March 31
1928

SIXTH ANNIVERSARY NUMBER

15
CENTS

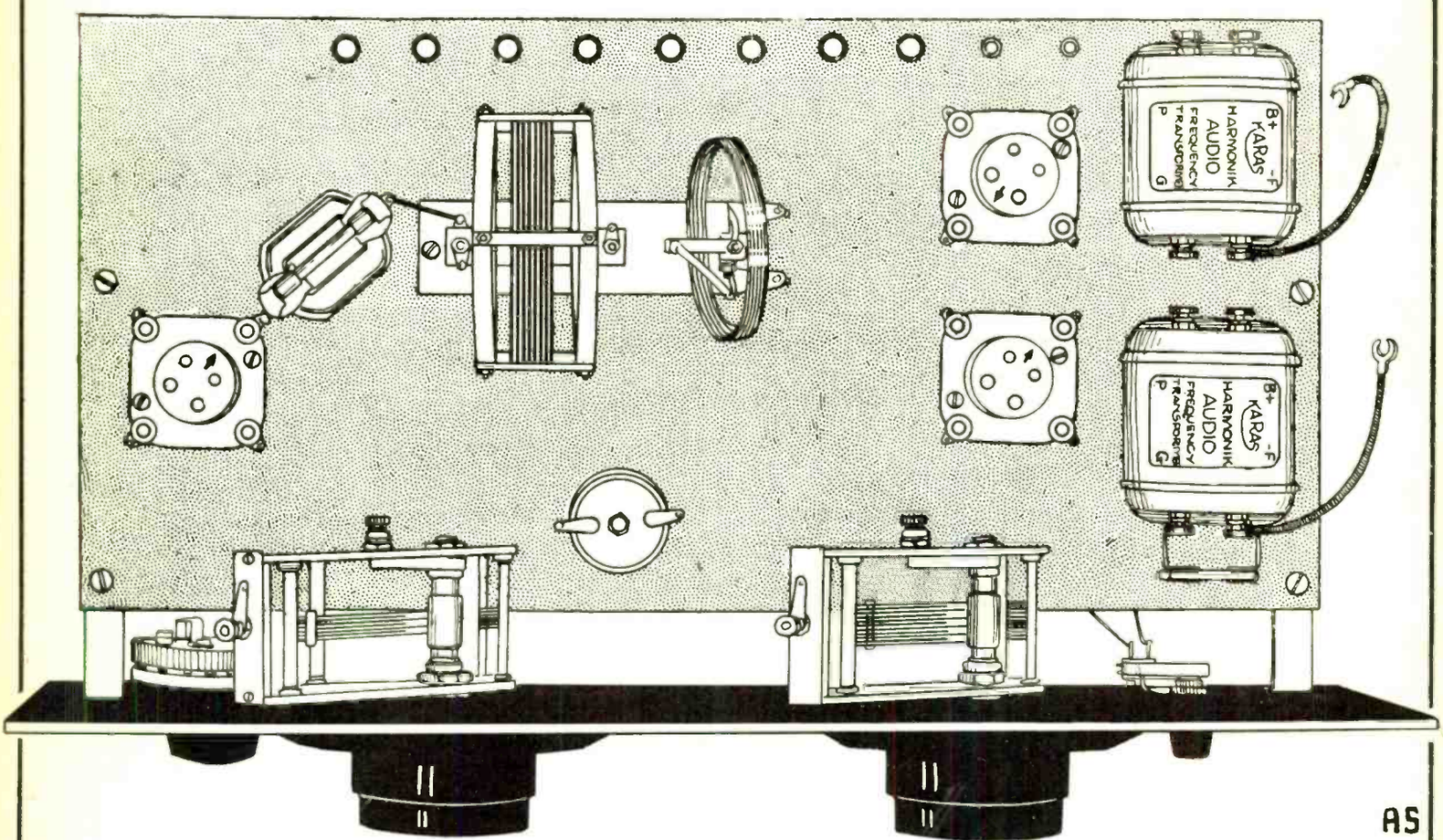
RADIO WORLD

REG. U.S. PAT. OFF.

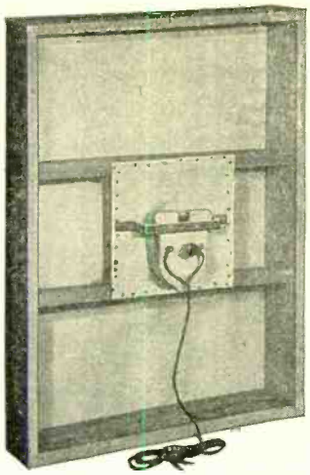
The First and Only National Radio Weekly

The Karas Short Wave Set

That Received Signals Half Way 'Round the World



Top view of the three-tube set that has a wave range of from 13 to 725 meters, and on short waves half encircled the globe.



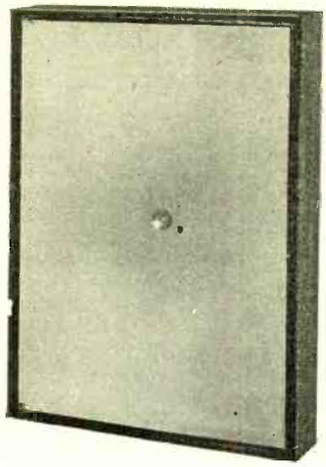
Rear View of the HBH Airplane Cloth Speaker
Size, 18x24 Inches

All Ready to Play with Amazing Fidelity

HBH

AIRPLANE CLOTH SPEAKER

"The Speaker That Speaks for Itself"



Front View of the HBH Airplane Cloth Speaker
Size 18x24 Inches

Size 18x24 inches, factory-constructed. All ready to play. Cat. No. 1088. $11.00

OTHER SIZES OF FACTORY-MADE MODELS

18x36" Cat. No. 1089....$13 24x36" Cat. No. 1090....$14 36x36" Cat. No. 1091....$16

Any factory-made HBH Speaker, or complete kit, less unit, deduct $3.75.

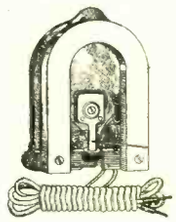
COMPLETE KITS AND SEPARATE PARTS FOR HBH AIRPLANE CLOTH SPEAKER

Genuine HBH Stiffening Fluid, secret compound, with superlative effect on tone quality. Large sized can, enough for three coats. Cat. No. 1097 .....$1.50

The HBH Airplane Cloth Speaker may be purchased completely made up, in factory-sealed cartons, at the prices listed above, but if you prefer to build the speaker yourself you may do so at a saving of from $1 to $2, depending on the size of the speaker.

The complete kit consists in each case of airplane cloth, frame, moulding, unit, stiffening fluid, apex, crossarm, brackets, long cord, apex, hardware and instruction sheet.

We sell separately every component of the kit. See announcements below.



Powerful unit, excellent for any cone or similar type speaker, standard for HBH speaker; very loud. Cat. No. 1098 .....$3.75

"DOPE"

HBH Stiffening Fluid may be used on any cloth type speaker to great advantage. It is of special manufacture, secret formula, and noted for superior effects on tone quality. Two coats will suffice. Three are slightly better. Large size can, enough for three coats. When the first coat dries, in 15 minutes, a special speed feature, apply the second coat. When that dries put on the third and last coat. Cat. No. 1097..$1.50

CLOTH

Genuine airplane cloth same as used for best airplanes; great tensile strength, light weight. Govt. specifications.
18x24" (with 7x7 for baffle). Cat. No. 1099.....$1.50
18x36" (enough extra to cut own baffle with shears). Cat. No 1100.....$1.80
24x36" (enough extra to cut own baffle with shears). Cat. No. 1101.....$2.00
36x36" (enough extra to cut own baffle with shears). Cat. No. 1102.....$2.50

FRAME

The wooden frame, with coping of decorative moulding, may be purchased in standard sizes and used as such, or may be cut down from a larger standard size to a smaller special size, and cloth cut by purchaser accordingly. The frames come complete with moulding and hardware, in factory sealed carton.
18x24" Cat. No. 1103. $5.00
18x36" Cat. No. 1104. 5.25
24x36" Cat. No. 1105. 5.35
36x36" Cat. No. 1106. 5.50

APEX

The apex is of the double type, so that one metal shield is placed outside the diaphragm and the other inside, but the same apex may be used on any type of cone speaker. Each apex is equipped with threaded sleeve and thumbnut for fastening unit drive. Highest quality and durability of metal used. Outside diameter of apex, 1¾". Guaranteed to be enduring and serviceable. Cat. No. 1107..... 25c

UNIT

The unit is the Powertone model, which provides high degree of volume and yet is sensitive. Stands great strain. Used successfully in all radio receivers, including power pack installations up to 550 volts on the plate. Up to 135 volts DC may be passed through coils of unit without damage. For higher voltages filtered output is recommended, but unit has long stood up to 180 v. unfiltered. Cat. No. 1108.....$3.75

Complete Kit, 18x24", Cat. No. 1109.....$10. Complete Kit, 24x36", Cat. No. 1110.....$12 Complete Kit, 36x36", Cat. No. 1111.....$14

Everybody wants a first-class speaker, because no set or power pack is any better than the speaker it feeds. Now the general public is enabled to obtain the famous HBH Airplane Cloth Speaker, both in factory-assembled form and in kit form, as well as each individual component of the kit separately, and thus can obtain a wonderfully clear-toned and faithful reproducer at the lowest cost at which such fine results are generally obtainable.

Those who have special cabinets, consoles, phonographs, etc., into which they want to build a fine speaker, have every opportunity now to build a speaker that will create a sensation. It is very simple to make the famous HBH Airplane Cloth Speaker any size you want. Determine the size desired, and multiply the dimensions in inches, thus obtaining the number of square inches. Multiply this by three cents to obtain price. Then send cash, check or money order with your order, as odd size kits are not C.O.D. items. All else are. Or you may order the next larger standard size C.O.D. and cut it down yourself. In either case you get complete kit.

The story of the excellence of the HBH Airplane Cloth Speaker is best told by the speaker itself. As all goods are sold on a five-day money-back guaranty, you run no risk. Also you **SEND NO MONEY.** Have one of these speakers in your home and let your friends, too, compliment you on the fine tone quality and volume. And, besides, think of all the real enjoyment you get yourself from the best speaker in the low-price range.

GUARANTY RADIO GOODS CO.,
145 West 45th Street, New York City

Ship me the following items as advertised in Radio World:

Cat. No.....Cat. No.....Cat. No.....
Cat. No.....Cat. No.....Cat. No.....

for which I will pay postman advertised price plus few cents extra for postage.

Name .....

Address .....

City .....State.....

Five-Day Money-Back Gauranty

REPLACEMENT COILS

You may have a unit in which there is nothing wrong except that the small coil built into it, or one of the two coils, or both, are burnt out. Replace these coils and you have the same old fine unit. These coils are hard to get, but we have plenty of them in three different sizes. When ordering, state the dimensions of the bobbin, or, preferably, send your old coil and we will send the correct replacement coil. Cat. No. 1112, each, 75c.

GUARANTY RADIO GOODS CO.
145 West 45th Street New York City

SIXTH ANNIVERSARY NUMBER

"UNINTERRUPTED READER INTEREST
EVERY WEEK — EVERY YEAR

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Phones: BRYant 0558 and 0559

The Karas Short Wave Receiver

By J. E. Anderson

Technical Editor

Principally a Set for Receiving Programs and Code on Waves Below the Broadcast Band, This Circuit Covers 13 to 725 Meters with Plug-in Coils—On the High Frequencies It Can Bring in Signals from Half Way 'Round the World

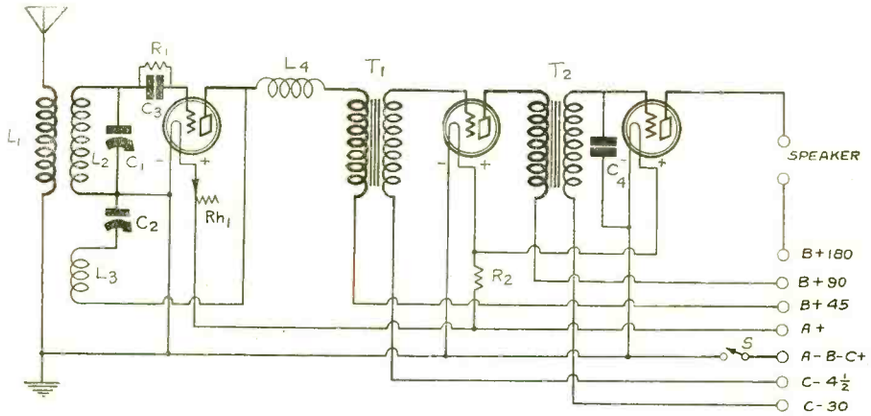


FIG. 1
THE CIRCUIT DIAGRAM OF THE KARAS 13 TO 725 METER RECEIVER

PART I

THERE is no more fascinating field in radio than that partly explored region of the spectrum which lies above the broadcast frequency range. At present the boundaries of this region may be taken as 1,500 kc and 60,000 kc, that is, 200 and 5 meters. There is room in that region, plenty of it, for all who wish to experiment, and there is variety in it to satisfy every listener and to keep him interested.

There is a surprise at every tiny turn of the dial. At one place is a conversation between a pair of local hams, at another the dots and dashes from a European amateur, at still another a broadcast program from one of the large broadcasting stations. There are besides these, signals from airplanes to the ground, beam signals, television and picture transmission signals, as well as countless others.

All of these are within reach of the man with a high frequency (short wave) receiver, particularly if that receiver is equipped with a complete set of plug-in coils of various inductance values.

Simple Receiver Enough

There is no wonder that sedate broadcast fans by the thousand should be carried by wanderlust into that partly explored realm. It would not be surprising if a popular rush started into that region which in magnitude and intensity would be gigantic as compared with the rush into broadcasting seven years ago.

The receiving equipment required for sounding the high frequency realm is simple. It is even simpler than the early broadcast receivers. A regenerative detector and two stages of audio frequency amplification will be enough—just three tubes.

The diagram published herewith shows the simplicity of the required circuit. It has a single tuner and one regeneration control. C1 is the tuning condenser and C2 the regeneration control condenser. The only volume control besides C2 is the rheostat Rhl in the filament circuit of the detector.

What follows the detector is a standard audio frequency amplifier using high grade transformers. And that simple circuit will bring in with loudspeaker volume almost any high frequency station. It is just as likely to bring in a European station in Chicago as a local, and it is just as likely to bring in transoceanic stations in the daytime as in the night. And stations located at the antipodes are not too far away from this receiver when the transmission conditions are favorable. And they are surprisingly often in connection with short wave communication.

Many Contacts

We could go on and enumerate contacts between two widely separated stations almost without number, which were established with receiving tubes for transmitters and circuits like the one described here for receivers. But such a list would be of little interest. But the fact that a receiver like the one described here can be used to receive the transmission from a miniature tube after the waves have travelled half way around the earth is of great interest. It shows that the receiver is exceptionally sensitive to the short waves and that these waves do travel a long distance.

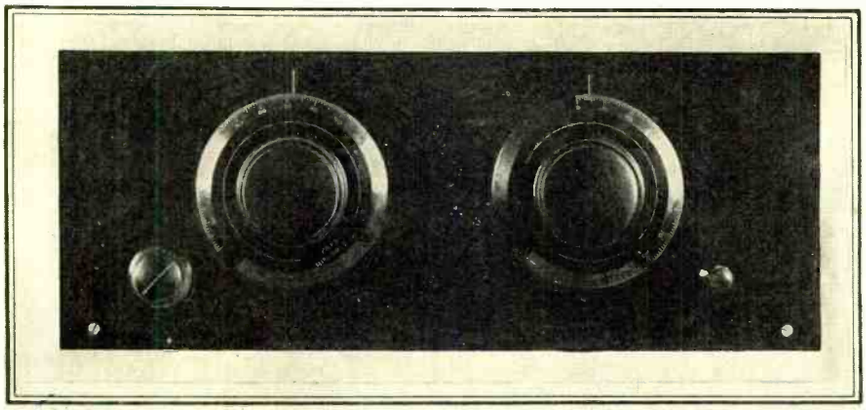
Another fact of great interest is that the cost of the receiver capable of picking up the short waves is small.

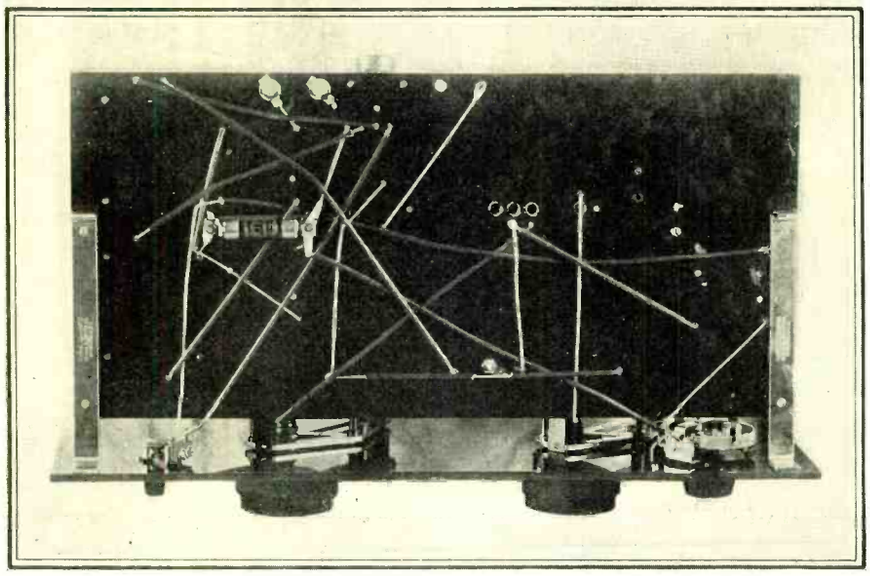
Plug-in Coils

Due to the large effects of stray capacities and inductances in circuits tuned to short waves it is very difficult to design a coil and a condenser which when connected in series will cover a desired range. Also on account of the high stray capacity in comparison with the tuning capacity a tuned circuit will not cover as wide a range as high frequencies (short waves) as a tuned circuit will at broadcast frequencies. This necessitates a set of interchangeable tuning coils with a simple arrangement for plugging any one of the coils into the circuit.

This set of coils must be so designed that the tuning ranges will overlap a little so as to make sure no part of the short wave range will be missed. For example, one coil may have a range from 13 to 30

How to Build the 3-Tube Set that





FIGS. 2 AND 3
THE FRONT PANEL AND AN UNDERNEATH VIEW OF THE SUBPANEL OF THE WIRED SET.

LIST OF PARTS

C1—One Karas .00014 mfd. variable condenser.
C2—One Karas .00025 mfd. variable condenser.
C3—One Sangamo .0002 mfd. fixed condenser with clips.
C4—One Sangamo .001 mfd. condenser (across sec. of T2).
T1, T2—Two Karas Harmonik audio frequency transformers.
R1—One 4 megohm Durhan grid leak.
R2—One No. 112 Amperite unit.
Rh1—One Yaxley 20 ohm rheostat.
S—One Yaxley No. 10 filament switch.
L1, L2, L3—One set of Aero short wave coils.
L4—One Aero radio frequency No. 60 choke coil.
Two Yaxley phone tip jacks.
Two Karas Micrometric dials.
Two Karas sub-panel brackets.
Three Benjamin sockets.
Eight X-L binding posts.
One Formica 7x18x3/16 inch panel.
One Formica 8x17x3/16 inch sub-panel.

meters, the next from 29 to 68 meters, and a third from 57 to 133 meters. This series of coils can be extended up to and slightly above the present broadcast range without the use of cumbersome coils.

