Oct. 18
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RADIO WORLD

VOL. 6. NO. 4. ILLUSTRATED EVERY WEEK

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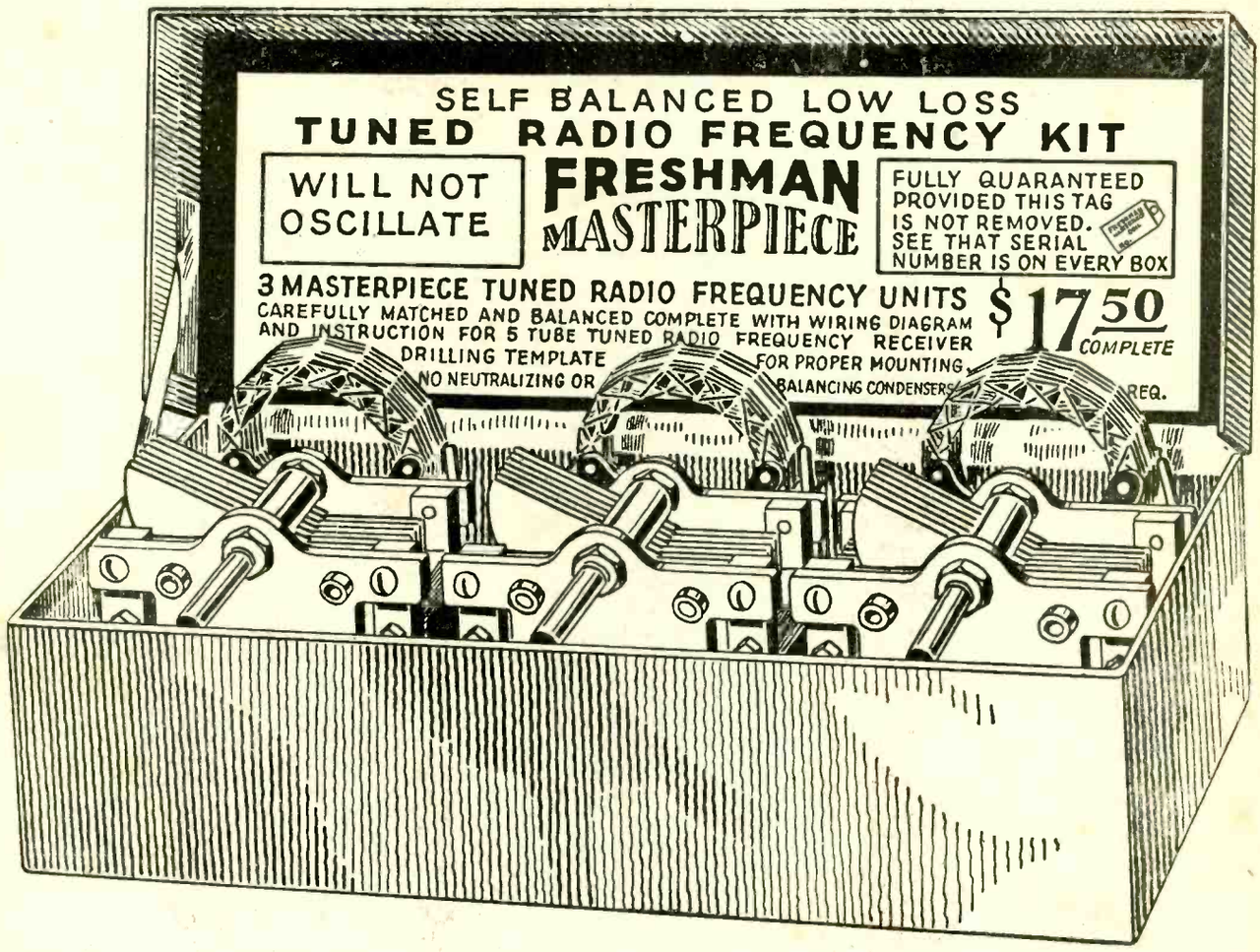

