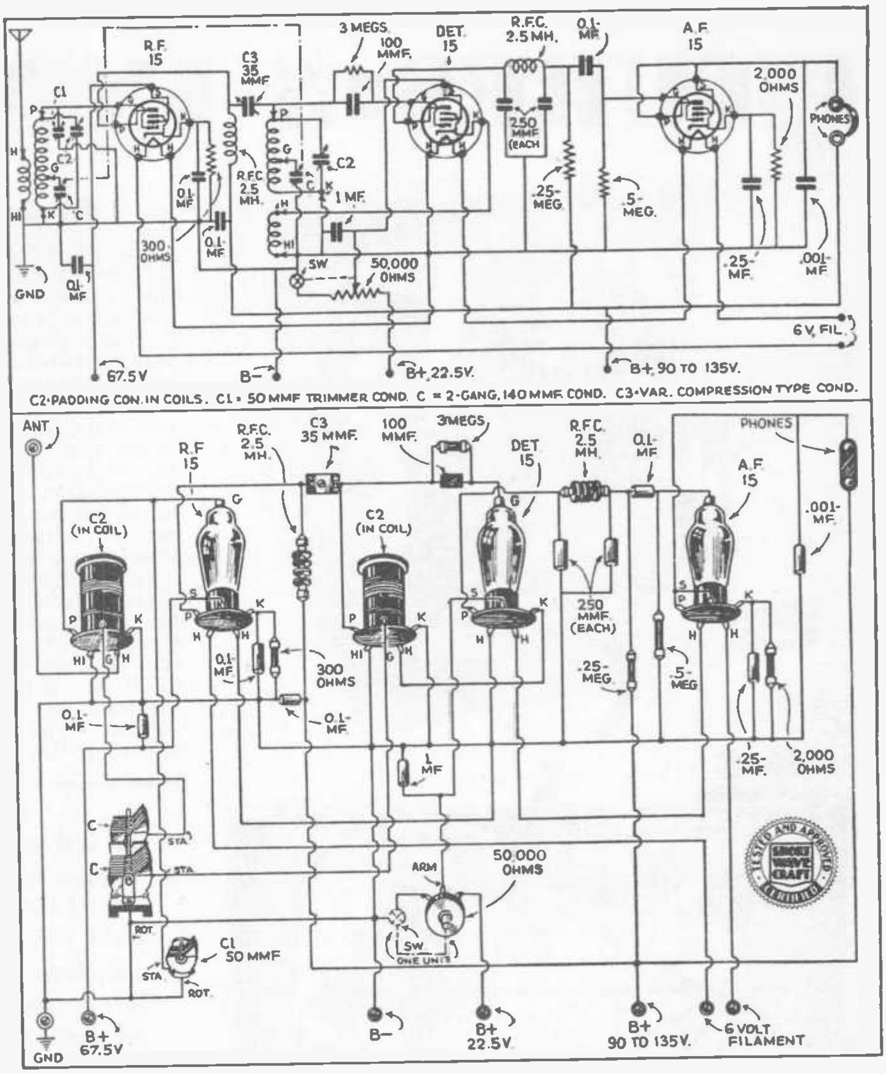
Battery Drain Low

As in the two tube set described last month, this set has the filaments of the tubes connected in *series* to allow economical use of batteries. When connected in this manner the filament power required is 6 volts at .22 ampere. This is provided by four dry cells connected in series and they will give months of service. The plate power for the set is provided by two or three 45-volt standard "B" batteries. Three batteries giving 135 volts will give slightly increased sensitivity. However the 90 volts give very fine results. The total plate current required is very low, which spells long battery service.

Coupling between the R.F. and detector stages is capacitive. While inductive coupling may have its advantages, the above method serves excellently and was used in order that the band-spread feature could be easily incorporated. With six-prong three-winding coils, inductive coupling is possible but these coils, as yet, are not made in band-spread form; it would require a seven-prong coil form and this type of coil is difficult to construct. The parallel condenser method of band-spread could have been used with the six-prong coils, but this would have necessitated the use of two more controls, adding greatly to the complexity of the receiver. The detector is a grid-leak condenser affair with the tickler connected in the cathode circuit. This produces a very smooth and stable operating circuit. Regeneration in the detector is controlled by a 50,000 ohm potentiometer connected in the screen-grid lead. By varying the screen-grid voltage in this manner, there is a minimum effect of *detuning* the grid circuit. A 1 mf. bypass condenser connected across the potentiometer, together with a well-constructed control, eliminates all noise from this source. The audio stage of this receiver is exactly the same as that of the two tube set. The screen-grid of the 15 audio amplifier is connected directly to the plate and gives us a high-mu triode. The pentode connection of the 15 tube will not match the earphones and the triode connection becomes a necessity.

Layout Hints

The entire receiver only measures 8¼" wide, 6¼" deep, and 7¼" high. This is really a "compact" set and we believe you will agree that with its crackle-finished panel and cabinet it is extremely neat in appearance. Looking at the rear view of the chassis we find that the R.F. stage is on the right, with the coil in front of the tube. The detector is on the left, with the coil located behind the tube. This arrangement brings the tuning condenser between the two stages, with all leads very short. Where is the audio tube? Look at the other photograph showing the bottom view, and we find that it is under the chassis! Crazy? Not at all! This position is just right: it allows shorter leads to the tube, easier wiring, and allows the set to be built on a much smaller chassis without crowding the parts. The position of the tube is not critical in the indirectly heated cathode type tube, so there is no danger of a sagging filament. The detector and R.F. coils are mounted with their sockets above the base of the chassis, in order to reduce losses, caused by the windings being close to the chassis.



Physical and schematic wiring diagrams of the "Economy 3" battery-operated receiver.

Parts List for the "Economy 3"

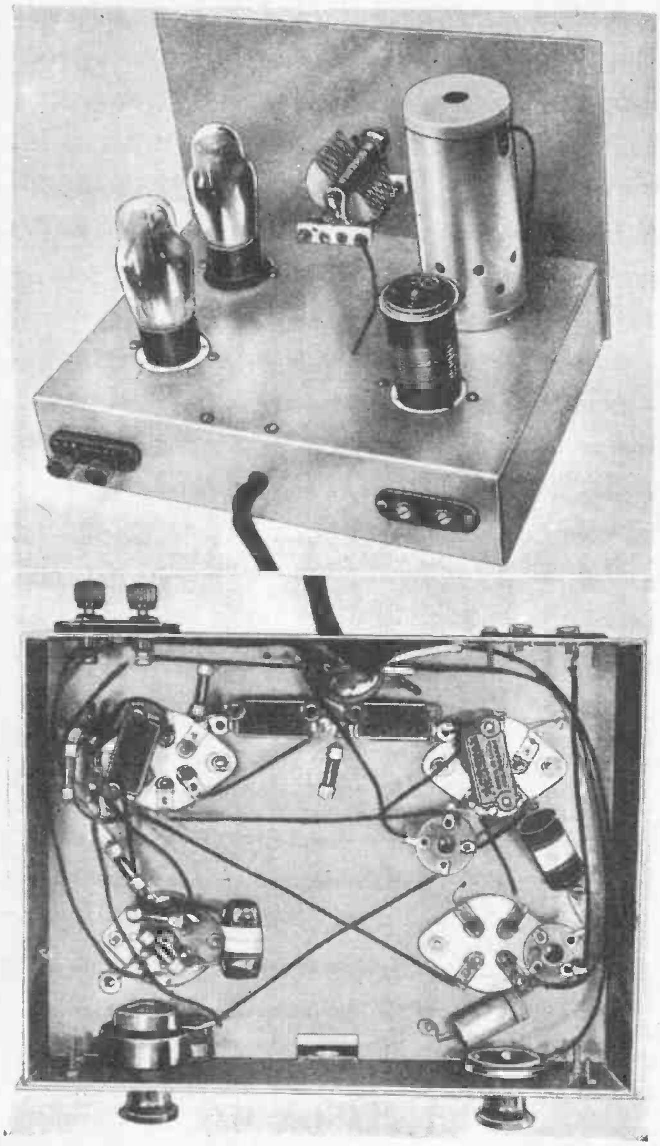
1—2 gang, 140 mmf. condenser (C2); Hammarlund.
1—50 mmf. midget "air tuned padding" condenser; Hammarlund.
5—.01 mf. by-pass condensers. Aerovox.
1—35 mmf. midget padding condenser (C3), compression type; Hammarlund.
1—.0001 mf. mica condenser, Aerovox.
2—.00025 mf. mica condensers, Aerovox.
1—.25 mf. by-pass condenser, Aerovox.
1—.25 mf., by-pass condenser, Aerovox.
1—300 ohm, half-watt resistor, Aerovox.
1—3 meg. half-watt resistor, Aerovox.
1—¼ meg. half-watt resistor, Aerovox.
1—½ meg. half-watt resistor, Aerovox.
1—2000 ohm, half-watt resistor, Aerovox.
1—50,000 ohm potentiometer, Electrad (with switch).
2—sets 15-200 meter plug-in coils, "band-spread" or "full coverage" (see text), Na-Ald. (Bud; I.C.A.).
1—2.5 mf. R.F. choke, Hammarlund.
5—5 prong wafer sockets, Na-Ald.
1—phone terminal strip, Na-Ald.
1—antenna ground terminal strip, Na-Ald.
1—6 wire battery cable. Na-Ald.
1—piece of 1/16 inch aluminum, 4½"x4½" for shield, Blan.
2—tube shields.
1—drilled cabinet and chassis, see text (sprayed black crackled enamel), Supertone.
1—2½ inch airplane type dial.
3—Knobs.
3—Sylvania type 15 R.F. pentodes.
3—45 volt B-batteries, Burgess.
4—No. 6 dry cells, Burgess.
1—pair phones, 2,000 or 5,000 ohms (5000 ohms most sensitive). Trimm.

● The "Economy 3" offers the short-wave fan a really efficient battery operated set, having very high sensitivity and none of the disadvantages present in former battery-operated receivers using filament type tubes. The tubes used in this receiver, while designed to operate in conjunction with batteries, have an indirectly-heated cathode, therefore eliminating the usual microphonic tube effects and providing a receiver comparable to one using the A.C. tubes. This receiver is operated entirely from batteries. Four No. 6 dry cells for the "A" supply and as low as 90 volts for the plate supply. This receiver brought in all the "foreign" stations with tremendous earphone volume.

3 TUBES=5 IN THIS SET

By George W. Shuart, W2AMN

● Did you ever crave a real smooth-working regenerative receiver using 3 tubes, which would tune in the stations like a good super-het? In this brand new receiver recently developed by Mr. Shuart, smooth and absolutely positive control of the regeneration is assured by utilizing one of the triode elements of a 19 tube for the regeneration alone; the other triode of the first 19 being used as a detector. A second 19 tube provides two stages of resistance-coupled audio, while a 34 acts as an R.F. tube.



You will find it a very simple matter indeed to build up this extraordinary 3-tube receiver, rear and bottom views of which are shown above. By employing Na-Ald or other "band-spread" coils the stations can be "spread over the dial" very nicely.

● MANY of our readers have asked for battery-operated receivers using the 2-volt type tubes. Many of these "Boys" are located in the rural districts where there is no main power source or where the lighting service is of the 32-volt type. Of course even the fellows in the cities have requested the battery sets because of the minimum amount of noise present in this type of receiver. There is no doubt of this when one considers the fact that most of the receivers used in the trans-Atlantic telephone are battery-operated. This is because of the extremely quiet operation afforded by a battery type receiver.

If care is taken in the design of battery-operated sets, it is possible to obtain results very closely approaching the sensitivity of an A.C. operated rig. In the receiver presented in this article the sensitivity is extremely high and operation is as good as any A.C. set. The set uses one type 34 tube as a stage of untuned r.f., a 19 as a detector and *separate regeneration* tube and, finally, a 19 as two stages of resistance-coupled audio.

Separate Tube Element Used for Regeneration

The use of the 19 in the special detector circuit is a very worth-while improvement over the usual arrangement. In this circuit the detector tube functions only as a triode rectifier and the amount of regeneration necessary to produce oscillation is taken care of in the other section of the 19.

This is unquestionably the most efficient way in which to obtain feed-back. Heretofore it has not been very popular, because it has been necessary to utilize an extra tube. However the use of the 19 twin-triode nicely overcomes this disadvantage. The stability obtained is really marvelous and the smoothness of control makes one wonder if this is really a regenerative receiver. You can set the regeneration control at any point in either the short-wave broadcast or amateur bands and the whole band can be covered without the slightest need of readjustment; it tunes like a superhet!

In adjustment of the regeneration control it differs slightly from the single-tube autodyne detector, in that the point of maximum sensitivity is not on the very threshold of oscillation, where much distortion exists. In fact maximum sensitivity is present quite a ways from the oscillation point, and remains such up to the point where the tube oscillates, providing a rather broad regeneration control. The regeneration control has very little if any effect on the tuning. Needless to say, the quality of a signal received on a detector of this type is far superior to the regular detector.

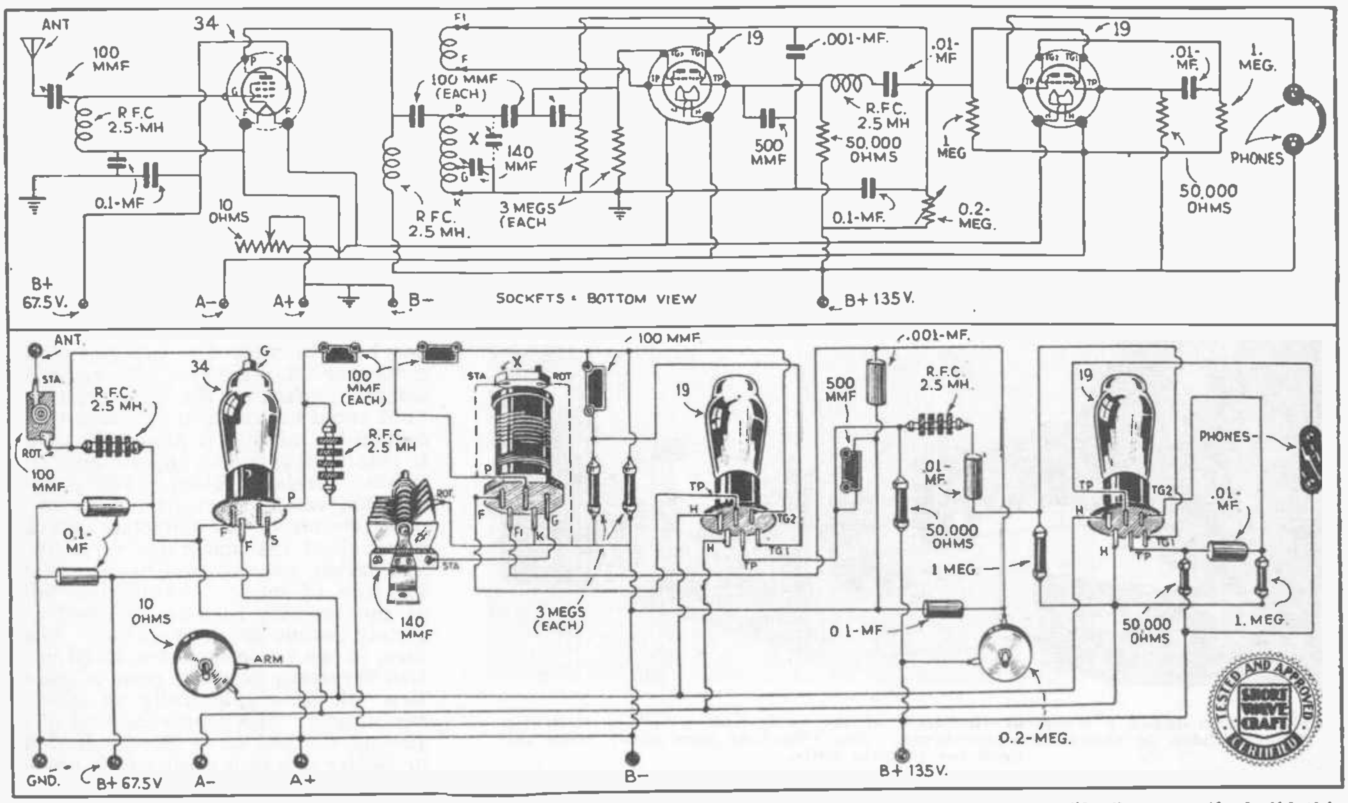
Untuned R.F. Stage

The untuned r.f. stage was used solely for the purpose of eliminating the effects of the antenna upon the grid circuit of the detector. There is not the slightest trace of dead-spots in this set. It is a stable and as smooth as a broadcast receiver!

The second 19 tube was used to obtain good quality rather than volume. A type 33 could have been used, but the quality would not have been near as good as the two stages of resistance-coupled audio afforded by the 19. Then again two stages of resistance-coupled audio will give very fine volume with practically no tube noises, where as the use of the 33 pentode would have resulted in more set noises.

Controls Are Simple

Looking at the front of the set we find the tuning dial in the center of the panel and the regeneration control knob in the lower left-hand side. The right-hand knob is the filament control rheostat. The 34 r.f. tube is the one shielded and directly in front of the plug-in coil. The 19 detector and regeneration control tube is located to the rear right of the base, and the one nearest to the panel represents the two stages of audio. The front panel is seven by ten inches and the base is eight by seven and two inches deep. This provides plenty of space for the parts and there is no undue crowding. A five-prong socket is



Wiring diagrams, both schematic and physical, are reproduced above so that even the inexperienced "fan" can easily build this 3-tube receiver which really gives 5-tube results.

used for the plug-in coils and provides a very versatile arrangement. For the short-wave broadcast bands the new Na-Ald broadcast band-spread coils are used with a very nice band-spread tuning effect. For the Amateur bands, the amateur band-spread coils are used and the "ham" bands are spread over nearly the whole dial. If one wishes to cover the entire short-wave range of from 15 to 200 meters, the five-prong general coverage coils are used. All these arrangements are possible without the slightest change in the wiring of the set. For the battery supply of this set many combinations can be used.

It is suggested that "B" batteries be used for the plate supply. Either the portable or regular type should last a long time, because the total drain on the B's is but 15 milliamperes with 135 volts on the tubes. The set will operate very nicely with 90 volts but the increase in volume is well worth the 135 volt potential. The filaments require 2 volts at .58 ampere. While a pair of No. 6 dry cells will give excellent service it is recommended that some of the other types be used for economical operation. A 2-volt storage battery should give years of service.

The designer of the "3-tube equals 5" Battery Receiver, which features the use of a separate regeneration triode, is here shown giving the set its final test. "O.K." says W2AMN.

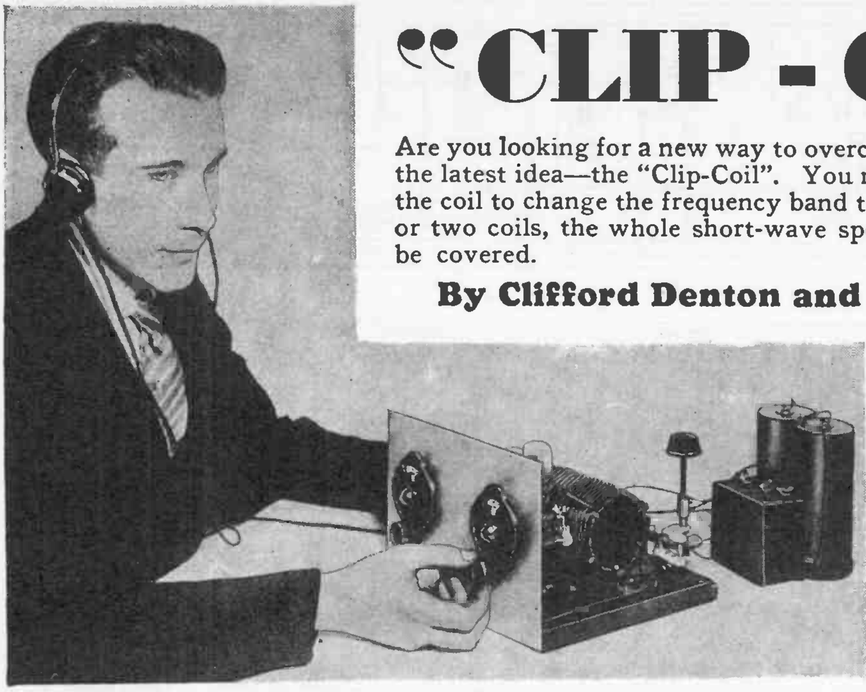
Alden Plug-in Coil Data

Meters Wave-length	Grid coil turns	Tickler turns	Distance between 2 coils
200-80	52 T. No. 28 En. Wound 32 T. per inch.	19 T. No. 30 En. Close wound (CW)	1/8"
80-40	23 T. No. 28 En. Wound 16 T. per inch.	11 T. No. 30 En. C. W.	1/8"
40-20	11 T. No. 28 En. 3-32" between turns	9 T. No. 30 En. C. W.	1/8"
20-10	5 T. No. 28 En. 3-16" between turns	7 T. No. 30 En. C. W.	1/8"

Coilform—2 1/8" long by 1 1/4" dia. 4-pin base.

Parts List for Separate Reg. Set

1—metal chassis and panel, see text, Blan.
1—set of 5 prong plug-in coils, Na-Ald.
3—2.5 mh. R.F. chokes, National.
3—.1 mf. by-pass condensers, Aerovox.
2—.01 mf. by-pass condensers, Aerovox.
1—.001 mf. mica condenser, Aerovox.
1—.0005 mf. mica condenser, Aerovox.
3—.0001 mf. mica condensers, Aerovox.
1—140 or 150 mmf. tuning condenser, National.
2—3 meg. resistors, Ohmite (Aerovox).
2—1 meg. resistors, Ohmite (Aerovox).
2—50,000 ohm resistors, Ohmite (Aerovox).
1—200,000 ohm variable resistor, Electrad, (potentiometer can be used.)
—10 ohm rheostat, Ohmite.
1—4 prong Isolantite socket, National.
1—5 prong Isolantite socket, National.
1—6 prong Isolantite socket, National.
1—6 prong Bakelite wafer socket, Na-Ald.
1—antenna ground terminal strip, Na-Ald.
1—phone terminal strip, Na-Ald.
1—6 wire battery cable.
1—type 34 tube, RCA Radiotron.
2—type 19 tubes, RCA Radiotron.
1—dial (Vernier), National.
1—34 tube shield, National.



"CLIP-COIL 2"

Are you looking for a new way to overcome the "plug-in coil" problem? Here's the latest idea—the "Clip-Coil". You merely move a pair of spring clips along the coil to change the frequency band to which the set will respond. With one or two coils, the whole short-wave spectrum between 15 and 200 meters can be covered.

By Clifford Denton and G. W. Shuart, W2AMN

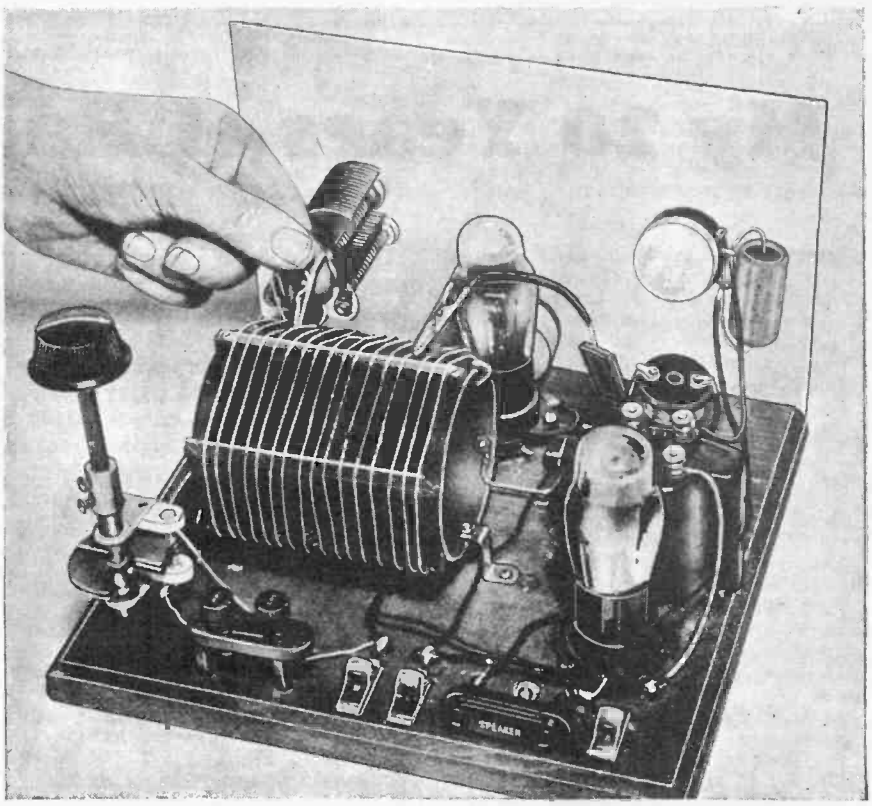
Mr. Shuart takes a whirl at the dials of the "Clip-Coil Two"—a radically different idea in short-wave receivers. The Clip-Coil does away with the need for plug-in coils.

• SHORT-WAVE fans are always on the alert for the latest news regarding some method which will eliminate the *plug-in coil*. The "Clip-Coil" here introduced, represents a radical departure from the usual plug-in coil and all that is necessary to change the bands is to move the two spring clips along the coil. One might ask quite naturally—"Why bother with the clip, when switches could be used just as well?" Tests by engineers, however, have frequently shown that the light contact form of switches commonly used on short-wave receivers, frequently do not make *perfect contact* between the blade and the switch points, whereas there is slight, if any chance of a good spring clip failing to make a perfect contact when it is properly clamped on the wire.

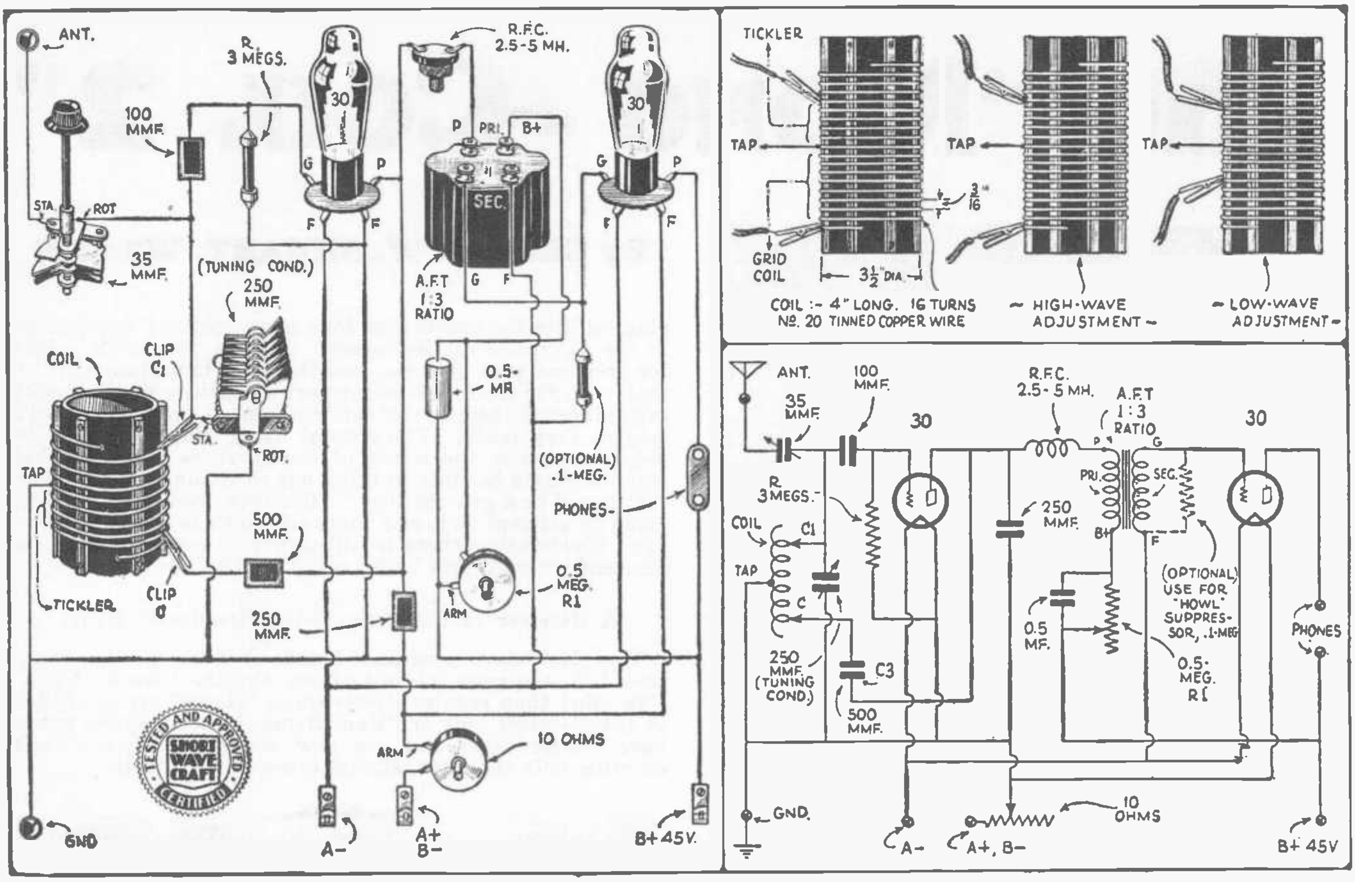
"The proof of the pudding lies in the eating thereof"—runs an old saw—and, "results" galore were obtained both by the authors and the editors, in numerous tests made in different locations with the "Clip-Coil Two". The first crack out of the box—the German transmitter at Zeesen bounced in, with comfortable sharpness of tuning. Part of the nice operating features of this set are undoubtedly bound up in the "Clip-Coil" itself, due to its optimum shape and size.

Changing wave-bands in short-wave receivers has always been a "bugaboo". Many switching arrangements, of course, do away with plug-in coils and these have been described from time to time. The *Clip-Coil* set shown in the photographs and described in this article is one of the most efficient methods of changing wave bands with a minimum of complications. The grid and tickler coil are both part of one winding. This is accomplished by center-tapping the coil and using one-half for feed-back or regeneration, and the other half for tuning the grid circuit. This coil is designed to take in all of the short-wave broadcast bands from 19 meters up to approximately 80 meters. It is possible to tune to 200 meters by adding a few more turns to the coil. Four or five turns would do nicely and could take in the popular "police" and 160 meter amateur bands.

Common methods of controlling the regeneration were tried out, using this "clip-coil" arrangement, but the one shown is the only method which proved absolutely foolproof. The usual method has been to vary the capacity of the condenser C3. However, this has a considerable effect on the tuning and stations could be tuned in or out with this condenser, making it almost impossible to obtain an optimum adjustment on the weaker foreign station. The one-half megohm variable resistor used in the plate circuit of the detector tube provides about the smoothest form of regeneration control we have had the pleasure of using. A complete swing of the variable resistor does not completely detune any one station. Therefore, it can be seen that a small variation necessary near the point of oscillation will have practically no effect on the tuning. The proper method of adjusting the coil is to set the feed-back or *tickler clip* at a point which provides ample regeneration with the proper setting of the resistor, R1, which is the variable plate resistor or regeneration control. In other words some tubes may be more sensitive detectors with high plate voltage, while others may require very low plate voltage. This may be taken care of by adjusting the amount of feed-back with the clip and then controlling regeneration with the variable plate rheostat. In constructing the coil,



The operator is shown in the act of adjusting one of the clips on the new Clip-Coil featured in the receiving set here described. The degree of regeneration is adjusted by changing one of the clips, while the wavelength to which the grid circuit can be tuned is changed by adjusting the second clip.



The circuit used with the new Clip-Coils is extremely simple. The top inset drawing shows relative clip positions along the coil for "high" and "low" wave adjustments.

Cut six strips of 3-16" bakelite, ¼" wide and 4" long. Place these at equal points around the 3½ inch diameter bakelite tube, which should also be 4 inches in length, then proceed to wind 16 turns of No. 20 tinned copper wire over the whole form of the tube. This will leave approximately 3/16 inch spacing between turns. Make sure the winding is tight and in order to secure it, drop small amounts of household cement at the point where the wires cross the ribs of the form. Enameled wire could be used with the insulation removed at points where the clip is attached. However, the bare copper would oxidize and in time would cause considerable trouble unless it was frequently cleaned.

In order to get a complete frequency coverage it is necessary to use a .00025 mf. grid condenser. While this capacity may seem very high no appreciable loss in sensitivity is apparent. The high amount of capacity is only present on the lower frequencies. In all cases, it is advisable to use as many turns as possible on the coil with a minimum of tuning capacity. This will result in less critical tuning. The entire set is mounted on a 9 inch by 10 inch baseboard with a 7 inch by 10 inch front panel. Looking at the front the regeneration control is on the left and the tuning condenser is on the right,

If the wiring diagram and constructional hints are followed carefully, the builder should experience no difficulty in getting wonderful results with this receiver. The audio stage is conventional and thoroughly illustrated by the diagram. As for results with the "Clip-Coil Two", we can heartily recommend it to the "beginner" and "old-timer".

No change in coil construction will be necessary if tubes are changed.

Tuning this receiver is a very simple matter and the most inexperienced beginner should have absolutely no difficulty in pulling in the *speech* and *music* from the foreign stations. As a starter we suggest attaching the grid clip to the first turn of the grid coil and the tickler clip to the third or fourth turn on the tickler coil. The tuning range will now be from approximately 50 to 80 meters. This will take in the airplane beacons, weather reports, etc., together with the 75 meter amateur *phone* section. For short-wave "phone" *broadcast*, attach the grid clip to the fifth turn from the outside of the grid coil and the tickler clip on the fifth turn of the tickler coil. This will take in the 25 to 49 meter short-wave "phone" broadcast bands and the "foreign" stations can be tuned in on this setting.

When tuning in a station the procedure is to adjust the regeneration control until a slight rushing sound is heard in the phones; this will indicate oscillation of the detector tube. Now, rotate the main tuning condenser until a whistle, which indicates the "carrier" of a station is heard. Retard the regeneration control until the whistle *just* disappears. Then reset the tuning condenser for maximum volume; when tuning to another station it is advisable to readjust the regeneration control so that the detector is oscillating again in order that no stations will be passed. It is much easier to tune in a station when the detector is in an oscillating condition because each station will produce a whistling sound in the phones. The antenna coupling condenser should, of course, be adjusted for maximum volume. As this condenser is adjusted the regeneration control and the main tuning condenser will have to be reset. If the antenna condenser is adjusted properly, there should be no "dead-spots" in the band; that is, spots where it is impossible to obtain oscillation. Perfect tuning can only be attained after considerable experience has been had in operating a set. In all cases, adjustments should be made very *carefully* and *slowly* in order that no stations will be missed. We feel certain that this latest invention, the "Clip-Coil", is due to become very popular and we will be very pleased to hear from our readers as to the *results* they obtain with it.

Parts List "Clip-Coil" Set

- **1 Panel and Baseboard—see text.**
- **1 Special "Clip-Coil" (see drawing for data). Gen-Win.**
- **1 .00025 mf. Variable Condenser. National (Hammarlund).**
- **1 .0001 mf. Mica Condenser. Polymet.**
- **1 .0005 mf. Mica Condenser. Polymet.**
- **1 3 megohm Grid-Leak, ½ watt. Lynch.**
- **1 .5 mf. By-Pass Condenser. Polymet.**
- **1 500,000 ohm potentiometer.**
- **1 3:1 ratio Audio Transformer.**
- **2 4-prong Tube Sockets.**
- **1 Antenna Ground Terminal Strip.**
- **1 Phone Ground Terminal Strip.**
- **1 2.5 mh. R.F. Choke. National (Hammarlund).**
- **2 230 RCA Radiotrons (Arco).**

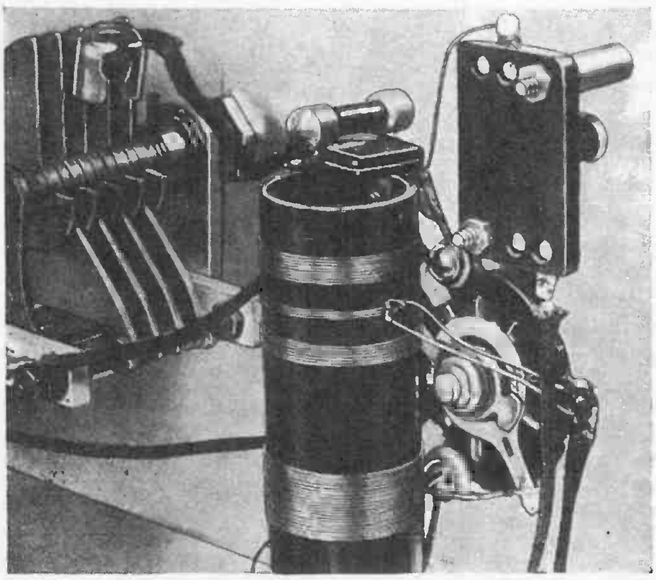
The "Mono-Coil 2"

By GEORGE W. SHUART, W2AMN

No wonder the young lady wears such a pleasant smile—for it is truly a wonderful experience to note the ease with which "foreign" short-wave "speech" and "music" programs come in on this "plugless" 2-tuber.

● THE King is dead—Long live the King. The plug-in coil has long been the Monarch of short-wave radio. While they are not dead by any means they are pretty ill and it's about time someone severed the "royal neck" and lays the "ole boy" gently to rest for ever and two days. It is not good manners to kick a fellow when he is down, but a few blows from the worthy "hammer" will "sorta" help to hasten his downfall.

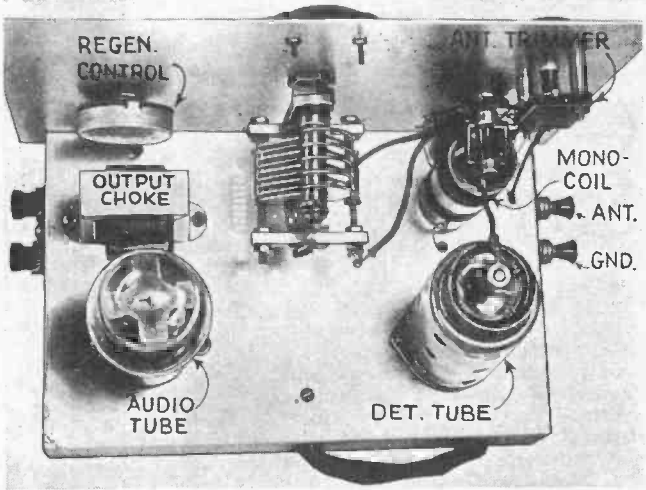
Plug-ins have always been the *sore-spot* in the average short-wave receiver. A careful check-up on the plug-in coil will show that it is not only a nuisance but a very inefficient piece of apparatus. Consider the connections for instance; on the average coil there are four soldered connections to the pins, four friction contacts when the coil is plugged into the socket and four more soldered connections to the terminals of the socket. Quite a few weak points for only one part of a set, and the most important part at that! As for the inconvenient part of it, little need be said; even plugging them in through the *front* of the panel doesn't help so very much. The idea of using plug-in coils is so deeply rooted in the minds of the short-wave public, that manufacturers hesitate to bring out something new for fear that it will be a general "flop." However, some of them have made an attempt at it and "hats off" to them for their courage. Nevertheless there is still plenty of room for improvemen and probably will be for many "moons" to come.



A close-up view of the "Mono-Coil"—the heart of Mr. Shuart's newest receiver. It does away with "plug-in" coils.

A Receiver to Cover the S-W "Broadcast" Bands

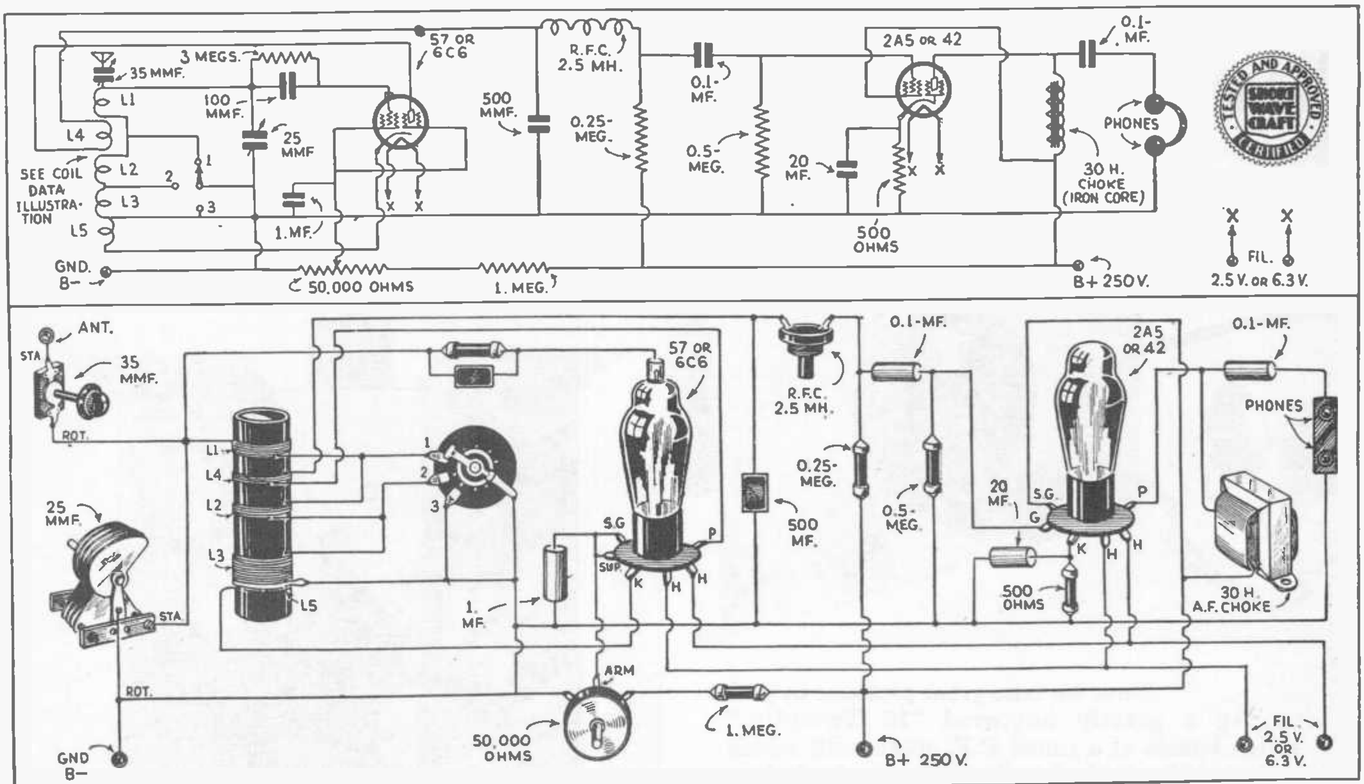
The shcrt-wave programs broadcast from *foreign* countries hold the most interest among the short-wave "Fans." Few other than regular Amateurs or "Hams" are interested in the so-called code or "Ham Bands." Set manufacturers have realized this and are now making "all-wave" sets covering only the international *broadcast* channels.



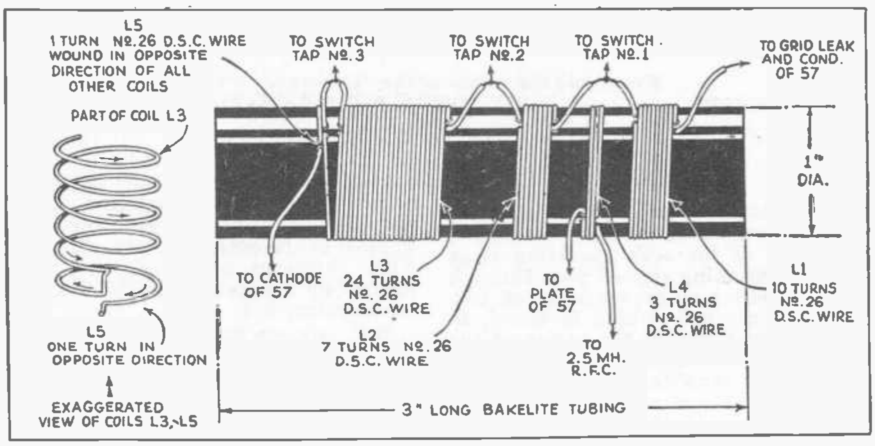
Rear view of the "Mono-Coil 2"—it eliminates "plug-in" coils. In the design here offered, it brings in all of the short-wave "broadcast" bands—including the 19, 31, and 49 meter channels. A "band-spread" tuning effect is also obtained.

A single tickler winding can be made to produce oscillation over a fairly great frequency range, but it will not allow a very high degree of sensitivity or rather, *an equal degree of sensitivity, on both ends of the tuning range of the coil.* A tapped tickler can be used but this necessitates the use of a two-gang switching arrangement.

The final point of attack was to build a coil, having taps, as efficiently as possible with a single moving contactor and worry about *regeneration* later. The coil was wound on a one-inch diameter bakelite tube, three inches in length. The winding consisted of three sections with two taps brought out so that two of the sections could be "shorted" out. With the proper number of turns and the correct spacing between the sections, this coil when tuned with a 25 mmf. (.000025 mf.) variable condenser, had a tuning range of from 16 to 55 meters. It was necessary to use close-wound coils (no spacing between turns), in order to have the fields of the windings as small as possible, to prevent losses due to the close proximity of the *unused windings.* A careful check proved that there was no appreciable loss when the unused coils were "shorted" out. However, when they were not shorted (short-circuited), losses ran very high and at points, it was found later, they prevented the detector from oscillating. So far we have a combination that will cover the



Schematic and picture diagrams which will enable even the "beginner" to build the "MONO-COIL 2" short-wave receiver are given above. This set is particularly designed for the short-wave "FAN," who wishes to listen to the European and other "foreign" and domestic musical and vocal programs broadcast daily.



Details of "Mono-Coil" winding.

International broadcast (program; music, speeches, etc.) bands with only a *three-point* switch. The capacity of the tuning condenser being only 25 mmf. provides an optimum LC ratio, resulting in a "high-gain" tuning circuit, and last but by no means least, the crowded broadcast bands were not jammed into two or three points on the dial—*the spread being from ten to fifteen degrees, depending on the width of the particular band encountered..* Weighing these several assets against the old plug-in proves that we have really accomplished something.

Solving the Regeneration Problem

Regeneration was next tackled and right here the old "cut and try" method proved to be the only successful method of attack. For a properly designed coil the feed-back must be adjusted to produce maximum efficiency and smoothness of control, on the highest frequency that will be used. Therefore the plate feed-back method was used and the tickler coil (L4) was placed between the two windings L1 and L2 to provide efficient feed-back from 16 to 35 meters the bands covered by L1 and L2 and controlled by taps 1 and 2. The tube now refused to oscillate on the lower frequency range of tap 3. This was with three turns in the tickler coil. It was believed that the number of turns could be increased slightly to produce oscillation on the 49 meter band. This was done but due to the tickler being coupled to the *grid-end* of the coil, the larger number of turns effected too much coupling on the high frequency end of the tuning range and in order to control the feed-back the "screen" voltage had to be reduced to a point where the sensitivity was ruined entirely—*three turns was unquestionably the proper number;* some other method had to be used to obtain oscillation on the lower frequencies without affecting the efficiency of the circuit at the higher frequencies.

As is usually the case with us mortals, the simpler things are not thought of first and many complicated arrangements were tried without success. Then came the gleaming light—*the one turn cathode coil,* and it sure "did the trick."

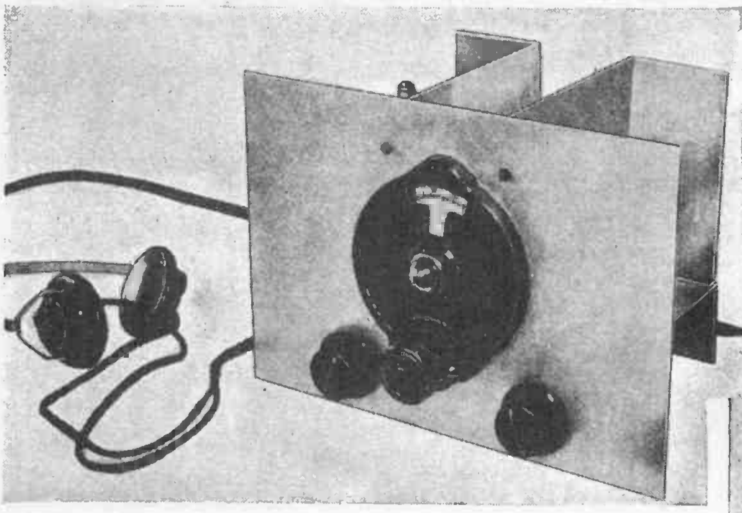
Now let's see just how the whole thing operates. When the switch is set on contact No. 3 the entire grid coil is in use with the three-turn plate tickler and the one-turn cathode coil providing just the proper amount of feed-back when the screen voltage of the tube is set for maximum sensitivity. Set on point No. 2 the switch *shorts* out L3, the cathode coil now becomes more or less inactive, which is just what we want. The plate coil is then left to work with L1 and L2. The range of each tap of the coil is of course affected by the adjustment of the antenna condenser but their approximate tuning range is as follows: tap-1, 16 to 28 meters, tap-2, 25 to 38 meters and tap-3, 45 to 55 meters. The drawing clearly shows the construction of the coil and the number of turns. *For best results follow the specifications exactly.*

The rest of the set is orthodox and needs but little mention. A 2A5 pentode is used as a resistance-coupled amplifier and has an output choke and condenser-filter which keeps the plate current of the tube out of the earphones.

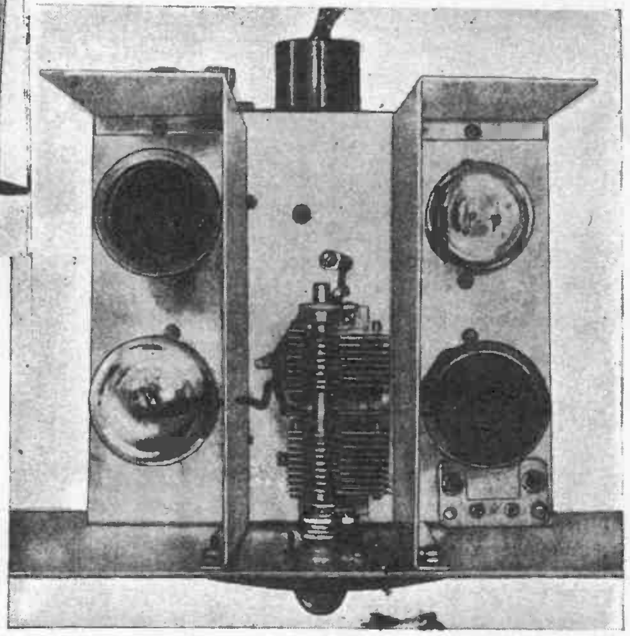
List of Parts for "Mono-Coil-2"

1—Chassis 5"x8"x1". Blan
1—Panel 7"x9". Blan
1—Mono-Coil—see text
1—4 pt. single pole switch. Blan
1—35 mmf. Var. Antenna condenser
1—25 mmf. condenser; tuning 270 degrees. National
1—.0001 mmf. fixed condenser (mica)
1—.1 mf.—1 mf. (paper)
1—.0005 mf. fixed (mica)
2—.1 fixed (paper)
1—20 mf. 25 volts (electrolytic)
1—3 meg. resistor (½ watt). Lynch
1—¼ meg. (½ watt). Lynch
1—½ meg (½ watt). Lynch
1—1 meg. (½ watt). Lynch
1—500 ohms 1 watt
1—50,000 potentiometer Acratest
1—J30 H. midget choke (iron core)
2—6 prong sockets. Na-Ald
1—Antenna ground terminal strip. Na-Ald
1—Phone terminal strip. Na-Ald
1—57 or 6C6 tube. RCA Radiotron. (Arco)
1—2A5 or 42 tube. RCA Radiotron. (Arco)

The "19" Advanced Twinplex



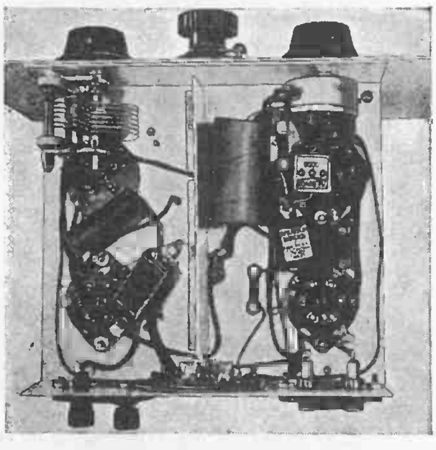
By LEONARD VICTOR and E. KAHLERT



Front and top views of the "Improved 19 Twinplex," which now "sports" a Tuned R.F. Stage.

Now we take great pleasure in presenting a greatly improved "19 Twinplex," which boasts of a tuned R.F. stage with which to boost those elusive "weak" signals, before they are passed into the detector stage. Also, this set makes 2 tubes do the work of 3; it operates on a 2-volt battery or equivalent "A" supply, while the "B" supply may be taken from batteries or a well-filtered "B" eliminator or power-pack.

● THE short-wave receiver here described is an improved version of the *Twinplex* circuit, introduced in the March '34 issue of SHORT WAVE CRAFT. This set utilizes a type 34 tube as a stage of *tuned radio frequency*, followed by a type 19 twin tube, as *detector* and *one-step of audio amplification*. The 34 is a pentode tube designed primarily for r.f. (radio frequency) amplification, and it performs very creditably at the higher frequencies. The 19 was originally designed as a twin Class "B" tube, and is really two triodes in one envelope. However, experimentation has shown it to be both an excellent detector, and a good straight Class "A" audio amplifier. The 19 is the 2-volt battery brother of the 53 A.C. tube.



Bottom view of the "Improved 19 Twinplex" Receiver.

The Circuit

The electrical circuit of the set is highly conventional. Briefly explained, the theory of the set's operation is as follows. Incoming signals pass through coil L-1 and set up currents in coil L-2, the secondary coil, which is tuned, to any frequency within the range of the coil condenser combination, by the .00014 mf. variable condenser. The *ground end* of coil winding L2 is connected to ground through a .006 mf. mica condenser, instead of directly, so that it may be possible to apply bias to the grid of the 34 r.f. pentode tube. The 34 amplifies the signal which has been tuned in by the L-2-C-1 circuit and through the transformer action of the detector coil circuit L-1, L-2 the incoming signal is applied to the detector grid of the 19 tube. Detection is accomplished by means of the grid-condenser grid-leak combination, R1-C4. The detector tuning circuit C1-L2, must be tuned to exactly the same frequency as the r.f. tuned circuit. It is here that the .0001 mf. midget variable padding condenser plays its part. Although both tuned circuits have the same capacity condenser, and identical coils, still there is some difference in the resonance of the two circuits due to internal tube capacities, mechanical considerations, etc. The trimmer, C2, is used to adjust the r.f. circuit into exact alignment with the detector circuit so that maximum amplification may be obtained.

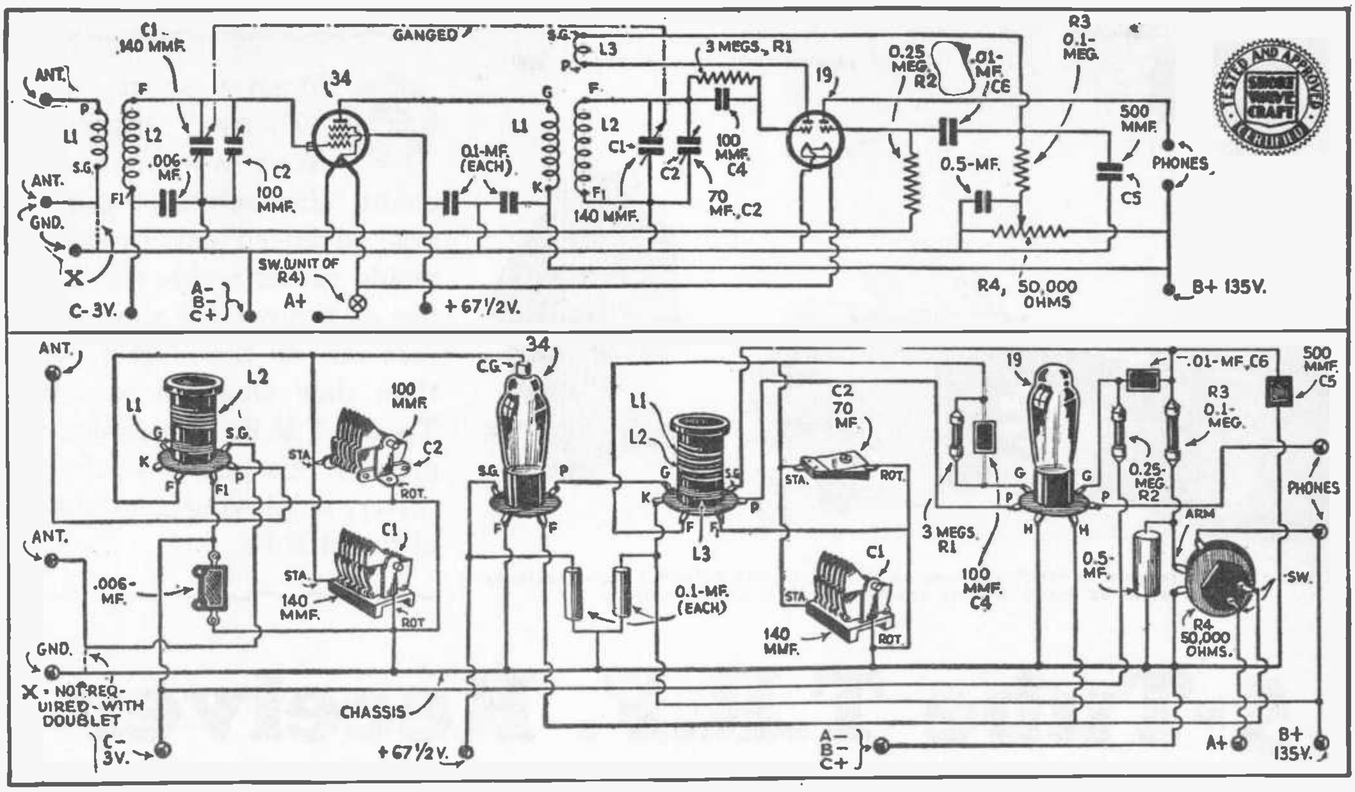
The winding L-3 on the detector plug-in coil is used to feed back a portion of the r.f. current flowing in the plate circuit of the tube, to the grid. This causes regeneration of the signal and allows the tube to oscillate. Oscillation is controlled by varying the voltage applied to the detector plate of the tube. This variation of voltage is accomplished by means of the 50,000 ohm potentiometer, R-4.

R.F. current flowing in the plate circuit is by-passed to ground by the small .0005 mf. fixed condenser, C5. This condenser is too small to bypass audio frequency current, but provides a good path to ground for the r.f.

The pulsating d.c. current (audio current) flowing through resistor R-3, sets up corresponding voltage variations in the grid circuit of the audio amplifier section of the tube. The .01 condenser, C-6, is used to prevent the plate voltage of the detector from being applied to the grid of the amplifier section, and serves as the audio coupling link. Negative bias is applied to the grid of the amplifier tube through the 250,000 ohm resistor R-2. The amplified audio signal in the form of pulsating direct current is passed through the earphones from the plate, and converted into audible sound.

Parts

As with everything else, a person gets as much out of a set as he puts into it. If you were to use cheap variables instead of isolantite insulated types, the difference would be hardly noticeable, yet the sum total of the losses, when cheap condensers, both fixed and variable, poor sockets, and "bootleg" tubes are used, is quickly seen. Hence it pays in the long run to use *good parts*, since they will give you better results, longer



Wiring diagrams, both schematic and physical, are here presented so that even the beginner will experience no difficulty in building this excellent short-wave receiver. This set is designed for headphone operation and works as smooth as silk.

service, and no "headaches" about whether they are functioning properly or not. A manufactured kit of coils was used, although data is furnished for constructing the same, if the builder wishes to "roll his own."

Layout

The set is built on two pieces of aluminum, 7"x10" in size. One piece is used as the panel; the other having two, two-inch, right-angle bends, is used as the sub-panel. On the front panel, from left to right, the controls are: a .0001 mf. trimmer condenser, the two-gang .00014 mf. main tuning condenser (with the vernier dial), and the 50,000 ohm regeneration control. On the top of the sub-panel, in front, are: the 34 r.f. tube, the main tuning condenser, and the detector coil socket. To the rear of the 34 is the r.f. coil socket, and behind the detector coil socket the 19 tube socket is located. On the rear bend of the sub-panel are mounted the twin binding posts (antenna-ground) and the phone-jack assemblies. In the center of the rear bend is mounted the five-prong tube socket for connection to the battery cable. All resistors and by-pass condensers are mounted on the lower side of the sub-panel, directly on the prongs of the sockets, as shown in the accompanying photographs.

Batteries

The filament drain of the two tubes is .32 ampere, and a pair of No. 6 dry cells, connected in series should run this set satisfactorily for at least six months of normal operation. If dry cells are used instead of the two-volt cell of the storage battery, either a regular 10-ohm rheostat, or a 3-ohm fixed resistance should be used in series with the "A" positive lead. Since the total plate current of this set is only seven milliamperes, the smallest size of 45 volt "B" battery can be used, and should last as long as their shelf life, which is about a year. Remember, however, that if cheap or *bootleg* batteries are purchased, they will inevitably become noisy and cause trouble. "C" bias can be provided by two of the smallest size flashlight cells in series, or by a regular "C" battery. Incidentally, this set will work quite nicely on only 90 volts of "B" battery. The screen voltage on the 34 should be kept constant at 67½ volts. Provided that it is well filtered, and has no trace of hum, a "B" power substitute, or eliminator may be used in lieu of the batteries.

Operation

After the set has been wired, and we hope, carefully checked, put the tubes in their sockets and connect the filament supply. Provided the tubes light properly, plug in a low frequency set of coils and connect the "B" and "C" supplies. The trimmer is used to line up the r.f. and detector coils for each band. The set is then operated with the main tuning control and regeneration control, just as any other short-wave receiver.

This little job has brought in quite a "log" of D-X stations, and if the reader realizes that it has all the excellent qualities of the *Twinplex*, plus a stage of high-gain r.f. he will understand that it is really a worth-while set. Remember, good results are just as much up to the builder of the set as to the original instigator of the circuit. Here's all the dope, fellows. Go to it, and, let's hear what you catch in the way of D-X (distance).

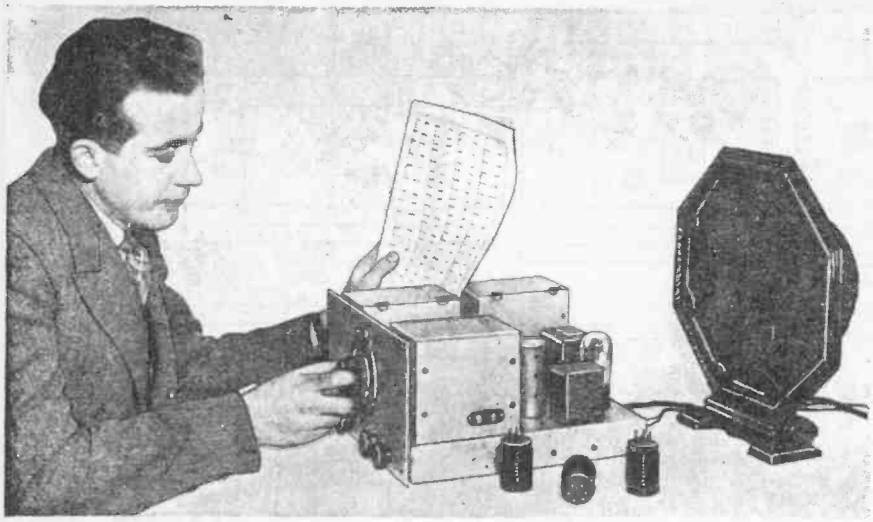
Parts List

2 gang .00014 mf. variable; American Sales.
.0001 mf. variable; American Sales.
3—6-prong sockets; American Sales.
1—4-prong socket; American Sales;
1—5-prong socket; American Sales.
50,000 ohm potentiometer; American Sales.
3—.1 paper condensers; American Sales.
.0001 mf. mica condenser.
.0005 mf. mica condenser.
.01 mf. paper condenser.
3 meg ½ watt resistor.
100,000 ½ watt resistor.
250,000 ½ watt resistor.
19 tube RCA Radiotron (Arco).
36 tube RCA Radiotron (Arco).
Chassis—Blan the Radio Man (Korrol).
1 set 3 winding coils; Na-Ald.
1 set 2 winding coils; Na-Ald.

TABLE NA-ALD "3"-WINDING COIL DATA
6 pin base for use with .00014 mf. (140 mmf.) tuning condenser

Band W.L.	Primary*	Secondary	Tickler	Dis. bet. Tick. & Sec.
10-20 meters	4T. No. 32 S.S.C. Interwound with sec. turns (tickler end).	5T. No. 26 S.S.C. wound 3/16" pitch bet. turns.	5T. No. 32 S.S.C.	3/32"
20-40	8T. No. 32 S.S.C. Interwound with sec. turns.	11T. No. 26 S.S.C. wound 3/32" pitch bet. turns.	7T. No. 32 S.S.C.	3/16"
40-80	15T. No. 32 S.S.C. Interwound with sec. turns.	23T. No. 26 S.S.C. wound 5/64" pitch bet. turns.	8T. No. 30 S.S.C.	3/32"
80-200	31T. No. 32 S.S.C. Interwound with sec. turns.	50T. No. 30 S.S.C. wound 1/32" pitch bet. turns.	16T. No. 30 S.S.C.	5/32"

*Tickler coil wound at bottom or pin end of 1¼" dia. form.
Prim. Turns interwound at lower end of Sec. (nearest tickler).
This winding not used on "antenna" coil.



It's a pleasure to tune in "DX" stations on this high-gain 5-tube T.R.F. receiver, the result of many months experimentation by the author.

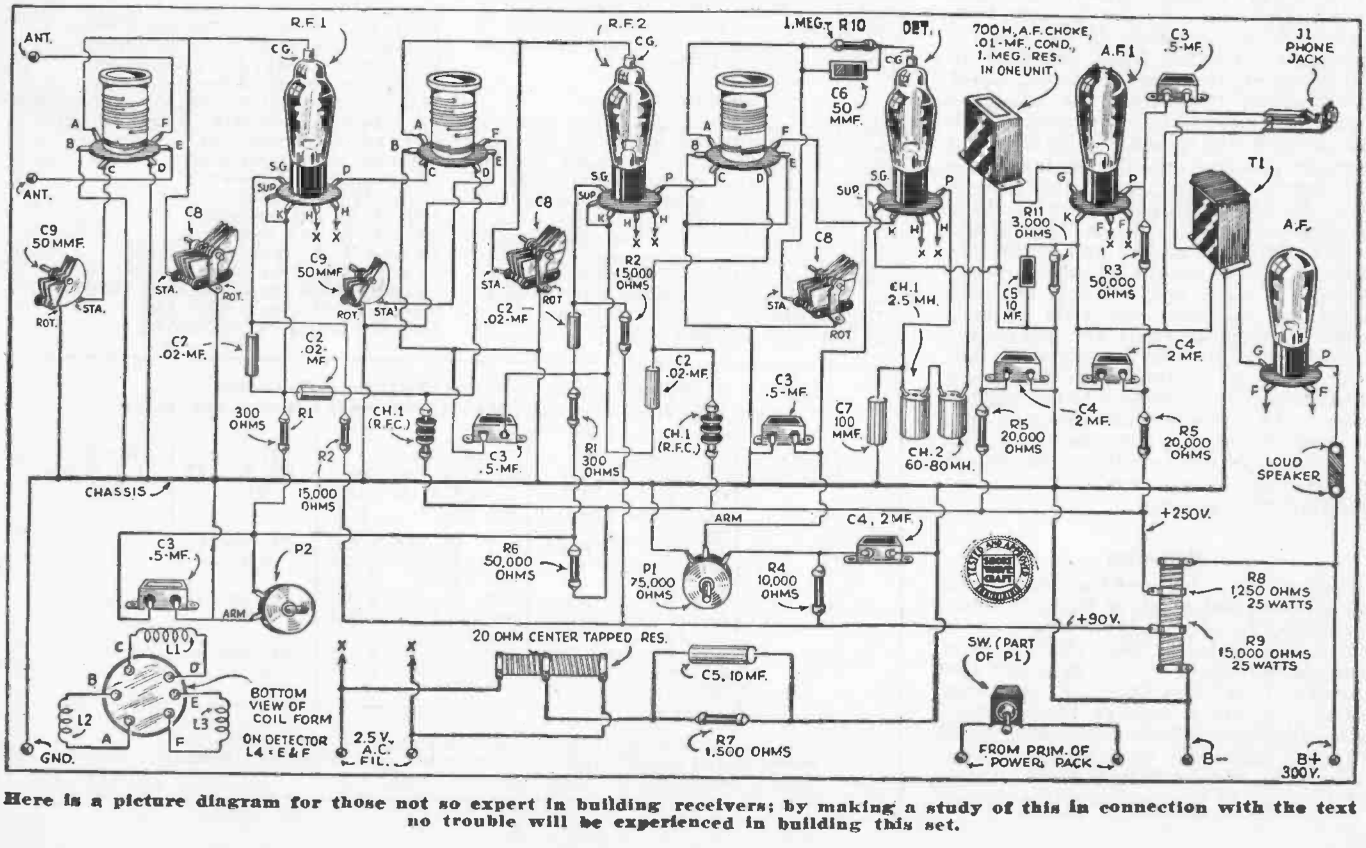
Many short-wave "Fans," especially those who neither count themselves beginners nor advanced experimenters, would rather tackle the building of a powerful short-wave receiver of the T.R.F. type than they would a superhet. To the T.R.F. enthusiasts we present this tested 5-tube receiver, employing two stages of tuned R.F.

5-Tube T.R.F. Receiver

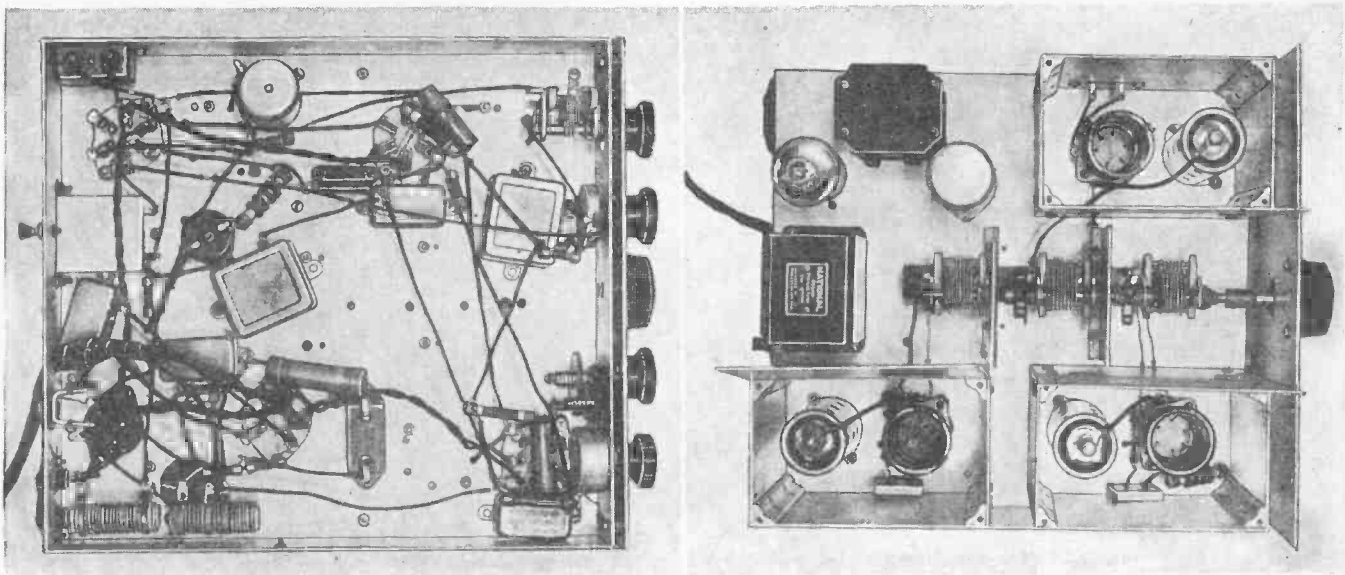
M. Harvey Gernsback

● THE RECEIVER described here is the outcome of a search for one which would combine the good features of a superheterodyne and the conventional regenerative receiver with one stage of R.F. (radio frequency) amplification.

The "superhet" is undoubtedly very sensitive and very selective; however, unless the design is very carefully worked out the noise level is apt to be high. In addition there is the bother of second channel pick-up unless the set incorporates a pre-selector stage of T.R.F. (tuned radio frequency), which also serves to complicate tuning and construction. The regenerative set, when correctly designed, has a very favorable signal-to-noise ratio. In addition it is simple to build and economical as well. Its greatest draw-back is lack of selectivity. This is a very serious factor on the congested short-wave broadcast and amateur bands. With two tuned R.F. stages preceding the detector much better selectivity can be obtained, providing a gain control for the R.F. stages is used. At the same time the noise-level will be low, except when the gain control is advanced toward maximum. It is seldom necessary to advance the control beyond half-way, so that the noise-level encountered in actual operation is very low.



Here is a picture diagram for those not so expert in building receivers; by making a study of this in connection with the text no trouble will be experienced in building this set.



Photos, above, show top and bottom view of the 5-tube T.R.F. receiver here described by Mr. Gernsback. Many short-wave enthusiasts prefer the T.R.F. receiver ahead of the superhet.

Set Uses 2 Tuned R.F. Stages

This receiver includes two tuned stages of R.F. utilizing the *high-gain* variable-mu R.F. pentodes, together with a control for varying the available gain. The detector is also an R.F. pentode, using an electron-coupled regenerative circuit which insures smooth regeneration and very good sensitivity.

T.R.F. Stage Details

Turning to details of the R.F. stages the coils are wound on low-loss plug-in forms and use isolantite sockets to further reduce losses. The midget tuning condensers have isolantite insulation and are constructed to give a more uniform spread of stations over the dial. The coil sockets are raised about three-quarters of an inch above the chassis to minimize losses. It should be noted that although the 3 tuning condensers are ganged, both rotor and stator plates are electrically insulated from each other. The rotors are ganged by means of insulated flexible couplings.

(The editor appends a table below giving coil data for use with a 90 mmf. tuning condenser. You can also use a 100 mmf. condenser without causing any great change in the wavelength response.)

Coil data (National Co.) for use with .00009 mf. (90 mmf.) tuning condenser connected across grid coil.

P.	S.	T.	Wave Length Range in Meters.
38 T. No. 32	63 T. No. 28	5 T. No. 32	200-115 m
22 T. No. 34	35 T. No. 24	4 T. No. 32	115- 65 m
13 T. No. 34	20 T. No. 18	4 T. No. 32	70- 40 m
8 T. No. 34	12 T. No. 18	3 T. No. 32	41- 23 m
4 T. No. 34	6½ T. No. 16	3 T. No. 32	24- 14.5 m
2 T. No. 34	3 T. No. 16	3 T. No. 32	15- 9 m

Dia. form 1½", 6 pin.

T= tickler; S= secondary or grid coil; P= primary or antenna coil.

Parts List

RESISTORS

2 300 ohms, 1 watt, R1. Lynch.
2 15,000 ohms, ½ watt, R2. Lynch.
2 50,000 ohms, ½ watt, R3. Lynch.
1 10,000 ohms, ½ watt, R4. Lynch.
2 20,000 ohms, ½ watt, R5. Lynch.
1 50,000 ohms, 2 watts, R6. Lynch.
1 1,500 ohms, 3 watts, R7. Lynch.
1 1,250 ohms, wire-wound, 25 watts, R8.
1 15,000 ohms, wire-wound, with slider, 25 watts, R9.
1 1. megohm, grid leak, ½ watt, R10. Lynch.
1 30,000 ohms, 1 watt, R11. Lynch.
1 75,000 ohms pot. with A.C. switch, P1. Acratest (I.C.A.).
1 10,000 ohms pot., tapered, P2. Acratest (I.C.A.).

CONDENSERS (Fixed)

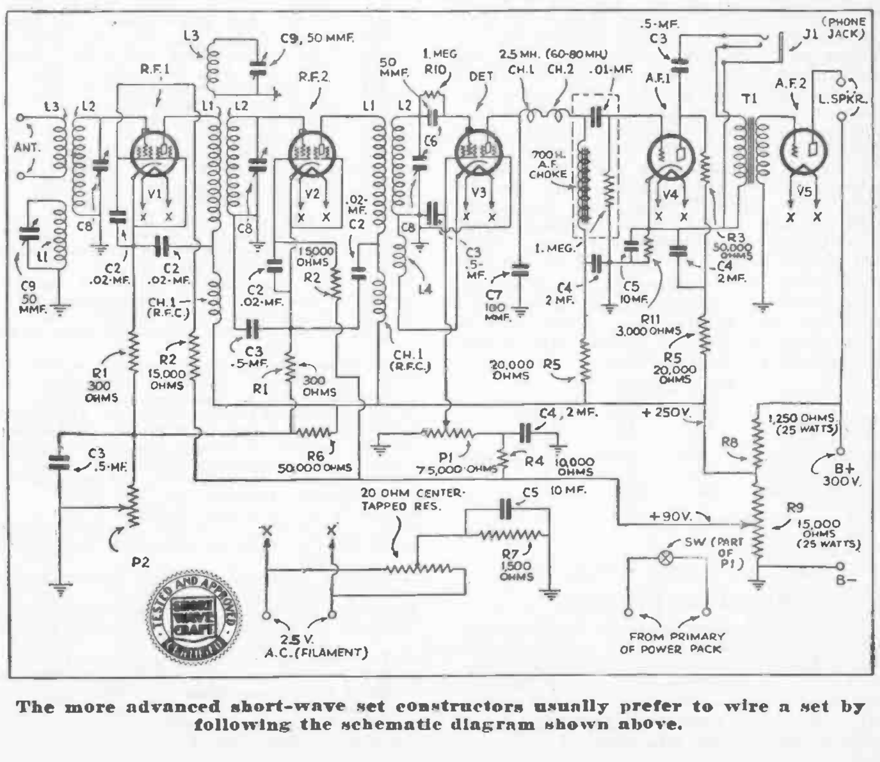
4 .02 mf., 400 v., non-inductive, C2. Polymet.
5 .5 mf., 100 v., non-inductive, C3. Polymet.
2 2. mf., 400 v., non-inductive, C4. Polymet.
2 10 mf., 50 v., electrolytic, C5. Polymet.
1 .00005 mf., mica, C6. Polymet.
1 .0001 mf., mica, C7. Polymet.

MISCELLANEOUS

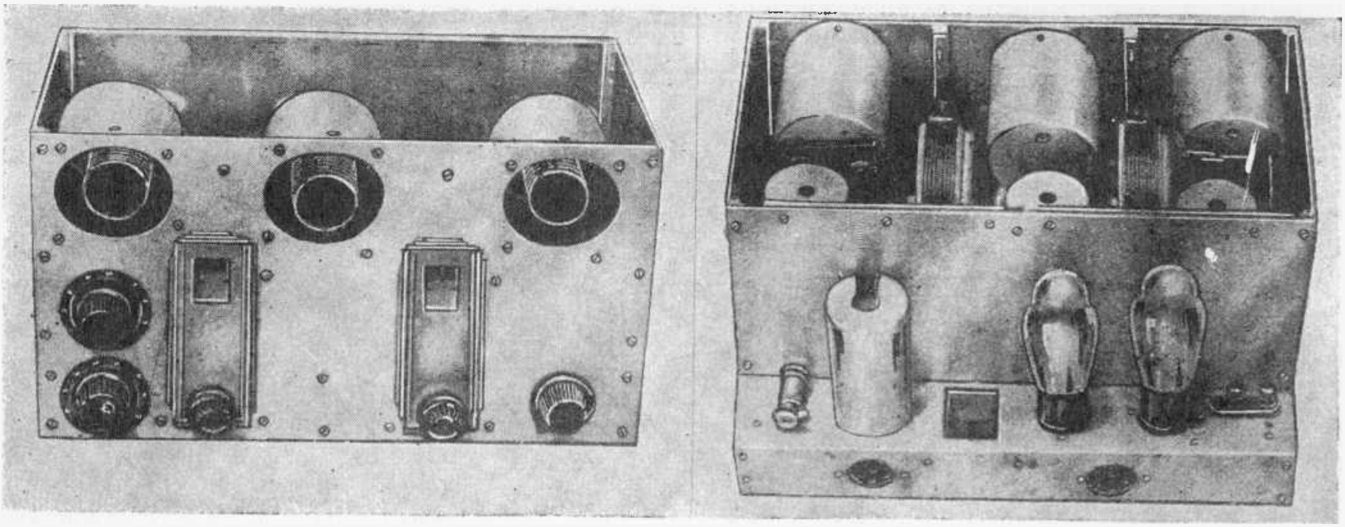
1 Dial, type VND (National).
3 R.F. chokes, 2.5 millihenries, Ch. 1. National (I.C.A., Hammarlund).
1 R.F. choke, 60-80 millihenries, low-loss, Ch. 2. Hammarlund (I.C.A.)
1 3/1 ratio audio transformer, T1.
1 Double circuit jack, J1.
3 6-prong isolantite tube sockets. National.
3 6-prong isolantite special coil sockets. National.
1 5-prong tube socket. Na-Ald (I.C.A.).
1 4-prong tube socket. Na-Ald (I.C.A.).
3 100 mmf. tuning cond., C8. Hammarlund Midline midgets.
2 50 mmf. tuning cond. C9. Hammarlund midgets.
3 National coil sets. (See article for specifications.)
1 S-101 impedance coupler. National.
1 4-wire cable.
2 tip jacks.

TUBES

2 58's, V1, V2. R.C.A. (Arco.)
1 57, V3. R.C.A. (Arco.).
1 56, V4. R.C.A. (Arco.).
1 45, V5. R.C.A. (Arco.).
1 aluminum chassis, 11½ inches x 12⅞ inches x 1¾ inches.
Set of aluminum cans (see drawings). (Chassis and all aluminum parts obtained from Blan.)



The more advanced short-wave set constructors usually prefer to wire a set by following the schematic diagram shown above.



Front and rear-top views of the specially designed 110 volt D.C. short-wave receiver.

The TRAVELER'S D.C.6

By ADOLPH HEISE

Coil Data

A table with coil data is given, but any other type of good short-wave coils can be used. All coils are wound on National R-39 coil forms. The primaries and secondaries of the coils covering 19.5 to 38 meters, and 38 to 80 meters, are closely interwound. This type of winding results in somewhat improved selectivity over the space wound type if used over the same wave bands. The coils covering 12 to 21 meters are space-wound 5 turns to the inch. Excellent results over long distances were obtained with coils covering the broadcast band. This ship leaves distances of up to 2,000 miles to the nearest American B.C. (broadcast) station, so the wavelength was chosen as to include mainly the powerful stations of 5 to 50 k.w., which are found between 250 to 480 meters. Of course, anybody interested in any additional wavelengths can wind his coils accordingly. The secondary of the "B.C." coils, beginning at the top of the form with the grid end, are bank-wound in three layers with No. 32 D.S.C. wire for 125 turns, then continuing with a space of ¼" from the bank layer, thirty turns are wound single-layer. Over this closely wound cathode end of the secondary are wound three layers of empire cloth, to give the proper spacing between the secondary and the primary, which consists of 30 turns of No. 32 D.S.C. wire wound closely over the empire cloth.

COIL TABLE

Wavelength	Pri. L1	Sec. L2	Tickler L3	
12- 21 meters	4**	5*	3	} No. 36E
20- 40 meters	5**	9***	4	} No. 36E
38- 80 meters	9**	17***	5	} No. 36E
250-480 meters	30	155	55	

* No. 16E (Enamel).
** No. 22 D.S.C.
*** No. 18E.
"B.C." Coil—All No. 32 D.S.C.

Marvellous Reception

The list of stations received with this set, and with *tremendous speaker* volume, is too long to be repeated. World major SW stations come in like "locals"! In a position just off the coast of Florida, the SW phone station on the "*Jacob Ruppert*" of the Byrd antarctic expedition, was received with volume to spare—the "*Jacob Ruppert's*" position being near "Little America" at the south pole, a distance close to 10,000 miles!

List of Parts

1—C .00005 mf.—Antenna Condenser. Mica.
3—C1 .00009 mf.—Main Tuning Condenser. National S.E. 90.
1—C2 .000035 mf.—Compensator Condenser. National.
1—C3 .1 mf.—GRD. Blocking Condenser. 500 volts.
1—C4 .01 mf.—A.F. Coupling Condenser. 600 volts.
5—C5 .1 mf.—By-pass Tubular NON-Inductive.
1—C6 .5 mf.—By-pass Detector S.G.-Inductive.
1—C7 .00025 mf.—Det. Plate Regen.—Mica.
1—C8 10 mf.—A.F. Bias—Tubular—50 volts.
1—C9 8 mf.—Line Filter, 500 volts. Trutest.
1—C10 4 mf.—Line Filter, 500 volts.—Trutest.
1—C11 .0001 mf.—Det. Grid Cond.—Mica.
1—R1 350 ohms—Bias Minimum—1 watt.
1—R2 25,000 ohms—Bias Rheostat.
1—R3 50,000 ohms—Bleeder—1 watt.
2—D4 7,000 ohms—R.F. S.G.—1 watt.
1—R5 75,000 ohms—Det. S.G.—1 watt.
1—R6 50,000 ohms—Det. S.G. Regen.
1—R7 5 Megs—Det. Grid Leak—½ watt.
1—R8 .5 Megs—Det. Plate—1 watt.
1—R9 1 Meg—A.F. Leak—1 watt.
1—R10 2,000 ohms—1 A.F. Bias—1 watt.
1—R11 180 ohms—Bias Power Tubes—25 watts.
1—R12 8 ohms—Pilot Bulb R—25 watts.
1—R13 240 ohms—Heater Shunt—25 watts.
2—CH 8 mh.—R.F. Plates—Hammarlund.
1—CH1 90 mh.—Det. Plate—National 90.
1—CH2 30 henry—Line Filter—180 ohms, 60 ma. Trutest.
3—39 Tubes—R.C.A. Radiotron (Sylvania).
1—37 Tube—R.C.A. Radiotron (Sylvania).
2—48 Tubes—R.C.A. Radiotron (Sylvania).
2—Coil Sockets—4 prongs—National (Isolantite).
1—Coil Socket—6 prongs—National (Isolantite).
3—Tube Sockets—5 prongs—National(Isolantite).
1—Tube Socket—5 prongs—Na-Ald (Bakelite).
2—Tube Sockets—6 prongs—Na-Ald (Bakelite).
8—Coil Forms—4 prongs—National R-39.
4—Coil Forms—6 prongs—National R-39.
1—Socket and Plug—4 prongs—Speaker—Na-Ald.
1—Socket and Plug—5 prongs—B Supply—Na-Ald.
1—Speaker, Dynamic—75 ohms field—with PP 48 Output Transformer.
1—Tr-3: 1 PP Input Transformer—Thordarson.
2—Drum Dials—270 degrees—Vernier—National Type H.
3—Tube Shields—2¼" by 5" high—National.
3—Coil Shield Cans—3" by 3¼" high—National.
4—Shaft Couplings—Brass (or National).
1—Cable—5 strands—Power Supply—5 ft.
1—Cable—3 strands—Speaker—5 ft.
1—Cable—Fixture D.C.—6 ft.
1—Plug—Fixture D.C.
1—ANT. and GRD. Posts.
Resistors—Ohmite.
Bypass Condensers—Cornell-Dubilier.

Adjusting Detector Stage

The 39 R.F. pentode tube makes an excellent grid-leak detector and oscillator. Regeneration control by means of the S.G. rheostat (R) of 50,000 ohms is very smooth down to 12 meters. To avoid long leads between this resistor and the detector tube elements, the resistor was placed close to the detector socket and fastened to the chassis by a bakelite support. The rheostat is operated from the front panel by a hard-rubber or bakelite rod, which is connected to the metal shaft of the resistor by a brass coupling. The main points to remember when adjusting the detector stage for the most efficient point of sensitivity and oscillation are: To get the detector tube oscillating smoothly over the range of the particular wave band with the *least plate voltage*, the *least number of turns* in the tickler winding, and the *least voltage* at the detector screen grid. Not more than 3 to 5 tickler turns, 15 volts on the plate and 20 volts on the S.G. of the detector are needed to obtain the best operating conditions for that stage.

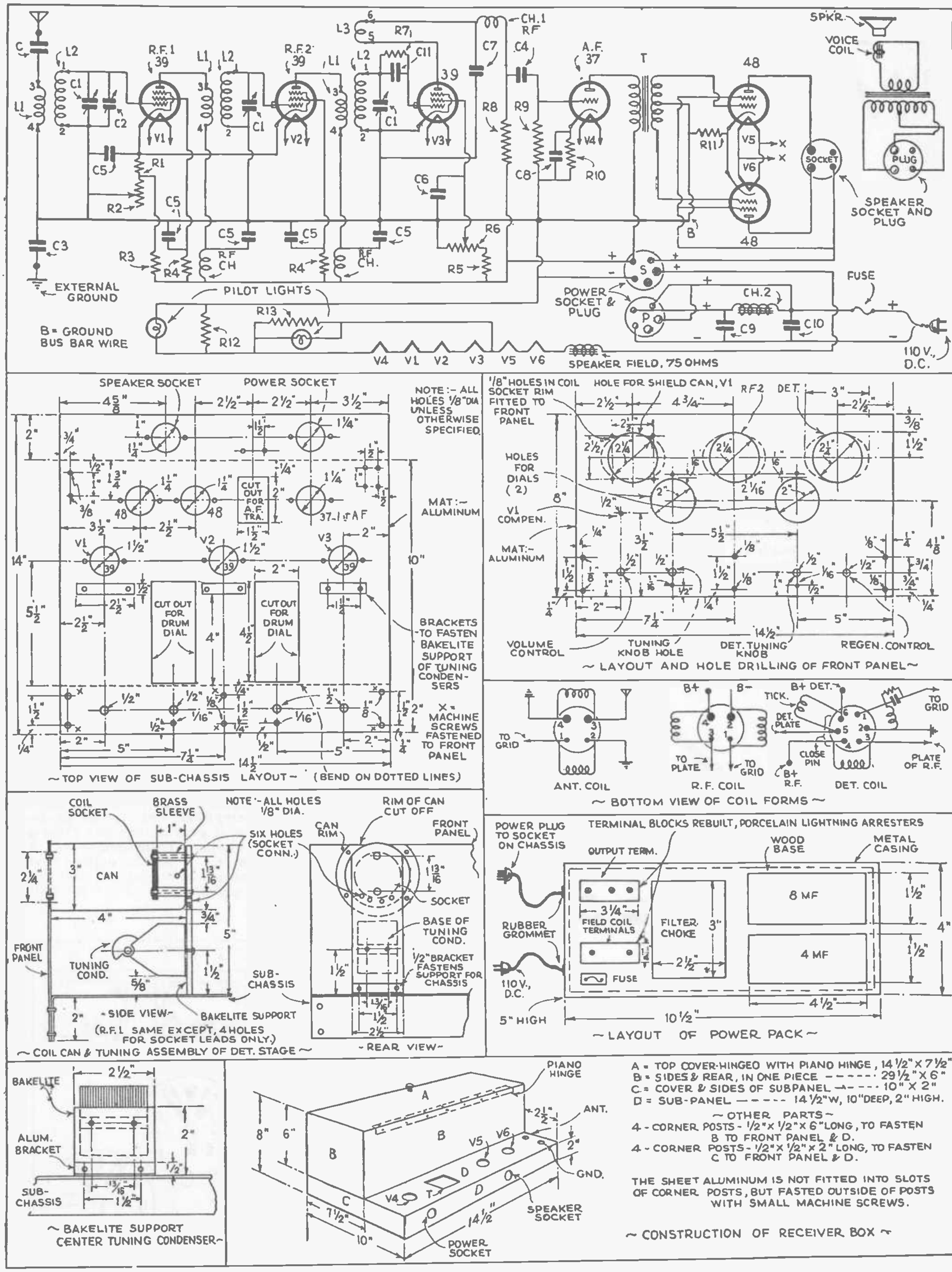
The remainder of the R.F. and Detector stages is self-explanatory and no difficulties should be encountered if the diagram is followed carefully. The writer tried a high grade S.G. plate-coupling impedance in the plate of the detector in place of the .5 meg. resistor, as well as a type 36 S.G. tube in place of the 39, but the final arrangement shown gave far better results.

A.F. Booster Stage

There follows the A.F. booster stage with its 37 automotive type tube, resistance-coupled to the detector stage. The 37 works into the push-pull 48 power output stage through the PP (push-pull) input transformer (Tr). These two 48 output tubes give 100 mills (M.A.), 3 watts in the output, with a tremendous volume, and only 95 volts on their plates.

The large heater surfaces of the 48 tubes generate quite an amount of heat; for this reason one should place the receiver in a location where there is sufficient cool air circulation.

Circuit and Mechanical Details of the D. C. 6

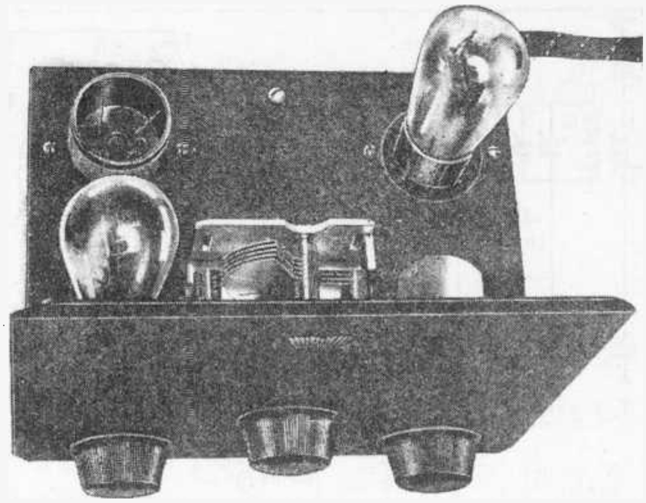


Circuit diagram and other details for building the "Traveler's D.C. 6"—It's a 6 tube 110 volt D.C. short-wave receiver; easily adaptable to battery operation.

17-In-1 "MULTI-KIT" SET

By W. Green*

Once in a blue moon some radio genius has a really new idea—here is the very latest. By adding a few small parts to a foundation kit, any one of 17 different type receivers can be built up, including battery, A.C., and A.C.-D.C. models.



Above—extremely neat and workmanlike appearance of the 2-tube battery model receiver, built up from a "multi-kit" foundation unit.

● HERE is a new idea in radio set construction—an idea which is sure to appeal to every short-wave experimenter and listener. How would you like to make a set which is so simple in construction that anyone, even though they don't know the first thing about radio, can make it, and what's more make it work well enough to bring in those elusive *foreign* shortwave broadcasters? And then when you finish with the set and want to try something better—one which will give louder signals or more distance—you find that all the parts of the original set, including the chassis, can be used for the new receiver.

17 Sets from 1 Basic Unit

In fact, you can choose from 17 different circuits, some of which are *world famous*, and ranging from the simplest 1-tube battery-operated model to an A.C.-D.C. set using two or three of the composite or "twin tubes" and supplying the results of a 3- or 4-tube receiver. Each of these 17 sets uses the same parts which you employed in the original, simple 1-tube set—with a few inexpensive additions, of course.

Think of the amount of fun you can have trying each of the 17 different sets and deciding which one is the best all-round model for your needs and location. In fact, the 17 circuits which have been devised around the original chassis and fundamental parts mentioned above, does not mean that this is the greatest number of circuits that you can use—these parts can be adapted to a great number of circuits—in fact almost any small set can be built with the parts.

What the "Multi-Kit" Consists Of

To explain in somewhat greater detail just what makes up the "multi-kit," as the chassis and fundamental parts mentioned above have been called, the pictures on this page should be examined. This multi-kit contains the drilled, crystalline-finished metal chassis and panel, a variable condenser, dial, antenna compensating condenser, regeneration control, four coils, coil socket, grid resistor, three by-pass condensers, speaker jack, two knobs and all the necessary screws, wire, etc., needed.

With these parts, plus a few inexpensive additions, you can construct the set shown in Fig. 1 and further illustrated in the photo of the complete model on this page.

This is a battery-operated short-wave set, consisting of a regenerative detector and a stage of audio frequency amplification, using two type 30 economical dry cell tubes.

Or if you prefer, the A.C. receiver shown in Fig. 2 can be made, using two type 56 tubes—and a somewhat different set of additional parts. The multi-kit is used in its entirety, of course. This set is also a regenerative detector and audio amplifier, but instead of using batteries it gets its current from a step-down filament transformer and a "B" eliminator. It will be noticed that the set contains a voltage divider, so that the simplest kind of a "B" unit will suffice.

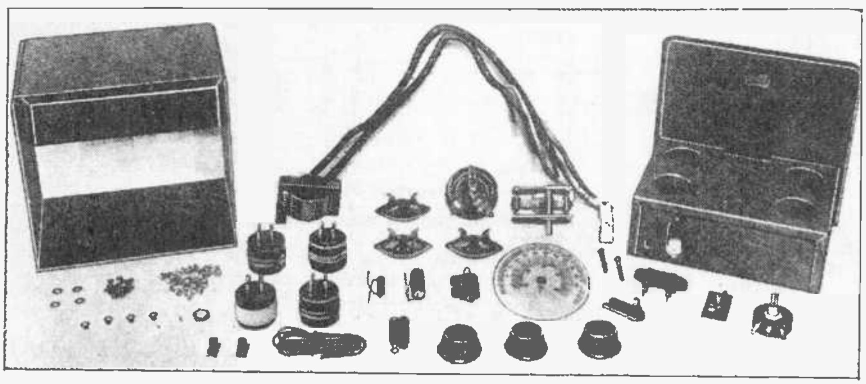
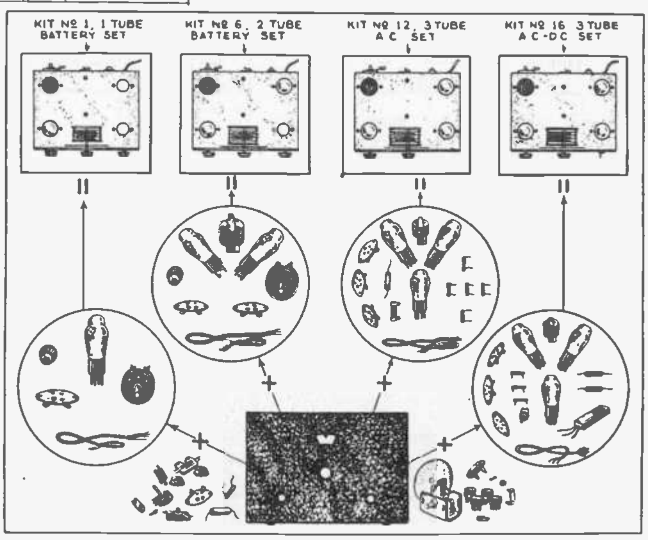


Photo above shows all of the parts included in a "Multi-Kit" foundation set, plus the few extra parts required for building up the complete 2-tube receiver shown in the picture at the head of this page. No. 284.



The illustration at right shows some of the possibilities of the "Multi-Kit". Extra parts available for building up to 17 different types of receivers, only 5 being indicated in this drawing.

*Chief Design Engineer, Harrison Radio Co.

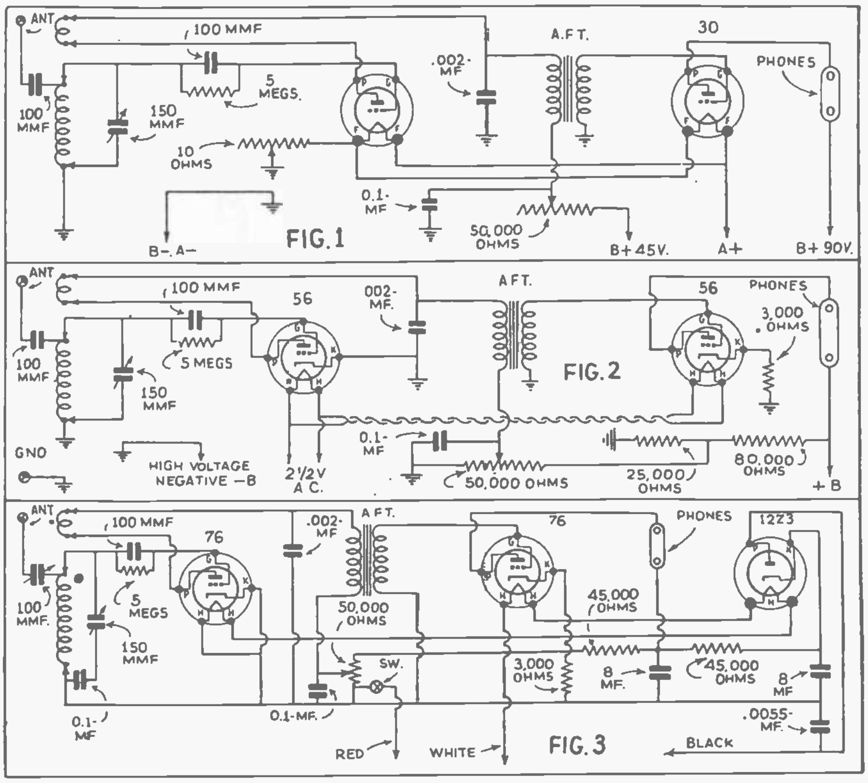
And to give a third example of the interesting sets that can be made up from the multi-kit, the one shown in Fig. 3 is presented. This is an A.C.-D.C. model—entirely self-powered and operating directly from any electric light socket. This set uses two type 76 tubes and a 12Z3 rectifier.

An examination of the values on the circuits of these three sets shows that the fundamental ones, in the multi-kit, are all the same and that the sets differ only because of the additional parts. This illustrates how it is possible to change from one circuit to another so easily.

Assembly is Extremely Simple

A study of the "multi-kit" diagram discloses that numerals have been added to the circuit wherever a wire terminates. These numbers are an invaluable aid in wiring any one of the 17 sets, as simple instructions can be obtained telling just how and where to connect the various wires. Each of the 17 circuits has the same numeral at each essential point, so that the changes from one circuit to another can be explained simply. The instructions merely tell that wire from figure 23 to figure 46 is removed and that a wire is added from 27 to 3, etc. Picture diagrams are included in these instructions and the numbers are given here also, so that a person with absolutely no knowledge of radio has no difficulty in making any of the sets or changing from one to another.

Complete instructions, including not only the easy wiring details described briefly above but also such fundamental facts as soldering hints, instructions for mounting parts, type of phones or speaker to employ, coil frequency ranges, instructions for adding band-spreading (for crowded amateur and broadcast short-wave bands) and hints on how to erect a good aerial and get the best all-round results can be obtained for any of the 17 sets.



3 Circuits for S-W Receivers which can be built up with the "multi-kit."

The 17 Sets—What They Are

To give an idea just how versatile the 17-in-1 multi-kit set is, a brief description of each circuit, and the type of tubes employed, is listed below, in three classifications—battery—A.C.—and universal A.C.-D.C. operation.

Battery Models

1—One type 30 or 01A tube—recommended for the beginner is short waves.

2—One type 19—this new 2-in-1 tube equals a detector and stage of audio.

6—Two type 30 or 01A tubes—this is the set shown in Fig. 1.

7—One 30 and one 33—this is similar to No. 6, but uses a power pentode for more volume.

8—Two 30s and one 33—a detector and two audio stages—full loudspeaker volume.

9—One 19 and one 33—similar to set No. 2, but with a power pentode to give full loudspeaker volume.

A.C. Models

3—One 56, 27, 37 or 76 tube—a simple 1-tube short-wave set which requires only 45 volts of "B" potential.

10—Two 56 or 27 tubes—supplies a detector and one audio stage with transformer coupling.

11—One 56 and one 2A5 tube—similar to No. 10 but using a power pentode for greater volume and better quality.

12—Two 56s and one 2A5—a very powerful set having a detector and two audio stages one of which is a power pentode.

Universal A.C.-D.C. Sets

4—One 12A7 tube—this set supplies its own power due to the rectifier section of the 12A7 tube. It has one pentode detector and rectifier.

5—One 76 and one 12Z3—a triode detector for stability and a rectifier for plate supply.

13—One 6F7 and one 12A7—a new 4-in-2 circuit. Each tube acts as two separate tubes which makes a very powerful set.

14—One 78 and one 12A7—supplying a power pentode and a pentode detector—this set is very sensitive.

15—One 76 and one 12A7—which supplies *3-tube* performance—a regenerative detector transformer coupled to a power pentode and a rectifier.

16—Two 76s and one 12Z3—this set supplies a triode detector, a triode amplifier and a separate rectifier.

17—One 6F7, one 76 and one 12Z3. This is a new 4-in-3 circuit supplying a detector, a triode A.F. stage, a pentode output tube and a rectifier for "B" supply. This set is both powerful and stable in operation.

This brief description and outline of the 17 circuits which have been devised up to this time for the multi-kit and accessories will serve to show you just what possibilities there are for the short-wave radio fan and constructor. If you are interested in making or listening to short-wave receivers, whether you know anything about radio set construction or not, you can have innumerable hours of fun making and trying these sets. And the cost of the multi-kit and the additional parts needed for changing from one circuit to another is so small that it will certainly not stand in the way of any ardent radio fan.

And just in case you prefer to obtain any of the 17 sets already assembled, ready to operate, they can be bought for a slightly higher price, though by obtaining them in this way you lose all the fun of making them and also the pride of doing something yourself which is really worthwhile.

A neat cabinet, in black crackle finish which fits any of the sets, is available. This cabinet is made in such a way that the aerial compensator, and the aerial, ground and speaker terminals are left exposed at the back. The top of this neat cabinet is also hinged so that tubes and coils can be easily changed.

There is plenty of room inside of the cabinet for the coils not in use. These sets, either in battery- or power-operated models make ideal portable units because of their small size and light weight.

Dr. Delmar Nicholson of Orlando, Fla., who makes a specialty of removing the poison from rattlesnakes to be used for treatment of spinal meningitis. He is here shown removing the poison from a 6-foot specimen of the dangerous rattler—the Florida diamondback.

SHORT WAVES IN MEDICINE

Short Waves Reduce POISON IN ASPIC VIPER'S VENOM

By DR. MARIE PHISALIX and
DR. COLONEL FRANCOIS PASTEUR*

● The poisonous effect of the venom of the Aspic viper was greatly reduced by subjecting the venom to a high frequency oscillating field. The various experiments carried out by the two French savants are here described

● IN earlier experiments we showed the action of various types of radiation on the venom of the *Aspic Viper*. The recent entry of short waves into the field of general therapeutics encouraged us to try their action also on this venom.

The technique of the researches we undertook can be understood from the following statement of our experimental conditions:

The solution of venom (10 in 1000) in saline (salt) solution, to the total quantity of 50 cubic centimeters was placed in a conical Erlenmeyer flask made of pyrex glass, having a total capacity of 100 cubic centimeters and a flat base 55 millimeters in diameter. It was suspended to avoid all propagation of the waves by direct contact, and corked to prevent evaporation and heat radiation, with an electrode of spherical base, 20 centimeters in diameter on either side. One cubic centimeter of this solution is sufficient to kill a mouse of 20 grams weight, following subcutaneous inoculation. The initial and exterior temperature of the liquid was 22 degrees; in the course of the experiments this temperature mounted to between 37.5 and 38 degrees no matter what the duration of the exposure, but the last represents an extreme figure beyond which it never rose.

Therefore the modifications in the chemical structure can be attributed solely to the electrical action of the short waves.

The power-head between the electrodes, which were sometimes 15 and sometimes 30 centimeters apart, was constant at 25 watts. The wave-length was fixed at 20 meters, thus corresponding to a frequency of the order of 15 million cycles per second.

EXPERIMENT 1—Length of exposure, 15 minutes: distance of the electrodes, 30 cm.; dose inoculated 1 cc.

Three mice were given the irradiated solution. Two of them weighed 23 and 19 grams; both died 1 hour 30 minutes after injection; the third, weighing 19 grams, died after 5 hours. Unirradiated solutions produce death for mice of this type after 6 hours normally. The toxicity of the venom thus seems to have grown, and the succeeding experiments show the reason.

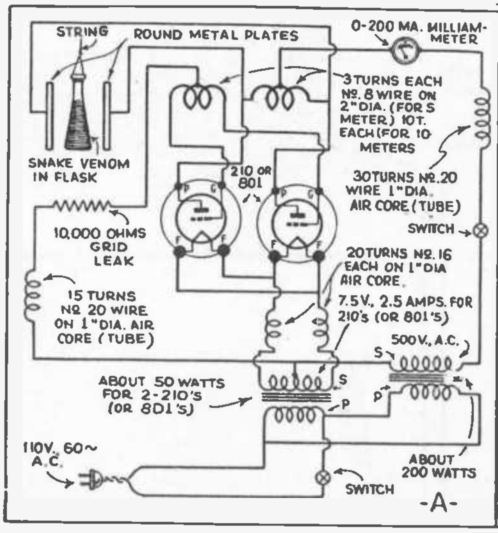
EXPERIMENT 2—Length of exposure, 30 minutes; distance of the electrodes, 30 cm. (12 inches); dose innoculated 1.1 cc. (cc=cubic centimeter.)

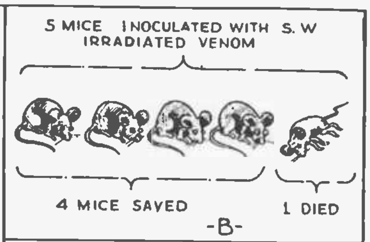
Four mice were inoculated with the irradiated solution, all weighing 23 grams each. Two of them died after 3 hours, the third after 7 hours, and the fourth in slightly less than 12 hours.

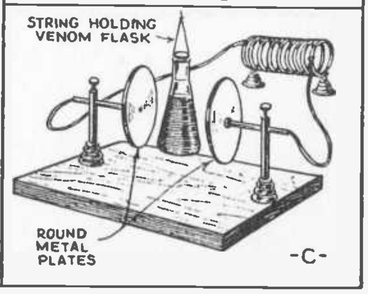
Two control mice were inoculated with unirradiated venom. One died after a period greater than 12 hours, the other resisted the venom, and moreover was vaccinated by it, for 6 days later he resisted a dosage of 1.1 cc. of pure venom, a dose infallibly fatal to a fresh animal. Thus the irradiation had had no effect on the venom.

EXPERIMENT 3—Length of exposure, 15 minutes; distance of the electrodes, 30 cm.; then another exposure of 45 minutes; distance of the electrodes 15 cm, dose injected 1 cc.

Three male mice were used. One, weighing 20 grams died after 20 hours; the two others, which weighed 19 grams each, died after 7 and 8 hours respectively. The control mice died after 5 and 6 hours respectively.







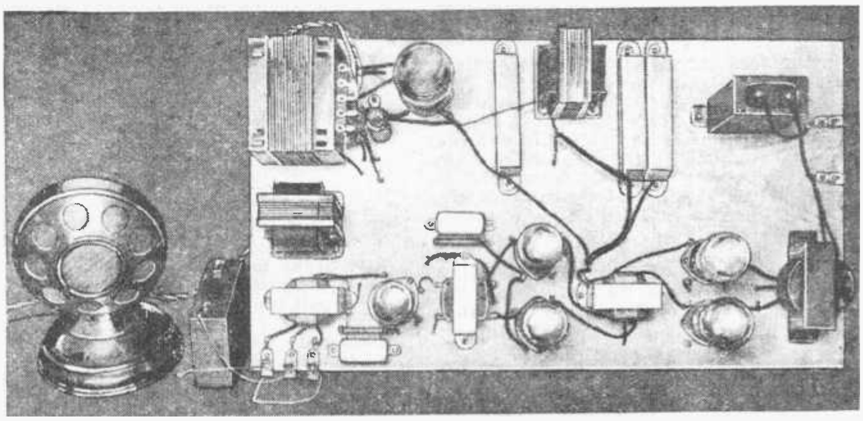
Above: Hook-up of high frequency oscillator similar to one used for such experiments as those described. Right: In one test 4 out of 5 mice were saved and only 1 died, after being inoculated with "irradiated" snake venom. Venom is treated by suspending between 2 discs connected to high frequency oscillator.

*See also the Academy of Sciences (French), proceedings: Vol. 199, No. 3, July 16, 1934, page 235.

S-W TRANSMITTERS

Low-Power Modulator

By LEONARD VICTOR, W2DHN



Top view of the low-power modulator, together with microphone and battery shown at the left of the photo.

The radio frequency amplifier, using a type '46 tube, is capable of taking 20 watts of power while being fully modulated. Hence, our problem was to secure some modulator (which in reality is only a speech power-amplifier), which would deliver 10 watts of undistorted audio, with good quality, and still not use any costly equipment.

Ordinary audio amplification, known as class "A," is very low in efficiency. To get our needed ten watts of audio, it would be necessary for us to use more than 100 watts input, which is much more than the entire radio frequency end of the transmitter uses.

Recently, however, a new system of audio, known as *Class A Prime*, has come into common use. This system is a hybrid, somewhere between class A and class B in operation. Efficiency with Class A Prime is of the order of 35%, which is much better than the 8% to 10% efficiency obtainable with straight Class A.

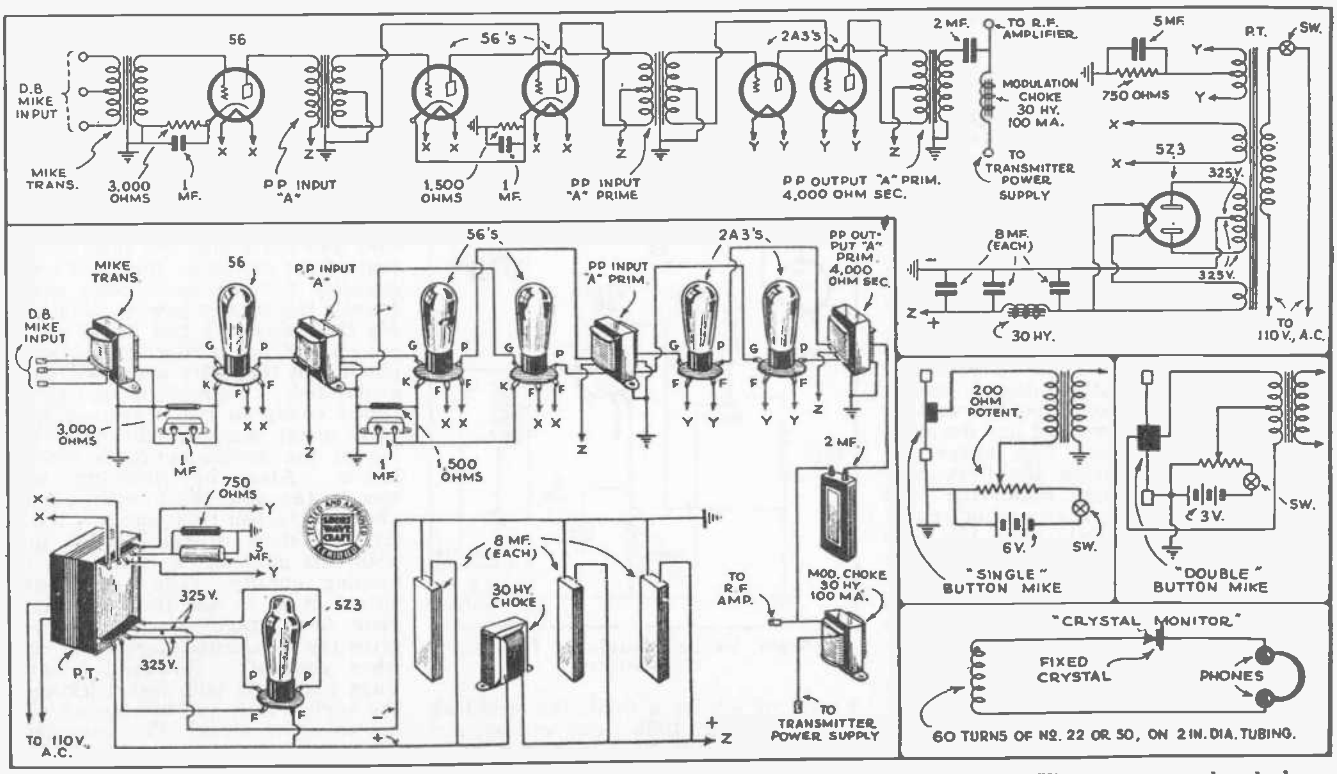
One of the new tubes on the market, known as the 2A3, is admirably suited for "A Prime" operation. This tube is a triode, the big overgrown brother of the type '45. A pair of these tubes, operating in push-pull, will deliver between 10 and 12 watts of undistorted audio with only 250 to 300 volts on the plate. Second harmonic distortion with these tubes is very low.

At this point it might be advisable to again repeat the rules for matching the modulator to a radio frequency amplifier.

1. Determine the audio output of the modulator (in this case 10 watts).

2. Determine the output impedance, or loud resistance into which the modulator works best. (The load resistance for the secondary of the 2A3 output transformer is 4000 ohms.)

3. Find a value of voltage and current twice the audio output of the modulator that produces the correct value of load resistance. Ohm's law is used to determine the correct current and voltage values. The law is: "Current, in amperes equals voltage divided by resistance."—(I=E/R). Hence, if we substitute 4000 ohms, the proper load value for R, a few simple arithmetical calculations will indicate what value that equals 20 watts power input, approximately, also satisfies the requirements of proper load resistance. Power input in watts is determined by multiplying the plate voltage



Wiring diagrams, both schematic and physical, for building the modulator here described by Mr. Victor are reproduced above; also, details for connecting single and double button mikes.

by the plate current in amperes. For example, 300 volts times .07 amperes, (70 milliamperes) equals 21 watts, which forms an approximate load resistance of 4000 ohms. In like manner, the proper values of power input to a radio frequency amplifier can be determined for virtually any values of voltage, current and impedance.

The modulator is actually a three-stage audio amplifier. The first stage uses a '56 tube, transformer coupled into two type '56 tubes in push-pull. These tubes are likewise transformer coupled into the two push-pull output tubes. The plates of the output tubes connect to a special 2A3 output transformer, the secondary of which works into a 4000 ohm load. An extremely heavy grid swing is necessary on the 2A3's, which is the reason for the use of two preceding audio stages.

The unit is built on a board 21" long by 12" wide. Two one inch under supports allow space under the board for wiring. On the front end of the board, from left to right, the layout is as follows:

Microphone transformer, first audio tube, push-pull input transformer, two second audio tubes, push-pull interstage transformer, output tubes, and special output transformer.

The layout on the back edge of the board, from left to right, is:

Power transformer, rectifier tube, 8 mf. filter condenser, filter choke, 16 mf. filter condenser, and 2 mf. output condenser.

In all audio work, only the best of equipment should be used, especially when another's ears are to hear the result. Ground all the audio transformer frames, and also the power transformer frame. This will help to eliminate hum, and the motor-boating that sometimes occurs with more than two stages of audio. The modulator is a relatively simple unit, and, provided good parts are used, and the diagrammatic and pictorial representations accompanying this article are carefully followed, no trouble will be experienced in getting the unit in operation.

Inasmuch as the microphone is the starting point of the transmitter, and can ruin the quality of the transmission, no matter how good the rest of the apparatus is, it might be well to interject a word as to its care and operation.

There are some very good *single-button* microphones on the market, and admirable results can be obtained with them, but extreme care should be taken in the choice of the instrument. The single-button microphone transformer should have an impedance of 200 ohms. Not more than six volts should be used on a single button, unless the manufacturer's instructions specify a higher voltage.

Recently, some very fine *double-button* mikes have been put on the market at prices almost as low as those charged for singles. If it can in any way be afforded, a double-button mike is an excellent thing to use, as it produces a great improvement in quality. The double-button mike transformer is necessarily center-tapped, and is usually of 200 ohms, impedance, per button. A double button microphone should never be used on more than 3 volts, unless the manufacturer so specifies.

Never move or jar a microphone while it is connected to the battery, and always remember that it is an extremely delicate piece of equipment that should be handled with care. The best "approach" is to talk across the face of the microphone, as this minimizes breath hiss. If a double button mike is used, have "ma," or the "YLF," (young lady friend), sew a little cloth cover to put over it. This will keep out dust and dirt, as well as protect the diaphragm from corrosion by moisture condensed from the speaker's breath.

Tuning Hints

The R.F. end of the set is tuned up in the normal way, as decribed last month, with the exception of the fact that the *modulation choke* is in series with the positive lead. Load up the antenna to exactly 70 milliamperes, making sure that there is 300 volts on the plate of the amplifier. The oscillator is run at the full voltage of the power supply, somewhere between 350 and 400 volts. Now "fire up" the modulator and check in the monitor; the voice of the person speaking into the mike should be heard clearly and distinctly at zero beat in the monitor. A diagram is shown for a little crystal monitor to be used to check on the quality of the transmitter. A small flashlight bulb connected in series with the antenna lead, should flicker up much brighter than normal when a person speaks into the microphone. It may be necessary to use a 45 volt battery as grid bias for the 46 amplifier instead of the resistance. A circuit diagram shows how to connect and bypass it.

The milliammeter in the lead to the plate of the R. F. tube should never swing more than 4 or 5 mills (M.A.); a larger swing than this indicates distortion. Cut down on the battery current until there is only a slight swing, if any. Keep the transmitter and modulator as far from each other as possible to prevent R. F. pickup in the audio end.

A little careful tuning, testing, and checking in the monitor will do a lot to get a good signal that makes or breaks a fellow's reputation on the air.

As one old-timer said: "It's more the operator, and what he does, than the apparatus itself, that makes a good station."

Let's hope you are all the kind of op's, and build up the kind of stations that would make any "old timer" proud. 73's.

Parts List

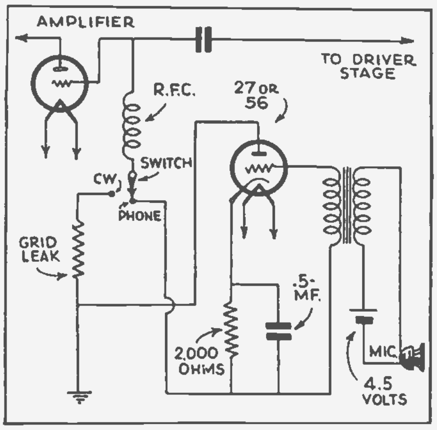
Microphone transformer, National. (Also R. T. Co.)
3—5-prong sockets, Eby.
3—4-prong sockets, Eby.
Push-pull input transformer, National. (R. T. Co.)
Push-pull interstage transformer, National. (R. T. Co.)
2A3 output transformer, National. (R. T. Co.)
2 mf. 1000 volt paper condenser, Flechtheim.
1—Power transformer, National. (R. T. Co.)
3—8 mf. 500 volt electrolytic condensers, Flechtheim.
2—30 henry 100 mill. chokes.
1—3000 ohm 1-watt resistor, Lynch (International).
1—1500 ohm 1-watt resistor, Lynch (International).
1—750 ohm 10 watt wire-wound resistor.
2—1mf. 200 volt paper condenser. Flechtheim.
1—50 volt 5 mf. electrolytic condenser.
1—Microphone; (Amplion; Lifetime; Miles; Mayo; Maylux).

An Ultra-Simple Modulation System

By Jerrold A. Swank, W8HXR

● IN order that I may show you that this will really work, and work well, I will merely say that I have QSL cards from a station in Bondsville, Mass., and one in Lorain, Ohio, which I worked one night in a three way contact on 160 meter phone a year or so ago from Chicago, from my station W9KRI. The reports were—from W1KK QSA 4 R 6 Tone quite good; from W8HBI T8, QSA 5 R 6. That is the only dx I can show, as I never tried it again. I built it that night, and tore it apart the same night fired by my luck to make a more pretentious modulator. The other day I hooked it up again, to test it before writing this article, and it worked fine during a few local contacts. The surprising thing was that during the first mentioned contact with Bondsville and Lorain I was using a 45 oscillator and a 45 final (not crystal), with 180 volts on them and my input was less than *two watts!* I know of a case where another ham used it on 20 meter phone, and worked several foreign countries with it, modulating a 50 watt tube in the final.

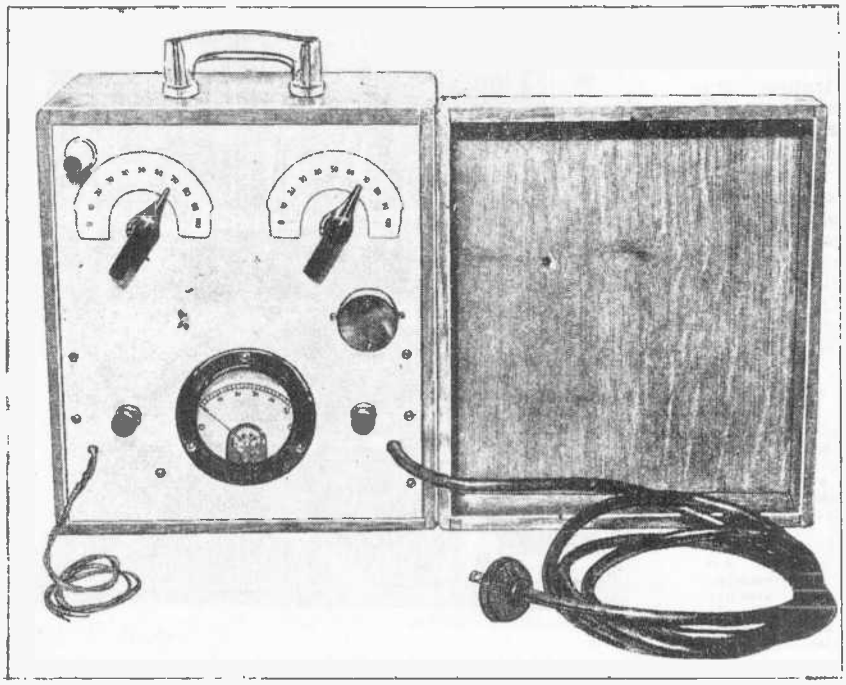
The total material necessary to change from CW to phone is one microphone, 1 microphone transformer, one 56 tube (or a 27), one 2000 ohm resistor, one ½ mf. condenser, and one socket for the tube. All of these parts are cheap, and most hams probably have them on hand. The circuit is self explanatory, I think. The two leads are inserted in place of the regular grid-leak resistor. In the case of



A Simple 1-tube Modulator for MOPA transmitter.

a pair of 46s in a final, the grid-leak resistor is only 1000 ohms or less, and therefor you may leave it in, and merely insert the leads in place of the key if it is being keyed in the grid lead, as most operators key their 46s. As you can see, the tube becomes a variable grid leak, with the variations in grid current being changed by the voice currents applied to the grid of the 56 tube. It is very easy to obtain high percentage modulation. In fact, it must be carefully watched to prevent overmodulation. The drawback to it is the same as with all forms of grid modulation, that you must run the tube at 25 per cent of its rating so that there will be capacity for the modulation peaks of 4 times the carrier power. So a pair of 46s that normally run at 50 watts input on CW will only give 12½ watts on phone, but that 12½ watts will be fully modulated. Overmodulation can be detected easily in two ways. First, the plate meter must not flicker. Flickering of the needle indicates overmodulation. Also, by listening to the speech (as you talk) with a pair of phones attached to a monitor, the quality will show overmodulation quickly with this method. It will get a rough rasping quality. The proper way to adjust it is to set the excitation for your final stage so that modulation gives the maximum *increase* in current when you talk. However, I have always had good luck just sticking it in the keying jack and talking and listening on my receiver. This may not give you all the efficiency obtainable, but everyone does not have an antenna ammeter. My experience has been that the tube drops the input very nearly to the right amount for proper operation.

Crystal Portable Transmitter



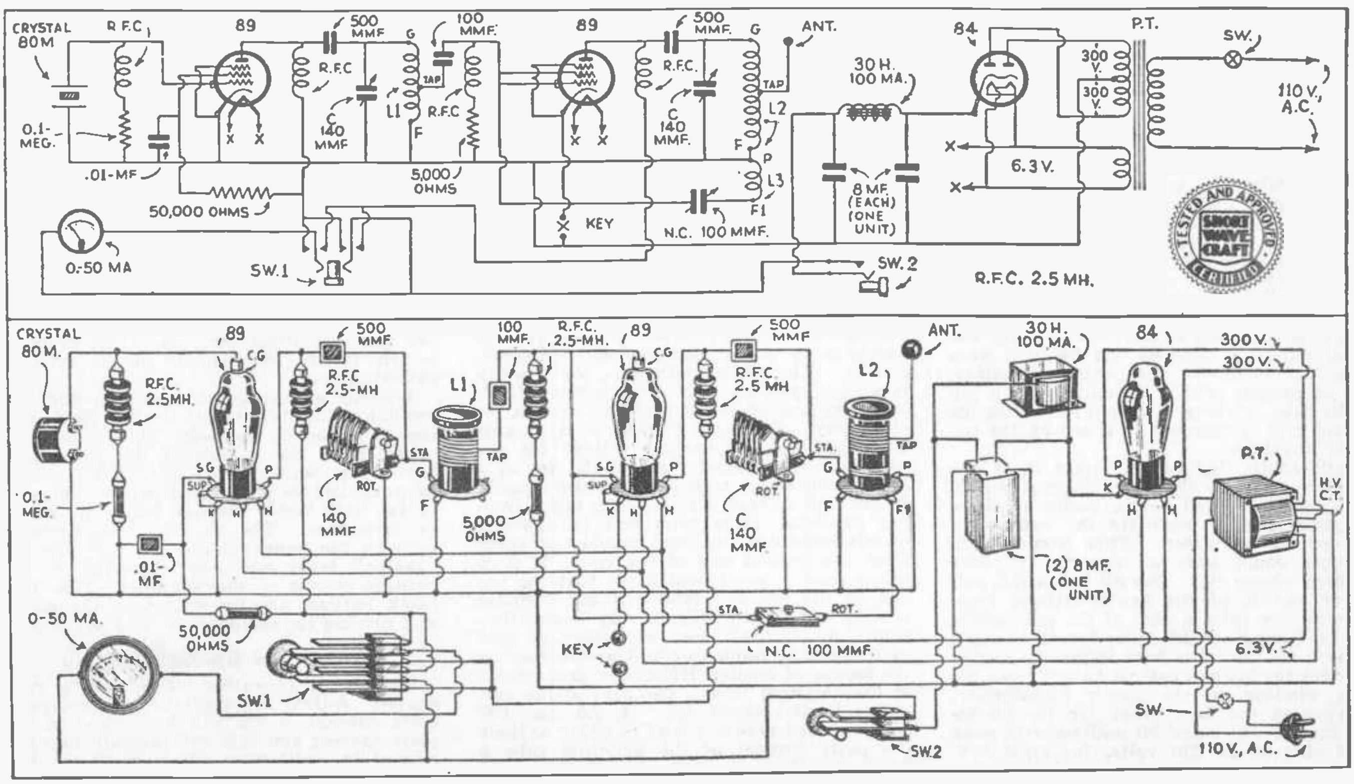
Note the fine "professional" appearance of this portable transmitter. The key connects to the twisted pair at the left of the set; the plug on the heavy cord at right is inserted into any 110 volt, 60 cycle A.C. outlet. Only a single-wire Hertz antenna, 132 feet long, is necessary.

This "portable" transmitter is up to the minute and maintains a very constant frequency, thanks to the use of a crystal. The transmitter is designed to operate on 110 volts, 60 cycle, A.C. and may be operated from a 6-volt storage battery by using one of the new "converters" which delivers 110 volts 60-cycle A.C. This set weighs but 10 pounds, yet it has held communication over 1000 miles on actual test by the author. Its output is 8 watts.

● NEARLY every Ham at some time longs for *a portable transmitter.* Particularly during the summer when camping trips and other vacationing activities take us away from the "old home town". And who will question the thrill of communicating with the "folks" especially when we can brag about the fine time we're having and all the "big fish" we nearly landed. Of course any ham that takes a portable on a vacation just for the sake of "operating a rig" should do little bragging, having had radio all year. Portables are nice to have around the shack at all times and should not be considered simply vacation equipment. Many uses for portables will suggest themselves and of them no mention need be made.

Should Be Well Built

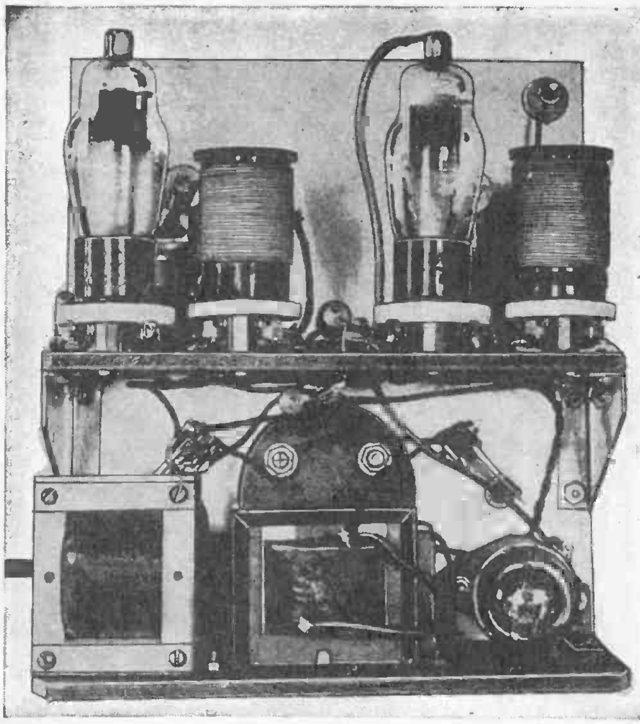
Portable transmitters should be built as well as the regular "home" station, if not better. They are apt to be subjected to some hard usage now and then. Most portables we have seen have been made up of all the old "junk" that could be found, dating back to the year one. The best of circuits and parts should be used, because a rig suitable for portable use will most necessarily have very low output, which means that the signal emitted should be of the steadiest and clearest in order to cut through QRM and QRN with the least difficulty.



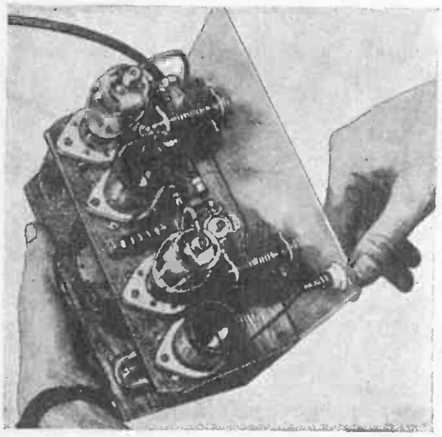
Both schematic and picture wiring diagrams are given above which make it a "cinch" to build a duplicate of Mr. Shuart's very attractive short-wave transmitter; it is designed for CW (code) transmission.

By Art Gregor

There are several kinds of portables, such as transceivers —A.C. and battery; battery-operated transmitters, and another type which is operated directly from the A.C. lighting mains. It is the latter that appeals to the writer most because they are far more economical to operate and usually provide more output per pound of weight. True, they have their limitations in that they cannot be used in places where there is no A.C. available, but, let's not forget that the average "ham" has a car and right here is the solution to the battery problem. Converters can now be readily obtained that will deliver 110 volts A.C. 60 cycles, directly from a 6-volt storage battery. So after all the A.C. operated portable gets the vote, says the designer, George W. Shuart, W2AMN.



Extremely neat appearance of the portable CW transmitter, which uses but 2 tubes and operates from any 110 volt, 60 cycle A.C. circuit. It can easily be adapted to "phone" transmission by the simple addition of a single 37 tube, as explained in the text.



Another view of the 2-tube portable CW transmitter, built and successfully tested by Mr. Shuart.

A portable must be small in size, light in weight, have fairly good output and deliver a steady, piercing signal. Right you are—it must be *crystal controlled!* The rig shown in the pictures has just about all that any *real* ham could desire, and I can guarantee that unlike many other sets I have built, this one will never be dismantled.

The weight is *ten and one-half pounds*.

Nine inches wide, ten inches high, and six inches deep. Output; a good eight watts. Circuit; crystal-controlled M O P A; Signal; XPDC, the best that can be obtained. A *real portable?*—you guess!

Tubes an Important Factor

Choosing the type of tubes for a portable deserves quite some thought. Tubes of the receiving type of course have to be used in a portable of very small dimensions, because there is little room for a power supply that would produce high voltage. Therefore transmitting tubes cannot be used to any advantage. After studying the tube manual for hours, and after every other tube had been investigated—the 89 was chosen as the oscillator and R.F. amplifier tubes. This tube is the little brother of the 59 and will do the job just as well as the 59, only with less power out-put. The 89 can be used as a class "A," class "B" or pentode amplifier. The suppressor grid is brought out to a pin on the base; making a six-pin base with the control grid coming out to a cap on the top of the envelope.

Incidentally, before we forget it, *if one can find space in the carrying case for it, a 37 could be used as an audio amplifier and employed to modulate the suppressor grid of the amplifier.* This would mean that we could have a very "nifty" low-powered phone rig. The 89 has a 6.3 volt heater and is of the heater-cathode type. The rectifier tube is also of the automobile type and requires 6.3 volts for the heater. Because all the tubes have indirectly heated cathodes the heaters can all be run from the same winding on the power transformer. Looking at the data sheet for the 89 we find that it will stand 90 milliamperes peak plate current at 250 volts, for class "B" service, so there is no danger of damaging the tube by drawing heavy plate currents. In this transmitter the 89's have 300 volts on the plates and the highest plate current for the amplifier is 50 milliamperes. Maximum output is attained at this input and there is no benefit in running it any higher. The oscillator draws normally under load 30 mills (M.A.), the plate voltage also being 300.

The 84 rectifier is slightly overloaded but has withstood the overload very nicely. It is rated at 225 volts and 50 mills, (M.A.) The insulation between the heater and cathode fortunately is specified at 300 volts.

Transmitter Circuit Conventional

The circuit of this transmitter is conventional in every respect. No trick circuits should be used in portable transmitters! Shunt plate-feed is used for both oscillator and amplifier in order that the two 140-mmf. tuning condensers could be mounted directly on the metal panel with no danger of short-circuit. The plate voltage is fed through receiving type 2.5 mh. r.f. chokes. Grid-leak bias is used in the oscillator circuit for simplicity. This is a 100,000 ohm, 2 watt resistor. The screen-grid voltage for the oscillator is obtained through the use of a 50,000 ohm series resistor connected directly to the high voltage. Excitation is taken from the oscillator plate tank coil at approximately one-third the total number of turns from the ground end of the coil. If it is taken from a point nearer the plate or *hot* end of the coil the tube will not oscillate readily and results will be very unsatisfactory. A .0001-mf. mica condenser is used as a blocking condenser and also serves as the means of feeding RF to the grid circuit of the amplifier tube. The grid of the amplifier is also shunt fed. A 2.5 mh. RF choke is used here also and in order to limit the plate current of the amplifier tube a 5,000 ohm 2 watt resistor is used as a grid leak. This is possible because the two grids (control and screen) are connected together, the tube then operating in class B fashion.

The amplifier plate circuit is identical to that of the oscillator except for the neutralizing coil which is wound at the ground end of the plate coil. The amplifier operates on the same frequency as the oscillator, and as the 89 is not a screen-grid tube, it has to be neutralized in order to prevent self-oscillation. The 100 mmf. postage stamp compression type condenser (nc) serves as the neutralizing adjustment.

The plate current for both oscillator and amplifier tubes is measured by a single 0-50 milliammeter. This is accomplished by a double-pole double-throw push switch; a knife switch can also be used.

The power supply is located on the bottom shelf and there is just enough space to mount the 300-0-300 transformer, the 30 henry filter choke and the double 8 mf. 500 volt electrolytic filter condenser. In order that all these parts including the meter would fit in such a small place the 84 rectifier tube is mounted against the front panel and lies in a horizontal position. This position is OK for the 84 because of the type of cathode it has.

Looking at the front panel we find the oscillator tuning control to the right and the amplifier to the left. The crystal is mounted on the outside of the panel just below the oscillator control. This is done in order that the crystal will not be subjected to the heat inside the box while the set is in operation. The flexible leads coming through the panel on the left side are the "keying" leads and are connected in the cathode circuit of the amplifier. The two black buttons are for switching the meter and turning the oscillator on and off.

Tuning and Operating Hints

Tuning and operating the portable is very simple. Adjust the oscillator for minimum plate current, a dip will be noticed in the plate current and this will indicate that the crystal is oscillating. Then with the key circuit of the amplifier open, swing the amplifier plate condenser back and forth until a change in oscillator plate current is noticed. Then adjust the neutralizing condenser until swinging the amplifier condenser has no effect upon the oscillator plate current. The amplifier will be sufficiently neutralized at this point. Then close the key and tune the amplifier tank to a point where the amplifier plate current is minimum. This will be between 5 and 10 milliamperes. We are now ready to connect the antenna.

For portable transmitters we need the most simple and efficient type of antenna, one that can be put up at a minute's notice and with the least trouble. The writer selected the end-fed Hertz. That is, one single wire which is fed directly at the end and which is clipped directly onto the plate tank coil. This antenna should be approximately 132 feet long. And it is tapped to the plate coil one-third the distance from the plate end of the coil. This arrangement will drive the plate current of the amplifier up to about 45 or 50 mills. (M.A.) With this arrangement no trouble was experienced in working stations over 1,000 miles distant.

The coils used are of the plug-in type as the forms were of the proper size and they can be changed easily if one wishes to operate in another band. The oscillator coil consists of 30 turns of No. 18 solid copper magnet wire, with single cotton covering. The amplifier coil has 33 turns of the same wire and the windings are given a coating of coil dope to make them firm and weatherproof. The neutralizing coil is wound at the bottom of the amplifier coil and has 10 turns of No. 26 D.S.C. wire. Standard Na-Ald 1¼ inch four-prong coil forms are used.

Here's a swell portable transmitter which should meet the most exacting requirements and will delight the builder with it's fine performance. Moreover, it can be built for a cost of only a few dollars.

Parts List for Portable Transmitter

1—Card index file box, see text.
1—8¼x9¼ inch aluminum panel, Blan (Korrol).
2—140 mmf. variable midget condensers; Hammarlund.
1—100 mmf. compression type variable condenser; Na-Ald.
1—.01 mf. mica condenser.
2—100 mmf. mica condensers.
2—500 mmf. mica condensers.
1—double 8 mf. electrolytic filter condenser (500 volt).
1—5,000 ohm 2 watt resistor.
1—100,000 ohm 2 watt resistor.
4—2.5 mh. receiving type R.F. chokes; National (Hammarlund).
2—4-prong isolantite sockets; National (Hammarlund).
2—6-prong isolantite sockets; National (Hammarlund).
1—4-prong wafer socket; Na-Ald.
2—4-prong Na-Ald coil forms.
1—0-50 milliammeter.
1—D.P.D.T. push switch; Blan.
1—S.P.S.T. push switch; Blan.
1—300-0-300 v., 6.3 v. 100 mill. (M.A.) power transformer.
1—30 Henry 100 mill. filter choke.
2—89 tubes RCA Radiotron.
1—84 tube RCA Radiotron.
2—aluminum brackets (shelf-supports) Blan.
1—80 meter crystal; Blilely.

"Break-In" Monitoring

By DONALD McKINLEY, VE3AU

The monitor (Fig. 1) is the typical oscillating frequency meter; its fundamental frequency being in the 160 meter band and the second, fourth and eighth harmonics used to check up on the transmitter in the usual way. The accompanying reference table gives the various values of inductance and capacity.

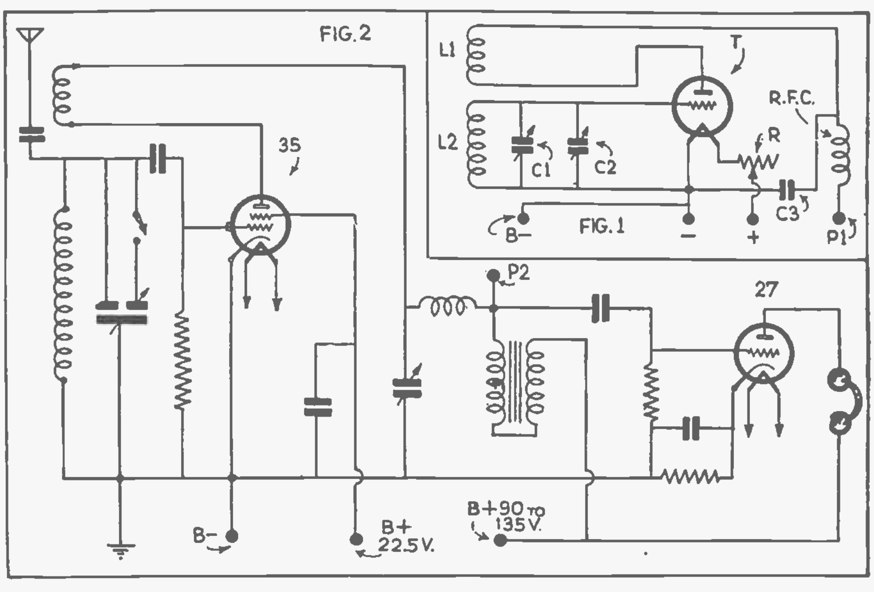
It will be found that the trimmer condenser C2 will be set at about full capacity, which, incidentally, helps to provide that Hi-C tank which is quite as important for frequency stability in monitors as in transmitters. The meter is calibrated by the zero beat method and the trimmer may be adjusted slightly from time to time if the dial readings should happen to slip from the calibration curve. A D.C. "battery" tube is used because the A.C. tubes seem to modulate and fail to give a faithful reproduction of the signal from the transmitter. However, if perfect fidelity in the reproduction of the transmitter note is not required, a 227 tube may be substituted for operation from the receiver filament transformer.

The receiver at this station is typical of the usual home-made job (Fig. 2) but the principle of break-in monitoring can be applied to almost any receiver.

The lead P1 from the monitor is connected to the plate end P2 of the amplifier choke (in this case, an audio transformer with windings in series) and the filament return is completed by a connection to the "B minus." In the case of receivers using two stages of amplification the lead P1 may well be connected to the plate side of the primary of the last transformer since one stage of audio has proved ample for all harmonic beats up to the eighth (20 meter band).

It is easily seen that the output from both the detector and the monitor is fed simultaneously into the same phones, the same "B" potential being used for all tubes.

When the transmitter key is pressed the detector of course is immediately blocked with excessive R.F. and the only signal heard will be the beat note when the monitor is tuned to the transmitter wave. The frequency corresponding to this dial reading we can now find from the calibration curve.



Circuit for the clever "break-in" monitoring system here described by Mr. McKinley, which permits hearing the "home" signal and also a "break-in" signal from an outside station.

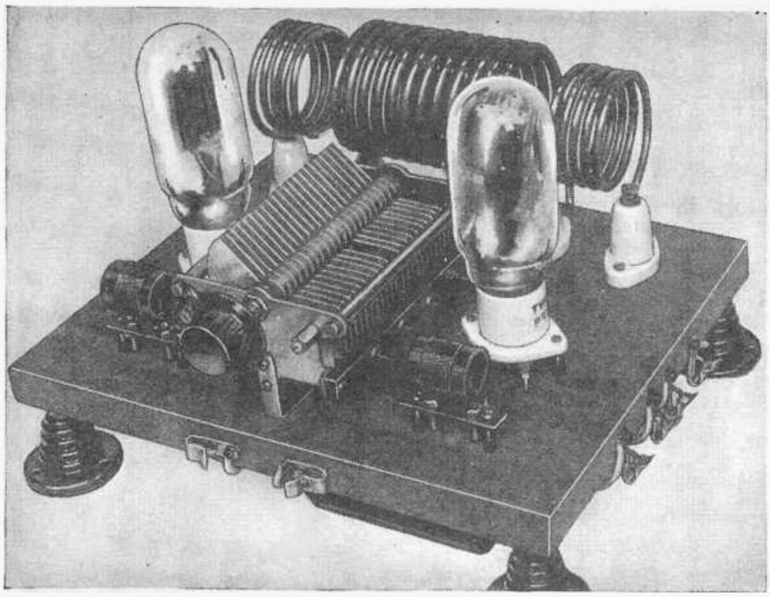
However, to make assurance doubly sure we let up the key, the detector immediately functions (unless the transmitter output is about a thousand watts, in which case it may be paralyzed for a few seconds) and we tune the receiver over the band till the beat from the monitor is heard. Frequency observation is highly important in these days of uncertain amateur privileges and this system of "check and double-check" is good insurance against having your license cancelled for off-frequency operation.

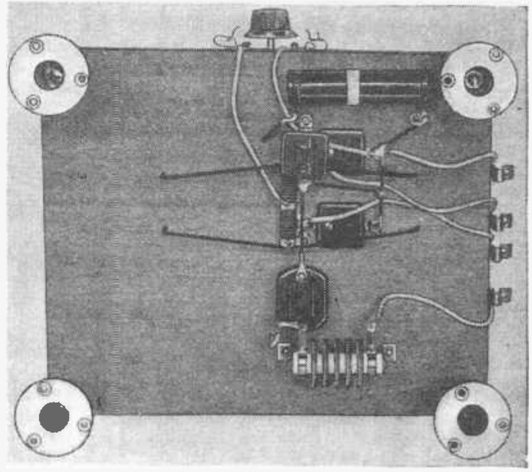
Assuming that the other station is located in the usual manner, i.e., after a CQ, a call, or on schedule, we now make use of the break-in monitoring system. Your monitor is tuned to your own transmitter while your receiver is tuned to the other station. Thus when the key is up you hear the other station (from your receiver) and when it is down you hear your own signals (from your monitor). No switches to throw, no plugs to fiddle with, no delay, merely pound the key or swing the "bug."

Obviously, of course, if the transmitters at both stations are on *exactly* the same frequency, both your receiver and your monitor would be on the same wave as the transmitter and in addition to hearing the other fellow's signals (key up) and the monitor-transmitter beat note (key down) the monitor-receiver beat note will also be heard (key up or down). However this condition occurs very rarely and in any case it is found that a shift of five kilocycles obviates any difficulty.

Harmonic Monitor Parts List

L1—18 turns No. 24 D.C.C. wire on a form 1.5 inches in diam.
L2—70 turns No. 24 D.C.C. on same form and spaced .25 inches from L1.
C1—50 mmf. midget condenser, with large tuning dial (25 mmf.). National.
C2—100 mmf. midget condenser, with knob for occasional adjustment. National.
C3—.002 mf. by-pass condenser. Cornell-Dubilier.
R.F.C.—Radio frequency choke 100 turns No. 30 D.C.C. on half-inch form; or National 2.5 M.H. R.F. choke.
T—Battery-operated tube (type '01-A, '99, '30, etc.). RCA Radiotron.
R—Filament rheostat for above tube. (A fixed resistor would be better.)
An aluminum panel, wooden base-board, screws, etc., to complete the job.



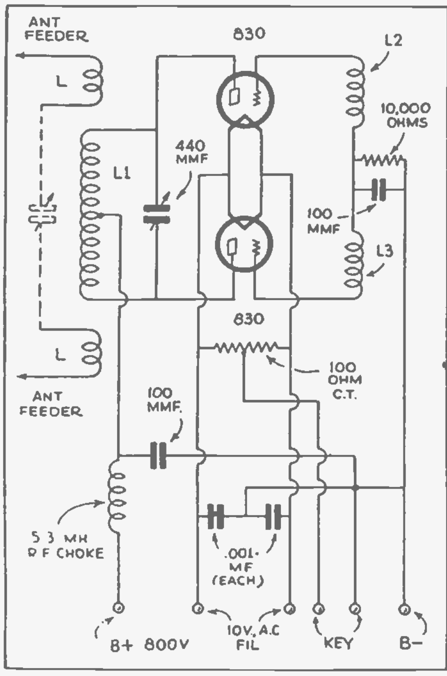


Note the unusual as well as convenient layout of parts, which permits the use of a panel arrangement.

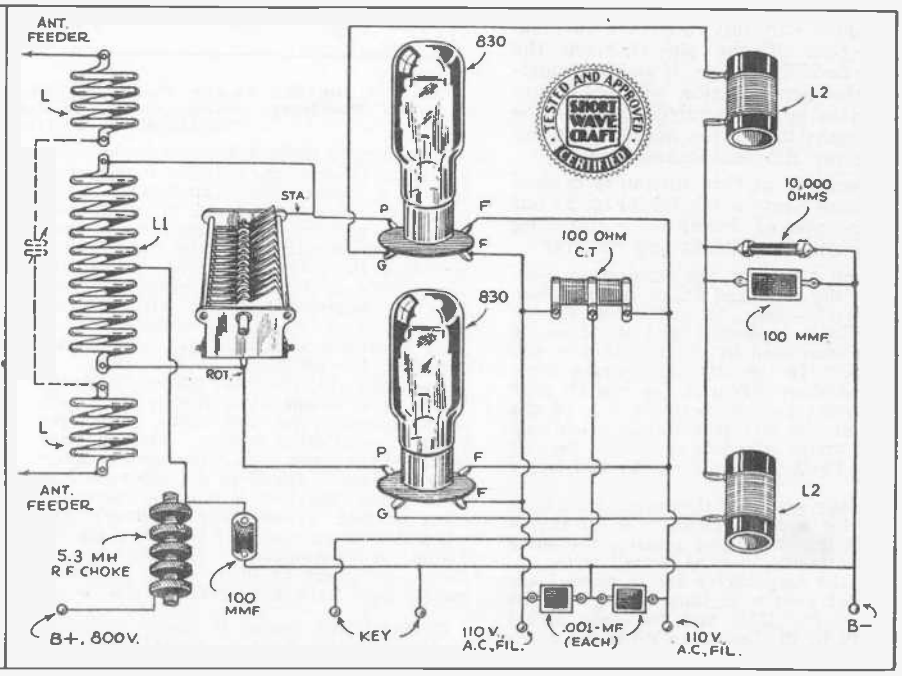
A Medium Power Transmitter
Using New Type Tubes

● THE average conversation between two newly acquainted amateurs starts off something like this: "How many watts do you get out of your 210's and how red do the plates get?" These words must have been ringing in the tube manufacturers ears and prompted them to put out new tubes having an output rating that is somewhere in between the 210 and the 50 watt (03A) tube. The tubes used in this transmitter are the new type 830, having an output of approximately twice that obtained from the average 210 type tube. This tube does not work with the same voltages as the 210 and therefore one would naturally expect the output to be somewhat higher. The writer has used the type 830's over a period of several months, with 800 volts on the plates, and the transmitter has emitted an extremely *steady* and *pure* signal. Due to the construction of the tube, together with its graphite plate, creeping — formerly caused by displacement of elements during changes in temperature of the tube, have been reduced to a minimum. In forming the layout used in this transmitter, a special effort was made to place the parts so that a panel could be mounted in the front of the base. The usual *push-pull* layouts do not permit the use of a front panel and still maintain a symmetrical appearance. The tuning condenser is always mounted over to one side or the other and never directly in the center of the panel. By mounting the two tubes on either side of the tuning condenser, as shown in the photograph, it was

This transmitter provides all that anyone could ask for in the line of power and it is capable of producing a very clear and steady signal. Next month we will describe a suitable "power supply" for this transmitter.



The above diagram clearly shows all connections, also values of the various parts.



Pictorial diagram clearly shows the construction of the plug-in grid coils and other components.

possible to obtain a perfectly symmetrical layout which facilitates the use of a front panel.

The stand-off insulators supporting the plate tank coil are equipped with jacks to accommodate the bananna type plugs, which are attached to each end of the plate coil. This allows easy changing of coils without the application of a pair of pliers. The antenna coils, of course, do not need to be changed and are not of the plug-in type. They are spaced about one inch from the plate tank coil and may be turned at various angles relative to the plate tank, in order to obtain a proper degree of coupling. Looking at the bottom of this transmitter, we will see that the R.F. plate choke, plate by-pass condenser, grid-leak, together with the filament by-pass condenser and center-tapped filament resistors have been mounted on the underside of the board.

Referring to the circuit diagram it will be seen that a 10,000 ohm grid-leak is used and this proved to be the optimum value. Filament by-pass condensers are shown, although in many cases they may not be necessary. In this particular transmitter it was found that .001 mf. condensers gave a decidedly improved signal.

After this transmitter is completely wired and the coils are constructed as shown in the attached coil table, the plate tank condenser should be adjusted for a minimum of plate current. At this point a monitor should be used in checking the frequency. If the frequency is too low it is permissible to detune the plate-tank condenser to the high frequency side of resonance with the grid coil. *Never* tune the plate tuning condenser to the low frequensy side of resonance with the grid coil, or a "poor quality" signal, with instability, will result! In other words the grid coil should be constructed so that resonance with a plate coil is at a lower frequency than the frequency on which one desires to work. After the transmitter has been adjusted to the approximate frequency at which you wish to work, attach the antenna feeder to the antenna coils. Tune the antenna condenser or condensers, whichever the case may be, until the plate current rises to a value of about 100 mils. (M.A.). Now loosen the coupling between the antenna and plate coils until the antenna condenser can be rotated through resonance with the plate current reaching a value not higher than about 125 milliamperes. With the transmitter adjusted as outlined above, you should obtain a pure D.C. signal, very closely approaching the stability of the crystal. In fact "crystal" reports have been obtained with this transmitter.—George W. Shuart, W2AMN.

Coil Table for Transmitter

Grid coils "close wound" on 1 inch dia. bakelite tube.

20 meters 7 turns No. 28 D.S.C. each coil
40 meters 18 turns No. 28 D.S.C. each coil
80 meters 35 turns No. 28 D.S.C. each coil

Plate coils.

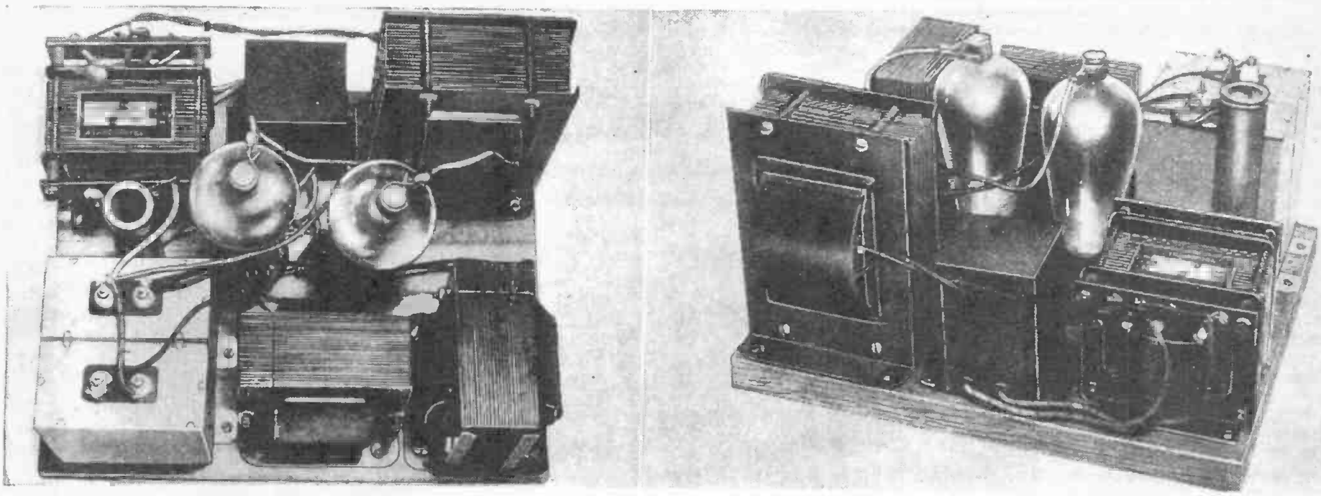
20 meters 4 turns
40 meters 6 turns
80 meters 12 turns

Antenna coils have 4 turns each of 3/16 copper tubing wound with an inside diameter of 2¼ inches.

Plate coils made of ¼ inch copper tubing inside diameter of coil is 2½ inches.

Parts for Transmitter

L—set of coils (see coil table)
1—.00044 to .0005 mf. transmitting condenser. National (Hammarlund: Cardwell)
2—.0001 mf. fixed (mica) transmitting condensers (2,000 vt.)
2—.001 mf. fixed (mica) transmitting condensers (2,000 vt.)
1—100 ohm C.T. resistor. R. T. Co.
1—10,000 ohm 20 watt grid-leak.
2—4 prong isolantite sockets. National (Hammarlund)
2—type 830 tubes. Sylvania.



The two photos, above, show top and perspective views of the power supply.

Power Supply Unit

For the "Medium Power Transmitter"

By GEORGE W. SHUART, W2AMN

● THE power supply described in this article was especially constructed to operate the medium-power transmitter described in the February SHORT WAVE CRAFT.

Care was exercised in choosing the different parts for this power supply in order that it would have a good safety factor and be free from future maintenance trouble. Separate filament transformers are used for the power oscillator tubes and the 866 rectifiers. It is safe to say that the majority of poor quality notes to be heard on the various amateur bands are caused by inferior power supplies rather than poorly designed RF portions of the transmitters. One rule which should never be violated in transmitters using self-controlled oscillators is to use separate filament transformer for the oscillator filaments. In almost every case where a poor note is encountered and where it is impossible to obtain a pure D.C. signal, the use of a separate oscillator filament transformer will cure the trouble. If you are having trouble of this sort try a separate transformers.

A separate transformer for the rectifier does not seem to effect the characacter of the note and is only used to maintain the filament voltage constant while the transmiter is being keyed and results in longer tube life.

In order to obtain the full value of the tubes used in last month's (Feb.) transmitter it is necessary to have from 750 to 800 volts on the plates. It is rather useless to install larger tubes and use the same plate voltage that was used on the smaller tubes.

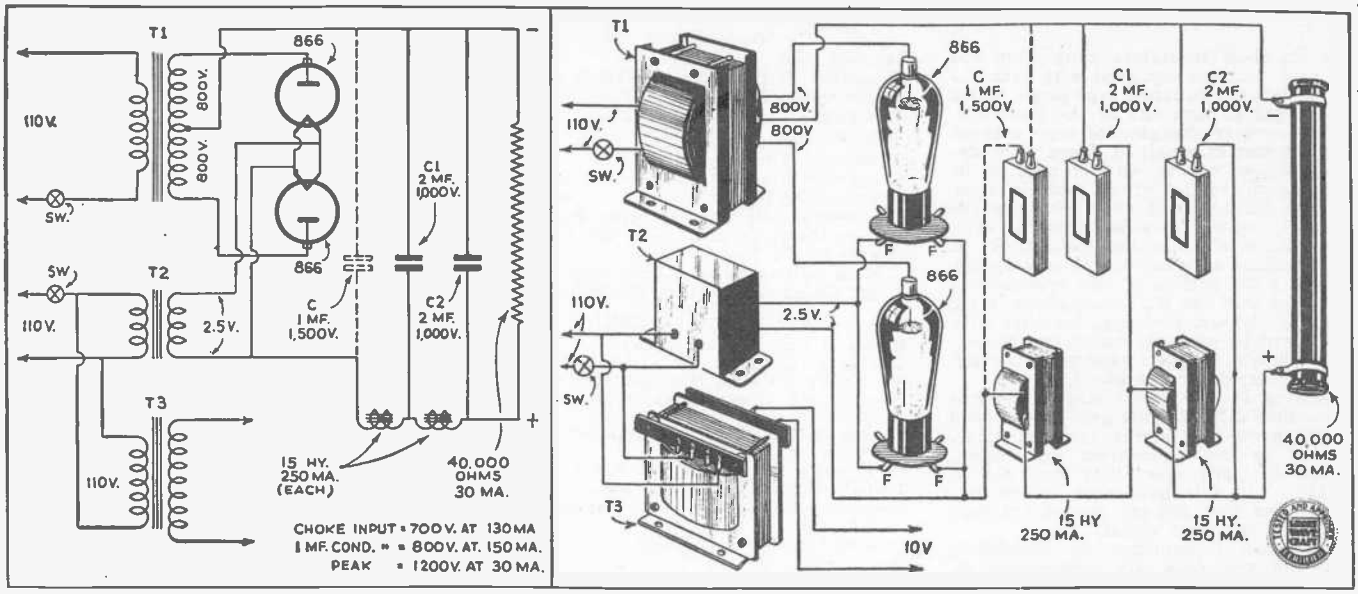
The plate transformer that filled the bill the most satisfactory was a unit having 800 volts each side of center tap and rated at 150 milliamperes. This transformer has no filament windings and hence is not suitable where separate filament transformers are not contemplated.

It is an accepted theory that mercury-vapor rectifier tubes are unquestionably better than ordinary vacuum tubes, because of their low and more constant voltage drop. However, these tubes create quite a lot of noise in the receiver because with a bleeder resistor, they are operating constantly. Here again separate filament transformers are an asset, because the high voltage transformer primary can be opened at will and without affecting the filaments, to obtain quiet reception.

The filter is the next in line on the power supply and deserves very careful attention. Nothing but the best chokes should be used together with condensers that will not puncture because of exceeding their rated voltage. It is much cheaper to start off by using good condensers rated to operate continuously at the voltage used, with no further expense, than to use low voltage condensers and be in danger of not only ruining the condensers but the rectifier tubes as well.

Chokes

The filter chokes employed are 15 henry heavy-duty units rated at 250 mills. These may seem to be heavier than necessary but a choke of this type provides better regulation and there is no danger of saturation due to over-loading.



Who couldn't build this power supply unit with the aid of the excellent diagrams shown above? The author has specified good "healthy sized" chokes and condensers, so that a steady, full voltage is maintained at all times.

With mercury vapor rectifier tubes it is generally accepted that a *choke-coupled input* to the filter is best. The diagram shows this method. And the resultant voltage with a 130 mill drain is 700 volts. With condenser input (C dotted in) the voltage is raised to 800 with a 150 milliampere load. The steady D.C. voltage across the filter condensers with a 1 M.F. condenser input to the filter system, and with no load other than the 30 mills (M.A.) drawn by the 40,000 ohm bleeder, is 1,200 volts. This may seem too high for the 1,000 volt filter condensers, but on the other hand a good paper condenser, rated at 1,000 working volts, will stand around 1,500 volts peak, without breaking down; this applies to condensers c1-c2. C should have a working voltage of around 1,500. The 800 volts obtained with condenser input provides a noticeable increase in R.F. output of the transmitter over the 700 obtained with choke input and no ill effect to the rectifier tubes was experienced, because even with condenser input the tubes are run far below their rating. By no means, however, should this power supply be operated without a bleeder resistor. 40,000 ohms is indicated but a much lower value would improve the regulation considerably. Lower values of bleeder resistances would impose a further load on the power transformer and this would necessitate a lower plate input to the oscillator tubes. In other words if the oscillators were drawing 150 mills (M.A.) and the bleeder 50 mills (M.A.) the 150 M.A. rating of the power transformer would be exceeded and the regulation would be no better than with the high resistance bleeder.