Thus with a set of six or seven plug-in coils it is possible to cover the entire spectrum from 13 to 1,000 meters on the same receiver. This range includes practically everything of interest to the radio fan.

Single Antenna Coil

In the coil system are three different winding with six terminals. If all of these coils were made for substitution there would have to be six terminal plugs on the coil and six corresponding sockets in the coil receptacle. This is not convenient. Therefore only four terminal plugs and four sockets in the receptacle are provided. These are for coils L2 and L3. The antenna coil L1 is attached permanently to the coil receptacle but is put on hinges so that the coupling between L1 and L2 can be varied according to the length of the antenna or to the frequency of the signals received.

For a short antenna the coupling should be close and for a large antenna it should be loose. Similarly, for high frequency the apparent coupling should be loose and for lower frequencies it should be close. Practically this means that when a large coil of many turns is used as the secondary the coupling should be close, and when a coil of a few turns is used the coupling should be loose.

This method coupling the antenna to the tuning coil works satisfactorily for all the coils in the set.

Effective Regeneration

The method of regeneration employed in this circuit is that which has been found to give greatest satisfaction on short wave work. The tickler coil L3 is fixed both as to position and as to the number of turns with respect to the secondary L2. The number of turns used depends on the number of turns on the secondary. It is placed inside the secondary with an air space between the two windings. This mounting is for the purpose of obtaining rather close coupling without much capacity between the two windings.

One end of the tickler coil is connected to the plate of the tube and the other is connected to the stator of a variable condenser C2 by means of which the amount of feedback is regulated. The rotor of this condenser is connected to the grounded side of the circuit.

When this method of variation is used there is no tendency to body capacity when manipulating the tickler, which is an extremely important feature on short wave work.

It is equally important that there be no body capacity effects when manipulating the tuning condenser C1. Hence the rotor side of this is grounded also. And the coil system is set back of the panel some distance so that the hands do not come near them while tuning. Thus the direct capacity effects between the hands and the coils is a negligible minimum.

High LC Ratio

The tuning condenser C1 has a maximum capacity of only .00014 mfd. That means that for any frequency tuned in the ratio of the inductance to the capacity is very high, a condition for maximum voltage transfer from the antenna circuit to the detector grid. This gain is more effective for the larger coils than for the smaller, but then increase in effectiveness is in about the same proportion in which it is needed. Hence the receiver is uniformly sensitive over its tuning range.

The regeneration condenser C2 is larger, having a maximum value of .00025 mfd. This is used to insure regeneration for all the coils in the system. The shape of the plates of the Karas condenser chosen is such that the large capacity does not make the tickling critical on the short wave, for the capacity variation at low capacity is extremely slow. The cut of the plates is straight line frequency. Then in addition the dials attached to the condensers are Micrometric with a high ratio.

Grid Detection

Grid detection is employed in this short receiver because this method is the most sensitive to weak impulses. The grid leak R1 may have any value between 1 and 5 megohms. The higher value is preferred on weak signals. The grid condenser C3 should have a value of about .0002 mfd.

The rheostat Rh1 in the filament circuit of the first tube should have a value of 20 ohms, assuming that the first tubes takes a current of ¼ ampere normally. This rheostat serves as an effective volume control in addition to the tickler.

Since this receiver is to be operated at extremely high radio frequencies it is necessary to put in a radio frequency choke coil L4 in the plate circuit to insure regeneration at all the frequencies in the tuning range of the circuit. If it were not for L4 the high frequency currents would go through the distributed capacity of the primary of the first transformer T1 instead of through L3. The distributed capacity in the transformer may even be enough to prevent oscillation at broadcast frequencies if L4 is not used to force the current through the proper channel.

Must Be Choke in Fact

Not only must L4 be an effective radio frequency choke in appearance at the higher radio frequencies within the range of the tuner, but it must be so in fact.

Reached Half Way 'Round the World

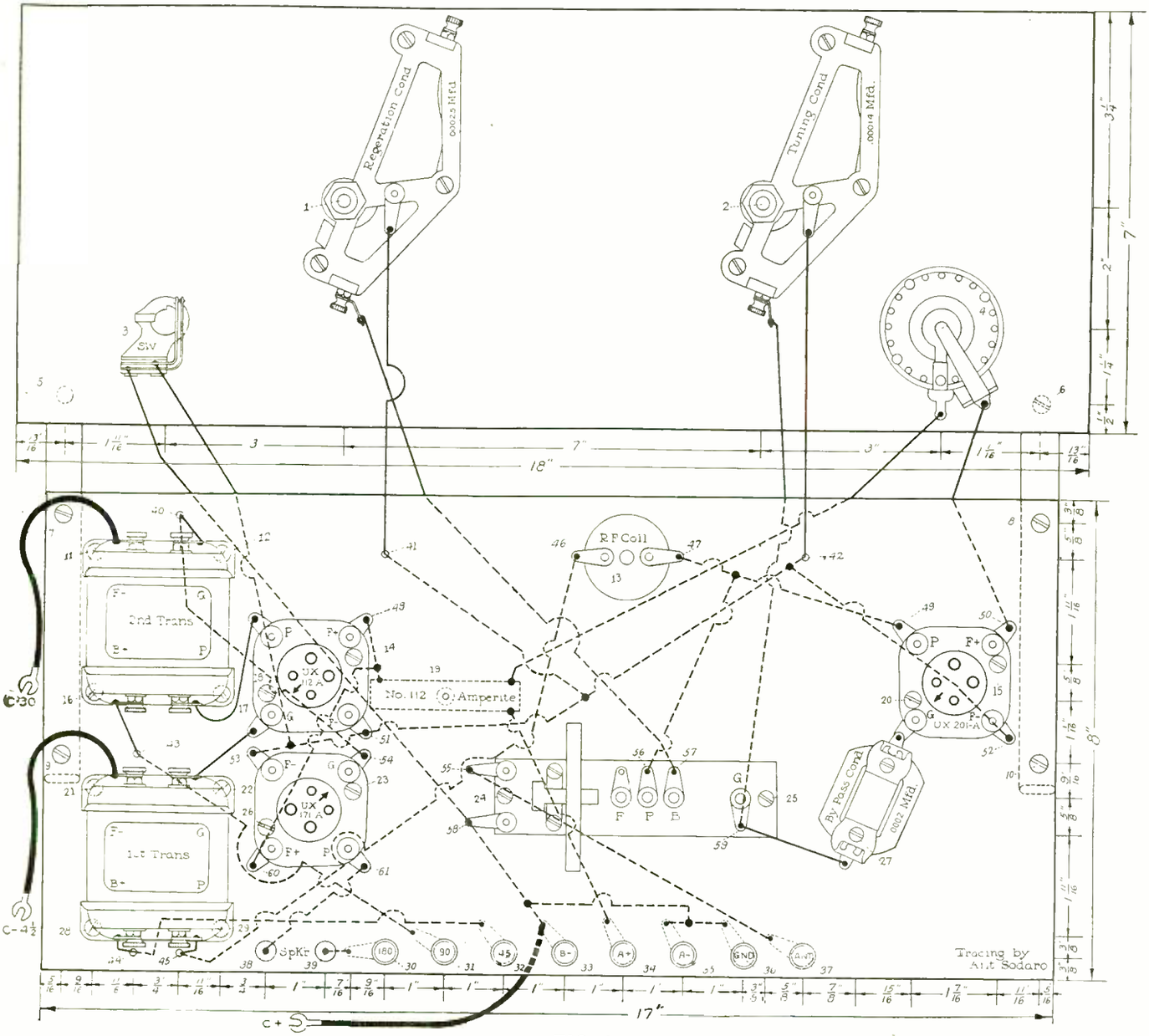


FIG. 4
THE PICTORIAL PLAN OF THE WIRING

In other words, L4 must not have so much distributed capacity that the coil looks like a condenser to the higher frequencies. Commercial coils of this kind are usually wound in slots with some separation between adjacent slots. this is to cut down the distributed capacity of the winding. And it is effective.

In a few cases it may be necessary to put two choke coils in the place of L4. One an ordinary RF choke, say of 85 millihenrys, and a second of about 150 microhenrys. These two should be connected in series. But if the circuit oscillates at all frequencies when condenser C2 is set at maximum the smaller coil is not necessary.

Audio Amplifier Faithful

If code were the only signals that could be received on the circuit it would be unnecessary to specify an audio amplifier system of supreme quality. Cheap transformers with sharp amplification peaks could be selected. But by far the greater interest in the short waves lies in broadcasting and in telephony. Both of these require high quality audio amplification. Consequently one has been chosen which amplifies all frequencies without partiality.

T1 and T2 are two Karas Harmonik transformers. The first tube in the audio amplifier is a 112A type and the last tube is a —71A type tube. Appropriate grid and plate voltages are provided for these tubes. An amplifier combination like this is capable of great volume without departing from the original purity of the signal.

Ballast Used

An Amperite R2 controls the filament current in the last two tubes. This is a No. 2 Amperite which carries ½ ampere, the proper amount for the two tubes. Note that both the Amperite and the filament rheostat are placed in the positive lead, which is contrary to usual practice. The object of this is to enable the grounding of the negative terminals of the filaments. Since the proper grid bias has been provided by means of batteries the connection of the rheostat and the Amperite is all right.

The filament switch S is put in the negative lead of the A battery, but the grounding of the circuit does not depend on this connection.

The plate voltages used are 45, 90 and 180 volts.

In the drawing two loudspeaker binding posts are shown in the plate circuit of the power tube. This does not mean that the speaker should be connected directly to the tube. A filter should be interposed between the loudspeaker and the tube in order to protect the speaker.

Set of Coil

Six different Aero coils are obtainable for the plug-in system. The designations and the wave length range of these coils when used with a tuning condenser of .00014 mfd. is shown below:

No. INT-0..... 13 to 29.4 meters
No. INT-1 ..... 15 to 33.5 meters
No. INT-2..... 31.5 to 68 meters
No. INT-3 ..... 57 to 133 meters
No. INT-4.....125 to 250 meters
No. INT-5.....235 to 550 meters

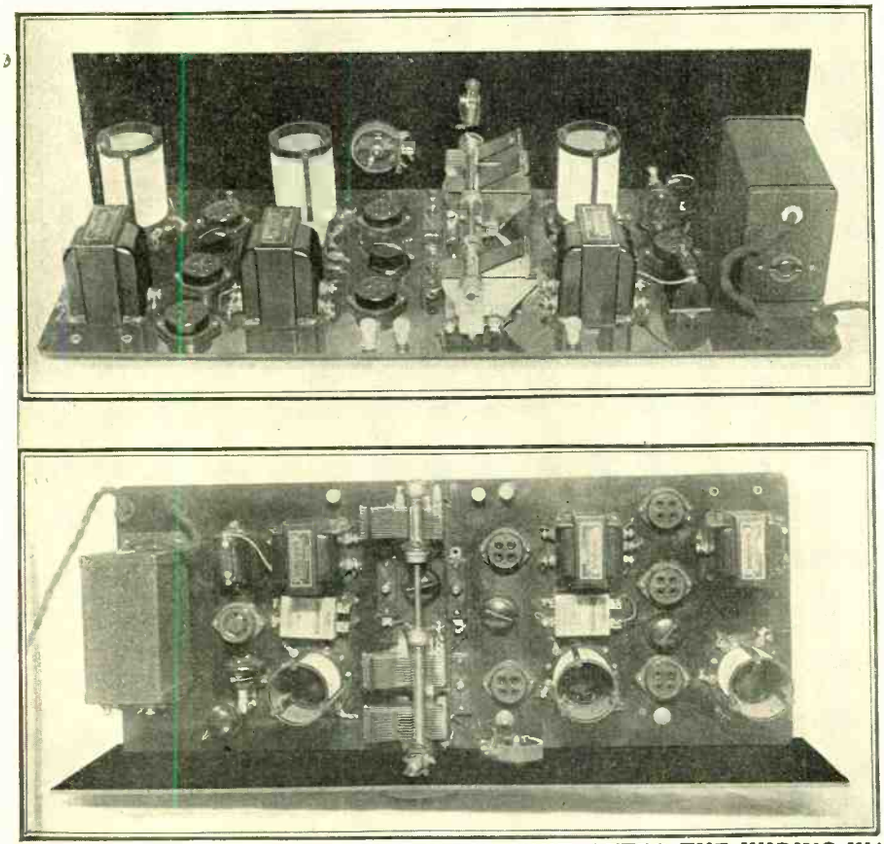
By adding a 100 mmfd. condenser in parallel with the tuning condenser and the No. INT-5 coil the wavelength range of that coil is raised to 725 meters.

Any reader who desires a full-size blueprint may obtain a complimentary copy by addressing J. E. Anderson, Technical Editor Radio World, 145 West 45th St., N. Y. City.

(Part II, conclusion of construction article, next week.)

The Supreme

By H. G.



OVERHEAD AND REAR VIEW OF THE CIRCUIT, AFTER THE WIRING WAS COMPLETED. THE LAYOUT OF PARTS IS WELL REVEALED. FOLLOW THIS SCRUPULOUSLY WHEN YOU BUILD THIS RECEIVER.

A GREAT public demand usually precedes every important development, and that of the batteryless radio receiver is no exception.

The set owner in the earliest days of broadcasting began to grumble about battery troubles. The B battery eliminator came out to stop the grumbling, and it did for a while until the receivers had grown to larger and more pretentious proportions. The eliminators had to grow, too, to keep up with the receivers, and in the process of development of larger B battery eliminators the radio fan grumbled and suffered. But that is all over now. The eliminators have outgrown the radio sets, and that is as it should be.

But the A battery situation was not so easily solved. That remained a grievous annoyance in every radio equipped home. Trickle chargers helped to some extent, but it was not until the advent of the AC tubes that the battery troubles were over. They were over because there were no more batteries in the set to run down, to get out of order, to burn the carpet. No more worry.

Careful Design Required

But an AC circuit must be carefully designed to avoid other difficulties which were not present in the DC operated set. For example, hum must be excluded.

While this problem requires care in its solution it is not especially difficult.

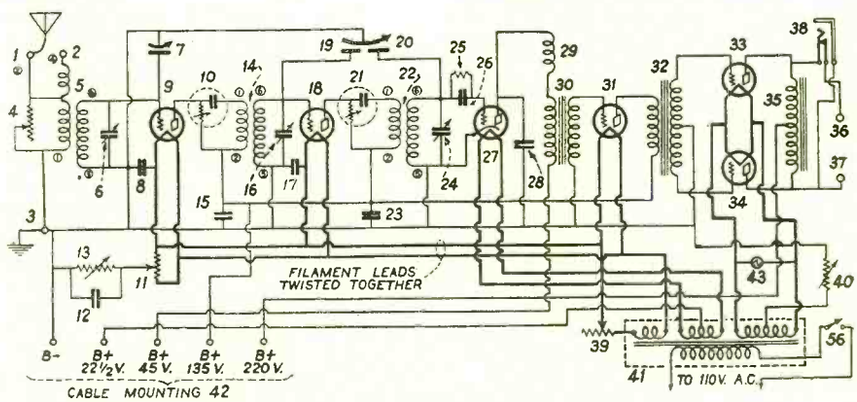
The sources of hum are well known and the remedies are equally well known in radio technical circles. The "Supreme AC Six" is an AC receiver carefully designed, and that accounts for its performance.

The fundamental circuit of this receiver consists of two stages of Phasatrol balanced tuned radio frequency amplification, a detector, one stage of single tube transformer coupled amplification, and finally a stage of push-pull.

Standard parts are used throughout and they have been selected especially for their adaptability for use in connection with the AC tubes. Thus Universal Aero coils are used because they are made to match the impedance of the AC tubes.

List of Parts
for Receiver

One Mar-Co vernier dial, new 1928 model with panel light (43).
Three Universal low-loss RF coils, type U-12 (5, 14, 22).
One .0005 mfd. Hammarlund Mid-Line Condenser (7).
Two .0005 mfd. Hammarlund Mid-Line Condenser with flexible coupling and rod (19, 20).
Three X-L variodenser (6, 16, 24) model N.
One Thordarson, type R-200 transformer (30).
One Thordarson input transformer, type T-2408 (32).
One Thordarson output choke, type T-2420 (35).
One Thordarson AC tube filament supply transformer, type T-2445 (41).
Two Electrad Phasatrols (10, 21).
Two Electrad variable resistances, type F (13, 40).
Five ½ mfd. Acme Parvolt series A cubical condensers (8, 12, 15, 17, 23).
One .001 mfd. Sangamo by-pass condenser (28).
One Samson RF choke, No. 85 (29).
One .00025 mfd. Sangamo grid condenser (26).
One 2 meg. Durham metallized resistor grid leak, with vertical single mounting (25).
One Yaxley 10-ohm air-cooled rheostat, type 110-K to be used as potentiometer (11).
One Yaxley Two Circuit Jack, No. 2-A (38).
Two Yaxley Pup Jacks (36, 37).
One Yaxley Cable Connector Plug with mounting, No. 660 (42).
Five Eby new style sockets, UX type (9, 18, 31, 33, 34).
One Eby new style socket, UY type (27).
Two Rolls Acme Celatsite wire.
One Carter ½-ohm "Imp" rheostat type IR-X5 (39).
One Carter 75-ohm "Imp" rheostat type IR-75 (4).
One Carter "Imp" power switch (56).
Three X-L "Push-Posts" (1, 2, 3).
One Cortlandt panel, 7"x26"x3/16".
One sub-panel, 10"x24½"x3/16".
Four brackets, low type.



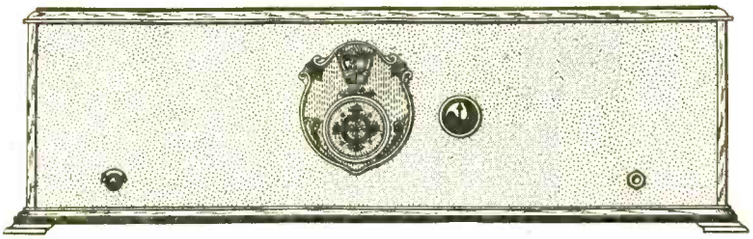
PICTORIAL DIAGRAM OF THE WIRING OF THE RECEIVER. FINE SENSITIVITY, WITHOUT APPRECIABLE HUM, IS ATTAINED IN THE SUPREME AC SIX, WHICH HAS AS ITS FINAL AUDIO STAGE A PUSH-PULL CIRCUIT, WHICH DOES MUCH TO RID THE CIRCUIT OF HUM, BESIDES KEEPING THE TONE QUALITY LEVEL HIGH. PUSH-PULL TENDS TO SUPPRESS THE EVEN HARMONICS, AND AS THE SECOND HARMONIC IS THE MOST PROFUSE SOURCE OF TUBE DISTORTION, THE QUALITY IS SPLENDID ALTHOUGH THE IMPRESSED SIGNAL VOLTAGE MAY BE HIGH.