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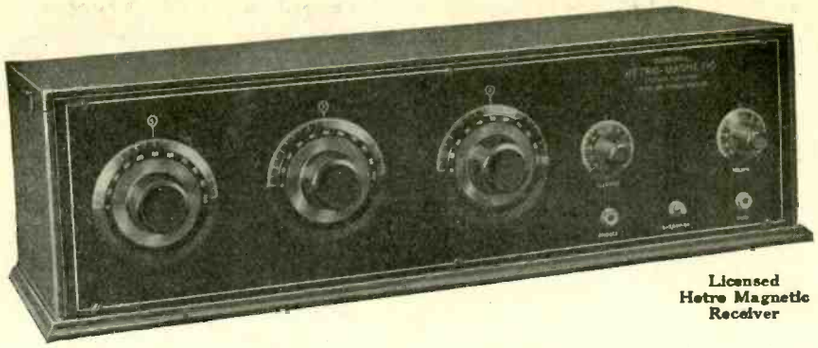

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Circuit: Three stages of tuned Hetro Magnetic frequency amplification and detector, and two stages of audio frequency amplification.*
Tubes: Five in all. Automatic five or four tube control.
Wave Lengths: 150 to 610, includes amateurs.
Aerial: Loop or out-door 75 to 100 ft.
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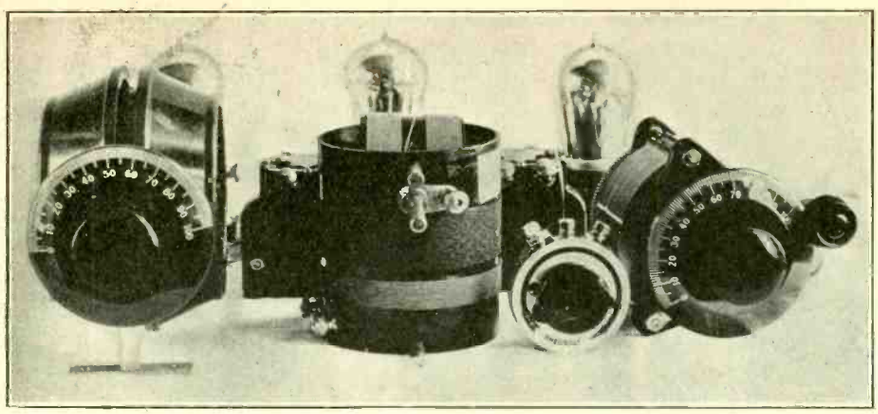
Scientific

RADIO WORLD, Vol. VI, No. 4. Whole No. 134, October 18, 1924. 15c. per Copy, $4.00 a Year.
[Entered as second-class matter, March 28, 1922, at the Post Office at New York, N. Y., under Act of March 3, 1879. A Weekly Paper Published Every Wednesday and Dated Saturday. by Hennessy Radio Publication Corporation from Publication Office, 1493 Broadway, New York, N. Y. Phones: Lackawanna 6976 and 2063.]

Tuning 3-Circuit Primary



A VARIOMETER (at left) may be used for tuning the primary in a 3-circuit aperiodic set.

ALAN ENGLANDER, happy over his radio set, a birthday gift.

VOLUME SIX OF

RADIO WORLD

[Entered as second-class matter, March 28, 1922, at the Post Office at New York, N. Y., under the Act of March 3, 1879]

A Weekly Paper Published Every Wednesday and Dated Saturday, by Hennessy Radio Publications Corporation from Publication Office, 1493 Broadway, New York, N. Y. Phones: Lackawanna 6976 & 2063.

