

MARCH 20 1926 15 CENTS

RADIO WORLD

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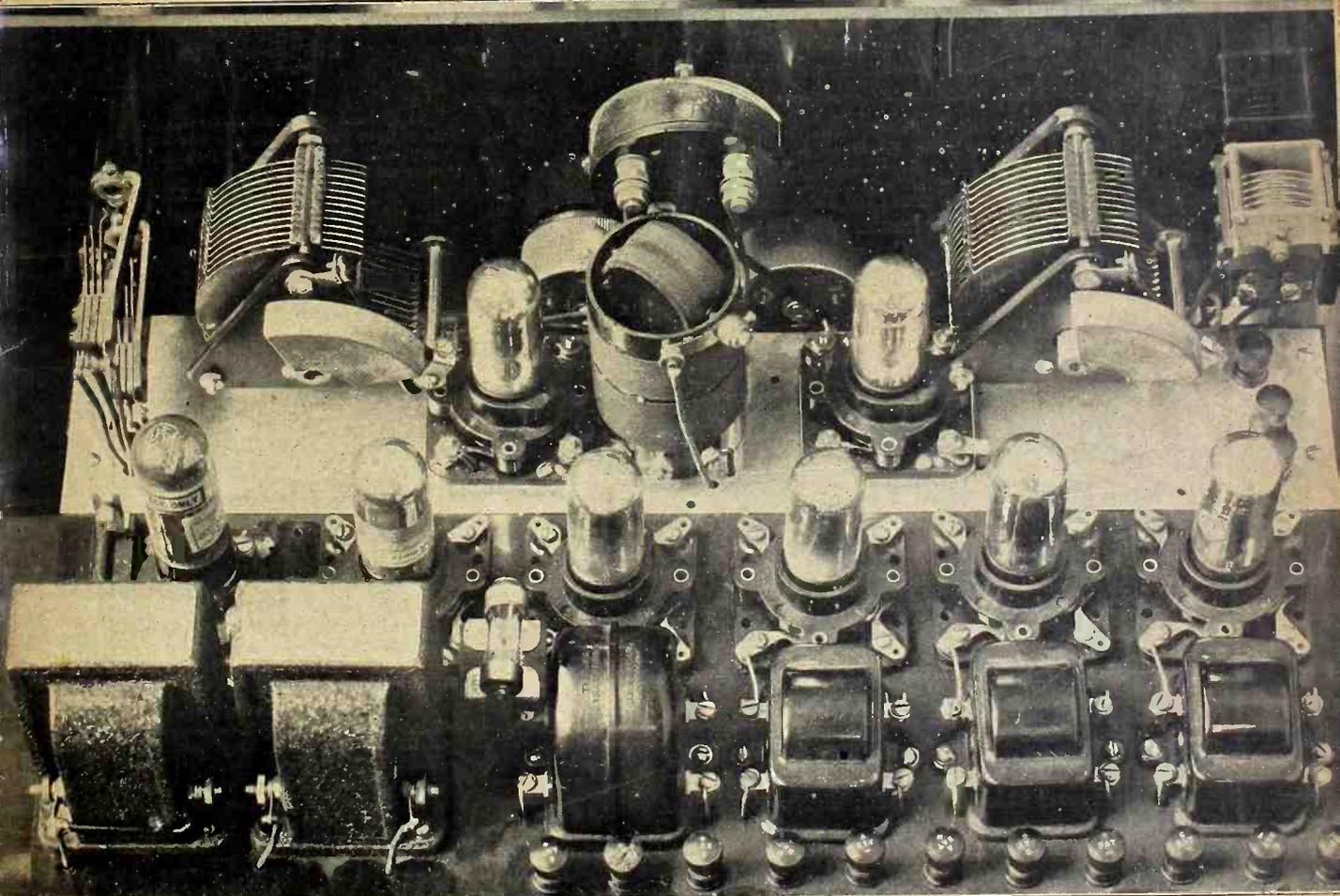
Vol. 8 No. 26 ILLUSTRATED Every Week

A 2-TUBE SPEAKER SET

STUDY OF CHOKE COIL AF

DEFINITIONS FOR NOVICES

A SUPER-HETERODYNE DE LUXE



THE DE LUXE SUPER-HETERODYNE as seen from the rear. Dry-Cell tubes (99 type) are used, with a power tube (120) in the last stage, at left. A feature of this set is its expert layout. Regeneration is used in the antenna circuit, the midget condenser affording this.

(Photo by Paul Hollingshead)

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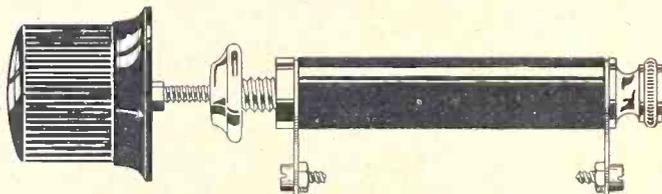
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I received the Bretwood Grid Leak. Thanks for your promptness. The Bretwood is the best grid leak that I have ever had. Since I placed it in my 1926 Model Diamond of the Air I have received stations from nearly every part of the country. WMBF, WSB, KOA, 6KW, WBAP, WIAX, WOC, KFKX, PWX, KGO and KFI were all brought in on the speaker as soon as this instrument was put into the receiver. As for clearing up distortion, I have never seen anything to equal the Bretwood Grid Leak. I have placed one also across the primary of the first audio-frequency transformer and the results are marvelous.

E. HIGGINS,
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* * *

An obligation of gratefulness impels me to write you that any one who has not used the Bretwood does not know what a grid leak is.

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* * *

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* * *

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Enclosed find \$1.50, for which please send me another one.

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* * *

With your grid leak I was able to bring in with good volume 15 W stations in one week with a Diamond of the Air set from a city hard to get out of.

Thanking you.

F. W. COLLINGWOOD,
3442 Sacramento St.,
San Francisco, Cal.

* * *

I received the Bretwood Variable Grid Leak last night and it sure did bring in stations. Denver was as far as I could get until last night, when, with the Bretwood in my set, I brought in KFI, Los Angeles, and KPO, San Francisco, Cal., clear and fine.

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4026 Grezella St.,
Pittsburgh, Pa.

* * *

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RADIO WORLD

[Entered as second-class matter, March, 1922, at the post office at New York, N. Y., under the Act of March 3, 1879.]

A Weekly Paper Published by Hennessy Radio Publications Corporation from Publication Office, 145 West 45th St., New York, N. Y. Just East of Broadway. Phones: BRYant 0558 and 0559.

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March 20, 1926

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NOT all high class radio receivers are built in laboratories by skilled men whose vocation is radio engineering. Not all high-class receivers are built in accordance with the ready-made plans published in the various radio journals, and laid out and described by professionals who are supposed to be well versed in the subject. A few superior receivers are built by fans in their own homes and in accordance with their own ideas and plans. One of the finest examples of home-constructed sets that the present writer has ever seen is the Super-Heterodyne described in this article, built by Paul Hollingshead, a photographer by vocation and an advanced radio experimenter by avocation. Naturally, Mr. Hollingshead did not essay a complicated Super-Heterodyne the first thing. This receiver is his nth, where n is a large number not accurately known. He began by building the simpler sets "way back in pre-Neutrodyne days, then increasing the complexity as both he and the art developed. He has used practically every good receiver that has come out since he began as stepping stones to his present standing.

Used His Head

In building his various receivers he was not satisfied by blindly running spaghetti-covered bus-bar between numbered terminals. He preferred to work from symbolic diagrams of the receivers, and to use his own judgment about layouts and connections. He learned the meaning of all the symbols, what the functions of all the component parts in the circuit were, and to what degree the various parts available could be expected to perform these functions. He was not satisfied with a finished receiver which would merely squawk. His sensitive musical ear demanded quality comparable with the original matter broadcast. His choice of parts from the aerial to the Western Electric cone-speaker was made in answer to this demand.

The present Super-Heterodyne represents Mr. Hollingshead's own ideas as to what constitutes a good receiver, both as to physical and electrical layouts; and it is the result of careful study of all the Super-

A Super-Heterodyne De Luxe

By J. E. Anderson
Consulting Engineer

Heterodynes that have been published during the last two years. A scrutiny of the circuit diagram will show that he is not alone in his opinion. The oscillator circuit is of the three winding type with one side of the oscillator condenser grounded. This type of oscillator was selected because it won out over the other types in actual trial.

Hand Capacity Absent

One of its main advantages is that there is no hand capacity effect, since the rotor side of the condenser is grounded, or at the same potential as the hand that operates the dial. The modulator is the grid bias type, which many engineers regard as the only logical type to use. Regeneration is employed in the loop or antenna circuit as a means of varying the sensitivity; and this regeneration is accomplished by the Hartley parallel feed method, with a midget condenser for controlling the feed back. The intermediate amplifier consists of three stages, iron-core transformer coupled; the detector is of the grid condenser, grid leak type, chosen because of its sensitivity, and this is coupled to the last IF stage by an air core filter-transformer; the first stage of audio is transformer coupled, while the last is auto-transformer coupled. The antenna input transformer L1L2 is not an integral part of the assembled receiver, but is external to it. Three binding posts merely are provided because the receiver is primarily intended for loop operation. The input transformer is used for long distance reception and in cases where a loop would prove inconvenient. The two windings L1 and L2 are wound on a piece of bakelite tubing 3" in diameter and have 10 and 43 turns, respectively, of No 24 double silk covered wire. The tap on the secondary is placed at the 15th turn, measured from the plate end of the coil.

The two windings L3 and L4 of the oscillator are wound on a piece of Bakelite tubing 2" in diameter with No. 26 double silk covered wire, the tickler containing 45 turns and the secondary 60 turns. The pick-up coil L5 is wound with 24 turns of No. 26

double silk covered wire on 1.5" Bakelite tubing, and this coil is mounted on bearings inside the larger tube near the tickler coil end. While the pick-up coil may be rotated for varying the amount of coupling between the oscillator and the modulator circuit, no control for this purpose is placed on the panel.

Constants Discussed

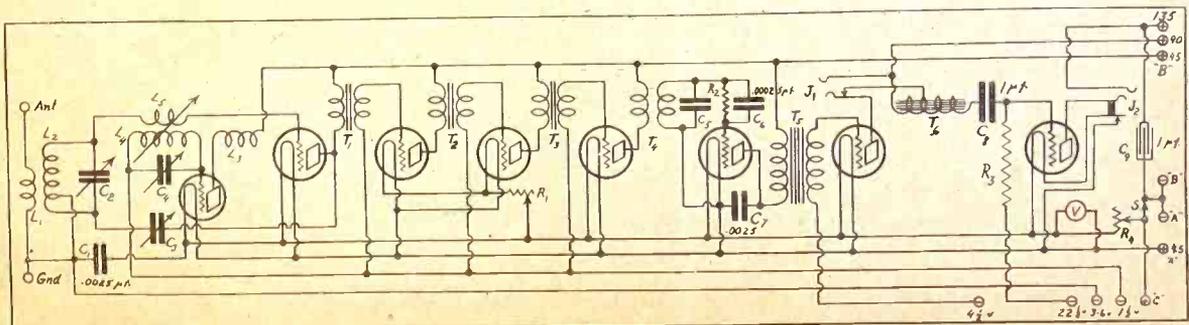
The two tuning condensers C2 and C4 are both of .0005 mfd. capacity of General Radio make. The capacity of these condensers and the inductance of the two windings across which they are connected are such as to cover satisfactorily the broadcast range of frequencies. The regeneration control condenser C3 is a midget, while the by-pass condenser C1 is a .0025 mfd. Sangamo Bakelite moulded condenser.

The first three intermediate frequency transformers T1, T2, and T3 are General Radio medium frequency iron core transformers, while the filter transformer T4 is of the same make, but in a tuned air core filter. The condenser C5 across the secondary of this transformer T4 is an integral part of this filter, placed there to tune the secondary to a frequency of 30,000 cycles. When building this circuit, therefore, this condenser should not be considered. It is merely included in the circuit drawing Fig. 1 to indicate that it is actually there.

The grid leak in the detector is variable, and over wide limits. The grid condenser C6 is a .00025 mfd. Dubilier, and the by-pass condenser C7 in the plate circuit of the detector is of the same size and make as C1.

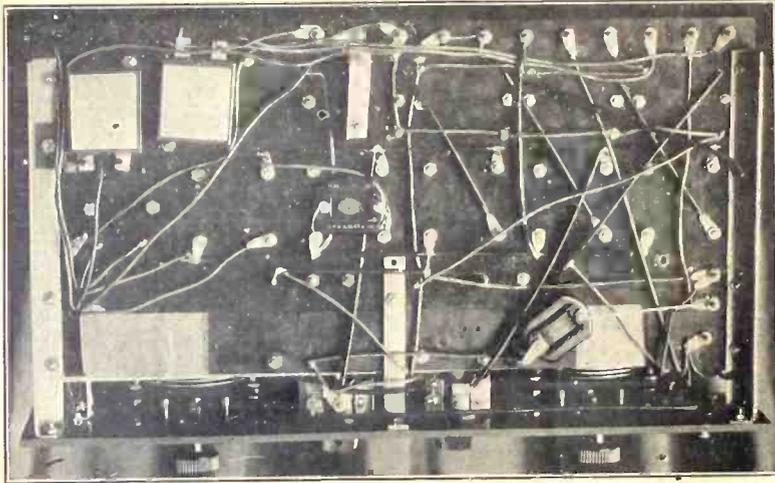
The Audio Channel

Both the audio frequency transformers are Rauland Lyrics. The first, or T5, is used as a straight transformer, but the second, or T6, is used as an auto-trans-



THE CIRCUIT PATTERN of the 8-tube dry-cell Super-Heterodyne in schematic form. The "first detector" uses the grid bias method, the "second detector" the grid leak-condenser method.

Assembly of the DX Set



MUCH OF THE WIRING is done under the subpanels, as this photograph by Mr. Hollingshead shows.

former. In connecting this transformer in this manner, the terminal marked G is connected to the positive of the plate battery, the terminal marked P is connected to the grid, and the two terminals marked B and F are joined together and connected to the spring of jack J1 which leads to the plate of the first audio amplifier tube. This places the largest winding in the primary or plate circuit and both the windings connected in series—aiding in the secondary or grid circuit.

The blocking condenser C8 is a 1.0 microfarad Dubilier. The grid leak R3 is a 250,000-ohm Daven, and the mounting for this is also of the same make. The by-pass condenser C9 across the B battery is of the same size and make as C8.

All the tubes in the circuit with the exception of the last are Cunningham 299. The last is the UX120 power tube. All the sockets for the small tubes are Benjamin and the socket for the power tube is a General Radio UX type.

Rheostat Control

A master rheostat R4 controls the filament current in all the tubes. A Weston voltmeter V is put across the common fila-

ment line on the tube side of the rheostat and the voltage is always held at 3. As a means of controlling amplification and oscillation in the intermediate frequency amplifier, a second rheostat R1, in series with the master rheostat, is connected in series with the first two IF amplifier tubes. This is an effective volume control and it does not seriously affect quality since it is used for the two tubes which are called on to handle only small signal grid voltages. With this minor exception there is no tampering with the filament current in an effort to tone down the volume in case it is too loud. Ample volume control is obtainable with the pick-up coil and with the tickler condenser C3.

Battery Voltages

The plate potential on all but the two last tubes is maintained at 45 volts with respect to the negative end of the filaments. On the first audio frequency amplifier tube the plate voltage is 90 volts, and on the last, or power tube, it is maintained at 135 volts. The grid potentials on the various tubes are adjusted for these plate potentials. On all the amplifier tubes and on the oscillator tube which have 45 volts on the plates the grid bias is $1\frac{1}{2}$ volts. On the modulator, or the second

LIST OF PARTS

- An antenna input transformer, L1, L2 (or a loop).
- An oscillating coil as described.
- Three General Radio medium frequency transformers, iron core, type 271.
- One General Radio 20-ohm rheostat, type former, type 331.
- Two Rauland-Lyric audio frequency transformers
- Two General Radio tuning condensers, .0005 mfd. each, type 247-F.
- One midget condenser.
- Two Marco vernier dials.
- Two Sangamo fixed condensers, .00025 mfd. each.
- Two Dubilier fixed condensers, 1.0 mfd. each.
- One Dubilier fixed condenser, .00025 mfd.
- One General Radio 20-ohm rheostat, type 214A.
- One General Radio 6-ohm rheostat, type 301.
- One Variable grid leak.
- One Daven grid leak, 250,000 ohms, with mounting.
- One double circuit jack.
- One single circuit filament control jack.
- One filament switch.
- One Weston filament voltmeter (panel type 0-7, 0-140).
- Seven Benjamin sockets for UV199 tubes.
- One General Radio socket for UX120 tube (type 349).
- Seven 99 type tubes and one UX120 tube.
- Accessories: Fourteen Eby binding posts (C-, C-, C-, C-, C+, A+, A-, B-, B+ Det., B+ Amp., B+ Amp.; three unmarked, for ant. ground loop); one 22.5 volt grid battery, tapped for every cell; twelve No. 6 dry cells; three 45-volt plate batteries, preferably large size; one Western Electric cone type speaker.

tube in the diagram, the grid bias is from 3 to 6 volts. Various values between these limits may be tried until the one is found that gives the best response. If two different values seem to give about equal volume, the greater negative value should be used since this is more economical with respect to plate battery drain. The tube operating on 90 volts on the plate should have a grid bias of about 4.5 volts or slightly more.

The last tube, which has 135 volts on the plate, requires a bias of 22.5 volts or somewhat less. The bias on the detector tube is, of course, positive, the grid return being connected to the positive end of the filament. The correct bias on the two last tubes may be found experimentally by means of the voltmeter. This is temporarily disconnected from its present position and then connected in series with the plate circuit of the tube for which the grid bias is to be adjusted.

The jacks may be used for this purpose. The grid bias is adjusted until the pointer on the meter neither jumps up nor down when very strong signals are being received. When each of the two last tubes has been adjusted in this manner, the voltmeter may be returned to its permanent position. It is, of course, not necessary to remove the meter from the panel when the adjustment is made.

Speaker on One Audio

The first jack, J1, is mainly provided for use with a headset, but it may be used for moderate volume on a loud speaker. J2 is the regular output jack for loud speaker operation. It is an automatic filament jack which leaves the filament of the last tube open when no plug is in the jack.

There are fourteen Eby insulated binding posts altogether in the circuit. Three of these are for the loop, five for the grid

Slipping of Dials Confuses Many Fans

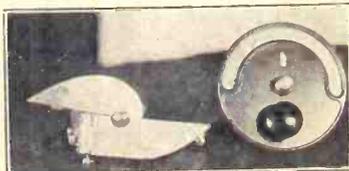


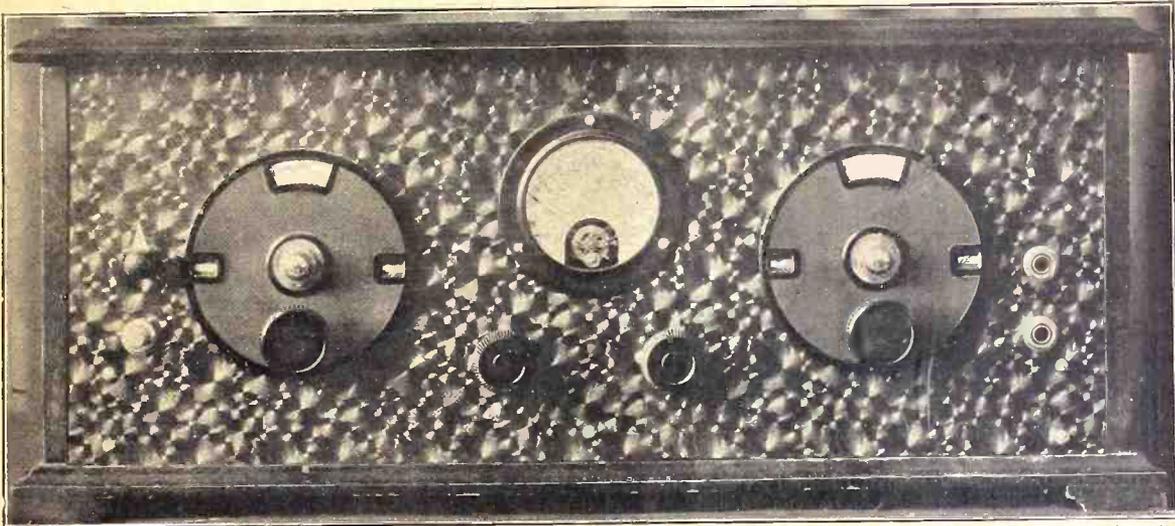
PHOTO represents minimum setting of the condenser and zero setting of the dial.

Much perturbation accompanies the seemingly inexplicable shifting of dial readings. Sometimes a radioist enjoys the simplified tuning attendant upon synchronously reading dials. Stations come in at 15-15, 20-20, 60-60, etc., if there are only two dials, or if there are more, they

read similarly in step. This is hailed as an accomplishment, as the stray capacity coupling in the antenna circuit sometimes makes the achievement of synchrony rather difficult. Then, as if for no reason, the whole scheme is upset!

This is often due simply to a loose set-screw on one or more of the dials. Especially if the tuning condenser has end-stops is there a tendency to jar the dial one way or the other, therefore the dial settings, but not the actual condenser settings, are changed. The solution is to re-adjust the "off" dial, so that at zero or at 100 it represents full capacity (depending on whether the frequency or wavelength system of tuning and dialling is used). Most fans, in either case, will prefer to have minimum capacity represented by zero on the dial, and should test both dials accordingly.

Panel View of Receiver



PANEL VIEW of the De Luxe Super-Heterodyne, as constructed and photographed by J. E. Anderson's personal friend, Paul Hollingshead. The 7x18" panel is of the frieze type. Photographed by Paul Hollingshead.

battery, two for the filament battery, and four for the plate battery.

The master rheostat is of 6 ohms resistance and the other, R1, is of 20 ohms. Both are of General Radio manufacture.

The filament power is supplied by a battery of 12 No. 6 dry cells connected in series-parallel to give 4.5 volts. Since the total filament current flowing is about .54 ampere when each tube is drawing normal current, each tube delivers about .137 ampere. This is near the rate at which dry cells deliver the greatest number of ampere-hours, and hence this combination is the most economical. The set may be operated on six of the cells connected in series-parallel, but the current then in each cell would be slightly excessive.

The Builder's Photography

Three photos, taken by the builder, are shown herewith. One of these shows the attractive panel layout. It shows the filament voltmeter at top center. Directly under this are the two rheostats, the master rheostat at the right and the other at the left. On either side of the voltmeter are the two vernier dials which control the tuning, the oscillator being on the right and the loop at the left. The knob controlling the regeneration condenser is shown directly to the left of the loop dial, and the filament switch S is directly under this knob. At the right end of the panel and symmetrically located with respect to the knob and switch are the two jacks. There is nothing superfluous on the panel. Size of panel is 7x18" and material is hard rubber.

The second picture shows the interior layout of the receiver. The width of the baseboard is 10", and it is divided into two parts, one of hard rubber and one of metal, both supported on metal brackets. One criticism may be offered to this arrangement, and that is the location of the oscillator coil with respect to the metal part of the baseboard. It is close to it and the field is at right angles to the metal sheet. Losses will be introduced by eddy current induction. The builder intends to replace this sheet of metal with a strip of hard rubber; and any one building the set should use insulating material throughout. Attention is called to the very short leads from the transformer secondaries to the various grids.

The third picture shows the wiring underneath the baseboard, together with the sup-

porting brackets and four of the five fixed condensers in the circuit.

DX Not So Bad

A few of the DX stations picked up with receiver from New York City follow:

Station	Ant.	Osc.
WSB, Atlanta, Ga.....	62	65.5
WCBD, Zion, Ill.....	41	44.5
KOA, Denver, Colo.....	36.5	39.5
KFKX, Hastings, Neb....	29	32
KNOX, St. Louis, Mo....	28	31
WCXB, Detroit, Mich....	26.5	29.5
KMOK, St. Louis, Mo....	24.5	27.5
WENR, Chicago, Ill.....	24	27
WDBO, Winter Park, Fla..	21	24

All of these stations were received with

loud speaker volume while most of the local stations in New York were on the air.