AC Six

Cisin

LIST OF PARTS

One Thordarson R-171 Power Compact (44).
One Raytheon BH, 125 milliampere tube (45).
One Eby socket, new style (45).
One Acme Parvolt Microfarad Reservoir, type 171 (46, 47—2 mfd. each) (48—8 mfd.) (49, 50—1 mfd. each).
One Acme Parvolt 1 mfd. series A cubical condenser (51).
One Electrad Truvolt, type T-75 (52).
One Electrad Truvolt, type T-25 (53).
One Electrad Truvolt, type T-30 (54).
One electrad Truvolt, fixed resistance type B-45 (55).
Five X-L "Push-Posts."
One Roll Acme Celatsite wire.
One wooden baseboard.
(Note—The numbers in parentheses refer to the numbers on the circuit diagrams of the receiver and of the power supply.)



NOT ONLY EFFICIENT BUT ALSO ATTRACTIVE IS THE SUPREME AC SIX, WHETHER ONE GLIMPSES THE FRONT PANEL OR LIFTS THE LID TO SEE WHAT'S ATOP THE SUBPANEL.....

The tuning condensers are Hammarlund "Mid-Line" variable condensers. The condensers are ganged together so that the tuning is accomplished with a single Mar-Co dial. There may be a double section condenser and one single. Slight differences which occurs in the tuned circuits may be compensated for by three X-L Model "N" Variodensers.

Oscillation Controlled

A Phasatrol is used in the plate circuit of each RF amplifier to discourage any tendency toward oscillation or over regeneration with consequent distortion.

Volume is controlled by means of a 75 ohm Carter rheostat shunted around a portion of the primary of the first RF transformer.

A Durham metallized grid leak and a Sangamo moisture proof, mica dielectric grid condenser, connected into the circuit in the conventional manner, help to render the detector circuit efficient and noiseless. The detection is aided by a Sangamo .001 mfd. condenser in the plate circuit of the tube.

A Samson RF choke coil is used in the plate circuit of the detector and in series with the primary of the first audio transformer to prevent radio frequency currents from getting into the audio amplifier.

Push-Pull Used

The audio frequency amplifier is built with Thordarson transformers the R-200 being used in the first stage and the 171 push-pull amplifier in the last stage. This gives plenty of volume with a quality which is truly surpassing in its realism. The filament power is supplied by a Thordarson filament transformer, which has windings for 2½, 1½ and 5 volt tubes.

No rheostat is connected in series with the filament circuit of the heater type detector tube. The grid return is connected to the cathode and the heater is kept at a positive voltage of 22½ volts with respect to the cathode in order to minimize possible hum.

The filaments of the -26 type tubes are critical and therefore it is necessary to employ a rheostat to compensate for excess line voltages. A heavy duty ½ ohm Carter rheostat is used for this purpose.

The grid returns for these amplifier tubes must be brought to the exact electrical center on the filaments. This makes it necessary to employ an accurately center tapped potentiometer of low resistance across the filaments, on the tube side of the rheostat. A Yaxley 10 ohm potentiometer is suitable. Negative bias for these tubes is obtained from a 2,000 ohm variable Royalty resistor connected between the center tap on the 10 ohm potentiometer and the negative side of the B supply.

Details on the Push-Pull

The filaments of the two -71 type tubes in the push-pull stage are heated from the five volt winding on the heating transformer. Since these tubes are not critical no rheostat is used in the circuit. Neither is the grid return critical so that the return goes directly to the center tap on the 5 volt winding. The grid bias of 40 volts is obtained by a 2,000 ohm variable Royalty resistor placed in the lead to the center tap. The total voltage between B minus and the plate of the two -71 tubes should be 220 volts to give 180 volts effective plate voltage and 40 volts grid bias to these tubes.

All filament leads from the transformer to the tubes should be twisted.

The power supply is controlled with a Carter power switch placed in the primary winding of the heating supply transformer.

By-pass condensers are placed where indicated in the circuit diagram to direct the radio and audio frequency currents in their proper channels.

New AC Tubes Used

CeCo tubes are used in the receiver because these tubes are humless in operation and have a copious supply of electron emitting material to insure long useful life.

The wiring of the set should be done with Celatsite flexible wire and all connections should be well soldered, following the circuit diagram published herewith.

The ganging of the tuning condensers has reduced the tuning controls to one which makes possible the dignified simplicity of the panel layout shown in the illustration.

Plate Voltage Supply

A full wave Ratheon rectifier is used for supplying the plate voltage to this receiver. The circuit diagram of this is shown in Fig. 3. It is composed of a Thordarson R-171 Power Compact, a Raytheon BH, 125 milliampere tube, an Acme "Parvolt" type 171 condenser block, and Electrad voltage distributing resistors.

Observe that there are three variable resistors in the output voltage divider. These are used so that all the voltages can be adjusted to the correct values, that is, to the values which give the best results.

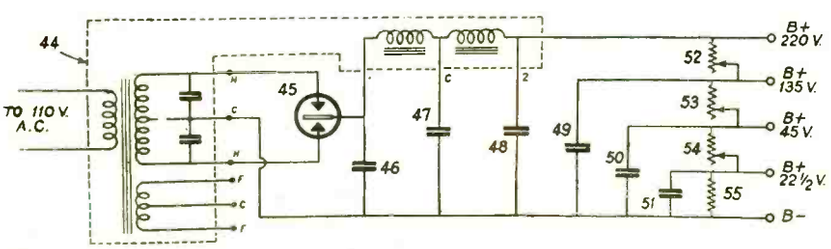
Accurate voltage adjustment cannot be obtained when fixed resistors are used because the actual voltages depend on the current that is flowing in each sector of the output resistance. And the current flowing depends on the number and type of tubes used on each voltage tap, on the filament current and on the grid bias applied to the various tubes.

How Current Divides

The power tubes draw the most plate current. None of this current flows through the resistor strip shown in the B power supply circuit.

Through (55) a steady current flows which is just sufficient to maintain a voltage of 22½ volts across the resistor. Through (5) flows this current plus that which flows between the heater and the cathode. Resistor (53) carries in addition to that the plate current of the detector. Resistor (52) carries still more by the amount of plate current used by the three —26 tubes which take 135 volts on the plates.

From this intricate division of the total current it is seen how difficult it would be to secure the correct voltages with fixed resistors. The only practical way of adjusting the voltages is by the aid of a high resistance voltmeter. The various resistors should be adjusted until the voltmeter reads 220 volts when connected between B— and B plus 220 V.



THE B POWER SUPPLY USES A RAYTHEON TUBE AND A THORDARSON COMPACT. THIS PARTICULAR UNIT IS EXTREMELY SIMPLE TO ASSEMBLE AND WIRE, AND GIVES ALL-SUFFICIENT VOLTAGE EVEN AT HIGH CURRENT DRAIN.

World's Record Super 10

By E. H. Scott

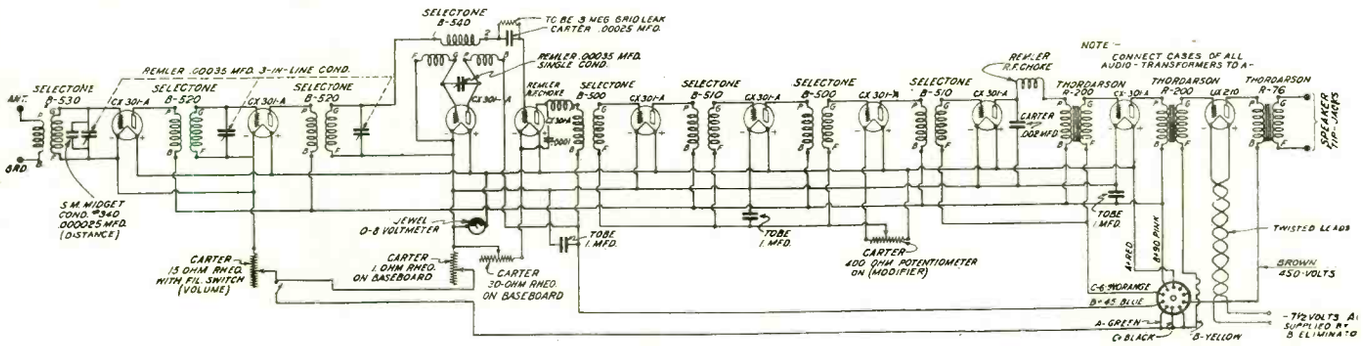


FIG. 2
THE SCHEMATIC DIAGRAM OF THE WORLD'S RECORD SUPER 10.

(Constructional data on this receiver were published last week, issue of March 17. Check-up, testing, balancing and operation are discussed in the following article.)

A 112-A power tube in the first audio stage will give better tone than can be obtained with the standard arrangement. In fact this combination will give practically perfect tone quality without a trace of distortion at practically any degree of volume and on any kind of selection, and is strongly recommended.

CHECKING UP WIRING

I should now advise you to take the schematio circuit diagram and carefully check all connections by it to see that you have all correct. Carefully examine all soldered joints to see that the solder is well flowed in. Go over all nuts to see that they are tight. Remember that either a loose soldered connection or a loose nut connection will manufacture lots of static for you.

FIRST TEST OF RECEIVER

Connect the A battery to cable and plug in, then insert a tube in each socket in turn. Turning on Fil. switch by turning 15 ohm rheo on slightly. If tube lights O.K. then connect up the B Eliminator. Insert a tube in one of the RF stages then switch on filaments and plug in Eliminator for a second. If tube stays lighted you know you have everything hooked up all right, so insert tubes in all sockets. Use regular lamp cord to connect the AC posts on B Eliminator to the binding posts of sub-panel that are connected to the filaments of the 210 power tube. BE SURE TO TWIST THESE WIRES TO ELIMINATE HUM.

Plug the speaker tips into the tip jacks and turn on the filament by means of the 150 ohm rheo. Adjust the 1 ohm rheostat until the voltmeter shows between 4¾ and 5 volts. You will not get satisfactory results with a battery that shows less than 4¾ volts on the voltmeter. Now plug in the B Eliminator. Turn on the 30 ohm rheostat about three-quarters, finally adjusting it on a distant station.

Tune in on a local station and see how the set sounds. It may be a little critical until you have the three gang condenser balanced.

HOW TO BALANCE CONDENSER

Tune in a station about 300 meters. To adjust, use the wooden screw driver furnished with the gang condenser. You will notice a small screw between each set of condenser plates. First screw down the one in the center practically as far as it will go. Now try turning the screw on the end up or down. You will notice that when you get to a certain point that the station will come in loudest and this is the proper point to leave it. Now adjust screw on other end (next drum) moving up or down until you get the best volume. Last, adjust the screw in the center in the same way. Before starting be sure that the midget condenser plates are about half way out.

This is only a rought adjustment. The final adjustment should be made on a distant station, the farther away the better, but always on a station with fairly low wavelength.

When this condenser is balanced up properly, the wavelength dial will tune quite sharply and the stations will silde in and out quite smoothly. When it is not balanced up properly you will notice that the set oscillates very easily, especially at the low wavelengths and the dials will appear broad in tuning.

The 15 ohm rheostat in the center acts both as a volume and oscillation control. The Pot. acts principally as a volume control.

Owing to the frequency which the transformers are peaked at, the two dials will not run together at all points, but cross about the center of the scale. This is not anything to worry about, as you can write the call letters of the stations on the paper dials and will soon learn where the various stations come in. They will always come in at the same point, providing you keep the filament voltage the same at all times.

(Next week efficiency data on the World's Record Super 10 will be set forth in authoritative detail by Mr. Scott.)

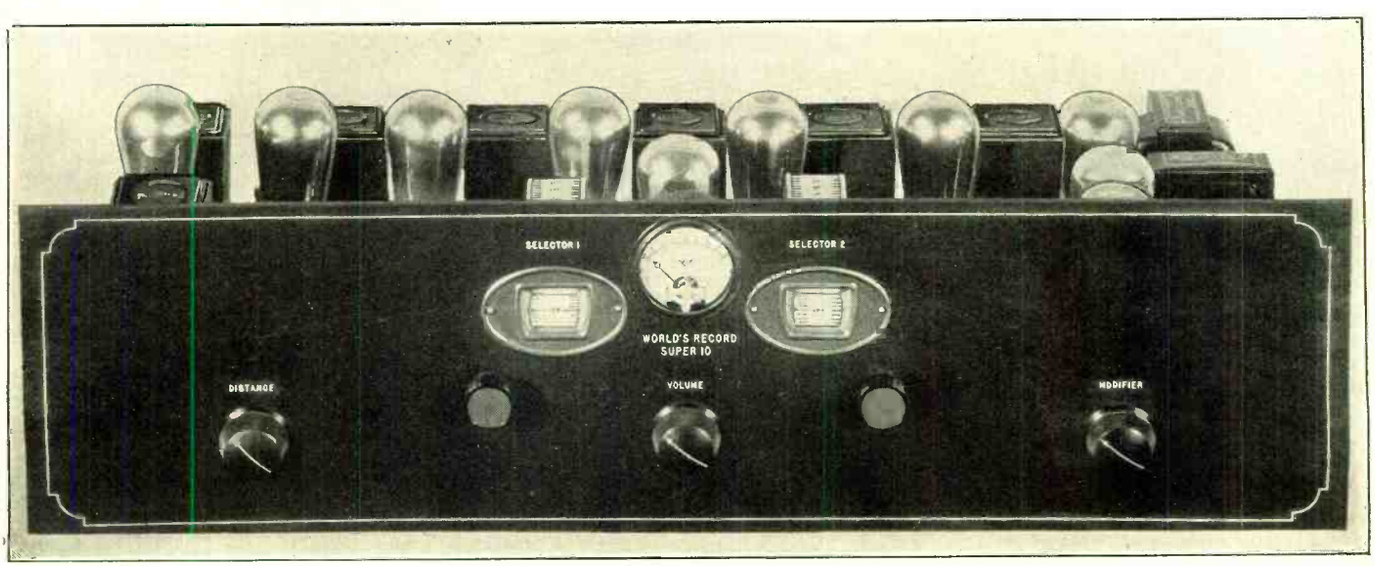


FIG. 3
THE FRONT PANEL OF SCOTT'S SUPER HAS GREAT EYE APPEAL AND SUPPORTS SMOOTHLY WORKING PARTS.

How I Improved My Set Without a Cent's Cost

By Billy Honduras

SOMEBODY once said that the best things in life are free, and several thousand years later a fellow wrote a song around this idea, and mentioned love, the trees, the air, the birds, etc. I'll sing a song to somewhat the same tune, only I'll mention radio parts. None of my friends sells love, trees, air, birds, etc.

But merchandising has nothing to do with it, anyway. In the first place, as you're not going to be asked to spend any money, you're not going to buy anything, still you're going to improve your set.

I'd like to meet the fellow who will kick about the price.

Set Had "Complications"

It so happens that I had a set that suffered from several ailments. "Complications" would describe the situation, since even doctors drag in that word as a generic description of a conglomeration of ailments too mysterious for them to diagnose. If you want to think that my predicament was like such a doctor's, who can stop you?

Making your set better without any expense at all should be worthy of anybody's close inattention. Therefore disregard me when I say that not only can it be done but it has been done. I dare you.

In the first place, I was troubled with hum. My set had an AC operated last audio tube. The rest of the tubes were of the DC type. The circuit was sensitive, on paper, but thick-skinned in actual practice. Yet it did hum faithfully and well, showing it was always in good humor. The set with a smile wins, but the set with a hum loses.

Therefore I set about to make my set a winner. I tried various expedients, but as they did little or no good I'll save you the time you would otherwise eagerly waste by reading about it.

Finally, I analyzed the resistor that I used for obtaining negative grid bias for the last tube. I had figured that as the center tap of the secondary of the power transformer was equivalent to what would be F minus in a DC operated tube circuit, that if I grounded the midtap I'd be doing quite the right thing. I spent several hours testing various connections —all save this one—until I discovered that the midtap was the wrong thing to ground. I then soldered the ground connection to B minus, removing it, of course, from the midtap, and, believe it or not, the hum virtually disappeared.

The total cost was zero.

Absolutely Nothing Spent

You may say in contradiction, that I surely spent something. First, my time. Well, that's worth nothing, as all my employers have proved. Second, solder costs money. But I got a roll of it as a birthday present from my wife, who encourages me to solder, because I drop only a few molten tokens on our Chinese rug. Third, I had to pay for the electricity that heated the iron. But I know my meters.

So it cost me nothing.

Next, I had a screen grid tube in the first radio stage. The coupler that had its primary in the plate circuit of that tube had a fairly large primary, about 26 turns I think, but this was midtapped for a neutralization capacity connection in some other circuit for which the coils had been specified. In wiring my receiver I had so connected the leads that half of the primary was in service and the other half dead ended, going nowhere.

Amplification Doubled

All I had to do was to remove the B plus connection from the midtap and make it instead to the actual end of the winding. This gave me a primary twice as large as the one I had been using and also gave me about twice as much amplification as I had obtained with the skinny primary.

These screen grid tubes need primaries larger than do the other DC, or the AC, tubes. Persons who complain that they don't notice the difference between screen grid tubes and —01A tubes simply confess they're using undersized primaries.

Still no money spent.

One of the coils in the set was too close to the panel, and body capacity effects resulted. I used to have the devil's own job tuning in distance, body capacity making it necessary to compensate for its expected effect, if the station was to be heard at all. At different frequencies this compensation differed, so I had to do logarithms to get straightened out. And how I do hate logarithms. So when I moved the coil farther back, I lost the body capacity effect entirely, and besides reduced the stray inductive coupling between this coil and others, so the set became more stable.

AC Cords in New Position

The set is supplied by a B eliminator that I built with my own hardened hands. The feed line came in through an opening in the crystalline-finished case that housed the eliminator. Also the speaker connection was made through this aperture, hence the feed line and the speaker lines were in parallel, electrically, and that's as good a way as any to get coupling. So I introduced the feed line through another hole, at the penalty of drilling this hole in the metal, and at first trial I found the last vestige of hum had disappeared.

I did this two days after I had grounded B minus, so this was to be a humless life for me from then on.

But hold on a second! I forgot to outline an intermediate step. It is true humlessness came upon me finally, but, alas, I discovered that after I had been operating my set—particularly the power pack that fed it with B food—for a couple of hours that friend hum would merrily inject itself into the program, and would gradually increase in intensity as the evening wore on and my nerves wore out.

Too Hot

This growing hum, I discovered, was due to the extreme heat inside the container of the B supply, and taught me the lesson of leaving the lid of the can open all the while the set was being used.

As I'm not particular whether the set hums or whistles when it's not in use, I could leave the lid on then, but I'm for the lid-off policy from now on, always, and never since has that guilty lid even touched the top of that innocent can.

The reason for the heat playing humming havoc, I suppose, is that the resistors get hotter than the code calls for, and so do the condensers. The resistors thus lose in resistance value and upset the cicuit balance, while the condensers function less efficiently because of the imperiled wax.

Well, I did all these things, spent not a cent, now have a receiver and B supply that work to perfection, and am not a bit sorry for the saving I effected.