With the 40,000 ohm bleeder and condenser input, the voltage is 1,200 with the key up and 800 with the tubes oscillating. This, while not the best regulation, does not result in heavy key impacts or a chirpy note. The regulation is twice as good with choke input, being 900 with no oscillator load and 700 with the oscillators drawing 130 mills (M.A.); the bleeder in each case remaining the same value.

Whether using condenser or choke input, this power supply in conjunction with the transmitter, produces a pure and steady D.C. note.

Parts List for Power Supply

1 800-0-800 volt 150 M.A. power transformer.

1 10 volt 7 amp. filament transformer. (For 830 tubes.)

1 2.5 volt filament transformer. (For 866 tubes.)

2 15 henry 250 milliampere filter chokes.

2 2 mf. 1,000 (working voltage) filter condensers.

1 1 mf. 1,500 (working voltage) filter condenser; optional for cond. input.

1 40,000 ohm bleeder resistor, 50 watt.

2 4 prong sockets.

2 866 mercury vapor rectifier tubes.

A Home-Made Condenser "Mike"

● FOR broadcasting or recording work the condenser mike has hardly any equal and, in fact, is considered by those who should know to be the best type of microphone obtainable.

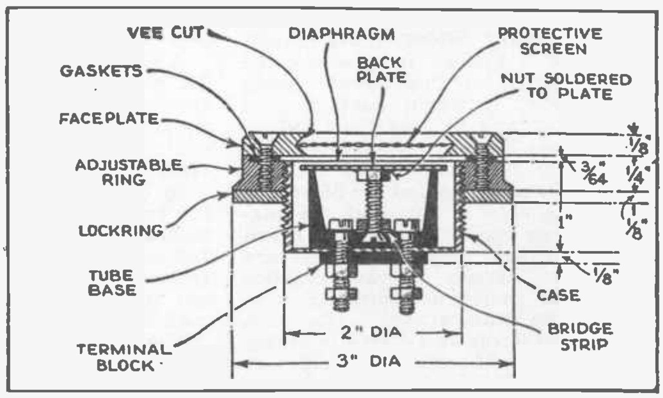
When compared with the carbon type of mike the most important item of interest where high quality is concerned, is the lack of back-ground noises. The "frying carbon hiss" which is generally associated with that of carbon mikes being entirely absent from the condenser mike, giving the clear bell-like response which can be detected instantly by anyone having had experience with high quality microphones.

The writer has experienced trouble, due to the remarkable sensitivity of the mike; the trouble was in the nature of echo effects, due to the room not being acoustically designed for the purpose.

In the average amateur's shack such troubles are to be experienced unless special precautions are taken to deaden the echoes; usually a number of blankets, or heavy curtains, hung around the room, will prove to be quite satisfactory.

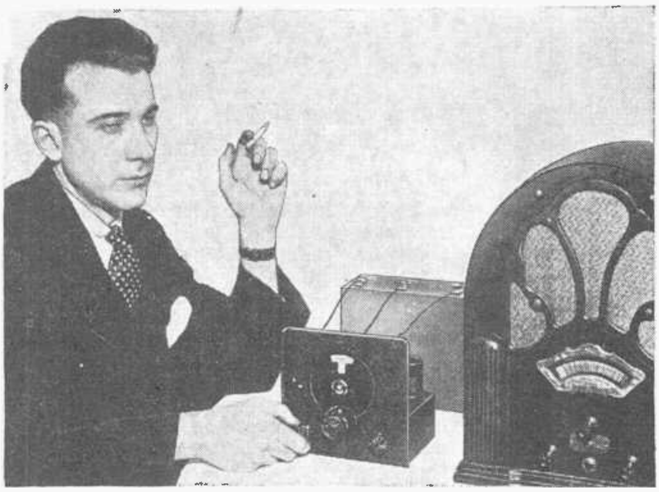
Construction of Microphone

The drawing clearly shows the various parts used in the construction of the microphone and all the important measurements are given. It must be stressed, in the construction of an instrument of this type, that extreme care be taken in all machine work in order that good tone quality will be obtained. The diaphragm must be stretched carefully and it must be free of nicks or wrinkles. The material used for the diaphragm is either tin or aluminum foil .005 inch thick; lay it on a clean piece of glass and rub with a piece of cloth until free of any irregularities. The gaskets are made of three thicknesses of paper about as thick as this page.—*Australian Radio News.*



This drawing shows how to make a first-class condenser microphone.

S-W CONVERTERS



The author adjusting the D.C. converter while bainging in a distant short-wave station.

A D. C. Battery-Operated S-W CONVERTER

By GEORGE W. SHUART, W2AMN

Here is a simple, yet highly efficient, short-wave converter of the D.C. type. It is operated from batteries and employs a type 19 tube, acting both as detector and oscillator. Exceptionally fine results were obtained on numerous tests.

The tuning condensers consist of a two-gang 140 mmf. midget variable, for tuning the two grid coils. It is necessary to use a small *padding condenser* connected across the first detector grid coil, in order to lower the detector frequency to the amount of the intermediate below the oscillator. The value of this condenser should be at least 50 mmf. This padding condenser also serves as the trimming condenser and needs a slight adjustment from time to time in order to keep the two tuned circuits "tracking", as they are tuned over quite a wide range of frequencies.

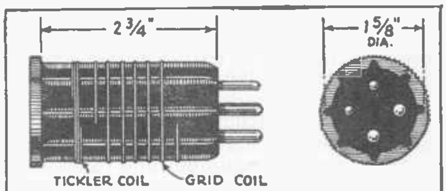
For best results it was found that the oscillator should have 45 volts on the plate. It will work with 22.5 but with slightly decreased efficiency. The detector voltage should be 22.5 in all cases unless regeneration is used, where of course it will have to be adjusted for proper results.

When connected to the broadcast receiver it is important to set the BC receiver to the frequency at which it is the most sensitive. This point is usually indicated by a pronounced rushing sound in the "BC" set. That is, with the volume control full on, the "BC" set will produce a high-pitched rushing sound and plenty of background noise on either the high or low frequency end of the "BC" band. It is at this setting that the "BC" set should be adjusted before the converter is attached.

After the converter has been wired and connected to the "BC" receiver according to the diagram, turn the volume control full on and adjust the small padding condenser on the converter to a point where there is an indication of background noise pickup. Then tune the two-gang condenser until a station is heard. It is best to start off with the 100 to 200 meter coil as there are almost always police stations or 160 meter amateur phone signals to be heard. After the knack of tuning has been acquired other coils can be tried and the various American and foreign short-wave stations tuned in.

Parts List—D.C. Converter

1 metal chassis. Blan.
1 2-gang 140 mmf. var. condenser. National (Hammarlund).
2 4-prong wafer sockets. Na-Ald.
1 6-prong wafer socket. Na-Ald.
1 50 mmf. var. condenser. National (Hammarlund).
1 20 ohm rheostat.
2 .0001 mf. mica condensers.
1 .00025 mf. mica condenser.
1 2.5 to 5 mh. R.F. choke. National. (Hammarlund).
1 dial. National "B".
1 2 meg. gridleak. Lynch.
1 20,000 ohm gridleak. Lynch.
1 19 tube R.C.A. Radiotron (Arco.).



RANGE OF COILS 16 - 220 METERS

-GRID COILS-

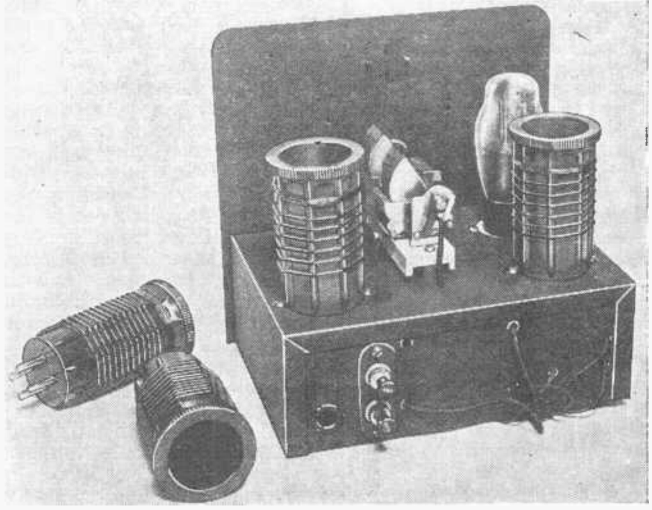
No.1	7 TURNS	No.18 ENAM. WIRE	SPACED OVER	1 1/2"
No.2	13 TURNS	No.18 ENAM. WIRE	SPACED OVER	1 5/8"
No.3	22 TURNS	No.20 ENAM. WIRE	SPACED OVER	1 5/8"
No.4	45 TURNS	No.28 ENAM. WIRE	SPACED OVER	1 1/2"

-TICKLER COIL-

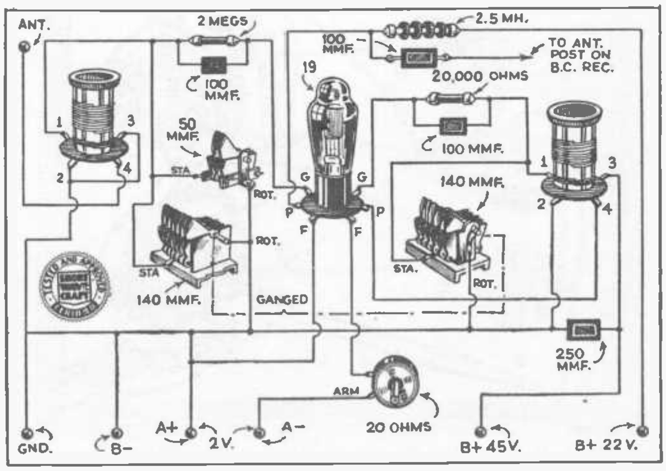
No.1	6 TURNS	No.28 ENAM. WIRE	CLOSE WOUND.
No.2	9 TURNS	No.28 ENAM. WIRE	CLOSE WOUND.
No.3	12 TURNS	No.28 ENAM. WIRE	CLOSE WOUND.
No.4	20 TURNS	No.28 ENAM. WIRE	CLOSE WOUND.

SPACE BETWEEN GRID AND TICKLER COILS 1/8"

Bruno coil data.



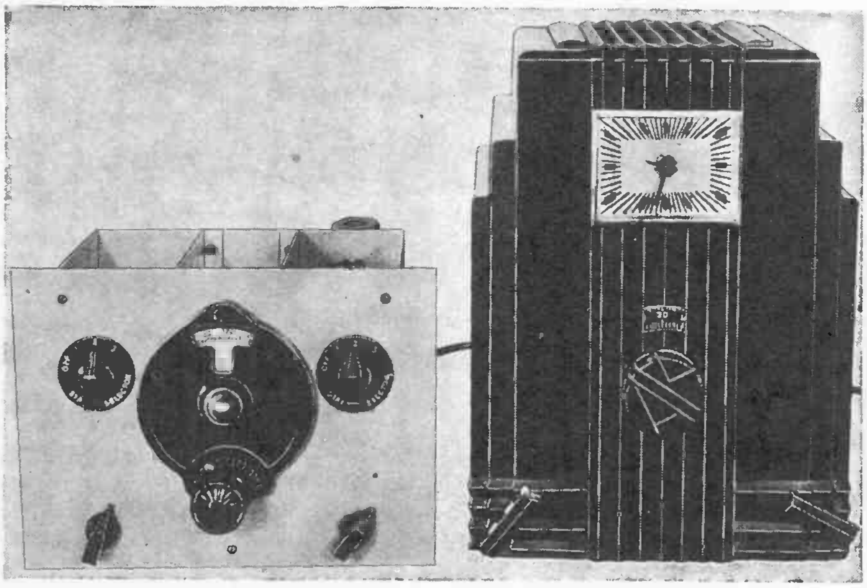
Rear view of the D.C. converter, which is operated from batteries and uses only a single 19 tube.



Both schematic and picture diagrams have been laid out by the author as shown above, so that even the tyro can build it.

Mono-Coil Converter

By GEORGE W. SHUART
W2AMN

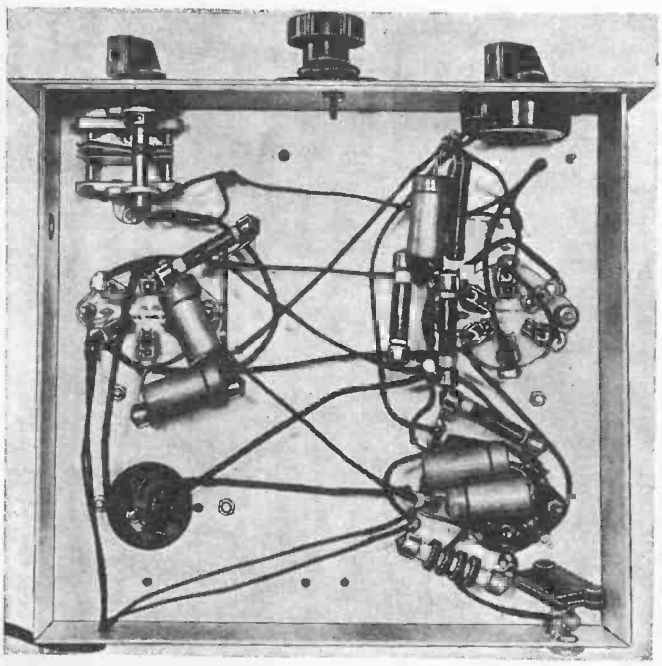


The "Mono-Coil" S.W. converter appears at the left of the photo, and when connected to a broadcast receiver (right), excellent short-wave reception was enjoyed.

● FOR the short-wave fan who is only interested in the reception of *phone* or *broadcast* stations, a good converter is the answer to his prayers. A well-designed superheterodyne converter used in conjunction with a fairly up-to-date broadcast (200 to 550 meter) receiver will provide really enjoyable short-wave reception for several well-known reasons. First, we usually have a good audio amplifier and speaker, which will give nice tone and volume, in the "BC" set. Second, the "BC" sets usually have tone-control and the later models have automatic volume control; these two features alone improve reception on the short waves more than can be imagined. The tone control can be used to lower the hiss and back-ground noise usually encountered in S-W reception, while the automatic volume control will go far to reduce the fading which has spoiled many a program.

Why Converters Fail

It is just as easy and some times more economical to build a converter than a regular receiver. This *Mono - Coil* converter will cost no more to build than a good three-tube receiver and the results will be far more gratifying. Many S-W fans have lost faith in converters because of the poor results they have obtained with them, having either built or purchased small one- or two-tube converters (or adapters) which yielded discouraging results. Well, a two-tube converter, unless carefully designed, will not work satisfactorily on all "BC" sets. If the "BC" set is not so sensitive no signals will be heard. A one-tube converter is hopeless unless in the hands of a magician and then he will probably get grey hair trying to pick up even the strongest stations.



Here's how the under-side of the "Mono-Coil" S.W. converter looks—pretty simple wiring, isn't it?

Works on Any Broadcast Set

The *Mono-Coil* converter will give excellent performance on any broadcast receiver having at least one stage of tuned radio frequency amplification. It was designed to give full loud speaker volume on the "weakest" *foreign* station, when used in conjunction with an A.C.-D.C. receiver having one stage of T.R.F., detector and one audio. These sets are known to have poor gain especially on the low frequency end of the tuning range (around 550 meters) where it has to be tuned to work with this converter. It was possible to bring in stations with enough volume to completely over-load the midget and it was necessary to turn the volume control nearly all the way off to get good tone!

When used with a set having two stages of T.R.F., the combination provided one of the most sensitive "SW" *superheterodynes* we have had the pleasure of working. The fine results produced by this converter is due to its efficient coil design and the use of the stage of I.F. *which is incorporated right in the converter.* The use of this I.F. stage makes it possible to use the converter on any set, even an old style battery receiver. For those living in districts where there is no 110 volt power supply, the substitution of 6.3 volt battery tubes for those shown in the diagram, will solve the problem. They should be a 6C6 for the detector, a 6C6 for the oscillator and a 6D6 for the I.F. amplifier. A six-volt storage battery together with 135 volts of "B" batteries will give excellent results. No change in the wiring of the converter is necessary when using the 6.3 volt tubes.

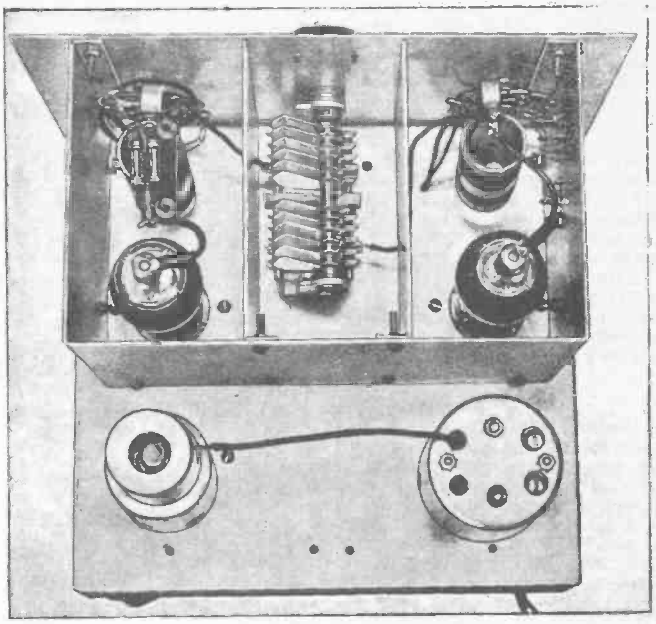
Separate Tubes Used

Separate tubes are used for the first detector and the high frequency oscillator. A 2A7 pentagrid converter could, of course, have been used but the same efficiency cannot be expected for one reason and that is that it is difficult to lay out the parts so as to provide short leads and still have ample shielding. Using two separate tubes it is possible to get an almost perfect layout and one that will allow the best possible shielding. The chassis used in building the converter is the same as used for the T.R.F. Mono-Coil set last month. This chassis was used, as we said before, because it permits a perfect layout with the best shielding, and the builder should by all means adhere to this design for best results.

The coils used are almost identical to those used in the T.R.F. job last month. In fact the detector coil is exactly the same, but the oscillator coil requires a slight change in the number of turns, it requiring slightly less grid turns than the detector coil. Complete details are given in the coil drawing.

The three-turn tickler coil used previously has been increased to four turns

By a few simple connections, as outlined in the article, this converter receives its power directly from the broadcast receiver. No separate eliminators or power supplies are necessary. The use of the new "Mono-Coils" together with a very efficient circuit design permits reception on all major stations with exceptionally great volume. Three tubes are used—one for the first detector, one for the high frequency oscillator, and another as the I.F. amplifier. Tests showed remarkable reception.



Note the extremely neat and effective layout of the apparatus in the "Mono-Coil" S.W. converter.

and the cathode coil now has five turns. The number of turns were increased to allow a stable oscillator because the grid-leak has been decreased in value. The few turns used last month would not provide even output over the entire tuning range covered by the oscillator.

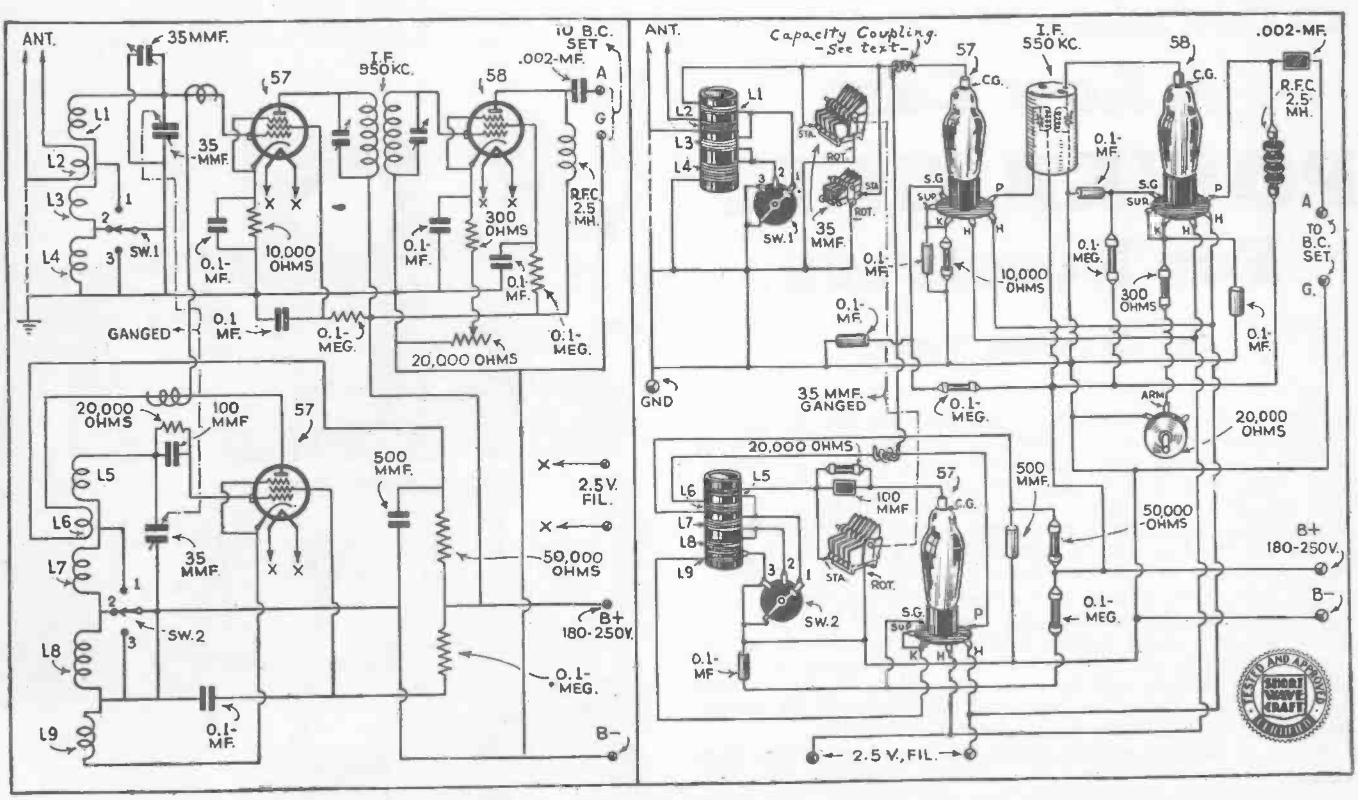
Circuit

The first detector is of the power type with the grid-bias being provided by the cathode resistor. Its tuned grid circuit is gauged with the oscillator grid circuit to provide single-control tuning. A small trimmer condenser is used to allow a fine adjustment of the detector circuit and to keep it in proper alignment with the oscillator. This trimmer need only be set once for any one of the bands covered by the converter.

The I.F. stage used in the converter is provided with a volume or gain control. This is very helpful as one does not have to turn to the broadcast set while tuning and at times a better signal-to-noise ratio can be obtained with the adjustment of this control.

Coupling between the oscillator and first detector is accomplished by a small capacity between the oscillator plate and the detector grid. The best amount of coupling was obtained by using a short length of hook-up wire and twisting it three times around the connecting wire right at the plate of the oscillator tube. The other end of the short wire is wrapped around the grid lead which connects to the stator of the trimmer condenser of the detector stage, three turns are also used here. This coupling method is clearly shown in the diagram.

This coil will not, or rather, does not cover the entire range of from 15 to 200 meters. The bands on which all the foreign and domestic stations are broadcasting are covered. (19, 25, 31 and 49 meter bands). This means



Schematic and picture wiring diagrams for building the "Mono-Coil" Short-Wave converter. The cost of building this converter is nominal. This is a "Certified" circuit.

that tuning can be done with a small condenser capacity allowing a better IC ratio and greater tuning ease. Changing of bands is accomplished with a simple single-pole three contact rotary switch for each stage.

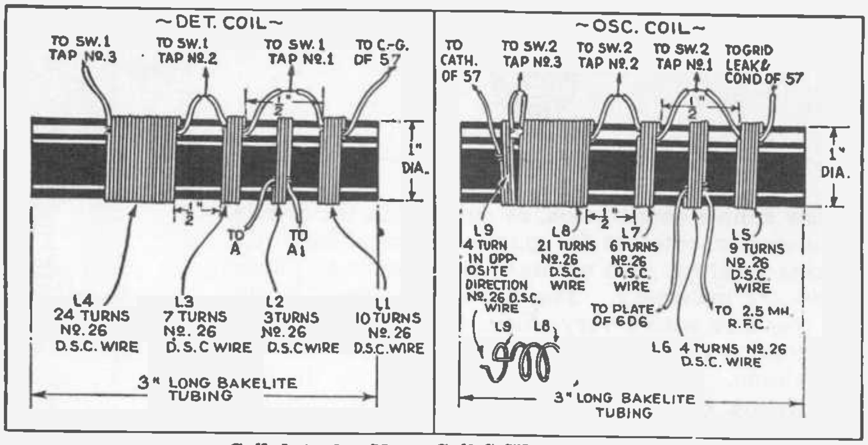
The layout of the parts is as follows: the two-gang tuning condenser is located in the center shield compartment, to the left of this is the detector stage and to the right is the oscillator stage. Behind the detector is the I.F. transformer and behind the oscillator stage is the I.F. tube. The detector trimmer is on the lower left of the panel and the volume control is on the lower right.

After the converter has been wired correctly the job of getting the whole thing lined up properly is at hand. This, if done according to the following instructions, is not at all difficult.

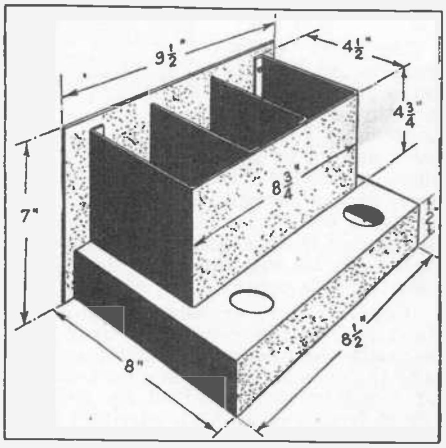
Aligning Converter

Connect the output of the converter to the antenna and ground posts of the "BC" set, connect the two filament leads to any pair of filament prongs of the "BC" set, except to those that go to 245 tubes. It is best to connect them to the filament prongs of an RF stage. Then connect the "B" plus lead of the converter to any point along the voltage divider of the "BC" set that gives between 135 and 250 volts; the "B" minus is taken care of in the connection to the chassis. Now turn the "BC" set on and tune it to the broadcast station that comes in on the lowest frequency.

Disconnect the grid cap of the oscillator tube of the converter; attach the antenna directly to the grid of the detector tube. Now adjust the I.F. transformer on the converter until that broadcast station, to which the set was tuned, comes in with maximum volume; the whole outfit is now aligned on that frequency. Now put the grid cap back on to the oscillator tube and connect the antenna to the antenna post on the converter. The next move is to tune the "BC" set slightly lower in frequency (about one point on the "BC" dial) than the "BC" station used to align the stages. Now tune the converter carefully until a station is heard, then readjust the I.F. transformer on the converter for maximum signal. A slight adjustment of the tuning dial as the I.F. stage tuned will result in perfect alignment.



Coil data for Mono-Coil S-W Converter.



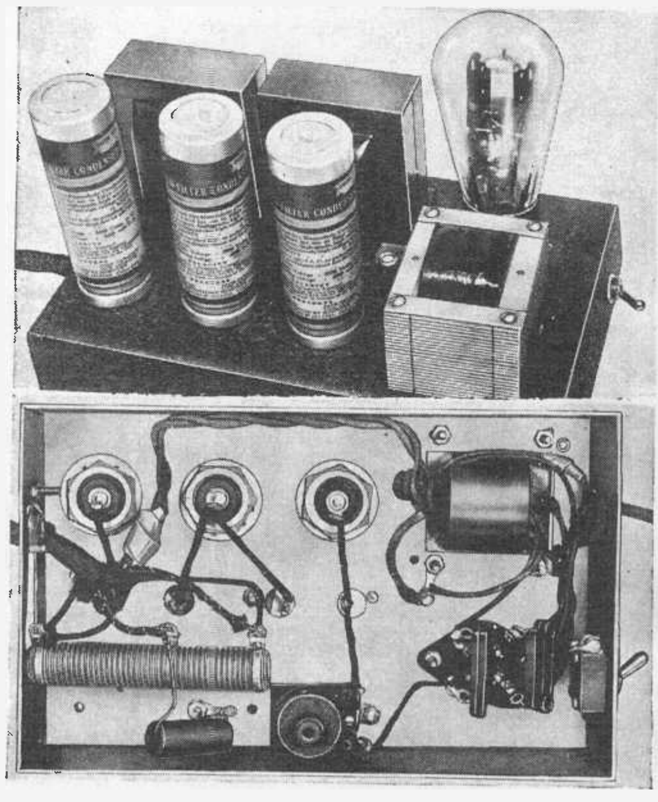
Chassis dimensions.

Parts List for Mono-Coil Converter

1—Aluminum chassis with shield components, see text. Blan. (I.C.A.; Korrol.)
2—Mono-Coils, for construction see drawing.
2—3 or 4 point rotary switches. Blan.
1—2 gang, 35 mmf. tuning condensers. Hammarlund.
1—35 mmf. midget condenser. Hammarlund.
1—.0001 mf. mica condenser. Cornell-Dubilier.
1—.0002 mf. mica condenser. Cornell-Dubilier.
1—.002 mf. mica condenser. Cornell-Dubilier.
1—.1 mf. by-pass condenser. Cornell-Dubilier.
1—20,000 ohm, ½ watt resistor. Ohmite.
1—10,000 ohm, ½ watt resistor. Ohmite.
3—100,000 ohm, ½ watt resistors. Ohmite.
1—50,000 ohm, ½ watt resistor. Ohmite.
1—20,000 ohm volume control resistor. Ohmite.
1—R.F. choke, 2.5 MH. Hammarlund.
1—I.F. transformer that will tune to 550 kc.
2—6 prong Isolantite sockets. Hammarlund.
1—6 prong laminated socket. Na-ald.
2—switch knobs and dials. Blan.
1—National type B dial.
1—tube shield. Hammarlund.
2—antenna ground terminal strips. Na-Ald.
1—four wire battery cable. Belden.

A Low Cost POWER UNIT For Receivers

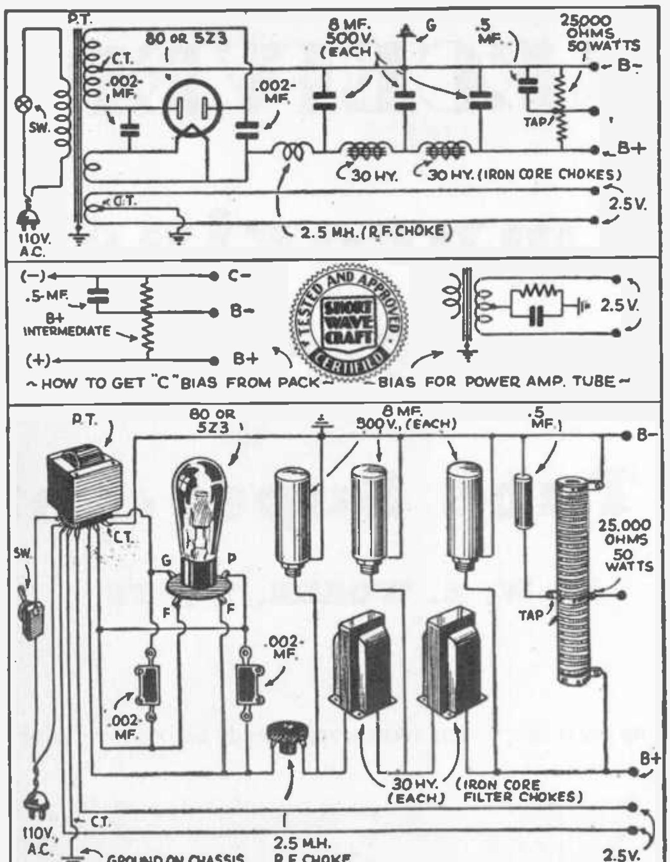
By Leonard Victor



● ONE of the most common bugaboos that the set builder runs across is hum in receivers. Peculiarly enough most constructors never give the *power source* much consideration. Yet, it is the life-supply for the set, the power-plant that supplies the "juice" to make the wheels go round! Most packs that I have seen were hay-wire affairs thrust off on the floor or the bottom shelf of a table, with leads running every which way from them.

The little pack shown and described is one that I made up for testing purposes around the "shack," and although it did not cost eight dollars in its entirety, still up to 300 volts of pristine pure, direct current at 60 mills is available when needed, and likewise 2½ volts at any current up to ten amperes. The layout of the pack can be clearly seen from the picture and schematic diagram.

There is nothing unconventional in any part of the pack circuit. A midget power transformer provides the high voltage, rectifier filament voltage, and the 2½ volt winding for filament supply on the unit with which the pack is used. A 280 is used as a conventional full-wave rectifier,



Schematic and picture diagrams of the "power-supply" unit

followed by a two section filter system and a bleeder resistor. The "B" and filament currents are connected to a five-foot cable which is used for connection to sets. The filter system consists of three 8 mf electrolytics and two 30 henry, 100 M.A. chokes. The following are general truths that can always be followed in choosing apparatus for power supplies.

Transformers

When purchasing a power transformer for a receiver, make sure that it will supply enough current for all the tubes in the receiver. For instance, if the set is a four tuber, with a '47 in the output, it will draw about forty milliamperes. Hence the rating of the high voltage winding should be at least 50 mills (M.A.), at the required voltage (300). For short-wave work, the best type of transformer is one that has an electrostatic shield. This is a winding between the primary and high-voltage winding, which is connected to the core of the transformer and grounded; this shield frequently eliminates annoying hums. Likewise be sure that the filament winding on the transformer will supply sufficient amperage for the set. Even the cheapest of transformers will stand some overloading, but it is good practice, and eliminates quite a few "headaches" if all apparatus is run *underloaded*. If the transformer is to be used, reused, and then once more reused, (as in most experimental shacks), get one with soldering lugs, as the type with wire leads will perhaps cause trouble in some instances, due to too short a lead or frayed and sloppy connections.

The Rectifier

A 280 is the most common choice for the rectifier, but if there is to be a heavy drain and the transformer is built to give a 3-ampere, 5-volt winding, a 5Z3 should be used. The 5Z3 is the big brother to the 280, and will give more current, with lower voltage drop in the tube. Never use mercury vapor tubes, such as the 82 and the 83, as this is only courting trouble from various types of *hums*.

The filter system consists usually of condensers across the positive and negative output of the transformer—rectifier system, with chokes in series with either the negative or positive lead. Electrolytic condensers are the most compact type, and being generally made with a 500 *volt rating* will usually be good enough for any receiver power supply. One caution though. Always be sure to buy a standard, reputable make of condenser. I had one of the surprises of my life when I saw several cheap brands of so-called 8 mf. electrolytics put across a capacity meter, while in operation. Their capacities ranged *anywhere from two to five mikes* under operating conditions! Likewise, cheap condensers usually have short life, and after a year or so will have to be yanked out and replaced. Chokes should be 30 henry units capable of carrying the current needed. If the pack is to supply 60 mills (M.A.), a choke with a 100 mill rating at thirty henries should be used. Again, as with the condensers, do not buy *cheap* chokes.

Bleeder Resistor

For a pack up to 350 volts, a 25,000, 50 watt resistor is the correct bleeder. Sliders on the resistor will provide any desired voltage between high and ground. Remember to *bypass* every tap to ground through a condenser, even if it by-passed in the set. Should it be desired to get "C" bias from the pack, it is only necessary to use some point above ground as "B" minus and the remainder of the resistor back to the negative point on pack will be at minus potential. This is shown in an accompanying diagram. To obtain bias for a power tube, such as a '45 or a '47, a resistor is put in series with the filament center-tap. This resistor is bypassed by a high capacity, low-voltage condenser, generally 5 or 10 mf. rated at 50 volts. The circuit for this is shown in the diagram. For a single 245, the resistor should be 1500 ohms! for a 47, 450 ohms. These resistors should be of 5 watt rating, wire-wound.

Tunable Hums

One annoyance sometimes encountered with home-made packs is the so-called *tunable* hum, a hum appearing at certain frequencies, particularly when the set is oscillating. This type of hum is unaffected by the amount of filter used. A simple scheme that works perfectly in most cases is shown in the main diagram. It consists simply of by-passing the elements of the rectifier tube with .002 mf. mica condensers. The capacity is not critical and .001 mf. may be used just as well. The little rf. choke between the rectifier tube and the first filter condenser is also a "hum-killing" gadget.

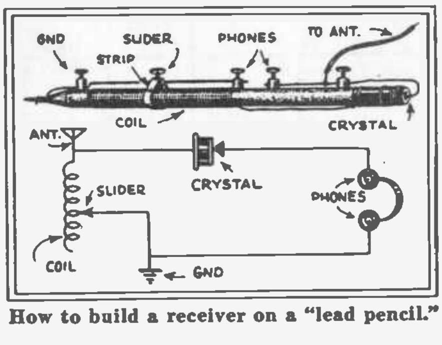
Remember to always use a *good* ground, and be sure that all chokes and transformers are *grounded* to the chassis. Likewise always to ground the centertap of all filament windings, even if they are only *spares* that are not being used on the set.

Parts List—Victor Power Supply

1—Chassis—American Sales Co.
1—Power transformer 325-0-325 V., 70 ma. 2½ volts, 5 volts, R. T. Co.
2—30 henry filter chokes, 70 ma. American Sales Co.
3—8 mf. electrolytic condensers (500 V).
1—½ mf. condenser (200 V).
1—25,000 ohm, 50 watt voltage divider. (With slider.)
2—.002 mf. mica condensers.
1—R.F. choke. 2.5 M.H. Hammarlund (I.C.A.)
1—4 prong wafer socket.
1—"On"-"Off" switch. (I.C.A.)
1—type 80 or 5Z3 RCA Radiotron (Arco)

A "Lead Pencil" Receiver

● BOYS will be boys, so why not be a boy again and build this pencil radio set? Just an ordinary everyday lead pencil, about eight or ten feet of No. 30 enameled wire, a crystal, and head set, with a few binding posts thrown in for good measure will do the trick. Be sure to use a pencil that has an eraser attached in a tin housing. Remove the eraser and fasten your crystal to the tin housing, either on the end or on the side. Your tuning slide can be made out of a square piece of bus-bar wire. To use this set out of doors fasten a piece of copper wire two and

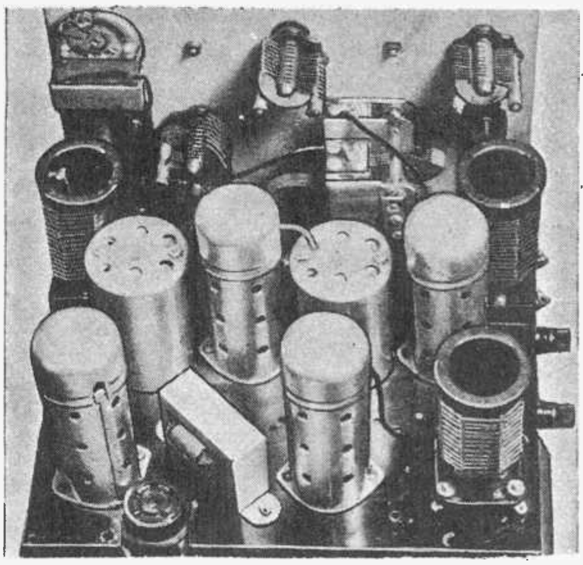


How to build a receiver on a "lead pencil."

½ feet long by ⅛ inch thick to the bottom of pencil, this will be convenient to ground the set and bring it up to the right height, so that you can tune in while sitting on a park bench; if the park bench is made of iron that will serve nicely as an antenna.—*A. F. Kuenzel.*

This crystal receiver can also be used in offices in cities where there are plenty of broadcasting stations. A good antenna in this instance is a small disc of metal placed under a regular desk phone base, connecting the antenna lead from the set to the disc.

SUPER-HET RECEIVERS



Improving the VICTOR 2 Tube Super-het

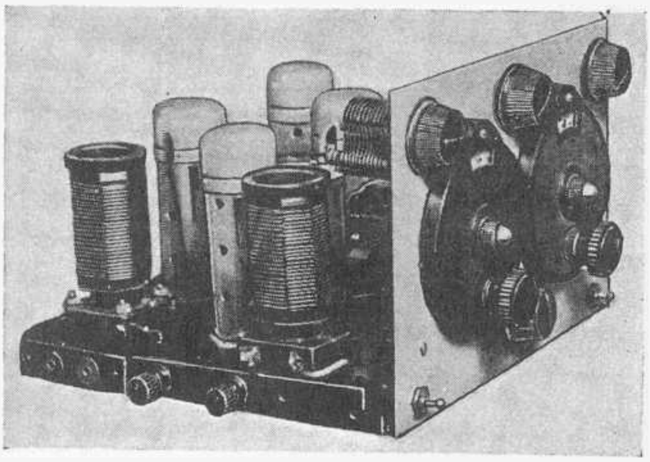
By W. A. WOEHR, W9PTZ

● RESULTS obtained by those who built the Victor 2-*Tube Super-Het*, described in the December, 1933, SHORT WAVE CRAFT, testify to its high efficiency in "pulling 'em in," despite the fact that only 2 tubes and a minimum number of parts are used. At the author's location, generally considered as being only "fair," this little set brought in all the well-known *foreign* short wave stations as well as a host of U. S. amateur, police, commercial and experimental stations. Consistent results of the "Victor" were certainly *above par* as compared with the usual run of popular short-wave receivers tried out, including both home-made and factory-built sets.

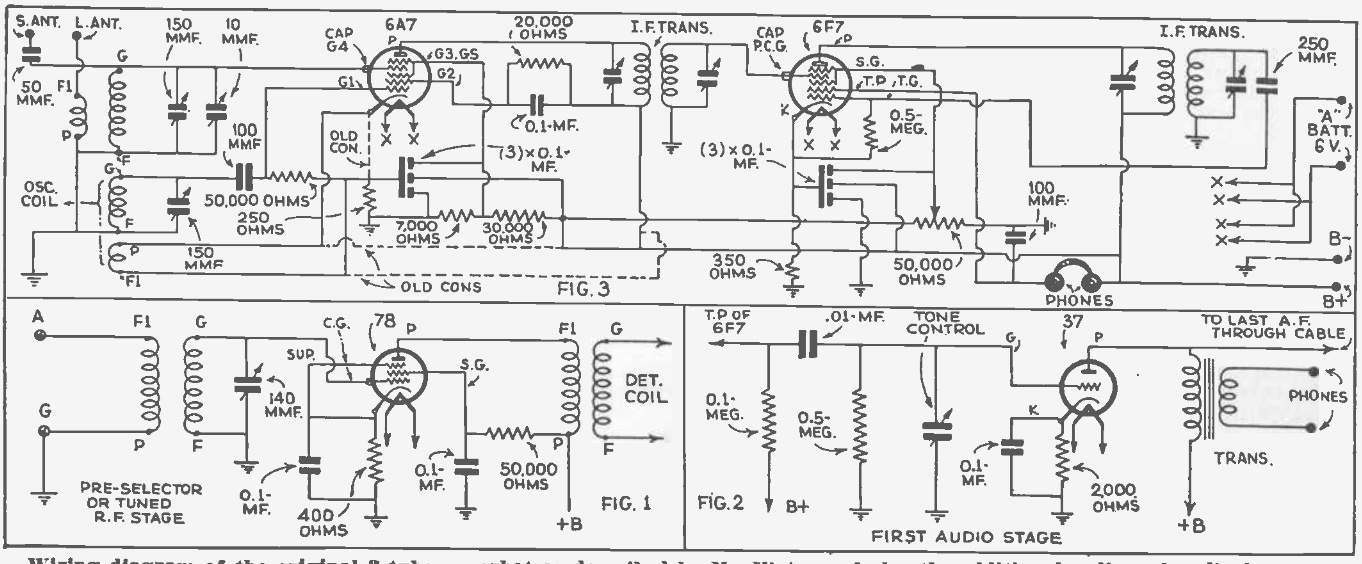
However, it was felt that this two-tube super-het would serve admirably as the basis for something just a little better, and capable of much greater performance, both as a stationary and as a "portable" receiver, with only a few changes and the addition of but two tubes.

R.F. and A.F. Stages Added

The main improvements, as first noticed on viewing the set (from the front), are a pre-selector stage of tuned R.F. and one stage of audio amplification. The other tuning dial is for *band-spreading*. The original oscillator circuit, using the triode portion of the 6A7, has the tickler of the oscillator coil, connected in the plate circuit. With a very steady line voltage or using "B" batteries, the original hook-up holds the weaker signals very steady but any variation of



Perspective view of the improved Victor superhet with added stages of R.F. and A.F.



Wiring diagram of the original 2-tube superhet as described by Mr. Victor and also the additional radio and audio frequency stage diagrams, to be added as described by Mr. Woehr.

plate voltage *detunes* the circuit more than is permissible.

This was very impressively brought to light one day while comparing the performance of the original super-het with a well-known factory-made three-tube battery model. The battery model was running circles around the Victor, that day, both in ease of tuning and freedom from fading; operation being in the 20 meter band. The Victor was all A.C. operated at the time. Changing over to "B" battery plate-supply the results were just about 100 per cent the reverse, in fact the Victor worked so much smoother and better, that the "B" eliminator was very carefully checked for a defect. A check of the line voltage showed variations of 5 to 15 volts which would give variations of as high as 35 volts to the oscillator plate. Since we could not "steady" the line voltage, any remedy used would have to be applied to the oscillator.

Cathode Coil in Oscillator Circuit

A simple variation of electron coupling was finally adopted, and while it may be considered a "trick" circuit by some, it certainly has proven its worth in operation from unsteady A.C. lines. The remedy is as follows. Remove the tickler from the plate circuit of the 6A7 and place it directly in the cathode circuit of the same tube. Connect it in right next to the tube, in the lead that runs from cathode to the 250 ohm resistor and by-pass condensers. The lead which formerly ran to F1 of the tickler is now run directly to "B" positive. Be sure the circuit oscillates after the changes are made, and in case it does not, *reverse* the tickler leads at the coil, as the correct polarity must be maintained.

"Band-Spread" Dial Added

The next improvement was the addition of a band-spread dial, a virtual necessity for amateur work. In the picture, it is the right-hand dial, the center knob at the top is the detector trimmer condenser and the knob between the two dials at the bottom, the volume control. The Band-spread condenser used is a midget made over into a double-section affair, having a common rotor and two stators. Each stator section contains three plates, this giving about 65 degrees spread on the 160 meter phone band. Two plates per stator will give about 90 degrees spread, if one cares for that much. In hooking up the *band-spread* condenser, the rotor is grounded, one stator connects to the main detector tuning condenser stator, the other midget stator goes to the oscillator condenser stator.

To use the band-spread, set the right-hand dial at about 10. Tune the set as usual to the very high frequency edge of the band being used. From now on, all tuning over this band is done with the band-spread dial, stations formerly hard to tune in being brought in with a new sense and ease of control. A slight adjustment of the detector trimmer condenser may be needed as we tune from one end of the band to the other.

In most locations a certain level of *background noise* is encountered and any receiver using a *tone control* can usually reduce this noise to a satisfactory level, for general reception. However, the application of the step capacity or resistor and capacity method of tone control has the disadvantage of also reducing signal strength along with the noise. Summer static, plus a more or less constant background-noise level, made the tone control a much wanted feature. It was felt advisable to add one stage of audio, with the tone control, to give us better reception with less noise, plus the added advantage of more over-all "gain" for the receiver. A type 37 tube is used, resistance coupled to the 6F7, together with a matching transformer in the plate circuit to couple to the headphones. This transformer is not needed but was used as it was at hand. The phones could just as well be placed directly in the plate circuit of the 37 as the plate current in only a few mills (milli-amperes). The tone control is of the four-point switch type used for replacement on broadcast sets, and is connected from the grid of the 37 to ground.

Looking at the front view of the set, the tone control is the right-hand knob; the audio stage being the tube and transformer at the right hand rear of the chassis. For amateur work in a "noisy" location the addition of this audio stage is greatly appreciated. In the author's receiver the 37 is impedance-coupled to a final audio stage using a 2A5, the primary of the audio transformer in the plate circuit of the 37 serving as the plate impedance, while a 500,000 ohm potentiometer is the grid resistor for the 2A5, the movable contact going to the grid, thereby giving us a volume control on the last audio. The headphones are left connected to the audio transformer and when used, the speaker is turned off by means of the last audio stage volume control.

R.F. Stage a Worthy "Added" Feature

Experiments with a stage of tuned R.F. ahead of the first detector removed all doubt as to its "justification" and left us with the firm impression that we had indeed been missing something worthwhile and did not know it. The *pre-selector stage* is the coil and tube on the left rear of the chassis, the tuning condenser being controlled by the upper left-hand knob on the panel. The R.F. circuit is given in Figure 1. Be sure to disconnect the ground lead to the detector "Ant" coil before hooking it up to the R.F. stage. A type 78 tube was used, although the type 6D6 could be used without any circuit changes.

As the set was to be used mostly for amateur work a 24 plate midget variable condenser was used to tune the R.F., but for all-around work a .00015 mf. size is recommended. A more elaborate set-up would be to use three-gang condensers on the main and band-spread tuning dials. In our case the midget covered the bands very nicely, all tuning over any one band being done with the band-spread dial and with slight adjustments of the R.F. knob.

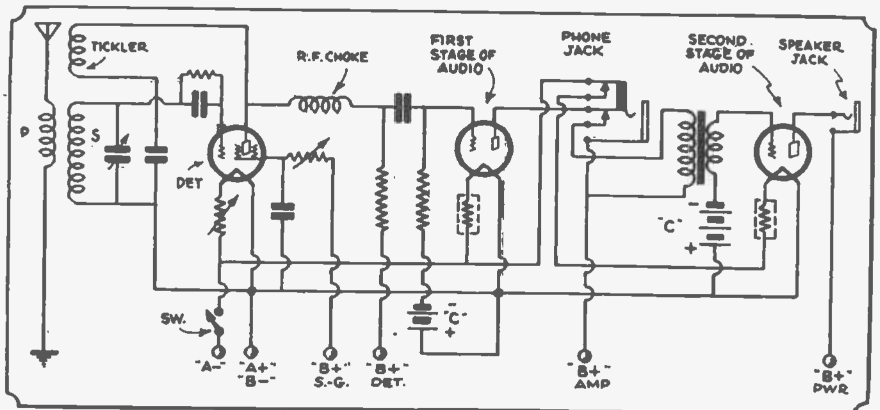
Four-prong plug-in coils, of the same type as used in the detector and oscillator stages, are employed for the pre-selector stage, although a tapped coil might also be used in this position, if one wished to avoid using another plug-in coil. As for actual results after adding this R.F. stage, a decided increase of the signal-to-noise ratio was at once apparent, together with a very much better "over-all" *gain*, plus a distinct increase in *selectivity*—something most amateurs always want but never seem to have enough of.

Parts for 2-Tube Superhet

Two sets of standard S-W receiving coils Na-ald (Bud).
1—2-gang .00015 mf. variable condenser National (Hammarlund).
1—.000015 mf. variable condenser (Trimmer), National (Hammarlund).
1—.00075 mf. fixed mica condenser (Cornell-Dubilier).
2—.0001 mf. fixed mica condensers (Cornell-Dubilier).
1—.00025 mf. fixed mica condenser (Cornell-Dubilier).
1—.1 bypass condenser (Cornell-Dubilier).
2—3x0.1 mf. bypass condensers (Cornell-Dubilier).
2—465 kc. intermediate transformers (National, Hammarlund).
1—50,000 ohm, 1 watt resistor, Ohmite.
1—250 ohm, 1 watt resistor, Ohmite.
1—7,000 ohm, 1 watt resistor, Ohmite.
1—30,000 ohm, 1 watt resistor, Ohmite.
1—150,000 ohm, 1 watt resistor, Ohmite.
1—350 ohm, 1 watt resistor, Ohmite.
1—500,000 ohm, 1 watt resistor, Ohmite.
1—20,000 ohm, 1 watt resistor, Ohmite.
1—50,000 variable potentiometer, wire-wound, Electrad.
1—2A7 wafer socket. Na-ald.

Improved Filament-Control Circuit

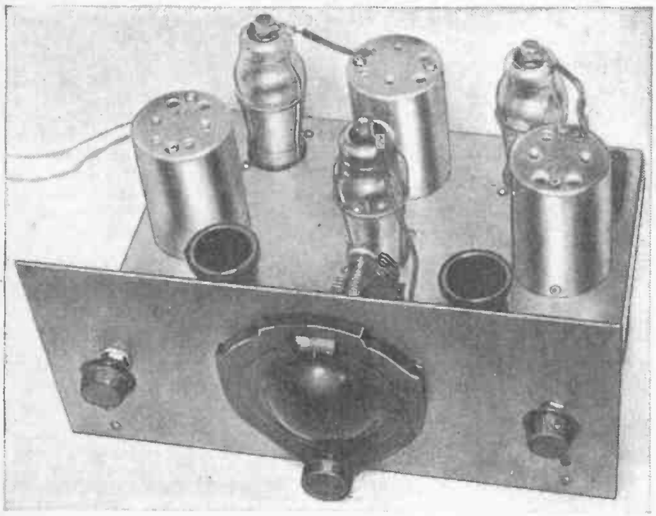
● IN the usual filament-control jack circuit employed in d-c. short-wave sets, the jacks are wired so that the filaments of all of the tubes in the set are turned off when the headphones are not plugged in. When the head-phone plug is put in the first jack, the detector tube is lighted; when the loud speaker plug is in the second jack, both the detector and amplifier tubes are lighted. However, two filament-control jacks are hardly necessary if a filament switch is employed. Instead, a single filament-control jack connected as shown in the diagram will make the set less complicated. This is an improvement over the usual filament-control jack circuit in that it is less expensive, easier to wire, and that when the headphones are plugged into the phone jack the filament of the last amplifier tube is turned off. When the phone plug is removed, all of the tubes are lighted and the loud speaker is in use. This arrangement is handy because it saves the operator the trouble of having a separate plug on the loud speaker. Headphones are not satisfactory for reception on more than one stage of audio amplification anyway, because the volume is usually too great. Binding posts or phone-tip jacks can be provided as connectors for the loud speaker. The phone jack can be placed in the output of the detector tube, instead of in the first stage of audio amplification, if preferred; although the latter connection, which is given in the diagram, is better.—*George Mark.*



With this easily wired circuit, employing a single "filament-control" jack, the last audio tube is cut out of the circuit when headphones are used.

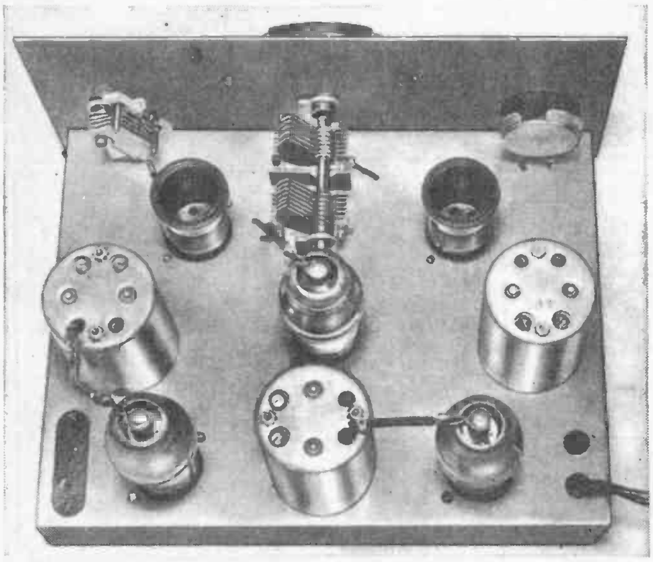
3 Tubes=6 In This SUPER-HET

By M. HARVEY GERNSBACK



Front view of "3 tubes=6" Super-het. European musical and vocal short-wave programs "rolled in" like nobody's business on this marvelous 3-tube receiver, which actually does the work of 6 tubes.

● THERE are now a number of multi-element "double-purpose" vacuum tubes on the market, such as the 6B7, the 6A7, the 6F7, etc. By suitable selection of these tubes it is possible to build a receiver using only 3 tubes which will give the performance of a much larger receiver. The set described uses a 6A7 as first detector and oscillator, a 6F7 as first I.F. amplifier and audio amplifier and a 6B7 as second I.F. amplifier, second detector and delayed A.V.C. tube. Three tubes perform 7 functions! The 6A7 is a pentagrid converter, the 6F7 a combination of a variable mu R.F. pentode and a separate triode, both sections of the tube employ a common cathode. The 6B7 consists of a variable mu R.F. pentode and 2 separate diodes. The 2



Rear view of "high efficiency" Super-het, designed to make maximum use of the latest "double-purpose" tubes. Three tubes perform seven functions!

pentode units are used for the I.F. amplifier stages with A.V.C. applied to one of them (the 6F7); the triode is used as the audio stage and the 2 diodes as second detector and A.V.C.

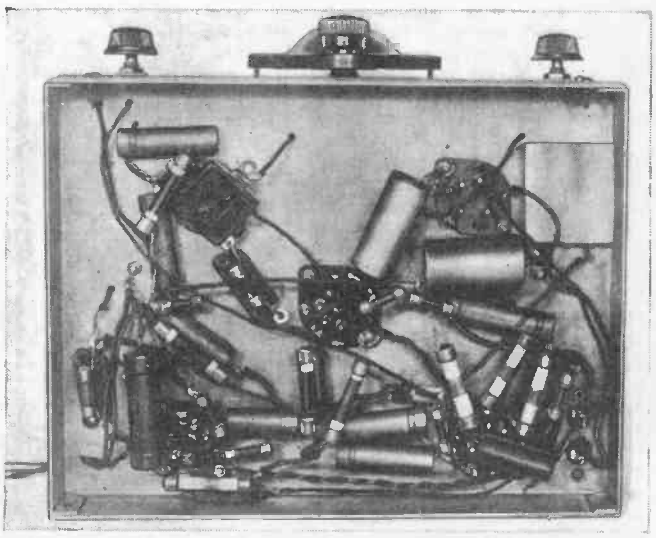
Not a "Freak" Set

It should be understood that this is not a freak set requiring careful manipulation of many controls. There are only 3 controls—volume, main tuning, and antenna trimmer. None of them are critical. As constructed the receiver is for headphone use. However the addition of a resistance coupled power stage employing a pentode (either a 41 or 42) will give full loud-speaker volume, even on European stations! An extra audio stage of this type was set up beside the receiver and connected to a 12-inch dynamic speaker; Daventry GSD was tuned in and it was necessary to reduce the volume to enjoy the program!

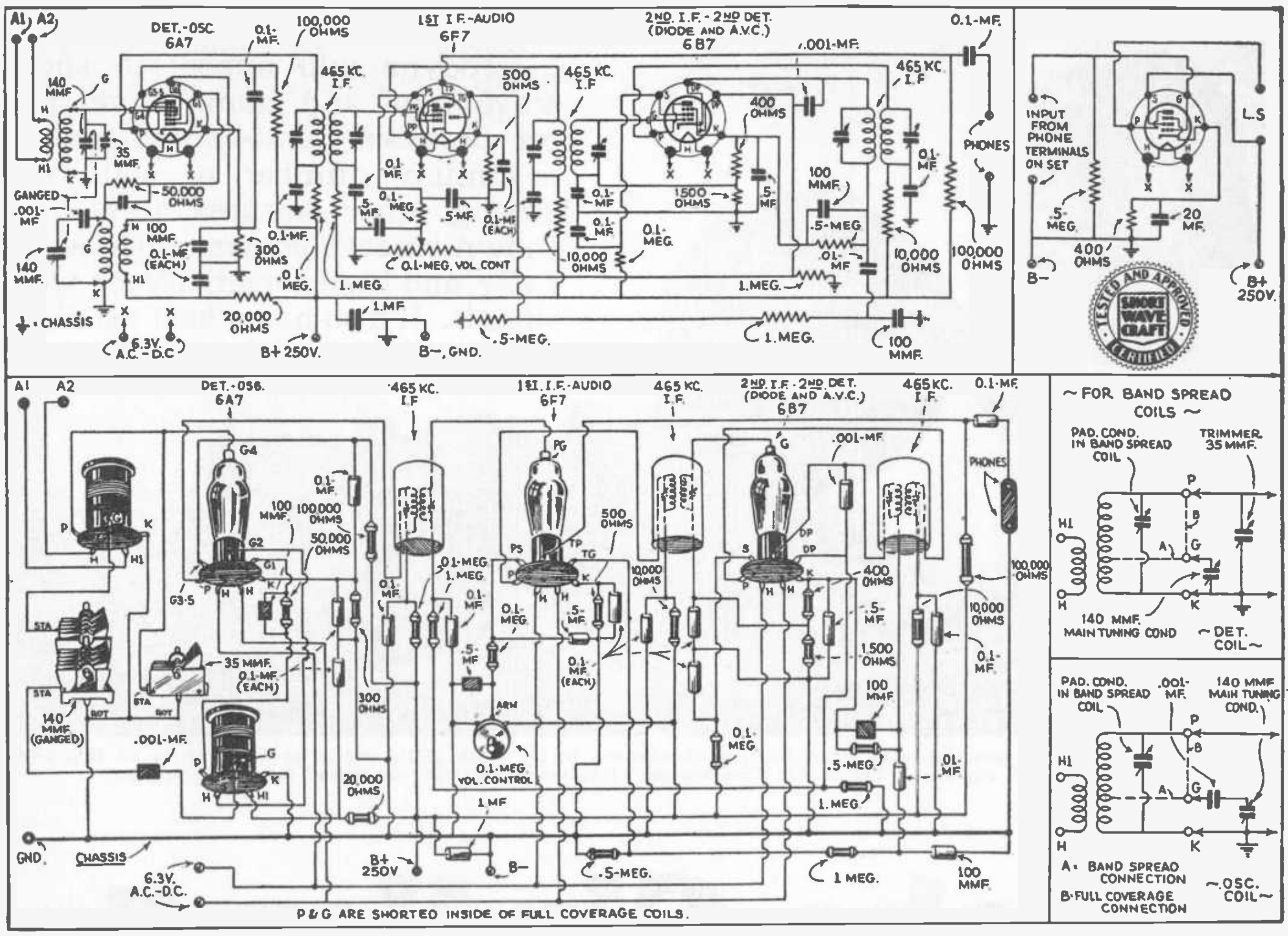
The construction of the set offers no difficulties provided the specified layout is followed. The main tuning condenser is a 2-gang affair, with 140 mmf. capacity in each section. The 1st detector and oscillator coils are of the 4 or 5 pin plug-in type. They are standard coils with 2 windings, grid and tickler. Several turns must be removed from the grid windings of the 2 largest oscillator coils (the ones tuning from 45-200 meters) to make them track properly. The antenna trimmer condenser has a capacity of about 35 mmf.

The I.F. amplifier stages follow conventional lines. The constructor should note the thorough decoupling of all plate and screen voltage supply leads to prevent oscillation in these stages. All isolating resistors and condensers should be wired into the set as close to the tube sockets and I.F. transformers as possible. The standard I.F. transformers generally have a lead for the control grid brought out through the top of the transformer to be connected to the control grid cap on the tube. It is necessary to remove one of the I.F. transformers from its can and remove this control grid lead. In its place solder a wire the same length as the other connecting wires of the transformer. This wire should be covered with metal shielding braid to within a half inch of the point where the wire is soldered to the transformer. This wire should be brought out through the *bottom* of the transformer together with the other leads. The reason for this alteration is that the second detector is a diode and the diode connection must be made to the base of the tube *and not to the cap.*

The "plate," and "Control grid" leads on all the I.F.



Bottom view of "3 tubes=6" Super-het. The set is simple to build and of low first cost.



Wiring diagrams, schematic and physical, are given above for the "3 tube = 6" Super-het. No trouble should be experienced in building this remarkable receiver. It has automatic volume control and "all the trimmings."

transformers should be covered with shielding braid if they are not supplied with this already done.

Aligning the I.F. Stages

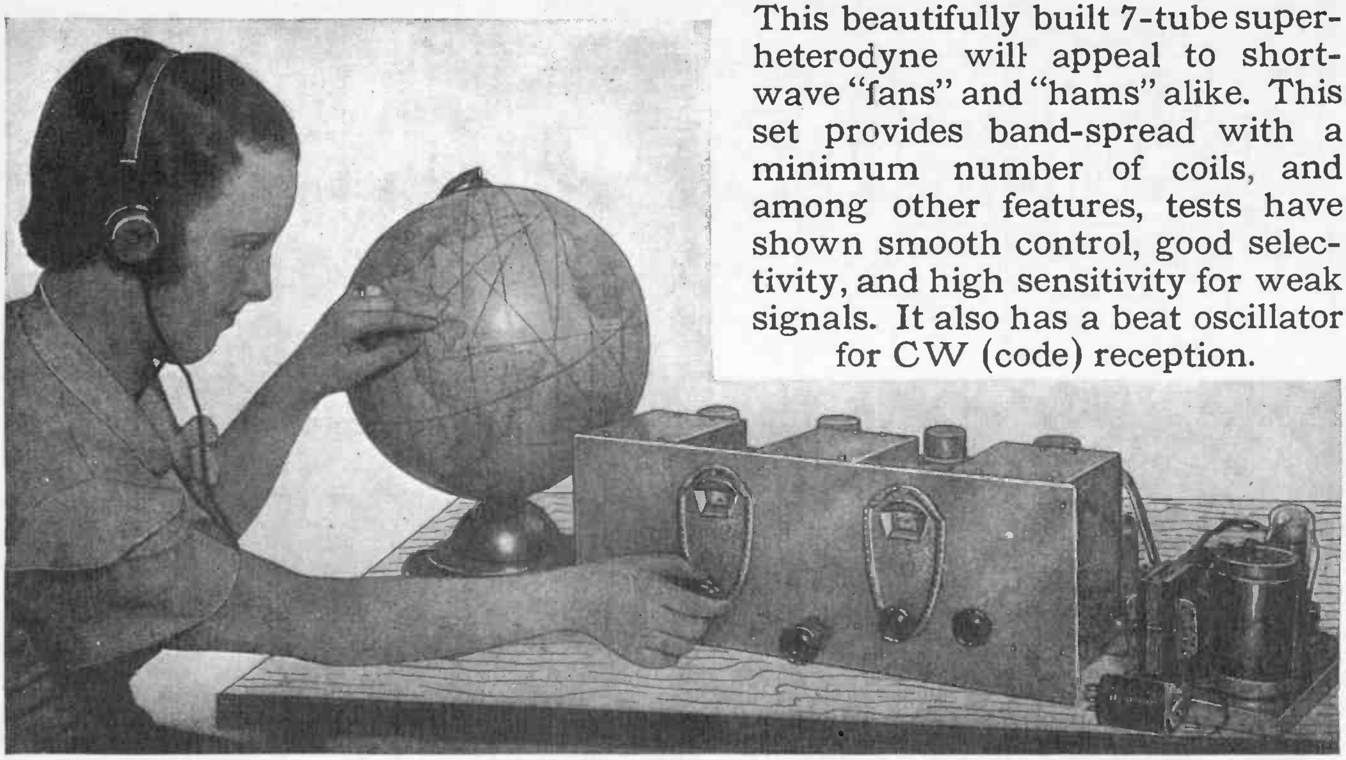
It is advisable to have an 0-25 mil. milliammeter available for this process. Connect the set up and plug in the set of coils covering the 49 meter band (No. 3) 1½ turns should be removed from the grid winding of the oscillator coil in set No. 3. Assuming that this has been done, tune over the dial till a signal is picked up. Bring it up to maximum by means of the antenna trimmer. Connect the milliammeter in series with the B plus lead to the receiver. With 250 volts applied to the set the meter should read between 20 and 25 mils (milliamperes). Start with the set-screw condensers on the first I.F.

transformer. Adjust these slowly with a screw-driver for maximum volume; proceed in the same way with the second and third I.F. transformers. During these operations the volume control should be nearly at maximum. After this preliminary line-up, note the meter reading. Detune the set slightly with the main tuning control. The meter reading should go up as the set is tuned away from the station. Tune the station in again and repeat the lining-up procedure of the I.F. transformers; watch the meter reading and adjust the set screw for *minimum* current on the meter. If the station is fading, the meter will fluctuate continually during the operation and it will be necessary to take an *average* reading on the meter. Repeat the lining-up procedure once more to insure accuracy and then leave it set.

Next check the tracking of the oscillator coil. As mentioned before it is only necessary to take turns off the oscillator coils covering the two highest wavelength ranges. The 49 meter coil should have had 1½ turns removed already, as mentioned in the paragraph on lining up the I.F. stages. Set the antenna trimmer condenser at the half-closed position and turn the main tuning control preferably to a point near where the rotary plates of the condenser are half way into the stationary plates. Tune in a station near this position (if one can be found). If no station is heard tune to the 49 meter band. If it comes in with maximum strength (as indicated on the meter by *lowest* reading) when the antenna trimmer is near the half-way closed position, no further alteration of the coil is necessary. If the resonance point is near maximum capacity on the trimmer, remove more wire from the grid winding of the oscillator plug-in coil, ½ turn at a time; ½ turn, or at most 1 turn, will bring the coils into line. Removing this wire will result in the station coming in at a position on the main tuning dial several degrees away from the former position, so that it is necessary to retune the main dial to pick up the station after the wire is removed from the coil. The largest coil set should be altered in a similar manner.

Parts List

2—Sets 5 prong plug in coils 15-200 meters. 4 coils to a set. (Na-Ald).
1—Dual gang midget variable condenser 140 mmf. per section (Hammarlund)
1—Midget variable condenser, trimmer, 50 mmf. (Hammarlund)
3—465 kc. I.F. transformers (Hammarlund)
3—10,000 ohm fixed resistors ½ watt (Aerovox)
3—100,000 ohm fixed resistors ½ watt (Aerovox)
1—100,000 ohm fixed resistor 1 watt (Aerovox)
1—50,000 ohm fixed resistor ½ watt (Aerovox)
2—500,000 ohm fixed resistors ½ watt (Aerovox)
3—1,000,000 ohm fixed resistors ½ watt (Aerovox)
1—20,000 ohm fixed resistor 1 watt (Aerovox)
1—400 ohm fixed resistor 1 watt (Aerovox)
1—300 ohm fixed resistor 1 watt (Aerovox)
1—500 ohm fixed resistor 1 watt (Aerovox)
1—1,500 ohm fixed resistor 1 watt (Aerovox)
12—.1 mf. fixed condensers (non inductive) 500 volt (Aerovox)
1—.01 mf. fixed condenser (non inductive) 500 volt (Aerovox)
1—.5 mf. fixed condenser (non inductive) 500 volt (Aerovox)
1—1. mf. fixed condenser (non inductive) 500 volt (Aerovox)
1—5. mf. fixed condenser (electrolytic 25 volt) (Aerovox)
1—.001 mf. fixed condenser mica (Aerovox)
3—.0001 mf. fixed condensers mica (Aerovox)
1—7 prong small isolantite tube socket (National)
2—5 prong small isolantite tube sockets (National)
1—100,000 ohm potentiometer (Electrad)
2—7 prong (small) wafer tube sockets (Na-Ald)
3—Type 58 tube shields (Hammarlund)
1—Headphone terminal strip (Insuline)
1—Antenna-Gnd. terminal strip (Insuline)
1—Ground Binding post (Insuline)
1—Vernier Tuning dial Type "B" (National)
1—6F7 tube RCA (Radiotron)
1—6A7 tube RCA (Radiotron)
1—6B7 tube RCA (Radiotron)
1—Metal chassis and front panel



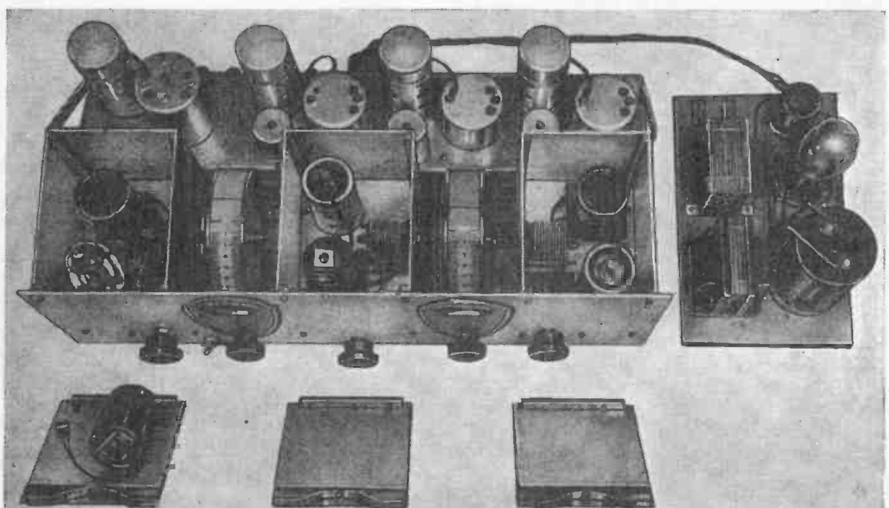
This beautifully built 7-tube superheterodyne will appeal to short-wave "fans" and "hams" alike. This set provides band-spread with a minimum number of coils, and among other features, tests have shown smooth control, good selectivity, and high sensitivity for weak signals. It also has a beat oscillator for CW (code) reception.

A good-sized globe is very essential as an aid in locating the stations in far parts of the world as they roll in on this 7-tube "Globe-Girdler" superhet. Yes, it has "band-spread" features and a "beat oscillator" for CW reception.

Globe-Girdler 7

By E. KAHLERT

● THE super-heterodyne receiver, long a luxury, now becomes almost a necessity for operation on the various amateur bands. Every year there has been a considerable increase in the number of amateur stations which are active on any one of the four amateur bands from 20 to 160 meters. This rapid increase in active stations has resulted in extreme crowding and calls for a very selective and sensitive receiver. It has long been the desire of the writer to possess a superheterodyne receiver that was really smooth in operation and would give a minimum of background noise. Much experimenting was done on the several sets built, in order to fulfill this desire. In each case it was found necessary to add a stage of tuned radio frequency to be operated ahead of the first detector in order to minimize the liability of image response. While image is not *absolutely* eliminated it is reduced to a value which is not at all objectionable.



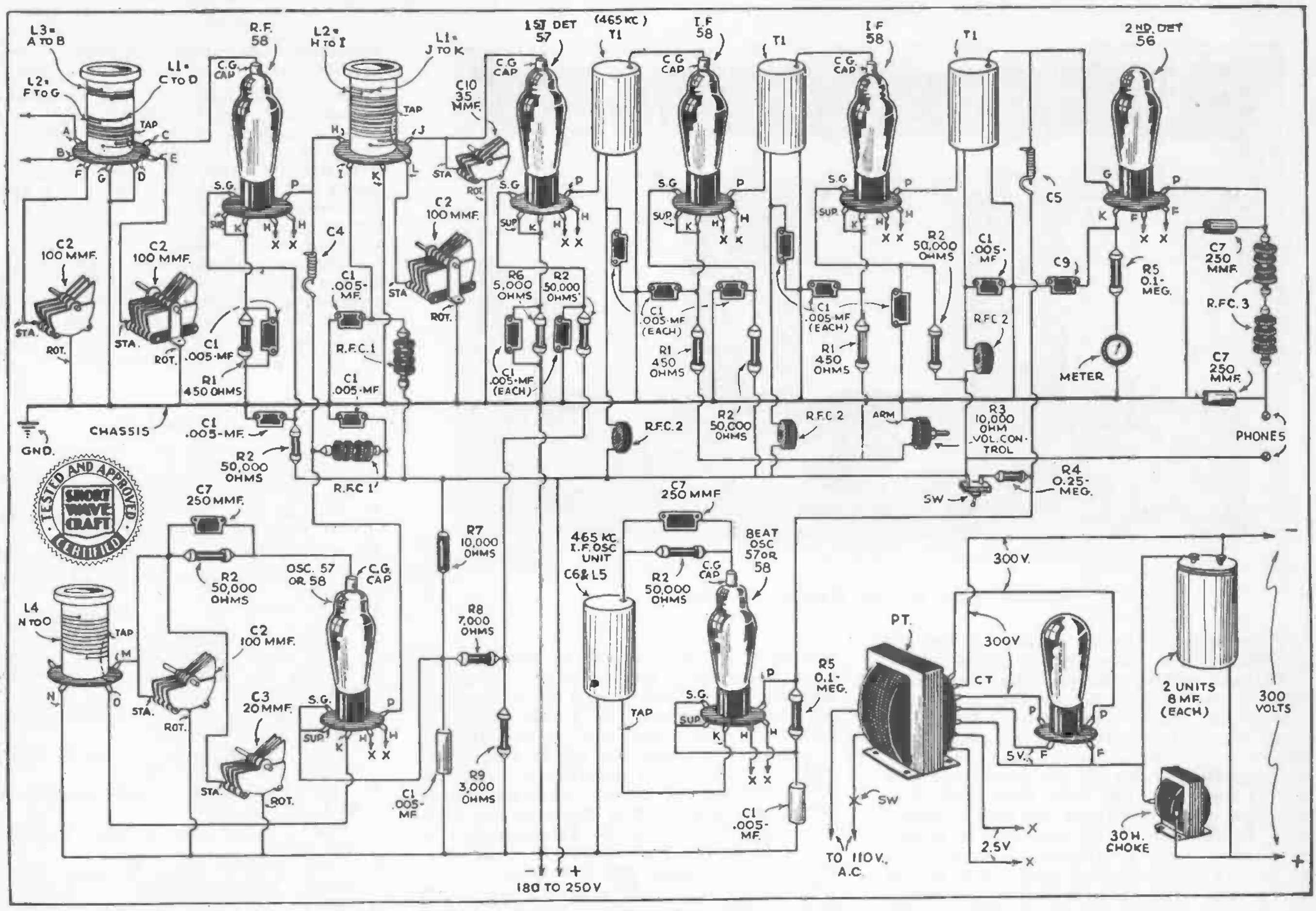
With a little care you can build as fine a set as the one here shown and the highest compliments are due Mr. Kahlert for his beautiful workmanship on this 7-tube superhet.

It was found that with two stages of I.F., intermediate frequency, plenty of by-pass condensers were needed in order to reduce feed-back (regeneration) in these stages to a point where full gain of the tubes could be realized without unpleasant reaction. Due to the fact that no audio amplifier of any kind was included in this set it was necessary to have two stages of intermediate frequency amplification. However, if a stage of audio was used it is quite possible that one stage of IF would suffice, but with a somewhat lesser degree of selectivity and sensitivity.

The final set uses one 58 TRF, 57 first detector, 57 or 58 oscillator, (whichever is available), two 58 IF stages, 56 second detector (to permit "cans" without an audio stage, which could only be used by people with "cast iron" ears. The ears take a mighty walloping indeed as it is, with the volume control wide open. A 57 or 58 beat oscillator completed the picture. A 57 is the best first detector to use and will give good response to weak signals.

Capacity coupling is used between the oscillator and first detector. Condenser reactance increases as the frequency becomes higher and this raises the sensitivity of the set on the shorter wave lengths, without impairing operation on the lower "short waves" frequencies.

The oscillator is tuned by a 20 mmf. midget condenser and the 80 meter os-

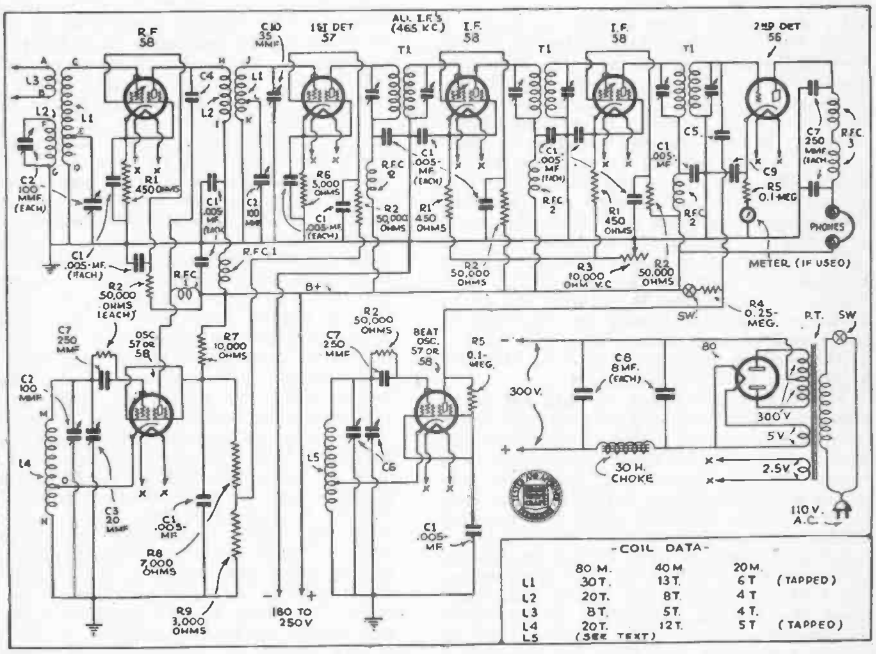


Picturized wiring diagram for the "Globe-Girdler 7"—You will experience no difficulty in building this handsome receiver by following this diagram.

cillator coil can be used on all bands similar to frequency meter usage, but band-spread will be increased by using the fundamental of the oscillator on each band. The condenser used to couple the oscillator to the first detector is approximately 5 mmf. and consists of 5 inches of twisted push-back hook-up wire rolled up after being soldered to a wire "mount" consisting of three soldering lug terminals on a piece of fiber, one being grounded when the "mount" is fastened to the chassis by a screw.

The RF chokes and IF transformers should be good ones. The chokes arrived at were found the best possible and the IF transformers used have large coils and the smallest padding condensers conveniently possible. It is admitted that mica is inferior to air for dielectric but if one manages to use a minimum of mica in the padding condensers, i. e., two plates separated by one sheet of mica, there will be approximately one-fourth the possible variation where four plates separated by two sheets of mica are used. There is no sense in deliberately courting error by using large mica condensers. Examination of several varieties of mica tuned transformers will confirm this conclusion. The IF tubes are run at rather high plate and screen voltages with high bias to limit the plate current to normal and to provide greater gain without the liability of reaction.

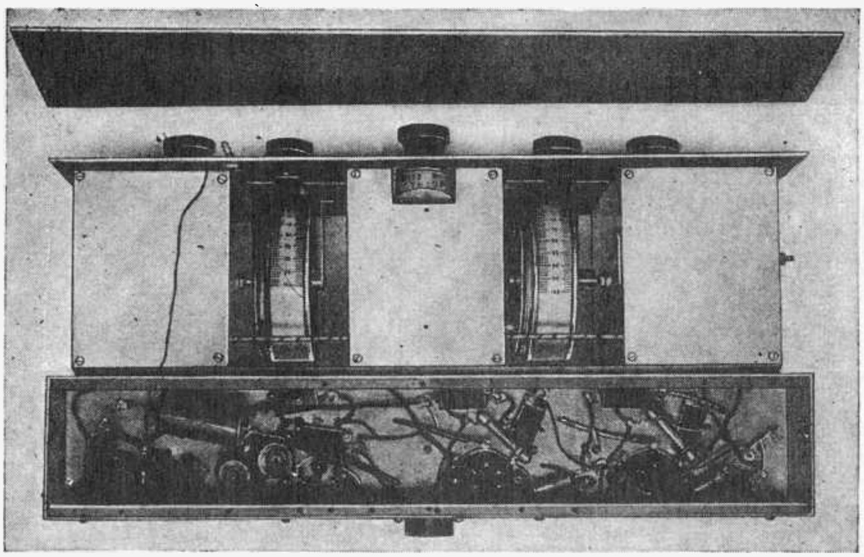
The best oscillator plate lead, shielded except for about one and one-quarter inches on one end, is coupled to the grid of the 56 detector by wrapping the unshielded portion around the grid lead



Wiring diagram for the "Globe-Girdler 7"—a superhet with all the latest "doo-dads."

of the 56 2nd detector. This method of coupling is very effective and the strongest C.W. signal can be heterodyned.

All by-pass condensers should have the shortest leads possible to make the by-passing most effective and all ground leads are connected with push-back wire. If "George Chassis" is left to do it, it will be done in poor fashion. The by-pass condensers do not necessarily have to be mica. A good grade of paper condenser .005 mf. or larger, will suffice; mica condensers were used in this



Bottom View of the Kahlert Receiver

set because they were gotten as cheaply as paper could have been purchased.

In constructing the set, there are several ways of arriving at the completed aluminum work. The writer bought a large sheet of one-sixteenth aluminum and sawed it into the necessary sizes. It would be possible to have all the pieces cut and folded to order but this would increase the cost. The aluminum can also be broken. Sawing and filing result in a neater job but is more laborious. A steel ruler or square is used, being held firmly to the aluminum while the aluminum is marked for sawing, or else heavily scored on both sides for breaking or folding. A knife with a small sharp pointed blade and rigid handle is best for this purpose. After sawing, which naturally should be carefully done, the edges should be filed. A large file, the larger the better, is necessary if the edges are to be made straight; push the file along the edge parallel to it so the file cuts all parts at once and therefore cuts evenly. After the aluminum has been scored for breaking or folding, it should be laid on a table with a sharp edge, the line in the aluminum coinciding with the table edge and then the free piece bent back and forth in small arcs till it breaks. Obstinate or large pieces, where the hands are not strong enough, will require the use of the vise.

The tap necessary in making the brass or aluminum pieces may be obtained in the 5 and 10 cent store. The hole that is drilled before tapping should be the size of the tap minus the threads.

The first three tubes of this set make a fine short-wave converter and after these were wired up and prior to finishing the wiring the set was tried out ahead of a seven-tube BC (broadcast) superhet, acting as an intermediate amplifier. The lead from the first detector plate was coupled to the antenna post of the "super-het" by a piece of hook-up wire broken by a .00025 mfd. condenser to prevent the first detector plate voltage from being "shorted" when the ground connection to the "BC" set was grounded. The plate voltage to the first detector was then fed through a choke of somewhere between 400 and 800 turns, to keep the RF where it belonged. The "BC" set was tuned to a clear frequency around 550 meters, where no interference could be picked up by the lead from the converter, and the 80 meter coils were placed in their sockets. Things worked O. K. and everything was brought in with satisfying volume, to say the least. Hooking up the front end of the set as described, is desirable as it boils down the field for "trouble shooting" in case the set is inoperative when the whole job is finished. It should be mentioned here that all the parts put in the set were tested before doing so, tubes included, as even new components may be defective and it is a real job to find blown or leaky condensers after they are wired in.

In tuning up the IF stages a 0-1 or 1.5 M.A. milliammeter and an oscillator covering the IF transformer range is very helpful to the exact peaking of all stages but not a necessity. If the meter is not available, the screws of the IF transformer should all be turned clock-wise as far as possible, giving maximum capacity to each condenser. Each should then be backed off 2 turns. Then the capacity of the plate and grid leads of each tube has to be considered; if they were all the same length, the IF stages would be in approximate resonance, but in this set they are not. These capacities from lead to shield are in effect parallel with the tuning capacities and consequently influence the tuning. If one of these capacities is greater than all the rest, i. e., one shielded lead is greater than all the others, compensation must be made for this by backing off the IF tuning condenser on this lead to a degree depending upon the difference in length or capacity between this lead and the others. After this is done, the 80 meter coils are placed in their sockets and a station tuned in. The IF trimmer condensers can then be varied for greatest response. If the IF trimmers are not taken care of as suggested it might seem as though the set were absolutely dead, as the IF tuning is rather sharp and they must be tuned very near resonance in order to have anything come through. In tuning with the meter a lead from the plate of the external oscillator or one from the plate of the oscillator in the set, should be loosely coupled to the grid of the second IF tube, and the trimmers of the third and grid trimmer of the second IF transformers should be varied for maximum meter reading. (Most precise tuning will be had using the least possible input.) The lead from the oscillator should then be coupled to the grid of the first IF tube and two more trimmers varied for maximum meter response. The lead should then be transferred to the first detector grid and the last trimmer adjusted. This can be done in far less time than it takes to tell. A process of this sort can also be used to "line up" the first detector and RF stage, using an antenna instead of the oscillator and without necessity of the meter. Needless to say, the tuning of the first detector and RF stage is rather broad.

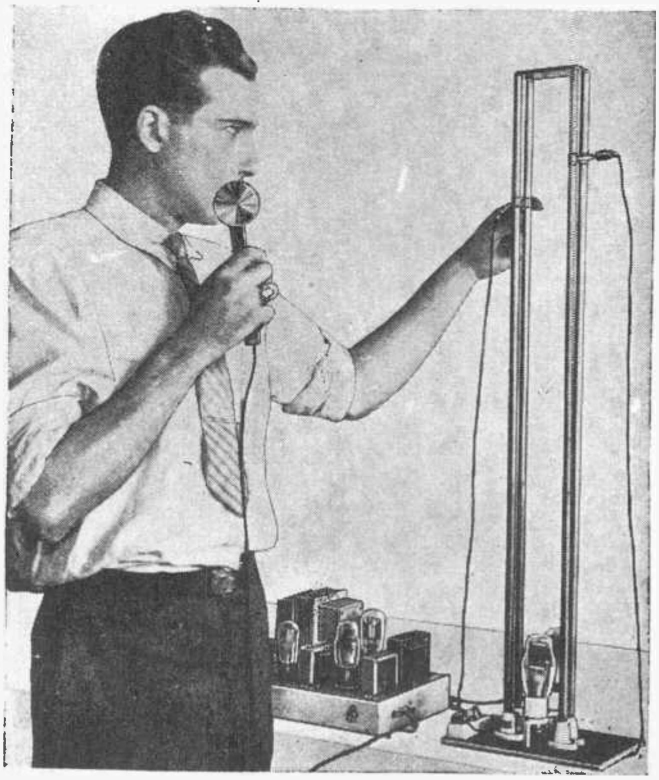
This set performs very well on 40 and 80 and fair on 20 meters. Using a 20 ft. antenna stretched around the room, VK's (Australian stations) have been heard on 40 in the afternoon about 4 P. M. and one ZT (African stations) was heard.

Parts List

15 (C1) .005 mf. fixed condensers
3 (C2) .0001 mf. midget variable condensers, National, (Hammarlund)
2 (C3) 20 mmf. variable midget condensers, National, (Hammarlund)
C4, (C5) Special condensers—see text
1 (C6) padding condensers of I.F. transformer
4 (C7) .00025 mf. mica condensers
2 (C8) 8 mf. electrolytic condensers
1 (C9) 1 mf. paper by-pass condenser
1 (C10) 35 mmf. I Hammarlund No. 35 condenser, 35 mf.
3 (R1) 450 ohm, 1 watt resistors (R1), Lynch, (International)
6 (R2) 50,000 ohm, 1 watt resistors, Lynch, (International)
1 (R3) 10,000 ohm volume control, Acratest, (R. T. Co.)
1 (R4) 250,000 ohm ½ watt, Lynch, (International)
2 (R5) 100,000 ohm, ½ watt resistors, Lynch, (International)
1 (R6) 5000 ohm, ½ watt, Lynch, (International)
1 (R7) 10,000 ohm, 1 watt resistor
1 (R8) 7000 ohm, 1 watt resistor, Lynch, (International)
1 (R9) 3000 ohm, Lynch, (International)
1 (RFC1) National R.F. Choke, 2.5 M.H.
3 (RFC2) Hammarlund SPC. 10 M.H.
2 (RFC3) 800 turn "universal" wound, 85 MH.
3 (T1) 465 kc. I.F. transformers, National, (Hammarlund), Gen-Win.
2 National drum dials
6 Coil forms, National
6 6-prong sockets, National
1 5-prong socket, National
6 Tube shields, National
2 Coil sockets 6 prong, National
1 Coil socket, 5 prong
1 Power transformer 300-0-300, 5V, 2.5 V., National, (R. T. Co.)
1 4-prong socket for 280, National
1 30 henry filter choke (60 ma.), National, (R. T. Co.)
4 Type 58 tubes, R. C. A. (Arco)
2 Type 57 tubes, R. C. A., (Arco)
1 Type 56 tube, R. C. A., (Arco)
1 Type 80 tube, R. C. A.. (Arco)

L1—is tapped for band spread; as the tap is taken off nearer the *ground* end of the grid coil, the band-spreading increases. About ⅓ distance from the *ground* end gives best results. L4, the local oscillator coil, is tapped to obtain oscillation; this tap should be taken off ⅓ the distance from the *ground* end of the coil. L5 is made from one of the coils removed from old 465 KC. I.F. transformer. Remove about 30 turns; solder on a tap at this point and wind back the wire previously removed. This coil should be connected into the circuit so that the tap at 30 turns is brought next to the *grounded* end of the coil.

ULTRA SHORT WAVE Transmitters and Receivers



High Impedance Lines Replace Coils

● WITH the constant increase in activity on the ultra-high frequencies among the transmitting amateurs, there is a dire need for improved transmitter and receiver design. Especially now that the amateurs are permitted to use any frequency above 110 megacycles.

It might be well to state the facts of this latest amateur privilege; the new ruling of the F. R. C. is as follows:

Rule 374a. The licensee of an amateur station may, subject to change upon further order, operate amateur stations on any frequency above 110,000 *kilocycles, without separate licenses therefore, provided:*

(1) *That such operation in every respect complies with the Commission's rules governing the operation of amateur stations in the amateur service.*

(2) *That records are maintained of all transmissions in accordance with the provisions of Rule* 386.

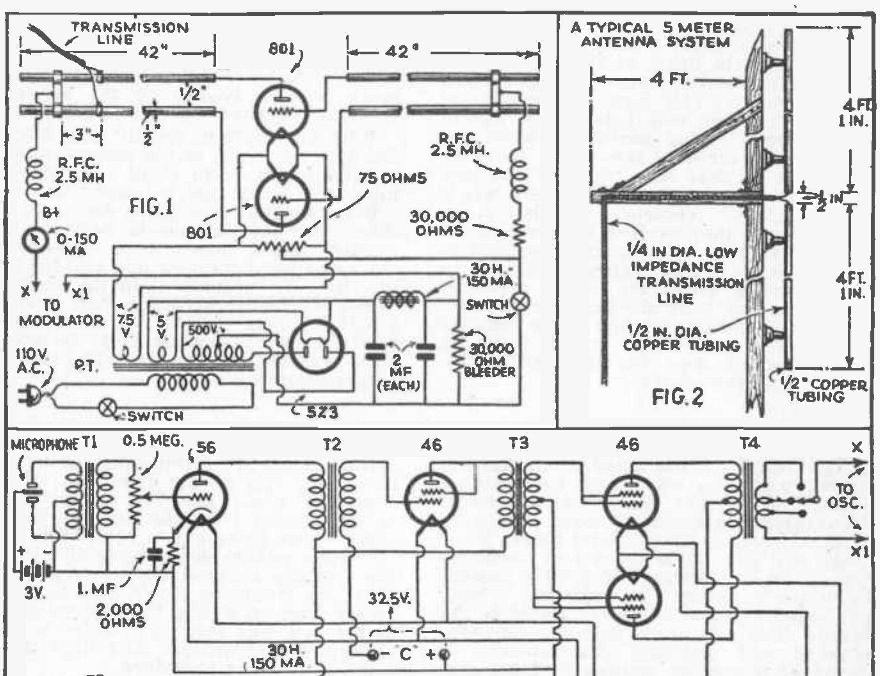
The apparatus to be described in this article is, in the opinion of the writer, the simplest and most efficient for general amateur use. It is highly recommended that every "Ham" now transmitting on the ultra-high frequencies give it a try.

It is a well-known fact that the parallel tuned tank circuit is very inefficient above 14 megacycles. And as we approach 56 megacycles it becomes impossible to obtain anywhere near the rated input and output of the present-day vacuum tubes; even those designed particularly for ultra-high frequency work.

With *"high-impedance resonant transmission lines"* used to replace tuned circuits in the plate and grid circuits of a standard push-pull oscillator, it is possible to obtain *stability* comparable to an ordinary crystal circuit and besides this, outputs very nearly approaching the rating of the tube can be obtained.

For instance, it is possible to get nearly the same output on five meters, that can be obtained with the same tubes in an ordinary oscillator, running with the same voltages and input on 80 meters. This really means something, because the plate dissipation of the tubes will be much lower for a given output and the tubes are bound to last much longer. The power output, when using "long lines," has been found to be as much as 100 per cent greater than that obtained with regular parallel tuned circuits with the same input. Not only that, but *this percentage of efficiency over parallel tuned circuits continues to become greater as the frequency gets higher.* This means that we can reach frequencies much higher than we can with the old method. From this it will be seen that for the frequencies above 110 MC (megacycles), the new system becomes a necessity.

"Long lines," which is the most convenient term for them, have been in use at W2AMN for several months and



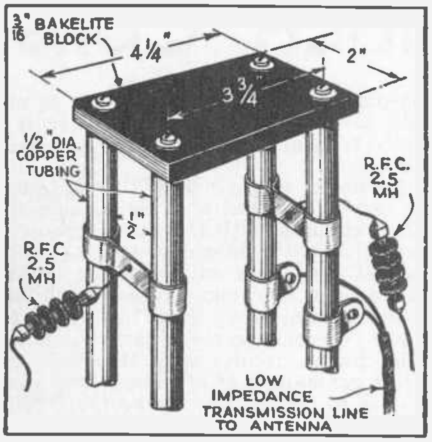
Above, we have the circuit diagram of a transmitter using "long lines" together with its power supply and a recommended modulating system.

By GEORGE W. SHUART W2AMN

have proven themselves to be the ideal thing. On *five meters*, changing from parallel tuned circuits to "long lines," increased the strength of the signal tremendously and it was possible to put a strong signal into places where it could not be heard with the old units; all this with not a volt more on the plates of the tubes and with a 20 *per cent decrease in plate current! The frequency was reported as "absolutely steady" and the modulation much improved in quality; the latter undoubtedly due to less frequency modulation.*

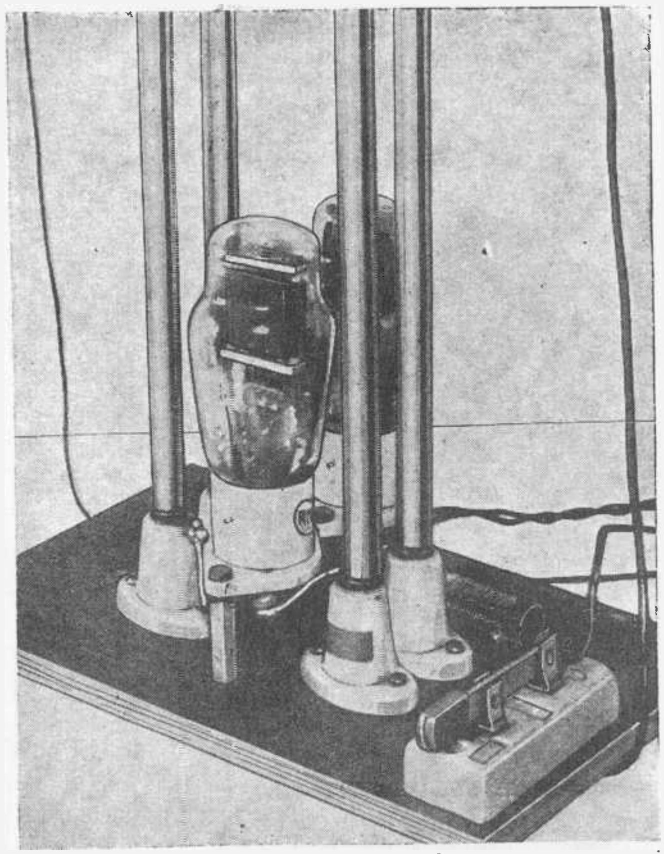
Improved Stability

An auto-dyne detector was constructed in order that the frequency stability could be more closely checked, super-



At the right, we have a close-up of the new transmitter which uses the new R.C.A. 801 tubes.

The drawing to the left, Fig. 4, shows the construction of "transmissionlines", together with the top support and the various sliders.



regenerators being too broad for this purpose. The transmitter was turned on and the receiver tuned to zero-beat with the transmitter, and, believe it or not, *the two stayed in zero beat over periods as long as 15 minutes without the slightest sign of "creeping" and would probably have remained that way for hours.* This was with 500 volts on the tubes, at 100 milliamperes plate current, and an antenna feeder current of .6 amperes. This input was modulated about 90 per cent and there was no sign of the frequency being modulated while the receiver was tuned to zero-beat. However when the receiver was "detuned" to give about a 1,000 cycle beat note, there was a slight sign of frequency modulation, so small though, that excellent quality could be obtained with the receiver out of oscillation. This is as good if not better stability than maintained by all of the master oscillator amplifiers that were checked over the air; M.O.P.A. transmitters are quite popular around this district. So much for the results obtained, now for the construction of a typical transmitter.

Line Design

The ideal *line* to use would be one that was exactly a quarter wavelength long and adjusted to provide maximum selectivity. However this is not easily done, due to the internal losses of the oscillator tubes. These losses will have to be taken into consideration in the line design. If it were possible to design a perfect line with the present day tubes, "crystal stability" would be the result. This line would have the following physical and electrical demensions: It would be a quarter wavelength long, constructed of one-half inch copper tubing spaced approximately one inch between centers; with one end "shorted" it would have an impedance of approximately 86,000 ohms and a Q, or *selectivity factor*, of 650; the line being designed for a frequency of 60 megacycles. But unless we have special tubes, this is not obtainable. The best we can do is to use tubes with very low internal capacities and having short plate and grid leads. We then adjust the line to resonate at the frequency on which we wish to operate. As the diameter of the conductors is increased the impedance and "Q" will increase directly in proportion; increasing the copper tubing to one inch in diameter we would have a Q of 1,300 and an impedance of 172,000 ohms! The transmitter shown in the photographs uses one-half inch tubing; the reader can use any size he wishes but nothing smaller than one-half inch should be used for best results. The space between centers of the conductors should be 4 times the radius of the tubing.

With tubes such as the 210, 801, 245, 71A and 12A the length of the copper tubes will be slightly less than three feet, and with tubes such as the 800, 825 and 852 the line will be slightly over three feet long. In either case the line should be made three or four inches longer than necessary in order to allow for tuning and also for losses that may be encountered in the lengths of connecting leads; make the line three and a half feet long, that is, for the *five meter* band; if the transmitter is to be used on lower wavelengths the line will have to be proportionately shorter.

Adjustment of Transmitter

Adjustment of the transmitter using "long lines" is a very simple procedure. Set the "shorting" clamp (see Fig. 4), about three or four inches from the end, set the grid slider about three inches below this point. The plate voltage should be applied low and the grid clip adjusted for lowest plate current; the frequency should then be checked on the receiver. Sliding the clips *up* or *down* as the case may require, in order to obtain the proper frequency. Attaching the antenna is the next procedure.

Antenna Used

The antenna shown in Figure 2 is used at the writer's station and gives excellent results. It is a *matched impedance* affair, of the *doublet variety.* The Lynch *Giant-Killer* cable is used as the transmission line. It has an impedance of approximately 70 ohms and when attached to the center of the dipole antenna gives excellent performance. The line feeding the antenna should be connected three inches from the "shorted" end of the plate circuit line. This point seems to provide maximum output, even though other settings will effect higher inputs. Connect an 0-1 R.F. ammeter in series with the feeder (a Xmas tree bulb can also be used) and adjust the grid slider for maximum feeder current. The plate slider will now need adjusting as the frequency will have changed. Whichever the case, *always make the final adjustment with the grid slider; maximum output will not be obtained with the grid slider at a point giving lowest plate current.*

Best Tubes to Use

The writer used many different types of tubes in his experiments with "long lines". The final model used the new R.C.A. 801 tubes. These tubes worked exceedingly well and the output was higher, with lower input, than any other tubes tried. With the 801's the grid-leak value that seemed to be optimum was 15,000 ohms. The plate current was 40 milliamperes with no load and maximum output attained with a plate current of 100 milliamperes; this was with 500 volts on the plates. The measured output was around 25 watts.

For those interested, the characteristics of the 801 are as follows:

Filament Voltage	7.5	volts
Filament Current	1.25	amperes
Amplification Factor	8	
Grid-Plate Capacity	6.	mmf.
Grid-Filament Capacity....	4.5	mmf.
Plate-Filament Capacity...	1.5	mmf.
Plate Voltage, Max........	600	volts
Plate Current, Max.......	70	ma.

For ultra high frequency operation:

Frequency	60	90	120	150
Plate Voltage—(Telephony) ...	480	360	310	260

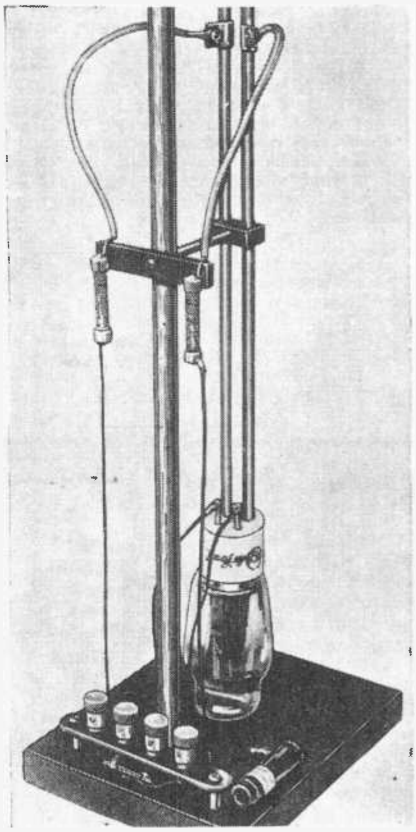
Parts List "Long Lines"

4—Copper tubes ½" outside diameter with 1/32" wall (each 42" long).
4—Stand-off insulators. National.
2—2.5 M.H. R.F. chokes. National.
2—Sliders (see drawing).
1—30,000 ohm 25 watt grid-leak. Ohmite.
1—75 ohm C.T. resistor. Ohmite.
2—4 prong Isolantite sockets. National.
2—801 tubes, R.C.A. Radiotron.

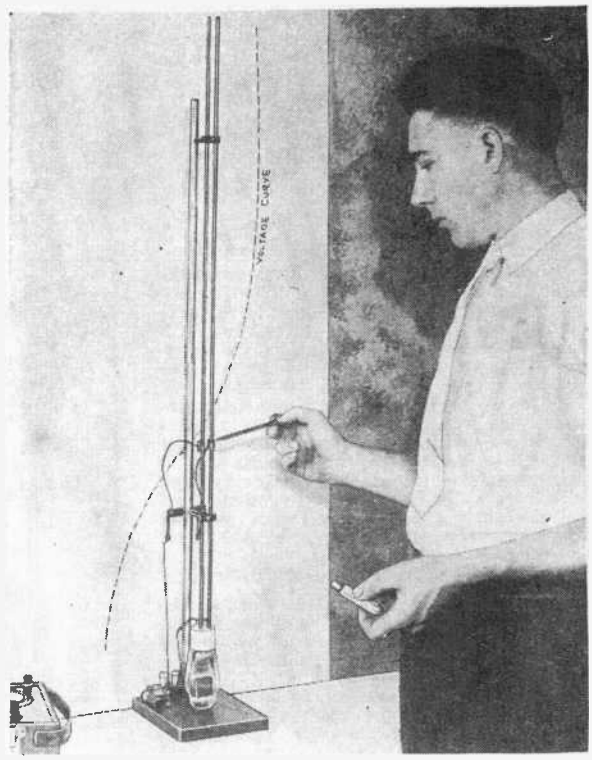
More Power on 2.5 Meters With Triodes

By GEORGE W. SHUART, W2AMN

We are pleased to present this very efficient 2.5 meter transmitter, in which present day tubes can be used with considerably more output than can be obtained with the ordinary "coil-condenser" combination. In this circuit, the tube elements actually form a part of a half-wave "resonant transmission line." One-quarter inch copper tubes are used and fit directly onto the plate and grid terminals of the tube, in order to eliminate losses in long connections. This transmitter can also be operated as low as one and one-quarter meters with a surprising "output" and a marked increase in "stability" over the usual ultra-high-frequency transmitter.



Left: Close up of 2.5 meter transmitter using resonant transmission line.



Right: The 2.5 meter transmitter, together with the voltage curve along the transmission line.

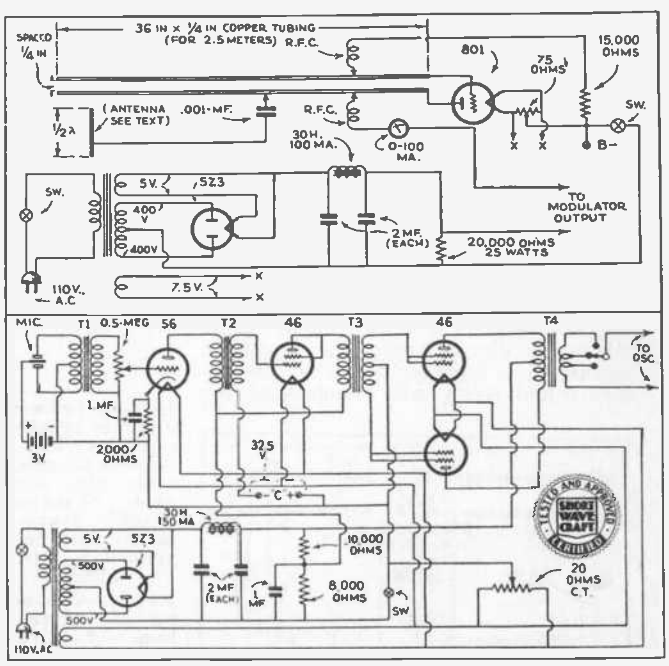
• SEVERAL of our friends have constructed the new 5 meter transmitter described in last month's SHORT WAVE CRAFT. They all experienced quite a surprise when they found out how efficient and stable the "rig" was. The output was reported to be three or four times as much as obtained with a conventional oscillator. And the writer was asked if the same principle could be applied to a 2.5 meter oscillator for use in the newly alloted amateur frequencies. It surely can, and such a transmitter is described in this article.

There is little use of going on the wavelengths below 2.7 meters with the regular parallel tuned oscillator as the R.F. output is extremely low, even with large inputs, the plate efficiency being so low as to practically ruin a tube in short order. Then again, being more or less unfamiliar with the characteristics of the extremely high frequencies, we need an oscillator that has a fair amount of output in order to enable us to communicate over any appreciable distance at all. This transmitter together with the receiver described elsewhere in this issue, has proved to be "workable" over distances up to 14 miles, with an R9 signal under ordinary geographical conditions. No one knows, as yet, the maximum possibilities of these frequencies and no doubt it will be quite some time before they do.

However, from the author's experience with these ultra-high frequencies it can be safely said that they exhibit essentially the same characteristics as does the five meter signals. It has been found that the transmitting and receiving antennas need to be a considerable height above the ground and that they are very directional; that is the directional qualities of these antennas are more noticeable than those operated on lower frequencies. The receiving antenna especially is very critical. The horizontal receiving antenna with its directional effects, seems to be superior to the vertical affair in most cases. The vertical transmitting antenna, of course, was used and is recommended as it radiates fairly well in all directions.

Details of Oscillator

The transmitter shown in the photo probably looks like anything else but what it is. As we have said before though, no one knows what our ultra high frequency apparatus is going to look like in the future, so don't let its appearance affect you too seriously. The transmitter uses a single tube employed as a feed-back oscillator, not a B.K. oscillator. Barkhausen-Kurz oscillators are notorious for their *low output*, even with special tubes. This oscillator uses an *open-end* transmission line, while last month's transmitter used *shorted-end* lines. *Shorted lines* would be far too short on 2.5 meters to derive any benefit from them. Push-pull was not used in the transmitter as considerable difficulty is encountered when *open-end* lines are used with tubes in push-pull. Further experimentation will probably result in the use of a tube at each end of the line. However, for the present this trans-



The diagram clearly shows the connections of the new transmitter, together with a recommended power supply and a modulator.

mitter is ideal; the addition of another tube only incurs additional losses in the circuit using open lines. Theoretically the lines having both ends open must be a half wave long. However this is not possible with the present-day tube construction, because the grid and plate of the vacuum tube actually becomes part of the line. Special tubes will no doubt be released in the near future. The match between the external part of the line and the tube is not perfect by any means, but the dimensions given are a fair compromise.

New 801 Type Tube Used

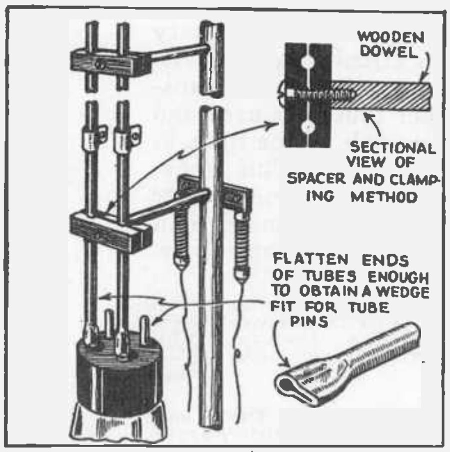
When designing his type of transmitter the new RCA 801 tube was used. The elements of the tube proved to be equal to approximately one foot of line. In other words subtract one foot from a half of the wave-length on which you intend to work. For 2.5 meters the line will be 36 inches long. This shows that the shortest wavelength at which this tube will function properly in the circuit described is 1.25 meters. Incidentally you will be surprised at the amount of R.F. generated by a transmitter of this type on 1.25 meters. Other types of tubes will require slightly different lengths of external line which will have to be determined experimentally.

Other types suggested and which are best suited are the 12A, 171, 201A, 245 and the 210. The 800, of course, is very fine for the higher powered "rig", the use of which will require a line slightly longer than the above-mentioned types.

Referring to the photograph we find that the voltage curve of the line has been plotted and photographed with the transmitter. Starting at the end of the line we find that we have a point of high voltage. As we proceed down the copper tubes we have a decrease in voltage, until we reach a point where the curve crosses the line; this is a point of minimum voltage and the distance between this point and the end of the line is exactly one-quarter of the wave-length on which the transmitter is operating. At this point the grid return and the plate voltage leads are connected, through the small R.F. chokes. This makes it easy to check the wave-length; it can be done with a yard stick. The length of the antenna is also governed by this distance—it is just twice this long for a half-wave radiator.

Construction Hints

Construction of the transmitter is not at all difficult. The drawing shows how the ends of the ¼ inch dia. copper tubes are squeezed together in order that they will *push on* the plate and grid pins of the vacuum tube. This eliminates long connecting leads from the line to the tube connections. The mounting which supports the oscillator consists of a ½ inch dia. dowel stick 36 inches long, set into a wood base-board of 1 inch thick stock, six inches square. Two ¼ inch bakelite rods are doweled into the wood upright to hold the line and tube firmly. The drawing also shows the formation of the two bakelite clamps which are fastened to the ends of the ¼ inch rods.



Details of 2.5 meter Transmitter.

The vacuum tube hangs in an upside-down position and two small clips are used to make the filament connections. Other details can be gotten from the drawings. The two small R.F. chokes are made by winding number 28 enameled wire on a 5 meg. resistor form. The spacing between turns is equal to the diameter of the wire. The resistor should be wound full of wire. Use a resistor having an isolantite or porcelain body.

The grid-leak used is 15,000 ohms and the plate voltage should not exceed 300 for the 801 tube. The plate current will be 100 milliamperes with normal antenna coupling. Higher plate currents will damage the tubes. Other tubes of the receiving types will require correspondingly lower plate voltages and currents.

The antenna is a half-wave long and the feeder should be connected to a point having a distance from the center equal to one-eighth its total length; the length of the feeder is not important. Tap the feeder to a point on the plate side of the line either side of the R.F. choke. This connection should be slid up and down the copper tube until a point is reached where normal plate current exists, the value of which will be between 80 and 100 milliamperes. In order to change frequency the length of the line will have to be changed. It is suggested that those interested should choose the 2.5 meter band, because if some hams are operating on 2 and some on 2.5 meters, there is little chance of working each other because some will be out of the tuning range of the other's receiver. Get organized on these high frequencies and worthwhile developments are sure to follow. A recommended power supply and modulator are shown in the drawings.

Parts List

1—Transmitter mounting (see text).
2—Lengths ¼ inch copper tubing (see text).
2—Special R.F. chokes (see text).
1—15,000 ohm grid-leak (Ohmite).
1—75 ohm C.T. (center-tap) resistor. (Ohmite).
1—801 tube, R.C.A.-Radiotron.

"LONG LINES" Xmitter With 800's

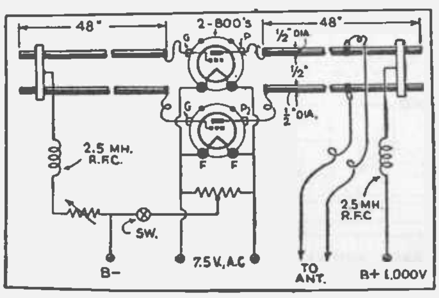
● SINCE the description of the "Long Lines" ultra high frequency transmitter in the October issue of this magazine, we have had innumerable requests for more dope regarding the construction and tuning. Many of the "Boys" who have a "yen" for high power have asked why we haven't used tubes such as the 800's or the 304A's. The truth of the matter is that we have been using 800's for three or four months and obtaining excellent results. The transmitter referred to is shown in the photographs and will be described in detail.

What Is "Long Lines" Oscillator?

For those less familiar with the subject it may be a good idea to explain just what we mean by a "Long Lines" oscillator. It consists merely of adjusting the length of two copper pipes which are placed fairly close together, so that they, together with the tube elements and leads, will resonate at the desired frequency. The advantage of a circuit of this type is that greater stability can be obtained with very high plate efficiency. The line is constructed so that the spacing between the pipes is equal to the diameter of the pipes; this seems to be the best all-round adjustment. One of these lines is used in the plate and one in the grid circuit of a push-pull oscillator.

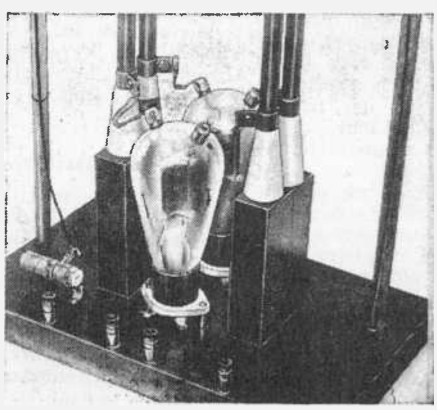
The material used in building this transmitter is one-half inch copper *pipe*—not tubing!. The difference being that the pipe is hard drawn and straight while the tubing is flexible and not so straight.

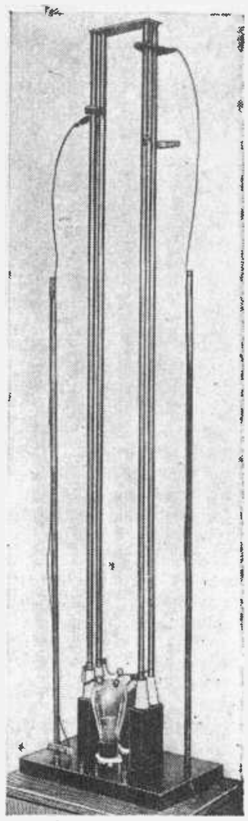
Right away it will be seen that there is need of a fairly sturdy base, if we expect this outfit to "stand on its own feet." The base of this one is made of wood stock, one and one-quarter inch thick. This base is 13 inches long and 8 inches wide. On this base there are mounted two 2¾x4½x1¼ inch uprights. These are for supporting the long copper pipes and it is necessary that they be doweled to the base plate with ⅝ inch dowels. Follow the drawing and use plenty of glue if you want a solid job. In order to fasten



Left—Wiring diagram of the copper tubes, also the vacuum tube, etc., for the "Long-Lines" Transmitter here described by Mr. Shuart.

Right—Close-up view of the base of the "Long-Lines" Transmitter; it employs two 800-type tubes.





Highly efficient "Long-Lines" oscillator.

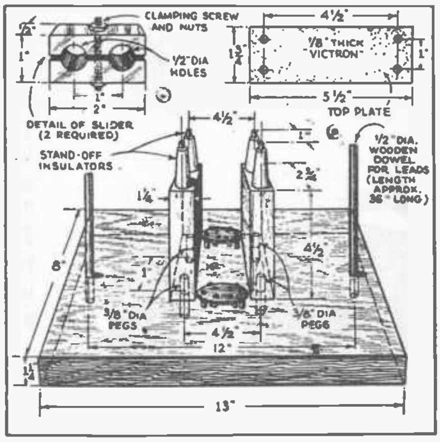
the large National insulators to the upright blocks, it is necessary to drill small holes for the screws of the insulator and fill the holes with some sort of cement, such as Dupont's "household" cement. Then force the screws into the holes by letting them make their own threads, when the cement has "set-up" the insulators may be attached and screwed down tight. When you buy the pipe ask for solid brass or copper rod that will be a drive fit in the end of the pipes; this is needed for mounting purposes. Drive about one-half inch of this stock into both ends of the four pipes; then drill and tap them to fit the screws of the stand-off insulators. The other ends of the pipes should be drilled and tapped for 6-32 machine screws in order to fasten the top supporting plate. This plate is made of ⅛th inch National *Victron* insulation and measures 5½x1¾ inches, drilled according to the drawing.

The two 800 tubes are mounted between the small blocks and the terminals of the tubes will be found to be even with the ends of the pipes; this will allow very short connecting leads to the tubes and *these leads must be short!* The leads are of *flexible* copper braid. Solid connectors should not be used, because the expansion of the tubes will create a strain on the glass and be liable to break the tubes. Small clips are made of brass or copper strip for connecting to the pipes.

Another problem was the "shorting straps" at the ends of the pipes. These are made of solid brass or copper and the dimensions are also given in the drawings. The problem of supporting the plate and grid return leads was solved by making use of two 36-inch by ½-inch dowel sticks; these are set and glued in the baseboard.

Operation

The plate voltage applied to the two 800's should be around 1000—the writer used 900 volts, with plate currents ranging from 100 to 140 milliamperes, depending upon the antenna coupling. With this *input* it was possible to obtain over *60 watts output*—quite a husky "ham" rig for 5 meters! The modulator unit should be a pair of 210's in class "B" or the equivalent. Typical adjustments for the 56 mc. end of the band are as follows: The plate "shorting bar," placed 2 inches below the end of the plate line, the grid bar 5 inches below the plate bar, and the antenna clipped onto the plate circuit 7 inches below the plate bar.



Details of Base Layout

In all cases the grid *shorting bar* should be placed 4 to 5 inches below the plate bar for best results. The adjustment of the grid bar controls the amount of excitation and the above position seems to be optimum. The plate current will be somewhere between 110 and 125 milliamperes and the grid current will be between 20 and 30 milliamperes. Always keep the grid current around this value.

In adjustment of the transmitter for maximum stability or minimum frequency modulation listen in on a 20-meter receiver and slide the grid bar until best results are obtained. It will be found that with no modulation the carrier will remain constant in frequency for a long period of time. Checks over a period of 10 minutes showed that the frequency was just about as steady as a crystal set. When properly adjusted the frequency modulation will not be greater than 5 or 6 kc.,—quite remarkable when we found that a check-up on other types of oscillators revealed frequency modulation up to 75 kc., and more. Transmitters of this type would justify the use of a superheterodyne receiver. An oscillator of this type, only of lower power, should make a very fine control oscillator of an MOPA "rig"; in fact W2AG, a well-known amateur, has been experimenting along this line and obtaining some very interesting results. Quite a few of these transmitters are in use in and around New York City and no doubt in other parts of the country. Let's hear from you fellows who have tried them!

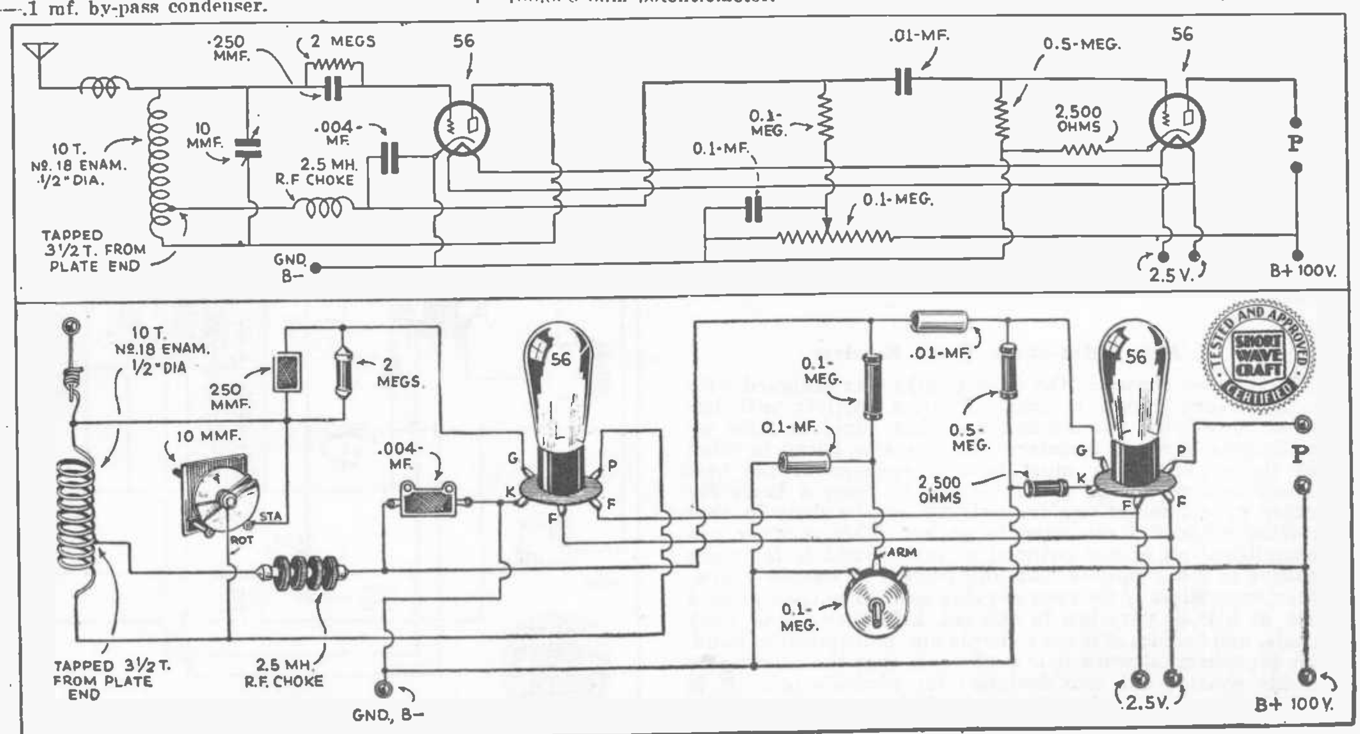
Long Lines Transmitter Parts List

1—wood base, see drawing.
16 ft., ½ inch O.D., copper "pipe." 4—4 ft. sections.
4—National stand-off insulators (threaded type).
2—4-prong, National sockets, Isolantite.
2—2.5 mh R.F. chokes. National.
1—10,000-ohm, 25-watt Electrad resistor, with adjustable slider.
1—100-ohm center-tap resistor.
Clips and shorting bars (see drawing).
2—36-inch, half-inch dowel sticks.
Sufficient National, ⅛ inch thick Victron insulation to make top plate.
2—RCA Radiotron 800 tubes.

Denton 5 Meter Super Reg. Receiver

Parts List for Denton 5-Meter Receiver

1—(approximately) 10 mmf. midget variable condenser.
1—.00025 mf. mica condenser.
1—.004 mf. mica condenser.
1—.1 mf. by-pass condenser.
1—.01 mf. fixed condenser.
1—2 megohm grid leak.
1—.1 meg. fixed resistor.
1—.5 meg. fixed resistor.
1—25 ohm fixed resistor.
1—100,000 ohm potentiometer.
2—5-prong sockets.
1—Special inductance (homemade)—see text.
1—2½ millihenry R.F. choke.
2—Type 56 RCA Radiotron tubes.
1—6"x10"x7" chassis. Blan; Insuline.



The 5-meter field is expanding rapidly as improved transmitters and receivers are being designed to facilitate the tuning of these extra low-wave stations. Both picture and schematic diagrams are given above for the improved 5-Meter "Bear-Cat."

2 to 5 Meter Set Works Loud Speaker

Above we see the new 2 to 5 meter receiver which will also serve as an excellent "portable" receiver.

George W. Shuart, W2AMN

Here is one of the most efficient ultra-high frequency receivers we have had the privilege of describing. It uses only two tubes, a 56 super-regenerative detector and a 2A5 pentode amplifier for A.C. operation. It can be used in an automobile or boat, by the use of a 6 volt auto "B" eliminator in which case the detector will be a 76 and a 41 for the audio amplifier. This set is surprisingly sensitive and selective.

Not so long ago the writer heard some one say—"the romance has practically gone out of radio". But today it is a sure thing that for those who like to DO THINGS there is romance and fascination in the ultra high frequencies heretofore undreamed of. The writer has spent the best part of the past three years delving into the possibilities of the ultra high frequencies. Many extremely interesting things were uncovered and proved to be contrary to popular belief.

The ultra-high frequency transmitting and receiving "gear" of tomorrow will look as different from the present-day apparatus as the old "spark-coil" outfit looks compared to the modern vacuum tube sets; witness the writer's *5-meter transmitter* described in the last issue of this magazine and the 2.5-meter outfit described elsewhere in this issue—and these are by no means the ultimate. Receivers will also take on the improvements set forth in these transmitters. We could go on for hours talking about these things but the purpose of this article is to describe a "new" receiver. All we can say is—*get busy on the ultra high frequencies and experience once more the real thrill of the "old days".*

A pentode is used as the audio amplifier with a volume control placed in its grid circuit, in order that earphones may be used. The entire set is enclosed in a black crackle-finished carrying case, measuring but 5¼ inches wide, 6¾ inches high and 8¾ inches deep. The case is in two sections, clearly indicated in the pictures, and is equipped with a convenient handle for carrying purposes.

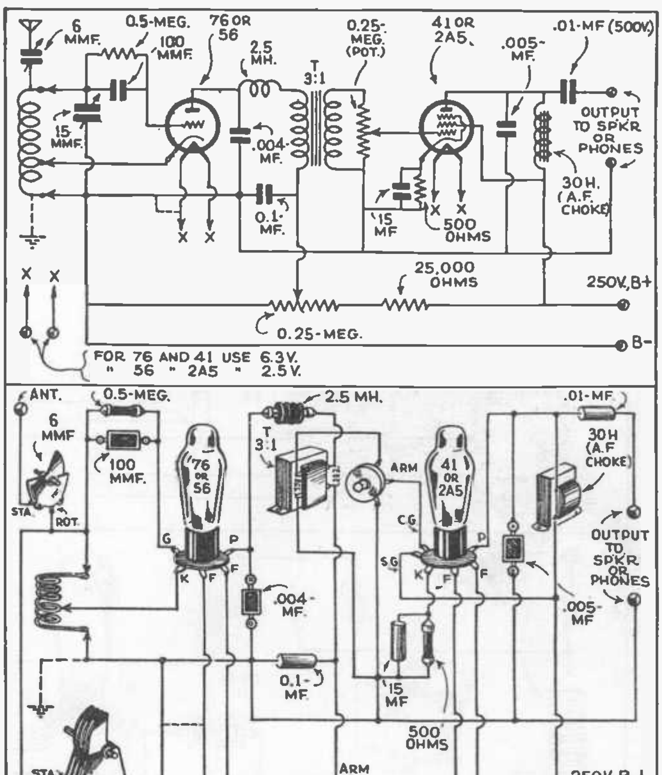
A New Ultra-Short Wave Receiver

The receiver shown in the photographs was designed with two important things in mind. First, a receiver with improved sensitivity and second, one that could be used on wavelengths down to 2 meters. It was also borne in mind that the experimenter must have a receiver of the best possible design, at the present time, to form a basis for further experimentation; for nothing can be done in that direction without a standard to go by. This receiver has accomplished all of the outlined objectives and is far more sensitive to *weak signals* than any *present day super-regenerator, regardless of the type of tubes used.* The back-ground noise, or hiss, is very low in this set, a further aid to weak signals, and besides it is very simple and economical to build.

In experimental work it is preferable that the receiver be sturdily constructed, and designed for *portable* use. It is for this reason that the set was built in a metal carrying case; it can therefore be readily used in an automobile or boat when carrying on experimental communications. Anyone desiring a better high frequency receiver for the *home station,* will find this set *"just the thing".*

Circuit Very Simple

Referring to the circuit diagram we find that the set is *simplicity* in itself. Only two tubes are used and provide *full loudspeaker volume,* far too much for the largest of rooms! A triode is used as the super-regenerative detector, in a circuit which lends itself beautifully to our requirements.



The schematic and physical diagrams shown above clearly show how to wire the 2 to 5 meter receiver.

The *tuning* is done with the small National dial on the front, while *regeneration* is controlled by the knob in the lower left-hand corner. The audio *volume control* is located to the right. The speaker or phone jack is located between the two last mentioned controls.

The small knob on the left-hand side of the box is the *antenna coupling* condenser, along side of this condenser is the antenna binding post; the power cable is brought out the back. Inside the can is mounted a 6½ by 4½ by 1/16 inch aluminum shelf on which most of the parts are mounted.

Tuning and Super-Regeneration Features

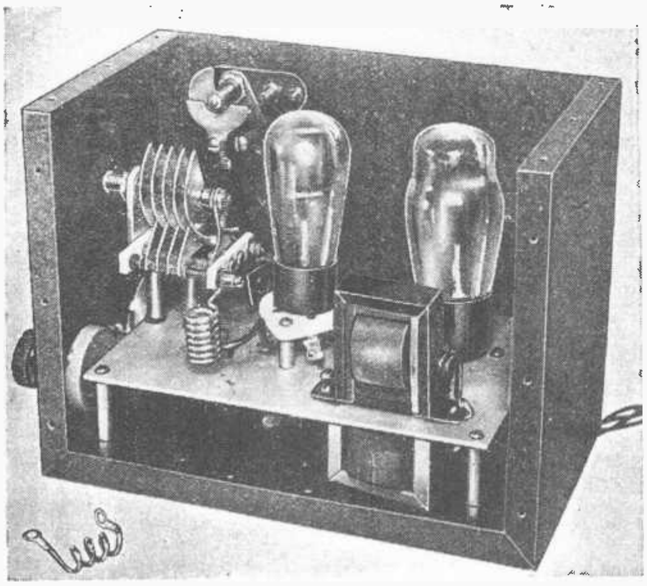
The tuning circuit consists of a single coil and a condenser making it much easier to change coils. The grid is connected to one end of the coil, through the grid-leak and condenser, and the "B" negative is connected to the other side of the coil. Regeneration is obtained by connecting the cathode of the tube to a point near the center of the coil, making it above-ground R.F. potential. When this is done the plate must be brought as near ground R.F. potential as possible. This is accomplished by the .004 mf. by-pass condenser connected from the plate to the "B" minus. The leads of this condenser must be very short and the "B" minus lead of the condenser should connect to the same point on the chassis as the ground end of the grid coil. In this circuit the rotor of the tuning condenser is at *ground potential* and eliminates the usual *hand-capacity* or the use of a long insulating extension shaft. *Super-regeneration* is obtained by using quite high plate voltage on the detector and allowing it to break over into *irregular oscillation*, the frequency of which is more or less determined by the value of the grid-leak.

The optimum value of grid-leak was found to be ½ megohm and the grid condenser .0001 mf. The detector tube socket is mounted on top of the chassis to permit *short leads*. The amount of regeneration is very nicely controlled by the 250,000 ohm potentiometer, which varies the plate voltage. The potentiometer is by-passed with a .1 mf. condenser to make its operation smooth and quiet. A 2.5 mh. R.F. choke proved sufficient to keep the low frequency voltage, generated by the detector, from the grid of the audio tube. In this circuit it was not found necessary to connect one side of the heater circuit to the chassis; however, in other cases the builder may find it beneficial and this connection should be tried for best results.

The Audio Amplifier

The audio circuit is very simple and needs little discussion. A 3 to 1 ratio audio transformer is used as the coupling medium and a 250,000 ohm potentiometer is connected across its secondary for a *volume control*. The *output* is obtained through a choke and condenser arrangement, so that the D.C. plate current does not run through the speaker or phones, whichever is used.

The 5 meter coil has 7 turns of No. 12 tinned buss bar with ½ inch inside coil diameter; the spacing between turns is 1/16 inch. The cathode tap is on the third turn from the *ground end*. For 2.5 meters the coil has 4 turns, ¼ inch inside diameter and 3/16 inch spacing between each turn. The tap is at the center of the coil.



Here we have the inside view of the set, showing just how the parts are placed.

All in all, this set is far more sensitive than the average and is about three times as selective. It ran rings around all other 2 to 5 meter sets compared with it. It is simple to build and costs very little, and can be run on batteries or a power-supply.

The writer has found some very interesting effects regarding the position of the receiving antennas for both 5 and 2½ meters. If a vertical half-wave rod is used and the lead-in taken off from the top, the signal strength will be found to be from 100 to 200 per cent greater. This can easily be proven by setting a vertical half wave rod along side the receiver and sliding the lead-in from top to bottom. The best point as mentioned before will be at the top of the vertical rod. If the antenna is mounted vertically on top of a building the lead-in should also be taken from the top and *not* the bottom. Recent tests have proven that signals could be received "R8" with the connection taken from the top; with the connection taken from the bottom these signals were absolutely inaudible. We hope to have more information along the lines of ultra high frequency antennas at a later date.

PARTS LIST FOR RECEIVER

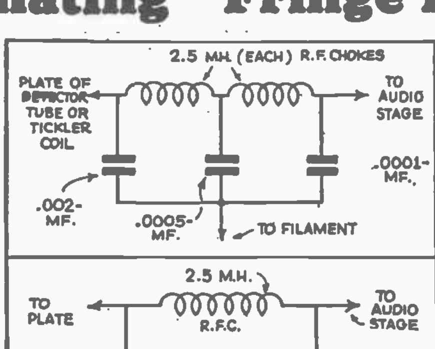
1—Portable carrying case, see text for details. Wholesale Radio.
1—6 mmf. variable condenser (large condenser cut down).
1—15 mmf. variable condenser. National.
1—100 mmf. condenser, mica. Aerovox.
1—.004 mf. condenser. Aerovox.
1—.005 mf. condenser. Aerovox.
1—.1 mf. condenser. Aerovox.
1—.01 mf. condenser. Aerovox.
1—15 mf, 25 volt, electrolytic condenser. Aerovox.
1—.5 meg. grid-leak. Ohmite.
1—500 ohm resistor. Ohmite.
1—25,000 ohm resistor. Ohmite.
2—250,000 ohm potentiometer. Electrad.
1—3:1 ratio audio transformer. Thordarson.
1—30 henry output choke.
1—5 prong Isolantite socket. National.
1—5 prong wafer socket. Na-Ald.
1—2.5 m.h. R.F. choke. National.
1—4 wire cable.
1—Small National vernier dial.
1—Antenna ground terminal strip.
1—56 or 2A5, RCA Radiotron (Sylvania).
1—76 or 41, RCA Radiotron (Sylvania).

Eliminating "Fringe Howl"

● IN SPITE of the many improvements in short-wave sets during the last few years, "fringe howl" or "threshhold oscillation" is still with us, especially in home-made sets. The most common method of getting rid of this trouble is to shunt a ¼ megohm fixed resistor across the secondary of the first audio transformer. Unfortunately this method, while eliminating the howl, eliminates most of the signal also.

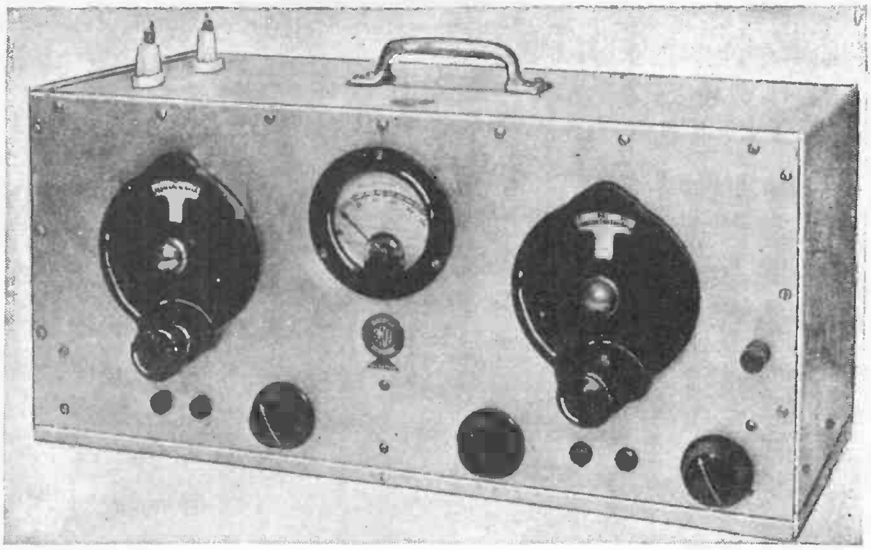
The radio-frequency filter circuit is the writer's favorite method of eliminating the troublesome howl. The arrangement shown in Fig. 1, consists of two 2½ millihenry R.F. chokes connected to three fixed condensers as shown. The circuit is exactly the same as that used in power supply filter systems, except that radio frequency chokes and small capacity condensers are used.

Sometimes very good results can be obtained by the use of only one choke and two condensers as shown in Fig. 1 "A".



Two methods described by the author for eliminating "fringe howl."

In many cases where pentode amplifiers are used in regenerative receivers trouble is experienced when the detector is near the oscillating point due to feedback between the audio stage and detector. This is in the form of a high pitched howl and can be very easily overcome by connecting a small by-pass condenser between the plate of the pentode tube and the B negative side of the circuit. The size of this condenser depends entirely upon the amount of feedback present. Usually any size from .002 mf. to .006 will cure the trouble. The pentode amplifiers also have the characteristic of giving a very "thin" tone with a high background rush or hiss. This is overcome by increasing the size of the by-pass condenser previously mentioned from .006 to .01. A .01 will give a very pleasing tone.



Front view of the 5-meter portable Transmitter-Receiver.

● Mr. Potter, operator of licensed amateur short-wave station, W9FQU, describes a very excellent 5-meter "transmitter-receiver" of the portable type. The receiver operates on the super-regenerative principle and it is provided with two stages of audio frequency amplification. This set is not a trans-ceiver, but has a distinct circuit for both transmitter and receiver. The transmitter employs two 31 tubes in a push-pull oscillator circuit. Class B modulation is employed, the driver tube being a 49, which drives two class B 49 modulator tubes. Batteries supply the plate and filament current.

5 Meter Transmitter-Receiver

By MARCUS L. POTTER, W9FQU

● BECAUSE W9FQU is primarily a *phone* station, it was only natural to design and build a five-meter transmitter and receiver very shortly after activity started on the 56 megacycle band.

At first no definite design was determined upon, simply because we first wanted to determine whether the transmitter and receiver should be strictly "portable" or otherwise.

After considerable experimental work using both low power receiving tubes with 180 volts of B battery and low-power transmitting tubes, with 500 volts rectified AC on the plates, it was found that the results using 31 type tubes were practically as good as the larger tubes, which used about two and one-half times the plate voltage. It was therefore decided that the transmitter would use two type 31 (two volt filament in series, with a total current drain of 130 milliamperes) in a conventional push-pull circuit, power to be furnished by six volts of "A" battery and 180 volts of "B" battery regardless of whether it be used for portable or permanent station work.

Receiver Design

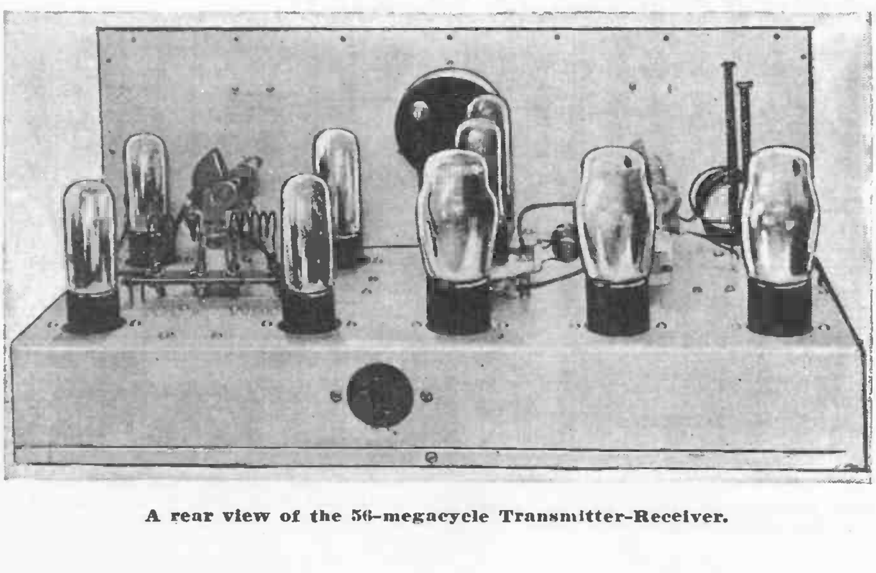
Receiver design came next, and it was decided to use a super-regenerative circuit with two stages of audio amplification. It is true that more audio power could be obtained by feeding a type 33 pentode directly from the detector and this would eliminate one tube; however, the current drain on the B battery would be several milliamperes more. For use in portable work it is always, of course, very desirable to utilize the smallest B current drain consistent with good results, and for this reason a two-stage audio unit was used instead of a power pentode.

The next consideration was whether it was desirable or not to incorporate both receiver and transmitter in one case. Because portability was desired, it necessarily follows that it, of course, would be good practice to follow the idea of building both transmitter and receiver in one unit. It should be distinctly understood that the receiver-transmitter is not of the *trans-ceiver* variety. The receiver is entirely separate from the transmitter, it having its own apparatus and tubes. A small amount of weight could have been eliminated by having one set of tubes for both the receiver and transmitter thereby making it a *trans-ceiver*, but the saving effected in this regard would have been very slight and would not offset the advantages gained by using separate tubes for both transmitter and receiver.

Case Rigid Yet Light

With all these ideas in mind, the portable 56 megacycle transmitter-receiver shown in the pictures was designed. The exceptionally rigid case is made of light weight cadmium-plated steel, which will more than stand the abuse usually encountered by portable apparatus. All coils clear the case and sub-panel, which also acts as a shield, by at least 2 inches, which minimizes the amount of r.f. loss that would otherwise be incurred.

Looking at the back of the chassis, the receiving apparatus is on the left-hand side. Thirty type tubes are used



A rear view of the 56-megacycle Transmitter-Receiver.

for the detector, interruption frequency oscillator and the first stage of audio. The fourth tube—the second audio amplifier—is a 31 type power tube, which supplies more than enough power to operate a loud speaker. Plug-in coils are used in the receiver so that if found desirable at any time the frequency band covered can be either raised or lowered from the present amateur five-meter band.

Transmitter Uses 31 Tubes

Located on the right of the chassis is the transmitter. Two type 31 tubes are used in a push-pull oscillator circuit. Class B modulation is employed, the *driver* tube being a 49, which drives two Class B 49 modulator tubes. 180 volts of B battery from an external battery box supplies both the Class B tubes and oscillator tubes. One hundred per cent modulation is assured by this combination.

Looking at the illustration showing the front view of the unit the National velvet-vernier dial at the left controls the frequency of the transmitter, the tuning covering the amateur band of 56 to 60 megacycles. The other National velvet-vernier dial at the right tunes the receiver which also covers the 56 to 60 megacycle amateur band. The knob at the lower right of receiver tuning dial controls the antenna tuning condenser; the receiving antenna connection being the binding post on the extreme right. The knob on the lower left of the receiver tuning dial is the receiver off-on switch and volume control. The third knob to the lower right of the transmitter tuning dial is the transmitter off-on switch. The two tip-jacks under the transmitter tuning dial are for the single-button microphone input, and the two tip-jacks under the receiver tuning dial are for the head phones or loud speaker.

Operation of Set

In operation the receiver is left on all the time, thereby permitting a constant check on the quality of transmission. During reception of another station, the transmitter is turned off but this can be done so quickly that it practically amounts to duplex operation. Keeping the transmitter off while receiving also prolongs B battery life, the transmitter draws about 30 milliamperes steady current and 60 to 70 milliamperes during modulation peaks and the receiver B battery drain is approximately 15 milliamperes.

Most any type of transmitting antenna may be used. Consistently good results, however, have been obtained with a Zep type, having four-foot feeders and a sixteen foot flat-top. For automobile work a current fed type consisting of two four foot pieces of wire attached to the antenna posts and separated 180 degrees apart have given exceptionally good results—R7 to R8 signals having been reported for distances up to three miles. During operation in W9FQU's station, the antenna posts are connected directly to the regular 75 meter fundamental Zep antenna, which also gives good results.

Parts List Transmitter-Receiver

Receiver

L1	5 turns No. 14 wire space wound ½ inch diameter.
L2	4 turns No. 14 wire space wound ½ inch diameter.
L3 and L4	Interruption frequency oscillator: primary or grid coil 1,400 turns: secondary or plate coil 900 turns honeycomb type of windings.
VT1	type 30 tube, R.C.A. Radiotron (Arco.)
VT2	type 31 tube, R.C.A. Radiotron (Arco.)
VT3	type 49 tube, R.C.A. Radiotron (Arco.)
C1	.000035 mf. Hammarlund midget receiving variable condenser.
C2	.0005 mf. fixed condenser.
C3	.002 mf. fixed condenser.
C4	.01 fixed condenser.
C5	.002 mf. fixed condenser.
C6	.00005 mf. Pilot midget variable condenser.
R1	1 megohm 1 watt resistor Lynch.
R2	30 ohm fixed resistor.
AT	audio transformer.
OT	output transformer.
VC	50.000 ohm volume control with "on-off" switch.
RFC	50 turns No. 30 D.S.C. wire close wound on ⅜" rubber rod.

Transmitter

L5	Antenna coils, each 1 turn No. 14 wire 1" diameter, ⅛" spacing.
L6	Plate tank coil, 5 turns No. 14 wire 1" diameter, ⅛" spacing CT.
L7	Grid coil 11 turns No. 14 wire ½" diameter space wound CT.
C7	Plate tank tuning condenser. Hammarlund .000035 mf. each section.
R3	15 ohm fixed resistor.
R4	100,000 ohm 1-watt grid leak Lynch.

Modulator and Speech Amplifier

MT	Acme single button microphone transformer.
IT	class B input transformer, for type 49 tubes
OT2	class B output transformer, for type 49 tubes and 5,000 ohm load.
MA	C-100 D.C. milliammeter.
C7	1 mf. Aerovox fixed bypass condenser.
C8	.002 mf. Sangamo fixed condenser.
SW	Off-on switch.

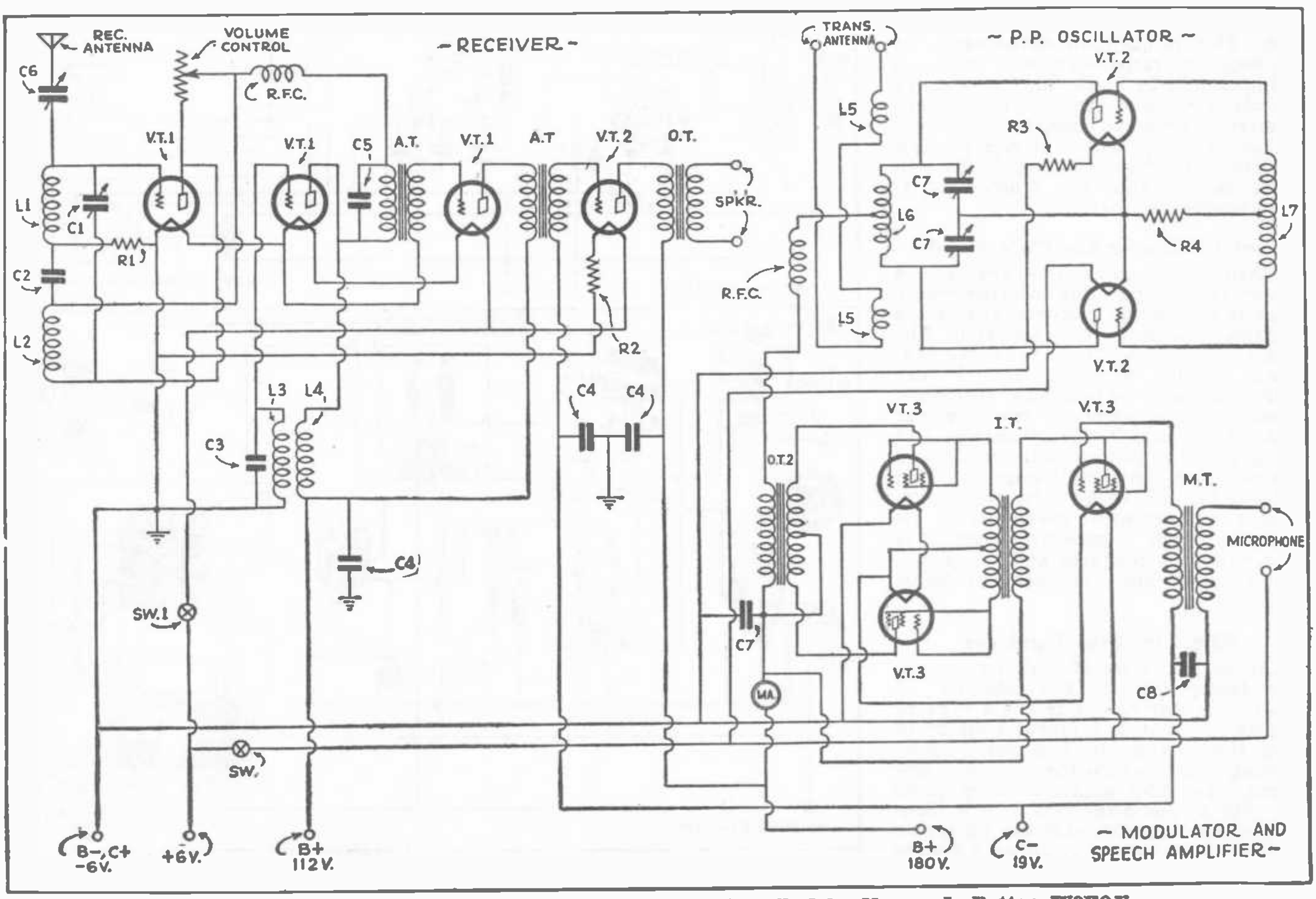
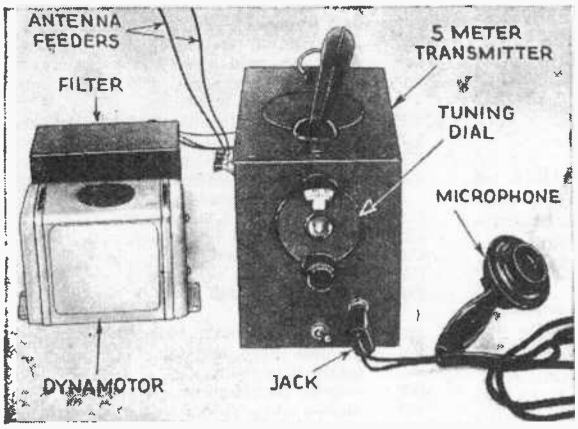


Diagram of the 5-meter Transmitter-Receiver here described by Marcus L. Potter, W9FQU.

5-Meter Mobile XMITTER Uses "Dynamotor"

We take pleasure in presenting this very compact and highly efficient "portable" transmitter designed to be used in an automobile. Only two tubes are used, a 6A6, push-pull oscillator, and a 42 modulator. A distance of 18 miles was covered by this transmitter during tests. It operates from a 6-volt car storage battery and a small dynamotor is used for the plate supply.



Here is the complete "portable" set-up with the exception of the storage battery.

● SINCE the 5-meter amateur band has been opened to the "ham" for mobile operation, many of the amateurs have installed *portable* transmitters in their cars and are obtaining excellent results. Many of them have covered fairly long distances, considering the very low power of the average portable transmitter. The now popular *transceivers* can be heard on the 5-meter band, in and around New York City, any evening. The object is to find a location that has considerable elevation, set up the portable "gear" and work as many fellow "hams" as possible.

The outfit shown in the photographs is *not a transceiver* but a complete transmitter intended as a companion unit to the compact receiver described in the November issue of SHORT-WAVE CRAFT. These two sets provide the operator with a complete installation with which "duplex" can be worked with ease. This is quite an advantage over the popular transceiver, with which it is impossible to work duplex. Duplex operation is one of the main advantages of ultra short-wave communication and we see no reason why it should not be a feature of the "portable rigs." We will agree though that the transceiver is more simple to construct.

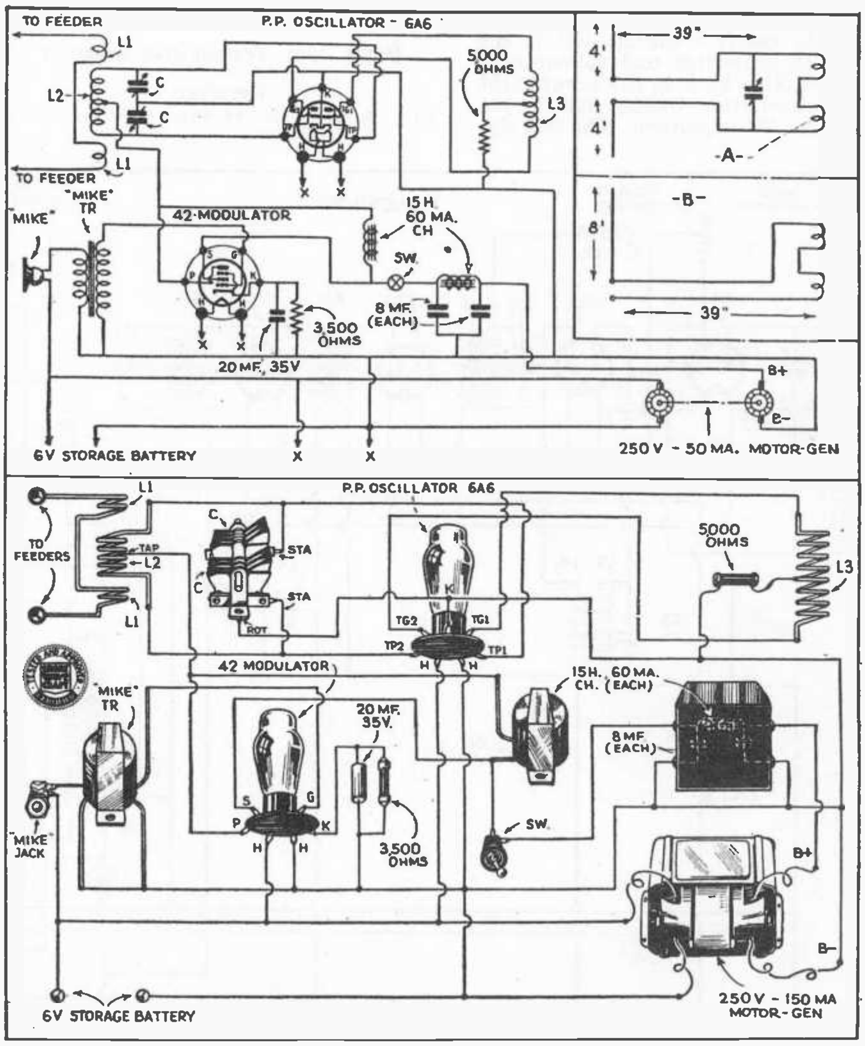
Uses Dynamotor for Plate Supply

When a transmitter is operated in a car or from a portable location where there is no electric power available the machine must be *battery* operated. The best arrangement is to use a *motor-generator* similar to those used in car radios intended for broadcast reception. These little "dynamotors" run by power taken from a 6-volt storage battery and the generator portion delivers around 250 volts at 50 to 60 milliamperes. This is ideal for the fellow who wants efficient and economical operation of his portable. Such a generator system is used with this portable and the photograph shows how compact the affair really is.

New 6A6 Tube Employed

The hardest part of building a portable transmitter is the selection of tubes. We started out to use a type 19 twin-triode with a filament resistor to drop the voltage to two volts. Fortunately, just before the set was completed, the tube manufacturers came out with a type 6A6; this tube is identical to the type 53 with the exception of the heater, which requires 6.3 volts instead of 2.5 as in the 53. This tube is just what we needed. Of course we cannot operate the 6A6 at full input in a "portable rig," because the problem of obtaining full modulation becomes more complicated and requires too much equipment to make the thing practical.

Consulting our Tube Manual, we find that the type 42 is the most advisable modulator to use where a single tube is used. Here is quite a problem; the 42, if operated under conditions advised by the manufacturers, will not

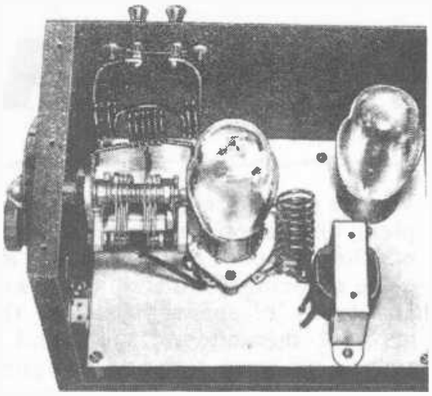


Schematic and physical drawings, clearly showing values of parts and connections for the 5-meter "mobile" transmitter.

provide enough power to modulate the 6A6, that is, with the microphone being used to drive the 42 and not a stage of speech amplification. Speech amplifiers complicate matters and it was decided to follow a course of cut and try in order to obtain the most efficiency. The "good book" says that the bias for the 42 with 250 volts on the plate should be 16.5 volts; this to be obtained with a 500-ohm resistor connected in series with the cathode. Under these conditions there was not enough modulation, with the oscillator running with 3 watts input, to make the voice "understandable." However, as the bias was increased on the 42, the output increased considerably. Best results were obtained with 3,500 ohms in the cathode lead. This brings about a condition where the 42 is operating nearly *class "A" prime.* Not a good condition in a single-ended audio amplifier, but the distortion at voice frequencies is not very bad—the proof is that the quality was reported "very good." The modulator is explained first, because it is much more "tricky" than the oscillator. With an audio circuit of this type, every possible amount of gain is needed and for this reason the reader is advised to try *reversing* the secondary connections of the microphone transformer, and also the connections to the "mike" battery itself, until best results are shown by an increase in the percentage of modulation.

How Tuning Condenser Is Made

If the following instructions are followed there will not be the slightest difficulty with the oscillator part of the transmitter. The tuning condenser was made from a National type ST90. The stator and rotor were remodeled to provide a split stator condenser having three rotor and two stator plates in each section. There are 6 turns in the plate coil and 8 turns in the grid coil. They are wound on a⅝ inch form and the spacing between turns is about equal to the diameter of the wire, which is number 12 solid enameled. Tinned buss-bar will do as well, of course. Each coil is center-tapped for the grid return and the B plus to the plates. The 6A6 operates as a 2-tube push-pull oscillator and gives remarkable efficiency at very low inputs. The size of the grid-leak was determined experimentally. We started with a 20,000-ohm unit and decreased it—the input to the oscillator increases as the leak resistance decreases—until we could just obtain full modulation. This gave a plate current of 20 milliamperes with a leak of 5,000 ohms. without the antenna the plate current was in the order of 14 or 15 "mills." (M. A.) The antenna coils have three turns each and are identical to the other coils in size of wire and diameter. We found that very close coupling was needed, but the reader is advised to experiment with various degrees of coupling to obtain best results.



Inside view of oscillator and modulator combination. Notice the extreme simplicity.

Referring to the diagram we see that the whole transmitter is simplicity itself. Plate modulation is used and the B plus is fed to the plates of the oscillator and modulator through a small iron core choke having about 15 henrys inductance and capable of carrying at least 50 milliamperes, which is the total amount of current drawn by both tubes. The condenser connected across the cathode resistor of the modulator tube *must* have a capacity of 20 mf. with a working voltage of 35 volts. The primary of the microphone transformer is connected so that the microphone button current is supplied by the storage battery, and it is only necessary to insert the plug in the jack provided on the front of the box. A single-pole single throw toggle switch allows the B plus to be broken in order to throw the transmitter "on" and "off."

The case in which the transmitter is built is identical to that used for the receiver previously mentioned and measures 6½" high, 5" wide and 8¾" deep. There is a subpanel measuring 5¾" by 7" and on it is all the equipment for the modulator and oscillator. The antenna connections are brought out at the left side of the box.

19 Miles Covered

Several types of antennas can be used with this transmitter and several are shown in the diagram. There is only one *tuning* control and that is the dial on the front of the box, and there is nothing to get out of adjustment. We have had the pleasure of working 19 miles with an R5 report—not bad, eh?

Parts List for 5-Meter Portable Transmitter

1—SE-90 National condenser, remodeled; see text.
1—20 mf., 35-volt electrolytic condenser, Aerovox.
2—8mf. 300-volt electrolytic condensers, Aerovox.
1—5000-ohm wire wound, 5-watt resistor, Aerovox.
1—3500-ohm, 2-watt resistor, Aerovox.
1—single-button microphone transformer. Universal.
2—15 henry, 60 ma., iron core chokes.
1—7-prong (large) Isolantite socket, National.
1—6-prong wafer socket, Na-Ald.
1—single open circuit jack, I.C.A.
1—Sp-St toggle switch. I.C.A.
1—250-volt, 50 to 60 ma., 6-volt dynamotor.
1—aluminum panel, 1/16"x5¾"x7". Blan.
1—carrying case, see text. Wholesale Radio.
1—6A6 tube, Sylvania.
1—42 tube, Sylvania.
1—National, 3-inch dial.
1—twin antenna terminal strip, Na-Ald.
1 set of coils, see text for winding details.
1—high-gain, single-button hand microphone. Universal.

An Ultra Short-Wave Transmitter

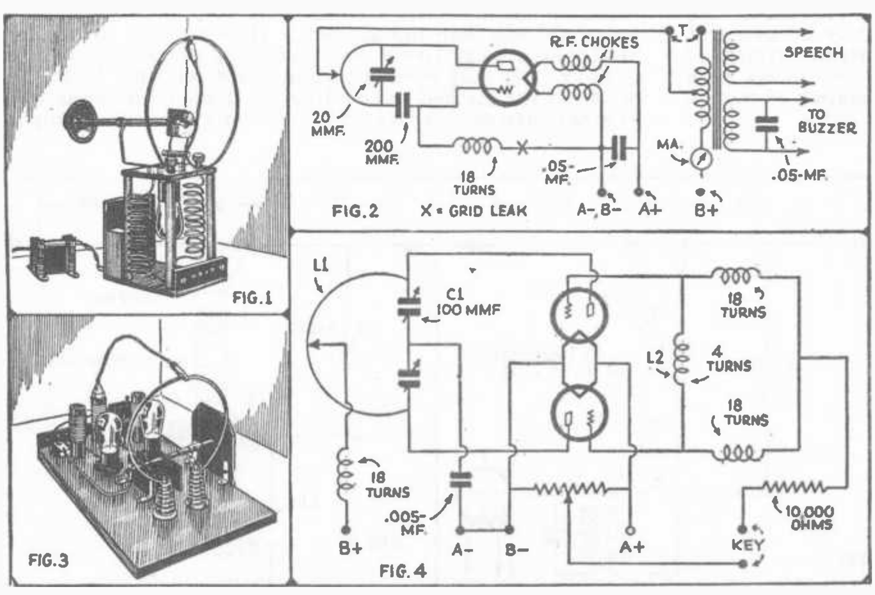


Fig. 1. Simple ultra short-wave transmitter. Fig. 2. Three-point transmitter circuit. Fig. 3. Construction of a push-pull transmitter. Fig. 4. Circuit of the push-pull transmitter.