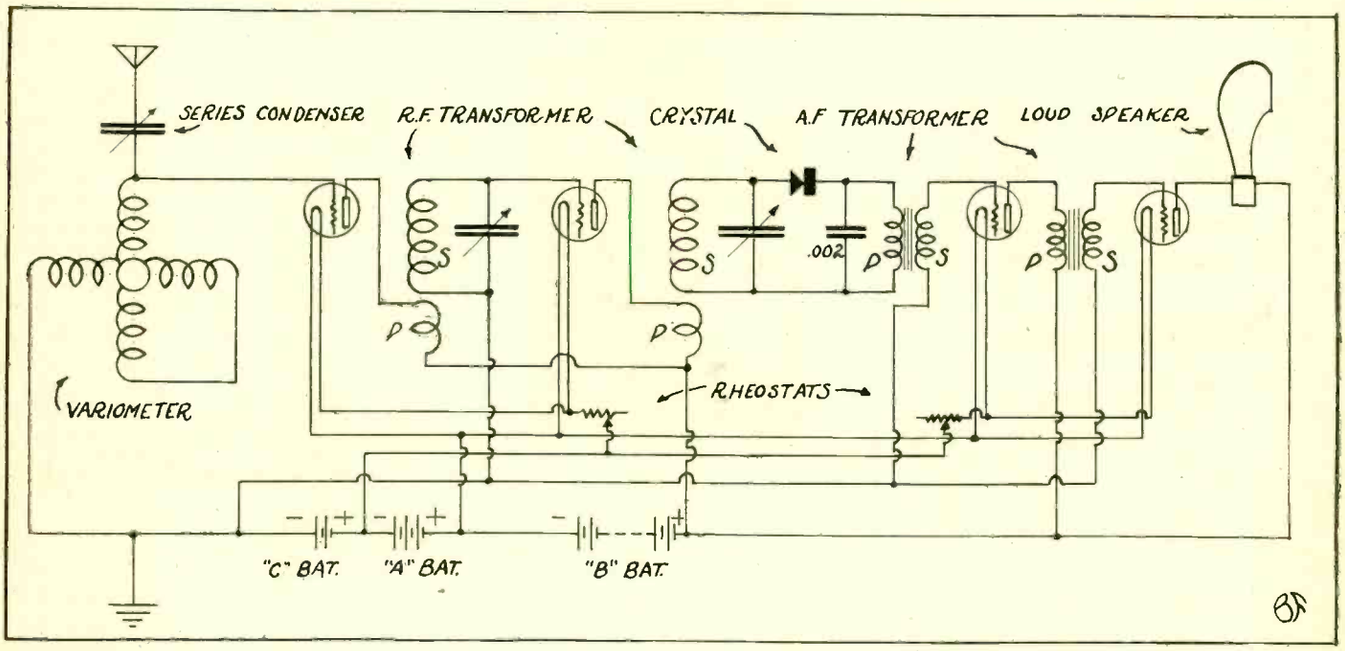
Vol. VI. No. 4. Whole No. 134. October 18, 1924 15c. per copy, $6.00 a year

MY FAVORITE RECEIVER

[Second of a Series by Noted Authors, Each Article Being of a Different Hookup]

By Brainard Foote

Tuned Impedance RF, Transformer-Coupled Tuned RF, Crystal Detector and Two Transformer-Coupled Audio Stages Employed in That Order



THE CIRCUIT is quite simple, with all unnecessary frills omitted. A C battery negatively biases the grids of all four amplifier tubes. The specially made primary windings of the RF transformers are marked P and the honeycomb coils S. Audio transformers are similarly lettered. This diagram reads from left to right, though the set is constructed right to left.