Now, if you should ask me how come that I did all those things wrong in the first place, my answer is: "I don't know, don't care and—dun't esk."

Jagel Found Radio His Stepping-Stone

Frederick Jagel

For Frederick Jagel, young tenor of the Metropolitan Opera House, who sang in the Atwater Kent Hour recently, radio was a stepping stone to success.

Prior to his study abroad, young Jagel had broadcast on numerous occasions, and was building a reputation for himself nationally on the radio when he went to Europe to study.

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Two AC Amplifiers for

One Has Single Audio Stage with Power Supply, Other Two-Step Amplifier—Tremendous Volume without Distortion Achieved for First Time for Home Use—Distortionless service to Audiences of 5,000 to 10,000 Outlined Also

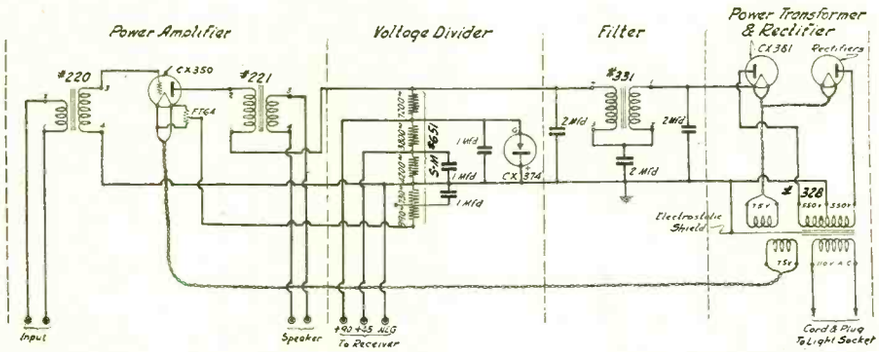


FIG. 1

A FINAL AUDIO STAGE IS SHOWN IN THIS 681-250, WITH B AND A SUPPLY, THE OUTPUT BEING A —50 TUBE. IF A TWO-STAGE AUDIO DESIGN IS DESIRED, FOLLOW FIG. 2.

By F. Edwin Schmitt

IN the search for high quality radio and electric phonograph reproduction progress has been made along the three general lines of (a) loudspeakers, (b) audio coupling devices and (c) audio power tubes, insofar as the home constructor and average radio listener are concerned.

In the last several years thoroughly high quality coupling devices and loudspeakers have been made available which to most of us seem to leave little to be desired. The larger tube manufacturers, while moving with the general trend, have not in the past seen fit to put out power tubes capable of meeting the simple requirement of distortionless amplification of all musical frequencies with volume sufficient for average home entertainment.

This is evidenced by the fact that within the past season not only have amplifiers using the —10 power tube become popular, but more experienced and enlightened fans have actually gone to push-pull power output stages employing two —10 tubes, such a combination delivering approximately three times the undistorted power output available from a single —10 tube.

New Tube Gratifying

Obviously, with the push-pull —10 stage becoming more and more popular for high grade custom-built broadcast receivers, the fact could not be ignored that the —10 tube alone was inadequate for distortionless reproduction with really high quality, and it was therefore most gratifying to learn recently of the advent of the —50 super-power amplifier tube.

The new —50 has about three times the undistorted power output capabilities of the —10 and is quite remarkable.

The —50 tube may not be used interchangeably with —10 tubes, for while the plate, grid and filament voltage requirements of the —50 and —10 tubes are much the same, the current drawn by a —50 tube delivering maximum output is approximately three times that of the —10 tube.

Must Stand Load

This means that a conventional power amplifier designed to deliver 425 volts to a —10 tube would only deliver approximately 300 to 325 volts to a —50 tube and at such an operating voltage the —50 tube is not appreciably superior to the —10. The characteristics of the —50 are given below:

Operating Voltages and Currents

Filament Volts	7.5
Filament Amperes	1.25
Plate Volts (Max.)	450.
Plate Current (Max.)	55 m.a.

Tabulated Data

Plate Volts	Neg. Grid Bias-Volts	Plate Current m.a.	Undistorted Power Output Milliwatts
250	—45	28	900
300	—54	35	1500
350	—63	45	2350
400	—70½	55	3250
450	—84	55*	4350*

* Approximate.

The First Case

The first amplifier (Fig. 1) consists of a high-grade flat characteristic audio and output transformer with a —50 tube forming a single stage power amplifier which may be used to replace the last audio stage of any receiver, with a tremendous improvement in quality and power, or it may be used as a third stage power amplifier with a well-designed receiver having a good audio amplifier.

The second amplifier (Fig. 2) is a complete two-stage outfit employing a —26 first stage tube and the —50 second stage tube. This amplifier will give marvelous quality at very good volume when operating directly out of the detector tube of any standard radio receiver, or it will operate for phonograph record production with a standard magnetic pick-up, giving volume and quality on a par with that obtainable from the more expensive electric phonographs.

AC Operated.

In each case the amplifier is completely light socket operated, deriving all power from any 105 to 120 volt, 60 cycle, lamp socket. Each power unit also furnishes B power for the operation of any standard receiver, at 45, 90 and 135 volts at currents up to 70 milliamperes with practically constant voltage due to the use of a UX874 automatic voltage regulator tube.

In the two-stage amplifier a filament transformer is shown included, which will furnish 1½ and 2¼ volts to any AC tube equipped receiver. (This transformer could, of course, be included in the single stage power amplifier just as well).

Both assemblies are essentially similar, varying only in the inclusion, or omission, of the first audio stage tube and transformer together with the optional filament lighting transformer.

This power supply delivers approximately 425 to 450 volts to the plate of the —50 tube with the requisite C bias, while a total of 70 milliamperes are available from the B binding posts for receiver operation (up to 10 milliamperes at 45 volts, up to 40 milliamperes at 90 volts and up to 20 milliamperes at 135 volts.)

The filament transformer may be easily included in the assembly to provide 1½ and 2¼ volts for an AC tube equipped receiver and 1½ volts for a first audio stage tube incorporated in the amplifier assembly. Filament voltage for the —50 and —81 tubes is obtained from the large power transformer.

Remarkable Quality

The quality of reproduction obtainable from either amplifier is truly remarkable, being notably superior to that obtained with amplifiers employing even a single —10 power tube, while it is utterly out of the class of the tone that may be obtained with 112 or —71 power tubes. The quality of a —10 push-pull stage and the straight single tube —50 power stage is practically on a par, with sim-

LIST OF PARTS

One S-M 328 full-wave power transformer	18.00
One S-M 331 Unichoke filter	8.00
One S-M 220 audio transformer	8.00
One S-M 221 output transformer	7.50
Four S-M 511 tube sockets	2.00
One Ward-Leonard 651 resistor set	7.00
Three 2 mfd. Acme Parvolt "C" condensers	10.50
Three 1 mfd. Acme Parvolt "A" condensers	3.75
One Frost FT 64 balancing resistor	.50
Seven Eby binding posts (INPUT, INPUT, SPEAKER, SPEAKER, B—, plus 45, plus 90)	1.05
One cord and plug	.75
Twenty-five feet fabric insulated hook-up wire	.50
Hardware consisting of machine screws, nuts, collars, threaded brass rod, insulating bushing and binding post insulating washers	.50

the Big New-50 Tube

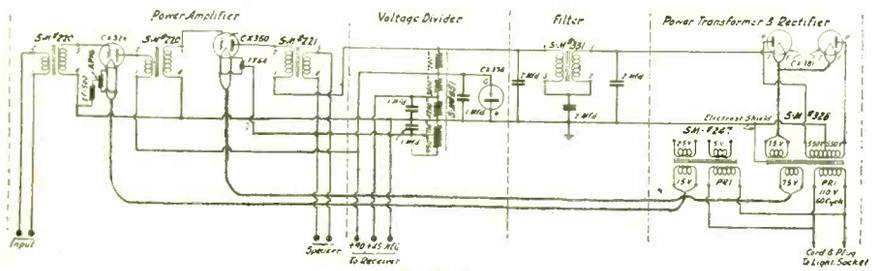


FIG. 2

A FULL-WAVE RECTIFIER, DELIVERING 550 VOLTS AT RATED DRAIN, USING TWO —81 TUBES FOR RECTIFICATION, AND PROVIDING TWO STAGES OF TRANSFORMER AUDIO, FEEDING A —50 OUTPUT TUBE. THE UNIT IS AC OPERATED. A FILAMENT TRANSFORMER TAKES CARE OF THE —26 TUBE. THIS IS THE S-M 682-250.

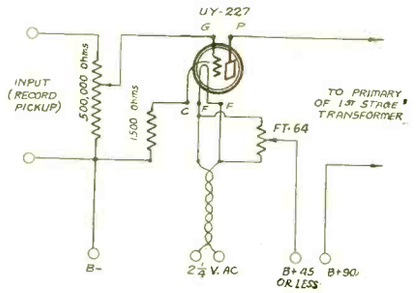


FIG. 3

PICK-UP COULPING STAGE IF STILL MORE VOLUME IS DESIRED, PARTICULARLY FOR PHONOGRAPH REPRODUCTION.

plicity, initial cost and tube life being far in favor of the —50 tube.

Big Improvement

The addition of the single stage amplifier to any standard receiver as a power output stage and receiver B supply would be a tremendous improvement, while the use of the two stage amplifier assembly and receiver A B C supply would be almost ideal, for it would allow any receiver, constructed with the audio amplifier omitted, to be operated directly from the two stage Unipac.

The 250 amplifier is naturally applicable to any standard receiver or for phonograph amplification.

The 135-Volt Provision

In the list of parts no provision has been made for obtaining 135 volts, and if this is desired an extra Eby plus AMP binding post with insulating washers should be added, to be connected to a tap found near one end of the larger section of the Ward-Leonard resistor, together with the necessary extra 1 mfd. bypass condenser.

For the two-stage amplifier (Fig. 2) it is simply necessary to add to the adjoining list of parts one S-M 247 filament transformer at $5.00, one S-M 220 audio transformer at $8.00, one Carter AP10, 10 ohm potentiometer at 75c., one 1 mfd. Acme Parvolt "A" condenser at $1.25, one S-M 511 tube socket at 50c. and one Yaxley 1,500 ohm resistor at 50c.

If A power is desired for AC tube operation in a receiver, four extra plain Eby binding posts will have to be added for connection to the filament transformer lugs.

The assembly of either amplifier is quite simple and an enjoyable task. The work can be laid out in such fashion as suits the constructor's convenience and necessity, for there is ample latitude to make the supply and amplifier fit any physical requirements. Breadboard layout gives good service.

Assembly Set Forth

All the binding posts should be carefully mounted with their insulating washers, and tested to make sure there is no short circuit to the bulkhead, except in the case of the B— and one of the speaker binding posts, which should make contact with the bulkhead.

The larger section of the Ward-Leonard resistor should be held to the back of the bulkhead using two collars and the end lugs to support it, the two inner lugs at each end being the end connections of the resistor, while the tap located about one-third down the resistor is the 135 volt B tap.

Single Output Tube Performs on a Par with Push-Pull Stage that Uses Two —10 Tubes—Variety of Choice Afforded in Physical Layout.—Good Ventilation Must Be Provided, as Heat Is Strong.—All Filaments AC Operated.

The 9,720 ohm section of the resistor set should be mounted on a long threaded brass rod, as shown, and care should be taken not to wire it in backwards, or the amplifier will not work. The whole job including the wiring is so simple that practically no cautions need be given except that the filament leads from the transformers to the various tube sockets should be twisted.

The unit should be carefully tested by having all tubes inserted and, if possible, have voltages measured with a suitable high resistance B eliminator voltmeter and an AC voltmeter. If such meters are not available everything can be assumed to be all right in the circuit if assembly has been properly executed.

Leave the Cover Open

The amplifier may be inserted in a case to be held in place by two screws in each end of the container, with the hinged portion of the cover over the tube compartment. (The cover over the tube compartment should always be left open when the amplifier is in operation, for the tubes become extremely hot.)

In operation it is simply necessary to connect the INPUT binding posts of the single stage Unipac to the first stage output of any radio receiver and connect the loudspeaker to the SPEAKER posts of the Unipac amplifier.

All receiver B leads may be connected to the B binding post of the Unipac, which will furnish B power to the set. Now, in the case of the two-stage amplifier, either a magnetic record pick-up or the detector output of a radio receiver can be connected to the input posts of the Unipac, which will furnish all necessary audio amplification for good loudspeaker operation, and will in addition furnish B voltages to the receiver at the values marked on the binding posts, and A voltage for AC tubes at 1½ and 2¼ volts, enough for four to five —26 and one to two —27 tubes.

Serves 5,000 to 10,000 Persons

Either amplifier if fed with a sufficiently strong signal will develop enough power for operation of one to four or more loudspeakers and will give thoroughly satisfactory coverage of a theatre with a seating capacity of 5,000 persons, or an outdoor assembly of 10,000 or more persons.

If the two-stage amplifier is to be used for record reproduction only, as in the case of a dance hall, it will develop enough power for a hall over 100 feet square, using two to four speakers grouped together.

If more volume is desired the circuit illustrated in Fig. 3 should be added, requiring an S-M 512 tube socket, a 1,500 grid resistor, an FT64 balancing resistor, a 500,000 ohm potentiometer and one —27 tube.

It is also quite feasible to substitute an S-M 242 microphone transformer for either the first stage transformer or for the record pick-up, so that with a Kellogg or Western Electric double button carbon microphone and a couple of dry cells voice amplification can be had.

A Great Advance

With one —26 and one —50 tube, voice coverage of a theatre, or crowd of 5,000 persons, is easily had. With the extra —27 tube added (and the 242 microphone transformer at least three feet from the amplifier case) coverage of a crowd of 25,000 persons, or a large hall or auditorium, is had both cheaply and effectively.

The assembled amplifier of either type makes a handsome and permanent addition to any radio receiver, and the power and amplification available will be about the finest that may be had for the operation of any receiver for years to come. It is doubtful if any real improvement upon the amplifiers described herewith will be effected in the next three or four years.

(Some suggestions for physical layout will be published in next week's issue, dated April 7.)

Six Simple Suggestions fo

1. *WHEN large pieces of metal are to be soldered, use a large iron. Radio bus bar alone does not require a large iron, but if the bus is connected to a large metal piece, like a condenser nearby, then a large iron must be used.*

3. *THE surface of the joint must be cleansed of oxides. Part of this work is done by the flux. But heavily oxided parts should be scraped with a knife or filed. Nickel plating etc. should be so treated.*

2. *SEE that there is no draught in the room when you are soldering. A draught tends to cool the joint you're trying to heat.*

4. *SEE that the two wires or lugs to be soldered make a mechanical joint and stay together before your attempt to solder. Apply the flux (if separate) at this time.*

5. *DO not melt the solder on the iron and carry the molten solder thus to the joint, but heat the components that are to be soldered, and as part of this process melt the solder then and there.*

6. *TUG at the joint after soldering, to test security.*

By Herbert E. Hayden

SOME radio experimenters often have trouble due to poor soldering. Joints look messy and uncertain, and often the solder will not flow at all. Such experimenters envy the clean and neat soldered joints turned out by the professional and wonder why the contrast.

An inquiry into the reasons discloses that the professional is using the same kind of soldering iron, the same kind of solder, and the same flux. Why, then, should there be such a difference?

The perplexed experimenter does some more inquiring and learns that there are many tricks of the trade.

Tricks of the Trade

Let us first consider the tool, which is usually a lump of copper and is called an iron. The object of this is to transfer heat to the work, or the joint to be soldered.

For good soldering the iron must be hot, not too hot, but hot enough to heat the joint to be soldered enough to melt solder. To get the work hot with an iron is a real trick which involves the nature of heat, or the behavior of heat toward metals, metallic oxides, dirt of various kinds and air.

A given size of metal, as copper for instance, holds a definite amount of heat for a certain temperature. If the metal gains heat, the temperature rises. If it loses, the temperature falls. When the hot iron is put in close contact with the metals to be soldered, some of the heat in the iron is conducted into the other metals. Hence the temperature of the iron falls and that of the work rises. The resulting temperature of the work may not be hot enough to melt solder.

Large Iron Needed

If the soldering iron is small in comparison with the metals heated with it, the temperature is sure to drop below that required for melting solder, even if the iron is electrically and continuously heated. Hence when large pieces of metals are to be soldered a large iron is needed, and there should be enough heat behind it to raise the temperature of the work to the required value.

If the work to be soldered consists of two small pieces of metals, such as the ends of the fine wires or two small terminal lugs, a small iron is enough because the small pieces of metal cannot take much heat from the iron without getting hot.

When the junctions to be soldered are small but are closely connected to large bodies of metal, the effect is the same as if two large bodies of metal are soldered because metal is a good conductor of heat and the heat supplied to the junction is quickly conducted into the large bodies. Hence the junction will not get hot enough without a plentiful supply of heat from the iron.

Large bus bar wires are often difficult to solder with a small iron because the heat is rapidly conducted away from the junction by the wires, as shown by the fact that spaghetti or other insulation on the wire will "cook" for several inches on either side of the junction

The heat storage capacity of a piece of metal is proportional to its volume, and its heat conductivity is about the same as its electrical conductivity. The larger its cross section the more rapidly is the heat conducted away.

Oxides Stop Heat

Metallic oxides are not good conductors of heat. In fact they are often good heat insulators. Hence the work to be soldered must be free of oxides. The soldering iron also must be free of oxides. Otherwise the heat will not move from the iron to the work fast enough.

The iron is usually tinned to keep it free from oxides and to aid in the transfer of heat. Tin, or solder, is a good conductor of heat.

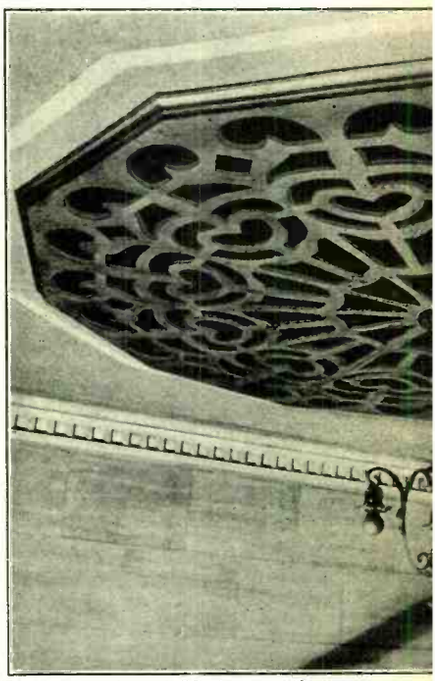
Any non-metallic dirt is usually a poor heat conductor. Hence both the iron and the work should be kept free of it. A well-tinned iron often appears to need retinning because of an accumulation of dirt on the surfaces, but if the tin has not actually been burned off, or rubbed off, the iron can be restored to well-tinned brightness by wiping it with a cloth.

It is well to keep a suitable piece of cloth near all the time, so that the iron can be wiped as soon as any dirt is seen on it. If this is done it is also very easy to re-tin the iron occasionally and thus keep it constantly in first class condition.