• FIGURE ONE shows a very simple construction for an ultra short-wave transmitter. The tube is mounted between the choke coils upside down in order to have the connections to the grid and to the plate as short as possible. The midget condenser of about 15-20 mmf. which controls the wavelength is connected across the oscillator coil and is clearly seen on the photograph. Fig. 2 gives the diagram of the circuit, an ordinary 3-point oscillator. For this transmitter a power output tube (type 45 or 71) is used. A by-pass condenser of .05 mf. is connected across the filament to protect it from accidental voltage surges, which during the previous tests destroyed one of the tubes. The modulation is performed in the plate circuit, but without the aid of a special modulator tube. For this purpose an A.F. push-pull transformer is used, of which the secondary is connected in the plate circuit. One of the primaries is operated from a buzzer, while the other primary is connected to the output ends of a 2-stage audio amplifier, in order to also enable telephony transmission. The plate tension of 200 volts is supplied from the D.C. line. However, satisfactory results can be obtained with 150 volts from batteries.

Short Wave Antennas

We are pleased to present this complete discussion on various types of short-wave antennas such as, noise reducing doublets, using various types of feeder systems, the inverted diamond antenna, and a general purpose antenna designed to tune to resonance with any of the short-wave broadcast bands. The good and bad features of each type of antenna are carefully brought out in this article after exhaustive tests were made to determine which antenna is best suited for general short-wave reception.

● A TRUE saying is that a receiver is no better than its antenna. It is also true that the average short-wave receiver will bring in stations with almost any type of antenna even to a short piece of wire several feet long. The ideal condition would be an antenna that is designed to operate on the specific frequency to which the receiver is tuned. Then, we would have a maximum pick-up by the antenna concentrated on a very narrow band of frequencies. This would mean high signal level and a low background noise level. First, because the antenna is tuned sharply and secondly, because the receiver gain control can be turned down on account of the strong signal that the antenna is feeding into the receiver. It has long been the desire of short-wave fans to construct a general purpose antenna, one that will respond to a wide range of frequencies preferably from around 15 meters up to 100. Theoretically it would require several antennas to cover this range of frequency and it is almost impossible to get a single antenna that will have the same efficiency over this wide range. In this article we will endeavor to set forth all the prominent types of antennas in use today. The advantages and disadvantages will be pointed out.

Doublet Antennas

In Fig. 1 we have a doublet antenna using the new Lynch Giant Killer, low impedance, transmission line. The two flat top portions are 30 feet each in length and the feeder should be at least 30 feet long. The approximate impedance of the flat top antenna when operated as a half wave affair will be between 70 and 75 ohms. The impedance of this new cable effectively matches the impedance of a half wave antenna, the feeder having an impedance of approximately 70 ohms. In the ntenna flat top, No. 12, solid enamel wire is recommended. The conductors used in the transmission line consist of 10 strands of No. 22 B. & S. gauge wire, each strand being enameled. Varnished cambric insulation is used around each conductor and then the twisted pair is sealed in heavy weather-proof rubber covering. The material used for insulation is non-wicking and no trouble will be encountered from the absorption of moisture. A small coil, L1, is used to couple the transmission line to the grid coil of the receiver. This coil should have approximately 10 turns of No. 20 double cotton covered wire. This antenna system of the dimensions shown in Fig. 1 will work very nicely on a range of frequencies from 15 up to approximately 50 meters and will produce a minimum of background noise.

Transposed Feeders

In Fig. 2, we have the familiar transposed feeder using two inch transposition blocks. The dimensions, of course, are the same as shown in Fig. 1. However, the transmission line will have an impedance of approximately 450 ohms and it does not match the antenna as well as the transmission line shown in Fig. 1. However, the higher impedance line shown in Fig. 2 can be tuned somewhat with the coil-condenser combinations shown in Fig. 3. This tends to make it slightly more selective. However, the background noise pick-up will be slightly greater than that of Fig. 1.

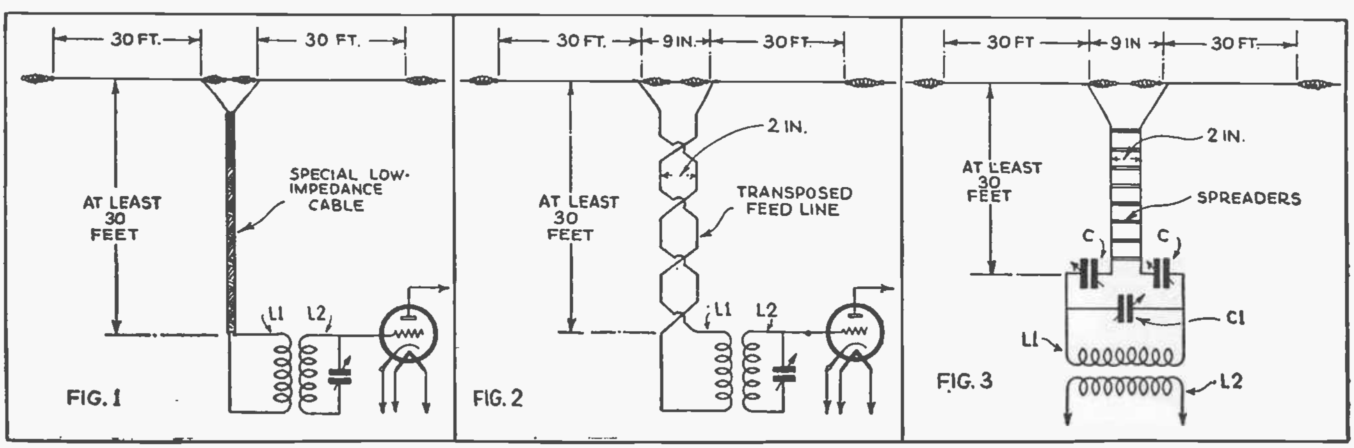
In Fig. 3 we have approximately the same thing as Fig. 2, except that instead of using transposition blocks, two inch spreaders are used and the feeder wires are run parallel. The dimensions here, are also the same as in Figs. 1 and 2. The tuning arrangement consisting of the two condensers, C and C1, provides a fairly flexible system and it will respond quite well to frequencies from 15 to 50 meters. Either spreaders or transposition blocks can be used. The advantage of tuning wherever possible in antennas, is that the antenna will peak up at a certain frequency and provide higher signal level with a lower amount of background noise.

Twisted Pair

In Fig. 4, it is the same antenna system only here we are using twisted pair or "lamp cord" for the feed line. Ordinary heavy duty twisted lamp cord has an impedance of approximately 100 ohms and is quite effective in reception. Although not being weather proof it has a tendency to absorb moisture and in the end not quite as good as the arrangements shown in Figs. 1, 2 and 3. However, if it were not for the absorption of moisture this system would be better than Fig. 2 and 3 and not quite as good as that shown in Fig. 1, that is considering that none of the feeders are tuned. Tuning, as we said before, will increase the efficiency and it is much easier to tune a line similar to that shown in Fig. 2 and 3 than those shown in Figs. 1 or 4.

Diamond Antennas

Inverted diamond antennas (Fig. 5) have received considerable comment lately and there is no doubt that they are more efficient than the doublets. However, one drawback is that they are extremely directional and for maximum signal pick-up they only receive best in one direction. In Fig. 4A, we show the method of coupling the diamond antenna to the regenerative detector and Fig. 4B shows the connections to a



Figs. 1, 2, and 3 in the above drawing show various feeder arrangements used with the doublet antenna. Fig. 3 shows how the feeders may be tuned.

The Best Types of S-W Aerials.

By GEORGE W. SHUART

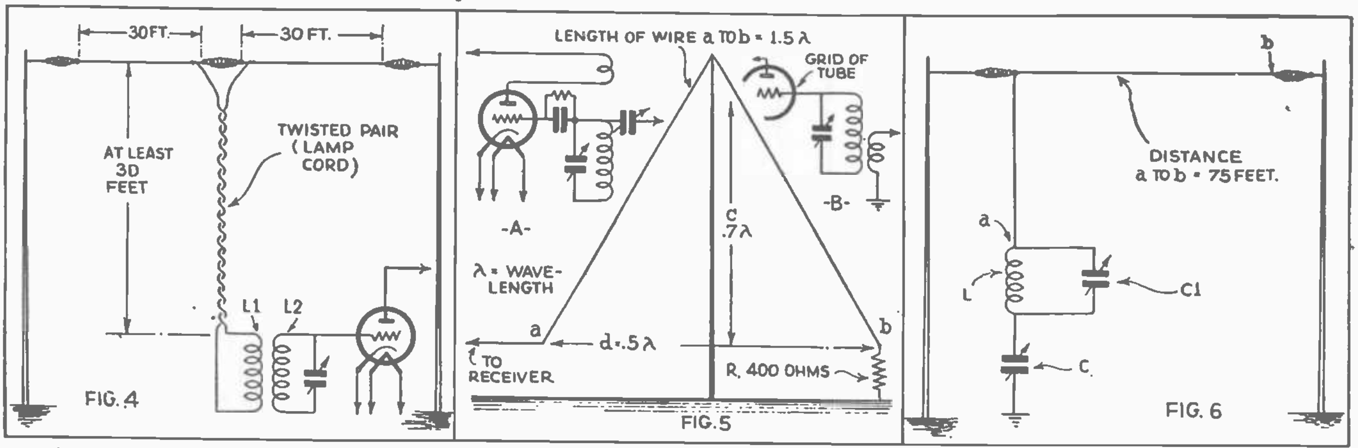


Fig. 4—We have the doublet using twisted pair as feeders. Fig. 5 shows the inverted diamond antenna which has proven quite popular in Europe. Fig. 6 shows an arrangement with which it is possible to tune the entire antenna system to the various short-wave bands.

tuned R.F. stage, or any receiver where a primary or antenna coil is used. One advantage of the diamond antenna is that it will respond to a fairly wide range of frequencies and in an antenna designed for 25 meters it would be very effective over a range from 15 to 50 meters and it does not need to be tuned. The figures for designing a 25 meter diamond antenna are as follows:

Height c = $.7\lambda$ *or* $.7 \times 25$ *or 17.5 meters*

There are 3.28 feet to a meter, therefore—

$3.28 \times 17.5 = 57.4$ *feet.*

The length of the wire from a to b =

1.5λ *or* $1.5 \times 25 = 37.5$ *meters, or*

$3.28 \times 37.5 = 123$ *feet.*

The base d or, distance between a and b =

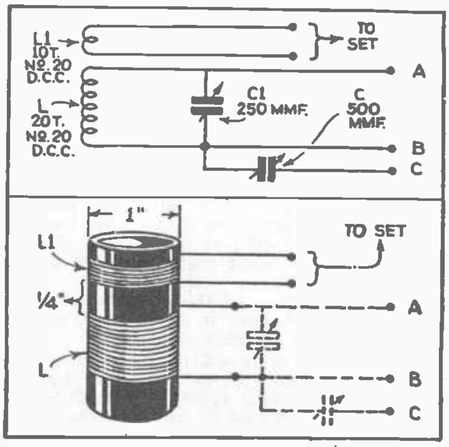
$.5\lambda$ *or* $.5 \times 25 = 12.5$ *meters, or*

$3.28 \times 12.5 = 41$ *feet.*

It is necessary that Point B in Figure 5 should be terminated through a 400 ohm resistor to ground. This antenna receives best from the direction in which the resistor points. For those who wish to receive in a given direction and where it is possible to erect an antenna of this type it is highly recommended.

A Tuned Antenna

In Fig. 6 we have endeavored to strike a happy medium, that is, an antenna that can be tuned and will respond to the short-wave broadcast bands, 19, 25, 31, 49 meters. The length of the antenna from A to B, that is the flat top and including what lead-in may exist, should be 75 feet. The ground lead should be as short as possible, not over four or five feet long. With C, C1 and L it is possible to tune this antenna to any of the four short-wave broadcast bands previously mentioned. On some bands it will be a Hertzian antenna and on others it will function as a Marconi antenna. On the 49 meter band a Hertzian antenna will have to be 80 feet long. By setting C to a minimum the system becomes in effect not grounded. Therefore, L and C1 can be used to tune it up to an effective length of 80 feet. In the 31 meter band, this antenna functions as a ¾ wave Marconi. C should be adjusted to approximately half the capacity and tuning done with C1. In the 25 meter band, it is also a ¾ wave Marconi, and is necessary that the effective length be reduced to 60 feet. This is accomplished by the adjustment of C with C1 set to a minimum capacity. In the 19 meter band it is possible to make this system function as a five quarter wave Marconi. The necessary length here is 75 feet so we can use condenser C for tuning and C1 should be set at minimum capacity. This antenna has no noise reduction provision such as transposed feeders, twisted pair or what have you. However, it is an ideal antenna for use where background noise is not too high. Due to the fact that it is *tuned* to each of the bands in which short-wave broadcasting is done, the noise level will be low. This is because it provides a stronger signal for the receiver.



Constructional details of antenna coupling unit. Fig. 7.

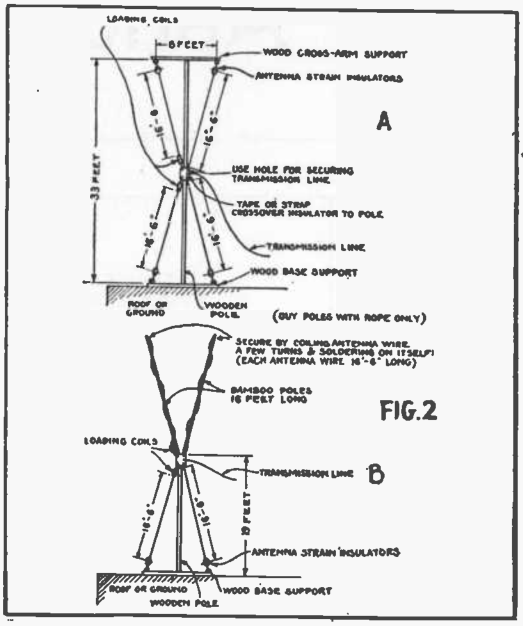
Antenna Coupling

The most effective way of coupling an antenna to the receiver, of course, is necessary in order to derive full benefits from a well-designed antenna system. In Fig. 7, we have an antenna coupling unit consisting of two coils and two condensers. The coil, L1, should be connected to the receiver and consists of 10 turns of No. 20 double cotton covered wire. Coil L, the antenna tuning coil, consists of 20 turns of No. 20 double cotton covered wire. Either the doublet antennas previously described or the antenna system shown in Fig. 6 can be used in this coupling arrangement. For a doublet antenna we connect the feeders to points A and B and use condenser C1 for tuning. For the antenna system shown in Fig. 6 we use points A and C. Point A will go to the antenna and point C connects to the ground. The dimensions for making this tuning unit are given in Fig. 7. It can be made up into a small unit and mounted into a box and will serve as a medium for coupling any antenna to any type of receiver.

We trust that among the various types of antennas described in this article, the reader will be able to select one that will best suit his needs.

Constructional Hints

There are quite a few important factors to bear in mind when constructing a short-wave receiving antenna. The first and most important is that the antenna should be as high above the ground as possible and away from all surrounding objects such as trees, roofs and electrical wires of any description. Heavy copper wire must be used and all connections thoroughly soldered. Either stranded or solid copper wire may be used. If solid wire is used, the size should be 10 to 14 B & S gauge enameled. Do not use bare wire as it corrodes very rapidly. If stranded wire is used nothing smaller than seven strands of No. 22 should be used and each strand should be separately enameled. When making a connection with stranded wire be sure to clean each strand thoroughly otherwise there may be a poor connection to one strand. Do not use a metal pole to support the antenna. Wood should be used wherever possible. If an antenna is hung from a tree, leave plenty of space between the end of the antenna proper and the branches of the trees.



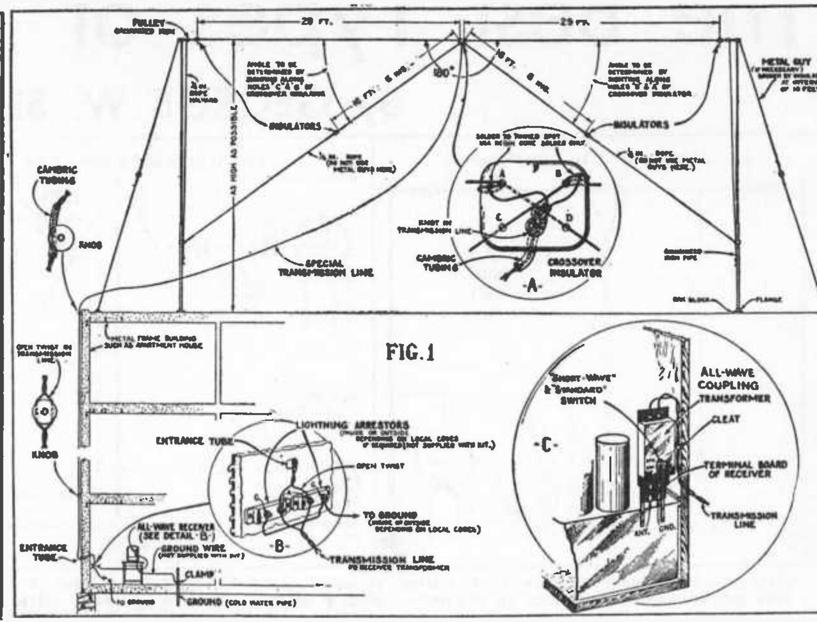


Fig. 2 shows the general construction of the vertical "double-doublet." While this is not a directional affair it has its advantages, in that it can be erected in a much smaller place than a large horizontal installation. Loading coils are inserted to make the effective length 29 ft. for each side. Fig. 1 shows the complete horizontal "double-doublet." Dimensions are given for those wishing to construct an antenna of this type. (No. 193.)

The Latest—A "DOUBLE-DOUBLET" Antenna

The "double-doublet" is a most efficient compromise in short-wave "noise-free" antennas; it actually comprises two separate doublet aerials designed to give maximum response on all bands.

● THE *world-wide antenna system* has been developed after considerable research. It provides, primarily, an efficient means of collecting the shorter-wave signals on a special "double doublet" or Duo Dipole Antenna.

The purpose of this arrangement is to approach an ideal antenna system for *all* the short-wave broadcast bands. Theoretically it would be best to have a doublet designed and installed for each band, namely, one each for the 16, 19, 25, 31 and 49 meter bands. This would mean five doublets, and each one should be sufficiently separated from its neighbor to prevent disturbance of the reception. Obviously this would be quite an installation problem and economically prohibitive. Therefore the arrangement evolved by the RCA Victor engineers and shown in Fig. 1 is the best approach to the ideal, as the 29-foot sections tend to tune or match the system toward the lower end (in frequency) of the short-wave broadcast band, namely, toward 49 meters, and the 16½ foot sections tend to tune or match the system toward the higher end (in frequency) of the short-wave broadcast band, namely, toward 16 meters. The connection of both doublets, or the "double-doublet," to the transmission line, tends to give a smooth *match* throughout the short-wave broadcast band.

The proper lengths for each doublet made from the two continuous antenna wires each 46½ feet long (6" allowed for each antenna strain insulator tie), is shown in the drawing. Connection of the transmission line should be made by rosin-core soldered joints as indicated by the detail of Fig. 1. Note that the long and short antenna wires, which are connected together, are located on opposite sides of the center transmission line connection. Height above ground should be considered as the distance from the 29 feet horizontal sections to ground, the latter to be considered as earth ground, if the span is on top of a frame dwelling with no grounded metal roof, or from a building to a nearby pole, tree, or another building. If the span is installed on top of a steel framework building, or any building with a grounded roof, the earth ground is usually considered at the roof.

Clearance from wires and buildings is necessary so as to prevent these objects from casting radio shadows on the antenna system with consequent reduction in signal strength pick-up.

Clearance or distance from wires, buildings containing electrical machinery, highways, trolley lines, etc., is very important.

For good results a minimum of 30 feet above ground is recommended. The signal strength received varies with the height above ground.

There is no directional effect with the vertical doublet, but, on the other hand, the horizontal doublet usually has a better signal-to-noise ratio. An advantage perhaps is that in some locations a vertical doublet of the type shown in Fig. 2 may be easier to install.

Theoretically, the doublet should be stretched out fully—each half making an angle of 180 degrees with the other, for most efficient reception. If this angle is reduced, due to constructional difficulties to 90 degrees signal strength will be decreased about 30 per cent from the signal received from the doublet in its full 180 degree span. Theoretically it receives best from stations located along the perpendicular and in the same plane to the horizontal span.

The full 110 feet of lead-in cable supplied must always be used, regardless if the doublet antenna system is only, for example, 60 feet of line run from the receiver location. The balance of 50 feet may be coiled up in a coil of convenient diameter, such as one foot, at the receiver end.

The connection of the conductors to the receiver transformer is immaterial, so long as the ends do not short-circuit.

Due to a most efficient match of the "double-doublet" to the receiver for the shorter waves (3.5 (3500 kc.) to 20 megacycles), there would be an unavoidable loss introduced for the frequencies assigned to broadcasting police calls, etc., namely, 550 to 3500 kc. A standard broadcast (STD) Short Wave (SW) switch is therefore provided on the receiver transformer for improving the reception of the stations operating on the frequencies between 550 and 3500 kc.

The matching transformer is a specially developed unit necessary to couple the transmission line inductively to the receiver. The use of electrostatic shielding balances out the *transmission line to ground* capacity.

The transformer is designed to mount directly on the *Antenna-Ground* terminal board of RCA-Victor latest model *All-Wave* receivers, thereby insuring the shortest possible connection to the antenna and ground terminals. The installation of the transformer to a late-production RCA-Victor Model 140 is illustrated in Fig. 1. It is important to note that the length of the ground connection of the special transformer is critical. To insure *maximum noise reduction* keep this connection at shortest possible distance (not over one inch) from chassis ground.

Care should be exercised to prevent the transformer antenna terminal from "shorting" to the chassis. On other manufacturers' receivers' having the chassis *grounded*, the transformer should be mounted on the side of the cabinet (by utilizing holes, spacers and screws provided) in such a manner as to permit having the transformer ground connector, when bent, slip under the ground terminal or a chassis nut. If this is not possible make the ground connection absolutely as short as possible.

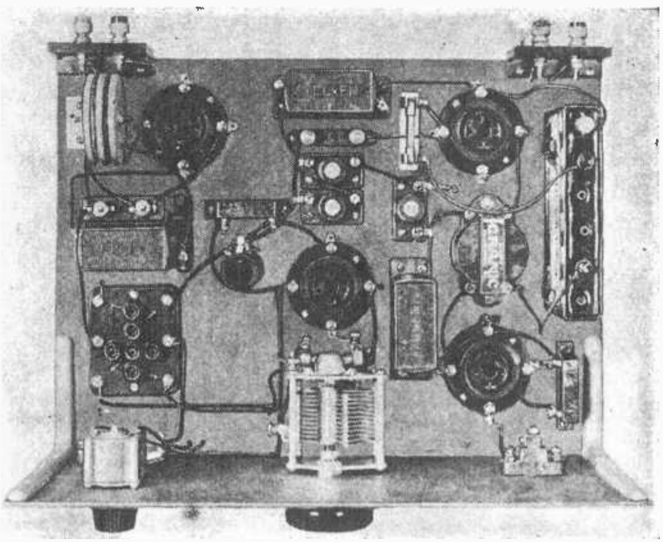
Ground wire should be obtained locally, as lengths for ground wire will vary. Use No. 14 rubber covered wire or larger if available and keep the run as *short* as possible.

For distances greater than 110 feet, additional length of line must be added in multiples up to two (2) times, or up to 220 feet. After this distance additional lengths can be added, up to 500 feet and can be cut anywhere convenient for connection to the receiver.

Examples:

Line Run to Receiver from Doublet in Feet.	Line Length Used in Feet.	Number of Lengths of 110 Feet.	Length to be coiled in Feet.
95	110	1	15
150	220	2	70
210	220	2	10
300	300	3	*
500	500	5	*

*No coil necessary. Cut off unused portion.



Top view of the "Super-Regenerator Four" here described by Mr. Dent.

The Super-Regenerator Four

By H. B. DENT

● WHENEVER a number of radio enthusiasts gather, it is reasonably certain that the subject of short-wave reception will come up for discussion, variations of the well-tried methods, as a rule, receiving greatest attention, with occasionally a discourse on some lesser-known arrangement. There is one system, however, namely super-regeneration, which is rarely mentioned, but possesses such obvious advantages that there is scope for further investigation, more especially since this system has not been thoroughly tried out on the short waves.

Will this become the recognized system in the future when ultra-short-wave transmissions are inaugurated? The present would be opportune to compile a few facts on the subject. Although ultra-short waves are not generally available for testing purposes at present, the general performance of the system can be gauged with reasonable accuracy by comparing the performance on wavelengths of about 20 meters, and on some higher wavelengths, say, in the region of 80 meters.

Recent experiments show that without a shadow of doubt there is a definite improvement at the lower end of the short-wave band, the particular advantages being simplicity of operation and absence of that annoying effect described as "threshold howling." The initial adjustments are not critical as those who have used this arrangement on broadcast wavelengths might seem to think. Indeed, the entire absence of any spurious effects, uncertainties and trickiness in the operation all lend weight to the suggestion that this system has much to commend it for the reception of the extremely high frequencies.

Now, what do we find on the debit side? First, the selectivity seems less good; this may not necessarily be a disadvantage, especially on the ultra-short waves. Secondly, background noises tend to increase, especially if the maximum amplification available is utilized. Possibly we must include also the inability to receive C.W. signals without the aid of a separate heterodyne, but this does not apply, of course, if our intentions are to develop a receiver for telephony reception only.

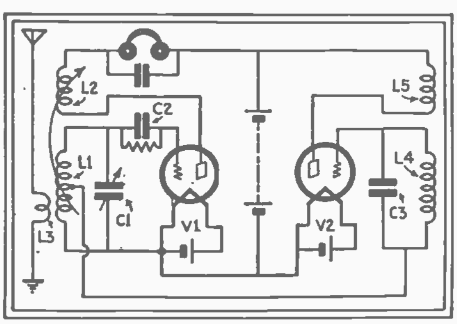


Fig. 1—Fundamental arrangement for super-regeneration. V1 is the detector-amplifier; V2, the "quenching oscillator."

Negative Resistance Explained

Now, before proceeding farther, it might be well to refresh our minds and consider a few fundamental facts relating to regenerative circuits in general, and super-regeneration in particular, since the two are closely interwoven. The effect of applying reaction to a circuit is to reduce its positive resistance, or, put in another form, it introduces a negative resistance tending to neutralize the existing resistance in the circuit. This negative resistance may be either less than, equal to, or greater than the positive resistance.

The one circuit that has perhaps greater possibilities than most any other circuit for short-wave receivers, is the Super-Regenerator. A number of new ideas are incorporated in the super-regenerative circuit here described by Mr. Dent, a well-known English radio expert. The super-regenerative circuit here presented is the result of the writer's experiments.

In the first case, when a signal is induced into the circuit the oscillations will build up to a certain definite amplitude determined by the effective positive resistance, and will be maintained so long as the signal continues. On cessation the oscillations die out.

When the negative resistance equals the positive resistance, the effect of injecting a signal E.M.F. is to cause oscillations to build up, which in time will attain an infinite amplitude, and these oscillations continue after the signal is interrupted, but without further increase in amplitude. The condition is

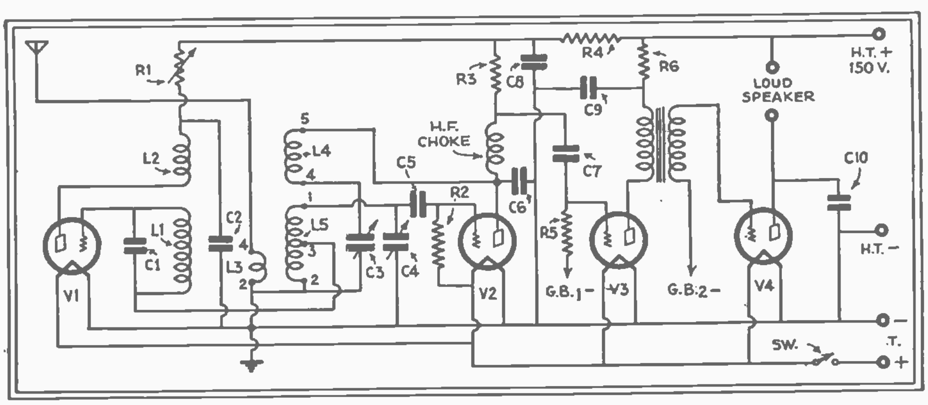


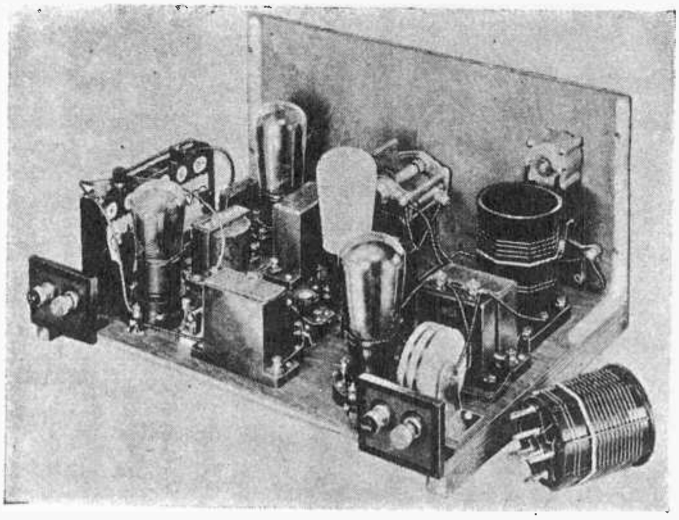
Fig. 2—Theoretical circuit diagram of the Super-Regenerative Four receiver for short waves. Values are as follows: C1, 0.05 mf.; C2, C8 and C9, 2 mf.; C3, 0.0003 mf.; C4, 0.00015 mf.; C5 and C6, 0.0001 mf.; C7, 0.01 mf.; C10, 0.001 mf.; R1, 0-2 megohm variable; R2, 5 megohms; R3, 30,000 ohms; R4, 20,000 ohms; R5, 2 megohms; R6, 10,000 ohms; V1, V2 and V3, average general purpose type tubes; V4, small power tube.

similar to one which we are familiar, namely, when the set is in a state of self-oscillation. The injected E.M.F. need not come from the ether, any minute electrical change in the circuit being sufficient to start this process of building up oscillations. In a practical case, however, self-oscillation appears before the effective positive resistance is completely neutralized, since there are other factors which come into the picture at this stage.

So far as the third condition is concerned, namely, when the effective resistance is negatived, it will suffice here to say that it is a theoretical condition only, being the logical conclusion having regard to the sequence of events concomitant with regeneration, but not attainable in practice.

Although space permits only a brief survey of this subject, it will have been realized that were it possible to devise a stable reactive detector circuit in which the effective resistance is lower than the critical value where self-oscillation appears, we should possess a receiver in its most simple form with phenomenal H.F. amplifying properties.

Super-regeneration attains this end and in a very simple manner, as it is now proposed to show. The arrangement is the outcome of some experiments carried out by E. H. Armstrong many years ago, and in its simplest terms consists of periodically varying the positive and negative resistance of the circuit, the balance being arranged so that the average resistance is positive; the circuit will not oscillate, therefore,



Rear view of the 4-tube super-regenerative receiver of unique design.

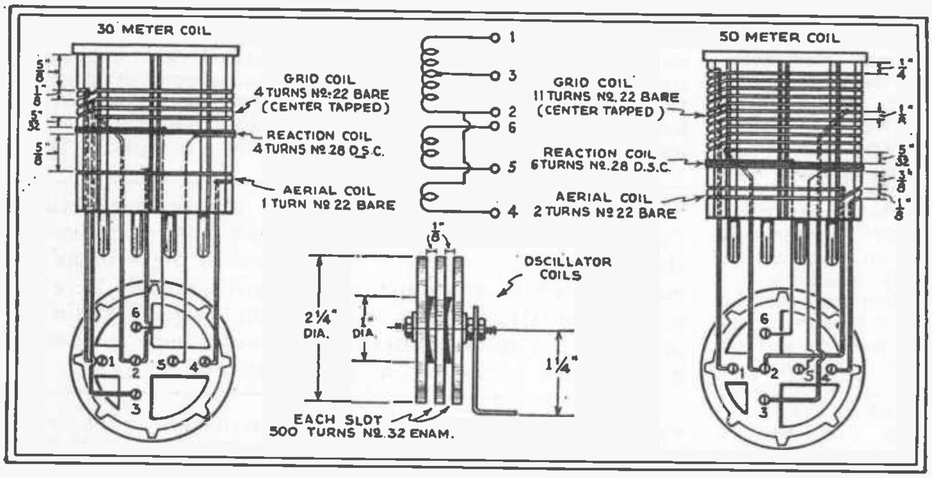


Fig. 3—Details of coils and winding data, also dimensions of wooden form for quenching oscillator coils.

of its own accord, but during the intervals when the resistance is negative, induced signals will build up to large amplitudes. Since the average resistance of the circuit is positive, these oscillations will die out immediately the impressed signal is interrupted, and indeed follow faithfully any change in its amplitude, but at a much higher level.

There are various ways of obtaining this effect in practice, but one only will be discussed here, and the form this takes is shown in Fig. 1. Briefly, its action is as follows: Variation in the resistance of the receiving circuit L1, C1 is achieved by varying periodically the potential on the grid of the valve V1 by means of a low frequency oscillating circuit L4, C3. When the oscillating potential of the grid of V2 is positive, a conduction current flows from the tuned circuit, thus increasing its effective resistance. During the other half cycle, when the grid of V2 is negative, no conduction current flows; the circuit of L1, C1 thus having a very low resistance, which is determined by the regenerative effect produced by the feed back, or reaction coil L2. It is during this period that signal currents flowing in the aerial circuit, coupled by the coil L3, build up, are rectified by the action of the grid detector V, and become audible in the headphones.

Intermittent Cessation of Signals

The ear, being unable to respond to rapid changes, does not notice the intermittent cessation of signals at each half cycle of the oscillator V2, and in this respect resembles the human eye, the retentive effect of an image on the retina precluding any determination of change in the form if the variations are sufficiently rapid. This defect, if it can be regarded as such, makes moving pictures possible, so likewise does the accommodation of the ear render super-regeneration possible. It has been suggested in some quarters that for the reception of broadcast matter and telephony signals the quenching oscillations generated by V2 should be above audibility, since obviously these will modulate the carrier wave and be superimposed on the signal. Recent experiments carried out by the present writer have shown, however, that the performance in general is better with a low quenching frequency, but practical considerations preclude the use of those much below 6,000 cycles per second, otherwise it cannot be filtered out after rectification without noticeable deterioration of the quality of reproduction.

Armed with these few fundamental facts it only remains now to consider how best we can apply the principle of super-regeneration to a practical case, for there are certain features inherent in the system that tend to impose a limit to the amplification desirable at the detector stage. If the maximum possibile amplification is extracted, background noise is inclined to be rather troublesome. This is due to the exceptional sensitivity of the detector-amplifier, which not only responds to minute electrical pulsations having a tunable component, but greatly amplifies the inherent valve noises brought about by very small changes in the operating state of the valve. For example, fluctuations in the electron emission from the filament normally passing unnoticed become audible in this system, but even with the valve operating well below its maximum the amplification available is quite sufficient for all practical purposes. Under these conditions the background is then comparable with that present in any other arrangement affording an equivalent over-all amplification.

Quenching Oscillations

Therefore, in the receiver with which the experimental work was undertaken there were two L.F. amplifiers after the detector, which, with the separate quenching valve, gives four valves in all. Since general-purpose tubes are now obtainable at a reasonable price, there is no point in unduly complicating the issue by endeavoring to make one tube serve two purposes, such as combining the functions of quenching oscillator and detector.

The theoretical circuit is shown in Fig. 2, from which it will be seen that, with the exception of the quenching oscillator V1, the circuit follows quite orthodox lines. Coils L1, L2, and condenser C1 constitute the quenching circuit, the frequency of which is just within the audible range, and if the superimposed oscillators are found to be troublesome they can be suppressed by fitting a filter between the plate of V3 and the primary of the A.F. transformer.

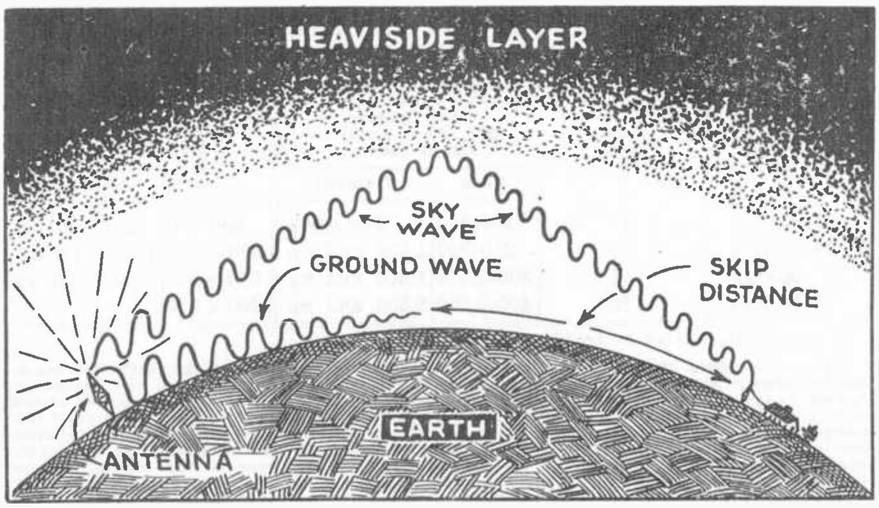
Details of the small wooden former supporting coils L1 and L2, together with the winding data, are given in Fig. 3. Oscillations generated by V1 are controlled by a variable resistance.

—Courtesy of Wireless World (London).

Fading and "Skip-Distance" Explained

By George A. Scoville*

Mr. Scoville has very ably explained in a clear and easily understood manner, just why it is that short-wave signals sometimes "fade"; also the reason why short-wave signals sometimes skip over a considerable area, in which even the "most sensitive" receiving set cannot hear a signal!



The drawing above shows in a general way the effect of the highly ionized Heaviside layer on the propagation of short waves over the earth's surface. Note that a station may pick up a signal on the ground wave at a certain distance from the transmitter, while beyond this certain distance a receiving station may not hear the signal at all! This area falls within what is known as the "skip" distance. Beyond this "skip" distance the transmitted signal may again be heard on the "sky" wave, reflected by the Heaviside layer as the diagram shows. In some cases, the distant receiving station picks up both the "ground" wave and the reflected "sky" wave, and when these two waves arrive out of synchronism, peculiar effects are obtained, the voice being all broken up, and in the case of television transmission "ghost" images frequently appear on the receiving screen.

● Let's consider why short-wave radio transmissions behave as they do. If direct current electricity is flowing through a wire from some generator or storage device, it can be shown that the current is evenly distributed throughout any cross section of the wire and, if you were to cut off a portion or hollow out the wire, you would reduce the amount of current that the wire would carry in the same proportion as the amount of metal taken away.

Now, if you put some sort of alternator machine in the circuit to change the direction of the current (thus changing the direct current into alternating current), the electricity begins to congregate around the outside surface of the wire, particularly when the alternator is turning at high speed, so that the inside could be removed without much change in current. Indeed, as the alternator is speeded up to rather high frequencies, we find that a portion of the electrical energy tries to jump off of the wire and is radiated in one form or another of electrical waves.

Starting from direct current, if we turn our alternator slowly and gradually speed it up, we first pass through the A.C. frequencies used for commercial power and lighting circuits, usually 25 or 60 cycles. Before we reach the 60 cycle frequency, however, our wire is already conducting what we radio men know as "audio frequency" currents (about 40 cycles to about 10,000 cycles per second), so called because if we employ some mechanical or thermal means to transform them into air vibrations, the human ear can hear them.

* Vice-President, Stromberg-Carlson Telephone Mfg. Co.

Long Wave Radio

Already, at these higher frequencies in the audio frequency range a small amount of radiation is beginning to occur. If we increase the speed of the alternator still further into super-audible frequencies of about 100,000 cycles, these radiations become stronger and we are in the region of "Long Wave" radio.

Most of the original work and early discoveries in radio development occurred in this long wave region and, indeed, for many years it was believed that the longest radio waves were the best for long distance transmission.

Naturally, all the commercial radio-telegraph companies and various government services wanted these long wave lengths for themselves, so the radio amateurs and, later on, the broadcasters, were pushed down into the wave lengths around 200 meters, which were then believed to be useful only for local service.

Strangely enough, these radio amateurs, transmitting with only 5 to 1,000 watts of power and below 200 meters, began to cover tremendous distances at certain hours of the day. Broadcasting stations, too, could be heard up to 10 times as far away at night as during the day.

These developments upset the former ideas as to the nature and behavior of radio waves and called for a new theory to explain them.

Two Kinds of Radio Waves

The one theory which seems to answer all of the conditions that experimenters have observed is that advanced by Professors Kennelley and Oliver Heaviside, which has come to be known as the "Heaviside Layer" theory. According to this theory, there are two kinds of radio waves. One of them, the so-called "earth" or "ground" wave, follows the curvature of the earth. It is rapidly absorbed by the earth and its metal deposits, hills, trees, steel buildings and bodies of water, yet it is steady and reliable in character and travels about the same distance day or night. Anyone able to receive the "earth" waves from a station is said to be in its "reliable service area", and is assured of good reception in daylight or darkness. This is the type of radio wave that the early experimenters had been dealing with, as most of the energy radiated at long wave lengths is of this "earth" wave type.

Relation to Light, Heat, etc.

Now, if we increase the speed of our current alternator to produce waves of a higher frequency or a shorter wave length, less and less of the radiated energy is transformed into "earth" waves (or perhaps it is absorbed faster by the earth, at higher frequencies) and more and more of it into a second kind of radio wave, known as "sky" waves. These apparently do not follow the surface of the earth but travel in straight lines and behave more like light and radiant heat and other types of electrical waves. In fact, there is a close relationship between them. As we increase the speed of our alternator, we pass through the "short wave" radio spectrum into "ultra-short" waves (at which television and two-way police radio transmission experiments are now being carried on), then to radiant heat, infra red, visible light, ultra violet, X-rays, etc., to the cosmic rays, which are at present the limit of our knowledge of electrical waves or radiations. Thus, it is apparent that the only difference between radio "sky" waves and visible light is a matter of frequency and we can expect them both to have certain characteristics in common.

If you are a beginner or layman in the realm of short waves — then you will find this article by Mr. Scoville most enlightening and authoritative. He answers such interesting and important questions as: — Which frequencies are practically free of static disturbances? Which frequencies are most free from disturbances caused by automobile ignition systems? At what wavelength do signals start to penetrate the Heaviside layer? Why do most set manufacturers refrain from making their sets tune down to 7 or 8 meters? What is the difference between the "earth" and the "sky" wave? Is the Heaviside layer a solid reflecting surface like a mirror, or is it a series of layers of different gases? What are the four principal short-wave bands in use for long distance transmission?

Kilocycles Versus Meters

The speed at which all radiated electric waves travel is practically the same as the speed of light: 186,000 miles a second or approximately 300,000,000 meters a second. Thus, we have a fixed mathematical relationship between the two means of reference commonly used to define a particular wave; namely, the "frequency", measured in cycles, kilocycles or megacycles, and the "wave length", measured in meters, centimeters or millimeters. The wave length method deals with the distance in metric units from any point of one radio wave to the same corresponding point on the next wave radiated. For most radio transmissions, this distance is measured in meters; it is only in the ultra-short radio and light wave regions, where wave-lengths are less than a meter, that centimeter and millimeter units are used. The other reference deals with the "frequency" or number of waves leaving the transmitting aerial every second in kilocycles or megacycles.

Inasmuch as any wave, regardless of its frequency or wave length, will travel the same distance as a light wave in a second, the number of frequencies or waves which follow it in that second, and the distance or wave length between them, are related. Thus,

$$\frac{300{,}000{,}000 \text{ (the speed of light in meters per second)}}{f \text{ (the frequency in cycles)}} = W \text{ (wave-length in meters)}$$

or

$$\frac{300{,}000}{f \text{ (frequency in kilocycles)}} = W \text{ (meters)}$$

or

$$\frac{300{,}000}{W \text{ (Wave-length in meters)}} = f \text{ (k.c.)}$$

Heaviside Layer Aids Short-Wave Transmission

These radio "sky waves", shooting out from the earth in all directions, are thought to encounter a resisting layer of ionized gases in the earth's atmosphere. These gases reflect or bend a portion of the "sky wave" energy from a straight course. They also absorb a portion, and perhaps allow some of this energy to pass straight through, but it is the bent or reflected portion which interests us. This Heaviside layer is not a solid reflecting surface like a polished mirror, but rather a series of layers of gases, some light, some heavy, which gradually bend the waves, much as light would be bent in passing through successive layers of air, glass and water.

EFFECT OF TIME OF DAY AND SEASONAL YEAR ON SHORT WAVE RECEPTION

(Time and Season apply to transmitting station)

Wave Length Band	Ground Wave Range (Miles)	Mid-Summer Sky Wave Approx. Range (Miles)		Mid-Winter Sky Wave Approx. Range (Miles)	
		Noon	Midnight	Noon	Midnight
49 Meters	75	100-200	250-5,000	200-600	400 and up
31 Meters	60	200-700	1,000 and up	500-2,000	1,500 and up
25 Meters	50	300-1,500	1,500 and up	600-3,000	2,000 and up
19 Meters	35	400-2,000	2,500 and up	900-4,000	X

X—Ordinarily cannot be heard.

The above table shows clearly how the transmitting ranges of the different wavelengths change from midsummer to mid-winter and vice versa. Although not commonly known to the layman, this matter of making a change in wavelength or frequency is not only made use of for the changes in the seasons and temperature, etc., but in such important short-wave transmission as that across the Ocean, where daily public telephone service is conducted by the A. T. & T. Company, for example, the wavelength is frequently changed several times during a short period extending over a few hours. These frequency changes are made by the engineers without disturbing the conversation being carried on by the radio telephone subscriber. The frequency is constantly being checked back and forth across the Atlantic, and the best one selected at all times for the "toll" message.

Explanation of "Fading"

One interesting part of this type of reflection is that the higher frequency waves seem to penetrate farther into the Heaviside layer and are therefore reflected differently from waves of lower frequency. In this regard, they are like the difference between a single rifle bullet ricocheting from the surface of a pool of water, as compared to perhaps the one-hundredth bullet in a stream of machine gun bullets which, following its predecessors, would penetrate farther into the water. Thus, the very low frequency or longest wave radio signals are almost entirely absorbed or pass through the Heaviside layer with practically no reflection. In the broadcast band, there is considerable reflection of the "sky" waves back to listeners located in the "reliable service" area, wherein listeners also receive the "earth" waves. This sometimes causes a fading or distortion of the "earth" wave signals at times when the "sky" wave reflections arrive a little later in time (having travelled a greater distance) and hence "out of phase" with the "earth" wave signals. These "sky" waves are also reflected to listeners located outside of the "reliable service" area of the station, especially at night, and thus enlarge its night-time service range.

"Skip Distance" on Short Waves

In short-wave radio transmission, the frequencies are such that almost no "sky" waves are reflected back to earth at points close to the transmitting station, but only at a distance from it and, in fact, there is usually a "skip distance" area of listeners who are too far away from the station to receive the "earth" waves and too close to it to receive the reflected "sky" waves, whereas listeners beyond this "skip distance" may get good reception from the distant transmitter.

The Heaviside layer is not a smooth spherical shell but rather a turbulent collection of gases that are almost constantly in motion and that rise and fall with relation to the earth, particularly under the influence of the sun, but also responding to attraction of the moon and other heavenly bodies; also Northern Lights, sun-spots, etc.

A further natural phenomenon is that the 19 meter band is usually quite free of static disturbances, so much so that a good, sensitive receiver may sometimes seem to be "dead" at the higher frequencies until a station is tuned in, and the other Short Wave bands are not so much affected by natural thunderstorm static as are broadcast transmissions, although interference from man-made static-generating devices, particularly automobiles, may be more troublesome at 49 and 31 meters than they are at longer or shorter wave lengths.

These ultra short waves, from about 10 meters to .001 meter, are not now useful and cannot be received efficiently using standard types of radio tubes. They are not included in the best all-wave and short-wave receivers built to sell on performance and entertainment value. A few radio manufacturers, seeking "exclusive" claims to more dial coverage even though it may be useless, are marking their dials down to seven or eight meters. If there were any stations transmitting at these frequencies, they could only serve a small local audience, and probably could not be heard on sets using standard tubes.

RECORD YOUR FOREIGN PROGRAMS

By M. HARVEY GERNSBACK

The recording machine shown in the center of the photo is that designed and built by the Universal Microphone Company and handles full-sized records. The lead-screw propells the recording head across the record so that it can cut the grooves as it moves along. The magnetic pick-up is shown at the rear of the machine and the headphones serve as a monitor.

There are several methods of making phonograph records at home which are suitable for use with equipment available to the average layman. As with everything else there is equipment to meet everyone's purse. The more expensive equipment, as would be expected, gives superior results but even with simple, inexpensive equipment results may be secured which will please even the most skeptical. The simplest method makes use of an ordinary electro-magnetic phonograph pickup which is used to reproduce standard records through the amplifying system and loud-speaker of the ordinary radio set. Many listeners have phonograph pickups which may be used but if the listener has none one can be procured from a radio supply house or dealer at a price of from two to fifteen dollars, depending upon the quality. The pickup must be of the magnetic type; crystal or condenser type pickups are not suitable. To make a home-recording with this equipment the pickup is used as a recording head (a recording head is a device which converts electric impulses from a radio set into mechanical motion, which is in turn impressed on a soft record in the form of grooves on the surface of the record). A blank *pre-grooved* record is required. There are two types of recording discs available, *pre-grooved* and *un-grooved.* The pre-grooved record is supplied with *unmodulated* grooves to permit the recording head to follow a spiral path when recording. The recording head modulates these grooves so that when the record is "played back," music, etc., will be heard. The un-grooved record is superior in that there is less *needle scratch* heard when playing a finished record and more faithful reproduction is obtained. The un-grooved record requires a *feed-screw* mechanism to cause the recording head to travel over the surface of the record while recording; it is naturally a more expensive mechanism. (It is described in greater detail in a later paragraph.)

Simplest Method

The pickup is connected to the *output* of the radio set through a suitable "matching" transformer, a special recording needle is placed in the pickup and the pre-grooved disc is placed on the turntable of the phonograph. When a program is tuned in on the short-wave set and the volume turned up to a little more than average room volume, the needle in the recording head will vibrate to the electrical impulses from the radio set. The recording head is placed at the beginning of the record. A weight must be placed on the recording head while recording; the proper weight for recording on aluminum blanks is about 10 to 14 ounces, on composition blanks (such as RCA Victor home-recording blanks) the proper weight is around 10 ounces. When the turntable is started and the record is rotating at the proper speed (78 r.p.m.) place the recording head on the starting groove of the record. The program that is being received on the receiver will be recorded on the disc, providing that the volume is sufficiently great.

The composition type of record requires a much louder signal for a good recording than does the aluminum. For this reason an amplifier with a undistorted output of at least 2 watts is necessary. A larger amplifier is preferable for superior results; this amplifier should be capable of delivering a signal which will fully load up the last stage to its rated output. A careful check on the *volume level* should be kept while recording, for if the signal is too strong the needle will jump from one groove to another, and if the signal is not strong enough a weak record will result. A little experimentation at different volume levels and with slightly different weights on the recorder will soon show the experimenter the best arrangement. Fig. 1 shows the arrangement of the equipment for this simple recording set-up. It is important that the recorder's impedance is matched to the impedance of the output of the receiver. This can be done by several methods as illustrated in Figs. 2, 3, 4. For "playing back" the finished record, the pick-up is connected to the *input* of the audio system of the set (see Figs. 5, 6) a special play-back needle is inserted in the pick-up and the record is then played in the ordinary manner. No weight is used on the pickup when *playing back.*

Fig. 7 shows a complete set with provision made for "cutting in" the pickup for *playing back* and for recording.

Best System Uses Feed-Screw

A more expensive method of recording uses a *feed-screw* mechanism and *un-grooved* records. The feed-screw guides the recording head and grooves the disc while recording. This method is more satisfactory in that better quality recordings with less *needle scratch* are obtained. Recording can be done on either aluminum, celluloid or acetate-coated aluminum. For general use aluminum and coated aluminum are most satisfactory. These two types require entirely different types of needles for recording. Recording on aluminum requires a weight of about 10-14 ounces on the recorder, while recording on the coated aluminum requires but 1 or 2 ounces pressure. The coated record gives a higher degree of fidelity with slightly more surface noise.

When the aluminum records are *played back* it is necessary to use a fibre or cactus needle. The acetate-coated aluminum

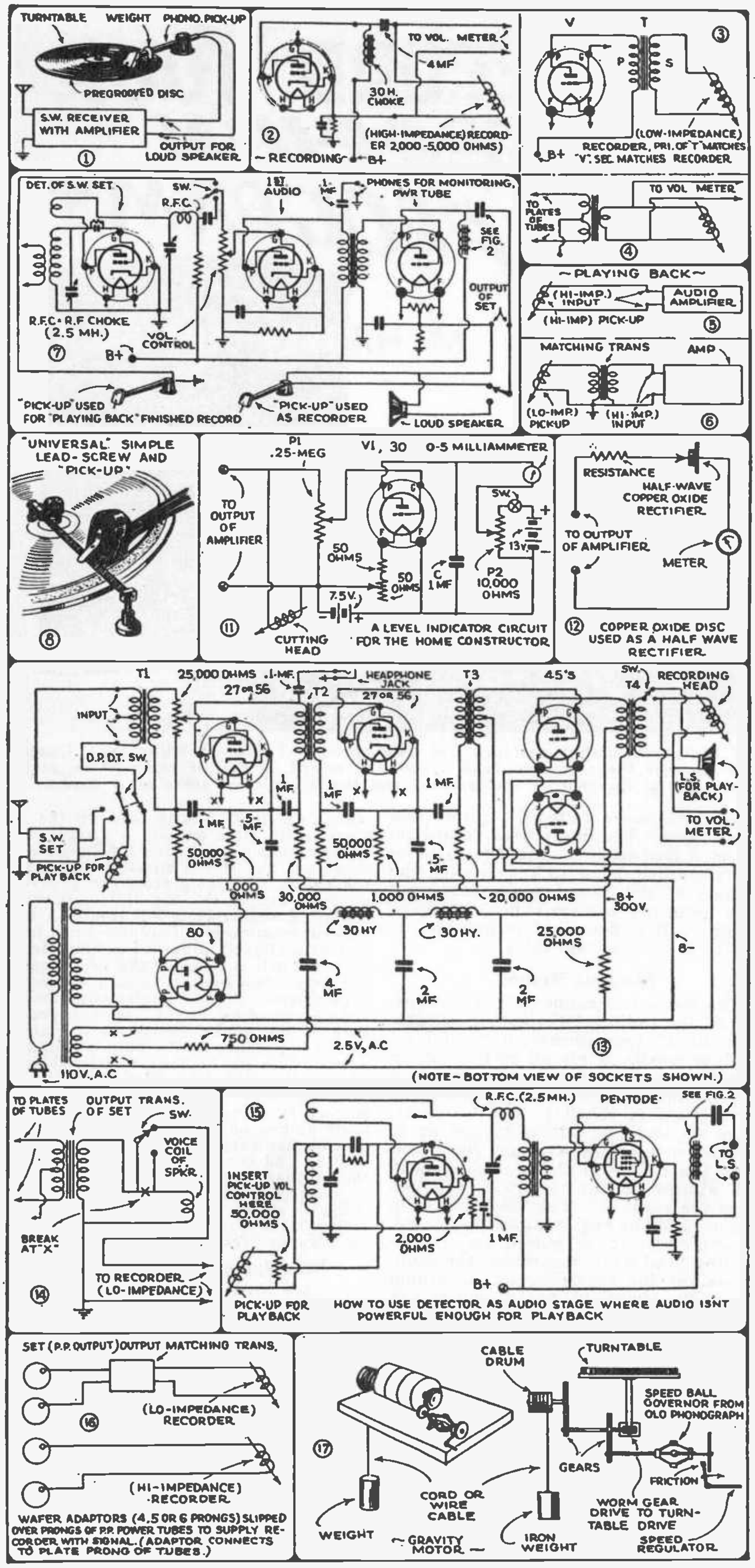


Fig. 1—Using magnetic pick-up and "pre-grooved" disc for recording short-wave programs. Figs. 2, 3, and 4—Various hook-ups for "recording." Figs. 5 and 6—"Playing back" hook-ups. Fig. 7.—Use of two magnetic pick-ups for "recording" and "play-back." Fig. 8—Simplest "Universal" lead-screw and recorder pick-up arm. Figs. 11 and 12—Volume 'meter" hook-ups. Fig. 13—Complete power amplifier for "Recording" and "play-back." Fig. 14—Switching "recorder" and "speaker." Fig. 15—Using detector as audio stage "booster." Fig. 16—Using "wafers" to attach recorder to audio output tube. Fig. 17—"Gravity" motor for recording.

records require either a fibre, cactus or an acetate-steel needle for playing back. The composition records are played back with the special blunt red-shank needle made especially for them. This needle may be used for recording on the pre-prooved composition blanks as well as for *play-back.* Figs. 8 and 9 show how a feed-screw mechanism is used for recording. In playing the finished record it is *not* necessary to use the feed-screw, as the record is then grooved properly. The recording head should not be used for playing back. A separate pickup is necessary for playing back.

Strong Motor Needed for Recording

In all recording it is essential that the turntable motor, whether it be of the spring, electric or gravity type, should possess sufficient power to permit the turntable to revolve at a *steady* speed while recording. Considerably more power is required for this than in ordinary playing back of records due to the fact that the recorder is weighed down and is also forming grooves in the record. A commercially available unit consisting of a powerful electric motor and turntable, a recording head and feed-screw, a separate pickup and a volume indicating meter, all mounted in a special case is illustrated in Fig. 10. Such equipment will range in price from about $55 to $200.

A *volume-indicating* meter is a very useful and important accessory in recording. It can be in the form of a vacuum tube voltmeter (see Fig. 11) or may be a 0-1 milliameter with a small meter type oxide rectifier in series with it, together with a series resistor (see Fig. 12). The series resistor value should be near the value of the impedance of the cutting head. For example with a 4000-ohm recorder a 3000-ohm resistor will be found suitable. The vacuum tube voltmeter while more expensive to build is more satisfactory as it draws no current from the recorder. The oxide rectifier type on the other hand will reduce the output of the recorder when connected across it and make necessary an increase in the volume level of the amplifier to compensate for it.

Recording Needles

In recording, sapphire needles or sometimes diamond point needles are used. In recording on ungrooved aluminum a sapphire needle which makes an agle of between 25 and 28 degrees with the vertical is used. For recording on pre-grooved aluminum and composition discs, a sapphire needle with slightly duller point is used. For recording on acetate-coated and celluloid records, a very hard sapphire point (chisel point) needle, making an angle of 2 degrees with the vertical. is used. These needles are supplied with bent shanks to secure the proper angle.

Details of Powerful Amplifier

For those who do not possess a sufficiently powerful amplifier for *recording* the circuit of a suitable amplifier with all values is given in Fig. 13. The *output* of the detector of the s-w. set is connected at the *input* of the *amplifier.* The recorder is connected to the output of the amplifier; in *playing back* the pickup is connected to the amplifier *input* in place of the s-w. set by a switch, and the loud-speaker is connected to the output of the amplifier. When *recording,* the speaker may be disconnected and a pair of headphones plugged in the phone jack of the amplifier for listening or "monitoring."

The average phonograph pickup has a high impedance and may be connected across the primary of the output transformer for *recording.* Some recording heads are of high impedance also and may be similarly connected. If the pickup used for recording is of the low impedance type (10 to 500) ohms, or if a low-impedance recording head is used it will be necessary to secure a *matching transformer* to connect the recorder to the output of the set or amplifier (see Figs. 3 and 4).

Fig. 16 shows how to use wafer adapters for attaching or connecting recorders to pins of output tubes. (See Fig. 14.)

HIGH-FIDELITY

By
WILHELM E. SCHRAGE

HOW TO IMPROVE Old Loud-Speakers and Baffles

High fidelity is not only a problem involving the sound reproducing mechanism, such as the loud-speaker, but it is also equally important that the audio frequency circuits as well as the detector and the radio frequency tuning circuits ahead of it, are all properly designed so as not to "cut" the side-bands.

Quite a number of the modern commercial higher quality receivers of the all-wave type are being fitted with two, and even *three* loud-speakers, each of a different pitch, so that by using low, medium, and high-pitched loud-speakers, operating simultaneously, the whole acoustic frequency scale, from 50 to 7,500 cycles, is faithfully reproduced. You may not think so but many a good-sounding dynamic loud-speaker has an abnormally *low* pitch, and such a speaker often lowers the tone of a singer half an octave or more. This is particularly noticeable on one make of receiver manufactured several years ago, which causes baritones to sound like bassos, and sopranos like altos.

What Is a High Quality Loud-Speaker?

Frequently we find that the frequency response curve of a dynamic loud-speaker resembles that shown in Fig. 1. This curve shows the reproduction range from approximately 50 to 7,500 cycles and such a loud-speaker should therefore fulfill our requirements of broad frequency response. Strange as it may seem, this loud-speaker as shown in Fig. 1, is a perfect example of an unsatisfactory type of speaker, its shortcomings not being apparent at first glance, owing to the small size of the curve here shown. Now glance at Fig. 2 where the weak points of this loud-speaker are shown graphically! Here the loud-speaker unveils its true face and, as we see, its response curve is a continuous chain of valleys and peaks. The useful sound reproduction range is much smaller than before, as becomes evident, and it is therefore not surprising if a loud-speaker having such a characteristic curve, when connected to even a good set, will yield very mediocre sound reproduction.

The reason for the radically different appearance of the curve in Fig. 2 and Fig. 1 is made apparent by noting the decibel (sound intensity unit) indication on the left side of the diagrams. Fig. 1 shows that the space between two indication lines is marked as a difference of 20 decibels, while the same space in Fig. 2 is indicated as only 2 decibels. This is, of course, an exaggerated example of a response curve "improved by watering." It is generally quite satisfactory if the space indication between the two lines is marked at 10 decibels only, but a 20-decibel allotment in a loud-speaker response curve should provide a good reason to suspect some hocus-pocus somewhere, and response curves of this kind should have their "pedigree" thoroughly examined and substantiated, if the purchaser of such a speaker wishes to avoid later disappointments.

Fig. 1—Typical loud-speaker response curve. Fig. 2—"True pedigree" of speaker charted at Fig. 1. Figs. 3 and 4—"Modifying" the old cone. Fig. 5—Connection of "tweeter." Fig. 6—How response curves of "dynamic" and "tweeter" speakers overlap and spread the response. Fig. 7—Simple hook-up for "tweeter" speaker.

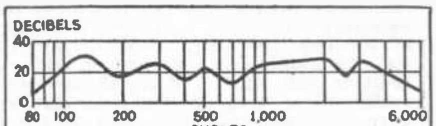


FIG. 1
LOUD SPEAKER RESPONSE CURVE IMPROVED BY "WATERING"

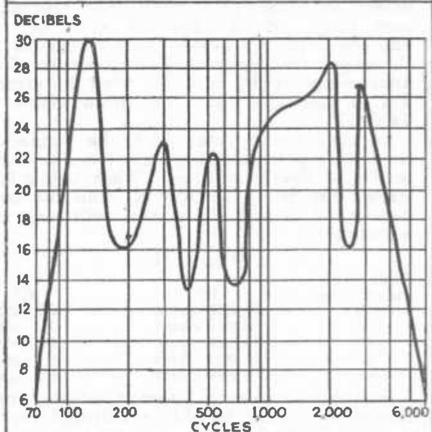


FIG. 2
THE "TRUE FACE" OF THE LOUD SPEAKER SHOWN IN FIG. 1

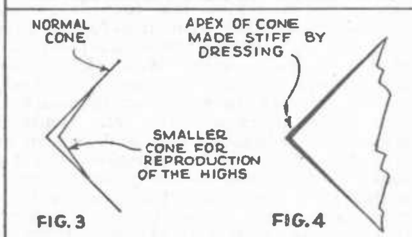


FIG. 3 FIG. 4

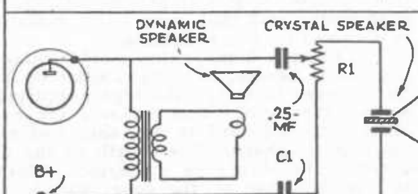


FIG. 5
CONNECTION OF A "TWEETER" WITH A DYNAMIC SPEAKER

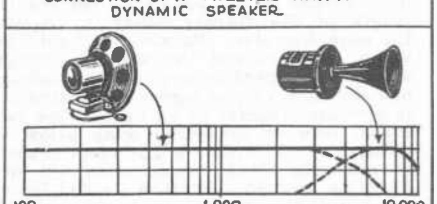
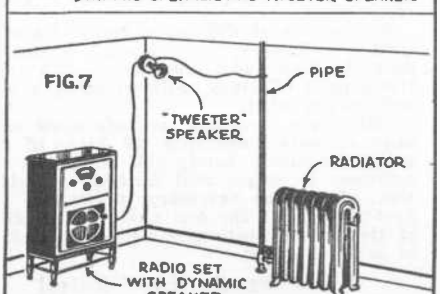


FIG. 6
THEORETICAL RESPONSE CURVE OF COMBINED DYNAMIC SPEAKER AND TWEETER SPEAKER

FIG. 7



The great importance of having a short-wave or other receiver carefully checked up so that it is capable of passing a wide frequency spectrum, together with the proper selection of a loud-speaker, is now made apparent and *high fidelity* performances can only be obtained if *both* the set and the loud-speaker are properly matched and designed to cover the frequency band required. Furthermore, there should not be variations in the response curve of more than 10 decibels over the whole acoustic range.

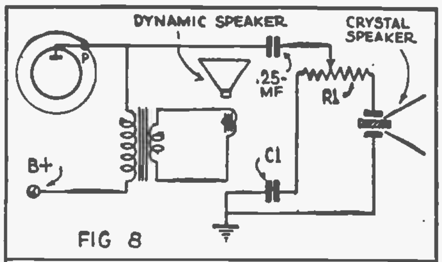
Improving Your Old Loud-Speaker

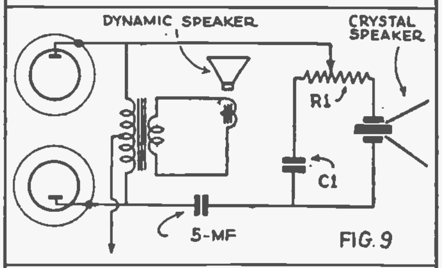
Well-designed and carefully matched loud-speakers are not cheap and experimenters and short-wave set builders are frequently the owners of a loud-speaker having a fairly satisfactory frequency-response curve, one covering for example 80 to 4,500 cycles. In such a case, it is not necessary to throw away the old loud-speaker and buy a new one, for it should be remembered also that there are on the market at present very few dynamic loud-speakers having a frequency-response range greater than 6,000 cycles, without showing a great many peaks and valleys.

A loud-speaker having a reproduction range up to 4,500 cycles can be radically improved by means of a relatively simple trick. According to electro-acoustic tests made by the R.C.A. and the Hazeltine Laboratories, the range of such a normal loud-speaker can be expanded to the higher audio frequency range by means of the methods shown in Figs. 3 and 4. The R.C.A. experts introduced into the center of the normal cone of a dynamic loud-speaker, a second but smaller cone, made from stiff cardboard. This method may easily be applied by experimenters successfully so as to improve the radiation of the higher audio frequencies.

The method used by the Hazeltine Laboratories is much simpler for the experimenter to apply. Here a cone such as that shown in Fig. 4 is used. The apex of the cone, close to the voice coil, is made of some stiff material, while the outer edge is constructed of lighter and more pliable cardboard. While the inner area radiates the high range the outer part of the cone, in connection with the inner part, radiates the lower range. This method can be applied to improve the response curve of your old loud-speaker with very little trouble. To the writer's best knowledge there are no cones of this type on the market and it is therefore necessary to build up such a modified cone yourself.

The simplest way to do this is by dressing the inner part of the old cone with glue in *very thin layers*. After one layer is dried, it is advisable to try the loud-speaker and if the effect is not sufficient, put another layer of glue upon the first one. The first layer shall cover, according to Fig. 4, about 1/5 of the entire cone length, the second layer but 1/6, and the third about 1/7, if a fourth one is necessary, it should cover about ⅛ of the whole length. So-called *bookbinders'* glue may be used for this purpose. Before actually starting the work it is important to make some experiments with small pieces of cardboard or heavy paper, because dressing it in very thin layers is not as simple as it





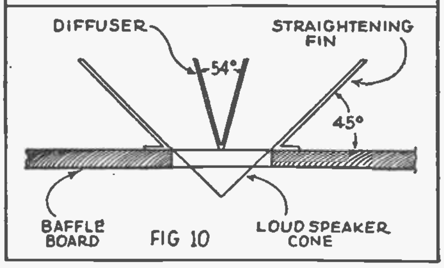


Fig. 8—Connection of "crystal speaker" with dynamic speaker. Fig. 9—Push-Pull output with dynamic and crystal speakers. Fig. 10—Use of "fins" and "diffuser" on speaker. Note angle of "diffuser" is 54 degrees.

might seem at first, and practice will be found necessary before the best routine is obtained.

Still another method for improving the sound of the speaker is to use very thin layers of paper, in place of the layers of glue, such as typewriter second sheets or India paper. The process of gluing the various paper layers upon the inner parts of the cone, and the sizes of the different paper layers, is about the same as that given for the glue dressing. The second method calls for an ingenious hand, because it is very difficult to stick or glue thin paper layers upon the cardboard without the appearance of small ripples in the paper.

The Addition of "Tweeters"

Another recommended method of expanding the frequency range of a given loud-speaker, without having recourse to expensive filter circuits and special transformers, to be described later, is that of adding a so-called *Crystal-Tweeter* to the old dynamic or other speaker. Fig. 5 shows how such a *tweeter* which reproduces the higher-pitched sounds, may be connected directly across the primary of the dynamic speaker transformer.

The sound reproduction range of the *tweeter* begins at the point where the response curve of the ordinary type speaker starts to fall off, and continues to 8,000 cycles. (See Fig. 6.) Since the efficiency of Crystal speakers is much greater than those of the dynamic type, it will often be found necessary to reduce the voltage supply of the crystal-tweeter by means of a potentiometer R1, in order that you may obtain the same acoustic output from the *tweeter* as that obtained from the dynamic speaker, through the use of a circuit like that shown at Fig. 5. The potentiometer R1 and the condensers C1 should have the following dimensions:

Table I

Type of the used tube	R1	C1
42	25,000 ohms	.015 mfd.
45	25,000 ohms	.05 mfd.
47	25,000 ohms	.015 mfd.
50	25,000 ohms	.05 mfd.
2A5	25,000 ohms	.015 mfd.

In case it is preferred to fix up the *crystal-speaker* a certain distance from the set, to obtain a kind of *binaural effect* as shown in Fig. 7, it is recommended you use the circuit shown in Fig. 8, because only one connection between set and speaker is then necessary. In order to reduce the capacity of the line, the other speaker connection may be obtained by grounding with the radiator pipe, etc. The *crystal-speaker* is really only a "singing" condenser, in which a rochelle salt crystal is used as the dielectric. Its capacity is about 0.002 mf. at 6,000 cycles only, but if the wire-to-earth capacity of the long lines frequently required is reasonably small, the reproduction range of the speaker may not be affected. In all other cases a cut-off in the upper frequency range may occur. The dimensions of R1 and C1 used in circuit Fig. 8 are the same as those given in Table I.

In case the tweeter is to be connected to a push-pull amplifier, the circuit shown in Fig. 9 should be used. When using this circuit the potentiometer R1 and the condenser C1 should have the following dimensions:

Table II

Type of the used tube	R1	C1
42	20,000 ohms	.03 mfd.
45	25,000 ohms	.1 mfd.
47	20,000 ohms	.03 mfd.
50	25,000 ohms	.1 mfd.
2A5	20,000 ohms	.03 mfd.

Another important factor often overlooked in trying to obtain faithful reproduction, is that sound waves are radiated in certain relation to their frequency. In other words—while the low frequencies have a propagation without definitive direction, the high ones have a radiation angle of limited degree only. What this physical phenomenon signifies can easily be checked up by listening to a concert in which the flute plays an important part. While the low audio frequencies can be heard in any direction from the loud-speaker, the high tones of the flute can only be recognized within an angle of about 20 degrees to the cone axis. That shows the high frequencies radiate only straight out from the cone-center and that very little radiation is obtained in other directions.

To obtain a high quality performance a *diffuser* is needed, like that shown in Fig. 10, in order to spread the high frequencies around the room. These *diffusers* are made from stiff cardboard or iron sheets of simple angular shape. The length of the diffuser vanes should be in certain relation to the diameter of the cone, and to the highest frequency which one intends to radiate with high efficiency. For a frequency band up to 7,500 cycles, the required length of the diffuser vanes is 1.3 times the cone diameter. Parallel to the diffuser vanes, are arranged two vertical straightening fins to produce both lateral radiation and diffusion of the higher frequencies. It is sometimes useful to fix up a single horizontal iron or cardboard *wing* below the diffuser vanes, with a slight upward angle, in order to obtain sound deflection in a direction upward. Another method for upward radiation is that of using a slightly inclined *baffle-board* as shown in Fig. 11 and used by Philco in their "high-fidelity" receivers.

By use of such diffuser vanes, and a cone with a stiff apex, it is possible to reproduce the high audio frequencies with relatively good efficiency, without using a second loud-speaker.

The above described methods show only improvements concerning the *highs* of the audio frequency band; this alone is not sufficient to obtain real faithful reproduction. It is also necessary to improve the performance of the *low* audio frequencies, if the desired *natural* sound reproduction is to be obtained.

Improving the "Low" Notes!

The best manner in which to improve the radiation and thus the performance of the *low* frequencies, is by the *correct use* of the *baffle-board*. Before starting with improvements concerning the baffle-board, it is necessary to eliminate a widely believed "superstition" concerning baffles. The belief that baffle-boards act as "sounding boards" or as "resonance areas" is all wrong!

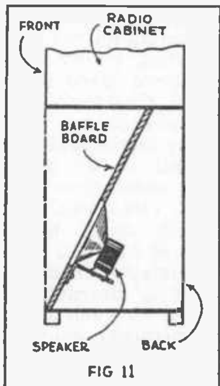
In order to avoid this unwanted effect, it is necessary to give the baffle-board a size which has a certain relation to the wavelength of the lowest sound frequency that is to be reproduced. The relation between the lowest sound frequency which shall be reproduced and the necessary side length of the baffle-board to be used is given in the following Table No. 3 in centimeters. (1 centimeter = 0.39 inches.)

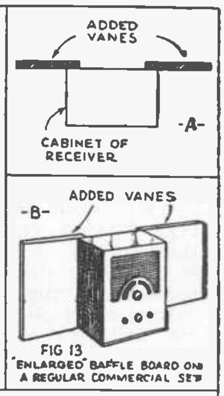
Table III

Lowest frequency to be radiated in cycles	Side length of the baffle-board in centimeters
500 cycles	75 centimeters
400 cycles	90 centimeters
300 cycles	100 centimeters
200 cycles	125 centimeters
100 cycles	175 centimeters
90 cycles	190 centimeters
80 cycles	205 centimeters
70 cycles	225 centimeters
60 cycles	250 centimeters
50 cycles	290 centimeters
40 cycles	400 centimeters

1 c.m. = .4 inch approx.

Table III shows that in order to obtain a natural reproduction in the *low* audio range, tremendous baffle-boards are necessary, especially for the range below 100 cycles! Baffle-boards of this size can be seldom applied in the home. Since baffle-boards offered the cheapest way in which to obtain a good reproduction of the *lows*, a great deal of work was done, to avoid the use of extremely large baffle-boards. Fig. 12 shows that the response curve of a loud-speaker can be much improved by using a baffle-board of *irregular* dimensions. A valley in the response curve resulting from the use of a *small* baffle-board in the frequency band of about 500 cycles (curve 1), is smoothed out by means of an *irregular* baffle-board No. 2 (curve 2). Fig. 13 shows how to improve the reproduction of the *lows* without employing tremendously large baffle-boards.





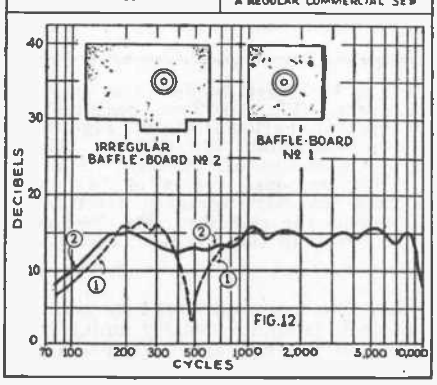
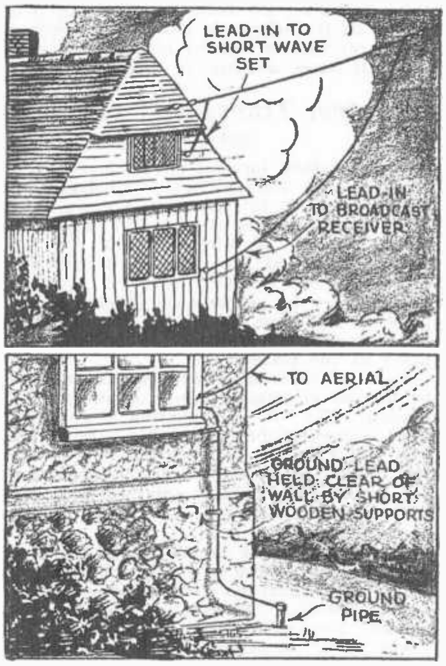


Fig. 11—Inclined baffle as an aid to "higher fidelity" sound reproduction. Fig. 12—Improved frequency response obtained by using "irregular shaped" baffle. Fig. 13—Improved acoustic response can often be obtained by enlarging baffle-board on many commercial sets.

FOREIGN S-W CIRCUITS

Short-Wave Antenna Hints

● SOME interesting facts concerning the aerials used for short-wave reception appeared in recent issues of *Popular Wireless*, an English weekly publication. The first of these is a hint for using a single aerial for both short-wave and broadcast reception. A glance at the illustration shows that a lead-in is brought into the house from each end of the aerial. One of these lead-in wires is connected to the broadcast receiver while the other connects to the short-wave set. When used in this way there is no interaction between the two receivers; each works as though it had an individual aerial and lead-in. The other hint concerns the placement of the ground lead which often introduces noises into a short-wave receiver, if it is placed near an electric light line or is allowed to rub against a wall, gutter or drain pipe. Varying capacity effects or static voltages set up either by induction or friction caused by rubbing introduces static voltages in the aerial coil which are picked up and amplified in the receiver.



This illustration shows how a single antenna may be used for both "broadcast" and "short-wave" reception.

The solution to the problem lies in correctly spacing the ground lead from any pipes or wires by the use of wood or other insulated spreaders. A glance at the sketch shows how a typical installation is made.

These simple hints show what interest is displayed in short-wave aerials in foreign publications. There is no doubt that worthwhile improvements in short-wave receivers can be made by simple changes in the aerial, especially in the position and care with which it is insulated.

The Picard Aerial for 5 Meters

● IN A recent issue of that interesting booklet—*The T & R Bulletin* of the Radio Society of Great Britain, the description of an aerial used by amateur station 2AVN was published. This description contained many useful facts for the amateur who is working on the 56 megacycle (5-meter) band.

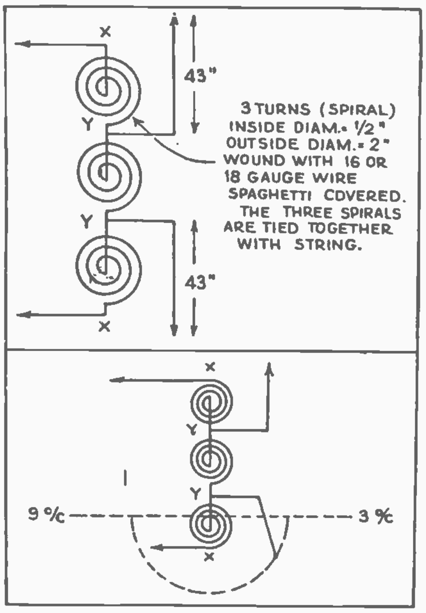
The Picard aerial at this station is a half-wave unit, fed at the center by means of three spiral coils of a few turns each, placed side by side and connected together to form an auto-transformer. The feeders are connected to the outer ends of the coils (X) while the taps to the aerial are taken off at points Y in the accompanying circuit. This method of matched impedance has been thoroughly tested by 2AVN, ***and the results definitely proved that it is superior to any other form of aerial coupling.*** The great advantage is that any convenient length of feeder lines can be used; wires from 4 to 45 feet have been tried with *identical* results.

The actual aerials used are telescopic legs from a camera tripod, with the impedance matching coils mounted in the center. It has been found that the rods have to be pushed in to a length of 43 inches instead of 49 inches due to the loading of the coupling coils at the center.

A varied collection of results has been accumulated, but one thing is agreed by all, that superior results are obtained by arranging the aerials as shown at B in the accompanying circuit. It will be noticed that one-half of the aerial (that is, one ¼ —wave rod) is vertical. The other can be placed in any position over the arc shown in the sketch.

The description in *The T & R Bulletin* offers no explanation for the latter phenomenon but it is suggested that it is due to the fact that the polarization of the signals change and this happens to suit the aerial arrangement at the receiving end, or vice versa, when the Picard aerial is used for reception purposes. This seems to offer a field for experimentation as there appears to be little doubt that the angle of polarization does not remain constant from transmitter to receiver, and in some cases is twisted as much as 90 degrees.

(EDITOR'S NOTE: ***Tilting one side of the doublet antenna or, the entire antenna, makes quite an improvement on most signals. We have noticed that certain 5 meter signals cannot be received unless the antenna was tilted in a certain direction and at a certain angle. It is well for our many 5 meter enthusiasts to devise a method for tilting their antennas in order that maximum results can be obtained.***)



Two diagrams showing different methods of connecting the Picard antenna. Fig. A is the upper drawing and Fig. B is the lower.

Ultra-Short Wave Developments

● THE introduction of ultra-short-wave radio communication into commercial use has speeded the practical development of this phase of communication to a marked degree.

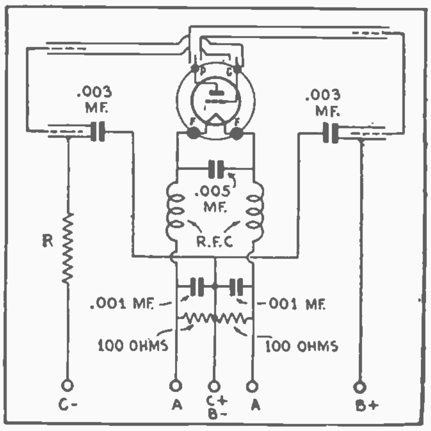


Diagram shows method of tuning grid and plate circuit by sliding copper tubes.

The use of these waves for telephony across the English Channel, etc., have furthered the need for dependable circuits and devices.

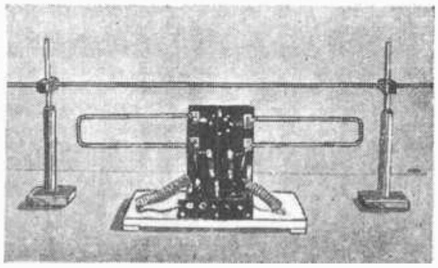


Photo of "trombone" tuner for grid and plate circuits of ultra short-wave set.

One of the difficulties that has hindered the rapid development of transmission on "ultra-shorts" is the need for flexible control of frequency, especially if *dipole* aerials are utilized.

A recent issue of *Funk* magazine, a German publication, outlines a new method for tuning transmitters—a development of Messrs. Kuhn and Huth—which overcomes some of the difficulties mentioned above. As shown in the accompanying illustrations, it consists of an oscillatory circuit in which the grid and plate tuning is accomplished by shifting sliding copper tubes which make up the grid and plate inductances, until the correct inductive and capacitative value is attained. A study of this circuit shows the similarity to the commonly used "tuned-grid, tuned-plate" circuit which all Hams have used on longer wave lengths at one time or another.

This easily tuned oscillator is then coupled to a half-wave radiator by simply bringing the entire oscillatory circuit near the aerial. This provides variable coupling to permit variation of output and to reduce aerial damping to a minimum. The oscillator can, of course, be coupled to any form of radiator, either inductively or through a suitable condenser, though other methods than the one shown do not offer the same flexibility or ease of adjustment.

The oscillator shown is a simple, theoretical circuit, which may be modulated, amplified, or keyed in any desired manner. It will, however, give the experimenter some "food for thought"

Hints in Short-Wave Receiver Design

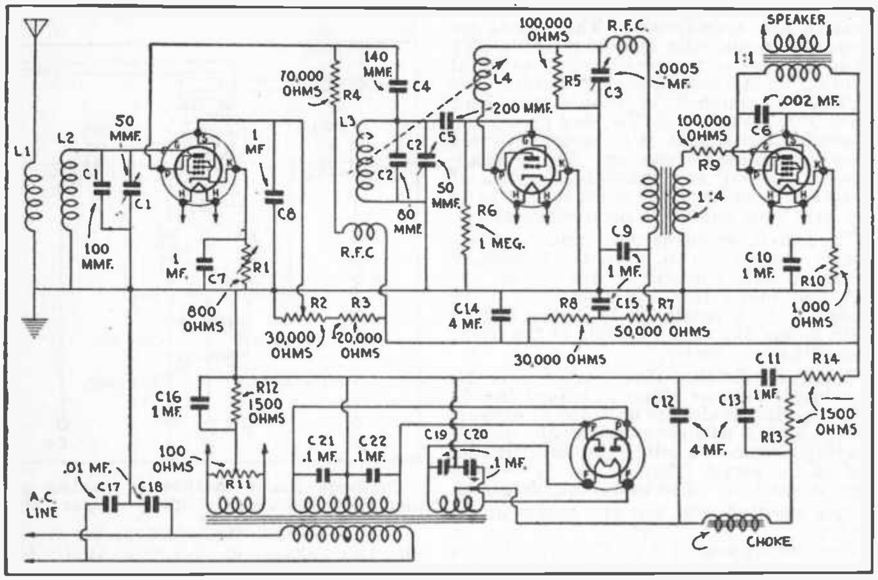
● THE circuit here, which appeared in the latest issue of *Bastelbriefe Der Drahtlosen,* a German radio magazine, while fundamentally quite common, being of the regenerative type with a stage of R.F. amplification and a pentode audio stage, has some novel tricks tucked away which are not at first evident.

Next, a continuously variable control in the form of a variable resistor and a fixed limiting resistor is used for the screen-grid of the R.F. tube. This seems superfluous, at first, but is a very handy control to have, when the last ounce of amplification is desired to bring in that weak station. By bringing the R.F. tube to a point approaching oscillation, the output of this tuned stage can be almost doubled, according to some experiments tried by the Editor. But the adjustment is dependent on frequency—therefore the adjustable control.

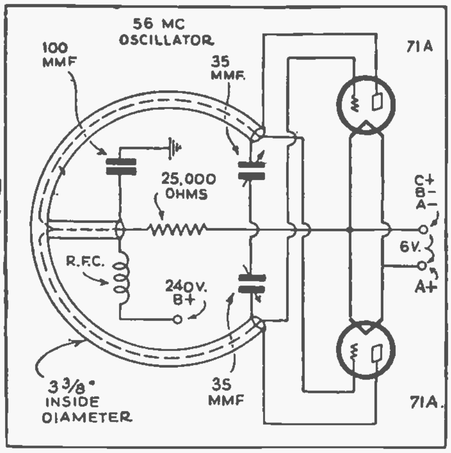
Regeneration in this set is controlled by a plate condenser, shunted by a fixed resistance. This resistor has the effect of broadening the adjustment of the condenser, to facilitate adjustment, and while it may reduce the regeneration a little, this is easily compensated by a little closer coupling of the tickler coil. The resistor also has a tendency to prevent "fringe howl" and is really a worth-while kink.

To further prevent the last named trouble, a resistor is connected in series with the secondary of the A.F. transformer which has the effect of suppressing oscillation tendencies in the pentode amplifier.

One other scheme resorted to, which is worth mentioning in this receiver, is the method of coupling the R.F. amplifier to the detector. Capacity coupling is used, but a 70,000-ohm resistor is connected in series with the choke.



Improved German hook-up of 3-tube S.W. receiver with highly filtered power-supply. Regeneration is controlled by a variable condenser shunted by a fixed resistance.



Oscillator portion of a 56 megacycle transmitter; it employs type 71A tubes for oscillators.

56 Megacycle Oscillator

● THE circuit here shows the oscillator portion of a 56 megacycle phone transmitter used by the police in experiments between two locations in Sydney, Australia. The method of coupling the grids and plates of the balanced oscillator is novel, in the fact that the grid turn is *through* the inside of the tube which acts as the plate coil.

This oscillator, which appeared in *Australian Radio News,* employs type 71A tubes for oscillation. The modulators which are not shown, were English "Cossor" 625P tubes connected in parallel.

The values of the parts used in the oscillator, including the diameter of the coils, are shown on the schematic circuit. Experimenters in the field of 5-meter transmission might find this novel oscillator of interest.

Amateur Transmitter Improvements

● THE marked interest shown in class "B" circuits in Europe (which we have mentioned before in this department) can be appreciated from this excerpt from an article which appeared in *Wireless World.*

To obtain 100 per cent modulation of a high frequency carrier, the usual modulator tube has to be operated at a higher mean plate voltage than the oscillator. Also, the usual modulator imposes a steady, heavy drain on the plate supply.

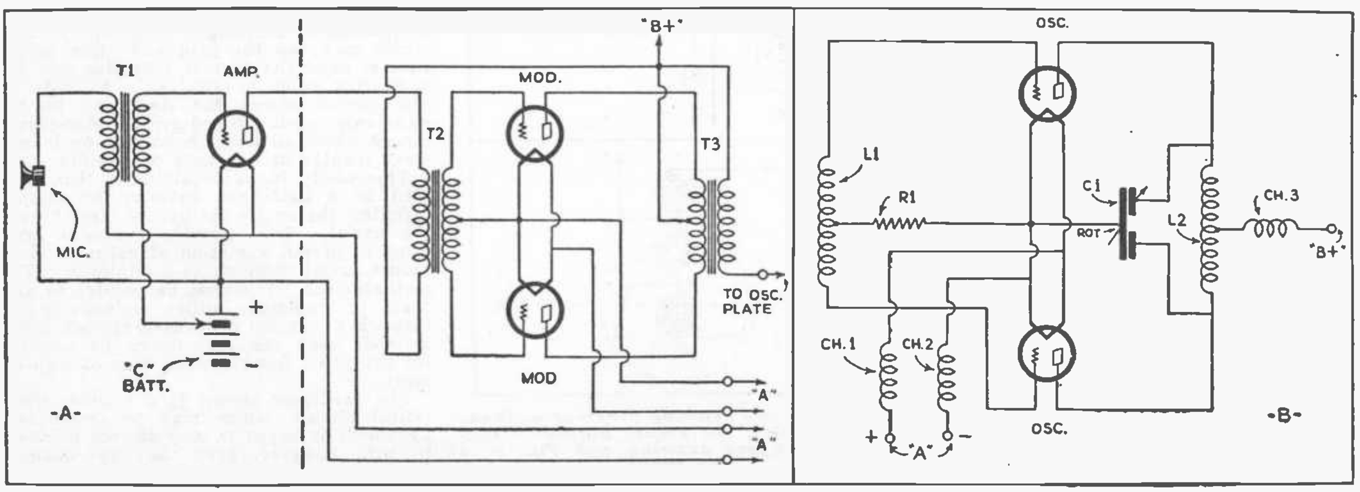
Both of these disadvantages are removed by the use of class B amplification and modulation. The "B" consumption of these systems is proportional to the depth of modulation which results in a saving of "B" current. Also, the efficiency of modulation compares with the efficiency obtained with class "B" amplifiers, and is thus an improvement over the usual methods.

The circuit of an amplifier and class "B" modulator are shown in Fig. A. Transformer T1 is the modulation transformer, while T2 and T3 are class "B" input and output transformers, respectively.

For small installations and especially for portable units, the push-pull oscillator arrangement shown in Fig. B, has many advantages over the ordinary oscillators, where the frequency is likely to shift over wide limits, especially if a high percentage of modulation is used.

While crystal-controlled units, and in some cases, electron-coupled oscillator arrangements are more stable, the push-pull circuit is ideal for portable use and for transmitters with small output. In the circuit shown at Fig. B, C1 is a double stator variable condenser (two gang) with approximately 50 mmf. maximum for each section. R1 is a 10,000 ohm resistor.

Coils L1 and L2 contain 20 turns of No. 14 wire on 1-in. dia. forms. Chokes Ch1 and Ch2 contain 30 turns of No. 18 D.C.C. wire on forms ½-in. in diameter; Ch3 contains 50 turns of No. 30 D.S.C. wire space-wound on a ½-in. dia. form.



The diagrams, above, show at Fig. A—the circuit of an amplifier and class "B" modulator. For small installations and especially for portable sets, the push-pull oscillator circuit shown in Fig. B will find many friends.

A German Short-Wave Set

● THE circuit shown here is novel for several reasons. In the first place, it is of German origin, although it appeared in a magazine published in Sydney, Australia—*Wireless Weekly.*

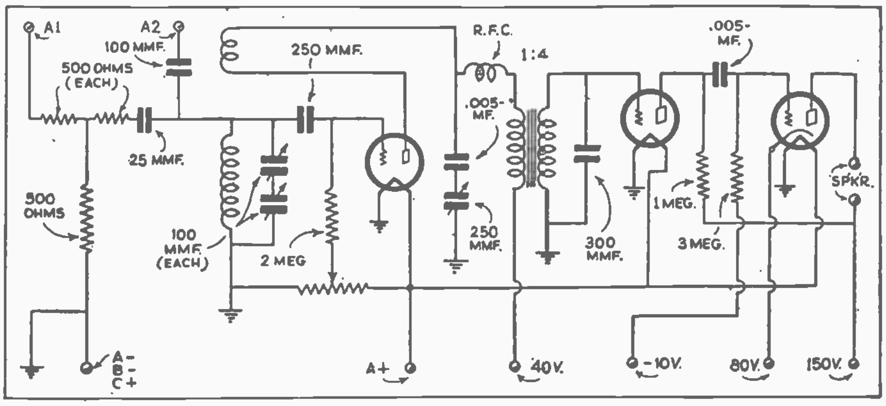
The set is a regenerative type of unit, in which the oscillation is controlled by a .00025 mf. condenser connected in series with a fixed capacity of .005 mf. This is done to make the adjustment of oscillation less critical; and in practice, in experiments conducted by the writer on an existing S.W. receiver, materially smoother control resulted.

Next, two .0001 mf. variable condensers are connected together in series as the tuning control This produces a sort of continuous *band-spread* effect which further simplifies the task of tuning.

Third, two methods of coupling the aerial to the grid circuit of the detector are shown. One is the conventional series condenser method, while the other consists of a network of resistors, in addition to the usual condenser. The latter method of connection was rather puzzling to the writer at first glance, and as no explanation was offered for its use, it was decided to try it out.

The result was surprising. While the signal strength from a distant station was cut down somewhat when this connection was employed, the signal-to-noise ratio was much improved, and the degree of fading was also cut down. It is not known if this was the intention of the designer of the set, and the action is not thoroughly understood, but you fellows on the look-out for new and interesting kinks in short waves might give it a try!

The remainder of the set consists of a conventional transformer coupled audio amplifier, followed by a pentode output tube, resistance-capacity coupled to the first A.F. amplifier. The entire design of the receiver shows consideration to ease in operation which should be an attraction to the short-wave beginner. The values of all parts are shown. Standard coils may be used.



In this receiver hook-up, it will be seen that the regeneration is controlled by two condensers connected in series, which renders the oscillation adjustment smoother than usual. Note the method of obtaining "band-spread" tuning by using two condensers in series.

An Inexpensive Transmitter

● LAST month's *Bastelbriefe Der Drahtlosen* featured an inexpensive amateur transmitter, covering the usual amateur bands of 20, 40 and 80 meters. While simple transmitters are not often advocated for amateur construction in this country, due to the interference difficulties encountered when such broadly tuned circuits are employed, this transmitter when used for C.W. work will be sufficiently selective as a beginner's unit.

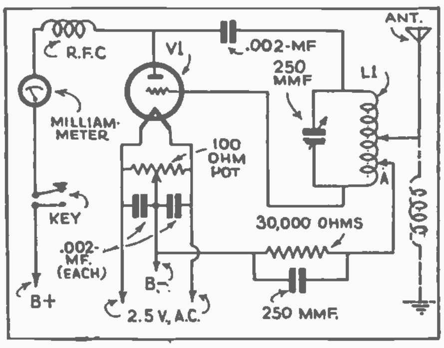


Diagram of simple triode transmitter.

The transmitter contains a single tube of the triode type using an A.C. filament supply. The coil for the 80 meter band consists of 15 turns of No. 10 or 12 wire, wound on a form 3 inches in diameter. The 40 meter coil contains 10 turns and the 20 meter coil, 6 turns. A spacing of approximately ⅛ inch is left between turns.

In the circuit here, direct coupling is used between the tuning coil and the aerial. The radio regulations in the U. S. prevents the use of such coupling and it will be necessary to connect the aerial to a small coil consisting of 3 or 4 turns of heavy wire wound on a form about 1½ inches in diameter.

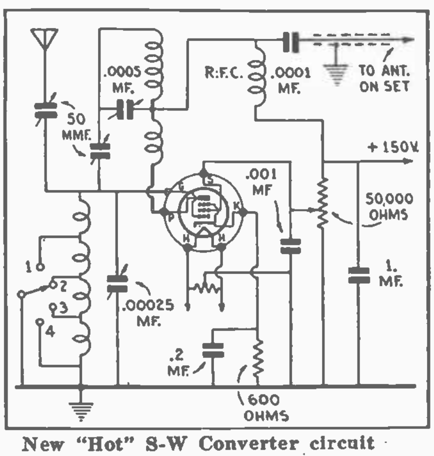
The R.F. choke in the plate supply circuit consists of 250 turns of No. 28 D.C.C. wire on a 1 inch form. The values of the remaining parts are shown in the circuit.

While the construction of a simple transmitter of this type is quite easy, the experimenter must keep several things in mind. First, it is necessary to have an amateur transmitting license to operate any radio transmitter. This applies to a unit of any power, however small, since short-wave transmitters can cover great distances with the simplest types of equipment. Second—it is necessary to keep within the regulations of the government regarding the frequency on which signals are transmitted; and third—with a transmitter of this type very low power should be used so that it does not interfere excessively with other amateurs. A small receiving tube such as the type 56 with about 200 volts on the plate will be a satisfactory compromise.

An Italian Converter

● IN this month's mail bag of foreign magazines, we have a new one—*Radio Lux* from Milan, Italy, which presents a simple short-wave converter.

The converter covers the wave lengths between 12 and 70 with a set of four tapped coils in the grid circuit. The grid coils are wound on a piece of 1½-inch-diameter tubing and consist of 4 turns for the first section, 4 for the second, 5 for the third and 6 for the fourth. Number 24 enamel wire is used and a space of ¼ inch is left between sections. The oscillator coils consist of 10 turns of No. 24 enam. wire on a tube 1½ inch in diameter with a tap at the sixth turn. The 6-turn coil thus formed is the grid section, while the 4-turn section is for the plate.

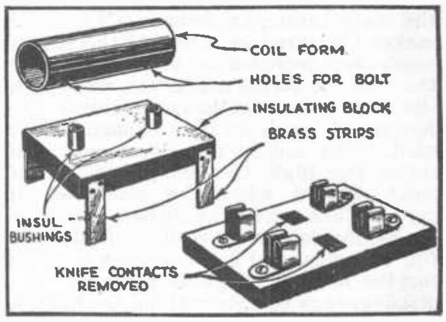


New "Hot" S-W Converter circuit

S.W. Coil Mounting

● ODD methods of mounting plug-in coils for short-wave receivers have long been the secret hobby of many a short-wave enthusiast, including the Editor.

An issue of *Toute La Radio,* a French magazine, contained a method which is interesting because it is so unique in design and also because it utilizes some of those old parts which are cluttering up the box in which you keep unused coils, condensers and similar "gadgets."



A unique method of mounting short-wave plug-in coils, using parts of an old knife-switch.

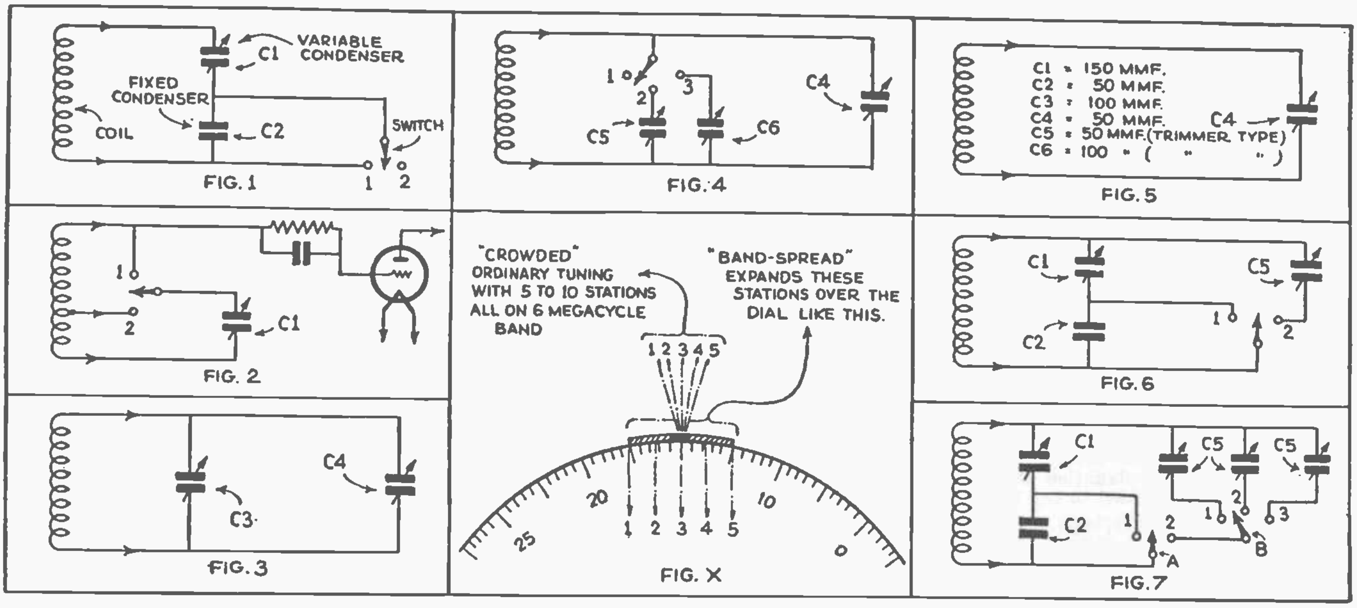
As shown in the accompanying sketches, the scheme consists of taking double-pole, double-throw knife switches, removing the throw contacts and insulated handle and putting the remaining four contact clips to work holding coils which are made to fit.

The knife portion of the switch is cut up into sections which are secured to bakelite, wood, or similar blocks of the right size, depending on the dimensions of the switch. The coils, themselves, which may be of any desired type, are secured to the insulated block and wired to the strips on the sides.

Only one switch is needed for each coil assembly, and any desired number of coils can be made to plug into the receptacle thus formed.

BAND-SPREAD Methods

Explained By Jerrold A. Swank



The diagrams above show how simple it is to provide "band-spread" tuning on your short-wave receiver. The center diagram illustrates the benefits derived from "band-spread" tuning.

Figure 1 shows a simple but effective method of switching from *band-spread* to *full coverage.* The drawings only show the *grid* or *tuning portion* of the coil, since this is the only portion affected. There is in addition the usual tickler coil, with which all of us are familiar. With this method shown in Figure 1, when the switch is open, there is a fixed capacity (C2) in series with the main tuning condenser (C1), which makes the large capacity of the tuning condenser decrease in accordance with the rule for series capacities, and it has the same effect as though a single condenser, of much smaller capacity were used. The coil in this case must just reach the high frequency end of the band desired when the condenser is open. Then when the switch is closed, the tuning condenser resumes its former full capacity, and full coverage is given for the normal range of the coil. The disadvantage of this method is that the coil must be wound to start at the end of the band which it is desired to spread.

However, if you will refer to Figure 6, you will see how this disadvantage may be easily eliminated. Here, instead of throwing the switch to an open position, it is thrown to connect C5 across the other capacity combination. C5 is an ordinary small trimming condenser of the screw-driver adjustment type, and is adjusted so that the desired band is properly placed on the tuning dial. Then when the switch is thrown back to position 1, the circuit is restored to normal, and C1 becomes alone the tuning condenser, giving the *normal full coverage.*

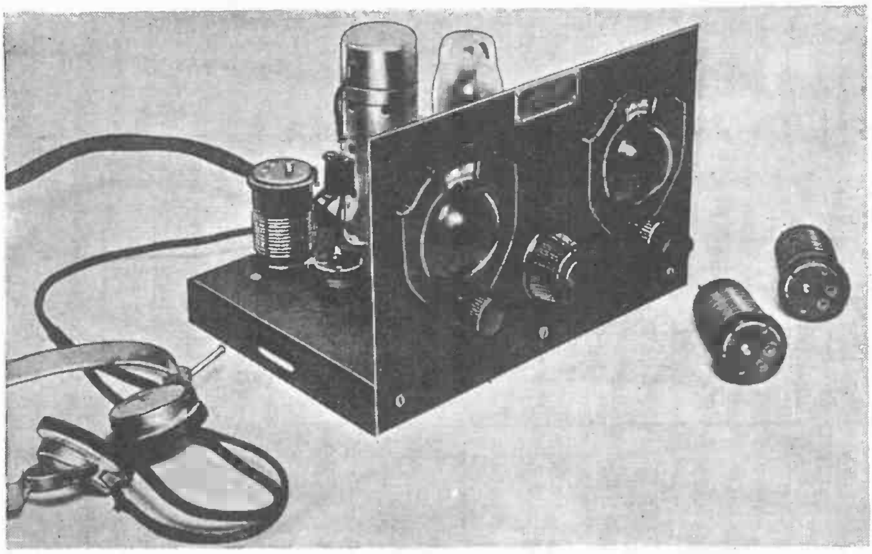
Figure 7 shows a "deluxe" version of this which the writer tried, and it works well, but rather limits the flexibility of the set. However, it shows to what extent the idea can be carried. Switch "A" is the switch which throws the set from *normal* to *band-spread,* and switch "B" determines the range of the spread portion. For example, in the instance cited the writer had the three trimmers (C5- set so that with switch "B" in position 1 the 49-meter broadcast band was on the dial, in position 2 the 40-meter *ham band* was "up", and in position 3 the 31-meter broadcast band was on deck. Thus I could tune in S-W broadcast stations when I wished without disturbing the settings of the *ham band,* so that I could find stations whose dial settings I had recorded.

Tapped Coil Method

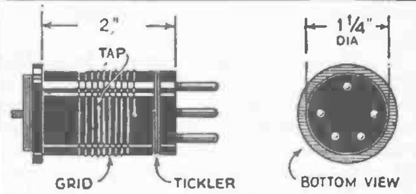
Figure 2 depicts a method popular in certain commercially built receivers, but changed to permit switching it *in* and *out.* A tap on the coil is made at such a place that the regular tuning condenser when placed across this portion will spread the desired band over a large portion of the dial. If you have a receiver that uses this method, such as the National SW3, and have band-spread coils, you can take out of the coils the band-spread arrangement they have, and by installing a simple single-pole double-throw toggle switch as shown here, make *full coverage* available at the "flip of a switch". Thus you quickly and effectively eliminate the necessity for separate coils for full coverage. Of course two switches will be necessary, so that both the RF and detector circuits can be switched. The writer tried it with a single switch, using a double-pole double-throw unit, and got a slight interlocking effect because of the proximity of the leads in the switch, and it was necessary to install separate switches for each circuit. Perhaps by careful shielding the effect could be eliminated, but with two separate switches, no trouble should be experienced.

The method shown in Figure 3 is simple and well known and in the opinion of many, the best of all. It simply uses a *band-setting* condenser and another condenser is parallel to *spread the band.* By setting the one condenser C3 on any desired portion of the range, the other one can be used to tune with, thus giving continuous band spreading and full coverage. A tip here—use the condenser values as given and you will be very pleased with the system. Here is why: The total of the capacities is .00015 mf. With C3 set on zero, C4 covers the first third of the range of the coil. With C3 set at *half closed,* C4 covers the second third of the dial, and with C3 set fully closed, C4 covers the final third of the dial. Furthermore, if you know the desired station's wavelength, you can hit the necessary dial setting rather closely. For example, suppose you want the 40 meter amateur band. The coil used covers 29 to 58 meters. You want 40 meters. The range of the coil is 29 meters. 29 from 40 is 11. 11/29 of 150 mmf. is 57 mmf. We set C3 on 50, which is half scale. Then remember the C4 spreads its 50 mmf. over 100 degrees so we multiply the remaining 7 mmf. by 2, and we get 14. Actually, on the writer's set, the band began at 20, making 6 divisions error. However, if you use kilocycles instead of meters, you will hit it much closer, since the frequency is nearer a straight line. This will make it unnecessary to search the whole band for a station, at any rate. The only disadvantage to this method is that it is a little difficult to return C3 to the same setting each time when you want to return to a "logged" station. This can be overcome by the method shown at Figure 4. Here we make use again of the little trimmers. Position 1 uses C4 alone. Position 2 adds in parallel a 50 mmf.-trimmer. Position 3 adds a fixed or trimmer of 100 mmf. These trimmers or fixed condensers remain set and the switch therefor returns positively to the same settings each time on each coil.

Figure 5 is the simplest of all, but its use is quite limited. However, within its limitations is a very good method. The coils used must each reach the high frequency end of the band when the condenser is open. The condenser is then of just the right size to *spread the band* over all or most of the dial. This is useful in a receiver used solely for ham work. Of course it will spread the 160 meter band the most, and the 20 meter band the least, so that the condenser must be large enough to reach all of the lowest frequency bands to be used.



Band-spread tuning is now available on the 2-Tube Electrified A.C. Doerle Receiver—"good news" to thousands of S.W. Fans and Hams.



20 METER COIL: GRID, 4½T. №. 24 WIRE TAPPED AT 1¼T. LENGTH OF WINDING 7/8". TICKLER, 5T. №. 30 WIRE CLOSE WOUND.

40 METER COIL: GRID, 11½T. №. 24 WIRE TAPPED AT 4½T. LENGTH OF WINDING 1". TICKLER, 7T. №. 30 WIRE CLOSE WOUND.

80 METER COIL: GRID, 26½T. №. 24 WIRE TAPPED AT 13T. LENGTH OF WINDING 1⅛". TICKLER, 8T. №. 30 WIRE CLOSE WOUND.

160 METER COIL: GRID, 52½T. №. 28 WIRE TAPPED AT 32T. LENGTH OF WINDING 1⅜". TICKLER, 17T. №. 30 WIRE CLOSE WOUND.

Coil winding data for band-spreading the 2-tube Doerle.

The DOERLE Goes "Band-Spread"

By GEORGE W. SHUART
W2AMN

• IT HAS been proven by the hundreds of letters received from readers of this magazine, that the Doerle sets are among the most popular. Along with these letters have come the requests of a great number of amateurs asking that we describe the 2-tube Doerle set modified for amateur or "Ham" use. In order for any set to comply with amateur requirements it is necessary that the set spread the various "Ham bands" over a goodly portion of the tuning dial. Operation on the amateur bands with an ordinary receiver not having *band-spread* is just about impossible, as the forty meter band, for instance, occupies only about five or six divisions of the dial and with the great congestion on this band this condition would be prohibitive.

Ham's Requirements Met

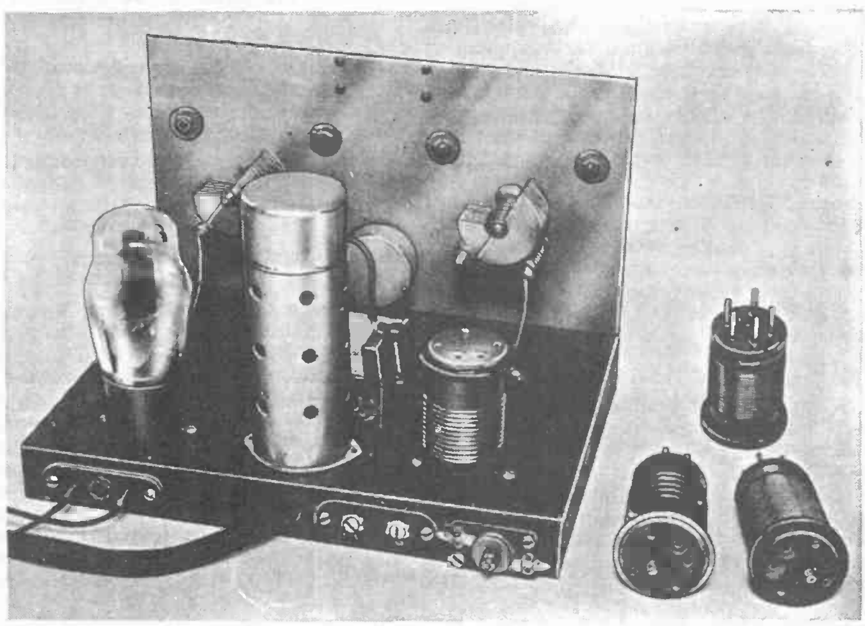
It is the purpose of this article to present a method by which the 2-tube electrified Doerle can be revamped to conform with the Ham's most rigid requirements, and also to serve as constructional information for any one wishing to build the set, if they have not already done so. For the amateur possessing a receiver of an older type and wishing to build something more satisfactory for his purpose, we can very highly recommend this little receiver. It is very economical to construct and will give most gratifying results.

The original receiver was described by the writer in the July, 1933, issue of this magazine. This set used a type 57 detector and a 56 as the audio amplifier. While this tube arrangement produced excellent results it was believed that there could be just a little more audio amplification to bring up those very weak signals. The new set utilizes a pentode amplifier, which will be discussed later.

New "Band-Spread" Coils Used

To introduce *band-spread* use is made of the new Na-Ald coils recently introduced by the Alden Mfg. Co. The construction of these coils can be seen by referring to the drawing and also the wiring diagram. It will be noticed that they are five-prong coils, having the regulation tickler and grid coil. The grid coil has been tapped and to obtain *band-spread* the main tuning condenser is connected across only a portion of the inductance. A small *padding condenser* has been mounted in the top of the coil form and this capacity is connected across the entire coil in order to obtain a stabilized tuning circuit. This capacity is also used to tune the coil so the band will appear in the center of the tuning dial. In general these coils are the same as those described by the writer in the February, 1933, issue of SHORT WAVE CRAFT and used in the 2-Tube Band-Spread set described in that article.

The Alden concern manufacture another set of the same type coils, which are designed to be used on the various short-wave "broadcast" bands. With these coils the short-wave "Fan" can have greater tuning ease on his favorite



A peek at the rear of the 2-Tube Electrified Doerle Receiver fitted with the newly adopted Na-Ald "Band-Spread" coils

foreign broadcast band. The set described in this article, together with a set of the short-wave "broadcast" band-spread coils, would make an ideal combination.

For those who have already built the 2-tube electrified Doerle it will be a comparatively simple matter to make the simple changes outlined. The first procedure is to remove the four-prong *coil* socket and the five-prong *tube* socket. The four-prong socket will be discarded but the one used for the 56 tube will now be used for the five-prong band-spread coils, and is mounted where the four-prong socket was formerly located. It will be necessary to obtain a 6-prong wafer socket to accommodate the 2A5 pentode amplifier tube. This will be mounted in place of the one used before for the 56. Mount the six-prong socket so that the filament terminals are facing the end of the chassis. The five-prong socket will be mounted with the filament holes toward the rear of the base. Mounting the sockets in this manner will simplify wiring to quite an extent. The rest is easy, just wire up the two sockets according to the diagram.

For the "Fans" who have not constructed the 2-tube Doerle, this set offers about the ultimate in 2-tube receivers; the builder will be more than thrilled with the results obtainable with this little "bandspread" two-tuber.

Chassis

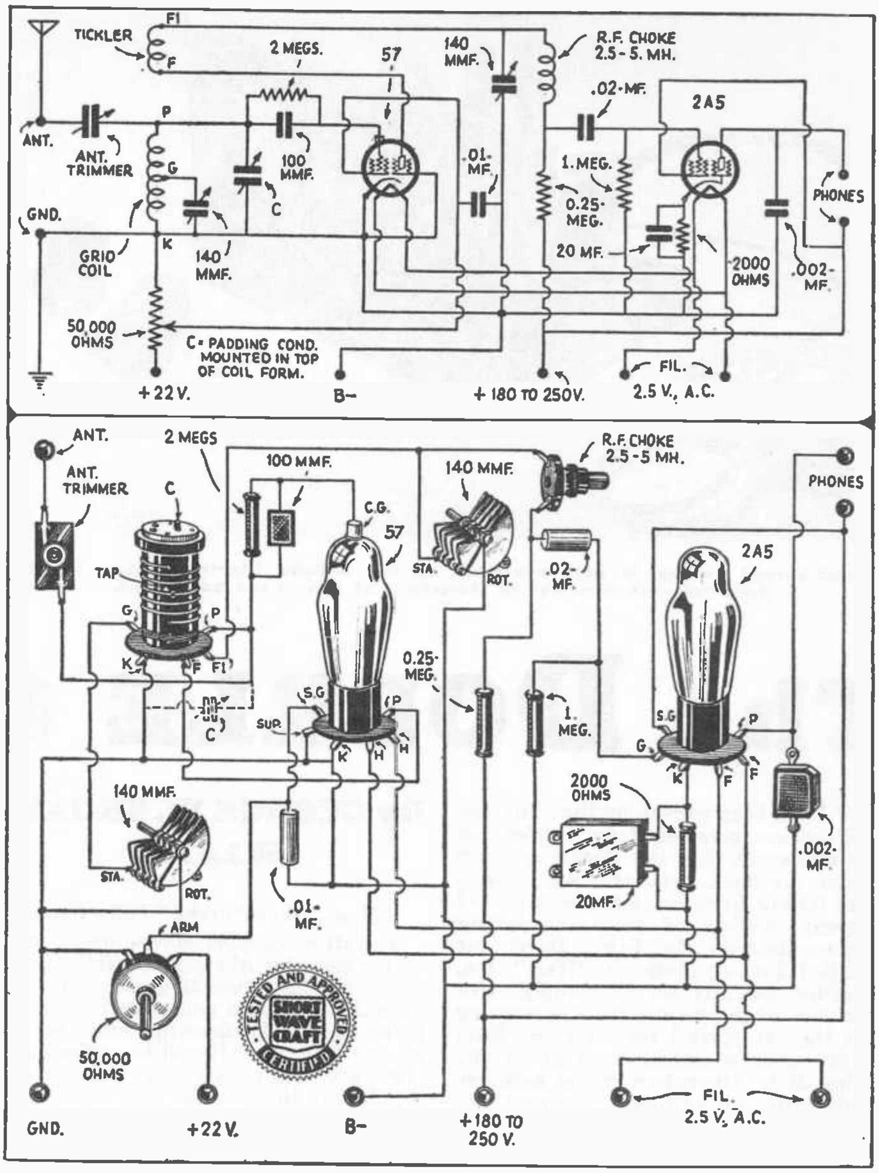
The metal chassis used in constructing this set is of the variety sold by nearly every mail-order house and comes completely drilled and finished in various colors of lacquer. These chassis are really cheaper to buy than to construct, and they present a more business-like appearance. The photos clearly show the placement of the various parts and this general layout should be followed as closely as possible in constructing the set.

It will be noticed that there are two more changes in the new version of the Doerle, viz.: the addition of a potentiometer in the screen-grid of the detector tube, and the 57 detector is provided with a shield. The potentiometer was added because various makes of 57 tubes require slightly different voltages on the screen-grid. And then again on the higher frequency bands, it has been found that a slight change in screen voltage is necessary to obtain smooth regeneration. Then in many cases the builder may not have provisions for adjusting the voltage from the power supply where the potentiometer permits the voltage to be set for maximum sensitivity. The regeneration is then controlled with the *throttle* condenser.

Detector Tube Shielded

When using a pentode, such as the 2A5 tube, it is necessary to shield the detector tube in order to prevent *feedback* between the two stages, which causes the pentode to howl. So don't forget to shield the detector tube! The same cathode biasing resistor that was used in the 56 amplifier of the original set is used for the 2A5. While 500 ohms is the proper value for the 2A5 tube, the 2,000 ohm unit was used to lighten the load on the earphones, when used directly in the plate circuit of the pentode; the 2,000 ohm resistor provided less plate current to pass through the phones and the slight difference in volume is nothing to worry about.

However if an output transformer is available its use is preferred and then, of course, the 500 ohm resistor should be used.



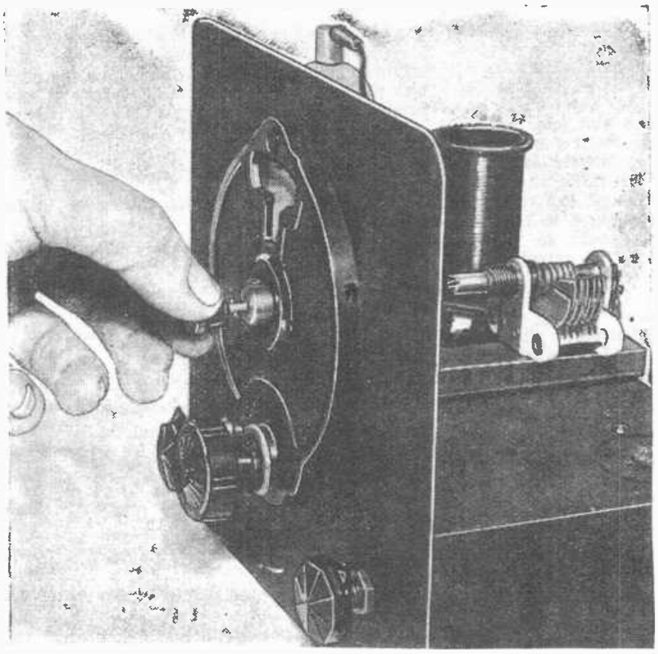
Wiring diagrams, both schematic and physical, showing the connections of the well-known 2-tube electrified Doerle receiver, as adapted to operation with the new Na-Ald Band-Spread coils. These coils serve to spread the stations over the dial and make short-wave tuning a real comfort.

Check All Connections

After the set is wired up it is advisable to check all connections to make sure everything is firm and in its right place. Connect the power supply to the set and we are ready to hear some real 2-tube performance. Tuning is exactly the same as in the original set, except that the "band-setting" condenser mounted in the top of the coil form will have to be adjusted to bring the desired band within the range of the dial. This only needs to be done once on each coil; after the adjustment has been made no further attention need be given to it.

Parts List—2-Tube Doerle Band-Spread

1 set of Na-Ald "band-spread" coils.
1 drilled metal chassis. Radio Trading Co.
1 antenna trimmer (low min. cap.) 35 mmf. max.
1 .0001 mf. mica condenser. (Polymet.)
1 .01 mf. bypass condenser. I.C.A. (Polymet.)
1 .02 mf. bypass condenser. I.C.A. (Polymet.)
1 .002 mf. bypass condenser. I.C.A. (Polymet.)
1 20 to 25 mf. 25-volt electrolytic condenser. (Polymet.)
2 140 mmf. variable tuning condensers. Hammarlund. (National; I.C.A.).
1 2 meg. grid-leak. Lynch.
1 1 meg. grid-leak. Lynch.
1 250,000 ohm resistor. Lynch.
1 2,000 ohm resistor. Lynch.
1 50,000 ohm variable potentiometer. Acratest. (I.C.A.)
1 2.5 to 5 mh. R.F. choke. National. (Hammarlund; I.C.A.)
1 5-prong wafer socket. Na-Ald. (I.C.A.)
2 6-prong wafer-socket. Na-Ald. (I.C.A.).
1 antenna-ground terminal strip. I.C.A.
1 phone terminal strip. I.C.A.
1 5-wire battery cable. I.C.A.
1 57 tube. R.C.A. (Arco.).
1 2A5 tube, R.C.A. (Arco.).



In order to change the tuning to "band spread," one has simply to operate the special button at the center of the dial.

UNITROL Receiver

Simplifies Band-Spread Tuning

By GEORGE W. SHUART, W2AMN

A brand-new *dual* tuning control is here described for the first time—without removing the hand from the tuning dial this device gives you the option of *ordinary* or *band-spread tuning*. It involves a simple mechanical arrangement which can be provided at slight cost, or the set-builder may do the work himself.

● THE main feature of this receiver is the tuning condenser, which incorporates, so far as the writer is aware, something a little different from the usual *band-spread* arrangement.

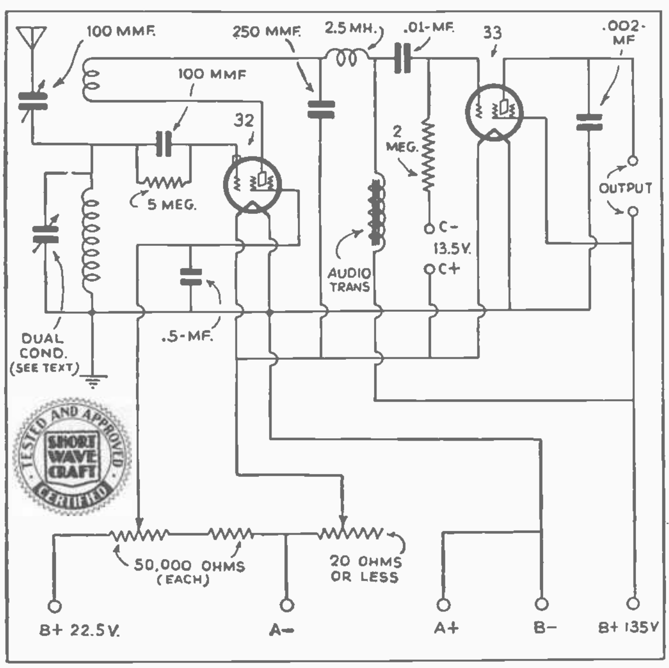
Most everyone operating a short-wave receiver will admit that the usual *band-spreading* methods on the average receiver are rather awkward when it comes to covering any large range of frequencies. That is, it is impossible to cover the entire range of a given short wave plug-in coil with a single dial and still be able to have *band-spread* when it is desired. Most receivers have two separate controls namely, the tank tuning condenser and a small one used for spreading out the congested short-wave amateur and broadcast bands. In this method, unless both condensers have accurately calibrated dials, it is impossible to reset them for a given frequency and have the same ratio of capacity between the two as before.

Then again in tuning across the whole range of a plug-in coil, it is necessary to tune a short way with the small tuning condenser and then reset the tank condenser, and if you should overshoot the mark with the tank condenser, you will miss out on a large portion of the band you wish to cover.

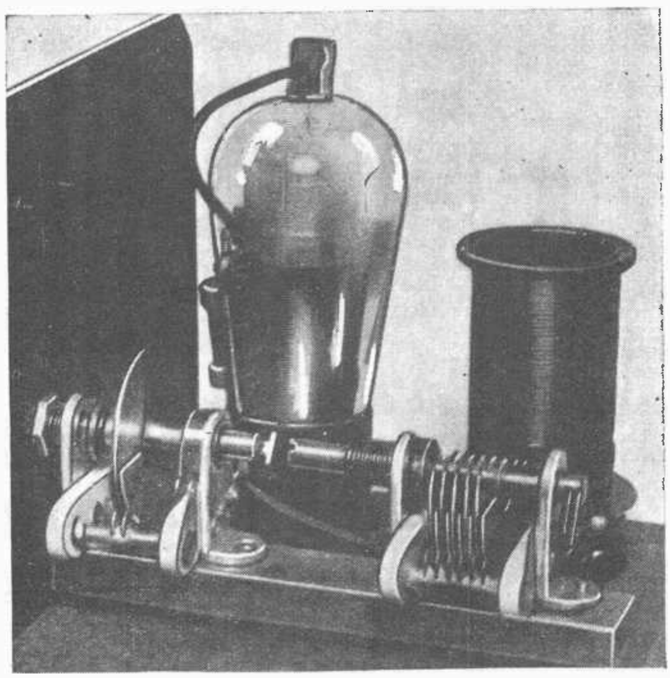
A brief description of the receiver may be in order, before we continue with the description of the condenser. A type 32 screen grid tube is used as a regenerative detector which in turn is impedance-coupled to the type 33 pentode audio stage. The coupler is a regular audio transformer with its primary and secondary connected in series to form a high impedance plate load for the detector tube. Resistance coupling could be used but with a slight decrease in audio volume. There is only one draw-back with impedance coupling and that is that there is usually a very serious fringe howl when the detector is brought into an oscillating condition. However, this is easily overcome by shunting a 250,000 ohm resistor across the transformer, which is now a choke.

Regeneration Control

Regeneration is controlled by varying the screen-grid voltage of the detector



Here is the simple hook-up for the "Unitrol" receiver, which gives optional "band-spread" tuning.



A close-up of the rear, showing "tank" and "band-spread" tuning condensers, together with clutch.

tube with a 50,000 ohm variable resistor. This control is made much smoother by connecting a fixed resistor as shown in the diagram from one side of the potentiometer to the "B" negative. The antenna is coupled in the usual manner using a small variable condenser connected between it and the grid. This is another sore spot in short-wave receivers and before long some young "Marconi" will present a better method to be used where there is no R.F. stage ahead of the detector.

This makes an ideal receiver for the beginner or a good auxiliary for the fellow who has an A.C. operated rig. Any station that can be received on any other type of receiver can be heard on this little set but, of course, with much less volume. Then again there are many fellows living in locations where lighting mains are not available and they should find this set to meet their needs readily, considering the fact that they can now purchase a 2 volt filament battery that can be recharged and will give years of service.

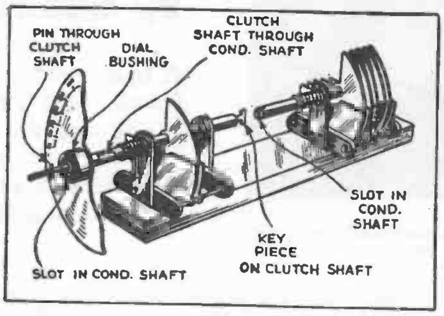
To construct the special tuning condenser shown in the photographs and drawings it is necessary to obtain one 20 mmf. and one 140 mmf. Hammarlund tuning condensers. These were chosen because they lent themselves readily to the arrangement.

A one-eighth inch hole is drilled through the center of the shaft of the 20 mmf. condenser unit. It is best, if one does not have a drill-press or lathe, to take it to the local machine shop and have it done accurately. After this is done saw a slot in the front of the shaft to fit a piece of number 14 buss bar. A similar slot is cut in the front of the 140 mmf. condenser shaft. These slots are used to lock the two condensers together. Now mount the two condensers on a metal strip as shown in the drawing and we are ready to install the shaft.

Procure a length of brass shafting that will fit snugly in the hole drilled in the shaft of the small condenser. Shape the end of the shaft to fit in the slot cut in the large condenser; if a better job is wanted a pin, as used by the author, can be fitted to the end instead. Now insert the shaft and engage it in the large condenser firmly, so that it can be marked for the front pin. The shaft has two pins, one for the rear and one for the front condenser. Mark the shaft for the pin which engages the small condenser and drill the hole very accurately as there should be no difference in the settings of the two condensers when the shaft is engaged in the two.

Thread the end of the shaft so that a small binding post-knob can be attached for shifting from "regular" tuning to "band-spread".

Tuning with this condenser is very simple; turn the *band-spread* condenser so that the shaft will lock the two condensers together and proceed to tune as usual. When a section of the range of the condenser is reached where you want brand-spread, just pull out the knob in the center of the dial and presto!

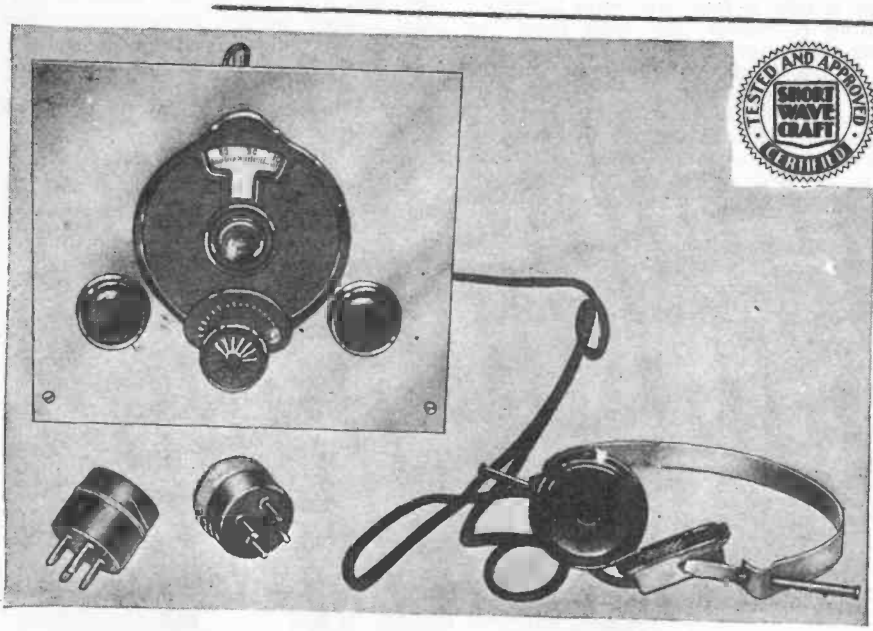


This cut shows clearly the construction of the new band-spread condenser "clutch". When the central shaft is pushed in, the two condensers are ganged together and when it is released the dial turns only a small condenser, allowing full "band-spread" at any frequency in the short-wave spectrum.

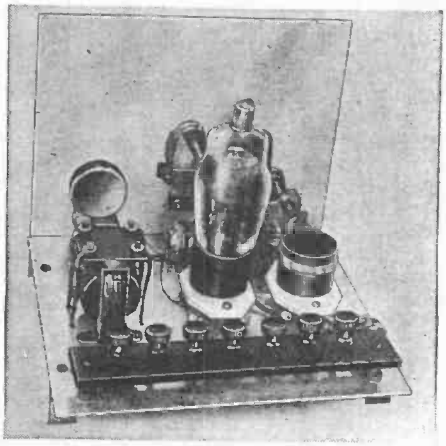
we have *band-spread,* just where we want it. To engage the two condensers the dial must be turned back to the position where the shaft was pulled out. In this manner we can have band-spread at any part of the short-wave spectrum, by just pushing a button!

Parts List for the Unitrol

- 1 two tube drilled chassis, Harrison Radio. (Blan.)
- 1 20 mmf. tuning condenser, Hammarlund. (National, Cardwell.)
- 1 140 mmf. tuning condenser Hammarlund. (National, Cardwell.)
- 1 0-100 mmf. antenna trimming condenser.
- 1 100 mmf. mica grid condenser.
- 1 250 mmf. mica condenser.
- 1 .002 to .004 mf. mica condenser.
- 1 2.5 M.H. r.f. choke; National.
- 1 .01 mf. condenser.
- 1 .5 mf. condenser.
- 1 5 meg. grid-leak, ½ watt. Lynch. (Int. Res. Corp.)
- 1 2 meg. grid-leak, ½ watt. Lynch. (Int. Res. Corp.)
- 1 50,000 ohm resistor, 1 watt. Lynch. (Int. Res. Corp.)
- 1 50,000 ohm potentiometer. Acratest. (R. T. Co.)
- 1 20 ohms or less, rheostat. (R. T. Co.)
- 2 4-prong wafer sockets. Na-ald.
- 1 5-prong wafer socket. Na-ald.
- 1 set of four 4-pin plug-in coils—15 to 200 meters. Alden. (Gen-Win.) See page 749 for coil data.
- 1 National type "B" dial.
- 1 Phone terminal strip.
- 1 Audio transformer.
- 1 32 tube; R.C.A. (Arco.)
- 1 33 tube; R.C.A. (Arco.)



This attractive one tube receiver, of undoubted interest to every short-wave beginner, employs the latest electron-coupled circuit. Distant short-wave transmitters in practically every country were heard with this receiver.



How the Electrodyne 1-tube receiver appears from the rear.

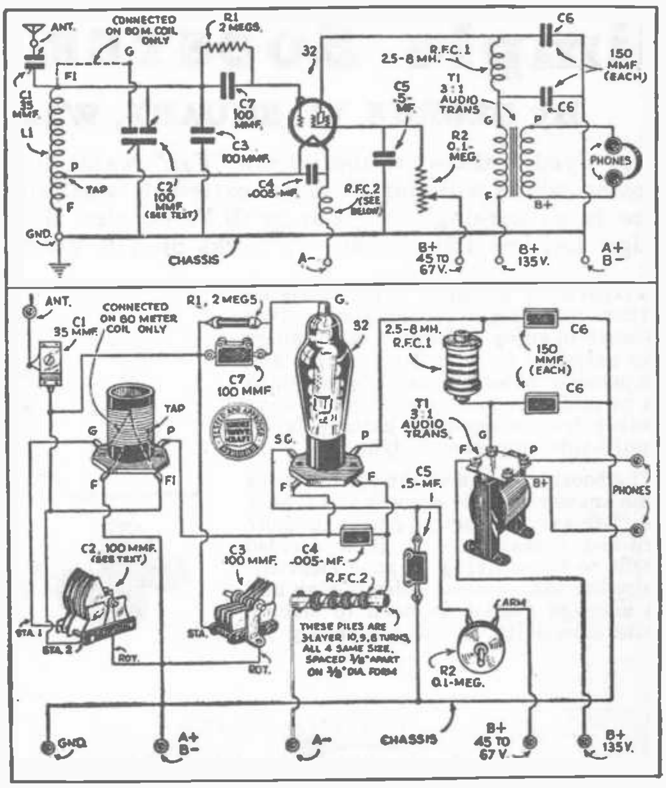
The ELECTRODYNE 1-Tube "Band Spread" Receiver

By LEONARD VICTOR and ERNEST KAHLERT

● SO MANY reports have been received on the excellent results obtained from the use of the electron-coupled detector circuit in the "Pee-Wee Ham-Band Receiver" that it was decided to try and adapt the same circuit for battery operation. After a good deal of experimentation, the circuit to be described, which is almost the simplest arrangement possible, was arrived at.

The electron-coupled oscillator, which was originally designed by Lieut. Dow, has found numerous applications in radio work. Not the least of these is the fact that it is the most efficient and stable detector circuit known.

This particular application of the "E.C." circuit uses a type 32 screen grid two-volt tube as the detector. With this set sufficient volume was obtained to comfortably work a pair of earphones on quite a few 'DX" stations. By this we do not mean the ten and twenty thousand watt short-wave broadcasters, but their little ten and twenty watt "brothers" in the "ham" bands. At one time during the test period, a fifteen minute conversation was held with SU1CH, 8,500 miles away in Alexandria, Egypt, using nothing but this little "one-tuber" at the receiving end! Other stations located on every continent on the globe, except Asia, were logged while the set was being tested.



Both schematic and picture wiring diagrams for the Electrodyne 1-tube receiver are given above.

General Physical Features

The physical layout of the set is exceedingly simple and was designed with the cardinal rule of short wave work in mind—*short leads!* Two 7x8 inch pieces of aluminum are used as panel and subpanel. On the panel the controls, from left to right, are: band-finding, band-spreading, and regeneration. The layout on the chassis, from left to right: coil, 32 tube, and transformer. The plate R.F. choke is located on the subpanel directly below the band-spreading condenser. The filament choke and all the by-pass condensers are mounted under the subpanel. A binding post strip is used for the connections to antenna, batteries, and earphone, but if the constructor so chooses, some other form of connection, such as a cable plug and socket, and a phone plug could just as well be used.

Doublet Antenna Advised

One of the most important things in a small set which it is desired to have working at optimum, is the antenna system. Provision is made for the use of a regular antenna-ground system, but if it is in any way possible, a doublet antenna should be used. The gain in signal-to-noise ratio is immediately noticeable when some such arrangement as the Lynch antenna doublet and transposed lead-in system is used. Various layouts for doublets have appeared in previous issues of this magazine.

This set having been built primarily for the amateur bands, a dual condenser arrangement is used for *spreading* the crowded amateur bands over a large portion of the dial. A National 100 mmf. variable was cut down into two sections, five plates and two plates. On twenty and forty meters the two plate section is in parallel with the 100 mmf. band-finding condenser, and spreads the bands over most of the dial, allowing easier tuning. On eighty meters the two plate section would not be sufficient to cover the entire band, so the extra five-plate section is thrown in parallel with it. This is accomplished by connecting the five-plate section to the blank prong on the coil socket. In the eighty meter coil a wire is run from the grid prong to the blank prong, and thus when the coil is plugged in, the extra section of condenser is thrown in parallel with the two-plate condenser.

Hi-C is used on all the "ham" bands for the greatest dynamic stability. That is, the band-finding condenser is at its greatest capacity when the band is tuned in.

Resistance-controlled regeneration is used, and in the electron coupled circuit there is practically no frequency shift when this control is adjusted.

Filament Choke Used

Since the tube is directly heated, and it is necessary to keep the filament above ground R.F. potential a filament choke is necessary. The .005 mf. condenser across the filament is used to provide a low-impedance path for R.F. so that both sides of the filament may be at the same potential above ground. The filament choke is wound on a piece of 3/8 inch dowel, 4 inches long. There are four pies of number 28 cotton covered wire on it. Each of these pies is wound in three layers. The bottom layer ten turns, the second layer nine turns, and the top layer eight turns. The pies are spaced 3/8ths of an inch apart. After the choke is completed it should be covered with a coat of collodion or clear Duco. With a little care this choke can be properly made, and caution should be taken, as the choke is one of the most important parts of the set.

The 32, being a screen-grid tube, has a very high plate impedance, hence we must find some means of matching this impedance to the phones. This is accomplished by using an audio transformer, reversed. The secondary of the 3 to 1 transformer is of high enough impedance to match the plate of the 32, and the primary, which is used as the secondary, works well into a pair of earphones or a loudspeaker.

Coils Wound On Tube Bases

The coils are wound on four-prong tube-bases, with number 30 d.c.c. wire. The following is the number of turns for the various bands:

Band	Grid to Fil.	Fil. to Ground
80m.	20 t.	1½ t.
40m.	12 t.	1½ t.
20m.	3 t.	1¼ t.

A little juggling with the tickler section of the coil, that is, moving it up and down on the tube base, may be necessary to get the set oscillating properly over the entire band with the particular antenna used. After the coils are correct, coat them with collodion or Duco, so that they will hold their characteristics.

The usual cautions about careful soldering and good wiring are in order, and especially so in a small set like this in which everything must be working perfectly. Needless to say, only the best of parts should be used. Good mica condensers and a good make of variable are requisites for satisfactory performance. A cheap variable will get noisy and become annoying in a short time.

After the set has been wired, checked, and then double-checked, connect up the batteries. Two volts from a storage battery were used for the filament, but dry cells can be used, and will last a long time. If dry cells are used, a 20 ohm rheostat should be provided for dropping the filament voltage.

Plug in the eighty meter coil and turn the regeneration control. At some point a low rushing noise will be heard. Then tune the band-finding condenser until some station is heard. If a regular antenna is used the antenna condenser should be adjusted as tightly as possible, while still allowing the set to oscillate all over the dial.

This set has low *background* noise level, is extremely sensitive, and is steady in operation. We earnestly believe that it will do all that could be expected from a small set. When conditions are right, the "sky is the limit" to what can be heard. We have had excellent results with this set, and would certainly like to hear what luck those that build it have.

Parts List for Electrodyne

1 35 mmf. antenna trimmer, National (Hammarlund).
1 100 mmf. National 270 degrees condenser cut down, see text.
1 100 mmf. condenser, variable, National (Hammarlund).
1 .005 mf. mica condenser.
1 .00015 mf. mica condenser.
1 .001 mf. mica condenser.
1 .05 mf. by-pass condenser.
1 1 meg. half watt resistor, Lynch (I.R.C.)
1 100,000 ohm variable resistor, Acratest.
1 2.5 to 5 mh. choke, National (Hammarlund).
1 filament choke (special), see text.
1 3 to 1 audio transformer, National (or other make).
2 four prong Isolantite sockets, National (Hammarlund).
1 dial, National type B; 270 degree.
1 set of coils, see coil table.
1 232 type tube, R. C. A. Radiotron

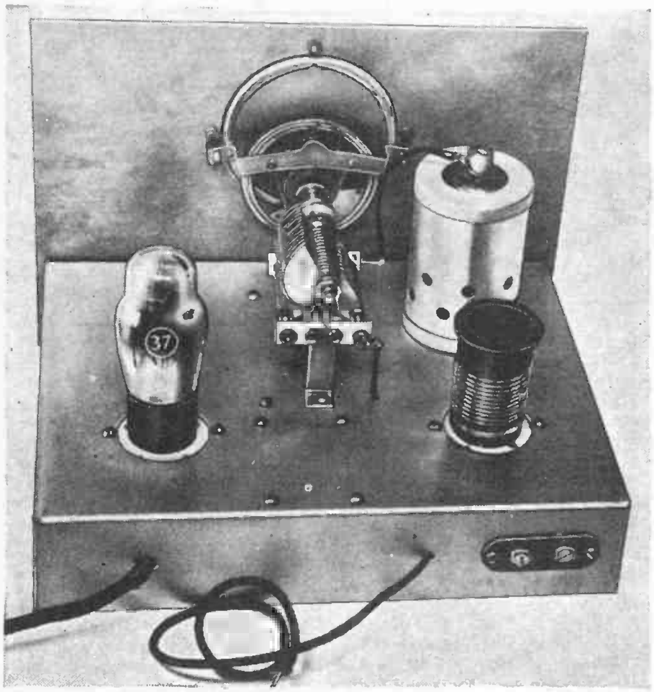
How To Build A Simple BOOSTER

By GEORGE W. SHUART, W2AMN

Every dyed-in-the-wool short-wave "Fan" wants to build an R.F. Booster, which will amplify those extremely weak distant stations. Here is a "corking" single-stage R.F. booster of unusually fine design and low initial cost. It works on 110 Volts A.C. or D.C.

● THERE is nothing more annoying than receiving a station just a little too weak to enjoy. Many of our readers have asked us to describe a simple and inexpensive booster stage, one which can be added to any type of short-wave receiver from a one-tube battery set to a multi-tube superheterodyne.

The booster shown in the photographs is the answer to their request and it sure is a "life-saver" when it comes to those hard-to-get stations. It is a decided benefit to those living in poor locations where the *back-ground* noise is high and the average station is none to strong. While selectivity is not materially in-



Directly above, we see the single-stage R.F. booster connected to a Midget all - wave receiver (right).

Left: Rear view of the one-stage R.F. Booster of simple, yet highly efficient design.

creased with a tuned R.F. stage, there is a decided increase in over-all signal strength and the signal-to-noise ratio is slightly better than without the benefits of a "preamplifier".

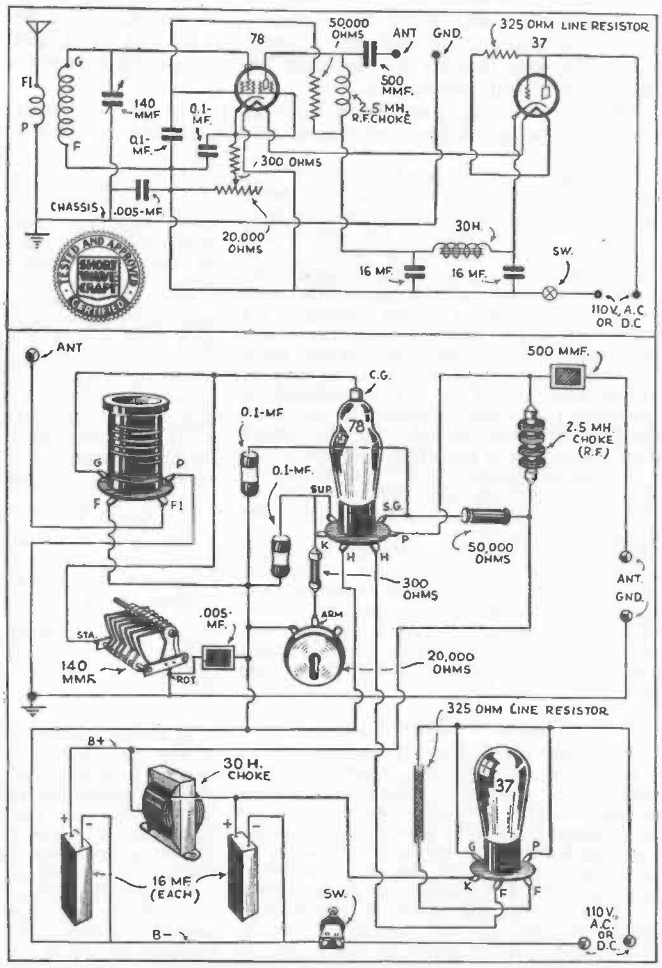
"A.C.-D.C." Circuit Used

It was decided to make this booster an "all-electric" affair, which could be operated from either A.C. or D.C. house mains, bearing in mind that about ninety per cent of the S-W fans live in homes having 110 volt lighting systems. This, of course, does not mean that the booster can't be built for battery operation. The same circuit can be used on batteries by just disregarding the rectifier and filter parts in the diagrams. A 6-volt battery is then needed for the filament supply and 90 volts of "B" batteries to furnish the plate voltage.

The chassis used to build up this amplifier is larger than necessary and some folks may wonder at the use of a precision dial being used. The whole story is that the chassis is to be used for another set and it was a pure economic move. The builder can use any convenient size chassis and the entire unit can even be mounted on a wood base-board.

Amplifier and Rectifier Tubes

A 78 tube is used as the R.F. amplifier and a type 37 is used for the rectifier; the filaments are in series and the voltage-dropping resistor is incorporated in the 110-volt "line" cord. The filter choke and the electrolytic filter condensers are mounted underneath the chassis. If you



Both schematic and picture diagrams are given above, so that even the tyro can build one of these R.F. boosters and amplify those weak DX stations.

build an R.F. amplifier do not fail to incorporate in it a volume control. Without it nearly all the short-wave broadcast stations overload the regenerative detector and the result is very poor quality speech or music. Regular short-wave plug-in coils are used and the data is given herewith.

There are two types of sets that this booster will probably be used on: One having an antenna coupling condenser which couples the antenna directly to the grid of the detector tube and another where the antenna is coupled inductively to the grid coil th.ough a small winding, such as that used in the booster. These sets are usually those having tuned R.F. stages. For each type of set there will have to be a different method used to couple the booster to the input stage. Coupling to the set having an antenna trimmer is an easy matter; it is only necessary to clip the out-put wire of the booster stage on to the antenna binding post and adjust the trimming condenser for best results. Those having the type just mentioned will find the added R.F. stage a decided improvement in that there will be no need for any further adjustment of the trimmer, even when coils or antennas are changed. Dead-spots caused by the antenna are no longer present. Sets having antenna coupling coils will also be improved by the use of an additional R.F. stage but the method of connection between the two is a little different, if full advantage of the booster is to be had. The output lead can also be connected to the antenna post, but better results will be obtained if the amplifier is connected directly to the grid of the first tube. This is done by inserting a small fixed or variable capacity in series with the lead directly at the grid terminal of the tube or coil. This capacity should not be greater than around 50 mmf. (.00005 m.f.) and preferably a little less, a 35 mmf. (.000035 mf.)

After all wiring is done and the connections checked, connect it to the receiver; turn the volume control full on and, while the receiver is oscillating rotate the tuning condenser of the amplifier until an increase in general back-ground sound is heard. This indicates resonance between the two tuned stages and we are now ready to explore the short wave bands, far better equipped than before. Always keep the amplifier and receiver in resonance while tuning. The amplifier will tune quite broad and no trouble will be encountered in its adjustment. The same antenna formerly used will of course now be connected to the new unit.

Alden 4-Pin Plug-in Coil Data

Meters Wave-length	Grid coil turns	Tickler turns	Distance between 2 coils
200-80	52 T. No. 28 En. Wound 32 T. per inch.	19 T. No. 30 En. Close wound (CW)	⅛"
80-40	23 T. No. 28 En. Wound 16 T. per inch.	11 T. No. 30 En. C. W.	⅛"
40-20	11 T. No. 28 En. 3-32" between turns	9 T. No. 30 En. C. W.	⅛"
20-10	5 T. No. 28 En. 3-16" between turns	7 T. No. 30 En. C. W.	⅛"

Coilform—2⅛" long by 1¼" dia. 4-pin base.

Parts List for R.F. Booster

1—Metal chassis and front panel; Blan; Insuline; Korrol.
1—Set of 4 plug-in coils; Na-Ald.
1—140 mmf. tuning condenser, National (Hammarlund).
1—.005 mf. fixed condenser; Mica.
2—.1 mf. by-pass condensers.
1—.0005 mf. mica condenser.
2—16 mf. 150-volt electrolytic condensers.
1—300 ohm 1 watt resistor; Lynch.
1—50,000 ohm 1 watt resistor; Lynch.
1—20,000 ohm variable resistor; Lynch.
1—Line cord with 325 ohm resistor incorporated.
1—2.5 millihenry R.F. choke; National (Hammarlund).
1—30 henry filter choke.
1—"On-Off" line switch.
1—4 prong Isolantite socket; National (Hammarlund).
1—6 prong Isolantite socket; National (Hammarlund).
1—5 prong laminated socket; Na-Ald.
1—78 tube; R.C.A. Radiotron; (Arco).
1—37 tube; R.C.A. Radiotron; (Arco).

Power Supply from Ford Coils

By C. V. CRANE, Ex. W9ARQ

● MANY "Hams" have expressed deep interest in this novel power supply, especially those living in rural communities, or communities not supplied with A.C. line current, for whom this article is especially written.

No doubt some may look upon it with disfavor, in fact I did until I had given it a trial. In its original form some trouble was experienced, but by many experiments the final circuit was developed, which far exceeded all expectations.

Some may say that the vibrator points will give no end of trouble, others may say that it will be impossible to secure a good P.D.C. note, and steady frequency. All I can say to the skeptical is "try it" and convince yourselves as I did.

In experimental tests covering a period of 4 or 5 days on the 85 and 160 meter bands with not over 2 hours of operation time per day, some 40 to 50 stations were contacted and *worked*. All reported absolutely steady frequency, some D.C. reports were received, but the majority were P.D.C. with audibility reports from QSA 3-5 and R 5-8. This is not so bad considering that a pair of 201-a tubes were used in the conventional Hartley oscillator circuit.

Not much time was spent on the 85 meter band or in trying to work DX. But to give an idea as to what can be done with this power supply in the low power field, from central Kansas stations were worked as far east as Ohio. As far north as the Canadian line. As far south as Port Arthur, Texas, and as far west as Livingston, Montana. And at no time was any trouble experienced with the vibrator points. Although the secret of the whole supply lies in the adjustment of the contact points and relays.

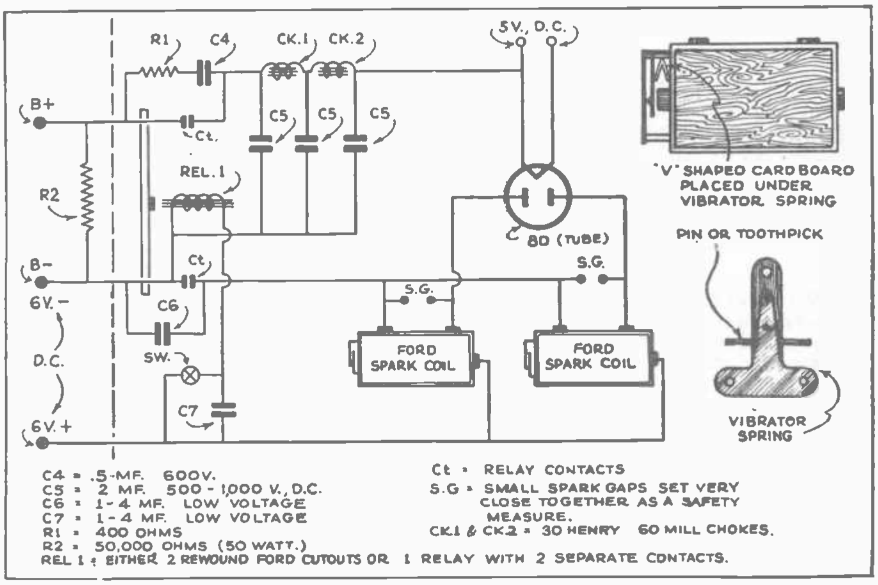
For the boys in the Rural districts, this power supply provides a very efficient source of plate voltage. It would also serve very nicely in camps, where temporary transmitters are used to communicate with the folks "back home."

Now for the adjustment of the vibrator points. Be sure they are good, new ones preferred. Cut a small piece of *stiff* cardboard about 2" long and ½" wide; bend it into a "V" and place it under the vibrating reed as shown.

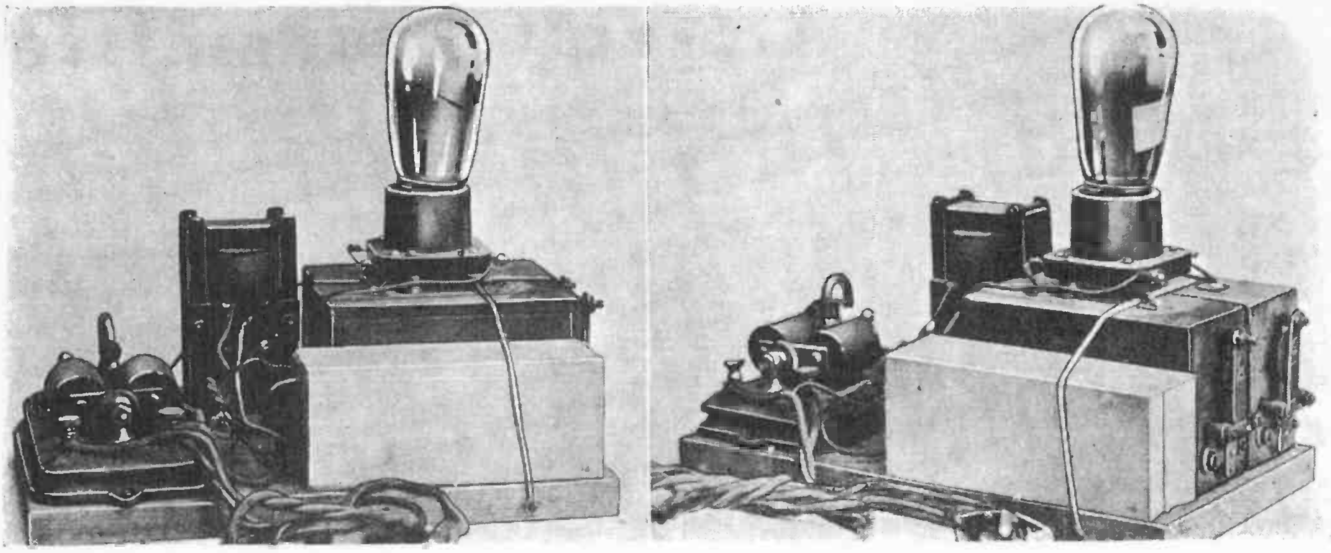
Next place a pin or toothpick between the upper reed and its mounting as shown in the drawing.

Now with the oscillator on and the power supply connected, adjust the vibrator points until the milliammeter in the plate lead to the oscillator reads maximum *steady* current. You are now ready to tune your oscillator and go on the air.

One thing to keep in mind is that in using the 280 type rectifier a separate storage battery is required, while by using the Raytheon type rectifier no such battery is needed. If sparking appears in the rectifier tube reverse the



The above diagram shows how the Ford spark coils are connected in this novel power supply.



The photographs clearly show how the various parts of the power supply are mounted.

polarity of the storage battery connections to the spark coils.

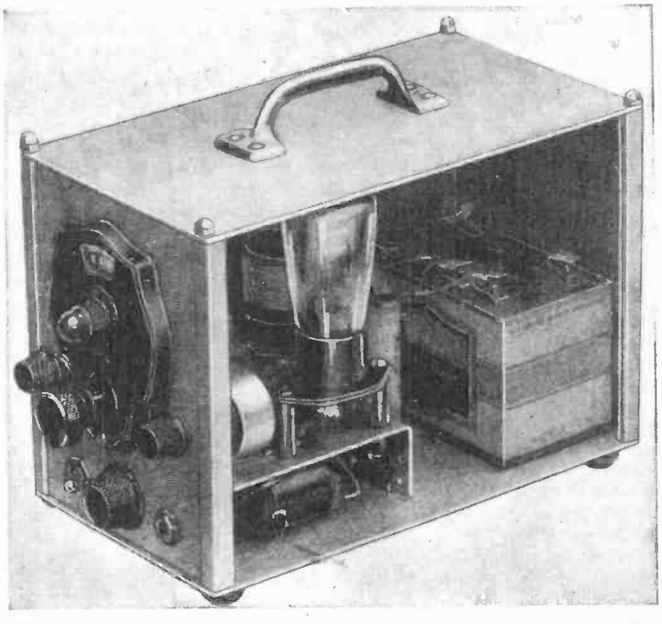
The relays are made by removing the original coil windings from Ford cut-outs, and winding the bobbin full of No. 28 cotton covered wire, care being taken to insulate the two leads coming off this coil from the contact points on the relay. This arrangement makes very satisfactory relays.

The relay connected in the high voltage lead to the plate of the oscillator should be adjusted until it closes a split second before the relay connected in the primary lead of the spark coil. This eliminates all chirps from the emitted wave. A word may be said as to the bleeder resistance connected to the output of the high voltage relay. Experiments show that if it were connected in the output of the filter system, a very noticeable voltage drop, and voltage lag occurred. While connecting it in the output of the relay no such drop or lag was noticed.

This power supply may be built very economically. By using choke coils designed for broadcast receivers capable of passing at least 60 mills of current, and using the condensers taken from Ford coils, in the filter system, and across points, etc. The filter condensers must be capable of standing at least 500 volts rectified A.C.

A Portable Battery-Type TRANS-CEIVER

By GEORGE B. HART
Engineer, WLW-WSAI-W8XAL
Operator, Ex-U8DK-W8GCR



Trans-ceivers are commanding a great deal of attention from the short-wave fraternity today, as they greatly simplify the building of a light-weight transmitter, the same tubes being used for reception as well. This set is now being used with fine results by a National Guard signal corps unit in Ohio. There are no switches to throw in changing from "transmitting" to "receiving."

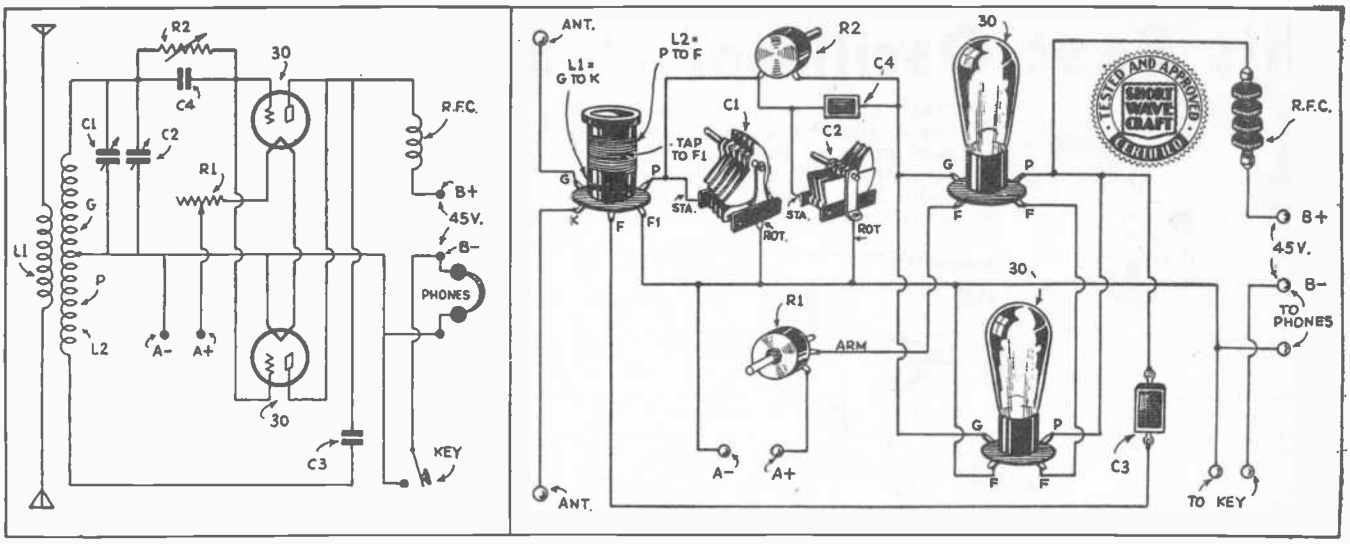
● IN the old days portable sets were in fashion only in summertime; nobody cared to sit out in a field with a portable station during the winter months. However, there are some amateurs whose business interests take them far from home and station; therefore having need of a transmitter-receiver.

Now it is a pretty fair electrical rule that one can always use a generator as a motor—or a transmitter as a receiver. With a few exceptions, that applies to all our circuits. So, too, the Hartley circuit makes a good receiver or transmitter, provided one makes a few changes to fit the job. Figure 1, the schematic, discloses that there is nothing unusual about the circuit from either a transmitting or a receiving angle. The only peculiarity is the fact that the key is shunted with a pair of headphones. They complete the receiving circuit, in which a simple form of grid-blocking super-regeneration makes possible the remarkable efficiency of the set as a receiver.

The circuit comprises a modified Hartley hook-up using two type 30 tubes, their filaments in series and their grids and plates in parallel, which for all purposes provides sufficient oscillation for transmission and ample volume on the phones for reception. While it is apparent that no extravagant claims can be made as regards "DX" (distance) possibilities, there is little doubt that for purely "local" communication with an improvised antenna system and low plate supply, this little set is hard to beat.

Portability being the desired characteristic, coupled with efficient local operation, it was found possible to construct the entire mechanism in an aluminum can 6"x5"x8". The container not only houses the *trans-ceiver*, but also the power supply of 45 volts; the total weight being less than four pounds.