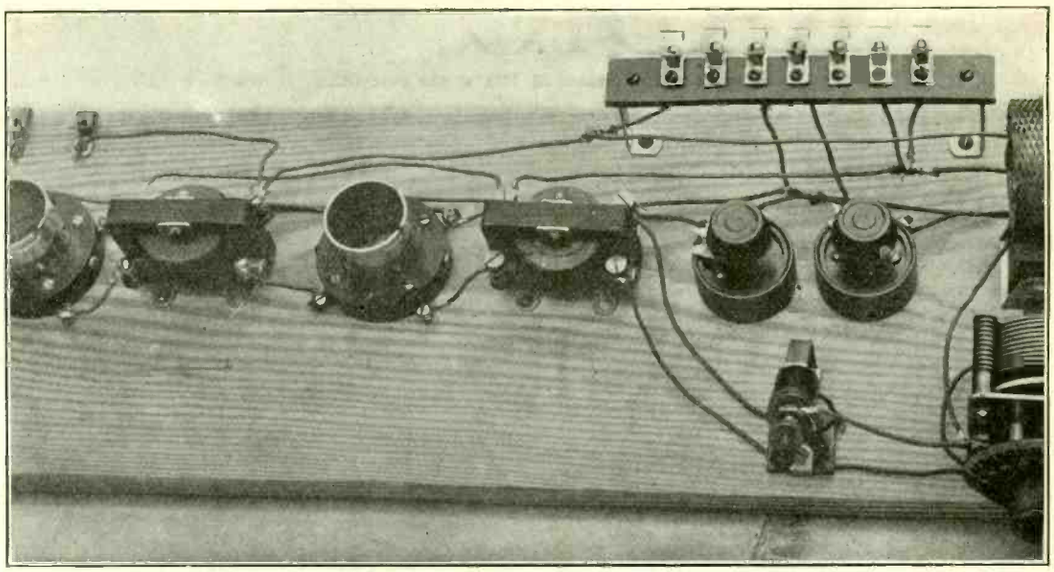
WHAT is my favorite receiving outfit? Since I would rather hear a good Marimba Band broadcast from our home town than a squeak from Missouri, my favorite receiving set must produce thoroughly enjoyable entertainment as music issues from the loudspeaker. If we want to hear some DX station out of range of my favorite, we use a little regenerative 1-tube outfit. Since our ideal outfit must be perfect in its reproduction, it's got to have a crystal detector. But the crystal is a puny affair without any particular amount of kick. So it has to be fed carefully with energy that is previously amplified by the radio-frequency system. We can use transformers of the tuned or untuned type, but, personally, I like to tune them because the selectivity is so very much better. To amplify the energy sufficiently, one or two stages of RF are requisite, preferably two, if we care for some reasonable DX. Then two stages of AF are added for loudspeaker operation.

The circuit may be reflexed, if you'll admit of some losses in tonal quality, but I like a straight circuit best. This makes our ideal outfit a 4-tube receiver—two radio, crystal and two audio.

An untuned antenna coupling may be employed, using a variable condenser for the first grid circuit. However, since we use the set principally for local reception, no greater selectivity is needed than is furnished by regular antenna tuning plus tuning in both stages of radio-frequency. Therefore, we include the grid circuit of the first tube right in the antenna circuit, suffering no doubt, some small loss in selectivity but gaining in volume.

The photo shows the outfit as assembled on a board. The wiring is from right to left. There's a good reason. Ordinarily sockets are placed with their filament terminals in front, or nearest the panel. Then the filament leads have to pass under or over the grid and plate wires in passing back to the terminal strip. Now if we turn the socket about, the filament wires can go straight to their destinations without getting mixed up with grid and plate wires and thereby incurring no undesirable coupling effects. But, when this is done,

Wiring of Foote's Favorite



SECTION PHOTOS of a receiving set embodying two steps of radio, a zincite-bornite crystal detector and two of audio. (See rest of photo in next page). The outfit is board-mounted from right to left in order to place filament connections at the rear and shorten the wiring as a whole. Honeycomb coils, with special primary windings inside of them, form the two radio-frequency transformers, the antenna circuit being tuned by a combination of adjustable condenser and variometer. This is the set that Brainard Foote, noted experimenter, prefers above all others. He likes it so much because of the fine quality of the received signal.

the grid terminal falls to the left instead of at the right, as formerly. Hence the set must be wired from right to left.

The photo will show how short the leads may be made. For a 4-tube receiver there doesn't seem to be an overabundance of them, either. The instruments fall naturally into such positions that leads of a couple of inches connect them. The grid wires, especially, are all short and not near other wiring. Note that the antenna post is by itself at the right-hand end, while battery and ground posts are mounted on a little panel or binding post strip of their own. Connections for the loudspeaker are just in view, to the left.

The crystal detector is a combination of zincite and bornite, by far the most rugged and stable for the work at hand. Several such detectors are on the market. One rheostat serves for the radio stages and one for the audio stages, about 16 ohms each. To remove hand capacity effects from the variometer a little extension, made of a length of composition tubing and a short length of ¼" brass rod, is adopted. The tubing is held to the shafts by two set screws, placed in such a manner that the extension shaft doesn't come near or touch the main shaft.