The photograph on the front cover shows the so-called modulator tape at right, near panel, the oscillator at left of the coupler. The intermediate chain runs from right to left, the transformers in foreground being T1, T2, T3 and T4 (filter) in that order. The four C— posts are in foreground at right, and reading thence to left are C+, A+, A, B—, B+ Det., B+ Amp., B+ Amp. The antenna coupler is not shown, as it would be external to the set, if used at all. A loop is inserted by placing its tips at the two posts that connect to C2. As L2, if used, is grounded, the three posts are for ant., grid and modulator grid.

An Expert's Analysis Of the Super-Heterodyne

[Part I of this article on "My Adventures with Super-Heterodynes," by J. E. Anderson, was published last week, issue of March 13, when the illustrations, referred to in this week's text, were printed too. More data will appear next week.]

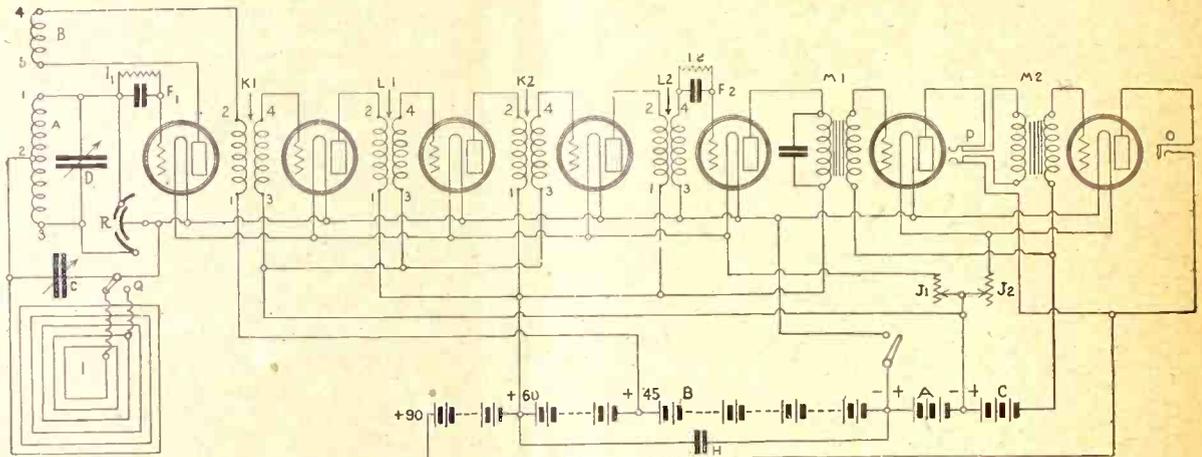
CALIBRATED once for all, three controls present no hardship. It is even possible to add two stages of radio frequency amplification and making this a regular Neutrodyne tuner. Some of the radio frequency tuned circuits may be combined so as to eliminate a control or two. If this is done it will be necessary to include a volume control in the radio frequency amplifier which is independent of tuning, otherwise the advantage of the radio frequency filter will be lost. This control may be a rheostat in the filament circuits of the radio frequency tubes, but preferably it should be a voltage input control. All pick-up of signal by the oscillator coil, the radio frequency coils, or leads must be carefully prevented by shielding. There should only be one avenue of ingress to the circuit, and that should be the loop or antenna. The electromotive force thus let in should be controlled as to intensity so that no part of the circuit becomes overloaded.

Much of the squealing interference

caused by radiating receivers has been attributed to regenerative sets in the past while the Super-Heterodyne has been given a clean slate. That is not entirely fair to owners of regenerative sets. It is safe to say that much of this type of interference during the international tests was caused by super-heterodynes. Many owners of the more humble sets knew by previous experience that they could not pick up trans-Atlantic stations, and probably did not try again. But owners of Super-Heterodynes thought they might, and they kept the oscillator dial whirling all the time in the hope that they would hear something of a foreign origin. And just because they could not hear their own squeals in the loud speaker they thought that no body else could. Every Super-Heterodyne worthy of the name has a good filter between the oscillator and the loud speaker which effectively prevents squealing of this type from getting through. But rare is the Super-Heterodyne which has any provision which keeps the radio wave generated by its own oscillator from getting out into space. Every Super-Heterodyne in operation radiates. Some radiate much, some just a little. Radiation of energy may take place from the battery and other leads, from the oscillator coil, and from

(Continued on next page)

The Super-Heterodyne



CIRCUIT DIAGRAM OF THE PRESSLEY Super-Heterodyne. This uses the Autodyne system, where the frequency conversion is accomplished in one tube (combined oscillator-modulator). R is a balancing condenser. A tapped loop is necessary. (Q.) J. E. Anderson discusses radiation in conjunction with this receiver. A rheostat J1 is the oscillation control of the medium frequency amplifier.

(Continued from preceding page)

the antenna or loop. Even the Pressley circuit, which is supposed not to be a radiator, does radiate. The radiation from the pick-up loop in a well balanced Pressley may be infinitesimal but the radiation from the open field oscillator is certainly not infinitesimal. A loop radiates if radio frequency energy is fed into it, and a solenoid coil is nothing but a miniature loop. Hence it radiates. No doubt the radiation from this circuit is very small in comparison with that from certain other forms of Super-Heterodyne, but it is there.

In connection with overloading it may be well to call attention to a phenomenon which is often observed in a Super-Heterodyne receiver. It sometimes happens that on a loud signal this will entirely disappear at that point of the dial where it should come in loudest; that is, the signal comes in weak at first as the oscillator dial is turned, increases slowly, then suddenly disappears and remains absent for several degrees on the dial, then appears with the same strength as it had when it disappeared, and then gradually disappears. This phenomenon sometimes also appears on the modulator tuning condenser and on the radio frequency condenser if there is one in the circuit; and when there is, it is more likely to happen. On these condensers the silent space is usually much wider than on the oscillator condenser. The reason for this silent space is obviously overloading of some part of the circuit, most probably either the modulator or the final detector. The remedy is to incorporate a volume or signal voltage intensity control in the circuit; and this must, of course, be placed ahead of the overloaded part. The best places to put it are in the grid circuit of the first radio frequency amplifier, the oscillator pick-up, and in the grid circuit of the first intermediate frequency tube. It is well to have one such control in the grid circuit of the first tube in each of the three levels of frequency.

Overloading Explained

This overloading may be explained with the aid of Fig. 1. AB represents a resonance curve of either the intermediate frequency filter or of one of the radio frequency tuned circuits. The ordinates represent the volume, or signal voltage amplitude, and the abscissas represents the frequency. F1 may be the frequency at which the signal becomes audible as

the control is varied. It then increases up to F2, where it is about as loud as it can be received clearly. At this point it becomes mushy and rapidly grows unintelligible, until the overloaded tube chokes up and silence results. This silence is noticeable for several divisions on the dial on either side of the setting which corresponds to the resonant frequency Fr. At F3 the signal becomes clear again and remains so until it becomes so weak at F4 that it can no longer be heard. In a well controlled set it should be clearest at Fr and it should not be heard at all at F2 and F3.

Intermediate Oscillation

It often happens in poorly adjusted or intentionally regenerative intermediate frequency amplifiers that oscillation occurs in one or more of the tubes. If this oscillation is feeble the set may be abnormally sensitive as a result, but if it is intense it may completely ruin the set, unless the oscillation can be stopped by some means. Oscillation in the medium frequency amplifier manifests itself in profuse squealing as the oscillator dial is moved. Beat squeals may be heard at every division of the dial over the entire scale, and sometimes the squeals overlap. The intensity of these squeals varies from the lower limit of audibility to ear-splitting howls. The squeals are due to beating between the I.F. frequency and its various harmonics as generated by the frequency changer with the frequency generated in the oscillating I.F. tube and with the harmonics of this frequency. The remedy for this kind of squealing is simply to stop oscillation in the tube that causes the trouble. This may be done by shielding the various stages from each other, by so placing the transformers as to minimize electro-magnetic and electrostatic coupling, by neutralizing the I.F. stages as in a neutrodyne, and, in an extremity, by reducing the filament current in the tube or tubes causing oscillation. This last method is bad practice, but is nevertheless the one most frequently resorted to.

How can radiation from a Super-Heterodyne, or any other oscillating circuit, be minimized? One way is by shielding. It was stated above that this should be done to prevent energy from coming into the circuit by all avenues of ingress except one, the loop or antenna. If this is done there is only one avenue of egress; and it is easy to prevent the radio frequency energy from backing up

and escaping through that avenue. The Pressley method of balancing is one effective way; neutralization of the radio frequency amplifier stage is another. And if the locally generated oscillations cannot escape the circuit of course there will be no radiation. A receiver so adjusted can be given a clean slate; the energy that would escape through any unbalance or through the shielding is not likely to cause any interference. Another way of minimizing radiation is by using closed field oscillator coils, such as a static and toroidal windings; and this method may be used in conjunction with shielding. Next time the proud owner of a powerful Super-Heterodyne is interfered with while fishing for distant stations let him first set his own house in order before he gives vent to his feelings against the tickler addict.

Blame for Harmonic Interference

In the Super-Heterodyne, and to a lesser extent in other receivers, there is sometimes considerable trouble from harmonic interference. There is cross talk between the second and even third, harmonic of a long wave station and the fundamental of a shorter wave station. For instance, WEAF, which is operating on a wave of 492 meters, sometimes interferes with the fundamental wave of a station operating on 246 meters; or WNYC, operating on 526 meters, interferes in the same manner with WBPI, which is operating on 263 meters. In the past this sort of interference has naturally been blamed on the big fellows, by accusing them of sending out broad waves, or waves rich in harmonics. For a time I was "taken in" by this accusation against the supposedly offending stations, but I have revised my opinion. I found that the receiver was to blame. The wave radiated by WEAF is quite free from harmonics, yet I have received that station with the set tuned to 246 meters. A wave trap tuned to 492 meters cut out the signal, but a trap tuned to 246 had no appreciable effect on the signal. This seemed to indicate that the harmonics arose in the receiver.

Harmonic Trouble

Frequency doubling occurred in one or more of the R. F. tubes, and the double frequency was selected and amplified. When the first tuner was set at 492 meters and the rest of the tuners at 246 meters, the signal was very loud, indicating that in this case, the first tube did most of the frequency doubling.

A 2-Tube Speaker Set

By Percy Warren

SPEAKER volume on only two tubes may be obtained from the reflex circuit shown in Fig. 1. The volume will be fairly good on local stations. High ratio audio-transformers may be used in both stages.

It is advisable to use storage battery tubes, but if dry cell tubes are used they should be of the 99 type.

The radio-frequency transformers L1L2 and L3L4 may be any commercial type, with tuning condensers C1 and C2 of suitable capacity, determined by the inductance of the secondaries. If the coils are to be wound by the constructor, they may be placed on 3 1/2" diameter tubing, 3 1/2" or 4" high. There would be two such forms. L1, the primary of the first transformer, would consist of 13 turns of No. 24 double cotton covered wire. The secondary would be wound with the same kind of wire and would consist of 45 turns if C1 is a .0005 mfd. variable condenser. If a .00035 mfd. instrument is used, make the number of turns on the secondary 58.

Crystal's Damping Effect

The crystal, because of its low resistance, will have a damping effect upon the second tuned circuit, hence it will be possible to utilize a greater transfer of energy than ordinarily. So L3, the primary of the second coil, may consist of 16 turns of wire. The secondary will have the same number of turns as the other secondary, depending on the capacity of the tuning condenser, as explained. The separation in each case between primary and secondary is 1/8".

The Circuit Described

The circuit consists of a stage of tuned radio frequency amplification, a crystal detector, a first stage of audio reflexed in the radio-frequency or first tube, and a second stage of audio, non-reflexed. The coupling media in the audio channel are transformers. Fans having any at hand may use those, and if the radios differ it may be advisable to put the higher radio in the first stage. This is AF1 in the schematic pattern.

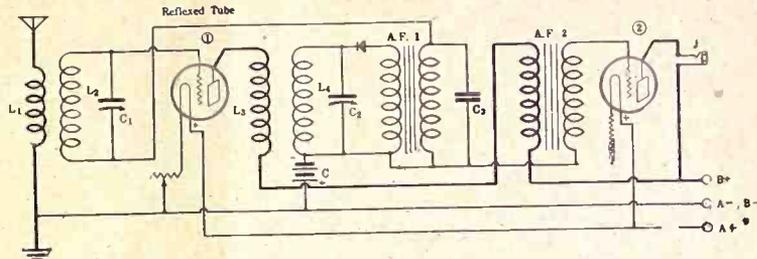
Oscillation Control

There is only one rheostat shown. This may be used to control excessive oscillation in the reflexed tube. Strong oscillation on the lower waves, say on 350 meters or less, is to be expected, due to the comparatively large number of turns on the primary L3.

A rheostat may be used for the final tube, also, but as this tube is not in a critical part of the circuit this resistor may be a ballast. If a 99 tube is used here, with a 4 1/2-volt A battery source (an ordinary C battery), then the ballast may be a 4 1/2-v-99 Amperite. If a ballast is used, put a switch in series with the A plus lead, not shown in the diagram, but if a rheostat replaces the ballast no switch will be needed.

Theory of Set

The set is a reflex because the first tube, designated by the numeral 1 in a circle, amplifies the signal both before and after detection. The radio wave enters the set through the antenna-ground system, L1 being the medium therefor, and is transferred to the secondary L2, by mutual induction. In this secondary circuit it is afforded a path of lowered resistance by virtue of the tuning of C1 and then is passed on to the other secondary, L4.



CIRCUIT PATTERN (Fig. 1) of a 2-tube reflex receiver that affords fairly good speaker volume in the reception of local stations. The resistor in the filament leg of the second tube is a ballast and its unconnected side should go to A minus. A switch in series with the A plus lead of the set and that post of the A battery should be included, if a ballast is used, but if a rheostat is substituted, omit the switch.

through the primary L3 of the interstage coupler. L4 is tuned likewise. The crystal is connected between the "high potential" side of L4 and the primary of the first audio-transformer, and thus separates the audio wave from the radio wave, rendering audibility possible. The action is called detection. The secondary of AF1 picks up the alternating current which the audio-transformer introduces and this is passed back to the first tube by connecting the G post of the transformer to the grid of that tube, through the coil L2. In other words, the grid return of L2 is made through the audio-transformer secondary. To facilitate the passage of the radio wave by-pass condenser is sometimes advisable across the audio-transformer secondary. This is C3 in Fig. 1. It should not be of large capacity, to avoid passing audio current. The plate of the first tube, at this stage, represents audio output, although, as we have seen, it is handling radio frequencies too. The end of L3 is brought to the P post of the second audio-transformer, and the B voltage is delivered through the primary of AF2 to the plate of tube (1). The audio current, again amplified, is delivered to the grid to filament circuit of the last tube, in the plate circuit of which, in series with the positive B, the speaker connections are made through a jack.

LAYOUT OF SET

The set may be made on a 7x18" panel,

LIST OF PARTS

- Two radio frequency transformers, L1L2, L3L4.
- Two variable condensers, C1, C2.
- One crystal detector.
- Two 4" dials.
- Two dial pointers.
- One 20-ohm rheostat.
- One 99 4v-99 Amperite.
- One single-circuit jack, J.
- Two sockets.
- One fixed condenser, .00025 mfd., C3.
- Two audio frequency transformers, AF1, AF2.
- One 7x18" panel.
- One 7x17" baseboard.
- Accessories: 100 ft. aerial wire, 50 ft. No. 14 insulated leadin wire, window lead-in connector, ground clamp, lightning arrester, bus bar, battery cable (connecting being made to most convention point direct on parts used); two 99 tubes; two 45-volt B batteries; two parallel connected 4 1/2-volt C batteries, used as A battery for 99 tubes; one extra C battery, used as C battery, bias 4 1/2-volts negative.

with plenty of room to spare. With panel in front of you, the coil L1L2 may be at the rear left rear of a 7x17" baseboard, the reflexed tube being in front of the coil. The other coil may be placed on the baseboard, too, its nearest point 8" back of the panel rear, (unless the condenser C2 is deeper), and the coil at right angles to the other coil, and about 7" away from the nearest point of L1L2. The first audio transformer would be at the right-hand front side of the baseboard, while the other audio-transformer would be behind L3L4, about 3" free space existing between the RF and the AF transformers mentioned. The final tube would be to the right of the second AF transformer.

The panel would show the two tuning dials, centers 4" from left and right of the panel edges, respectively, with 6" in between the two dial edges. The rheostat would be under dial No. 1 and the switch under dial No. 2, with the single circuit jack 9" from left and 1 1/4" up. Two dial pointers should be added, unless the dials used are of the type that do not require them, such as the window model dials.

The Reflexing

The actual reflexing is one of the problems, especially for a beginner, as he gets confused in the doubling up of the purposes. Therefore the wiring of the reflexed stage will be stressed, in conjunction with a sketch of the wiring work.

Be sure to connect the coils so that, if they are placed with primary considered on top, the connections would be: aerial to top terminal of L1, ground to bottom of L1; top of L2 (point adjoining end of L1) to G post of AF1, other terminal of L2 to grid of tube (1). Beginning or top of L3 to plate, end to P post of AF2; beginning of L4, (point adjoining end of L3) to minus C; other terminal of L4 to one side of the crystal. The other side of the crystal goes to the P post of AF1.

The rotor plates of the variable condensers go to the G post of AF1 and to C minus, respectively.

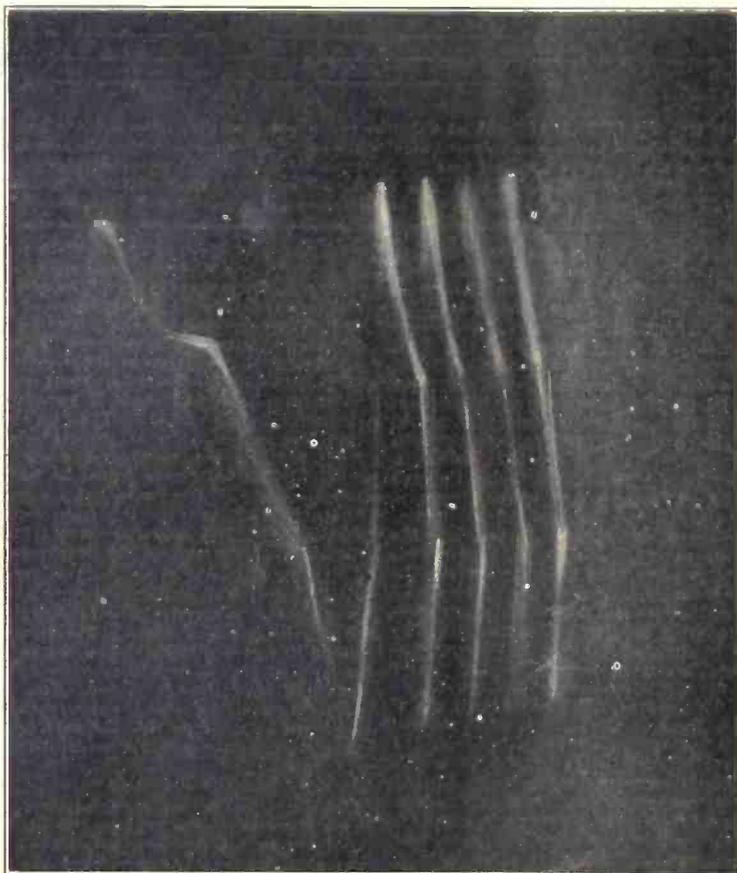
The fixed condenser C3 is placed across the secondary of AF1. Note that the end of the primary of AF1 and the end of the secondary are connected together, that is, both terminals go to C minus. This imparts no negative bias to the crystal, since the output side is not connected to A minus.

Note that in the diagram one side of the ballast is not connected. It goes to A minus. Draw the line in there, hopping over A plus on the way down.

NEWS DEALERS, ATTENTION! There is a big demand for RADIO WORLD'S "1926 Diamond of the Air" Booklet and Blue Print. Retail at 50 cents. You can get supply at wholesale rates from RADIO WORLD Offices or from the American News Company and Branches.

Choke Coil Amplification

Substitution of Primary of Bell-ringing Transformer for Regular Choke Coil Impairs Purity of Wave Form, Photographs and Tracings of Actual Wave Forms Show



PHOTOGRAPH of an audio-frequency wave, made from the fluorescent screen of a cathode ray oscillograph tube. This shows a 60-cycle note, the familiar line hum.

[This is the second of a series of articles describing the results of making audio waves visible by means of a cathode ray oscillograph. The electronic stream in this tube enables portrayal of audio wave form and amplitude on a ground glass at the top of the tube. Thus the waves may be photographed or traced. Last week's article compared the purity of crystal rectification with that of ordinary tube rectification, the author reporting no difference, except that the amplitude (voltage) was much greater when the tube was used. This week the choke coil audio amplifier is discussed.]

By **John F. Rider**

Member, Institute of Radio Engineers
(Copyright, 1926)

IT is said that a little knowledge is dangerous. That statement is indeed true, and nowhere is its accuracy so frequently and forcibly illustrated as when that proverb is applied to radio matters. Without attempting to assume the role of a critic, it must be admitted that many erroneous statements have been made under the guise of well-intended suggestions. The majority of these have been suggestions of various substitutes to be used in place of the original. This is especially true when the discussion pertains to audio-frequency amplification

and the audio-frequency amplifier unit of any one receiver. Particular reference is being made to choke coil audio-frequency amplification.

The Rule in Amplifiers

The comparative degree of efficiency of the choke coil amplifier and that of the transformer and the resistance units are at this time beyond the point, and will not be discussed. But the selection of various chokes adaptable as the coupling media in this type of audio-amplifier is of greater interest. It has been frequently demonstrated in many fields and activities that substitutes as a rule are not as good as originals; if they were they would not be classed as substitutes. And this is significantly true in audio amplifying units of the impedance coupled type, as intense electrical design is necessary so that the proper operation be obtained. This in fact is true with practically every unit utilized in the radio receiver art. Hence one need not be an electrical expert to comprehend the fact that by virtue of the design factor, an electrical unit specifically designed for a definite function will not afford the maximum when applied to some other use.

Now with due respect to the well meaning individuals who recommend the use

of various types of bell ringing transformers, spark coils, etc., in place of the choke coil designed for use with impedance coupled audio amplifiers, it is highly recommended that the practice be stopped, since it is not conducive to the results strived for. This fact was conclusively determined by the writer in a series of experiments conducted in an endeavor to ascertain just how effective these various substitutes were, when compared with chokes expressly designed for the purpose. It might just as well be mentioned at this stage that the substitutes proved dismal failures, insofar as faithful amplification of the input signal was concerned.

Taste a Personal Factor

No doubt many fans will not agree with the writer, these fans having at one time or other utilized bell ringing transformers as chokes in impedance coupled amplifiers, and obtaining what were considered satisfactory results; or some are now using these units with perfect satisfaction to themselves. But the question naturally arises as to the individual's musical palate and the fidelity of amplification. Between these two there is a great divergence. Some of us prefer high tones rather than low tones, the coloratura soprano being more popular than the basso. But in the selection of equipment to be used in an audio amplifier, so the tone frequency, amplification will be as perfect as possible, especially when the system is recommended to others, personal likes and dislikes become secondary. The item of importance becomes the faithful reproduction of the signal that was passed into the amplifier. Consequently the equipment used, irrespective of manufacture, should afford these results.

Now in view of this situation it is mighty difficult to suggest substitutes to take the place of specific units designed for a certain function, especially when the test upon the substitute is conducted by means of the ear. That is, the ear is the judge of the output tone entirely without knowledge of the input tone. This, in substance, is the reason for the statement that bell ringing transformers should not be suggested as chokes in choke coil coupled audio amplifiers.