Cooling Draughts

A draught of air near the iron and the joints has a very decided cooling effect, and for this reason should be kept away while soldering This is usually more important while soldering small pieces than large, for the small pieces will cool much more easily than the large. The small pieces at a given temperature contain only a very small

WORLD'S LARGEST SP



(Underwood and Underwood)

THE LARGEST RADIO LOUDSPEAK CEILING OF A RESIDENC

WCDA Sues WOR fo

The Italian Educational Broadcasting Company, operating WCDA, New York City, has brought suit for $100,000 in Federal Court against L. Bamberger & Co., operating WOR, claiming that WOR is interfering with the reception of WCDA.

WOR is operating on a frequency of 710 kc and WCDA on 1,420 kc, which is the second harmonic of station WOR. Heretodyne whistles are caused by the carrier of WOR in all receivers tuned in on station WCDA, says the complainant, and these whistles make it impossible to receive programs from WCDA clearly. It is charged that the engineers of station WOR are negligent and that they permit the radiation of the second harmonic.

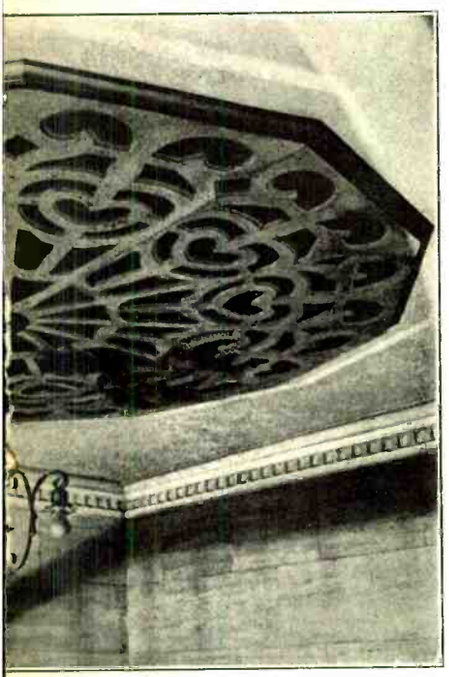
Interference between two stations one of which is operating on the second harmonic frequency of that of the other is common. There are several cases of the kind in the New York area. For example, WEAF, operating on 610 kc, interferes with stations WAAT and WEVD, both operating on 1,220 kc. WJZ, 660 kc, interferes with stations WSGH and WBBC, 1320 kc. WOR, interferes with WCDA and WRST, 1420 kc.

RF Tubes of Set Rectify

The interference is not necessarily caused by the radiation of the second harmonic by the lower frequency stations. Most of these stations send out a very pure wave, which can be demonstrated by the fact that if a receiver is tuned in on one of them when no second harmonic station is operating no reception results,

r Safe and Sane Soldering

EAKER HITS CEILING



R IN THE WORLD, BUILT INTO THE
E AT OAK PARK, ILLINOIS

amount of heat while the large pieces contain much.

Cleanliness of the iron and the work has already been discussed from the point of view of heat conduction. But there is still greater reason for keeping the surfaces clean during soldering. Tin or solder will not join metallic oxides nor dirt. But it will join a clean copper or brass surface, free of oxides, provided that the metals are hot enough.

Use of Flux

Hence before applying heat to the junction the two pieces must be carefully cleaned. Particularly the oxides on the surfaces must be removed. If the pieces to be soldered together are already tinned this precaution is unnecessary. But they should be wiped clean just the same.

If the parts to be joined can't be cleaned with a rag, scrape or file them.

When heat is applied to a metal surface the oxide forms much more rapidly than when it is cold. The oxygen in the air combines with the metal more rapidly when hot than when cold. The only practical way to prevent the formation of oxide on the clean surfaces is to keep the oxygen away from the metal. This is done by a flux, which is a material that excludes the air and that does not itself combine with the metal. Some fluxes actually remove the oxide and other impurities.

Corrosive fluxes, though they greatly simplify and speed up soldering, are not suitable for radio purposes, because if every trace of the flux is not removed immediately after soldering, the remaining flux will attack the wires and ultimately break or impair the circuit. This point is the more important the finer the wires are.

Rosin Flux Used

The flux most generally used in radio work is rosin. While this is not nearly as effective in attacking oxides as some other types of flux, it is the only fluxing material which can be used with safety and which at the same time has the necessary fluxing value.

It is not corrosive and hence the only object of removing it after the soldering has been done is to improve the appearance of the work.

But rosin is a good electrical insulator. Care should be taken to insure that a rosin joint is not formed. In a joint of this type the rosin, not the solder, holds the two metals together. No current will flow through the joint under such conditions. Thorough heating prevents this occurrence.

Tug at the joint after solder has cooled, as a test of security.

Flux in Core

Solders ordinarily used like rosin core solder, contain the flux material in the core. This is the most convenient way of applying the flux and the solder. As the solder is applied to the heated joint, the rosin melts first and flows over the joint.

When it has been thoroughly fluxed the heat is removed and after a few moments the solder has solidified and the job is complete.

One point about flux-core solder, particularly rosin-core, is that if the solder is melted on the iron and carried thus to the joint, it has a tendency to roll of the iron, as the flux makes a slippery path. This trouble arises again from erroneous practice. While it is often convenient to melt some solder on the iron and carry it molten to the joint, this tends to incinerate the solder and cause a brittle joint. The two parts to be soldered should be heated by the iron and, as part of the continued process of heating, the solder should be melted right then and there—at the joint. Hold the iron there until the solder flows freely about the joint.

Before soldering any joint for radio make it a mechanical joint, so the two parts stay together without any aid. Then solder.

Variable Resistor Controls Feedback With Pleasing Ease

The most common method of controlling the amount of regeneration in a receiver is by means of a tickler coil.

Perhaps the next most popular method is by means of a variable condenser. Both of these methods are excellent, or they would not be used so extensively. But they are not the only methods, nor indeed the best under all circumstances.

There is another method of varying the amount of regeneration and the volume. And that is by a variable, smooth-running resistor.

For example, suppose that the tickler coil is fixed in position as well as to the number of turns. In that case a variable condenser is not necessarily the most suitable control. The variable resistor, if smooth-running, is excellent.

The condenser can also be fixed if the resistor is used. An important advantage of this combination is that the space required by a fixed resistor, a fixed condenser and a variable resistor is very much less than when a variable condenser is used.

The fixed coil need take no room in addition to the tuning coil. The space required by a fixed condenser of about .001 mfd. is negligible. And there are smooth-running variable resistors of the required resistance value which do not occupy much more room than the fixed condenser. An example is the Volume Control Clarostat. It is so small that it does not take any more room on the penal than the knob with which it is controlled.

Surely such control of the regeneration in many circuits is worthy of consideration.

Independent of Frequency

If the condenser is chosen properly with respect to the inductance of the tickler it is possible to obtain an almost uniform degree of regeneration independent of the frequency, that is, of the setting of the tuning condenser.

If the fixed condenser is too small, say .00025 mfd., the regeneration will be greater on the higher frequencies.

If it is too large, say .1 mfd. or more, then the regeneration will be greater on the lower frequencies. So that an average value is about .001 mfd. for best results.

This is based on a tickler which has about half as many turns as the secondary of the tuning coil with which it is coupled.

A few years ago variable resistor control of regeneration became extremely popular. Its favor was well-earned, and home constructors discovered there was really an easily-controlled way of utilizing the thousand-fold amplifying possibilities of adjustable feedback.

Harmonic Generation

even when the receiver is relatively close to the transmitting antenna of the lower frequency station.

The interfering second harmonic originates in the receivers tuned to the second harmonic stations as a result of the rectifying property of the tubes. When the interference occurs it means that the receiver is not selective enough to exclude the first harmonic of the interfering station sufficiently.

Bias and Shielding Suggested

The fundamental of the lower frequency station is partly accepted by the tuner. The first tube in the circuit doubles the frequency, and subsequent tuned circuits accept the locally generated harmonic, and the RF amplifiers amplify it together with the frequency to which the circuit is tuned. Hence the interference.

Receivers in which this type of interference is present can be improved by carefully excluding the fundamental or the interfering station before its frequency has been doubled. This usually requires very careful shielding of the receiver as well as making the individual tuned circuits more selective. Correct negative grid bias helps considerably.

The low frequency station operators are not always at fault. The Federal Radio Commission should not assign high frequency stations to operate on the second harmonic of other stations in the same locality.

—J. E. Anderson.

Questionnaire Seeks Views

THIS is questionnaire week for custom set builders. I'm starting a nation-wide club of such folk and I hope you can join me. A few thousand have expressed their interest in the project. Herewith are 270 more names of persons interested in the formation of the club.

Such questions as the name and objects of the club, qualifications of prospective members, dues, etc., must be considered. So fill out and mail in the questionnaire. Note how to address the envelope (explained below).

Everything is going along nicely. Soon the club will be an organized and functioning power. Do your share! Act now!—McCord.

All Prospective Members Fill Out Questionnaire!

Herewith is a questionnaire which **all** prospective members of the custom set builders club should fill out and mail to RADIO WORLD, 145 West 45th Street, New York City, attention Mr. McCord. If you have already filled out and sent in one of the coupons previously published, it is nevertheless necessary to fill out and mail to RADIO WORLD the accompanying questionnaire.

Only from the list of those who send in the questionnaire will those be chosen to whom membership application blanks will be sent.

Please answer all questions frankly. If more room is needed, write on a separate sheet of paper.

Do not hesitate to answer any question. Do not fail to send in questionnaire just because you prefer not to answer some question or questions. All replies will be treated in strict confidence. Not even names of those sending in questionnaires will be published. No obligation attaches to mailing in a questionnaire. If you want blanks for others or a duplicate for yourself, write to RADIO WORLD, enclosing 2c stamp.

(1) Your name .....

Address .....

City .....State .....

(2) How old are you?.....

(3) Are you a citizen of the United States?.....

(4) If not, of what country?.....

(5) Do you make custom radio sets as your exclusive means of livelihood?.....

(6) If not, do you make custom radio sets for hire as a side line?.....

(7) How long have you been making custom radio sets? .....

(8) How many have you made?.....

(9) If you do not make them for pay, do you make them for others without charge for labor? .....

(10) Do you make radio sets exclusively for your own use and enjoyment?.....

(11) From whom do you buy your parts?.....

.....

(12) Are you an annual mail subscriber for any radio magazines? .....

(13) If so, state which.....

(14) If not, do you regularly buy radio magazines at news-stands? .....

(15) If so, state which.....

(16) How did you obtain your radio knowledge? .....

(17) How much did you spend last year (1927) on parts? .....

(18) Are you a beginner interested in attaining radio knowledge so you may become a custom set builder? .....

(19) Are you neither a custom set builder nor a prospective one, but interested in purchasing a custom made set?.....

(20) From what institutions of learning were you graduated? Include public school, high school, college, with addresses

.....

.....

.....

(21) Do you favor incorporation of the prospective custom set builders club?.....

(22) Do you favor co-operative buying by the club for its members?.....

(23) Do you favor local branches of such a club, in addition to the central organization?.....

(24) What dues, if any, do you think should be charged? .....

(25) Do you favor the club maintaining a central laboratory for the benefit of its members? .....

(26) And sending out confidential circuits, tube and other data, including blueprints?.....

(27) What circuits, if any, have you specialized in? .....

(28) How many customers have you?.....

(29) Do you sell factory-made sets?.....

(30) If so, state which.....

(31) Do you service sets other than those of your manufacture? .....

(32) Do you accept time payments for sets you make? .....

(33) If so, does anybody discount this paper for you? .....

(34) What is your gross income per year from custom set building?.....

(35) Net income from same?.....

(36) Give two references as to your character.

Name of reference.....

Address .....

Name of reference.....

Address .....

(37) Give name and address of three whom you recommend for membership.

Name .....

Address .....

Name .....

Address .....

Name .....

Address .....

(Be sure to choose the name you want the club to bear. See next column.)

VOTE HERE ON NAME FOR CLUB

Here are names suggested by readers. Vote for one by putting a cross in the square opposite the name. If you prefer some unlisted name, write it on the blank line at bottom. But also vote for one of the listed names.

American Radio Set Builders Association.....☐
American Radiotricians .....☐
American Society of Set Builders.....☐
Association of Radio Technicians.....☐
Custom-Built Radio Set Guild.....☐
Custom Radio Builders Club.....☐
Custom Radio Builders of America.....☐
Custom Radio Guild .....☐
Custom Radio Builders Guild.....☐
Custom Set Builders Association .....☐
Custom Set Builders Club.....☐
Custom Set Builders Guild.....☐
Custom Set Builders of America.....☐
Custom Set Builders.....☐
Custom Set Builders of the World.....☐
Custom Set Guild.....☐
Guild of Master Radiotricians.....☐
Home Radio Builders Club .....☐
Institute of Master Radio Receiver Constructors.....☐
Master Builders of Custom Made Sets.....☐
Master Custom Radio Receiver Constructors.....☐
Master Custom Radio Receiver Constructors' Guild .....☐
Master Radio-Tricians Club of America.....☐
Master Radiotricians' Guild.....☐
Mutual Association of Radiotricians.....☐
National Association Custom Radiotricians.....☐
National Custom Set Builders Club of America .....☐
Nacuset Builders' Association.....☐
Naraset Builders' Association .....☐
National Association of Radio Builders.....☐
National Radio Builders League.....☐
National Radio Custom Builders Association.....☐
National Radio Technicians.....☐
Organized Institute of Custom Set Builders.....☐
Professional Radio Set Builders .....☐
Professional Radio Set Builders of America.....☐
Professional Set Builders Club.....☐
Professional Set Builders Club of America.....☐
Professional Set Builders Union.....☐
Radio Builders Club .....☐
Radio Craftsman .....☐
Radio Craftsman Club of America.....☐
Radio Repair & Service Club.....☐
Radio Repair & Service Union.....☐
Radio Set Builders Association.....☐
Radio Set Builders Association of America.....☐
Radiotricians, Inc. .....☐
Set-U-Need Builders .....☐
Society of Master Custom Radio Set Builders..☐
Society of Radiotricians.....☐
United Custom Set Builders.....☐
I prefer the following name to any listed above:

.....

Here are 270 more names of prospective members who filed coupons of intention:

H. A. Buckingham, 21537 Barbara Ave., Detroit, Mich.
Harry H. Wagner, 18 Prospect St., Nelliston, N. Y.
Fred Martin, 1216 24th Ave., Meridian, Miss.
E. Seider, Sour Lake, Texas
F. J. LeClaire, Box 15A, Aylmer, Que., Canada.
Richard H. Addison, 29 Armandine St., Boston, 24, Mass.
Homer McKnulty Hevlow, 124 East Second St., Dover, Ohio.
C. A. Hale, Ontarioville, Illinois.
H. M. Andrews, 640 Kerckhoff Building, Los Angeles, Calif.
Virgil D. Greathouse, 328 Stewart St., Morgantown, W. Va.
W. J. Waldron, 460 W. 3rd St., Pomona, Calif.
E. Carter, P. O. Box 521, Sherman, Texas.
A. I. Murray, 115 10th Ave., Dayton, Ky.
Wm. S. Doyle, 1932 S. Salford St., Philadelphia, Pa.
W. J. Rhodes, Fort McIntosh, Laredo, Texas.
Fred Scott, 3822 Maffitt Ave., St. Louis, Mo.
Thomas F. McGrath, 420 East 138th St., New York City.
Clayton J. Hibbert, 8581 Helen Ave., Detroit, Mich.
Wm J. Allen, 5429 Howe St., Pittsburgh, Pa.
William Fiore, 1101-66 St., Brooklyn, N. Y.
John M. Smith, 3707 E. First St., Superior, Wis.
Chas. A. King, 1830 Santiago St., San Francisco, Calif.
Carl A. Hage, 2215 17th Ave., San Francisco, Calif.
Roy O. White, 4752 Columbus Ave., Minneapolis, Minn.
D. P. Bryan, c/o Ritz-Carlton Hotel, 8 S. Texas Ave., Atlantic City, N. J.
W. M. Palmer, 8546 Blackstone Ave., Chicago, Ill.
Henry G. Meyers, 20 S. East Ave., Baltimore, Md.
C. F. Eveleth, 2341 Carnegie Ave., Cleveland, Ohio.
T. J. Caton, 3025 James Ave., So., Minneapolis, Minn.
Lloyd C. Pollock, 755 E. Buchtel Ave., Akron, Ohio.