The primary windings of the RF transformers are made of "doughnut" coils wound on a form slightly smaller than the inside diameter of the honeycomb coils. The coil thus made is removed from the form and the turns allowed to spring apart inside of the other coil until they fit snugly. They are then drawn together by several narrow strips of tape and pushed inside the honeycomb coil firmly. In the case of the transformer coupled to the crystal, a 25-turn primary is used, while with the first stage of RF, only 20 turns are required. In case of serious and persistent oscillation the B battery is shunted by a large fixed condenser, .01 or thereabouts, or if necessary some turns are taken off the primary windings of the two RF transformers.

Low ratio audio transformers are advised, to conserve the quality, as the volume from locals within 60 miles will be all that can be desired.

In any circuit, we realize that regeneration and oscillation can be prevented by coupling between the antenna and the oscillating tube. With small coupling, however, oscillation may readily occur. In this receiver, the antenna's absorbing effect is employed for the very purpose of controlling the sensitivity of the RF amplifier. This is accomplished by the balance of inductance and capacity existent between the variometer and the series condenser. With a high capacity setting of the condenser and a low inductance setting of the variometer, a certain wavelength may be tuned in. But the antenna's absorption of energy is sufficient to prevent oscillation and perhaps the volume won't be quite enough.

Then the situation may be reversed. We may get the very same wavelength by using a low capacity setting of the condenser and a high inductance setting of the variometer. Now the antenna's absorption is opposed by the small capacity of the condenser and actual oscillation may be obtained. The best results are obtained by carefully "juggling" these myriad possible combinations for each wavelength until we have good sensitivity without oscillation. Then the tuning may be done by the variometer alone, with the condenser left in its position indefinitely. It is the chief function of the series condenser to bring about that happy coupling relation between set and antenna where we have good sensitivity but no "squealing." The tuning then is a pleasure, the dial readings of the central control or of the first RF tuning condenser being noted down for future reference.

When we come to tube illumination on AC, such a set is ideal for the purpose and the lighting of all four tubes may be done as I outlined RADIO WORLD, issue of August 16, so successfully that a close listener cannot tell whether AC or storage battery is being employed for filament illumination. This set produces the highest quality of tone of speech and music, its adjustment will not bother the impatient man, and its upkeep is inexpensive.