Condenser C1 is a 50 mmf. variable



You have probably never seen a simpler circuit for a combination short-wave TRANSMITTER and RECEIVER than the one here pictured. The great things are simple someone has said, and so it is with this Trans-ceiver—and it surely steps out and delivers the goods as many tests have demonstrated.

condenser used as the transmitting tuning condenser. This control is set for operation within the amateur band selected and C2 employed to tune the receiver. C2 is a 7 mmf. variable condenser and is readily returned to zero mesh for transmission. Its small size assures band-spread tuning. The remainder of the components are not unusual with the exception of R2 which is a variable 0-50,000 ohm grid-leak. In fact, grid leak control is the secret of the set when operated as a receiver.

To operate as a receiver, screw the grid-leak down tight and light the filaments to full brilliancy. The set will then oscillate quietly but too strongly to receive any but the strongest local signals. To check this, listen in on another receiver. Proper operation should result in the paralysis of the second receiver. Now increase the grid resistance slowly and the set will burst into a quiet whistle that denotes super-regeneration. This whistle is not annoying. Signals will now be heard, the volume of which, may be increased by slowly increasing R1. The whistle will increase in volume and in frequency but only up to a certain point, after which the signals will not be heterodyned but will have a blocking effect on the tube, stilling the whistle and giving the effect of a *back-wave.*

Fortunately, the best adjustment for receiving is also the best for transmission.

The antenna is cut to the wave-length desired and tightly coupled to the secondary circuit. This results in its response to any tuning of the secondary and eliminates an antenna tuning condenser. Forty meter operation has been done here (at Cincinnati, Ohio) using a 25 feet antenna and similar counterpoise coupled to the outfit through a five turn antenna coil. Resonance was indicated by a small flashlight bulb.

Excellent local contacts have been made on 40 and 80 meters, while signals have been "heard" from *both coasts* on 20, 40, and 80 meters.

Operation is quite simple as there are no switches to throw to change from transmitting to receiving. It is only necessary to return C2 to zero mesh to *transmit.*

Coil Data

L1

Band	*Lg*	*Lp*	
1750 kc	70 turns	10 turns	No. 32 scc
3500	36	7	
7000	20	4	No. 30 scc
14000	8	6	

All coils are close wound except the 14000 kc coil. The spacing on this coil is varied until the band is covered. Spacing is approximately half the diameter of the wire. Tube bases are used as forms, with the exception of the 1750 kc coil which is wound on a 1½" coil and then attached to a tube base for plug-in purposes.

Parts List

1. Aluminum can 6"x5"x8" (one screen door handle to be used as carrying grip).
2. C1—50 mmf. midget variable condenser. National (Hammarlund, Cardwell).
3. C2—7 mmf. midget variable condenser. National (Hammarlund, Cardwell).
4. C3—2000 mmf. fixed condenser. Flechtheim.
5. C4—2000 mmf. fixed condenser. Flechtheim.
6. R1—Filament rheostat. R. T. Co.
7. R2—0-50,000 ohm variable resistor. Acratest. (R. T. Co.).
8. L1 approximately five turns of No. 18 wire, wound on 1" dia. form for 40 meter operation.
9. L2 approximately 16 turns of No. 20 wire, wound on 1" dia. form for same band (ratio of G/P should be ½).
10. For 40 meters the RFC should be one of 80 turns, wound on a lead-pencil form.

A Practical Line Filter For S-W Receivers

By A. D. Lodge*

● THIS filter proved it could absolutely eliminate every trace of line noise in the short-wave receiver between 11 and 200 meters.

Duo-lateral or "honey-comb" coil with its low distributed capacity was found to be most effective. Incidentally, as the inductances must be able to carry the entire current drawn by the receiver, the heavy wire used in the "Fultest" duo-lateral coils makes them admirably suited for use in this filter.

The condensers should be of the mica type, moulded in bakelite, as they are non-inductive, have low leakage, and are impervious to atmospheric conditions. The value of the four fixed condensers used is 5,500 mmf. (.0055 mf.) each. Other sizes may be substituted but the filter will not be as effective. The variable filter tuning condenser is a compensator type with a maximum capacity of 100 mmf. (.0001 mf.).

Five 100 turn coils are needed. Four are used as they are, but the fifth one (LT) is adjusted by the "cut and try" method until the tuned circuit (LT and CT) is peaked at the most efficient point. The coils are mounted on a bakelite, hard rubber, or wooden panel approximately 3½" x 7", using a small piece of bakelite ½" x 2" to hold L1-L2 and L3-L4 in place. A larger piece is used to mount LT and CT is fastened on top of it.

Both power plugs should be reversed individually until the best combination is found.

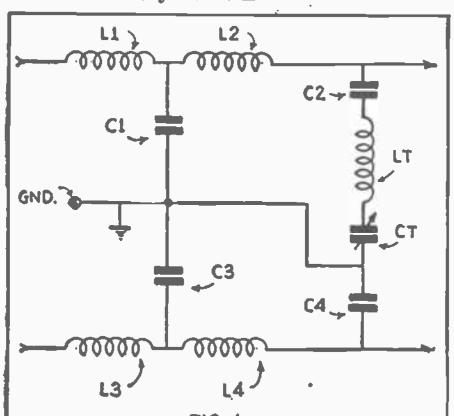


FIG. 1

Hook-up of 110 Volt "Line" Filter.

To tune the filter we turn the volume control of the receiver up full and tune the receiver to the frequency at which the background noise is at its highest. Now vary CT from maximum to minimum, listening for a decrease in the noise. If none is noted remove approximately ten turns at a time from LT, varying CT as above until the point of minimum noise is found. The final size of LT may be as small as ten turns as its size is determined by the frequency of maximum interference.

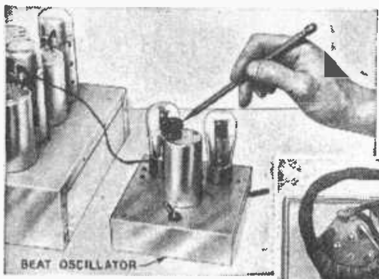
As a final touch the connections to the large coils may be reversed one at a time until the whole filter is functioning at peak efficiency.

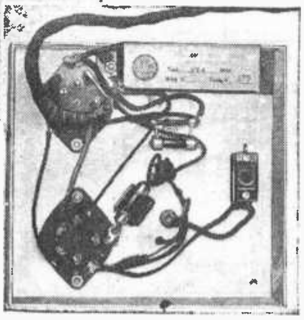
*Harrison Radio Co.

Parts List

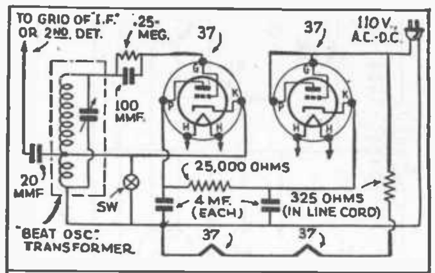
C1, C2, C3, C4—.0055 mf. Fixed Mica Condenser.
CT—.0001 mf. Trimmer Condenser. Hammarlund.
L1, L2, L3, L4, LT—100 turn Fultest Honeycomb Coil. Harrison.
Shield Can.
Bakelite Sub-panel.
A.C. Cord and Plug.
A.C. Outlet.

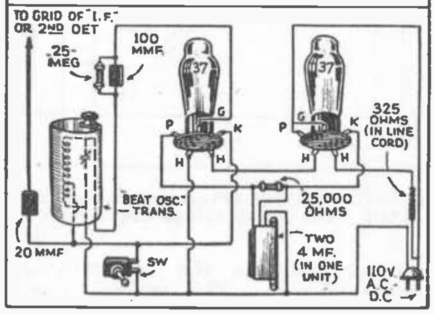
This Beat Oscillator Helps Find Stations





Two photographs showing the construction of this very handy "beat oscillator," which aids considerably in finding stations. The wiring diagram is shown to the extreme right of this page.





● THE much discussed *beat oscillator*, while being a very simple piece of apparatus, is one of the most useful pieces of equipment that a short wave "fan" could own. That is, the "fan" who has a superheterodyne receiver. While a good many of the commercial receivers are equipped with an oscillator to provide an audio beat note on a CW signal, there are many that are not. The fan who builds his own super does not always incorporate this feature either.

The purpose of a beat oscillator is to provide some form of audible tone on an unmodulated continuous wave signal. This is accomplished by beating the oscillator against a signal at a frequency sufficiently removed from its frequency to cause a third sound. The difference between the two frequencies is the frequency of the third sound. For instance—if we have a CW signal of 465 kc. frequency and we heterodyne or beat another against it, having a frequency of 466 kc., we would have a resultant sound of 1,000 cycles. This 1,000 cycles can be heard by the human ear while the two previously mentioned frequencies 465 kc. and 466 kc.) cannot be heard. This provides us with a means of checking audibly, the character of an inaudible signal. We trust that the foregoing explanation, while brief, will give the reader the picture of *how and why* the beat oscillator works. Of course considering that both frequencies are received by some kind of rectifier and a pair of earphones.

True enough the incoming station on our short-wave super does make some sort of rushing sound in the speaker. But a very weak station which is not being modulated by voice or music, at the particular moment we are listening, may be easily passed over unnoticed. While if we were equipped with a beat oscillator we would hear in the speaker or phones, a squeal varying in pitch as we passed over even the weakest station. This squeal is only needed to locate the station, we don't want the squeal while voice or music is coming over. However, for the reception of continuous wave unmodulated code, we must have the separate heterodyne oscillator.

The instrument shown in the photographs is a 2-tube affair designed to work from either an A.C. or D.C. lighting supply. This oscillator *operates entirely independent of the receiving set and has no effect upon the operation of the receiver whatsoever*, except to provide the above-mentioned features. This oscillator uses two tubes—one as the *oscillator* tube and the other as the *rectifier* which provides plate voltage for the oscillator tube; they are both type 37's.

The instrument is really quite simple to build and the constructional cost is very low; at the present prices it can be built for around five dollars without a doubt, and it is well worth the investment. The coil used in this model is a factory-made affair which can be purchased more cheaply than it can be built by the layman. The whole outfit is built on an aluminum chassis five inches square and one and one-half inches deep. Looking at the diagram we find that there are three leads from the coil, one is connected to the "B" negative, the other to the cathode of the 37 oscillator, and the third lead is connected through the grid-leak and condenser to the grid of tube.

On top of the coil shield is a knob which operates a small condenser and this serves to tune the oscillator to the intermediate frequency of our receiver. The value of the grid condenser in the oscillator circuit is .0001 mf. and the leak has a value of 250,000 ohms. The plate of the oscillator tube is connected to the "B" plus lead of the power supply portion. There has to be some means of beating the oscillator with the incoming signal and this is done by connecting a short length of wire to the cathode of the oscillator tube, through a 20 mmf. fixed condenser. The other end of this wire is placed near the grid of one of the "I.F." amplifiers in the receiver, preferably the one next to the second detector. The simplest method is to form a hook in the end of the wire and hang it over the grid-lead, right near the cap on the tube.

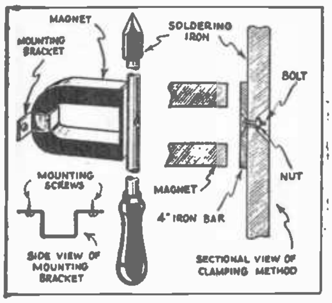
The heaters of the two 37's are connected in series and fed from a special resistor-line cord. The plate and grid of the rectifier are connected together as can be seen in the diagram. The filter which smooths out the current after it has passed through the rectifier, consists of a 25,000 ohm resistor and two 4 mf. 300 volt electrolytic condensers. A switch is connected between the cathode and B minus to serve as a *silencer* of the oscillator when it is not needed. This switch does not turn off the heaters of the tubes, the plug must be removed, or another switch can be incorporated. As the heaters take quite some time to heat up it is advisable to use the silencing switch. One warning *do not attempt to "ground" the oscillator* as the fuses in the house-lighting circuit will blow out. Also don't touch the metal chassis while near a radiator or other *grounded* object or you will be shocked.

After the oscillator has been built, connect it as previously explained and tune in a station on your receiver. Then adjust the knob of the oscillator until a squeal is heard on the station. Tuning from one station to another will reveal the squeal to be present on all of them. A slight adjustment may be needed from time to time to keep the oscillator in tune. Always leave the tubes in the oscillator on for at least two minutes before it is used because the frequency changes slightly as the tubes heat up. Build it and see if DX'ing isn't easier.

Beat Oscillator Parts List

1—chassis 5"x5"x1½". Blan. (Korrol.)
1—.00025 mf. condenser. Aerovox.
1—20 mmf. condenser. Aerovox.
1—250,000 ohm resistor. Aerovox.
1—25,000 ohm resistor. Aerovox.
1—dual 4 mf. 300 volt electrolytic condenser. Aerovox.
1—Beat oscillator coil (frequency depending on that of the set.) National; Hammarlund; Gen-Win.
2—5 prong wafer sockets. NaAld.
1—line cord AC*DC 325 ohms.
2—type 37 RCA Radiotrons.

SOLDERING IRON SUPPORT



The soldering iron is a tool that always seems to be in the way, when working on radio sets. This kink offers a novel way of solving the problem. The illustration clearly shows the arrangement, but it may be well to add, that in case the soldering iron is made of iron, the small iron bar shown, of course, will not be necessary; as some irons are made of brass, etc., the magnet will not carry the iron, which calls for the use of the iron bar.

The writer obtained the steel magnet from an old cone speaker, but any good magnet will fulfill the purpose. The magnet may be mounted in any desired position. In this case it was placed on the wall right over the work bench. This kink can be used on both electric as well as gas irons. The heat from the iron will not affect the magnet.—Henry Henriksen.

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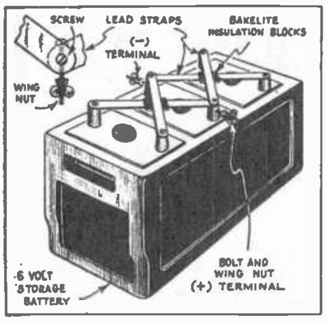
CHANGING 6 VT. BATTERY TO 2 VT.



The six volt storage batteries may be easily adapted to supply the two-volt tubes by first cutting out with a hack saw the connecting straps between cells as shown in sketch. Then make four new straps of heavy lead to reach diagonally across to the three plus and three minus terminals. Then drill down into the top of each battery terminal and tap for a small machine screw; also drill holes in the ends of each of the straps. Then secure the straps to the tops of the posts as illustrated, fastening them down with brass machine screws. Drill through the two center posts to take a wing-nut. Finally solder all post connections carefully. Bakelite strips may be placed between the connecting straps to prevent a short-circuit. When charging use the two and four volt sides of the charger.—John Terveen.

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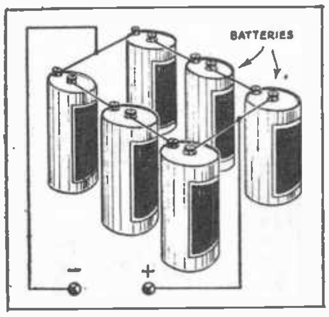
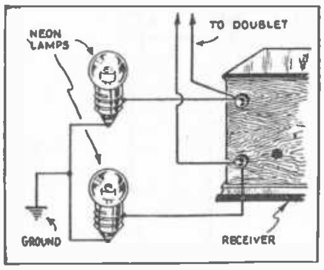
BATTERY KINK



If your "A" or "B" batteries must withstand a high amperage drain there is a more economical method than connecting the cells in series and buying a new set when they are worn out. The method is to buy two sets at the same time and connect them in multiple series. They will last at least thirty per cent longer than if the two series of cells had been used consecutively.—Patrick A. Schiavone.

SHORT WAVE KINKS

AUTOMATIC LIGHTNING VALVE

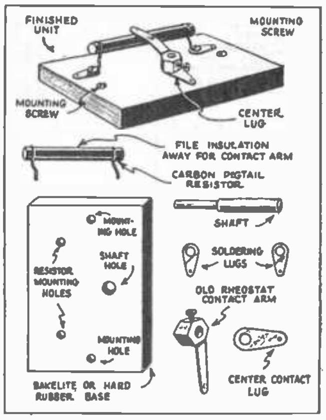


As no ground is used with the "doublet" antenna (one wire being used as a counterpoise), there must be a switch which will enable a person to "ground" the doublet antenna when not in use, especially in the summer time. The antenna should always be grounded when not in use. This device is entirely automatic, that is, it is connected across the receiver all the time and it functions whether or not the receiver is in use. It consists of two small Neon bulbs, which are mounted in a double porcelain socket. The screw section of each bulb is connected across either side of your antenna.

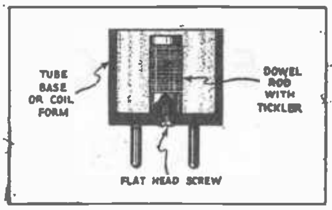
▼ ▼ ▼

HOME-MADE POTENTIOMETER

By purchasing a number of different makes and sizes of ordinary lead pencils, quite serviceable rheostats and potentiometers can be made with a rotating slider arm made of spring brass arranged to slide over the graphite strip within the pencil, one side of the pencil wood being ground away or one-half of the pencil wood removed by soaking.



This device can be used to a great advantage and is surprisingly efficient when built correctly. Now as to the cost of construction: it runs about ten cents. To construct this "pot" first take a piece of bakelite or hard rubber about 2" x 2½" and drill the holes to fit the shaft used and the resistor, which is of the carbon pigtail type. Next procure an old rheostat with a removable contact arm and shaft and mount on the bakelite base as shown in the drawing. Take the resistor, whether it is 1,000 or 50,000—no matter what size —and file the insulation off lengthwise, bend loops in the end and fasten down with small bolts and attach the soldering lugs. Now, if this resistor is used just to try out some new circuit which you think will be a "wow." I would advise you to buy a good volume control, as this outfit takes a very fine adjustment and covers the whole scale in about 45 degrees.—John Zoellner, Jr.

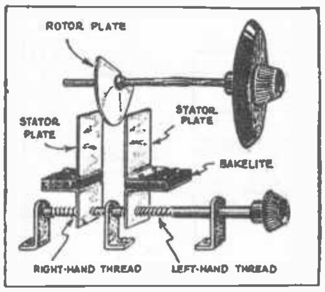


SPACE-SAVING TICKLER

The tickler coil frequently takes up more space than one has available, especially when winding plug-in coils for the higher bands on tube bases. To overcome this difficulty the idea shown in the accompanying drawing may be employed and will be found a very useful wrinkle indeed. The tickler coil is wound on a small piece of wooden dowel rod and is held inside the coil form by a screw.

BAND-SPREAD KINK

With three plates of a condenser and a skate "toe clamp adjustment" a very good arrangement may be made to form a band-spread condenser. Use large plates; bolt the two stator plates on pieces of bakelite which in turn are fixed on a piece such as



a toe clamp of a roller skate. Use the screw part to vary the distance between plates by extending a shaft on to it and a knob. If a skate "gadget" is not available a suitable arrangement may be made by threading a rod with left and right hand dies, and suitably tapping angle-pieces to screw on the threads.—Stuart Smith.

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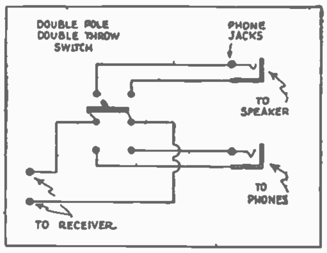
PHONE-SPEAKER JACK SYSTEM



The diagram shows two phone jacks, one for "headphone" connection and the other for "loud speaker" connection. When the reception is not loud and clear for the speaker, throw the double-pole, double-throw switch to the phone position and vice-versa.—Eugene Knauss.

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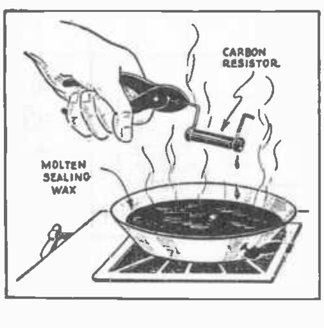
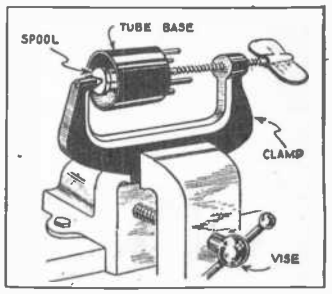
COATING RESISTORS

To cover unprotected carbon resistors obtain two or three old "B" batteries and remove the sealing wax that covers the top surface of the batteries. Now, place the wax in a pan or tin can and heat over a stove to melt the substance. When the wax is thoroughly melted, dip the carbon resistors in the wax.—M. Oyama.



WINDING TUBE-BASE COILS



Tube-base coil forms are easily mounted for winding by means of a spool and C-clamp held in a vise as illustrated.—Alvin Falley.

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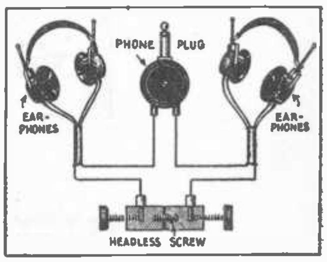
CONNECTING TWO PAIRS OF PHONES



When some stray ham blows into the shack to hear your outfit perk, you hunt around, vainly seeking an elastic band to bind the phone tips together for an extra pair of phones. By joining two binding posts with a headless screw many temperamental hams have been converted into "refined gentlemen," and we are sure that this amazingly simple device will make new men of you too!—Edward S. Hill.

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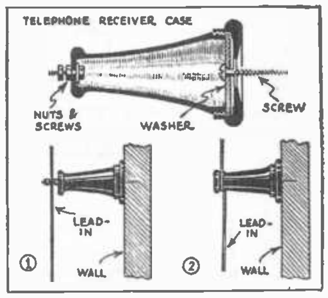
STAND-OFF INSULATOR



Needing a "stand-off" insulator and not having one handy, I made one from an old telephone receiver case. The cap is screwed to the wall and the other part twisted on. The wire may be looped around the end or fastened to a nut and bolt in the hole in the end as illustrated.—Herbert Plummer.

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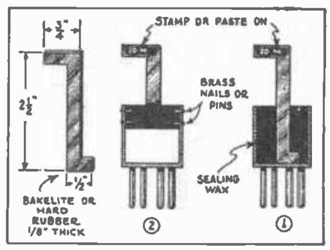
HANDLE FOR PLUG-IN COILS

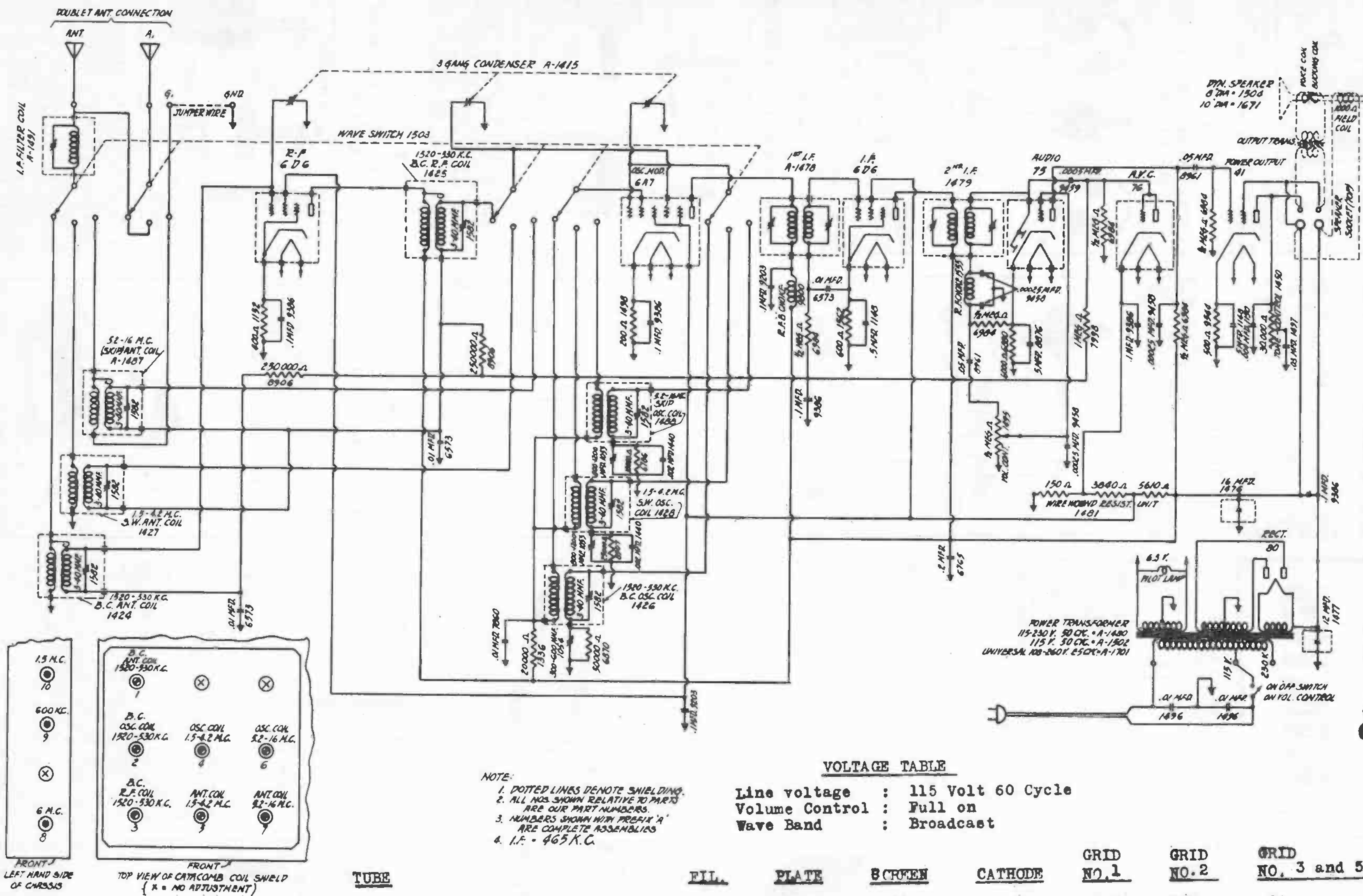


This handle protects the windings, and the coils can be plugged in with more ease. Cut a piece of bakelite as shown for each handle, pour sealing wax in the tube base, insert small end of bakelite in the base and hold in place until the wax hardens. The handle may also be pinned in place, instead of using wax to hold it in place. It is considered the best practice to keep the inside of the coil forms empty or hollow; otherwise certain dielectric losses occur.—W. Hargett.

SERVICE SECTION

ALLIED RADIO CORP.

MODEL G 9643-45



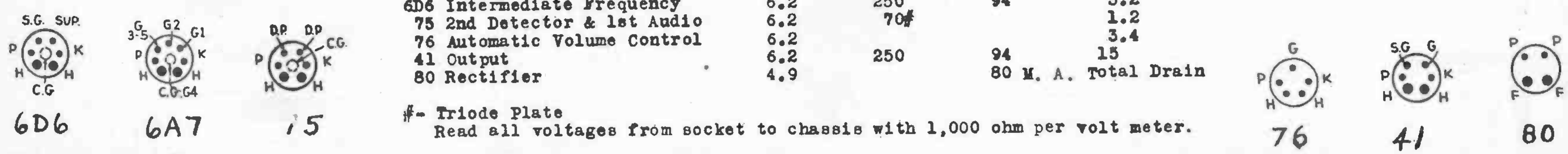
NOTE:
1. DOTTED LINES DENOTE SHIELDING.
2. ALL NOS. SHOWN RELATIVE TO PARTS ARE OUR PART NUMBERS.
3. NUMBERS SHOWN WITH PREFIX 'A' ARE COMPLETE ASSEMBLIES.
4. I.F. - 465 K.C.

VOLTAGE TABLE

Line voltage : 115 Volt 60 Cycle
Volume Control : Full on
Wave Band : Broadcast

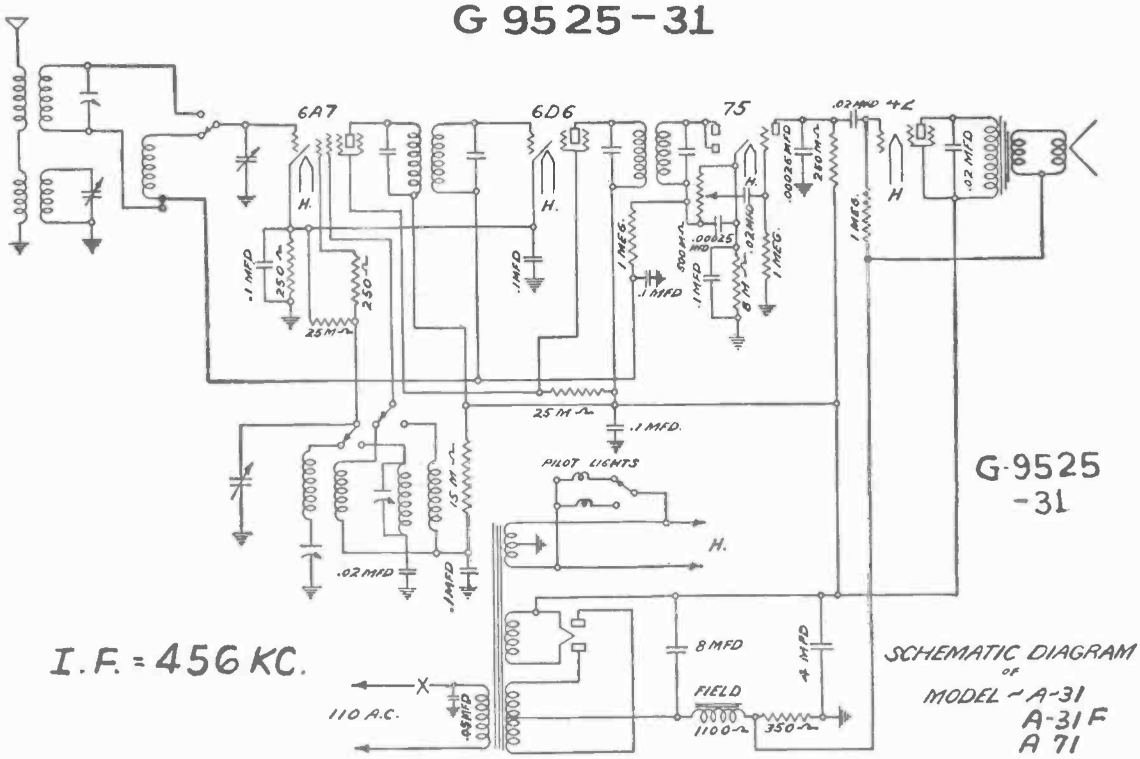
TUBE	FIL.	PLATE	SCREEN	CATHODE	GRID NO. 1	GRID NO. 2	GRID NO. 3 and 5
6A7 Oscillator & 1st Detector	6.2	250	94	2.5	4.5	175	94
6D6 Radio Frequency	6.2	250	94	3.4			
6D6 Intermediate Frequency	6.2	250	94	3.2			
75 2nd Detector & 1st Audio	6.2	70#		1.2			
76 Automatic Volume Control	6.2			3.4			
41 Output	6.2	250	94	15			
80 Rectifier	4.9		80 M. A. Total Drain				

#- Triode Plate
Read all voltages from socket to chassis with 1,000 ohm per volt meter.

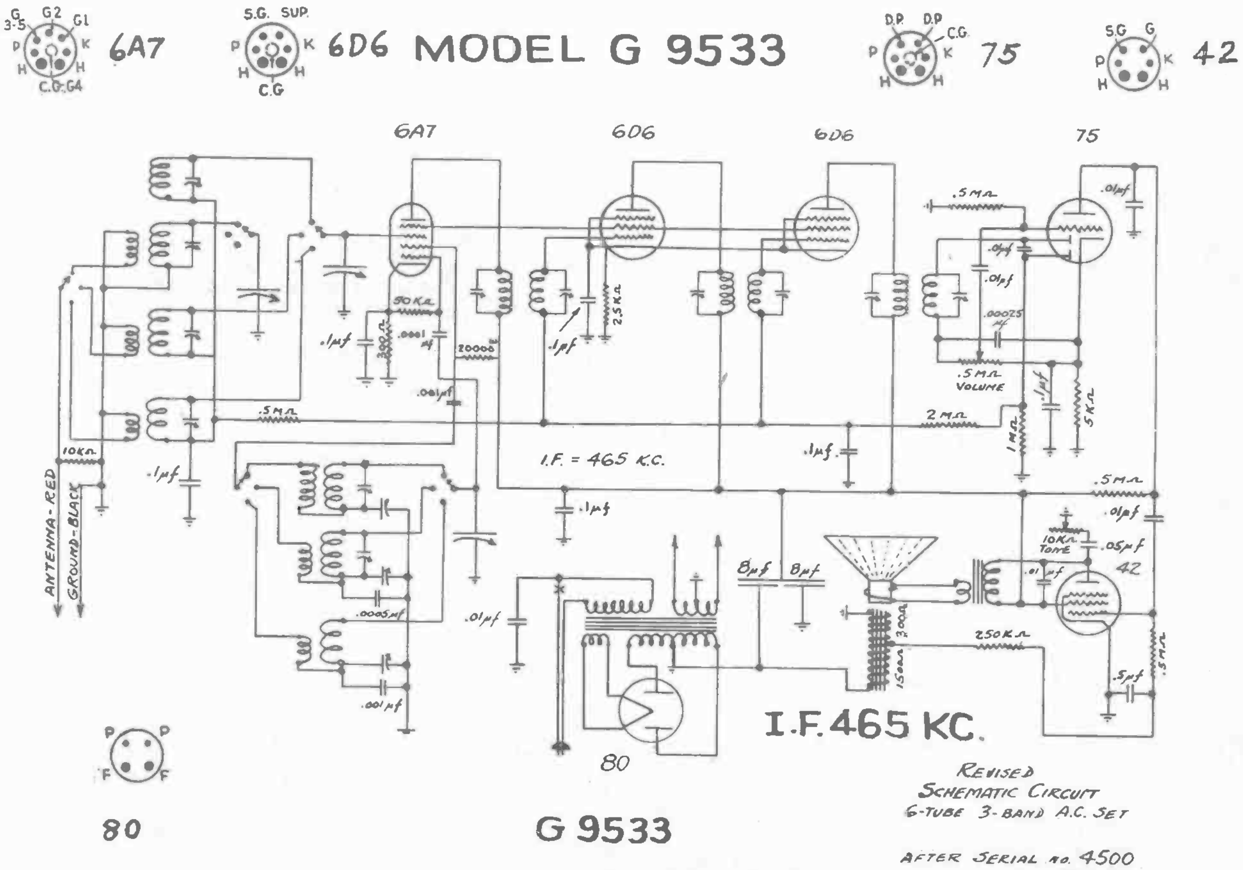


ALLIED RADIO CORP.

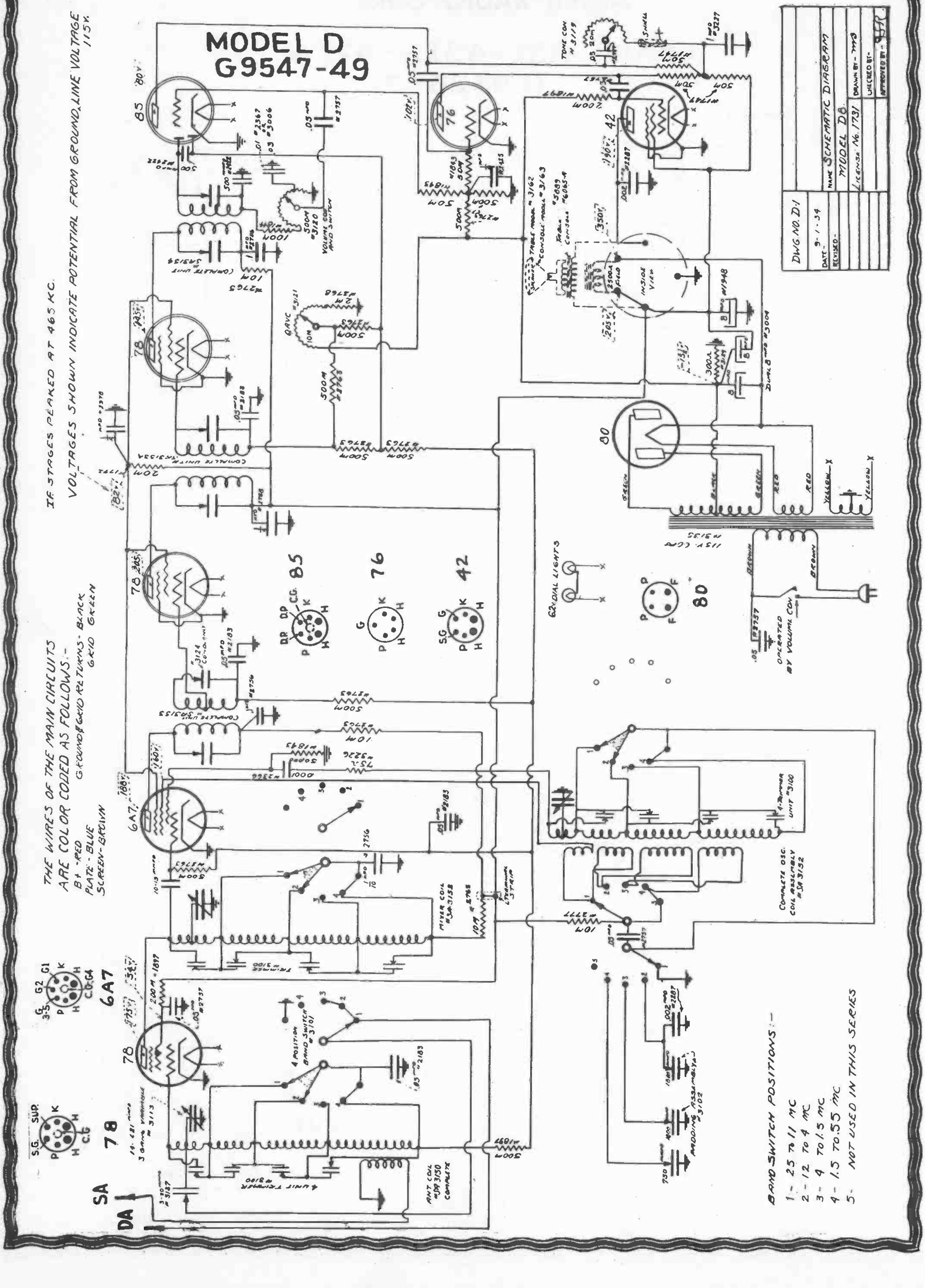
MODEL A31-A31F-A71 & G 9525-31



MODEL G 9533



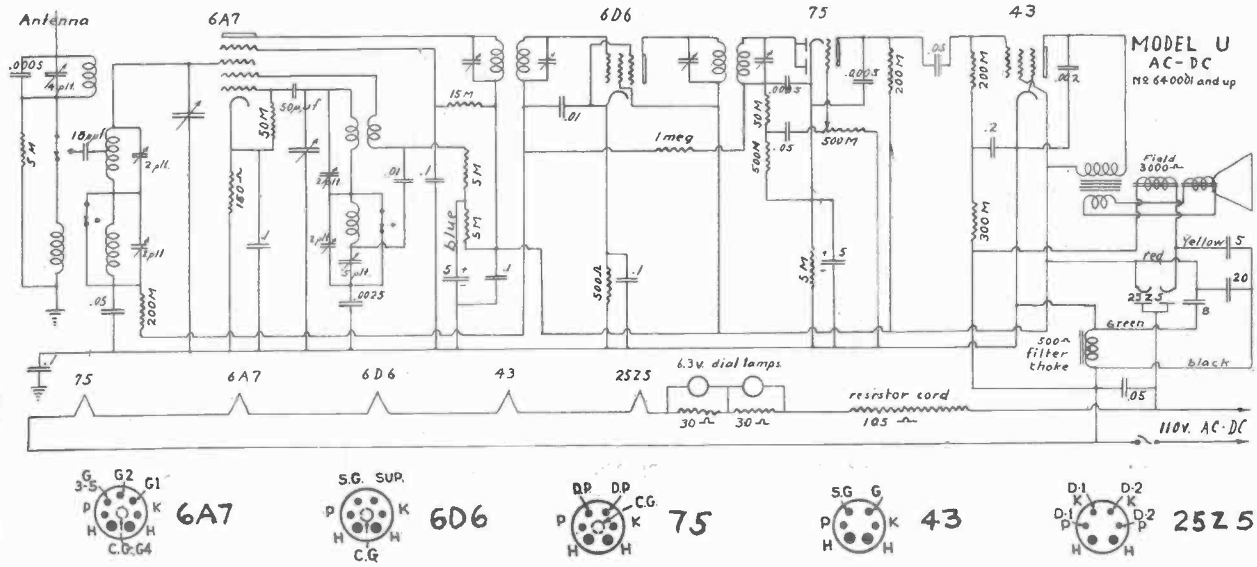
ALLIED RADIO CORP.



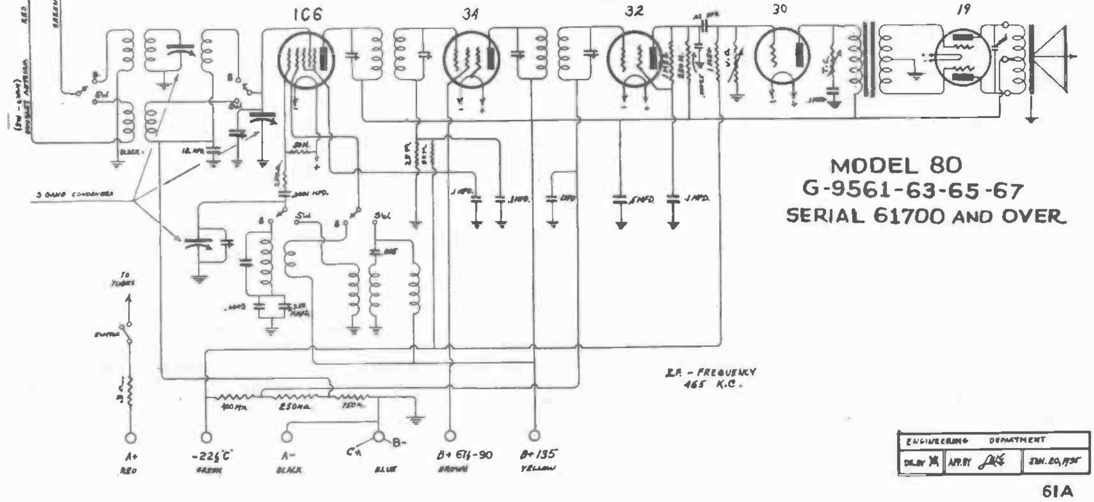
ALLIED RADIO CORP.

G9553

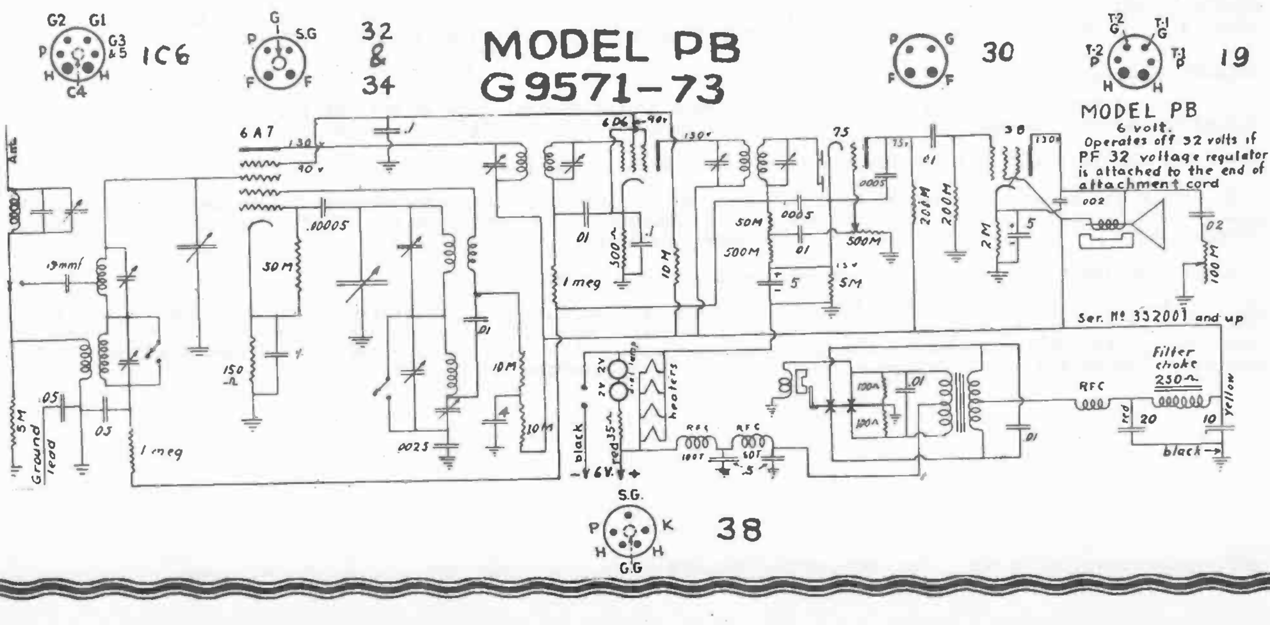
MODEL G 9553



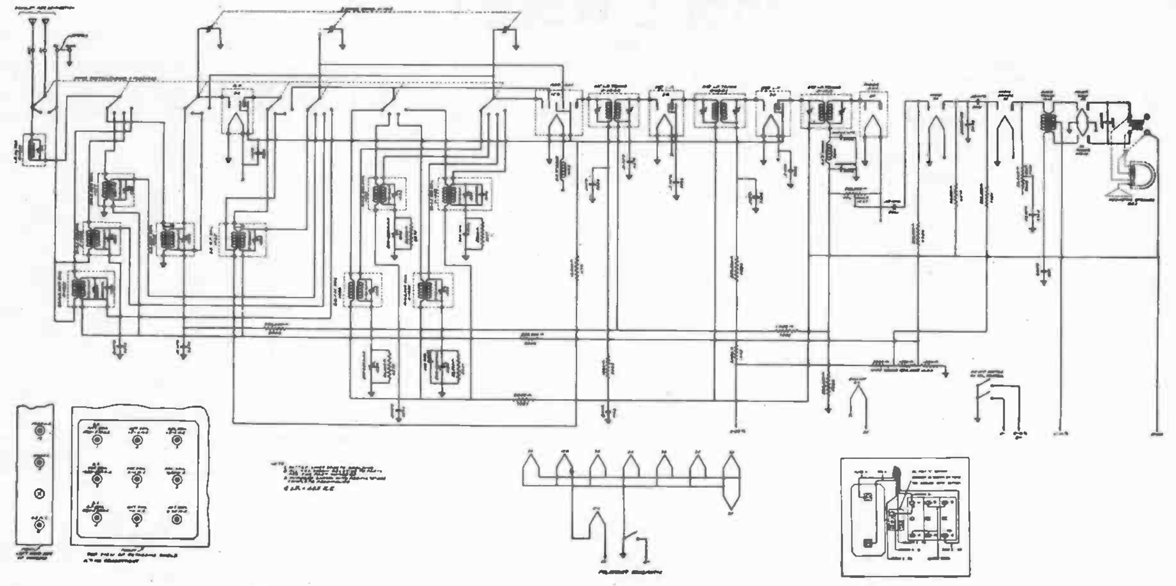
2 VOLT BATTERY SET SPLIT BAND
5 TUBE SUPERHETERODYNE



MODEL PB G9571-73



MODEL G9627-31-33-35-37-39



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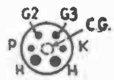


1C6

30

TUBE	FILAMENT	PLATE	SCREEN	GRID NO. 2	GRID NO. 3 & 5	CONTROL GRID
1C6 Oscillator & 1st Detector	1.9	135		135	75	3.5
34 Radio Frequency	1.9	135	75			
34 1st Intermediate Frequency	1.9	135	75			
34 2nd Intermediate Frequency	1.9	135	75			
30 2nd Detector & AVC	1.9					
30 1st Audio	1.9	60#				
30 Audio Driver	1.9	125				
30 Output	1.9	125				
30 Output	1.9	125				

(Total "A" Drain 600 M.A.)
(Total "B" Drain 23 M. A. with no signal)

Comparative voltage only. Read all voltages from socket to chassis with 1,000 ohm per volt meter. When making voltage checks use batteries that deliver full voltage with the receiver turned on.

Realignment of this receiver should never be necessary unless one of the oscillator, antenna or RF coils has been replaced and then only the frequency band in which that coil is used will require realignment. Lack of sensitivity, selectivity, and poor tone quality may be due to any one or a combination of causes such as weak or defective tubes or speaker, inadequate or excessively long antenna, open or grounded bias resistor, bypass condenser, etc. Under no circumstances should realignment be attempted until all other possible sources of trouble have been first thoroughly investigated and have been definitely proven not to be the cause. If an IF tube is replaced it is advisable to realign the IF amplifier particularly if the replacement tube is one of a different manufacture than the one in the receiver.

NOTE: NEVER LIFT THE RECEIVER BY GRASPING THE CATACOMB SHIELD, TO DO SO MAY MOVE THE SHIELD THEREBY DETUNING THE RECEIVER.

ALIGNMENT PROCEDURE: It is important when aligning to carefully follow the procedure in the order given, otherwise the receiver will lack sensitivity and the dial calibration will be incorrect. IT IS IMPERATIVE THAT AN ACCURATELY CALIBRATED OSCILLATOR BE USED WITH SOME TYPE OF OUTPUT MEASURING DEVICE.

INTERMEDIATE ALIGNMENT:

1. Connect the high side of the oscillator output to the control grid of the 1C6 tube, leaving the grid cap disconnected. Connect the ground side of the oscillator to the receiver ground post.

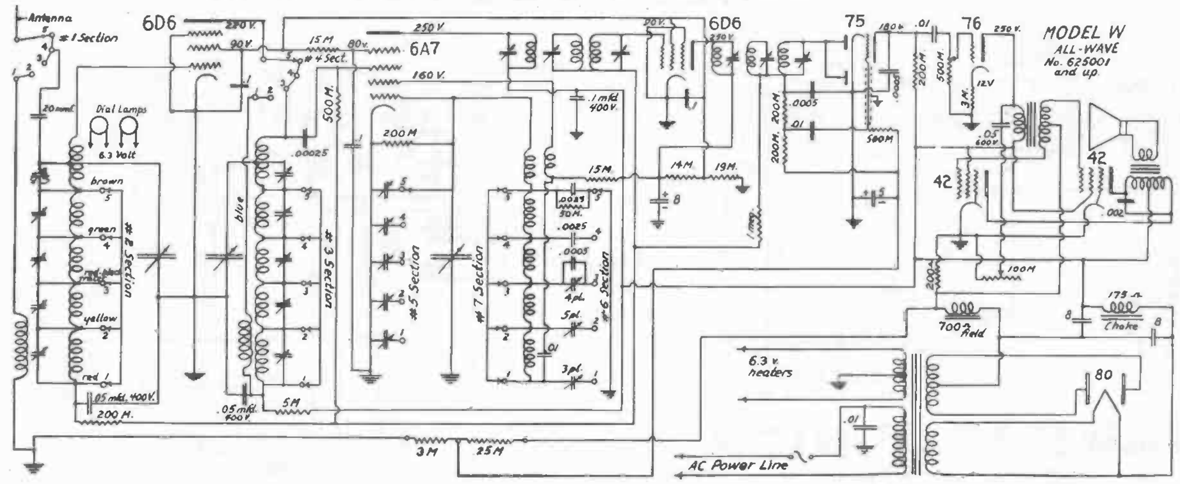
2. Set the test oscillator frequency to 465 kilocycles. (This must be accurate).

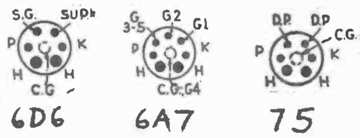
3. Align the first intermediate transformer by turning one of the trimmer screws up and down (increasing and decreasing capacity) until maximum reading is obtained on the output meter, after which adjust the other trimmer screw of the same transformer for maximum sensitivity.

4. Adjust the other intermediate transformers in the same manner.

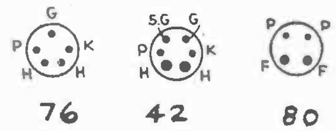
NOTE: Two type intermediate transformer trimmers have been used in this receiver. One type has two parallel holes in the top of the shield, one for each trimmer. The other type has a brass hex nut for adjusting one trimmer, the other intermediate trimmer being adjusted with the trimmer screw located inside of the brass hex nut. Regardless of which type trimmer is used, the procedure is the same.

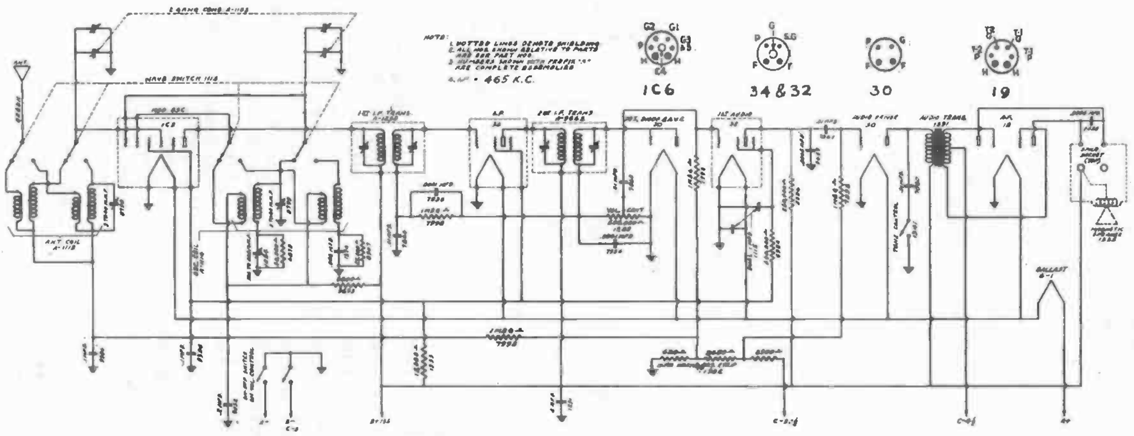
ALLIED RADIO CORP.
MODEL LW-G9575 TO G9605





MODEL 7700A
G9617-19-21-23-25-27





WIRING DIAGRAM
MODEL 7700A RECEIVER

VOLTAGE TABLE
"A" Battery - 3 Volt Dry Cell
"B" Battery - 3 45 Volt "B" Batteries
"C" Battery - 1 22½ Volt Battery

TUBE		FIL.	PLATE	SCREEN	GRID NO.2	GRID NO 3 & 5
1C6	Oscillator & 1st Detector	2.1	135		115	67½
30	Second Detector	2.1				
34	I. F.	2.1	135	67½		
32	1st Audio	2.1	37.5##	20##		
30	Driver	2.1	135			
19	Output	2.1	135 each plate			

Comparative voltage only
Read all voltages from socket to chassis

Total "B" Drain - .023 Amperes
Total "A" Drain - .620 Amperes

When making tube voltage checks use batteries that deliver full voltage with the receiver turned on.

INTERMEDIATE ALIGNMENT:

1. Connect the high side of the oscillator output to the control grid of the 1C6 tube leaving the grid cap disconnected. Connect the ground side of the oscillator to the receiver chassis.

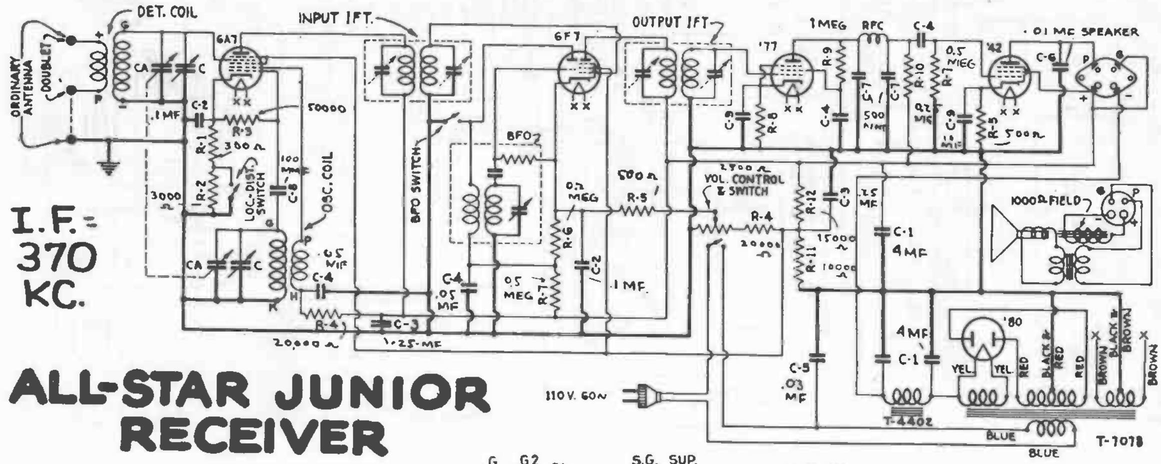
2. Set the test oscillator frequency to 465 kilocycles (this must be accurate).

3. Align the first intermediate transformer by turning one of the trimmer screws up and down until maximum reading is obtained on the output meter, and then adjust the other trimmer screw of the same transformer for maximum sensitivity.

4. Adjust the second intermediate transformer in the same manner.

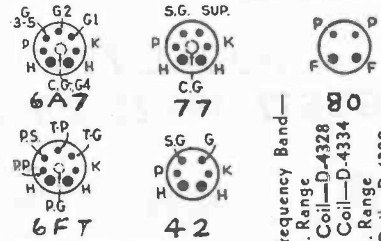
NOTE: Two type intermediate transformer trimmers have been used in this receiver. One type has two parallel holes in the top of the shield, one for each trimmer. The other type has a brass hex nut for adjusting one trimmer, the other intermediate trimmer being adjusted with the trimmer screw located inside of the brass hex nut. Regardless of which type trimmer is used the procedure is the same.

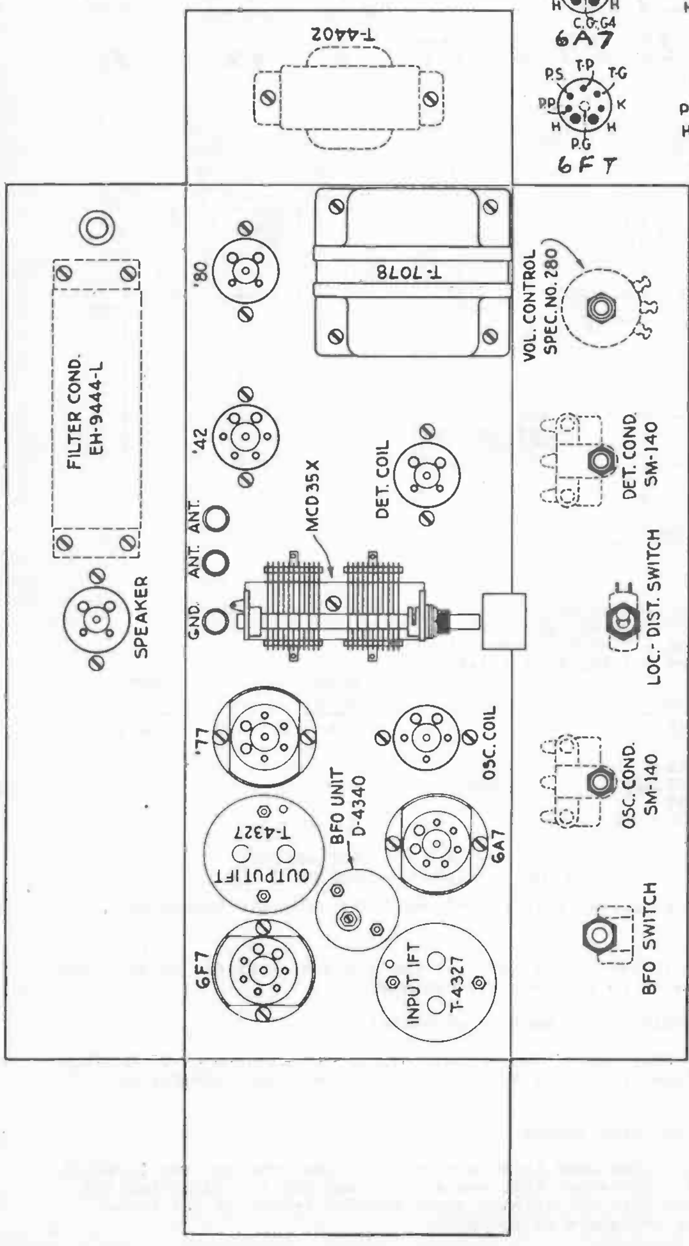
ALL-STAR



I. F. = 370 KC.

ALL-STAR JUNIOR RECEIVER



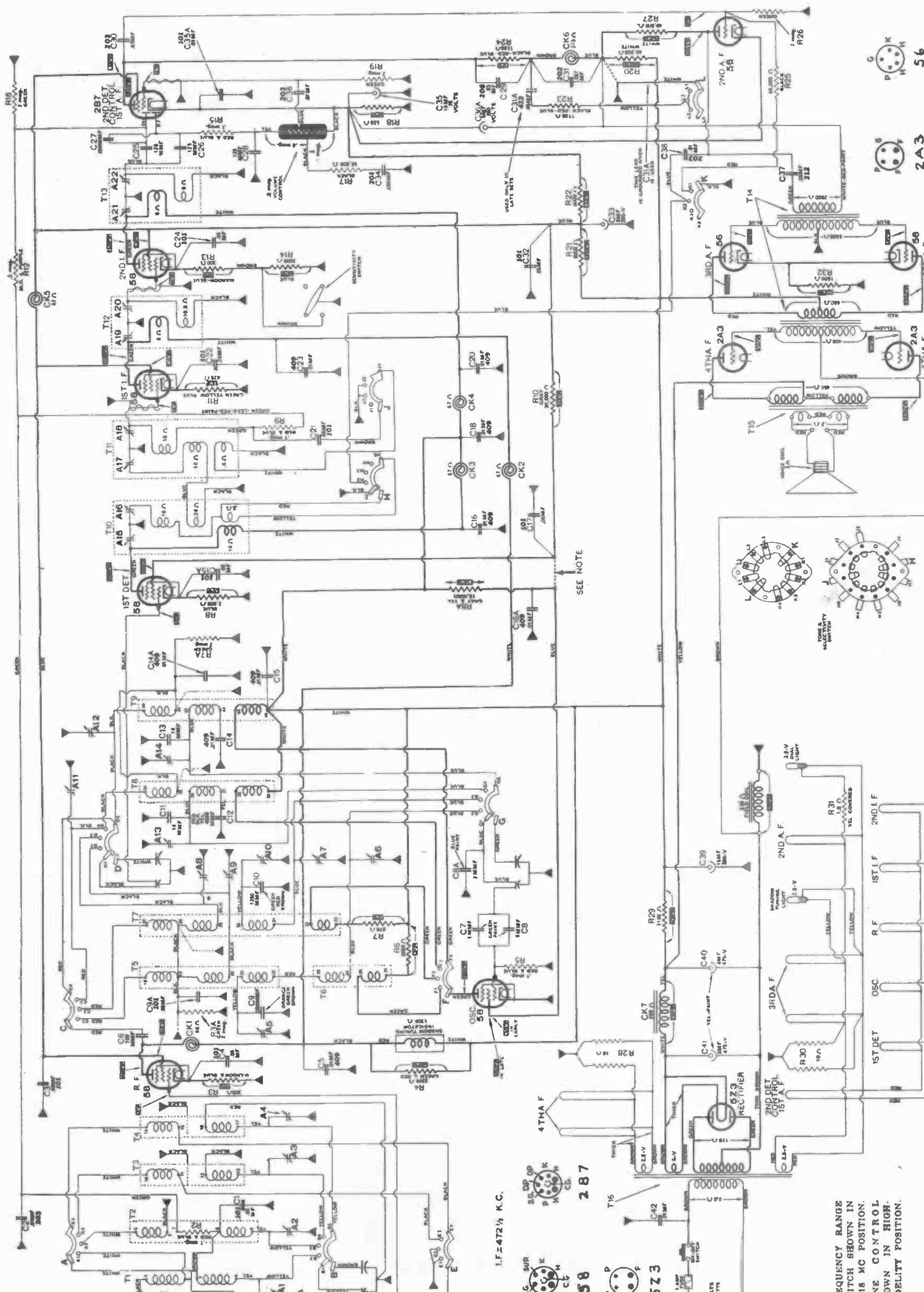


Coils for each Frequency Band—
- 540—1200 Kc. Range
  - Antenna Coil—D-4328
  - Oscillator Coil—D-4334
- 1100—2300 Kc. Range
  - Antenna Coil—D-4329
  - Oscillator Coil—D-4335
- 2200—4400 Kc. Range
  - Antenna Coil—D-4330
  - Oscillator Coil—D-4336
- 3800—8900 Kc. Range
  - Antenna Coil—D-4331
  - Oscillator Coil—D-4337
- 7750—16000 Kc. Range
  - Antenna Coil—D-4332
  - Oscillator Coil—D-4338
- 15.5—30 Mc. Range
  - Antenna Coil—D-4333
  - Oscillator Coil—D-4339

Fine tuning may be accomplished by rotating the shaft of the twin tuning condenser. If you hear only a canary-like whistle during the tuning process, it indicates that the BFO switch is open and that it should be turned to eliminate the whistle. If no difficulty is experienced with local stations, open the BFO switch and adjust the trimmer screw on top of the BFO unit until a whistling note of pleasing intensity is heard. If the trimmers on the I. F. transformer have not been disturbed, no adjustment will be found necessary, as these units are pre-tuned at the factory to 370 kilocycles. If they have been thrown out of adjustment, you may be able to bring them back into alignment by adjusting each trimmer until you receive a distant station loudest. Accurate adjustments must be made with a serviceman's I. F. oscillator.

Before attempting to receive short-wave stations, mount the front panel and dial mechanism, running the twisted wires from the dual pilot lights to the H and H terminals of the 77 tube socket. Try each pair of short-wave coils in succession to make certain the receiver is operating on all ranges.

ATWATER KENT MFG. CO.
MODEL 112

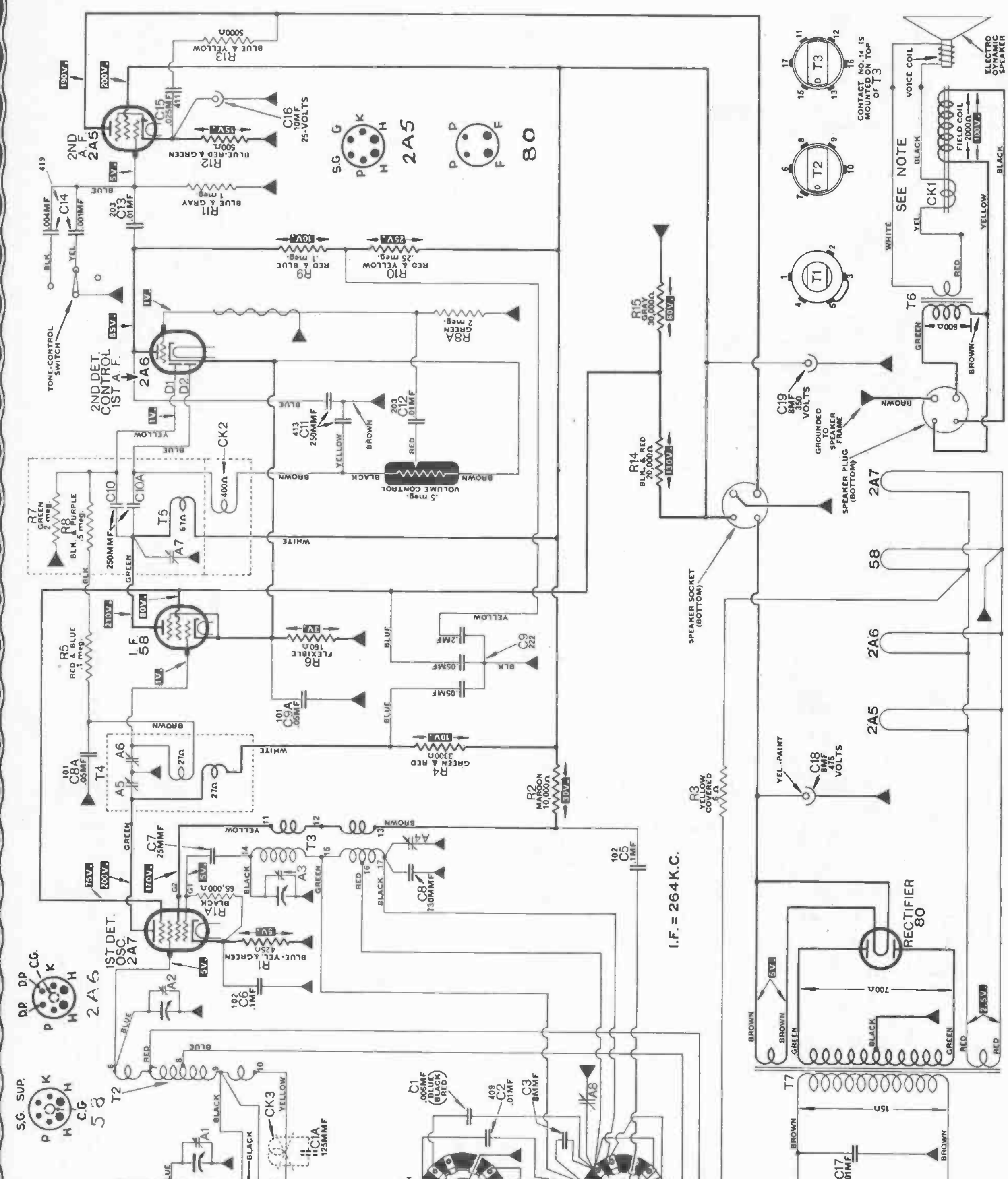


In early sets, contact 19 on T5 is grounded, and contact 41 on T9 is grounded. In later sets, these contacts are not grounded, but are connected to condensers C9A and C14A and resistors R3A and R7A as shown. At the same time the oscillator screen voltage was increased by adding resistor R8A and condenser C16A and connecting as shown. The connection of the oscillator screen in early sets is shown in dotted lines.

The voltages in this diagram were made with the 250-volt scale of a 1000 Ω per volt D. C. voltmeter.

ATWATER KENT MFG. CO.

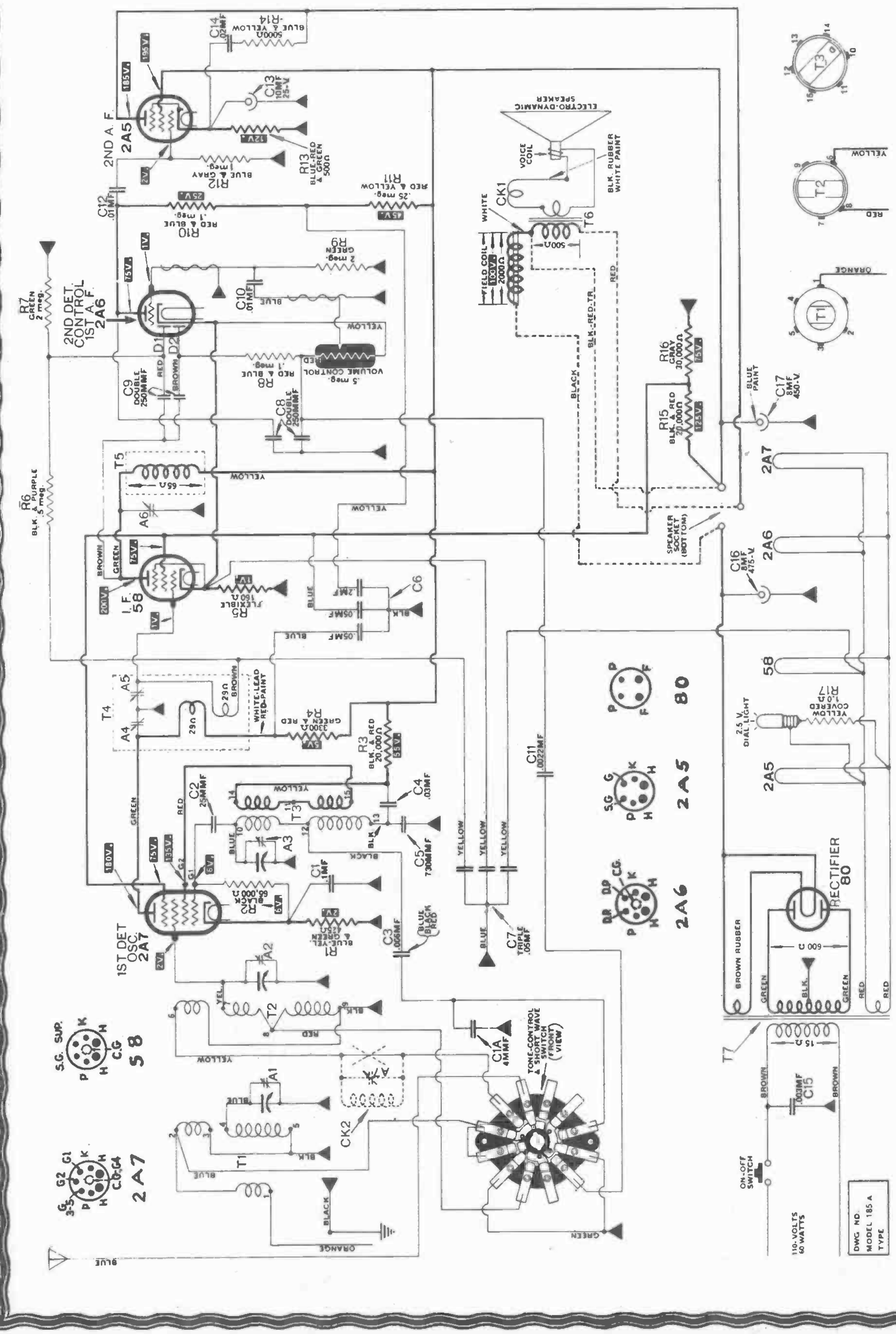
MODEL 145 AND 325



In Model 325 the field coil is 1200 Ω and the voltages throughout are slightly higher than shown in diagram. In later sets C4 is not used, the diode circuit is changed and there are some minor changes in the frequency-switch circuit.

ATWATER KENT MFG. CO.

MODEL 185-A

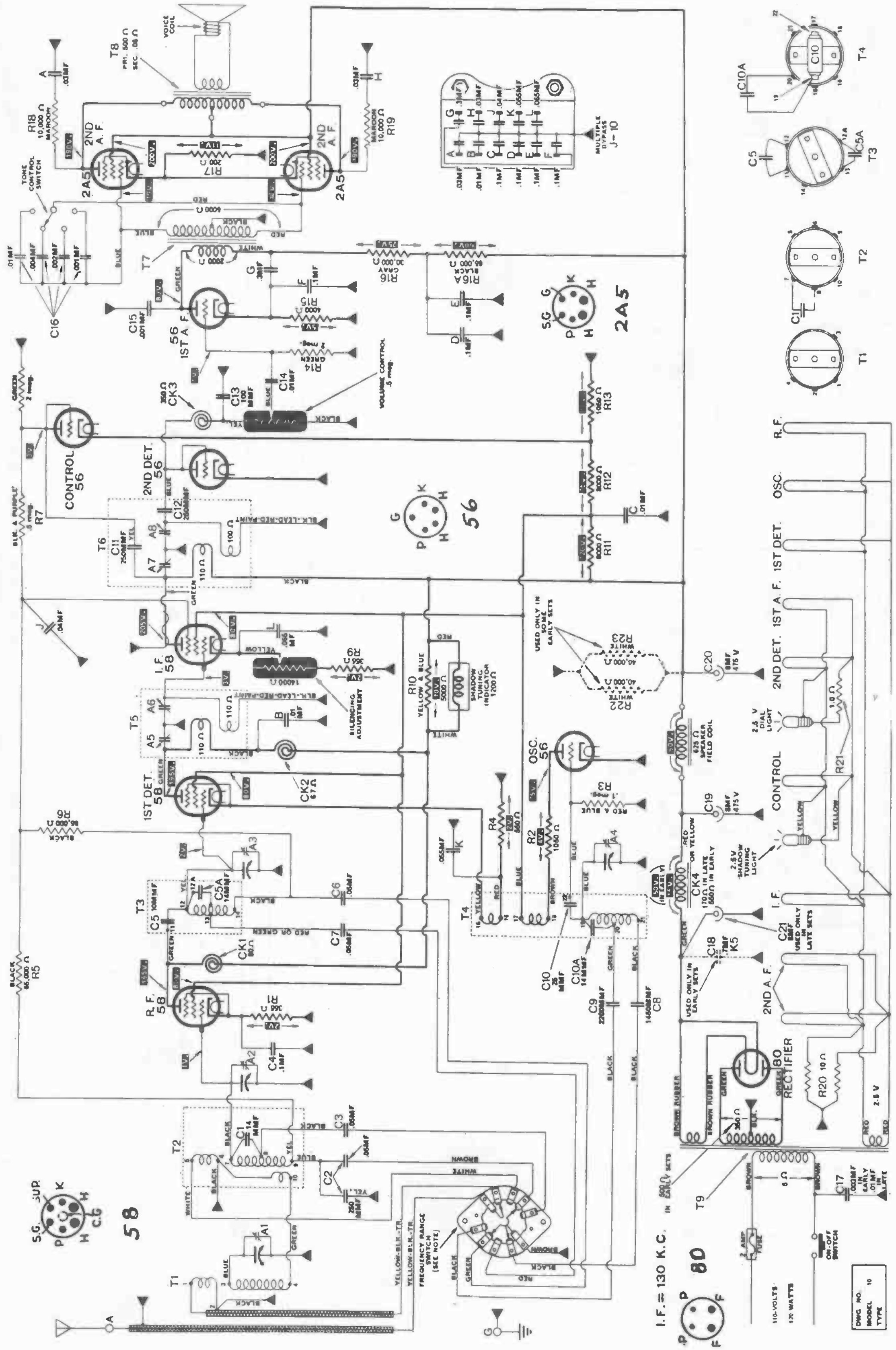


I. F.=264 KILOCYCLES

Above voltages were made with a line supply of 110 volts. The trap circuit CK2 and A7 shown in dotted lines is used only in some Model 185-A sets. This trap is tuned to the I. F. frequency.

ATWATER KENT MFG. CO.

MODEL 310 AND 510

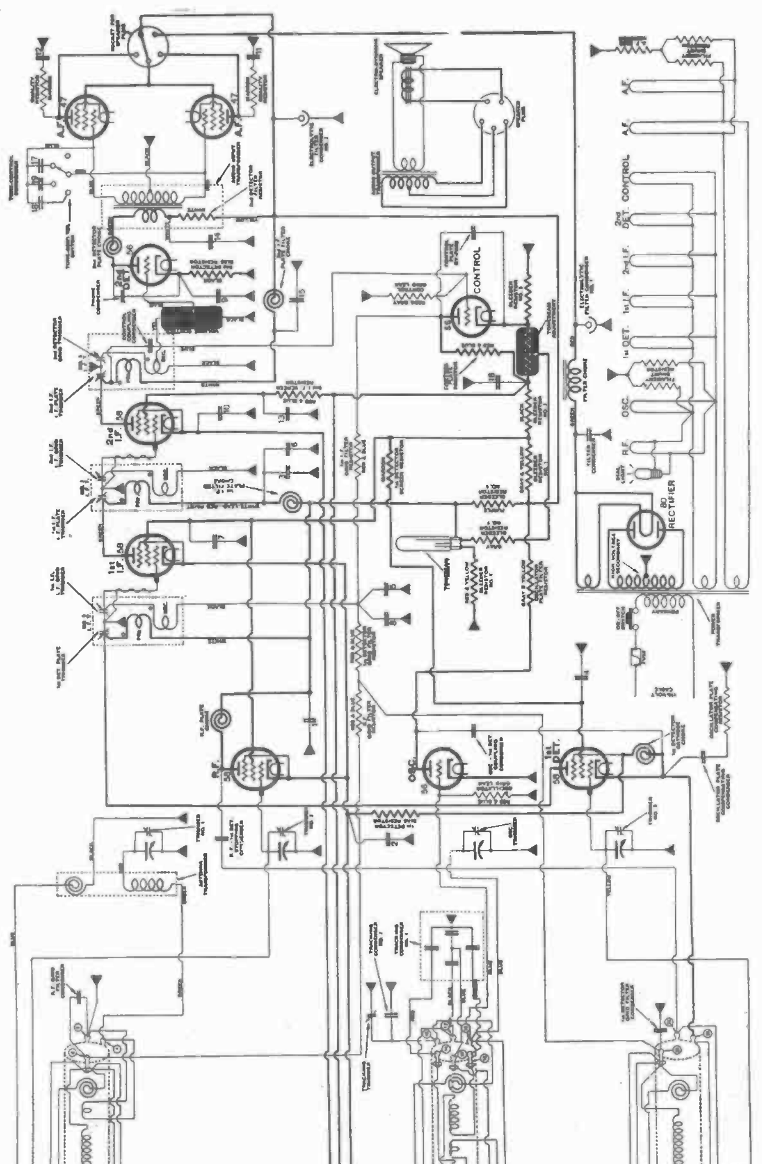


The 2 megohm (green) resistor on the plate of the control tube is R8. Voltage measurements were made with a line supply of 110 volts. The frequency-range switch is shown from the rear in the broadcast position.

ATWATER KENT MFG. CO.

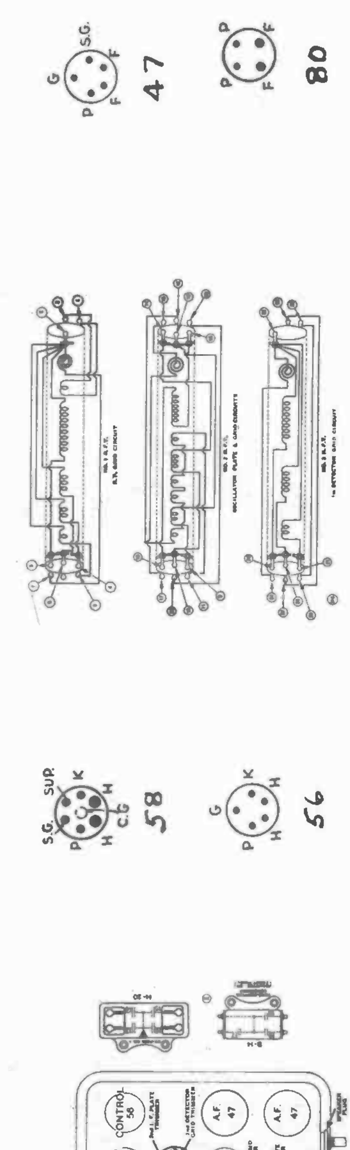
MODEL 480

(Intermediate Frequency, 472½ Kilocycles)



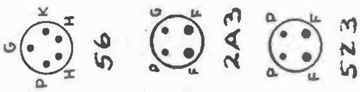
In some early-type Model 480 receivers the circuit arrangement and contacts of the frequency-band switch are different from that shown above. The early circuit arrangement is shown on page 411.

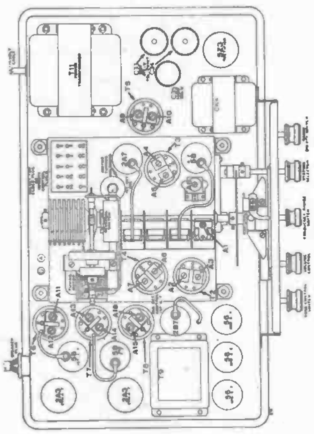
IMPORTANT: In late-type Model 480, the control-coupling condenser and the control grid leak are omitted; and there is no blue lead from No. 3 I. F. T. In these late sets, the grid of the control tube is connected to the yellow lead from No. 3 I. F. T.

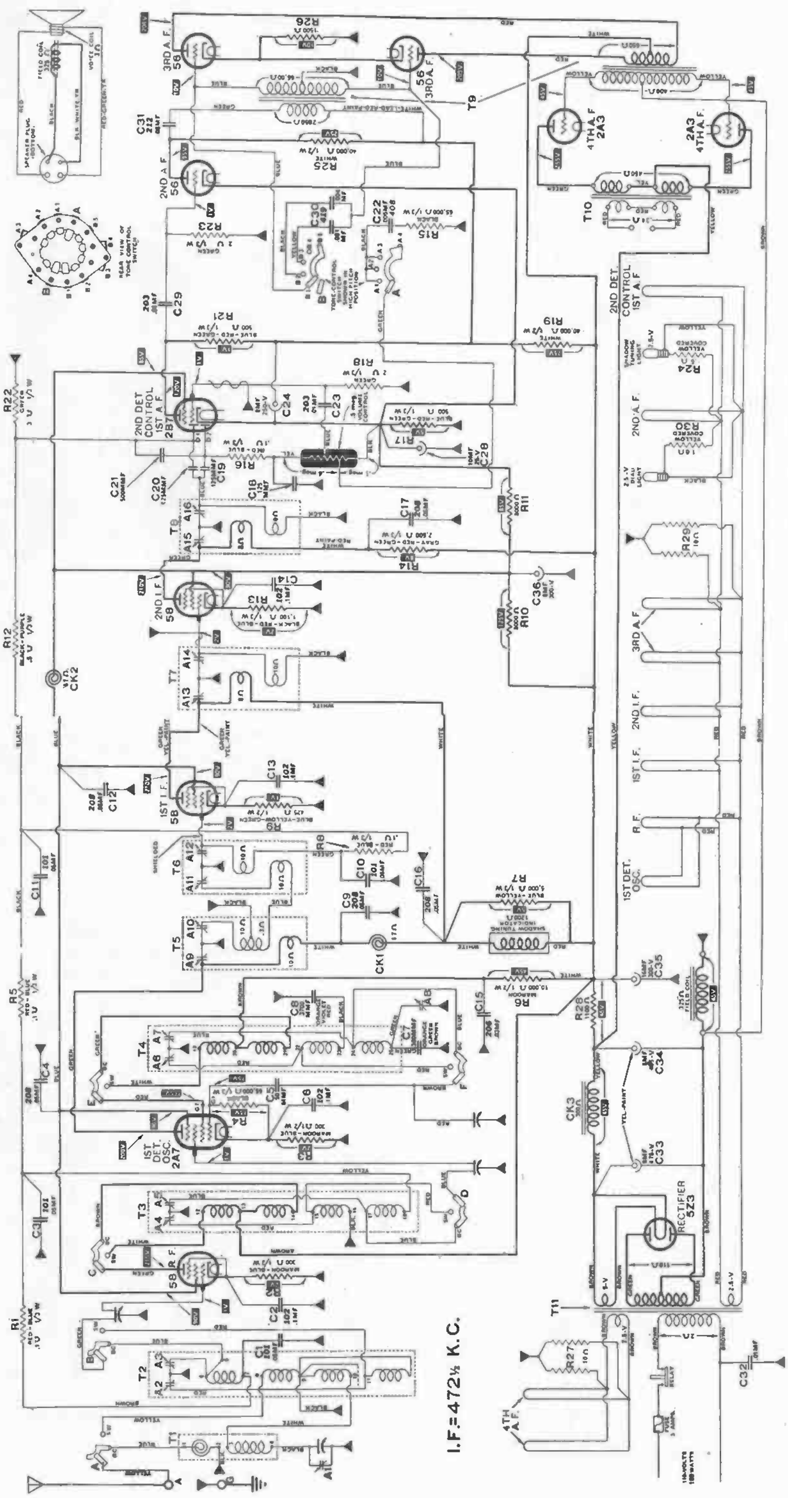


ATWATER KENT MFG. CO.

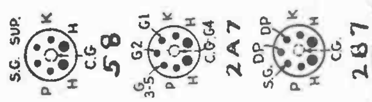
MODEL 511 TUN-O-MATIC

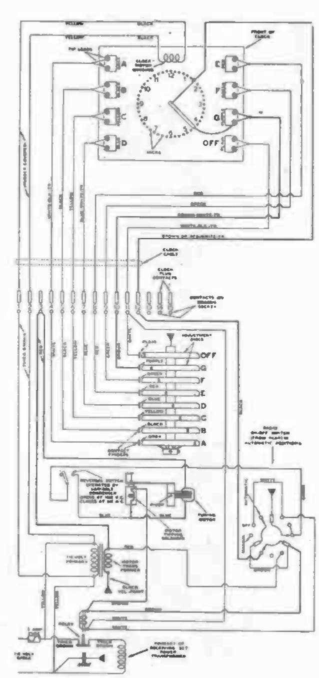






Only the late type audio circuit is shown above. In early sets, the plate circuit of the 2B7 is similar to that used in Model 112.

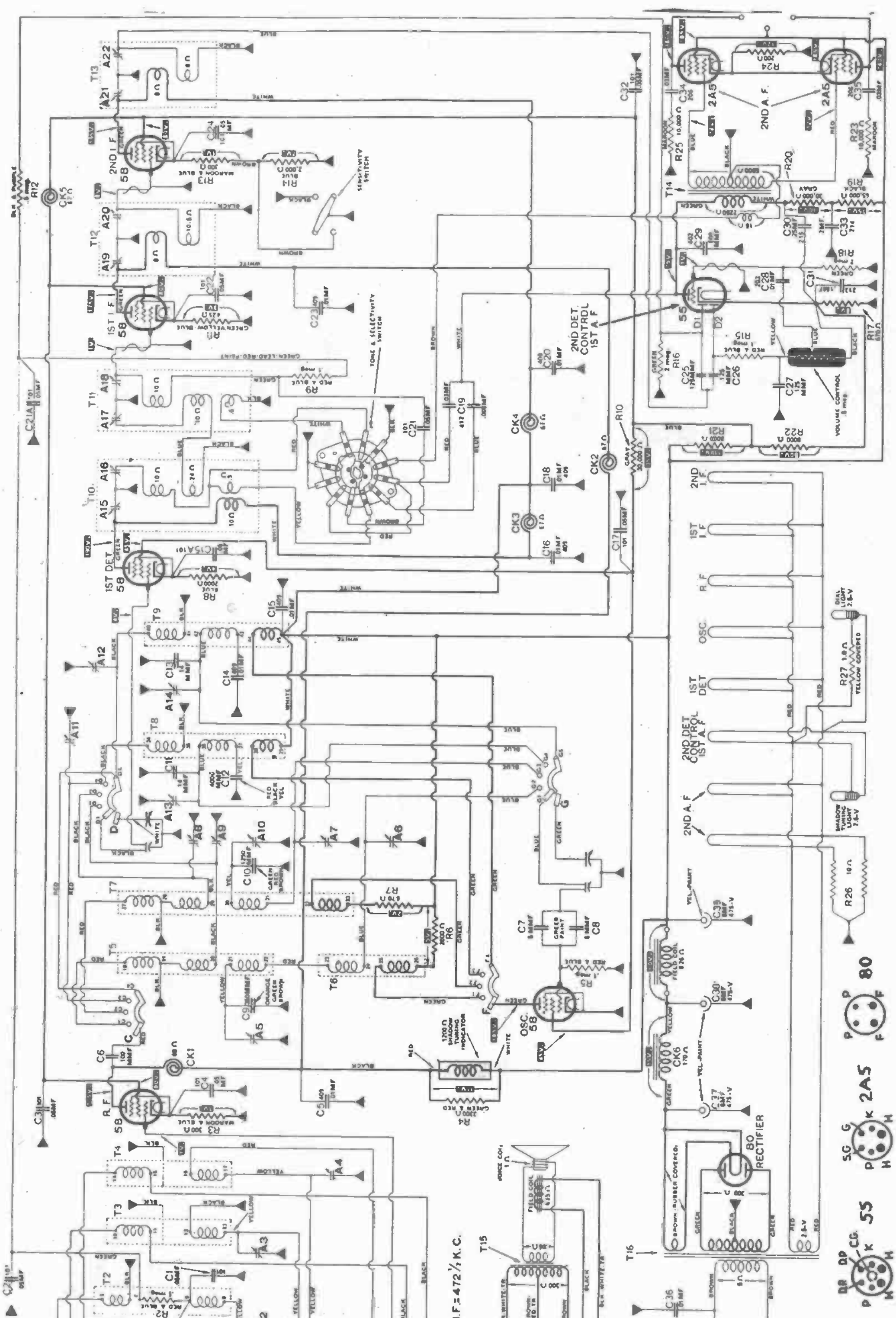




Model 511 has two frequency ranges: the broadcast range (BC) covers 540 to 1600 kilocycles, and the short-wave range (SW) covers 5900 to 15500 kilocycles.

ATWATER KENT MFG. CO.

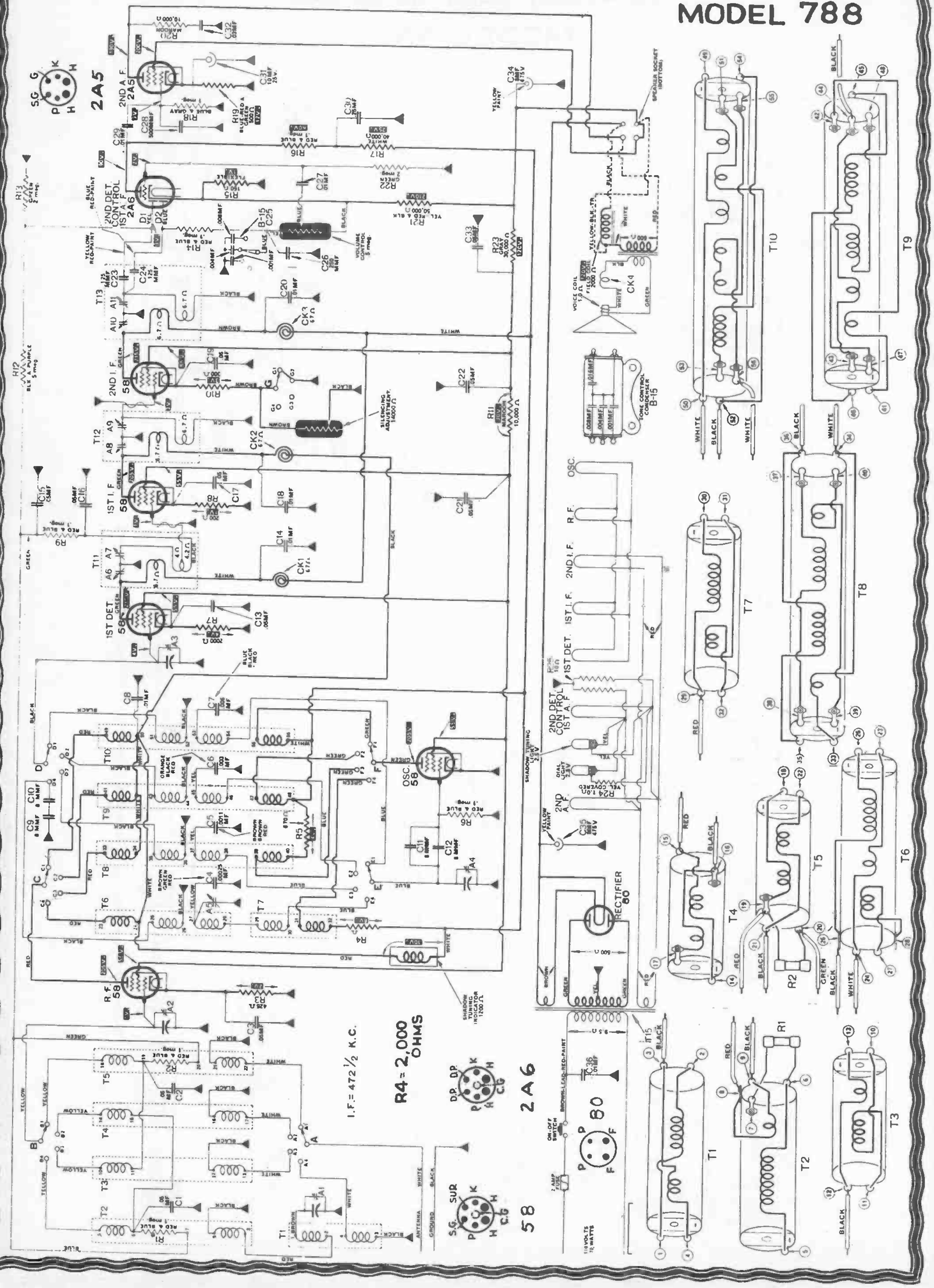
MODEL 559



Voltage measurements were made with sensitivity switch at "local." The R. F. and I. F. circuit of Model 112 is the same as Model 559.

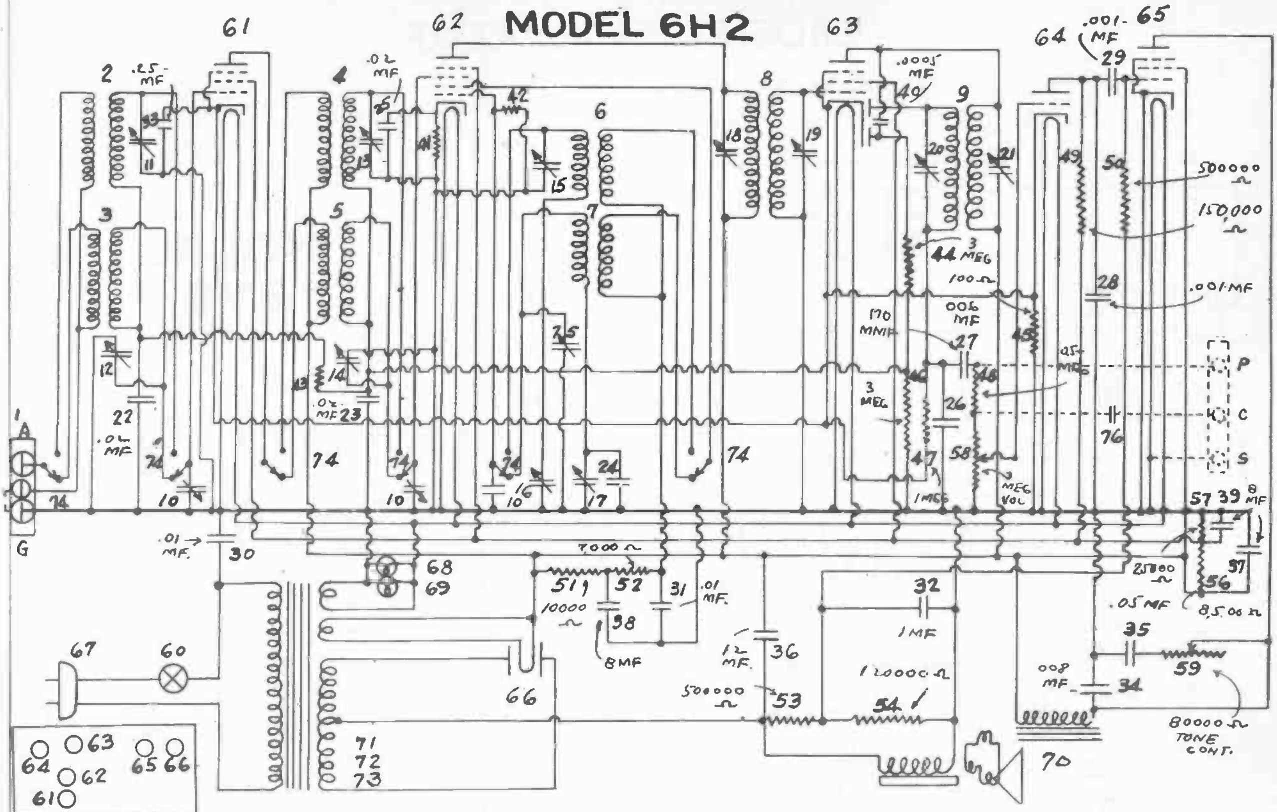
ATWATER KENT MFG. CO.

MODEL 788

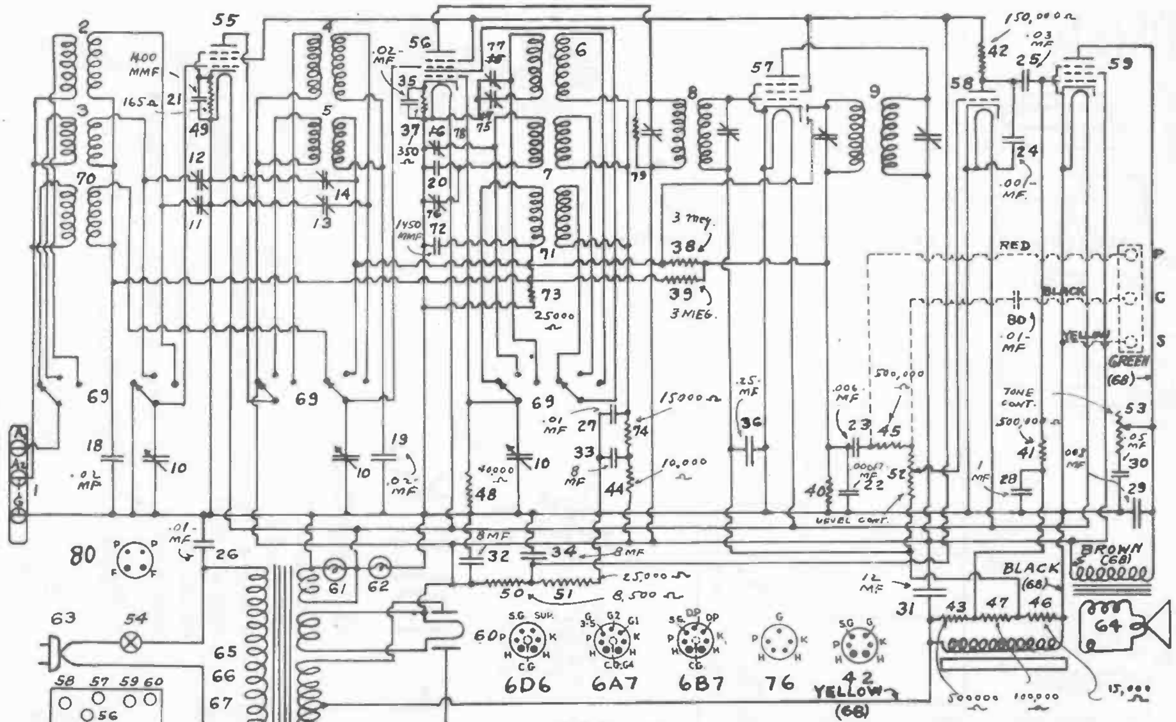


CROSLEY RADIO CORP.

MODEL 6H2



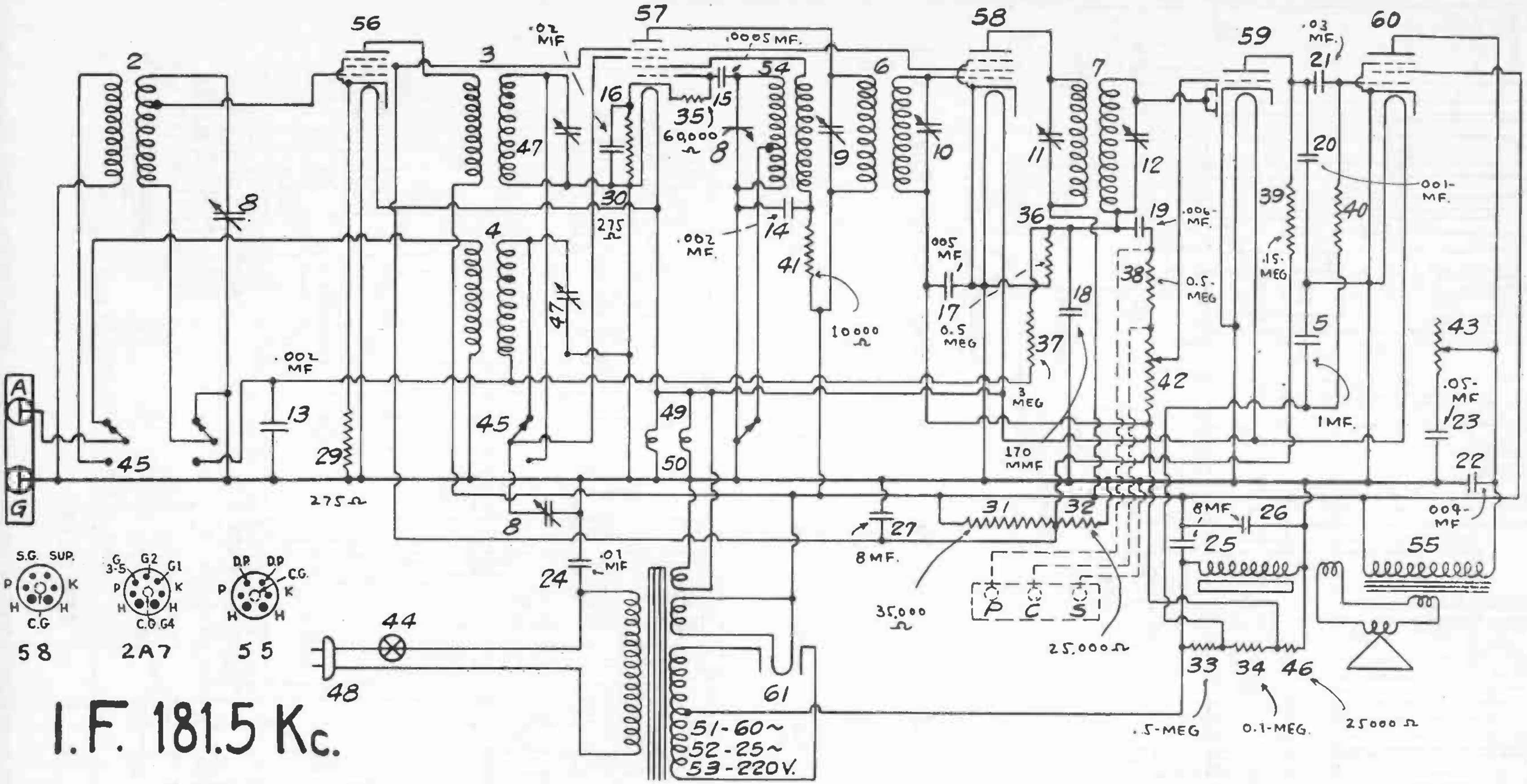
Type	Where Used	Ef	Ep	Eg	Ek	Esg	Esup	Epl	Egl
6D6	R.F.	6.5	250	0	–3.5	125	—	—	—
6A7	Osc.-Mod.	6.5	250	0	–3.5	125	—	190	–15.0
6B7	I.F.-Diode	6.5	250	0	–3.5	125	—	—	—
76	A.F.	6.5	35	0	–3.5	—	—	—	—
42	Output	6.5	230	–18	0	250	—	—	—
80	Rectifier	5.1							



456 Kc. I.F.

CROSLEY RADIO CORP.

MODEL 6V2



I.F. 181.5 Kc.

General Description . . .

Chassis 6V2 is used in the Dual Sixty and Dual Sixty Lowboy. It is a 6-tube 3-gang automatic volume control dual range receiver. The chassis has a continuously variable tone control. The frequency bands covered are 535 to 1700, and 1650 to 4500 Kc. The intermediate frequency is 181.5 Kc., the use of which insures adequate selectivity.

Tubes Used and Their Function . . .

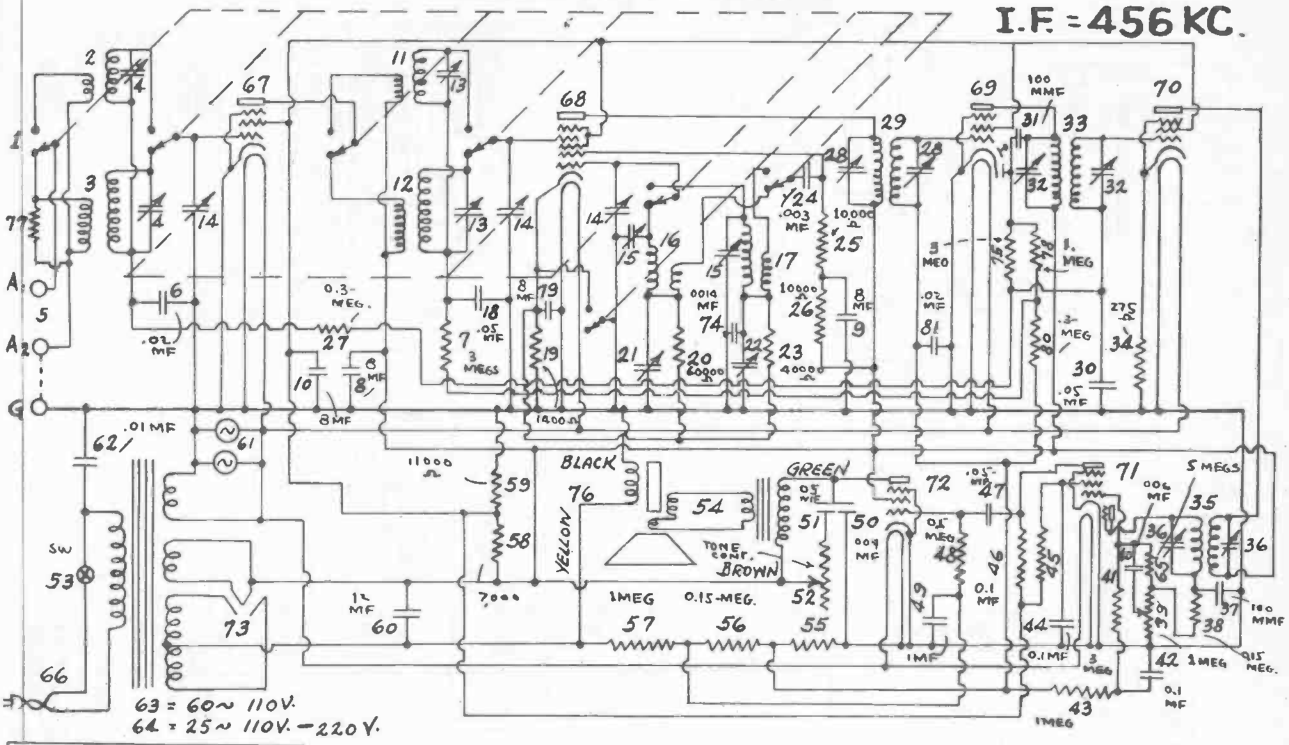
The tubes used are type 58 R. F. amplifier, type 2A7 oscillator modulator, type 58 I. F. amplifier, type 55 diode and A. F. amplifier, type 2A5 output, and type 80 rectifier. The tube voltages are shown in the table below:

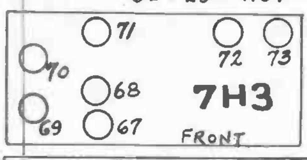
Type	Where Used	Ef	Ep	Eg	Ek	Esg	Ep-osc	Eg-osc
58	R. F.	2.5	225	0	3	120	—	—
2A7	Osc.-Mod.	2.5	225	0	3.5	120	175	-15
58	I. F.	2.5	225	-4	0	120	—	—
55	Diode-AF	2.5	40	-4	0	—	—	—
2A5	Output	2.5	210	-18	0	225	—	—
80	Rectifier	4.9	330AC	—	225	—	—	—

CROSLEY RADIO CORP.

MODEL 7H3

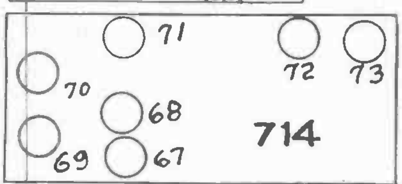
I.F. = 456 KC.

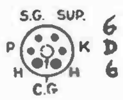




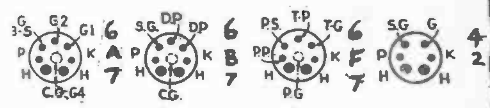
Type	Where Used	Ef	Ep	Eg	Ek	Esg	Ep-Osc
6D6	R.F.	6.5	225	—	0	100	—
6A7	Osc.-Mod.	6.5	225	—	(10LF) (0HF)	100	150
6B7	1st I.F. & A.V.C. Diode	6.5	225	0.3	0	100	--
6D6	2nd I.F.	6.5	225	—	2.0	100	—
6F7	Diode & I.F.	6.5	30	.5	0	22	—
42	Output	6.5	215	2.0	0	225	—
80	Rectifier	4.9	—	—	225	—	—

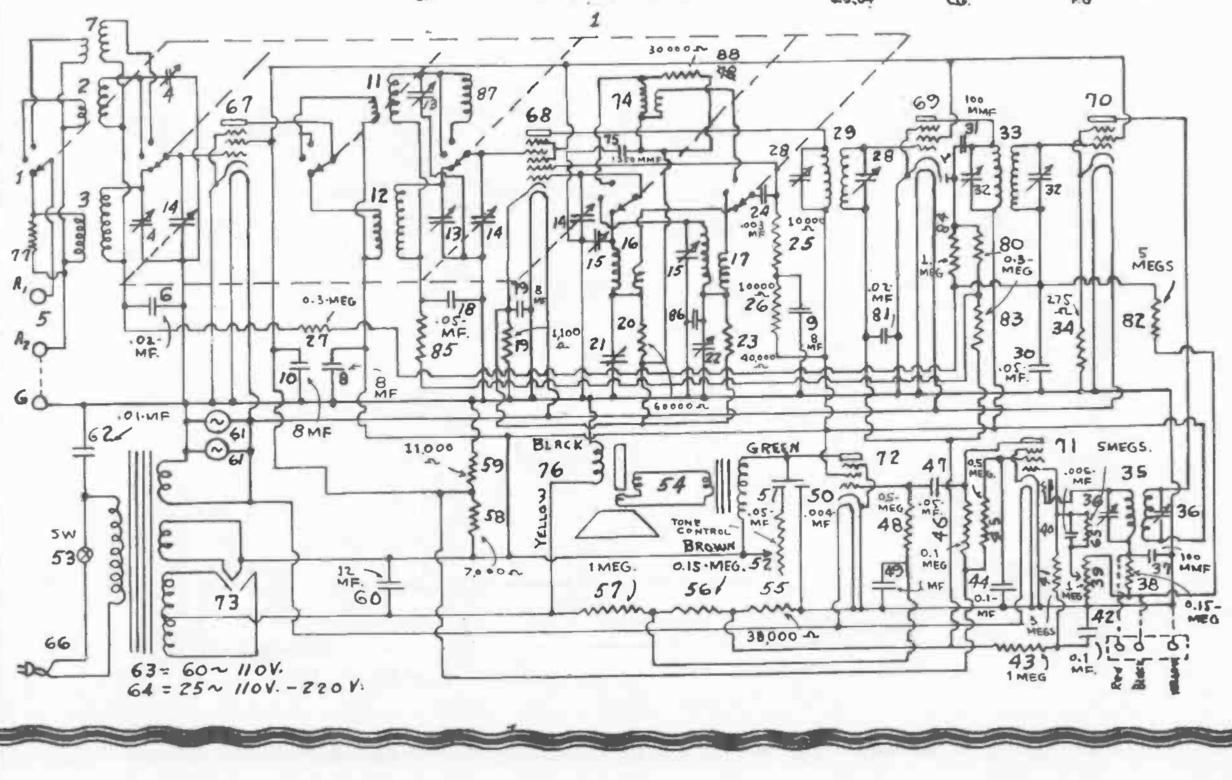
105 volts across speaker field.





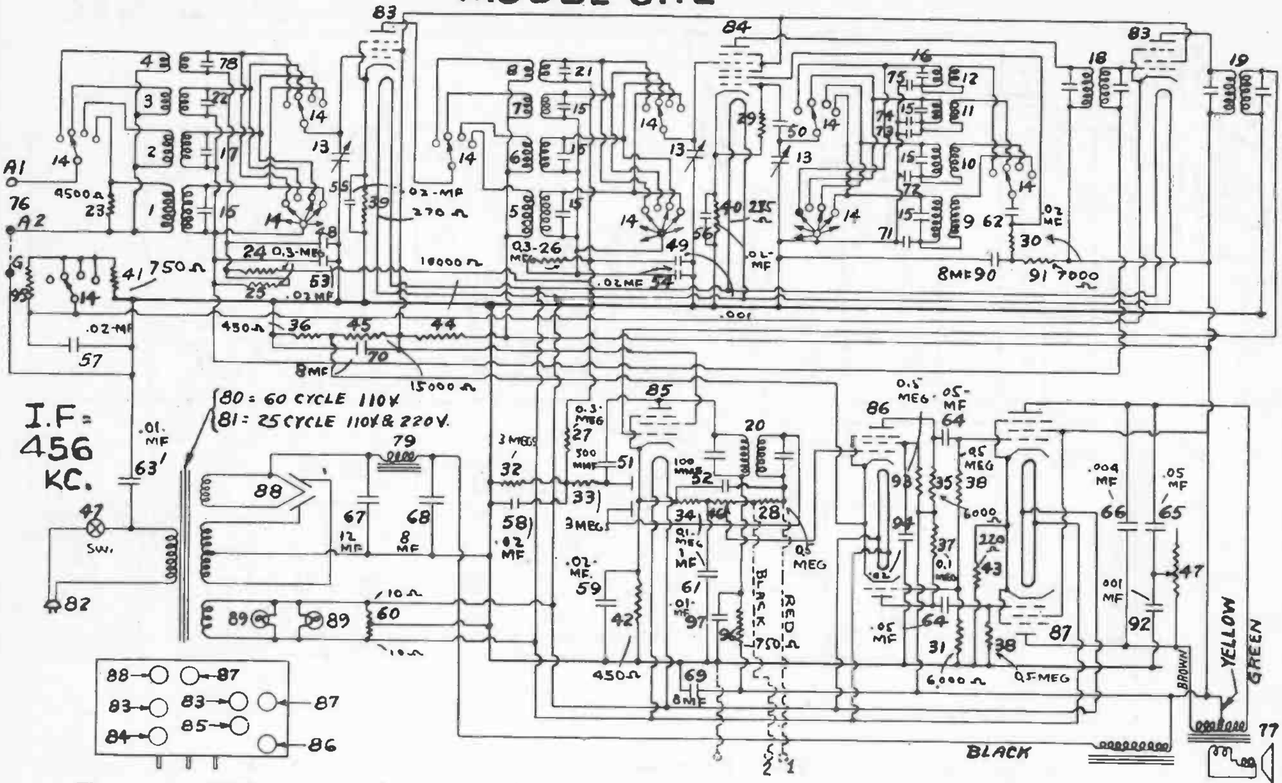
MODEL 714





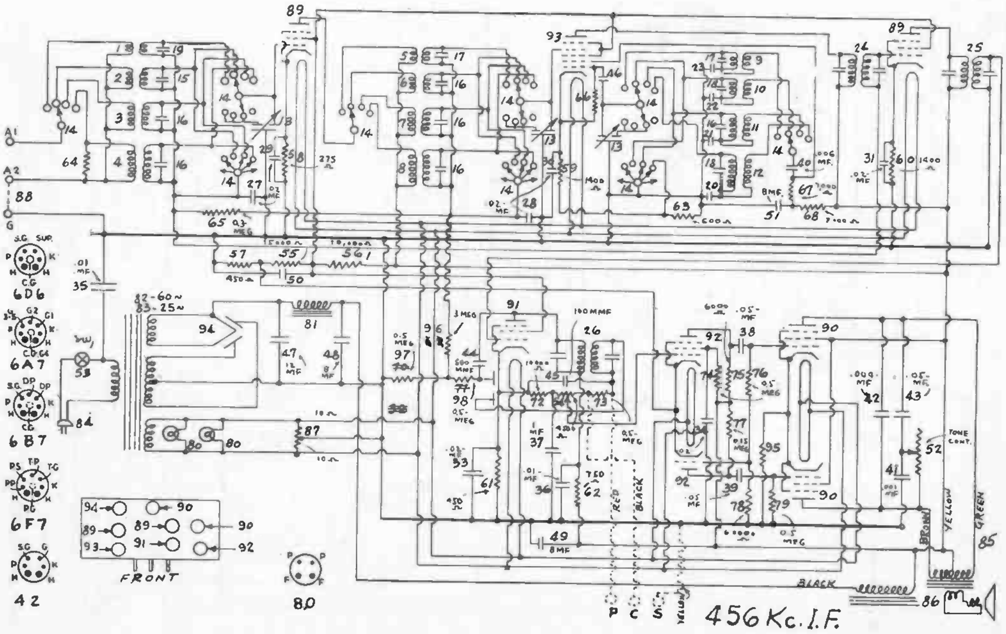
CROSLEY RADIO CORP.

MODEL 8H1



Type	Where Used	Ef	Ep	Eg	Ek SW-BC	Esg	Epx	Egx
6D6	R.F.	6.3	250	0	3	100	—	—
6A7	Osc.-Mod.	6.3	250	0	3	100	220	0 to −10
6D6	1st I. F.	6.3	250	0	7-21	100	—	—
6B7	2nd I. F. and Diode	6.3	250	0	3	100	—	—
6F7	A.F. and Phase Inv.	6.3	140	0	4	35	70	0
42	Output	6.3	240	0	16	250	—	—
80	Rectifier	5.0	—	—	350	—	—	—

MODEL 814



CROSLEY RADIO CORP.

Model 136-1

Specifications

Model 136-1 is a ten tube superheterodyne for operation from A. C. electric circuits. Five sets of coils give the following frequency ranges: 550 to 1500 KC, 1500 to 3500 KC, 3500 to 6500 KC, 6500 to 12000 KC, and 12000 to 20000 KC. The intermediate frequency used is 456 KC.

Tubes And Voltage Limits

The following are the voltages measured with the receiver in operating condition but with no signal to the antenna circuit. Use a high resistance D. C. voltmeter (1000 ohms per volt, or more) for all but filament voltages. In measuring filament or heater voltages use a low range A. C. meter. The voltage limits are + or — 10% of values given in the following table.

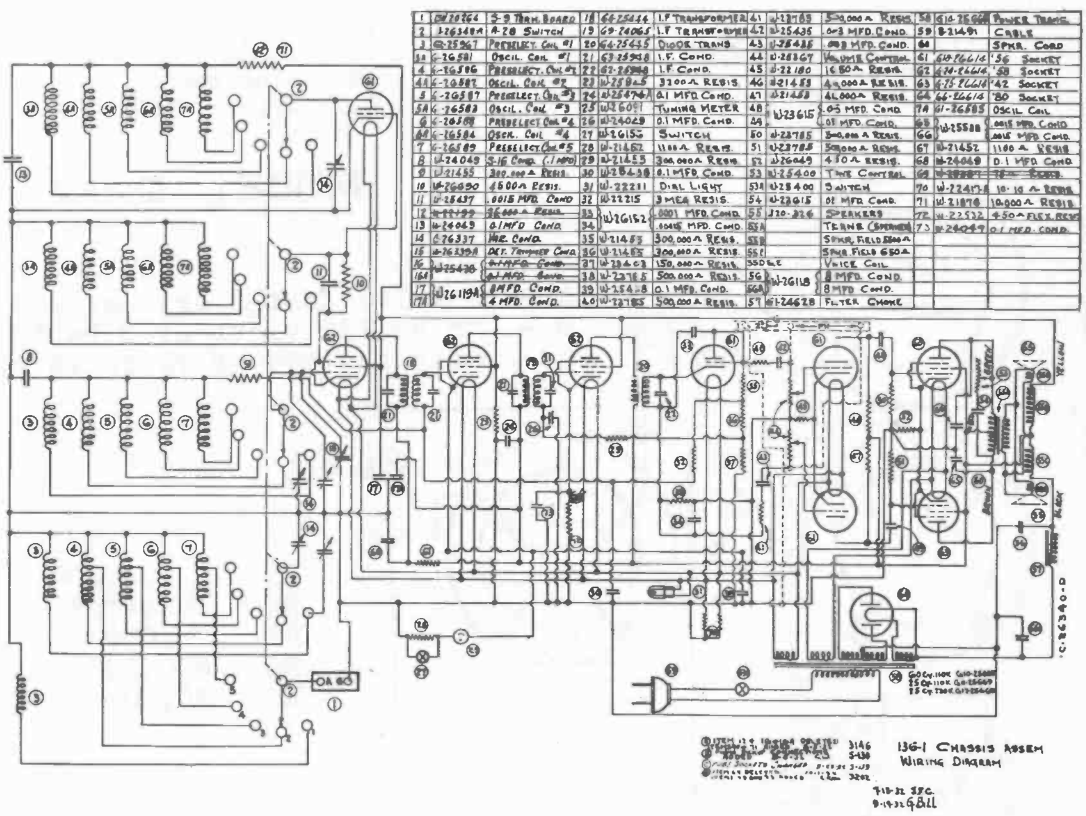
Line voltage—117.5 volts (235 for 220 volt receivers).

Plate voltage measured from plate contact to cathode contact.

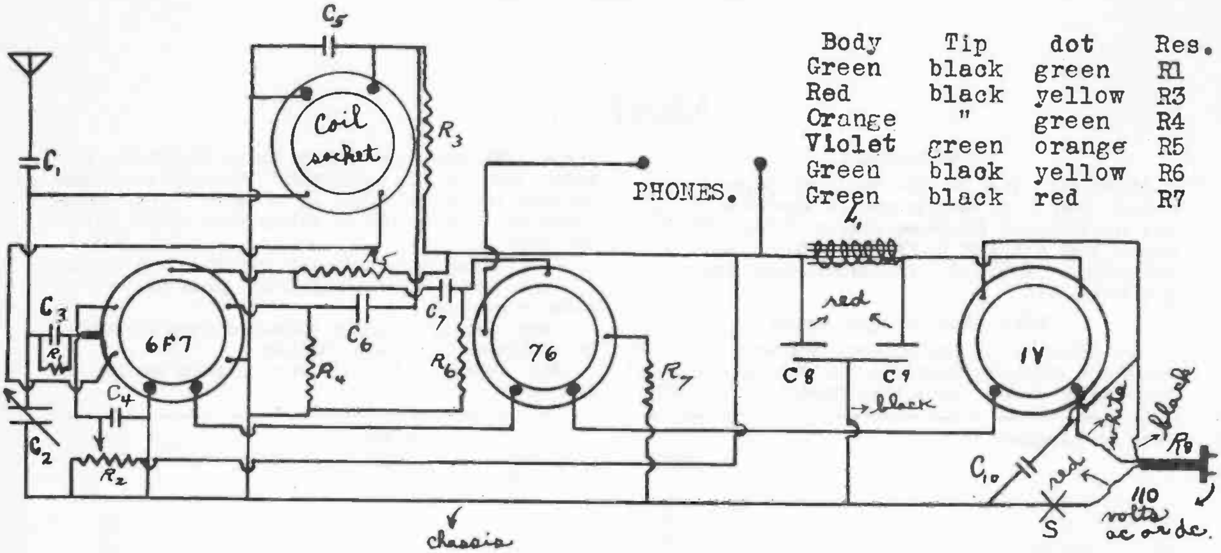
Suppressor grid voltage measured from suppressor grid contact to cathode contact.

Bias voltage measured from cathode contact to chassis.

Tube	Position	Voltages				
		Plate	Screen Grid	Supp. Grid	Bias	Fil.
-56	Oscillator	45			0	2.5
-58	1st Detector	275	100	0	10.0	2.5
-58	1st I. F. Amplifier	275	100	0	2.5	2.5
-58	2nd I. F. Amplifier	275	100	0	4.0	2.5
-56	Diode Detector	0			0	2.5
-56	Push Pull A. F. Amplifier	135		0	7.0	2.5
-56	Push Pull A. F. Amplifier	135		0	7.0	2.5
-42	Output	270	275		20.0	6.3
-42	Output	270	275		20.0	6.3
-80	Rectifier	370				4.8



EILEN RADIO LABS. INC.
3 TUBE ALL-WAVE



Body	Tip	dot	Res.
Green	black	green	R1
Red	black	yellow	R3
Orange	"	green	R4
Violet	green	orange	R5
Green	black	yellow	R6
Green	black	red	R7

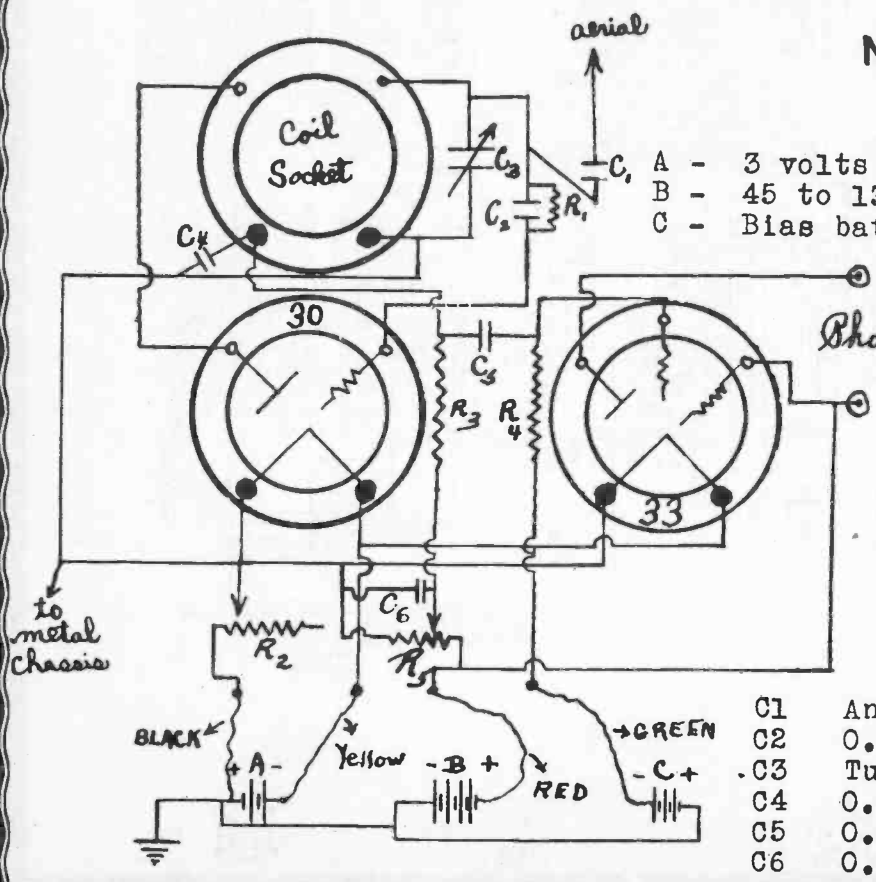
Socket connections in above diagram represent bottom views of same.

C1 Antenna series condenser.
C2 Tuning condenser
C3 0.0001 mfd mica condenser
C4 0.10 " tubular "
C5 0.0001 " mica "
C6 0.01 " tubular "
C7 0.01 " " "
C8, C9 double section filter condenser.
C10 0.01 mfd tubular condenser.

S switch.

R1 5,000,000 ohms
R2 100,000 ohm potentiometer.
R3 200,000 ohms
R4 3,000,000 ohms
R5 75,000 "
R6 500,000 "
R7 5,000 "
R8 Line cord.
L1 Filter choke.

MODEL DX-2



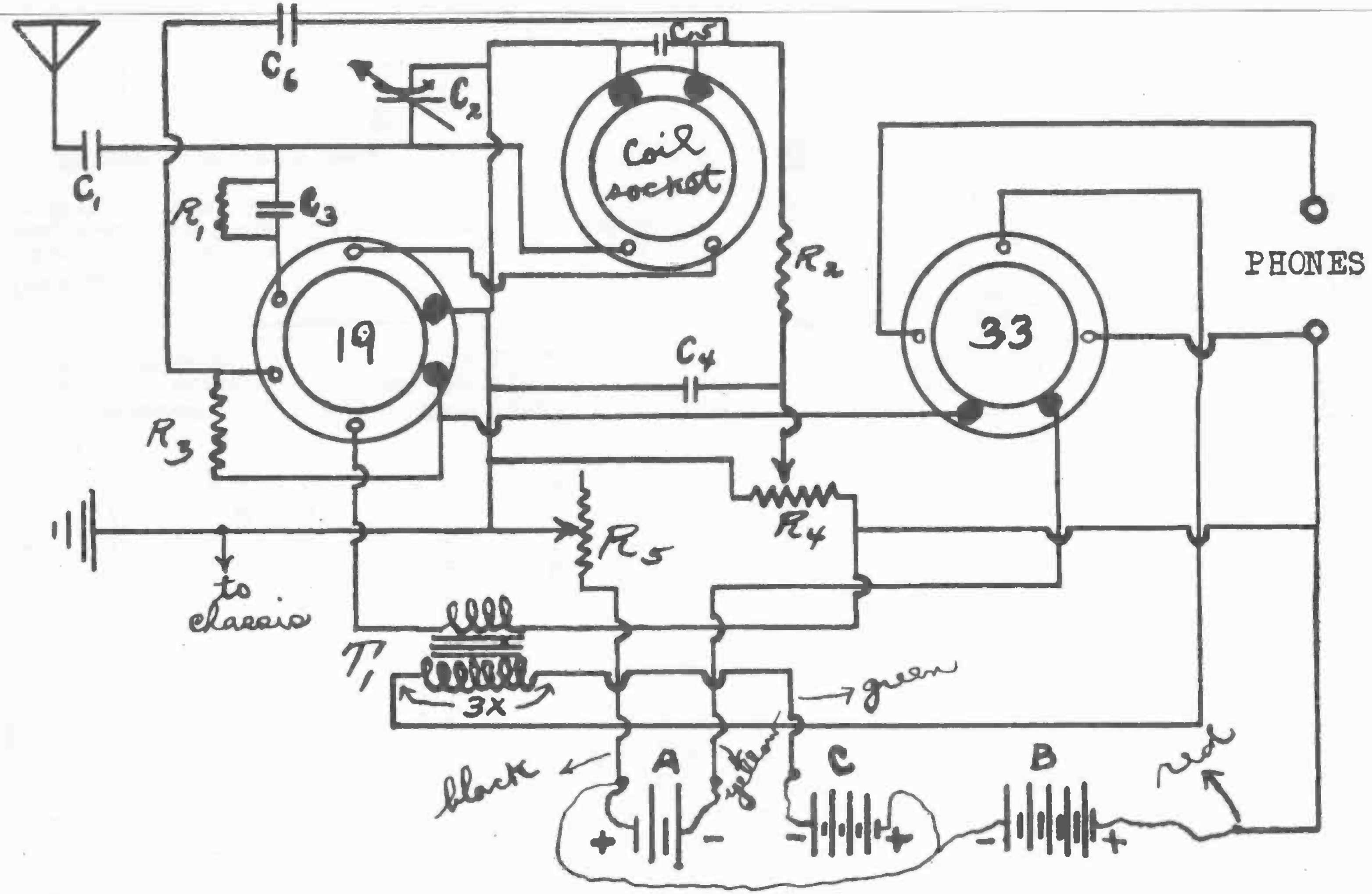
A - 3 volts from 2 dry cells
B - 45 to 135 volts of B batteries.
C - Bias battery of 7½ to 13 volts.

R1 5,000,000 ohms.
R2 Rheostat
R3 75,000 "
R4 500,000 "
R5 75,000 "

C1 Antenna series condenser.
C2 0.00015 mfd mica "
C3 Tuning "
C4 0.0005 mfd mica "
C5 0.01 " " "
C6 0.10 " " "

EILEN RADIO LABS. INC.

MODEL DC



Socket connections in above diagram represent bottom views of same.

Resistor Color Code.

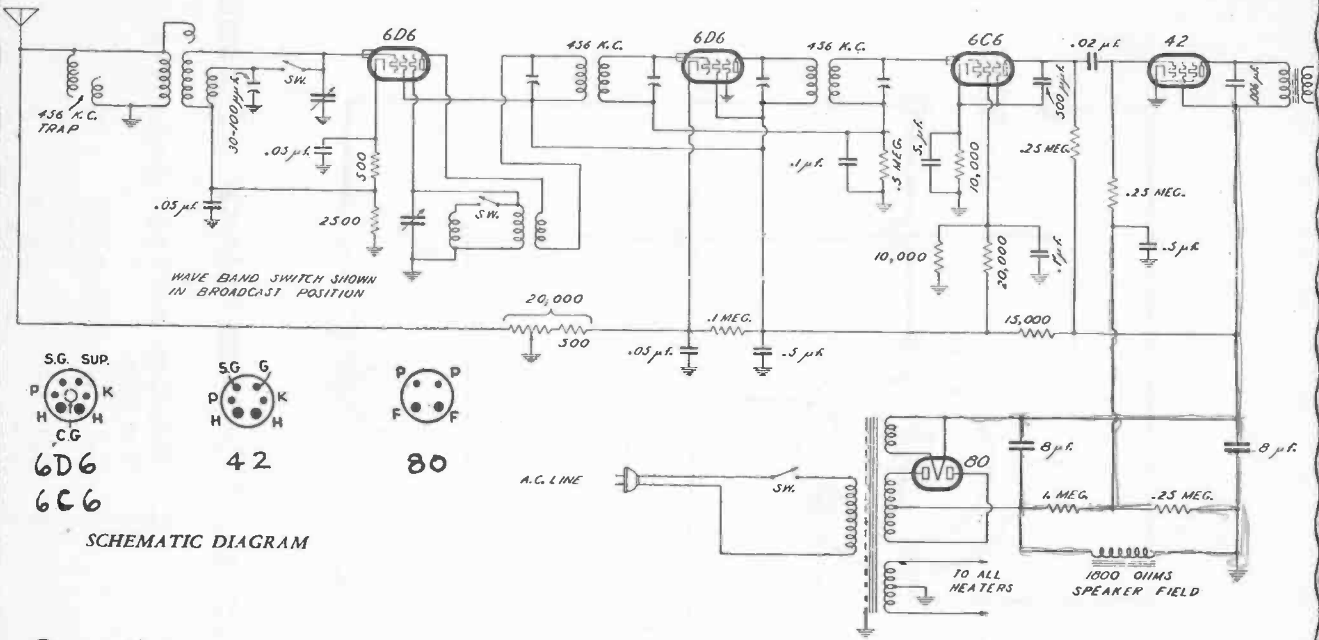
Body	Tip	Dot	Ohms
Green	Black	Green	5,000,000
Violet	Green	Orange	75,000
Orange	Black	Green	3,000,000

R1	5,000,000 ohms
R2	75,000 "
R3	3,000,000 "
R4	Regeneration control
R5	Rheostat.

C1	Antenna series condenser.
C2	Tuning "
C3	0.0001 mfd mica "
C4	0.10 " tubular "
C5	0.0005 " mica "
C6	0.01 " tubular "

EMERSON RADIO & PHONO. CORP.

MODELS 5J (CHASSIS) 28



SCHEMATIC DIAGRAM

I.F. = 456 KC.

Operation:

Turn the left hand knob ("on-off" switch and volume control) to the right. The switch will be felt to snap on as the knob is first turned.

Turn the right hand knob to the left if broadcast reception is desired. For short-wave reception, turn it to the right.

Select your station by turning the central knob and observing frequencies of stations on the calibrated dial.

To increase the volume, turn the volume-control knob to the right.

To decrease the volume, turn it to the left.

To shut off the set, turn the volume control knob all the way to the left until the snap of the switch is heard, and the dial light goes out.

Voltage Readings:

For the convenience of servicemen, the following voltage readings will serve as a guide in trouble shooting.

Readings are to be taken with all the tubes in their places, volume control turned on full and antenna wire grounded to chassis.

The D.C. Voltmeter used should be 1000 ohms per volt, or over. Line volts 117 A.C.

	Fil.	Ground to Plate	Ground to Screen	Ground to Cathode	Ground to Suppressor
6D6 Osc. 1st Det.	6.3 A.C.	80 D.C.	80 D.C.	12 D.C.	....
6D6 I.F. Amplifier	6.3 A.C.	80 D.C.	80 D.C.	3 D.C.	....
6C6 2nd Det.....	6.3 A.C.	150 D.C.	30 D.C.	1.7 D.C.	1.7 D.C.
42 Output	6.3 A.C.	245 D.C.	255 D.C.	....	....
80 Rectifier	5.0				

Voltage across speaker field, 90.

Broadcast
540—1500 Kilocycles
550— 200 Meters

Short Wave
1500—3000 Kilocycles
200— 100 Meters

Description:

The Model 28 is a five-tube superheterodyne radio receiver bringing in regular broadcast stations, and, in addition, stations on the short-wave band down to 100 meters.

The following tubes are employed:

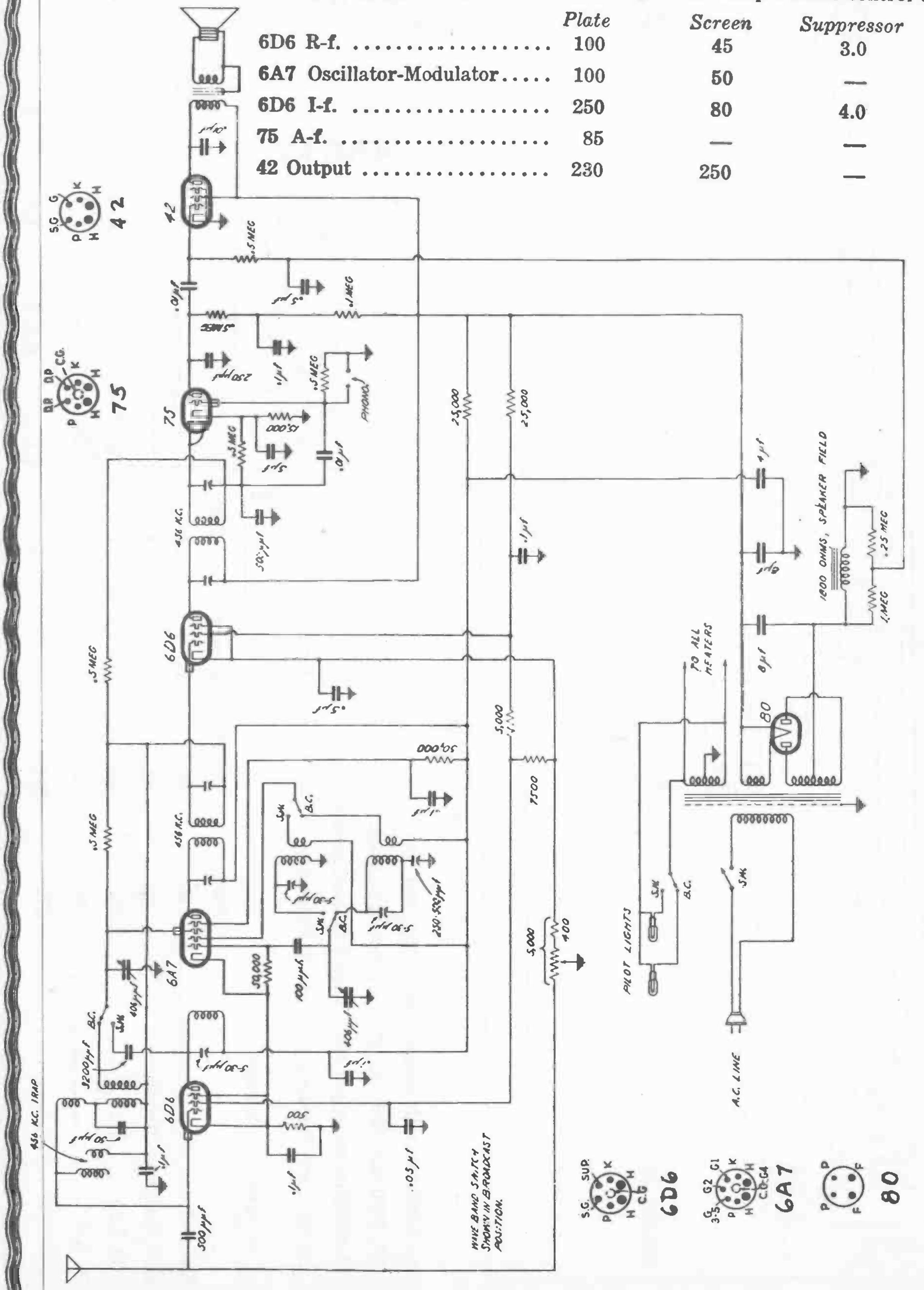
1 – 6D6 R.F. Pentode (1st Detector-Oscillator)
1 – 6D6 I.F. Amplifier
1 – 6C6 R.F. Pentode (2nd Detector)
1 – 42 Output-Pentode
1 – 80 Rectifier

EMERSON RADIO & PHONO. CORP.

MODELS 6BD (CHASSIS) 45, 60 & 69

Voltages listed below are from the point indicated to ground. Keep volume control on full.

	Plate	*Screen*	*Suppressor*	*Cathode*
6D6 R-f.	100	45	3.0	3.0
6A7 Oscillator-Modulator.....	100	50	—	3.0
6D6 I-f.	250	80	4.0	4.0
75 A-f.	85	—	—	1.5
42 Output	230	250	—	0

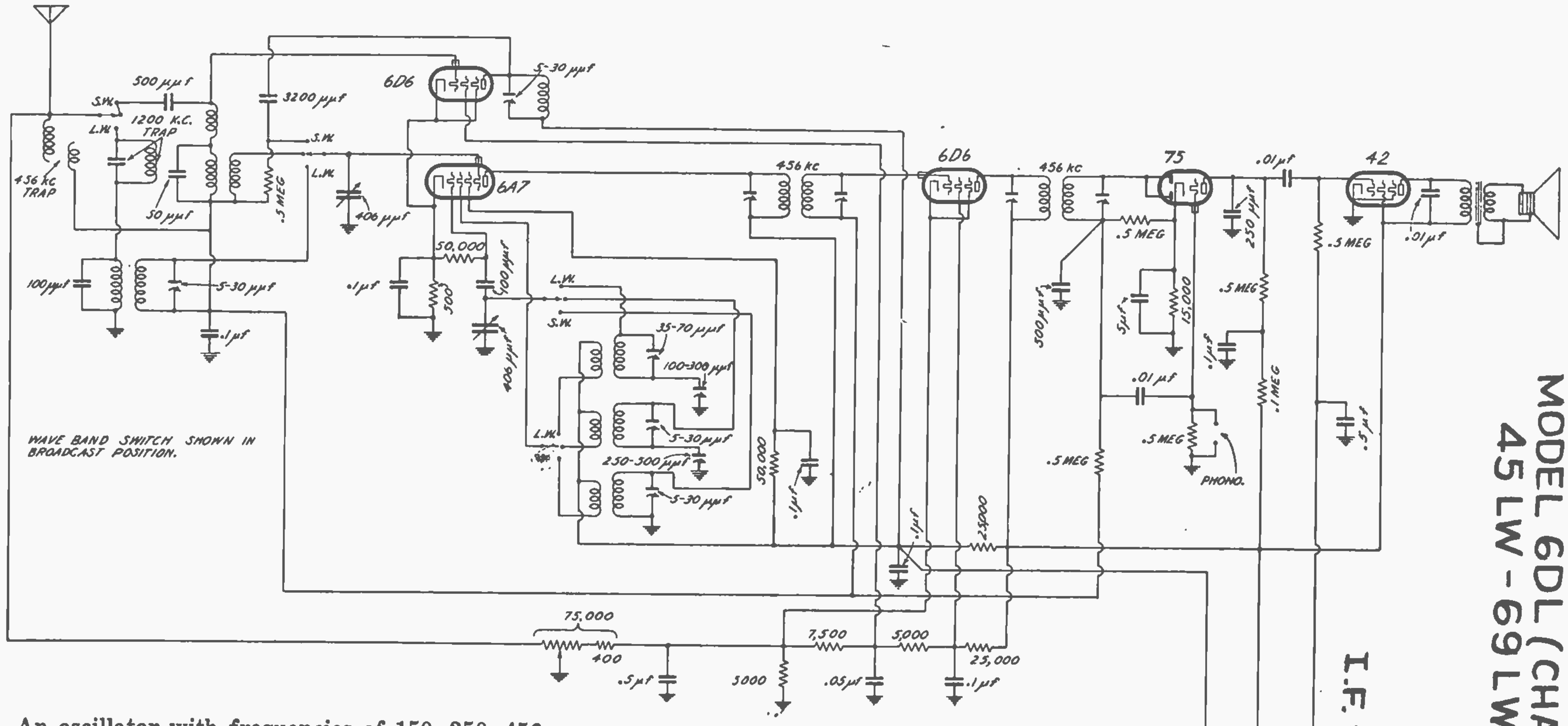


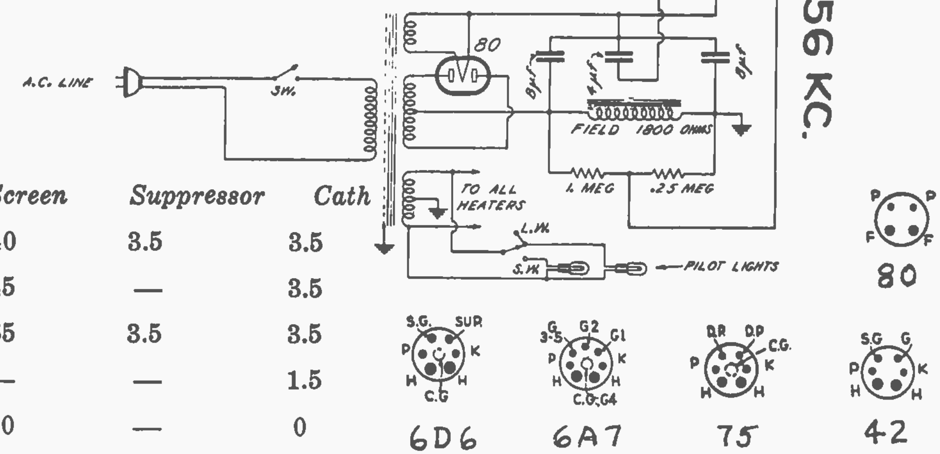
An accurate oscillator should be used with frequencies of 456, 600, 1600 and 15000 kc (15 mc).
In addition, an output meter across the voice coil should be used for the precise results necessary.

EMERSON RADIO & PHONO. CORP.

MODEL 6DL (CHASSIS) 45 LW - 69 LW

I.F. = 456 KC.





An oscillator with frequencies of 150, 350, 456, 600, 1600 and 15000 kc (15 mc) should be used. In addition, an output meter should be used across the voice coil, for the precise results necessary.

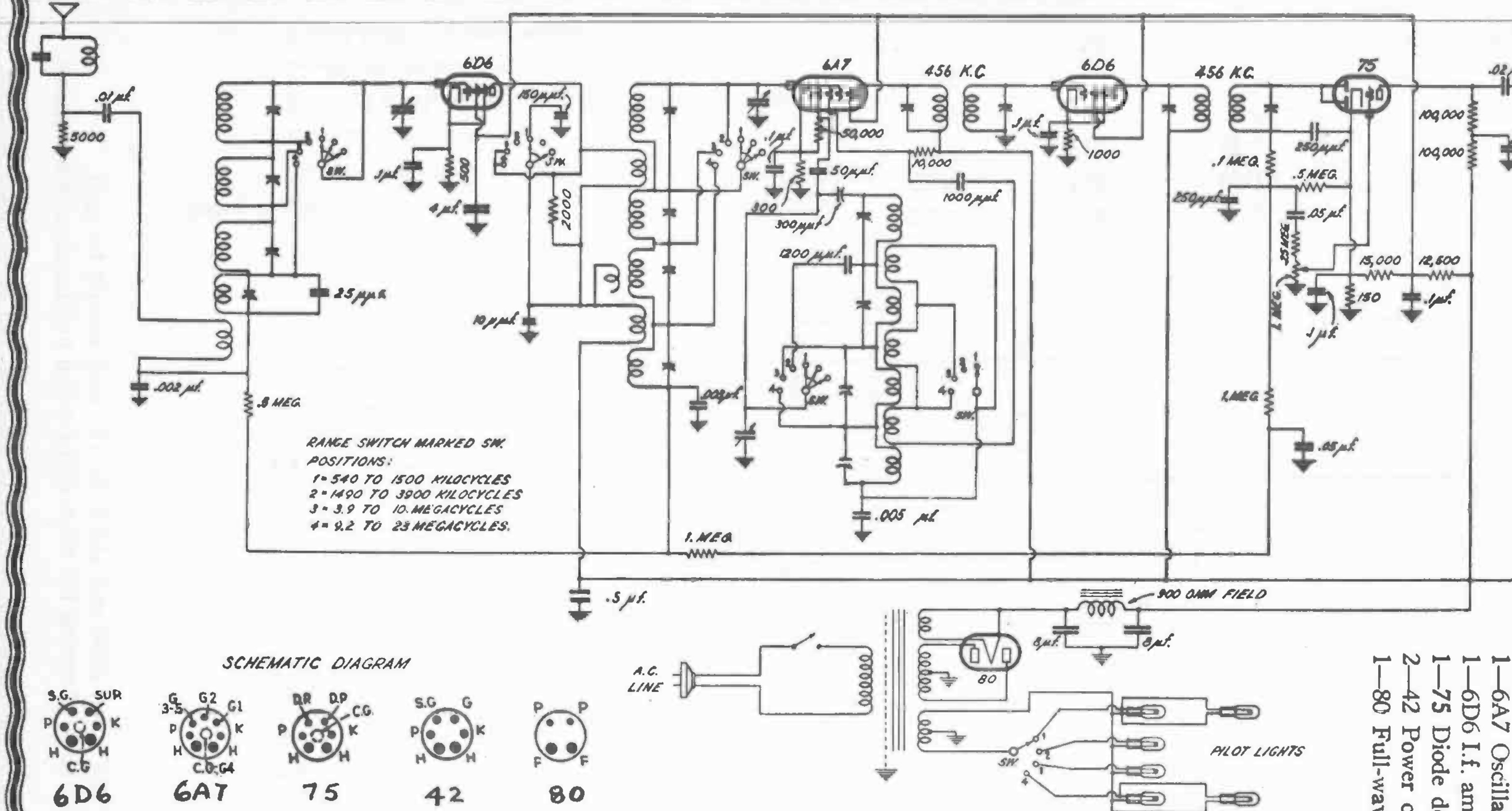
SCHEMATIC DIAGRAM

	Plate	Screen	Suppressor	Cath
6D6 R-f.	95	40	3.5	3.5
6A7 Oscillator-Modulator	95	45	—	3.5
6D6 I-f.	235	65	3.5	3.5
75 A-f.	70	—	—	1.5
42 Output	215	230	—	0

EMERSON RADIO & PHONO. CORP.

MODELS A7 (CHASSIS) 71 100 770

1—6D6 R.f. amplifier.
1—6A7 Oscillator-modulator.
1—6D6 I.f. amplifier.
1—75 Diode detector, audio amplifier and a.v.c. tube.
2—42 Power output pentodes.
1—80 Full-wave rectifier.

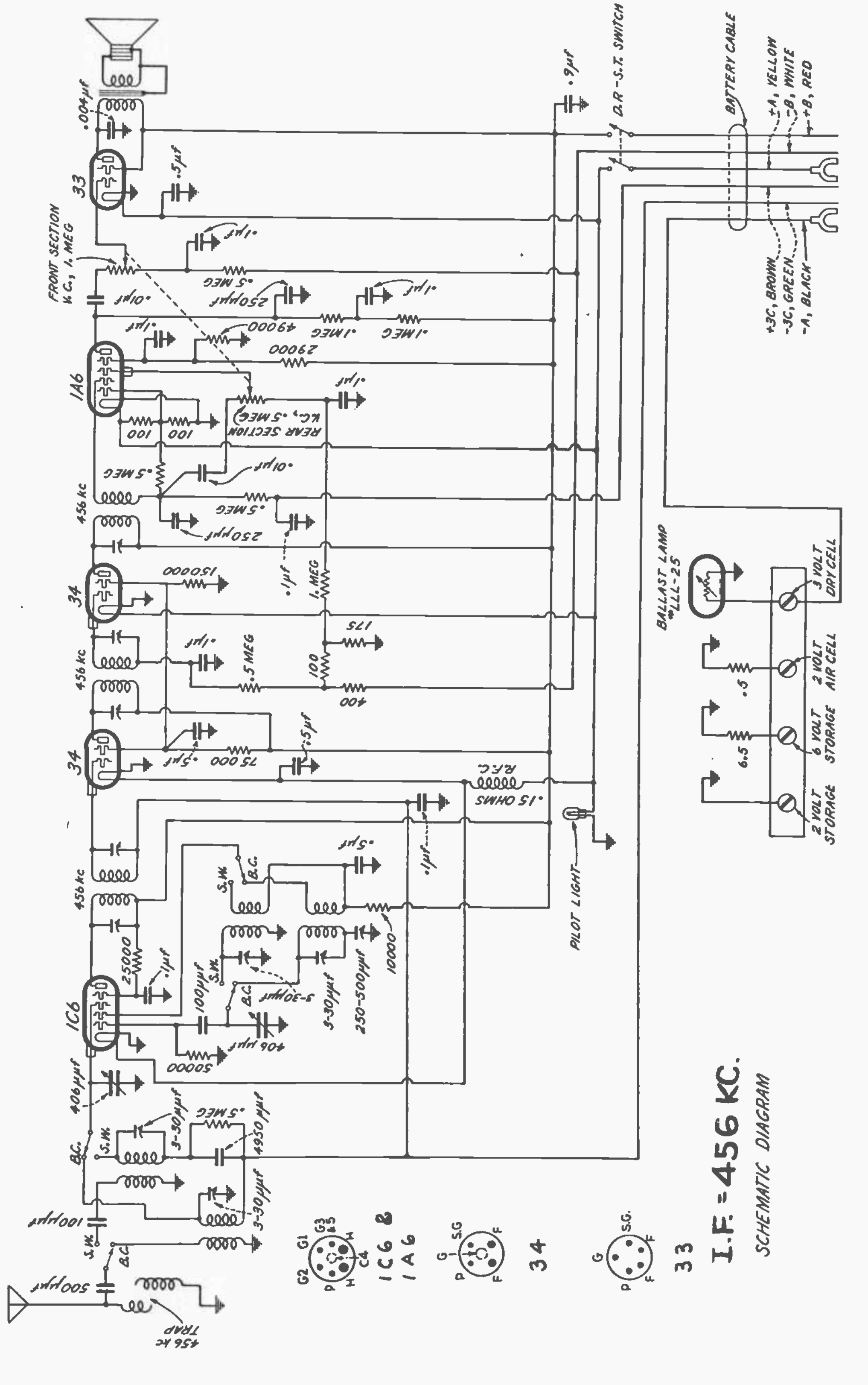


Line voltage 117.5 *volts, a.c.*—60 cycles.

	Plate to ground	*Screen to ground*	*Cathode to ground*	*Oscillator Anode to ground*
6D6 R-f amplifier	236	90	4.0	...
6A7 Oscillator-modulator	240	90	4.0	190
6D6 I-f amplifier	240	90	5.0	...
75	115	...	1.25	...
42	235	240	16.5	...

This all-wave receiver is designed to operate over four ranges covering all the frequencies between 545 and 20,000 kilocycles. The first range includes the standard broadcast band, from 545 to 1500 kilocycles (550 to 200 meters). The next range includes the police band and covers from 1500 to 3900 kilocycles (200 to 76 meters). The third range covers from 3,940 to 9,180 kilocycles (76 to 33 meters) and includes one internationally-assigned band,—the 49 meter band. The last range extends from 9,100 to 20,000 kilocycles (33 to 15 meters) and includes four internationally-assigned bands, the 16, 19, 25 and 31 meter bands. These bands cover all the short-wave stations in use throughout the world.

EMERSON RADIO & PHONO. CORP.
MODEL F6D (CHASSIS) 280



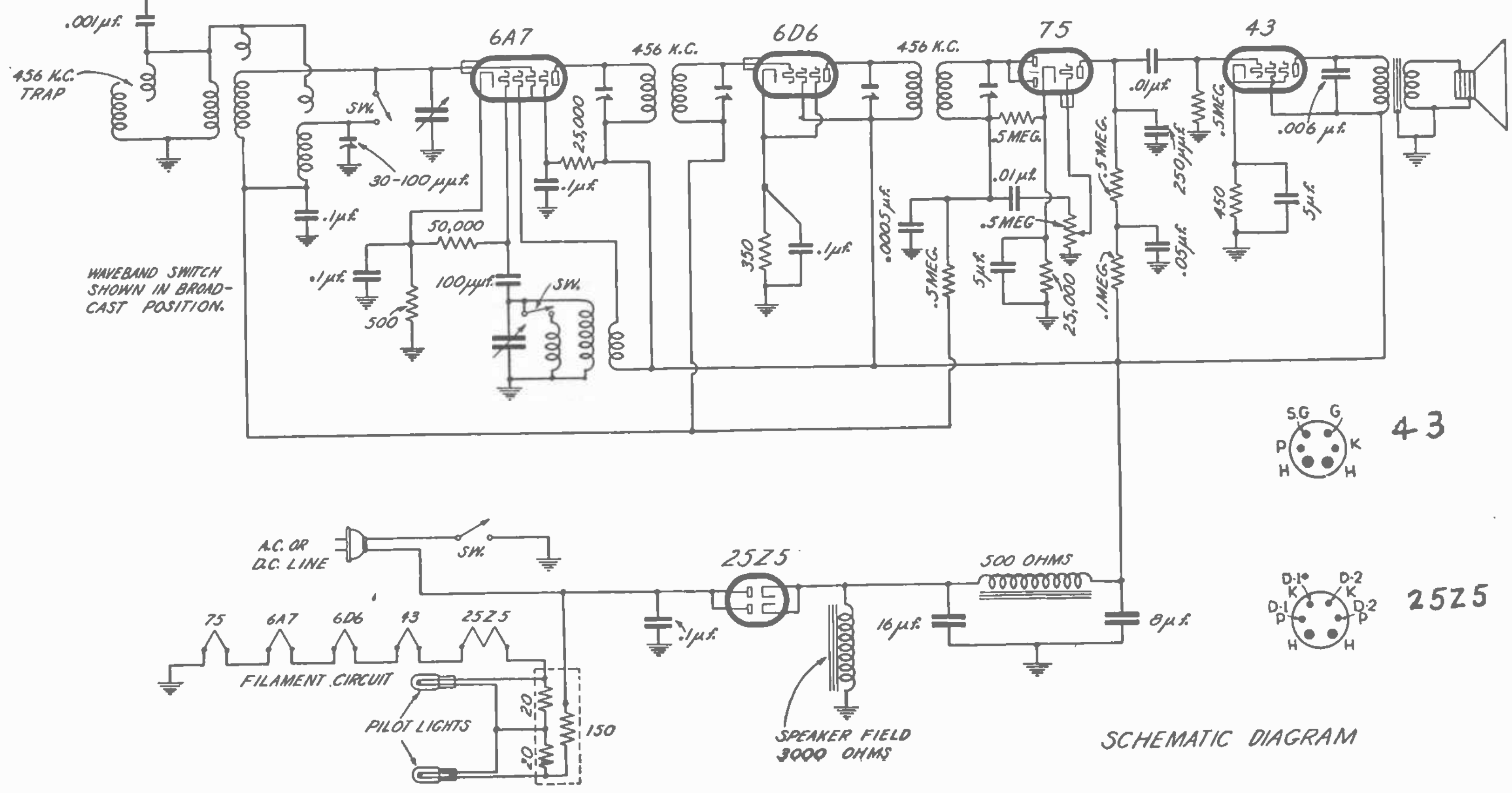
Tube	Plate	S. G.	Bias	Osc. plate
1C6	118	60-70	—3 to +3C	85
34	118	45-50	—3 to +3C	
34	118	45-50	—6	
1A6	70	32-38	—3.8	
33	116	118	—15	

Tubes Employed:
1—1C6 oscillator-detector
2—34 i-f amplifiers
1—1A6 diode detector, a.v.c tube and a-f amplifier
1—33 pentode power output
1—LLL-25 voltage regulator.

An oscillator with frequencies of 456, 550, 1600 and 15000 kc (15 mc) should be used. In addition, an output meter should be used across the voice coil for the precise results necessary.

EMERSON RADIO & PHONO. CORP.

MODELS U5S (CHASSIS) 32



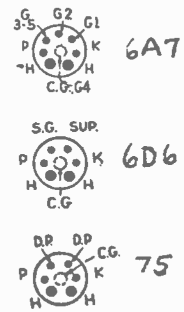
SCHEMATIC DIAGRAM

A.C.-D.C. . . . 105-130 Volts . . . 25-70 Cycles

Short-Wave Range	Broadcast Range
1500—3000 Kilocycles	540—1500 Kilocycles
200— 100 Meters	550— 200 Meters

The following tubes are employed:

1—6A7 Oscillator-modulator.
1—6D6 I-f amplifier.
1—75 Diode detector, a. v. c. tube and a-f amplifier.
1—43 Pentode power output tube.
1—25Z5 Dual half-wave rectifier.



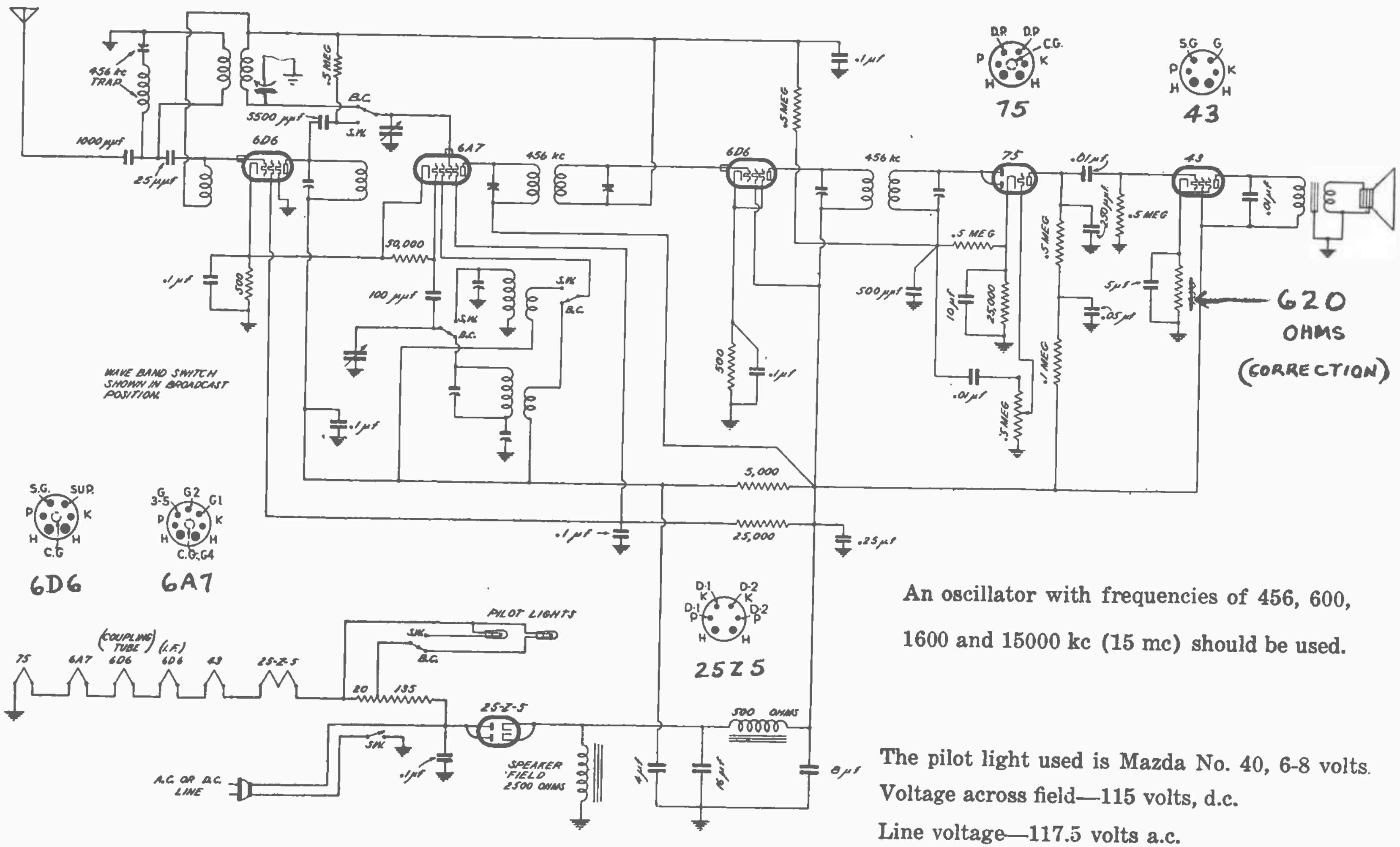
Voltage Readings:

Readings should be taken with volume control on full, using a d-c voltmeter of 1000 ohms-per-volt. Measurements given are for a line voltage of 117.5 volts, 60 cycles and are measured from point indicated to ground with the antenna grounded to the metal chassis.