One Element Lacking

The difference between the input and the output tones is not noted, simply because the input is unknown, and if any amount of amplification is obtained it is assumed that the tonal characteristics have been retained. This will be cleared up by comparisons of the input wave form and the output wave form with various types of bell ringing transformers used as chokes, and compared against a regular choke designed for that purpose.

The equipment utilized is a cathode ray oscillograph. The process of operation is to obtain a photograph of the original output of the audio oscillator as fed into the amplifier and then to again photograph the output wave form as obtained from the amplifier. Any variation other than increased amplitude will immediately become apparent, which variation in wave form will constitute a difference in tone, although this difference in tone does not signify a difference in frequency, but

A Test of Audio Quality

rather a loss in the distinguishing characteristics. By distinguishing characteristics is meant the difference in tone of middle C on a saxophone and middle C on a banjo.

Vocal Differences

This loss in distinguishing characteristics with certain amplifying units is the reason that the broadcast voice may be recognized with one type of unit and not with another. The former retains the small but important variations whereas they are lost entirely in the latter.

The equipment utilized consists of four distinct units. They are, the cathode ray oscillograph itself; the time constant producing device, by means of which the image upon the oscillograph screen can be made stationary; the audio oscillator and the audio amplifier. To give wiring diagrams and explanations of the first two units would require excessive space, but wiring diagrams of the audio oscillator and the audio amplifier are given in Figs. 1 and 2. The chokes tested were a Thordarson, compared against a Dongan, a Viking, a Killark small, and Killark large. In each of the four bell ringing transformers the primary was used, that is, the coil was connected to the AC line, with the secondary left open. This is the arrangement usually recommended.

A 50-Cycle Note Used

To proceed, a note of approximately 50 cycles was generated by means of the audio oscillator and the image as shown on the oscillograph traced and reproduced as in Fig. 3. This low frequency was selected as the lower frequency spectrum is the cause of most discussion among the radio fraternity. It is said that resistance and impedance coupling bring out the low notes lost in regular transformer coupling, therefore the tests should really be made upon low frequencies. As an incidental comparison between the regular choke and resistance coupling, the curves of Fig. 3 A and B are also given. Curve 3 A is that for resistance and curve 3 B for the Thordarson choke. These curves are the amplified reproductions of the original wave form shown in Fig. 3 after being amplified by the audio amplifier. The constants for the amplifier unit were arranged so that the tube was operating at best efficiency. Relative to the variance between the amplification characteristics of the two methods, the general opinion is sustained, namely that resistance coupling is truer than choke coil coupling. In this paper, however, this fact is beyond the point, but will be discussed in detail in a subsequent paper.

Effect of Substitution

Inserting the Viking bell ringing transformer in place of the Thordarson choke and utilizing, as has been mentioned, the primary of that transformer as the choke, everything else remaining constant, the wave form shown in Fig. 4 was obtained. In amplitude this wave was approximately one-sixth that of the Thordarson choke output. A close examination of the wave form is not necessary to disclose the fact that it has undergone a change other than in amplitude. Certain additional peaks and depressions have made their appearance, which cannot be found in the original input. An audible notation of the output by means of a loud speaker in place of the oscillograph brings to light this change by a different pitch to the output signal. Now, if the original input wave form were not available it would be perfectly logical to assume that the wave form as obtained with the bell ringing transformer as a choke is the correct one

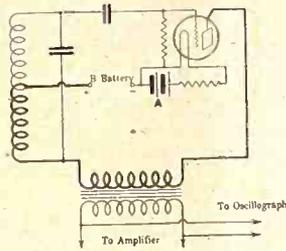


FIG. 1 THE AUDIO OSCILLATOR

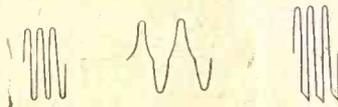


FIG. 3

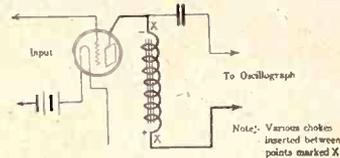


FIG. 2 THE AUDIO AMPLIFIER

Note: Various chokes inserted between points marked X

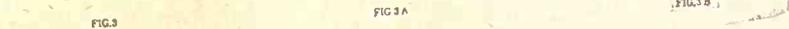


FIG. 3 A

FIG. 3 B

and correspondingly the note as emitted by the loud speaker to be the correct one. A comparison between the input and the output however shows up the discrepancy.

Continuing further, the Viking unit was replaced by a Killark, large size, and the curve obtained is shown in Fig. 4 A. The wave form amplitude was even smaller than that obtained with the Viking, and the distinguishing characteristic was again maintained. In addition, the depressions and slope marked D and S in Fig. 4 have been shifted somewhat. Replacing the large Killark unit with the smaller one results in the curve 4 B. The difference this time is more in amplitude than in wave form, the smaller unit affording a greater output. Connecting the Viking and the small Killark primaries in series results in the curve shown in Fig. 4 C. A large increase in amplitude but the same deficiency in wave form are present.

The Moral

Now to show the detrimental effects to a still greater degree a more complex wave form was obtained. This was the output of a rotary converter. The original as obtained from a step-down transformer is illustrated in Fig. 5. The output with the Thordarson choke is shown in Fig. 5 A. This is followed in Fig. 5 B and 5 C by the output wave forms with the various bell ringing transformers. While the output of the Thordarson choke is not an absolute amplified reproduction of the input, it is nevertheless a more nearly perfect reproduction than either of those shown in Figs. 5 B and 5 C.

As to the moral, there is only one and it is very simple. Do not employ bell ringing transformers as the coupling media in impedance coupled audio amplifiers. If you desire impedance coupling use the chokes designed for that purpose. Insofar as the operation of these chokes

is concerned upon frequencies above those used in the measurements, the same deficiency will exist. And in addition, the average voice wave forms are even more complex than those shown herewith and the output from the audio amplifier equipped with bell ringing transformers for chokes will be far removed from the actual input wave form, assuming perfect amplification and rectification preceding the audio unit.

The bell ringing transformers mentioned herein function well when used for the purpose intended, but do not employ them as impedance coupling units for the amplification of the voice frequencies.

An Improved Leak



A PIECE OF PAPER, dipped in India ink, makes a grid leak of unknown resistance and short life, but handy in an emergency.

RESULTS EDITOR:

I wish to add my congratulations to the very many folks who have praised Herman Bernard and his 1926 Model Diamond of the Air. I was located in the toughest spot for reception in New York City and probably in the United States. With WJZ, WJY, WHN, WGBS, WMCA and WHAP all going, I had no trouble in receiving stations in Chicago, etc.—J. L. Dunn, Kansas City, Mo.

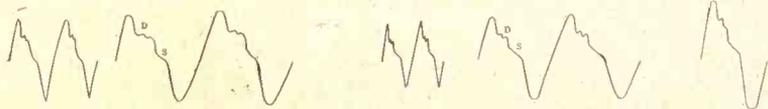


FIG. 4

FIG. 4A

FIG. 4B

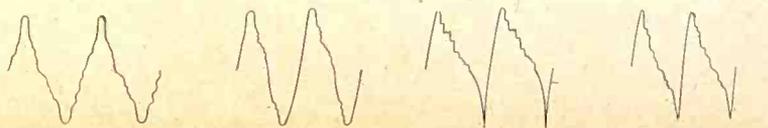


FIG. 5

FIG. 5A

FIG. 5B

FIG. 5C

The Pickle-Bottle Coil



FIG. 1, take fairly stiff piece of cardboard, mark off eight lines as shown. **Fig. 2,** take this marked strip and with the edge of the ruler bend the cardboard so as to make an octagon-shaped tube. **Fig. 3,** this tube so formed is shown in this photo, being held together with adhesive tape. Place the tape on the inside of the cardboard, using two strips about 4" long. **Fig. 4,** before the actual winding is started, cut two pieces of the tape, and fix them under the wire so that the sticky side will be face up. The wire is then wound right over this. **FIG. 5** shows the completed winding, with the two pieces of the tape folded over, thereby holding the coil in shape.

By Herbert E. Hayden

Photographs by the Author

THE construction of a pickle-bottle coil is shown in the accompanying photographs. The diameter may be measured when the cardboard is in circular fashion. before the octagonal separation is



FIG. 6, the winding form is now torn apart and the finished coil removed as shown.

made, and the amount and kind of wire to put on will be the same as for the straight solenoid. Winding directions were given for a variety of coils in the March 6 issue

of RADIO WORLD, and these may be followed. For a radio-frequency transformer, if No. 24 single or double silk covered wire is used, or even No. 24 double cotton covered, the wave band will be covered with a .0005 mfd. condensers if the secondary has 45 turns on a 3" diameter. For straightline frequency condensers, however, the number of turns on the secondary might well be 50. The primary, separated $\frac{1}{8}$ " from the secondary, would consist in either case of 10 turns of the same kind of wire as was used on the secondary. For condensers of smaller capacity or of the same capacity, but with smaller diameters, more turns would have to be used, and it is advisable to consult last week's table to ascertain the answers.

SCHNELL IN NEW POST
HARTFORD, CONN.

F. H. Schnell, traffic manager of the American Radio Relay League since 1920, has resigned to go with the C. F. Burgess Laboratories at Madison, Wisconsin, where he will undertake experimental radio development.

How Best to Utilize Broadcast Time Signals

By Capt. P. V. O'Rourke

Formerly Navigating Officer, U. S. Merchant Marine

IN determining exact time, a vast convenience in all the affairs of everyday life, radio has played an important part.

In many large cities the dropping of a ball on a high tower indicates exact noon. The error of the signal, only a fraction of a second, is published in the local newspapers of the following day.

Correct time is established by astronomers at the Government Observatory at Washington, D. C., by observations of the fixed stars, the sun and other planets.

Method of Regulation

Clocks and watches are regulated to run according to the average or "fictitious" sun, which makes all the days of equal length; the sun itself is sometimes ahead of this "fictitious sun" and sometimes behind it. This deviation is called the equation of time and varies from a second to nearly seventeen minutes.

The mechanical equation causing time-pieces to gain or lose time makes it necessary to have some means of checking this error to insure uniform time for regulating our various affairs.

One of the first practical uses to which radio was put was the sending of time signals to ships at sea where time is the most important factor in accurately determining latitude and longitude and conducting a ship from port to port.

Makes Big Difference

The difference of one second equals one quarter of a mile at certain positions on the earth's surface.

The consequences due to an unknown error in time at sea can be readily appreciated.

One day I was called upon by a radio fan to determine the possible cause of a diurnal disturbance which blurred his reception for about five minutes. It was more annoying than static, but disap-

peared suddenly without any apparent effort on his part in manipulating the set.

Many Think It's "Trouble"

Since then I've inquired among other radio set owners and much to my surprise found that he was not the only one having this "trouble."

There were some who admitted it gave them some concern until they finally heard the last line: "The next dash you will hear will be exactly ten o'clock Eastern Standard Time."

The time signals as sent out by NAA at Arlington, Va., are not sent out on the broadcasting wave band, but they are retransmitted by several broadcasting stations throughout the country at 9:55 P. M., Eastern Standard Time, and continue until 10 P. M.

The Schedule

The schedule is as follows: the first dash at 9:55 P. M. and subsequent dashes at one second intervals for 28 seconds, the 29th second silent and starting again on the 30th second, continuing at one second intervals until the 54th second and remaining silent five seconds, resuming on the 60th second or whole minute. The dashes are repeated in this way until the 49th second of the last minute, when there is a silence of ten seconds; it is at this period when the announcer cuts in with the warning—that the next dash you will hear is the final signal.

You may find it necessary to depend on your chronometer to catch a train or reach the bank or file an important document or for some other reason where the correct time is imperative hence it is well worth knowing the rate of gain or loss of your timepiece.

This may be established by keeping a record of your time daily for a week or ten days and noting whether the amount of gain or loss is constant. Where the daily error is irregular compute the total number of seconds and divide by the number of days recording, the answer being the average rate of gain or loss.

The KB-8

By M. B. Sleeper

[Part I of this article on the KB-8, a 5-tube non-regenerative set, was published last week, issue of March 13. The final installment will appear in the March 27 issue. The photographs published this week are by courtesy of "Radio Engineering."]

PART II

THE pictures show the manner that Lastites have been used for nearly all of the connections. When a screw is too long to take a Lastite, put the screw in place and fasten it with an ordinary 6-32 nut instead of the Lastite. Then cut the screw off and remove the nut. That will leave the screw just long enough to go into the Lastite. A 1/4" Spintite wrench makes this work a great deal easier. In two or three cases it is necessary to cut the head from a screw in order that one end can go into a Lastite or coil mounting pillar, with a Lastite on the other end.

When the set is mounted in a cabinet it may be well to arrange a small wooden block at the back of the cabinet so as to support the two corners of the large tube panel. The construction is very sturdy, however, for three angle brackets hold the horizontal panel in place. The vertical panel, in turn, is fastened to the front panel by four heavy panel support pillars.

Panel Data

The front panel measures 7x24". The original model was made with Celoron, 3/16" thick, although the Crowe Name Plate Company is furnishing a metal panel, beautifully engraved and finished, which can be used in this set without any loss of efficiency.

In the rear there are two panels 2 1/2 x 3 1/2" and two 9 1/2 x 3 1/2", all of 3/16" Celoron.

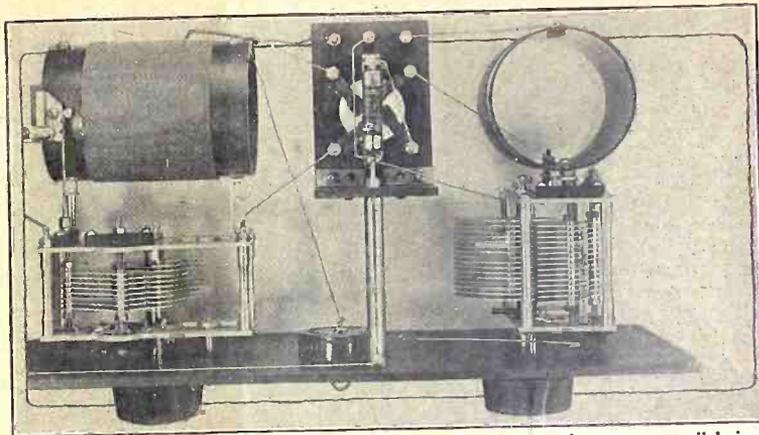
No engraving for the binding posts is called for, for Eby posts have been used throughout. If you can't get a binding post engraved B-C+, use a plain binding post and scratch the markings on it yourself, filling them in with white crayon.

Just to bring the binding post arrangement right up to the minute, we used a red Eby binding post for the 135 volts. As a matter of fact it is well to be a little careful in handling that lead for, although 135 volts is not dangerous, it is possible to get a slight kick from it.

Tubes for the Set

Either a UX199 tube with a Pacent Isolantite adapter or a UV201A tube can be used in the RF stage.

We are inclined to prefer the UV201A



THE RADIO SIDE of the circuit, viewed from the bottom, the antenna coil being at right. Note the method of mounting the Amperite under the RF socket.

as being more sensitive, although it may be easier to neutralize the UX199. We do not recommend the UV199 with an adapter because adapters for UV199s too often develop contact troubles.

The UV201A as a detector is entirely satisfactory in this set for all ordinary purposes but, as has been stated previously, the Donle tube gives a very definite increase in distance, volume, and quality, certainly more than enough improvement to justify the increased cost.

The first and second amplifying tubes should be Daven Mu-20, with a Daven Mu-6 for the last stage. These three audio tubes were chosen because they operate directly from 6 volts and do not require a rheostat. For this reason, it is well to watch the storage battery so that it will not drop appreciably below 6 volts.

Other types of amplifier tubes can be used provided they are the equivalent of the Daven tubes in their electrical characteristics.

Binding posts on this set call for 22 1/2, 67 1/2, 90, and 135 volts.

The current drain on the set with 9 volts C battery for the last tube, with a UV201A for the RF amplifier, Donle detector tube, two Mu-20 and one Mu-6 is divided as follows: RF tube, 1.75 milliamperes, Donle detector tube, 0.1 M.A., first two AF tubes, 2.75 M.A., and the last power tube 5 M.A. This is with a 9-volt C battery on the last tube.

It is interesting to note that strong

signals decrease the current in the last tube, instead of increasing it. Therefore, the total drain fluctuates between 7 and 10 M.A.

The Acme B eliminator is quite satisfactory for this outfit. The low voltage binding post on the eliminator should go to the B+22 volts binding post on the set and the high voltage tap should be connected to the B+67 1/2, B+ 90, and B+135 posts. That puts the full voltage on the RF and AF tubes.

Installation Notes

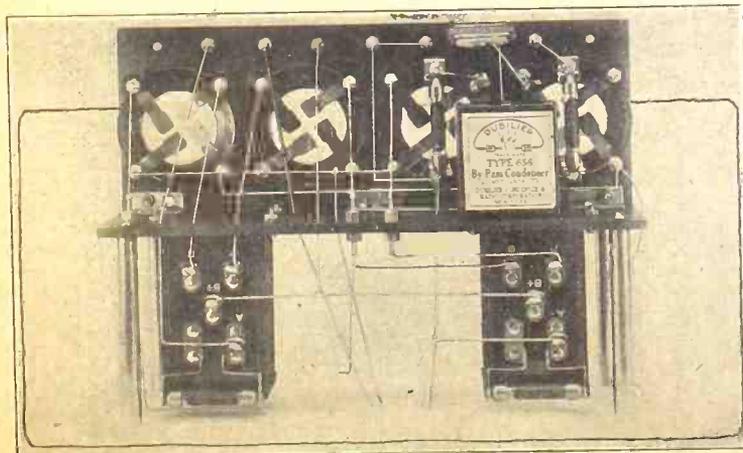
Thirty or forty miles from New York City, the KB-8 gives as sharp tuning as anyone can ask of a set, even when it is operated on a 100-ft. single wire antenna. This is a convenient size, not too big, but large enough for good pick-up. With a 75- or 100-ft. antenna the range is equal to any of the very best receivers.

In congested areas where there are a number of broadcasting stations operating simultaneously, it is necessary to reduce the antenna to 25 or 30 ft. The ground lead should not be more than 10 or 15 ft. If it is necessary to use a longer ground lead, reduce the length of the antenna accordingly. Then the tuning will be sharp enough to cut out local interference. The ability to use the KB-8 on such a short antenna makes it particularly well suited for installation in apartment houses where an outdoor antenna is not practical.

Any standard 7x24" cabinet can be used for the KB-8, allowance having been made around the edges of the panel so that the parts behind will not interfere. A depth of 7-1/6" is required.

On general principles we do not recommend a cabinet which has a loudspeaker chamber built as a part of the cabinet. Often mechanical vibration from the loudspeaker causes the tubes to howl. However, a cabinet such as the Jewett Radio Highboy, which has a separate papier-maché sound chamber mounted at the back of the cabinet, with the bell coming up to a screened opening, does not develop that trouble.

It is advisable to have the B battery eliminator mounted a slight distance from the set itself, and not directly behind it in the same compartment, although we have not had any difficulty with the Acme eliminator in this respect.



DETAIL of the bottom of the detector-AF unit. The detector tube is at right. The impedance transformers are shown underneath, with the audio leaks mounted thereon.

THE 4-TUBE DIAMOND OF THE AIR, by Herman Bernard, appeared in RADIO WORLD dated Jan. 23. 15c. per copy, or start subscription with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

A 2-Tube Eliminator

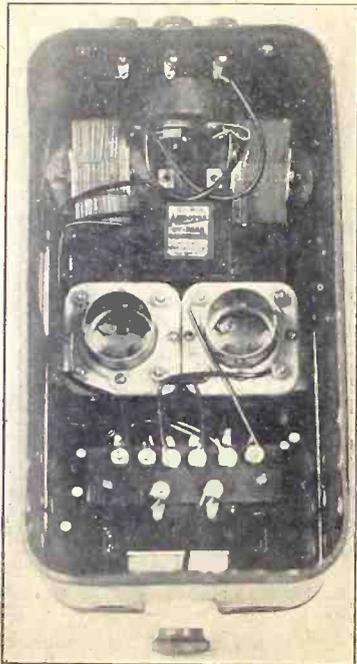


FIG. 1, looking down upon the completed eliminator in the cabinet.

By Lewis Winner

Associate, Institute of Radio Engineers

[Part I of this article on the construction of a B battery eliminator which rectifies both sides of the wave was published last week, issue of March 13. The conclusion follows.]

PART II

CONNECT the leads of the cord to the terminal in the plug. Do not yet connect the B terminals to the set. Screw the plug into the line socket. The tube should light fairly bright and make a very slight hum, which can be heard only by placing your ear close to the tube. Disconnect the line now and connect the B terminals to their respective places on the receiver. Connect the line to the

eliminator. Do not place the eliminator very close to the set. That is, there should be at least a 2-foot separation between the two. The strength of the signals can be increased or decreased by the varying of the voltage, through the means of the variable resistor, R2.

Now as to the detailed information regarding the chokes, transformers, aluminum strips, panel and special cabinet. The transformer used was one that was wound by machine. That is the reason for no transformer head, etc., being employed. However, those who wish to wind their own may consult my description in the Dec. 19 issue, on pages 12 and 13 in conjunction with that given herewith.

The machine employed to wind the transformer produces a solid foundation, wraps a layer of insulation between every 100 turns, paraffines the ends of the windings, so as to keep the windings rigid, and places a covering over the completed winding. An adjustor is set to the different number of turns, which automatically stops, as the required number of turns is reached. This same procedure may be followed, with the use of a hand-winding machine, if the person is very careful. It is not difficult, but plenty of patience is required.

A solid foundation may be made by taking a common cotton spool, with a diameter of 1", and pouring hot paraffine over. The layer formed should be $\frac{3}{4}$ " thick. This foundation should be fitted on the spool of the winding unit. A layer of manila paper .005" thick should be placed over this paraffine, so that when winding, the wire will not cut. Layers of paper are placed over every layer of wire. You can either bring the leads from the winding direct to the respective terminals or make a bracket as is seen in Fig. 2, of last week's issue. A piece of insulating strip is placed over the aluminum strip where the binding posts are to be placed and the leads then are brought to their respective positions.

In order to mount the condensers, sockets, etc., you have to use aluminum strips, the dimensions of which are given herewith.

Procure an aluminum strip, $9\frac{3}{8}$ " long and 1" wide. Bend as per Fig. 4. (1). This strip is used for mounting the condenser bank and the sockets. Drill holes for mounting the sockets. The exact positions of these holes will not be given as they vary for different sized sockets,

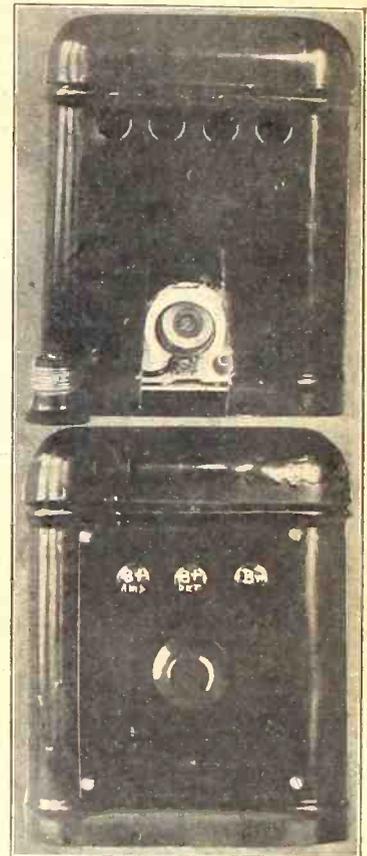


FIG. 2 (top), showing the back of cabinet. Note the holes, which allow air to enter and cool the tubes, in case they have become overheated. The input voltage socket is at the bottom. Fig. 3 (bottom), showing the front of the cabinet with the three binding posts and the variable resistor knob.

no special make being necessary. Lay this aside. Now procure two pieces of aluminum stripping, $3\frac{3}{4}$ " in length and $\frac{3}{4}$ " in width, Fig. 4 (2), used for con-

LIST OF PARTS

One AC 220-volt step-up transformer (Shore).

Two 30-henry choke coils, L1L2 (Shore).