About Custom Set Club

Anthony Clark, 255 W. 50 St., New York City.
Firmin A. Vergote, 3570 Maryland Ave., Detroit, Mich.
G. H. Paris, 217 Torrey Bldg., Duluth, Minn.
Edward L. Miller, P. O. Box 312, Republic, Ohio.
C. G. Oman, 156 Concord St., St. Paul, Minn.
James Daly, c/o Hunts Point Hospital, Lafayette Ave., Bronx, N. Y. C.
Alfred J. Stephen, 56 Chapman St., Hillside, N. J.
Geo. Malinoski, 220 Monroe St., Passaic, N. J.
Oscar F. Buhner, 69 Moffatt St., Brooklyn, N. Y.
G. W. Kotts, Hope, N. Dak.
J. B. McClelland, 7912 Park Ave., Elkins Park, Pa.
Eugene Barker, 149 Dakota Ave., Columbus, Ohio.
Henry W. Gaul, 432 Baltimore Ave., Covington, Ky.
Locke Etheridge, 312 S. Raymond Ave., Louisville, Ky.
Russell H. Slimm, 570 Auburn St., Camden, N. J.
Bernard E. Lehrter, 26606A Glasgow, St. Louis, Mo.
O. H. Reed, 803 North Grand Ave., Portland, Oregon.
Ronald G. Sechler, R. F. D. No. 4, Norristown, Pa.
Chas. L. Manning, 1004 N. James St, Rome, N. Y.
J. G. Bear, Moller Apts., Hagerstown, Md.
W. J. Shortall 10 5th St., Weehawken, N. J.
Louis J. Ravo, 9 Hensler St., Newark, N. J.
Charles A Thurston, 1552 Harding Ave., Detroit, Mich.
Gilbert N. Caprenter, 23 Price St., Kingston, Pa.
Clair B. Bellows, 106 Temple St., Syracuse, N. Y.
E. L. Whipple, 100 Tomkins, Cortland, N. Y.
William E. Link, Blue Hill Farms, Pemberton, N. J.
Joseph H. Johnson, 239 Roxbury St., Keene, N. H.
A. J. Pietsch, 225 West 16th St., New York City.
C. Shannon, 563 Herman St., Philadelphia, Pa.
C. L. Strope, 435 Morris Ave., Providence, R. I.
J. Stanley Eagler, 159 Pennebaker Ave., Lewistown, Pa.
Archie Bunting, Orchard St., White Plains, N. Y.
John C. M. Seaman, 208 Siegel St., Philadelphia, Pa.
Marion L. James, 213 W. 3rd St., Winslow, Ariz.
B. E. Blackwood, 1615 West Montgomery Ave., Philadelphia, Pa.
Benjamin Smith, 57 Prospect St., New Bedford, Mass.
Philip G. Rust, 805 N. Broome St., Wilmington, Del.
C. C. Lary, Box 505, Visalia, Calif.
F. M. McDaniel, 925 W. 9th St., Wilmington, Del.
E. M. Smith, Esopus Ave., Kingston, N. Y.
Marvin C. Haynes, 2821 Orchard Ave., Baltimore, Md.
Thomas Davies, Jr., 1011 Washington St., Freeland, Pa.
Charles L. Van Cleve, 8012 89th Ave., Woodhaven, N. Y.
Thomas A. Nieman, 1940 S. Halsted St., Chicago, Ill.
Charles S. Frick, 311 N. Cherry St., Van Wert, Ohio.
Al Johnson, 1409 Shelby St., Sandusky, Ohio.
John Angus, 71 Pomeroy St., Rochester, N. Y.
Earle C. Nichols, 32 Wendell St., E. Saugus, Mass.
Charles M. Earl, 108-16 164 St., Jamaica, Queens, N. Y.
Samuel D. Holcombe, 606 B. Broadway, McKees Rocks, Pa.
Carl Alverson, Dansville, New York.
Trigve Nordhougen, Stanley, N. Dak.
William M. Hawks, R. F. D. 3, Irwin, Pa.
G. H. Allen, R. R. 3, Box 132, South Bend, Ind.
Walter Herbst, 1041½ West 54 St., Los Angeles, Calif.
Harry J. Quinn, 2022 South Opal St., Philadelphia, Pa.
Lucius M. Hammonds, 6333 Harper Ave., Chicago, Ill.
Geo. H. Berlin, 1569 E. 34th St., Portland, Ore.
C. E. Hopkins, 541 Hanford St., Columbus, Ohio.
J. W. Crupe, 5239 Calumet Ave., Chicago, Ill.
A. W. Clement, Box 205, Bay City, Texas.
Vernie H. Walker, 12 Front St., New London,
H. E. Kelley, 943 Gas and Electric Bldg., Denver, Colo.
W. L. Gwyer, 316 First St., Monenssen, Pa.
Malcolm F. Griswold, 5627 So. Laflin St., Chicago, Ill.
O. C. Ross, 766 Pacific Bldg., San Francisco, Calif.
N. J. Bittner, 103 N. 24th St., Kenmore, Ohio.
Bernard S. Shay, 2610 Freemont Ave., So., Minneapolis, Minn.
John K. Lenox, 126 Deerfield, Buffalo, N. Y.
G. F. Schaaf, 430 W. Grand Ave., Lima, Ohio.
G. E. Forsberg, 3835 N. Central Park Ave., Chicago, Ill.
N. P. Fox, 1280 Marcy St., Akron, Ohio.
John Greiner, 9139 80 St., Woodhaven, L. I., N. Y.
Thomas Radio Co., 403 N. Brauson St., Marion, Ind.
F. Yuidrock, 421 Fourth Ave., Dayton, Ky.
L. B. Fulmer, 230½ Washington St., Conneaut, Ohio.
Cameron F. Dunbar, Russell Springs, Ky.
G. W. Henry, 556 Calif. St., San Francisco, Calif.
J. M. Flynn, 56 Everton St., Dorchester, Mass.
Heinrichs Bros., 718 Tennessee Ave., LaFollette, Tenn.
Lee LeBer, 55 Church St., Springfield, Mass.
Ernest R. Eybel, 605 Winchester Ave., New Haven, Conn.
Cyril B. Cluff, Price, Utah.
Francis A. Thau, 235 Old Bergen Road, Jersey City, N. J.
William Bessey, 604 Bellevue Ave., Syracuse, N. Y.
William Bauer, 233 Holland St., Syracuse, N. Y.
C. Neilsen, 121 West 114th St., New York City.
G. J. McAdoo, Box 403, 443 McAdoo Ave., Greensboro, N. C.
N. H. Remler, 433 East 3rd St., Berwick, Pa.
E. H. Morningstar, 5515 Spruce St., Philadelphia, Pa.
John G. Barrett, 505 Buchanan St., Gary, Ind.
E. R. Watts, 416 10th Ave., So., Birmingham, Ala.
M. A. Richardson, Conklinville, N. Y.
Lucien A. Derouin, 14 Galivan St., Waterbury, Conn.
R. J. Kempton, P. O. Box 28, Presque Isle, Maine.
Frank H. Gradt, 152 Sherman Ave., New York City.
William Beckett, 403 Elm St., Camden, N. J.
Joseph D. Levinson, 322 Roseberry St., Philadelphia, Pa.
C. J. Jenks, Stillwater, Minn.
Arnold A. Hallock, 435 Morris Ave., Rockville Center, N. Y.
Frank A. Menne, 1217 Nelson Ave., New York City.
J. Doll, 128 Bergen St., Newark, N. J.
E. F. Mangis, R. F. D. 4, Mt. Vernon, Ind.
Claire D. Dudley, 709 N. Stanton St., El Paso, Texas.
W. V. Sloggett, 973 Walnut St., Niagara Falls, Ont. Can.
O. H. Marvel, 32 Saratoga St., Springfield, Mass.
Hugh Wood, 2329 Bessemer Blvd, Birminghaim, Ala.
V. L. Newcomb, P. O. Box 735, Syracuse, N. Y.
J. G. Parsons, 1821 Duquesne St., McKeesport, Pa.
F. B. Wheeler, 4430 Walker Ave., Houston, Texas.
J. Hassler, 714 Lincoln Ave., Alameda, Calif.
J. Molay, 1484-86 Sterling Place, Brooklyn, N. Y.
Samuel Watkinson, P. O. Box 179, New Lebanon, N. Y.
William H. Aitken, 5907 Cedar Ave., Philadelphia, Pa.
Ira D. Witter, 1215 E. 37th St., Brooklyn, N. Y.
J. C. Hendricks, 1834 22nd St., Boulder, Colo.
Sewall Morse, 44 Canal St., Brattleboro, Vt.
V. M. Henney, Room 1223, 159 N. State St., Chicago, Ill.
James F. Golden, 4018 Wilson Ave., Baltimore, Md.
James M. Hillman, 303 Caldwell Ave., Wilmerding, Pa.
Dix Orndorf, 114 Market St., Johnstown, Pa.
R. S. Lytle, Harlingen, Texas.
A. W. Blake, 4911 Green Court, Denver, Colo.
Vernon V. Vaupel, 2106 Lunt Ave., Chicago, Ill.
E. C. Taylor, 1738 5th St., S. E., Canton, Ohio.
W. H. Raw, 2311 N. Langford St., Greenville, Tex.
W. M. K. Young 5208 Prospect St., Kansas City, Mo.
W. C. Cassell, 416 N. Elizabeth St., Pittsburgh, Pa.
M. A. Mater, 648 Fulton St., Brooklyn, N. Y.
Earl Hayne, 1051 Jenks St., St. Paul, Minn.
O. J. Goeltzenleuchter, 2101 Linwood Ave., Toledo, Ohio.
H. A. King, 3910 Warwick Blvd., Kansas City, Mo.
W. R. Murray, c/o Caffrey, 699 East 139th St., New York City.
J. A. Biron, Box 122, Rice Lake, Wis.
Harry W. Burgoyne, 1160 Brice Ave., Lima, Ohio.
Arthur Jones, 897 Elton Ave., New York City.
Leo H. Ware, 2338 East 85th St., Cleveland, Ohio.
R. E. Bryans, 113 Wayne St., Jersey City, N. J.
L. R. Annett, 812 Cherry St., Santa Rosa, Calif.
E. V. Ingels, 20 Ridgeview Ave., West Orange, N. J.
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Use Large Primaries

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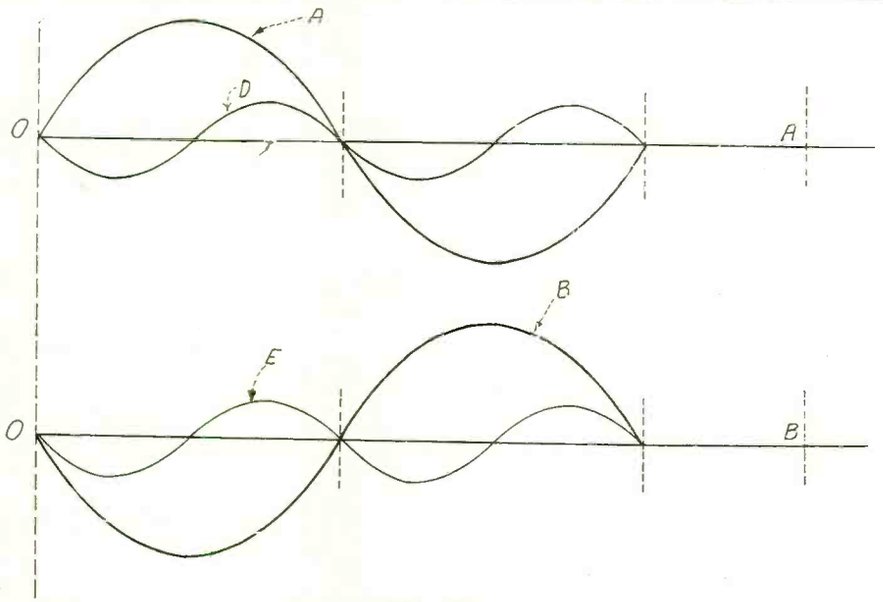

FIG. 612

GRAPHICAL REPRESENTATION OF THE VOLTAGES, OR CURRENTS, IN THE TUBES OF A PUSH-PULL STAGE SHOWING HOW THE EVEN HARMONICS BALANCE OUT AND HOW THE ODD ADD UP.

CAN I USE the three circuit tuner which I now have for the screen grid Diamond of the Air? It tunes with a .0005 mfd. condenser and it has 11 turns on the primary winding.

(2)—If this coil is not suitable is it possible to rewind it so that it will be? If is is possible please give the number of turns to use.

(3)—Is it necessary to shield the screen grid tube and the first tuner from the rest of the circuit?

(4)—Can I use resistance coupling throughout in the audio portion of the set or is it necessary to use transformers?

JOSEPH J. FITZGERALD,
Birmingham, Ala.

(1)—You should not use the three circuit tuner in its present condition. Skinny primaries render the screen grid tube of little value.

(2)—Leave the secondary and the tickler windings as they are and add turns to the primary. Remove primary and replace it with another of from 25 to 40 turns. Ordinary three circuit tuners, with skinny primaries, should not be used.

(3)—Not necessary if only one screen grid tube is used. But put a Vac-Shield over the tube and connect the Vac-Shield to F+ or F—.

(4)—Resistance coupling works just as well with thes creen grid tube as it does with any other radio frequency amplifier tubes.

* * *

I BUILT the four tube screen grid Diamond just as you described it, except that I used the three circuit tuner which I already had, and I do not get any better results than I did with the old tube in the circuit. Do you think that my tube is defective?

FRANCIS E. MIDDLETON,
Chattanooga, Tenn.

The tube is probably all right, but you deviated from the description on the most essential point. The specified Hammarlund HR23 coil has a large primary when the center tap is ignored and the total turns are used as the load. Use a three circuit tuner with a large primary, even up to half as many turns as on the secondary. See answer to J. J. Fitzgerald.

* * *

SOME TIME AGO you published a diagram showing how the even harmonics are balanced out in a push-pull stage. I am unable to locate the copy containing this diagram and I should like very much to have it. Will you please publish it again with a brief explanation?

See Fig. 612 for this schematic. The curves on the OA baseline represent the fundamental and the second harmonic of the signal in one tube and the curves on the OB baseline represent the same in the tube working on the opposite side of the same stage. One cycle of the fundamental is shown on each baseline. Curves A and B are the fundamental and curves D and E are the second harmonics. The output voltage of a complete stage is the albebraic difference between the two sets of curves. Since the fundamentals are always in opposite phase the algebraic difference between the two sets of curves. Since the fundamentals are always in opposite phase the albebraic difference is actually the absolute sum of the two, measured from the base line in each case to the curve. Since the second harmonic curves are always in phase the algebraic difference is also the absolute difference, and being equal they cancel each other. All odd harmonics are in opposite phase like the first, and hence they appear in the output. All the even harmonics are in phase and thus cancel out in the output.

* * *

IS IT PRACTICABLE to use a pair of the new —50 power tubes in a push-pull amplifier in place of a pair of —71A tubes? I want to use these tubes so that I will get the best possible quality and no overloading.

(2)—If the tubes can be used, what changes are necessary in the hook-up?

(3)—Will the power supply and filter system used for the —71A tubes work with the —50 tubes?

WILLIS K. NEWELL,
Atlanta, Ga.

(1)—It is not practical without making considerable changes in the equipment.

(2)—It is necessary to provide a more powerful pack, with higher voltage and greater current capacity, It is also necessary to adjust the grid bias and to insure that the tube preceding the push-pull stage is not overloaded.

(3)—The voltage of the power pack should be about 450 volts when the current drain of the entire set is about 125 milliamperes. The choke coils and transformers used must be able to carry this current. The filter condensers must be rated at least 1,000 volts.

* * *

I BUILT a nine-tube Super-Heterodyne exactly as you described it. I have checked all wiring several times. The tubes are all in first class condition and the loudspeaker is one of the best made. Yet I cannot get the results which I believed I would get when I bought the parts. The receiver lacks sensitivity, it is noisy, it motorboats at times and the quality of the output is very poor. I have changed by-pass condensers and grid leaks without any improvement. I use a commercial eliminator rated at 180 volts.

(1)—Do you think that if I matched my tubes that results would improve?

(2)—Would matching the intermediate frequency coils help any?

(3)—Would I get better results if I used some other speaker? If so, which would you recommend?

(4)—Would a different loop improve the condition?

(5)—Do you suppose that the tuning condensers are the right kind for this set?

(6)—Will you kindly suggest remedies which will make the receiver work as it should?

EMIL BRADWELL,
Philadelphia, Pa.

(1)—There is no object in changing the tubes or of matching them unless one or more of the tubes are actually defective.

(2)—The trouble is not in the matching of the transformers at all.

(3)—You might find a better loudspeaker, but that would not remedy the condition you speak of.

(4)—Not at all.

(5)—The condensers are all right if the circuit tunes right.

(6)—The trouble is with the eliminator

for Screen Grid Tubes

lems Solved

you use. It was not designed for the heavy work which you demand of it. The receiver is not getting enough plate voltage. The fact that the B battery eliminator israted at 180 volts does not mean that the tubes get the proper voltage when all the tubes are drawing current from the eliminator. The actual voltage may drop to 100 volts or less. Get a heavy duty power supply, either batteries or an eliminator which can deliver the necessary power.

* * * *

I HAVE NOTICED a peculiar condition in my Super-Heterodyne receiver which I cannot understand. I tune in a local station accurately and in a few minutes the signal fades out completely. I have to retune and readjust the volume controls to bring it back. The station is operated from a piezo chrystal so that the difficulty cannot be caused by a variation in the station frequency. Can you suggest a reason for this phenomenon and a remedy?

ELMER BASCOM,
Chicago, Ill.

The trouble may be due to one of two causes. The frequency of your own oscillator may vary due to changing conditions about your set. Or somebody near you may be tuning in and out the same station you are listening to. Your frequency may change because of changes in the plate and filament voltages, or because somebody in the neighborhood is tuning his own receiver. This condition is common when power packs are used to supply the plate power to the tube, and also when the loop is very close to another antenna.

* * * *

I USE A WELL-KNOWN power pack on my regenerative receiver. When I listen in with a head set there is a decided hum. Should this be? Also I notice that the eliminator itself hums. Is that normal? CHARLES W. YEAGER,
Alhambra, Calif.

(1)—It should not be, but it is a prevalent condition with regenerative sets. Remove ground from A minus or wherever else it is. Instead ground B minus.

(2)—The power pack itself should not hum. If it does very often it is the case of a transformer case which vibrates. A slight hum is tolerable.

* * * *

IN MY RADIO equipment I have many transformers which I plug separately into an outlet. That requires that I pull out several plugs when I want to turn my set off. This is very unsatisfactory, because sometimes I forget to pull some out and let the current flow all night. It is also very inconvenient to turn the set on since I have to insert several plugs into the outlets before the set will start. Can you show some scheme which will enable me to turn on and off with a single switch.

SYLVAN FORRESTER,
Harrisburg, Pa.

See Fig. 613 for one arrangement that will do it. If you need more than two outlets controlled by a single switch you can use a three way socket adapter, or a multiple socket adapter in the same way. The line switch can be put on the panel or in any other convenient position, but care should be taken that the wiring complies with the underwriters' rules applicable in your locality.

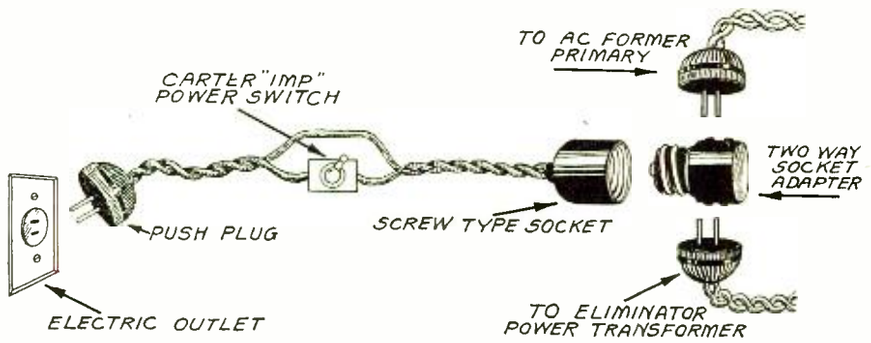

FIG. 613

A DIAGRAM SHOWING HOW A SINGLE POWER SWITCH CAN BE INSERTED INTO THE LINE TO CONTROL TWO OR MORE TRANSFORMERS OR OTHER DEVICES.

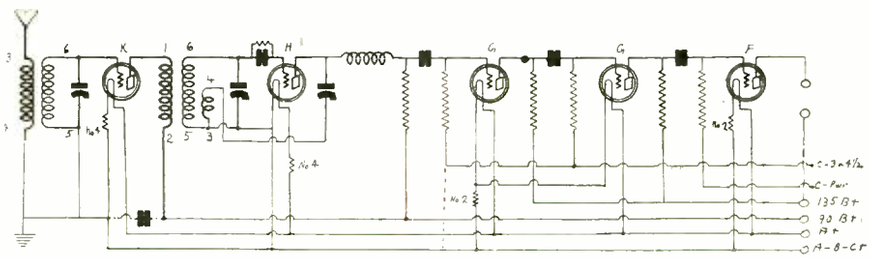

FIG. 614

THE CIRCUIT DIAGRAM OF A FIVE TUBE RECEIVER COMPRISING ONE TUNED RF STAGE, A REGENERATIVE DETECTOR, AND THREE STAGES OF RESISTANCE COUPLED AUDIO.

* * *

WILL YOU PLEASE publish a circuit diagram of a receiver containing one tuned radio frequency amplifier, a regenerative detector and a three-stage resistance coupler amplifier? I prefer to vary the regeneration with a condenser rather than a tickler coil.

WILFORD WEST,
Detroit, Mich.

See Fig. 614 for such circuit. The regeneration condenser is 12 or 15 mmfd.

WHEN I MEASURE the grid bias on my push-pull amplifier from the filament to one grid I get a reading of 15 volts and when I measure it to the other grid I get 20 volts. The same grid voltage is applied to both of the tubes. Will you please explain this discrepancy?

WARBURTON DEE,
Seattle, Washington.