	Plate	Screen	Cathode	Suppressor	Osc. Plate
6A7 Oscillator-modulator	100	55	3	——	100
6D6 I.f.	100	100	3	3	——
75 A.f.	30	——	1.5	——	——
43 Output	80	100	11	——	——

Voltage across speaker field, 125 volts.

EMERSON RADIO & PHONO. CORP.
MODEL U6 (REPLACES U6D) 38, 42 AND 49



An oscillator with frequencies of 456, 600, 1600 and 15000 kc (15 mc) should be used.

The pilot light used is Mazda No. 40, 6-8 volts.
Voltage across field—115 volts, d.c.
Line voltage—117.5 volts a.c.

	Plate	Screen	Suppressor	Cathode
6D6 R.f.	75	45	0	3
6A7 Oscillator-Modulator	95	45	—	3
6D6 I.f.	95	95	3.5	3.5
75 A.f.	35	—	—	1
43 Output	90	93	—	~~11.5~~ 13.5

I.F. 456 KC.

EMERSON RADIO & PHONO. CORP.

MODEL U6L (CHASSIS) 38LW & 42LW

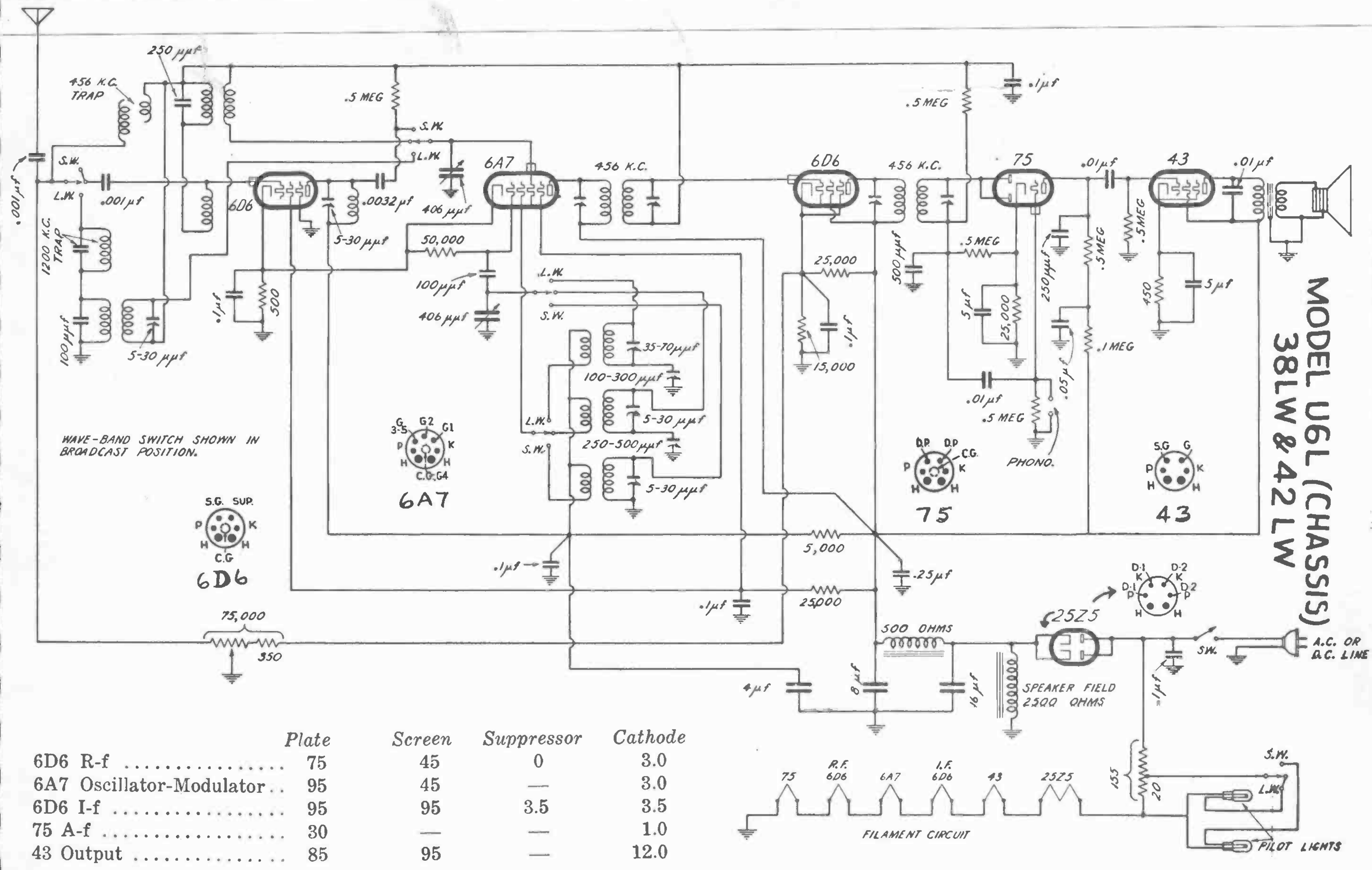
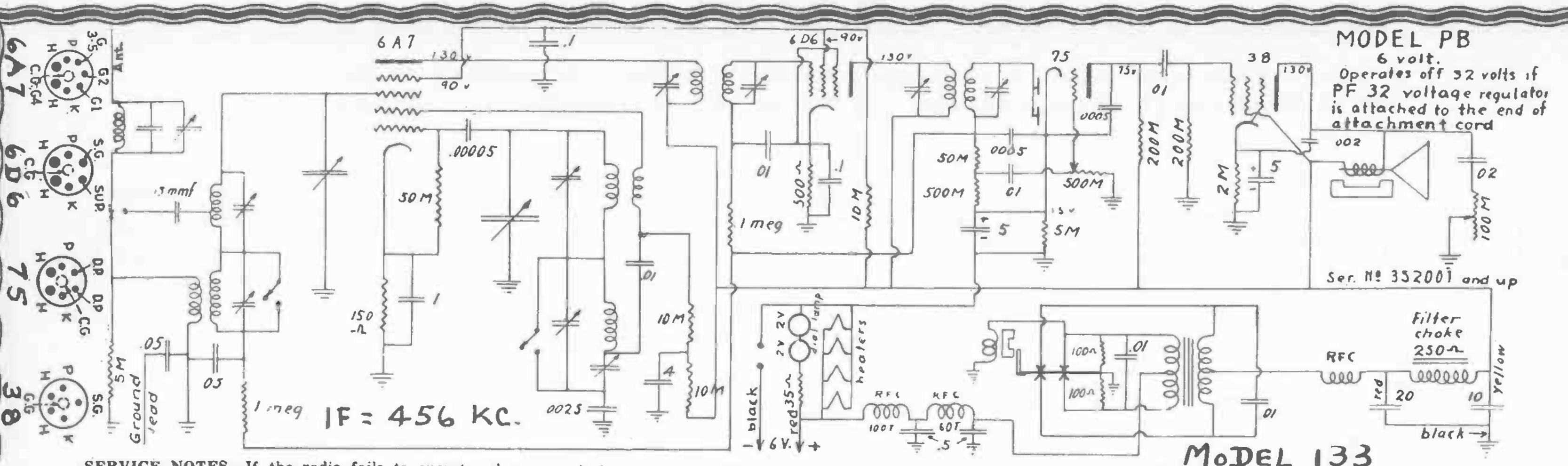


	Plate	Screen	Suppressor	Cathode
6D6 R-f	75	45	0	3.0
6A7 Oscillator-Modulator	95	45	—	3.0
6D6 I-f	95	95	3.5	3.5
75 A-f	30	—	—	1.0
43 Output	85	95	—	12.0

An oscillator with frequencies of 150, 350, 456, 600, 1600 and 15000 kc (15 mc) should be used. In addition, an output meter should be used across the voice coil, for the precise results necessary.

FEDERATED PURCHASER, INC.

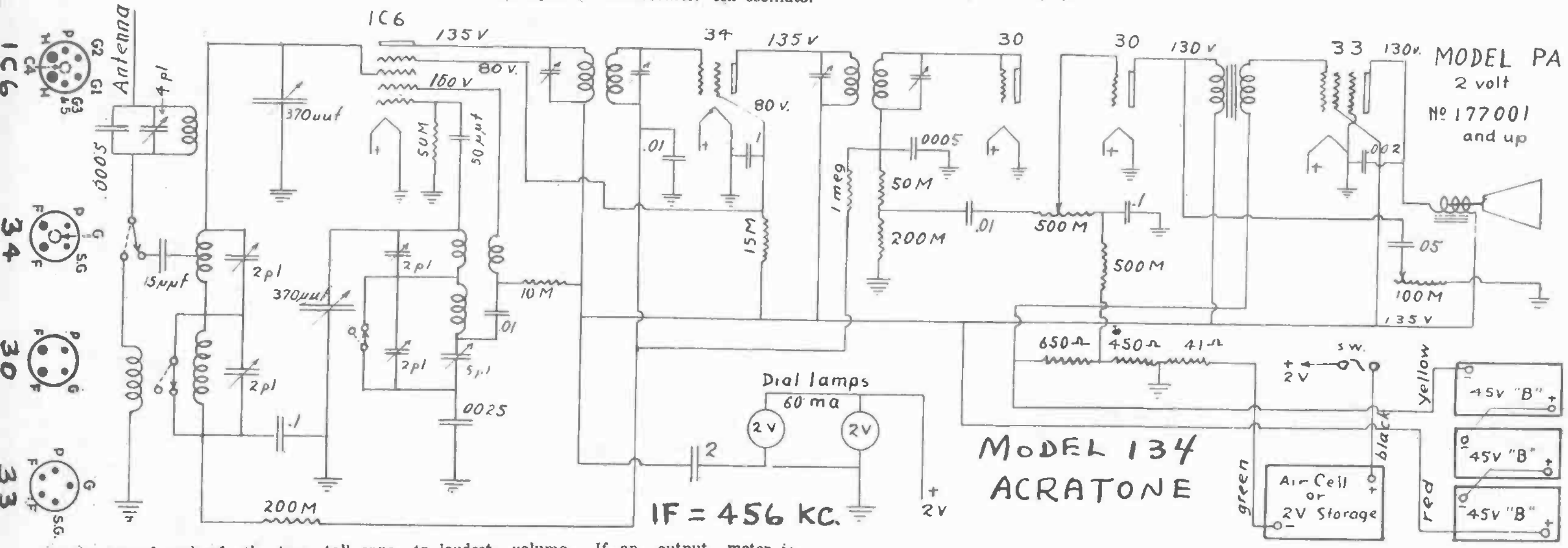
MODELS 133 PB



SERVICE NOTES—If the radio fails to operate when unpacked, or stops working after a few days, proceed as follows: (1) Have the tubes checked. (2) Remove the chassis from the cabinet and check for loose connections. (3) Have a competent "Radio Service Man" check over entirely. Do not return unless you have made the above tests. This set left the factory carefully inspected.

The intermediate stages are carefully phased to 456 KC at the factory. Should rephasing be necessary attach the output lead from a 456 KC test oscillator to the grid cap of the 6A7 tube, keep the signal to a very low audible value and carefully adjust the two screws in the top of each of the two tall cans to the loudest volume. If an output meter is available it should be used across the two black leads at the speaker transformer. An oscillator covering a frequency from 550 KC to 16 MC should be used to rephase the R. F. and the oscillator output is attached to the aerial lead of the set. At all times keep the oscillator signal turned down to a low point of audibility. Trim the short-wave band first, then the broadcast band, setting the dial pointer to a frequency near the high frequency end of the scale in each case. The short-wave oscillator trimmer is located directly across the large (oscillator) coil looking at the under side of the set and the R. F. short-wave trimmer at the right hand end of this coil. The broadcast band is next trimmed at the high frequency end of the broadcast scale, applying a signal from the oscillator corresponding to the dial setting and adjust the porcelain base trimmer at center of chassis until the signal is heard at the correct location on dial.

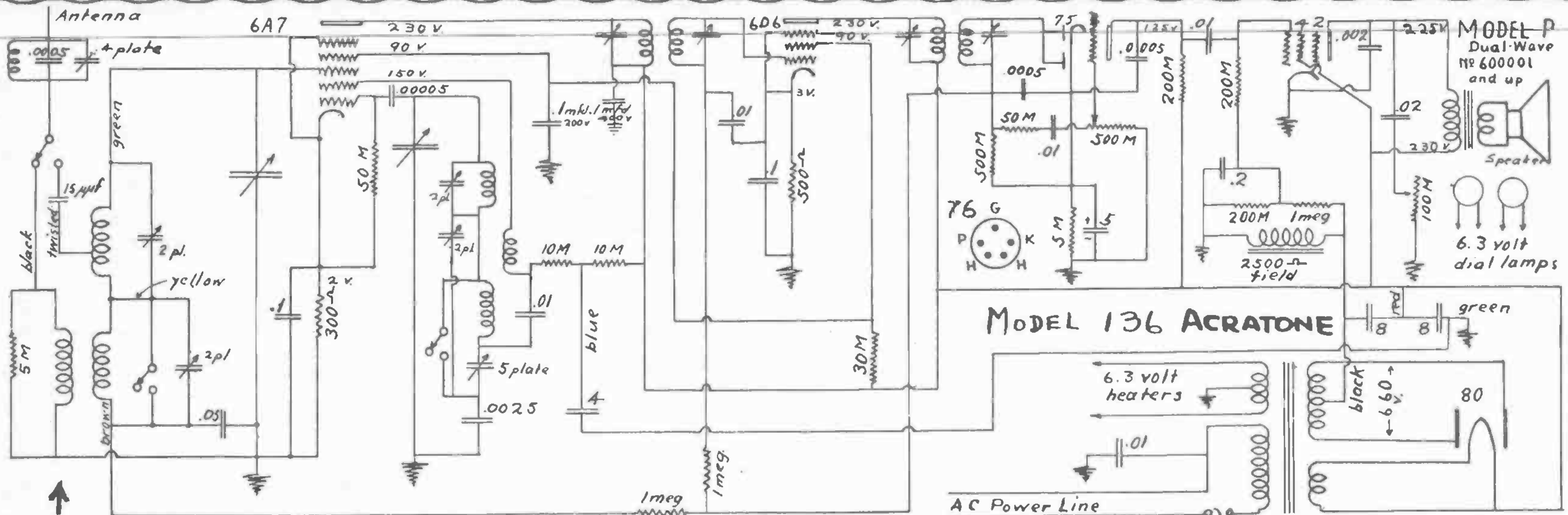
MODELS 134 PA



The intermediate stages are carefully phased to 456 KC at the factory. Should rephasing be necessary attach the output lead from a 456 KC test oscillator to the grid cap of the 1C6 tube, keep the signal to a very low audible value and carefully adjust the screws in the top of each of the two tall cans to loudest volume. If an output meter is available it should be used across the two black leads at the speaker transformer. An oscillator covering a frequency from 550 KC to 16 MC should be used to rephase the R. F. and the oscillator output is attached to the aerial lead of the set. At all times keep the oscillator signal turned down to a low point of audibility. Trim the short-wave band first, then the broadcast band, setting the dial pointer to a frequency near the high frequency end of the scale in each case. The short-wave oscillator trimmer is located directly across the large (oscillator) coil looking at the under side of the set and the R. F. short-wave trimmer at the right hand end of this coil. The broadcast band is next trimmed at the high frequency end of the broadcast scale, applying a signal from the oscillator corresponding to the dial setting and adjust the porcelain base trimmer at center of chassis until the signal is heard at the correct location on dial.

FEDERATED PURCHASER, INC.

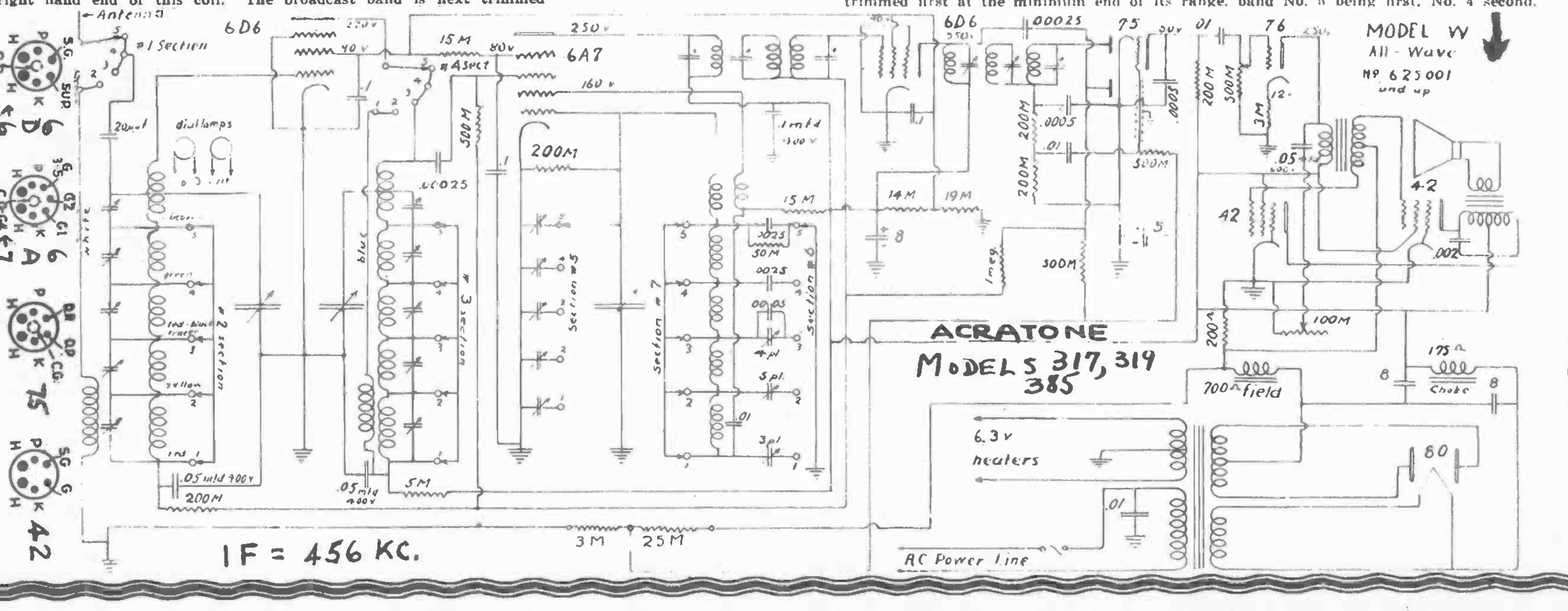
MODELS 136 & P



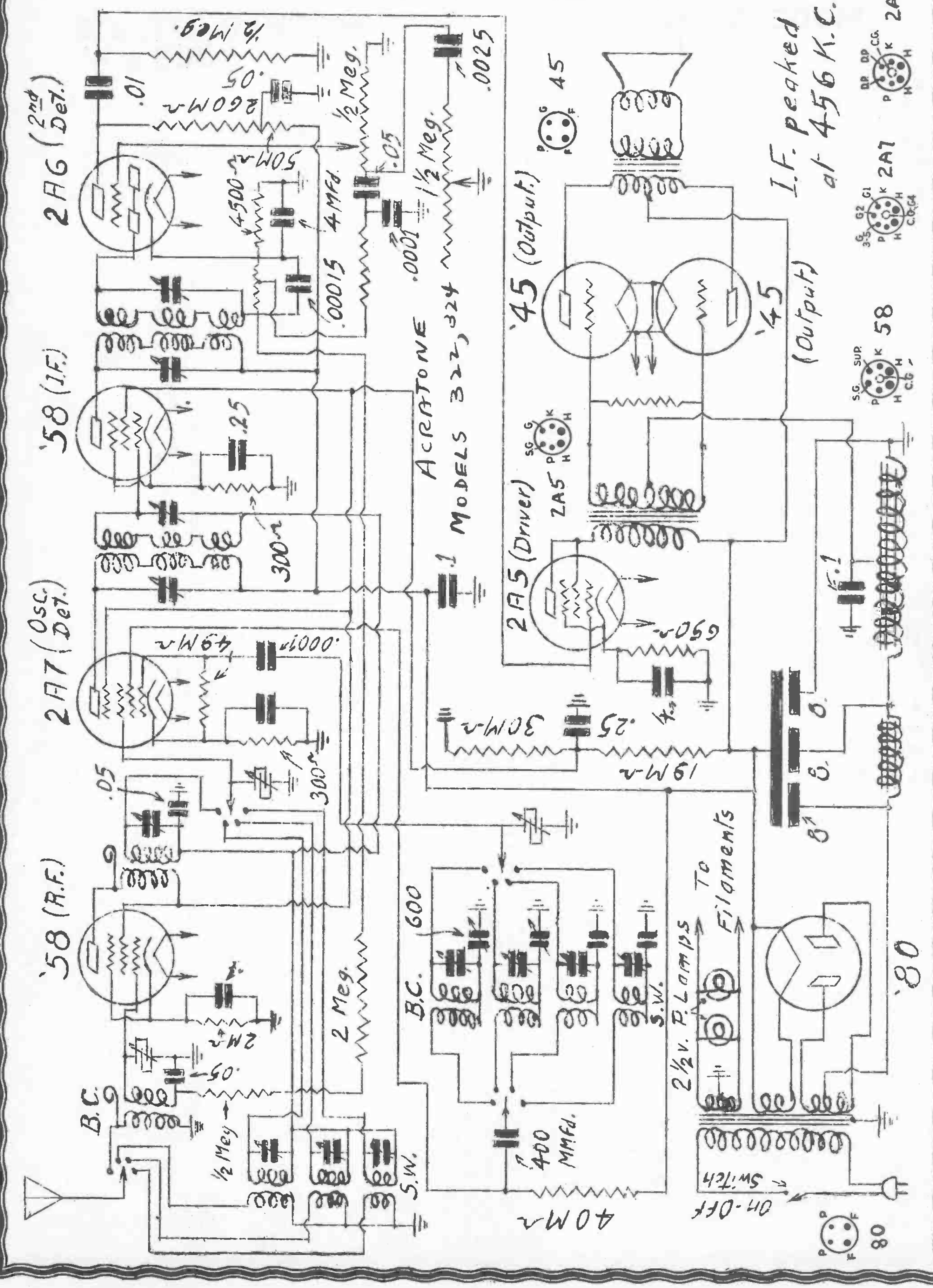
The intermediate stages are carefully phased to 456 KC at the factory. Should rephasing be necessary, attach the output lead from a 456 KC test oscillator to the grid cap of he 6A7 tube, keep the signal to a very low audible value and carefully adjust the two trimmer screws in the top of each of the two tall cans to loudest volume. If an output meter is available it should be used across the two black leads at the speaker transformer. An oscillator covering a frequency from 550 KC to 16 MC should be used to rephase the R. F. The test oscillator output is attached to the aerial lead of the set. At all times keep the oscillator signal turned down to a low point of audibility. Trim the short-wave band first, then the broadcast band, setting the dial pointer to a frequency near the high frequency end of the scale in each case. The short-wave oscillator trimmer is located directly across the large (oscillator) coil looking at the under side of the set, and the R. F. short-wave trimmer at the right hand end of this coil. The broadcast band is next trimmed

An all-wave oscillator having a range from 150 KC to 20 MC will be necessary to rephase the frequency bands. The oscillator output is attached to the aerial lead of the set and the oscillator output kept always at a low audible level. The R. F. coil trimmers are reached through a series of five (5) holes in the side of the R. F. shield cans and correspond to frequency band Nos. 1, 2, 3, 4, and 5, from top down. The oscillator parallel trimmers are seen on the under side of the set when the front of it is raised and are located alongside of the band switch, No. 1 being the one nearest the back of chassis and No. 5 nearest the front. The dual porcelain trimmers at back of chassis are series padders, the left hand for band No. 2 and the right hand one for band No. 1. The series padder for band No. 3 is the single trimmer at the center of the chassis. Each band is trimmed first at the minimum end of its range, band No. 5 being first, No. 4 second.

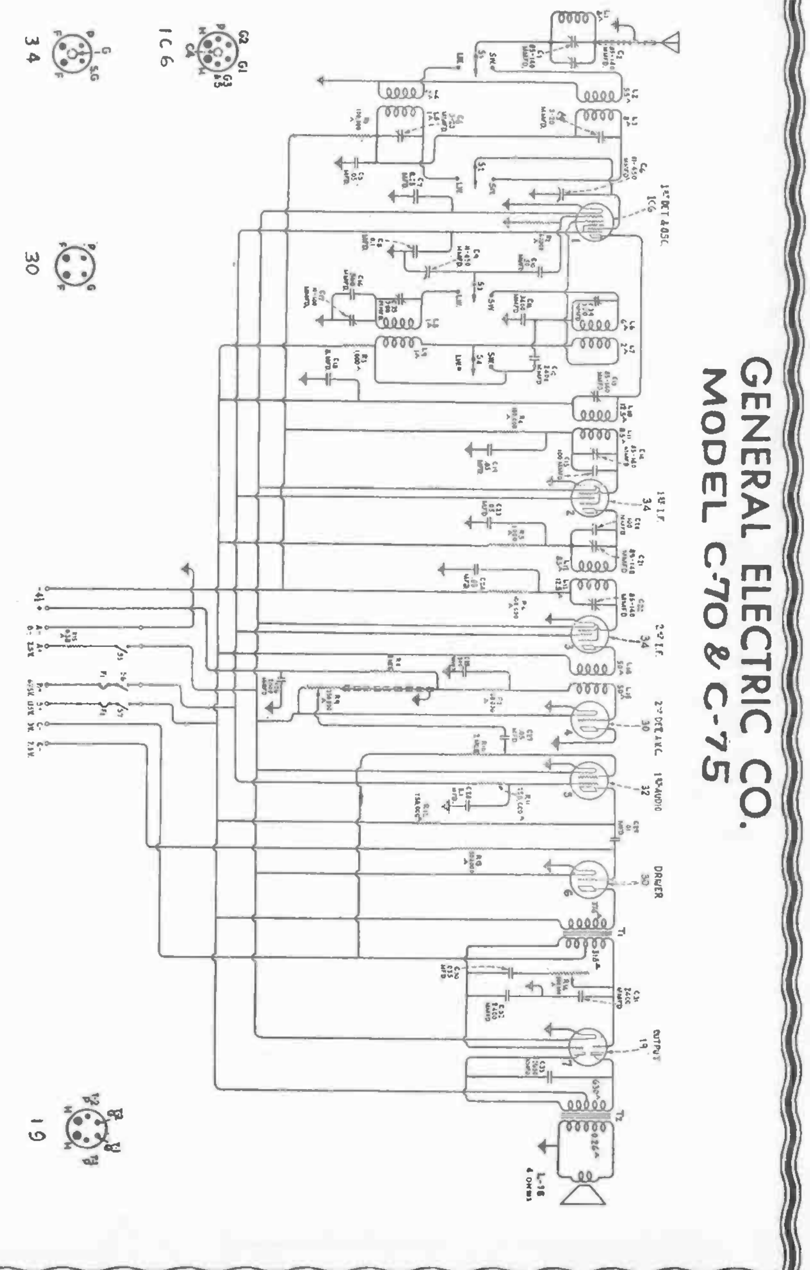
MODELS 317, 319 385 & W



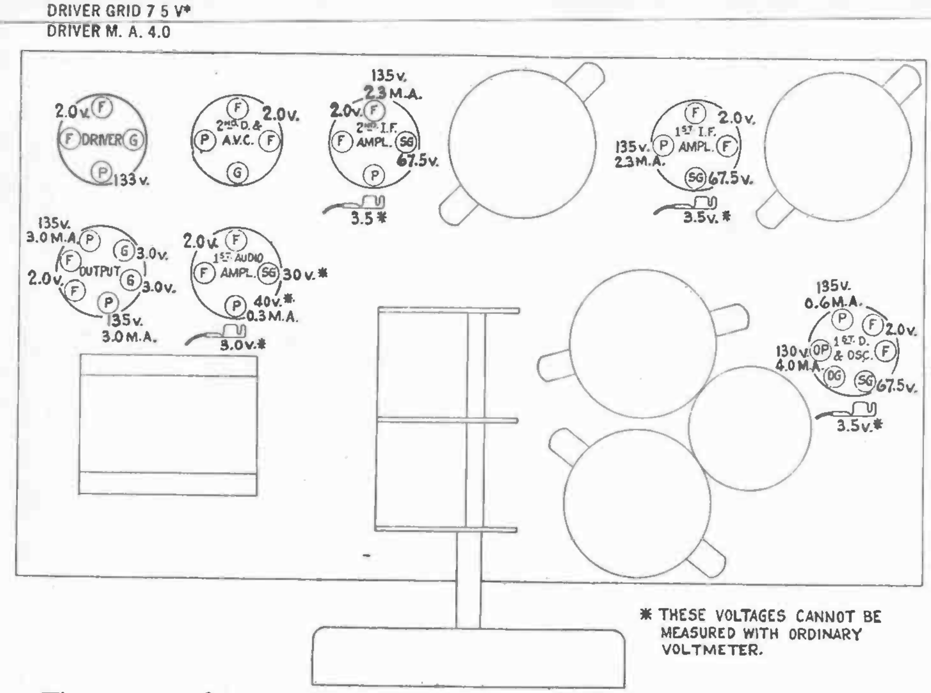
FEDERATED PURCHASER, INC.
MODEL 322.324 & 802-803



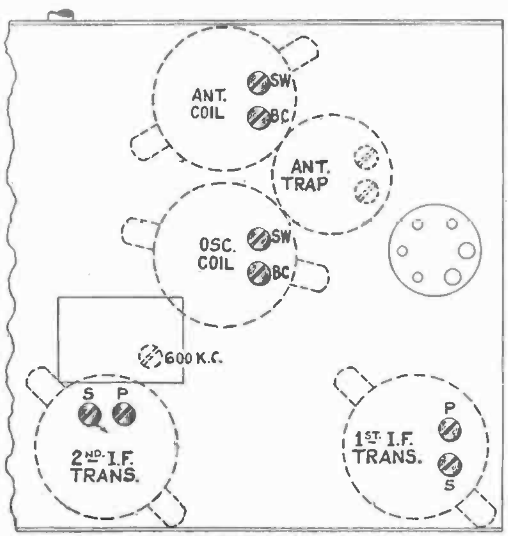
GENERAL ELECTRIC CO.
MODEL C-70 & C-75



I.F. = 460 KC.
TRAP = 460 KC.



* THESE VOLTAGES CANNOT BE MEASURED WITH ORDINARY VOLTMETER.

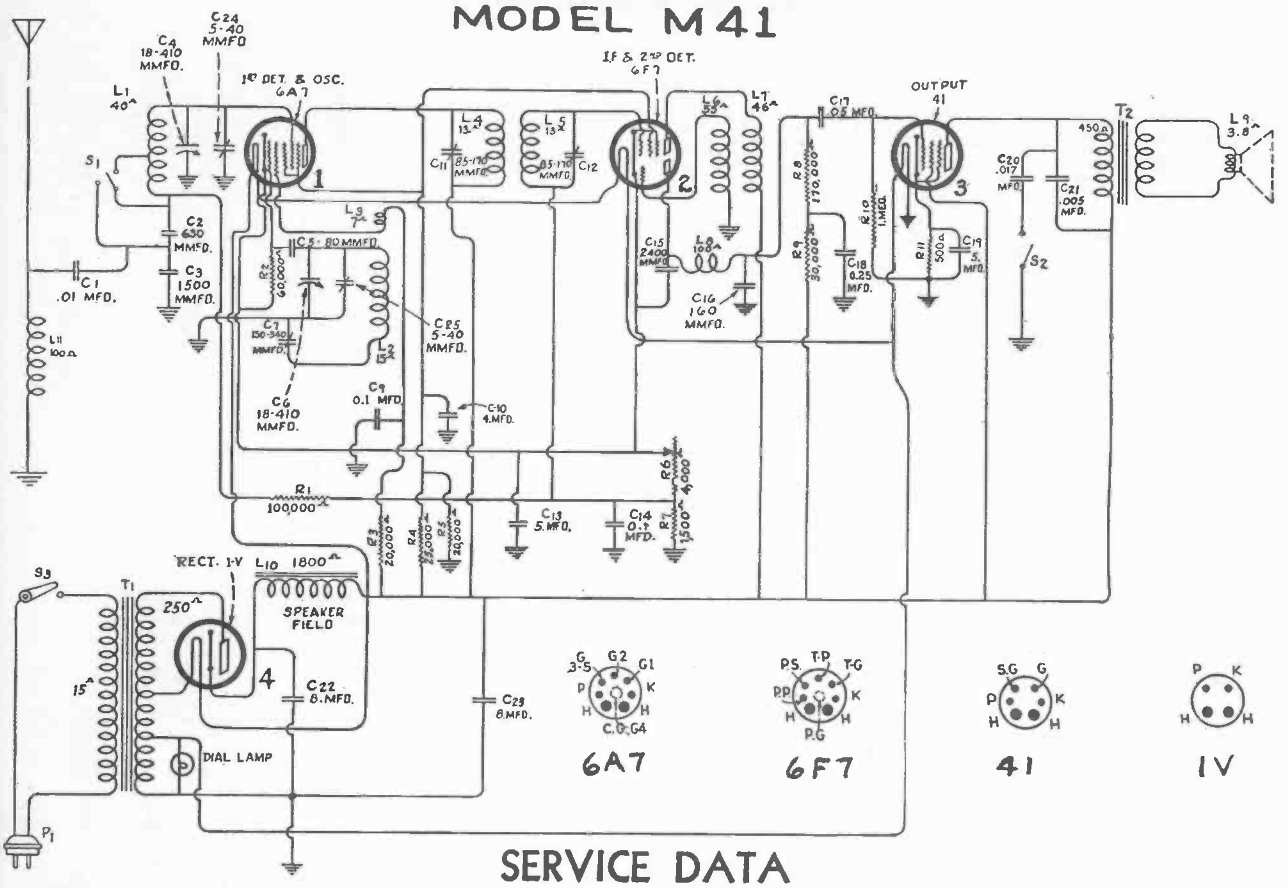


BOTTOM VIEW

The circuit is of the superheterodyne type and consists of a combined oscillator-detector stage, two I. F. amplifying stages, a combined second detector and automatic volume control, a two-stage audio amplifier and a Class "B" output stage. Separate coil systems are used for each band, in conjunction with a push-pull type Range Switch. A three-pole operating switch opens one "A" and two "B" battery leads when the switch is at the "off" position.

The signal enters the receiver through a shielded antenna lead and trap circuit and is applied through the antenna transformer to the tuned grid circuit of the first detector. The trap circuit is tuned to 460 K. C. and reduces the effect of signals at or near the I. F. frequency. The grid circuit of the first detector is tuned to the desired signal. The RCA-1C6, which functions as the first detector, also functions as the local oscillator for producing a signal, 460 K. C. higher in frequency than the incoming signal.

GENERAL ELECTRIC CO.
MODEL M41



SERVICE DATA

Voltage Rating............................105–125 Volts
Frequency Rating...................25–60 or 50–60 Cycles
Power Consumption............................40 Watts
Number and Type of Radiotrons—
1 RCA-6A7, 1 RCA-6F7, 1 RCA-41, 1 RCA-1-V
Undistorted Output............................1.9 Watts
Frequency Range......540–1500 K. C. and 1600–3500 K. C.

This receiver is a four-tube superheterodyne incorporating features such as wide tuning range, electro-dynamic loudspeaker, two-point tone control, illuminated dial and the inherent sensitivity, selectivity and tone quality of the superheterodyne.

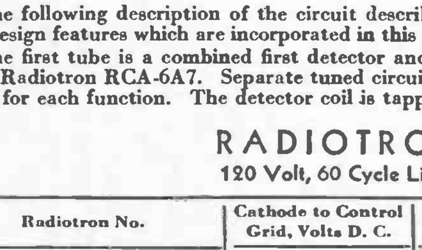


Figure C—Loudspeaker Wiring

The following description of the circuit describes several new design features which are incorporated in this receiver.

The first tube is a combined first detector and oscillator using Radiotron RCA-6A7. Separate tuned circuits are provided for each function. The detector coil is tapped so that the tuning range may be extended merely by shorting out a portion of the coil. The oscillator circuit is not tapped, the high frequency range being obtained by use of its second harmonic instead of the fundamental for obtaining the I. F. frequency.

The next tube is a combined I. F. stage and second detector using Radiotron RCA-6F7. It has two sets of elements, one being used as a screen grid I. F. amplifier and one as a triode detector. The I. F. frequency in this receiver is 460 K. C. The output stage is a single Pentode RCA-41.

The rectifier is an RCA-1-V used in a half-wave rectifying circuit. A feature of this circuit is that only one transformer secondary is used. This is accomplished by having a cathode type rectifier, a series arrangement of filaments and a tapped secondary winding.

Figure A shows the schematic circuit, Figure B the wiring diagram and Figure C the loudspeaker wiring.

Line-Up Adjustments

The detector and oscillator line-up trimmer capacitors are adjusted by setting both the dial and an external oscillator first at 1400 K. C. and adjusting the tuning capacitor trimmer capacitors for maximum output, then changing the oscillator frequency and dial setting to 600 K. C. and adjusting the submounted trimmer capacitor for maximum output. The I. F. adjustments are made by adjusting the two trimmer capacitors located on the first I. F. transformer for maximum output when a 460 K. C. signal is connected between the control grid of the first detector and ground. Be sure and set the station selector at a point where no signal is being received when making I. F. adjustments.

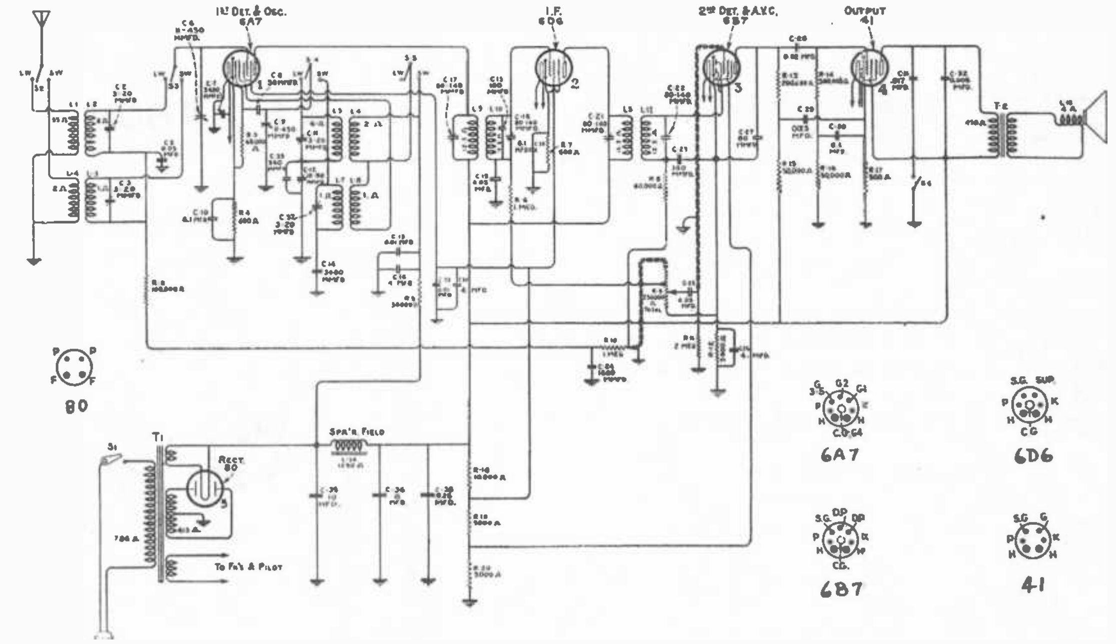
RADIOTRON SOCKET VOLTAGES

120 Volt, 60 Cycle Line—Maximum Volume Control Setting—No Signal

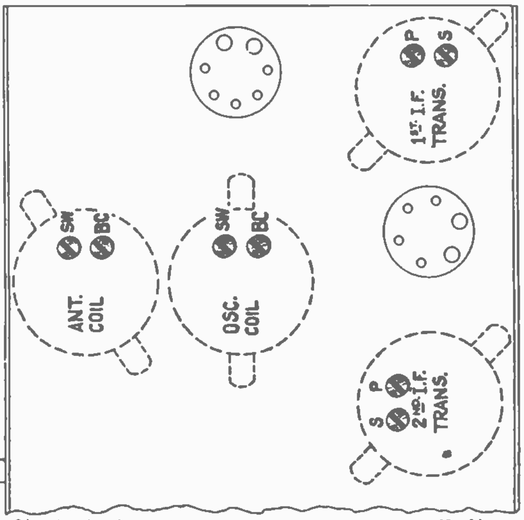
Radiotron No.		Cathode to Control Grid, Volts D. C.	Cathode to Screen Grid, Volts. D. C.	Cathode to Plate, Volts D. C.	Plate Current, M. A.	Heater or Filament, Volts
RCA-6A7	First Detector	1.25	70	235	2.5	6.3
	Oscillator	—	—	180	3.5	
RCA-6F7	I. F.	1.25	70	235	5.5	6.3
	Second Detector	19	—	145*	0.4	
RCA-41 Output		17	240	230	26.5	6.3
RCA-1-V Rectifier		—	—	335 RMS	50	6.3

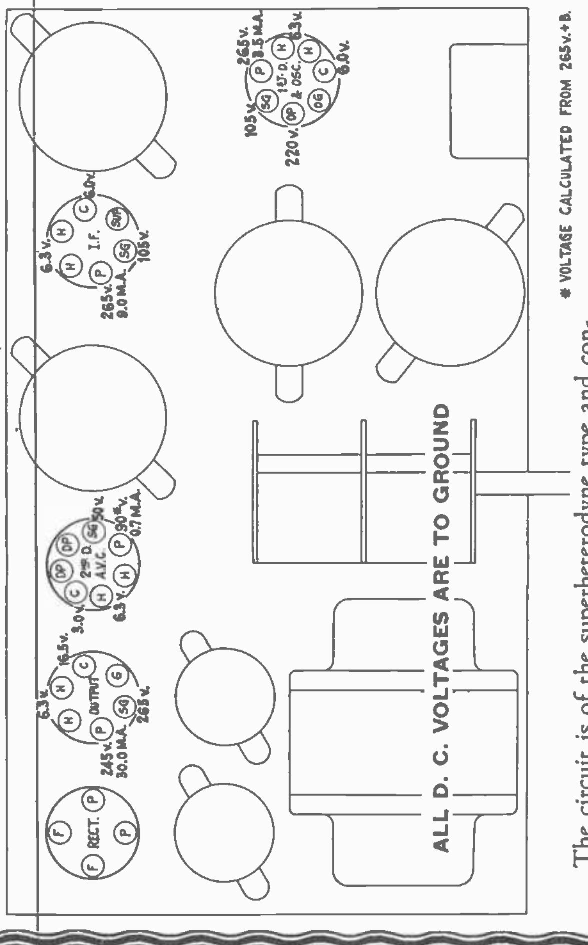
* Actual voltage cannot be measured with ordinary voltmeter.

GENERAL ELECTRIC CO.
MODEL M51 & M56



I.F. = 460 KC.





The circuit is of the superheterodyne type and consists of a combined oscillator and first detector, an I. F. stage, a combined second detector and automatic volume control and a Pentode output stage. An RCA-80 is used as a rectifier for providing grid and plate power to all other tubes.

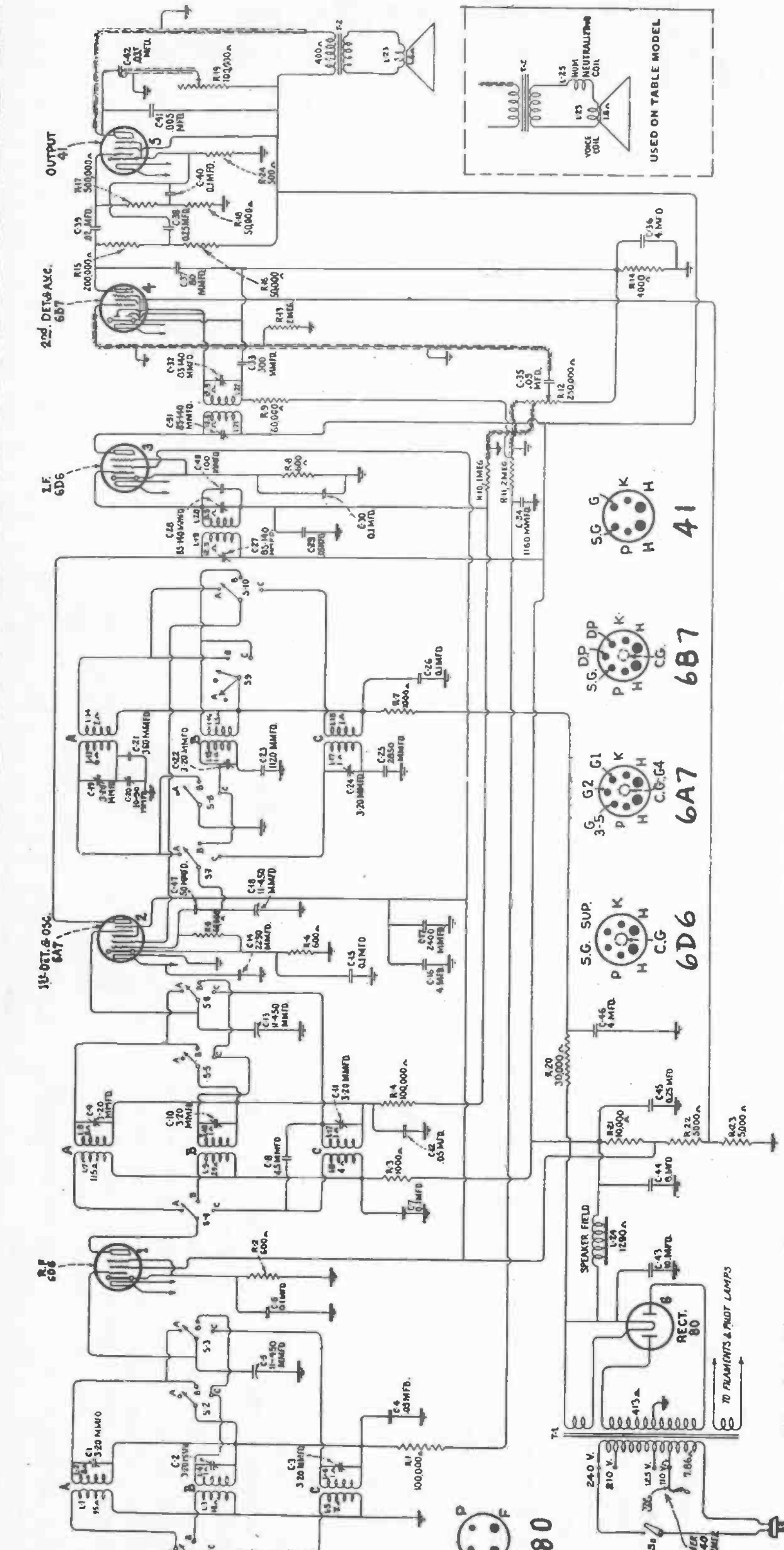
The signal enters the receiver through the antenna system and is applied through a tuned circuit to the grid of the first detector. Combined with the signal is the local oscillator signal, which is at a constant frequency difference (460 K. C. higher) throughout the tuning range. The combined signals after passing through the first detector produce the I. F. signal, which is 460 K. C.

The output of the I. F. amplifier is then applied to the diode sections of the RCA-6B7, which is a combined second detector, automatic volume control and A. F. amplifier. The direct current component of the rectified signal produces a voltage drop across resistor R-9. The full voltage drop constitutes the automatic bias voltage for the first detector while a tap is provided for the I. F. voltage. These automatic bias voltages for the detector and I. F. give the automatic volume control action of the receiver.

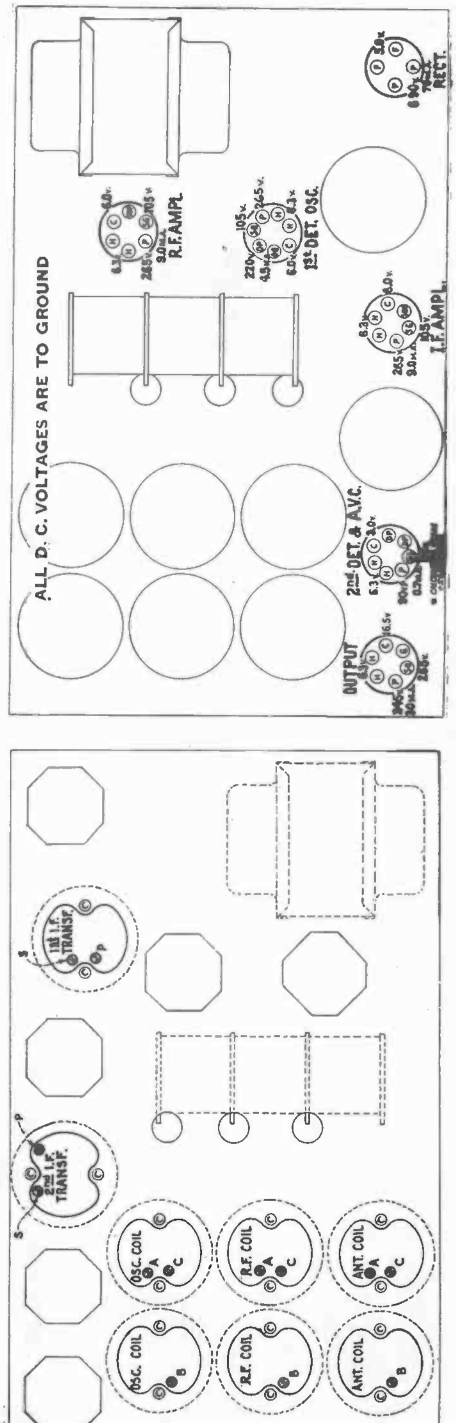
GENERAL ELECTRIC CO.

MODEL M61 & M67

I.F. = 460 KC.

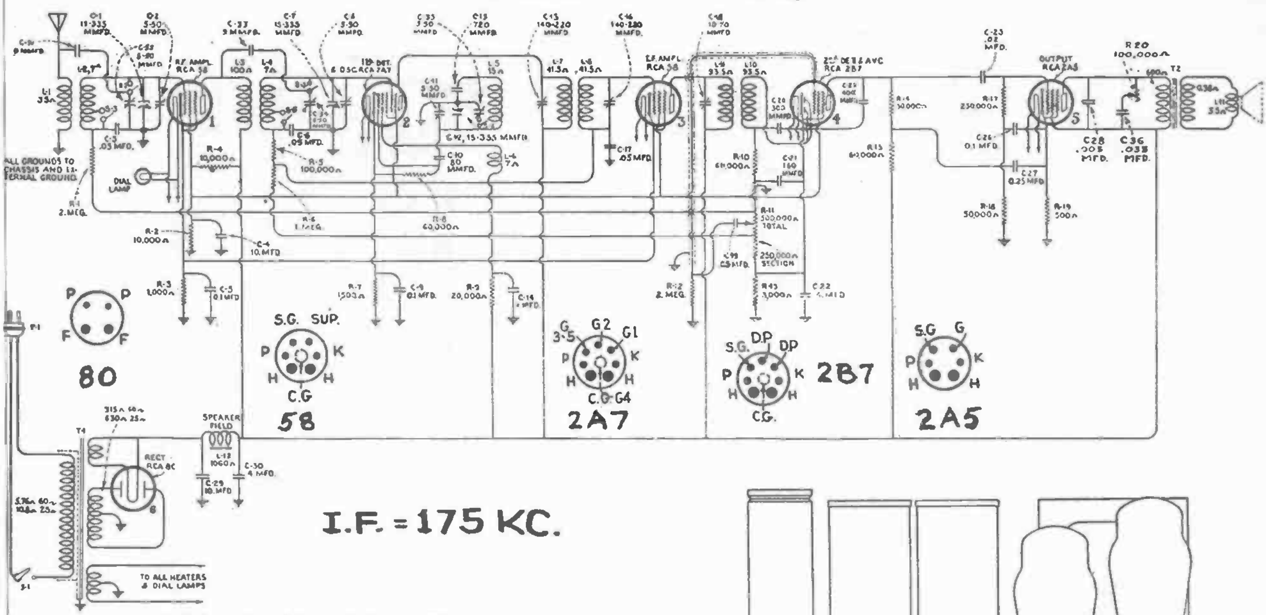


Line-Up Frequencies.........460 K. C., 600 K. C., 1720 K. C., 5160 K. C., 18,000 K. C.



GENERAL ELECTRIC CO.

MODEL M63



LINE-UP ADJUSTMENTS

I. F. Tuning Adjustments—Two transformers comprising three tuned circuits (the secondary of the second transformer is untuned) are used in the intermediate amplifier. These are tuned to 175 K. C. and the adjustment screws are accessible as shown in Figure D. Proceed as follows:

(a) Procure a modulated oscillator giving a signal at 175 K. C., a non-metallic screw driver such as Stock No. 7065 and an output meter.

(b) Short-circuit the antenna and ground terminals and tune the receiver so that no signal is heard. Set the volume control at maximum and connect a ground to the chassis.

(c) Connect the oscillator output between the first detector control grid and chassis ground. Connect the output meter across the voice coil of the loudspeaker and adjust the oscillator output so that with the receiver volume control at maximum, a slight deflection is obtained in the output meter.

(d) Adjust the primary of the second, and the secondary and primary of the first I. F. transformers until a maximum deflection is obtained. Keep the oscillator output at a low value so that only a slight deflection is obtained on the output meter at all times. Go over these adjustments a second time, as there is a slight interlocking of adjustments. This completes the I. F. adjustments.

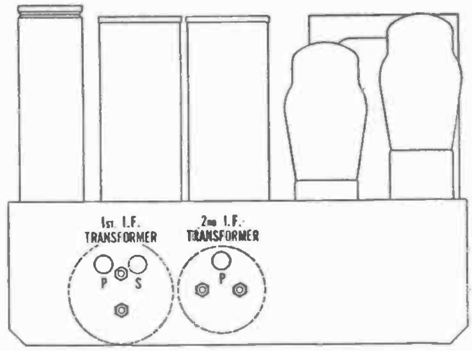


Figure D—Location of I. F. Line-up Adjustment Screws

R. F. and Oscillator Adjustments—The three gang capacitor screws are accessible at the bottom of the chassis. The high frequency capacitor screws are located on the Range Switch. Proceed as follows:

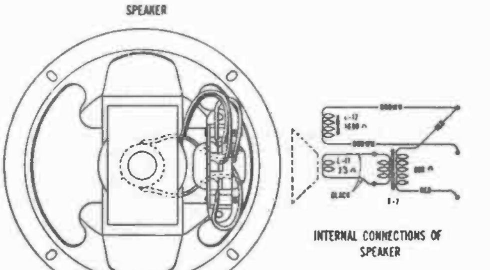
(a) Procure a modulated oscillator giving a signal at 1400 and 2440 K. C., a non-metallic screw driver such as Stock No. 7065 and an output meter.

(b) Connect the output of the oscillator to the antenna and ground terminals of the receiver. Check the dial at the extreme maximum position of the tuning capacitor. The indicator should be opposite the last division of the low frequency end of scale with the indicator at its center position. Then set the dial at 140, the oscillator at 1400 K. C. and connect the output meter across the cone coil. Adjust the oscillator output so that a slight deflection is obtained when the receiver volume control is at maximum.

(c) With the Range Switch at the counter-clockwise position, adjust the three tuning condenser line-up capacitors until maximum deflection is obtained in the output meter. Then shift the oscillator to 2440 K. C., the Range Switch to the clockwise position and the dial to 120. The three line-up capacitors located on the Range Switch should then be adjusted for maximum output.

When making both the I. F. and R. F. adjustments, the important points to remember are that the receiver volume control must be at its maximum position and that the input signal from the external oscillator must be no greater than necessary.

SPEAKER



INTERNAL CONNECTIONS OF SPEAKER

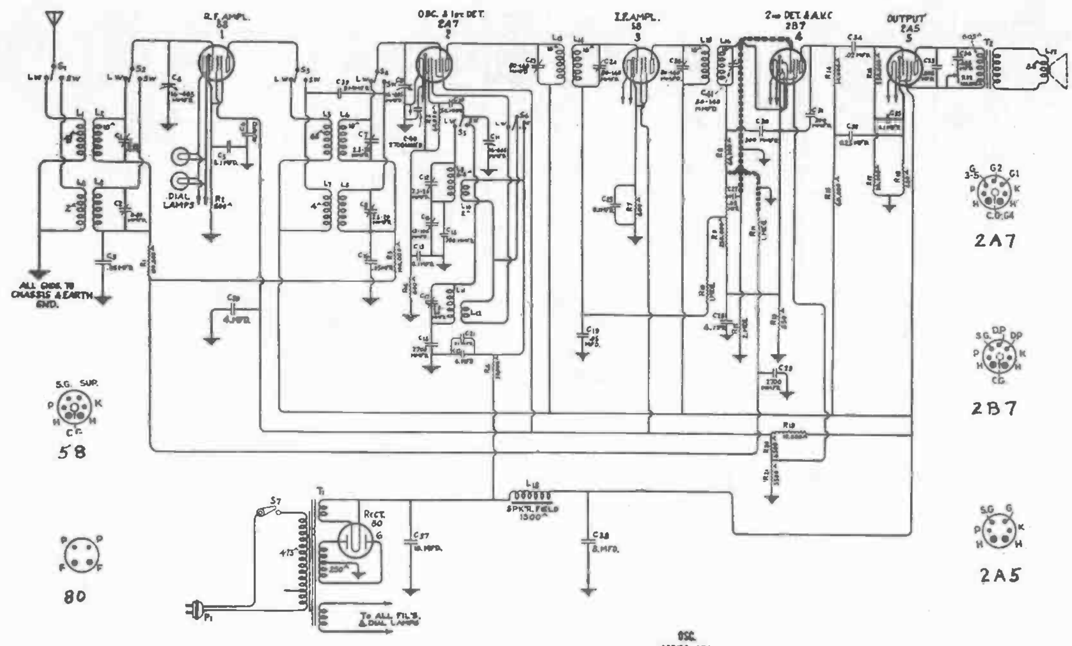
TUBE SOCKET VOLTAGES

115 Volts, A. C. Line—No Signal

Radiotron No.	Cathode to Control Grid, Volts	Cathode to Screen Grid, Volts	Cathode to Plate, Volts	Plate Current M. A.	Heater Volts
1. RCA-58 R. F.	4.0	95	255	5.0	2.31
2. RCA-2A7 1st Det. Osc.	5.0*	95*	255*	3.0*	2.31
3. RCA-58 I. F.	4.0	95	255	5.0	2.31
4. RCA-2B7 2nd Det. A. V. C.	7.5	92	60	2.0	2.31
5. RCA-2A5 Power	20.0	250	235	33.0	2.81
6. RCA-80 Rectifier	700–350 Volts—75 M. A. Total Current				4.82

*The voltages and current refer to the detector part of the tube. The total cathode current is 10 M. A.

GENERAL ELECTRIC CO.
MODEL M65



I. F. Tuning Adjustments—Two transformers comprising four tuned circuits are used in the intermediate amplifier. These are tuned to 370 K. C. and the adjustment screws are accessible as shown in Figure D. Proceed as follows:

(a) Short-circuit the antenna and ground terminals and tune the receive so that no signal is heard. Set the volume control at maximum and connect a ground to the chassis.

(b) Connect the test oscillator output between the first detector control grid and chassis ground. Connect the output meter across the voice coil of the loudspeaker and adjust the oscillator output so that, with the receiver volume control at maximum, a slight deflection is obtained in the output meter.

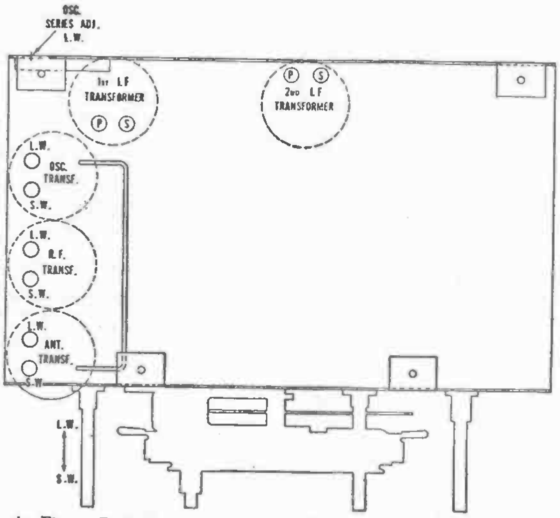
(c) Adjust the secondary and primary of the first and then the second I. F. transformers until a maximum deflection is obtained. Keep the oscillator output at a low value so that only a slight deflection is obtained on the output meter at all times. Go over these adjustments a second time, as there is a slight interlocking of adjustments. This completes the I. F. adjustments.

R. F. and Oscillator Adjustments—The R. F. line-up capacitors are located at the bottom of the coil assemblies instead of their usual position on the gang capacitor. They are all accessible from the bottom of the chassis except the 600 K. C. series capacitor, which is accessible from the rear of the chassis. Proceed as follows:

(a) Connect the output of the oscillator to the antenna and ground terminals of the receiver. Check the position of the indicator pointer when the tuning capacitor plates are fully meshed. It should be coincident with the radial line adjacent to the dial reading of 540. Then set the Test Oscillator at 1400 K. C., the dial indicator at 1400 and the oscillator output so that a slight deflection will be obtained in the output meter when the volume control is at its maximum position.

(b) With the Range Switch at the "in" position, adjust the three trimmers under the three R. F. coils, designated as L. W. in Figure D, until a maximum deflection is obtained in the output meter. Then shift the Test Oscillator frequency to 600 K. C. The trimmer capacitor, accessible from the rear of the chassis, should now be adjusted for maximum output while rocking the main tuning capacitor back and forth through the signal. Then repeat the 1400 K. C. adjustment.

(c) Now place the Range Switch at the "out" position, shift the Test Oscillator to 15,000 K. C. and set the dial at 15 on the megacycle scale. Adjust the three trimmer capacitors designated as S. W.



in Figure D for maximum output, beginning with the oscillator trimmer. It will be noted that the oscillator and first detector trimmers will have two positions at which the signal will give maximum output. The position which uses the lower trimmer capacitance, obtained by turning the screw counter-clockwise, is the proper adjustment for the oscillator, while the position that uses a higher capacitance is correct for the detector. *Both of these adjustments must be made as indicated irrespective of output.* The R. F. is merely peaked. In conjunction with the detector adjustment, it is necessary to rock the main tuning capacitor back and forth while making the adjustment. This completes the line-up adjustments.

The important points to remember are the need for using the minimum oscillator output to obtain a deflection in the output meter with the volume control at its maximum position and the manner of obtaining the proper high frequency oscillator and detector adjustments.

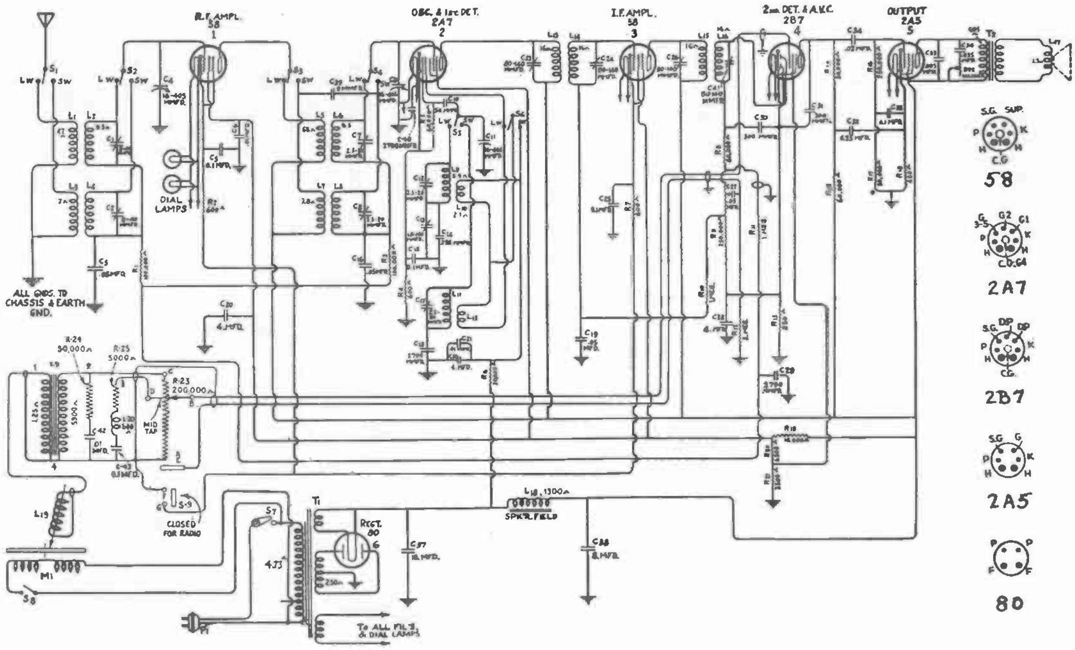
TUBE SOCKET VOLTAGES

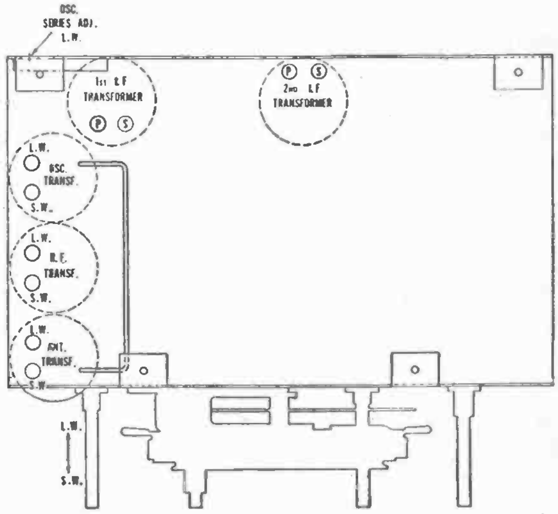
115 Volts, A. C. Line—No Signal

Type No.	Cathode to Control Grid, Volts	Cathode to Screen Grid, Volts	Cathode to Plate, Volts	Plate Current M. A.	Heater Volts
1. RCA-58 R. F.	3.0	100	265	6.0	2.42
2. RCA-2A7 1st Det. Osc.	3.0	100*	265*	2.0*	2.42
3. RCA-58 I. F.	3.0	100	265	6.0	2.42
4. RCA-2B7 2nd Det. A. V. C.	1.5	35	100	1.5	2.42
5. RCA-2A5 Power	16.0	255	240	35.0	2.42
6. RCA-80 Rectifier	725 Volts R. M. S.—75 M. A. Total Current				4.80

* The voltages and current refer to the detector part of the tube.

GENERAL ELECTRIC CO.
MODEL M68





I. F. Tuning Adjustments—Two transformers comprising four tuned circuits are used in the intermediate amplifier. These are tuned to 370 K. C. and the adjustment screws are accessible as shown in Figure D. Proceed as follows:

(a) Short-circuit the antenna and ground terminals and tune the receiver so that no signal is heard. Set the volume control at maximum and connect a ground to the chassis.

(b) Connect the test oscillator output between the first detector control grid, and chassis ground. Connect the output meter across the voice coil of the loudspeaker and adjust the oscillator output so that, with the receiver volume control at maximum, a slight deflection is obtained in the output meter.

(c) Adjust the secondary and primary of the first and then the second I. F. transformers until a maximum deflection is obtained. Keep the oscillator output at a low value so that only a slight deflection is obtained on the output meter at all times. Go over these adjustments a second time, as there is a slight interlocking of adjustments. This completes the I. F. adjustments.

R. F. and Oscillator Adjustments—The R. F. line-up capacitors are located at the bottom of the coil assemblies instead of their usual position on the gang capacitor. They are all accessible from the bottom of the chassis except the 600 K. C. series capacitor, which is accessible from the rear of the chassis. Proceed as follows:

(a) Connect the output of the oscillator to the antenna and ground terminals of the receiver. Check the position of the indicator pointer when the tuning capacitor plates are fully meshed. It should be coincident with the radial line adjacent to the dial reading of 540. Then set the Test Oscillator at 1400 K. C., the dial indicator at 1400 and the oscillator output so that a slight deflection will be obtained in the output meter when the volume control is at its maximum position.

(b) With the Range Switch at the "in" position, adjust the three trimmers under the three R. F. coils designated as L. W. in Figure D, until a maximum deflection is obtained in the output meter. Then shift the Test Oscillator frequency to 600 K. C. The trimmer capacitor accessible from the rear of the chassis should now be adjusted for maximum output while rocking the main tuning capacitor back and forth through the signal. Then repeat the 1400 K. C. adjustment.

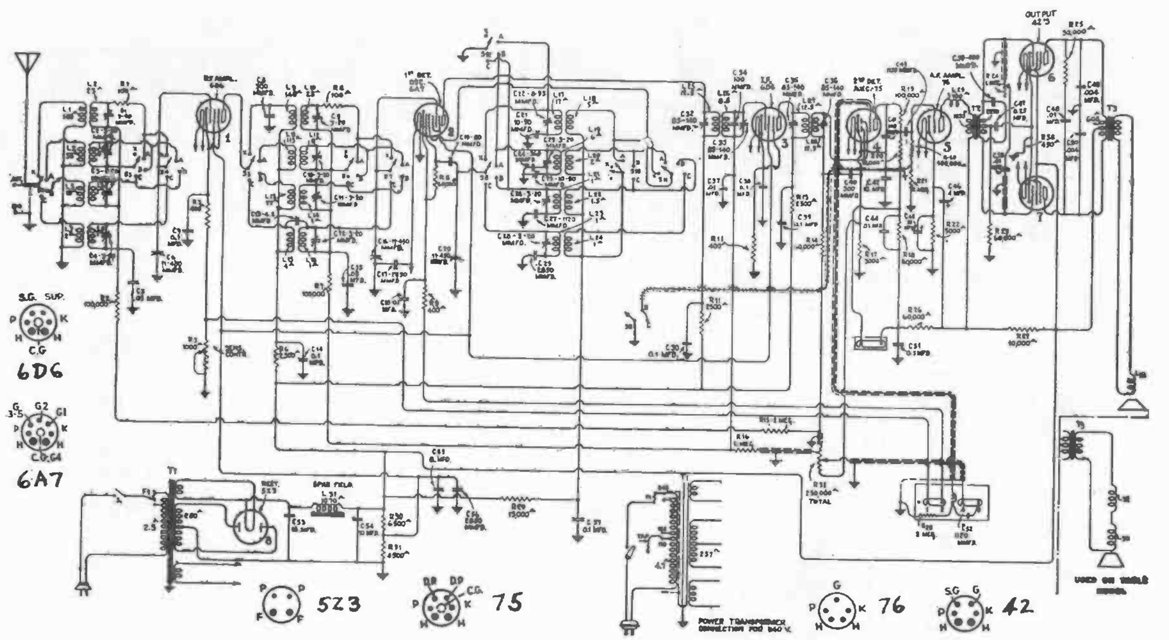
(c) Now place the Range Switch at the "out" position, shift the Test Oscillator to 15,000 K. C. and set the dial at 15 on megacycle scale. Adjust the three trimmer capacitors designated as S.W. in Figure D for a peak, beginning with the oscillator trimmer. It will be noted that the oscillator and first detector trimmers will have two peaks. The position which uses the lower trimmer capacitance, obtained by turning the screw counter-clockwise, is the proper adjustment for the oscillator while the position that uses a higher capacitance is correct for the detector. *Both of these adjustments must be made as indicated irrespective of output.* The R. F. is merely peaked. In conjunction with the detector adjustment, it is necessary to rock the main tuning capacitor back and forth while making the adjustment. This completes the line-up adjustments.

TUBE SOCKET VOLTAGES (RADIO OPERATION)
115 VOLTS, A. C. Line—No Signal

Radiotron No.	Cathode to Control Grid, Volts	Cathode to Screen Grid, Volts	Cathode to Plate, Volts	Plate Current M. A.	Heater Volts
1. RCA-58 R. F.	3.0	100	265	6.0	2.32
2. RCA-2A7 1st Det. Osc.	3.0	100*	265*	2.0*	2.32
3. RCA-58 I. F.	3.0	100	265	6.0	2.32
4. RCA-2B7 2nd Det. A. V. C.	1.5	35	100	1.5	2.32
5. RCA-2A5 Power	16.0	255	240	35.0	2.32
6. RCA-80 Rectifier	725 Volts R. M. S.—75 M. A. Total Current				4.80

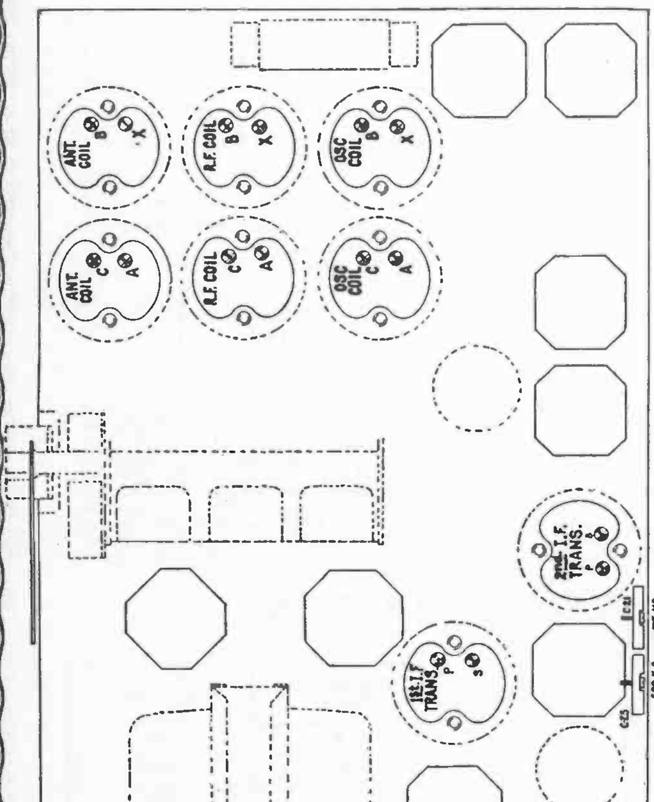
* The voltages and current refer to the detector part of the tube.

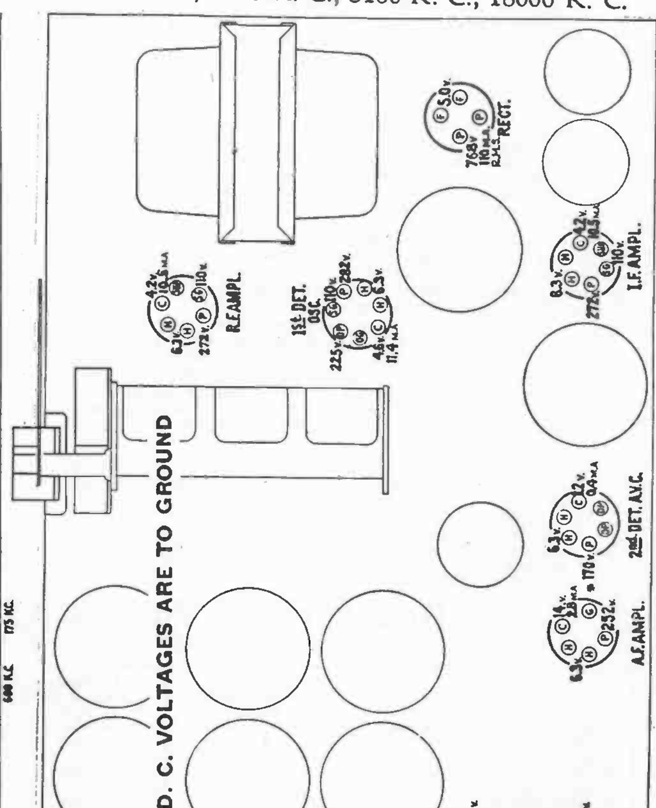
GENERAL ELECTRIC CO.
MODEL M-81 & M86



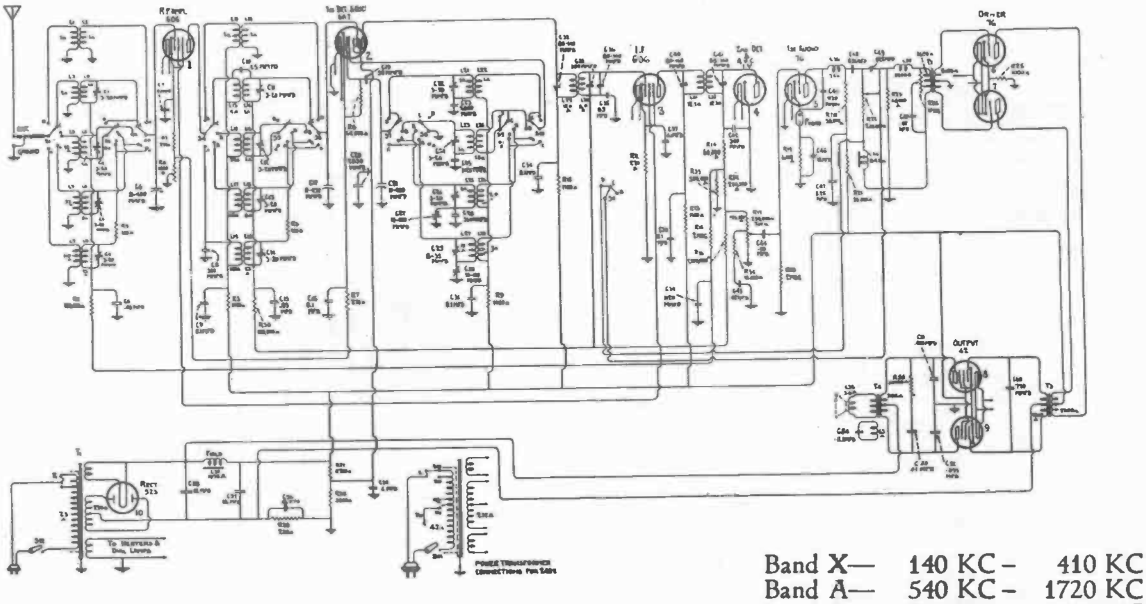
Tuning Frequency Range .... Band X— 140 K. C.– 410 K. C.
Band A— 540 K. C.– 1720 K. C.
Band B—1720 K. C.– 5400 K. C.
Band C—5400 K. C.–18000 K. C.

Line-up Frequencies......175 K. C., 410 K. C., 460 K. C., 600 K. C., 1720 K. C., 5160 K. C., 18000 K. C.



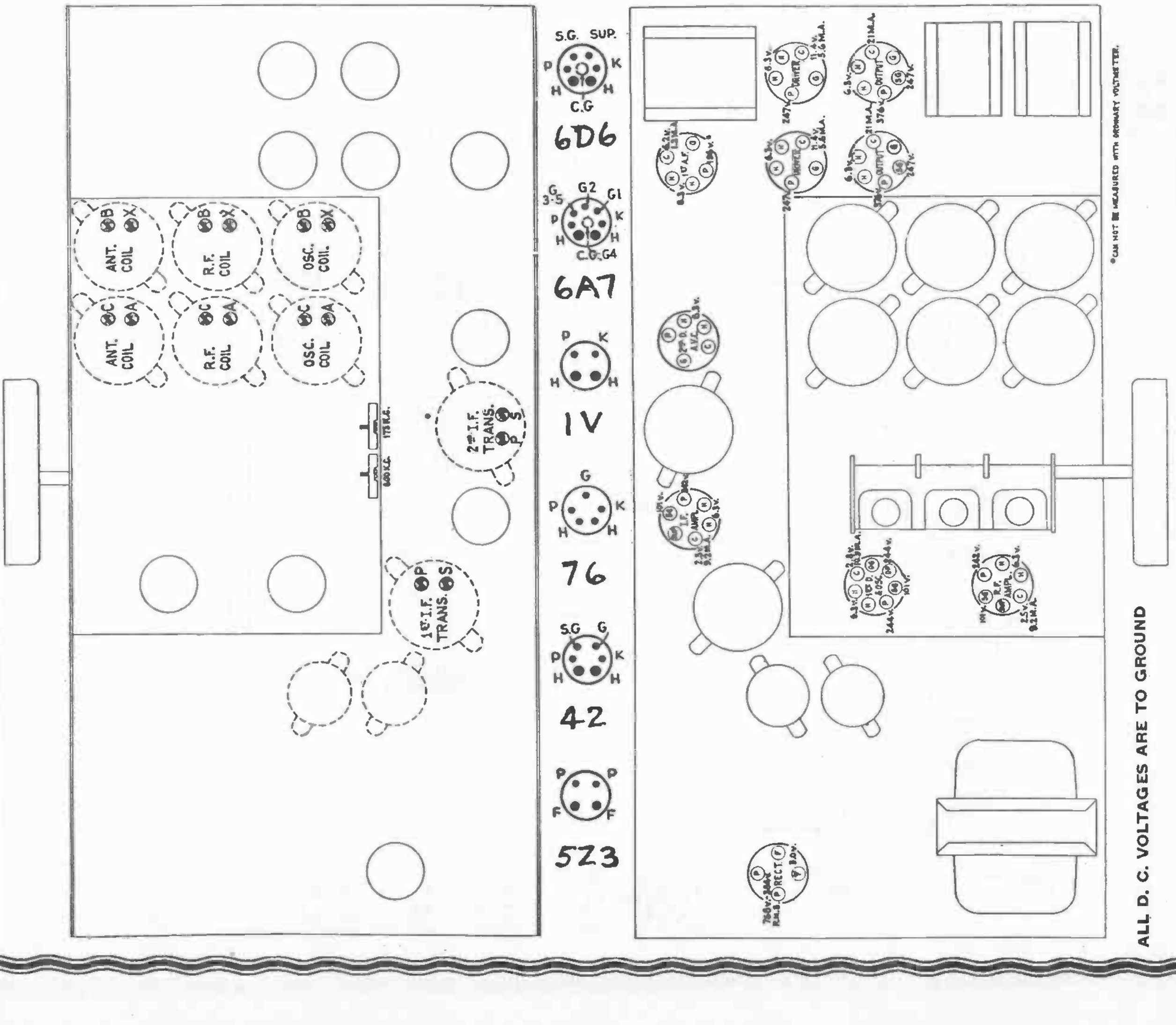


GENERAL ELECTRIC CO.
MODEL M 106



Band X— 140 KC - 410 KC
Band A— 540 KC - 1720 KC
Band B— 1720 KC - 5400 KC
Band C— 5400 KC - 18,000 KC
Band D—18,000 KC - 36,000 KC

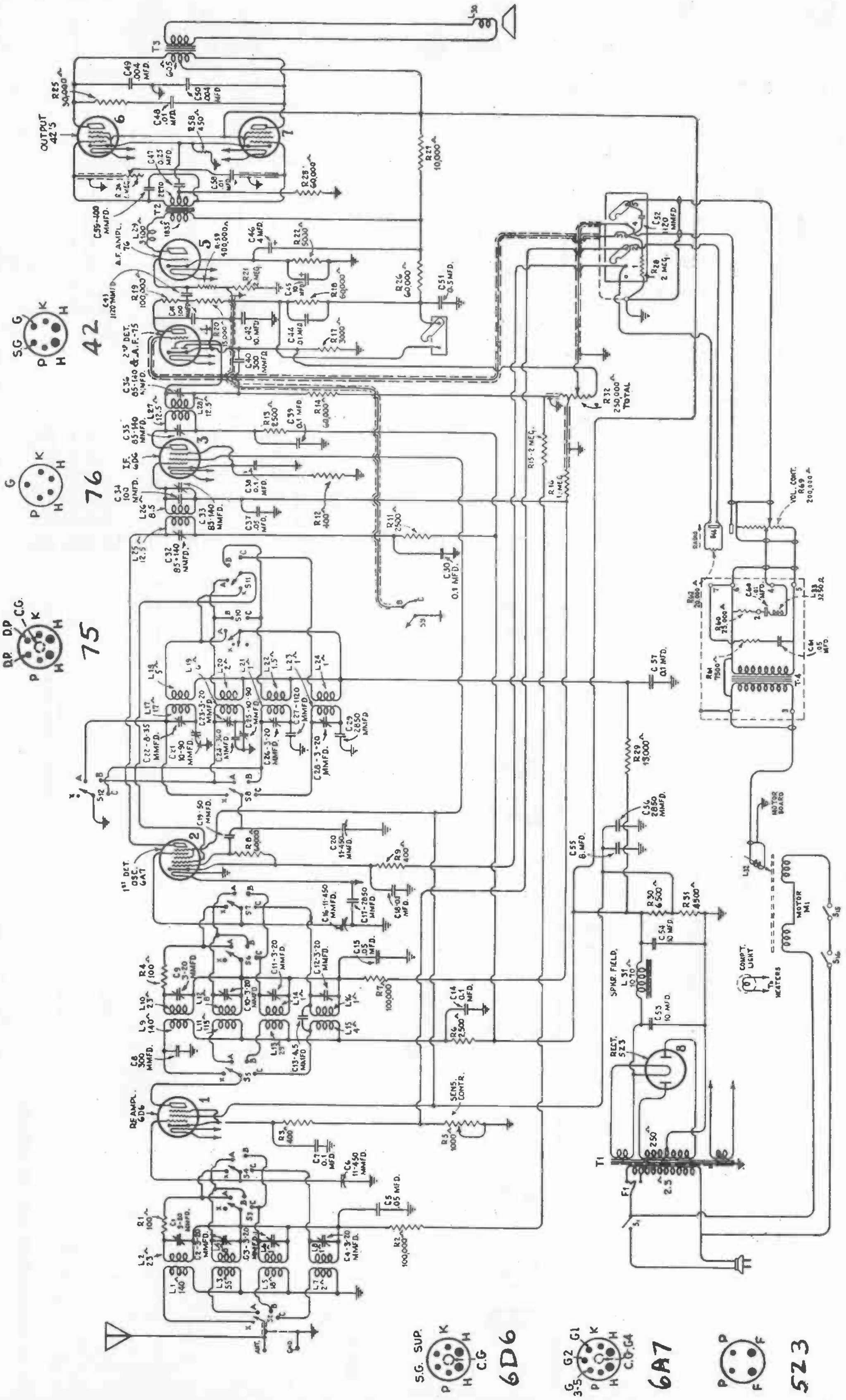
Line-up Frequencies....................175 KC, 410 KC, 460 KC, 600 KC, 1720 KC, 5160 KC, 18,000 KC



GENERAL ELECTRIC CO.

MODEL LM89

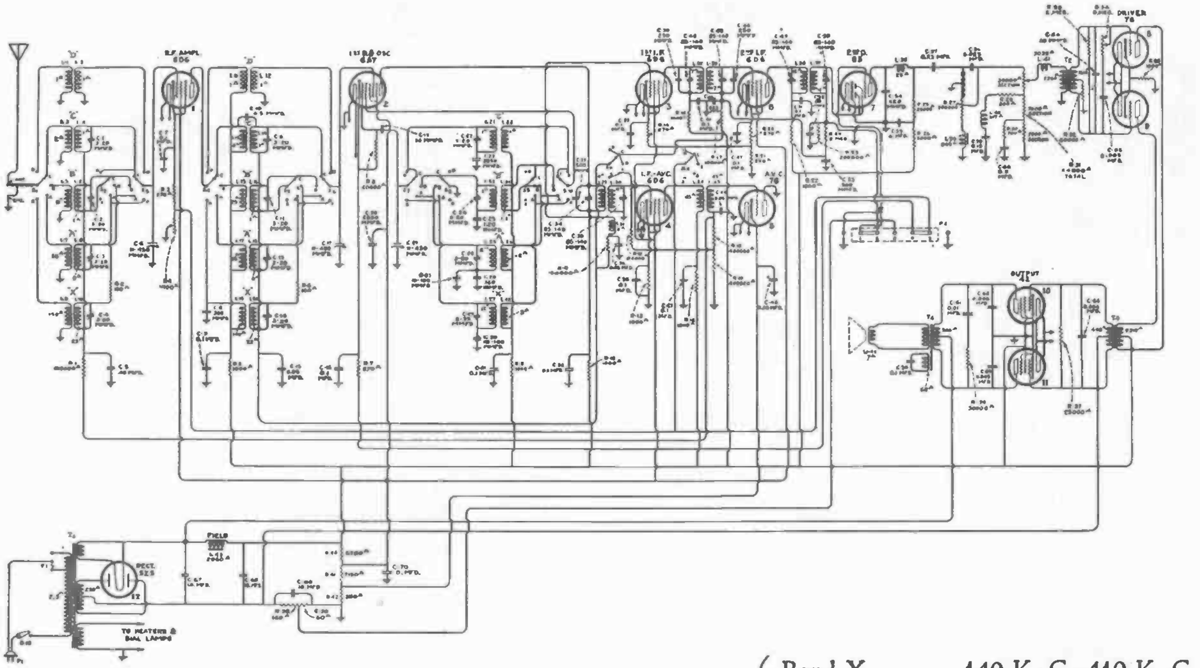
I.F. = 460 KC.



Tuning Frequency Range ......
Band X— 140 K. C.– 410 K. C.
Band A— 540 K. C.– 1720 K. C.
Band B—1720 K. C.– 5400 K. C.
Band C—5400 K. C.–18,000 K. C.

Line-up Frequencies ......175 K. C., 410 K. C., 460 K. C., 600 K. C., 1720 K. C., 5160 K. C., 18,000 K. C.

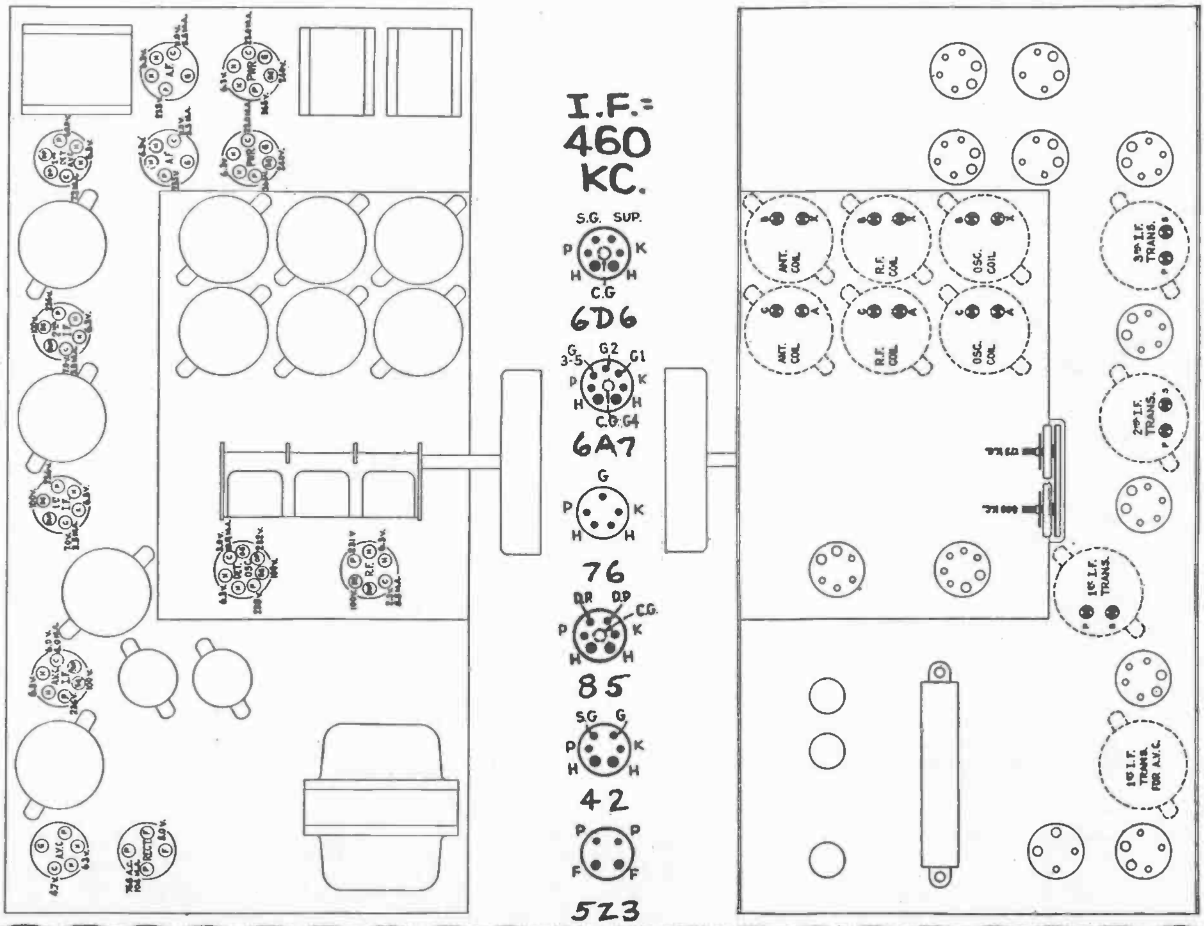
GENERAL ELECTRIC CO.
MODEL M-125



Tuning Frequency Range..

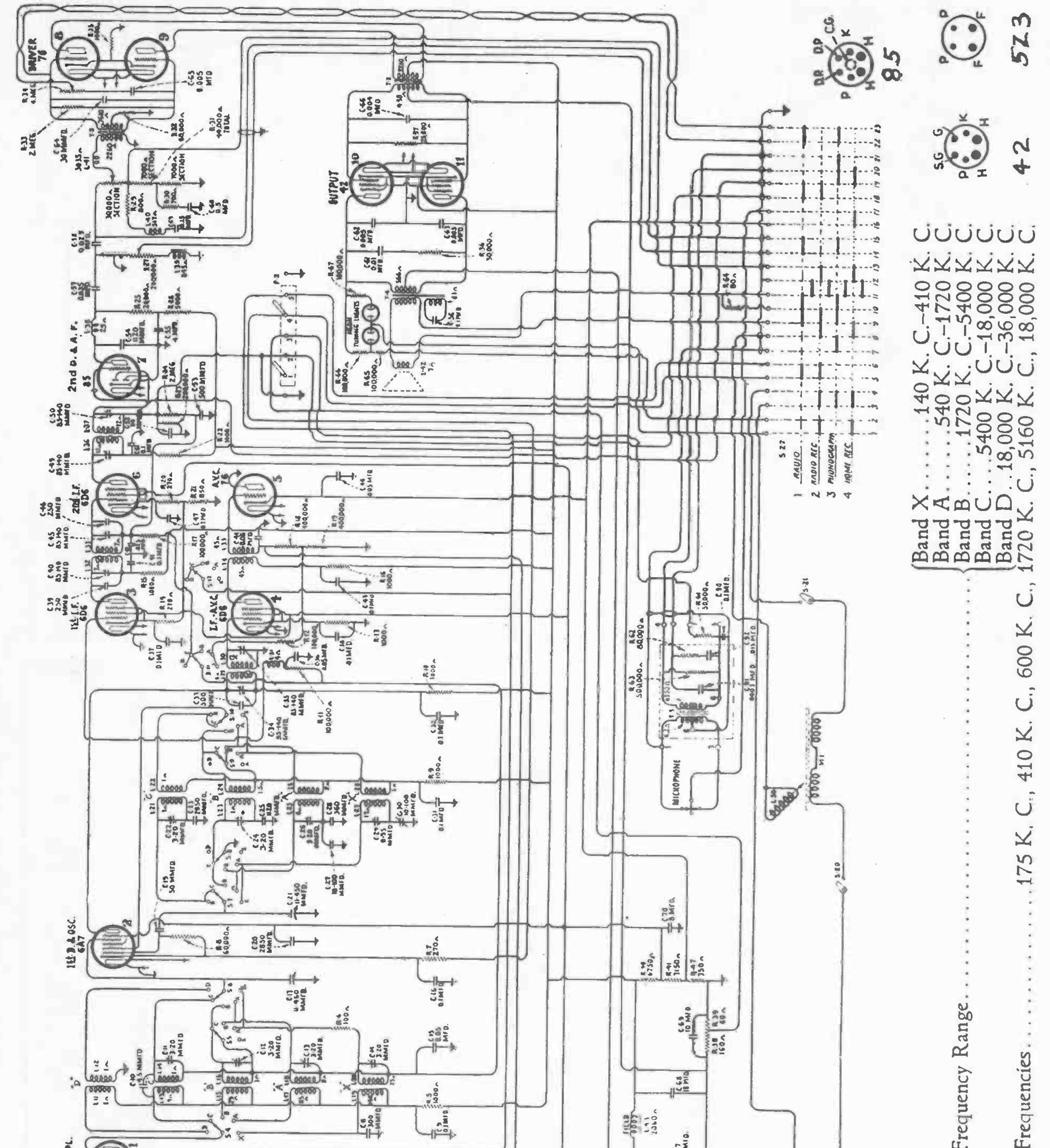
- Band X........140 K. C.–410 K. C.
- Band A......540 K. C.–1720 K. C.
- Band B......1720 K. C.–5400 K. C.
- Band C....5400 K. C.–18,000 K. C.
- Band D..18,000 K. C.–36,000 K. C.

Line-up Frequencies.......175 K. C., 410 K. C., 460 K. C., 600 K. C., 1720 K. C., 5160 K. C., 18,000 K. C.



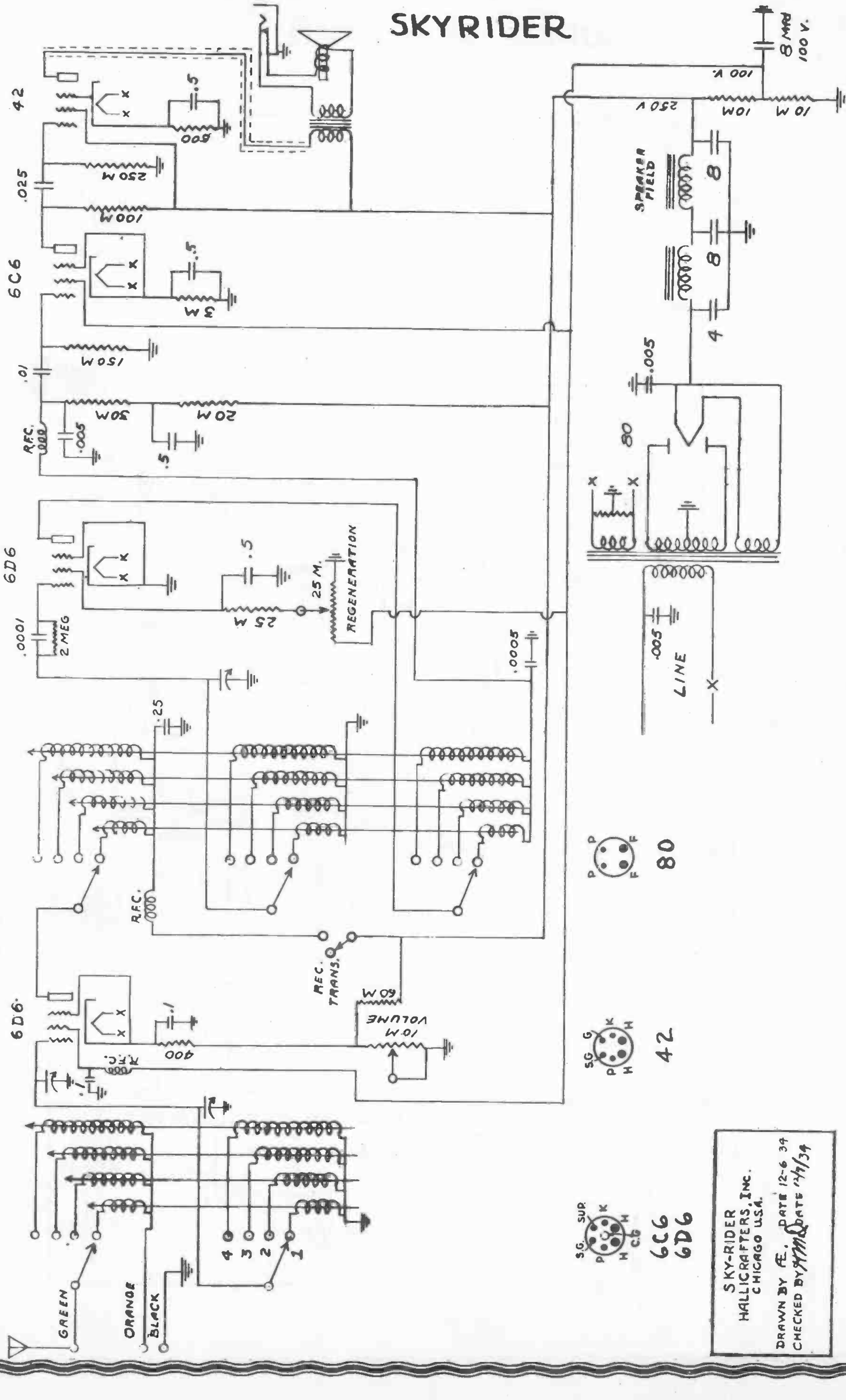
GENERAL ELECTRIC CO.

MODEL M-129



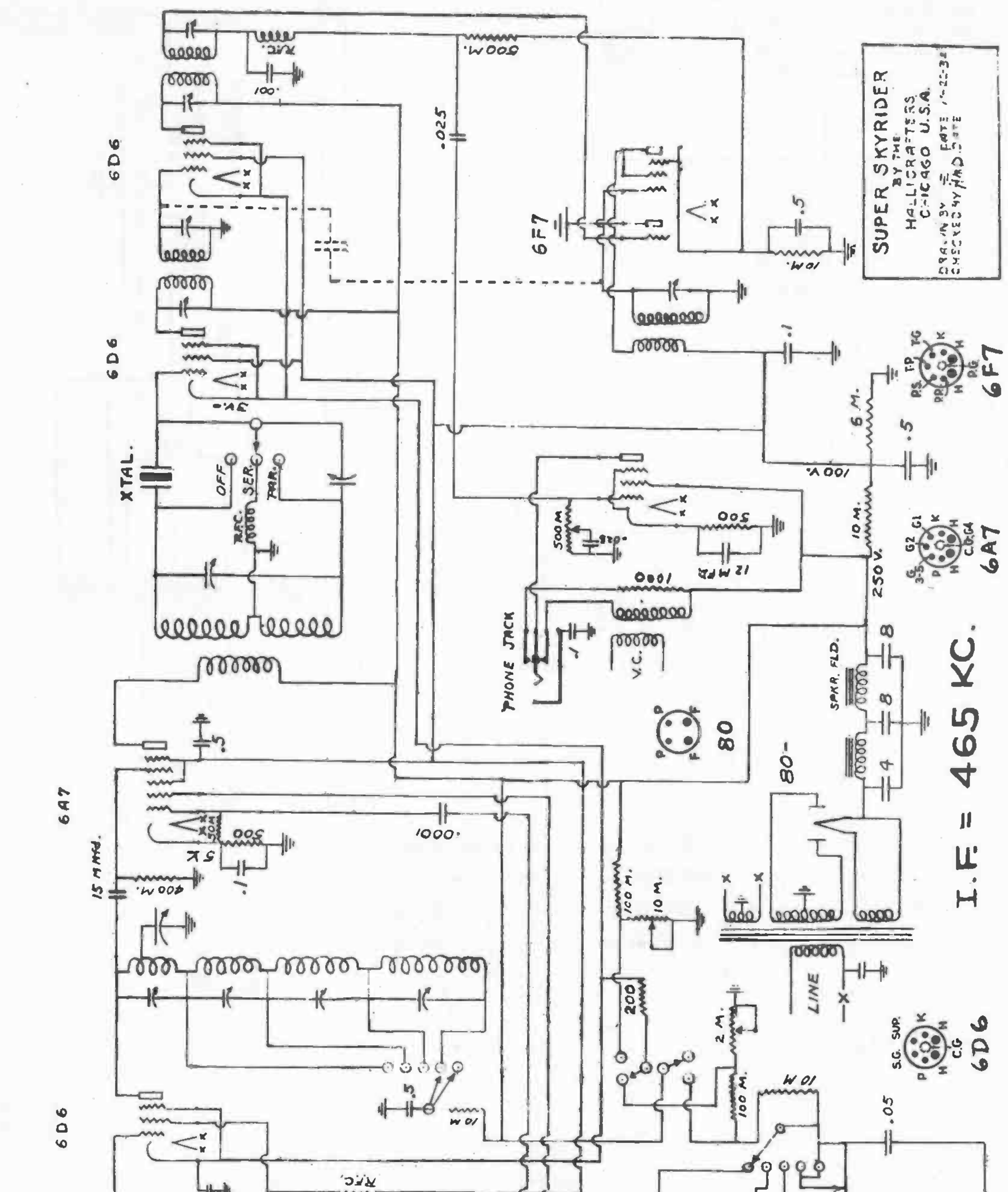
HALLICRAFTERS, INC.

SKYRIDER

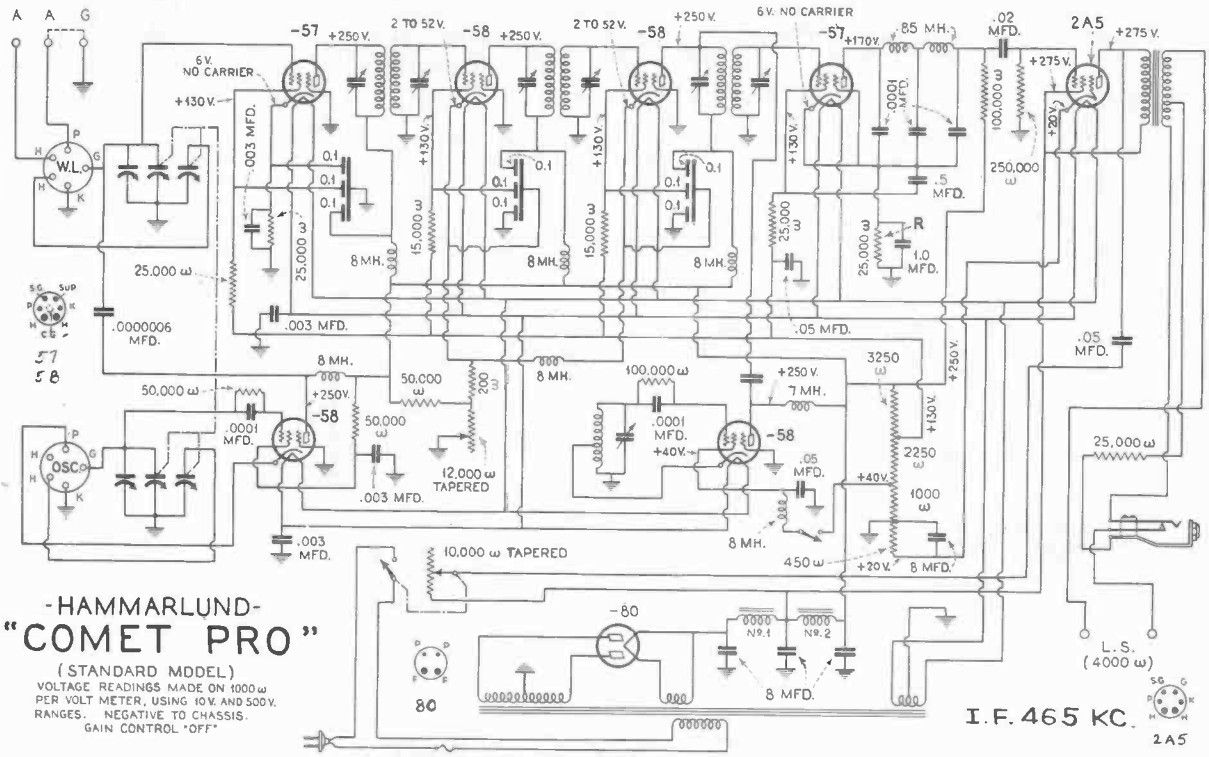


HALLICRAFTERS, INC.

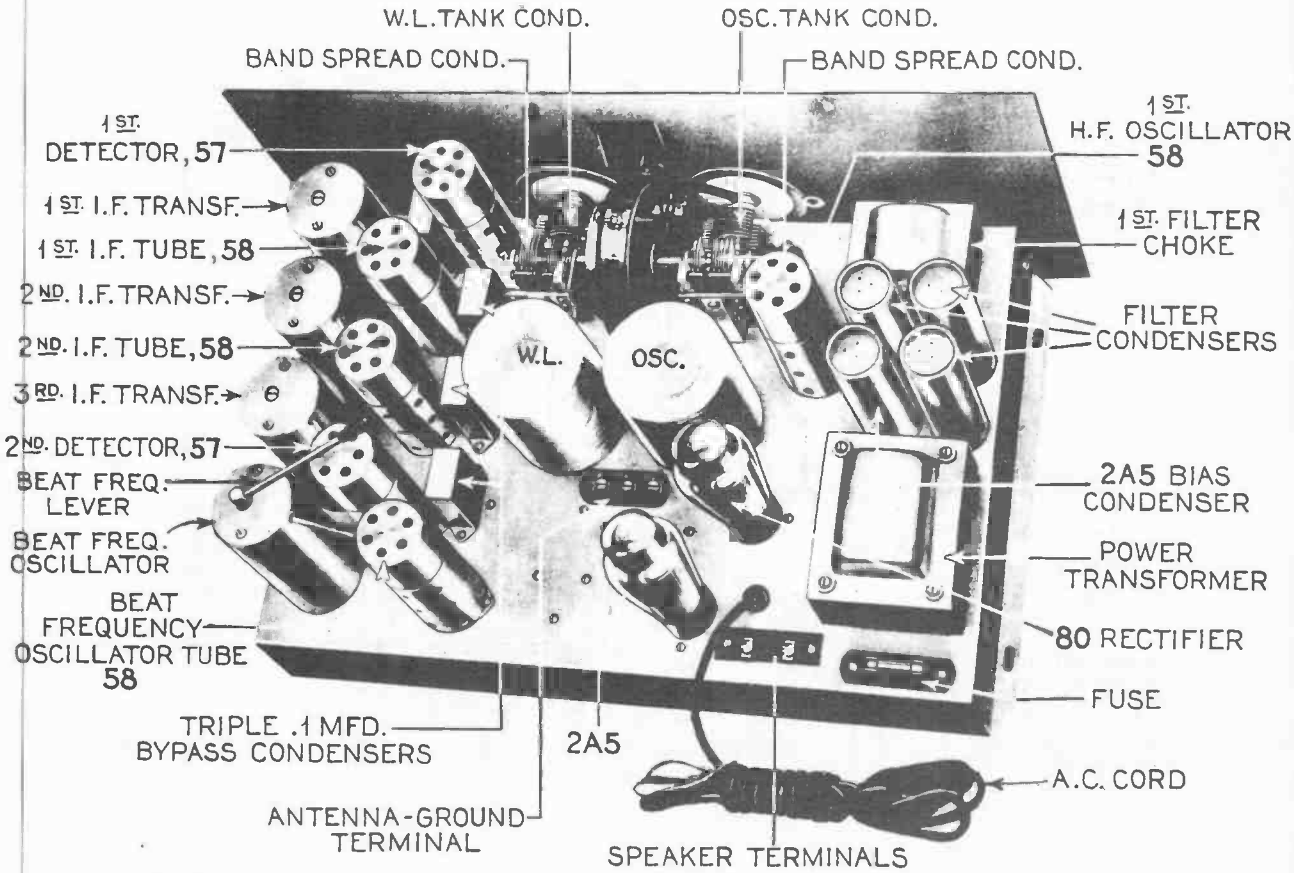
SUPER SKYRIDER



HAMMARLUND MFG. CO.
COMET "PRO" (STANDARD)

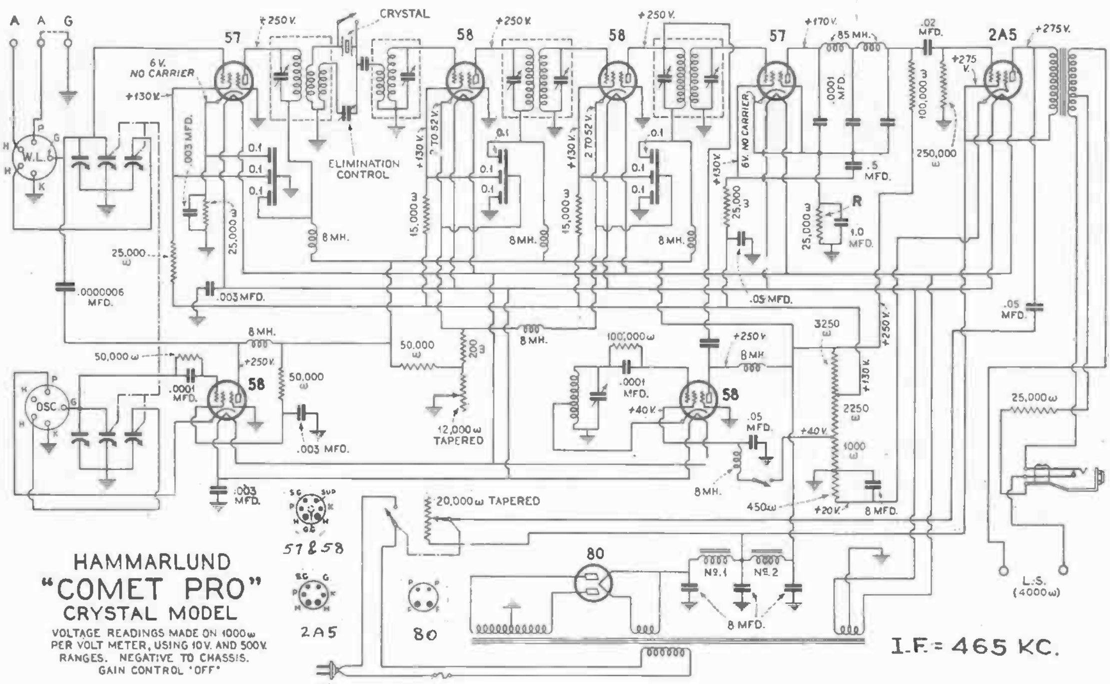


-HAMMARLUND-
"COMET PRO"
(STANDARD MODEL)
VOLTAGE READINGS MADE ON 1000 ω PER VOLT METER, USING 10 V. AND 500 V. RANGES. NEGATIVE TO CHASSIS. GAIN CONTROL "OFF"



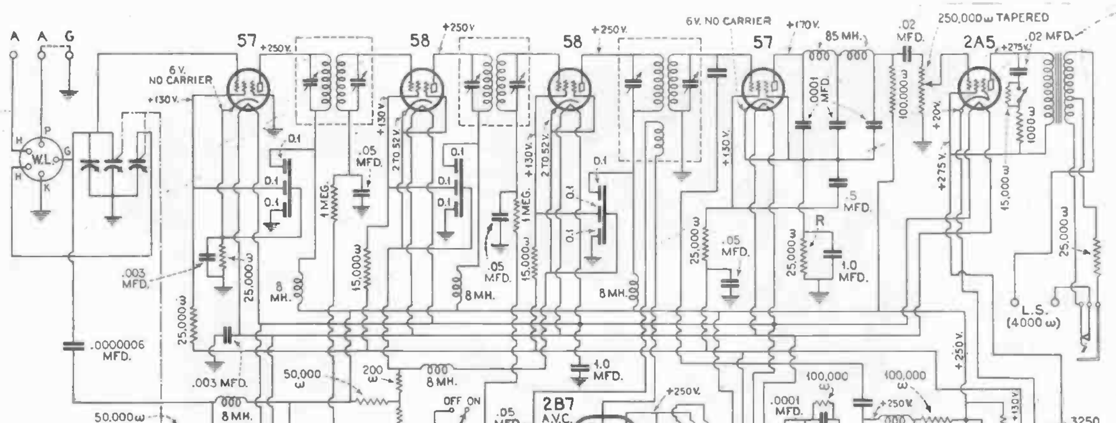
HAMMARLUND MFG. CO.

COMET "PRO" CRYSTAL MODEL



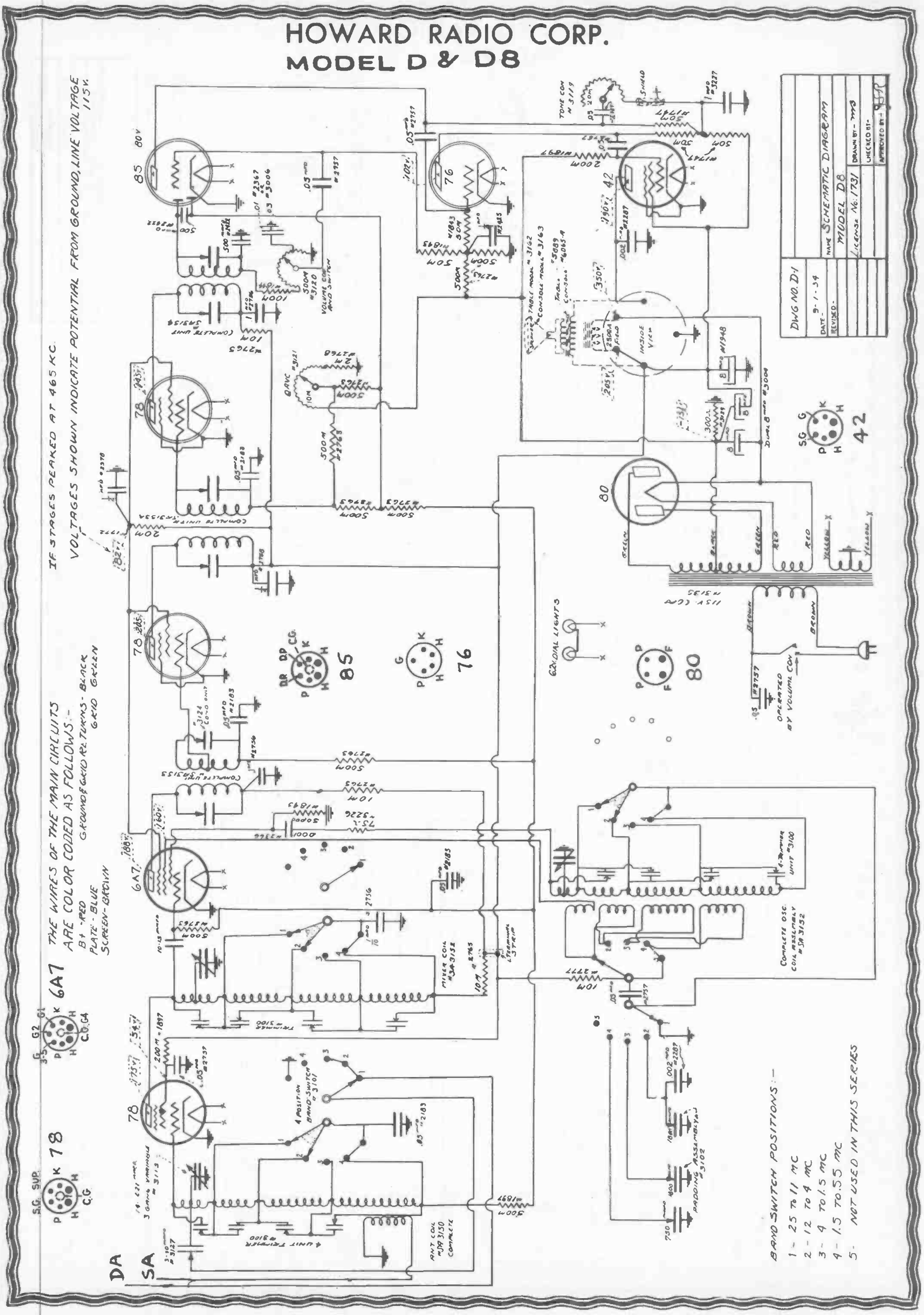
HAMMARLUND
"COMET PRO"
CRYSTAL MODEL
VOLTAGE READINGS MADE ON 1000 ω PER VOLT METER, USING 10 V. AND 500 V. RANGES. NEGATIVE TO CHASSIS. GAIN CONTROL "OFF"

COMET "PRO" A.V.C. MODEL

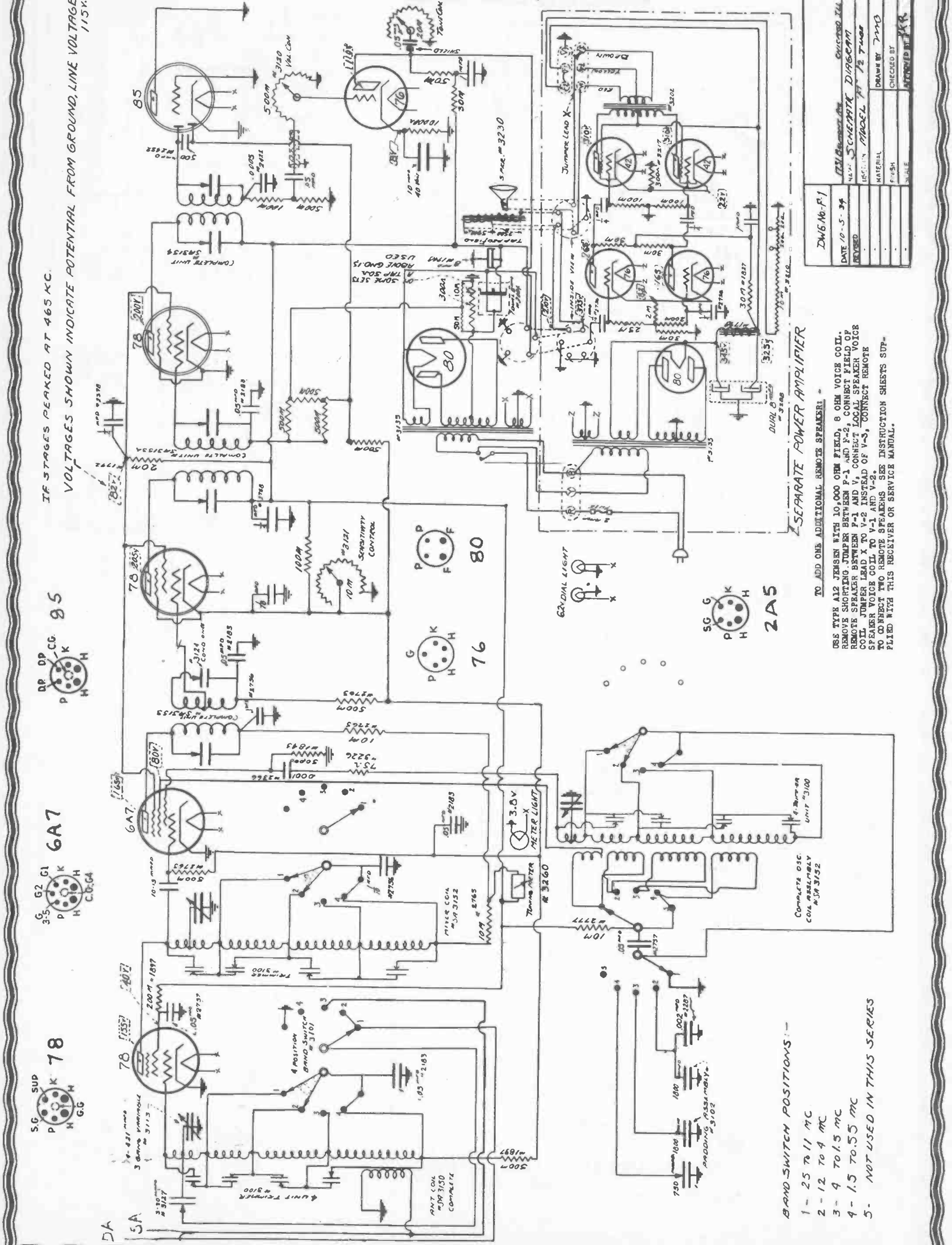


HAMMARLUND
"COMET PRO"
A.V.C. MODEL
VOLTAGE READINGS MADE ON 1000 ω PER VOLT METER, USING 10 V. AND 500 V. RANGES. NEGATIVE TO CHASSIS. GAIN CONTROL "OFF"

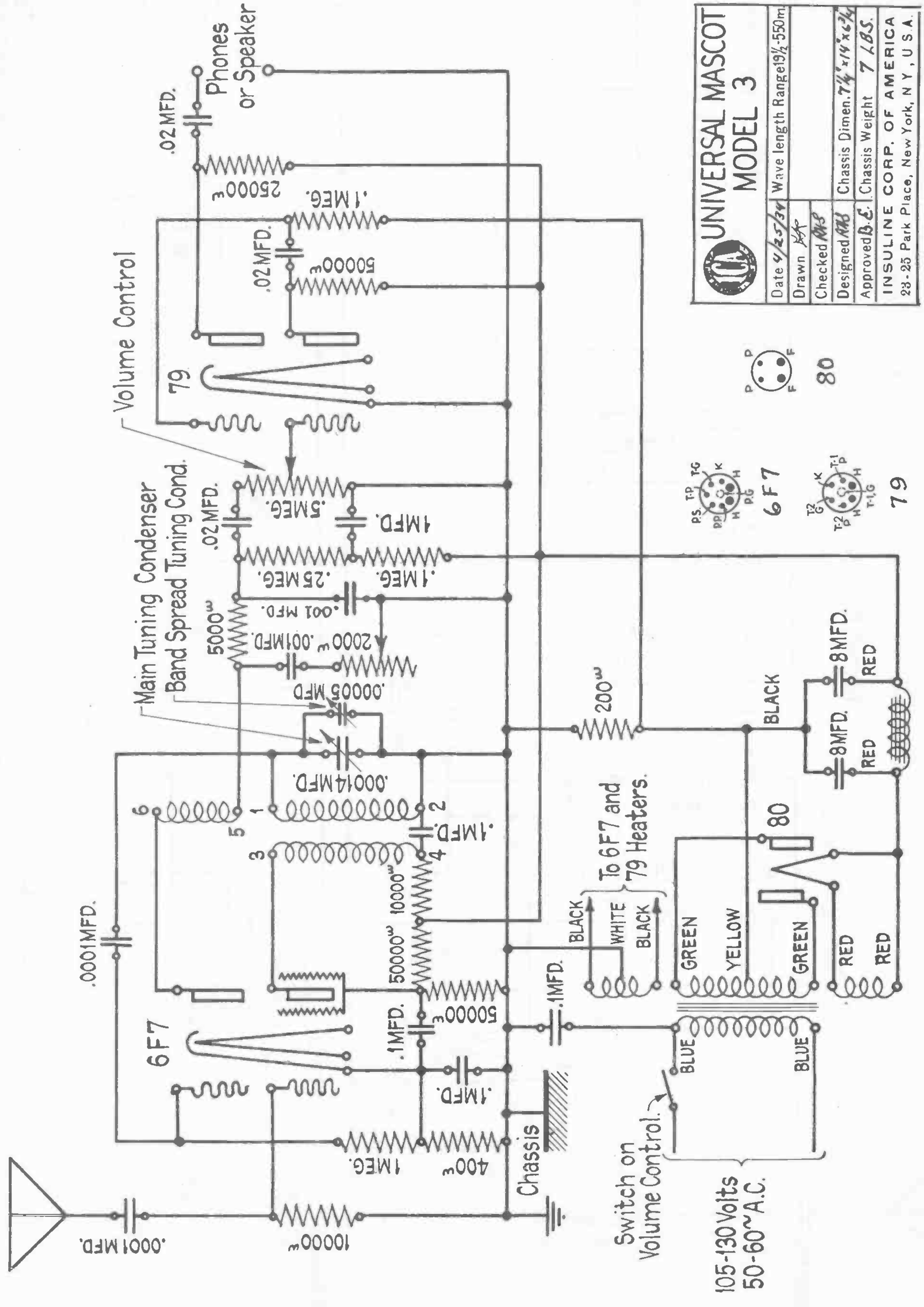
DECEMBER, 1933


HOWARD RADIO CORP.
MODEL D & D8
IF STAGES PEAKED AT 465 KC.
VOLTAGES SHOWN INDICATE POTENTIAL FROM GROUND, LINE VOLTAGE 115V.
THE WIRES OF THE MAIN CIRCUITS ARE COLOR CODED AS FOLLOWS:-
B+ - RED
PLATE - BLUE
SCREEN - BROWN
GROUND OF GRID RETURNS - BLACK
GRID GREEN
BAND SWITCH POSITIONS:-
1 - 25 TO 11 MC
2 - 12 TO 4 MC
3 - 4 TO 1.5 MC
4 - 1.5 TO .55 MC
5 - NOT USED IN THIS SERIES
DWG NO. D-1
DATE - 9-1-34
NAME SCHEMATIC DIAGRAM MODEL D8
LICENSE No. 1731
DRAWN BY
CHECKED BY
APPROVED BY
78
6A7
85
76
42
80
DA
SA
62 DIAL LIGHTS
OPERATED BY VOLUME CON.
COMPLETE OSC. COIL ASSEMBLY #SA 3152
PADDING ASSEMBLY #3102
ANT. COIL #SA 3150 COMPLETE
4 UNIT TRIMMER #3100
3 GANG VARIABLE #3113
MIXER COIL #SA 3132
4 POSITION BAND SWITCH #3101
TERMINAL STRIP
VOLUME CON. AND SWITCH #3120
TONE CON. #3119
QAVC
INSIDE VIEW

HOWARD RADIO CORP.
MODEL F

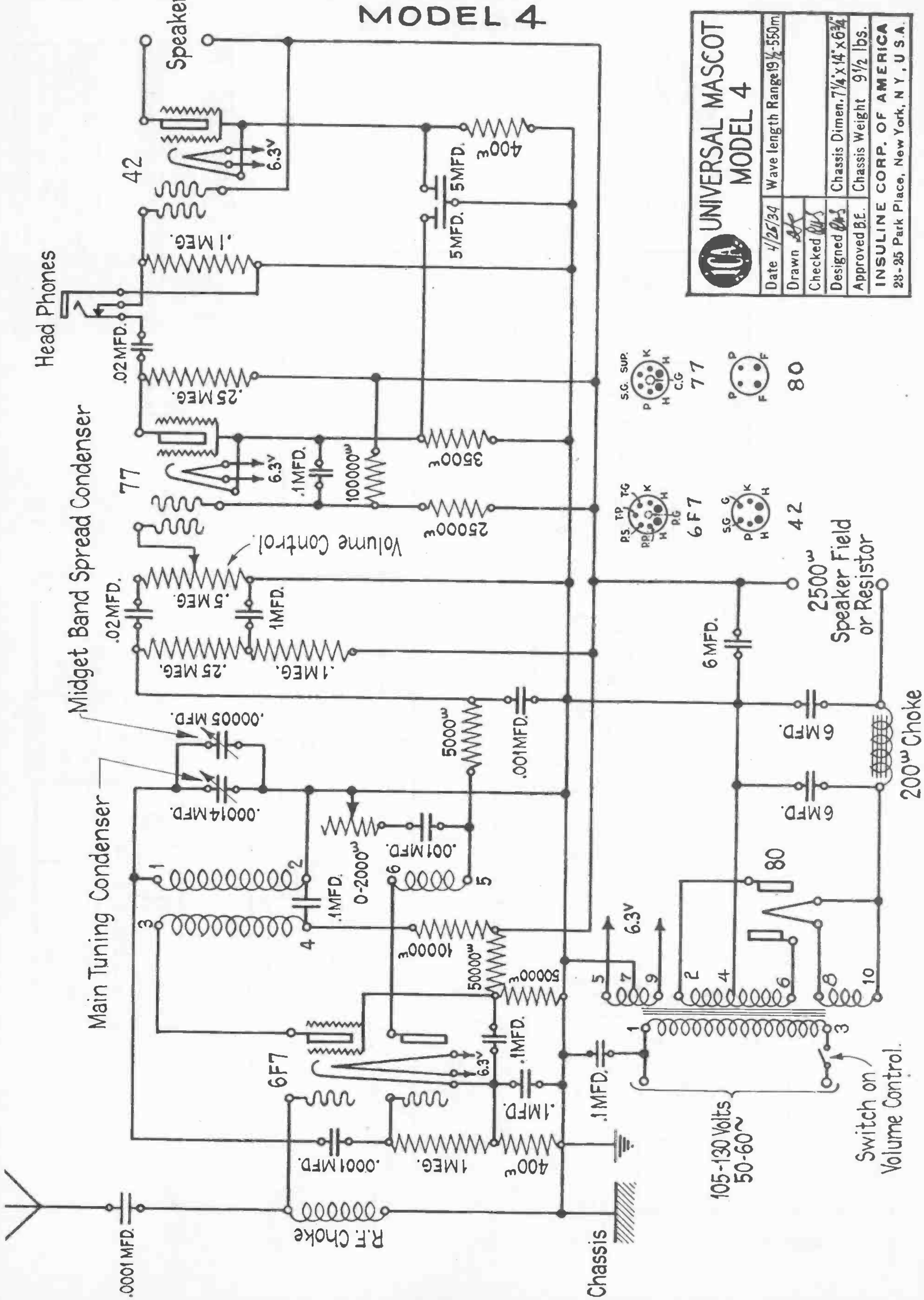


INSULINE CORP. OF AMERICA
MODEL 3



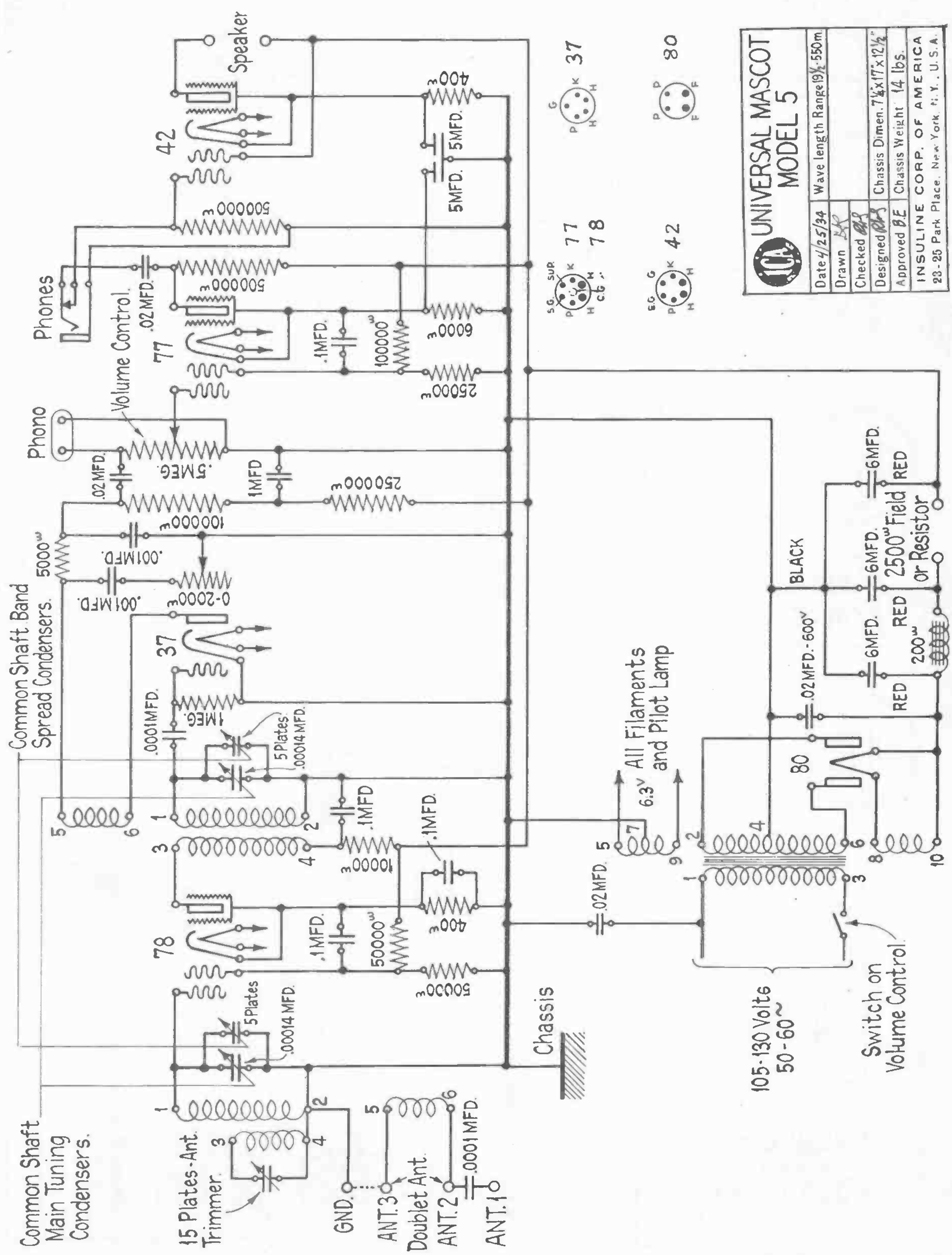
INSULINE CORP. OF AMERICA

MODEL 4

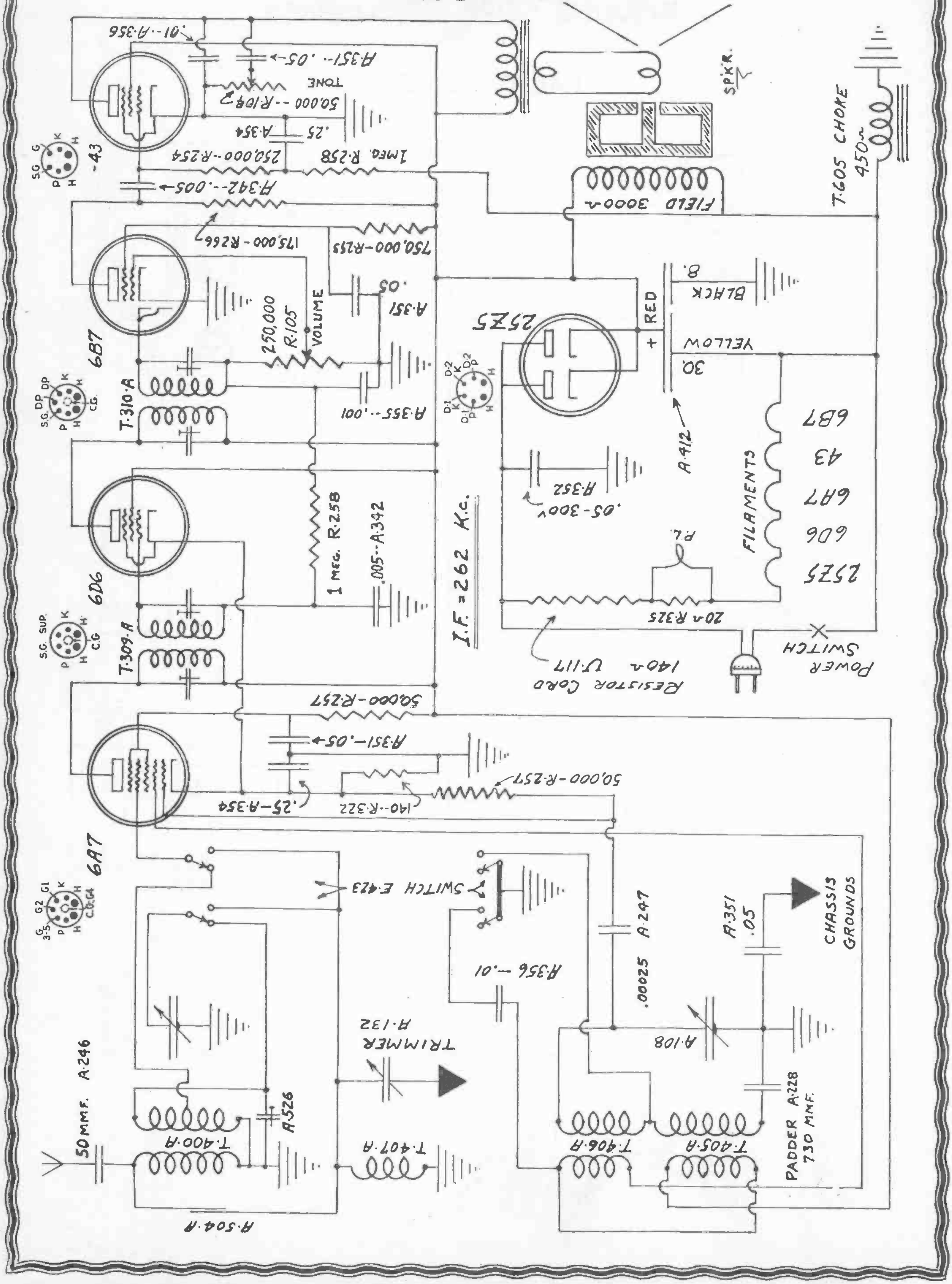


INSULINE CORP. OF AMERICA

MODEL 5

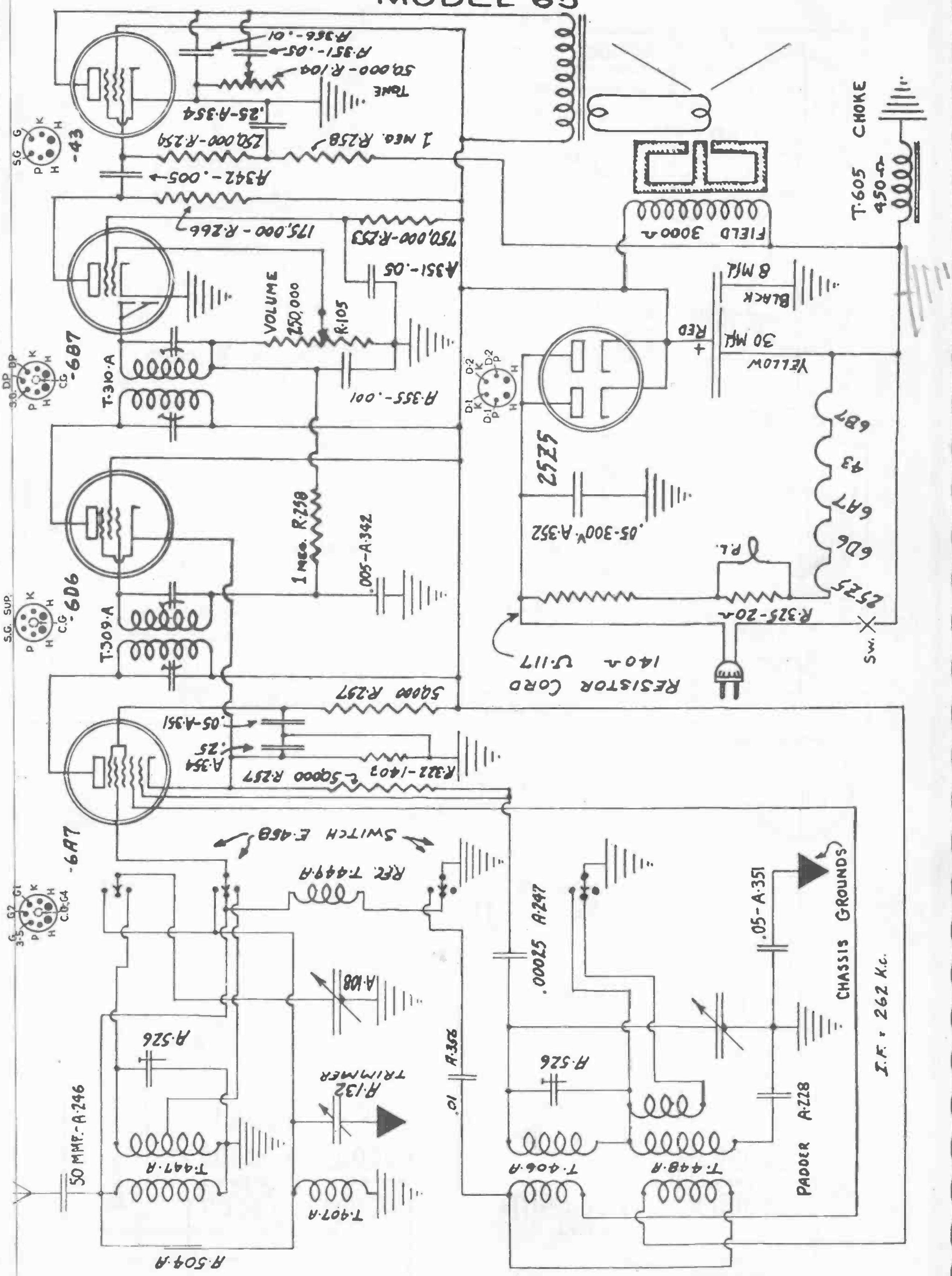


INTERNATIONAL RADIO CORP.
MODEL 60



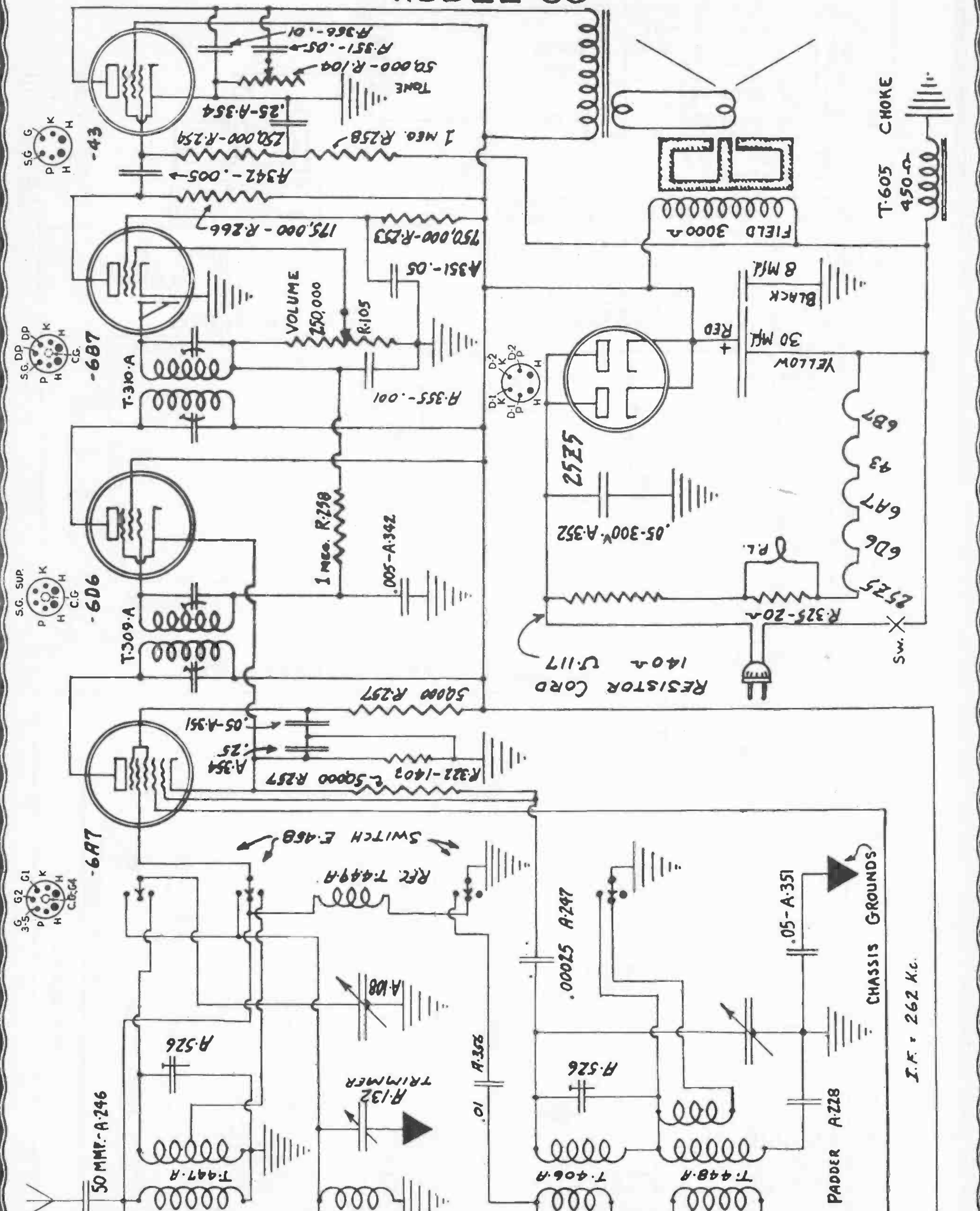
INTERNATIONAL RADIO CORP.

MODEL 65



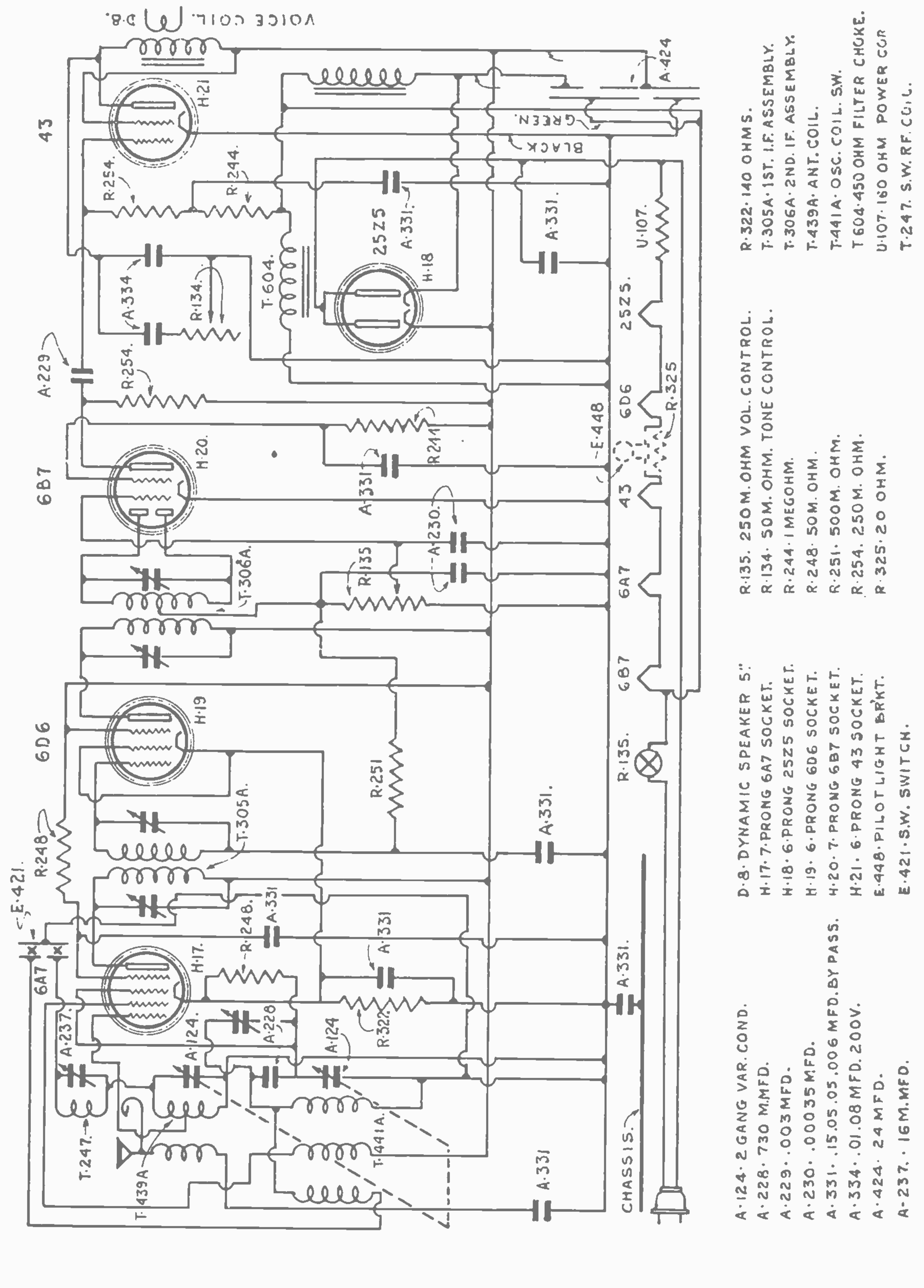
INTERNATIONAL RADIO CORP.

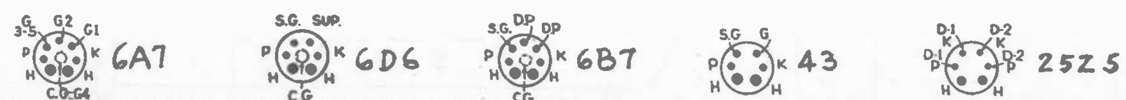
MODEL 80



INTERNATIONAL RADIO CORP.

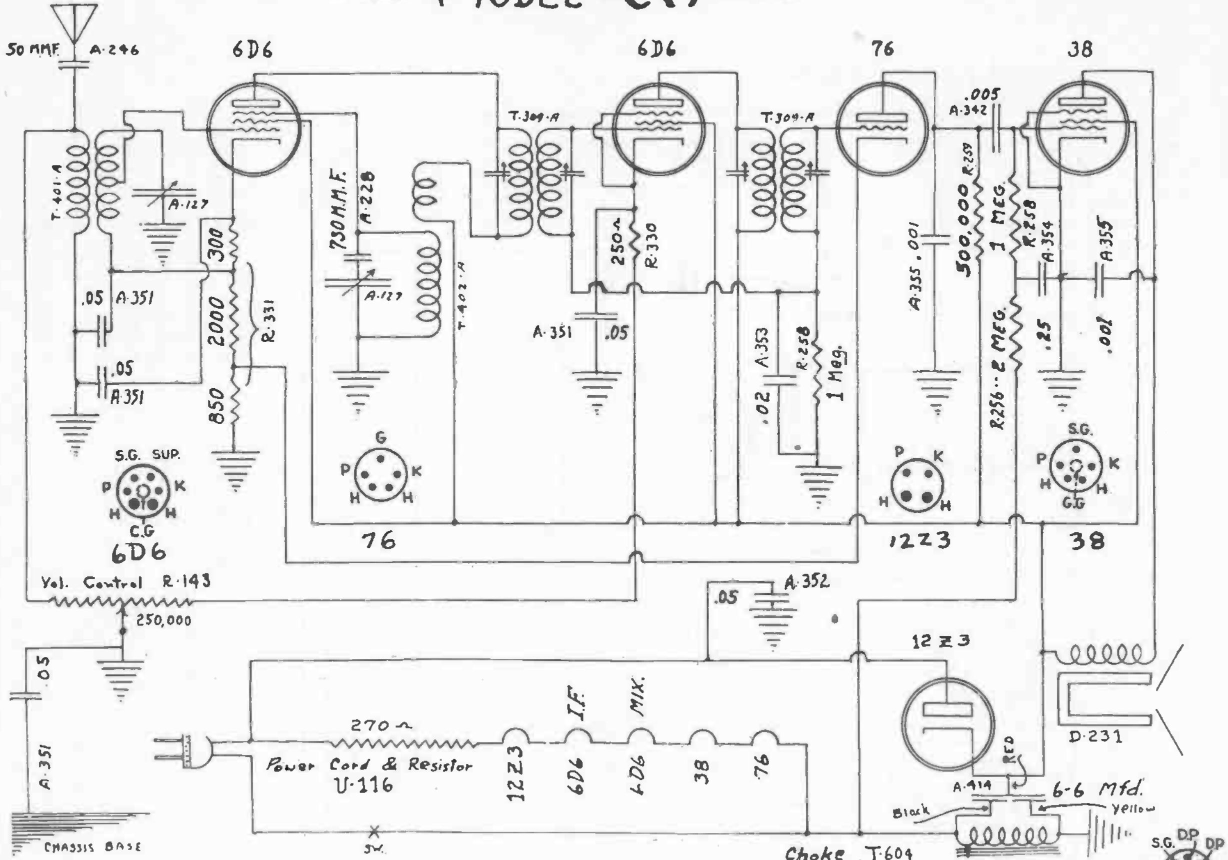
MODEL A & B



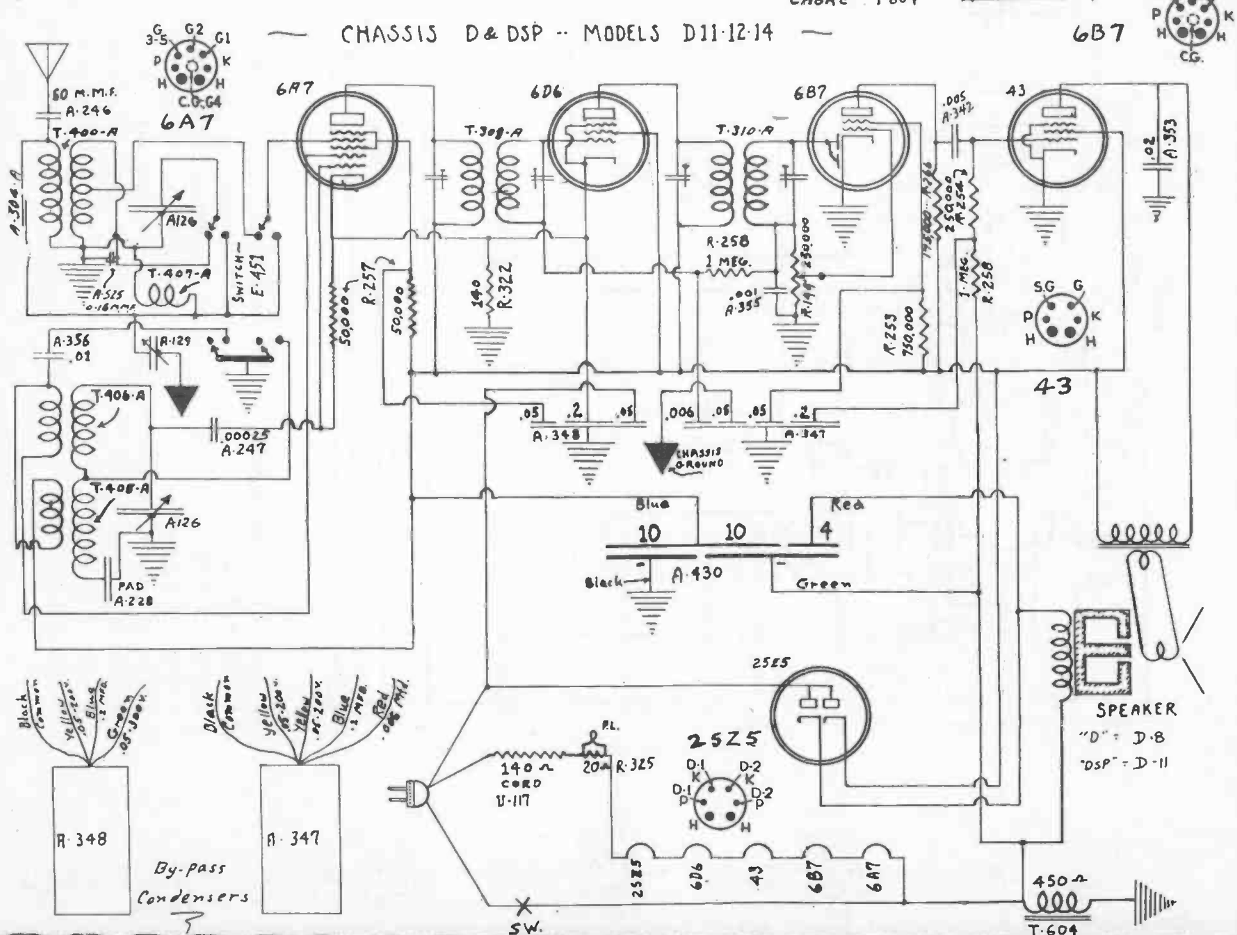


INTERNATIONAL RADIO CORP.

— MODEL CM —

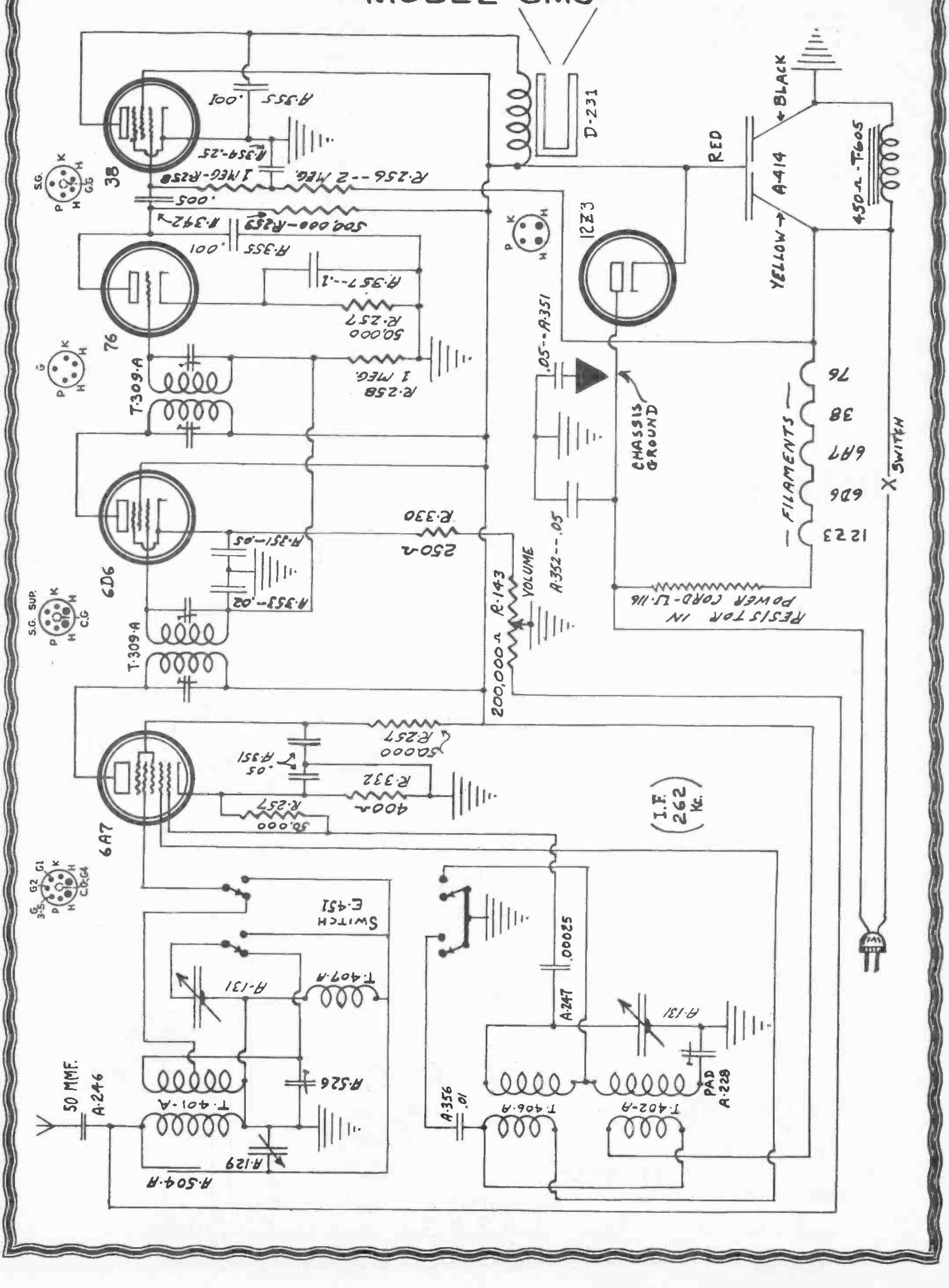


— CHASSIS D & DSP -- MODELS D11·12·14 —



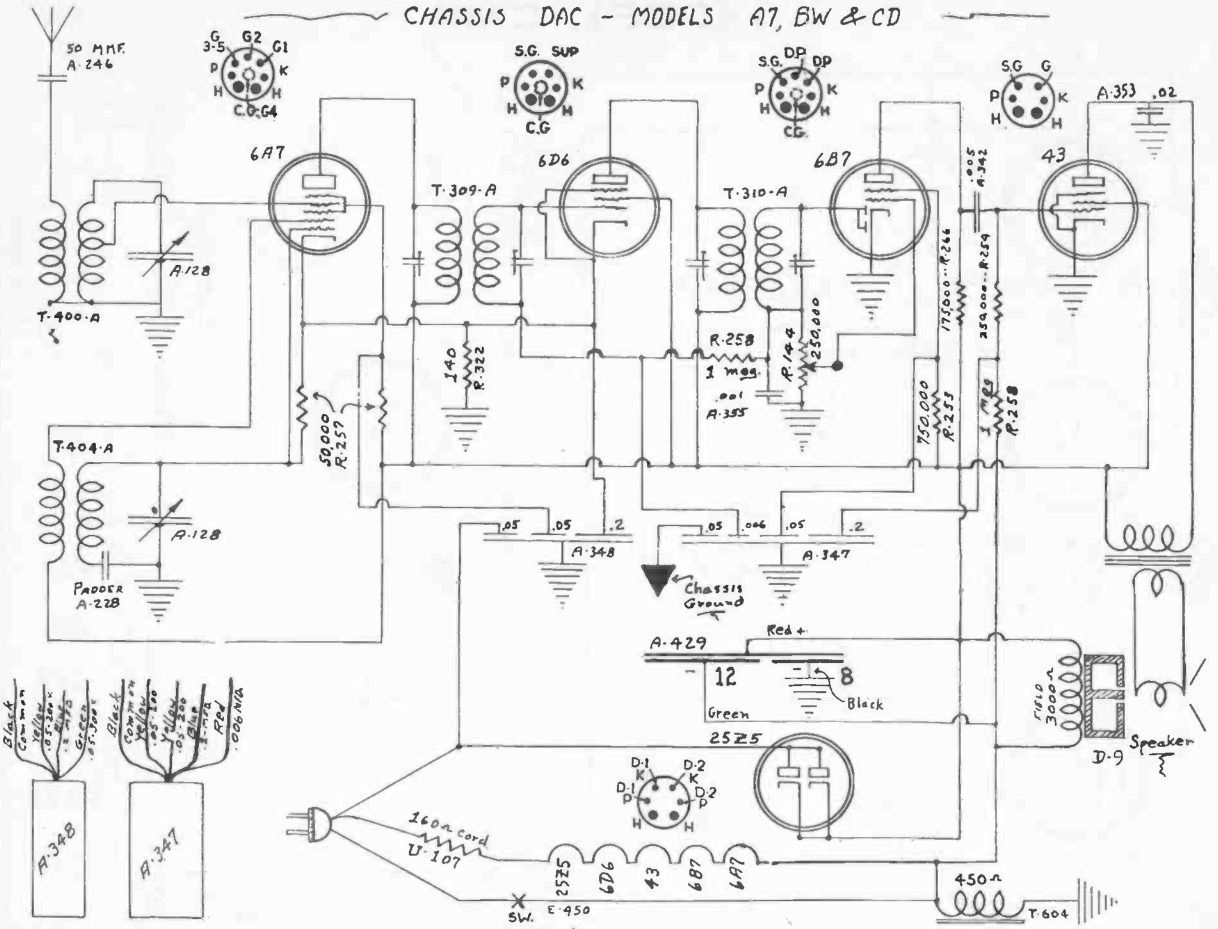
INTERNATIONAL RADIO CORP.