Two .5 mfd. fixed condensers, C1 C2 (Aerovox).

One .5 or 1 mfd. fixed condenser, C6 (Aerovox).

One condenser unit; one 3 mfd. fixed condenser, C3; one 2 mfd. fixed condenser, C4; one 6 mfd. fixed condenser, C5 (Aerovox).

One variable resistor, Clarostat, R2 (American Mechanical Laboratories).

One 10,000 ohm fixed resistor, R1 (Aerovox).

Two rectifying tubes (Tectron).

Two sockets, standard base.

One socket for input voltage.

One switch, S.

One panel.

One fuse, F.

One socket for holding fuse.

Accessories: Lamp cord, aluminum brackets, screws, nuts, cabinet, flexible wire, binding posts, insulating strips, etc.

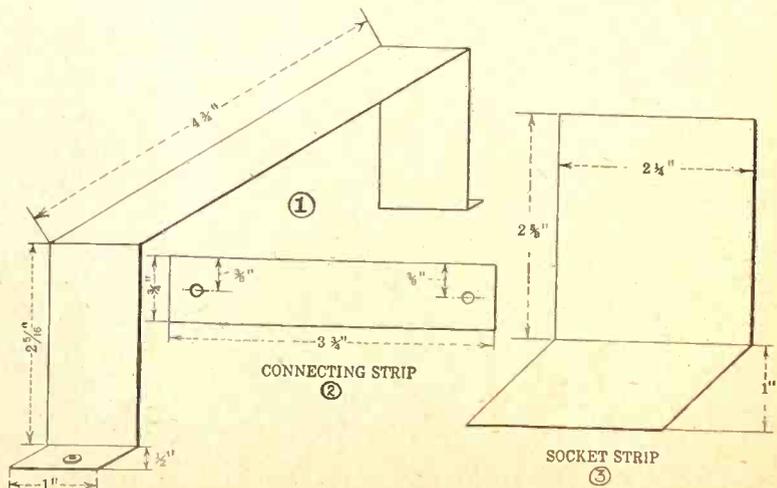


FIG. 4, showing the different dimensions of the aluminum strips required.

Choke Coils for Tectron

necting the laminations of the choke coils, using the closed core style (Fig. 6). The last piece of stripping required is that for the socket. This is $3\frac{5}{8}$ " in length and $2\frac{1}{4}$ " in width and is seen in Fig. 4 (3). By following the template, shown last week, the holes for the mounting of the strip on the baseboard, may be obtained. For the positions of the holes holding the input voltage socket, it is best to make the measurements direct from the type of socket employed, as the size and positions vary.

As was explained last week, there are two methods of making the cores for the choke coils. The methods are shown clearly in Figs. 5, 6, 7, 8 and 9. In the closed core method, instead of placing the laminations in alternate layers as per transformer, they are placed as per Fig. 9. That is, there are two stacks of 60 laminations banked. They are then placed through the center of the windings. A piece of manila paper, of .005" thickness is placed between the laminations. This is shown in Fig. 5. This is done only at one point, although there are two places as per Fig. 9. The aluminum strips are then placed through the windings and over the laminations, as per Fig. 6.

Bolting the Laminations

Screws running through the holes on both the strips and laminations are then bolted. With the shell type of core, the laminations are just slipped through the center of the winding. This is shown in Fig. 7. Here the laminations have normal gaps. This is also shown in Fig. 8. Therefore no paper is necessary to place between laminations. The laminations for this shell type core, have the following dimensions according to Fig. 8: A is $\frac{3}{8}$ " B is $\frac{3}{4}$ " while C at the top is $\frac{1}{2}$ ". This means that between B and the top of C there is a $\frac{1}{4}$ " reduction. The

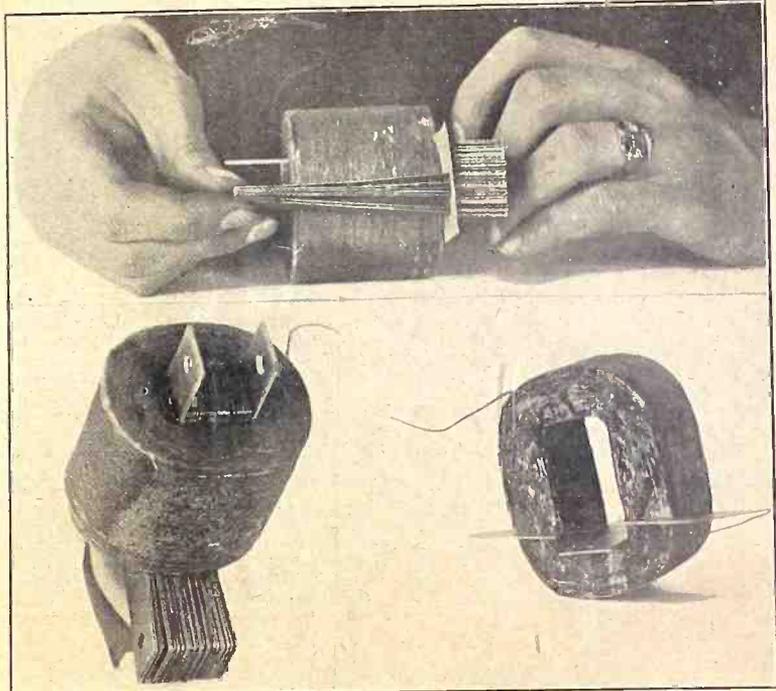


FIG. 5 (top), placing a piece of manila paper between laminations. Fig. 6 (left), showing the aluminum connecting strips, over the laminations and through the center of the choke coil, employing the closed core method. Fig. 7 (right), showing the shell type lamination placed through the core. Note the difference in size between the windings, where the closed core and the shell core are used.

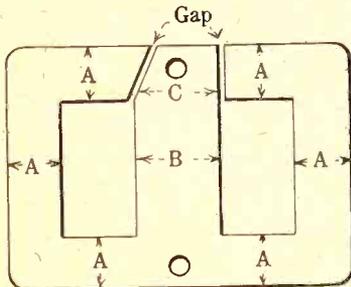
holes are $\frac{1}{8}$ " from the top and the bottom of B and C.

Angle irons are placed at the bottom of the cores, so that they may be mounted on the plate.

The panel for the mounting of the variable resistor and binding posts is shown in Fig. 10. The center hole is for the variable resistor. The three top holes are for the binding posts. The two bottom

holes are for the mounting of the panel on the baseboard, as per Fig. 4, last week.

If so desired, the complete eliminator may be placed in a steel cabinet, as per Figs. 1, 2 and 3. The cabinet shown is a rough laboratory model, which was made out of sheets of tin. I would not advise the layman to attack this proposition, as they can be purchased for a very small price from the Shore Electric Co.



SHELL TYPE LAMINATION

FIG. 8, showing the shell type lamination. Note the normal gap, also the decreasing in width of C.

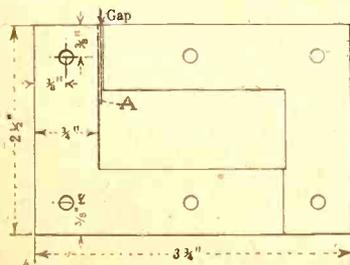
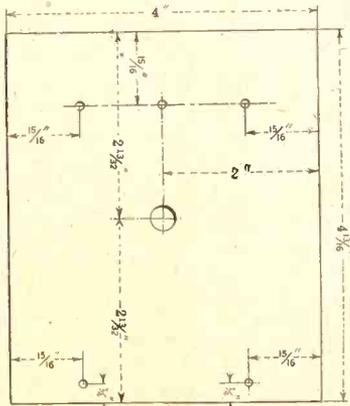


FIG. 9, showing the method of placing the laminations, so as to make a closed core. A is the piece of paper making the gap.



PANEL FOR RHEOSTAT AND BINDING POSTS

FIG. 10, showing the panel. Note that the arrangement of the holes on the bottom are for the placing of the panel on a simple baseboard. However, when using the panel in the cabinet, the holes should be in the same level, on both top and bottom, e.g., $\frac{1}{4}$ ", while the distance of the holes from the edges is $\frac{1}{8}$ ", instead of $\frac{15}{16}$ ".

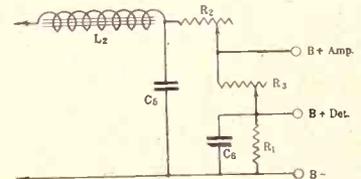


FIG. 11, showing a method of placing variable resistors, whereby both the amplifier and the detector voltage may be varied. The varying of R2 will change the value of R3. This, however, does not apply vice versa action. Therefore, do not attempt to adjust R2 and R3 at the same time.

BAD PRACTICE TO USE NEW B BATTERY WITH OLD

It is not good practice to place a worn out B battery with a fresh B battery, as the new battery will be run down very quickly, due to the high internal resistance of the worn out battery. By purchasing a fresh pair of batteries, the saving in comparison as to when using the old one and the new one, will be beyond comparison. As soon as the B batteries (45 volt type), are run down, so that they read 35 volts, it is high time to throw them out.

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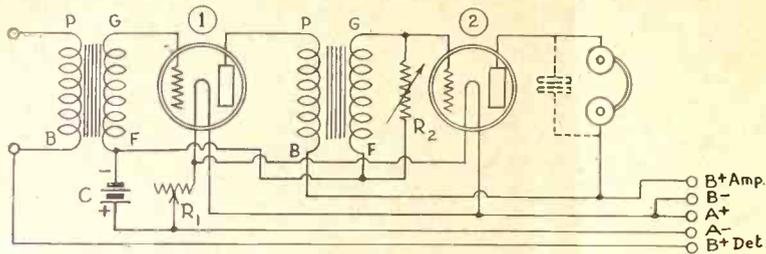


FIG. 276, showing the amplifier diagram, Mr. McDonall requested.

PLEASE GIVE a schematic diagram of a 2-stage transformer coupled audio-frequency amplifier for use with 01A type tubes, with a C battery inserted in series with the F posts of the AFT, a variable resistor shunting the secondary of the second AFT and a fixed by-pass condenser shunted across the output. I would like to have the constants stated also.—James McDonall, Passaic, N. J.

Fig. 276, shows the diagram. Both the transformers should be of the low ratio type. R1 is 6 ohm, ½ ampere variable rheostat. R2 is a 500,000 ohm variable resistor. The by-pass condenser which is shunted across the output (drawn in dotted lines, as it is not absolutely necessary) is of the .001 mfd. fixed type. If you are going to place 90 volts on the plate of these tubes, then a 4.5 volt C battery should be used. If you are going to place 135 volts on the plates of the amplifier tubes, then a 9 volt C battery should be used. The P post on the first AFT goes to the plate output of the detector circuit.

REGARDING the Victoreen, as pictured in your issues of February 20, 27, March 6 and 13, is the approved layout of parts shown? I have seen different arrangements.—Dinny Reinitz, 127A Clarkson Ave., Brooklyn, N. Y.

The set shown in the photographs published in those issues is orthodox and the layout should be followed. That set was built for experimental purposes by Paul R. Fernald, c-o H. & F., 168 Washington St., N. Y. City.

I AM very much interested in the Bernard 1-Tube set, which appeared in the October 24 issue of RADIO WORLD. I have two .0005 mfd. variable condensers, which I would like to use instead of the .000375 and .00025 mfd. variable condensers specified. What would be the correct number of turns to place on L1 and L2 so that these condensers may be employed?—Leslie James, 312 Estelle St., Houston, Tex.

The primary winding, L1, no matter what capacity C2 or C1 may be, is the same, 10 turns. This is wound on a tubing a 3/8" in diameter and 4" high. Use No. 22 double cotton covered wire. The secondary, L2, is wound on the same tubing. There is a 1/4" separation between the two windings. This secondary consists of 45 turns. However, there is a tap made on this secondary, which is located at the third turn from the beginning. It is preferable to use a .00025 mfd. variable condenser, instead of the .0005 mfd. variable condenser, as regeneration is easier to control. If the latter is to be used, then make the tap at the second turn.

IN REFERENCE to the 3-tube 3-circuit tuner receiver, described in the October 10 issue of RADIO WORLD by Capt. P. V. O'Rourke. (1) What ratio audio-fre-

quency transformers should be employed? (2) Please state the number of turns to place on a form 3 1/2" in diameter and 3" high, to constitute the primary and secondary windings of the tuner? (3) How many turns should be placed on a form 3" in diameter, to constitute the tickler windings? The tickler is to be wound with No. 26 single silk covered wire, while the primary and the secondary windings are to be wound with No. 22 double cotton covered wire. The secondary winding is to be shunted by Remler .0005 mfd. variable condensers. (4) Are these condensers all right to use here? (5) I tried to get a .00025 mfd. fixed by pass condenser, but the clerk told me that they were the same as the plain .00025 mfd. fixed condensers. Is this true?—Cary Clenenger, 1518 Pauline Ave., Rockford, Ill.

(1) Both transformers are of the low ratio variety. (2) The primary winding consists of 10 turns. The secondary winding consists of 45 turns. There is a 3/8" separation between the two windings. (3) The tickler winding consists of 36 turns. (4) Yes. (5) Yes.

I HAVE constructed the 3-tube 3-circuit tuner described in the October 10 issue of RADIO WORLD by Capt. P. V. O'Rourke, but am having some trouble. Only the local stations come in with volume. I cannot make the set oscillate. The tickler has no effect. I am using a standard tuner, with a 10 turn primary, 45 turn secondary, wound on a tubing 3/4" in diameter and a 30 turn tickler wound on a tubing 2 1/4" in diameter. No. 22 double cotton covered wire is used to wind the primary and the secondary, while No. 26 single silk covered wire is used to wind the tickler. How can this trouble be remedied?—Elton Jackson, 1706 Texas Ave., Houston, Tex.

Add 10 turns to the tickler coil. Reverse the leads from the tickler. Try a small fixed condenser across the tickler, say .00025 mfd.

I AM about to build the 1926 Model Diamond of the Air, but before doing so I would like to have some information. (1) I have a Daven 3-stage resistance coupled audio-frequency amplifier, with two Daven hi-mu 20 tubes and one Daven lo-mu 6 tube. Would it be practical to use this after one stage of transformer coupled AF amplification, or would it be advisable to cut out the transformer stage and just use the three stages of resistance coupled AF amplification? (2) If I use a transformer of the 2 to 1 ratio type and then follow it with the resistance coupled AF amplification, would the volume be too great for a common phonograph unit loud speaker?—J. P. Smith, Chester, Pa.

(1 and 2) It would not be advisable to use the transformer stage in this case. The resistance stages will suffice amply.

I WOULD like to know if the following method of hooking up a two stage audio-frequency amplifier, to a step of tuned RF and a regenerative detector, using a 112 tube in the last stage is all right? The G post on the first AFT goes to the G post on the socket holding the first AF tube. The P post on this same socket goes to the P post on the second and last AFT. The F minus post on this socket goes to a terminal of a ballast resistor, the other terminal going to the A minus post of the battery. The F plus post of this socket goes to the A plus post. The F post on the first AFT goes to the minus post of a 4.5 C battery, the plus post going to the A minus post. The B plus post on the second AFT goes to the 90 volt post on the B battery. The G post on the second AFT goes to the G post on the last socket. The P post of this socket goes to the top terminal of the single circuit jack. The bottom terminal of this jack goes to the 135 volt terminal on the B batteries. The F post on the AFT goes to the minus post of a 9 volt C battery. The plus post of this battery goes to the minus post of the A battery. A ballast resistor is in series with the negative leg of the filament. The F plus post of this socket goes to the A minus post. (2) Is it necessary to place a .001 mfd. fixed condenser in series with a choke coil, which is in series with the P post on the last socket, the other terminal of which goes to the 135 volt post, while the other terminal of the fixed condenser goes to the top terminal of the jack, with the bottom terminal of the jack going to the A minus post, instead of the F plus post so as to obtain quality reception?—Sol Michael, 1615 Townsend Ave., Bronx, N. Y. City.

(1) The wiring of the amplifier is O. K. (2) No.

IS IT possible to add two stages of audio-frequency amplification to the 1-tube receiver, described by Wm. Mercer on page 17 of the Feb. 20 issue of RADIO WORLD? (2) If so, a description of it, would be very much appreciated.—T. E. Crawford, 1534 Emily St., Philadelphia, Pa.

(1) Yes. (2) First make a 100-turn choke coil, wound on a tubing 1" in diameter, using No. 30 single silk covered wire. Insert it in series with the plate of the detector tube and the top terminal of a double circuit jack. The second terminal from the top goes to the plate post of the AFT. The third terminal from the top goes to the B post on the AFT. The bottom terminal goes to the B plus 22 1/2 terminal. The G post on this same AFT goes to the G post on the socket holding the first AF tube. The F post on the AFT goes to the F post on the next AFT. This then goes to the minus post of a 4.5 C battery. The plus post of this C battery goes to the minus post of the A battery. A ballast resistor is placed in series with the negative legs of both the tubes. The F plus posts go to the A plus post. The P post on the second AFT goes to the P post on the first AF socket. The G post on this AFT goes to the G post on this same socket. The P post on the last socket goes to the top terminal of a single circuit jack. The bottom terminal goes to the 90 volt terminal.

I WOULD like to have the circuit diagram of a 4-tube set, employing a regenerative detector, with the 3-circuit tuner and 3 stages of resistance coupled audio-frequency amplification. The constants of the various parts which make up this receiver are also requested. A rheostat should control the filament of the detector tube, while one ballast resistor should control the filaments of the three amplifier tubes.—Henry Ukarts, New Lebanon, N. Y.

Fig. 277, shows the 4-tube receiver. The

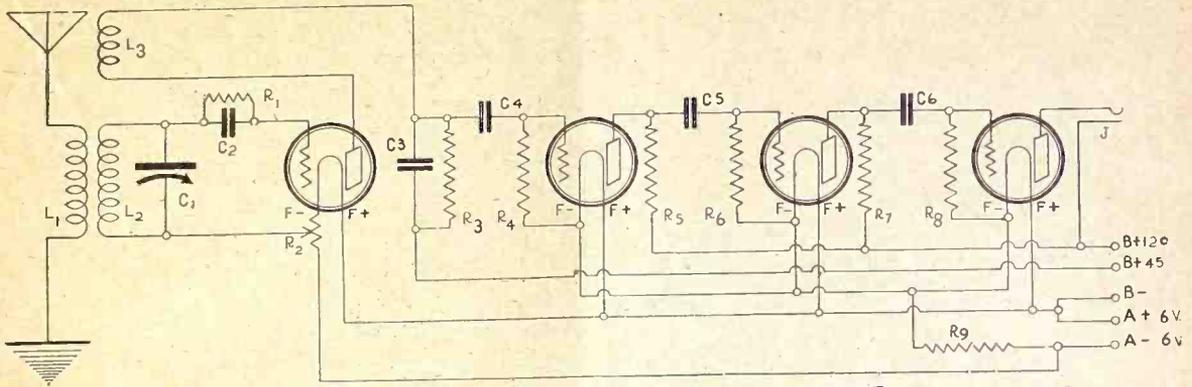


FIG. 277, showing a 3-circuit tuner with resistance coupled AF.

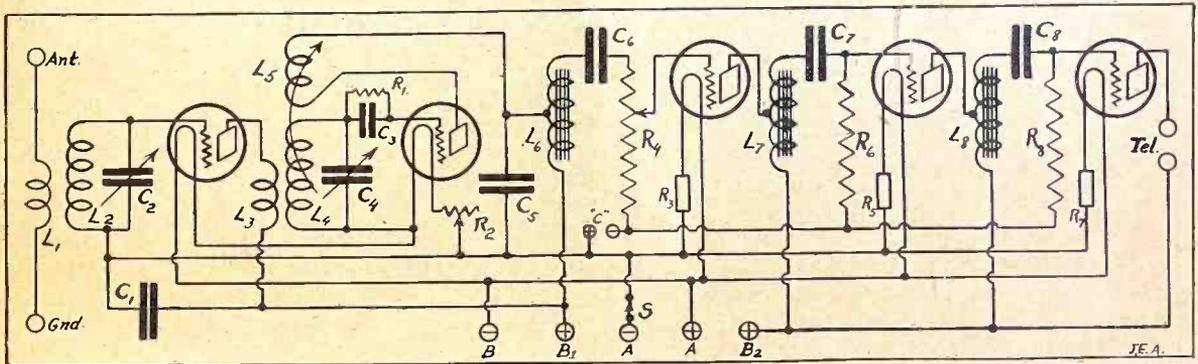


FIG. 278, showing the schematic diagram of the quality receiver.

tubing, upon which the primary and the secondary, L1L2, is wound is 3/4" in diameter and 4" high. The primary, L1, consists of 10 turns. The secondary, L2, consists of 45 turns. No. 22 double cotton covered wire is used. There is a 3/4" separation between the two windings. The tickler, L3, is wound on a tubing 2 1/4" in diameter and consists of 36 turns. No. 26 single silk covered wire is used. A .0005 mfd. variable condenser is shunted across the secondary, L2. The grid condenser, C2, is of the .00025 mfd. fixed type. A 2 megohm grid leak, R1, is also used. R2 is a 10 ohm rheostat, with a carrying capacity of 1/4 amperes. C3 is a .001 mfd. fixed condenser. C4, C5 and C6 are all .25 mfd. fixed condensers. R3, R5 and R7 are all .1 megohm resistors. R4 is a .5 megohm resistor. R6 and R8 are .1 megohm resistors. R9 is a 3/4 ampere ballast resistor. The -01A type tubes are employed. It is advisable to use a 6 volt C battery, in series with the F- posts of the last socket. J is a single circuit jack.

L6, L7 and L8 are autotransformers. S is a filament switch. Now as to the tubes employed. It will be seen that the filaments of the first two tubes are connected in series, while the filaments of the other tubes, which are the amplifiers are connected in parallel: The 99 type tubes are used as the RF and the detector stages, while the 01A tubes are used as the amplifiers. The 99 type tubes require 60 milliamperes at 3 volts. Hence two of these tubes may be connected in series and then placed across a 6 volt battery. This is what is done in this receiver. These tubes will operate well until the voltage falls to about 5.8, when it may be considered as fully discharged. In that case, the least voltage across the terminals of each tube will be 2.9, only .1 less than normal. The power saved when two are connected in series is .36 watt and the current saved, of

course is 60 milliamperes. You therefore obtain the efficiency of two tubes, while only using the power of one tube.

I AM desirous of purchasing a cone speaker for use with the 1926 Model Diamond of the Air. Will the Crosley Musicone loud speaker be satisfactory for use in conjunction with this set?—G. T. Garnett, 116 West Grace St.

WHERE COULD I get information regarding the 1-Dial 6-tube sensitive DX getter, which is shown on the bottom of page 12 in the Dec. 26 issue of RADIO WORLD?—J. A. Kukuk, Brookings, S. D.
See Capt. P. V. O'Rourke's article in the July 11 issue of RADIO WORLD.

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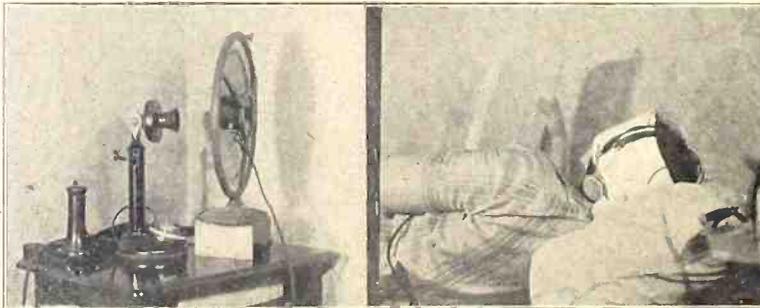
I WOULD like to have the circuit diagram of a 5-tube set, in which quality reproduction is stressed. A regenerative detector, using a 3-circuit tuner, should be used. Please state the constants of all the parts.—Robert James, Newport Center, Vt.
Fig. 278, shows such a diagram, L1 and L3, the primaries consists of 10 turns. L2 and L4, the secondaries, consists of 45 turns. The tubing that these windings are placed upon is 3/4" in diameter and 4" high. No. 22 double cotton covered wire is used here. The tickler is placed on a tubing 2 1/4" in diameter and consists of 36 turns of No. 26 single silk covered wire. C2 and C4 are .0005 mfd. variable condensers. C1 is a .005 fixed condenser. C5 is a .001 mfd. fixed condenser. C6, C7 and C8 are all .01 mfd. fixed condensers. R4 is a 500,000 ohm potentiometer. R1 is a 1 or 2 megohm grid leak. R2 is a 10 ohm rheostat. R3, R5 and R7 are 1-A Amperites. R6 is a .5 megohm grid leak. R8 is a .25 megohm grid leak.