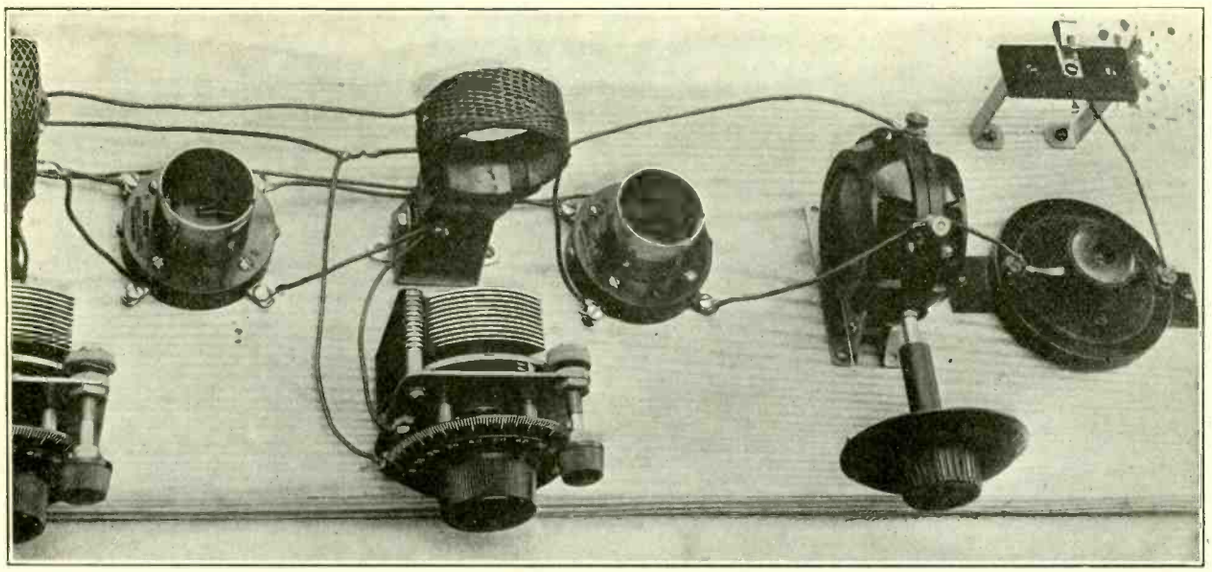
Wiring Directions for Foote's Set

[*The following instructions are based on the circuit diagram and are on the basis of reading from left to right. The photos show the wiring actually made from right to left, but the photos are not followed in this reckoning. Please note that the beginning of a honeycomb or duolateral coil emerges from under the winding. The end is on top.*]

1. Connect the aerial to the rotor or movable plates of the series condenser so marked in the circuit diagram. The stator or fixed plates are connected (a) to the grid of the first tube, the one shown at extreme left in the circuit diagram and which is an RF tube, and (b) to the beginning of the vario-

Short Leads Accomplished

meter. Either terminal of the variometer may be taken as the beginning and the other terminal as the end, and the set will work. But if possible determine the direction of the winding and discover the actual beginning in this fashion: where the stator is joined, usually by a pigtail or flexible insulated wire, to the windings of the rotor ball is the end of the stator and beginning of the rotor, an identical point, hence the actual beginning of the variometer is at the other end of the stator. Where the rotor lead terminates, at a point where the rotor winding is brought out to a post on the variometer, is the end of the variometer winding.



THIS is the aerial side of the set, the rest of the set being shown on the opposite page. The set-up is from right to left. The author explains why.

2. Wire the A and C battery connections as follows: Join the end of the variometer, the remaining free terminal, (a) to the ground, (b) to the C minus, (c) to the end of the secondary of the first RF transformer, that is, the honeycomb coil at left, (d) to the rotary plates of the condenser that is across this coil, the second variable condenser from the left in the circuit diagram, (e) to the end of the secondary, the F or S2 post, of the first audio-frequency transformer, the one second from the loud speaker in the circuit diagram and (f) to the end of the secondary of the other AFT. Connect the C+ to the A— and this same lead goes to one leg of each of the two rheostats. Thus the A— goes through the rheostat. Note that one rheostat each controls two tubes, the rheostat at left governing the two RF tubes at left and the rheostat at right the two AF tubes at right. This is accomplished by connecting the A— lead to the leg of one rheostat, and connecting the remaining free terminal of that rheostat to the F— posts of the two sockets whose tubes are to be controlled by that rheostat. Repeat that operation on the next rheostat for the next two tubes. The A+ is connected directly from the A battery + post to the F+ posts of the four sockets. The B— is joined to the A+.

3. The plate of the first tube, the one at extreme left, is connected to the beginning of the primary of the first RF transformer, the one shown at left, next to the variometer. The end of this primary, which is the home-made part of the transformer, goes to the B+, as does the end of the primary of the next RF transformer. Hence these two primary ends and the B+ are joined in one lead. The beginning of the secondary of the first RF transformer goes to the grid of the second tube from left in the diagram and to the stator plates of the variable condenser across that secondary. The beginning of the secondary of the last RF transformer, instead of going to the grid of any succeeding tube, as did its corresponding predecessor, goes to one side of the crystal detector. This lead also is connected to the rotary plates of the remaining variable condenser. The crystal may be either fixed or adjustable, but better constancy of volume is usually reported from the use of an adjustable or catwhisker crystal. However, if an extra control, such as this amounts to in a close reckoning, is objectional, a good fixed crystal may be used and will give excellent results, too. The remaining free side of the crystal goes to the P or P1 post of the first audio-frequency transformer (second from left from loud speaker in diagram). The end of the primary of the first AFT, marked B or P2, goes to the remaining unconnected side of the variable condenser and to the remaining terminal of the RF coil. The .002 fixed condenser, one side of which goes to the P or P1 post of the first AFT, and the other side to the P2 or B post, may be mounted directly on this AFT.