MODEL CMS

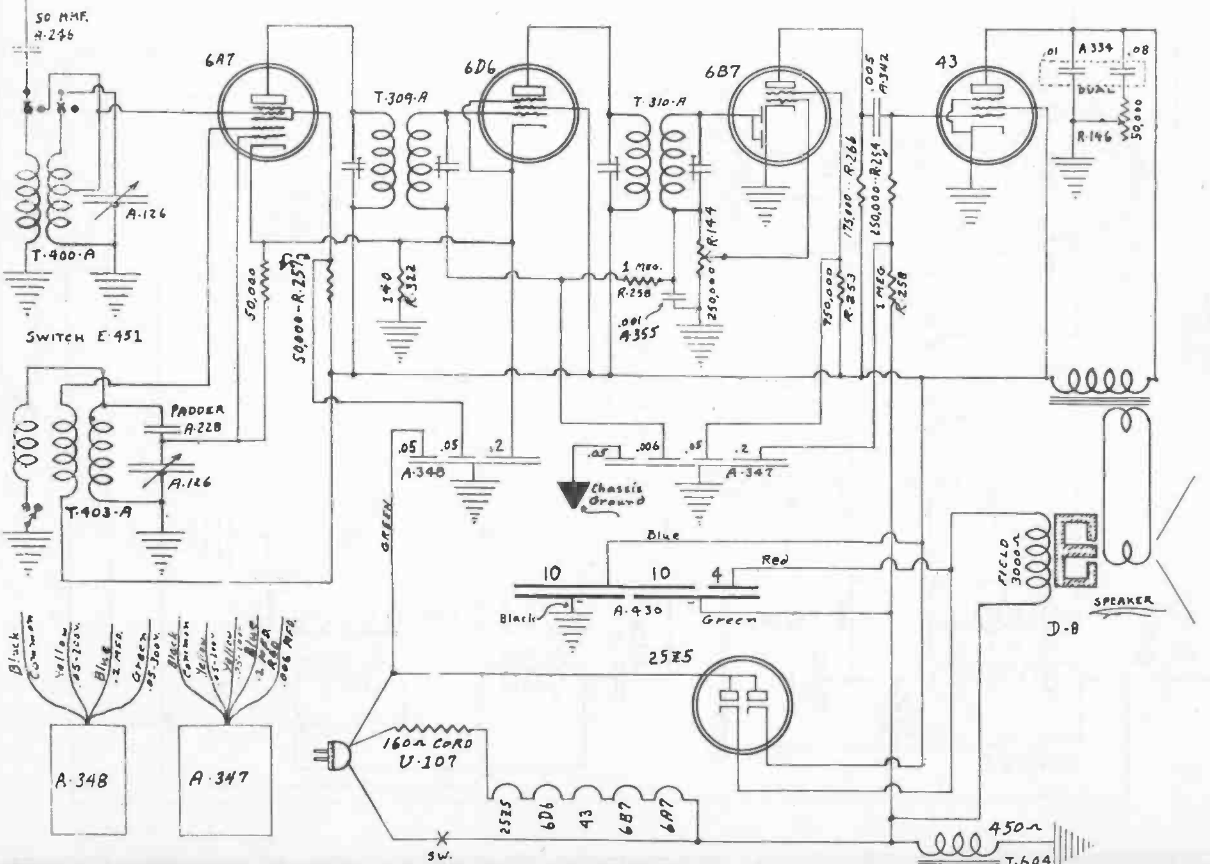


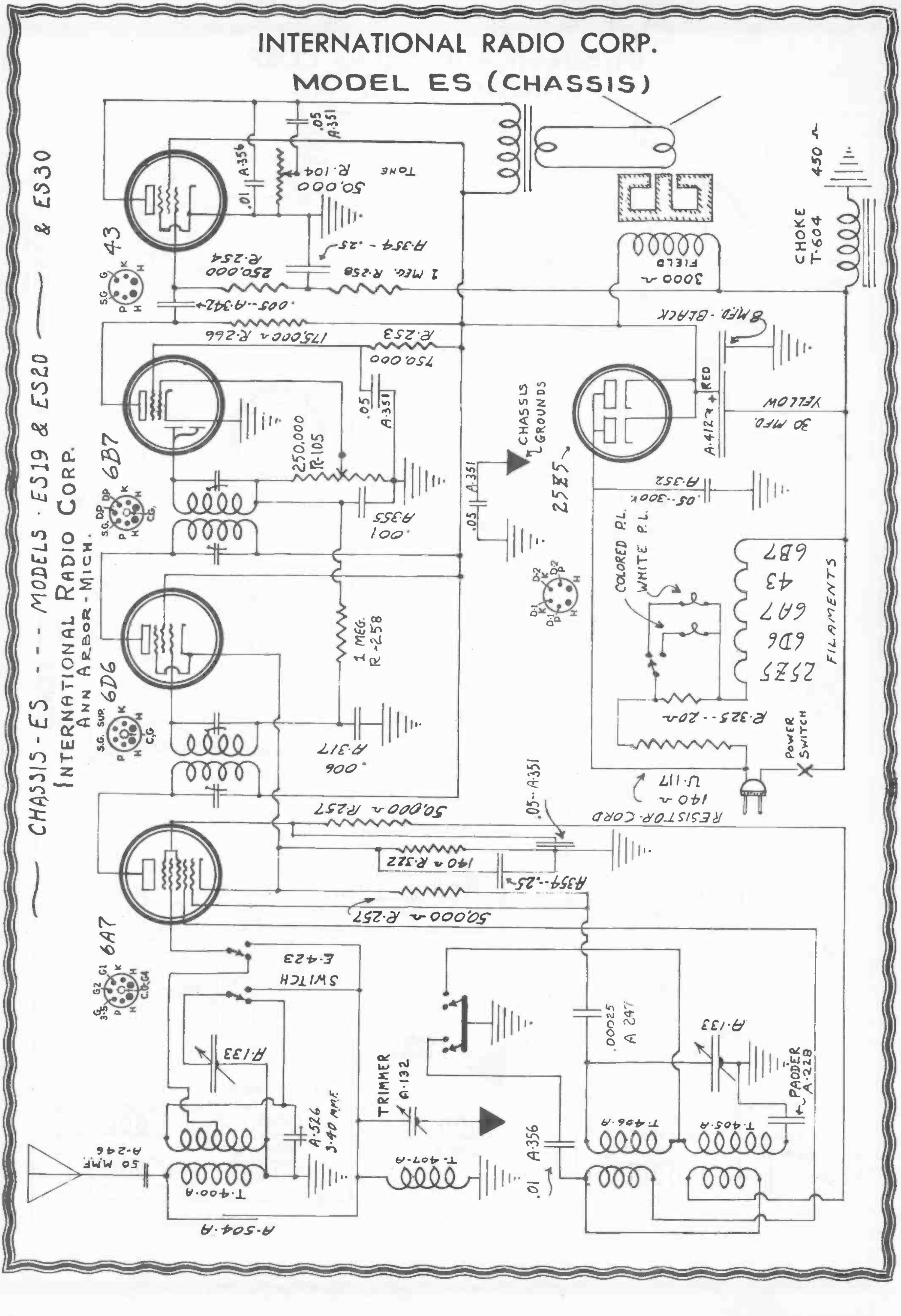
INTERNATIONAL RADIO CORP.

CHASSIS DAC - MODELS A7, BW & CD

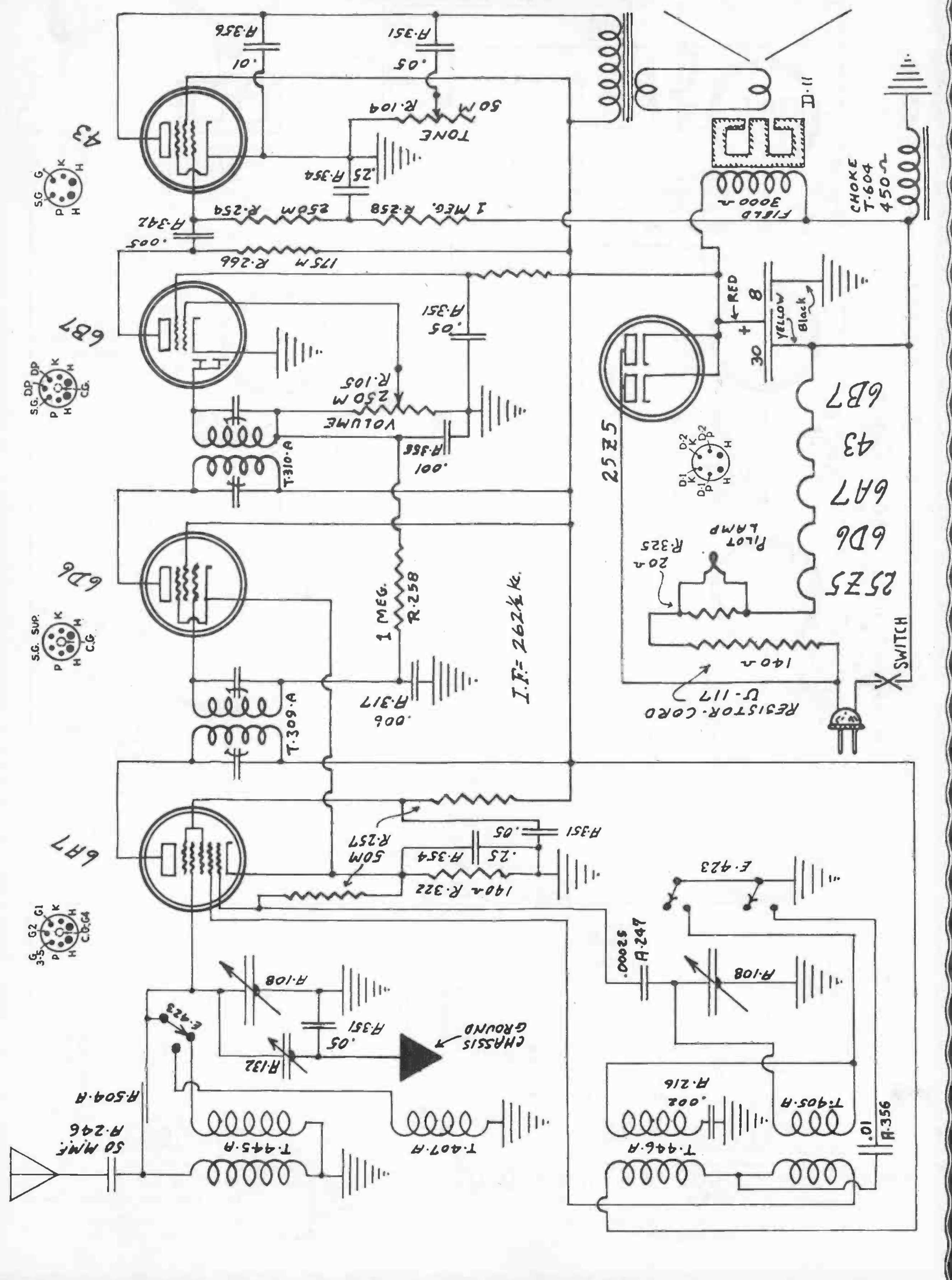


CHASSIS "DAS" - MODELS A8-9-10




INTERNATIONAL RADIO CORP.
MODEL ES (CHASSIS)
CHASSIS - ES --- MODELS ES19 & ES20 — & ES30
INTERNATIONAL RADIO CORP.
ANN ARBOR - MICH.
43
6B7
6D6
6A7
25Z5
.05 A·351
.01 A·356
TONE R·104 50,000
A·354 - .25
250,000 R·254
1 MEG. R·258
.005 - A·342
3000 Ω FIELD
CHOKE T·604
450 Ω
8 MFD. - BLACK
RED
YELLOW
30 MFD.
A·412
175,000 Ω R·266
R·253 750,000
250,000 R·105
A·355 .001
CHASSIS GROUNDS
A·352 .05 - 300V.
COLORED P.L.
WHITE P.L.
FILAMENTS
1 MEG. R-258
A·317 .006
R·325 - 20 Ω
POWER SWITCH
U·117 140 Ω RESISTOR-CORD
50,000 Ω R·257
.05 - A·351
140 Ω R·322
A·354 - .25
SWITCH E·423
A·133
.00025 A 247
PADDER A·228
TRIMMER A·132
A·526 3-40 MMF.
50 MMF. A·246
T·400·A
T·407·A
A·356
T·406·A
T·405·A
A·504·A

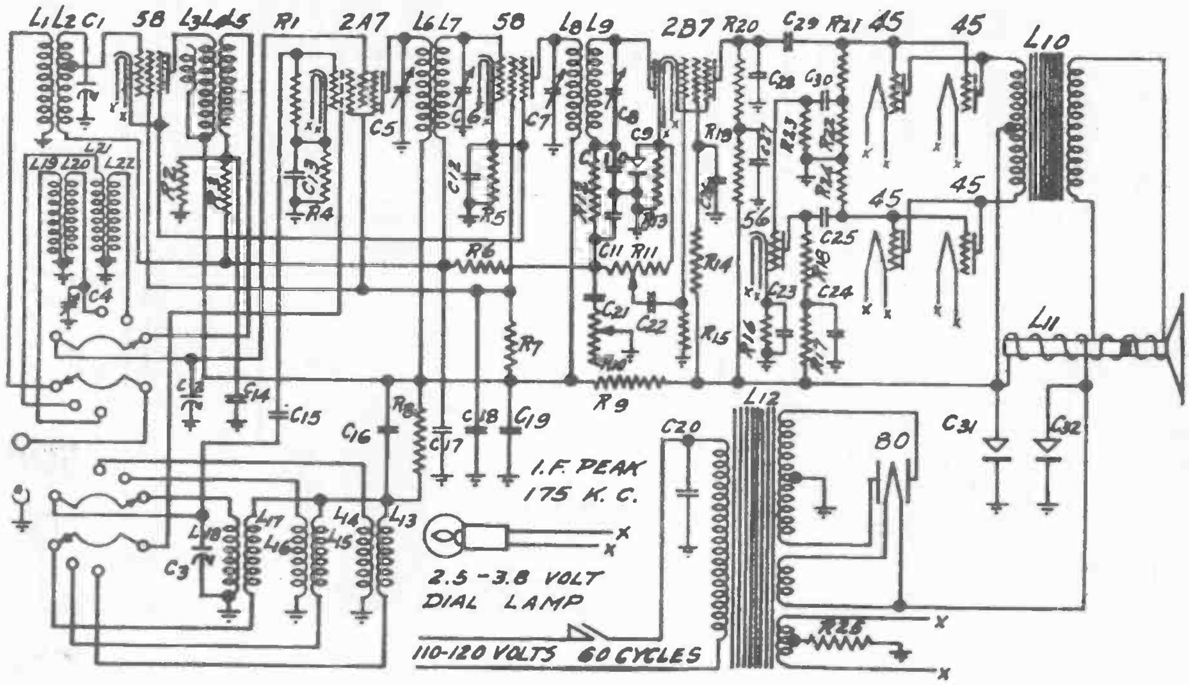
INTERNATIONAL RADIO CORP.
MODELS ES-25



LAFAYETTE RADIO MFG. CO.

MODEL AM-44

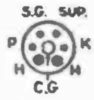
1090



CODE	PART NO.	
		RESISTORS
R1	53-898	50,000 Ohm Oscillator Grid
R2	53-925	500,000 Ohm A.V.C. Network
R3	53-923	100,000 Ohm A.V.C. Network
R4	53-1062	250 Ohm 2A7 Cathode
R5	53-1061	150 Ohm R.F. & I.F. Cathode
R6	53-926	1 Meg Ohm A.V.C. Network
R7	53-195	25,000 Ohm 2A7 & 58's Screens 1 Watt
R8	53-920	10,000 Ohm Oscillator Plate
R9	53-1420	2,500 R.F. & I.F. Plate Series
R10	19-1317	250,000 Ohm Tone Control
R11	19-1291	500,000 Ohm Volume Control & Switch
R12	53-898	50,000 Ohm Diode Network
R13	53-1065	1,000 Ohm 2B7 Cathode
R14	53-926	1 Megohm 2B7 Screen
R15	53-925	500,000 Ohm 2B7 Grid Leak
R16	53-1144	2,000 Ohm 56 Cathode
R17	53-923	100,000 Ohm 56 Hum Filter
R18	53-923	100,000 Ohm 56 Plate
R19	53-924	250,000 Ohm 2B7 Hum Filter
R20	53-923	100,000 Ohm 2B7 Plate
R21	53-925	500,000 Ohm First Position Output Grid Leak
R22	53-921	100,000 Ohm Push-Pull Network
R23	53-925	500,000 Ohm 56 Grid Leak
R24	53-925	500,000 Ohm Second Position Output Grid Leak
R25	53-1419	650 Ohm 45 Cathode Bias
		CONDENSERS
C1	77-833	371 MMFD. Preselector Section of 3 Gang
C2	77-833	371 MMFD. Preselector Section of 3 Gang
C3	77-833	336 MMFD. Oscillator Section of 3 Gang
C4	78-972	2 Plate F.B. Preselector Trimmer
C5	78-1104	75-150 MMFD. First I.F. Primary Trimmer
C6	78-1105	75-150 MMFD. First I.F. Secondary Trimmer
C7	78-1106	75-150 MMFD. Second I.F. Primary Trimmer
C8	78-1107	75-150 MMFD. Second I.F. Secondary Trimmer
C9	18-928	25 Mfd. 25 Volt Electrolytic 2B7 Cathode
C10	76-339	.0001 Mfd. Mica Diode Filter
C11	76-339	.0001 Mfd. Mica Diode Filter
C12	75-267A	.5 MFD. 200 Volt R.F. & I.F. Cathode By-Pass
C13	75-272A	.1 MFD. 200 Volt 2A7 Cathode By-Pass
C14	75-272A	.1 MFD. 200 Volt 2A7 Grid Isolation Condenser
C15	76-264	.00005 MFD. Oscillator Coupling
C16	75-272A	.1 MFD. 200 Volt Oscillator By-Pass
C17	75-272A	.1 MFD. 200 Volt A.V.C. Network By-Pass
C18	75-1326A	.1 MFD. 400 Volt 2A7 & 58's Screen By-Pass
C19	75-266	1 MFD. 400 Volt B Supply By-Pass
C20	75-269A	.01 MFD. 400 Volt Line By-Pass
C21	75-269A	.01 MFD. 400 Volt Tone Control Condenser
C22	75-269A	.01 MFD. 400 Volt 2B7 Grid Feed Condenser
C23	75-272A	.1 MFD. 200 Volt 56 Cathode By-Pass
C24	75-1326A	.1 MFD. 400 Volt 56 Plate Hum Filter
C25	75-269A	.01 MFD. 400 Volt Push-Pull Audio Feed
C26	75-272A	.1 MFD. 200 Volt 2B7 Screen By-Pass
C27	75-369A	.2 MFD. 400 Volt 2B7 Plate Hum Filter
C28	75-265	.001 MFD. Mica 2B7 Plate Filter
C29	75-269A	.01 MFD. 400 Volt Audio Feed
C30	75-269A	.01 MFD. 400 Volt Push-Pull Audio Feed
C31	18-721	8 MFD. Dry Electrolytic Condenser
C32	18-721	8 MFD. Dry Electrolytic Condenser
		INDUCTANCES
L1	17-1552	Broadcast Preselector Primary 450 Turns #36 S.S.E.
L2	17-1552	Broadcast Preselector Secondary 91 & 108 Turns #36 D.C.C.
L3	17-1554	Broadcast Detector Coad. Winding 32 Turns #36 S.S.E.
L4	17-1554	Broadcast Detector Primary 450 Turns #36 S.S.E.
L5	17-1554	Broadcast Detector Secondary 144 Turns #36 D.C.C.
L6	17-1101	8000 Microhenry First I.F. Primary 175 K.C.
L7	17-1101	8000 Microhenry First I.F. Secondary
L8	17-1101	8000 Microhenry Second I.F. Primary
L9	17-1101	8000 Microhenry Second I.F. Secondary
L10	64-1415	45 Parallel Push-Pull Output Transformer
L11	64-1415	500 Ohm Speaker Field
L12	80-1333	Power Transformer (Unless Special)
L13	17-1444	Foreign Band Oscillator Primary 9½ Turns #36 D.C.C.
L14	17-1444	Foreign Band Oscillator Secondary 8¼ Turns #24 S.S.C.
L15	17-1567	Police Band Oscillator Primary 15 Turns #36 S.S.E.
L16	17-1567	Police Band Oscillator Secondary 42 Turns #36 D.C.C.
L17	17-1616	Broadcast Oscillator Primary 50 Turns #36 S.S.E.
L18	17-1616	Broadcast Oscillator Secondary 90 Turns #36 D.C.C.
L19	17-1525	Foreign Band Preselector Primary 16 Turns #32 P.E.
L20	17-1525	Foreign Band Preselector Secondary 8¼ Turns #24 S.S.C.
L21	17-1556	Police Band Preselector Primary 25 Turns #36 S.S.E.
L22	17-1556	Police Band Preselector Secondary 43 Turns #36 D.C.C.

TUBES

Pre-Amplifier	1 #58
Oscillator First Detector	1 #2A7
Intermediate Amplifier	1 #58
Second Detector	1 #2B7
Inverter	1 #56
Power Output	4 #45
Rectifier	1 #80



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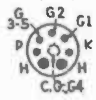
45



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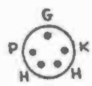

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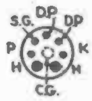
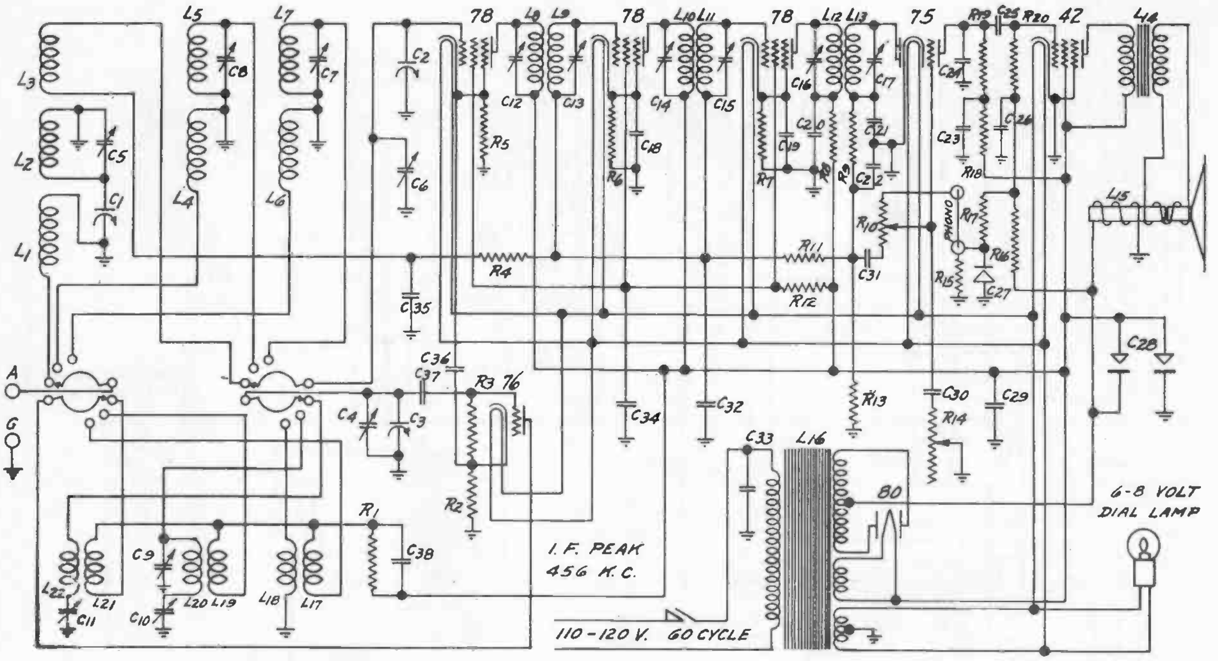


2B7

80

LAFAYETTE RADIO MFG. CO.
MODEL A 87



CODE	PART NO.		RESISTORS
R1	53-277	10,000	ohm Oscillator Plate Resistor
R2	53-1062	250	ohm Oscillator Cathode Resistor
R3	53-941	20,000	ohm Oscillator Grid Resistor
R4	53-923	100,000	ohm A.V.C. Network Resistor
R5	53-1144	2,000	ohm First Detector Cathode Resistor
R6	53-1063	500	ohm First I.F. Cathode Resistor
R7	53-1063	500	ohm Second I.F. Cathode Resistor
R8	53-919	5,000	ohm Second I.F. Plate Resistor
R9	53-898	50,000	ohm Diode I.F. Filter Resistor
R10	19-1291	500,000	ohm Volume Control & Switch
R11	53-926	1	Megohm A.V.C. Network Resistor
R12	53-921	40,000	ohm Screen Resistor
R13	53-925	500,000	ohm Diode Load Resistor
R14	19-1317	250,000	ohm Tone Control
R15	53-919	5,000	ohm C Bias Network Resistor
R16	53-926	1	Megohm C Bias Network Resistor
R17	53-923	100,000	ohm C Bias Network Resistor
R18	53-923	100,000	ohm Second Detector Hum Filter Resistor
R19	53-924	250,000	ohm Second Detector Plate Resistor
R20	53-925	500,000	ohm Output Grid Resistor

CONDENSERS

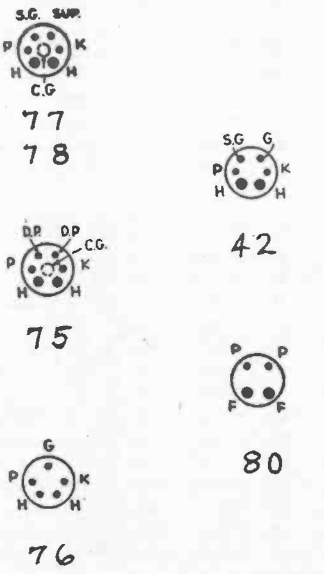
C1	77-1581	16-366	MMFD. First Section of 3 Gang Condenser
C2	77-1581	16-366	MMFD. Second Section of 3 Gang Condenser
C3	77-1581	16-366	MMFD. Third Section of 3 Gang Condenser
C4	77-1581		Broadcast Oscillator Parallel Trimmer on C3
C5	77-1581		Broadcast First Preselector Trimmer on C1
C6	77-1581		Broadcast Second Preselector Trimmer on C2
C7	78-1588	3-30	MMFD. Foreign Band Preselector Trimmer
C8	78-1588	3-30	MMFD. Police Band Preselector Trimmer
C9	78-1588	3-30	MMFD. Police Band Oscillator Parallel Trimmer
C10	78-1572	1600	MMFD. Police Band Oscillator Series Trimmer
C11	78-1572	600	MMFD. Broadcast Oscillator Series Trimmer
C12	78-1561	70-120	MMFD. First I.F. Primary Trimmer
C13	78-1561	70-120	MMFD. First I.F. Secondary Trimmer
C14	78-1561	70-120	MMFD. Second I.F. Primary Trimmer
C15	78-1561	70-120	MMFD. Second I.F. Secondary Trimmer
C16	78-1561	70-120	MMFD. Third I.F. Primary Trimmer
C17	78-1561	70-120	MMFD. Third I.F. Secondary Trimmer
C18	75-272A	.1	MFD. 200 Volt First I.F. Cathode By-Pass
C19	75-272A	.1	MFD. 200 Volt Second I.F. Cathode By-Pass
C20	75-269A	.01	MFD. 400 Volt Second I.F. Plate Isolation Condenser
C21	76-339	.0001	MFD. Mica Diode Filter Condenser
C22	76-339	.0001	MFD. Mica Diode Filter Condenser
C23	75-1326A	.1	MFD. 400 Volt Second Detector Plate Hum Filter
C24	76-265	.001	MFD. Mica Second Detector Plate By-Pass
C25	75-269A	.01	MFD. 400 Volt Audio Feed Condenser
C26	75-183A	.2	MFD. 200 Volt C Bias Network Condenser
C27	18-928	25	MFD. 25 Volt Electrolytic Condenser
C28	18-1274	4-4	MFD. 450 Volt Electrolytic Condenser
C29	75-266	1.	MFD. 400 Volt B Supply By-Pass Condenser
C30	75-269A	.01	MFD. Tone Control Condenser
C31	75-269A	.01	MFD. Audio Feed Condenser
C32	75-272A	.1	MFD. 200 Volt A.V.C. Network Condenser
C33	75-269A	.01	MFD. 400 Volt Line By-Pass Condenser
C34	75-272A	.1	MFD. 200 Volt Screen By-Pass Condenser
C35	75-272A	.1	MFD. 200 Volt A.V.C. Network By-Pass
C36	75-269A	.01	MFD. 400 Volt Oscillator Coupling Condenser
C37	76-264	.00005	MFD. Mica Oscillator Grid Condenser
C38	75-269A	.01	MFD. 400 Volt Oscillator Plate Condenser

INDUCTANCES

L1	17-2025	Broadcast Preselector Primary
L2	17-2025	Broadcast Preselector First Secondary
L3	17-2025	Broadcast Preselector Second Secondary
L4	17-1668	Police Band Preselector Primary
L5	17-1668	Police Band Preselector Secondary
L6	17-2017	Foreign Band Preselector Primary
L7	17-2017	Foreign Band Preselector Secondary
L8	17-2010	1200 Microhenry First I.F. Primary
L9	17-2010	1200 Microhenry First I.F. Secondary
L10	17-2010	1200 Microhenry Second I.F. Primary
L11	17-2010	1200 Microhenry Second I.F. Secondary
L12	17-2010	1200 Microhenry Third I.F. Primary
L13	17-2010	1200 Microhenry Third I.F. Secondary
L14	64-2003	Single 42 Output Transformer
L15	64-2003	2500 ohm Speaker Field
L16	80-1068	Power Transformer
L17	17-2018	Foreign Band Oscillator Primary
L18	17-2018	Foreign Band Oscillator Secondary
L19	17-1667	Police Band Oscillator Primary
L20	17-1667	Police Band Oscillator Secondary
L21	17-1646	Broadcast Oscillator Primary
L22	17-1646	Broadcast Oscillator Secondary
	68-2003	First I.F. Transformer Assembly
	68-2003	Second I.F. Transformer Assembly
	68-2004	Third I.F. Transformer Assembly

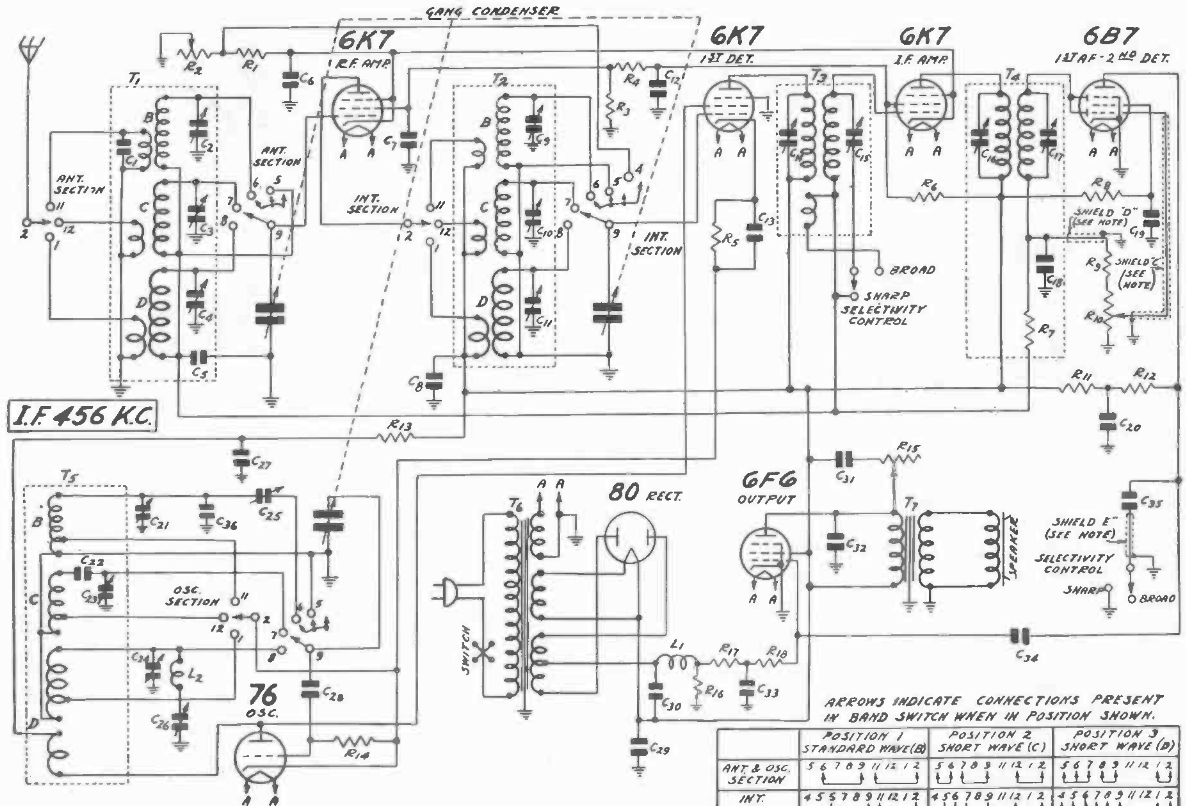
TUBES

I. F. Amplifier	#78
Oscillator	#76
1st. Detector	#77
I. F. Amplifier	#78
2nd. Detector	#75
Output	#42
Rectifier	#80



LAFAYETTE RADIO MFG. CO.

MODEL B 21

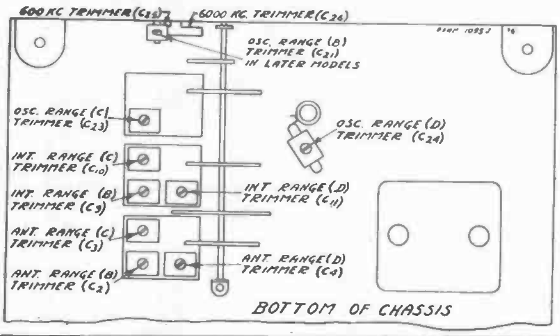


CONTACT LOCATIONS 3, 4 AND 10 IN ANT. AND OSC. SECTIONS AND 3 AND 10 IN INT. SECTION ARE BLANK.

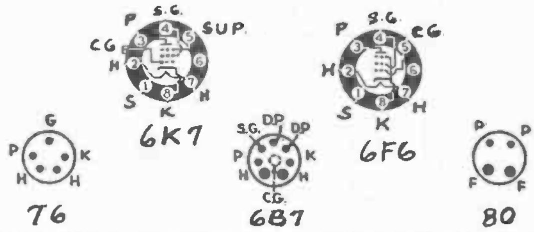
GROUPS OF CIRCUIT ELEMENTS ENCLOSED IN DOTTED RECTANGLES COMPRISE DISTINCT MECHANICAL ASSEMBLIES.

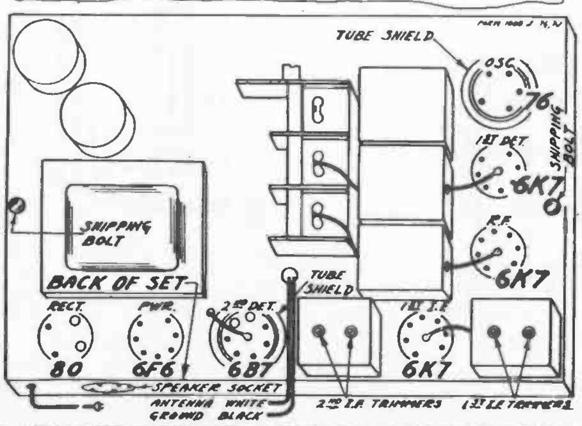
THE CAPACITY OF SHIELD "C" "D" AND "E" IS 50 MMF EACH.

C 1 250 mmf.
C 2 2-25 mmf.
C 3 2-25 mmf.
C 4 2-25 mmf.
C 5 .05 mf. 180 V.
C 6 .25 mf. 180 V.
C 7 .05 mf. 240 V.
C 8 .10 mf. 360 V.
C 9 2-25 mmf.
C10 2-25 mmf.
C11 2-25 mmf.
C12 .25 mf. 240 V.
C13 .05 mf. 180 V.
C14 70-150 mmf. } ONE
C15 70-150 mmf. } UNIT
C16 70-150 mmf. } ONE
C17 150-250 mmf. } UNIT
C18 50 mmf.
C19 .25 mf. 360 V.
C20 .25 mf. 360 V.
C21 2-25 mmf.
C22 1400 mmf.
C23 2-25 mmf.
C24 2-25 mmf.
C25 300-600 mmf. } ONE
C26 40-100 mmf. } UNIT
C27 .10 mf. 360 V.
C28 35 mmf.
C29 18 mf. 300 V.
C30 14 mf. 400 V.
C31 .05 mf. 600 V.
C32 .002 mf. 600 V.
C33 .03 mf. 180 V.
C34 .01 mf. 480 V.
C35 .004 mf. 600 V.
R 1 150 ohm .2 W.
R 2 2500 ohm } Dual Vol.
R10 500000 ohm } Control
R 3 30000 ohm .5 W.
R 4 6000 ohm .5 W.
R 5 2500 ohm .2 W.
R 6 16000 ohm 2.0 W.
R 7 2.0 Megohm .2 W.
R 8 300000 ohm .5 W.
R 9 50000 ohm .2 W.
R11 20000 ohm .2 W.
R12 60000 ohm .5 W.
R13 25000 ohm 1.0 W.
R14 80000 ohm .2 W.
R15 150000 Tone Cont.
R16 235 ohm 2.0 W.
R17 100000 ohm .2 W.
R18 500000 ohm .2 W.
T 1 Antenna R.F. Trans.
T 2 Interstage R.F. Trans.
T 3 1st. I.F. Trans.
T 4 2nd I.F. Trans.
T 5 Osc. Inductors
T 6 Power Trans.
T 7 Output Trans.
L 1 Speaker Field
L 2 Osc. Tracking Coil



BOTTOM OF CHASSIS





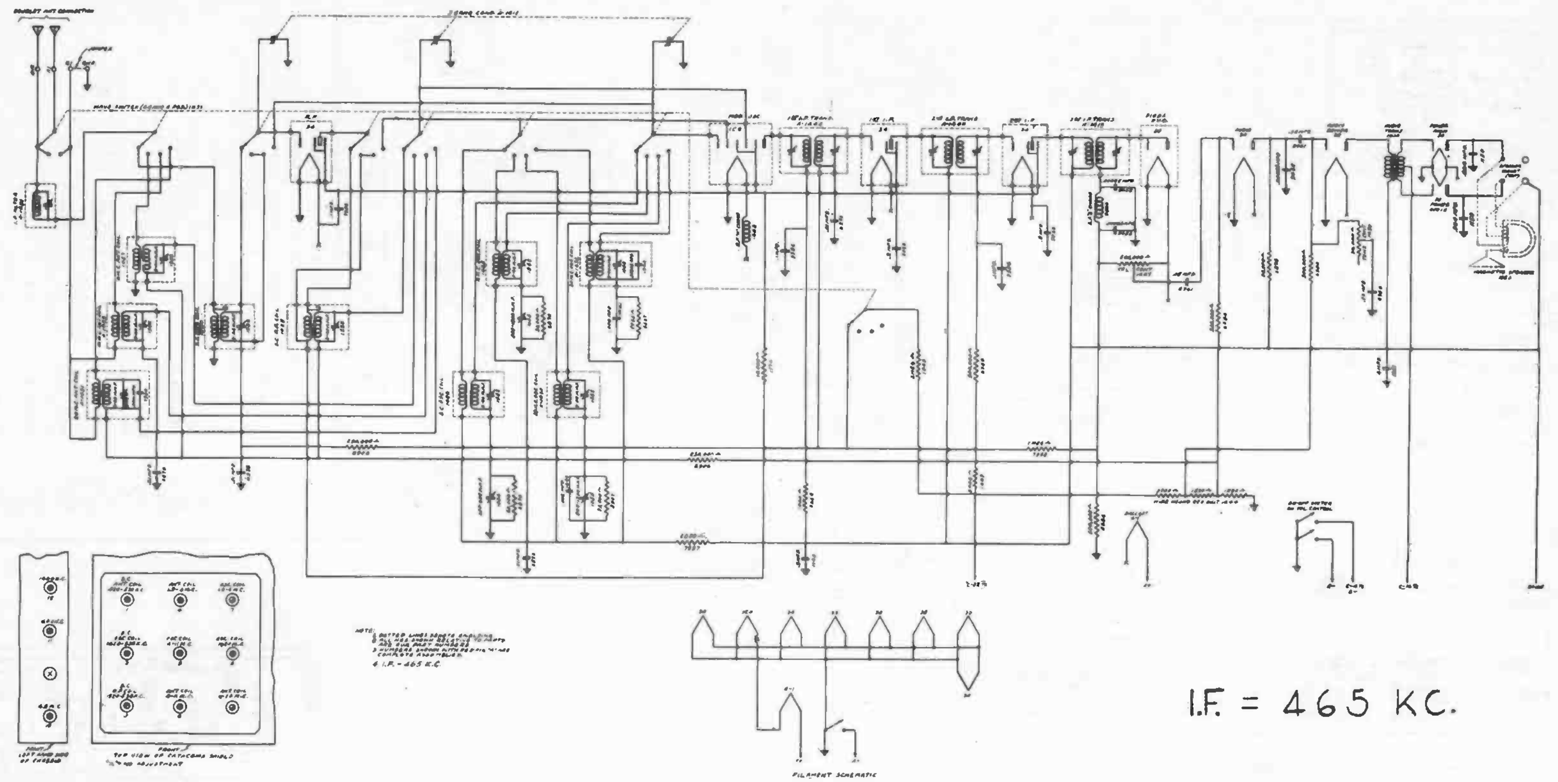
VOLTAGES AT SOCKETS
Line Voltage, 115 - Volume Control at Maximum
Antenna Shorted to Ground

Type of Tube	Function	Heater or Filam't	Plate to Ground	Screen to Ground	Cathode to Ground	Plate M. A.
6K7 (6D6)	R. F.	6.1	230	95	3.0	6.4
6K7 (6D6)	1st Det.	6.1	230	100	9.0	3.2
76	Osc.	6.1	100			5.2
6K7 (6D6)	I. F.	6.1	230	120	3.0	9.
6B7	2nd Det.	6.1	55(1)	40		2.3
6F6 (42)	Power	6.1	215	230	17(2)	30.0
80	Rectifier	4.7				34. per plate

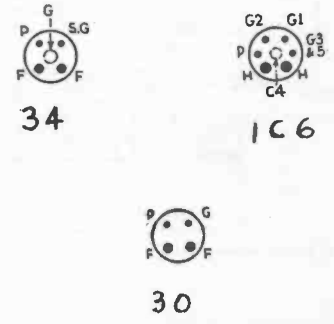
(1) As read with 500,000 ohm meter
(2) As read across R16

LAFAYETTE RADIO MFG. CO.

MODEL F-55



I.F. = 465 KC.



VOLTAGE TABLE

"A" Battery - 3 Volt Dry Cell
"B" Battery - 3 45 Volt "B" Battery
"C" Battery - 1 22½ Volt "C" Battery

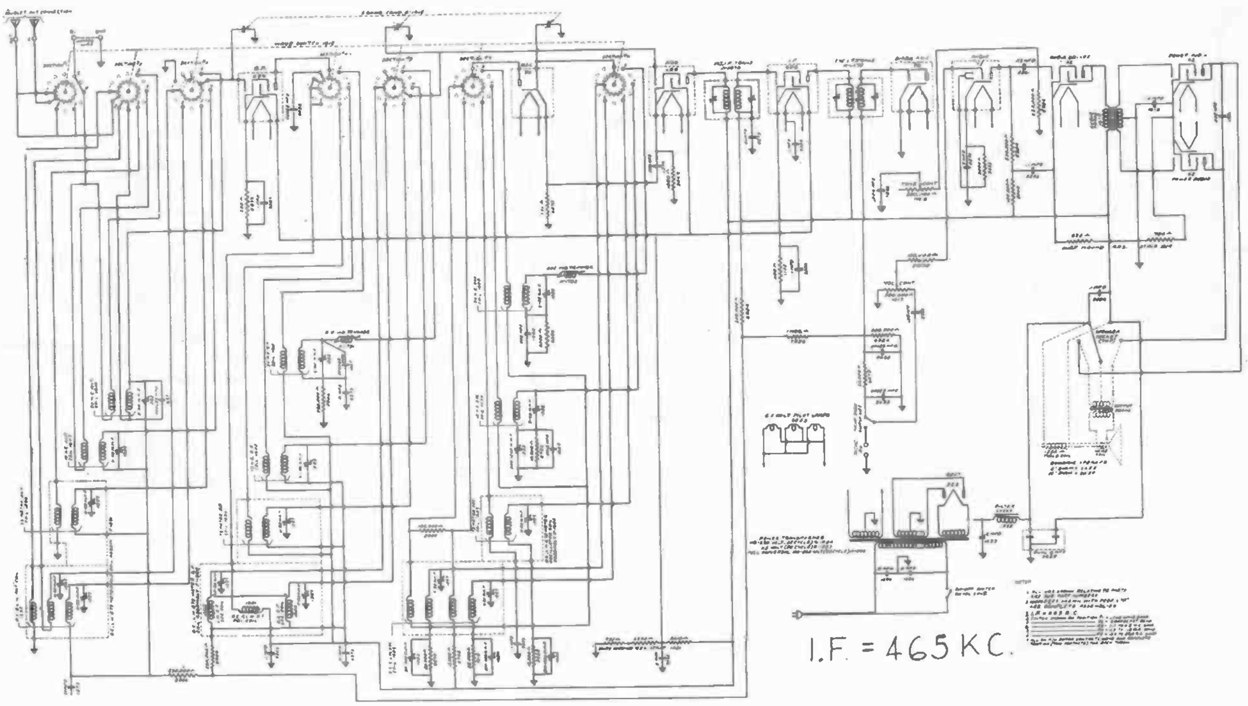
TUBE		FILAMENT	PLATE	SCREEN	GRID NO. 2	GRID NO. 3 & 5	CONTROL GRID
1C6	Oscillator & 1st Detector	1.9	135		135	75	3.5
34	Radio Frequency	1.9	135	75			
34	1st Intermediate Frequency	1.9	135	75			
34	2nd Intermediate Frequency	1.9	135	75			
30	2nd Detector & AVC	1.9					
30	1st Audio	1.9	60#				
30	Audio Driver	1.9	125				
30	Output	1.9	125				
30	Output	1.9	125				

(Total "A" Drain 600 M.A.)
(Total "B" Drain 23 M. A. with no signal)

Comparative voltage only. Read all voltages from socket to chassis with 1,000 ohm per volt meter. When making voltage checks use batteries that deliver full voltage with the receiver turned on.

LAFAYETTE RADIO MFG. CO.

MODEL F58

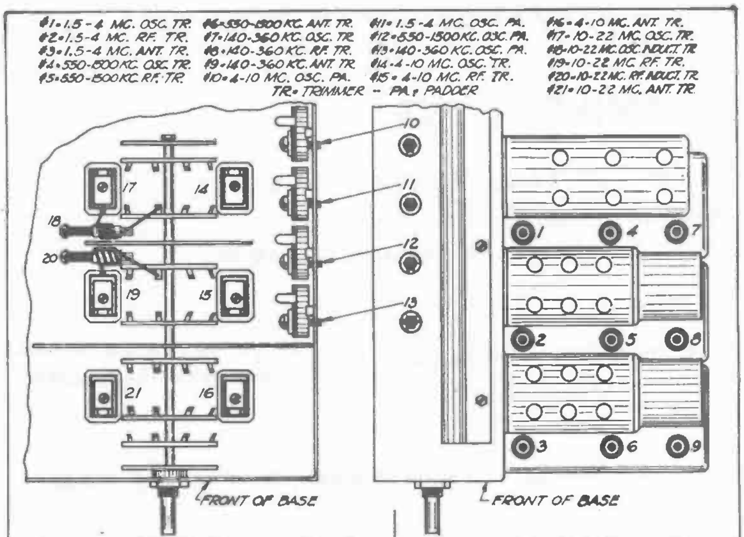


VOLTAGE TABLE

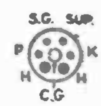
Line Voltage : 115 Volume Control : Full on Wave Band : Broadcast

TUBE		FILAMENT	PLATE	SCREEN	CATHODE
6D6	Radio Frequency	6.2	250	94	2.2
76	Oscillator	6.2	115		2.2
6D6	Modulator	6.2	250	94	4.5
6D6	Intermediate Frequency	6.2	250	94	2.2
76	Second Detector & AVC	6.2			
75	Audio	6.2	55*		1
42	Audio Driver	6.2	225		16
42	Output	6.2	330		28
42	Output	6.2	330		28
5Z3	Rectifier	4.8		118 M. A. Total Drain	

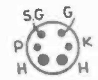
Triode Plate comparative voltage only.
Read all voltages from socket to chassis with 1000 ohm per volt voltmeter.



RIGHT HAND BOTTOM (INSIDE) OF CHASSIS — LEFT HAND SIDE OF CHASSIS
VIEWS SHOWING LOCATION OF PADDERS & TRIMMERS



6D6



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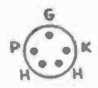

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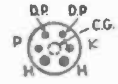
5Z3



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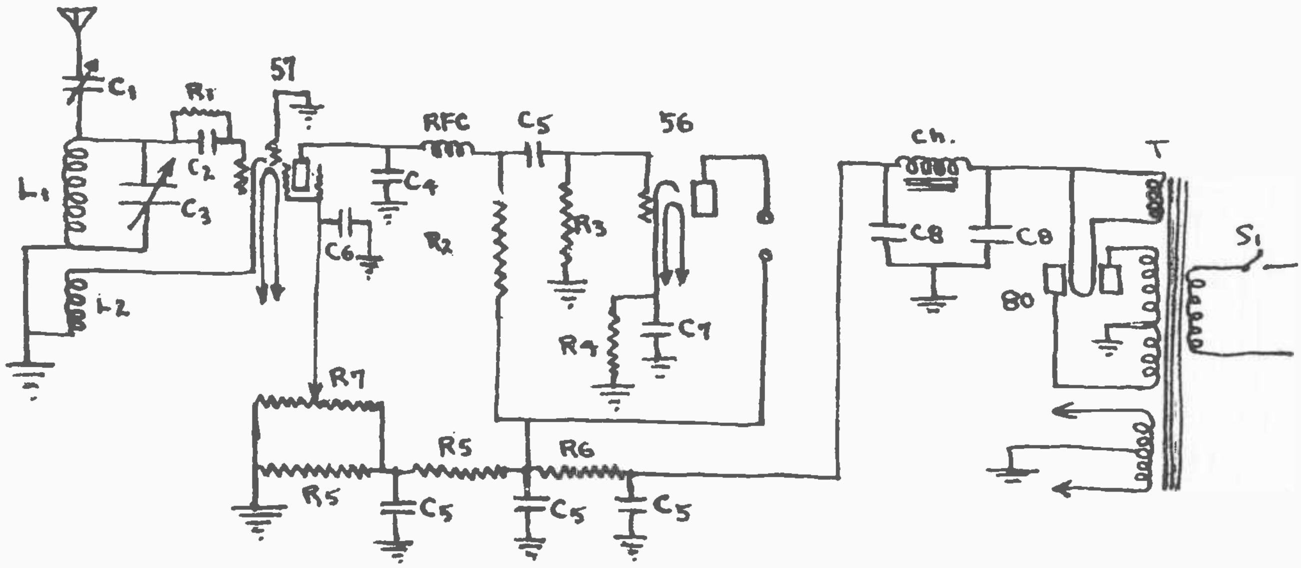
M. & H. SPORTING GOODS CO.

MAH CO INTERNATIONAL 3



LEGEND

S1 - A.C. Switch.
T - Special Mahco electrostatically shielded power transformer.
RFC- 2.5 millihenry RF choke
C1 - 35 mmfd. antenna condenser
C2 - .0001 mfd. grid condenser
C3 - .00014 Special Mahco shielded tuning condenser
C4 - .00015 bypass condenser
C5 - .1 mfd. tubular condenser
C6 - .02 bypass condenser, tubular
C7 - .5 tubular bypass condenser
C8-- Double 8 MFD electrolytic filter condenser.
R1 - 1 megohm grid-leak.
R2 - .25 megohm resistor.
R3 - .25 megohm resistor.
R4 - 2000 ohm one watt resistor.
R5 - 10000 ohm one watt resistor.
R6 - 5000 ohm one watt resistor.
R7 - 50000 ohm regeneration control potentiometer.

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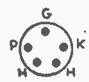

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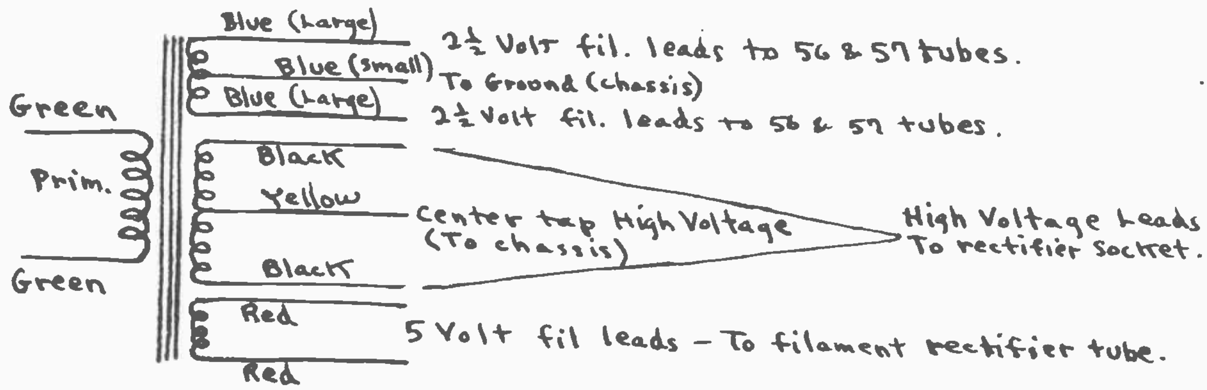
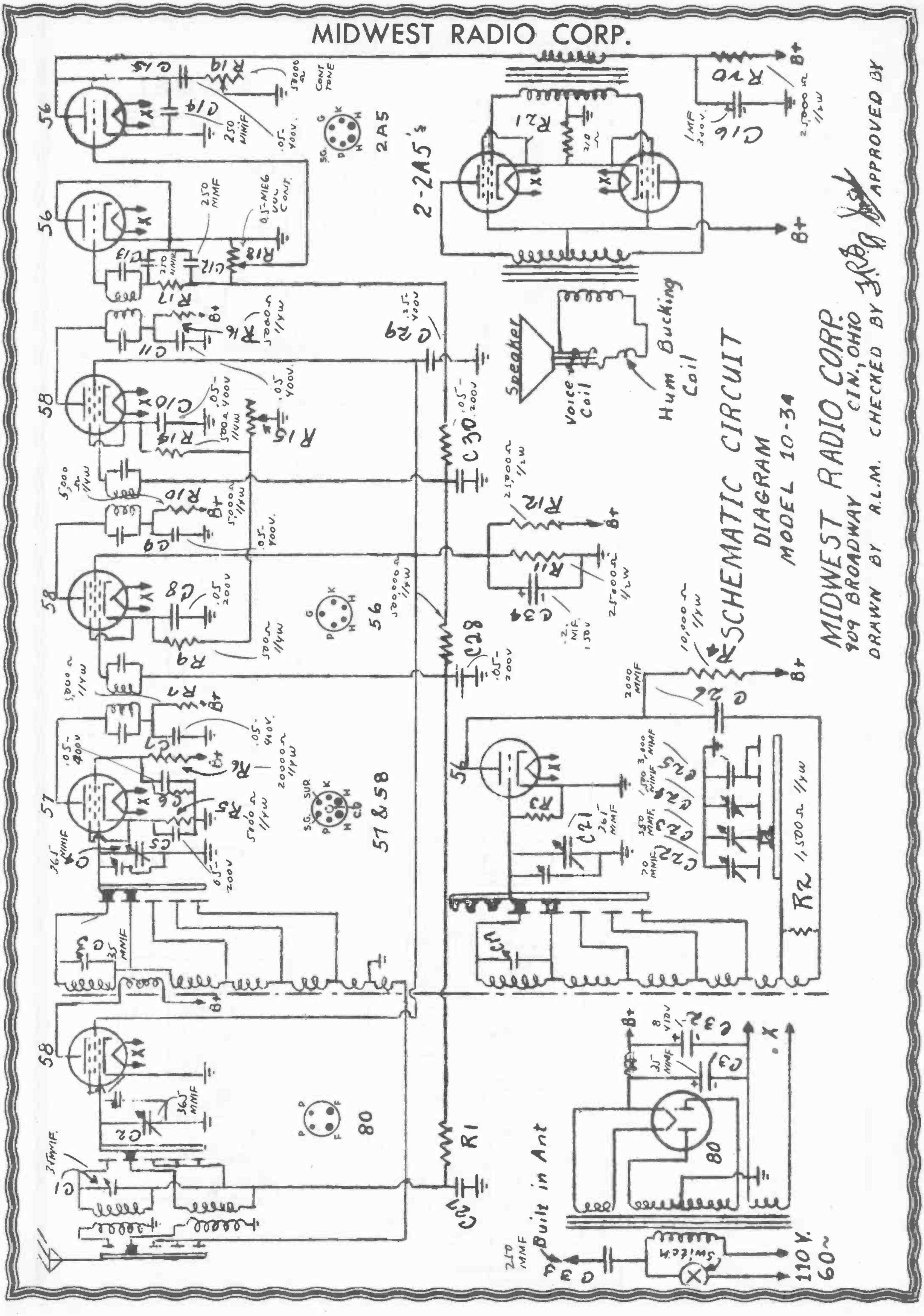
TRANSFORMER CONNECTIONS




MIDWEST RADIO CORP.
SCHEMATIC CIRCUIT DIAGRAM
MODEL 10-34
MIDWEST RADIO CORP.
909 BROADWAY
CIN., OHIO
DRAWN BY R.L.M. CHECKED BY
APPROVED BY
Speaker
Voice Coil
Hum Bucking Coil
Built in Ant
2-2A5's
110 V. 60~

MIDWEST RADIO CORP.

MODEL 10-35

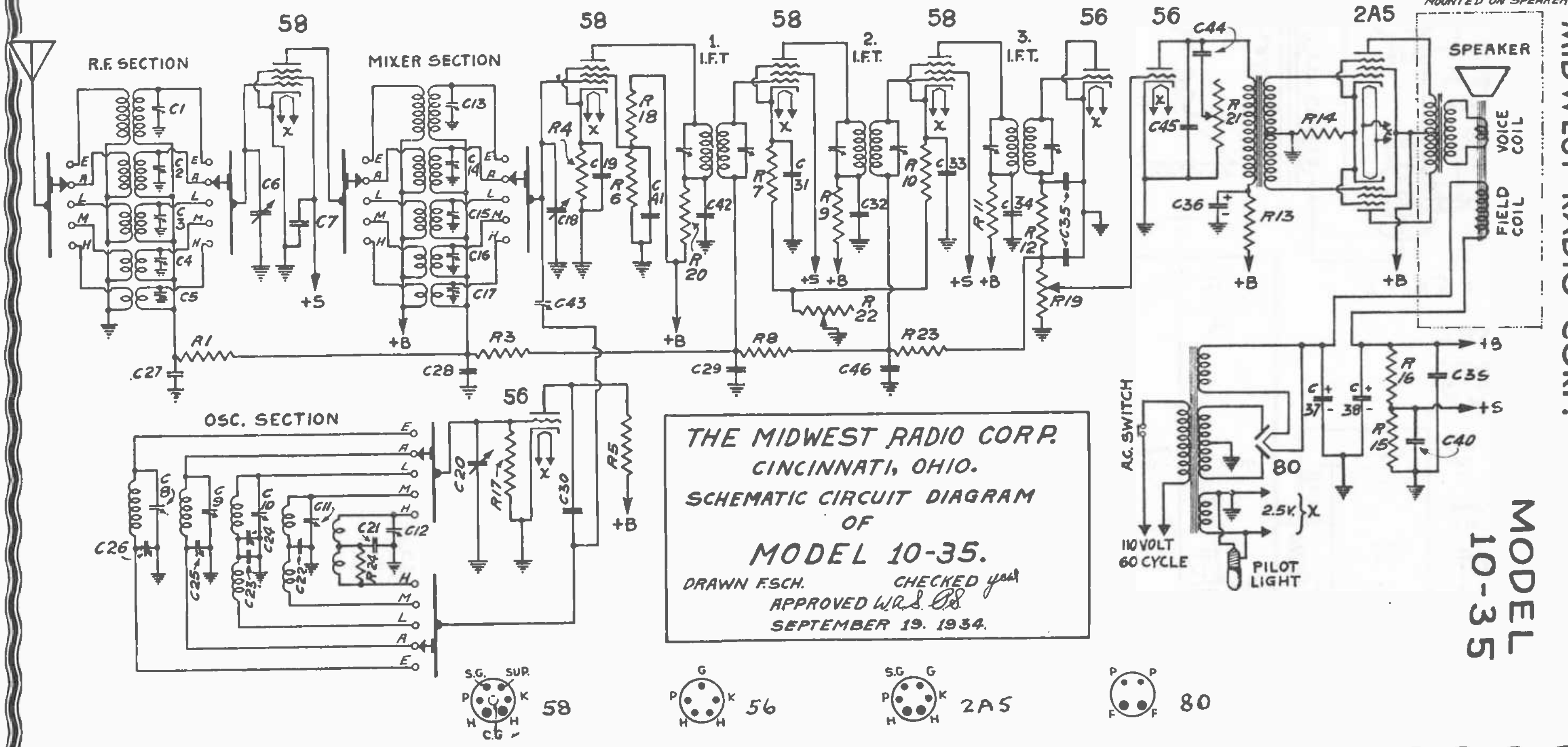
C 1 - 35 mmfd - TRIMMER
C 2 - 35 " "
C 3 - 35 " "
C 4 - 35 " "
C 5 - 35 " "
C 6 - 365 " TUNING COND.
C 7 - 2 mfd - 150 VOLT
C 8 - 35 mmfd - TRIMMER
C 9 - 35 " "
C 10 - 35 " "
C 11 - 35 " "
C 12 - 35 " "
C 13 - 35 " "
C 14 - 35 " "
C 15 - 35 " "

C16 - 35 mmfd TRIMMER
C17 - 35 " "
C18 - 365 " TUNING COND.
C19 - 05 mfd 200 VOLT
C20 - 365 mmfd TUNING COND.
C21 - 01 mfd 200V. H. BAND
C22 - 3000 mmfd MICA M "
•C23 - 500 " " L "
C24 - 700 " L "
C25 - 400 " A "
C26 - 70 " E "
(C22–C26: PADDERS)
C27 - 01 mfd 200 VOLT
C28 - 01 " 200 "
C29 - 05 " 200 "
C30 - 2000 mmfd MICA

C31 - 05 mfd 200 VOLT
C32 - 05 " 400 "
C33 - 05 " 200 "
C34 - 05 " 400 "
C35 - 250 - mmfd - MICA - DUAL
C36 - 1 mfd 300 VOLT
C37 - 8 " 450 V. ELECTROLYIC
C38 - 16 " 450 V. ELECTROLYIC
C39 - .25 " 400 VOLT
C40 - .25 " 400 "
C41 - 05 " 200 "
C42 - 05 " 400 "
C43 - 35 mmfd COUPLER
C44 - 05 mfd 400 VOLT
C45 - 250 mmfd MICA
C46 - 05 mfd 200 VOLT

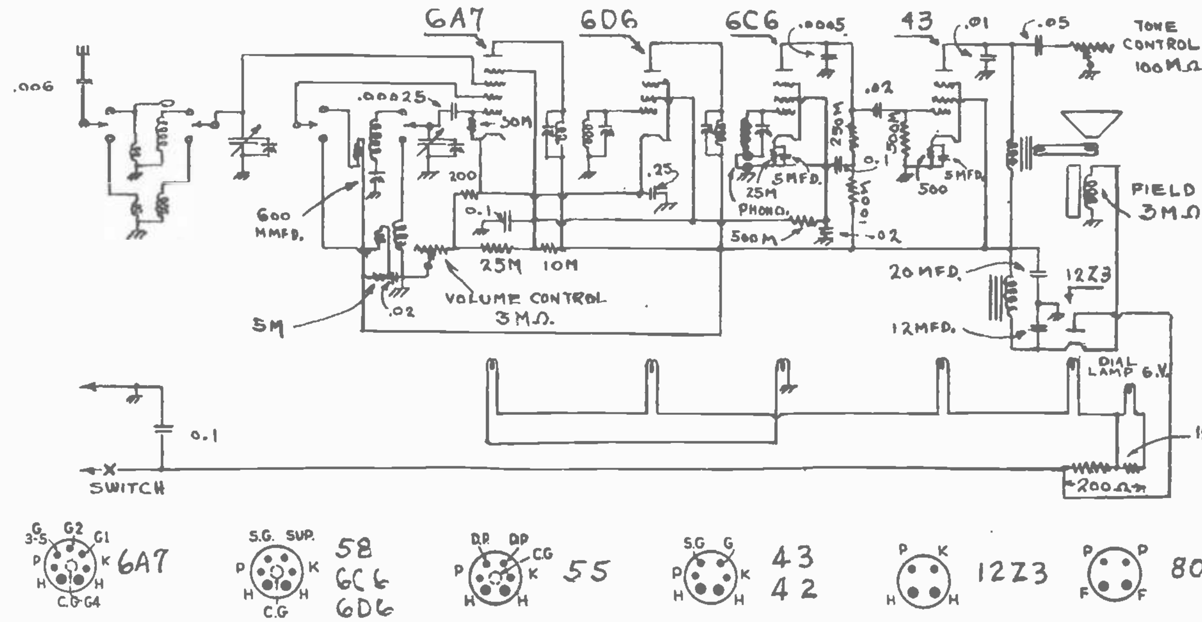
R 1 - 100 000 Ω .1 WATT
R 2 -
R 3 - 100 000 Ω .1 "
R 4 - 5 000 Ω .25 "
R 5 - 15 000 Ω 1 "
R 6 - 25 000 Ω .25 "
R 7 - 1 000 Ω .25 "
R 8 - 500 000 Ω .1 "
R 9 - 5 000 Ω .25 "
R10 - 1 000 Ω .25 "
R11 - 5 000 Ω .25 "
R12 - 25 000 Ω .1 "
R13 - 25 000 Ω .5 "
R14 - 210 Ω 2 " FLEXIBLE
R15 - 25 000 Ω .5 "

R16 - 25 000 Ω .5 WATT
R17 - 100 000 Ω .25 "
R18 - 200 000 Ω .25 "
R19 - 500 000 Ω VOLUME CONTROL
R20 - 5 000 Ω .25 WATT
R21 - 50 000 Ω TONE CONTROL
R22 - 1 000 Ω VARIABLE
R23 - 500 000 Ω .1 WATT
R24 - 1 000 Ω .25 "

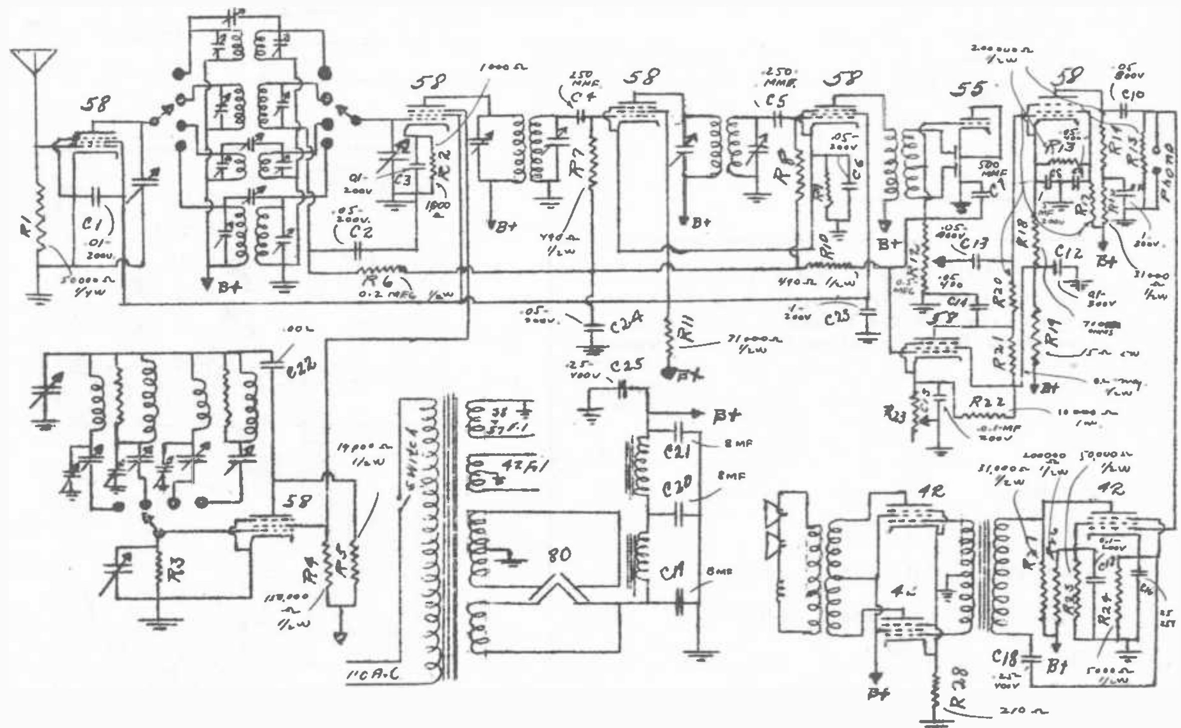


MIDWEST RADIO CORP.

MODEL 35 SW.

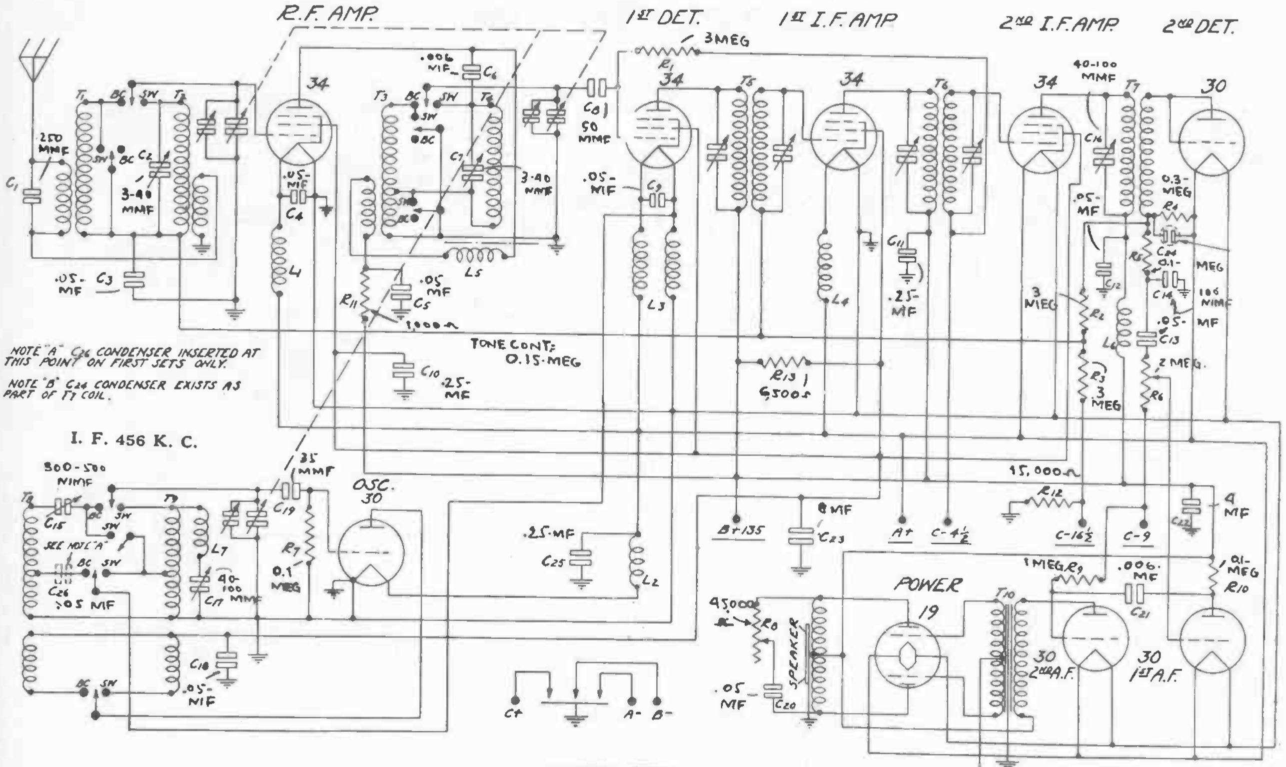


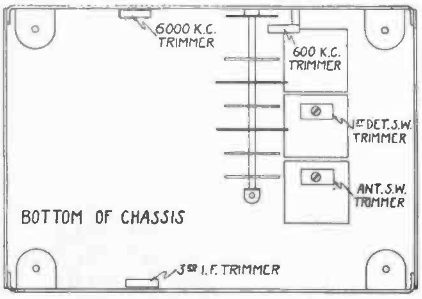
MODEL AC 12
(150 TO 550 METERS)

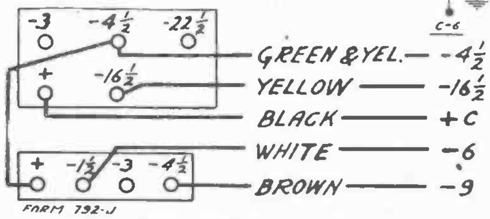


MONTGOMERY WARD & CO.

MODEL 62-124 & 62-129







-Optional 'C' Battery Connections

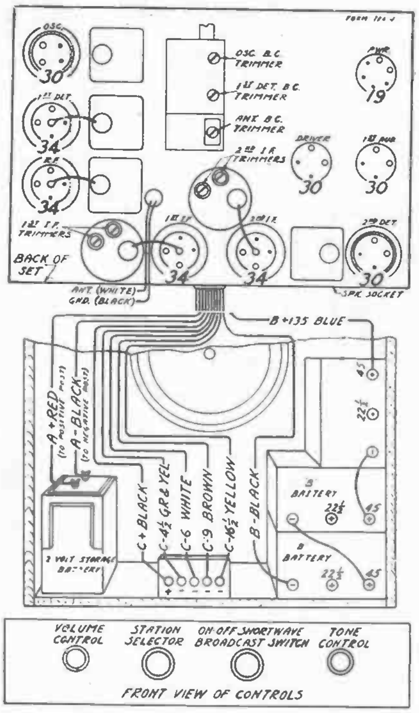
I.F. = 456 KC.

Voltages at Sockets

Antenna Shorted to Ground
Batteries Up to Rated Voltages. See Fig. 1
Voltages Read from Negative Filament Terminal

Type of Tube	Function	Across Fila-ment	Plate to Gnd.	Control Grid to Ground	Screen to Gnd.	Normal Plate M. A.
34	R. F.	2.0	135	4.5(1)	80	2.8
34	1st Det.	2.0	135	4.5(1)	80	3.0
30	Osc.	2.0	80			2.8
34	1st I. F.	2.0	135	4.5(1)	80	2.8
34	2nd I. F.	2.0	135	4.5	80	2.8
30	2nd Det.	2.0				
30	1st Audio	2.0	95	9.0(2)		0.35
30	2nd Audio	2.0	135	9.0(3)		3.0
19	Output	2.0	135	6.0		1.3

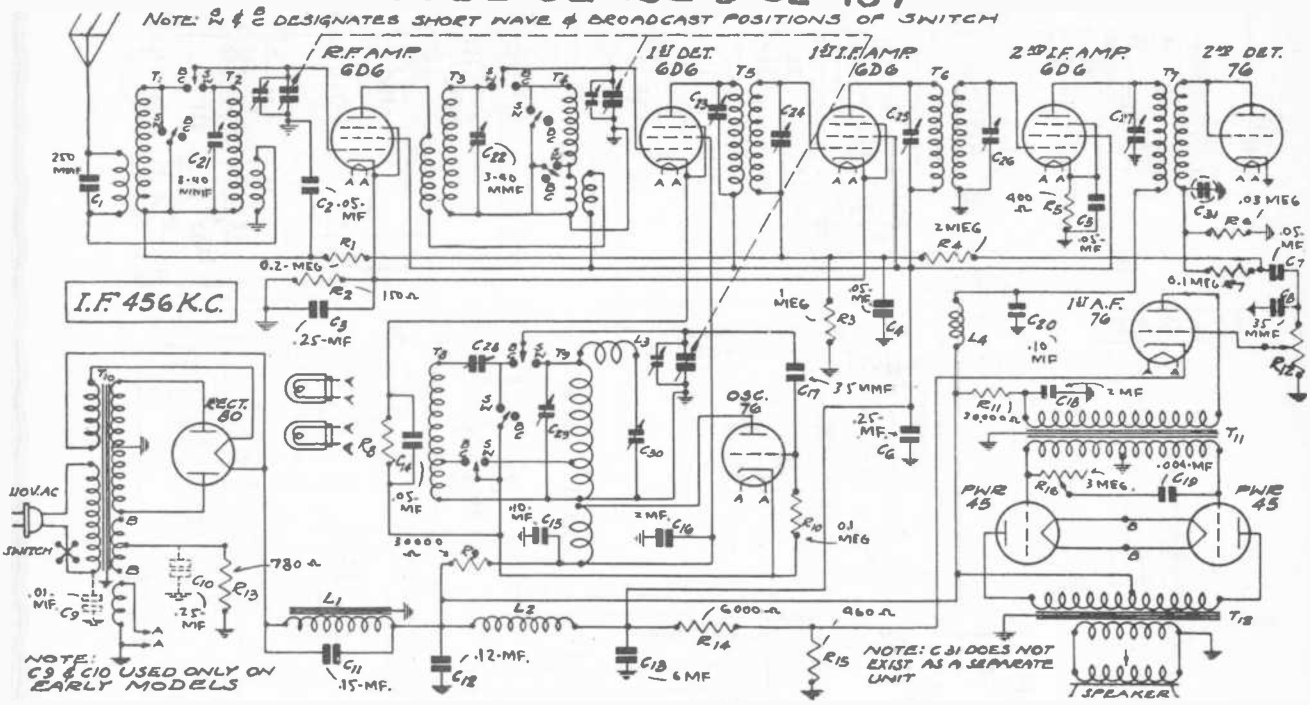
(1) Computed figure—cannot be read because of high resistance cir.
(2) Volume Control at minimum.
(3) As read at battery.



-Arrangement of Tubes, Batteries and Controls

MONTGOMERY WARD & CO.

MODEL 62-132 & 62-137

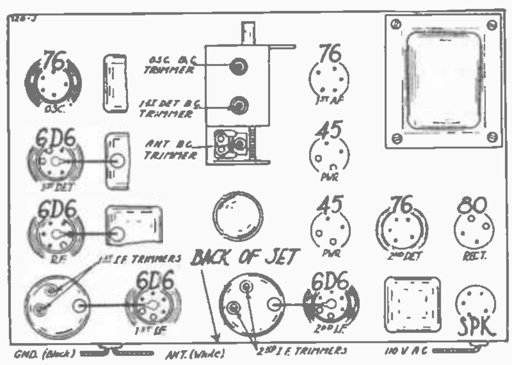


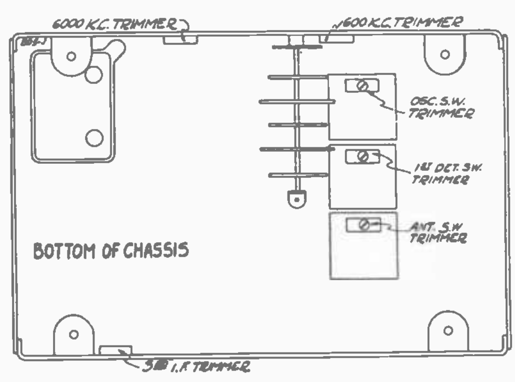
Voltages at Sockets

LINE VOLTAGE — 115

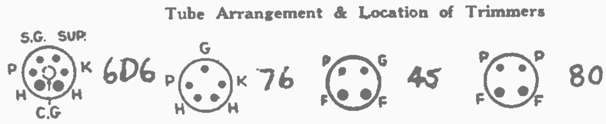
ANTENNA SHORTED TO GROUND

Type of Tube	Function	Across Fila. or Heater	Plate to Cath.	Screen to Cath.	Cath. to Ground	Normal Plate M. A.
6D6	R. F.	6.3	95	95	2.8	7.0
6D6	1st Det.	6.3	88	95	9.2	2.9
76	Osc.	6.3	110	—	—	5.0
6D6	1st I. F.	6.3	95	95	2.8	7.0
6D6	2nd I. F.	6.3	300	95	3.3	6.0
76	2nd Det.	6.3	—	—	—	—
76	1st Audio	6.3	160	—	9.0	4.0
45	Output	2.5	245	—	48.0	30.0
80	Rectifier	5.0	890 V. A. C. pl. to pl.			58.0 per plate





Tube Arrangement & Location of Trimmers



In aligning the short wave band of the receiver, it will be noted that the signal will be heard with the signal generator set at two points 912 K. C. apart. That is, if the receiver is tuned to 15,000 K. C. a signal will be heard when the signal generator is set at 15,000 K. C. and again at approximately 15,912 K. C. This is due to image reception or the fact that a 456 K. C. beat is obtained when the signal is 456 K. C. lower than the receiver oscillator and also when the signal is 456 K. C. higher than the receiver oscillator. Care should be taken to see that the receiver is tracked with the signal generator adjusted to the lower of the two frequencies at which a signal is heard, in order that the oscillator in the receiver will be 456 K.C. higher in frequency than the signal.

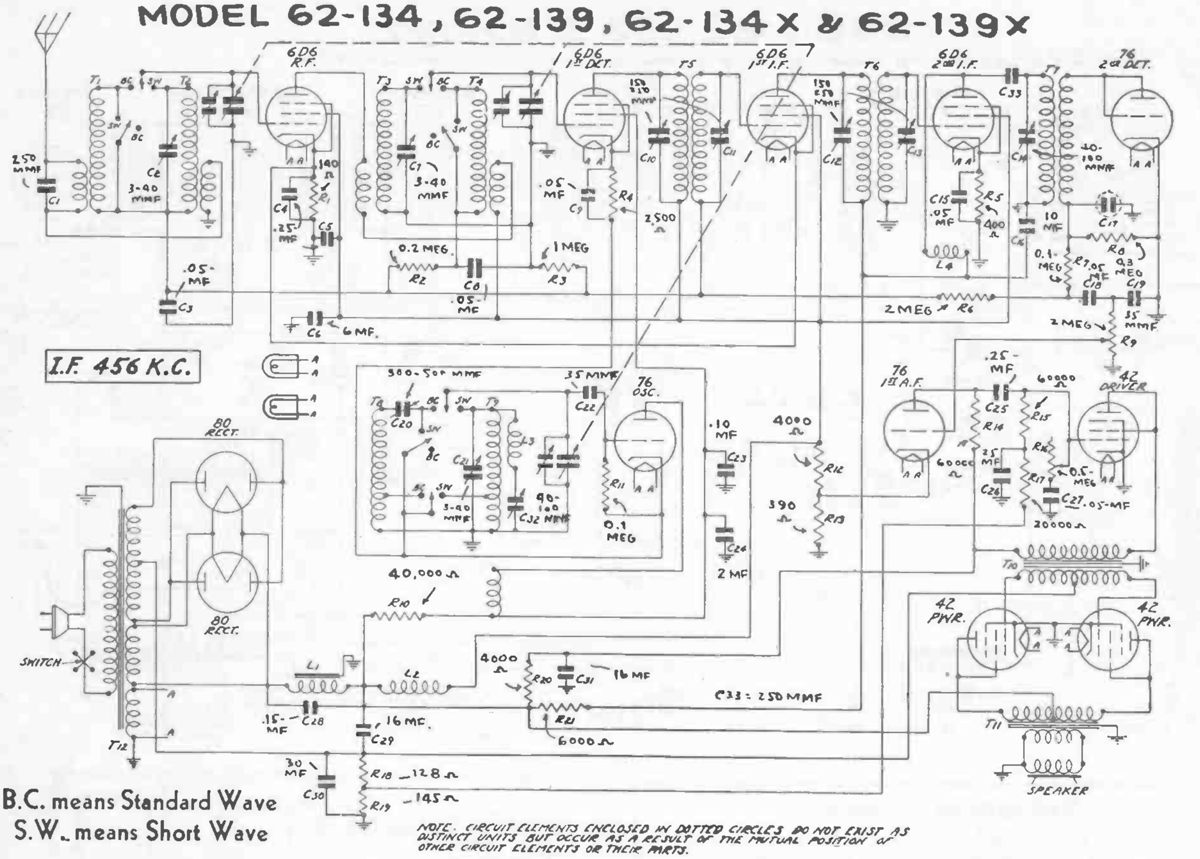
Turn the broadcast short wave switch to the short wave position. Turn the rotor to the full open position. As explained above, the volume control should be at the maximum position and the signal should be reduced to prevent A. V. C. action. Set the signal generator for 18,300 K. C. Then adjust the oscillator short wave trimmer for maximum output. This trimmer is reached from under the chassis and its position is shown in Fig. 2. If a maximum output peak cannot be reached, it may be due to the fact that the antenna and 1st detector short wave trimmers are screwed down too far. Back off these two trimmer screws two or three turns and then adjust the oscillator short wave trimmer for maximum output.

Next set the signal generator for 15,000 K. C. Turn the rotor until maximum output is obtained. Then adjust the antenna and 1st detector short wave trimmers for maximum output.

Next set the signal generator for 6000 K. C. and adjust the 6000 K. C. trimmer.

MONTGOMERY WARD & CO.

MODEL 62-134, 62-139, 62-134X & 62-139X

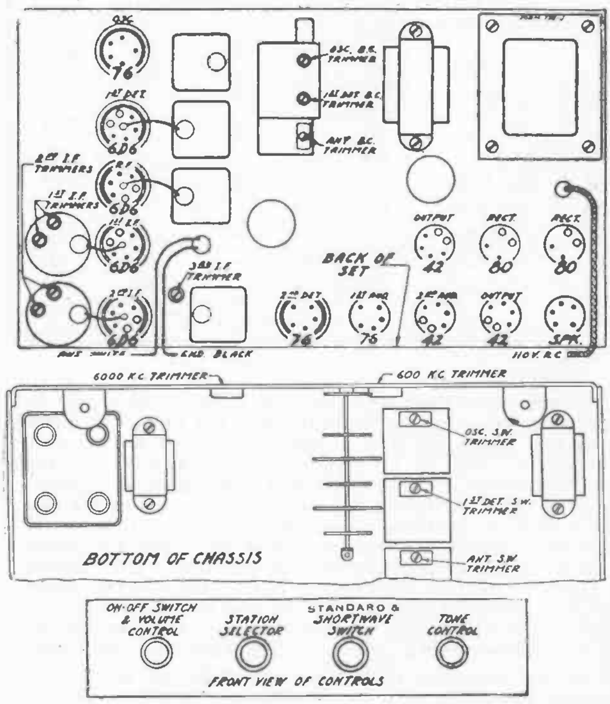


Voltages at Sockets

LINE VOLTAGE — 115
ANTENNA SHORTED TO GROUND

Type of Tube	Function	Across Fila. or Heater	Plate to Cath.	Screen to Cathode	Grid to Cath.	Normal Plate M. A.
6D6	R. F.	6.3	105	105	2.8	8.8
6D6	1st Detector	6.3	95	105	10.0	3.3
76	Oscillator	6.3	115		0.0	5.8 (1) 7.7 (2)
6D6	1st I. F.	6.3	260	105	2.8	8.8
6D6	2nd I. F.	6.3	260	105	3.2	7.2
76	2nd Detector	6.3				
76	1st Audio	6.3	170		11.0	1.2
42	Driver Stage	6.3	235	235	18 (3)	26.5
42	Output	6.3	350	350	38.0	21.0
80	Rectifier	4.6	435			35.5 per plate

(1) Switch in Standard Wave position.
(2) Switch in Short Wave position (No Signal).
(3) Measured across resistor R19.



-Location of Tubes, Trimmers and Controls

Short Wave Band Adjustment

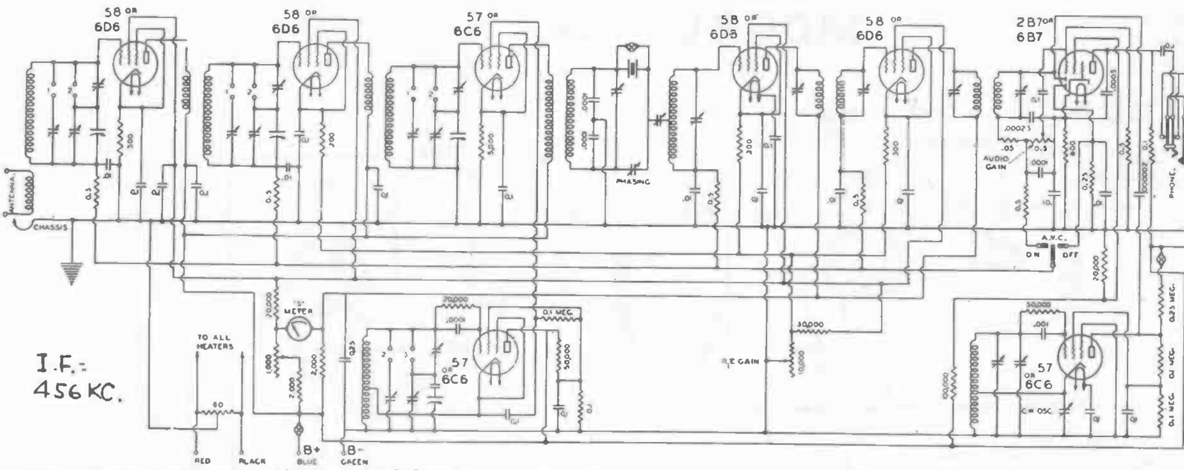
Turn the standard-short wave switch to the short wave position. Turn the rotor to the full open position. As explained above, the volume control should be at the maximum position and the signal should be reduced to prevent A. V. C. action. Set the signal generator for 18,300 K. C. Then adjust the oscillator short wave trimmer for maximum output. This trimmer is reached from under the chassis and its position is shown in Fig. 2. If a maximum output peak cannot be reached, it may be due to the fact that the antenna and 1st detector short wave trimmers are screwed down too far. Back off these two trimmer screws two or three turns and then adjust the oscillator short wave trimmer for maximum output.

Next set the signal generator for 15,000 K. C. Turn the rotor until maximum output is obtained. Then adjust the antenna and 1st detector short wave trimmers for maximum output.

Next set the signal generator for 6000 K. C. and adjust the 6000 K. C. trimmer.

NATIONAL CO.

Schematic Diagram — Type H.R.O. Receiver.



The coil panel screws must be in the left-hand terminal blocks to give the full coverage range, as described in the preceding section. The tuning dial is turned to approximately 490 and a frequency meter, or accurate test oscillator, is set to the frequency indicated by the general coverage calibration chart. This will, incidentally, always be near the high-frequency edge of some amateur band. The oscillator coil trimmer, shown on the layout diagram of the receiver as No. 8, is then adjusted so that the dial reading checks the calibration curve. Trimmers Nos. 2, 4 and 6 are then adjusted for maximum sensitivity. In adjusting these three trimmers, no signal is necessary, as the correct adjustment is that which will give maximum background or tube noise. This background noise should be fairly loud when the R.F. and audio gain controls are fully advanced, the crystal filter being switched off. The tuning dial should then be rotated to the low-frequency end of the range. The background noise should not vary greatly as the dial is being turned. If it does, however, poor ganging is indicated.

The ganging is checked by pressing the outside rotor plate of the oscillator condenser sideways toward the stator, but not far enough to short the condenser. If sensitivity is increased, more inductance is needed in the oscillator coil. On the three low-frequency coil assemblies oscillator inductance is increased by loosening the nut which holds the inductance trimmer disc, inside the oscillator coil, so that the disc may move toward the back of the coil shield. If, however, sensitivity decreases when the oscillator rotor plate is bent toward the stator, the other condensers, particularly the first detector tuning condenser, should be tested the same way. If sensitivity decreases when the rotor plate is moved in, ganging is perfect and the general coverage range is completely adjusted. However, if sensitivity increases, the oscillator coil inductive trimmer must be adjusted to decrease inductance. In the case of the 14 to 30 megacycle coils, inductive trimming is accomplished by moving a loop of wire around the end of the oscillator coil. Bending this loop from right to left across the end of the coil form will increase inductance. After any change in the oscillator coil inductance has been made, it will be necessary to tune back to the high-frequency end of the range in order to readjust the No. 8 trimmer condenser. The procedure as outlined above is then repeated until the ganging is correct.

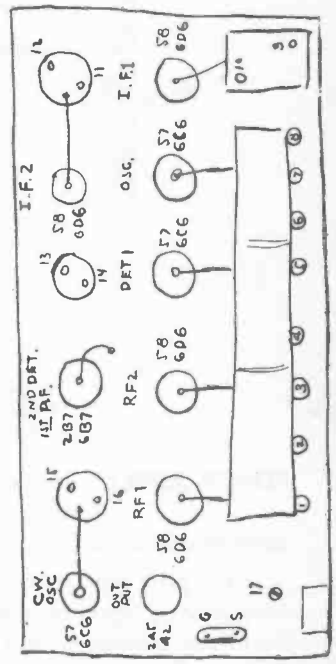
It will be found that the setting of the various trimmers, particularly the No. 8, is quite critical, but that the setting of the inductive trimmer is not at all sharp and, when making the inductance adjustment, the nut may be rotated a full turn for each trial.

In the case of the 14 to 30 megacycle coils, special care must be exercised to see that the oscillator is operating on the high-frequency side of the signal. Two points will be found when adjusting the No. 8 trimmer and of these, the correct one is on the counter-clockwise side. Furthermore, in adjusting the No. 6 trimmer of this coil assembly, there will be some interaction or interlocking between the first detector and oscillator circuits. In adjusting the No. 2 trimmer, it will be necessary to have the antenna connected with some signal or noise input.

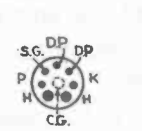
The band-spread range may now be adjusted. It should be pointed out here that adjustments for the general coverage range will affect the band-spread range, but the separate band-spread adjustments may be made without changing the general coverage alignment.

The four screws must be shifted to the right-hand terminal blocks, as outlined under "Coil Ranges" in the preceding section. The tuning dial is set at 450 and a test oscillator adjusted to the exact high-frequency edge of the proper amateur band. Trimmer No. 7 (of the layout diagram) is adjusted until the signal is picked up. Trimmers Nos. 1, 3 and 5 are then adjusted for maximum sensitivity. The dial is then rotated to the low-frequency end of the band; that is, to 50; and the left-hand calibration curve should be checked. If found incorrect, it will be necessary to adjust the band-spread series padding condenser, mounted inside the oscillator coil and adjustable from the rear by means of a socket wrench. If the low-frequency end of the band is tuned in at any dial reading above 50, the capacity of this series padding condenser must be decreased. If the low-frequency edge of the band is found between 0 and 50, the capacity must be increased. The setting is critical. After making a trial adjustment, the dial is returned to 450 and trimmer No. 7 readjusted. The above procedure is repeated until the dial checks the calibration curve.

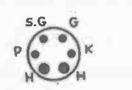
Tracking of the two R. F. and first detector circuits may then be checked by tuning to the low-frequency end of the band and checking the adjustment of the Nos. 1, 3 and 5 trimmers. If more capacity is needed for best sensitivity (as indicated by improved signal strength when the trimmer is rotated clockwise), the series padding condenser of the coil being adjusted must have more capacity. If any of the Nos. 1, 3 or 5 trimmers require less capacity, a corresponding decrease must be made in the capacity of the series padding condenser. After the series padding condenser has been adjusted for trial, the dial is returned to 450 and the procedure repeated.



57 -58
6C6 - 6D6



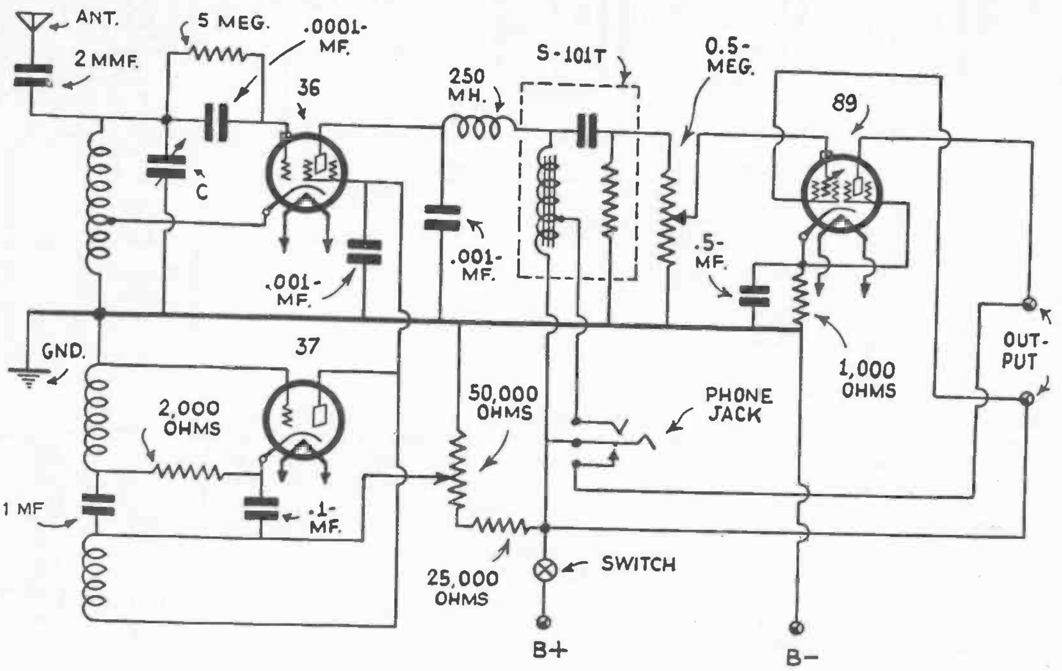
2B7 - 6B7



2A5 - 42

NATIONAL CO.

MODEL SRR



POWER SUPPLY. The heater circuit requires approximately 6 volts at .9 amperes. The voltage is not critical and may be between 5.5 and 6.5 volts. The supply may be either A. C. or D. C. except as noted under instructions for the Low Frequency Coils.

The plate supply voltage normally required is 180 volts and this may be obtained either from B-batteries or from an A. C. operated power supply. The NATIONAL TYPE No. 5886 AB power unit fulfills these requirements and is supplied with a suitable receptacle for the 4-prong cable plug. 135 volts of B-battery may be used with good results, provided the 25,000 ohm resistor, mounted near the center of the chassis (underneath), is changed to 10,000 ohms. Fair results may be obtained with 90 volts of B-battery, in which case this resistor should be shorted out entirely.

LOW FREQUENCY COILS. Coils are available for covering the 10, 20, 40, 80, and 160 meter bands. When using these coils the low frequency oscillator (237) should be removed from the socket. Under certain circumstances the use of super-regeneration when receiving ICW signals on the 10 meter band will greatly improve sensitivity.

The heater circuits must be supplied from a D. C. source, such as a storage battery, in order to eliminate A. C. hum.

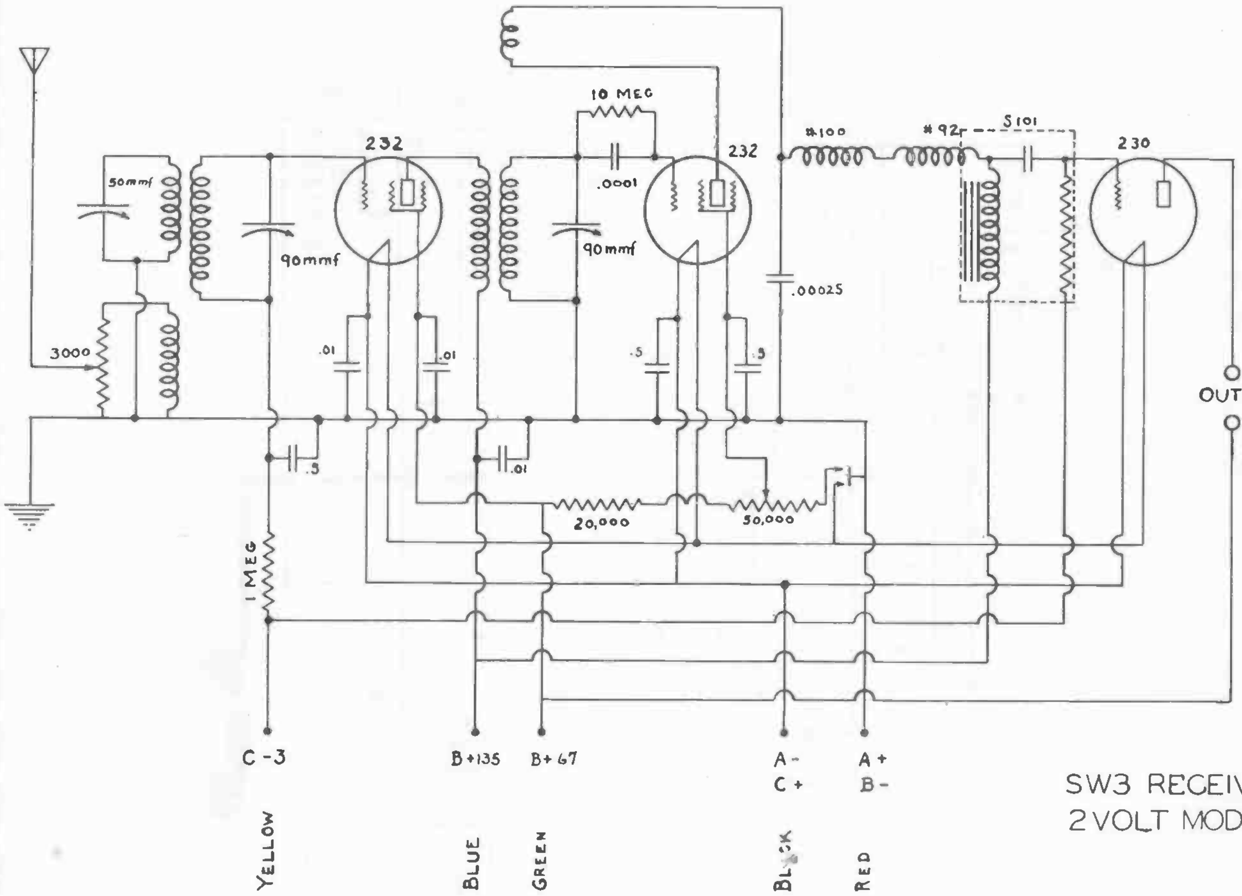
If A. C. operation is desired on these bands, it will be necessary to change the tubes to the 2.5 volt type. A 224 may be substituted for the 236; a 227 for the 237, and a 2A5 for the 89—altogether this last substitution will require some re-wiring of the output tube socket. The bias resistor required for the 2A5 tube is approximately 500 ohms and should replace the 1,000 ohm resistor used for biasing the 89.

Due to the fact that as a general rule super-regeneration cannot be used on the low frequency bands, the sensitivity of the receiver will be considerably less than on the 56-60 m. c. band and it is, therefore, advisable to use the headphones connected in the output circuit instead of the loudspeaker.

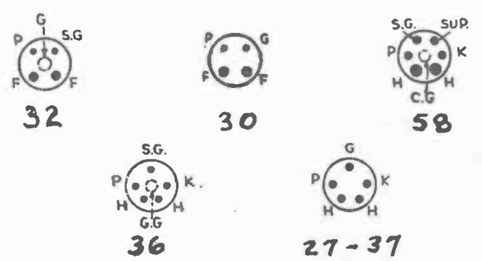
ADDITIONAL HIGH FREQUENCY COILS. Additional coils are available for covering the frequency range between 40 and 75 megacycles (7½ to 4 meters).

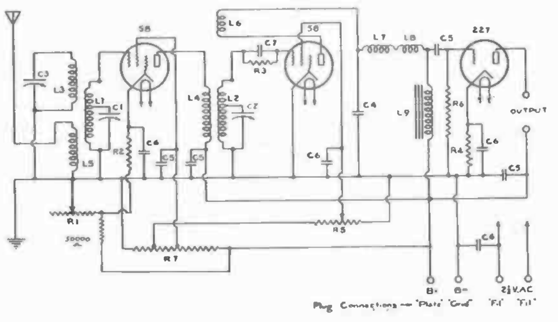
NATIONAL CO.

MODEL SW-3



SW3 RECEIVER
2VOLT MODEL

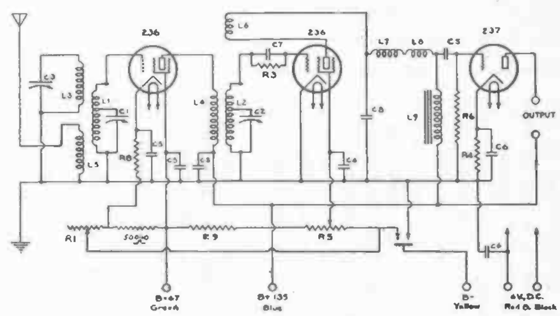




CIRCUIT DIAGRAM OF THE ACSW-3

This receiver employs only a-c tubes, as indicated, and should be selected for complete a-c operation, or for partial a-c operation (using plate batteries) where a 2.5 a-c heater potential will always be available. The circuit constants are as follows —

L_1, L_2, L_3, L_4, L_5 and L_6 — R.F. Transformers.
L_7 — No. 100 Ultra High Frequency R.F. Choke.
L_8 — No. 92 Low Radio Frequency Choke.
L_9 — 700 Henry Choke — Part of S-101 Audio Coupler.
C_1 and C_2 — Ganged S.F.L. 270° Tuning Condensers with isolated rotors. 90-μμf per section.
C_3 — Midget Type Trimmer Condenser — 50-μμf.
C_4 — 250-μμf mica by-pass condenser.
C_5 — .01-μf non-inductive mica fixed condensers.
C_6 — .5-μf non-inductive paper by-pass condenser.
C_7 — 100-μμf small mica grid condenser. Incorporated in Detector R.F. transformer.
R_1 — 10,000 ohm potientiometer — special taper — used as gain control.
R_2 — 300 ohm cathode resistor, 2 watt type.
R_3 — 5 megohm detector grid leak.
R_4 — 2000 ohm cathode resistor, 2 watt type.
R_5 — 50,000 ohm potentiometer for regeneration control.
R_6 — 250,000 ohm audio grid resistor — part of S-101 Coupler.
R_7 — Voltage Divider-total resistance 12,000 ohms.



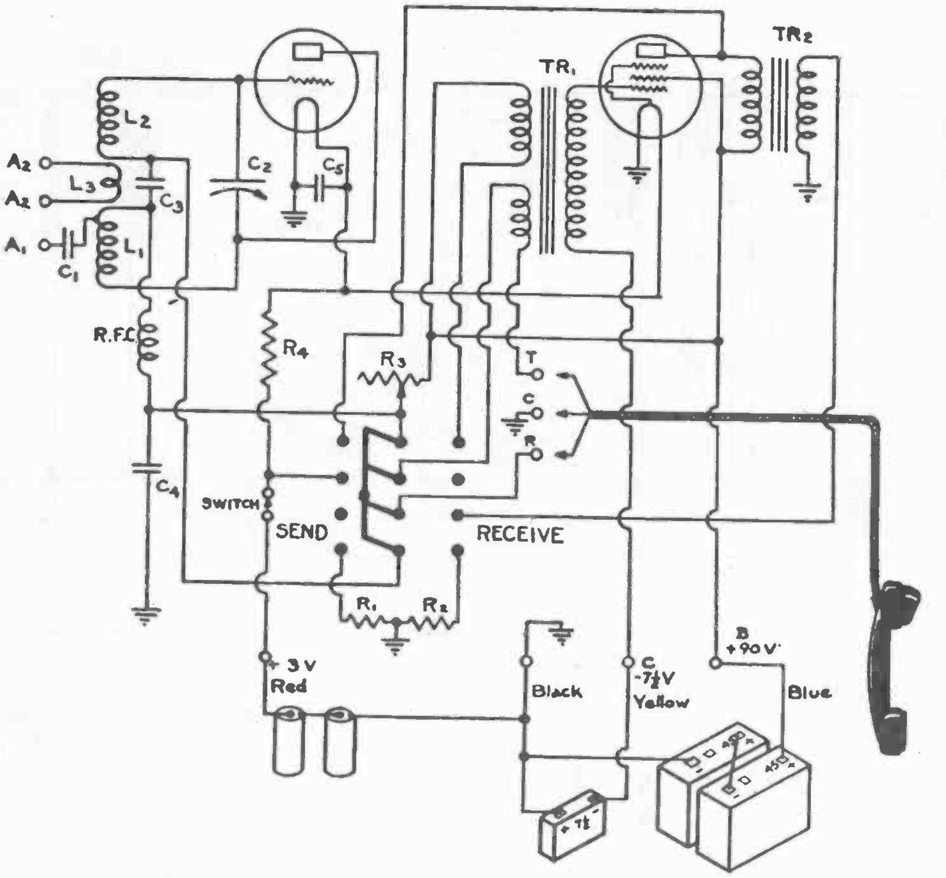
CIRCUIT DIAGRAM OF THE DCSW-3

This is the combination circuit which should always be selected when battery operation may be required. It can, however, readily be converted to a-c operation using the standard 235 and 227 tubes. The circuit constants are identical with those indicated in Figure 1, with the following exceptions —

R_8 — 350 ohm resistor.
R_9 — 20,000 ohm 2-watt type resistor.
SW — Regeneration control and cathode circuit switch.

NATIONAL CO.

PORTABLE TRANSCEIVER



PARTS LIST FOR NATIONAL TRANSCEIVER

C_1—.001 μfd. Aerovox No. 1460.
C_2—6 μμfd. National STN-6.
C_3—.0001 μfd. Aerovox No. 1465.
C_4—.003 μfd. (omitted in some models).
C_5—.001 μfd. Aerovox No. 1460.
R_1—10,000 ohms, 2-watt type.
R_2—100,000 ohms, 1-watt type.
R_3—50,000 ohms-variable Centralab No. 2108.
R_4—2 ohm filament resistor Yaxley.
RFC—2½ m.h. National R-100.
Switch—General Radio Type 339-A.
TR_1—Audio and Microphone Transformer, National TR-1.
TR_2—Output Transformer, National TR-2.

30 33

The batteries are wired as follows: The two B-batteries are connected in series; that is, the positive terminal of one is connected to the negative terminal of the other. The two dry cells are likewise connected in series. By means of the short length of wire provided, the free B-negative is connected to the positive terminal of the "C" battery, and also to the free negative terminal of the "A" battery. (Outside, or rim, connection.) The Black cable wire is also connected to the negative "A" terminal. The Red wire is connected to the positive "A" terminal. The Yellow cable wire is connected to the negative terminal of the "C" battery, and the Blue wire to the free positive terminal of the B-battery. (B+90)

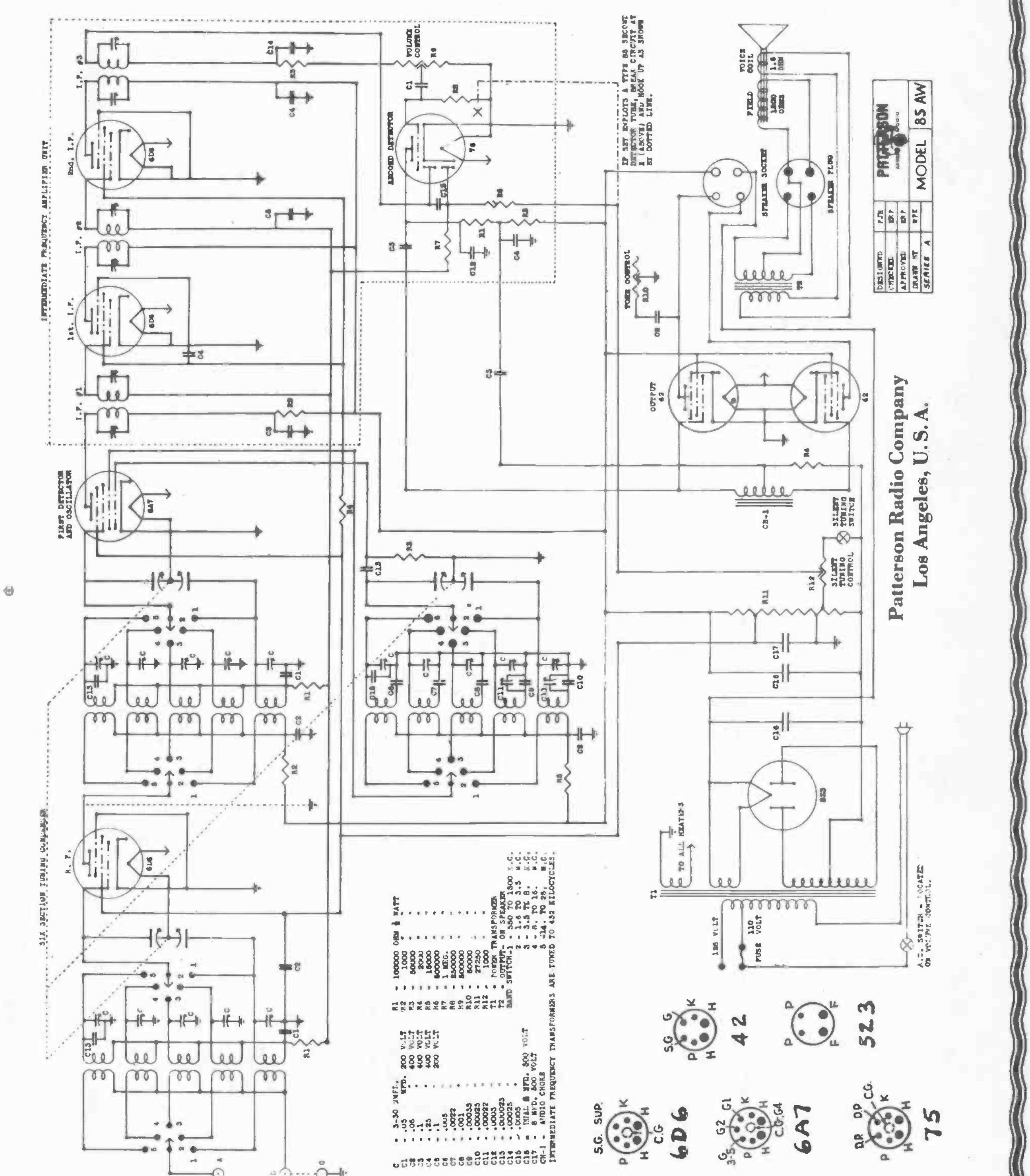
Three terminals are provided for connecting the hand telephone set, and are located in the TRW unit underneath the panel near the volume control. These are marked "T", "C" and "R", meaning, respectively, "Transmitter," the "Common" connection between transmitter and receiver, and "Receiver." The corresponding color code of the Type E-1 Western Electric unit is, Brown with Red Tracer, "Transmitter," (T); Black, the "Common," (C); and Brown with White Tracer, "Receiver," (R).

To put the Transceiver in operation after the batteries have been properly connected and a suitable antenna erected, it is only necessary to turn the filament switch (righthand knob) to the "On" position. With the selector switch on the receiving side, a loud hissing or rushing sound will be heard in the receiver. When a station is tuned in, however, this background noise will be greatly reduced, the amount of the reduction depending upon the strength of the signal.

As previously mentioned, the 56–60 megacycle band covers from 30 to 80 on the dial. When using a correctly constructed antenna, there should be a point on the dial a few degrees in width where the background noise is slightly weaker than at other dial settings. This point indicates the resonant frequency of the antenna system and most efficient operation of the unit, particularly when using it as a transmitter, will be had at this dial setting. If the point (where the background hiss is weaker) cannot be found, or if the background hiss is absent entirely over several dial divisions, the antenna coupling must be adjusted. This is accomplished by changing the position of the 3-turn antenna coil, which is mounted between the two tuning coils. If the point where the hiss is weaker cannot be found, the antenna coil should be pushed in, so that it is more nearly in line with the two other coils.

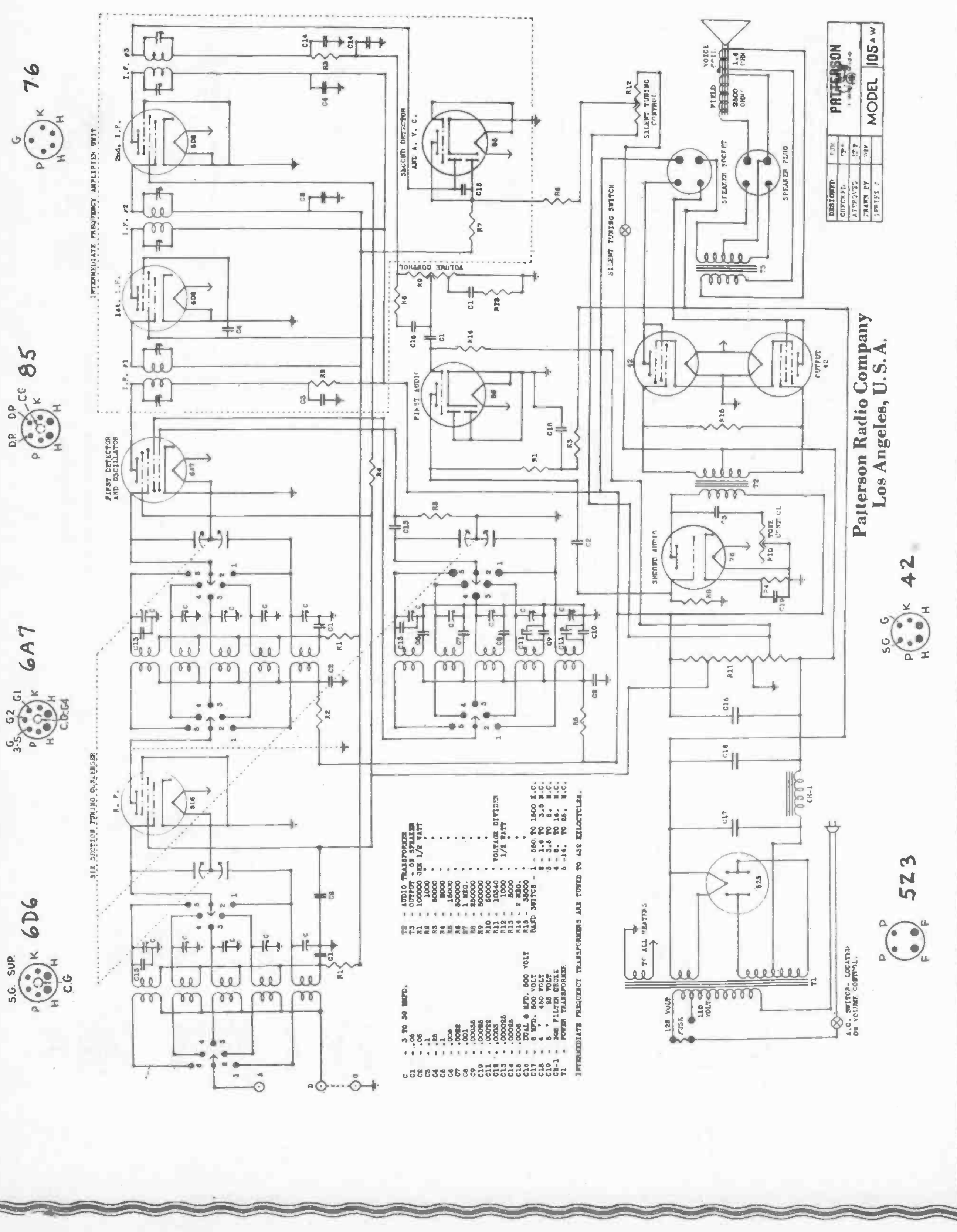
PATTERSON RADIO CO.

MODEL 85 AW



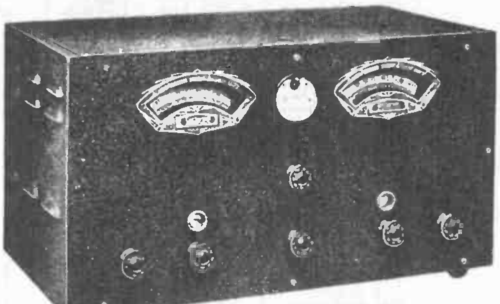
PATTERSON RADIO CO.

MODEL 105 AW

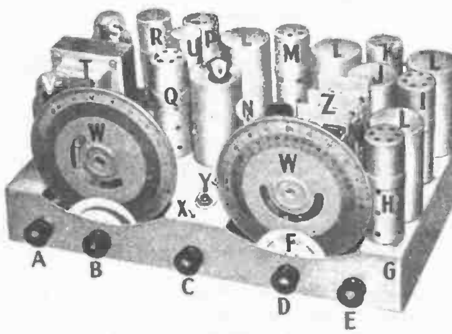


PATTERSON RADIO CO.

MODEL PR-10



PR-10 Model



PR-10 Chassis

Everything from A to Z

A—"B" on and off. Beat Oscillator switch.
B—Push. Tone Control. Normal. Band Spread.
C—Volume Control. Power Switch.
D—Push. Band Change. Normal. Main Tuning.
E—Short-Wave Trimmer, two gang.
F—Band Indicator.
G—Heavy 18-gauge Chromium Plated Chassis.
H—First Detector—#57.
J—First I. F. Tube—#58.
J—B. C. and 75 Meter Oscillator.
K—Second I. F. Tube—#58.
L—Three Stages I. F.
M—Third I. F. Tube—#58.
N—High Frequency Oscillator Tube —#56.
O—Beat Oscillator Control.
P—Second Detector and AVC Tube —#55.
Q—Beat Oscillator Tube—#57.
R—Vacuum Tube Volt Meter—#57.
S—Output Tube—#59.
T—Heavy Duty Power Supply.
U—Moisture-proof Filter.
V—Rectifier Tube—5Z3.
W—Patterson Velvet Tuning Dials.
X—Manual Control Mounts Here.
Y—Sensitivity. "R" Meter Adjustments.
Z—Three-gang Condenser, Rubber Mounted.

To Bandspread Amateur Bands Set Main Tuning Dial As Shown

Operation of the PR-10

Band	Main Dial	Switch Location
20 Meter Fone	46.5 or 51.5	15— 33 Meters
20 Meter Total	46 or 51	15— 33 Meters
40 Meter C. W.	28	30— 75 Meters
75 Meter Fone	92	30— 75 Meters
75 Meter Total	7	75—200 Meters
160 Meter Total	Use Main Tuning Dial	75—200 Meters

Broadcast—Set band spread dial at 0 and use main tuning dial. Trimmer is not connected when switch is set for broadcast.

GENERAL INFORMATION

To locate the various Amateur bands, use the above scale. In all cases the band spread dial starts with 10 as the minimum. The trimmer condenser should always be used at the minimum resonant point. This assures tracking over the complete range of the main tuning dial.

The best type of antenna is a heavy wire as long and as high as possible. We have used 800 feet to good advantage. A small antenna will give you just as good results on loud stations but it will not receive extremely weak ones.

If more power is wanted from the beat oscillator, this can be had by adding a .1 mfd. condenser across the .006 mfd. condenser on the oscillator tube. We do not advise this change as it will cover up extremely weak stations.

The condenser gang is accurately trimmed and should not be touched under any conditions. The line-up is as follows: The section nearest the dial is the oscillator gang. The middle section tunes the first detector input. The rear section tunes the antenna coil. The trimmer on the antenna gang can be varied slightly to compensate for the different lengths of antenna.

To obtain the best possible results from the PR-10 requires a complete understanding of the receiver.

When the set is first put in operation be sure the speaker is plugged into the socket in the rear of the chassis before the power switch is turned on.

For a baffle board use either a box about 15 inches square made of 1-inch lumber, or next best, a large heavy board at least 3 feet square. Some amateurs mount the speaker in the wall; this is ideal.

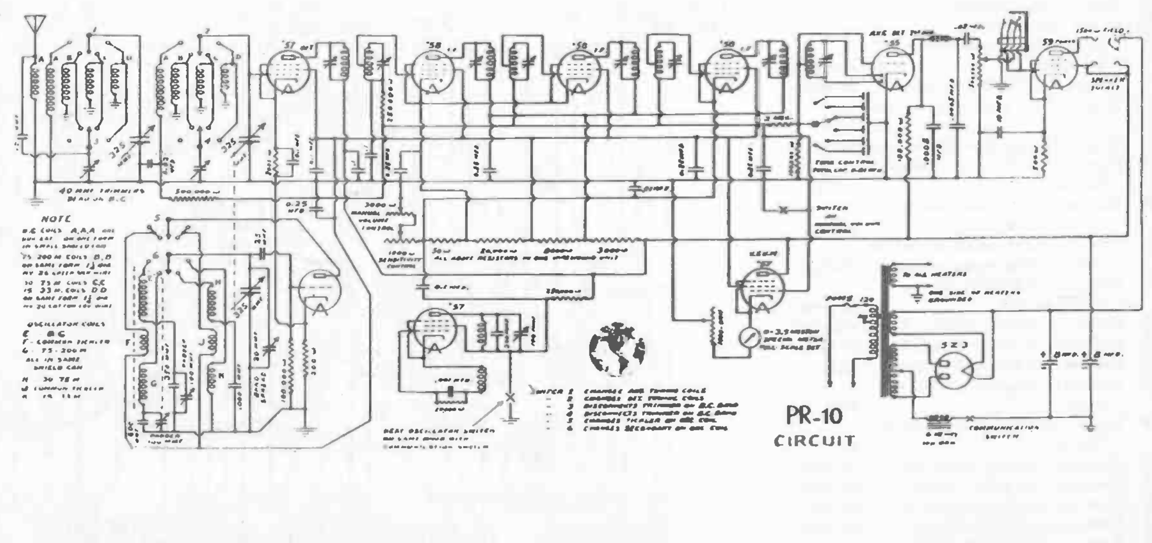
We do not advise using a doublet antenna but if the owner wants to experiment with one, hook it to the antenna and ground posts. Try tuning the feeders by using a condenser of about 300 M.M.F. in series with each lead. The best results are obtained when an extremely long antenna is used. The PR-10 is being operated by owners with 200 to 800 feet of aerial. Keeping the antenna in the clear is the most important part.

SETTING

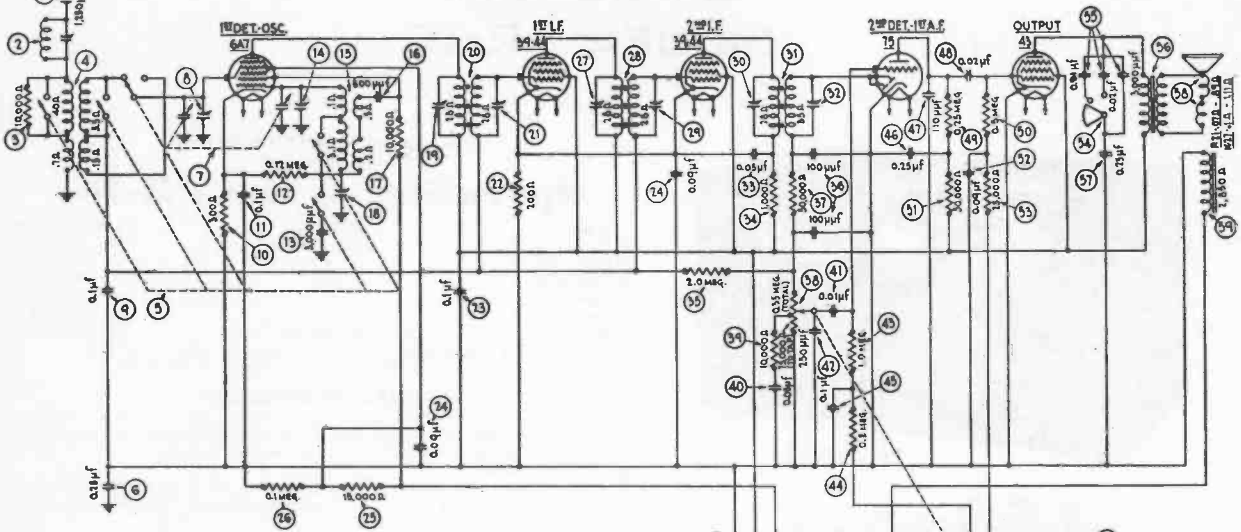
To set the sensitivity and meter controls on the inside of the cabinet properly, turn the main tuning dial to "O" on the 15-33 meter, disconnect the antenna, and turn the sensitivity control until the tube hiss is about R-5 by ear volume; then adjust the meter control until the hand of the meter is in the set position. If this is done properly, the meter will read the correct R strength of carrier input to the antenna. Each band uses a separate coil changed by a six pole switch. The two coils on the top of the chassis are the band pass antenna coils for the 15-33 and 30-75 meter bands. The efficiency of these coils is kept high by not shielding them. The Broadcast antenna coil is in the small shield behind the condenser. The 75-200 meter coil is under the chassis below the two low wave coils.

The PR-10 does not use a crystal filter circuit owing to the fact that this set uses three stages of I.F. and the selectivity is somewhat in excess of the average two stage I.F. receiver when using crystal.

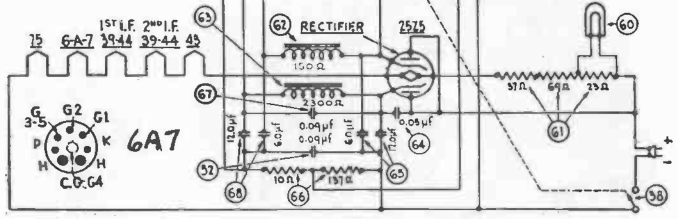
The PR-10 cuts side bands on voice reception at 1200 cycles off resonance and it is possible to single signal a code signal by offsetting the Beat Oscillator. A number of skeptical amateurs have tried to better code reception by introducing a crystal in

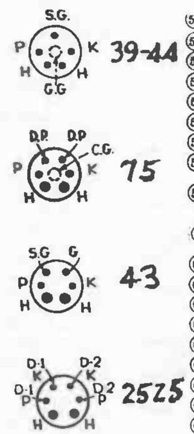


PHILCO RADIO & TELEVISION CORP.
MODEL 28

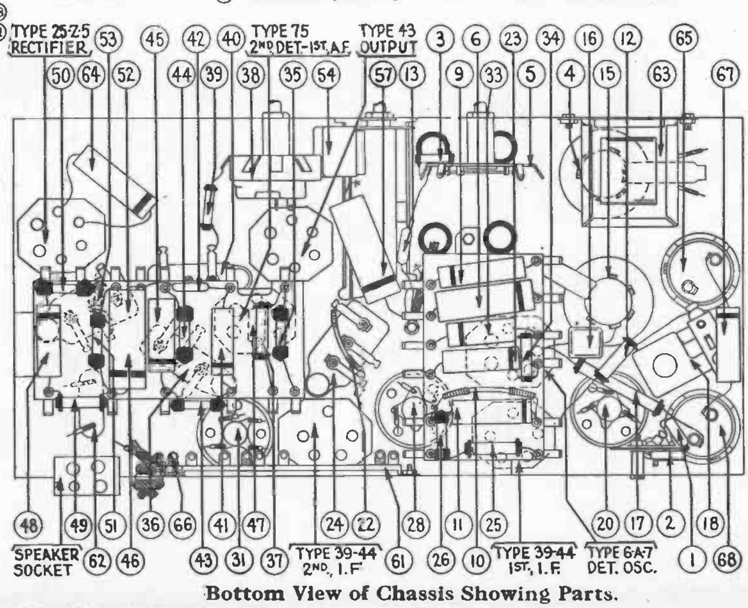


I.F.=460 KC.





No. on Figs.	Description	Part No.
1	Condenser (.00125 mfd.—Mica)	5836
2	Wave Trap	38-6050
3	Resistor (10,000 ohms) (Brown-Black-Orange)	33-1000
4	Antenna Transformer	32-1360
5	Wave Band Switch	42-1062
6	Condenser (.25 mfd.—Tubular)	30-4146
7	Tuning Condenser Assembly	31-1366
8	Compensating Condenser (Antenna)	Part of (7)
9	Condenser (.1 mfd.—Tubular)	30-4122
10	Resistor (400 ohms—Flex.) (Yellow-Black-Brown)	33-3016
11	Condenser (.1 mfd.—Tubular)	30-4122
12	Resistor (120,000 ohms) (Brown-Red-Yellow)	33-1128
13	Condenser (.003 mfd.—Mica)	30-1023
14	Compensating Condenser (Osc. H. F.)	Part of (7)
15	Oscillator Transformer	32-1361
16	Condenser (.0008 mfd.—Mica)	5878
17	Resistor (10,000 ohms) (Brown-Black-Orange)	3524
18	Compensating Condenser (Osc. L. F.)	04000S
19	Compensating Condenser (1st I. F. Primary)	Part of (20)
20	First I. F. Transformer	32-1362
21	Compensating Condenser (1st I. F Secondary)	Part of (20)
22	Resistor (200 ohms—Flex.) (Red-Black-Black)	7217
23	Condenser (.1 mfd.—Tubular)	30-4122
24	Condenser (.09 mfd.—Twin-Bakelite Block)	4989M
25	Resistor (15,000 ohms) (Brown-Green-Orange)	6208
26	Resistor (.1 meg.) (White-White-Orange)	4411
27	Compensating Condenser (2d I. F. Primary)	Part of (28)
28	2d I. F. Transformer	32-1363
29	Compensating Condenser (2d I. F. Secondary)	Part of (28)
30	Compensating Condenser (3d I. F. Primary)	Part of (31)
31	3d I. F. Transformer	32-1364
32	Compensating Condenser (3d I. F. Secondary)	Part of (31)
	Condenser (.05 mfd.—Tubular)	30-4020
33, 34	Resistor (1000 ohms) (Brown-Black-Red)	5837
35	Resistor (2 megs.) (Red-Black-Green)	5872
36	Condenser (.0001 mfd.—Twin-Bakelite Block)	8035E
37	Resistor (50,000 ohms) (Green-Brown-Orange)	4518
38	Volume Control and On-Off Switch (350,000 ohms, tapped at 75,000)	33-5066
39	Resistor (10,000 ohms) (Brown-Black-Orange)	33-1000
40	Condenser (.05 mfd.—Bakelite Block)	3615-BU
41	Condenser (.01 mfd.—Tubular)	30-4124
42	Condenser (.00025 mfd.—Mica)	5858
43	Resistor (1 meg.) (Brown-Black-Green)	4409
44	Resistor (.5 meg.) (Yellow-White-Yellow)	4517
45	Condenser (.1 mfd.—Tubular)	30-4122
46	Condenser (.25 mfd.—Tubular)	30-4146
47	Condenser (.00011 mfd.—Mica)	30-1031
48	Condenser (.02 mfd.—Mica)	30-4113
49	Resistor (.25 meg.) (Red-Yellow-Yellow)	4410
50	Resistor (.5 meg.) (Yellow-White-Yellow)	4517
51	Resistor (50,000 ohms) (Green-Brown-Orange)	4518
52	Condenser (.09 mfd.—Twin-Bakelite Block)	4989M
53	Resistor (25,000 ohms) (Red-Green-Orange)	33-1013
54	Tone Control (3-point)	30-4211
55	Condensers (In tone control)	Inside (54)
56	Output Transformer (28C)	32-7243
57	Condenser (.25 mfd.—Tubular)	30-4146
58	Voice Coil and Cone Assembly: P-21	02861
	Voice Coil and Cone Assembly: K-27	36-3159
59	Field Coil and Pot Assembly: P-21	36-3357
	Field Coil and Pot Assembly: K-27	36-3352
60	Pilot Lamp	4567
61	Resistor (Wire Wound, New Type) (37, 63, 29 ohms)	33-3159
62	Filter Choke	6658
63	Filter Choke	32-7018
64	Condenser (.05 mfd.—Tubular)	30-4123
65	Condenser (Electrolytic 6 and 12 mfd., 150 volts)	30-2083
66	Resistor (Wire Wound, New Type) (10, 137 ohms)	33-3158
67	Condenser (.09 mfd.—Tubular)	30-4122
68	Condenser (Electrolytic 6 and 12 mfd., 150 volts)	30-2083



Bottom View of Chassis Showing Parts.

PHILCO RADIO & TELEVISION CORP.

MODEL 29

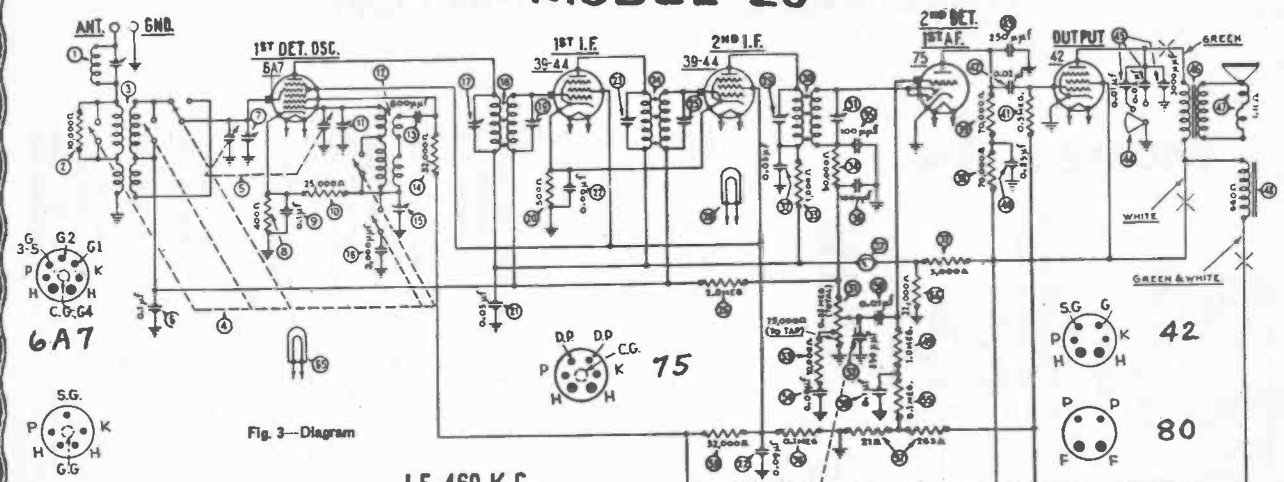
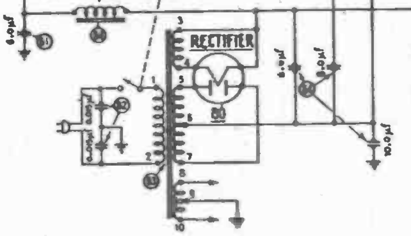


Fig. 3—Diagram



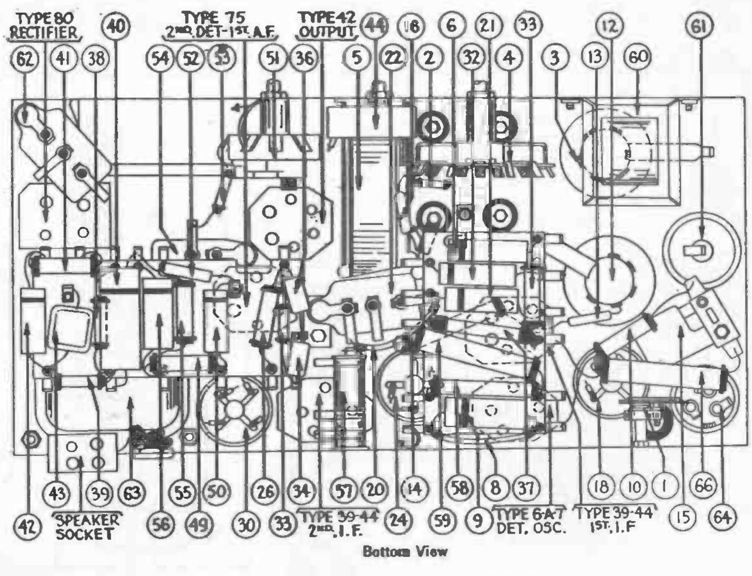
I.F. 460 K.C.

Nos. on Diagram	Description	Part No.
1	Wave Trap	38-5199
2	Resistor (10,000 ohms) (Brown-Black-Orange)	33-1000
3	Antenna Transformer	32-1360
4	Wave-Band Switch	42-1062
5	Tuning Condenser Assembly	31-1192
6	Condenser (.1 Mfd. Tubular)	30-4122
7	Compensating Condenser (Det.)	Part of 5
8	Resistor (400 ohms Flexible Wire-Wound)	33-3016
9	Condenser (.1 Mfd. Tubular)	30-4122
10	Resistor (25,000 ohms) (Red-Green-Orange)	4516
11	Compensating Condenser (Osc. H. F.)	Part of 5
12	Oscillator Transformer	32-1361
13	Condenser (.0008 Mfd. Mica)	5878
14	Resistor (32,000 ohms) (Orange-Red-Orange)	3525
15	Compensating Condenser (Osc. L. F.)	04000S
16	Condenser (.003 Mfd. Mica)	7301
17	Compensating Condenser (1st I. F. Primary)	Part of 18
18	First I. F. Transformer	32-1362
19	Compensating Condenser (1st I. F. Sec.)	Part of 18
20	Resistor (500 ohms Flexible Wire-Wound)	6977
21	Condenser (.05 Mfd. Tubular)	30-4123
22	Condenser (.09 Mfd. Twin) (Bakelite Block)	4989-Z
23	Compensating Condenser (2d I. F. Pri.)	Part of 24
24	2d I. F. Transformer	32-1363
25	Compensating Condenser (2d I. F. Sec.)	Part of 24
26	Resistor (2 Megohms) (Red-Black-Green)	5872
27	Shadowmeter	6497
28	Pilot Lamp (Shadowmeter)	Part of 27
29	Compensating Condenser (3d I. F. Pri.)	Part of 30
30	3d I. F. Transformer	32-1364
31	Compensating Condenser (3d I. F. Sec.)	Part of 30
32	Condenser (.05 Mfd. Tubular)	30-4123
33	Resistor (1,000 ohms) (Brown-Black-Red)	5837
34	Resistor (50,000 ohms) (Green-Brown-Orange)	6098
35	Condenser (.0001 Mfd. Mica)	30-1031
36	Condenser (.0001 Mfd. Mica)	30-1031
37	Resistor (5,000 ohms) (Green-Black-Red)	3526
38	Resistor (70,000 ohms) (Violet-Black-Orange)	5385
39	Resistor (70,000 ohms) (Violet-Black-Orange)	5385
40	Condenser (.25 Mfd. Tubular)	30-4134
41	Resistor (500,000 ohms) (Yellow-White-Yellow)	4517
42	Condenser (.02 Mfd. Tubular)	30-4113
43	Condenser (.00025 Mfd. Mica)	5858
44	Tone Control	30-4178
45	Condensers (Inside 44)	Part of 44
46	Output Transformer	32-7178
47	Voice Coil and Cone Assembly (H-16)	02625
48	Field Coil and Pot. Assembly (H-16)	36-3218
49	Resistor (1 Meg.) (Brown-Black-Green)	4409
50	Condenser (.01 Mfd. Tubular)	30-4124
51	Volume Control and On-Off Switch	33-5066
52	Condenser (.00025 Mfd. Mica)	5858
53	Resistor (10,000 ohms) (Brown-Black-Orange)	33-1000
54	Condenser (.09 Mfd.) (Bakelite Block)	4989-AM

NOTE: Run No. 6 has a No. 33-1114 resistor (8000 ohms) (Gray-Black-Red) shunted across shadowmeter. Runs No. 7 and after have No. 5309 resistor (2900 ohms) (Red-White-Red) shunted across shadowmeter.

Nos. on Diagram	Description	Part No.
55	Resistor (100,000 ohms) (White-White-Orange)	4411
56	Condenser (.1 Mfd. Tubular)	30-4122
57	B. C. Resistor (263 ohms; 23 ohms; Wire-Wound)	33-3069
58	Resistor (.1 Meg.) (White-White-Orange)	3767
59	Resistor (32,000 ohms) (Orange-Red-Orange)	33-1026
60	Filter Choke	32-7018
61	Condenser (Electrolytic—6 Mfd.)	30-2020
62	Condenser (.015 Mfd. Twin—Bakelite Case)	3793-E
63	Power Transformer	32-7229
64	Condenser (Electrolytic—8 Mfd., 8 Mfd., 10 Mfd.)	30-2073
65	Pilot Lamp (Dial)	6608
66	Resistor (32,000 ohms) (Orange-Red-Orange)	33-1026

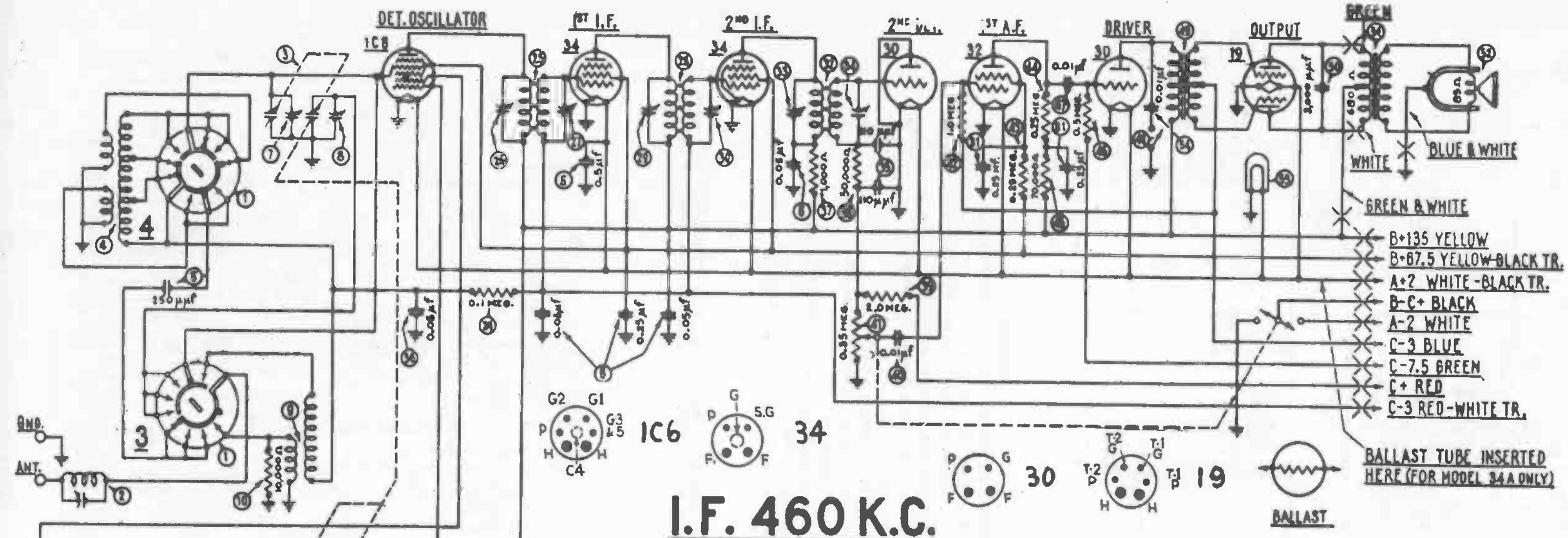
*Note: Some Model 29 sets use tuning condenser assembly No. 31-1250, which has dial assembly 31-1245. This is not interchangeable with 31-1192 and 31-1208.

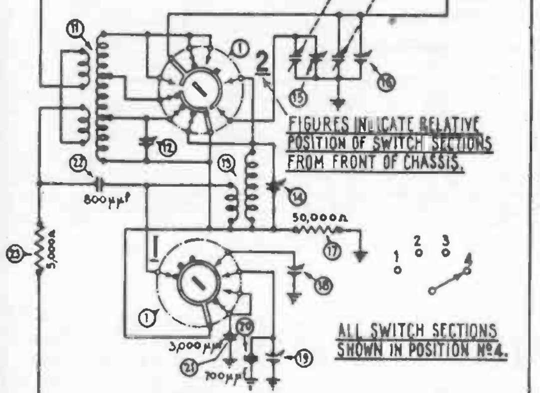


Bottom View

PHILCO RADIO & TELEVISION CORP.

MODEL 34





I.F. 460 K.C.

1—ADJUSTMENT OF THE INTERMEDIATE FREQUENCY—Remove the grid clip from the type 1C6 tube and connect the "ANT" output terminal of the signal generator to the grid cap of the tube. Connect the "GND" terminal of the signal generator to the "GND" terminal of the receiver chassis.

Connect the output meter to the primary terminals of the output transformer. Set the signal generator at 460 K.C. (the intermediate frequency of Model 34) and adjust each of the I.F. compensating condensers in turn, to give maximum response in the output of the receiver. The location of the I.F. compensating condensers is shown in Figure 2. Each of these transformers has a dual compensating condenser mounted at its top, and accessible thru a hole in the top of the coil shield. In the dual compensators, the Primary circuit is adjusted by turning the screw; the Secondary circuit is adjusted by turning the hex-head nut.

2—ADJUSTMENT OF THE WAVE TRAP—Replace the grid clip upon the Detector-Oscillator tube (Type 1C6). Connect the output leads from the signal generator directly to the antenna and ground terminals of the receiver. Set the Wave-Band Switch of the receiver to the standard broadcast band (Range 1) and the Station Selector at the low frequency (520 K.C.) end. Adjust the Wave Trap ② condenser to give MINIMUM response to a 460 K.C. signal from the signal generator. The Wave Trap ② is located at rear and underneath the chassis, and is shown in Figures 2 and 5. It is reached from the rear of the chassis.

3—ADJUSTMENT OF THE DIAL FREQUENCIES—Model 34 has four separate frequency bands or ranges, each obtained by one of the four positions of the wave-band switch. There is a compensating condenser for each range, which must now be adjusted. In the following procedure, the frequency ranges referred to, and obtained by the different positions of the switch are:

Range 1	520 K.C.—1500 K.C.
Range 2	1.5 M.C.—4.0 M.C.
Range 3	4.0 M.C.—11.0 M.C.
Range 4	11.0 M.C.—23.0 M.C.

Connect the output terminals of the Model 091 or equivalent Signal Generator, to the "ANT" and "GND" terminals of the receiver chassis. Connect an output meter to the primary terminals of the Output Transformer of the receiver. Set the Wave-Band Switch to Range 4, and the Station Selector at 21.6 M.C. The sixth harmonic of the 3.6 M.C. crystal in the Model 091 Signal Generator is picked up at this point. Adjust the compensating condenser ⑮ on Section 1 of Tuning Condenser for maximum response in the output of the receiver.

Turn the Wave-Band Switch to Range 3, and the Station Selector to 10.8 M.C. Here, the third harmonic of the 3.6 M.C. crystal will be heard. Adjust the compensating condenser ⑯ on Section 2 of Tuning Condenser for maximum response in the output of the receiver.

Turn the Wave-Band Switch to Range 2, and adjust the Station Selector to 3.6 M.C. The "Antenna" connection between the Signal Generator and the receiver chassis must be removed for this adjustment, otherwise the output of the Signal Generator will be too great. Adjust the compensating condenser ⑫ to give maximum response in the output circuit. This compensating condenser is located underneath the chassis and is not accessible from above. See Figure 5.

This concludes adjustments requiring the Model 091 (or equivalent) high frequency signal generator.

The Model 048 or its equivalent is now used again. Turn the Wave-Band Switch of the set to Range 2 and the Station Selector to 1.5 M.C. Set the Signal Generator at 1500 K.C. Make sure the "Antenna" connection between the Signal Generator and the Chassis has been restored. Adjust compensating condenser ⑲ located underneath the chassis, (Figure 5). Adjustment is made from the underside of the chassis.

Tune the Wave-Band Switch to Range 1 and the Station Selector to 1400 K.C. Set the Signal Generator at 1400 K.C. Adjust compensating condenser ⑭, which is located underneath the chassis. (See Figure 5). This adjustment is made from the underside of chassis.

Finally, with Wave-Band Switch at Range 1, and Station Selector at 520 K.C., set the Signal Generator at 520 K.C. and adjust compensating condenser ⑱ (Figure 5). This compensating condenser is also mounted underneath the chassis, and reached from below.

PHILCO RADIO & TELEVISION CORP.

MODEL 66

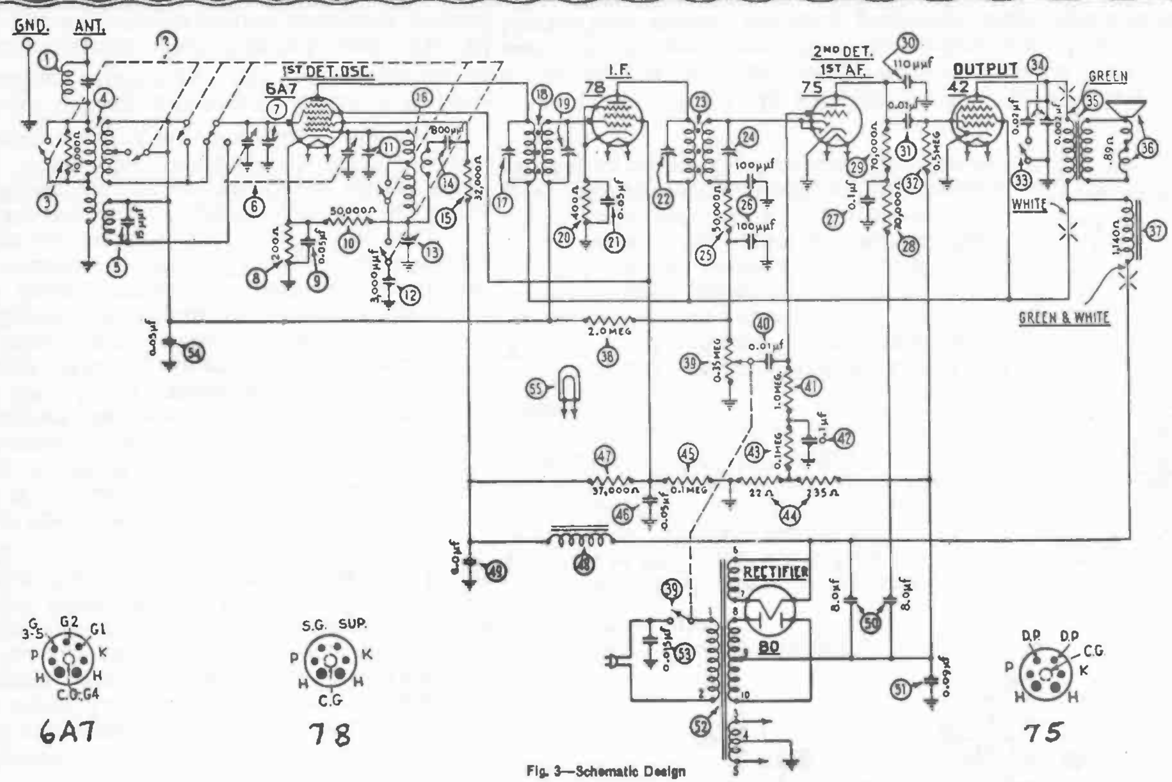


Fig. 3—Schematic Design

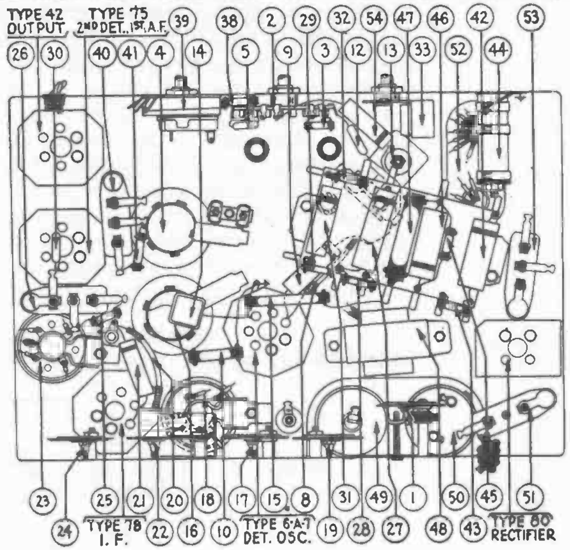


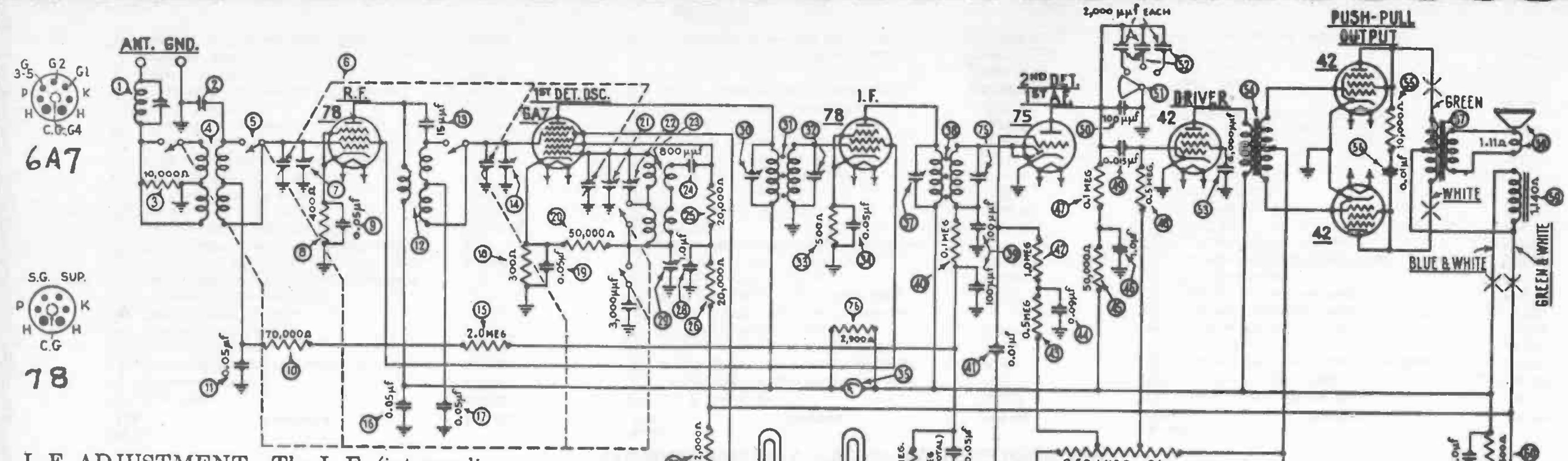
Fig. 4—Base View

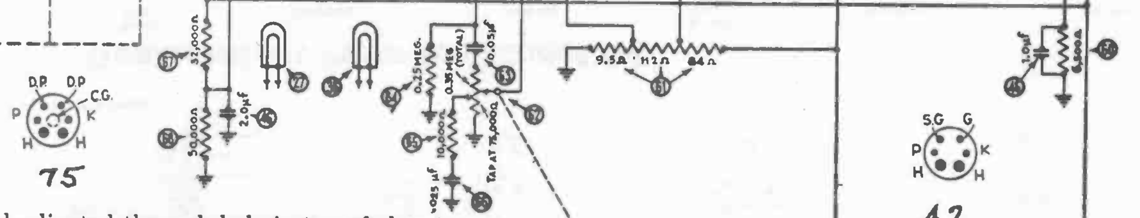
Replacement Parts for Model 66

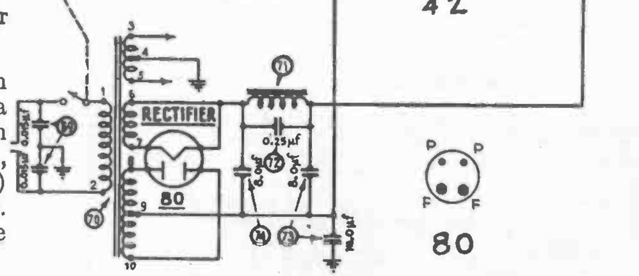
No. on Figs.	Description	Part No.
1	Wave Trap	38-5199
2	Wave-band Switch	42-1066
3	Resistor (10,000 ohms) (Brown-Black-Orange)	33-1000
4	Antenna Transformer	32-1412
5	Condenser (.000015 Mfd.)	30-1030
6	Tuning Condenser Assembly	31-1231
7	Compensating Condenser (ANT)	Part of 6
8	Resistor (200 ohms Flexible) (Red-Black-Brown)	7217
9	Condenser (.05 Mfd. Tubular)	30-4020
10	Resistor (50,000 ohms) (Green-Green-Orange)	6098
11	Compensating Condenser (OSC. HF)	Part of 6
12	Condenser (.003 Mfd. Mica)	30-1028
13	Compensating Condenser (Osc. I. F.)	04000-S
14	Condenser (.0008 Mfd. Mica)	5878
15	Resistor (32,000 ohms) (Orange-Red-Orange)	5279
16	Oscillator Transformer	32-1413
17	Compensating Condenser (1st I. F. Pri.)	04000M
18	1st I. F. Transformer	32-1414
19	Compensating Condenser (1st I. F. Secondary)	04000M
20	Resistor (400 ohms Flexible)	33-3016
21	Condenser (.05 Mfd. Tubular)	30-4020
22	Compen[illegible]ting Condenser (2d I. F. Primary)	04000M
23	2d I. F Transformer	32-1415
24	Compensating Condenser (2d I. F. Secondary)	04000J
25	Resistor (50,000 ohms) (Green-Brown-Orange)	6098
26	Condenser (.0001 Mfd. Twin Bakelite Block)	8035-B
27	Condenser (.1 Mfd. Tubular)	30-4170
28	Resistor (70,000 ohms) (Violet-Black-Orange)	33-1115
29	Resistor (70 000 ohms) (Violet-Black-Orange)	33-1115
30	Condenser (.00011 Mfd. Mica)	30-1006
31	Condenser (.02 Mfd. Tubular)	30-4113
32	Resistor (500,000 ohms) (Yellow-White-Yellow)	6097
33	Tone Control	30-4192
34	Condensers in Tone Control	Inside 33
35	Output Transformer	32-7019
36	Voice Coil & Cone Assembly (S-12)	36-3014
37	Field Coil and Pot. Assembly (S-12)	36-3341
38	Resistor (2 Megohms) (Red-Black-Green)	33-1025
39	Volume Control and On-Off Switch	33-5006
40	Condenser (.01 Mfd.) (Bakelite Block)	3903-AB
41	Resistor (1 Megohm) (Brown-Black-Green)	33-1096
42	Condenser (.1 Mfd.)	30-4122
43	Resistor (.1 Meg.) (White-White-Orange)	6099
44	Resistor (B.C. Wire-wound) (22 [illegible] ohms)	33-3037
45	Resistor (.1 Meg.) (White-White-Orange)	6099
46	Condenser (.05 Mfd. Tubular)	30-4123
47	Resistor (37,000 ohms) (Orange-Violet-Orange)	33-1098
48	Filter Choke	32-7018
49	Condenser (Electrolytic—6 Mfd.)	30-2021
50	Condenser (Electrolytic—8-8 Mfd.)	30-2028
51	Condenser (.09 Mfd. Bakelite Block)	4989-D
52	Power Transformer	8046
53	Condenser (.015 Mfd. Bakelite Block)	3793-W
54	Condenser (.05 Mfd. Tubular)	30-4020
55	Dial Light	6608
	Four Prong Socket	7544
	Six Prong Socket	7547
	Seven Prong Socket	27-6005
	Tube Shield	28-1107
	Chassis Mounting Screw	W-567
	Chassis Mounting Washer (Metal)	W-315
	Chassis Mounting Washer (Rubber)	5189
	Knob (Large)	27-4051
	Knob (Small)	27-4052
	Dial Assembly	31-1234
	Dial Scale	27-5057
	A. C. Cord and Plug Assembly	[illegible]3A

PHILCO RADIO & TELEVISION CORP.

MODEL 118







I. F. ADJUSTMENT—The I. F. (intermediate frequency) of Model 118 is 260 K. C.

Remove the grid clip from the top of the 6A7 tube and connect the shielded antenna lead from the Signal Generator to the cap of this tube. Connect the ground lead of the Signal Generator to the ground post of receiver. Connect the output meter to the primary terminals of the output transformer of receiver. Set the waveband switch at the left position (standard broadcast).

Set the wave switch on the Signal Generator at 260 K. C., and the dial of the receiver at 550. Turn on the set (volume full on), and the Signal Generator. Now adjust the 1st I. F. Primary and Secondary condensers (Nos. ⑳ and ㉜ in Fig. 3) and the 2d I. F. primary and secondary condensers (㊲ and ㊵) to give maximum reading on the output meter. The I. F. primary condenser is adjusted by turning the screw on top of the I. F. transformer and the secondary is adjusted by turning the nut. The I. F. transformers are in the smaller metal "cans". The screw and nut are reached through the hole in top. If the needle on the output meter goes off the scale, turn down the "attenuator" on the Signal Generator until a lower reading is obtained.

Note: In early production the 1st I. F. compensating condensers only are adjusted as described above. Part ㊷ is not used. The 2d I. F. primary ㊲ is an 04000A condenser reached and adjusted through hole in top of chassis near the 42 driver tube.

WAVE TRAP—Remove antenna lead from grid cap of 6A7 tube and attach it to antenna post on set. Replace cap on 6A7 tube. With Signal Generator still operating at 260 K. C., adjust wave-trap condenser (① in Figs. 3 & 4) so as to get MINIMUM reading in output meter. This adjustment is made from underneath the chassis.