Testing Broken Cables by Radio



A NOVEL and ingenious method of finding out where broken cables are present, with the use of a radio receiver, has been put into use by some large power companies in the eastern portion of the United States. A super-sensitive receiver, employing a loop as the collector of energy, is used to detect the stray noises. (Underwood & Underwood)

Telephoning Program Cheers up a Patient



PROGRAM coming through speaker being delivered into telephone (left) and being received by a patient, miles away, who has no radio accessible (right).

If a speaker, with the usual volume output, is placed with the nearest emitting point not less than $3\frac{1}{2}$ " from the edge of a telephone receiver, as shown in photo at left, you may call up some one who is sick and let him or her listen to a snatch of program. Of course this should not be kept up long, despite the beneficent effort, because the telephone lines should be kept open for the normal traffic. Yet a sick and tired patient may be cheered up by a snatch of music heard during this pleasant interval.

The patient is called on the phone in the usual way and the telephone receiver is placed on the table when the patient is ready to receive the music. If the patient

has a telephone at her bedside the music may be heard plainly and comfortably if the afflicted one's telephone receiver is laid on a pillow with the diaphragm even a few inches from the ear.

At the patient's end greater volume would be obtained if the telephone receiver were placed against a regular speaker unit, used for the nonce as a microphone, the unit cords connected to the input of an audio amplifier. Then a speaker or earphones could be used for reception. At places where headpiece receivers are used in regular telephony of course the problem is simplified, for the telephoned signals are snugly received, as shown in the photo at right.

Divide Stations Nationally Senator

By C. C. Dill

United States Senator from Washington and author of the Dill Radio Bill now pending in Congress.

RADIO during the last two years has become a source of real public service. It has gradually passed beyond the experimental stage and reached the point where the people of this great country may rely on it for entertainment and instruction.

I do not mean that radio development has reached perfection. I gather from engineers and scientists with whom I have discussed the subject that much greater improvements may be expected in transmitting and receiving apparatus, and that we may also have radio vision within the near future.

The Task of Congress

It is with the thought of dedicating this great service to the permanent use of the people as a whole that Congress is attempting to frame legislation for its regulation. There seems to be no doubt that regulation is necessary and that a new radio law is needed immediately.

The question has arisen during our consideration of the bill as to whether the regulation of radio should be entrusted to the Secretary of Commerce or to any other one man. It is my belief that at the present stage of development, the details of administration should remain with the Department of Commerce, but that a non-partisan commission should be established now with authority to pass finally upon questions which may be referred to it by the Secretary of Commerce or any one else. The decisions of this commission should, of course, be subject to review in the courts.

Service Curtailed

A highly important feature connected with the administration of the radio law is the number of stations required to serve the American public. Due to the service area limitation imposed upon broadcasting stations by weather conditions and other forms of interference it would seem as if a large number of stations would be necessary.

Under the present arrangement there are 89 wavelengths and 536 stations. There are applications on file at the Department of Commerce for 400 more new stations.

The crowding of 536 stations on 89 wavelengths has practically rendered un-serviceable a large portion of the broadcasting band. I am by no means an expert on radio, but I am a fan with the average appreciation of programs and with the average desire to pick up a wide variety of stations.

Interference Troublesome

The broadcasting band is divided into two sections. From 545 to 280 meters is given to class B, or the higher grade of stations. From 280 to 200 meters are the

s Into d Locals, ill Suggests

s A stations. The class B section was
vided to capacity many months ago and
umber of those stations was placed in
class A band.
rom my experience with my set and
n what I have been told, there are so
ny stations between 280 to 200 meters
it is difficult to get any of them with-
interference. Even in the Class B
d the separation is none too great and
ference is sometimes experienced.
ecause of the congestion in the class
and it seems as if these valuable wave-
ngths are almost entirely lost to the
lic. This presents a grave problem to
gress. I think, however, it is a prob-
of administration and that legislation
uld be enacted to give some agency
hority to correct this situation.

Urges Re-allocation

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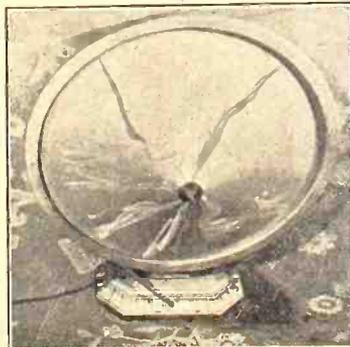
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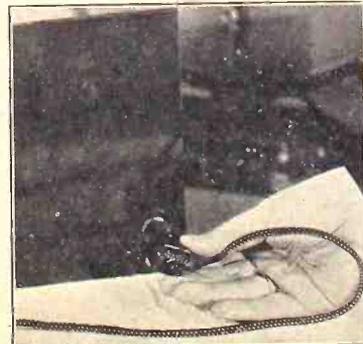
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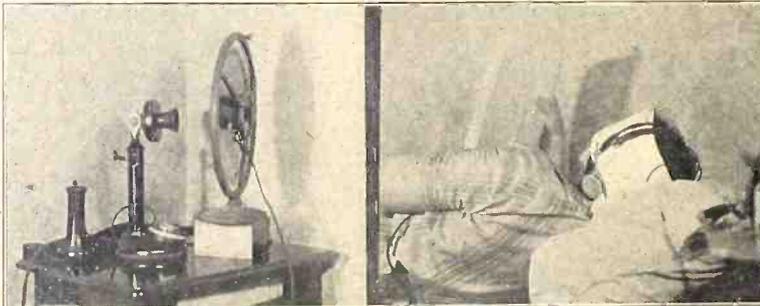
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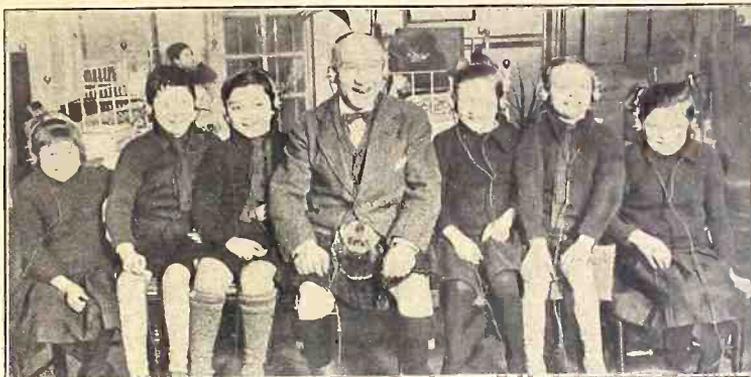
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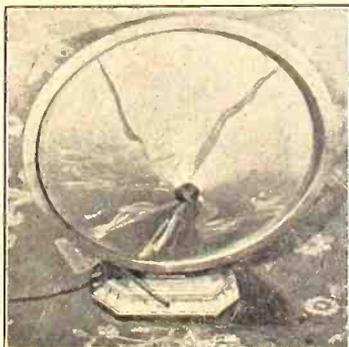
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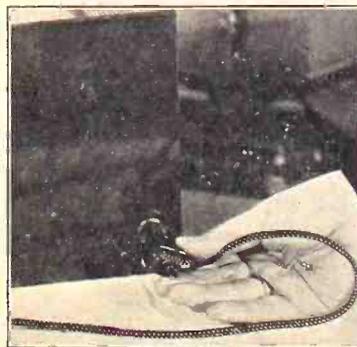
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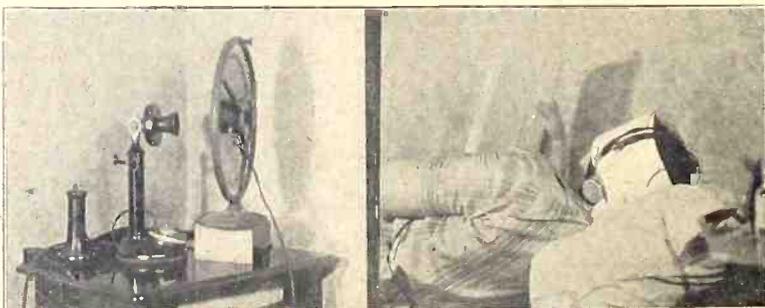
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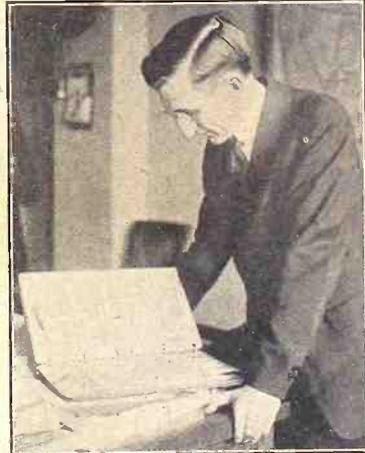
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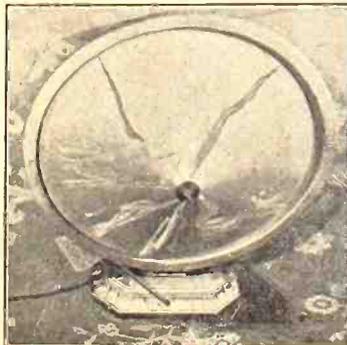
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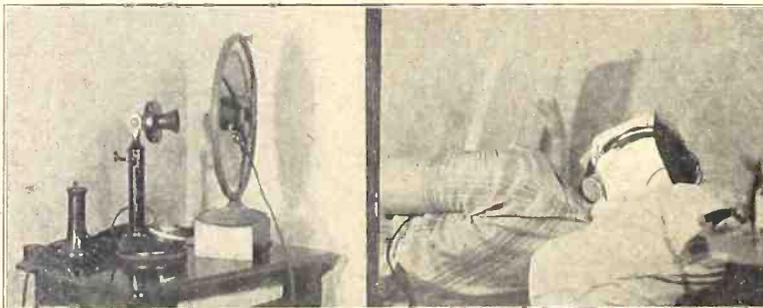
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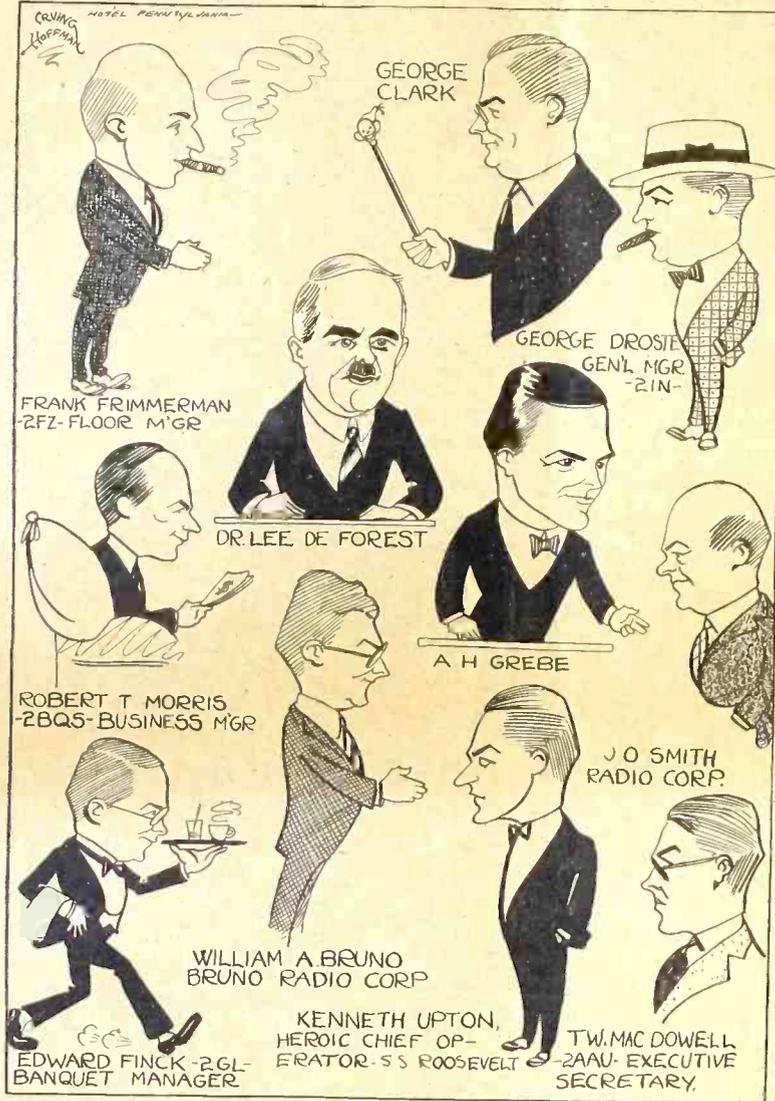
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Notables at the New York Show *Short Waves* Featured at New York Show



The Executive Radio Council of the New York district held its sixth annual show at the Hotel Pennsylvania, New York City. The show lasted one week. Short wave transmitters and receivers were featured. An engineer said that the development of instruments to receive waves under 100 meters is not an indication that all broadcasting will be shifted to the short wave band. He said that this show, unlike the Fall shows, was an amateur affair and naturally short wave devices were the dominating feature, because amateurs are experimenting in the field under 100 meters.

Forty manufacturers had booths in which complete sets and accessories were displayed.

Two short wave transmitting sets were in operation in the ballroom, one operating under the call letters 2ERC and two others, 2QA and 2ZV.

Visitors at the show throughout the week were invited to file radiograms for any part of the world. The messages were broadcast direct over the short wave route, or relayed by amateur stations in the American Radio Relay League.

The department of Commerce established a branch office at one end of the ballroom where amateurs took examinations for licenses.

The army, represented by Colonel E. T. Hartmann, chief signal officer of the Second Corps Area, had an exhibit introducing the special equipment developed by army engineers for use in the army-amateur transcontinental radio net.

Many of the short wave sets on display differed from the ordinary broadcast receiver in that the tuning coils were interchangeable and mounted on top of the cabinet so that they could be quickly substituted and plugged into the circuit. These coils were arranged in various sizes and designed to cover a definite wave band. A complete tuning unit covered from 10 to 200 meters (1,500 to 30,000 kilocycles). Most of the receivers were equipped with straight line frequency condensers and cushion sockets.

London and N. Y. Talk 4 Hours By Radio Phone

After three and a half years of intensive experimenting with transatlantic radio telephony, on the part of the American Telephone and Telegraph Company, the Radio Corporation of America and the British General Post Office, successful conversations were held recently between New York and London by radio telephony.

The American terminus of the high circuit was in the A. T. & T. building at 25 Walker St., N. Y. City, where the former broadcasting equipment of the A. T. & T. also was located. The other point was in the British Post Office in London.

From New York the signals were sent over telephone wires to the radio transmitting station of the Radio Corporation of America at Rocky Point, L. I., a distance of 70 miles. Thence they were transmitted by radio to Wroughton, Eng., where they were caught by the receiving station of the British General Post Office and then sent over telephone wires. The

speeches from London, being sent to the United States, were carried by wire eighty-five miles to Rugby and thence sent by radio for 2,900 miles to Houlton, Me., there to be caught by a receiving station and sent the remaining 600 miles to N. Y. by means of the telephone lines. The wavelength of the station at Rocky Point was 5,260 meters, while the Rugby station transmitted the signals on a wavelength of 5,770 meters. The power used in transmitting from each end was 100 kilowatts.

The volume of the signals on either side was so great that frequently those listening-in had to tell the party to speak more softly. More than thirty engineers and newspapermen talked from the telephone headquarters in N. Y. City to a similar group at the British Post Office in London. The feat was hailed as the forerunner of the trans-Atlantic broadcasting of programs.

Welty Unit Makes Set Building Easy

A 3-tube detector-amplifier on a $9\frac{1}{4} \times 4\frac{1}{4}$ " subpanel is manufactured by William A. Welty, 36 S. State St., Chicago, Ill. The parts that comprise this unit are of the best. All one need do is to make a 1-tube circuit, use the first tube as regenerative detector hooked up to this circuit, connect the batteries to binding posts and plug to speaker jack, and hear very loud signals on the speaker.

There are two rheostats, one for the detector, the other for the AF tubes. The grid condenser and bypass condenser are Micamold, while the two audio transformers are Welty. The switch, speaker, jack, fixed condensers and audio transformers are mounted underneath, out of sight. Lastites are used for soldered connections. The subpanel is Bakelite and the sockets are moulded, too. There are nine binding posts on top, each colored for identification. The entire set-up is very attractive to the eye.

HERMAN BERNARD, managing editor of **RADIO WORLD**, broadcasts every Friday at 7 p. m., from WGBS, Gimbel Bros., N. Y. City, 315.6 meters. He discusses "What's Your Radio Problem?" Listen in!

The Goat At the Mike

By Herman Bernard

EVERY newcomer in a broadcasting studio, who is scheduled to take up some time on the air, is viewed with suspicion. Until one has proven worthy his merit is doubted, and often for long thereafter. The numerical preponderance of small stations, with their familiar type of talent, abstracts all essence of surprise from this.

But it must be said in favor of studio managers, announcers, operators and power room executives, that one can not discover offhand the doubts that thrive on ignorance of the performer's qualifications. These studio fixtures have seen so many who were willing, eager, but, alas, not able, come and go, and then not come again, that they draw on a big fund in the bank of experience.

Effective Concealment

The concealment of the real doubts is so effective as to be misleading. Moreover, the rule of courtesy that exists, perhaps through the grace of executive order, leaves the unproven genius feeling that he is greatly appreciated. As the "artist" stops at the program board, and catches a gratifying glimpse of his name thereon, he hesitates to move upon the reception room, or substitute therefor. He may be lucky enough to be recognized, otherwise must go through the ordeal of self-introduction. The greeting is a fine one. And when finally he has finished his broadcasting the announcer will say "Thank you," and make him feel that he was really worth while, but it is more consoling not to know that in advance, because pre-knowledge somehow robs the expression of some of its sincerity. It is a fact that artists whose art is doubted to the extent of a secret prohibitory order on the subject of reappearance, have received thanks in the most gushing volume.

The Audition

These remarks may lead some to wonder what has become of the old-fashioned practice of giving auditions, or private tryouts, before the artist is entrusted to the much-mentioned "unseen audience." It still exists, but the hard practice of supplying a station with talent sufficient to cover the allotted hours on the air is like the problem of the pauper who has been bequeathed a palace and lacks sufficient carpet for the floors.

While some stations give close scrutiny to manuscript speech of some intended orator, most of them do not, especially as men of reputation resent such censorship, and some of them—in one instance a Major-General of the United States Army—actually speak in a spirit of defiance. The soldier I refer to was asked to omit a certain paragraph from his prepared speech but somehow forgot to do so!

And then there are countless other exigencies, including non-appearance of scheduled performers and no musical stores on hand to feed the empty microphone. As a last resort—an unalterably final one, really—a hurry-call will be sent to some music publisher, if the station is in a large city. Then a couple of song pluggers, or maybe a trio, as if to make matters 50 per cent. worse, hasten gladly to the studio, and interspersed with the reiteration of the song titles, name and address of the publisher, identity of the composer, etc. are a few rhythmic renditions, called popular songs, the popularity somehow reminding one of a hope chest.

The Welcome Orchestra

A dance orchestra is always a safe bet and the studio manager or announcer who has been left in a lurch will phone to some cabaret or hall. He knows that the worst that can happen is that only four men show up, instead of the eight or ten expected, and a few discords and faux tempos get on the air. Besides, if an orchestra will play only songs that the public prefers at the moment,



any artistic shortcoming always can be forgiven—if it is observed at all. Especially if songs in which the saxophonist does long solo stretches of a whining or drawing nature are included on the program, the day is safe, or even the night. It is well-known that night audiences are more critical than day audiences, because in the daytime it is so often a case of having to listen to this or that station, or none, while at night a choice exists that will suit any one's fancy, and the dials turn easily.

With singers, of course, it is necessary to be quite careful, as so many persons suffer from the hallucination that they can sing, and are confirmed in this by their nearest relatives and their music teacher, with whom business is not so good that he can afford to be undiplomatic. Most singers, unless reputed, must suffer the indignity of an audition, but they may pass that very handily and yet fail completely before the microphone. That is due perhaps to the sympathetic frame of mind of the audition conductor, usually a man, and his sympathies are not so hard to rouse, unless he is listening to a man! Also, microphone fright makes failures out of many, because the studio manager is not likely to risk many attempts by one ambitious to succeed. When composure finally would be gained—say at the sixth broadcast—the station might have lost its reputation, and as some stations still have some left, that might be serious.

The Talkers

Then we finally get down to talkers. They are classed as "artists," too, although professionalism is likely to be utterly absent. If the idea of a talk on a given subject has been "sold" to the studio director or program manager, the identity or ability of the talker in most cases hardly is considered. Assuming the talker knows what he is going to talk about, else those sponsoring him would not send him there, the rest is taken for granted, and he finally treads into the studio where so many real artists take regular exercise. He gets a fine greeting (from somebody who has been warned to be polite to all comers at the risk of his job) and begins to feel important. This sensation would be ascendant, were it not for the dread he begins to feel as the moment for going on the air draws near. He wonders whether he should read his speech or try to deliver it "extemporaneously." Amid the excitement he forgets what his decision was, for the announcer has given the necessary introduction, the talker half stumbles to his chair, and the typewritten speech somehow forces its way onto the table where the microphone is perched. Instead of moving closer to the microphone, for comfort's sake the talker, still silent, moves the microphone nearer him, by dragging it over the table, whereupon the announcer bursts from the control room, snaps off the microphone from the transmitter, and (barring executive orders not to talk loudly) shouts:

"Don't move that mike! You'll break your listeners' ears!"

The Ordeal

Finally the talk is begun. Meanwhile many radioists have been amusing themselves

listening to the carrier wave or have been taking manual exercise of a rotary nature and have stopped at a certain set of figures not representative of this particular station.

And what an ordeal it is to talk! Whether you sit or stand, your knees shake. Words that once seemed so easy to pronounce that you uttered them while munching cherries, twist themselves about, and syllables become as if but the facets of a kaleidoscope. As you turn them over with your tongue they form themselves into things grotesque, until you wonder what you are talking about and seem to hear listeners' snickers coming back at you through the microphone! It is the zero hour in this radio life.

The Sign of "Pipe Down"

You were allotted ten minutes. You had forgotten to put your watch on the table. Suddenly the announcer presents himself before you like an ogre, half stretching out his arm, hand extended, palm down, and pumps this arm up and down with a motion from the elbow. Spurred by this gentle warning you stumble onto the conclusion of your talk, leaving the main threads of it hanging in the air, so that mayhap some passing wave of another frequency will pick them up and transport them to their proper destination!

"Thank you," says the schooled announcer, smiling pleasantly, and then proceeds to identify the deliverer of the interesting talk. Yet, if one lingers to listen, he feels that the transition from that motif to the emphasis of the call letters and the sighless prophesy of the next feature was oddly hurried.

On the way home the newly created artist feels proud and wonders why persons in the streets and cars do not stare at him the way they would at the Prince of Wales. Before getting very far the artist begins to feel a growing stiffness in his neck and maybe a slight pain in the eye. He can not remember that anybody had hit him in the studio (for conduct is restrainedly gentlemanly there, whatever the natural impulses). He can not understand it.