4. All that remains are the connections for the AF stages. The ends of both secondaries (S2 or F on both AFT), go to C— and to ground, a connection already made. The S1 or G posts of both AFT go to the G posts on the sockets of the two AF tubes, the two at extreme right on diagram. The G or S1 post of the first AFT goes to the G post on the third tube, the tube second from right in the circuit diagram. The plate of the third tube goes to the P or P1 post of the last AFT, the one at right in diagram, and the B or P2 post of this AFT goes to the B+, the same lead that went to the secondaries of the two RF transformers. The G or S1 post of the last AFT goes to the grid of the last tube. The S2 or F post already has been connected. Now there are left only two connections, one being the lead from the plate of the last tube, the other being a B+ connection. The plate of the fourth tube goes to one side of a single-circuit jack and the other side of the jack goes to the plate of the last tube, if a jack is used. Otherwise the loud speaker cords may be connected directly to this plate and B+. The striped cord goes to B+.

[*Those who construct this circuit are requested to write to Results Editor, Radio World,* 1493 *Broadway, New York City, and state how they fared. When possible give the trade names of the parts you use, or the manufacturers' names. Results letters will be published, including trouble-shooting letters. Readers may include questions in the same letter. The questions will be answered in the Radio University Department.*]

Ice Pick Is Pulmotor for Dry Cells

DRY cells have a habit of giving up the ghost in the midst of a particularly interesting DX concert. About twenty holes punched into the casing of the battery with an ice-pick and a hammer will add a few more hours of life to the cell. Theoretically this stunt is all wrong, but in practice it is all right, and no soaking of the cell in sal-ammoniac solution is required.

USING PHONOGRAPH SPIDER FORM

EXPERIMENTERS who contemplate using spider-web coils for tuning will find that the cheap, small-size phonograph discs, properly slotted and cut to size with the hot blade of a knife, are admirably suitable.

RF With the 3-Circuit Tuner

By Herman Bernard

A STAGE of radio-frequency amplification ahead of the 3-circuit tuner is very popular with experimenters these days, especially with those who have constructed the 3-circuit set, have tasted of its DX powers and are desirous of reaching out still farther.

As this is a combination of RF and a regenerative detector one must realize that the problem of controlling oscillations may arise. I have built this set, using no potentiometer or any other external balancing device, but depending solely on good engineering and low-loss coils and condensers to carry me through. The result has been a success. The best way to proceed, no doubt, is to build the set as I am about to outline, and then if any oscillation control is needed a potentiometer may be added without inconvenience and at very small expense. A potentiometer is a source of losses; nevertheless the circuit, if it oscillates, must be controlled at all hazards. Otherwise you get poor reception or critical tuning or don't hear a thing.

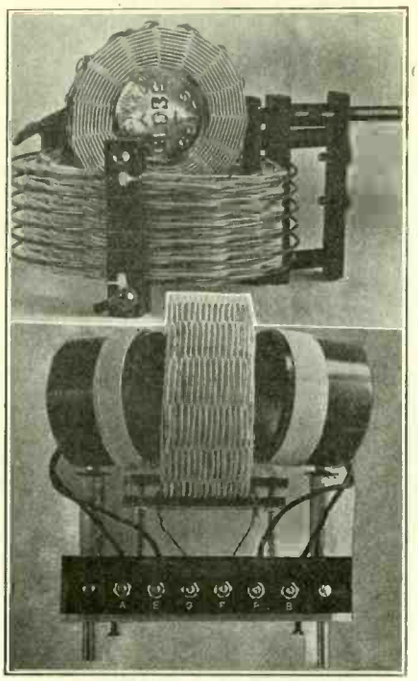


FIG. 2 (top), low-loss 3-circuit tuning coil, aperiodic primary. Bottom, primary and tertiary coils variable.

The construction is simplicity itself to those who have had any experience in building sets. If those who are entirely new to this enticing pastime will follow directions they may attain just as good success as an expert. There is no regenerative circuit to which RF may be added with greater constructional ease than that to the 3-circuit tuner, on account of its convenient aperiodic or untuned primary.