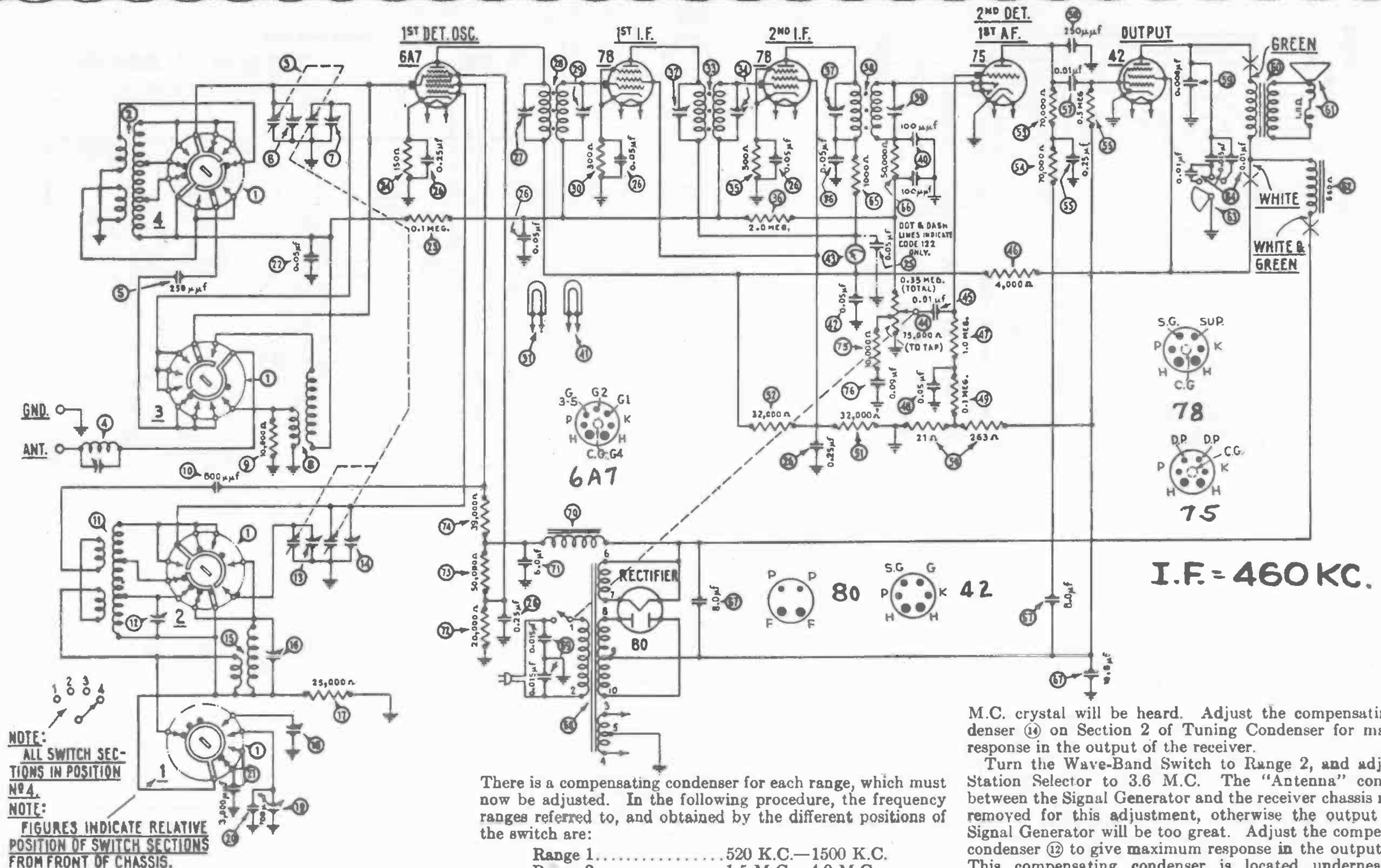
ANTENNA, DETECTOR AND OSCILLATOR H. F. (Broadcast)—These condensers Nos. ⑦, ⑭, and ㉑, are located on top of the tuning condenser gang, adjustment made by means of the fibre wrench. Set the signal generator at 1500 K. C., tune in the signal at 1500 on dial and adjust these condensers in the order given, to give maximum output reading. ⑦ is located on the section nearest the front and ⑭ on the center section.

OSCILLATOR—LOW FREQUENCY—This is condenser ㉘ (see Figs. 3 and 4) located underneath chassis and accessible from underneath. Use the fibre wrench. Set signal generator switch at 600, tune in the signal at 600 on the dial and adjust condenser to maximum.

ANT. AND OSC. H. F.—SHORTWAVE—The crystal controlled signal generator is used for these adjustments. These are condensers ② (Ant. H. F.) and ㉒ (Osc. H. F.) located underneath chassis, and adjusted from underneath. The fundamental frequency of the Philco Model 091 crystal controlled signal generator is 3600 K. C. or 3.6 megacycles. The third harmonic of this is 10.8 M. C. Turn the waveband switch of the set to the right and the dial to just below 11 M. C. The 10.8 harmonic should be picked up here and the two condensers should be adjusted

PHILCO RADIO & TELEVISION CORP.

MODEL 144



ADJUSTMENT OF THE WAVE TRAP—Replace the grid clip upon the Detector-Oscillator tube (Type 6A7). Connect the output leads from the signal generator directly to the antenna and ground terminals of the receiver. Set the Wave-Band Switch of the receiver to the standard broadcast band (extreme left) and the Station Selector at the low frequency (520 K.C.) end. Adjust the Wave Trap ④ condenser to give MINIMUM response to a 460 K.C. signal from the signal generator. The Wave Trap ④ is located at rear and underneath the chassis, and is shown in Figures 4 and 5. It is reached from the rear of the chassis.

ADJUSTMENT OF THE DIAL FREQUENCIES—Model 144 has four separate frequency bands or ranges, each obtained by one of the four positions of the wave-band switch. There is a compensating condenser for each range, which must now be adjusted. In the following procedure, the frequency ranges referred to, and obtained by the different positions of the switch are:

Range 1	520 K.C.—1500 K.C.
Range 2	1.5 M.C.—4.0 M.C.
Range 3	4.0 M.C.—11.0 M.C.
Range 4	11.0 M.C.—23.0 M.C.

Connect the output terminals of the Model 091 or equivalent Signal Generator, to the "ANT" and "GND" terminals of the receiver chassis. Connect an output meter to the primary terminals of the Output Transformer of the receiver. Set the Wave-Band Switch to Range 4, and the Station Selector at 21.6 M.C. The sixth harmonic of the 3.6 M.C. crystal in the Model 091 Signal Generator is picked up at this point. Adjust the compensating condenser ⑬ on Section 1 of Tuning Condenser for maximum response in the output of the receiver. Turn the Wave-Band Switch to Range 3, and the Station Selector to 10.8 M.C. Here, the third harmonic of the 3.6 M.C. crystal will be heard. Adjust the compensating condenser ⑭ on Section 2 of Tuning Condenser for maximum response in the output of the receiver.

Turn the Wave-Band Switch to Range 2, and adjust the Station Selector to 3.6 M.C. The "Antenna" connection between the Signal Generator and the receiver chassis must be removed for this adjustment, otherwise the output of the Signal Generator will be too great. Adjust the compensating condenser ⑫ to give maximum response in the output meter. This compensating condenser is located underneath the chassis and is not accessible from above. See Figure 4.

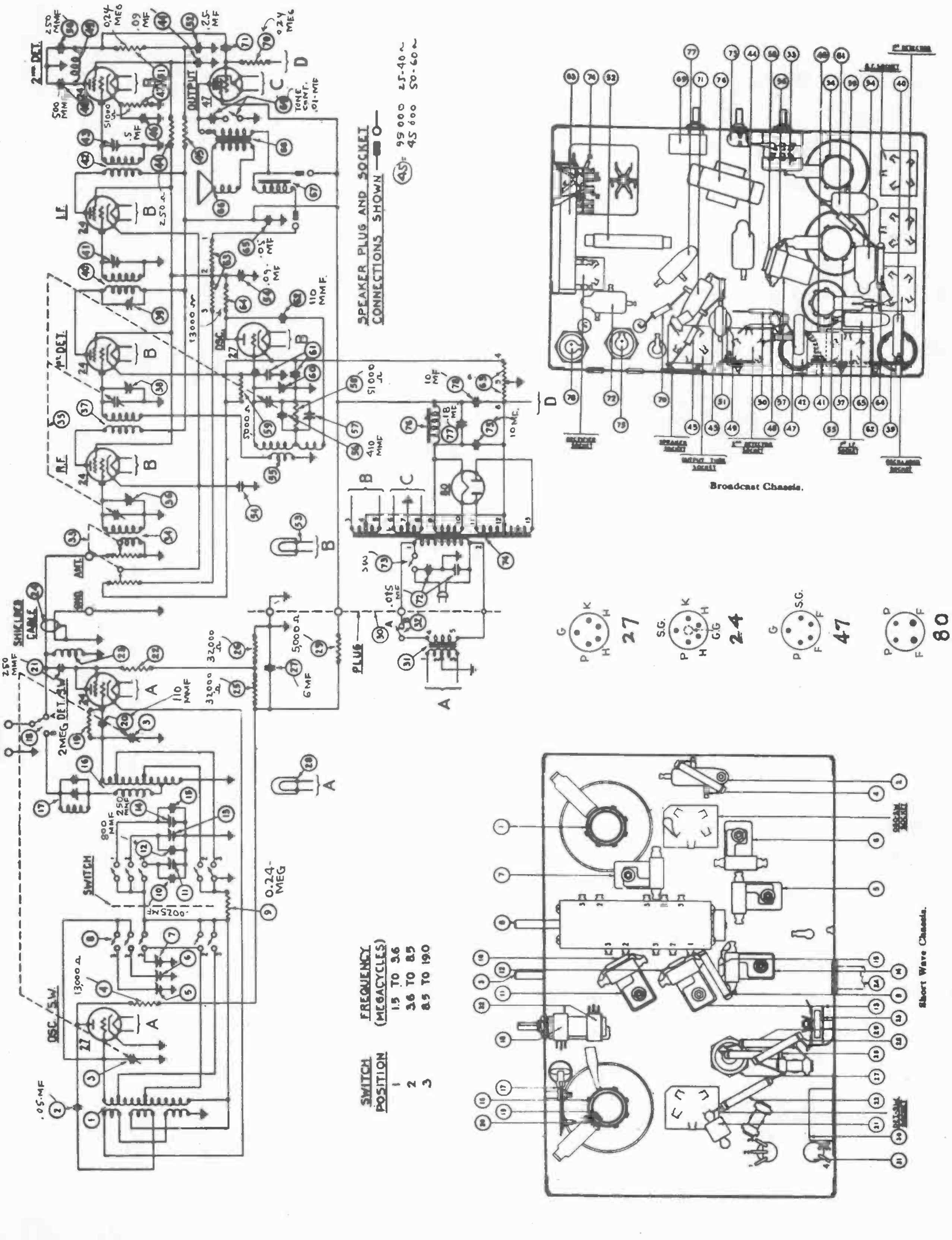
This concludes adjustments requiring the Model 091 (or equivalent) high frequency signal generator.

The Model 024 or its equivalent is now used again. Turn the Wave-Band Switch of the set to Range 2 and the Station Selector to 1.5 M.C. Set the Signal Generator at 1500 K.C. Make sure the "Antenna" connection between the Signal Generator and the Chassis has been restored. Adjust compensating condenser ⑲ located underneath the chassis, (Figure 4). Adjustment is made from the underside of the chassis.

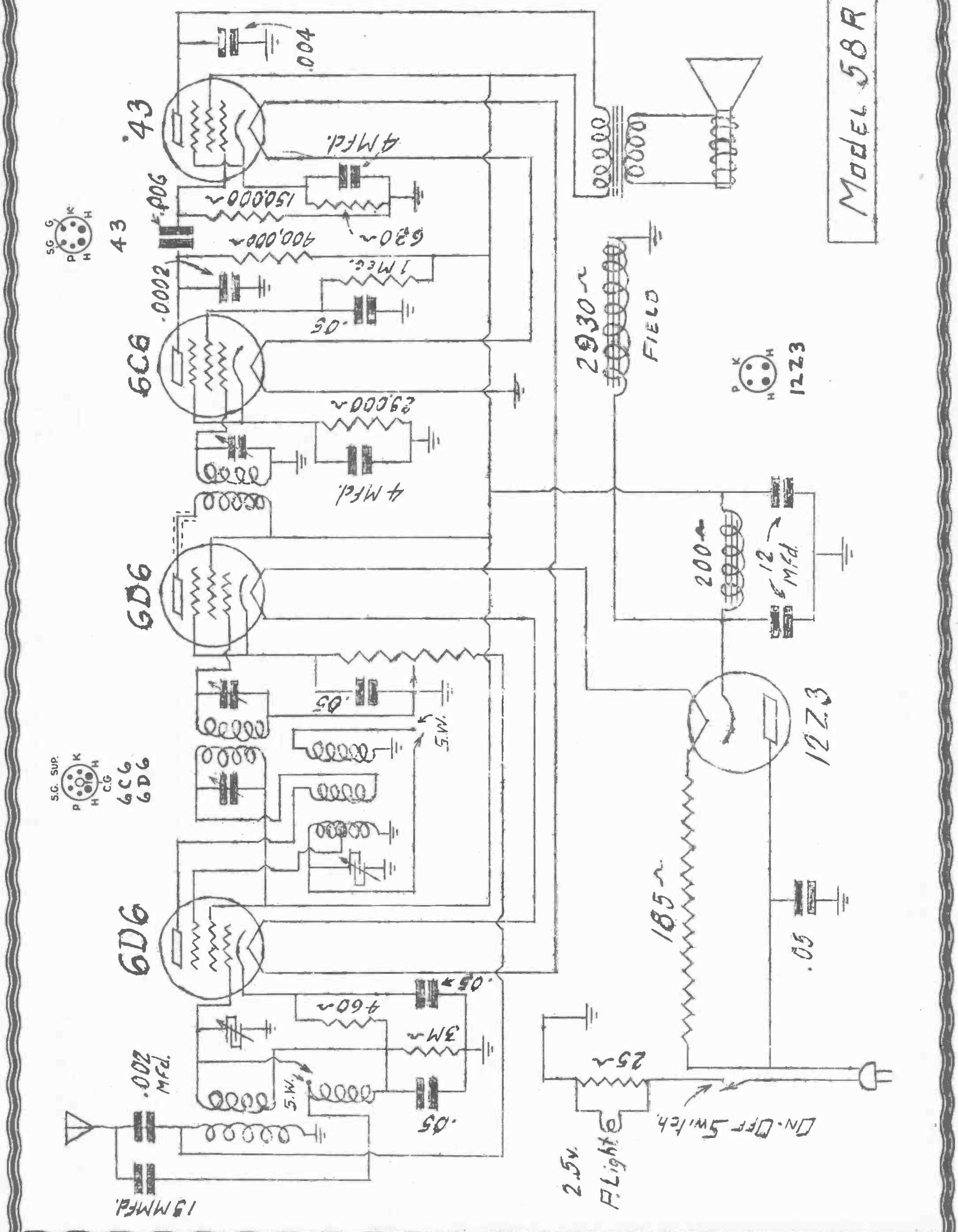
Turn the Wave-Band Switch to Range 1 and the Station Selector to 1400 K.C. Set the Signal Generator at 1400 K.C. Adjust compensating condenser ⑯, which is located underneath the chassis.

PHILCO RADIO & TELEVISION CORP.

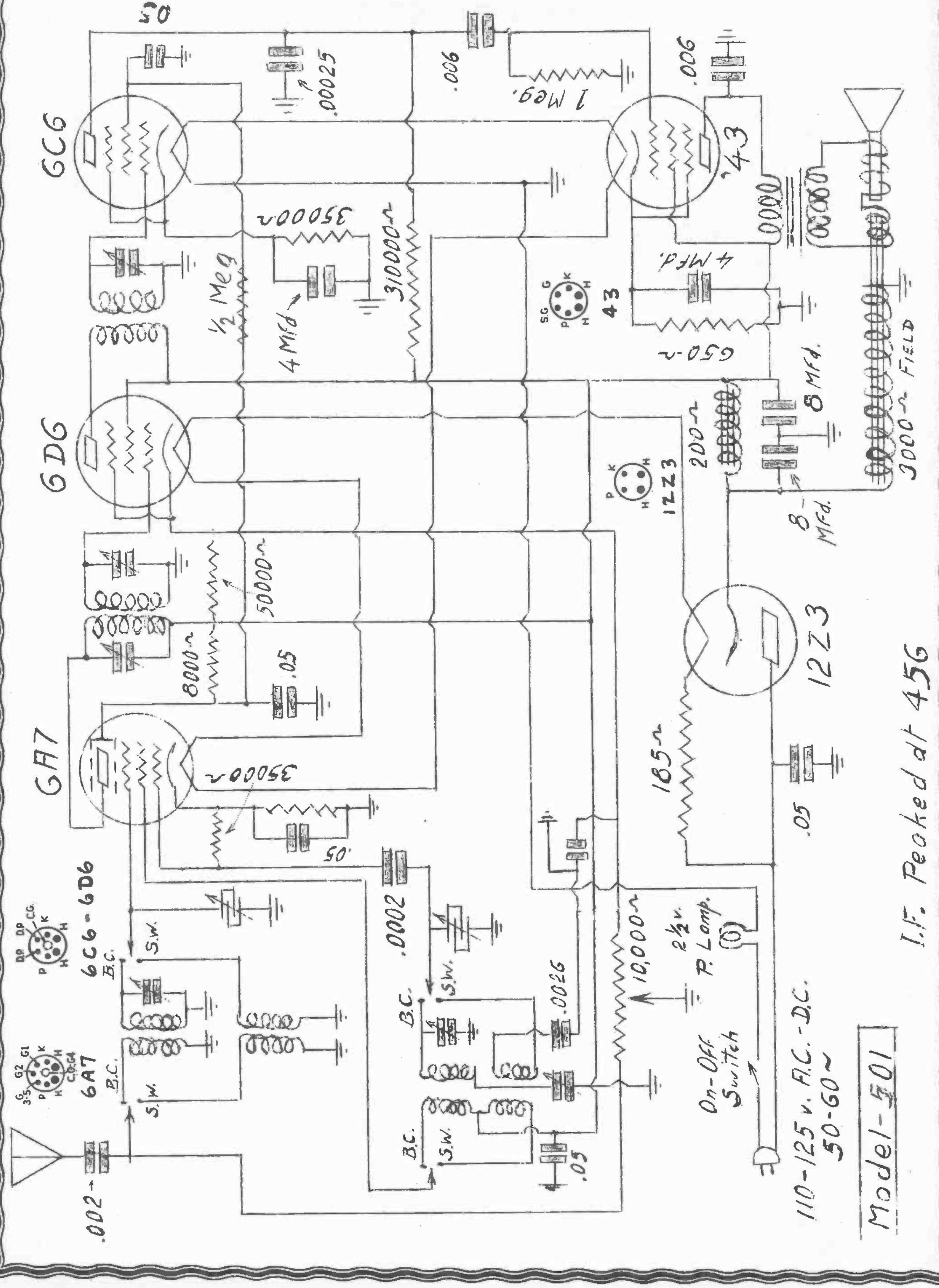
MODEL 470 & 470A



PIERCE AIRO INC.
MODEL 58R

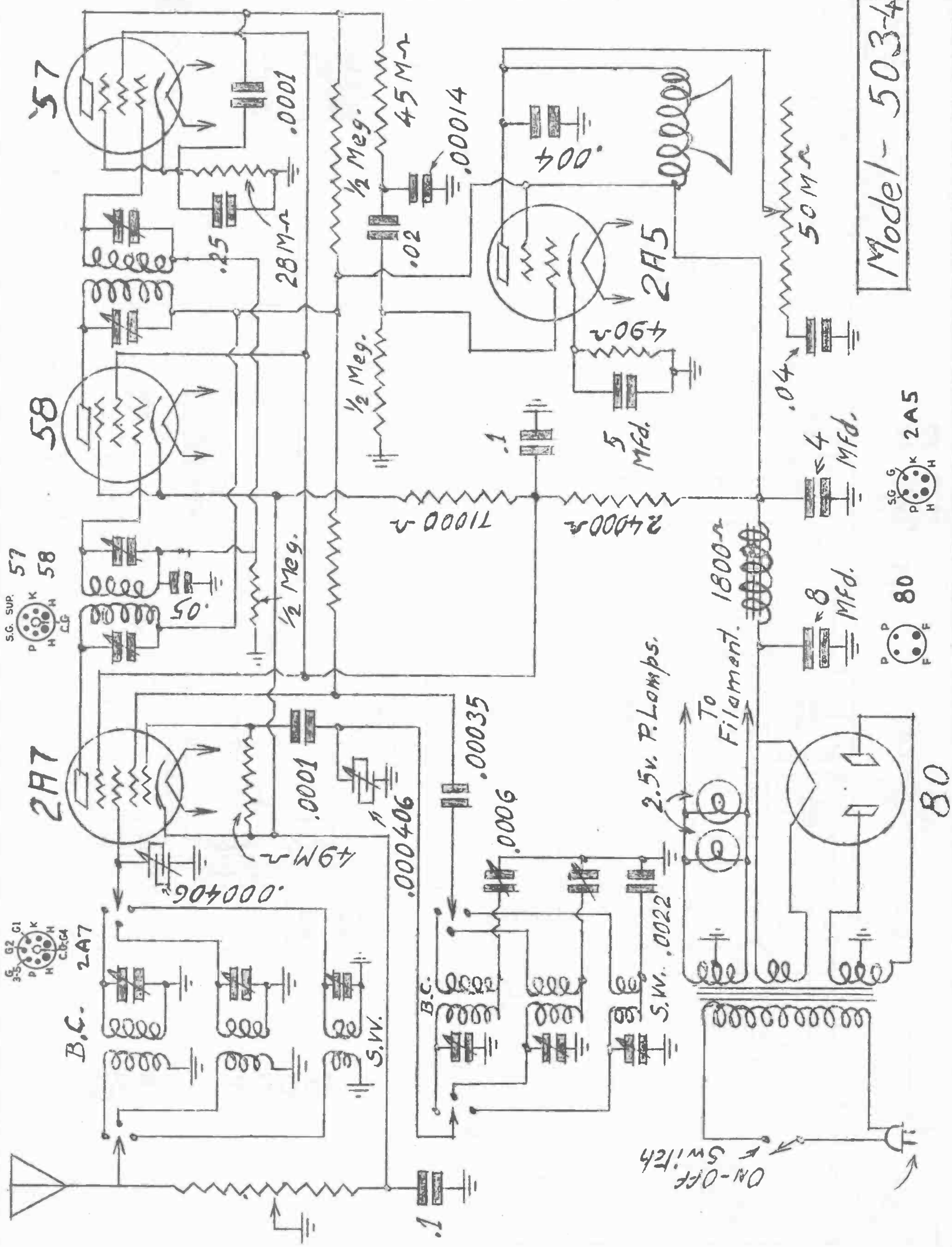


PIERCE AIRO INC.
MODEL 501

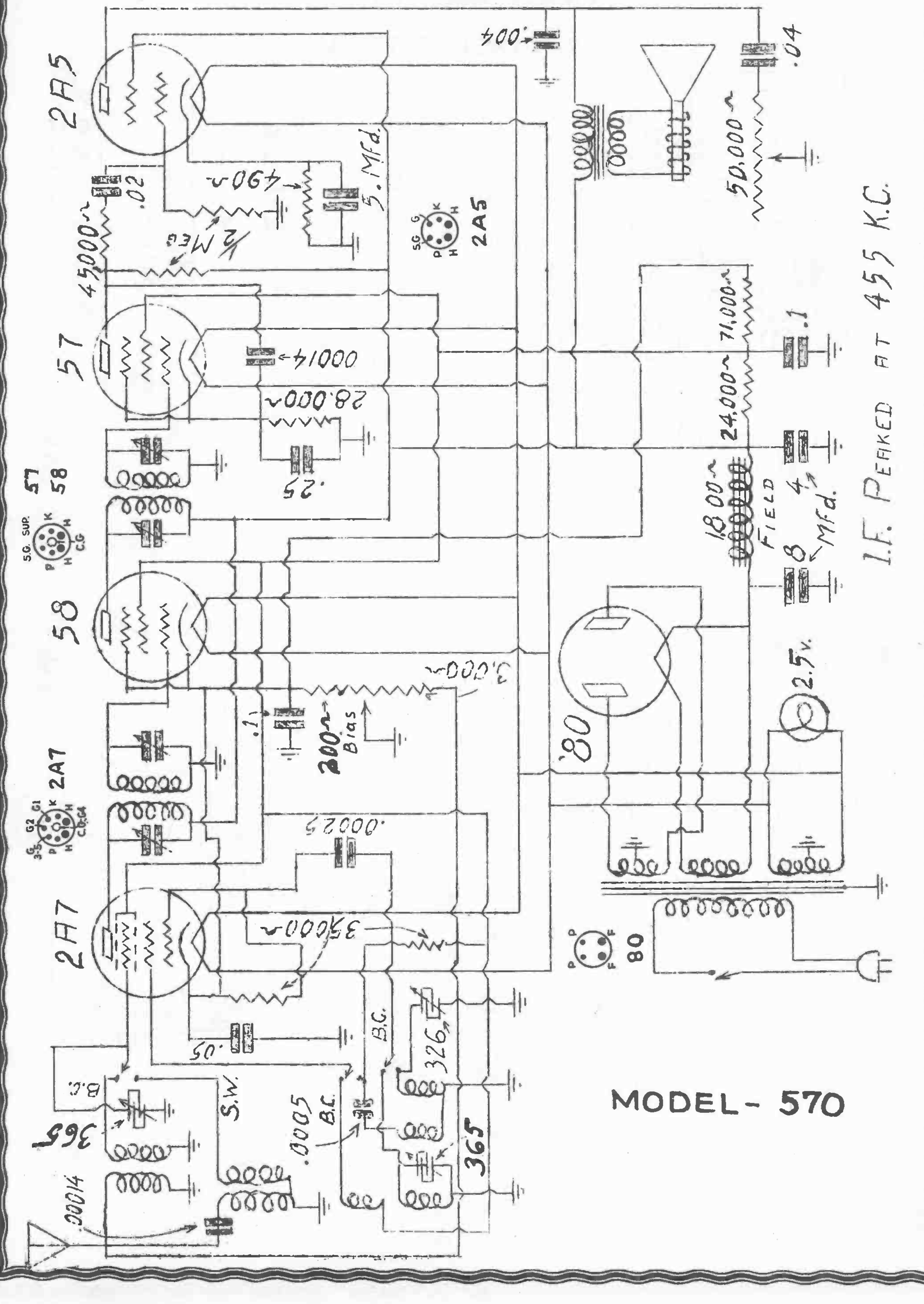


PIERCE AIRO INC.

MODEL 503-4

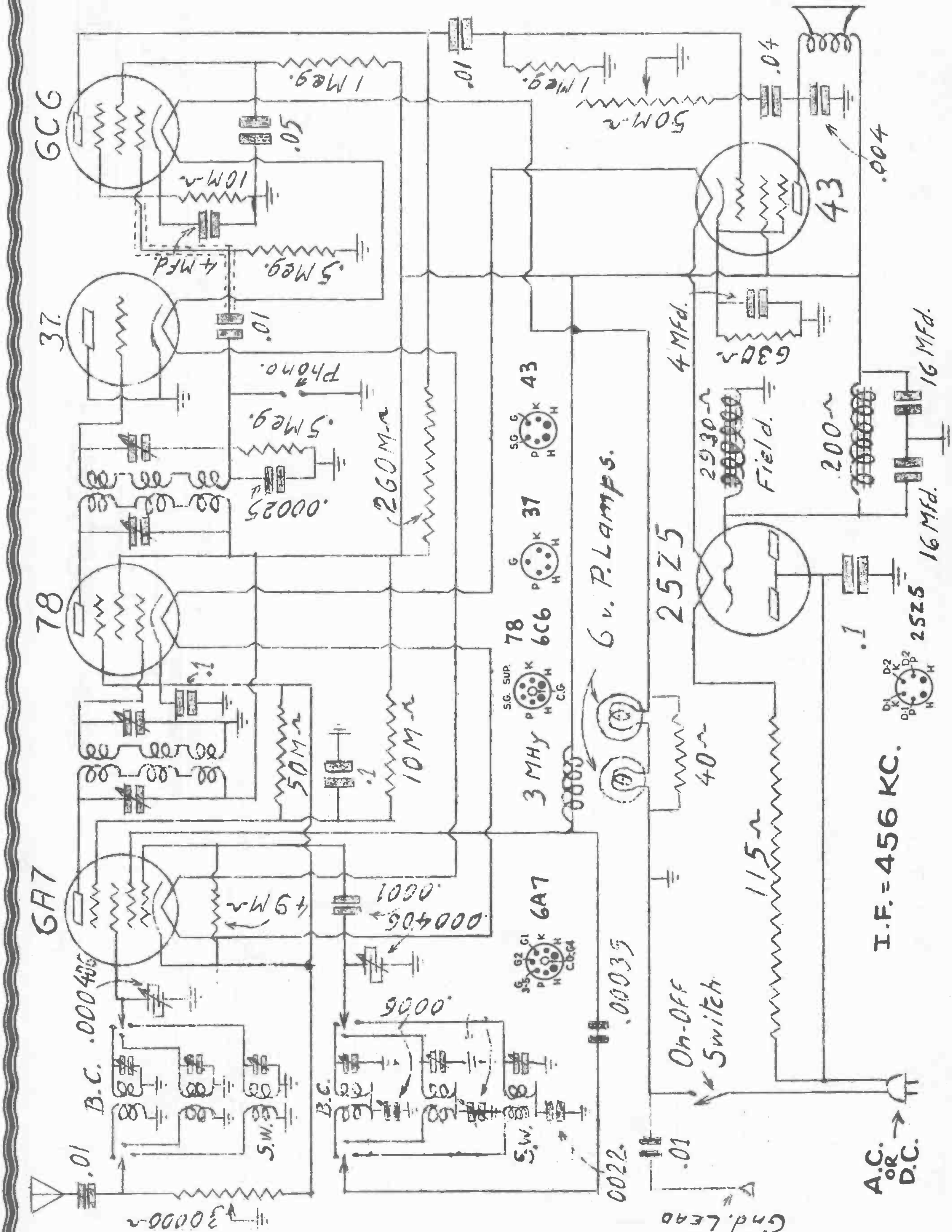


PIERCE AIRO INC.



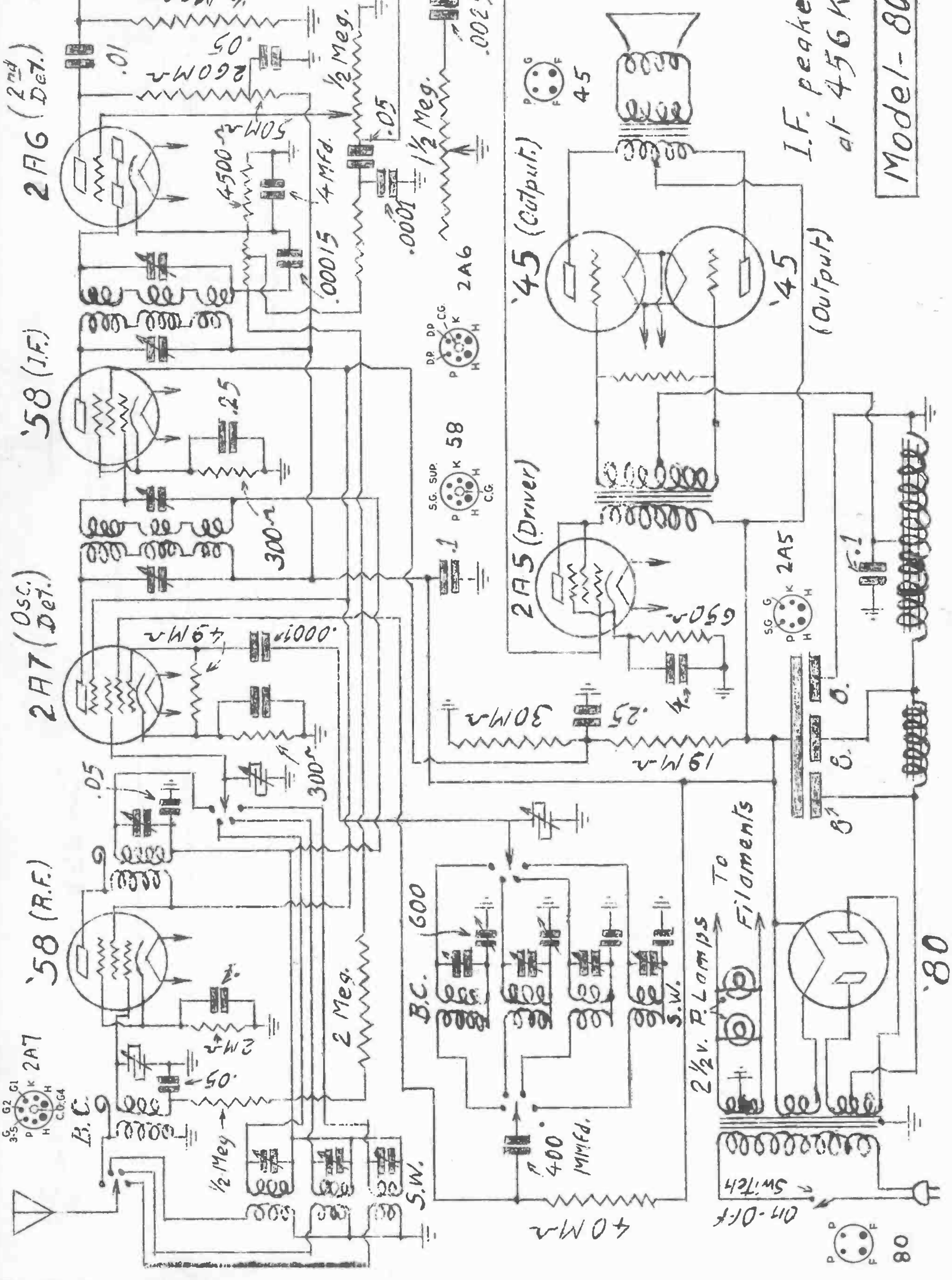
MODEL- 570

PIERCE AIRO INC.
MODEL 600-1



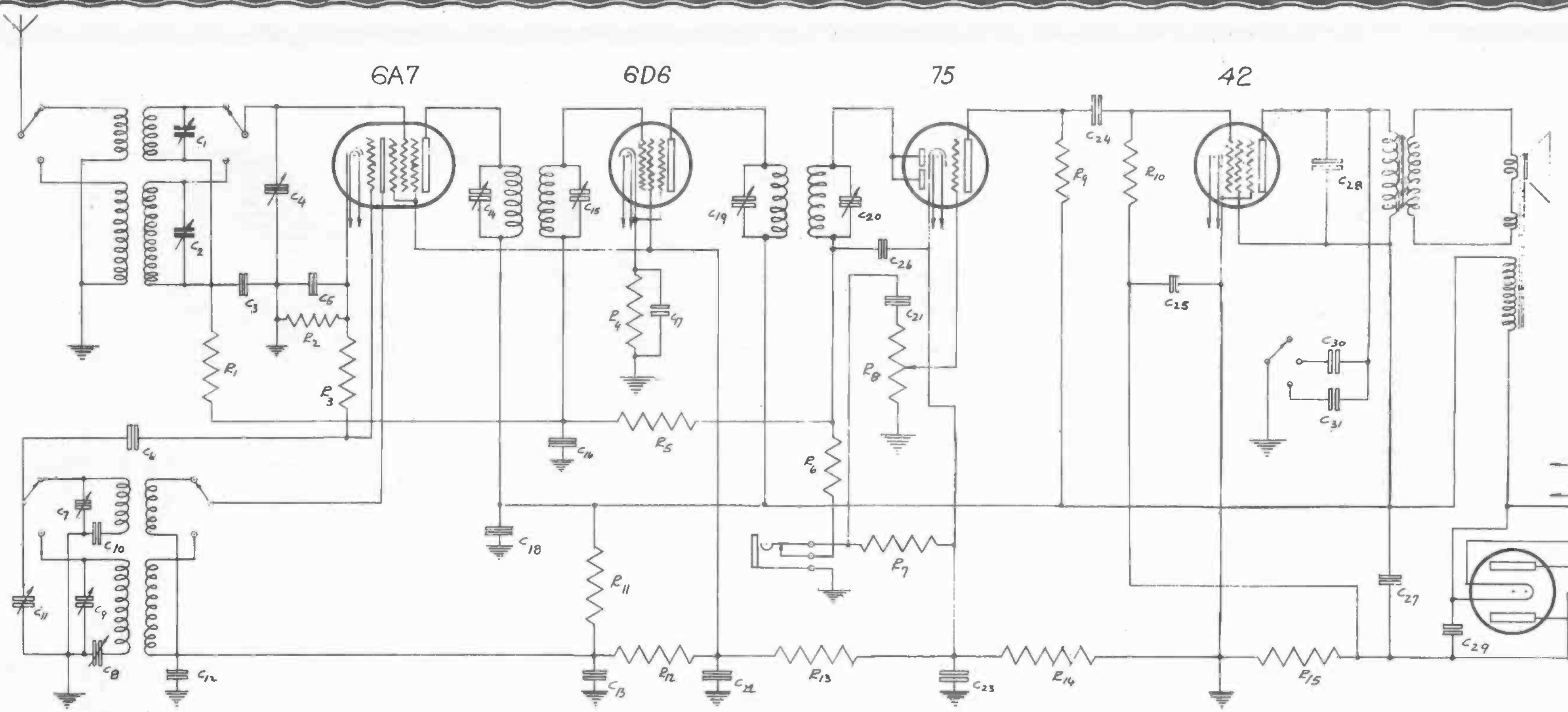
PIERCE AIRO INC.

MODEL 802-3



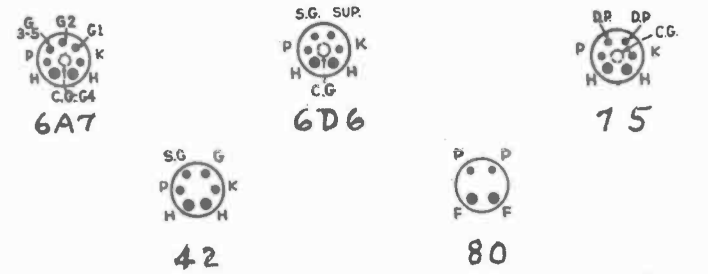
PILOT RADIO CORP.

MODEL 103



CONDENSERS		
DESIGNATION	PART NO	DESCRIPTION
C_1 C_2 C_7 C_9	71168	TRIMMERS ON BAND SW. ASSY.
C_3 C_5 C_{16}	22055-J	.05 MF. 200 V PAPER
C_4 C_{11}	71181	406 MF. 2 GANG VARI.
C_6	27723	50 μμf MICA
C_8	16052-A	SINGLE TRIMMER
C_{10}	27734	.006 MF MICA
C_{12} C_{18} C_{22}	22055-P	.05 MF 400V PAPER
C_{13}	71215	4 MF. 400 V ELECTRO.
C_{14} C_{15}	71166-2	TRIMMER 1st I.F.
C_{17}	22055-M	.1 MF 200V PAPER
C_{19}, C_{20}	70937-4	TRIMMERS 2ND I.F.
C_{21} C_{24}	22055-A	.01 600 V PAPER
C_{23}	22055-F	.25 200 V PAPER
C_{25}	22055-S	.5 MF 200 V
C_{26}	27712	500 μμf MICA
C_{27} C_{29}	71045-3, B	DUAL 8 MF. 475 VOLTS.
C_{28}	22055-R	.005 MF. 1000 V PAPER
C_{30}	22055-U	.01 MF 1000 V PAPER. TONE CONTROL
C_{31}	22055-V	.03 MF 1000 V PAPER TONE CONTROL

RESISTORS		
DESIGNATION	PART NO.	DESCRIPTION
R_1	13031	100.000 OHMS .25 WATT
R_2 R_4	13115	400 OHMS .25 WATT
R_3 R_6	13164	50.000 OHMS .25 WATT
R_5	13001	1.000.000 OHMS .25 WATT
R_7	13147	300,000 OHMS .25 WATT
R_8	71211	750,000 VOLUME CONTROL
R_9	13171	250,000 OHMS .25 WATT
R_{10}	13024	500,000 OHMS .25 WATT
R_{11}	13073	3000 OHMS .5 WATT
R_{12}	13129	15000 OHMS 1.0 WATT
R_{13}	13148	30.000 OHMS .25 WATT
R_{14}	13130	420 OHMS .25 WATT
R_{15}	13059	250 OHMS 1.0 WATT



ALL DIMENSIONS UNLESS OTHERWISE SPECIFIED MUST BE HELD TO A TOLERANCE OF ± .005"

GROSS WEIGHT INCLUDING SCRAP — W'GHT PER ___ P'CS ___ LBS — RAW MATERIAL: LENGTH, WIDTH, THICK., DIA.

NET WEIGHT

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LONG ISLAND CITY, N. Y. U. S. A.
SCHEMATIC DIAGRAM
MODEL 103

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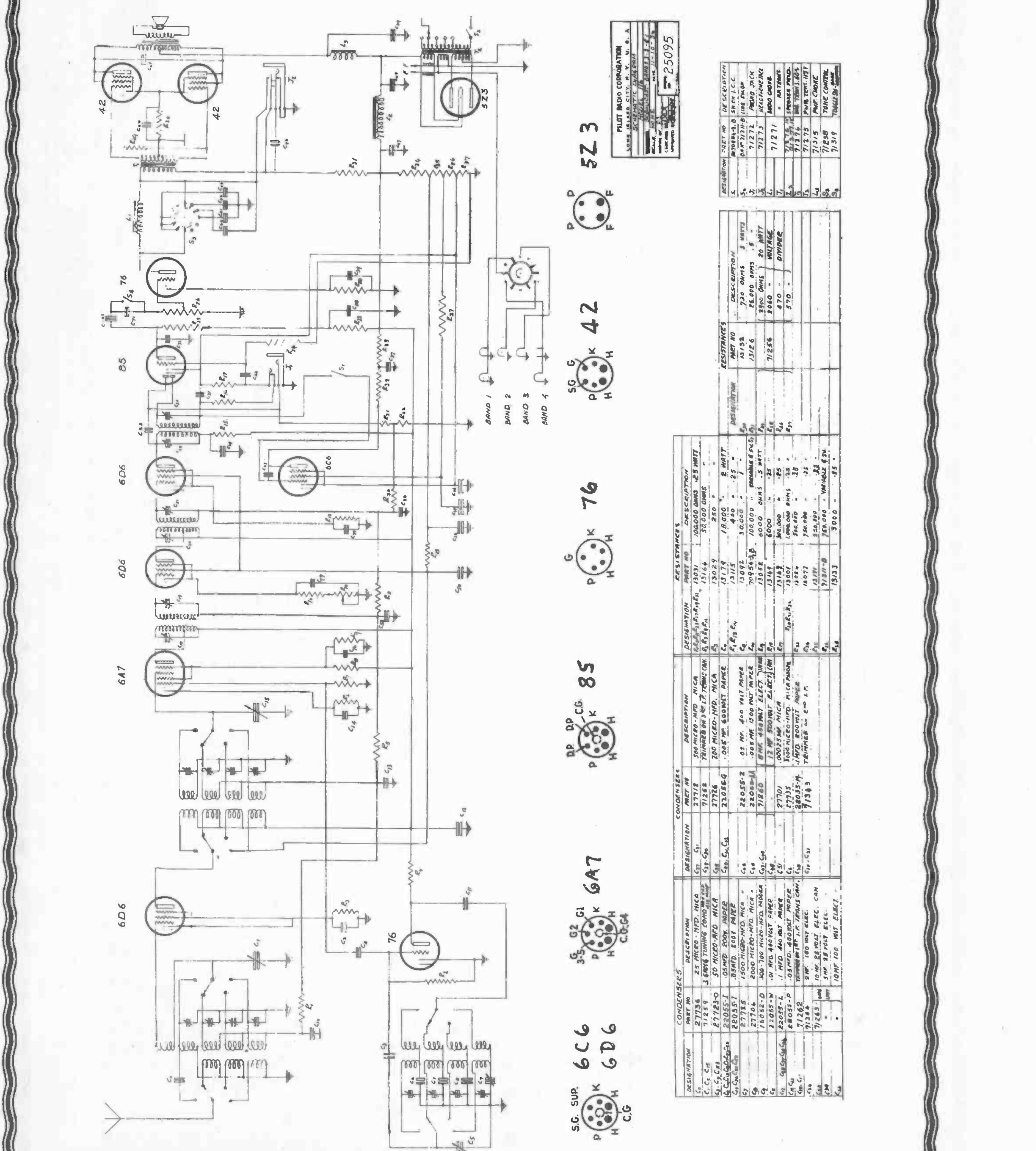
PILOT RADIO CORP.

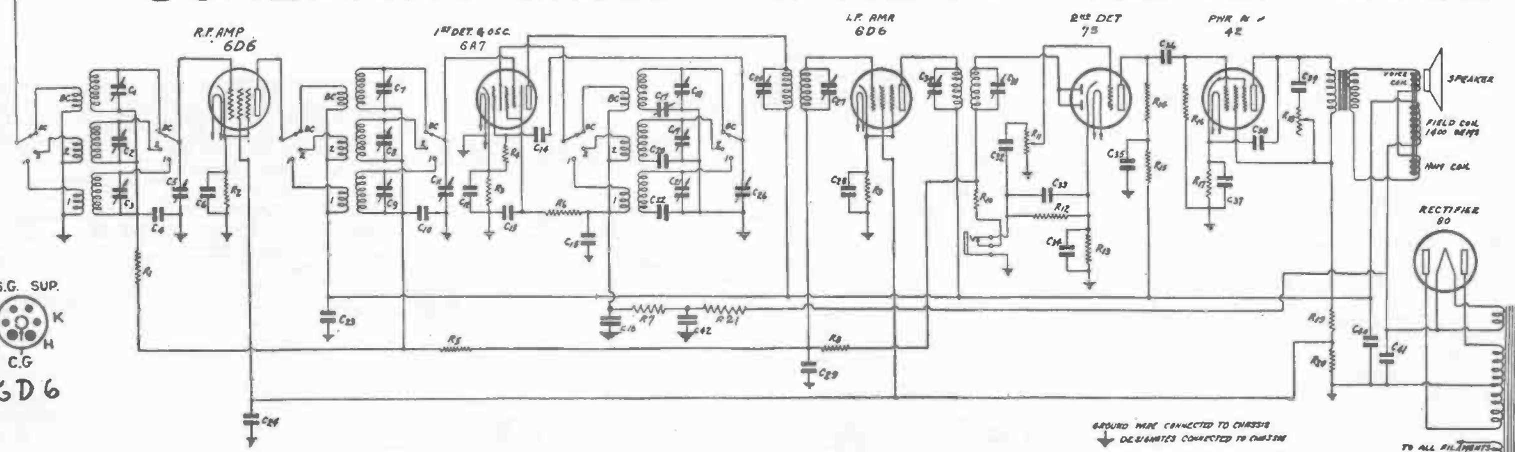
MODEL 114

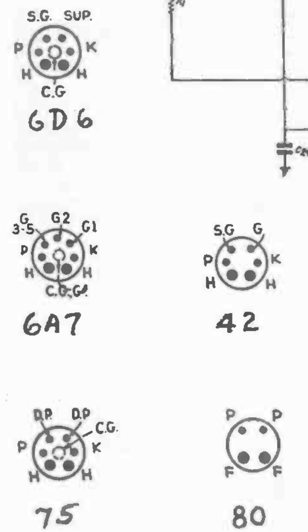


PILOT RADIO CORP.

MODEL 63

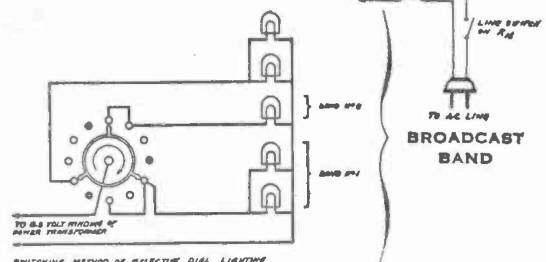
SCHEMATIC CIRCUIT DIAGRAM MODEL No. 63





CONDENSERS		
DESIGNATION	PART No.	DESCRIPTION
C1, C2, C3	70969-A	TRIMMER STRIP ON BAND SW HOUSG
C4, C6, C10, C20, C24	22055-I	.05 MFDS-200V TUBULAR PAPER
C5, C11, C26	70957	406 MMFDS 3 GANG VARIABLE
C7, C8, C9	70969-A	TRIMMER STRIP ON BAND SW HOUSG
C12	22055-M	.10 MFDS-200V TUBULAR PAPER
C13, C15	22055-P	.05 MFDS-400V TUBULAR PAPER
C14	27723	.00005 MFD MICA
C16	71106	2 MFDS. 475 V. ELECTROLYTIC
C17	16052-A	450 MMFD PADDER
C18, C19, C21	70969-A	TRIMMER STRIP ON BAND SW HOUSG
C20	27717	.0028 MFD MICA
C22	27732	.0016 MFD MICA
C23, C24, C29	22055-L	.10 MFDS-400V TUBULAR PAPER
C25, C27	70936	TRIMMERS IN 1ST I.F. TRANS. CAN
C30, C31	70937	TRIMMERS IN 2ND I.F. TRANS. CAN
C32, C36	22055-A	.01 MFD-600V TUBULAR PAPER
C33	27712	.0005 MFD. MICA
C34, C37	70971	DUAL 5 MFD-25V TUBULAR ELECTRO
C38	22055-Q	.005 MFD-600V TUBULAR PAPER
C39	22055-C	.05 MFD-600V TUBULAR PAPER
C40, C41	71106	2-8 MFDS-475V. ELECTROLYTIC BLOCK
C42	71106	2 MFD. 475V. ELECTROLYTIC BLOCK

RESISTORS		
DESIGNATION	PART No.	DESCRIPTION
R1, R5, R15	13031	100,000 OHMS .25 WATT CARBON
R2, R3, R9	13115	400-OHMS .25 WATT CARBON
R4, R10, R20	13164	50,000-OHMS .25 WATT CARBON
R6	13068	30,000-OHMS .50 WATT CARBON
R7	13053	10,000-OHM 1. WATT CARBON
R8	13001	1-MEGOHM .25 WATT CARBON
R11	70955	750,000-OHMS VOLUME CONTROL
R12	13167	300,000-OHMS .25 WATT CARBON
R13	13169	6000-OHMS .25 WATT CARBON
R14	13171	250,000-OHMS .25 WATT CARBON
R16	13024	500,000-OHMS .25 WATT CARBON
R17	13108	410-OHMS 1. WATT CARBON
R18	70954	10,000 OHMS TONE CONTROL & SWITCH
R19	13092	14,000-OHMS 1. WATT CARBON
R21	13053	10,000-OHMS 1. WATT CARBON



SWITCHING METHOD OF SELECTIVE DIAL LIGHTING SYSTEM ON MODEL No. 63 RECEIVER.

RECEIVER DESCRIPTION

Operating Voltages—115, 125, 150, 220, 240 volts, Alternating Current.

Frequency Rating —50 to 60 cycles.

Power Consumption—70 Watts.

Tubes —1 type 6A7
2 type 6D6
1 type 75
1 type 42
1 type 80

Circuit —One stage of Tuned Radio Frequency amplification for all frequencies, electron-coupled oscillator-modulator, diode detector, class "A" pentode output stage, automatic volume control.

Wavelength Range —From 550 meters to 16 meters (545 kc to 18,800 kc).

Undistorted power output—3 watts.

Intermediate Frequency — 456 kc.

Tube Functions —Type 6D6: R. F. amplifier for all bands.
Type 6A7: Electron emission control oscillator-detector.
Type 6D6: I. F. amplifier.
Type 75: Duo-diode detector-amplifier.
Type 42: Class "A" power pentode.
Type 80: Full-wave rectifier for power supply.

VOLTAGES

The D. C. voltages measured at the tube sockets of the set should be read with a high resistance voltmeter of at least 1000 ohms per volt.

	R.F. Type 6D6	OSC. DET. Type 6A7	I.F. Type 6D6	DIODE DET. Type 75	POWER PENTODE Type 42	RECTIFIER Type 80
Plate	235	235	235	120*	210	
Cathode	4.	4.5	4.	1.5	14.	
Screen	90	90	90		230	
Filament	6.3	6.3	6.3	6.3	6.3	

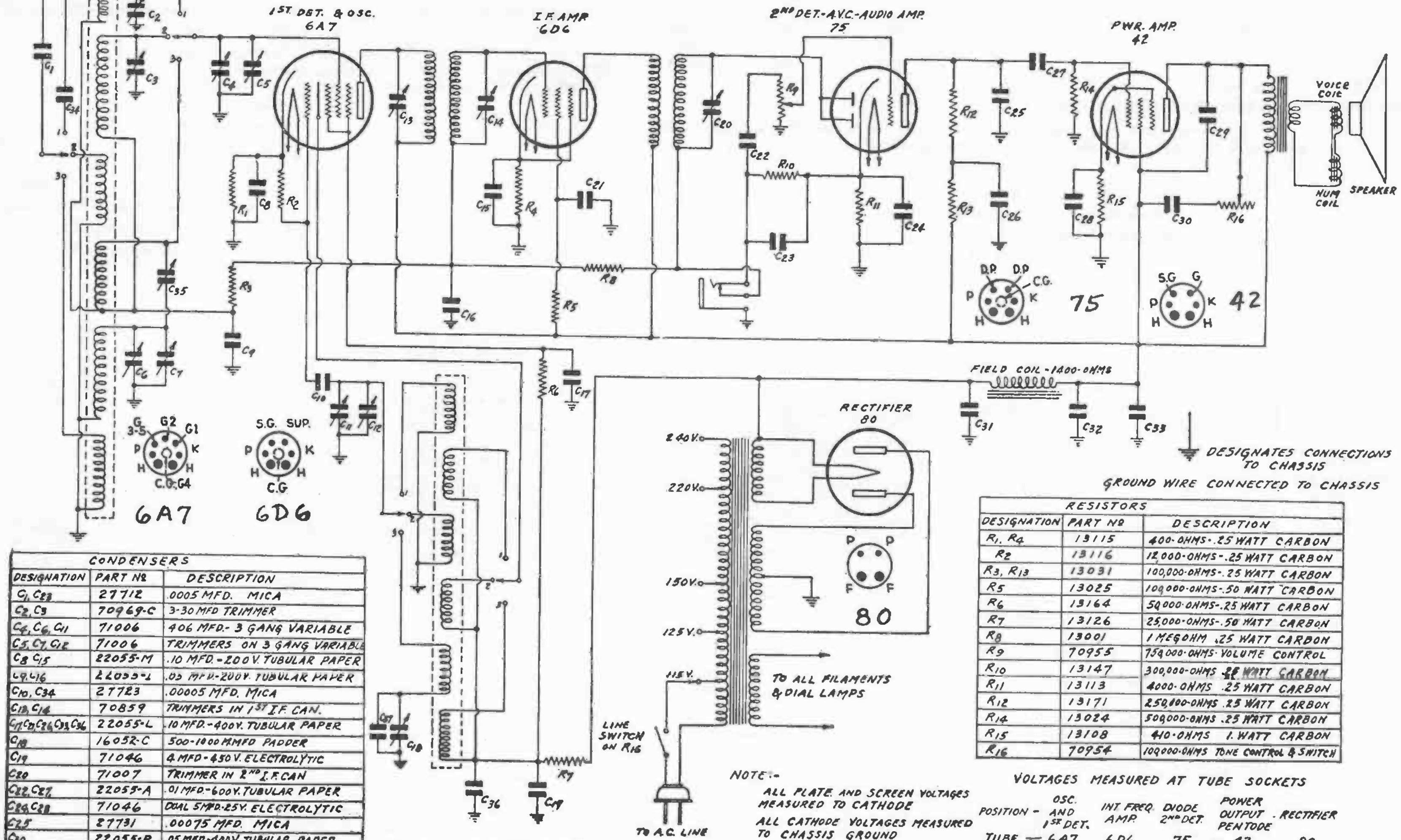
*Voltages measured through 250,000 ohm plate resistor.

Speaker field voltage 110 volts. All plate voltages measured to cathode. All screen voltages measured to cathode. All cathode voltages measured to chassis frame.

PILOT RADIO CORP.

MODEL 53 AND 55

SCHEMATIC CIRCUIT DIAGRAM MODEL No. 53



GROUND WIRE CONNECTED TO CHASSIS

CONDENSERS		
DESIGNATION	PART No.	DESCRIPTION
C_1, C_{23}	27712	.0005 MFD. MICA
C_2, C_3	70969-C	3-30 MFD TRIMMER
C_4, C_6, C_{11}	71006	406 MFD.- 3 GANG VARIABLE
C_5, C_7, C_{12}	71006	TRIMMERS ON 3 GANG VARIABLE
C_8 C_{15}	22055-M	.10 MFD.-200V. TUBULAR PAPER
C_9, C_{16}	22055-1	.05 MFD.-200V. TUBULAR PAPER
C_{10}, C_{34}	27723	.00005 MFD. MICA
C_{13}, C_{14}	70859	TRIMMERS IN 1ST I.F. CAN.
$C_{17}, C_{21}, C_{26}, C_{33}, C_{36}$	22055-L	.10 MFD.-400V. TUBULAR PAPER
C_{18}	16052-C	500-1000 MMFD PADDER
C_{19}	71046	4 MFD-450V. ELECTROLYTIC
C_{20}	71007	TRIMMER IN 2ND I.F. CAN
C_{22}, C_{27}	22055-A	.01 MFD.-600V. TUBULAR PAPER
C_{24}, C_{28}	71046	DUAL 5 MFD.-25V. ELECTROLYTIC
C_{25}	27731	.00075 MFD. MICA
C_{30}	22055-P	.05 MFD.-400V. TUBULAR PAPER
C_{31}, C_{32}	71045	DUAL 8 MFD.-475V. ELECTROLYTIC
C_{35}	70866-A	5-40 MFD. TRIMMER
C_{29}	22055-G	.005 MFD.-600V. TUBULAR PAPER
C_{37}	27733	.0008 MFD. MICA.

RESISTORS		
DESIGNATION	PART No.	DESCRIPTION
R_1, R_4	13115	400-OHMS-.25 WATT CARBON
R_2	13116	12,000-OHMS-.25 WATT CARBON
R_3, R_{13}	13031	100,000-OHMS-.25 WATT CARBON
R_5	13025	100,000-OHMS-.50 WATT CARBON
R_6	13164	50,000-OHMS-.25 WATT CARBON
R_7	13126	25,000-OHMS-.50 WATT CARBON
R_8	13001	1 MEGOHM .25 WATT CARBON
R_9	70955	750,000-OHMS- VOLUME CONTROL
R_{10}	13147	300,000-OHMS .25 WATT CARBON
R_{11}	13113	4000-OHMS .25 WATT CARBON
R_{12}	13171	250,000-OHMS .25 WATT CARBON
R_{14}	13024	500,000-OHMS .25 WATT CARBON
R_{15}	13108	410-OHMS 1. WATT CARBON
R_{16}	70954	100,000-OHMS TONE CONTROL & SWITCH

VOLTAGES MEASURED AT TUBE SOCKETS

POSITION -	OSC. AND 1ST DET.	INT. FREQ. AMP.	DIODE 2ND DET.	POWER OUTPUT PENTODE	RECTIFIER
TUBE	6A7	6D6	75	42	80
PLATE	260	260	130	225	660*
SCREEN	55	100	—	250	—
CATHODE	3	4	1	16	—
FILAMENT	6.3	6.3	6.3	6.3	4.9

SPEAKER FIELD VOLTAGE - 85 DIAL LIGHTS - 6.3V. EACH

* A.C. VOLTAGE BETWEEN BOTH PLATES

NOTE:-
ALL PLATE AND SCREEN VOLTAGES MEASURED TO CATHODE
ALL CATHODE VOLTAGES MEASURED TO CHASSIS GROUND
USE A VOLTMETER WITH A 1000-OHMS PER VOLT RATING

I.F. = 115 KC.

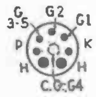
DRAWING No. 25088

PRINTED IN U.S.A.

PILOT RADIO CORPORATION Long Island City, N. Y., U. S. A.

RADIOBAR CORP.

6 TUBE ALL-WAVE



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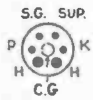

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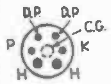

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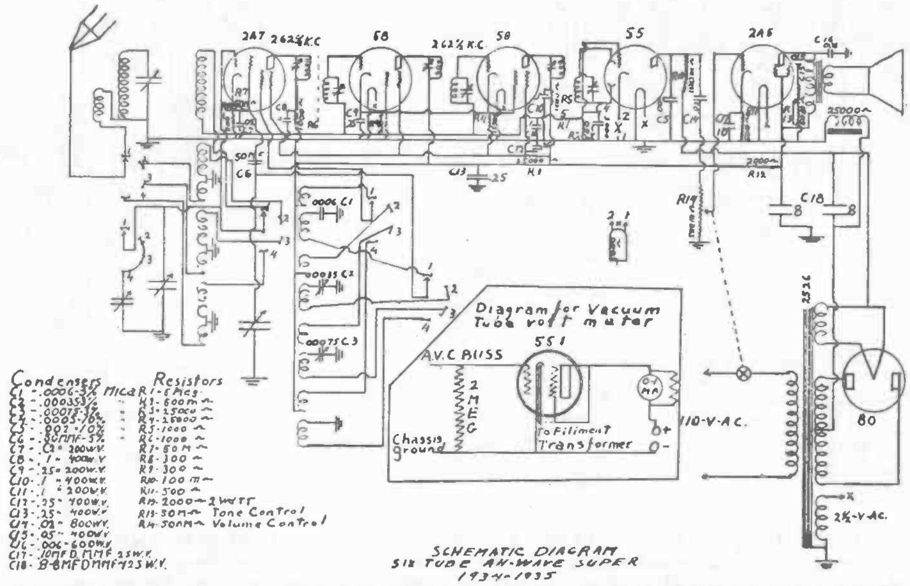


2A5

80

SERVICE DATA (SIX TUBE ALL-WAVE SUPER HETERODYNE 1934-1935)

All models have automatic volume control of the diode type, controlling the first detector as well as the high frequency amplifier tubes. This A.V.C. makes it impossible to service and rebalance without a meter of the type to be described. This meter will work on any make or type of A.V.C., provided care is used. It can not be damaged by improper connection of the leads.

PARTS REQUIRED FOR VACUUM TUBE VOLT METER

1—O to 1 or O to 1.5 milliampmeter.
1—Bell ringing transformer with secondary of 6-10 volts.
1—5 prong socket.
1—551 tube.
1—2 megohn grid leak.
1—10 ohm rheostat.
1—45 volt B battery.
Clips, Box, Cord, Hookup Wire.

USING VACUUM TUBE VOLT METER

The cathode clip is connected to the cathodes of the tubes controlled by the A.V.C. The buss clip is connected to the A.V.C. buss in front of the isolating resistor.

Adjust rheostat shunt until meter shows full scale reading.

All balancing is done with maximum peak indicated by the meter swing toward O. Sensitivity of various receivers can be checked by the swing of meter from a known station. Short Wave fading can be seen by tuning in the station with meter connected to set.

REBALANCING

Do not rebalance a set until you are sure it requires it. 99 per cent of the sets do not need it. We do not find one case in one hundred that really should be rebalanced.

INTERMEDIATES

Connect a 262½ K. C. oscillator to the first detector grid (No. 2-A 7 tube) leaving grid cap in place. Set dial at 1400 K.C. Hook up vacuum tube meter as described and carefully adjust 3 screws on top of Intermediates for maximum gain (minimum reading of meter). Don't flat top any stages. Have all shields in place. Keep volume control at lowest level.

CONDENSER GANG

Set dial at 1400 K.C. when gang is at minimum position and tighten dial set screws. Tune in a station (or use an oscillator) to a known frequency signal around 1400 K.C. Carefully adjust oscillator section of gang until frequency is correct on dial.

If the intermediates are balanced on 175 K.C., the dial will now track within 5 K.C. over the entire dial.

Adjust first detector section for maximum gain and follow by adjusting band pass trimmers.

Don't bend any condenser plates unless absolutely necessary.

OVERLOADING—OR POOR QUALITY AT LOW VOLUME

The chief cause of this trouble is too long an antenna. A powerful local station will cause the R. F. tubes to block. Check this by disconnecting the antenna on the station causing the trouble. If too close to a powerful station, installing a switch in the aerial circuit helps this. In rare cases the set seems to overload and the A.V.C. works too quickly on all stations.

Check the following:

Disconnect 2 meg. resistor from A.V.C. buss at tie point. Have all tubes cold. Use high voltage, high resistance ohmmeter capable of reading 25 megohms and test from ground to A.V.C. buss for leakage. After condensers have charged, no leakage should be shown. This must read around 100 megohms to ground.

If slight leakage is observed, disconnect bypass condensers from buss until defective one is found. Sometimes moisture is found on coil terminals. Scrape this clear.

NOISY OPERATION (Not Static)

A defective tube will cause a sharp 60 cycle R.F. pickup. This is most prominent on low frequency. Replace with a good tube.

In many cases it is found that the noise cannot be eliminated by servicing the receiver. Noise may enter into the light lines or via the antenna. The only way to check the source is to turn off one after another all electrical apparatus in the vicinity of the set.

There is no freak or trick antenna that will eliminate natural static.

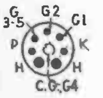
GENERAL

All resistors, bypass condensers and filter units are marked.

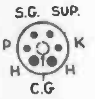
Voltages are shown at tube socket on diagram.

99 per cent of trouble in a chassis is caused by defective tubes, check them carefully.

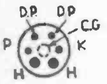
RADIOBAR CORP.
8 TUBE ALL-WAVE



2A7



58



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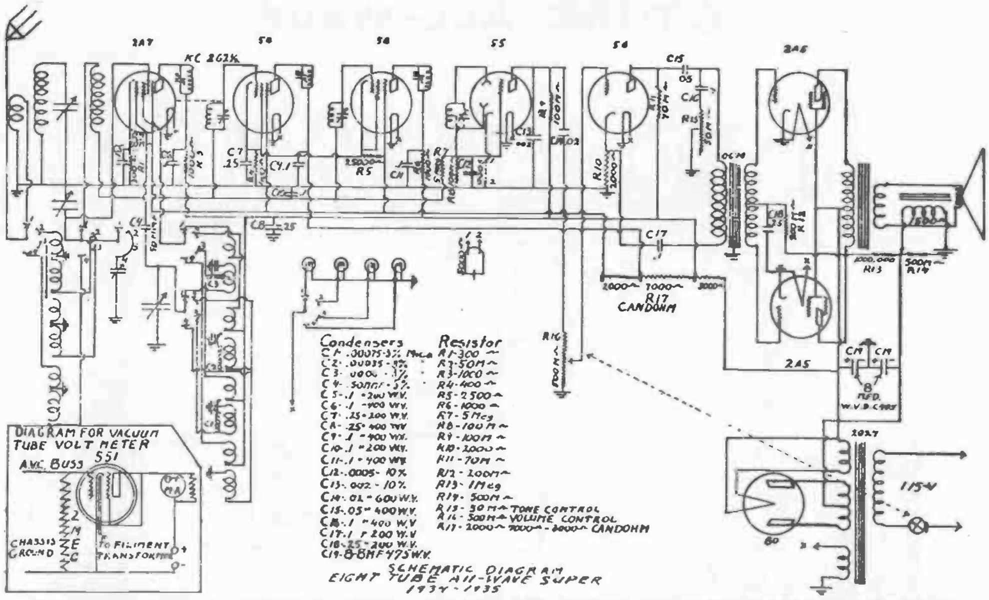
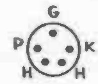
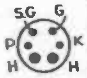




56



2A5

80

SERVICE DATA (EIGHT TUBE ALL-WAVE SUPER HETERODYNE 1934-1935)

All models have automatic volume control of the diode type, controlling the first detector as well as the high frequency amplifier tubes. This A.V.C. makes it impossible to service and rebalance without a meter of the type to be described. This meter will work on any make or type of A.V.C., provided care is used. It can not be damaged by improper connection of the leads.

PARTS REQUIRED FOR VACUUM TUBE VOLT METER

1—O to 1 or O to 1.5 milliampmeter.
1—Bell ringing transformer with secondary of 6-10 volts.
1—5 prong socket.
1—551 tube.
1—2 megohn grid leak.
1—10 ohm rheostat.
1—45 volt B battery.
Clips, Box, Cord, Hookup Wire.

USING VACUUM TUBE VOLT METER

The cathode clip is connected to the cathodes of the tubes controlled by the A.V.C. The buss clip is connected to the A.V.C. buss in front of the isolating resistor.

Adjust rheostat shunt until meter shows full scale reading.

All balancing is done with maximum peak indicated by the meter swing toward O. Sensitivity of various receivers can be checked by the swing of meter from a known station. Short Wave fading can be seen by tuning in the station with meter connected to set.

REBALANCING

Do not rebalance a set until you are sure it requires it. 99 per cent of the sets do not need it. We do not find one case in one hundred that really should be rebalanced.

INTERMEDIATES

Connect a 262½ K. C. oscillator to the first detector grid (No. 2-A 7 tube) leaving grid cap in place. Set dial at 1400 K.C. Hook up vacuum tube meter as described and carefully adjust 3 screws on top of Intermediates for maximum gain (minimum reading of meter). Don't flat top any stages. Have all shields in place. Keep volume control at lowest level.

CONDENSER GANG

Set dial at 1400 K.C. when gang is at minimum position and tighten dial set screws. Tune in a station (or use an oscillator) to a known frequency signal around 1400 K.C. Carefully adjust oscillator section of gang until frequency is correct on dial.

If the intermediates are balanced on 175 K.C., the dial will now track within 5 K.C. over the entire dial.

Adjust first detector section for maximum gain and follow by adjusting band pass trimmers.

Don't bend any condenser plates unless absolutely necessary.

OVERLOADING—OR POOR QUALITY AT LOW VOLUME

The chief cause of this trouble is too long an antenna. A powerful local station will cause the R. F. tubes to block. Check this by disconnecting the antenna on the station causing the trouble. If too close to a powerful station, installing a switch in the aerial circuit helps this. In rare cases the set seems to overload and the A.V.C. works too quickly on all stations.

Check the following:

Disconnect 2 meg. resistor from A.V.C. buss at tie point. Have all tubes cold. Use high voltage, high resistance ohmmeter capable of reading 25 megohms and test from ground to A.V.C. buss for leakage. After condensers have charged, no leakage should be shown. This must read around 100 megohms to ground.

If slight leakage is observed, disconnect bypass condensers from buss until defective one is found. Sometimes moisture is found on coil terminals. Scrape this clear.

NOISY OPERATION (Not Static)

A defective tube will cause a sharp 60 cycle R.F. pickup. This is most prominent on low frequency. Replace with a good tube.

In many cases it is found that the noise cannot be eliminated by servicing the receiver. Noise may enter into the light lines or via the antenna. The only way to check the source is to turn off one after another all electrical apparatus in the vicinity of the set.

There is no freak or trick antenna that will eliminate natural static.

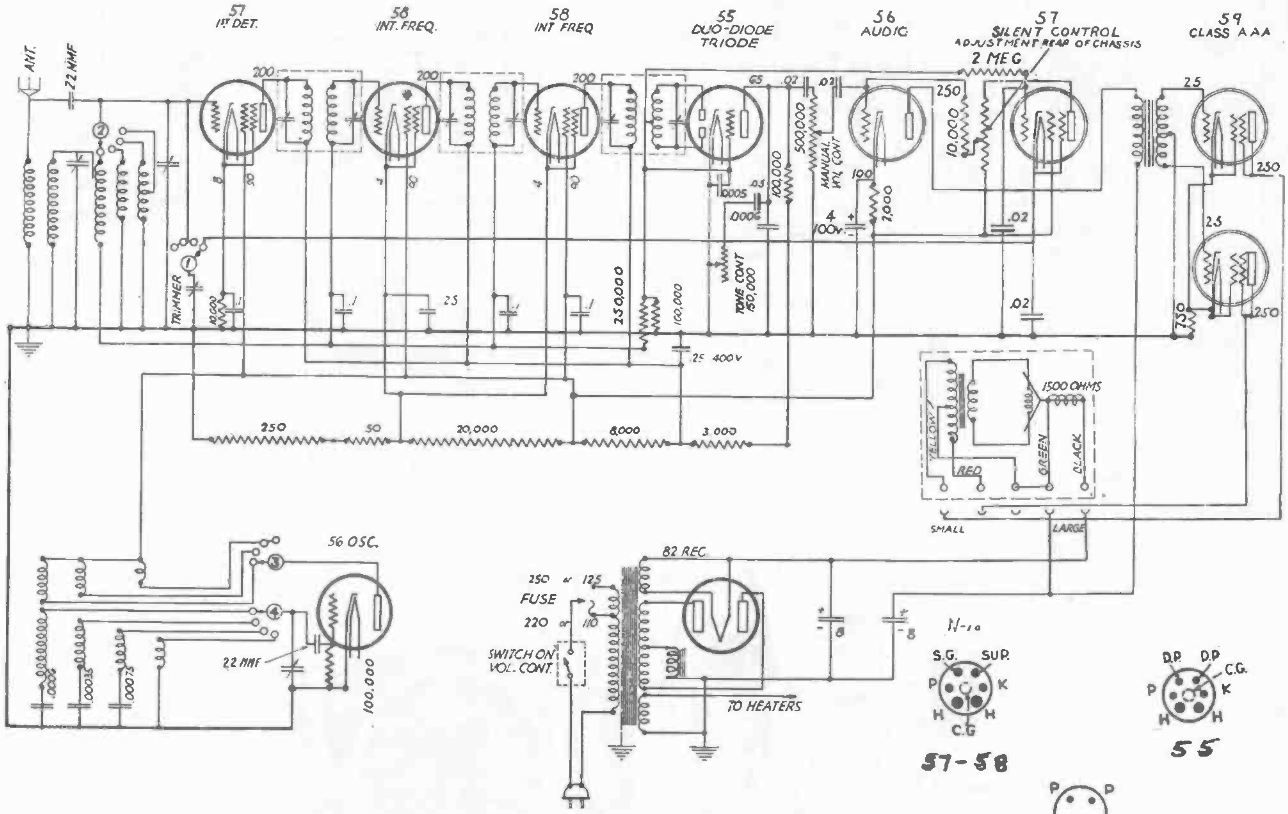
GENERAL

All resistors, bypass condensers and filter units are marked.
Voltages are shown at tube socket on diagram.
99 per cent of trouble in a chassis is caused by defective tubes, check them carefully.

RADIOBAR CORP.

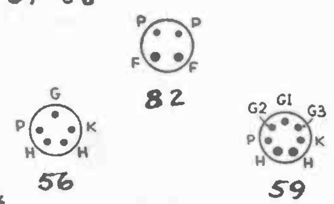
10 TUBE MODELS (Consoles)

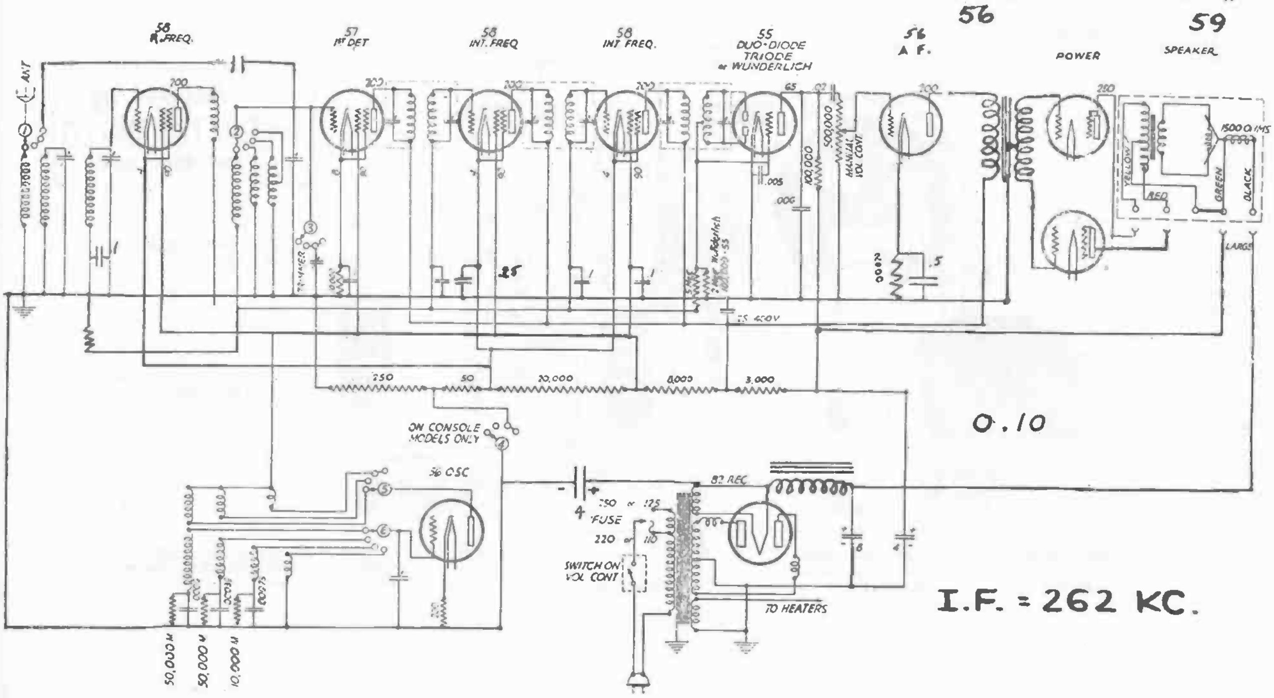
With Rear Fuse and Cover
No. 59 Power Tubes



10 TUBE MODELS (Consoles)

Without Rear Fuse and Cover
No. 46 Power Tubes



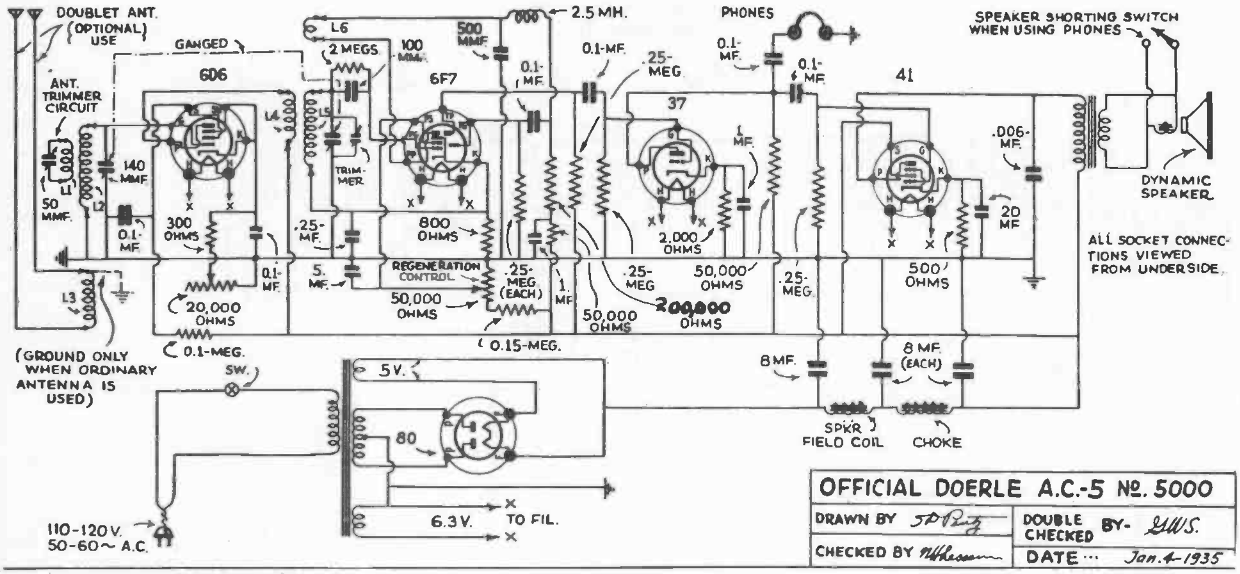


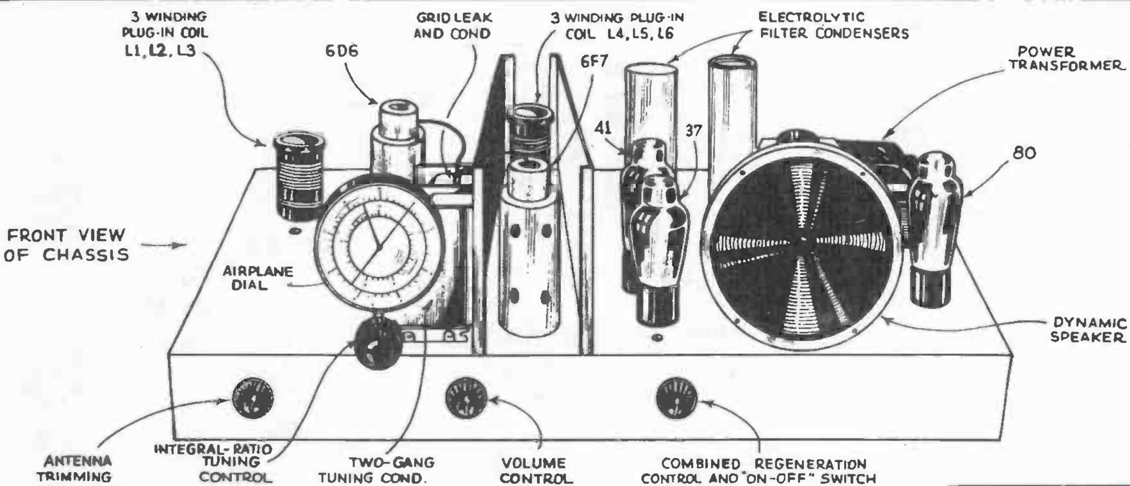
O.10

I.F. = 262 KC.

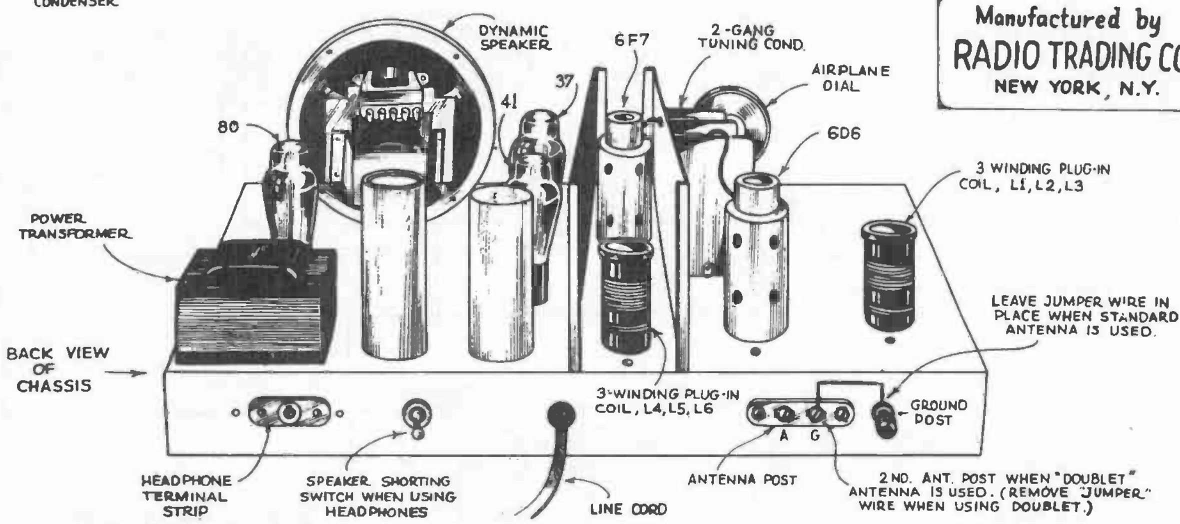
RADIO TRADING CO.

MODEL 5,000



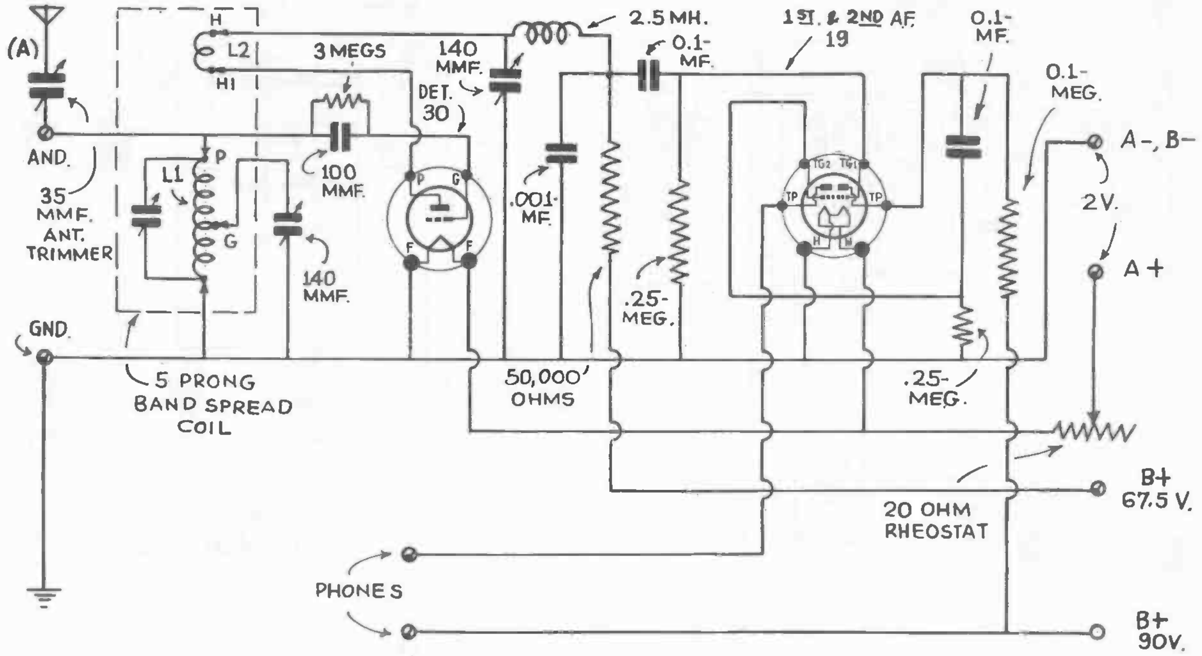


Manufactured by
RADIO TRADING CO.
NEW YORK, N.Y.



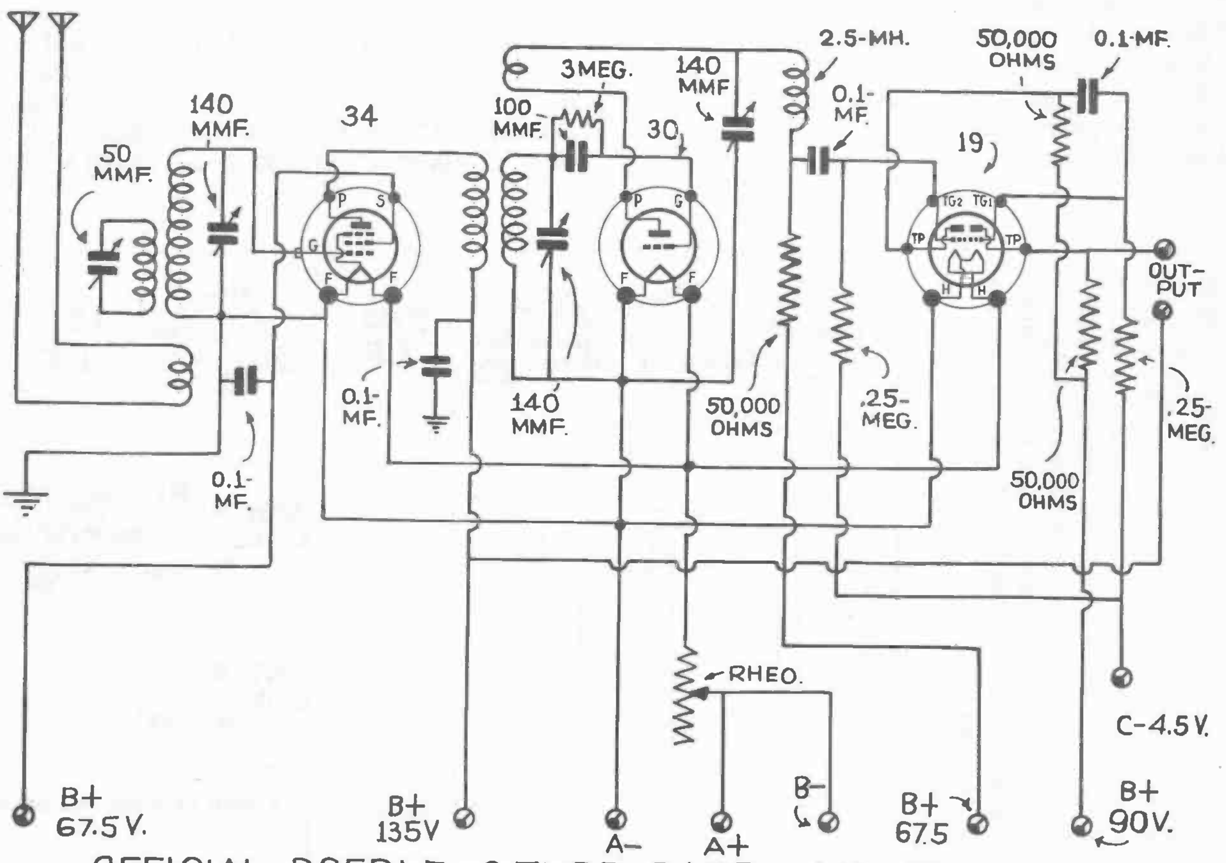
RADIO TRADING CO.

MODEL 5009



OFFICIAL DOERLE 2 TUBE BATT. No. 5009

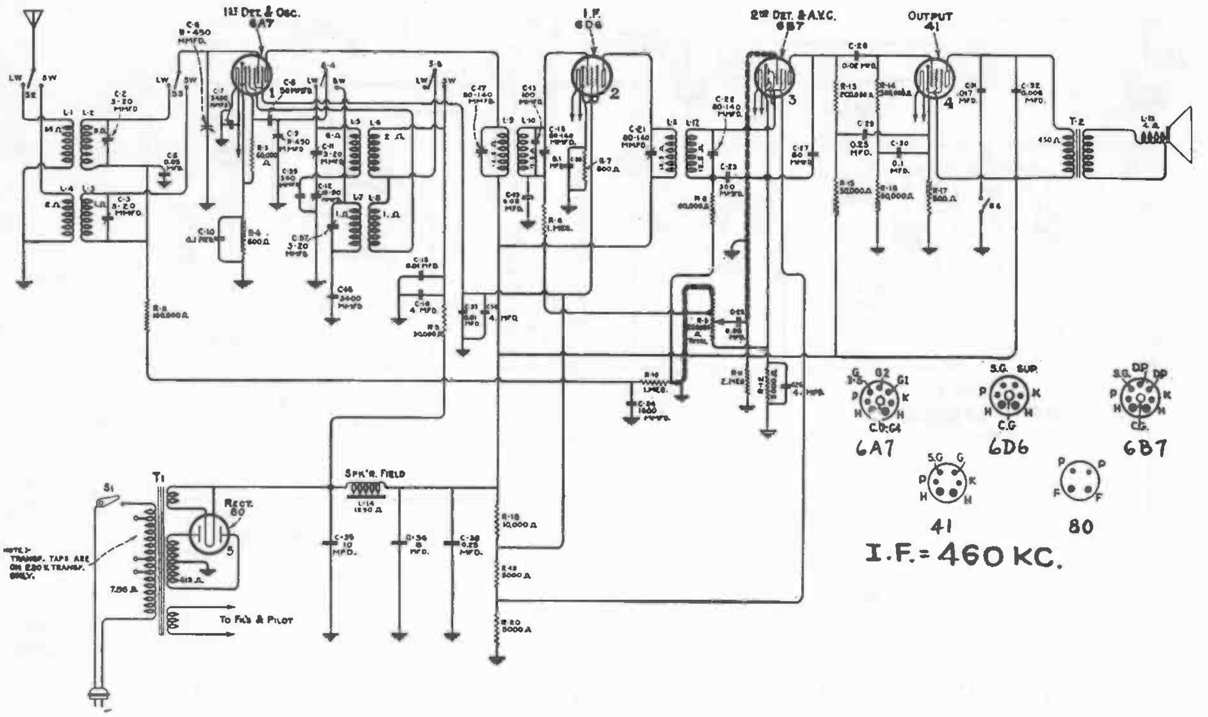
MODEL 5006



OFFICIAL DOERLE 3 TUBE BATT. No. 5006

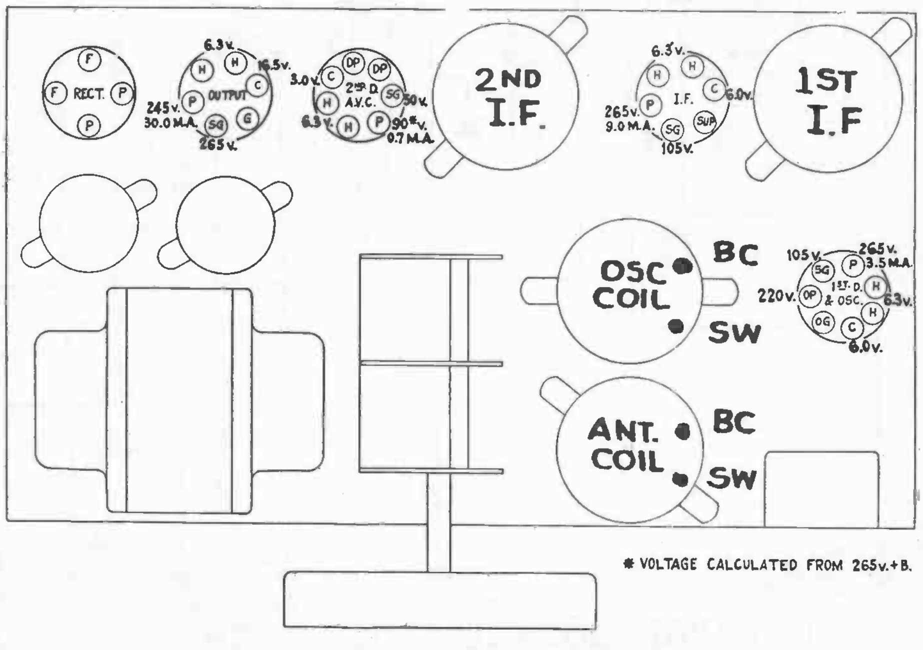
RCA MFG. CO.

MODELS 118 AND 211



Voltage Rating....................105–125 Volts and 100–130/195–250 Volts (double range transformer)
Frequency Rating....................25–60 and 50–60 Cycles
Power Consumption (All Frequencies)....................85 Watts
Number and Types of Radiotrons...1 RCA-6A7, 1 RCA-6D6, 1 RCA-6B7, 1 RCA-41, 1 RCA-80—Total, 5
Undistorted Output....................1.9 Watts
Maximum Output....................3.5 Watts
Tuning Frequency Ranges....................540 K. C.–1720 K. C.—5400 K. C.–18,000 K. C.
Line-up Frequencies....................460 K. C., 600 K. C., 1720 K. C. and 18,000 K. C.

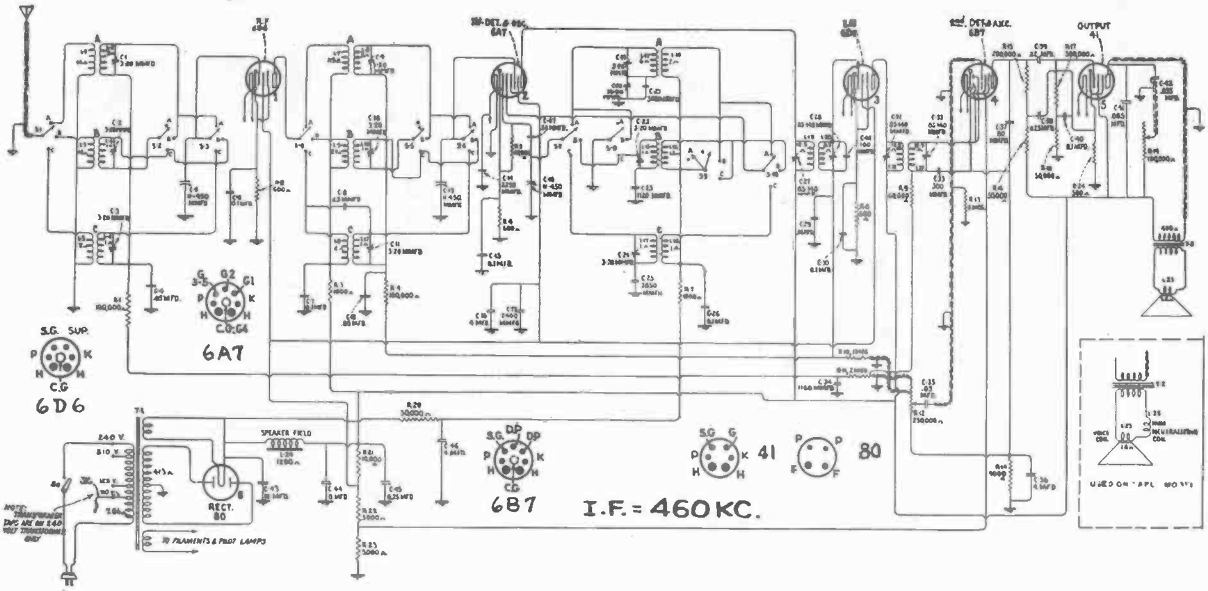
The signal enters the receiver through the antenna system and is applied through a tuned circuit to the grid of the first detector. Combined with the signal is the local oscillator signal, which is at a constant frequency difference (460 K. C. higher) throughout the tuning range. The combined signals after passing through the first detector produce the I. F. signal, which is 460 K. C. The RCA-6A7 is the combined detector and oscillator.



* VOLTAGE CALCULATED FROM 265V.+B.

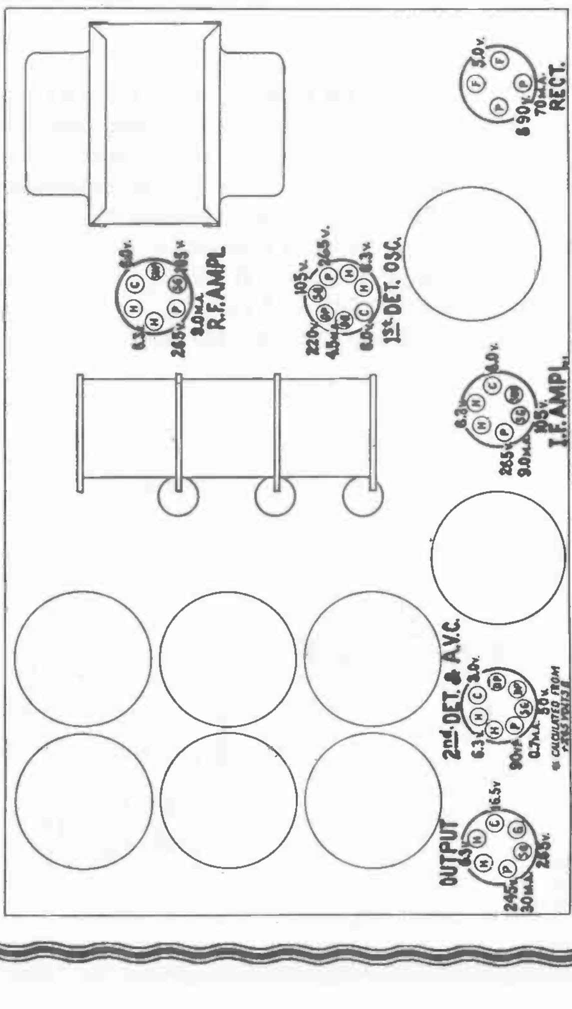
RCA MFG. CO.

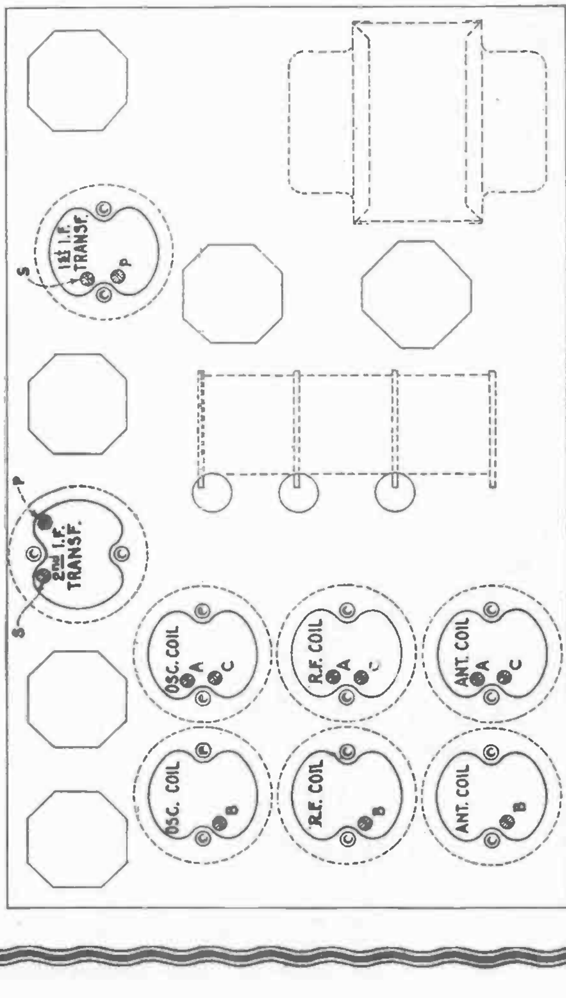
MODEL 128 AND 224



Tuning Frequency Range . . . . . . {Band A—540 K. C.–1720 K. C.; Band B—1720 K. C.–5400 K. C.; Band C—5400 K. C.–18,000 K. C.}

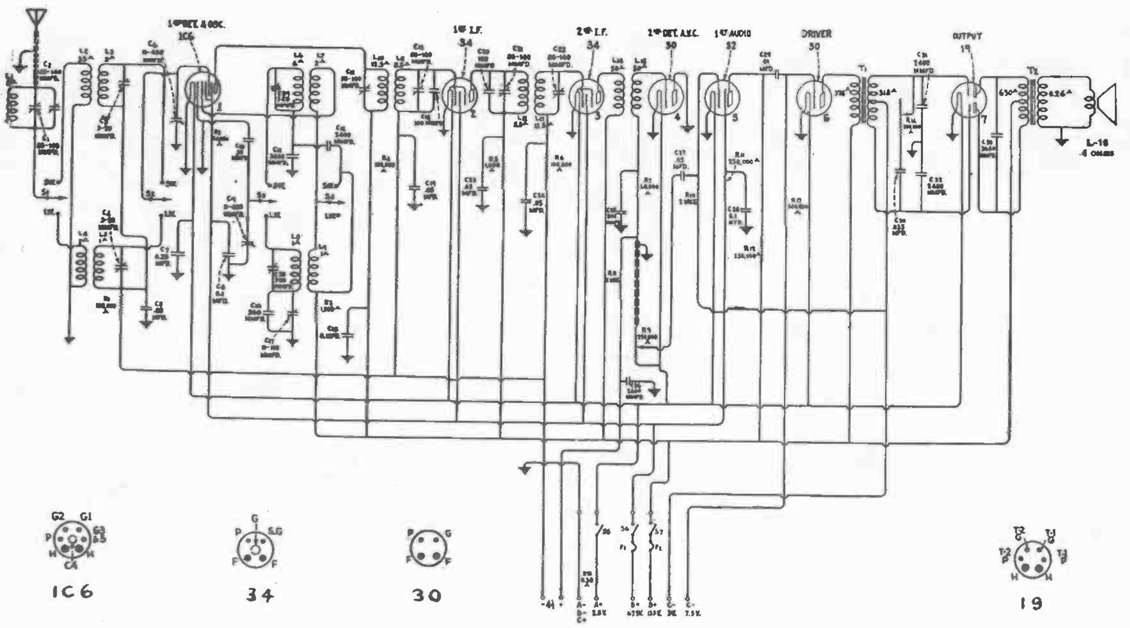
Line-Up Frequencies . . . . . . 460 K. C., 600 K. C., 1720 K. C., 5160 K. C., 18,000 K. C.



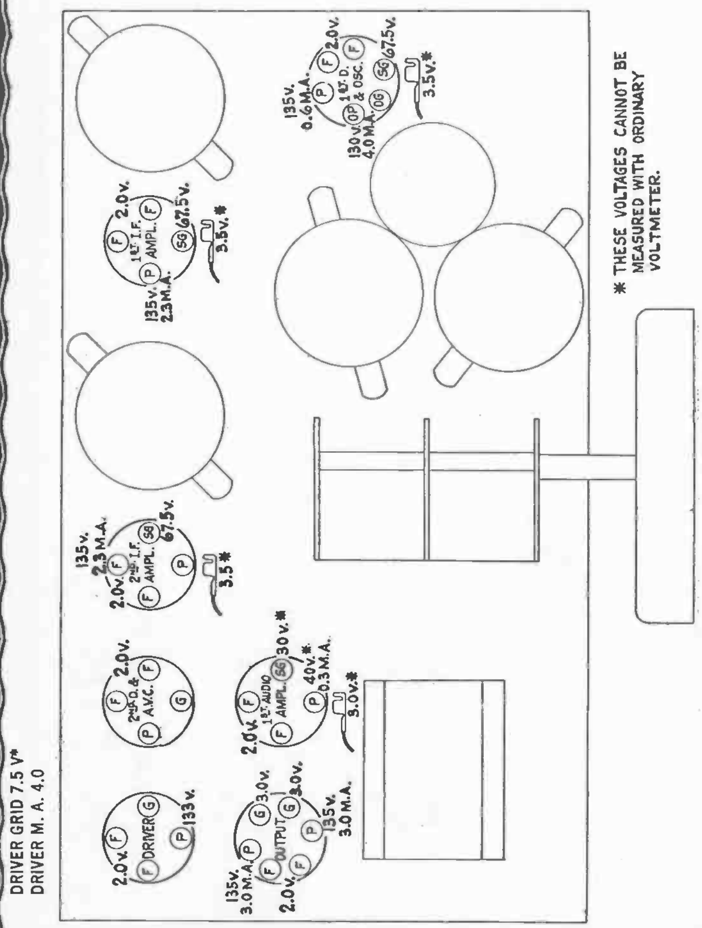


RCA MFG. CO.

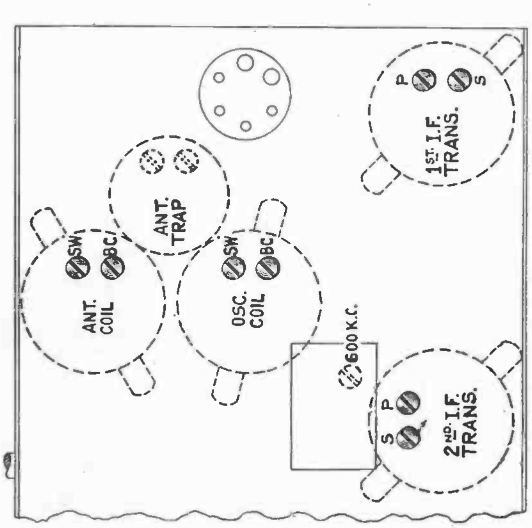
MODELS 135-B AND 235-B



Tuning Ranges.................................540 K. C.–1720 K. C.—5400 K. C.–18,000 K. C.
Line-up Frequencies...............................460 K. C., 600 K. C., 1720 K. C. and 18,000 K. C.

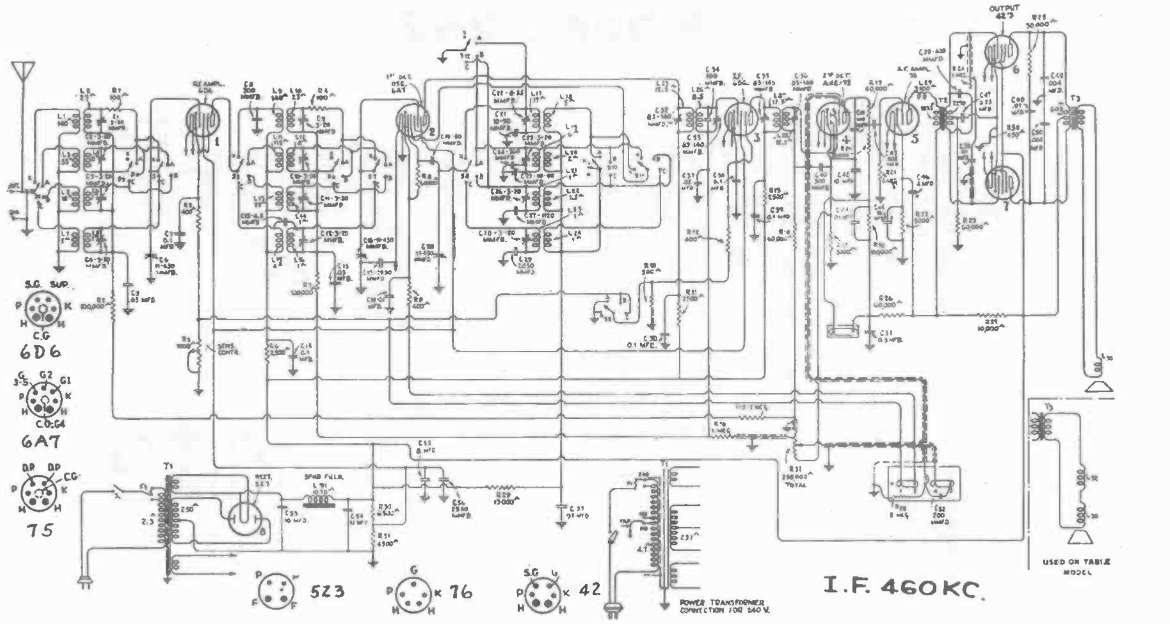


The circuit is of the superheterodyne type and consists of a combined oscillator-detector stage, two I. F. amplifying stages, a combined second detector and automatic volume control, a two-stage audio amplifier and a Class "B" output stage. Separate coil systems are used for each band, in conjunction with a push-pull type Range Switch. A three-pole operating switch opens one "A" and two "B" battery leads when the switch is at the "off" position.



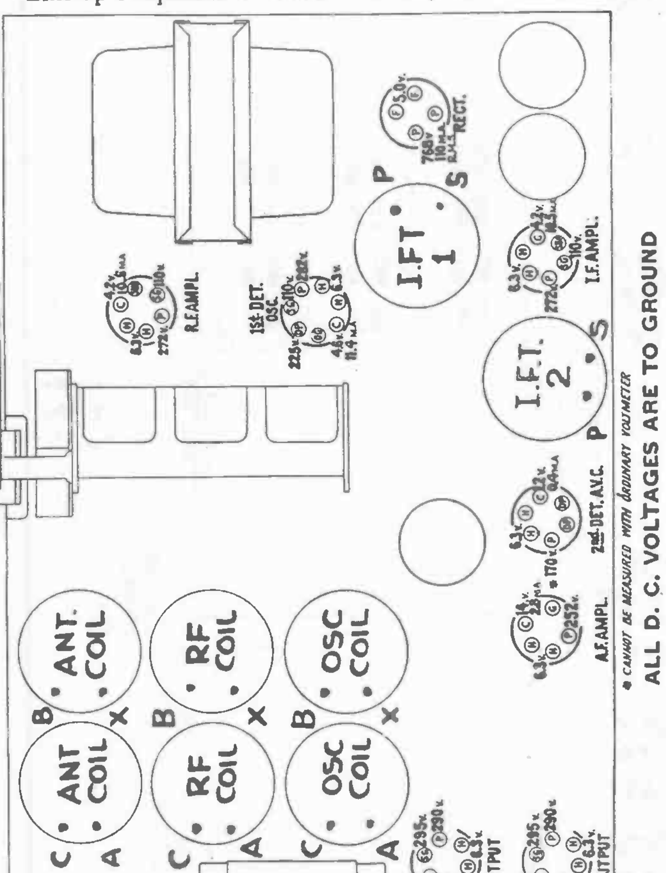
Location of Line-Up Capacitors

RCA MFG. CO.
MODEL 143 AND 242



Tuning Frequency Range. . . . .
- Band X— 140 K. C.– 410 K. C.
- Band A— 540 K. C.– 1720 K. C.
- Band B—1720 K. C.– 5400 K. C.
- Band C—5400 K. C.–18000 K. C.

Line-up Frequencies. . . . . .175 K. C., 410 K. C., 460 K. C., 600 K. C., 1720 K. C., 5160 K. C., 18000 K. C.



The general circuit arrangement consists of an R. F. stage, a combined oscillator and first detector, an I. F. stage, a combined second detector and automatic volume control, a first audio stage and a push-pull Pentode output stage. An RCA-5Z3 rectifier, together with a suitable filtering system, provides plate and grid voltages for all tubes and field excitation for the loudspeaker.

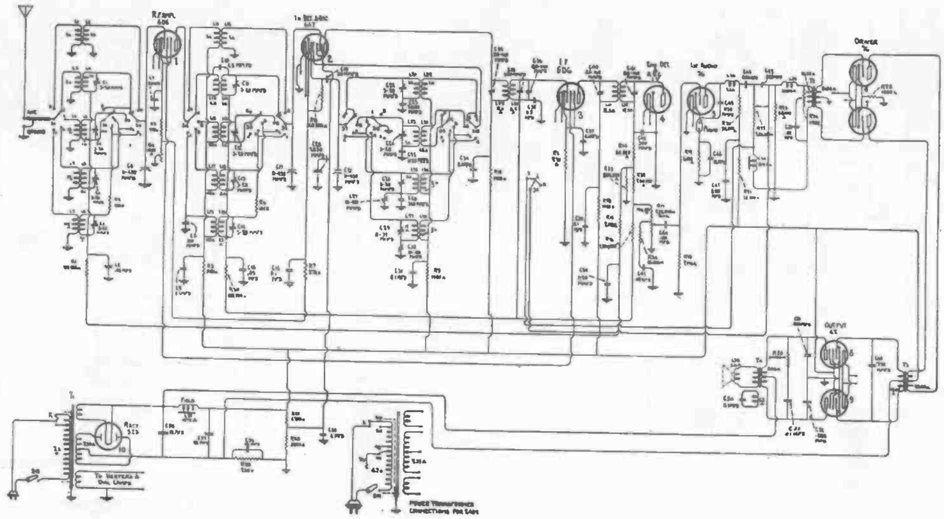
The signal enters the receiver through a shielded antenna lead and is applied to the grid of the R. F. tube through the antenna coupling transformer. The secondary of this transformer is tuned to the signal frequency by means of one unit of the gang capacitor. The output of this stage is transformer coupled to the grid circuit of the first detector, which is also tuned to the signal frequency by a unit of the gang capacitor.

Combined with the signal in the first detector is the local oscillator, which is always at a 460 K. C. frequency difference (higher) from the signal frequency. A separate coil system and the third unit of the gang capacitor are used in this circuit.

In conjunction with these three tuned circuits, it is well to point out that four different groups of tuned circuits are used, one for each tuning band. A four-position selector switch is provided for selecting the band in which the desired signal is located. In addition to selecting the desired coil system, additional groups of contacts are provided for short-circuiting the preceding lower frequency R. F. and detector coils and the two preceding oscillator coils. This is to prevent "dead" spots due to the absorption effects caused by the coils, the natural period of which, with the tuning capacitor disconnected, falls in the next higher frequency band.

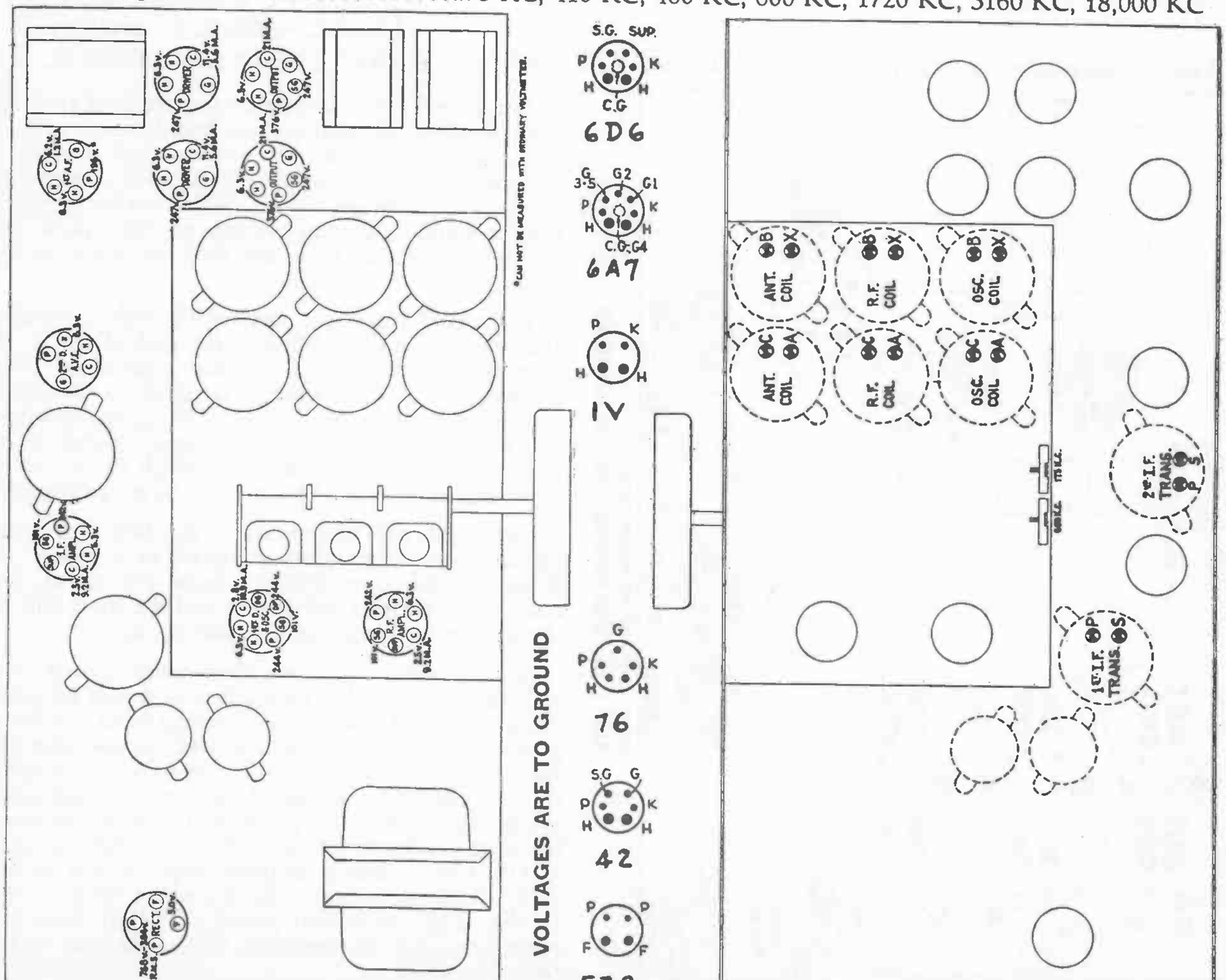
RCA MFG. CO.

MODEL 262



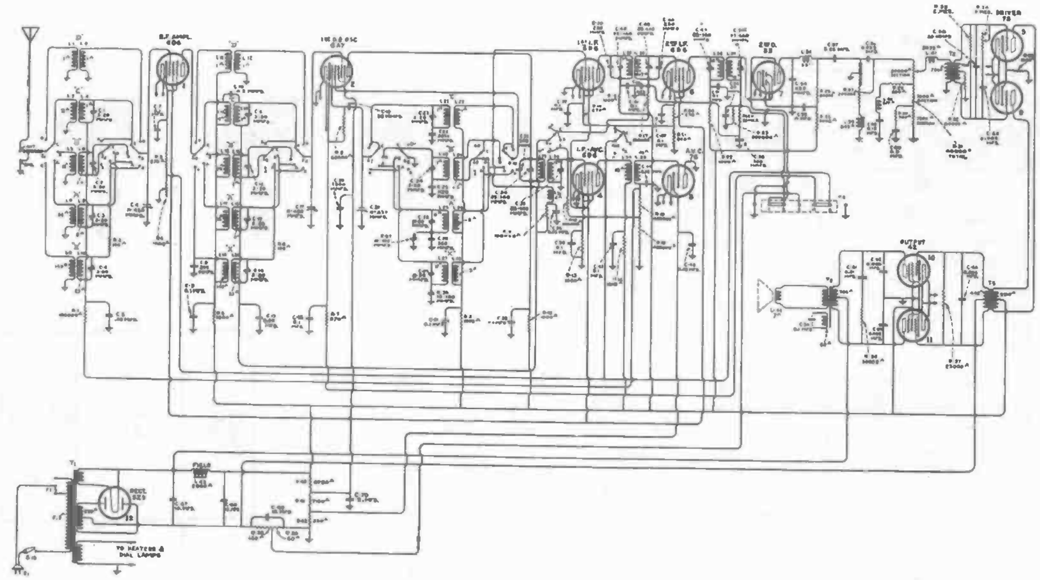
Tuning Frequency Range	
Band X—	140 KC – 410 KC
Band A—	540 KC – 1720 KC
Band B—	1720 KC – 5400 KC
Band C—	5400 KC – 18,000 KC
Band D—	18,000 KC – 36,000 KC

Line-up Frequencies....................175 KC, 410 KC, 460 KC; 600 KC, 1720 KC, 5160 KC, 18,000 KC



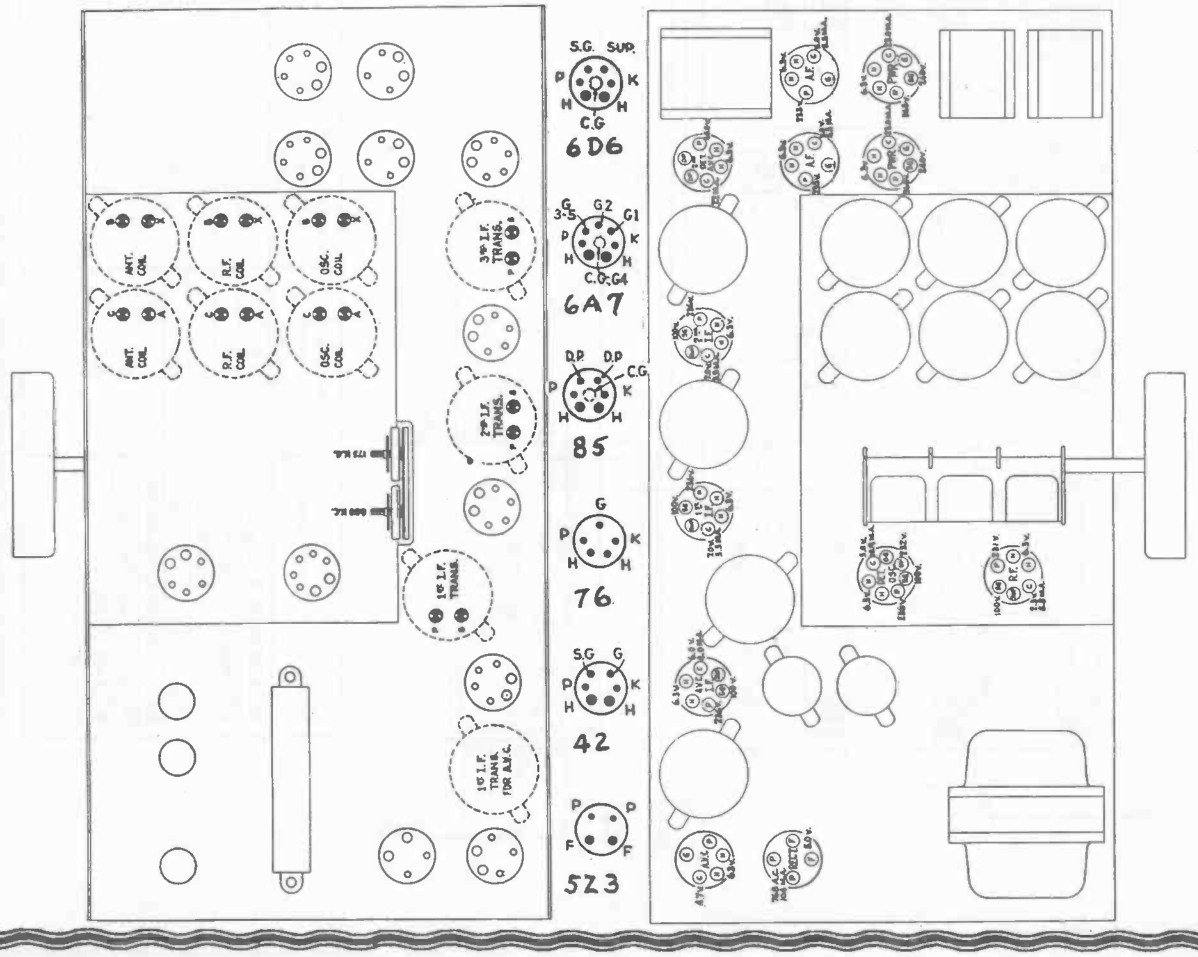
RCA MFG. CO.

MODEL 281



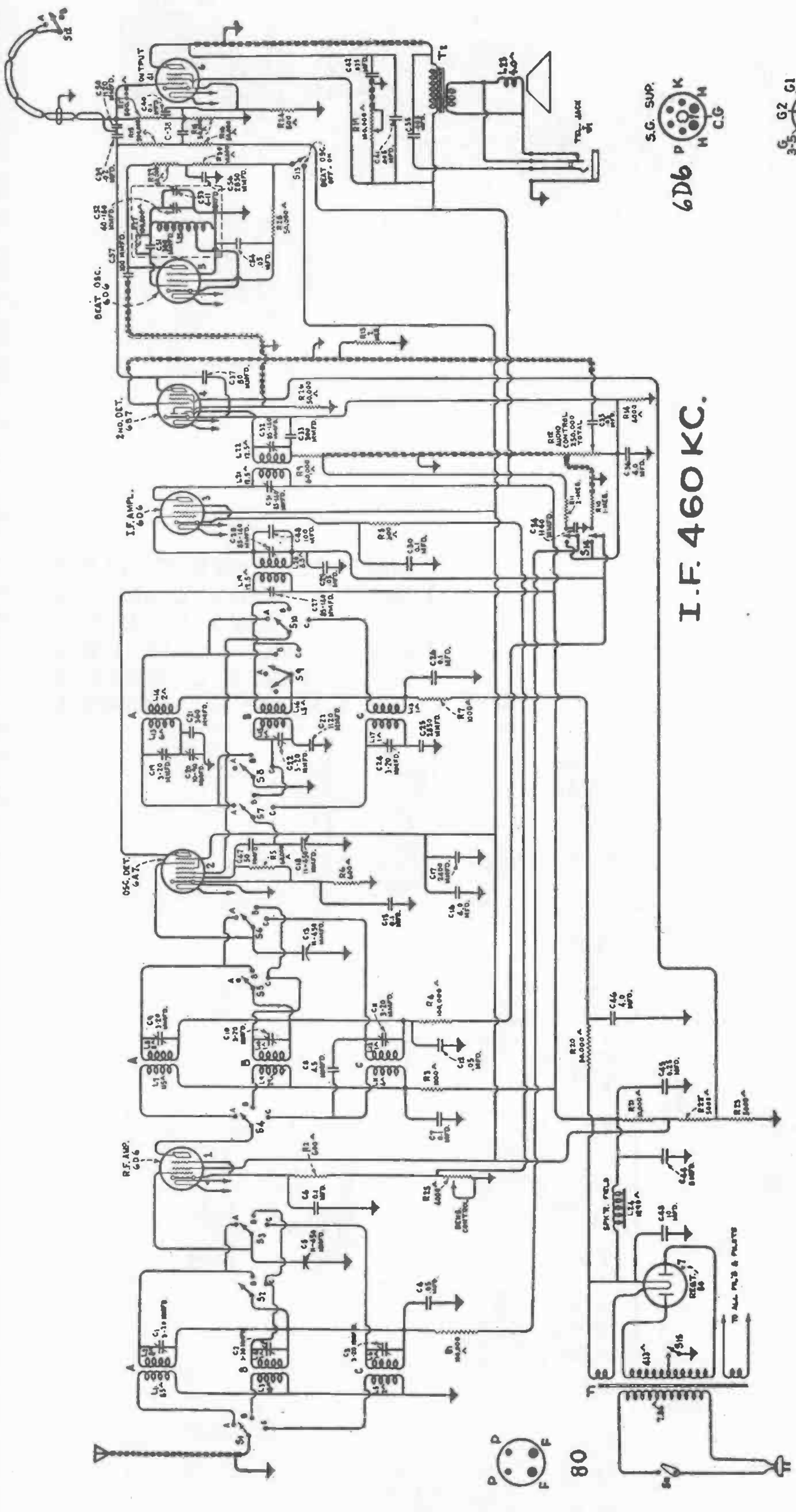
Tuning Frequency Range	Band X .... 140 K. C.–410 K. C.
	Band A ...... 540 K. C.–1720 K. C.
	Band B ...... 1720 K. C.–5400 K. C.
	Band C .... 5400 K. C.–18,000 K. C.
	Band D .. 18,000 K. C.–36,000 K. C.

Line-up Frequencies ....175 K. C., 410 K. C., 460 K. C., 600 K. C., 1720 K. C., 5160 K. C., 18,000 K. C.

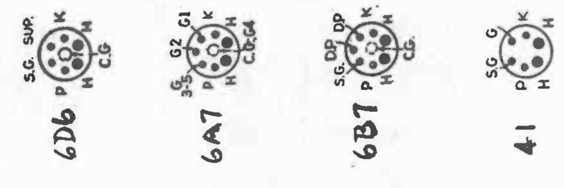


RCA MFG. CO.

MODEL ACR-136



I.F. 460 KC.

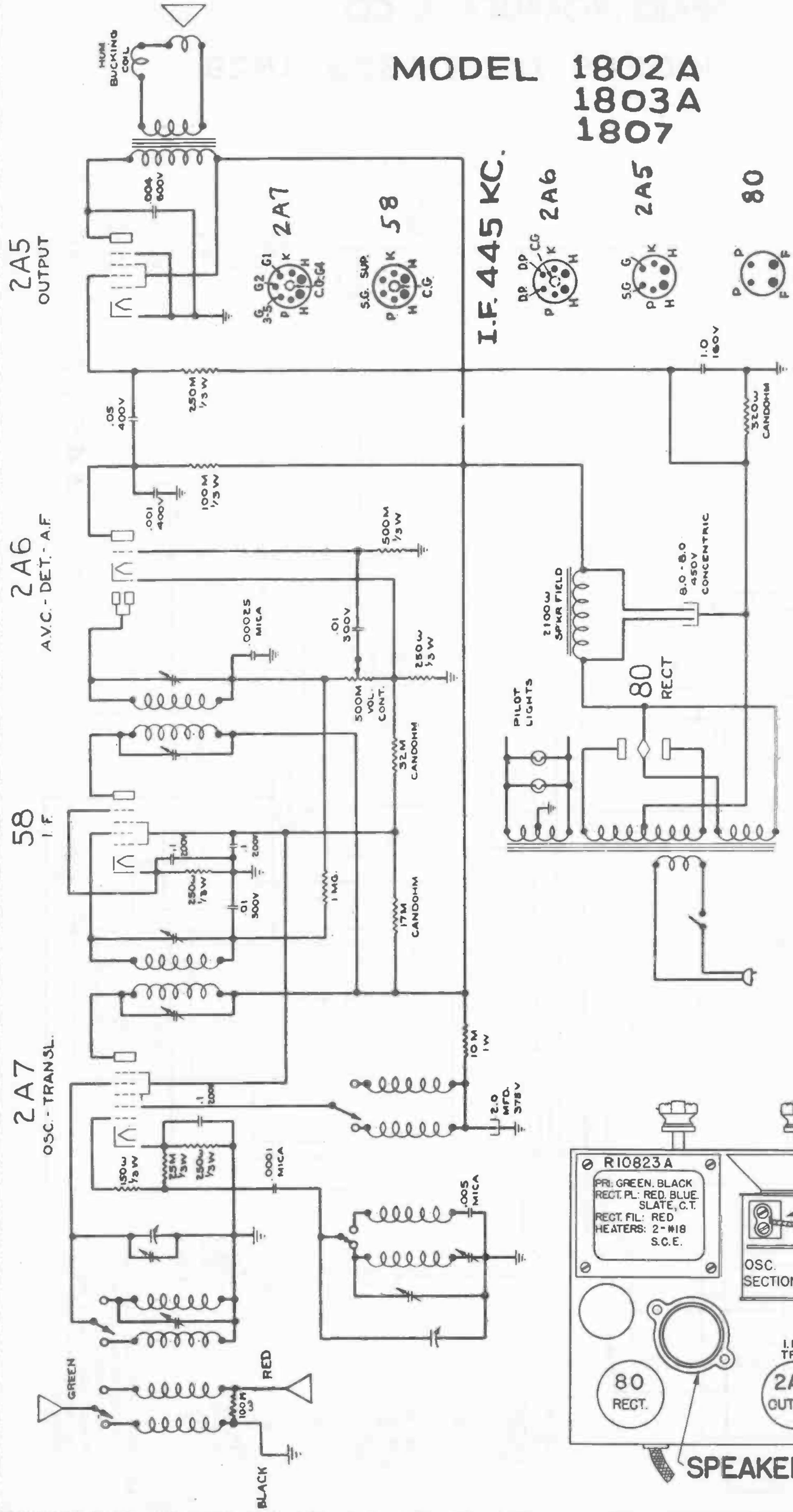


Radiotron Type Number	Cathode to Ground (Volts)	Screen Grid to Ground (Volts)	Plate to Ground (Volts)	Plate Current (M. A.)	Heater Volts
RCA-6D6 (R-F Amplifier)	6.0	105	265	9.0	6.3
RCA-6A7 (1st Detector)	6.0	105	265	3.5	6.3
(Oscillator)	—	—	220	4.5	
RCA-6D6 (I-F Amplifier)	6.0	105	265	9.0	6.3
RCA-6D6 (Beat Oscillator)	—	50*	40*	—	6.3
RCA-6B7 (2nd Detector)	3.0	50	90*	0.7	6.3
RCA-41 (Output)	16.5	265	245	30.0	6.3
RCA-80 (Rectifier)	—	—	690 (r-m-s) Plate to Plate	70.0 Total	5.0

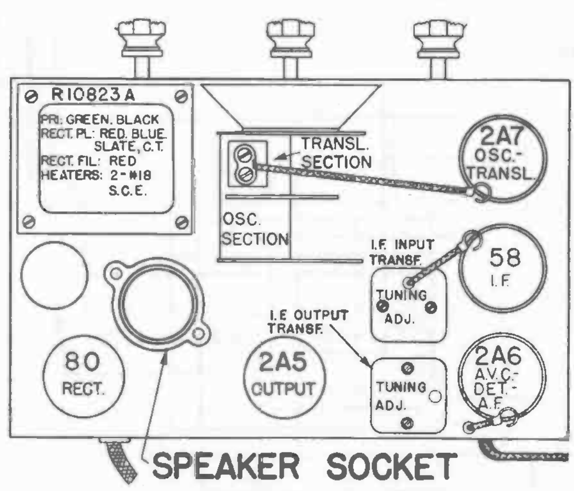
* Difficult to measure—Calculated from 265 Volts (+B).

SEARS ROEBUCK & CO.

MODEL 1802A 1803A 1807

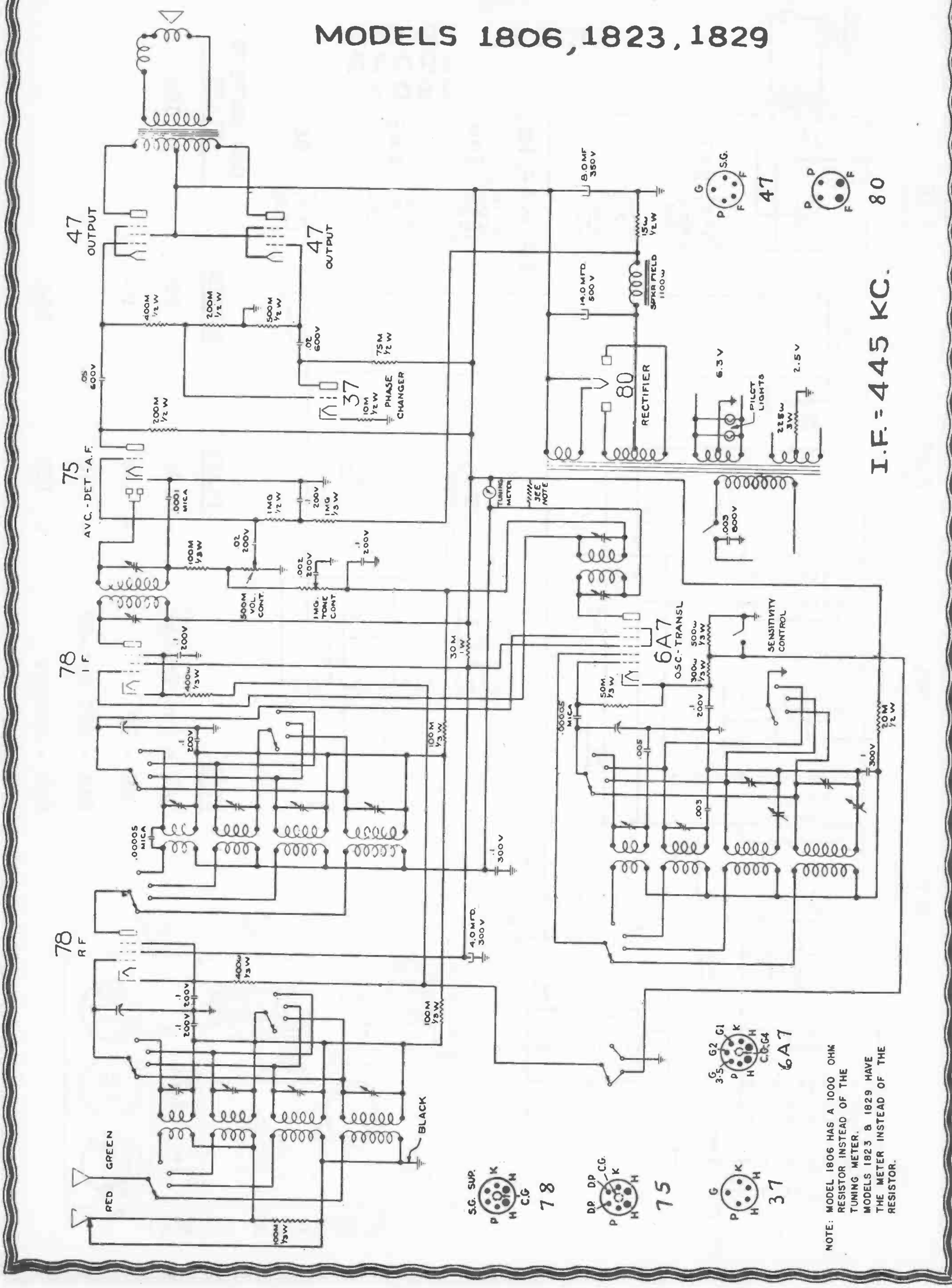


TUBE	PLATE	SCREEN	OSC. SECTION PLATE
2A7 - Osc-Transl	195	90	155
58 - IF	195	90	
2A6 - AVC-Det-AF	115		
2A5 - Output	185	195	



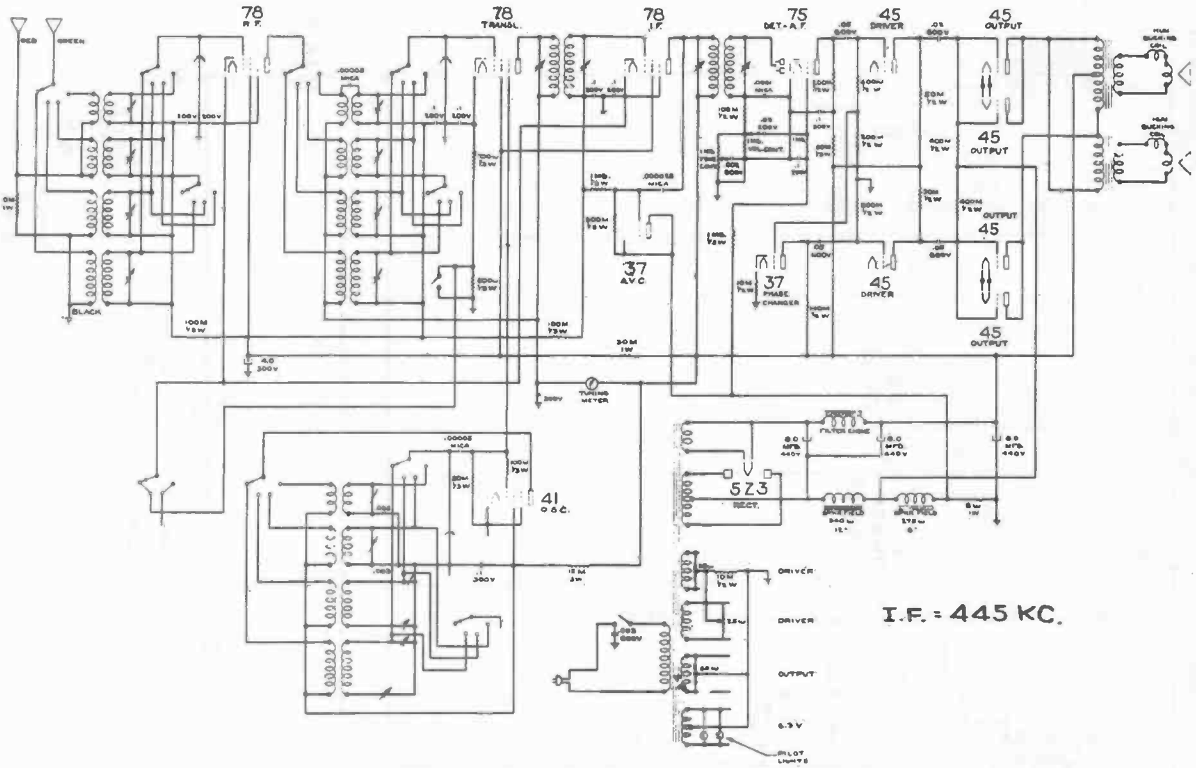
SEARS ROEBUCK & CO.

MODELS 1806, 1823, 1829



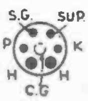
SEARS ROEBUCK & CO.

MODELS 1822 AND 1831

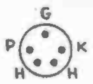


I.F. = 445 KC.

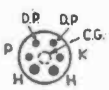
TUBE		PLATE	SCREEN	CATHODE
78 - RF	-	255	100	
41 - Oscillator	-	90	90	
78 - Translator	-	255	100	
78 - IF	-	260	100	
37 - AVC	-	Used as diode with no applied DC voltage		
75 - Detector-AF	-	115		
37 - Phase Changer	-	120		12
45 - Drivers	-	160		37
45 - Output	-	250		0
5Z3 - Rectifier	-			285



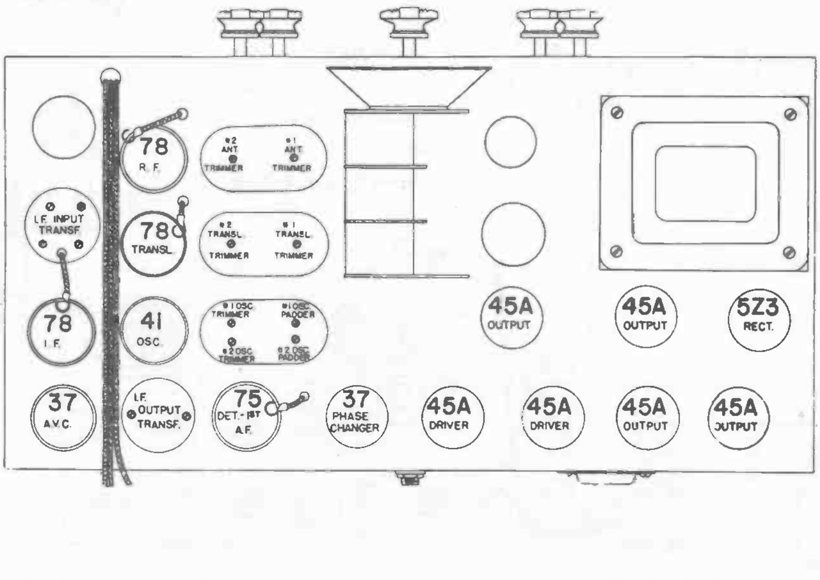
78

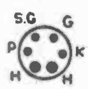


37



75





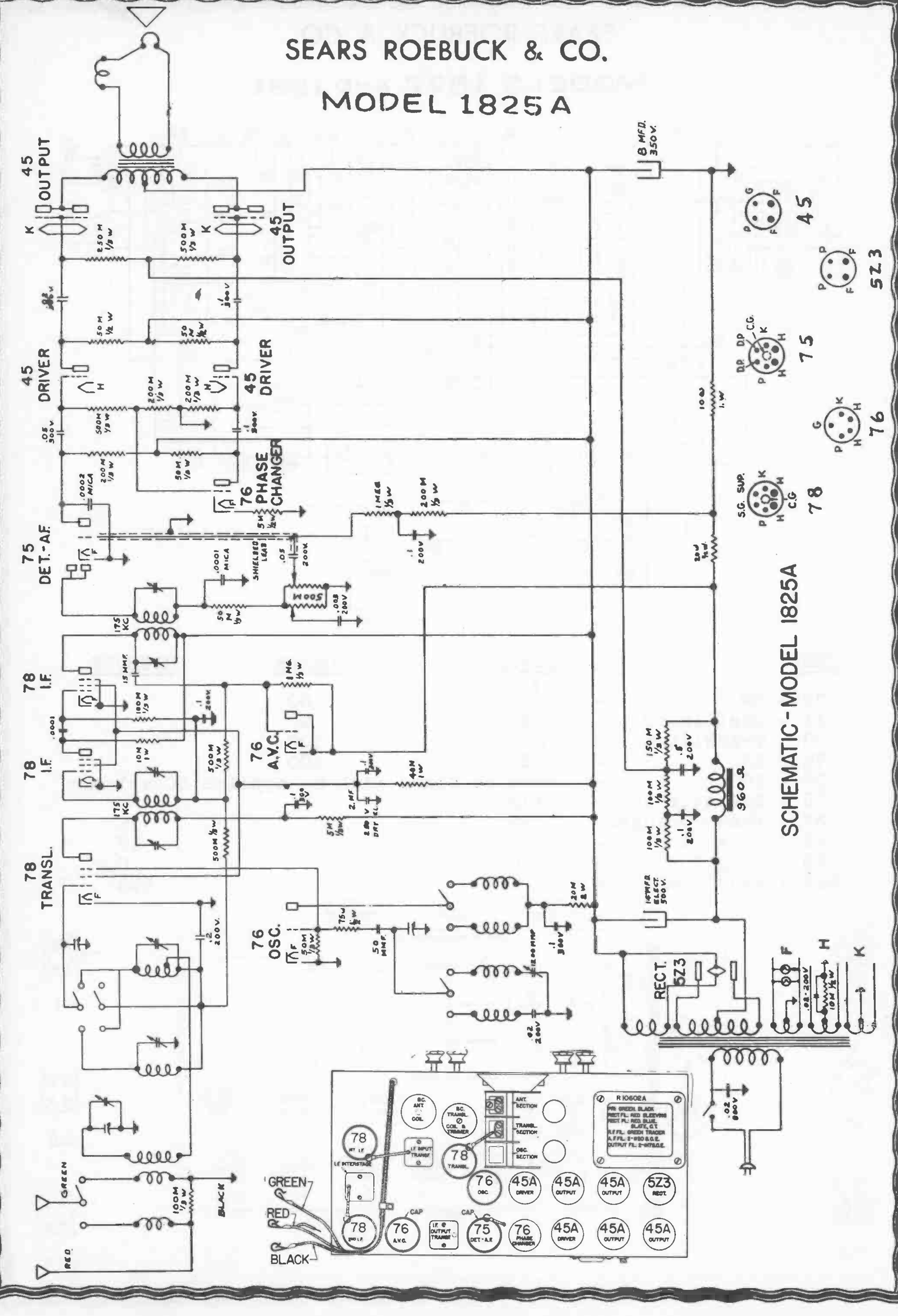
41

45

5Z3

SEARS ROEBUCK & CO.

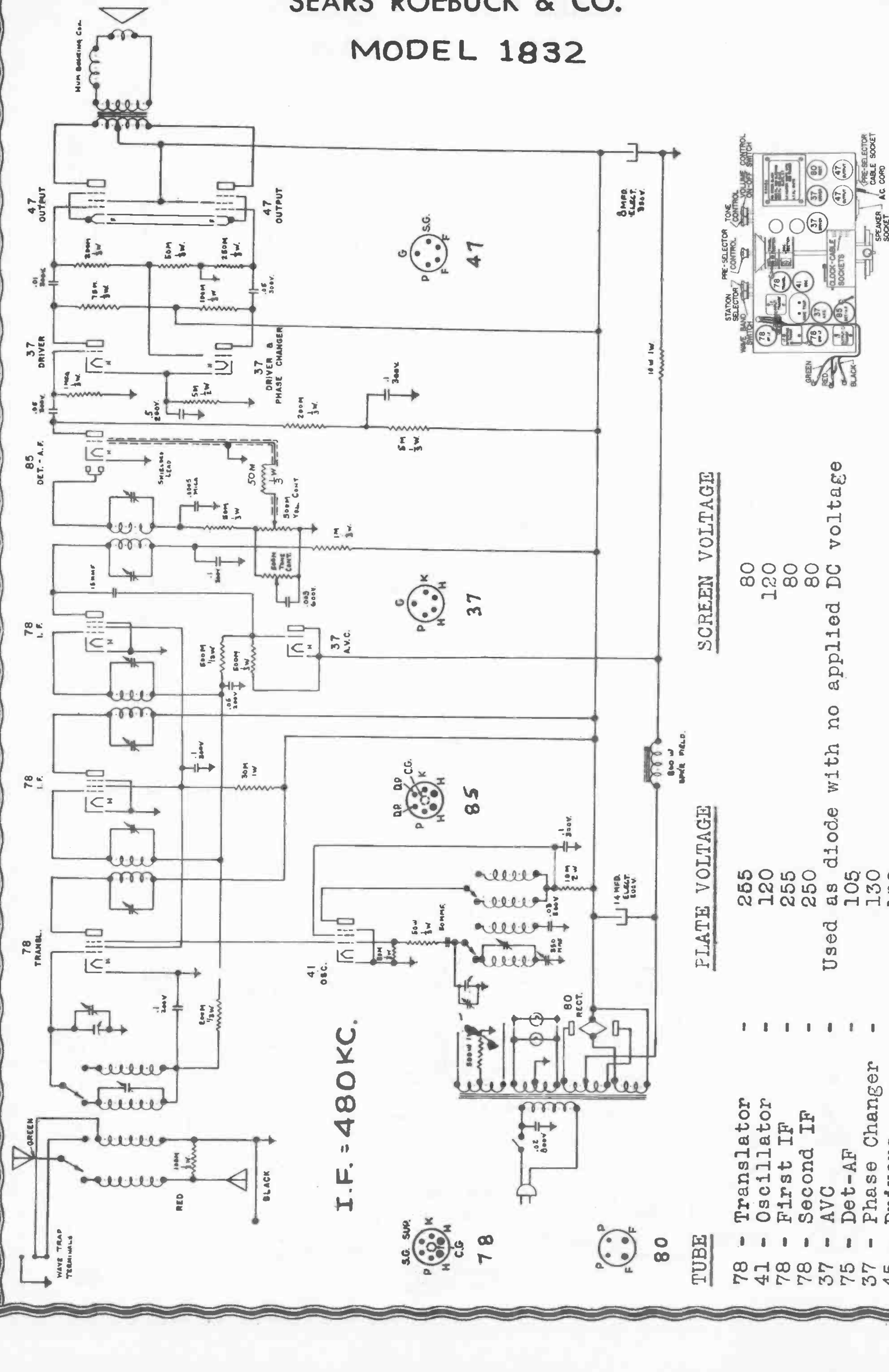
MODEL 1825A



SCHEMATIC-MODEL 1825A

SEARS ROEBUCK & CO.

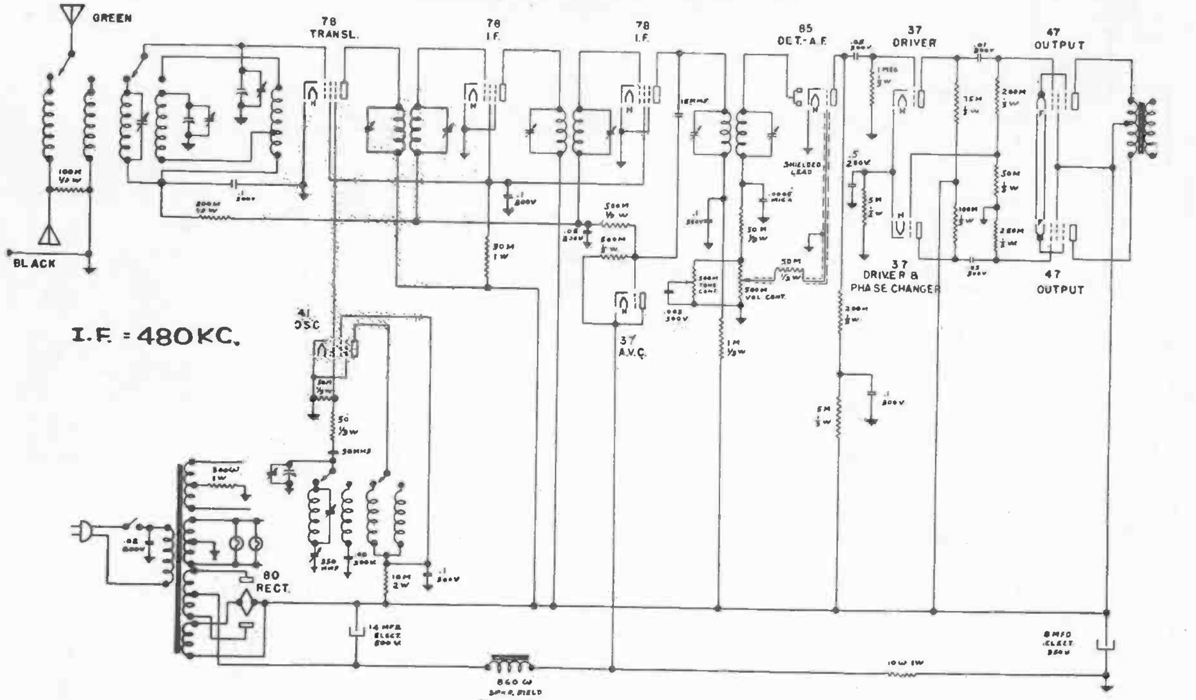
MODEL 1832



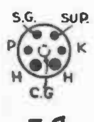
TUBE		PLATE VOLTAGE	SCREEN VOLTAGE
78 - Translator	-	255	80
41 - Oscillator	-	120	120
78 - First IF	-	255	80
78 - Second IF	-	250	80
37 - AVC	-	Used as diode with no applied DC voltage	
75 - Det-AF	-	105	
37 - Phase Changer	-	130	
45 - Drivers	-	150	
45 - Output	-	250	

SEARS ROEBUCK & CO.

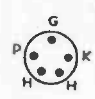
MODEL 1832A



TUBE	PLATE VOLTAGE	SCREEN VOLTAGE
78 - Translator	255	80
41 - Oscillator	120	120
78 - First IF	255	80
78 - Second IF	250	80
37 - AVC	Used as diode with no applied DC voltage	
75 - Det-AF	105	
37 - Phase Changer	130	
45 - Drivers	150	
45 - Output	250	


78


85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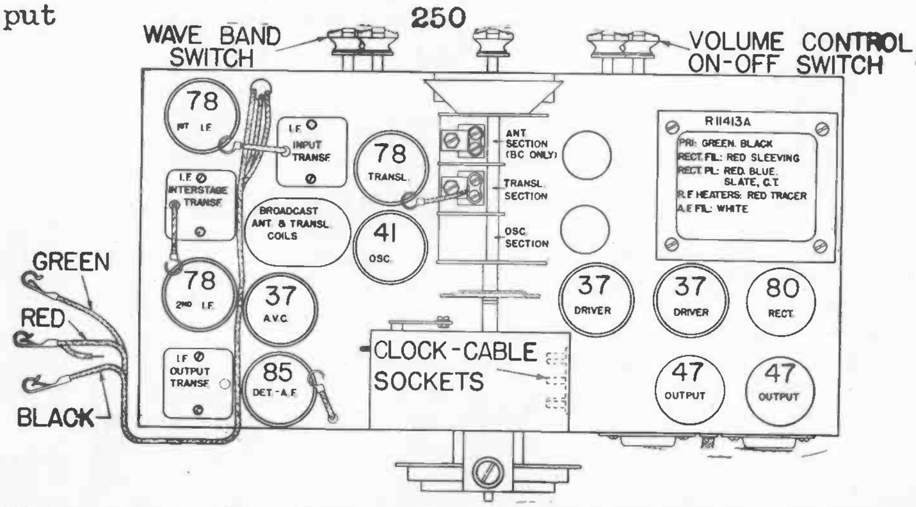

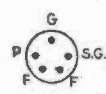
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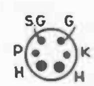
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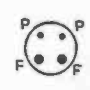
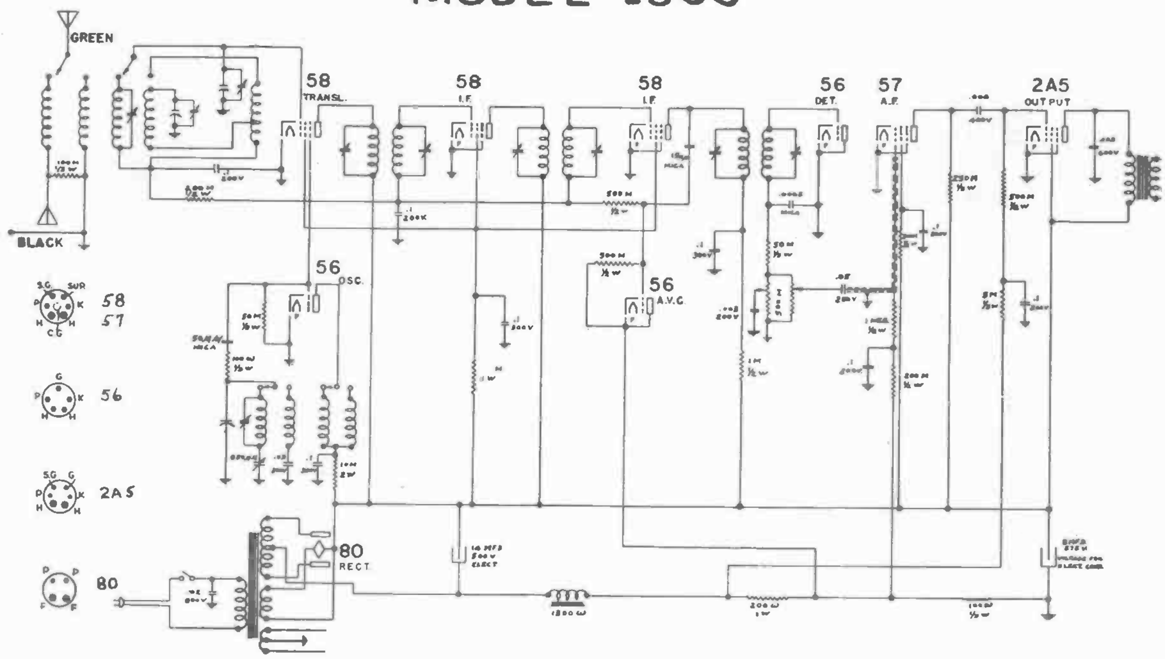
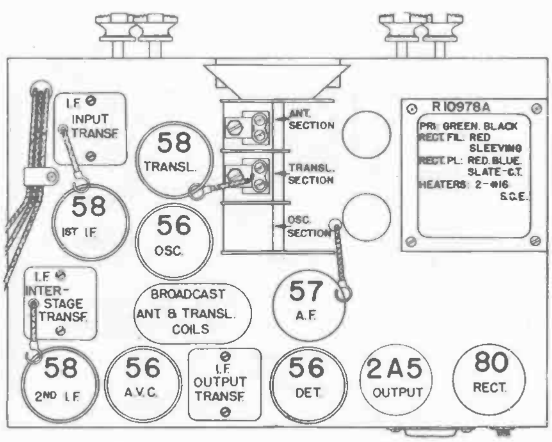

80

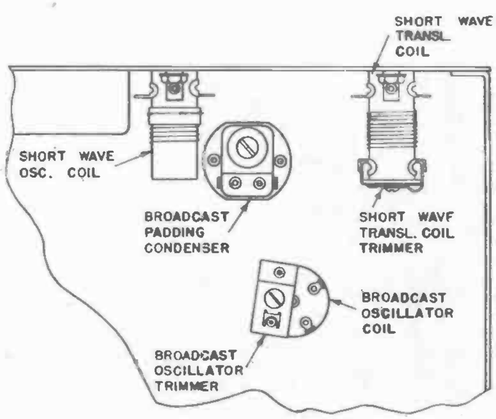
SEARS ROEBUCK & CO.

MODEL 1835



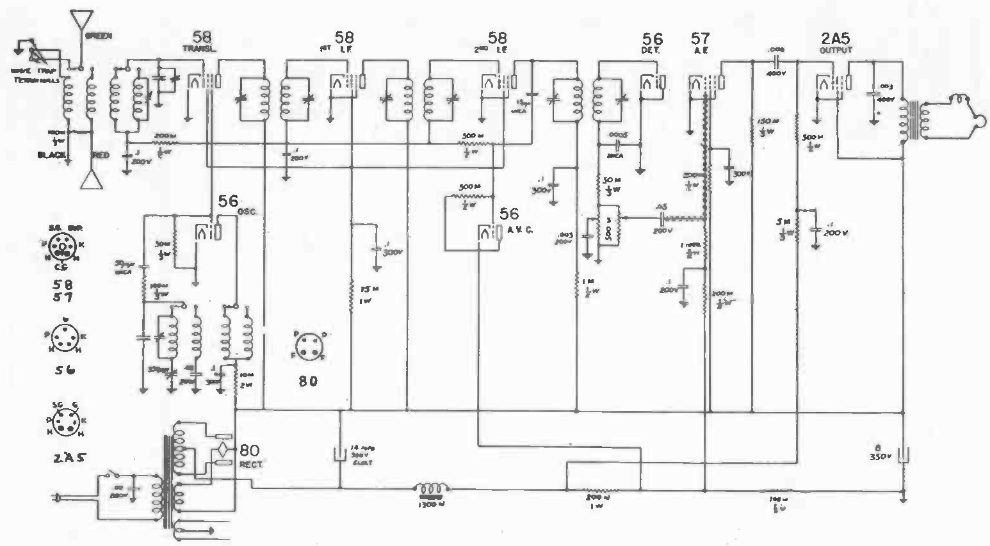
TUBE	PLATE	SCREEN
58 - Translator	260	95
56 - Oscillator	140	
58 - First IF	260	95
58 - Second IF	255	95
56 - AVC	Used as diode with no applied DC voltage	
56 - Det.	Used as diode with no applied DC voltage	
57 - Audio	85	80
2A5 - Output	250	260



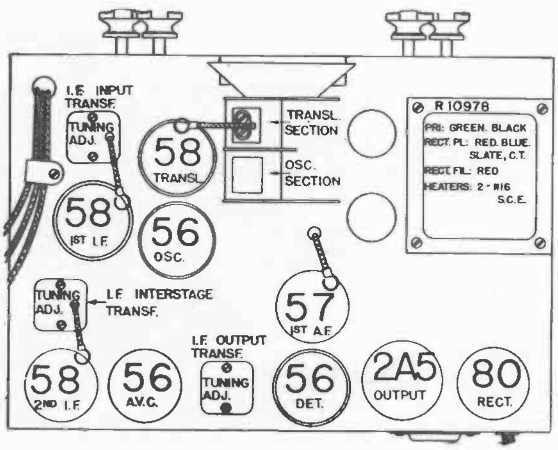


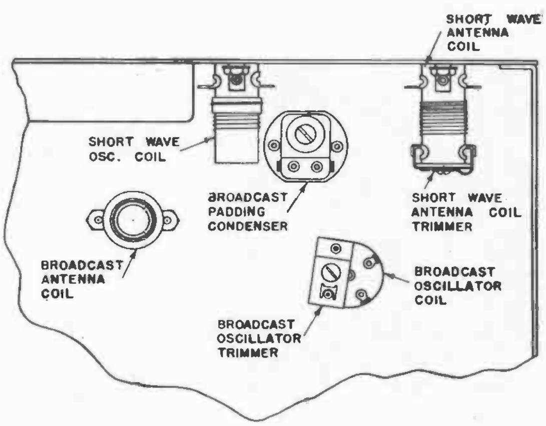
SEARS ROEBUCK & CO.

MODEL 1840



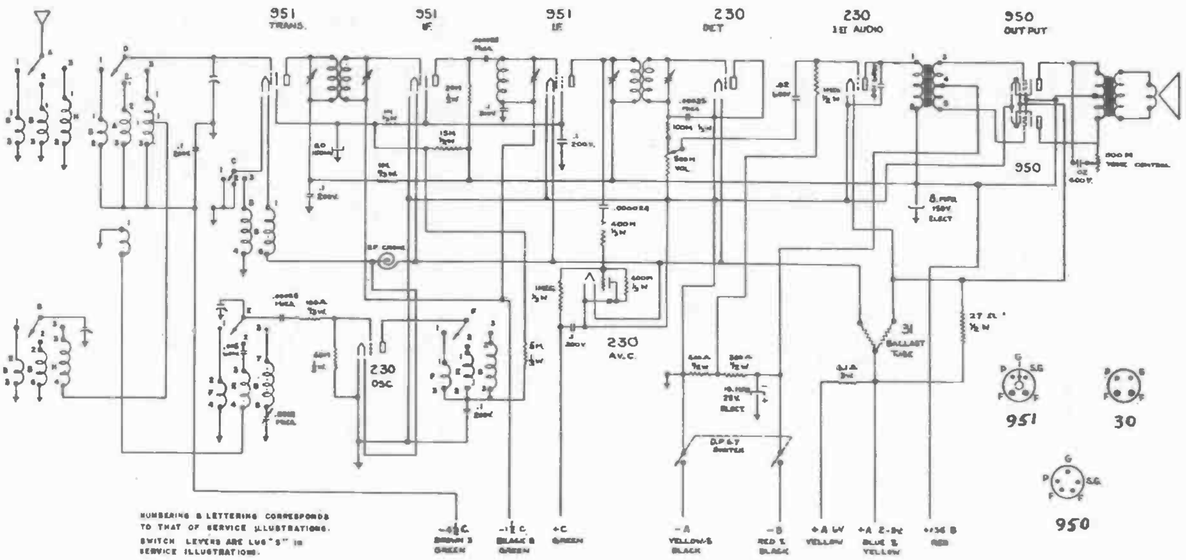
TUBE		PLATE	SCREEN
58 - Translator	-	260	95
56 - Oscillator	-	140	
58 - First IF	-	260	95
58 - Second IF	-	255	95
56 - AVC	-	Used as diode with no applied DC voltage.	
56 - Detector-AF	-	Used as diode with no applied DC voltage.	
57 - Audio	-	95	85
2A5 - Output	-	250	260



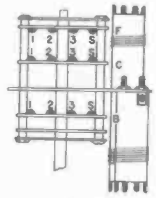


SEARS ROEBUCK & CO.