Sees for Second Time

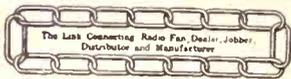
On the second appearance, just one week later—supposing that the glib information purveyor is granted the privilege of a reappearance—he is less uneasy, hence better able to note his surroundings. For the first time, he sees that the studio walls are heavily curtained, and that there are no windows, or, if windows are there, none is ever open. Also when he starts to read his manuscript this time he realizes that the microphone is directly before him, hence to speak with his mouth five frontal inches away from it he has to put his manuscript on one side, and read it from the corners of his eyes, meanwhile straining his neck. Another piece of close observation is that an orchestra leaves the studio as he is about to begin and returns immediately after he has finished. This orchestra, the program week after week will reveal, spends fifty minutes each Friday evening, doling out "Who," from "Sunny," "The Prisoner's Song," "Lullaby Lane" and other rare finds of musical quest. At about his fourth appearance the talker begins to

(Concluded on page 30)

A THOUGHT FOR THE WEEK

"A radio set for every home" is RADIO WORLD's slogan. Let's all work to that end for the glory of radio and the joy of humanity.

RADIO WORLD



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

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General Advertising	
1 Page, 7 1/2 "x11"	462 lines.....\$300.00
1/2 Page, 7 1/2 "x5 1/2"	231 lines..... 150.00
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26 times consecutively or E. O. W. one year	15%
4 consecutive issues	10%

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CLASSIFIED ADVERTISEMENTS

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Entered as second-class matter March 23, 1922, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

MARCH 20, 1926

Roemer, of Zenith Denies Job Change

The following letter was received by RADIO WORLD from H. H. Roemer, director of sales promotion, Zenith Radio Corp., Chicago:

"An article appeared in a magazine stating that I had severed connections with Zenith Radio Corporation and gone with some Bridgeport concern. Such a report is erroneous and absolutely without foundation. Publishers printing such matter as news certainly should secure confirmation before placing a man in the position this publication has placed me. I shall consider it a personal favor if you will run in the first issue, following receipt of this letter, a denial of the report."

The magazine he refers to was not RADIO WORLD.

HEAR JOHN F. RIDER, contributing editor of RADIO WORLD, broadcast every Thursday at 9 p. m. from WGPC, 252 meters. D. W. May, Inc., Newark, N. J. Mr. Rider discusses radio problems.

Standard Definitions Compiled by Experts

Definitions of intense interest to radio experimenters are contained in the Institute of Radio Engineers' Report of the Committee on Standardization for 1926. This contains definitions of terms, standard and graphical symbols used in Radio Engineering. The report is copyright, 1926, by the Institute of Radio Engineers (Inc.). The following excerpts are reprinted by special permission of the copyright owner:

RECEIVING

Receiving Set (Receiver)—A device for converting radio waves into perceptible signals.

Monitoring Receiver—A receiver arranged to enable an operator to check the operation of a transmitting set.

Heterodyne Reception—The process of receiving radio waves by combining the received current with locally generated alternating current. The locally generated frequency is commonly different from the frequency of the received current, thus producing beats. This is called beat reception.

Self-Heterodyne Reception (Autodyne Reception)—A system of heterodyne reception through the use of a device which is both an oscillator and a detector.

Homodyne Reception—The process of detecting a wave by the aid of a locally generated wave of carrier frequency. (Sometimes called zero-beat reception).

Super-Heterodyne Reception—A method of reception in which the received current is combined with the current from a local oscillator and converted into current of an intermediate frequency which is then amplified and detected to reproduce the original signal wave.

Intermediate Frequency—A frequency of a magnitude between that of the carrier employed in radio transmission and the frequency of modulation, and to which the carrier is converted in the super-heterodyne process of reception.

Reflex Circuit—An arrangement in which one or more amplifiers are used,

each to amplify the signal both before and after detection.

Tuning—Primarily, the adjustment of a circuit or circuits to resonance. Use also to mean the adjustment of a circuit or system to secure maximum transmission of a desired signal.

Sensitivity—The degree to which a radio receiving set responds to signals of the frequency to which it is tuned.

Selectivity—The degree to which a radio receiving set is capable of differentiating between signals of different frequencies.

Detector—That portion of the receiving apparatus which, connected to a circuit carrying currents of radio frequency, and in conjunction with a self-contained or separate indicator, translates the radio-frequency power into a form suitable for operation of the indicator. This translation may be effected either by the conversion of the radio-frequency power, or by means of the control of local power. The indicator may be a telephone receiver, relaying device, tape recorder, and so on.

The most common type of detector is a vacuum tube operated on a non-linear portion of its characteristic curve, thereby converting a modulated radio-frequency current into a modulated direct current.

A tube which operates similarly to a detector tube, but the output of which does not operate an indicator, may properly be called a frequency converting tube.

Telephone Receiver—An electrically operated device designed to produce sound waves which correspond to the signal current actuating it.

Loud Speaker—A telephone receiver designed to produce sound of sufficiently large volume to be heard at a substantial distance.

Interference—Confusion of reception due to strays, undesired signals or other causes; also that which produces the confusion.

House Clashes Over The Monopoly Clause

WASHINGTON.

The White bill to be considered by the House will not be encumbered by Section 4, which was considered so objectionable by Mr. White and most of the radio manufacturers and broadcasters. Section 4 was the provision making it unlawful to transport in interstate commerce radio apparatus or tubes upon which there were restrictions as to use.

As originally reported by the House committee, the White bill contained the anti-monopoly clause. Mr. White was opposed to the clause on the ground that it conflicted with the patent laws. Therefore, Mr. White introduced a new bill, similar to the bill reported out by the House committee, with the exception that the anti-monopoly clause was eliminated. The new White bill was sent to committee and immediately reported back to the House.

An effort will be made by a number of House members to have the anti-monopoly clause reinserted into the bill. A proposal will also be offered to establish a new commission with authority to take over radio in its entirety from the Department

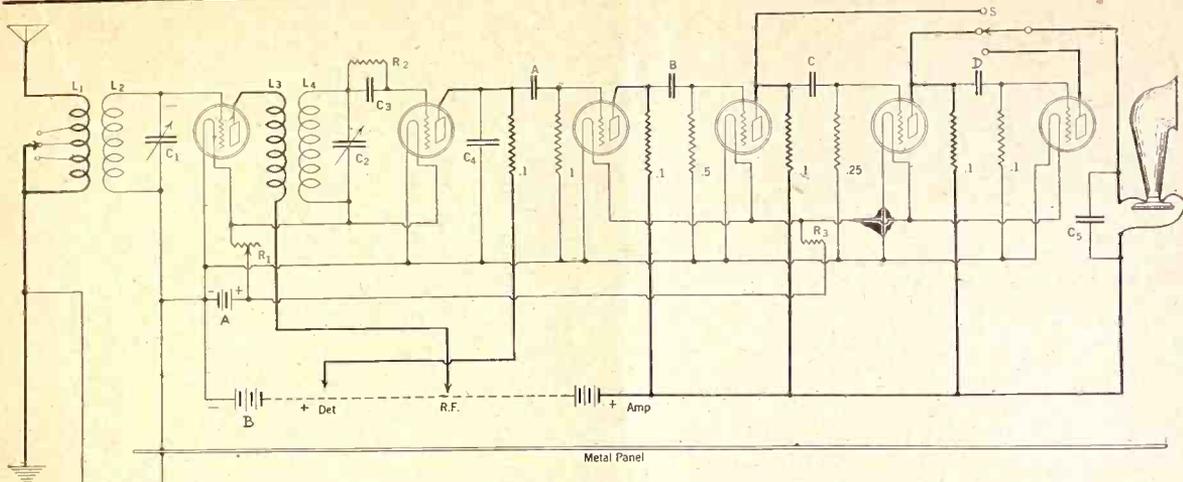
of Commerce. This commission would be somewhat along the lines of the Interstate Commerce Commission which has jurisdiction over the railroads.

Heading these proposals will be Rep. E. L. Davis, of Tennessee. Judge Davis is thoroughly convinced that certain interests are trying to get a strangle hold on radio and that they will succeed unless drastic steps are taken immediately. Judge Davis is the ranking Democrat on the House committee which considered the White bill. It was at his instance that section four was added to the measure. In a long minority report, Judge Davis called attention to the Federal Trade Commission report on the alleged radio monopoly, and quoted some of the witnesses appearing before the committee as bearing out his contention.

WFBI NOW WGAM

WASHINGTON.

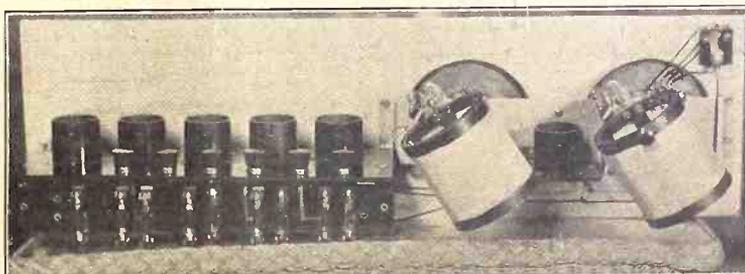
The call signal of WFBI, Camden, has been changed to WGAM. The station is owned by the Galvin Radio Supply Company and uses 250 watts power.



VOLUME is controlled by a switch in this 6-tube set, which has four stages of resistance-coupled audio.



Panel View of the Set



THE REAR VIEW of the set. Note that the coils are mounted at an angle.

Factory Sets

A weekly department for the Owners and Prospective Purchasers of Manufactured Receivers. Address questions to Factory Set Editor, RADIO WORLD, 145 West 45th St., N. Y. C.

THE 6-tube Airway Receiver, the circuit diagram, rear view and front panel of which are illustrated on this page, utilizes resistance coupled audio frequency amplification for supreme tonal quality. So that utmost volume will be obtained on distant stations there is a fourth stage of audio, a switch enabling one to utilize the three or four stages, without removal of the speaker plug.

On the radio side the set has a stage of tuned radio frequency amplification ahead of a non-regenerative detector. The antenna coil is comparatively large, and it is tapped, so that best reception for any given aerial will be achieved, and also so that utmost sensitivity may be enjoyed in distance reception, when one setting of the tap may function better than another. The coils used are low-loss radio-frequency transformers of efficient design, the primaries being inside the secondaries. The set tunes without squealing, due to the coil construction and position, and to the use of high-grade parts throughout. The set is marketed in a handsome cabinet and is sturdily constructed and packed. It is very easy to tune, due to the presence of only two dials, and affords a remarkably enjoyable quality.

Interesting Definitions

WHAT DOES micro mean?

Micro is a prefix meaning one millionth. That is, a microfarad is one millionth of a farad.

WHAT DOES milli mean?

Milli is a prefix meaning one thousandth. That is, a milliamperere is one thousandth of an ampere.

What Type of Program Best Suits Your Likes?

The canvass conducted by RADIO WORLD to discover what its readers prefer in programs is nearing its end. So far symphonic concerts are preferred and jazz is in fifth place. Readers who ballot will be helping themselves to get what they

want, because stations are co-operating and some may frame their programs on the basis of the tabulated result.

Fill out and mail in to the Program Editor the following coupon and mail today.

Program Editor, RADIO WORLD, 145 West 45th Street, New York City:

My preference for entertainment and instruction on the radio is as follows, the numbers next to the listed items representing the order of preference:

- | | | |
|----------------------|---------------------------|---------------------|
| Grand opera..... | Ringside | Football game..... |
| Jazz Orchestra..... | boxing report..... | Hockey match..... |
| Talk | Classical instru- | Recitation |
| State subject | mental solo..... | Musical comedy |
| of talk here..... | State kind here..... | (stage) |
| Classical vocal | Jazz songs | Short play |
| solo | vocal | (drama) |
| State kind here..... | Waltz (orchestral)..... | Short play |
| Musical saw..... | Symphony concert..... | (comedy) |
| Vocal duet..... | Instrumental duet..... | Banquets, with |
| Vocal trio..... | Instrumental trio..... | speeches |
| Vocal quartet..... | Instrumental quartet..... | Sermons |
| Old-time music..... | Brass quartet..... | Market reports..... |
| Band concerts..... | Bedtime story..... | Weather report..... |
| World Topics..... | Baseball game..... | Organ recital..... |

If you particularly dislike any of the above listed offerings, write "No" on the dotted line.

Other offerings (not listed above).....

Remarks (if any).....

Fill out and
mail this
coupon today!

Name

Address

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

Literature Wanted

THE names of readers of RADIO WORLD who desire literature from radio jobbers and dealers are published in RADIO WORLD on request of the reader. The blank below may be used, or a post card or letter will do instead.

Trade Service Editor,

RADIO WORLD,
145 West 45th St., N. Y. City.

I desire to receive radio literature.

Name

City or town

State

Are you a dealer?

If not, who is your dealer?

His Name

His Address

Walter L. Sudbrook, 2913 Walnut, Kansas City, Mo.
Harry Finger, P. O. Box 9, City Hall Sta., N. Y. City, N. Y.
D. J. Doherty, 5 Emmett Terrace, Revere, Mass.
J. C. Crow, Rt. 6, Box 215, Oklahoma City, Okla.
A. Elvin, 3618 Cambridge St., Des Moines, Ia.
John R. Vollmer, 1034 Brock St., Ashland, Penn.
Geo. Schrier, 461 McLaughlin Ave., Muskegon, Mich.
Ernest Seitzler, 1618 Michigan Ave., Dallas, Tex.
John C. Clifford, 4925 Broad St., Pittsburgh, Pa.
L. Colombo, 2326 N. 72nd Court, Elmwood Park, Ill.
Walter H. Kozaczko, Jr., Box 66, Uxbridge, Mass.
S. J. Fluke, Clark Mills, N. Y.
T. J. Welch, Box 265, Syracuse, N. Y.
J. C. Higginson, 303, The Temple.
Frank Finn, 448 Maple Ave., Elizabeth, N. J.
Lloyd Blue, 415 Stone St., Georgetown, Ill.
R. E. Ramgran, 2568 Marcy St., Omaha, Nebr.
O. L. Lezotte, 6057 Normal Blvd., Chicago, Ill.
George H. Schroff, 308 E. 155th St., N. Y. City, N. Y.
T. Weiss, 102 Park St., Millvale Boro, Pittsburgh, Pa.
G. E. Faulk, Island Radio Shop, 636 Virginia Ave., Butler, Penn.
R. A. Cabot, 3442-42nd St., Long Island, N. Y.
Robert Dagher, 1327 Amsterdam Ave., N. Y. C.
Carl G. Andrews, Madalin, N. Y.
R. E. Graeff, Box 117, Ambler, Pa.
Chas. Boehnker, 2843 Brant Ave., Portsmouth, Ohio.
Rudolf Sucky, Box 88, Blaine, O.
G. M. Gertz, Rossford, O.
C. R. Cook, 104 N. Stafford Ave., Richmond, Va.
Ernest Williams, 552 Wood St., Niles, O.
H. J. Kappus, P. O. Box 777, Shawnee, Okla.
J. Wilson, Nacogdoches, Tex.
Herbert Addison, 86 Hawthorne Ave., Newark, N. J.
J. J. Schuessler, 376 E. 155th St., N. Y. City, N. Y.
Raymond Arnett, 1316 Terrill St., Chester, Pa.
G. A. Ashland, Douglas Steam Laundry, Douglas, Wyo.
Wm. Lee Dale, Box 269, Versailles, Ky.
R. C. Gustin, 108 N. Kanthus St., Tulsa, Okla.
W. H. Kilbourne, Box 1844, Tulsa, Okla.
Wm. F. Gaetz & Son, 606 W. Perry St., O. (Dealer).
The Little Radio Shop, 9 Henry St., Portland, Me. (Dealer).
S. G. Reynolds & Co., Sanitaria Springs, N. Y. (Dealer).
Irving B. Kunz, 3419a Pestalozzi St., St. Louis, Mo.
George H. Male, 1843 East 25th St., Cleveland, Ohio.
Hal De Lamatre, Kimfalls, O.
Arnold Walder, 1902 Waveland Ave., Chicago, Ill. (Dealer).

The DC-112 Power Tube

The DC-112 tube made by the Connevey Electric Laboratories, Hoboken, N. J., has an amplification constant of eight and an exceedingly low plate impedance. Its characteristics are such that it can handle large power surges with complete ease. The result is a rich, heavy flow of power from filament to plate and thus to the loud speaker. That is why in the final audio socket you get a fullness of volume and richness of tone. As a detector also the DC-112 delivers fuller signals. When properly biased it is excellent in the radio frequency sockets.

The following is the C battery table:

Plate Volts	Negative Bias
90	6
112½	7½
135	9
157	10½

THE RADIO TRADE

17,500 More Sets Used This Year In Milwaukee

Factory-Made Receivers Increase 18 Per Cent., While Home-Made Products Show Proportionate Loss.

A big increase in the listening audience in Greater Milwaukee, meaning increase in the number of radio receiving sets in Milwaukee homes, is indicated by figures obtained in the preliminary studies of the Merchandising and Research Bureau of "The Milwaukee Journal."

The number of receiving sets grew during 1925 from a total of 23,000 to 40,000. More than 17,500 Greater Milwaukee families "went in for radio" during the year. Twenty thousand sets were purchased and 8,000 were built or assembled by the owner. This indicates that approximately 11,000 sets were discarded, traded in or rebuilt, most of these, of course, being crystal and one-tube affairs.

18 Per Cent More Factory Sets

The percentage of Greater Milwaukee families owning a purchased set as of January 15, 1926, in comparison with those who built their own set, shows an increase of 18 per cent, while those in the latter class show a proportionate loss. Because of the increased number of families in the city this year as against last year, however, the total number of home-made sets is a trifle larger than it was last year. Of the home-made sets, 29 per cent were made from standard kits, or according to standard circuit. Crystal sets are on the decline, and this year will probably be the last of this type for, while the percentage of the total number of radio set owners who owned a crystal set on January 15, 1925 was 8, the percentage this year is only 1.7. The majority of crystal sets, as was the case last year, fall under the heading of home-made.

Radio sets in combination with phonographs have not as yet taken a great hold in this market. Only 5.5 per cent of all the families in Greater Milwaukee who owned a radio set on January 15, 1926, owned a set which was in combination with a phonograph.

Freshman Sets Most Popular

"Freshman sets have increased in popularity to first place on January 15, 1926," says the report. "Sets manufactured by the Radio Corporation of America, which were in first place last year, take second place this year with Atwater-Kent third."

Five-tube sets maintain their lead, this year their percentage being well over 53 per cent, as compared to 22 per cent of all the sets last year. The greatest decline is in three-tube sets, which dropped from 36 per cent of the total to 15 per cent. Six-tube sets show an increase of 3 per cent. The average hours of use per family per week have increased from 21.2 to 27.

As to loud speakers, 67 per cent of all families in Greater Milwaukee who own a radio set own a horn type; 12 per cent use the built-in speaker in connection with the set; 7 per cent use the cabinet type; 3.5 per cent use a phonograph at-

tachment, and 2 per cent use cones. Nine per cent do not use any loud speaker.

Battery Eliminators

As yet, battery eliminators have not come into great use among Greater Milwaukee radio set owners. Forty-three one hundredths (.43) of one per cent of radio set owners own and use the combination A and B battery eliminator. Fifty-two one hundredths (.52) of one per cent of all radio set owners use an A battery eliminator. B battery eliminators are used by 3.54 per cent of all Greater Milwaukee radio set owners.

Fifty-five and sixty-five one hundredths (.55.65) per cent of all Greater Milwaukee radio set owners own a battery charger. Of those Greater Milwaukee radio set owners who use batteries, 79.5 per cent use the wet type, and 20.5 per cent the dry type.

In dry A batteries, Eveready leads with 45 per cent of the total, this being an increase of 25 per cent over last year. Burgess, which is in second place, shows an increase of 7 per cent over the total for last year.

Wet Battery Users Decrease

Of those owners of radio sets in Greater Milwaukee who have occasion to use B batteries, 12.97 per cent use the wet type, and 87.03 per cent use the dry type. In the last analysis compiled for 1924, the wet users represented 13.38 per cent. This shows a slight decrease in the percentage of wet B battery users. In the dry type, Eveready again leads with 46.50 per cent of the total, an increase of 8 per cent over last year. Burgess is second with 23.91 per cent of the total, an approximate loss over last year of 10 per cent.

Analyzing the type of antennas used by Greater Milwaukee radio fans, the investigators found an increase of 14 per cent in the inside type, with a corresponding loss in the outside type; loops showing a very small decrease. Fifty per cent of all antennae are inside; fifty-five per cent outside; and 7.6 per cent loops. The fact that the percentage exceeds a total of 100 is due to a number of radio owners using more than one type.

Business Opportunities Radio and Electrical

Rates: 10 c per word; Minimum, \$1.00; Cash with order

RADIO STORE, splendidly located, Times Square section; new, up-to-date furnishings and fixtures; sets and accessories only; franchises include R. C. A., Stromberg-Carlson, Atwater Kent; present volume of business satisfactory but can be greatly increased; rent under \$600 monthly; excellent lease; other interests compel owner to sacrifice for immediate sale; terms arranged. Box 1. RADIO WORLD.

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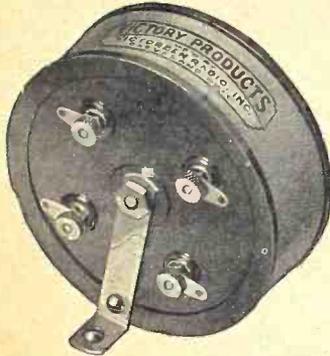
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4. No. 170 R.F. Transformers @..... \$7.00
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You can secure these and all other parts necessary from your dealer.
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General Service Stations, N. Y. City, wireless apparatus, \$10,000; J. H. Dempsey, M. C. Rosenthal, F. Feldman. (Atty., E. Petigor, 233 West 42d St., N. Y. City).
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TERMINALS LOCK ALL CIRCUIT CONNECTIONS PERMANENTLY. SAVE TIME AND LABOR. THEY ARE NEATER. ISN'T THAT GOOD?

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From
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Direct to You

\$7.50

19-inch, full size, full floating cone. Would cost \$30. in a retail store. You save by buying direct. It is superior to any speaker made. Try it in your home; if not satisfied, return and get money back.

Accusti-Cone Laboratories
96 Church St. New York

no par; A. H. Lynch, R. A. Sayres, L. R. Beardsley. (Atty., F. J. Knorr, Albany, N. Y.)
Alkradync Radio Corp., N. Y. City, \$20,000; M. Bellfort, M. Montag, M. M. Simon. (Atty., Greenspan & Morris, 305 Broadway, N. Y. City).
Radio Shop, 2336 Broadway, N. Y. City, \$10,000; C. Essinger, W. Surnamer. (Atty., P. Abrahams, 552 5th Ave., N. Y. City).
Uco Radio Corp., Utica, N. Y., \$50,000; C. A. Schmidt, F. C. Hopkins, O. J. McKeown. (Atty., Dunmore, Ferris & Dewey, Utica, N. Y.)
So-Lo Radio Corp., Paterson, N. J., manufacture, \$25,000; Frieda Solow, Paterson, N. J. Max Goldberg, Newark, N. J. (Atty., W. J. Broody, Paterson N. J.)
Radioette Corp., Queens, N. Y., radio, 500 shares, \$100 each; 2,800 common, no par; A. L. J. M. McCaffery, M. M. H. Ravel. (Atty., A. L. Mariley, 20 Nassau St., N. Y. City).
Smith & Cowper, Lynbrook, L. Is., N. Y., radio accessories, \$10,000; W. C. Cowper, L. Skinner, A. R. Smith. (Atty., Buchdahl, Males & Lempel, 276 5th Ave., N. Y. City).
Petite Radio Corp., of New York, N. Y. City, 30,000 common, no par; L. R. Seidel, H. B. Matheson, G. J. Horvitz. (Atty., Bassett, Thompson & Gilpatric, 233 Broadway, N. Y. City).
Bailey's Music and Radio Shop, N. Y. City, \$1,000; E. McCarthy, A. L. Williams. (Atty., D. B. McNamara, Jr., 5th Ave. and 9th St., N. Y. City).

NAME CHANGES
Kardon Radio Corp., N. Y. City, to Diva Radio Corp.
Niagara Battery Corp., Niagara Falls, N. Y., to C. S. Bettinger.

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The performance of a radio receiving set depends primarily upon two things, an efficient circuit and the use of good parts.