(1)—The push-pull input transformer lacks balance. There is more resistance on one side than the other. The discrepancy is large because you measure the voltage with a low resistance voltmeter.

A THOUGHT FOR THE WEEK

A FOUR-YEAR course for announcers of the lighter programs is contained in George M. Cohan's admonitory line: "Always leave them smiling when you go!"

SEVENTH YEAR

RADIO WORLD

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Radio World's Slogan: "A radio set for every home."

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Coolidge Backs Bill to Continue Board

Washington.

President Coolidge was anxious to have radio legislation passed by Congress, it was stated officially. The views of the President as outlined at the White House are as follows:

The Radio Board had not been able to finish its preliminary work when its powers expired, March 15; but, since the Department of Commerce has the power to delegate radio control, this has been delegated to the present Radio Board and it continued to function under the old law. Meanwhile a bill was in conference which provided for the extension of the old powers of the Radio Board, and President Coolidge was anxious to have this reported out favorably with some perfecting amendments.

Modified Equalization Voted by Conferees

Washington.

House and Senate conferees on the radio bill (S. 2317) agreed on a revised version of the "equalization" amendment offered by Representative Davis (Dem.), of Tullahoma, Tenn., and passed by the House the previous week.

The conference "equalization" amendment incorporates the wording of the Davis amendment, declaring there shall be an equal allocation of stations, wavelengths and powers to each of the five radio zones into which the country is divided under the Radio Act of 1926.

It includes a declaration, however, that such equality shall be effected when and in so far as there are applications for an equal share of station licenses, wavelengths, power and time of operation.

Conditional Power Grants

It also directs that the licensing authority shall carry into effect the equality of broadcasting service by granting or refusing licenses or license renewals and by other changes when applications are made.

There is a proviso that if there are not enough applications from any zone for its proportionate share, the remainder of the proportion may be temporarily assigned to applicants from other zones for 90 days.

The conferees accepted the House amendment limiting the terms of broadcasting licenses to three months and those of other stations to one year. They also agreed to the amendment by Representative Lehlbach (Rep.), of Newark, N. J., providing that the site of the studio rather than the transmitter shall be regarded as the location of a station in considering State apportionments.

Life of Board

The Senate amendment introduced by Senator Pittman (Dem.), of Nevada, terminating the terms of the present commissioners on February 23, 1929, and requiring the appointment of new commissioners after that time to terms provided for in the original Radio Act of 1927, was accepted.

Representative Davis stated orally that he had declined to sign the conference report because of his disapproval of the clause reading "when and in so far as there are applications therefor." He said he approved the remainder.

What Davis Wants

"I fear also that it will be construed that the Commission is not authorized to make any reductions of power or changes of wavelengths either with respect to particular stations or with respect to zones or States, because no station would make application for a reduction of station power nor for changes of wavelength, if they are on a favorable wavelength, or for a reduction of time authorized to broadcast.

"Everybody familiar with the situation realizes that the present situation has just grown up and there is not only an unequal but an unscientific allocation of power and wavelengths.

"In my opinion the Commission should be left free to work out a more scientific and equal allocation by making both increases and reductions and changes of wavelength assignments whenever necessary or proper.

Fears Modification

"I fear it may be construed that the language to which I object may be construed to modify the equalization clause which it follows in such a way that the present broadcasting structure must be accepted as it is, and that the Commission by said clause is deprived of the authority to make the changes I have indicated.

"It is true that there was adopted another provision offered as a substitute for the language to which I objected. It was adopted by the conference as an additional amendment instead of as a substitute. It will be contended that this cures the objection made to the language which it was offered to replace.

The Full Text

Following is the full text of the conference equalization amendment:

"It is hereby declared that the people of all the zones established by Section 2 of this Act are entitled to equality of radio broadcasting service, both of transmission and of reception; and in order to provide said equality the licensing authority shall as nearly as possible make and maintain an equal allocation of broadcasting licenses, of bands of frequency or wavelengths, of periods of time for operation, and of station power, to each of said zones when and in so far as there are applications therefor; and shall make a fair and equitable allocation of licenses, wavelengths, time for operation, and station power to each of the States, the District of Columbia, the Territories and Possessions of the United States within each zone, according to population.

"The licensing authority shall carry into effect the equality of broadcasting service hereinbefore directed, whenever necessary or proper, by granting or refusing licenses or renewals of licenses, by changing or reassigning wavelengths, by changing periods of time for operation, and by increasing or decreasing station power, when applications are made for licenses or renewals of licenses.

"Provided, that, if and when there is a lack of applications from any zone for the proportionate share of licenses, wavelengths, time of operations or station power to which such zone is entitled, the licensing authority may issue licenses of the balance of the proportion not applied for from any zone, to applicants from other zones for a temporary period of 90 days each, and shall specifically designate that said apportionment is only for said temporary period.

"Allocations shall be charged to the State, district, territory or possession where the studio of the station is located and not where the transmitter is located."

Board Acts Under Grant from Hoover

The Federal Radio Commission lost its enacted powers as the radio administrative body when Congress failed to pass in time the bill continuing the life of the Commission. Failure was due principally to differences on the equal franchise provision, then before a joint conference of the House and the Senate.

Meanwhile, however, Secretary Hoover, with President Coolidge's consent, turned over to the Commission the duties of administering radio affairs, which automatically had become vested in the Department of Commerce. Thus the Commission actually continued temporarily the same administrative work it had been doing.

NEW SHAKE-UP OF WAVES AND POWER NEARS

Washington.

While the House and Senate conferees were considering the radio bill, the Federal Radio Commission consulted Government specialists and radio engineers from the radio industry on means designed to provide a more equitable distribution of radio assignments to broadcasting stations. A statement issued by the Commission follows in full:

"In an effort to put into effect some valuable suggestions made by Congress at recent hearings, and to crystallize all proposals made from various sources tending to improve radio reception, the Federal Radio Commission for some weeks has had the free services of numerous experts who are studying the complex technical problems involved.

Trained Men Aid

"Highly trained men from the Army, Navy, Bureau of Standards, and other Government agencies, have volunteered their services, as well as experts from private industries and corporations.

"Criticisms and suggestions from the broadcasters have also been sought by some of the Commissioners, in the hope that radio reception can be improved.

"In calling in the experts the Commission asked them to confine their studies solely to the technical and engineering problems involved and to work out a fair and equitable distribution of power and wavelengths for each and every community in the country.

Nears Completion

"Their work is approaching an end, and if the theoretical set-up is approved by the Commissioners the latter will then decide what stations should be assigned to the various channels and the power to be used in each instance.

"A number of changes in power and frequencies may be necessary as to result of the studies now being made.

"The Commission feels that in calling upon the outstanding radio engineers of America, representing all branches of the industry, it will be guided along the proper channels, and any defects in the present allocation will be pointed out by them and will be corrected by the Commission.

"In the light of recent information the Commission hopes it may be possible to improve reception in many parts of the country."

[*In view of the impending changes in wavelengths, power, etc., the list of stations which ordinarily would be published in this issue of* RADIO WORLD, *is omitted until the changes go into effect.*]

Standard Frequency Schedule Announced

Washington.

The Bureau of Standards announced a new schedule of radio signals of standard frequencies, for use by the public in calibrating frequency standards and transmitting and receiving apparatus.

The signals are transmitted from the Bureau's station WWV, Washington, D.C. They can be heard and utilized by stations equipped for continuous-wave reception at distances up to about 500 to 1,000 miles from the transmitting station.

The transmissions are by continuous wave radio telegraphy. The signals have a slight modulation of high pitch which aids in their identification.

Three-Part Transmission

A complete frequency transmission includes a "general call" and "standard frequency" signal, and "announcements." The "general call" is given at the 8-minute period and continues for about 2 minutes. This includes a statement of the frequency. The "standard frequency signal" is a series of very long dashes with the call letter (WWV) intervening. This signal continues for about 4 minutes.

The "announcements" are on the same frequency as the "standard frequency signal" just transmitted and contain a statement of the frequency. An announcement of the next frequency to be transmitted is then given. There is then a 4-minute interval while the transmitting set is adjusted for the next frequency.

May Use Harmonics

Information on how to receive and utilize the signals is given in Bureau of Standards Letter Circular No. 171, which may be obtained by applying to the Bureau of Standards, Washington, D. C.

Even though only a few frequency points are received, persons can obtain as complete a frequency meter calibration as desired by the method of generator harmonics, information on which is given in the letter circular. The schedule of standard frequency signals is as follows, with frequencies in kilocycles:

E. S. T.		April 20	May 21	June 20	July 20	Aug. 20	Sept. 20	Oct. 22
10:00—10:08	P.M.	3000	650	1500	3000	125	300	650
10:12—10:20	P.M.	3300	750	1650	3300	150	350	750
10:24—10:32	P.M.	3600	850	1800	3600	175	400	850
10:36—10:44	P.M.	4000	950	2000	4000	200	450	950
10:48—10:56	P.M.	4400	1060	2250	4400	225	500	1050
11:00—11:08	P.M.	4900	1200	2500	4900	250	550	1200
11:12—11:20	P.M.	5400	1350	2750	5400	275	600	1350
11:24—11:32	P.M.	6000	1500	3000	6000	300	650	1500

Radiophoto Signature Invalid as "Facsimile"

HARRISBURG, PA.

Ralph B. Strassburger, Norristown publisher, sent his signature by radio from Europe to Harrisburg to satisfy an objection that his petitions as candidate-at-large to the Republican National Convention lacked an original signature.

The signature was sent over from Paris to London whence it was sent by the radiophoto service to its destination. The received facsimile was 24 inches long and 5 inches wide. The cost of the transmission was $388.

Later the signature was invalidated by a court decision which ruled that the signal received by radio was a facsimile and not an original.

LITERATURE WANTED

R. Parker, 205 King St., Midland, Ontario, Canada.

Selwall Morse, 44 anal Street, Brattleboro, Vermont.

W. J. Shortall, 10 Fifth St., Weehawken, N. J.

R. E. Wareham, 452 Broadway, Augusta, Kansas.

Robert Rachuba, 2314 E. Fayette St., Baltimore, Md.

J. B. McClelland, 7912 Park Ave., Elkins Park, Penna.

P. J. Back, 7227 N. Paulina St., Chicago, Ill.

W. H. Hardman, 458 King St. London, Ont., Canada.

J. G. Bear, Moller Apt., Hagerstown, Md.

A. J. Pietsch, 225 West 16th St., New York, N. Y.

Text of the Bill That House Wanted

The full text of the radio bill as it stood when passed by the House is as follows:

"Be it enacted by the Senate and House of Representative of the United States of America in Congress assembled, that all the powers and authority vested in the Federal Radio Commission by the Radio Act of 1927, approved February 23, 1927, shall continue to be vested in and exercised by the commission until March 16, 1929; and wherever a reference is made in such Act to the period of one year after the first meeting of the Commission, such reference shall be held to mean the period of two years after the first meeting of the commission.

Sec. 2. The period during which the members of the commission shall receive compensation at the rate of $10,000 per annum is hereby extended until March 16, 1929.

Sec. 3. Prior to January 1, 1930, the licensing authority shall grant no license or renewal of license under the Radio Act of 1927 for a broadcasting station for a period to exceed three months and no license or renewal of license for any other class of station for a period to exceed six months.

Sec. 4. The second paragraph of section 9 of the Radio Act of 1927 is amended to read as follows:

"The licensing authority shall make an equal allocation to each of the five zones established in section 2 of this Act of broadcasting licenses, of wave lengths, and of station power; and within each zone shall make a fair and equitable allocation among the different States including the District of Columbia and the territories and possessions thereof in proportion to population and area."

Television Received On Ship in Mid-Ocean

Passengers on board the liner Berengaria recently witnessed for two hours the images of persons in London by means of the Baird television system. This was the first time that television from mid-ocean had been accomplished.

The test was conducted by Captain O. G. Hutchinson, managing director of the Baird Television Development Company, who recently was in the United States and while there succeeded in establishing television connection between New York and London.

During the tests from the Berengaria the images at times were unusually clear. Stanley Brown, chief radio operator of the liner, recognized the features of his fiancee, Dora Seeley, who had been asked to the Baird laboratories at the request of Mr. Brown. Recognition was established when Miss Seeley turned her profile on the televisor and by her characteristic method of dressing her hair.

NEW CORPORATIONS

First National Radio Corp.—H. G. Kosch, 383 Madison Ave., New York.

Wapantee Electric Radio Corp.—H. Salitan, 160 Broadway, New York, N. Y.

Bright Electric and Radio Shop—I. H. Mandel, 50 Court St., Brooklyn, N. Y.

U. S. Broadcasting Corp., Wilmington, Del.—Corporation Trust Co. of America, Wilmington, Del.

Russell Hulse, 2383 Washington Ave., New York, N. Y.

S. J. Crabtree, 3114 Madison St., Alameda, Calif.

FORTY TIMES as Much Amplification!

The New Shielded Grid

4-TUBE DIAMOND OF THE AIR

Designed by H. B. HERMAN and described by him in the February 4 11 and 18 issues of RADIO WORLD.

The favorite four-tube design, simple as can be, takes a great step forward, so that home constructors of radio receivers, and custom set builders, can build a distance-getting and voluminous set, the parts for which list remarkably low.

The new shielded grid tube is used as the radio frequency amplifier. That is why the amplification is boosted forty times over and above what it would be if an —01A tube were used instead.

Such simplicity of construction marks the receiver that it can be completely wired, skillfully and painstakingly, in two and a half hours.

All you have to do is to follow the official blueprint, and lo! a new world of radio achievement is before you! Distant stations that four-tube sets otherwise miss come in, and come in strong. No tuning difficulty is occasioned by the introduction of this new, extra powerful, startling tube, but, in fact, the tuning is simplified, because the signal strength is so much greater.

When you work from the official wiring diagram you find everything so delightfully simple that you marvel at the speed at which you get the entire receiver masterfully finished. And then when you tune in—more marvels! 'Way, 'way up, somewhere around the clouds, instead of only roof high, will you find the amplification!

You'll be overjoyed. But you should place every part in exactly the right position. Stick to the constants given, and, above all, wire according to the blueprint!

Front Panel, Subpanel and Wiring Clearly Shown

When you work from this blueprint you find that every part is shown in correct position and every wire is shown going to its correct destination by the ACTUAL ROUTE taken in the practical wiring itself. Mr. Herman's personal set was used as the model. This is a matter-of-fact blueprint, with solid black lines showing wiring that is above the subpanel, and dotted lines that show how some of the wiring is done underneath.

Everything is actual size.

Not only is the actual size of the panel boles and instruments given, but the dimensions are given numerically. Besides, it is one of those delightful blueprints that novice and professional admire so much—one of those oh-so-clear and can't-go-wrong blueprints.

Be one of the first to send for this new blueprint, by all means, and build yourself this outstanding four-tube receiver, with its easy control, fine volume, tone quality, selectivity and utter economy. It gives more than you ever expected you could get on four tubes—and the parts are well within the range of anybody's purse.

The circuit consists of a stage of tuned RF shielded grid tube amplification, a regenerative detector, and two transformer coupled audio stages.

What a receiver!

$1.00 for 27" x 27" Blueprint,

Send your order today!

.....

RADIO WORLD,
145 West 45th St., N. Y. City.
Enclosed please find:

☐ $1.00, for which send me at once one official blueprint of the Four-Tube Shielded Grid Diamond of the Air, as designed by H. B. Herman, and described by him in the February 4, 11 and 18 issues of Radio World.

45 cents extra for Feb. 4th. 11th. 18th issues.

NAME .....

ADDRESS .....

CITY .....STATE .....

Alda Lifts Long Ban on Puccini Broadcasts

The listening public had the unusual opportunity of hearing Puccini music when by special permission of the Puccini publishers, a permission never before granted. Madame Frances Alda broadcast the best known arias from "Madame Butterfly" and "La Boheme," in the Atwater Kent Hour.

The arias were "Addio" (Farewell) from "Boheme" and "Un bel di Vedremo," (Some Day He'll Come) from "Madame Butterfly." Mimi's "Farewell" is generally considered one of the loveliest in the entire opera and is a universal favorite. "Some Day He'll Come" is the most famous air in "Madame Butterfly," where the pathetic heroine expresses her faith in the return of her American lover, Lieutenant Pinkerton, U. S. N.

Several years ago the Puccini publishers and his estate took steps to prohibit the broadcasting of Puccini compositions.

Take Your Choice of 7 Other Publications

For NEW RADIO WORLD Subscribers Ordering NOW

Radio World has made arrangements

—To offer a year's subscription for any one of the following publications with one year's subscription for RADIO WORLD—

RADIO NEWS or POULAR RADIO or SCIENCE AND INVENTION or BOYS' LIFE or RADIO DEALER or RADIO (San Francisco) or RADIO AGE.

This is the way to get two publications

—for the price of one!
—Send $6.00 today for RADIO WORLD
—for one year (regular price
—for 52 numbers)
—and select any one of the other
—nine publications for twelve months.

—Add $1.00 a year extra for
—Canadian or Foreign Postage
—Present RADIO WORLD subscribers
—can take advantage of this offer by
—extending subscriptions one year
—if they send renewals NOW!

Radio World's Special Two-for-Price-of-One Subscription Blank

RADIO WORLD, 145 West 45th Street, New York City.

Enclosed find $6.00 for which send me RADIO WORLD for twelve months (52 numbers), beginning ..... and also without additional cost, Popular Radio, or Radio News, or Science and Invention, or Radio Dealer, or Radio (San Francisco), or Radio Age, or Boys' Life (or $10.00 for a two-year subscription to one address). No other premium wtih this offer.

Indicate if renewal.

Offer Good Until

April 30, 1928

Name .....

Street Address .....

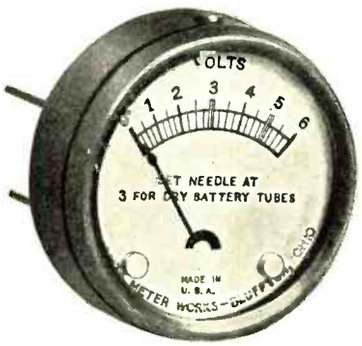
City and State .....

SEND NO MONEY

"Double R" Meters Improve Your Set

Use Them to Maintain Accurate Voltages and Currents So That Maximum Reception Efficiency is Assured

Pin Jack 0-6 Voltmeter for A Battery Measurement



This 0-6 voltmeter, No. 306, is especially useful for the No. 25 and No. 28 Radiolas, because it is equipped with pin jacks which fit into the plugs with which those sets are provided. The meters may be used in any home-constructed set, too, where the builder desires to place tip jacks on the front panel, so the meter can be plugged in for obtaining reading. The meter may be kept permanently in circuit, if desired.
No. 306, 0-6 volts DC..... **$2.50**

Also Track Down Trouble in a Jiffy and Permanently Cure It with the Aid of These Fine Meters

It is absolutely necessary to use a high resistance voltmeter in measuring the voltage of B eliminators, either across the total output or at any intermediate voltage. A low resistance meter at least partly short-circuits the eliminator and causes the voltage reading to be away off. Sometimes the reading is as little as 25 per cent of the total actual voltage.

All "Double R" meters are accurate to 2½ per cent, plus or minus, and all, except the ammeters Nos. 1 and 338, may be kept permanently in circuit.