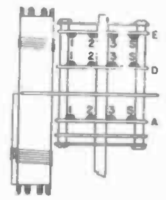
MODEL 1854



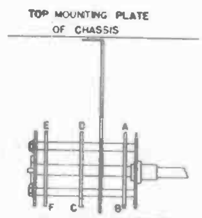
I.F. = 175 KC.



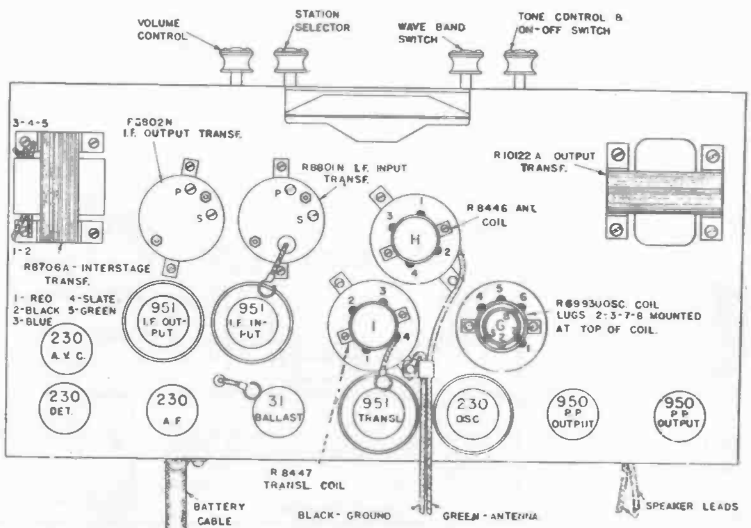
POSITIONS OF LUGS ON SWITCH PLATES AS VIEWED FROM UNDER CHASSIS.

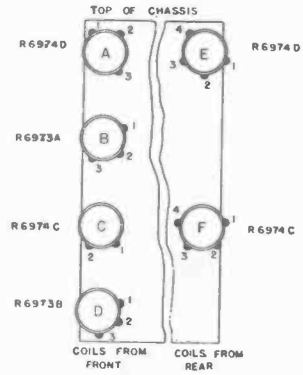


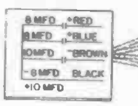
POSITIONS OF LUGS ON SWITCH PLATES AS THEY WOULD APPEAR IF VIEWED FROM TOP OF CHASSIS.



WAVE CHANGING SWITCH R 10538





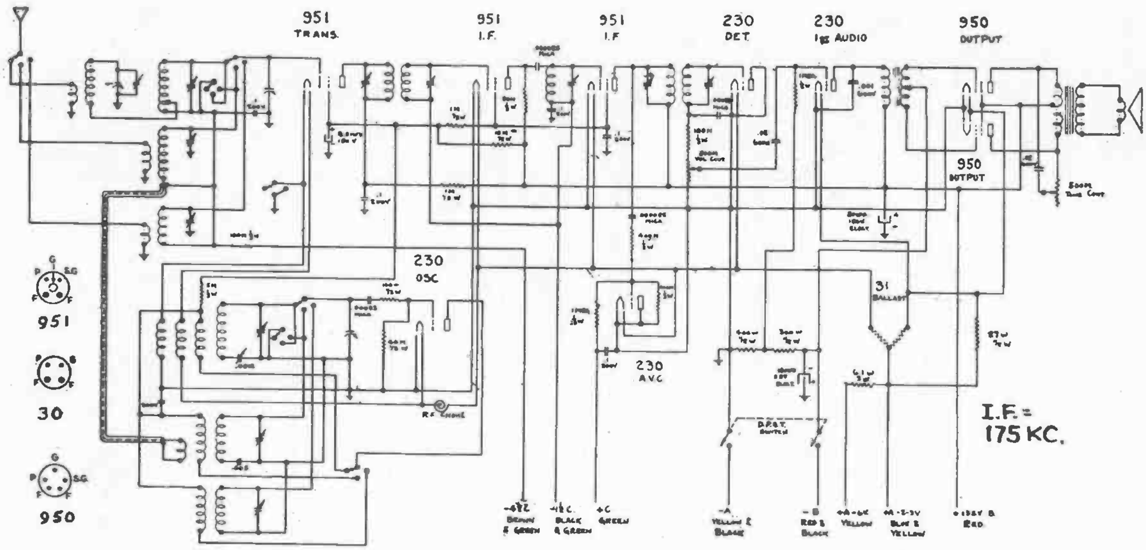


R 10555 ELECT. CONDENSER

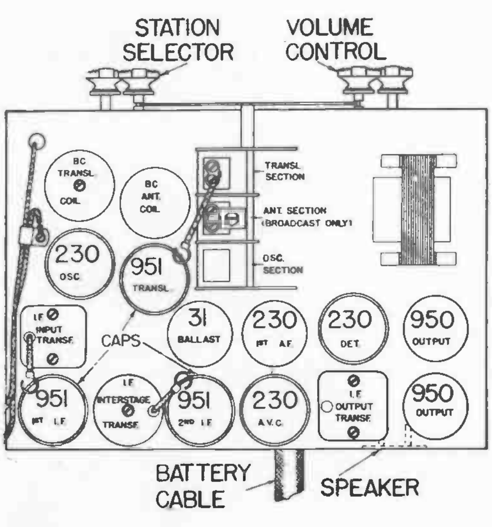
NUMBERING & LETTERING CORRESPONDS TO THAT OF SCHEMATIC DIAGRAM.

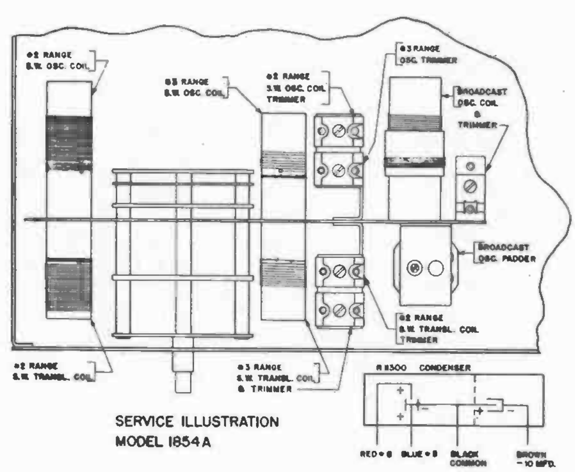
SEARS ROEBUCK & CO.

MODEL 1854 A



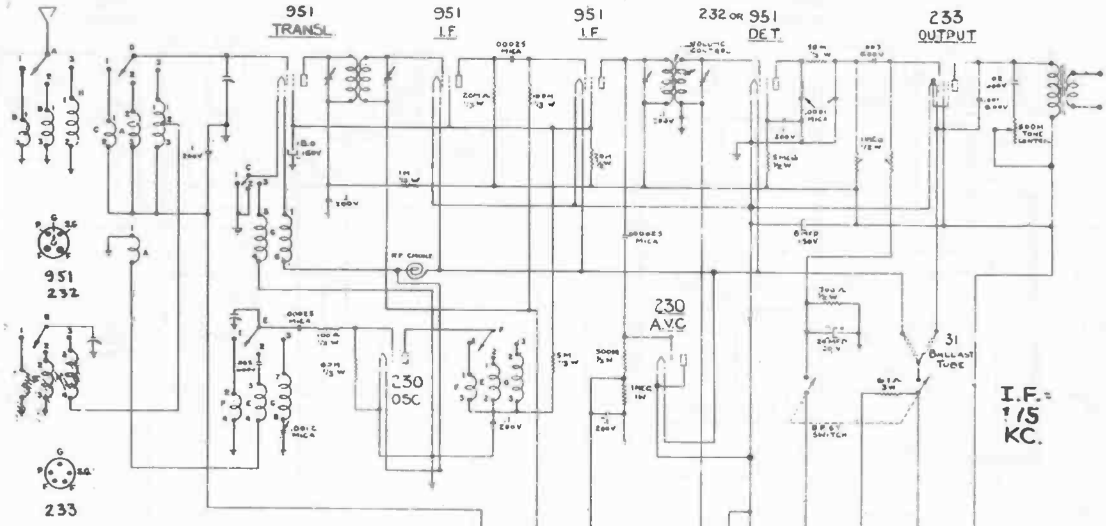
Tube	Plate Voltage	Screen Voltage
951 - Translator	118	65
230 - Oscillator	50	
951 - First IF	80	60
951 - Second IF	120	60
230 - AVC	Used as diode with no applied DC voltage.	
230 - Detector	Used as diode with no applied DC voltage.	
230 - Audio	120	
950 - Output	120	120



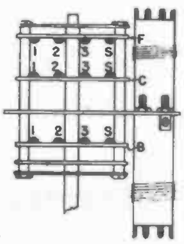


SEARS ROEBUCK & CO.

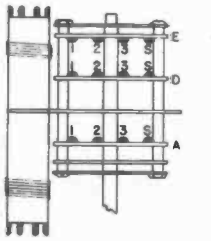
MODEL 1857



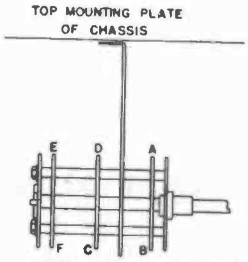
NUMBERING & LETTERING CORRESPONDS TO THAT OF SERVICE ILLUSTRATIONS SWITCH LEVERS ARE LUG "S" IN SERVICE ILLUSTRATIONS.



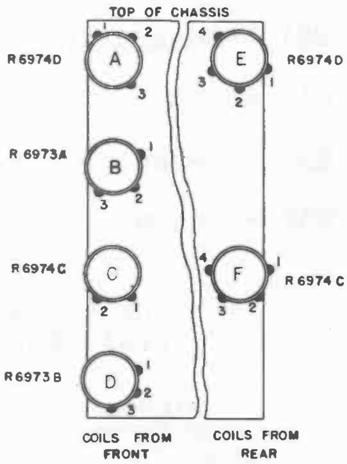
POSITIONS OF LUGS ON SWITCH PLATES AS VIEWED FROM UNDER CHASSIS.

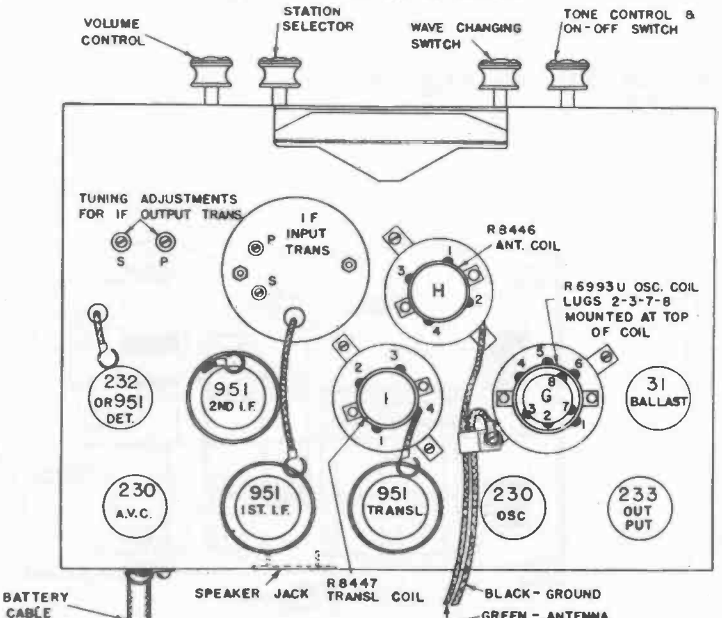


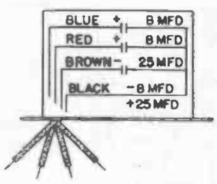
POSITIONS OF LUGS ON SWITCH PLATES AS THEY WOULD APPEAR IF VIEWED FROM TOP OF CHASSIS.



WAVE CHANGING SWITCH R 10538





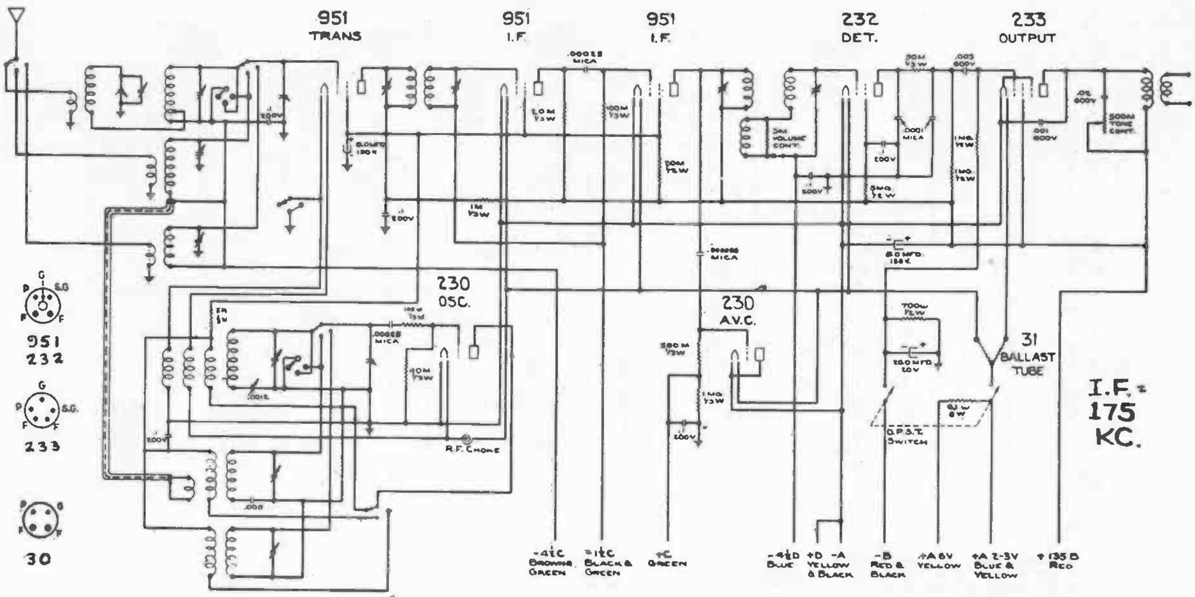


R 10546
ELECT. CONDENSER

NUMBERING & LETTERING CORESPONDS TO THAT OF SCHEMATIC DIAGRAM.

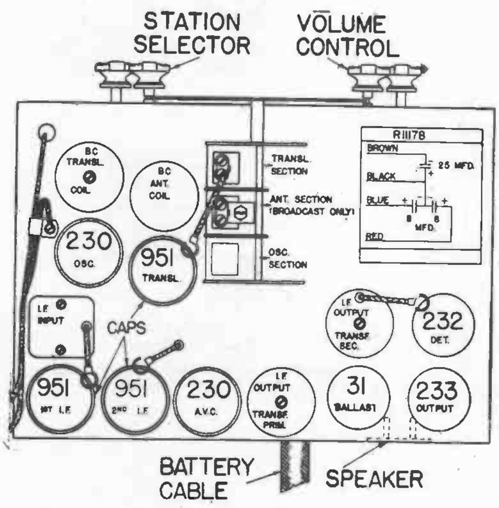
SEARS ROEBUCK & CO.

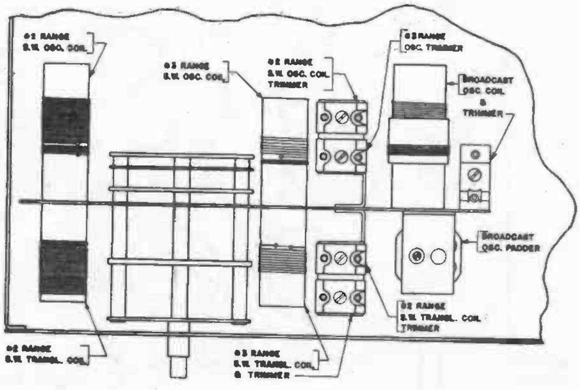
MODEL 1857A



Tube	Plate Voltage	Screen Voltage
951 - Translator	120	50
230 - Oscillator	35	
951 - First IF	90	50
951 - Second IF	120	50
230 - AVC	Used as diode with no applied DC voltages.	
232 - Detector	*	*
233 - Output	115	120

* - Indicates low reading due to high series resistance in circuit.

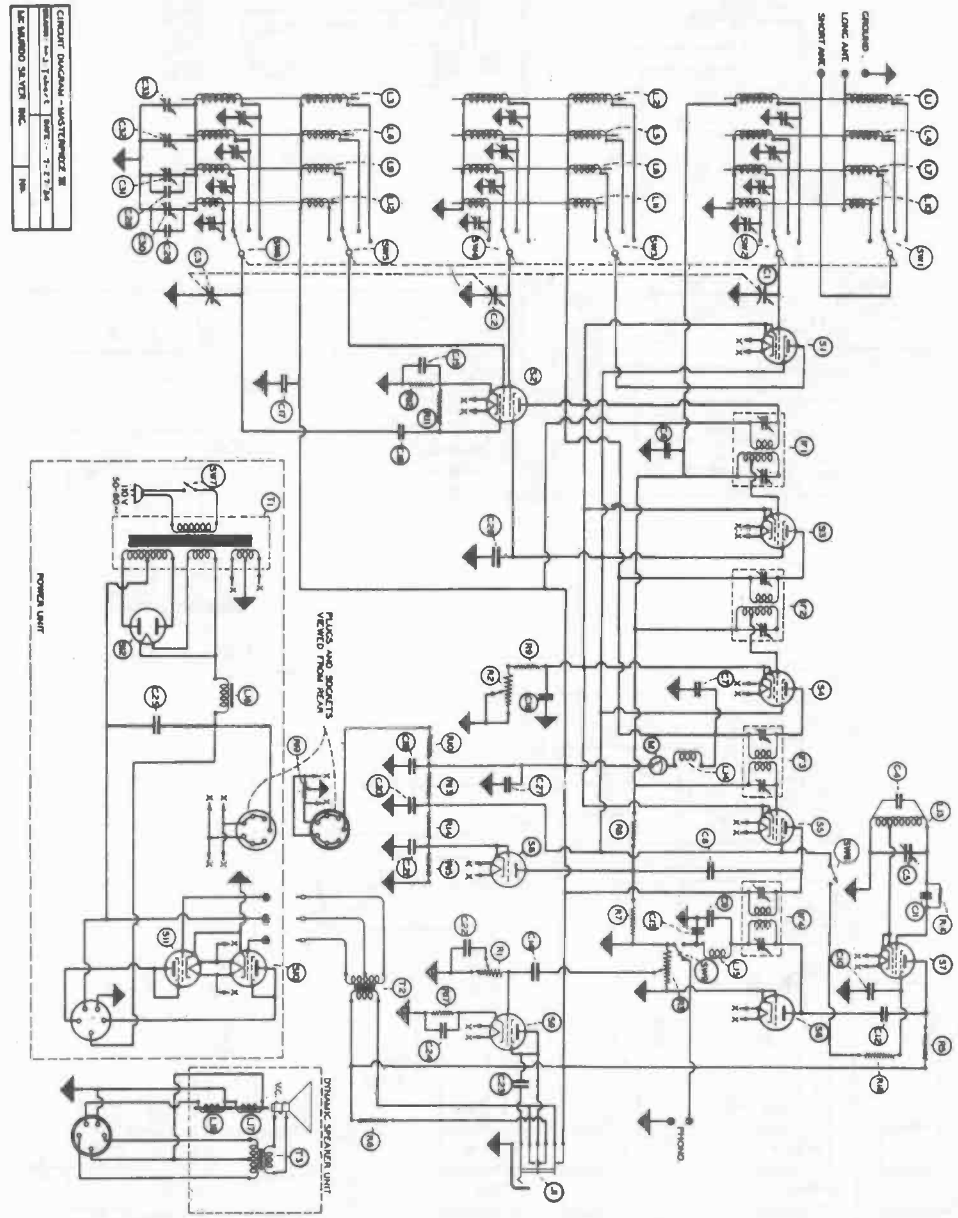




SERVICE ILLUSTRATION
MODEL 1857A

Mc MURDO SILVER INC.

MASTERPIECE III



ALIGNMENT INSTRUCTIONS

To align the MASTERPIECE III receiver a thoroughly good and accurate test oscillator is required capable of delivering frequencies of 465 kc., 600 kc. and 1400 kc. In addition an output meter is necessary.

The i.f. amplifier should be first aligned by connecting the output of the test oscillator, which should be set at 465 kc., to the grid cap of the 2A7 first detector tube (with normal set grid connection removed) and to the ground binding post of the tuner. With the bottom plate removed, the two trimmer screws found beneath each i.f. transformer can should be adjusted for maximum deflection of the output meter, taking care that the oscillator output is kept low enough so that the volume and sensitivity controls of the set can be well advanced during this adjustment. This adjustment should be gone over a second time very carefully to obtain maximum deflection of the tuning meter.

Do not attempt to align the single trimmer screw under the right (seen from bottom) i.f. can until after the i.f. amplifier is fully aligned. This is the beat oscillator adjustment. It may be set to give the desired beat note (with the beat oscillator switch on) afterwards, using any C.W. (unmodulated) test signal, either provided by the test oscillator, or by an actual signal.

The separate output meter in this alignment procedure should be connected across the secondary of the output transformer found in the speaker, the voice coil circuit of the speaker being broken during this test.

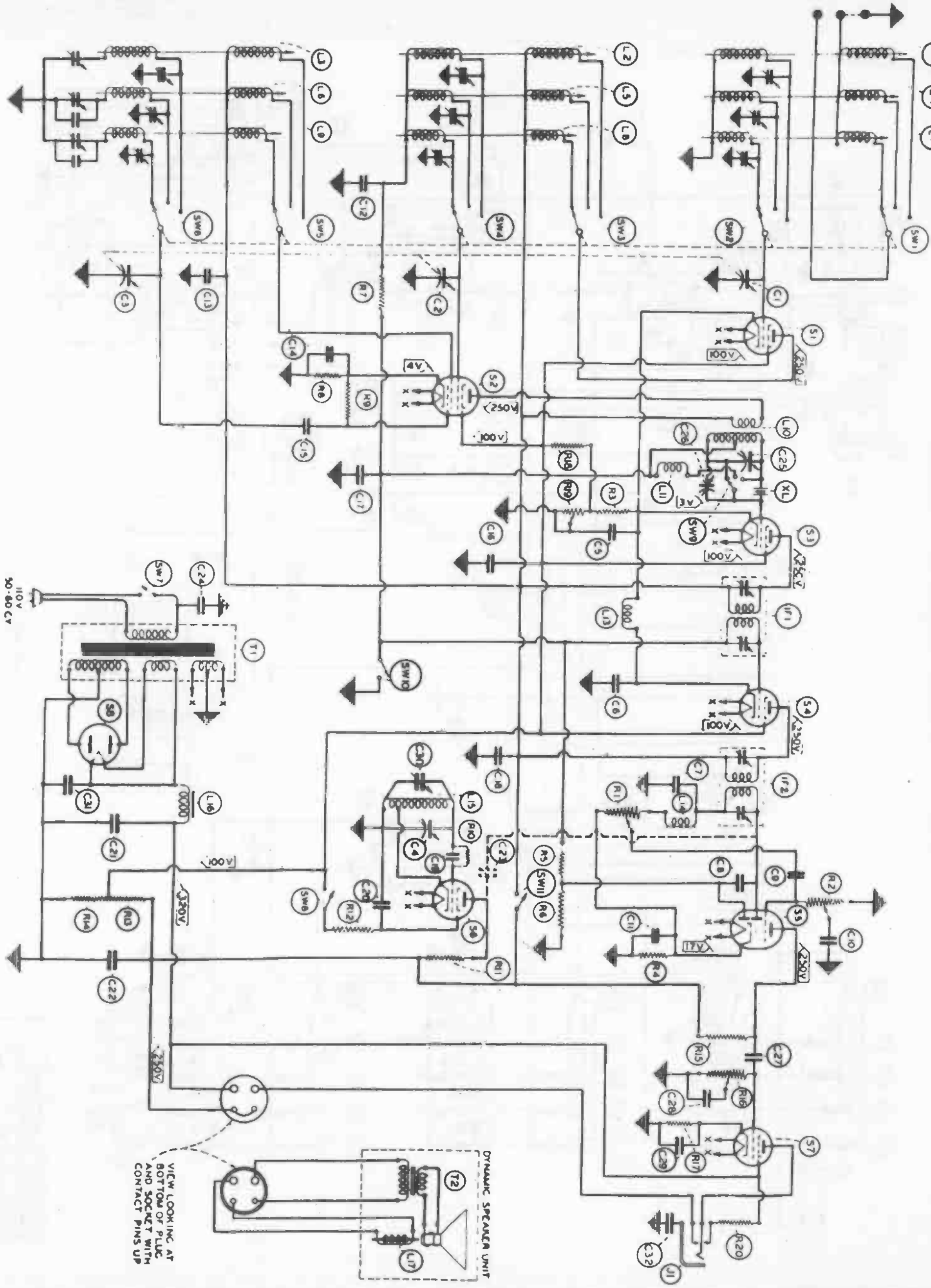
With the i.f. amplifier properly aligned for maximum output, the oscillator should be reconnected to the Antenna and Ground (Ground and Long Antenna posts connected together) binding posts of the set, and set at 1400 kc. The main dial should be set at exactly 1400 kc., and the three trimmers marked WHITE in the photo adjusted with screw driver for maximum deflection of the output meter. Without changing any connections the oscillator should be reset at 600 kc. and the dial likewise set to 600 kc.

Then disconnect the wire leading to the oscillator section (rear) of the gang condenser and connect an external condenser of approximately 400 mfd. in its place. Bring the external condenser and the gang in the set to resonance with each other or, in other words, adjust for maximum deflection of the output meter. After this adjustment has been made, carefully disconnect the external condenser and reconnect the oscillator section of the gang condenser into circuit; then without changing the dial setting adjust the WHITE oscillator pad behind the coils for maximum deflection of the output meter. This completes all adjustments required for the broadcast band.

On the short waves, the adjustments are essentially the same, being made with the three small trimmers at the high frequency end of the short wave bands. Use 4000 kc. for GREEN, 12,000 kc. for YELLOW and 17,000 to 18,000 kc. for ORANGE ranges. Short wave broadcast signals are the best sources. In setting the high frequency oscillator trimmers, it is important to use the low capacity setting, or the one with trimmer screw farthest out (loosest). If this is not done, "cross-over" of oscillator and first detector will occur, with resultant instability. The method required to adjust the low frequency end of the ranges is the same as that given for the 600 kc. band, using frequencies of 2000 kc. for the GREEN range, 6000 kc. for the second YELLOW range, and 12,000 kc. for the third ORANGE range. After all of these adjustments have been made carefully the set is completely aligned. Oscillator harmonics may be used for short wave alignment, or short wave signals close to the frequencies specified above. After replacing bottom pan, go over high frequency alignment again, trimmers being accessible through holes in the bottom pan for this purpose.

The above procedure will permit maximum results to be obtained from the receiver, and will permit of accurate adjustment of the short wave dial calibration. The above alignment procedure permits dial calibration to be effected exactly, if sufficient care is used.

Mc MURDO SILVER INC.
WORLD-WIDE 9



ALIGNMENT INSTRUCTIONS

To align the WORLD WIDE NINE receiver a thoroughly good and accurate test oscillator is required capable of delivering frequencies of 465 kc., 600 kc. and 1400 kc. In addition an output meter is necessary.

The i.f. amplifier should be first aligned by connecting the output of the test oscillator, which should be set at 465 kc., to the grid cap of the 2A7 first detector tube (with normal set grid connection removed) and to the ground binding post of the tuner. With the bottom plate removed, the two trimmer screws found beneath each i.f. transformer can should be adjusted for maximum deflection of the output meter, taking care that the oscillator output is kept low enough so that the volume and sensitivity controls of the set can be well advanced during this adjustment. This adjustment should be gone over a second time very carefully to obtain maximum deflection of the tuning meter.

Do not attempt to align the single trimmer screw under the right (seen from bottom) i.f. can until after the i.f. amplifier is fully aligned. This is the beat oscillator adjustment. It may be set to give the desired beat note (with the beat oscillator switch on) afterwards, using any C.W. (unmodulated) test signal, either provided by the test oscillator, or by an actual signal.

The separate output meter in this alignment procedure should be connected across the secondary of the output transformer found in the speaker, the voice coil circuit of the speaker being broken during this test.

With the i.f. amplifier properly aligned for maximum output, the oscillator should be reconnected to the Antenna and Ground (Ground and Long Antenna posts connected together) binding posts of the set, and set at 1400 kc. The main dial should be set at exactly 1400 kc., and the three trimmers marked WHITE in the photo adjusted with screw driver for maximum deflection of the output meter. Without changing any connections the oscillator should be reset at 600 kc. and the dial likewise set to 600 kc.

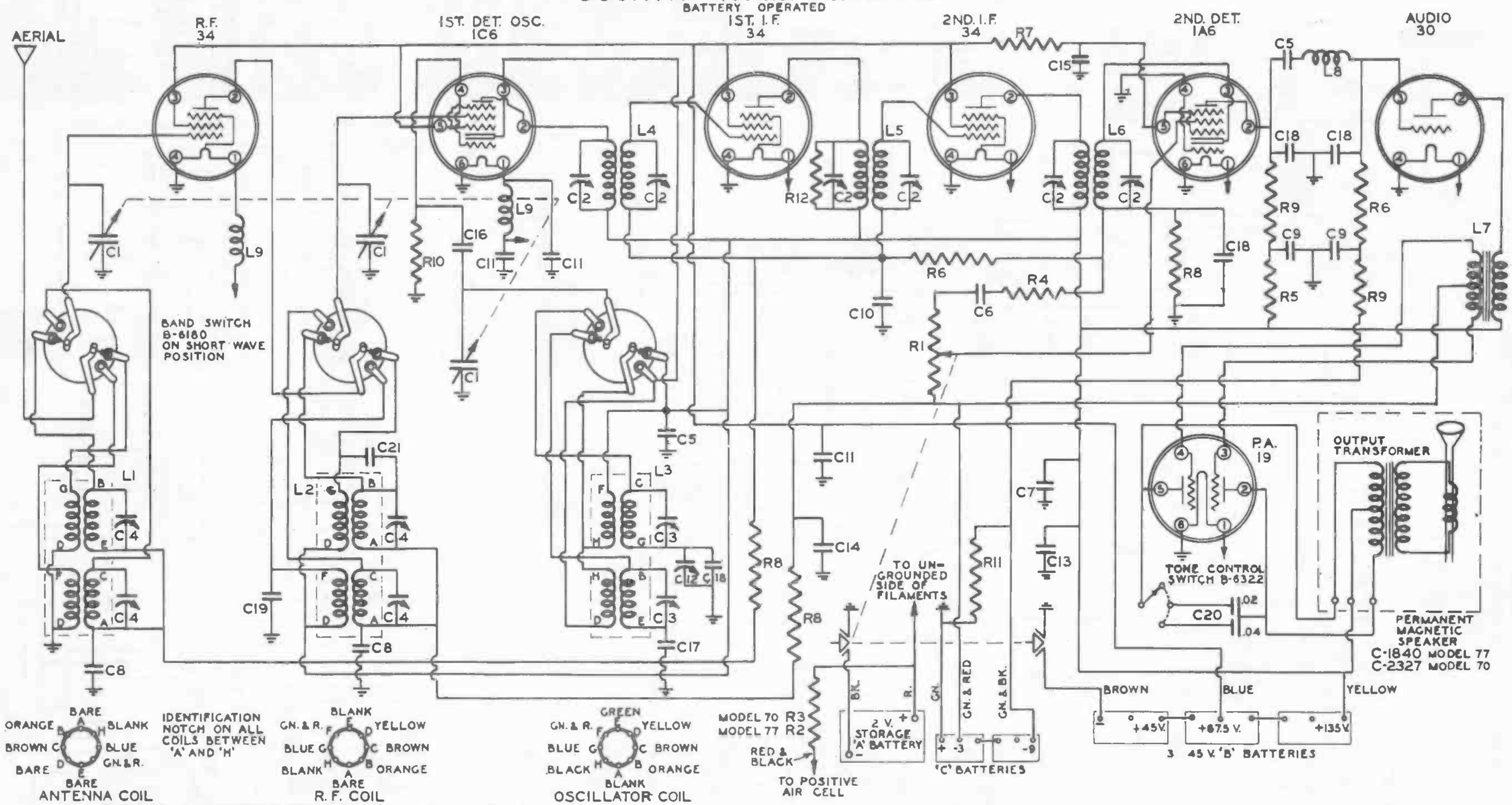
Then disconnect the wire leading to the oscillator section (rear) of the gang condenser and connect an external condenser of approximately 400 mfd. in its place. Bring the external condenser and the gang in the set to resonance with each other or, in other words, adjust for maximum deflection of the output meter. After this adjustment has been made, carefully disconnect the external condenser and reconnect the oscillator section of the gang condenser into circuit; then without changing the dial setting adjust the WHITE oscillator pad behind the coils for maximum deflection of the output meter. This completes all adjustments required for the broadcast band.

On the short waves, the adjustments are essentially the same, being made with the three small trimmers at the high frequency end of the short wave bands. Use 4000 kc. for GREEN, 12,000 kc. for YELLOW and 17,000 to 18,000 kc. for ORANGE ranges. Short wave broadcast signals are the best sources. In setting the high frequency oscillator trimmers, it is important to use the low capacity setting, or the one with trimmer screw farthest out (loosest). If this is not done, "cross-over" of oscillator and first detector will occur, with resultant instability. The method required to adjust the low frequency end of the ranges is the same as that given for the 600 kc. band, using frequencies of 2000 kc. for the GREEN range, 6000 kc. for the second YELLOW range, and 12,000 kc. for the third ORANGE range. After all of these adjustments have been made carefully the set is completely aligned. Oscillator harmonics may be used for short wave alignment, or short wave signals close to the frequencies specified above. After replacing bottom pan, go over high frequency alignment again, trimmers being accessible through holes in the bottom pan for this purpose.

The above procedure will permit maximum results to be obtained from the receiver, and will permit of accurate adjustment of the short wave dial calibration. The above alignment procedure permits dial calibration to be effected exactly, if sufficient care is used.

SPARKS WITHINGTON CO.
MODELS 70 & 77

SCHEMATIC DIAGRAM
SPARTON MODELS 70 AND 77 SUPERHETERODYNE COUNTRY HOME RECEIVER
BATTERY OPERATED



BOTTOM VIEW OF R.F. COILS SHOWING TERMINAL ARRANGEMENT

C1	VARIABLE CONDENSER			B-6212
C2	I.F. TRIMMERS ON COILS			
C3	R.F. TRIMMER & BRACKET			A-11289
C4	R.F. TRIMMERS			A-11454
C5	.01	MFD.	400 V.	A-9611
C6	.025	MFD.	400 V.	A-11409
C7	.5	MFD.	200 V.	A-11086-5
C8	.05	MFD.	200 V.	A-9919
C9	.1	MFD.	200 V.	A-10207
C10	.2	MFD.	200 V.	A-9922
C11	.2	MFD.	200 V.	A-7420

C12	100-300 MMF. PADDER	A-7809-5
C13	8 MFD. ELECTROLYTIC	A-11623
C14	10 MFD. ELECTROLYTIC	A-10377
C15	.1 MFD. 100 V.	A-11130-1
C16	.00005 MFD. MOLDED	A-5175-1
C17	.0032 MFD. MOLDED	A-7038-8
C18	.00025 MFD. MOLDED	A-9578-5
C19	.0001 MFD. MOLDED	A-9578-6
C20	.02-.04 MFD. 400 V.	A-9612
C21	8 TO 9 MMF.	A-11261

R1	250,000 Ω	V.C. AND 2 POLE SWITCH	A-11575
R2	.39 TO .4 Ω	WIREWOUND	A-10000-6
R3	.3 TO .31 Ω	WIREWOUND	A-10000-5
R4	50,000 Ω	.25 W.	B-5737-4
R5	10,000 Ω	.25 W.	B-5737-12
R6	500,000 Ω	.25 W.	B-5737-5
R7	25,000 Ω	.25 W.	B-5737-9
R8	250,000 Ω	.25 W.	B-5737-1
R9	100,000 Ω	.25 W.	B-5737-2
R10	50,000 Ω	.25 W.	B-5458-31
R11	20,000 Ω	.25 W.	B-5458-6
R12	100,000 Ω	.25 W.	B-5458-2

L1	NO.1 R.F. COIL	A-11231
L2	NO.2 R.F. COIL	A-11232
L3	NO.3 R.F. COIL	A-11233
L4	NO.1 I.F. TRANSFORMER	A-6313-6
L5	NO.2 I.F. TRANSFORMER	A-6313-7
L6	NO.3 I.F. TRANSFORMER	A-6313-8
L7	AUDIO TRANSFORMER	A-11574
L8	16 M.H. CHOKE	A-3506
L9	CHOKE COIL .5 Ω	A-10401

SPARKS WITHINGTON CO.

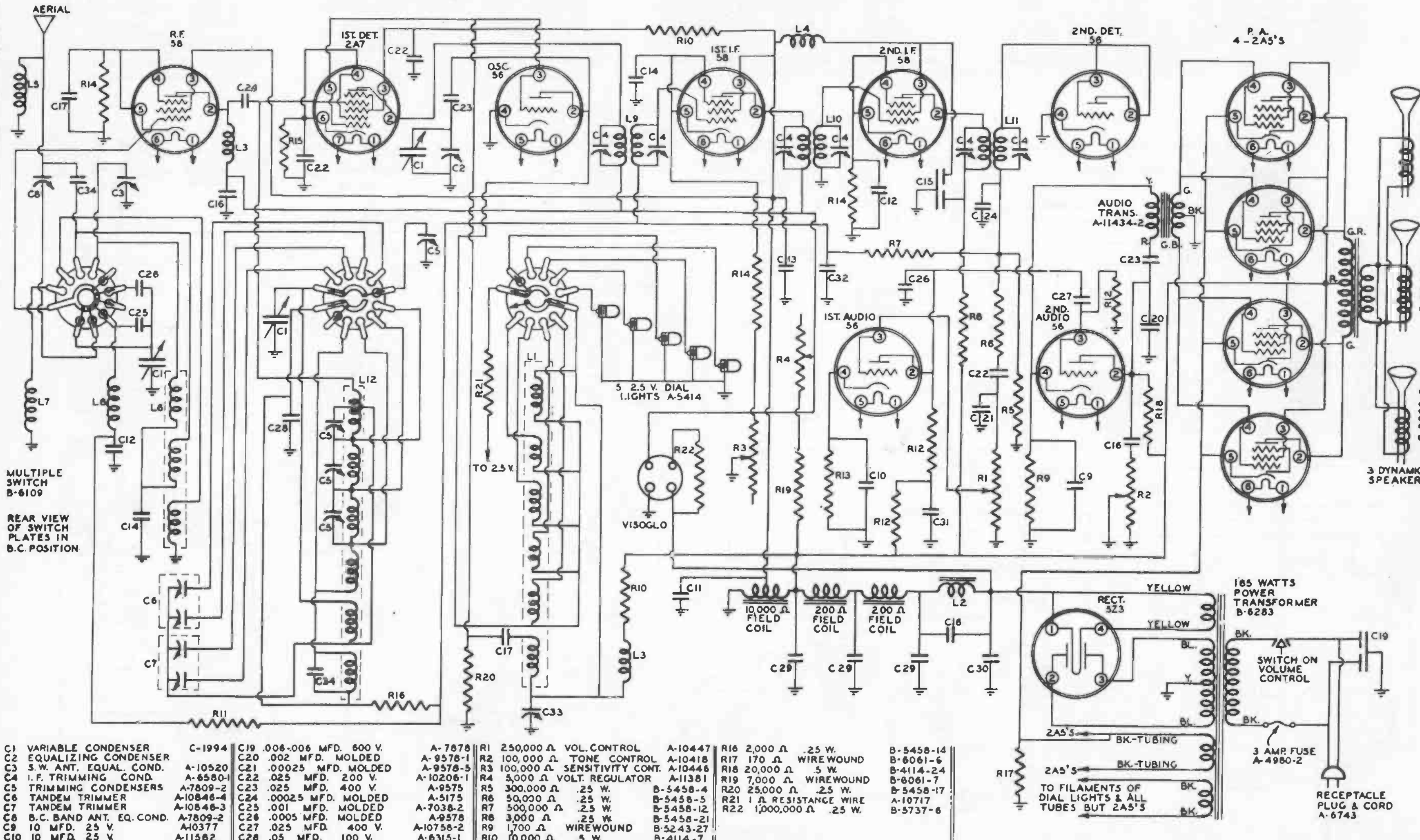
MODELS 134 & 136

SPARTON MODELS 134 AND 136 SUPERHETERODYNE

SCHEMATIC DIAGRAM

INTERMEDIATE FREQUENCY 456 KILOCYCLES

(TOP VIEWS OF SOCKET CONNECTIONS SHOWN)



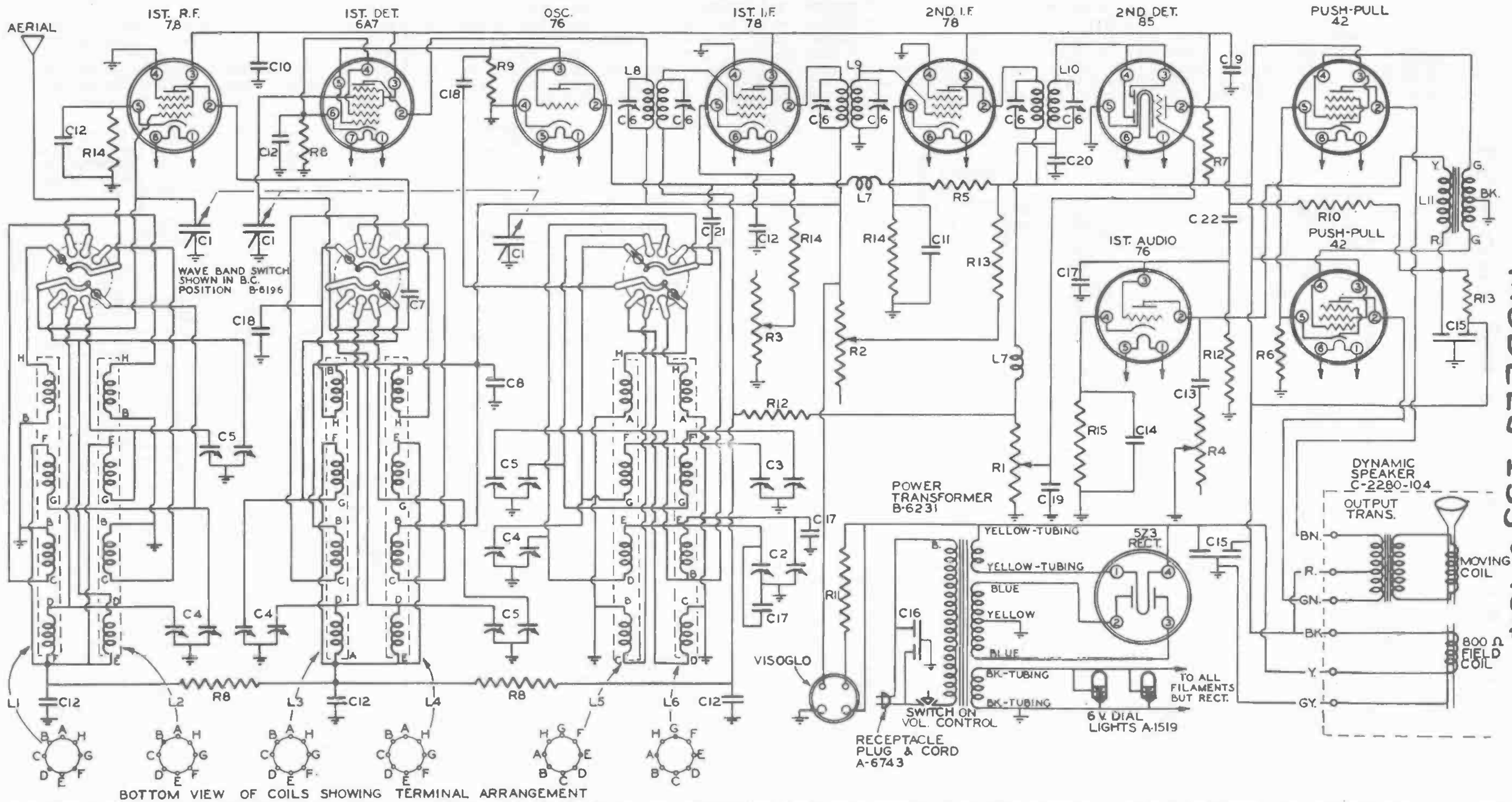
C1	VARIABLE CONDENSER	C-1994
C2	EQUALIZING CONDENSER	
C3	S.W. ANT. EQUAL. COND.	A-10520
C4	I.F. TRIMMING COND.	A-6580-1
C5	TRIMMING CONDENSERS	A-7809-2
C6	TANDEM TRIMMER	A-10846-4
C7	TANDEM TRIMMER	A-10846-3
C8	B.C. BAND ANT. EQ. COND.	A-7809-2
C9	10 MFD. 25 V.	A-10377
C10	10 MFD. 25 V.	A-11562
C11	10 MFD. 200 V.	A-6316-1
C12	.1 MFD. 200 V.	A-7224
C13	.2 MFD. 200 V.	A-7005
C14	.05 MFD. 200 V.	-10205
C15	.05-.05 MFD. 400 V.	A-9920
C16	.05 MFD. 400 V.	A-6927
C17	.006 MFD. 400 V.	A-9916
C18	.5 MFD. 400 V.	A-10758-3
C19	.006-.006 MFD. 600 V.	A-7878
C20	.002 MFD. MOLDED	A-9578-1
C21	.00025 MFD. MOLDED	A-9578-5
C22	.025 MFD. 200 V.	A-10206-1
C23	.025 MFD. 400 V.	A-9575
C24	.00025 MFD. MOLDED	A-5175
C25	.001 MFD. MOLDED	A-7038-2
C26	.0005 MFD. MOLDED	A-9578
C27	.025 MFD. 400 V.	A-10758-2
C28	.05 MFD. 100 V.	A-6315-1
C29	5 MFD. 400 V.	A-6611-A
C30	4 MFD. 500 V.	A-8123-1
C31	2 MFD. 250 V.	A-10609-1
C32	.1 MFD. 100 V.	A-11130-1
C33	PADDING CONDENSER	A-9941
C34	.000012 MFD.	A-10896

R1	250,000 Ω	VOL. CONTROL	A-10447
R2	100,000 Ω	TONE CONTROL	A-10418
R3	100,000 Ω	SENSITIVITY CONT.	A-10446
R4	5,000 Ω	VOLT. REGULATOR	A-11381
R5	300,000 Ω	.25 W.	B-5458-4
R6	50,000 Ω	.25 W.	B-5458-5
R7	500,000 Ω	.25 W.	B-5458-12
R8	3,000 Ω	.25 W.	B-5458-21
R9	1,700 Ω	WIREWOUND	B-5243-27
R10	10,000 Ω	.5 W.	B-4114-7
R11	10,000 Ω	.25 W.	B-5458-20
R12	100,000 Ω	.25 W.	B-5458-34
R13	5,000 Ω	.5 W.	B-4114-20
R14	400 Ω	WIREWOUND	B-5243-41
R15	500 Ω	WIREWOUND	B-5243-32
R16	2,000 Ω	.25 W.	B-5458-14
R17	170 Ω	WIREWOUND	B-6061-6
R18	20,000 Ω	.5 W.	B-4114-24
R19	7,000 Ω	WIREWOUND	B-6061-7
R20	25,000 Ω	.25 W.	B-5458-17
R21	1 Ω	RESISTANCE WIRE	A-10717
R22	1,000,000 Ω	.25 W.	B-5737-6

L1	OSCILLATOR COIL	A-10629
L2	CHOKE COIL	A-8572-2
L3	16 M.H. CHOKE COIL	A-3506
L4	CATHODE CHOKE COIL	A-7209
L5	ANT. CHOKE COIL	A-8145-1
L6	NO. 2,3,4 S.W. ANT. COIL	A-10893
L7	NO. 5 S.W. ANT. COIL	A-10853
L8	NO. 1 R.F. COIL	A-10605
L9	NO. 1 I.F. TRANSFORMER	A-10454
L10	NO. 2 I.F. TRANSFORMER	A-10455
L11	NO. 3 I.F. TRANSFORMER	A-10456
L12	R.F. TRANSFORMER	A-10885

SPARKS WITHINGTON CO.
MODELS 135 & 104

SPARTON MODEL 135 SUPERHETERODYNE
SPARTON MODEL 104 SUPERHETERODYNE
SCHEMATIC DIAGRAM
INTERMEDIATE FREQUENCY 456 KILOCYCLES
(TOP VIEWS OF SOCKET CONNECTIONS SHOWN)



C1 VARIABLE CONDENSER			B-6218
C2 OSC. PADDER 10 PLATE			A-10846-1
C3 OSC. PADDER 7 PLATE			A-10846-2
C4 R.H. TRIMMER			A-11454
C5 L.H. TRIMMER			A-11455
C6 I.F. TRIMMER IN COILS			
C7 8 TO 9 MFD.			A-11261
C8 .2 MFD.	400 V.		A-11473-3
C9 .2 MFD.	200 V.		A-11130-6
C10 .1 MFD.	200 V.		A-11089-2
C11 .1 MFD.	100 V.		A-11089-1
C12 .1 MFD.	100 V.		A-11130-1
C13 .025 MFD.	600 V.		A-11130-8
C14 10 MFD.	25 V.		A-10377
C15 8-8 MFD.			A-11223-1
C16 .006-.006 MFD.			A-7878
C17 .001 MFD. MOLDED			A-9578-10
C18 .0001 MFD. MOLDED			A-11095-3
C19 .00025 MFD. MOLDED			A-11095-4
C20 .0005 MFD. MOLDED			A-9578
C21 .00005 MFD. MOLDED			A-11095-2
C22 .01 MFD.	400 V.		A-11130-5

R1 250,000 Ω	VOL. CONTROL		A-11297
R2 5,000 Ω	VOLT. REGULA.		A-11381
R3 100,000 Ω	NOISE SUPP.		A-10446
R4 100,000 Ω	TONE CONT.		A-11334
R5 10,000 Ω	1 W.		B-4540-9
R6 250 Ω	WIREWOUND		B-6061-4
R7 15,000 Ω	10 W.		B-5029-2
R8 1,000 Ω	.25 W.		B-5458-11
R9 50,000 Ω	.25 W.		B-5458-5
R10 500,000 Ω	.25 W.		B-5737-5
R11 1,000,000 Ω	.25 W.		B-5737-6
R12 250,000 Ω	.25 W.		B-5737-1
R13 3,000 Ω	WIREWOUND		B-6061-3
R14 400 Ω	WIREWOUND		B-5243-41
R15 2,000 Ω	.25 W.		B-5458-32

L1 NO. 1 ANTENNA COIL	A-11211
L2 NO. 2 ANTENNA COIL	A-11212
L3 NO. 1 R.F. COIL	A-11213
L4 NO. 2 R.F. COIL	A-11214
L5 NO. 1 OSC. COIL	A-11215
L6 NO. 2 OSC. COIL	A-11216
L7 16 M.H. CHOKE	A-3506
L8 NO. 1 I.F. TRANSFORMER	A-6313-3
L9 NO. 2 I.F. TRANSFORMER	A-6313-4
L10 NO. 3 I.F. TRANSFORMER	A-6313-5
L11 AUDIO TRANSFORMER	A-11434-1

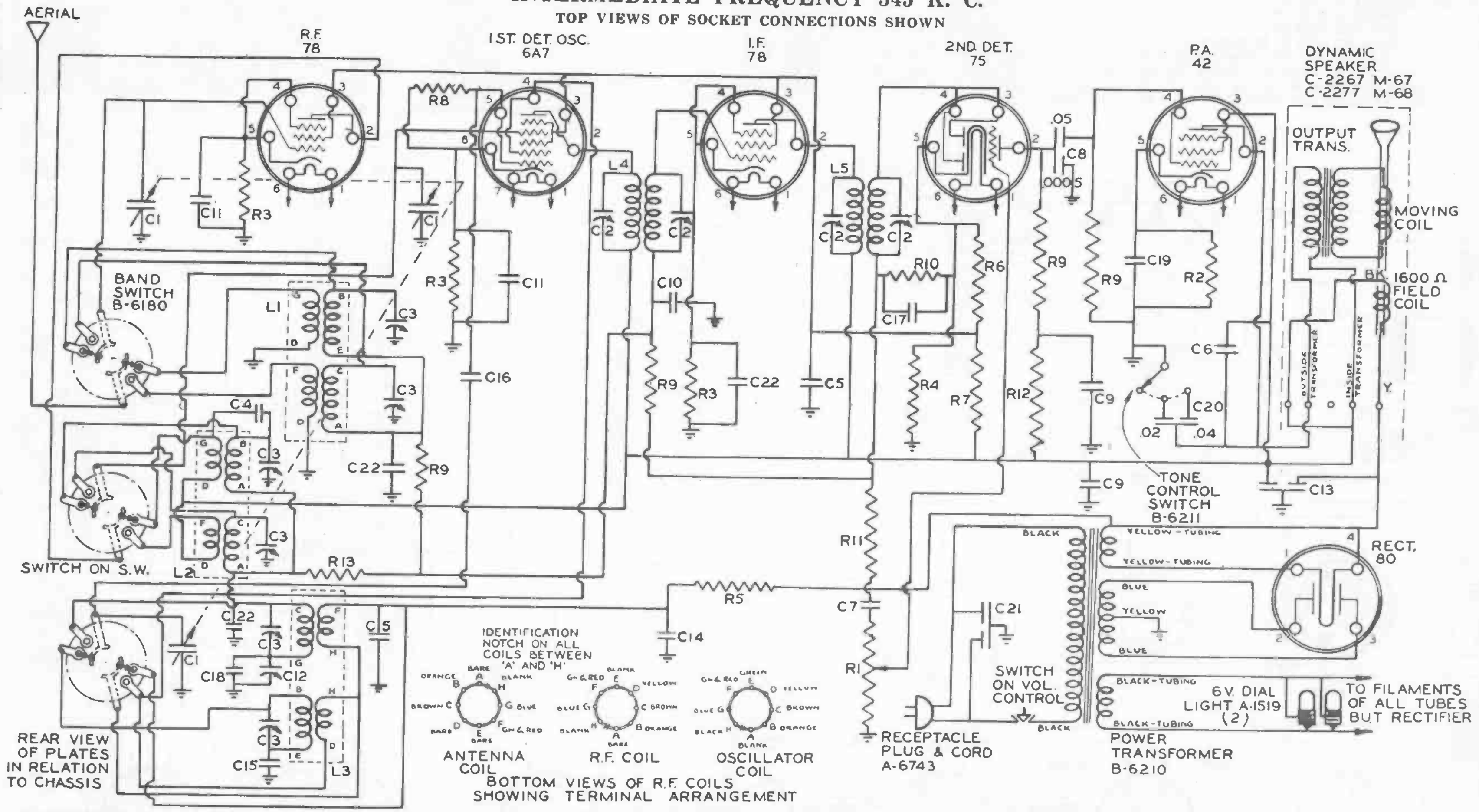
SCHEMATIC DIAGRAM CHANGE Effective Nov. 30, 1934: Condenser C17 (located immediately above the word "Visoglo") is changed to connect in series with terminal F of coil L5.

SPARKS WITHINGTON CO.

MODELS 685, 67, 68 AND 691

SPARTON MODEL 685 SUPERHETERODYNE SCHEMATIC DIAGRAM
SPARTON MODELS 67, 68 AND 691 SUPERHETERODYNE
INTERMEDIATE FREQUENCY 345 K. C.

TOP VIEWS OF SOCKET CONNECTIONS SHOWN



C1	VARIABLE CONDENSER		B-6212
C2	I.F. TRIMMERS	(WITH COILS)	
C3	R.F. TRIMMERS	(DOUBLE)	A-11455
C4	8-9 MMF.		A-11261
C5	.01 MFD.	400 V.	A-11130-5
C6	.006 MFD.	400 V.	A-9916
C7	.025 MFD.	400 V.	A-11409
C8	.05-.0005	400 V.	A-11408
C9	.2 MFD.	600 V.	A-11473-4
C10	.2 MFD.	200 V.	A-11473-2
C11	.1 MFD.	200 V.	A-11473-1

C12	100-300 MMF. PADDER	A-7809-5
C13	8-8 MFD. ELECTROLYTIC	A-11223-1
C14	4 MFD. ELECTROLYTIC	A-11224-1
C15	.0032 MFD. MOLDED	A-7038-8
C16	.00005 MFD. MOLDED	A-5175-1
C17	.0005 MFD. MOLDED	A-5175-2
C18	.00025 MFD. MOLDED	A-9578-5
C19	10 MFD. 25 V.	A-10377
C20	.04-.02 MFD. 400 V.	A-11407
C21	.006-.006 MFD.	A-7878
C22	.05 MFD. 200 V.	A-11410
C23	R.F. TRIMMERS	A-11289

R1	250,000 Ω	VOL. CONTROL & SWITCH	A-11245
R2	500 Ω	WIREWOUND	B-5243-38
R3	600 Ω	WIREWOUND	B-5243-19
R4	230 Ω	WIREWOUND	B-5243-21
R5	30,000 Ω	1 W.	B-4540-12
R6	20,000 Ω	1 W.	B-4540-5
R7	10,000 Ω	3 W.	B-4539-3
R8	50,000 Ω	.25 W. (CARBON)	B-5458-31
R9	250,000 Ω	.25 W.	B-5737-1
R10	500,000 Ω	.25 W.	B-5737-5
R11	50,000 Ω	.25 W.	B-5737-4
R12	100,000 Ω	.25 W.	B-5737-2
R13	4,000 Ω	.25 W.	B-5737-7

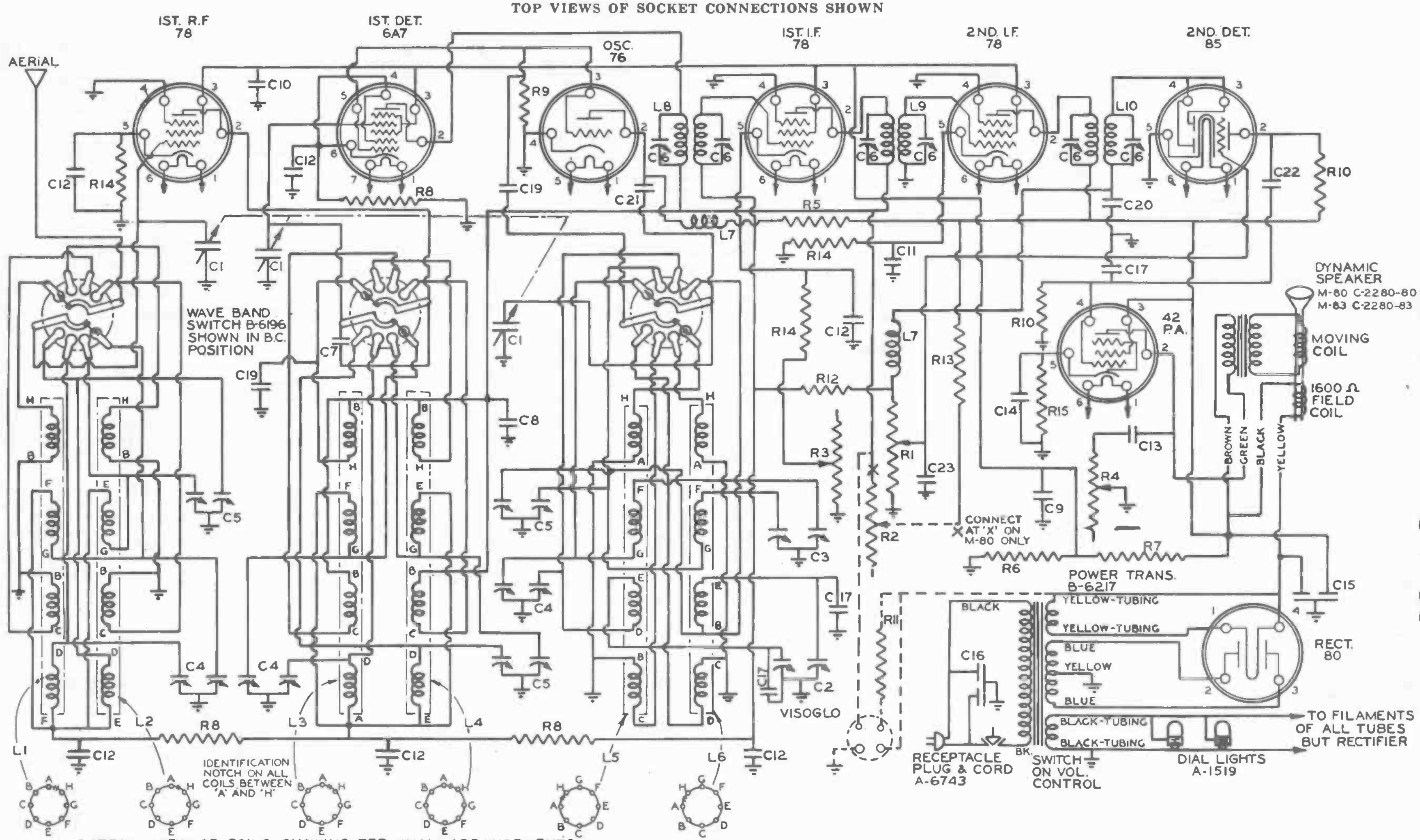
L1	NO. 1 R.F. COIL	A-11231
L2	NO. 2 R.F. COIL	A-11232
L3	OSCILLATOR COIL	A-11233
L4	NO. 1 I.F. TRANSFORMER	A-6314-1
L5	NO. 2 I.F. TRANSFORMER	A-6314-2

SPARKS WITHINGTON CO.

MODELS 835, 80, 83, 84, 85X & 86X

SPARTON MODEL 835 SUPERHETERODYNE
SCHEMATIC DIAGRAM
SPARTON MODELS 80, 83, 84, 85-X AND 86-X SUPERHETERODYNE
INTERMEDIATE FREQUENCY 456 K. C.

TOP VIEWS OF SOCKET CONNECTIONS SHOWN



BOTTOM VIEW OF COILS SHOWING TERMINAL ARRANGEMENTS

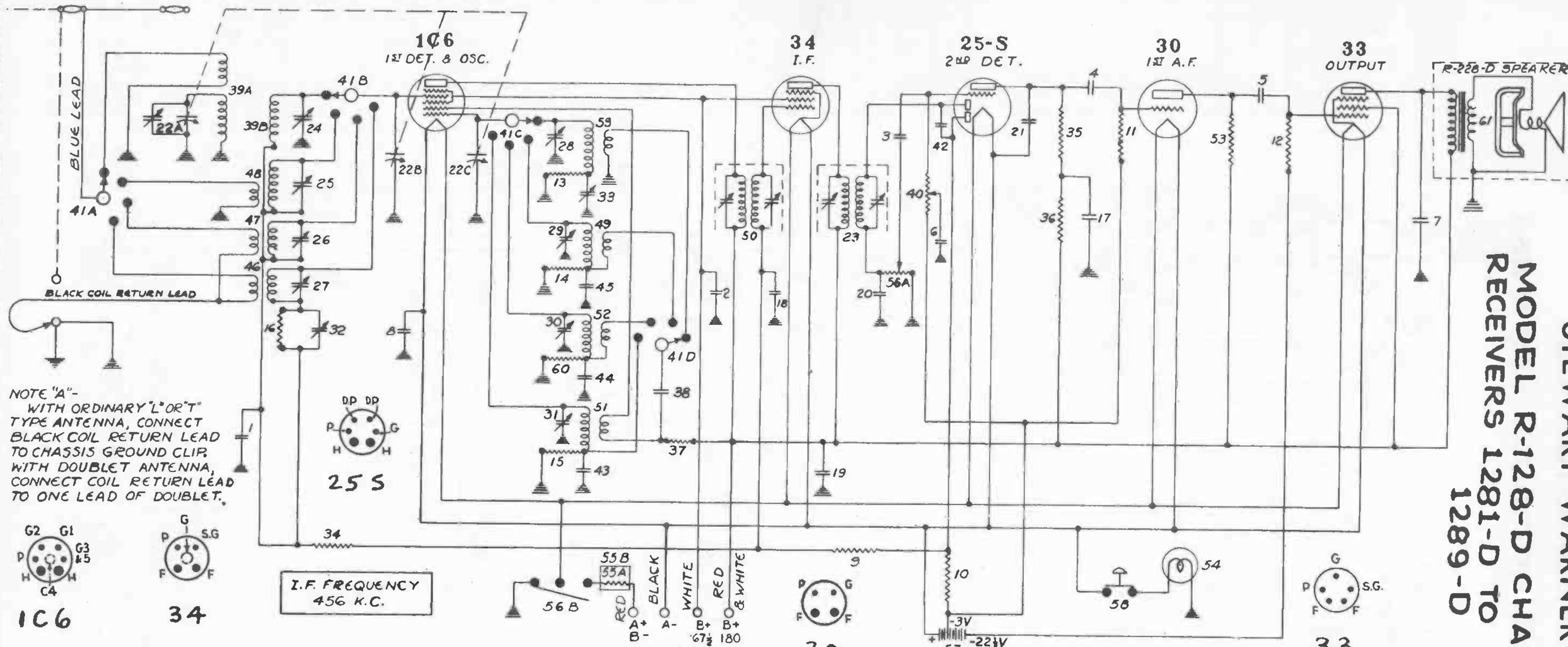
C1 VARIABLE CONDENSER		B-6218
C2 OSC. PADDER	10 PLATE	A-10846-1
C3 OSC. PADDER	7 PLATE	A-10846-2
C4 R.H. TRIMMER		A-11454
C5 L.H. TRIMMER		A-11455
C6 I.F. TRIMMER	IN COILS	
C7 8 TO 9 MFD.		A-11261
C8 .2 MFD.	400 V	A-11473-3
C9 .2 MFD.	200 V.	A-11130-6
C10 .1 MFD.	200 V	A-11089-2
C11 .1 MFD.	100 V.	A-11089-1
C12 .. MFD.	100 V	A 11130-1
C13 .025 MFD.	600 V	A-11130-8
C14 10 MFD.	25 V.	A-10377
C15 8-8 MFD.		A-11223-1
C16 .006-.006 MFD.		A-7878
C17 .001 MFD. MOLDED		A-9578-10
C19 .0001 MFD. MOLDED		A-11095-3
C20 .0005 MFD. MOLDED		A-9578
C21 .00005 MFD. MOLDED		A-11095-2
C22 .01 MFD.	400 V.	A-11130-5
C23 .00025 MFD. MOLDED		A-11095-4

R1 250,000 Ω	VOL. CONTROL		A-11297
R2 5,000 Ω	VOLT. REGULA.		A-11381
R3 100,000 Ω	I. N. SUPPRESS.		A-10446
R4 100,000 Ω	TONE CONTROL		A-11334
R5 20,000 Ω		1 W	B-4540-14
R6 25,000 Ω		10 W.	B-5029-1
R7 15,000 Ω		10 W.	B-5029-2
R8 1,000 Ω		.25 W.	B-5458-11
R9 50,000 Ω		.25 W.	B-6458-5
R10 500 000 Ω		25 W.	B-5737-5
R11 1,000,000 Ω		.25 W.	B-5737-6
R12 250,000 Ω		.25 W.	B-5737-1
R13 5,000 Ω	WIREWOUND		B-6061-5
R14 400 Ω	WIREWOUND		B-5243-41
R15 500 Ω	WIREWOUND		B-5243-42

L1 NO. 1 ANTENNA COIL	A-11211
L2 NO. 2 ANTENNA COIL	A-11212
L3 NO. 1 R.F. COIL	A-11213
L4 NO. 2 R.F. COIL	A-11214
L5 NO. 1 OSCILLATOR COIL	A-11215
L6 NO. 2 OSCILLATOR COIL	A-11216
L7 16 M.H. CHOKE	A-3506
L8 NO. 1 I.F. TRANSFORMER	A-6313-3
L9 NO. 2 I.F. TRANSFORMER	A-6313-4
L10 NO. 3 I.F. TRANSFORMER	A-6313-5

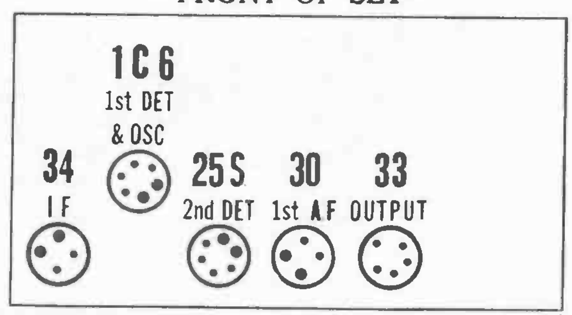
STEWART WARNER CORP.

MODEL R-128-D CHASSIS RECEIVERS 1281-D TO 1289-D



TUBE LOCATIONS

FRONT OF SET



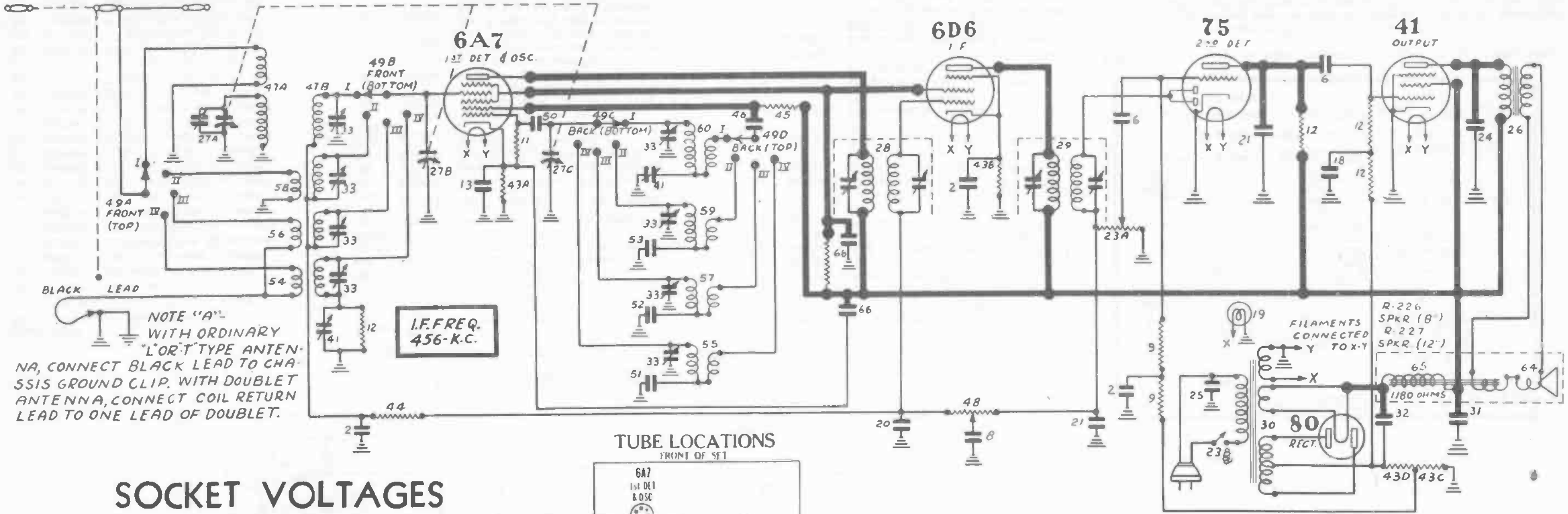
Form 6339 Printed in U.S.A.

DIAG. NO.	PART NO.	DESCRIPTION	LIST PRICE
33	84196	Padding Trimmer (300-600 mmfd.)	$ .50
34	84198	110,000 ohm, 1/4 watt carbon resistor.	.20
35	84198	110,000 ohm, 1/4 watt carbon resistor.	.20
36	84198	110,000 ohm, 1/4 watt carbon resistor.	.20
37	84199	16,000 ohm, 1/4 watt carbon resistor	.20
38	84200	.004 mfd. molded mica condenser. 600 volt	.50
39A, 39B	84229	Broadcast Pre-Selector Coil Assembly	1.00
40	84368	300,000 ohm, variable Tone Control resistor	.80
41A, 41B, 41C, 41D	84369	Range Switch	1.50
42	84370	.00011 mfd. molded mica condenser. 500 volt	.15
43	84371	.0004 mfd. molded mica condenser. 600 volt	.20
44	84372	.006 mfd. molded mica condenser. 500 volt	.60
45	84373	.0015 mfd. molded mica condenser. 500 volt	.25
46	84377	#4 band antenna coil	.90
47	84381	#3 band antenna coil (substitute #84734)	
48	84385	#2 band antenna coil	.55
49	84387	#2 band oscillator coil	.55
50	84511	1st. I. F. Transformer	1.75
51	84512	#4 band oscillator coil	1.00
52	84513	#3 band oscillator coil	.85
53	84514	51,000 ohm 1/2 watt carbon resistor	.20
54	84515	Dial light bulb (2.0 volts, .06 amp)	.25
55A	84527	Manganin Resistance Wire 5-1/2"	.02
56A, 56B	84528	(500,000 ohm volume control) (on-off switch) In one unit	1.25
57	84529	22-1/2 volt tapped C battery	
58	84532	Dial light push button switch	1.00
59	84542	Broadcast oscillator coil	.75
60	84553	26,000 ohm, 1/4 watt carbon resistor	.20
47	84734	#3 band antenna coil	.75
61	R-228-D	P.M. Speaker and Output Transformer	12.00

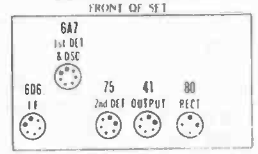
DIAG. NO.	PART NO.	DESCRIPTION	LIST PRICE
55B	67035	Tubing for 84527. 4-3/8"	$ .06
1	81630	.1 mfd. 100 volt tubular paper condenser.	.30
2	81630	.1 mfd. 100 volt tubular paper condenser.	.30
3	83007	.02 mfd. 600 volt tubular paper condenser.	.35
4	83007	.02 mfd. 600 volt tubular paper condenser.	.35
5	83007	.02 mfd. 600 volt tubular paper condenser.	.35
	83011	.004 mfd. 600 volt tubular paper condenser.	.30
	83011	.004 mfd. 600 volt tubular paper condenser.	.30
8	83063	.5 mfd. 100 volt tubular paper condenser.	.45
9	83072	510,000 ohm, 1/4 watt carbon resistor.	.20
10	83072	510,000 ohm, 1/4 watt carbon resistor.	.20
11	83072	510,000 ohm, 1/4 watt carbon resistor.	.20
12	83072	510,000 ohm, 1/4 watt carbon resistor.	.20
13	83080	51,000 ohm, 1/4 watt carbon resistor.	.20
14	83080	51,000 ohm, 1/4 watt carbon resistor.	.20
15	83080	51,000 ohm, 1/4 watt carbon resistor.	.20
16	83082	260,000 ohm, 1/4 watt carbon resistor.	.20
17	83214	.25 mfd. 250 volt tubular paper condenser.	.30
18	83353	.05 mfd. 100 volt tubular paper condenser.	.30
19	83429	.5 mfd. 300 volt tubular paper condenser.	.55
20	83539	.00025 mfd. molded mica condenser. 500 volt.	.25
21	83539	.00025 mfd. molded mica condenser. 500 volt.	.25
22A, 22B, 22C	84174	3 gang variable condenser	4.00
23	84188	2nd I. F. Transformer	1.75
24	84194	R. F. Trimmer condenser (3 to 23mmfd.)	.15
25	84194	R. F. Trimmer condenser (3 to 23mmfd.)	.15
26	84194	R. F. Trimmer condenser (3 to 23mmfd.)	.15
27	84194	R. F. Trimmer condenser (3 to 23mmfd.)	.15
28	84194	R. F. Trimmer condenser (3 to 23mmfd.)	.15
29	84194	R. F. Trimmer condenser (3 to 23mmfd.)	.15
30	84194	R. F. Trimmer condenser (3 to 23mmfd.)	.15
31	84194	R. F. Trimmer condenser (3 to 23mmfd.)	.15
32	84195	Padding Trimmer (300-600 mmfd.)	.60

STEWART WARNER CORP.

MODEL R127 CHASSIS (1271 TO 1279)



TUBE LOCATIONS
FRONT OF SET

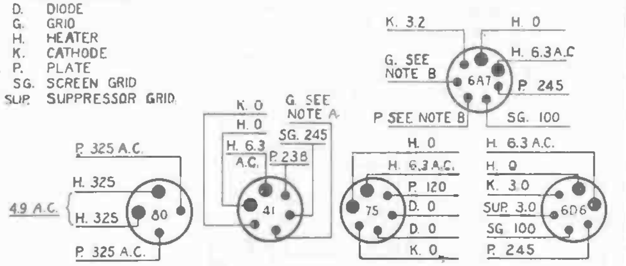


SOCKET VOLTAGES

LINE VOLTAGE 115 VOLTS Volume Control on Full ANTENNA GROUNDED
RANGE SWITCH SET ON BROADCAST POSITION DIAL SET AT 530 K. C.

VOLTAGES MEASURED BETWEEN CHASSIS AND SOCKET TERMINALS AS SEEN FROM THE BOTTOM

ABBREVIATIONS
- D. DIODE
- G. GRID
- H. HEATER
- K. CATHODE
- P. PLATE
- SG. SCREEN GRID
- SUP. SUPPRESSOR GRID



IMPORTANT: Use a high resistance voltmeter of 1000 ohms per volt. Readings will vary depending upon voltage range of meter, being higher for higher range instruments. This variation is most marked for second detector plate voltage.

Speaker field voltage with coil warm is 73 volts D. C.

NOTE A: The actual bias on the 41 output tube is —16.5 volts measured across the metal clad bias resistor 43C and 43D. The grid bias on the 75 2nd detector tube is —1.5 volts measured across the metal clad bias resistor 43C.

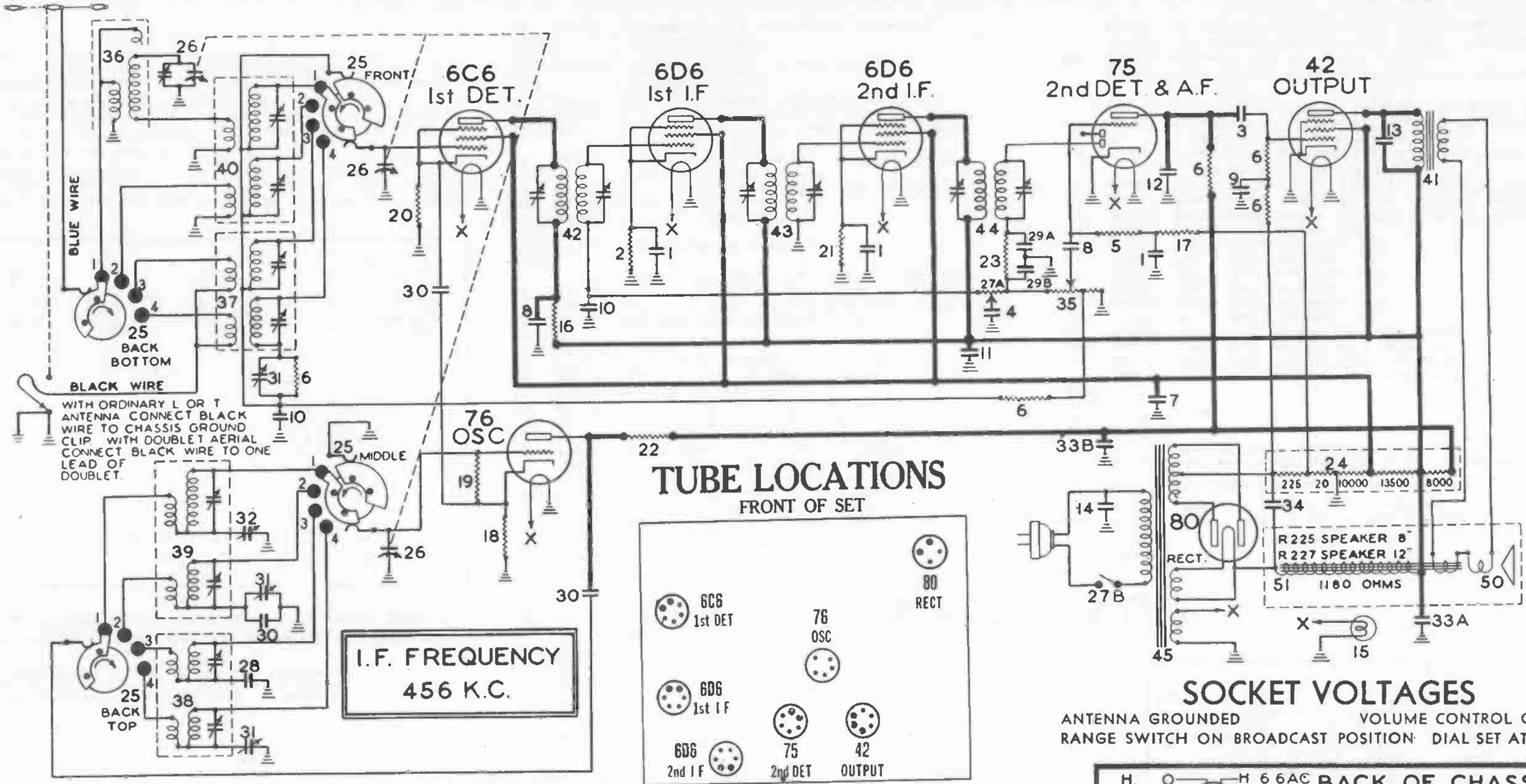
NOTE B: The oscillator plate voltage with the range switch on broadcast position and with the dial set at 530 K.C. should be approximately 188 volts. The oscillator grid voltage under similar conditions should be approximately —14 volts.

R-127 PARTS LIST

Diag. No.	Part No.	DESCRIPTION
1	62183	30,000 ohm, 1 watt carbon resistor.
2	81630	.1 mfd. 100 volt paper condenser.
6	83007	.02 mfd. 600 volt paper condenser.
8	83011	.004 mfd. 600 volt paper condenser.
9	83072	510,000 ohm, ¾ watt carbon resistor
11	83080	51,000 ohm, ¼ watt carbon resistor.
12	83082	260,000 ohm, ¼ watt carbon resistor
13	83214	.25 mfd. 250 volt paper condenser
18	83219	.01 mfd. 600 volt paper condenser
19	83278	6.3 volt dial light bulb.
20	83353	.05 mfd. 100 volt paper condenser.
21	83539	.00026 mfd. molded mica condenser.
23-A, 23-B	83551	500,000 ohm volume control and line switch.
24	83706	.006 mfd. 600 volt paper condenser.
25	83976	.012 mfd. 1000 volt shielded paper condenser
26	84153	Output transformer (for R-226 8" speaker). See 84312 for 12 inch speaker transformer.
27-A, 27-B, 27-C	84174	3-gang variable condenser.
28	84187	1st I. F. Transformer.
29	84188	2nd I. F. Transformer
30	84189	Power Transformer (110 volts, 60 cycle) (R-127-A only)
31	84192	16 mfd. 350 volt wet electrolytic condenser (sub. No. 84193)
32	84193	16 mfd. 350 volt wet electrolytic condenser
33	84194	R. F. trimmer condenser (3 to 23 mmfd.)
41	84195	Trimmer Condenser (300-600 mmfd.)
43-A	84196	300 ohm resistor (in one unit)
43-B	84196	300 ohm resistor (in one unit)
43-C	84196	25 ohm resistor (in one unit)
43-D	84196	275 ohm resistor (in one unit)
44	84198	110,000 ohm ¼ watt carbon resistor.
45	84199	16,000 ohm ¼ watt carbon resistor.
46	84200	.004 mfd. molded mica condenser.
47-A, 47-B	84229	Broadcast Pre-Selector Coil Assembly.
	84312	Output transformer (for R-227 12" speaker
48	84368	300,000 ohm variable tone control.
49-A, 49-B, 49-C, 49-D	84369	Range Switch
50	84370	.0001 mfd. molded mica condenser
51	84371	.0004 mfd. molded mica condenser
52	84372	.006 mfd. molded mica condenser
53	84373	.0015 mfd. molded mica condenser
54	84377	No. 4 band antenna coil.
55	84380	No. 4 band oscillator coil.
56	84381	No. 3 band antenna coil.
57	84383	No. 3 band oscillator coil
58	84385	No. 2 band antenna coil.
59	84387	No. 2 band oscillator coil
60	84389	Broadcast oscillator coil.
61	84404	Phonograph Switch (D.P.D.T.) (R-127-X only)
62	84407	Phonograph Terminal Strip (R-127-X only).
63	84408	Power Transformer (100 to 240 volts, 25 to 133 cycles) (R-127-X only).
64	84504	Diaphragm and Shell Assembly (For R-226 8" speaker) (Also see No. 84506).
65	84505	Field Coil and Housing (For R-226 8" speaker)
	84506	Diaphragm and Shell Assembly (For R-227 12" speaker)
	84507	Field Coil and Housing (For R-227 12" speaker)
66	84601	.25 mfd. 300 volt paper condenser.
	R-226	8" Dynamic Speaker with output transformer
	R-227	12" Dynamic Speaker with output transformer

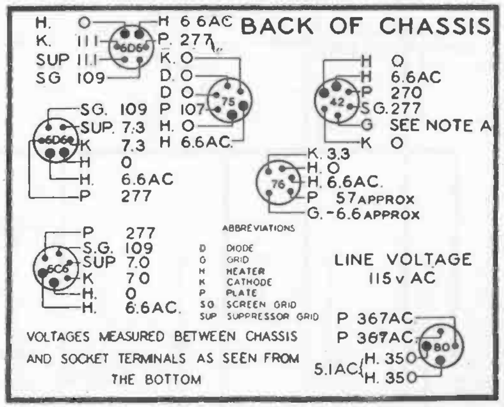
STEWART WARNER CORP.

R-126 CHASSIS MODELS 1261 TO 1269



SOCKET VOLTAGES

ANTENNA GROUNDED VOLUME CONTROL ON FULL
RANGE SWITCH ON BROADCAST POSITION DIAL SET AT 530 K.C.



R-126 PARTS LIST

SEE FOURTH PAGE FOR MISCELLANEOUS PARTS

Diag. No.	Part No.	Description
1	81630	.1 mfd. 100 v. cond.
2	81829	1500 ohm. ¼ w. res.
3	83007	.02 mfd. 600 v. cond.
4	83011	.004 mfd. 600 v. cond.
5	83072	510,000 ohm ¼ w. res.
6	83082	260,000 ohm ¼ w. res.
7	83214	.25 mfd. 250 v. cond.
8	83219	.01 mfd. 600 v. cond.
9	83352	.015 mfd. 600 v. cond.
10	83353	.05 mfd. 100 v. cond.
11	83440	.1 mfd. 400 v. cond.
12	83539	.00026 mfd. mica cond.
13	83706	.006 mfd. 600 v. cond.
14	83976	.012 mfd. 1000 v. cond
15	84058	Dial bulb (6-8 volt).
16	84199	16,000 ohm, ¼ w. res.
17	84235	1.1 meg., ¼ w. res.
18	84237	510 ohm, ¼ w. res.
19	84238	11,000 ohm, ¼ w. res.
20	84239	6,100 ohm, ¼ w. res.
21	84240	4,000 ohm, ¼ w. res.
22	84241	31,000 ohm, ½ w. res.

Diag. No.	Part No.	Description
23	84242	31,000 ohm, ¼ w. res.
24	84273	Voltage divider
25	84274	Range switch
26	84275	3 gang variable condenser
27A, 27B	84279	300,000 ohm tone control and line switch.
28	84280	.006 mfd. mica condenser.
29A, 29B	84281	Dual .00026 mfd. mica cond.
30	84282	.001 mfd. mica condenser.
31	84283	Short wave padding trimmer
32	84284	Broadcast padding trimmer
33A, 33B	84286	8 mfd. 450 v.cond. / 2 mfd. 400 v.cond.
34	84288	14 mfd. 475 v. cond.
35	84289	500,000 ohm vol. cont. (tap at 125,000 ohms from ground)
36	84290	Broadcast antenna coil.
	84295	Coil trimmer condenser.
37	84298	No. 3 ant. coil and trimmer / No. 4 ant. coil and trimmer
38	84302	No. 3 osc. coil and trimmer / No. 4 osc. coil and trimmer
39	84305	Broadcast osc. coil & trimmer / No. 2 osc. coil and trimmer

Diag. No.	Part No.	Description
40	84308	B.C. 1st det. coil & trimmer / No. 2 ant. coil and trimmer
41	84312	Output transformer
42	84320	1st I.F. trans. (or sub. 84187)
43	84321	2nd I.F. trans. (or sub. 84187)
44	84322	3rd I.F. trans. (or sub. 84188)
45	84324	Power transformer (115 volts 60 cycles) (R-126-A only). (See 84410 for 100-240 volts)
46	84404	Phono. switch (R-126-X only)
47	84407	Phonograph Terminal Strip (R-126 x only)
	84410	Power trans. (100 to 240 volts, 25 to 133 cycles) (R-126-P & X)
49	84412	Phonograph Terminal Strip (R-126-P only).
50	84504	Diaphragm and shell assem. for 8" speaker (also see 84506).
51	84505	Field coil assem. R-225 speaker.
	84506	Diaphragm and shell assem. for R-227 12" speaker.
	84507	Field coil assem. R-227 speaker
	R-225	8" speaker and output trans.
	R-227	12" speaker and output trans.

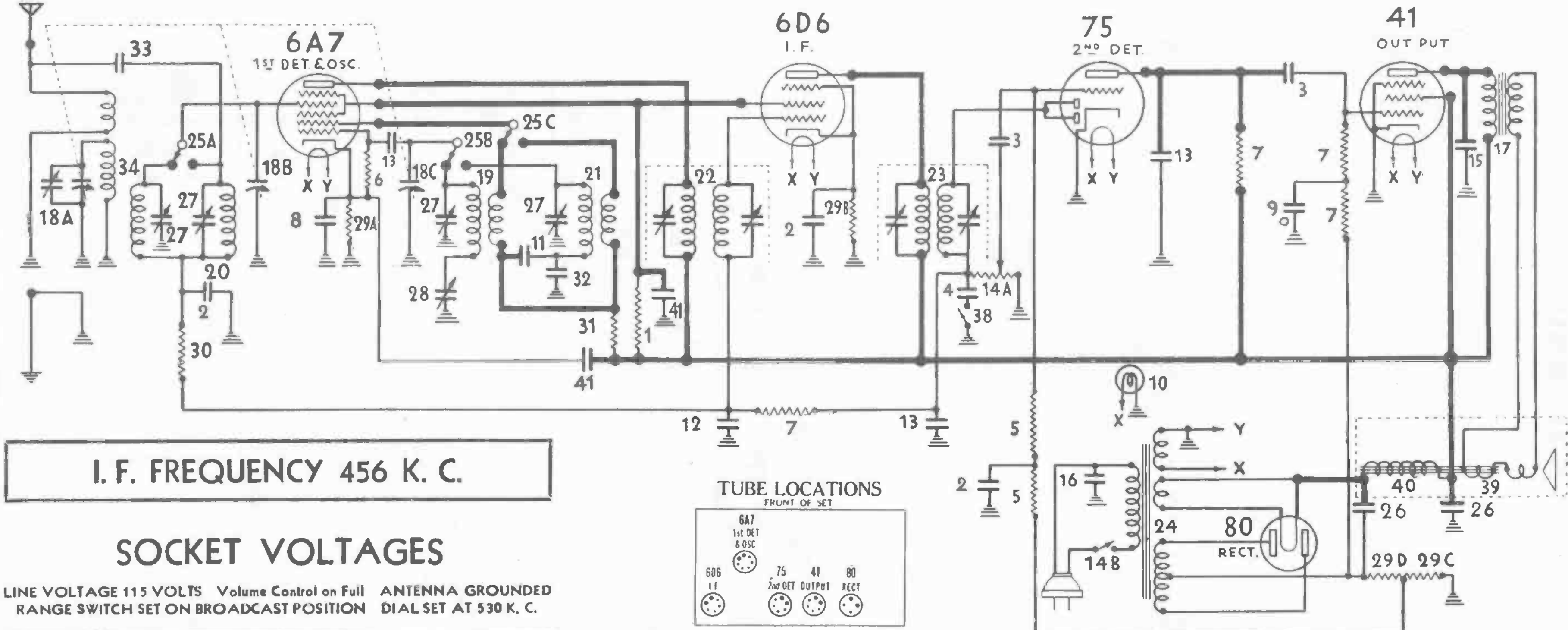
IMPORTANT: Use a high resistance voltmeter of 1000 ohms per volt.

Speaker field voltage with coil warm is 75 volts.

Note A: The actual bias on the 42 tube is —17.5 V. measured across the 225 and 20 ohm sections of the voltage divider. The grid bias on the 75 tube is —1.4 V. volts measured across the 20 ohm section of the voltage divider.

STEWART WARNER CORP.

STEWART-WARNER MODEL R-125 CHASSIS (RECEIVER MODELS 1251 to 1259)



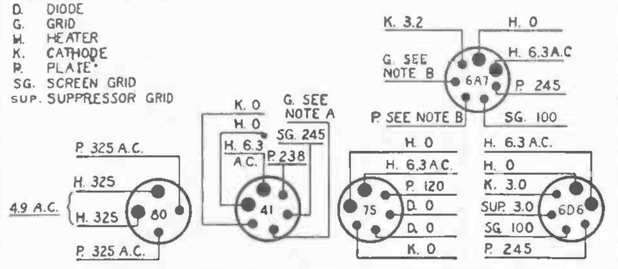
I. F. FREQUENCY 456 K. C.

SOCKET VOLTAGES

LINE VOLTAGE 115 VOLTS Volume Control on Full ANTENNA GROUNDED
RANGE SWITCH SET ON BROADCAST POSITION DIAL SET AT 530 K. C.

VOLTAGES MEASURED BETWEEN CHASSIS AND SOCKET TERMINALS AS SEEN FROM THE BOTTOM

ABBREVIATIONS
- D. DIODE
- G. GRID
- H. HEATER
- K. CATHODE
- P. PLATE
- SG. SCREEN GRID
- SUP. SUPPRESSOR GRID



IMPORTANT: Use a high resistance voltmeter of 1000 ohms per volt. Readings will vary depending upon voltage range of meter, being higher for higher range instruments. This variation is most marked for second detector plate voltage.

Speaker field voltage with coil warm is 73 volts D. C.

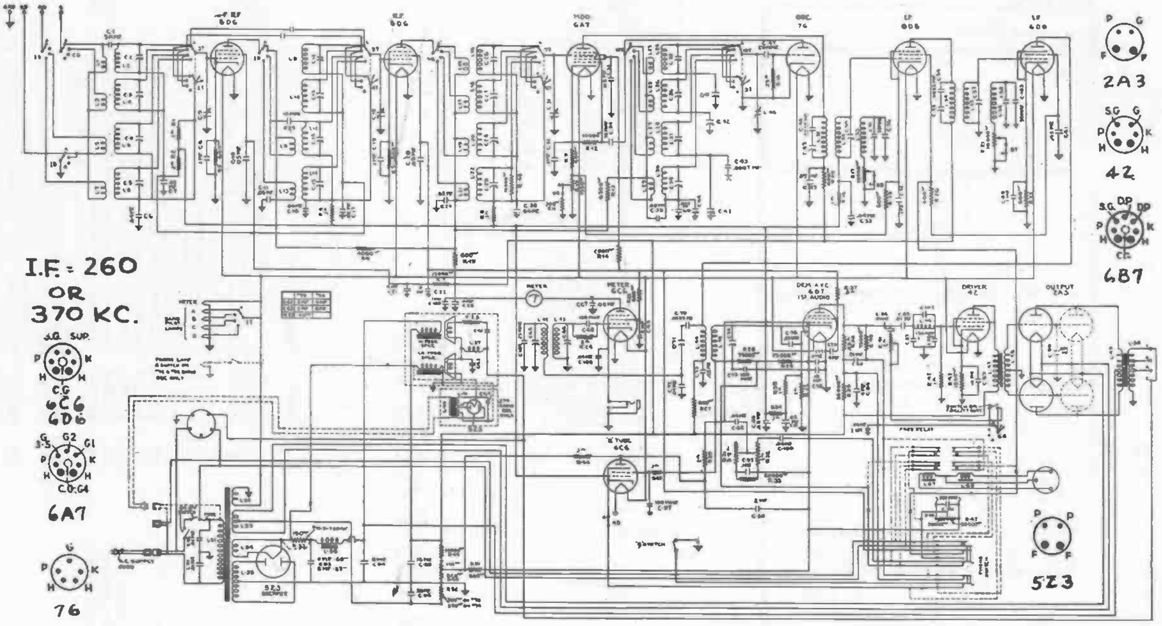
NOTE A: The actual bias on the 41 output tube is —16.5 volts measured across the metal clad bias resistor 43C and 43D. The grid bias on the 75 2nd detector tube is —1.5 volts measured across the metal clad bias resistor 43C.

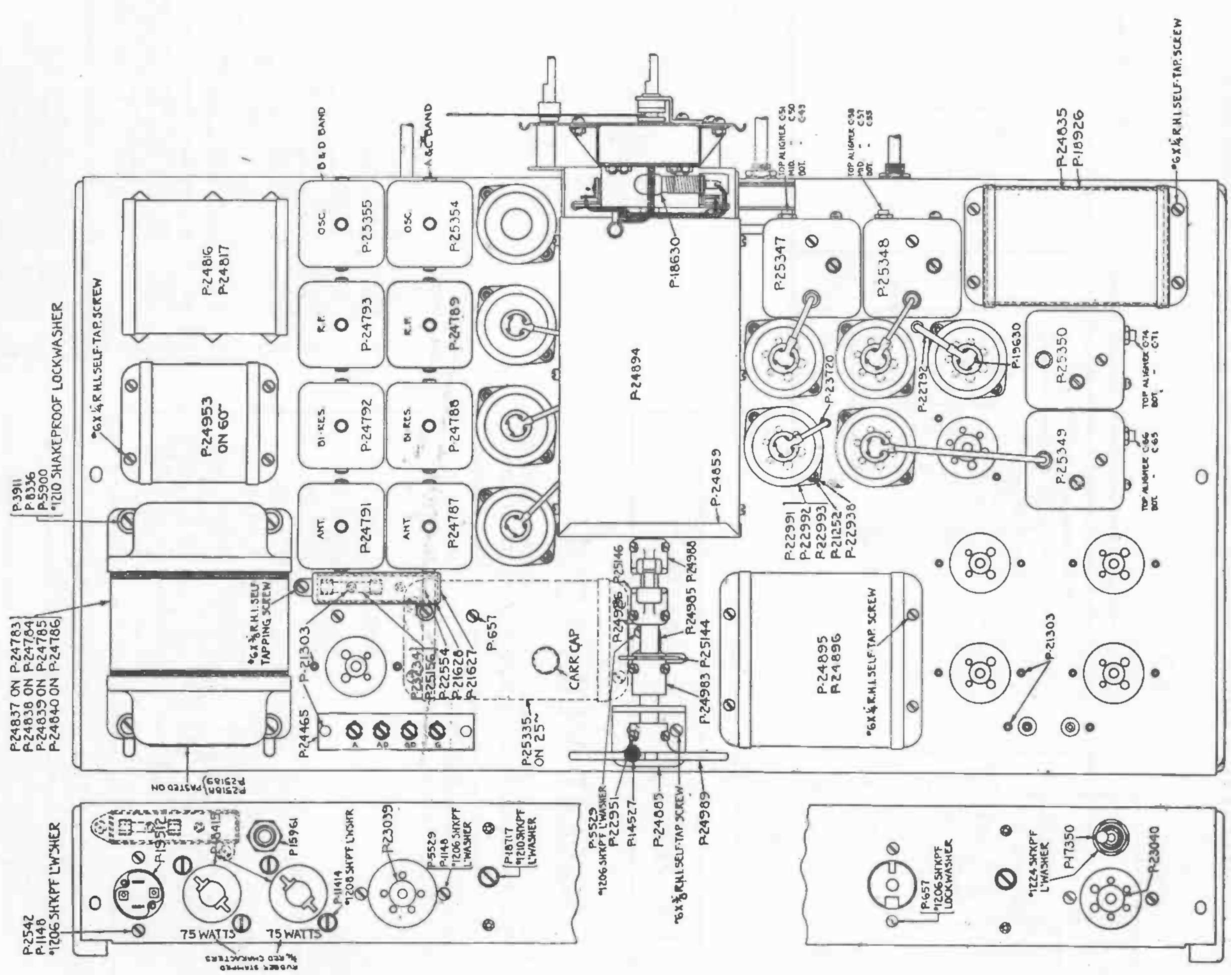
R-125 PARTS LIST

Diag. No.	Part No.	DESCRIPTION
1	62183	30,000 ohm, 1 watt carbon resistor
2	81630	.1 mfd. 100 volt paper condenser.
3	83007	.02 mfd. 600 volt paper condenser.
4	83011	.004 mfd. 600 volt paper condenser.
5	03072	510,000 ohm, ¼ watt carbon resistor
6	83080	51,000 ohm, ¼ watt carbon resistor.
7	83082	260,000 ohm, ¼ watt carbon resistor
8	83214	.25 mfd. 250 volt paper condenser.
9	83219	.01 mfd. 600 volt paper condenser
10	83278	6.3 volt Dial Light bulb.
11	83352	.015 mfd. 600 volt paper condenser
12	83353	.05 mfd. 100 volt paper condenser.
13	83539	.00026 mfd. molded mica condenser.
14-A, 14-B	83551	500,000 ohm volume control and line switch
15	83706	.006 mfd. 600 volt paper condenser.
16	83976	.012 mfd. 1000 volt shielded paper condenser.
17	84153	Output transformer (for R-226 8 inch speaker) (See 84312 for 12 inch speaker transformer)
18-A, 18-B, 18-C	84174	Three gang variable condenser.
19	84180	Broadcast Oscillator Coil
20	84183	Short Wave Antenna Coil
21	84185	Short Wave Oscillator Coil
22	84187	1st I. F. Transformer.
23	84188	2nd I. F. Transformer.
24	84189	Power Transformer 115 volts 60 cycles.
25-A, 25-B, 25-C	84191	Range Switch
26	84193	16 mfd. 350 volt Wet Electrolytic Condenser
27	84194	R. F. Trimmer Condenser (3 to 23 mmfd.).
28	84195	Oscillator Padding Trimmer (300-600 mmfd.)
29-A	84196	300 ohm resistor
29-B	84196	300 ohm resistor
29-C	84196	25 ohm resistor
29-D	84196	275 ohm resistor
30	84198	110,000 ohm ¼ watt carbon resistor.
31	84199	16,000 ohm ¼ watt carbon resistor.
32	84200	.004 mfd. molded mica condenser.
33	84220	Antenna Coupling Condenser (20 mmfd.).
34	84229	Broadcast Pre-Selector Coil Assembly consists of No. 84175 and 84178 coils.
38	84420	Tone Control Switch.
39	84504	Diaphragm and Shell Assembly for R-226 8" Speaker (Also see 84506)
40	84505	Field Coil and Housing for R-226 8" Speaker
	84506	Diaphragm and Shell Assembly for R-227 12" Speaker
	84507	Field Coil and Housing, for R-227 12" Speaker
41	84601	.25 mfd. 300 volt paper condenser

STROMBERG - CARLSON TELEPHONE CO.

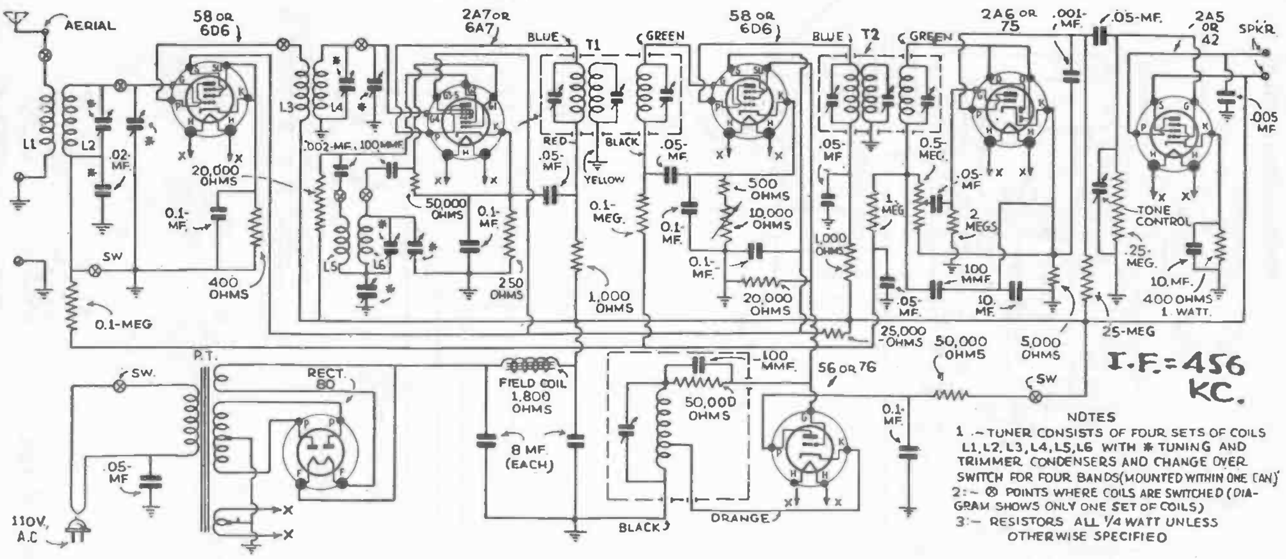
MODEL 70 CHASSIS

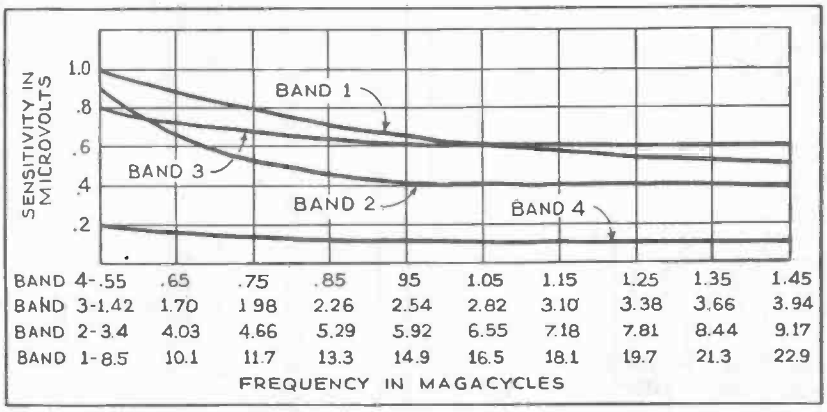




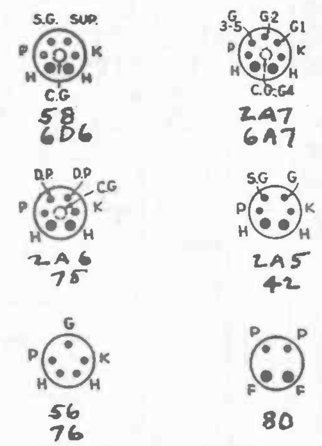
TOBE DEUTSCHMANN CORP.

BROWNING "35"





Sensitivity Curve for "Browning 35" Receiver



Tuning Range from 13.2 to 555 Meters

The "Browning 35" covers the whole short and long wave broadcast tuning range up to 555 meters, or the entire frequency spectrum between 22.6 and .54 megacycles. Its sensitivity throughout this wide range is better than one microvolt which means that the R.F. gain is greater than can be used except under the most favorable atmospheric conditions in a very "quiet" receiving location. It can be seen from the accompanying sensitivity curves that the response on any one band is almost uniform while the entire variation over all four bands is unusually small. The uniformity of these curves is a direct indication of the high efficiency of the all-wave tuning unit employed.

The receiver is absolutely *single-control.* The twelve trimming condensers and four tracking or padding condensers in the SUPER-TUNER unit make it possible to maintain accurate synchronism between the preselector, detector and oscillator circuits over the entire frequency range.

Band-Spread Over Entire Range

Tuning is done with a 40 to 1 ratio microvernier dial. Stations are logged by reference to two pointers, one on the main shaft of the tuning condenser and the other on the vernier shaft. The vernier dial has a 2½" diameter and covers 360°. Thus continuous *band-spread* is accomplished over the entire tuning range. The advantage of such tuning control can be seen by considering one individual band. Take, for instance, the highest frequency band which tunes from 22.6 megacycles (13.2 meters) to 8.8 megacycles (34 meters). On the large calibrated dial this band is 8½" long. While the long pointer on the main dial is covering this distance the vernier pointer makes 20 complete revolutions on its 2½" scale, covering actually 15¾". The 20-meter amateur phone band, which is only 100 kilocycles wide, covers 72° on the 2½" vernier dial!

Oscillator Is Electron-Coupled

The beat frequency oscillator is combined with the first detector and electronically coupled to it in the 2A7 tube. This precludes any "locking-in" effects between the antenna or R.F. stage and the oscillator. Another feature of the oscillator circuit is the parallel voltage feed to the anode. This can be seen by reference to the accompanying schematic circuit diagram, where the 20,000-ohm resistor is shown in series with the power supply and in parallel with the plate inductance of the oscillator. This circuit arrangement tends to keep the R.F. output of the oscillator at a constant level over its tuning range and permits more efficient operation of the mixer.

Double Band-Pass Filter

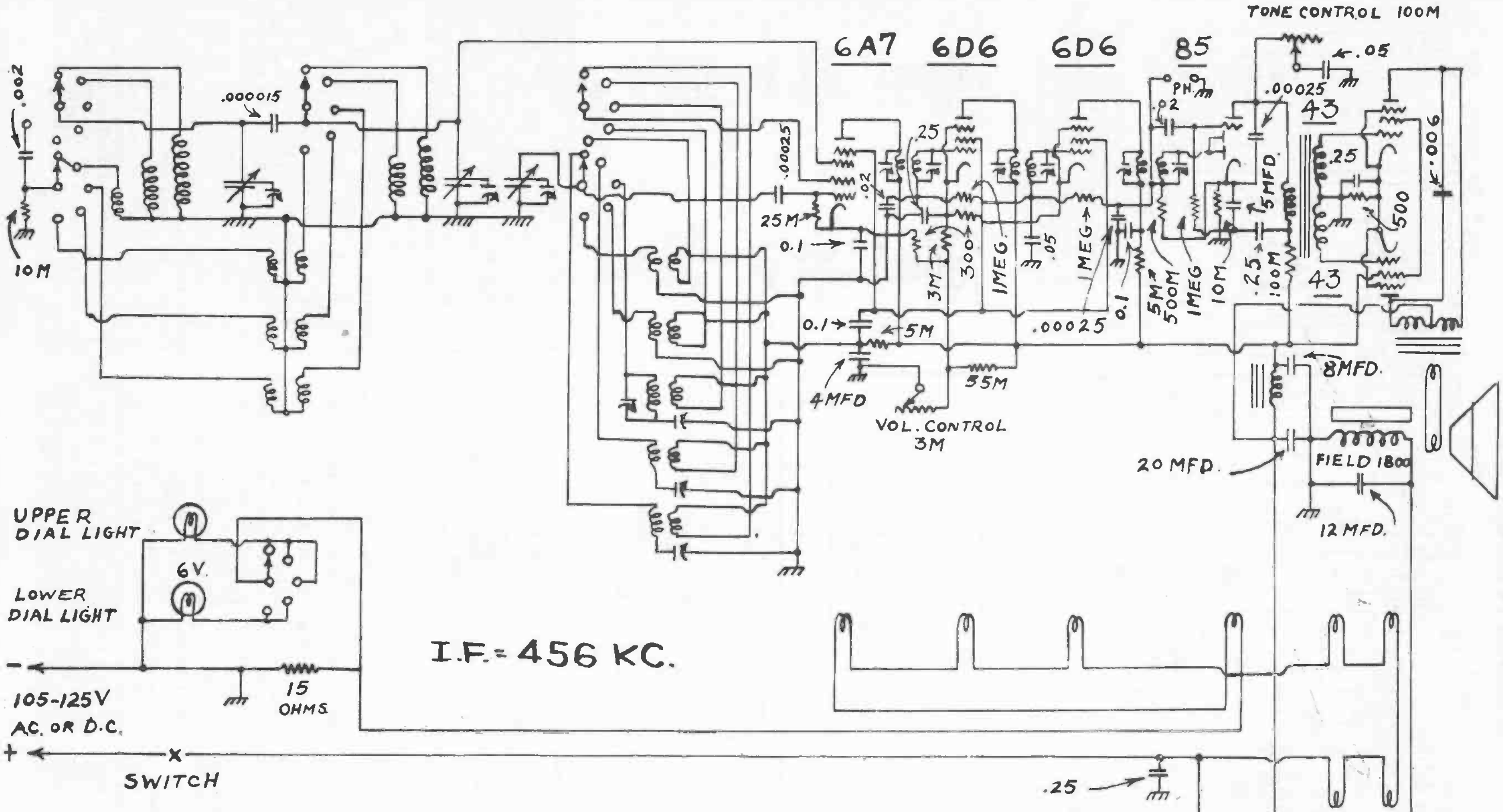
Only one stage of intermediate frequency amplification is used. This was done deliberately in preference to using two or more stages, and not for the sake of economy. The 58 supercontrol tube, which is used here, has an amplification factor of 1280 and, when used with effective high impedance grid and plate coupling, is capable of delivering as much intermediate R.F. amplification as can be used under actual operating conditions.

It is common practice to make use of two or more intermediate stages of amplification operating at low efficiency, each slightly off resonance with the other, in order to obtain a selectivity and amplification curve which is not too sharply peaked. While this is good theory, from a practical standpoint the results are not always satisfactory. Tube capacities vary, their characteristics change and tuned circuits shift their peaks. An oscillator, together with an oscillograph, are necessary to properly readjust such an I.F. amplifier.

The "Browning 35" makes use of a double band-pass filter to accomplish this purpose. Six tuned circuits are employed in this one I.F. stage, two of these being link circuits which are conductively connected only to ground, and are consequently not affected by tube variations, etc. Three of these filter circuits are contained in each of the two I.F. transformers, the center one in each case being the independent link circuit.

TRANSFORMER CORP. OF AMERICA

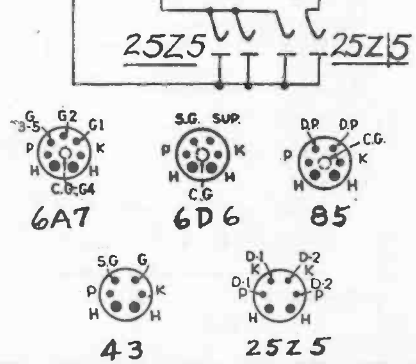
MODEL TC 37



Readings should be taken with volume control fully on. Use a D.C. Voltmeter having a resistance of 1000 ohms per volt.

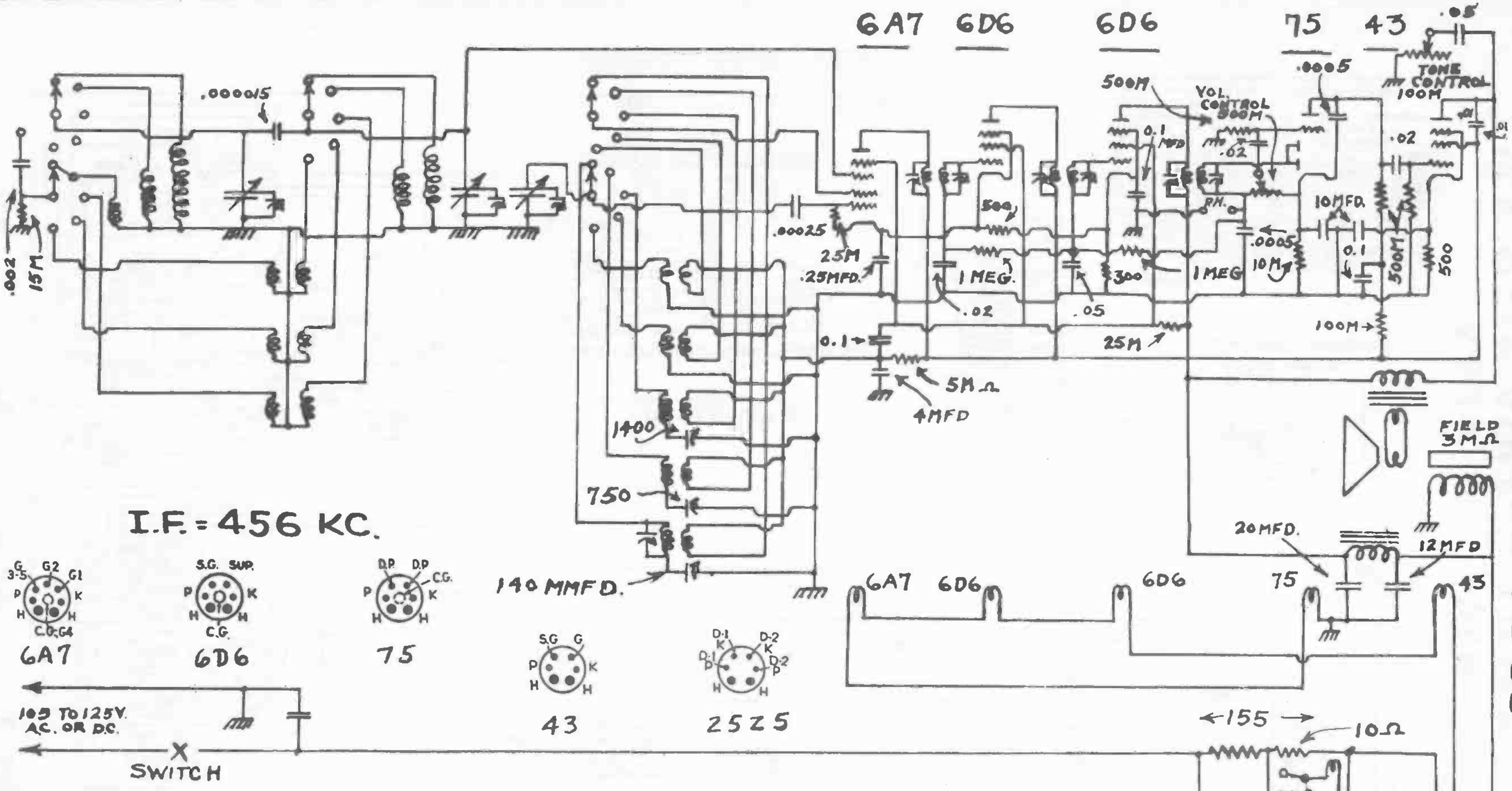
	Plate to Ground	Screen to Ground	Cathode to Ground	Suppressor to Ground
6D6 IF Amp. (1)	128	38	7	7
6D6 IF Amp. (2)	123	38	7	7
85 Diode Det.	57	--	6	6
43 Output Tubes	129	127	20	20
25Z5 Rectifier	132			
6A7 Det. Osc.	127	37	3	Grid (1) 8, Grid (2) 114

Power Drawn by receiver 47 watts.



TRANSFORMER CORP. OF AMERICA

MODEL TC 38



VOLTAGE READINGS:

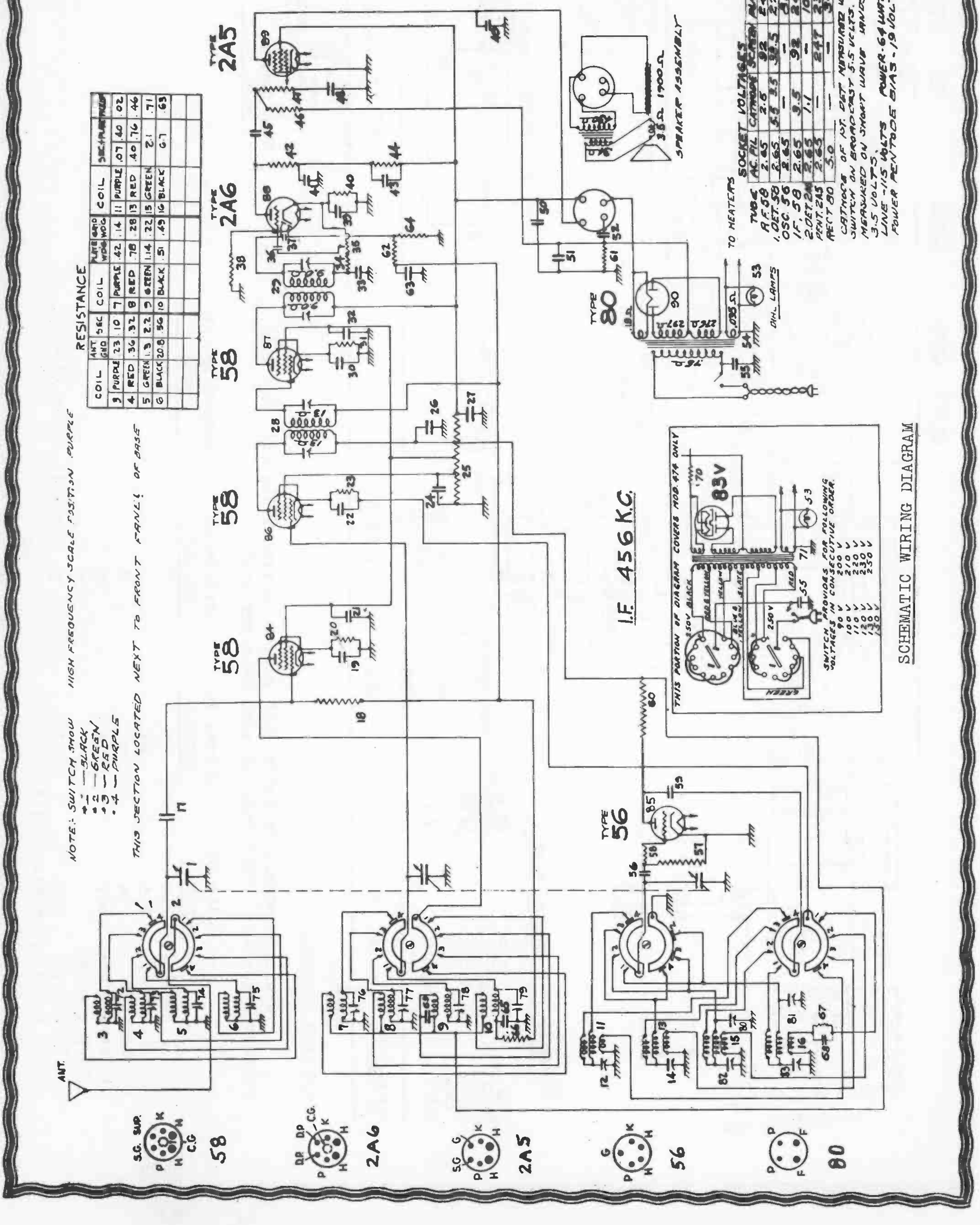
Readings should be taken with volume control fully on. Use a D.C. Voltmeter having a resistance of 1000 ohms per volt.

	Plate to Ground	Screen to Ground	Cathode to Ground	Suppressor to Ground
6D6 IF Amp.(1)	114	42	5	5
6D6 IF Amp.(2)	105	42	2	2
75 2nd. Det.	34	--	2	
43 Output Tube	107	115	15	
25Z5 Rectifier			127	
6A7 Det. Osc.	115	43	5	Grid#1-3, Grid#2-100

Power Drawn by receiver 40 Watts.

UNITED AMERICAN BOSCH CORP.

MODELS 470, 470G, 470V, 471G, 471V, 474G AND 474V.



RESISTANCE

Coil		Ant Gnd	Sec	Coil		Plate Wdg	Grid Wdg	Coil		Sec+Plate		
3	PURPLE	23	10	7	PURPLE	.42	.14	11	PURPLE	.07	.40	.02
4	RED	.36	.32	8	RED	.78	.28	13	RED	.40	.76	.46
5	GREEN	1.3	2.2	9	GREEN	1.14	.22	15	GREEN	2.1		.71
6	BLACK	20.8	5.6	10	BLACK	.51	.49	16	BLACK	6.7		.63

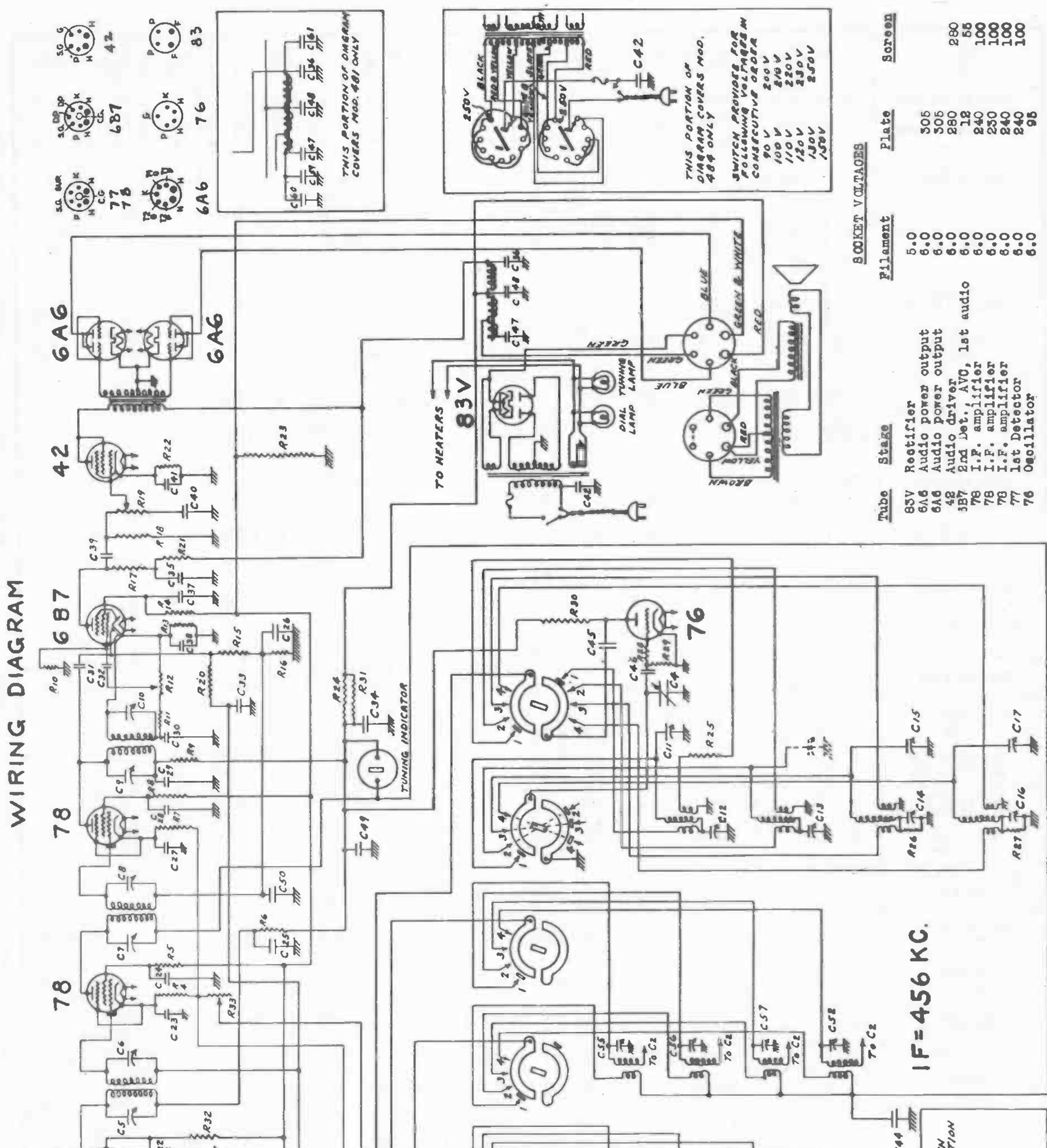
SOCKET VOLTAGES

TUBE	AC. FIL.	CATHODE	SCREEN	PLATE
R.F. 58	2.65	2.6	92	247
1. DET. 58	2.65	5.5 3.5	92.5	220
OSC. 56	2.65	—	—	81
I.F. 58	2.65	9.5	92	247
2. DET. 2A6	2.65	1.1	—	100
PENT. 2A5	2.65	—	247	238
RECT. 80	5.0	—	—	340

CATHODE OF 1ST. DET. MEASURED WITH SWITCH ON BROADCAST 5.5 VOLTS. MEASURED ON SHORT WAVE BANDS 3.5 VOLTS.
LINE - 115 VOLTS POWER - 64 WATTS
POWER PENTODE BIAS - 19 VOLTS

UNITED AMERICAN BOSCH CORP.

MODELS 480 ED.1, 480 ED-2, 481, 484



SOCKET VOLTAGES

Tube	Stage	Filament	Plate	Screen
83V	Rectifier	5.0		
6A6	Audio power output	6.0	305	
6A6	Audio power output	6.0	305	
42	Audio driver	6.0	280	280
3B7	2nd Det., AVC, 1st audio	6.0	18	55
78	I.F. amplifier	6.0	240	100
78	I.F. amplifier	6.0	250	100
78	I.F. amplifier	6.0	240	100
77	1st Detector	6.0	240	100
76	Oscillator	6.0	95	

TUBE CHART I

THE KENRAD CORP.

TUBE TYPE	CLASSIFICATION BY CONSTRUCTION	TYPE CATHODE	FILAMENT SUPPLY	FILAMENT VOLTAGE	FILAMENT CURRENT	MAXIMUM PLATE VOLTAGE	MAXIMUM SCREEN VOLTAGE	RMS VOLTS PER PLATE	MAXIMUM DC OUTPUT MILLIAMPERES	PEAK CURRENT MILLIAMPERES	PEAK INVERSE VOLTS	GRID VOLTAGE	SCREEN VOLTAGE	SCREEN CURRENT	PLATE VOLTAGE	PLATE CURRENT	PLATE RESISTANCE (OHMS)	MUTUAL CONDUCTANCE	AMPLIFICATION FACTOR	LOAD FOR RATED OUTPUT (OHMS)	POWER OUTPUT WATTS	BASE CONNECTION	OUTLINE DRAWING	TUBE TYPE
1A4	RF AMPLIFIER PENTODE	FIL.	DC	2.0	.06	180	67.5					3.0	67.5	0.7	180	2.3	960,000	750	720			4-2	2	1A4
1A6	PENTAGRID CONVERTER	FIL.	DC	2.0	.06	180	67.5	OSCILLATING CONDITION				3.0	67.5	2.4	180	1.3	500,000	CONVERSION CONDUCTANCE 300				6-7	2	1A6
1B5-258	DUPLEX DIODE TRIODE	FIL.	DC	2.0	.06	135						3.0			135	1.0	42,000	475	20			6-8	1	1B5-258
1C6	PENTAGRID CONVERTER	FIL.	DC	2.0	.12	180	67.5	OSCILLATING CONDITION				3.0	67.5	2.0	180	1.5	750,000	CONVERSION CONDUCTANCE 325				6-7	2	1C6
1-V	HALF-WAVE RECTIFIER	HTR.	AC	6.3	.3			350	50	150	1000											4-3	1	1-V
2A3	POWER AMPLIFIER TRIODE	FIL.	AC	2.5	2.5	250						45.0			250	60.0	800	5,250	4.2	2,500	3.5u	4-1	6	2A3
2A5	POWER AMPLIFIER PENTODE	HTR.	AC	2.5	1.75	250		TRIODE CONNECTION				20.0			250	31.0	2,700	2,300	6.2	3,000	.650u	6-3	4	2A5
						315	315	PENTODE CONNECTION				22.0	315	8.5	315	42.0	100,000	2,300	230	7,000	5.0			
						350		CLASS AB - TWO TUBES				38.0			350	21.0a				8,000b	18.0			
2A6	DUPLEX DIODE HI-MU TRIODE	HTR.	AC	2.5	.8	250						2.0			250	0.8	91,000	1,100	100			6-2	2	2A6
2A7	PENTAGRID CONVERTER	HTR.	AC	2.5	.8	250	100	OSCILLATING CONDITION				3.0	100	2.2	250	3.5	360,000	CONVERSION CONDUCTANCE 520				7-2	2	2A7
2B7	DUPLEX DIODE PENTODE	HTR.	AC	2.5	.8	250	125					3.0	125	2.3	250	9.0	650,000	1,125	730			7-3	2	2B7
5Z3	FULL-WAVE RECTIFIER	FIL.	AC	5.0	3.0			500	250		1500											4-4	6	5Z3
5Z4	FULL-WAVE RECTIFIER	HTR.	AC	5.0	2.0			400	125		1100											5-A	13	5Z4
6A3	POWER AMPLIFIER TRIODE	FIL.	AC	6.3	1.0	250						45.0			250	60.0	800	5,250	4.2	2,500	3.3u	4-1	6	6A3
6A4	POWER AMPLIFIER PENTODE	FIL.	DC	6.3	.3	180	180					12.0	180	3.9	180	22.0	45,500	2,200	100	8,000	1.4	5-3	4	6A4
6A6	TWIN TRIODE AMPLIFIER	HTR.	AC	6.3	.8	300		CLASS B - SINGLE TUBE				0			300	17.5a	INPUT SIGNAL .350 WATT			10,000b	10.0e	7-5	4	6A6
						294		CLASS A-TRIODES PAR.				6.0			294	7.0	11,000	3,200	35	30,000e	.400e			
6A7	PENTAGRID CONVERTER	HTR.	AC	6.3	.3	250	100	OSCILLATING CONDITION				3.0	100	2.2	250	3.5	360,000	CONVERSION CONDUCTANCE 520				7-2	2	6A7
6A8	PENTAGRID CONVERTER	HTR.	AC	6.3	.3	250	100	ANODE GRID 200 VOLTS MAX.				3.0			TOTAL CATHODE CURRENT - 14 M.A. MAXIMUM							8-A	10	6A8
6B5	DUPLEX TRIODE AMPLIFIER	HTR.	AC	6.3	.8	300	300f	CLASS A - SINGLE TUBE				0	300f	6.0f	300	45.0	24,100	2,400	58	7,000	4.0u	6-9	4	6B5
						400	400f	CLASS A - TWO TUBES				13.0	400f	4.5fa	400	40.0a				10,000b	20.0u			
6B7	DUPLEX DIODE PENTODE	HTR.	AC	6.3	.3	250	125					3.0	125	2.3	250	9.0	650,000	1,125	730			7-3	2	6B7
6C5	DETECTOR AMPLIFIER TRIODE	HTR.	AC	6.3	.3	250						8.0			250	8.0	10,000	2,000	20			6-A	11	6C5
6C6	DETECTOR AMPLIFIER PENTODE	HTR.	AC	6.3	.3	250	100					3.0	100	.5	250	2.0	1,500,000*	1,225	1500*			6-1	3	6C6
6D5	POWER AMPLIFIER TRIODE	HTR.	AC	6.3	.7	275		CLASS A - SINGLE TUBE				40.0			275	31.0	2,250	2,100	4.7	7,200	1.4u	6-A	9	6D5
						300		CLASS AB - TWO TUBES				50.0			300	23.0a				5,300b	5.0			
6D6	SUPER CONTROL RF PENTODE	HTR.	AC	6.3	.3	250	100					3.0	100	2.0	250	8.2	800,000	1,600	1280			6-1	3	6D6
6E6	TWIN TRIODE AMPLIFIER	HTR.	AC	6.3	.6	250						27.5			250	18.0	3,500	1,700	6.0	14,000b	1.6u	7-5	4	6E6
6F5	HI-MU AMPLIFIER TRIODE	HTR.	AC	6.3	.3	250						2.0			250	0.9	66,000	1,500	100			5-B	10	6F5
6F6	POWER AMPLIFIER PENTODE	HTR.	AC	6.3	.7	250	250	PENTODE CONNECTION				16.5	250	6.5	250	34.0	80,000	2,200	200	7,000	3.0	7-A	9	6F6
						250		TRIODE CONNECTION				20.0			250	31.0	2,600	2,700	7	4,000	.850u			
						250	375	CLASS AB - PENTODES				26.0	250	2.5a	375	17.0a				10,000b	19.0			
						350		CLASS AB - TRIODES				38.0			350	22.5a				6,000b	18.0			
6F7	TRIODE PENTODE	HTR.	AC	6.3	.3	250	100	PENTODE AMPLIFIER				3.0	100	1.5	250	6.5	850,000	1,100	900			7-4	2	6F7
						100		TRIODE AMPLIFIER				3.0			100	3.5	17,800	450	8.0					
6H6	TWIN DIODE	HTR.	AC	6.3	.3			100	2													7-B	12	6H6
6J7	DETECTOR AMPLIFIER PENTODE	HTR.	AC	6.3	.3	250	125					3.0	100	0.5	250	2.0	1,500,000*	1,225	1500*			7-C	10	6J7
6K7	SUPER CONTROL RF PENTODE	HTR.	AC	6.3	.3	250	125					3.0	100	1.7	250	7.0	800,000	1,450	1160			7-C	10	6K7
6L7	PENTAGRID MIXER AMPLIFIER	HTR.	AC	6.3	.3	250	150	MIXER OPERATION				6.0	150	8.0	250	3.5	2,000,000*	CONVERSION CONDUCTANCE 325				7-D	10	6L7
						250	100	AMPLIFIER OPERATION				3.0	100	5.5	250	5.3	800,000	1,100						
6Z4-84	FULL-WAVE RECTIFIER	HTR.	AC	6.3	.5			350	50	150	1000											5-4	1	6Z4-84
12A5	POWER AMPLIFIER PENTODE	HTR.	AC	12.6	.3d	180	180					27.0	180	8.0	180	38.0		2,300		3,800	2.6	7-6	1	12A5
12A7	DUPLEX PENTODE RECTIFIER	HTR.	AC	12.6	.3	135	135	PENTODE SECTION				13.5	135	2.5	135	9.0	102,000	975	100	13,500	.550	7-7	2	12A7
						RECTIFIER SECTION		125	30															
12Z3	HALF-WAVE RECTIFIER	HTR.	AC	12.6	.3			250	60	180	700											4-3	1	12Z3
25Y5	FULL-WAVE RECTIFIER	HTR.	AC	25.0	.3			250	85													6-5	1	25Y5
25Z5	RECTIFIER DOUBLER	HTR.	AC	25.0	.3			125	100	300	350											6-5	1	25Z5
01A	DETECTOR AMPLIFIER TRIODE	FIL.	DC	5.0	.25	135						9.0			135	3.0	10,000	800	8.0	20,000	.055u	4-1	4	01A
10	POWER AMPLIFIER TRIODE	FIL.	AC	7.5	1.25	425						39.0			425	18.0	5,000	1,600	8.0	10,200	1.6u	4-1	8	10
12A	DETECTOR AMPLIFIER TRIODE	FIL.	DC	5.0	.25	180						13.5			180	7.7	4,700	1,800	8.5	10,650	.285u	4-1	4	12A
15	RF AMPLIFIER PENTODE	HTR.	DC	2.0	.22	135	67.5					1.5	67.5	.25	135	1.85	800,000	750	600			5-2	2	15

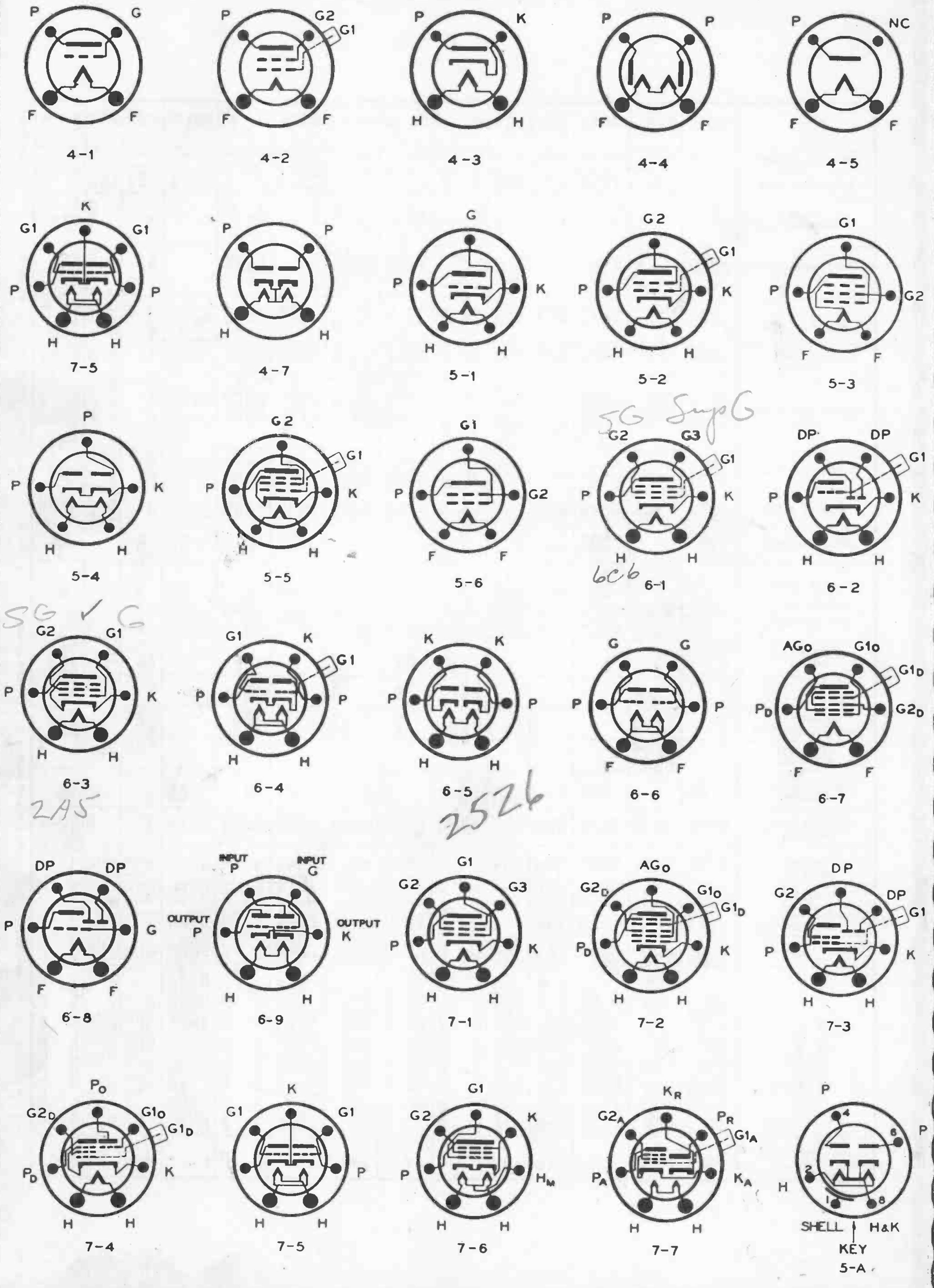
* - MINIMUM u - UNDISTORTED a - ZERO SIGNAL PER PLATE b - PLATE TO PLATE c - MAXIMUM d - .8 AMPERE AT 6.3 VOLTS e - APPROX. f - INPUT PLATE

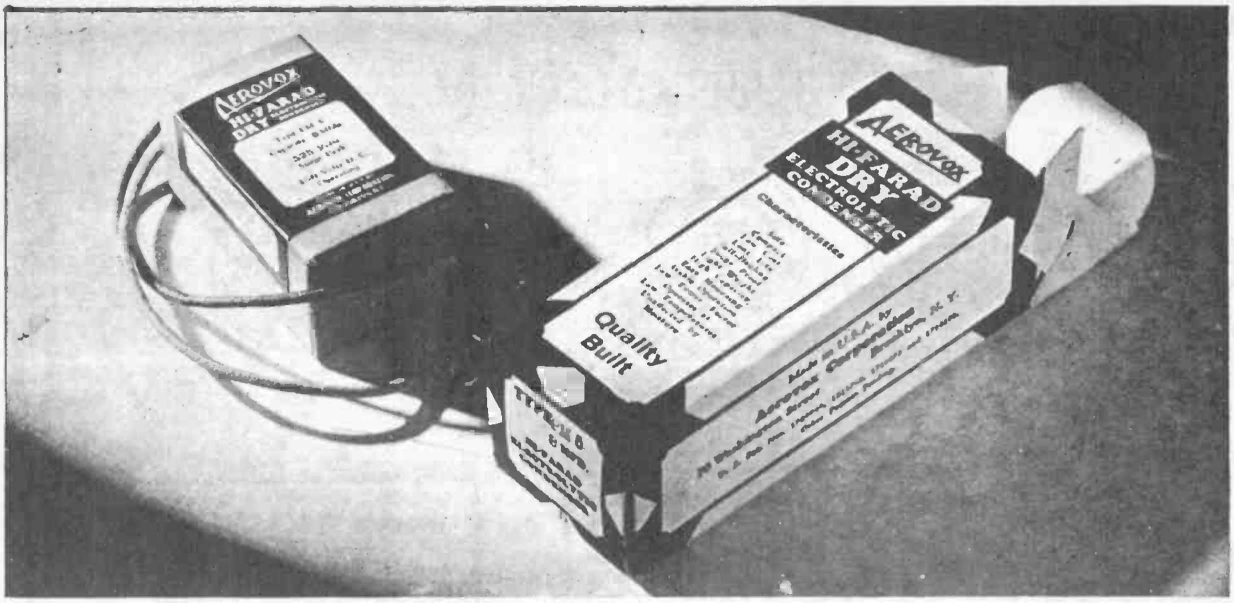
TUBE CHART II

TUBE TYPE	CLASSIFICATION BY CONSTRUCTION	TYPE CATHODE	FILAMENT SUPPLY	FILAMENT VOLTAGE	FILAMENT CURRENT	MAXIMUM PLATE VOLTAGE	MAXIMUM SCREEN VOLTAGE	RMS VOLTS PER PLATE	MAXIMUM DC OUTPUT MILLIAMPERES	PEAK CURRENT MILLIAMPERES	PEAK INVERSE VOLTS	GRID VOLTAGE	SCREEN VOLTAGE	SCREEN CURRENT	PLATE VOLTAGE	PLATE CURRENT	PLATE RESISTANCE (OHMS)	MUTUAL CONDUCTANCE	AMPLIFICATION FACTOR	LOAD FOR RATED OUTPUT (OHMS)	POWER OUTPUT WATTS	BASE CONNECTION	OUTLINE DRAWING	TUBE TYPE
19	TWIN TRIODE AMPLIFIER	FIL.	DC	2.0	.26	135		CLASS B - SINGLE TUBE				0			135	5.0a	INPUT SIGNAL .170 WATT			10,000b	2.1	6-6	1	19
20	POWER AMPLIFIER TRIODE	FIL.	DC	3.3	.132	135						22.5			135	6.5	6,300	525	3.3	6,500	.110u	4-1	7	20
22	RF AMPLIFIER TETRODE	FIL.	DC	3.3	.132	135	67.5					1.5	67.5	1.3c	135	3.7	325,000	500	160			4-2	5	22
24A	RF AMPLIFIER TETRODE	HTR.	AC	2.5	1.75	250	90					3.0	90	1.7c	250	4.0	600,000	1,050	630			5-2	5	24A
26	AMPLIFIER TRIODE	FIL.	AC	1.5	1.05	180						14.5			180	6.2	7,300	1,150	8.3			4-1	4	26
27	DETECTOR AMPLIFIER TRIODE	HTR.	AC	2.5	1.75	250						21.			250	5.2	9,250	975	9.0			5-1	1	27
30	DETECTOR AMPLIFIER TRIODE	FIL.	DC	2.0	.06	180						13.5			180	3.1	10,300	900	9.3			4-1	1	30
						157.5		CLASS B - TWO TUBES				15.0			157.5	0.5a				8,000b	2.1			
31	POWER AMPLIFIER TRIODE	FIL.	DC	2.0	.13	180						30.0			180	12.3	3,600	1,050	3.8	5,700	.375u	4-1	1	31
32	RF AMPLIFIER TETRODE	FIL.	DC	2.0	.06	180	67.5					3.0	67.5	0.4c	180	1.7	1,200,000	650	780			4-2	5	32
33	POWER AMPLIFIER PENTODE	FIL.	DC	2.0	.26	180	180					18.0	180	5.0	180	22.0	55,000	1,700	90	6,000	1.4	5-3	4	33
34	SUPER CONTROL RF PENTODE	FIL.	DC	2.0	.06	180	67.5					3.0	67.5	1.0	180	2.8	1,000,000	620	620			4-2	5	34
35-51	SUPER CONTROL RF TETRODE	HTR.	AC	2.5	1.75	250	90					3.0	90	2.5c	250	6.5	400,000	1,050	420			5-2	5	35-51
36	RF AMPLIFIER TETRODE	HTR.	AC	6.3	.3	250	90					3.0	90	1.7c	250	3.2	550,000	1,080	595			5-2	2	36
37	DETECTOR AMPLIFIER TRIODE	HTR.	AC	6.3	.3	250						18.0			250	7.5	8,400	1,100	9.2			5-1	1	37
38	POWER AMPLIFIER PENTODE	HTR.	AC	6.3	.3	250	250					25.0	250	3.8	250	22.0	100,000	1,200	120	10,000	2.5	5-5	2	38
39-44	SUPER CONTROL RF PENTODE	HTR.	AC	6.3	.3	250	90					3.0	90	1.4	250	5.8	1,000,000	1,050	1,050			5-5	2	39-44
41	POWER AMPLIFIER PENTODE	HTR.	AC	6.3	.4	250	250					18.0	250	5.5	250	32.0	68,000e	2,200	150e	7,600	3.4	6-3	1	41
42	POWER AMPLIFIER PENTODE	HTR.	AC	6.3	.7	250		TRIODE CONNECTION				20.0			250	31.0	2,700	2,300	6.2	3,000	.650u	6-3	4	42
						315	315	PENTODE CONNECTION				22.0	315	8.5	315	42.0	100,000	2,300	230	7,000	5.0			
						350		CLASS AB - TWO TUBES				38.0			350	21.0a				8,000b	18.0			
43	POWER AMPLIFIER PENTODE	HTR.	AC	25.0	.3	135	135					20.0	135	7.0	135	34.0	35,000	2,300	80	4,000	2.0	6-3	4	43
45	POWER AMPLIFIER TRIODE	FIL.	AC	2.5	1.5	275						56.0			275	36.0	1,700	2,050	3.5	4,600	2.0u	4-1	4	45
46	POWER AMPLIFIER TETRODE	FIL.	AC	2.5	1.75	250		CLASS A - SINGLE TUBE				33.0			250	22.0	2,380	2,350	5.6	6,400	1.25u	5-6	6	46
						400		CLASS B - TWO TUBES				0			400	6.0a	INPUT SIGNAL .650 WATT			5,800b	20.0			
47	POWER AMPLIFIER PENTODE	FIL.	AC	2.5	1.75	250	250					16.5	250	6.0	250	31.0	60,000	2,500	150	7,000	2.7	5-3	6	47
48	POWER AMPLIFIER TETRODE	HTR.	AC	30.0	.4	125	100					20.0	100	9.5	125	56.0	10,000e	3,900	39e	1,500	2.5	6-3	6	48
50	POWER AMPLIFIER TRIODE	FIL.	AC	7.5	1.25	450						84.0			450	55.0	1,800	2,100	3.8	4,350	4.6u	4-1	8	50
53	TWIN TRIODE AMPLIFIER	HTR.	AC	2.5	2.0	300		CLASS B - SINGLE TUBE				0			300	17.5a				10,000b	10.0e	7-5	4	53
						294		CLASS A-TRIODES PAR.				6.0			294	7.0	11,000	3,200	35	30,000e	.400e			
55	DUPLEX DIODE TRIODE	HTR.	AC	2.5	1.0	250						20.0			250	8.0	7,500	1,100	8.3	20,000	.350u	6-2	2	55
56	DETECTOR AMPLIFIER TRIODE	HTR.	AC	2.5	1.0	250						13.5			250	5.0	9,500	1,450	13.8			5-1	1	56
57	DETECTOR AMPLIFIER PENTODE	HTR.	AC	2.5	1.0	250	100					3.0	100	0.5	250	2.0	1,500,000*	1,225	1,500*			6-1	3	57
58	SUPER CONTROL RF PENTODE	HTR.	AC	2.5	1.0	100						3.0	100	2.0	250	8.2	800,000	1,600	1,280			6-1	3	58
59	POWER AMPLIFIER TETRODE	HTR.	AC	2.5	2.0	250		TRIODE CONNECTION				28.0			250	26.0	2,300	2,600	6.0	5,000	1.25u	7-1	6	59
						250	250	PENTODE CONNECTION				18.0	250	9.0	250	35.0	40,000	2,500	100	6,000	6.0			
						400		CLASS B - TWO TUBES				0			400	13.0a	INPUT SIGNAL 1.5 WATTS			6,000	20.0			
71A	POWER AMPLIFIER TRIODE	FIL.	DC	5.0	.25	180						40.5			180	20.0	1,750	1,700	3.0	4,800	.790u	4-1	4	71A
75	DUPLEX DIODE HI-MU TRIODE	HTR.	AC	6.3	.3	250						2.0			250	0.8	91,000	1,100	100			6-2	2	75
76	DETECTOR AMPLIFIER TRIODE	HTR.	AC	6.3	.3	250						13.5			250	5.0	9,500	1,450	13.8			5-1	1	76
77	DETECTOR AMPLIFIER PENTODE	HTR.	AC	6.3	.3	250	100					3.0	100	0.5	250	2.3	1,500,000	1,250	1,500			6-1	2	77
78	SUPER CONTROL RF PENTODE	HTR.	AC	6.3	.3	250	125					3.0	125	2.6	250	10.5	600,000	1,650	990			6-1	2	78
79	TWIN TRIODE AMPLIFIER	HTR.	AC	6.3	.6	250		CLASS B - SINGLE TUBE				0			250	5.3a	INPUT SIGNAL .380 WATT			14,000b	8.0	6-4	2	79
80	FULL-WAVE RECTIFIER	FIL.	AC	5.0	2.0			550	135	WITH 20 HENRY CHOKE INPUT ONLY												4-4	4	80
81	HALF-WAVE RECTIFIER	FIL.	AC	7.5	1.25			700	85													4-5	8	81
82	FULL-WAVE RECTIFIER	FIL.	AC	2.5	3.0			500	125	400	1400				MERCURY VAPOR TYPE - TUBE VOLTAGE DROP 15 VOLTS							4-4	4	82
83V	FULL-WAVE RECTIFIER	HTR.	AC	5.0	2.0			400	200													4-7	4	83V
85	DUPLEX DIODE TRIODE	HTR.	AC	6.3	.3	250						20.0			250	8.0	7,500	1,100	8.3	20,000	.350u	6-2	2	85
89	POWER AMPLIFIER TETRODE	HTR.	AC	6.3	.4	250		TRIODE CONNECTION				31.0			250	32.0	2,600	1,800	4.7	5,500	.900u	6-1	2	89
						250	250	PENTODE CONNECTION				25.0	250	5.5	250	32.0	70,000	1,800	125	6,750	3.4			
						180		CLASS B - TWO TUBES				0			180	3.0a	INPUT SIGNAL .350 WATT			9,400b	3.5			
99	DETECTOR AMPLIFIER TRIODE	FIL.	DC	3.3	.063	90						4.5			90	2.5	15,500	425	6.6			4-1	7	99

* - MINIMUM   u - UNDISTORTED   a - ZERO SIGNAL PER PLATE   b - PLATE TO PLATE   c - MAXIMUM   d - .6 AMPERE AT 6.3 VOLTS   e - APPROX.   f - INPUT PLATE

TUBE CHART III





Compact, inexpensive paper condensers for tight places and flat pocketbooks.

Metal-case paper condensers for good-looking assemblies and lowest cost in long run.

Cardboard case electrolytics . . . maximum capacity and working voltage values in minimum bulk.

Metal-can electrolytics . . . enormous capacity and working voltage values in minimum bulk . . . multi-section units, too.

Built to Stand the Gaff!

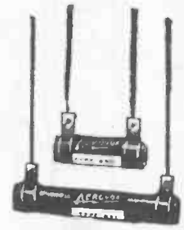
FOR that critical high-frequency tuning circuit, high-fidelity amplifier, power pack . . . anticipating those superlative results of 1935 radio technique . . . and building for long, satisfactory, economical service—be sure to use AEROVOX condensers and resistors, because:

AEROVOX components represent the greatest variety in essential condensers and resistors. They come packed in individual yellow-and-black cartons . . . free from unnecessary handling and tampering and that shopworn look of unpackaged goods. And in each carton you find the AEROVOX guarantee slip protecting you against defective materials and workmanship. Finally, behind that AEROVOX label stands a research, engineering and production reputation second to none. Why pay more for less quality?

FREE DATA New catalog covers complete line of condensers and resistors. Also sample copy of Research Worker . . . the cream of the crop of monthly radio developments.

Mica condensers in molded and in metal cases . . . available in thirteen standard types . . . every capacity and voltage. Ideal for precision work, especially at those higher frequencies.

Adjustable Pyrohm resistors . . . wire-wound; vitreous-enamelled; one or more slide bands; removable mounting feet.



Pyrohm resistors . . . from tiny 5-watt to huge 200-watt . . . all resistance values . . . positive conductivity; noiseless operation. Conservatively rated.

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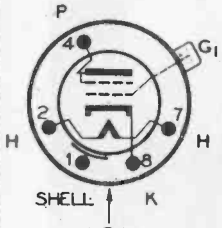
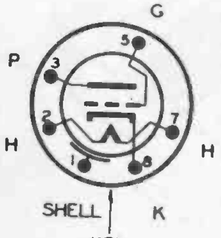
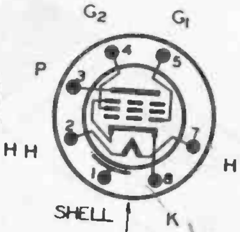
TUBE CHART IV



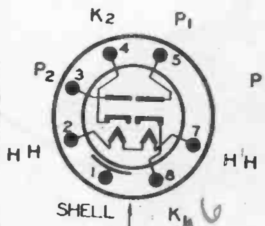
KEY 5-B



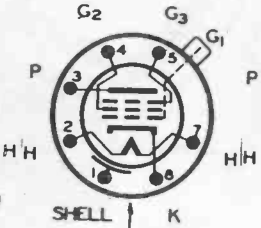
KEY 6-A*



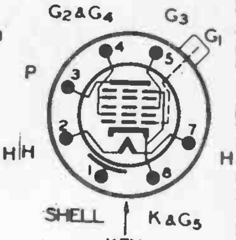
KEY 7-A



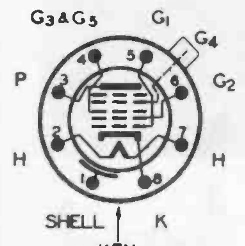
KEY 7-B



KEY 7-C



KEY 7-D



KEY 8-A

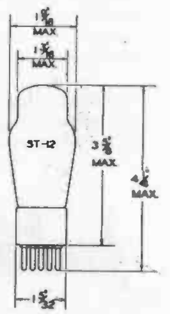
LEGEND FOR BASE CONNECTION DRAWINGS

SUBSCRIPTS

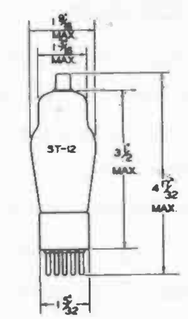
A—Amplifier Elements
O—Oscillator Elements
D—Detector Elements
M—Midpoint
R—Rectifier Elements

LEGEND FOR BASE CONNECTION DRAWINGS

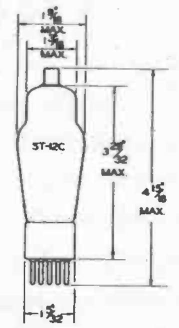
G-1—Control Grid	P—Plate
G-2—Screen Grid	K—Cathode
G-3—Suppressor Grid	NC—No connection
H—Heater	DP—Diode Plate
F—Filament	AG—Anode Grid



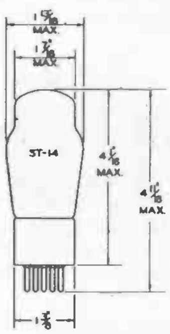
OUTLINE DRAWING No. 1



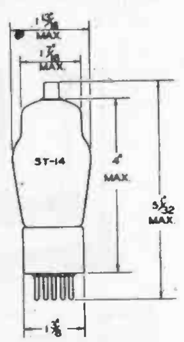
OUTLINE DRAWING No. 2



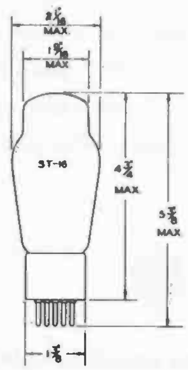
OUTLINE DRAWING No. 3



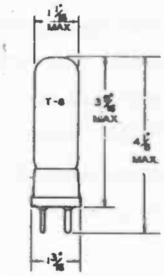
OUTLINE DRAWING No. 4



OUTLINE DRAWING No. 5



OUTLINE DRAWING No. 6



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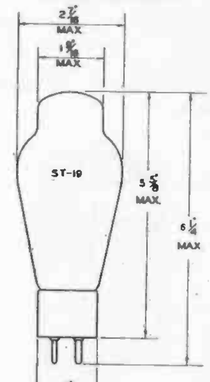
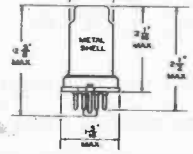
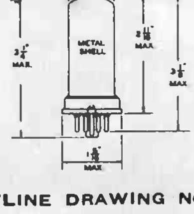


OUTLINE DRAWING No. 8



OUTLINE DRAWING No. 11



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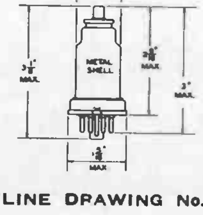
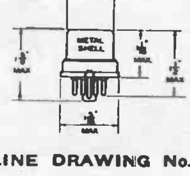
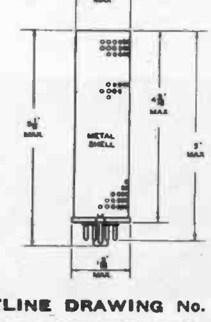


OUTLINE DRAWING No. 10

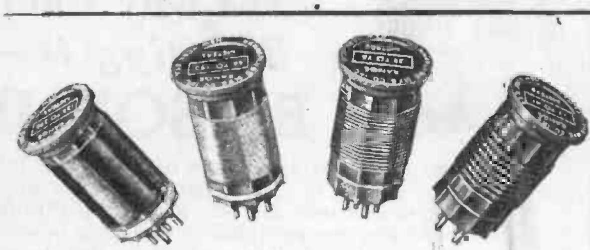


OUTLINE DRAWING No. 12



OUTLINE DRAWING No. 13

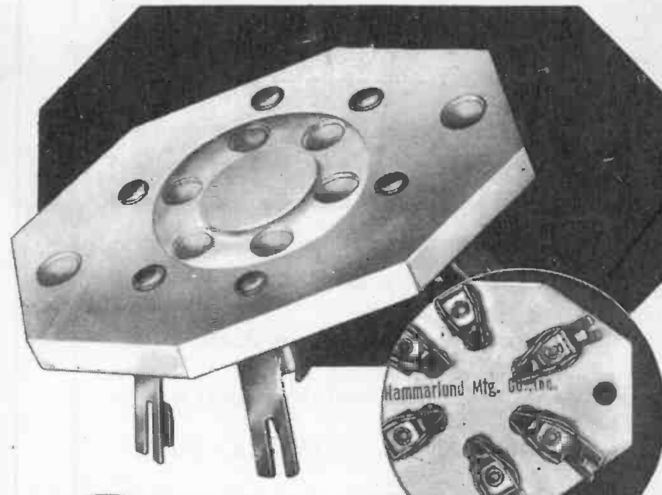
HAMMARLUND Presents

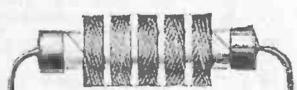


"XP-53"

LOW - LOSS, LOW - PRICE COILS and COIL FORMS

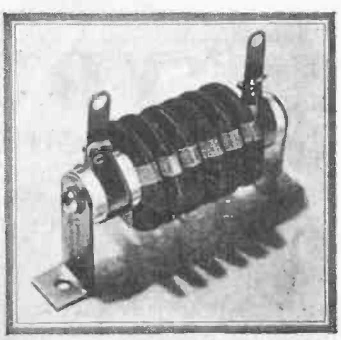
Get more stations, louder signals and sharper tuning. Users say they out-perform any other coils at any price. "XP-53", the new Hammarlund low-loss dielectric, has no artificial coloring to cause losses. Forms are ribbed for air-spacing, have easy-grip flanges and handy "Meter-Index" inserts for coil ranges. 4 or 6-prong coils for 15-270 meters. Extra coils for broadcast band.

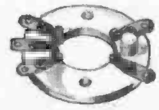




R. F. and TRANSMITTER CHOKES

Two exceptional new Hammarlund developments. The smallest R. F. choke ever devised, wound on Isolantite core. Inductance 2.1 mh. D.C. resistance 35 ohms. Distributed capacity 1 mmf. The heavy-duty transmitter choke has more than 500,000 ohms of impedance in the 20, 40, 80 and 160 meter amateur bands. Isolantite core. Inductance 2.5 mh. D.C. resistance 8 ohms. Distributed capacity less than 1.5 mmf.





New "ACORN" ULTRA HIGH FREQUENCY SOCKET

For .5 to 5-meter work. A real low-loss achievement. Isolantite base, with top and sides highly glazed. Silver-plated, double-grip, non-slipping spring clips. 1⅞" diameter.

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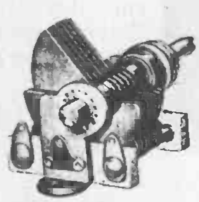
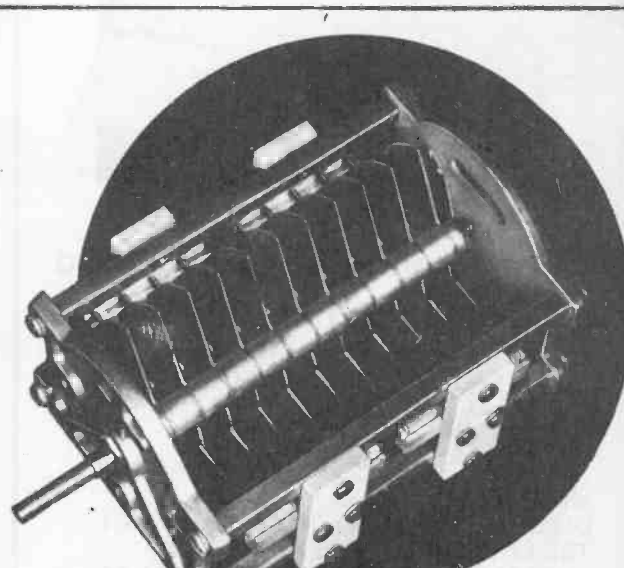
RECEIVING and TRANSMITTING CONDENSERS

Whatever your condenser need may be, Hammarlund makes it in the required capacity rating—eighteen different types, for receiving, transmitting, balancing, padding, antenna tuning, etc.



And as to QUALITY—practically every amateur and professional operator, and every radio manufacturer throughout the world, since 1910, has respected Hammarlund prestige.

Hammarlund Condensers will improve the performance of any circuit.



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Write Dept. OM-35 for catalog. Attach 10c for new 32-page Short-Wave Manual of most popular circuits.

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