Wherever you find a popular circuit you will invariably find General Radio parts.

General Radio parts are built to exacting laboratory standards by a company which has contributed more in scientific apparatus for radio research than any other one company in the history of radio.

To insure maximum performance from your set select a reliable circuit—then build it carefully with General Radio parts.

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Price, \$5.00



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GENERAL RADIO INSTRUMENTS

"Behind the Panels of Better Built Sets"

The Ways of a Magnet; 2 Processes Explained

A natural magnet is a substance, which if it is dipped into filings of iron, the filings will adhere to the magnet, or if a portion of the substance is suspended by a cotton or silk thread, it will place itself with its longer axis to the north and the south direction. The magnet is usually magnetic iron ore and is found in the earth in the form of black oxide of iron.

Now if a rod of steel is brought near to a piece of this magnetic iron ore, or is rubbed with the ore, the steel bar becomes magnetized. If the bar is of a very hard steel, this effect persists, even after the rod is taken away. The steel rod is then called a permanent magnet. Usually these pieces of steel are made in the shape of horseshoes.

There is another way in which a sub-

stance can be given magnetizing properties and that is by passing a current through a coil of insulated wire, which is placed over a rod. This rod is usually made of soft iron. The magnet has this property only as long as the current is passing through.

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I have been a radio bug since my period in the army. I have tried the hookups

published in RADIO WORLD and have fared well with all of them. I built the most popular of circuits, the Diamond of the Air, and have had wonderful results. There is a local station five blocks away from me and it is not difficult to tune it out. Chicago stations can be brought in with great volume with this local going. A home-made loop is used as the collector of energy. I also wound my own coils, which are of the basket weave type.

ROBERT HAMILTON,
Preston Hotel, Dallas, Tex.

FOR CLEAR, QUIET "B" POWER



RADIO Storage "B" Battery

12 Cells
24 Volts
Lasts Indefinitely—Pays for Itself
Economical and performance unobtainable elsewhere. Recharged at a negligible cost. Delivers unflinching power that is clear, pure and quiet. Approved as a standard by leading Radio Authorities, including Pop. Radio Laboratories, Pop. Sci. Inst., Standard Radio News Lab., Reflex, Inc., and other important institutions. Equipped with Solid Rubber Case, an insurance against acid and leakage. Extra heavy glass jars. Heavy rugged plates. Order yours today!

SEND NO MONEY Just state number of batteries wanted and we will ship day order with order. Wall your order now!
WORLD BATTERY COMPANY
1219 So. Wabash Ave., Dept. 82 Chicago, Ill.
Makers of the Famous World Radio "A" Storage Battery
Prices: 6-volt, 100 Amp. \$11.25; 150 Amp. \$13.25; 140 Amp. \$14.00. All equipped with Solid Rubber Case.

World STORAGE BATTERIES
Set your Radio Dials at 210 meters for the new 1000 watt World Storage Battery Station, WSBG, Chicago. Watch for announcements!
KOKA - WFAF - WGN - WJZ - KIL - KGO - KFAP - WJW - KORB

KB-8

(Non-Regenerative Browning-Drake)
NO MORE BLOOPERS!

That's the new Golden Rule of radio. Your neighbors won't tear their hair when you tune in a KB-8, because it is non-regenerative. And you will get the quality of reception which only a non-regenerative set can produce. **THE KB-8 WILL BRING IN AT FULL VOLUME ANYTHING THAT A SUPER-SENSITIVE SET CAN RECEIVE WITH GOOD QUALITY.**

DATAPRINTS for SET BUILDERS..... \$1.00

Detailed description and 12 photographs are given in Radio Engineering Magazine, March issue. Send 20c in stamps, or \$2.00 for a year's subscription. Radio Engineering is not sold on newsstands.

RADIO DEALERS

The KB-8 is the very latest thing in Browning-Drake development. Dataprints can be bought at full discount. Sell them to move parts. It is non-regenerative.

Dataprints Sold in Individual Tubes

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for volume and tone quality
3 STAGES RESISTANCE COUPLED
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Easily added to any set
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for 201-A and 199 types

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\$4.50 and this coupon
Renew all of your tubes for less than the cost of two. Send no money. Reviver will be mailed C. O. D. to those sending coupon. Satisfaction, or money back.

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Name
Address
City State

Cross out
one
201-A
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Offer Good Until Street Address
April 7. City and State

Things Unsaid Make Announcer, Says Hay

George Dewey Hay, known to the radio fans of the country as "The Solemn Old Judge," now director of radio station WSM, Nashville, Tennessee, won his way

to fame and popularity not only through his original ideas of broadcasting and novel stunts, but because of strict adherence to his radio slogan, "Never Fail To Broadcast A Smile." Mr. Hay is now living up to his reputation at WSM, where he is guiding genius of the station as well as chief announcer, for "The Solemn Old Judge" still keeps in touch with his large radio following over the microphone, in

addition to directing the activities of WSM.

"It isn't so much what the announcer says into the mike," declares Mr. Hay, "as what he doesn't say, that counts toward popularity." "The Solemn Old Judge" is a newspaperman, who recognizes the importance of the radio as a news medium; a humorist who appreciates a joke when it is on himself as well as when it is on the other fellow, and who understands without being cynical that people and their doings are always amusing; a psychologist who knows the importance of putting himself in a position of middleman between the artist and the listener.

Mr. Hay was born in Attica, Indiana, and spent ten years of his life in the Hoosier town. Before his debut as a radio announcer he was a newspaper reporter and feature writer on the Memphis Commercial Appeal. He brought every bit of this experience to his radio work and regards radio as practically a new kind of newspaper, with a circulation running into the millions. "The announcer must have a nose for news," he says. "Radio is the world's newspaper and the announcers are its reporters."

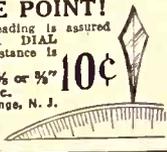
"The Solemn Old Judge" took his first radio steps as chief announcer for WMC.

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40 Hodden Place East Orange, N. J.

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THE VICTOREEN

How to build this 8-tube Super-Heterodyne described in February 20, 27, March 6 and 13 issues of RADIO WORLD. Send 60c for all four copies, including FREE blueprint. Send \$6 for year's subscription and get these four copies and blueprint FREE!

RADIO WORLD
145 W. 45th St. New York City

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A Guaranteed Radio Tube Within Reach of All

Every tube guaranteed. A tube for a dollar of \$2 value. A trial order will convince you as it has thousands of others. Send your orders at once.

Orders sent C.O.D. parcel post.

Type .199A

Type .199

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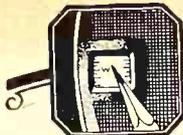
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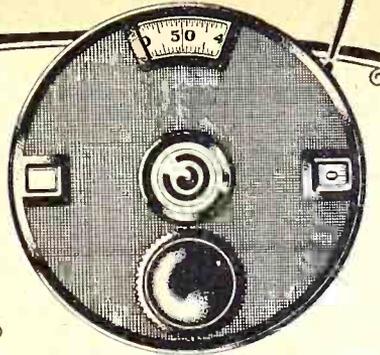
Dept. W., 200 B'way, N. Y. C.
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Lafayette Bldg., Detroit, Mich.



for the Super de Luxe



—right on the dial itself—
your record of station settings



SCARCELY a single well-designed new circuit . . . today . . . but uses MAR-CO dials. On the Super-heterodyne de Luxe, described in this issue by J. E. Anderson, two MAR-CO dials provide the searching

dial-action that is one of the features of this set. Put MAR-CO dials on your own set tonight. To put it off is to miss the best your set can do. Martin Copeland Company, Providence, New York, Chicago.

Hair-trigger response

MAR-CO DIALS

Micrometer-like action



The 1926 model tuning control

CHANGES OF ADDRESS

should be sent to Subscription Department at least two weeks in advance of publication in order to insure early and proper attention. RADIO WORLD'S subscription list is so large that it is necessary that changes be sent in as requested. Address, Subscription Department, RADIO WORLD, 145 W. 45th St., New York.

Results Editor:

I have built the 4-tube Diamond of the Air, as described by Herman Bernard in the Jan. 23 issue of RADIO WORLD. I have found this set to be wonderful. I have been able to get loud speaker reception from stations WOAI, WOAW, WHO, KFUA, KPRC, KDKA, KFKX, KDKA, KFKX, WJZ, WRC, WGN, KPRC, WSAI, WLW, WLS, WJAX, WSB, WSMB, WAAM and PWX. I might mention that the RFT is wound on an old style talking machine cylinder or record.

G. MCCHESENEY,
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Montgomery, Ala.

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Build a 5-Tube Tuned Radio-Frequency Set, Using the Streamline Kit **\$7.50**



Boxed Kit consists of 3 Streamline straight line frequency .00035 mfd. condensers, 3 basketweave coils, 3 mountings. Above, with 3 Bruno Slo-Moshen Vernier Bakelite Dials \$12.50

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.00035 mfd. 2.25	
.0005 mfd. 2.50	



STREAMLINE RADIO CO.
213 FULTON STREET
New York City

Have you seen the Clinical Study of Low-Loss Coils, covered by the Bureau of Standards, that appeared in our Jan. 16 issue? Send 15c for a copy.

The Ways of a Magnet; 2 Processes Explained

A natural magnet is a substance, which if it is dipped into filings of iron, the filings will adhere to the magnet, or if a portion of the substance is suspended by a cotton or silk thread, it will place itself with its longer axis to the north and the south direction. The magnet is usually magnetic iron ore and is found in the earth in the form of black oxide of iron.

Now if a rod of steel is brought near to a piece of this magnetic iron ore, or is rubbed with the ore, the steel bar becomes magnetized. If the bar is of a very hard steel, this effect persists, even after the rod is taken away. The steel rod is then called a permanent magnet. Usually these pieces of steel are made in the shape of horseshoes.

There is another way in which a sub-

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ROBERT HAMILTON,
Preston Hotel, Dallas, Tex.

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RADIO Storage "B" Battery

12 Cells 24 Volts Lasts Indefinitely—Pays for Itself Economy and performance unequalled before. Recharged at negligible cost. Delivers unflinching power that is clear, pure and quiet. Approved and listed as Standard by leading Radio Authorities including Pop. Radio Laboratories, Pop. Sci. Inst. Standards, Radio News Lab., Cefax, Inc., and other important institutions. Equipped with Solid Rubber Cases, an insurance against acid and leakage. Extra heavy glass jars. Heavy rugged plates. Order yours today!

SEND NO MONEY Just state number of batteries wanted and we will ship day order. Extra offer: 4 batteries in series (96 volts), \$10.50. Pay expression after examining batteries. 6 per cent discount for cash with order. Mail your order now!

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1219 So. Wash Ave., Dept. 82 Chicago, Ill.
Makers of the Famous World Radio "A" Storage Battery
Prices: 6-volt, 100 Amp. \$11.25; 150 Amp. \$13.25; 110 Amp. \$14.00. All equipped with Solid Rubber Case.

World STORAGE BATTERIES
Set your Radio Dial at 210 waits for the new 1000 watt World Storage Battery Station, W.S.B.C., Chicago. Watch for announcements.
WOKA-WLAF-WGN-WJS-KHU-KGO-KFAP-WJW-KOP

KB-8

(Non-Regenerative Browning-Drake)
NO MORE BLOOPERS!

That's the new Golden Rule of radio. Your neighbors won't tear their hair when you tune in a KB-8, because it is non-regenerative. And you will get the quality of reception which only a non-regenerative set can produce. **THE KB-8 WILL BRING IN AT FULL VOLUME ANYTHING THAT A SUPER-SENSITIVE SET CAN RECEIVE WITH GOOD QUALITY.**

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RADIO DEALERS

The KB-8 is the very latest thing in Browning-Drake development. Dataprints can be bought at full discount. Sell them to move parts. It is non-regenerative.

Dataprints Sold in Individual Tubes

M. B. SLEEPER, Inc.
TECHNICAL PUBLISHER
V-52 Vanderbilt Ave.
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The Daven Super-Amplifier
for volume and tone quality
3 STAGES RESISTANCE COUPLED
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Easily added to any set
Saves Several Hours' Assembly
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Offer Good Until April 7. City and State

Things Unsaid Make Announcer, Says Hay

George Dewey Hay, known to the radio fans of the country as "The Solemn Old Judge," now director of radio station WSM, Nashville, Tennessee, won his way

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Polished Nickel or Gift. $\frac{1}{2}$ or $\frac{3}{8}$ " **10c**
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40 Hedden Place East Orange, N. J.
Dealer Inquiries Solicited.



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Every tube guaranteed. A tube for a dollar of \$2 value. A trial order will convince you as it has thousands of others. Send your orders at once.

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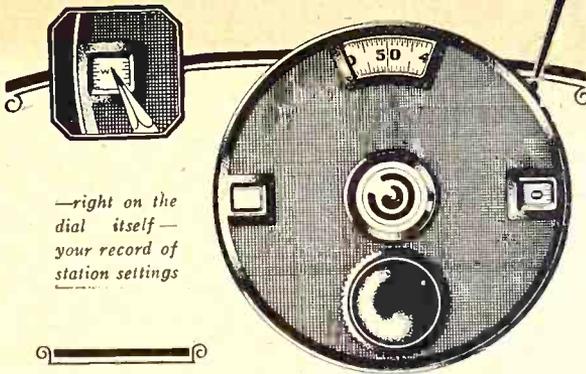
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220 So. State St., Chicago, Ill.
Lafayette Bldg., Detroit, Mich.



for the Super de Luxe



—right on the dial itself—
your record of station settings

SCARCELY a single well-designed new circuit . . . today . . . but uses MAR-CO dials. On the Super-heterodyne de Luxe, described in this issue by J. E. Anderson, two MAR-CO dials provide the searching

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should be sent to Subscription Department at least two weeks in advance of publication in order to insure early and proper attention. RADIO WORLD'S subscription list is so large that it is necessary that changes be sent in as requested. Address, Subscription Department, RADIO WORLD, 145 W. 45th St., New York.

Results Editor:

I have built the 4-tube Diamond of the Air, as described by Herman Bernard in the Jan. 23 issue of RADIO WORLD. I have found this set to be wonderful. I have been able to get loud speaker reception from stations WOAI, WOAW, WHO, KFUA, KPRC, KDKA, KFKX, KDKA, KFKX, WJZ, WRC, WGN, KPRC, WSAI, WLW, WLS, WJAX, WSB, WSMB, WAAM and PWX. I might mention that the RFT is wound on an old style talking machine cylinder or record.

G. MCCHESENEY,
203 1/2 Park Place,
Montgomery, Ala.

DISTANCE AND VOLUME AT YOUR COMMAND

Build a 5-Tube Tuned Radio-Frequency Set, Using the Streamline Kit **\$7.50**



Boxed Kit consists of 3 Streamline straight line frequency .00035 mfd. condensers, 3 basketweave coils, 3 mountings. Above, with 3 Bruno Slo-Moshen Vernier Bakelite Dials . . . \$12.50

Streamline Condensers

.00025 mfd. \$2.00	Straight Line
.00035 mfd. 2.25	Frequency
.0005 mfd. 2.50	



STREAMLINE RADIO CO.
223 FULTON STREET
New York City

Have you seen the Clinical Study of Low-Loss Coils, covered by the Bureau of Standards, that appeared in our Jan. 16 issue? Send 15c for a copy.

Eveready Hour Shows The Art in the Irish

The average American's ideas concerning the typical Irishman probably run largely to red hair, stocky build, witty tongue and ready fists. Perhaps it is because the average American rather admires all that sort of thing and perhaps it is—but, after all, who knows just what is the true origin of any popular nation?

All Irishmen aren't natural born policemen or prize fighters. There is another side of the true Irish nature which is just as beloved among those admirers of the Irish who are thoroughly aware of it. It is the whimsical, the dreamy, the artistic temperament which so often is an outstanding characteristic of the sons and daughters of old Erin. And that was the theme of the special St. Patrick's Eve program for the "Eveready Hour" broadcast Tuesday evening, March 16, through station WEAF, New York, and fourteen

affiliated stations scattered through the East and Middle West.

Last year the "Eveready Hour" program on the evening of St. Patrick's Day, portrayed the rough and ready side of the Irish nature. It told, in music and dialogue, the story of a typical St. Patrick's night party in a little town on the "ould sod."

This year the program directing staff

of the "Eveready Group" worked for weeks to build a program of quality.

VICTOREEN Super Heterodyne

Build the Right Set

COAST TO COAST-ON-A-LOOP

No Oscillations, Howls or Squeals
No Matching of Tubes

Range-Clarity-Selectivity-

Ease of Operation

KIT—
COMPLETE PARTS—
SPECIAL **\$64.00**

Including the Same Parts as Described in This and Other Issues of Radio World.

A demonstration will convince you. Tubes, batteries, cabinet and aerial, of course, not included. Packed, ready for you anywhere, with blue print instructions for connecting up.

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If your dealer cannot supply you
send us 25c in postage

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BEAUTY-QUALITY-LOW PRICE

TYPE 5SS \$45
5-Tube Tuned Radio Frequency.

TYPE 6RR \$50
6-Tube Resistance Coupled Audio, Tuned Radio Frequency.

If your dealer cannot make immediate delivery we will ship direct from factory

American Interstate Radio Service
183 Greenwich Street, New York City
Distributors, Jobbers, Dealers, write for special trade terms

"Bruno" MAGIC DIAL



The Newest Wonder in Radio

Makes condensers that are not straight-line frequency tune as if they were. Moulded

Bakelite. No gears, \$2.50
no back lash

"Bruno Slo-Moshen" Vernier
Dial, \$2

BRUNO RADIO CORP.
223 Fulton Street New York City

ULTRA-LOWLOSS CONDENSER

SPECIAL CUTLASS PLATES DISTRIBUTE THE STATIONS EVENLY OVER THE DIAL SIMPLIFIES TUNING CAPACITY 0005 MFD

\$5.00

PHENIX RADIO CORP., 116-F East 25 St., N.Y. C.

Join the Happy Diamond Family!

Build This Famous 5-Tube Set
and Know Real Quality
Reception!

Easy to Build, Easy to Tune!

Herman Bernard, designer of this wonder circuit, has written an illustrated booklet on "How to Build RADIO WORLD'S 1926 Model Diamond of the Air." Send 50c and get this booklet, including a full-sized wiring blueprint.

Outstanding Features of Set:

- (1) Fans, charmed by tone quality, sensitivity and selectivity, report speaker reception of far-distant stations with great volume.
- (2) A 2-tube earphone set, a 5-tube speaker set, and a separate 3-stage audio-amplifier for immediate use with any tuner, are combined in one.
- (3) No rheostats are used.
- (4) The set is inexpensive to construct and maintain.

What the Circuit Is

The 1926 Diamond consists of one stage of tuned radio-frequency amplification, regenerative detector, one transformer, coupled audio stage, and two resistance audio stages—the utmost from five tubes!

Follow Bernard

You can't go wrong if you follow the directions as written by the designer himself, as contained in the booklet. The diagrams, including blueprint, are guaranteed 100% accurate. Play safe!

Send \$6 for year's subscription and get booklet and blueprint FREE.

[Newsdealers or radio dealers, order the booklets with blueprints included, in quantity, direct from American News Co. or branches.]

RADIO WORLD

145 West 45th St., New York City

EXTRA SPECIAL—NOW IN PREPARATION

The Greatest Issue of the Year

RADIO WORLD'S FOURTH ANNIVERSARY NUMBER

DATED APRIL 3rd

Last Advertising Forms Close March 24, A. M.
Last Red Form March 22, A. M.

Radio World's weekly subscribers have doubled since our Third Anniversary Number. Still advertising rates remain the same—\$240 a page, or \$8 an inch, on yearly contract. With Radio World's 100,000 weekly circulation this advertising rate is only \$2.40 per page per thousand—a lower rate than any other 100% radio interest publication.

On page copy received by Monday A. M., March 22, an extra color, red (two printings), will be given in this great anniversary issue without extra charge.

For space reservation write or phone F. S. Clark, Advertising Manager.

RADIO WORLD, 145 WEST 45TH STREET, NEW YORK

Telephone: Bryant 0558-0559

428 Seek Wavelength; Illinois First With 47



CLAROSTAT

prescribed by LEWIS WINNER for the TECTRON "B" ELIMINATOR. Also O.K.'d by RAYTHEON and a host of other Nationally Known Eliminator manufacturers. \$2.25. American Mechanical Laboratories, Inc. 285 N. 6th St. Brooklyn, N. Y. Dept. R.W.

A book of valuable radio diagrams and information covering the above subjects will be mailed to you upon receipt of four cents in stamps.

WASHINGTON. The Department of Commerce has just made public for the first time a list of applicants for new broadcasting stations throughout the United States. The list reveals that 428 new broadcasting stations would soon be on the air if there were wavelengths to accommodate them.

According to officials of the Department of Commerce, the list indicates the great publicity value attached to broadcasting. At the present time there are 536 stations. The applicants are from forty-five states

and the District of Columbia. Illinois leads with 47 applicants. California is second with 40, and New York is third with 28. A list of states, with the number of applications from each, follows:

Illinois, 47; California, 40; New York, 28; Florida, 22; Iowa, 18; Massachusetts, 18; Pennsylvania, 16; Minnesota, 14; Texas, 13; Nebraska, 13; Maine, 12; Ohio, 12; Indiana, 11; Wisconsin, 11; Tennessee, 11; North Carolina, 11; North Dakota, 9; Missouri, 9; Michigan, 9; Virginia, 8; New Jersey, 7; Oklahoma, 7; Arkansas, 7; Colorado, 6; South Dakota, 6; Kansas, 5; Connecticut, 5; Georgia, 5; Alabama, 5; Louisiana, 5; New Hampshire, 4; Rhode Island, 4; Vermont, 4; Oregon, 4; Montana, 4; Kentucky, 3; Idaho, 3; West Virginia, 3; Washington, 2; Mississippi, 2; Maryland, 1; District of Columbia, 1; Utah, 1; Arizona, 1; Wyoming, 1, and New Mexico, 1.

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Is Specified
By LEWIS WINNER

for the TECTRON
AND ALL OTHER RADIO WORLD'S
"B" ELIMINATORS

Why? Because they are "BUILT TO BE BETTER."
Also FIXED MICA CONDENSERS, RESISTORS and
RESISTANCE-COUPLED UNITS.

AEROVOX WIRELESS CORP.

489-491-493 Broome Street

New York City



Wonder Radio Log

The Wonder Radio Log Co., of Chicago, Ill., is putting out a booklet, comprising a list of broadcasting stations in the United States, Alaska, Philippine Islands, Canada, Mexico, Cuba and Porto Rico, etc., by their call letters, kilocycles and location. A map and a diary are also included. The broadcasting stations are stated by call letters. Space is allowed for keeping a log of the type of reception accorded with each station. If any change occurs in the standing of the present day stations, there is ample room to make a note of the change. Alongside of the list of the stations by kilocycles, there are also spaces for placing remarks, as to reception.

TECTRON TUBES

Should Be Used in the
TECTRON "B" ELIMINATOR
for Quietness in Operation and Maximum
Voltage and Amperage Output



They were selected by Lewis Winner as the most suitable for this wonderful Eliminator.

TECTRON RECTIFIER TUBES are built especially for the Eliminator described in this issue. They will deliver the maximum of current and voltage over a reasonably long period of burning hours.

Price \$2.50

If your dealer cannot supply you order direct.

Special Prices to Manufacturers

Tectron Radio Co.

1270 Broadway

New York

For real reception, clarity and volume use:
Tectron 201A.....\$2.00
Power Tube.....\$5.00

Special Compact Model Tectron "B" Eliminator, 4x7x7 inches, small enough to be placed in the cabinet of a set. Will deliver up to 150 volts and 60 milliamps. Fully guaranteed. Price, complete, ready to operate.....