Panel meters take 2 5/64-inch hole.

Our Complete Meter Catalogue is contained in this advertisement.

High Resistance Meters for B Eliminators

Here is the meter you've been wishing for! A 0-300 DC voltmeter with a very high resistance. Specially made that way so it will test the output voltages, from maximum to any intermediate voltage, of any B eliminator or grid biasing resistor. It also makes all the measurements of any other meter of its voltage range, hence will give correct readings of B batteries, C batteries, cells, or any other DC voltage source not exceeding 300 volts. Full nickel finish. Portable type (fits in sack coat pocket easily). Accurate to 2½ per cent, plus or minus. Fully guaranteed. Requires 35 different dyes to make. Furnished with long connecting cords and convenient tips. May be kept permanently in circuit. **$4.50**
No. 346 .....

[Note: 0-500 volts, instead of 0-300 volts, is No. 347. Tests ALL power packs—Price $5.50.]

MULTI-TUBE SET MILLIAMMETER

Panel model. Recommended for sets having six tubes or more, particularly if a -71, -10 or -50 tube is used as the output. May be kept permanently in circuit. For DC measurements 0-100 milliamperes.

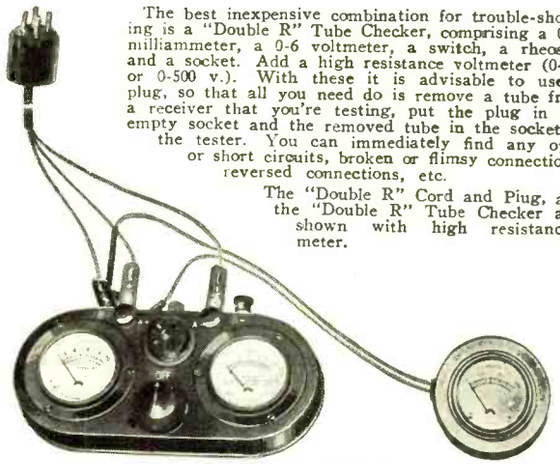
$1.65

No. 390 .....

TROUBLE-SHOOTING TEST SET

The best inexpensive combination for trouble-shooting is a "Double R" Tube Checker, comprising a 0-10 milliammeter, a 0-6 voltmeter, a switch, a rheostat and a socket. Add a high resistance voltmeter (0-300 or 0-500 v.). With these it is advisable to use a plug, so that all you need do is remove a tube from a receiver that you're testing, put the plug in the empty socket and the removed tube in the socket of the tester. You can immediately find any open or short circuits, broken or flimsy connections, reversed connections, etc.

The "Double R" Cord and Plug, and the "Double R" Tube Checker are shown with high resistance meter.



PANEL VOLTMETER FOR A BATTERIES

One of the most popular meters, the 0-6 panel voltmeter, DC. May be kept permanently in circuit. Panel model.

$1.65

No. 326 .....

PANEL AC VOLTMETERS

No. 351 For reading 0-15 volts AC.....$2.25
No. 352 For reading 0-10 volts AC..... 2.25
No. 353 For reading 0-6 volts AC..... 2.25
(See No. 348 under "Pocket and Portable Voltmeters.")

PANEL MILLIAMMETERS

No. 311 For reading 0-10 milliamperes DC $1.95
No. 325 For reading 0-25 milliamperes DC 1.85
No. 350 For reading 0-50 milliamperes DC 1.65
No. 399 For reading 0-300 milliamperes DC 1.65
No. 394 For reading 0-400 milliamperes DC 1.65

DC PIN JACK VOLTMETERS

No. 308 For No. 20 Radiola, 0-6 volts DC $2.50
No. 307 Desk type voltmeter with cord, 0-6 volts DC..... 2.50

6-VOLT A BATTERY CHARGE TESTER

No. 23 For showing when 6-volt A battery needs charging and when to stop charging; shows condition of battery at all times $1.85

PANEL AMMETER

No. 338 For reading amperage, 0-10 amperes DC.....$1.65

POCKET AMMETER

No. 1 For testing dry cells, 0-40 ampere DC scale pocket meter.$1.50

POCKET AND PORTABLE VOLTMETERS

No. 8 For testing A batteries, dry or storage, 0-8 volts DC scale $1.65
No. 10 For testing A batteries, dry or storage, 0-10 volts DC scale 1.65
No. 13 For testing A batteries, dry or storage, 0-16 volts DC scale 1.65
No. 50 For testing B batteries, dry or storage, but not for B eliminators, 0-50 volts DC scale 1.65
No. 39 For testing B batteries, dry or storage, but not for B eliminators, 0-100 volts DC scale 1.85
No. 40 For testing A and B batteries, dry or storage, but not for B eliminators; double reading, 0-8 volts and 0-100 volts DC scale..... 2.25
No. 42 For testing B batteries, dry or storage, but not for B eliminators; 0-150 volts DC scale 2.00
No. 348 For testing AC current supply line, portable, 0-150 volts 4.50

VOLTAMMETERS

No. 18 For testing amperage of dry cell A batteries and voltage of dry or storage A batteries, double reading, 0-8 volts, and 0-40 amperes DC..$1.85
No. 35 For testing amperage of dry cell A batteries and voltage of B batteries (not B eliminators); double reading, 0-50 volts, 0-40 amperes DC.. 2.00

SERVICE MEN!

No. 210 Tube Checker, consists of 0-6 volts DC Voltmeter, 0-10 DC Milliammeter, Grid Bias Switch, Rheostat, Socket, Binding Posts (with instruction sheet) $6.50
No. 21, cord and plug. For connecting meters in A and B leads of a receiver without any disconnections. Terminals correspond with posts on No. 210 tube checker.....$1.85
No. 346 DC Voltmeter (high resistance).....$4.50
No. 347 DC Voltmeter (high resistance).....$5.50

The cord terminals of the plug leads correspond with the binding posts of the tube checker.

Now connect the 0-300 or 0-500 volts high resistance voltmeter from A+ to B+ posts and you get all necessary readings. You can test plate voltage from B eliminators, or any other B supply, DC plate current and DC filament voltage, as well as the efficacy of the tube, by throwing the grid bias switch, for the plate current should change within given limits, depending on the type of tube.

Equip your testing outfit with the indispensable combination that constitutes the Trouble Shooting Test Set and Time-Saver. You quickly locate trouble while others flounder about.

Complete Combination Nos. 21 and 210 (with 0-300 Voltmeter, No. 346)..$12.00
Complete Combination Nos. 21 and 210 (with 0-500 Voltmeter, No. 347)..$13.00

PANEL VOLTMETERS

No. 335 For reading DC volt-ages, 0-8 volts.....$1.65
No. 310 For reading DC volt-ages, 0-10 volts..... 1.65
No. 316 For reading DC volt-ages, 0-16 volts..... 1.65
No. 337 For reading DC volt-ages, 0-50 volts..... 1.65
No. 339 For reading DC volt-ages, 0-100 volts..... 1.75
No. 342 For reading DC volt-ages, 0-150 volts..... 1.75
No. 340 For reading DC volt-ages, double reading, 0-8 volts, 0-100 volts..... 2.25

GUARANTY RADIO GOODS CO., 145 W. 45th St., N. Y. City.
Please send at once your meters, catalogue numbers:

....

for which I will pay postman advertised price plus few cents postage.

Name.....

Address.....

City..... State..... RW-28

ALL METERS SOLD ON FIVE-DAY MONEY-BACK GUARANTY.

Curve and Ear Unite to Judge Transformers

When a radio engineer wants to know what the quality capability of a certain piece of apparatus he asks to see the curve. The curve may be the relation between the frequency and the sound pressure, or the frequency and the power output, or the frequency and the amplification, or any other relationship which to the engineer is the index of performance.

If the piece of apparatus is an audio transformer, or an amplifier using audio transformers, the index of performance is a certain relationship between the frequency and the voltage amplification. And the engineer wants to know how nearly this relationship represents a straight line.

"Is the characteristic curve a straight line?" he asks.

When a musician wants to know the quality capability of a receiver he listens to the reproduction of instruments and voices with which he is most familiar. He does not interpret the reproduction in terms of straight lines but in realism. Now, some of the engineers are musicians and some of the musicians have an understanding of the engineering principles, and these know real reproduction when they hear it. By engineer and musician are not necessarily meant the individuals who make their livelihood in one or the other of these professions, but those who have the points of view of the members of those professions.

We might take some particular unit's audio frequency characteristic curve as an example of a straight curve. The engineer looking at this curve would say that this transformer is capable of a high degree of fidelity to the original. The straightness of that line satisfies him, and he knows from theory, measurement and experience that when the curve looks like that the quality should be good.

The musician looking at that curve does not comprehend a note. He cannot use that curve to play a tune, he cannot visualize, or shall we say auralize, how an orchestral selection would sound over a familiar loudspeaker after it had wound its way through an amplifier coupled with a pair of transformers like that.

But he knows when he hears the reproduction that the original realism has not been lost. It is still the orchestra that is playing.

RECENT ISSUES of Radio World, 15c each. Be sure to give date of issue when writing. Radio World, 145 West 45th Street, New York City.

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SUBSCRIPTION BLANK

RADIO WORLD

RADIO WORLD *145 West 45th Street, New York City (Just East of Broadway)*

Please send me RADIO WORLD for .....months, for which please find enclosed .....

SUBSCRIPTION RATES:
Single Copy .....$ .15
Three Months 1.50
Six Months 3.00
One Year, 52 Issues..... 6.00
Add $1.00 a Year for Foreign Postage; 50c for Canadian Postage.

New Singing Contest Announced by Kent

Encouraged by the countrywide interest evoked by its first National Radio Audition held last year, the Atwater Kent Foundation of Philadelphia has announced its purpose to hold another contest this year. While the contest in 1927 enlisted the interest of 50,000 amateur singers from among whom ten finalists were chosen to compete for awards aggregating $17,500, besides conservatory tuition, it is expected that an even larger number of youths and misses within the eligible ages—18 to 25—will participate in 1928. Similar awards are offered this year.

A. Atwater Kent

The larger number of entrants and an even more widespread interest are expected this year, owing to the greater period of time for preparation for the finals, which will be held in December.

The contest last year aroused such enthusiasm among radio users that it has been decided to retain the principle then established—that in the selection of contestants to represent states and districts, the votes of radio listeners shall weigh 60 per cent. and the vote of boards of competent judges 40 per cent.

EVERY FRIDAY at 5.40 P. M. (Eastern Standard Time) Herman Bernard, managing editor of Radio World, broadcasts from WGBS, the Gimbel Bros. station in New York, discussing radio topics.

Quick Action Classified Ads

Radio World's Speedy Medium for Enterprise and Sales

10 cents a word — 10 words minimum — Cash with Order

SETS BUILT TO ORDER, modernized, repaired. Save money on kits and radio supplies. Write: Geibel, 1243 North 30th Street, Philadelphia, Pa.

GUARANTEED Safety Razor, with strop, in neat, strong carrying case, 25 cents. First-class, new. Send coin, M. O. or stamps.—P. Cohen, 226 Varet Street, Brooklyn, N. Y.

NEW SHIELDED GRID TUBES for Diamond, S-M Six or Laboratory Super, Tyrman 70. Price $5 each. Philip Cohen, 236 Varet St., Brooklyn, N. Y.

MAKE YOUR RECEIVER do all the manufacturer claims it can! The answer is a practical, proven fact—Scott's Single Pole Tuned Radio Antenna—no trick—description FREE. Scott, Dept. RW, 719 1st St., New Orleans, La.

MAGNAVOX M7 cone speaker, List $15, A1 condition, used two weeks. Fine tone. Price, including baffle, $9. Send M. O. on 5-day money back guarantee. I. Andersen, 118 Goodrich St., Astoria, N. Y. City.

BE THE LICENSED RADIO DOCTOR in your community. $7-$10 spare time evenings. Our co-operative plan secures all the work you want. Secure franchised territory now. Write for booklet. **Co-operative Radio Doctors, Dept. W, 131 Essex St., Salem. Mass.**

TELEGRAPHY—Both Morse and Wireless taught thoroughly. Big salaries. Wonderful opportunities. Expenses low; chance to earn part. School established fifty years. Catalog free. Mention Radio World. Dodge's Institute, Cour St., Valparaiso, Ind.

RADIO SETS built to order. Sets repaired. Superhets a specialty. Sweeney Radio Shop, Dept. RW, Pearsall, Texas.

LARGE MANUFACTURER of popular priced Radio Cabinets wants representatives selling radio dealers. Models listing at $13 and up. Well made in large modern plant. Quantity sellers. Straight commission basis. For full details, address Drawer RW 10, Boonville, N. Y.

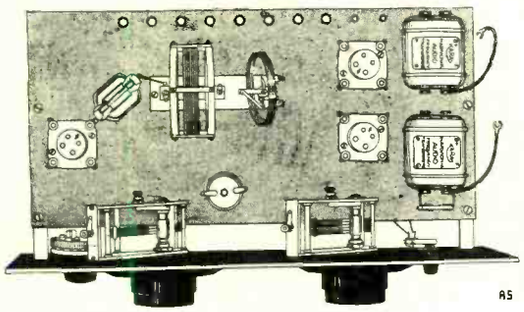
AIRPLANE CLOTH SPEAKER SUPPLIES—Genuine cloth, 24"x24" at 70c; 18"x18" at 50c. Dope, $1.00. Can apexes, 30c. Units, $3.50 and $5.00. Jefferson Mail Service, Box 184, Maplewood, N. J.

EVERY FRIDAY at 5.40 P. M. (Eastern Standard Time) Herman Bernard, managing editor of Radio World, broadcasts from WGBS, the Gimbel Bros. station in New York, discussing radio topics.

"RADIO THEURY AND OPERATING," by Mary Texanna Loomis, member Institute of Radio Engineers, Lecturer on radio, Loomis Radio College. Thorough text and reference book; 886 pages, 700 illustrations. Price $3.50, postage paid. Used by Radio Schools, Technical Colleges, Universities, Dept. of Commerce, Gov't Schools and Engineers. At bookdealers, or sent on receipt check or money order. Loomis Publishing Company, Dept. RW, 405 9th St., Washington, D. C.

RECENT ISSUES of Radio World, 15c each. Be sure to give date of issue when writing. Radio World, 145 West 45th Street, New York City.

New Marvel in the Short Wave Field



The KARAS SHORT WAVE 3 TUBE KIT

—INCLUDES THESE FAMOUS KARAS PARTS:

- Karas Micrometric Dials, 0–100
- Karas .00025 Mfd. Variable Condenser, Orthometric
- Karas .00014 Mfd. Variable Condenser, Orthometric
- Karas Subpanel Brackets
- Karas Harmonik Transformers

—and all other parts by famous manufacturers!

Cost of Complete Kit: $58.95

HERE it is! A short wave kit using the famous Karas parts—your guarantee of satisfaction! The Karas Micrometric dials included in the kit are the only practical dials for short wave receivers — smooth, even tuning — free from backlash — made of handsome Bakelite! Instantly applied; requires no drilling; only one set screw; two knobs—rough tuning and vernier. The equipment includes also Karas Orthometric Variable Condensers, built of the finest materials under precision standards. Greater separation—broader tuning range! Build this new set and experience the thrill of amazing results. **Get the complete kit at your dealer's or write to**

KARAS ELECTRIC COMPANY

4039CE North Rockwell Street Chicago

At Last!—Real Radio Reproduction!

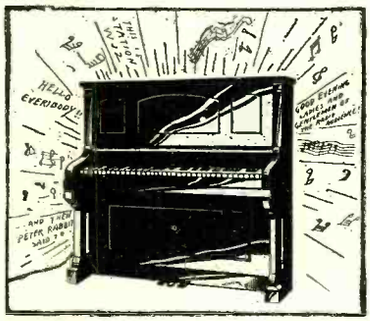
ENSCO PIANO UNIT

makes a marvelous Loud Speaker of your Piano. You will be astounded at the superb tone quality your piano is capable of delivering. Superior to anything you ever heard. And why not? There is no better reproducing medium than the seasoned wood sound board of your piano. Are not the most important musical instruments—the violin, 'cello and piano—made of wood?

The Latest Development of ENSCO Engineers

The Ensco Piano Unit allows you to take advantage of this most perfect of reproducing mediums. You attach it in two minutes—no fuss, no extra equipment, any radio set, any piano. Does not show and does not mar or interfere with piano.

New Model, Thumb Lever Instantaneous Adjustment



The Sensation of the Day in Radio

ONLY $10

10-Day Money-Back Guarantee

Complete with 20 foot cord. It is the ideal loudspeaker. You do not need to know music to realize this fact. Hear it—try it—and be convinced. Can be used in all consoles. Gives good results on any piece of furniture, back of door, etc.

On demonstration at all ENSCO Studios. Mail and telegraph orders filled. Make checks and money-orders payable to Engineers Service Co. Order at once from nearest office. Approved by RADIO WORLD Labs.

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ENGINEERS' SERVICE COMPANY

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331 Bay Street Toronto, Canada

Allow us to introduce to you the—

STANDARD CLAROSTAT

The oldest member of the Clarostat family, yet very much up-to-date in its all-metal shell. Long the standard with radio manufacturers and set builders as the universal variable resistance, with a range of from practically 0 to 5 megohms. This enormous range is covered in several turns of knob, thereby giving a better separation of resistance settings than in most devices of but a fraction of the range. That is why it is called micrometric resistance, with its razor-sharp settings. The Standard Clarostat is employed to control voltage taps in radio power units and electrified receivers. It has many other applications where high resistance together with ample current-handling capacity is required. And all for $2.25.

Your dealer stocks the Clarostat line. Ask him to see the various types and to tell you how to use them for better radio results. Or write us direct for literature.

American Mechanical Laboratories, Inc.

MEMBER RMA

Specialists in Variable Resistors

285-7 N. Sixth Street Brooklyn, N. Y.

Improves-

tone fidelity, clarity, sensitivity—by automatically keeping tube filament voltage constant, despite "A" battery variations.

AMPERITE

REG U S PAT OFF

The **"SELF-ADJUSTING"** *Rheostat*

eliminates hand rheostats. Simplifies wiring, tuning, panel design. Particularly essential with Battery Eliminators. Accept only Amperite. $1.10 mounted (U.S.A.)

FREE—"Amperite Book" of latest circuits and construction data. Write Dept. RW-6.

RADIALL CO. 50 Franklin St., New York

SCOTT WORLD'S RECORD

Build the 9,400-mile receiver. **SUPER 10** Listen in on all the world. Easy and economical to construct. Results guaranteed. Write today for free circuit diagram, parts list and copies of long distance reception verifications.

SCOTT TRANSFORMER CO.

7626 Eastlake Terr. Dept. E Chicago

FOUR WORLD'S RECORDS

★ **SCOTT'S SUPER TEN** ★

Official Service Station

Also for **NEW** Screen Grid **DIAMOND** of the **AIR**

Sets Built of Tested, Guaranteed Parts. Shipped Anywhere. Satisfaction Absolutely Guaranteed.

H. & F. RADIO LABORATORIES, Inc.

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PANELS

BAKELITE—HARD RUBBER

All Popular Circuits in Stock

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Special Panels Complete to Order

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