\$35.00

SHORE

TRANSFORMERS
CHOKE COILS
CONDENSERS

Will

Enable You to
Build Your Own

TECTRON "B" BATTERY ELIMINATOR

As described by
Lewis Winner in this issue

Full Instructions
Sent on Request

for
RAYTHEON
REX, and
CHEMICAL
RECTIFIERS

Prices on request

SHORE ELECTRIC CO., Inc.
64 University Place
New York City

All types of special
transformers built
to specifications

Tradiograms

**\$650,000,000 Year
Prophesied For 1926**

The output of companies manufacturing radio apparatus has grown from \$2,000,000 in 1920 to more than \$500,000,000 in 1925, says Arthur J. Tryer, Deputy Commissioner, Department of Commerce, Bureau of Navigation. He estimated that business in 1926 would amount to \$650,000,000.

Tryer said that development of the radio had been so rapid that the department found it hard to keep its inspection instruments advancing with other apparatus.

Freed-Eisemann Gets Six-Story Factory

Freed-Eisemann will occupy a new 6-story and basement building, seven factory floors—at Liberty Avenue and Junius Street, in the East New York section, Brooklyn.

FREE RADIO CATALOG

WRITE for a copy of
our NEW 100-Page
Radio Catalog—Parts, Accessories — Kits — Sets —
Everything for the Fan.

DEPT. R. W.

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509 S. State Street, CHICAGO, U. S. A.

The world's greatest variable grid leak, distributed by the North American Bretwood Co., is selling enormously, and is giving universal satisfaction. Get more out of your set by using the Bretwood Grid Leak. Mailed for \$1.50. Radio Division, The Columbia Print, 145 W. 45th St., N. Y. C.

BARBLEY'S FOLDER

Dealers who are on the lookout for a new means of stirring up good business will receive a beautifully printed folder that will help them make new radio history, on application to Barbley's Radiop Service, 135 Liberty St., New York City. The Barbley Brothers are pioneers in radio and are well known for their research work. Mention RADIO WORLD.

LOUD SPEAKER RECEPTION

from either coast on three tubes

Blueprint and instructions..... \$1.00
Necessary low loss coil..... 2.50
Beautiful finished instrument..... 35.00

S. A. TWITCHELL CO.

1930 Western Avenue Minneapolis, Minn.

WELTY'S DETECTOR AMPLIFIER UNIT



Can be used in any receiver. Extremely compact. Size 4 1/2 x 9 1/2. All strictly high class parts. Universal sockets. Distortionless transformers. Will handle the volume of any set. Only 4 connections necessary to hook up to any tuning apparatus. Color scheme binding posts, also switch and jack. Whenever a detector and two stages of audio are required you can use this splendidly made Welty Unit to decided advantage. It saves time in building. Price only \$19.50.

A NEW

SUPERADIODINE KIT, \$17.50

With Perfectly Matched Transformer and Filter



This is a SUPERADIO Product—Your
Guarantee of Satisfaction!

The most selective, the most powerful, longest ranged, finest toned 8 tube super ever designed. Intermediate transformers matched to identical peaks and filter tuned to same peak. Kit includes Antenna Coupler, Oscillator Coupler, Special Variable Condenser, Tuned Input Transformer, 3 matched intermediate transformers and hardware. Complete with booklet, diagrams and full sized working drawings which positively assure perfect success. Order now. Only \$17.50.

Write for our free Radio Catalog of parts.

WILLIAM A. WELTY & CO.

36 South State Street, Chicago

Phone: State 6952
Radio Dept.



RADIO BROADCAST Laboratory, where many of the Knockout Sets were developed.

Now you can build ROBERTS RECEIVERS

including the complete series of Radio Broadcast Knockout Receivers. One to fit every radio location and pocket-book!

A One-tube
Knockout,
the first of
the series.



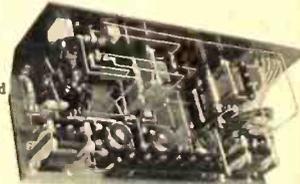
A Knockout
employing
two tubes—
it's a
Roberts



Resistance
coupled
audio
in a
Knockout
Receiver



A well
designed
three-
tube
Roberts



To make it easy to build these efficient sets Radio Broadcast has prepared a book showing with complete wiring diagrams and instructions how to build twelve types of them. No constructor's data is complete without this book. These receivers are known to be good, and the best of it is that you can test their value for yourself by means of these clear and interesting instructions complete and separate for each receiver. The cost of this 88-page book is one-dollar; the technical skill and experimentation behind it are priceless. Send your mailing instructions along with one dollar, today. There is only a small edition of these books, printed for the few who can appreciate the best.

DOUBLEDAY, PAGE & COMPANY,
Garden City, New York

Please find enclosed \$1.00 for RADIO BROADCAST'S KNOCKOUT RECEIVERS to be sent to

Name
Address

FILL OUT AND MAIL NOW SUBSCRIPTION BLANK RADIO WORLD

RADIO WORLD

145 West 45th Street, New York City
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Please send me RADIO WORLD for months, for which

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SUBSCRIPTION RATES:

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Three Months 1.50
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Add \$1.00 a Year for Foreign
Postage; 50c for Canadian Post-
age.

Public Radio Monopoly Is Asked in Britain

LONDON.
An official committee has recommended to Parliament that the control of radio be taken from the British Broadcasting Co.,

a private company, and vesting it in a public corporation.

The committee expresses the view that broadcasting "will become the handmaiden rather than the usurping rival of literature and the arts—in fact, we feel justified in

Expert "on Location".



THE LOCATION of a loud speaker has much to do with the quality and volume of signals, says T. L. Seaman, of the New York office of the Thordarson Electric Manufacturing Co. Mr. Seaman is shown experimenting with the location and position of a cone speaker to get best results.

predicting that in the long run art will not be injured by science."



**Vacuum Tubes
Rebuilt
\$1.00 each**

POSITIVELY GUARANTEED equal to new tubes in every respect. Money will be refunded if tubes prove unsatisfactory for any reason other than burn-outs.

Send us your broken and burned out tubes by parcel post. (Not necessary to insure or guard against breakage.) We make return shipments by parcel post C.O.D. and try to maintain 24-hour service.

**HARVARD RADIO
LABORATORIES**
200 Old Colony Avenue
South Boston, Mass.

LISTEN TO YOUR LOCAL STATIONS
with

THE TALKING BOOK

Reg. U. S. Pat. Off.

A complete radio set in the form of a book, bound in fine cloth with gold stamping. Equipped with Towers head phones and antenna.

Guaranteed range fifteen miles.

An ideal auxiliary to a tube set. Costs nothing to operate and lasts forever.

Just the set for the children and fine for the travelling man.

PRICE FIVE DOLLARS, sent prepaid.

Approved by the Popular Radio Laboratory

Mfd. by
LISTEN-IN PUBLISHING CO.

110 Main St. Cambridge, Mass.

Publishers of the Listen-In Radio Record.

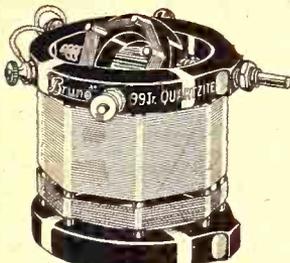
If you live within ten miles of a broadcasting station write for exclusive agency.

KITS—KITS—KITS AND STILL MORE KITS!

The Demand for the 1926 Model, Boxed and Sealed

DIAMOND OF THE AIR KIT.....\$35.00

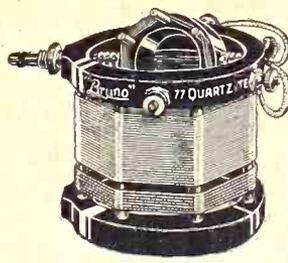
Is Exceeding Our Wildest Expectations. The Country Is Going DIAMOND Crazy!
Recognition Like This Must Be Deserved!
No Kit Is Genuine Unless It Bears the Seal and signature of HERMAN BERNARD



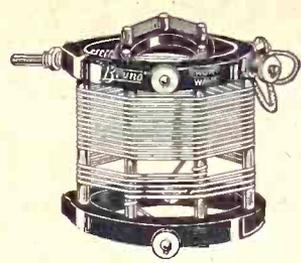
"Bruno 99" 3-circuit tuner wound on quartzite glass and specified in the Diamond of the Air.....\$5.50



"Bruno 55" matched Radio frequency coil for 99 and used in the Diamond of the Air.....\$3.00



"Bruno 77" 3-circuit tuner wound on quartzite glass with special tickler for smooth regeneration control.....\$5.50



"Bruno" short wave coil. Tunes from 25-110 meters with .00025 condenser. Wound with flat ribbon wire.....\$5.50

Here are a few of RADIO WORLD'S most famous kits, which were presented to its readers in the past few months. The parts included in each are exactly as specified by the authors in the articles. Full instructions for construction will be included in each kit for the convenience of the builders. Our kit department carries nearly every kit ever described, and if not included in these columns, we would be glad to advise you as to its price, etc.

Bruno Powertone Kit—
A 5-tube single control receiver. Described Aug. 29, Sept. 5 and Dec. 12.. **22.50**

The Bernard DX 1-Tube Receiver. Distance on 1 tube. Described Oct. 24 **7.75**

The 3-Tube, 3-Circuit Receiver. An efficient DX getter. Described Oct. 10 **18.50**

Sidney E. Finkelstein's 25-110 Meter Short Wave 2-Tube Set. Described Sept. 12..... **12.95**

Herbert E. Hayden's A-A Receiver. An efficient, all-around set. Described Nov. 14 and 21..... **22.50**

The Pathfinder—A 4-tube receiver of exceptional merit. Described Oct. 31 and Nov. 7.. **31.25**

Bernard's Audio Amplifier—3 stages of amplification with volume. Described Oct. 3..... **10.50**

The Famous RX1 Receiver. Described in issues of Oct. 17 and 24..... **21.50**

Thordarson Wade Kit—Clarity, Volume and Selectivity. Described Oct. 3, 10, 17..... **41.50**

The 4-Tube DX Dandy—Herbert E. Hayden's Receiver. Described Feb. 27..... **15.95**

Bernard's Loudboy—Distance and Volume on 1 Tube. Described Feb. 21..... **9.65**

Bruno 3-Tube DX Set—All Low Loss Parts Used for DX and Volume... **18.50**

Intimate Adventures Before the Microphone

(Continued from page 19)

realize that his worth was well appreciated in advance, for an orchestra was beguited into playing for 25 minutes before his own dramatic entry, to inspire the audience, if not recruit them, and for 25 minutes after he has finished, so that the thrill of his words would stand out in contrast to the commonplaces that nearly all America enjoys as jazz!

The Other Side

Yes, the chronological surroundings were just right! It may never dawn upon him that an hour's uninterrupted work is tiresome for an orchestra, so a talker—any kind of a talker, or even a child soprano would do—is sandwiched between the halves, merely to stop the gap. While the talker's talk may be education—indeed it may even enlighten radioists on the technique of their sets—

We Specialize in Complete Kits
The M. & H. Engineering Service Will Supply Parts
or Complete Sets of Any Hook-up

DESCRIBED IN THIS OR ANY
OTHER RADIO MAGAZINE

M & H SPORTING GOODS CO.
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SUPER-HETERODYNES

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Complete parts in stock—Write
WALDEN ELECTRIC CO.
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S. HAMMER RADIO CO.
303 Atkins Avenue, Brooklyn, N. Y.
Please send me FREE, Your NEW
RADIO CATALOG

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JOHN F. RIDER

announces that his laboratory is now available as a service institution catering to the radio fan constructor and the broadcast listener.

Also his personal services are available to radio fans as consultant in matters pertaining to radio receivers in all their phases.

Mr. Rider is the author of the Laboratory Scrap Book appearing each Saturday in the New York Sun Radio Magazine, Contributing Editor of Radio World, and contributor to many other leading radio periodicals in the country.

LABORATORY OF JOHN F. RIDER
145 West 45th Street New York City
Telephone Bryant 2383



New—Different
The Beautiful De Luxe Radio
Log You've Always Wanted.
**The Wonder
Radio Log**

Rich seal grain binding stamped in gold. Top edge gilt, 144 pages, size 5 x 7 1/2. Printed on heavy bond paper.

Lists the Broadcasting Stations three convenient ways—(1) by Call Letters; (2) by Locations and Owners; (3) by Kilocycles and Meters. Includes 28-page Wonder Radio Diary by months and days and Wonder Radio Distance Map. Ample space for keeping complete Log and for changes, additions and revisions.

Delights everyone who has it.

"I have sold or seen practically every Radio Log issued for five years, but never saw a complete one until the WONDER arrived. It has no rival."

"It is a WONDER—beautiful, complete and up-to-date. Check for \$5.00 is from five friends."

It will delight you. Order today.
Price \$1.00 Post Paid.

THE WONDER RADIO LOG COMPANY
705 So. Dearborn St. Chicago

really he is rated by the whole station, from the owner down to the janitor, as merely humanitarian, the enjoyers of this social hospitality of course being the perspiring musicians.

It is a fact that perspiration abounds in broadcasting studios. It is surprising how much one can perspire when simply sitting still. Most broadcasting talkers are seated during their period of grief (more like elec-

VEBY HIGH-MU TUBES

Made especially for Resistance Coupled Amplifiers. Now you can get more volume with greater clarity.
A. F. 20 for the 1st and 2nd Stage \$3.00
A. F. 6 Power Tube for the 3rd Stage 4.50

VEBY RADIO CO.

47-51 Morris Avenue Newark, N. J.

HARD RUBBER

SHEET—ROD—TUBING

Special Hard Rubber Parts Made to Order
Send Sample or Sketch for Quotation

PANELS ANY SIZE

RADION AND HARD RUBBER

PRICE LIST FOR ALL RADION PRODUCTS
ON REQUEST

WHOLESALE RETAIL
NEW YORK HARD RUBBER TURNING CO.
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DEALERS BIG DISCOUNTS

Radio's biggest season is here. Get our new catalog showing huge stocks of radio parts, sets, kits, at lowest rock-bottom prices. Quick service, wonderful special offer on best sets, tubes, batteries. Write for free copy.
W. C. Braun Co., 32-60 So. Clinton St., Chicago, U. S. A.

HARD RUBBER PANELS

Size	Black
7 x 10.....	.32
7 x 12.....	.39
7 x 14.....	.42
7 x 18.....	.56
7 x 21.....	.64
7 x 24.....	.75
7 x 26.....	.85
7 x 30.....	.96

RIX RADIO
SUPPLY HOUSE, Inc.

5505—4th Ave.
Brooklyn, N. Y., U. S. A.

QUICK ACTION CLASSIFIED ADS

10 CENTS A WORD. 10 WORDS MINIMUM. CASH WITH ORDER

CONSTRUCTION OF THE 4-TUBE A-A RECEIVER, by Herbert E. Hayden, appeared in RADIO WORLD dated Nov. 21. 15c per copy, or start your subscription with that number.

HERMAN BERNARD, managing editor of RADIO WORLD, broadcasts every Friday at 7 p. m., from WGBS, Gimbel Bros., N. Y. City, 315.6 meters. He discusses "What's Your Radio Problem?" Listen in!

1926 DIAMOND OF THE AIR BOOKLET with full instructions to make the Diamond, with blue print, 50c. Newsdealers and radio dealers can get supply from American News Co. and its branches, RADIO WORLD, 145 W. 45th St., N. Y. C.

HEAR JOHN F. RIDER, contributing editor of RADIO WORLD, broadcast every Thursday at 9 p. m. from WGCP, 252 meters, D. W. May, Inc., Newark, N. J. Mr. Rider discusses radio problems.

trocation than like hanging), but a stinky dampness pervades the chair and sometimes the carpet. Women talkers have their troubles in this direction, too, particularly under the arms, even though they articulate without a single gesture. Rouge runs from ruby lips and powder is rendered as useless as a drenched ammunition dump.

Becomes Normal Person

The day finally dawns when, if the talker retains sufficient favor at the studio, he becomes a natural person in all his broadcasting and attendant duties. He speaks and acts

FENWAY BLUE PRINTS

"PICTURE" DRAWINGS

Easily the finest radio prints ever made

Price, Postpaid—\$3.00

Build a Laboratory Set with
Fenway Blueprints!

LEO FENWAY

29 WEST 64th STREET NEW YORK, N. Y.

22½ volt
rechargeable
"B"

Storage
Battery

\$2.95

Includes
chemical



45 volts, \$5.25; 90 volts, \$10.00; 112½ volts, \$12.50; 135 volts, \$14.75; 187½ volts, \$18.80. Truly the biggest buy today. Easily charged on any current, including 22-volt systems. Any special detector plate voltage had. Tested and approved by leading authorities such as Popular Radio Laboratories. Over 3 years sold on a non-red tape, 30-day trial offer with complete refund if not thoroughly satisfied. Further guaranteed 2 years. Knock-down kits at great savings. Complete "Hawley" "B" battery charger, \$2.75. Sample cell, 35c. Order direct—send no money—simply pay the expressman cost on delivery. Or write for my free literature, testimonials and guarantee. Same day shipments. A. B. Hawley Smith, 318 Washington Ave., Danbury, Conn.

How to Build THE FENWAY

The famous DX set that, by the turn of a switch, is a 4-tube tuned RF set, with regeneration, or a 9-tube Super-Heterodyne! Remarkably sensitive!

Described by Leo Fenway himself in the February 6, 13, 20 and 27 issues, including trouble shooting. Send 6c for all four issues, or send \$6 for year's subscription and get these four copies FREE!

RADIO WORLD, 145 W. 45th St., N. Y. C.

"ME WANTS MORE DX"—worth framing. This is the front page of RADIO WORLD dated March 6. If you haven't a copy, get this number and you will find that this youngster with the earphones is one of the cutest little kids you ever saw, except your own, of course. 15c per copy, or start sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

BULLDOGS
BEAUTIFUL REGISTERED BULL PUPS. 515.
Bulldogs, 501 Rockwood, Dallas, Texas.

HELP WANTED MALE
Earn \$110 to \$250 monthly, expenses paid as Railway Traffic Inspector. We secure position for you after completion of 3 months' home study course or money refunded. Excellent opportunities. Write for Free Booklet, G-161 Stand. Business Training Inst., Buffalo, N. Y.

freely and easily, with only enough nervousness to prevent the fatality of indifference. The supreme moment arrives when the middle-aged girl who runs the elevator in the studio building, greets him by name. This usually happens just prior to Christmas. If

by coincidence one starts his broadcasting career at that time, the incident of the elevator girl surely will turn any man's head! For at the beginning he is expecting much, while later on he expects nothing in particular and receives all of that and less.

Finally, after several months of steady appearance, the artist begins to feel like a man on parole, reporting to headquarters each week lest he be "sent back" for violation. It becomes part of the steady grind that helps make this life bearable and to distinguish it from the next.

"I Heard You"

He has ceased to inquire of all who honor him with their presence whether they listened in the other night when he was on.

He seldom mentions his broadcasting but is glad when some one voluntarily tells him

he listened night before last. There is little he can say in fair return. It is absurd to ask, "How did you like it?" It invites disaster or diplomacy, and both are bad, world history of twelve years ago having proven diplomacy the worse. No plea for utter frankness is genuine, for no broadcaster, not even a mere talker, and certainly not a singer or instrumentalist, wants to hear adverse criticism. He may say that he welcomes it, but, if he has any brains, he is conscious of his own shortcomings, and if he hasn't any shortcomings he hasn't any brains.

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"Omaha, Nebraska, February 10, 1926.

Kane Antennae Co.,

Gentlemen: I received 2BD, Aberdeen, Scotland, on a "Kane 1" during the recent International Tests. Reception was officially verified by Radio Broadcast Magazine, who conducted the tests. I built the Antennae a year ago from one of your blue prints. It has more than met expectations in the elimination of outside electrical interference, as well as in increased volume and distance. GUY H. CHAMBERLAIN

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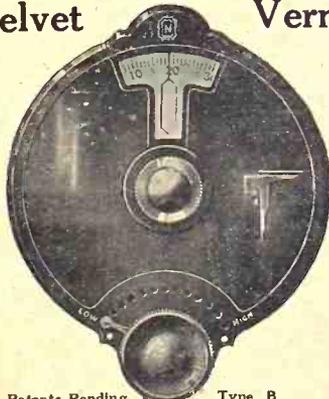
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- Variable Ratio
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Patents Pending Type B

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Of special importance is a new and novel device which enables the user to adjust at will the reduction to any ratio from 6-1 to 20-1. This feature aids greatly in the separation of stations operating on the lower wave lengths. This new dial is moulded from black bakelite in a highly ornamental design.

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Counter-Clockwise 200-0 (360°)	\$2.50	\$3.00
Clockwise 0-200 (360°)	2.50	3.00

Send for Bulletin 109 RW

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| 2 General Radio Type 277-D Coils, or 1 General Radio Type 277-D Coil and 1 General Radio Type 277-C Coil | 1 General Radio Type 236 0.5 MF. Fixed Con- denser |
| 4 General Radio Type 349 Sockets | 17 General Radio Type 138-Z Binding Posts |
| 1 General Radio Type 368 Micro Condenser | 2 General Radio Type 310 Dials |
| 2 General Radio Type 274-H Condensers | 1 .0001 MF. Fixed Condenser |
| While the coils are such that the best range will be obtained with the Type 274-H Con- densers, the Type 334-H Condensers may be substituted when so desired. | 1 .00025 MF. Fixed Condenser |
| 1 General Radio Type 301—10 ohm Rheostat | 1 Durham Grid Leak 2 Meg. |
| 1 General Radio Type 301—30 ohm Rheostat | 1 Durham Grid Leak Mounting |
| 2 General Radio Type 285-L Audio Transformers, or 1 General Radio Type 285 Audio Trans- former and 1 General Radio Type 285-L Audio Transformer | 2 Radiall Co. “Amperitas” with Mountings (cor- rect type for tubes used) |
| 1 General Radio Type 274 Telephone Plug and Jack | 1 Elnetrad Royalty Resistance Type C (500 to 50,000 ohms) |
| | 1 Panel 7"x18"x3/16" |
| | 1 Baseboard 7"x17"x1/2" |
| | 1 Terminal Strip 9 3/4"x1 1/2"x3/16" |
| | 1 Yaxley Filament Switch |
| | 2 Brackets 1 1/2"x1 1/2"x1/2" (may be obtained at any hardware store) |
| | 1 Special Bracket, as shown in Fig. 5b |

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3 General Radio Medium Frequency Input Transformers, No. 271, each \$5.00	15.00
2 General Radio 6-ohm Rheostats, No. 301, each \$1.25	2.50
1 General Radio 400-ohm Potentiometer, No. 214	3.00
2 General Radio Audio Transformers I, No. 285 and 1 No. 285-L, each \$6.00	12.00
2 Silver-Marshall Changeable Coils, No. 110-A and 1 No. 111-A, each \$2.50	5.00
2 Silver-Marshall Coil Sockets for No. 110-A and No. 111-A, each \$1.00	2.00
1 Special R. F. Variable Coupler mounted on sub panel with switch and taps, all wound ready for use	6.00
3 Gem Fuses and Base	1.00
1 Royalty Type B Resistance	1.50
1 Yaxley Filament Switch	.50
1 Yaxley Filament Control Jack	.70
1 Yaxley 2 Circuit Jack	.80

1 Yaxley D. P. D. T. Switch, No. 60	\$1.25
9 Air-Gap Sockets, each 75c	6.75
3 National Vernier Dials (new type), each \$2.50	7.50
8 Eby Binding Posts, each 15c	1.20
50 Foot Celastite Wire, per foot, 4c	2.00
1 Jewell Combination Volt Meter 0 to 8-80-160	12.50
1 Jewell Meter 0 to 50 Milli-Amps	7.50
1 Micamold Condenser Grid .00025	.35
1 Micamold Condenser Grid .0005	.45
1 Micamold Condenser By-Pass .001	.40
1 Micamold Condenser By-Pass .01	.90
3 Micamold Condenser By-Pass .5, each 90c	2.70
1 Micamold Grid Leak 2 Megs.	.30
1 Micamold Grid Leak 5 Megs.	.30
1 Micamold Grid Leak Mount	.30

Total \$133.00

NOTE—Silver-Marshall Transformers can be supplied at an additional cost of \$4.00 per set.

NOTE—For those desiring to wind their own coils, coupler and other special parts, the proper parts may be had on receipt of order for same.



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