The advantage of a stage of RF is its reaching-out power. As for locals, not much improvement may be confidently expected, only some gain in volume. There is a mistaken idea that RF does not add to volume, due no doubt to the popularity of the expression "RF for distance, AF for volume." While one or two stages of AF, strictly speaking, do not add to the DX powers of a set, a stage or two of RF does build up the volume. Two stages of RF will not work ahead of a regenerative detector, as may be inferred when the subject of oscillations from only one RF stage is worthy of attention. Adding AF, on the other hand, enables one to hear DX stations which, while they come in on the detector alone, do not do so with any volume, making even earphone service poor. Everybody who has had any experience with radio sets knows that in many cases, even with two stages of AF, only enough volume is obtained from DX stations, say 1,000 miles away, to operate earphones comfortably.

We are, therefore, confining our promises to DX improvement in taking up the subject of a stage of RF ahead of a regenerative set. Once in a while an experimenter will not even get better DX results from an RF stage, but will find that without any RF his 3-circuit tuner functions better in all respects than with the RF. Such a condition is due nearly always to the experimenter himself, and not to the circuit. All theories swept aside, you get an amplification factor of about 4 when you add a stage of RF to the circuit I am discussing.

You need not be surprised if, after you build this set, you haul in stations 1,500 to 2,000 miles away, although I am not promising anything. You can cut through locals successfully and get DX even while they are operating. I have heard 2,500 miles on the earphones, with two stages of AF, using this circuit, and operated a loud speaker on stations 100 to 800 miles away, depending on seasonal conditions.

Considerable thought should be given to the selection of the coils and condensers. As a variocoupler of some kind must be used, and as many fans have not the facilities for making their own coupler, I am taking it for granted that some commercial type is to be used. I find that to make a coupler requires hardware, shaft, rotor balls, etc., that not all of us find it easy to lay our hands on, but those who prefer to make their own coupler, and a really excellent one, should see RADIO WORLD, September 20.

Now, you may get a coupler in which the primary is on a separate rotor and the tickler on another rotor, thus giving you a two-control coupler and bringing the set in the class of 3-circuit tuner with all circuits tuned. That type ordinarily is to be preferred, and it calls for no change in the wiring, only in the panel layout and the tuning, since there must be three controls, instead of the usual two. The circuit's primary, the coil connected to aerial and ground when no RF is used, should preferably be fixed, if it is to be used in conjunction with a stage of RF, because otherwise the plate of the RF tube would be tuned, thus occasioning regeneration in the RF tube, which is to be severely avoided. Hence we will use a fixed primary for the detector circuit, tuning the secondary as usual with a variable condenser and using the rotary winding or tickler for regeneration.

By all means get a low-loss coil. One with widely-separated primary with low number of turns, say 6 to 10, is preferable in conjunction with an RF stage.

Fig. 2 (top) gives an idea of such a coil, while the variable-primary type of coil is shown at bottom. However, as many experimenters no doubt already have a coil they desire to use, of the type shown in Fig. 3, that may be employed instead. The Fig. 3 coil is not low-loss, as may be seen from the fact that the stator and rotor are solid insulation. It must not be supposed that this coil does not work well. It certainly does. Only the low-loss type works still better. In Fig. 3 the binding posts are numbered 1, 2 and 6 and the shafts lettered A, B and C. The B shaft is at bottom and into it one of the machine screws goes through the panel. The A shaft is at center, and to this the tickler dial is affixed, while the C shaft, at top, is also for accommodating a machine screw through the panel. The coil was photographed in the position it occupies in the set when you are at the front of the panel. No. 1 goes to aerial and No. 2 to ground, when no RF is used, but when, as in the present case, RF is employed, No. 1 goes to the plate of the RF tube, the one at left in Fig. 1, and No. 2 goes to B+ 90 volts. No. 6 goes to the phones. The other posts, not shown, are for grid, A+ and detector plate connection. If two posts are diametrically opposite to 6 be sure to use the one which will hold a wire connection, as the other will be part of the rotating shaft and if the detector plate lead were connected there it would soon

(*Continued on next page*)

Making the Low-loss RF Coil

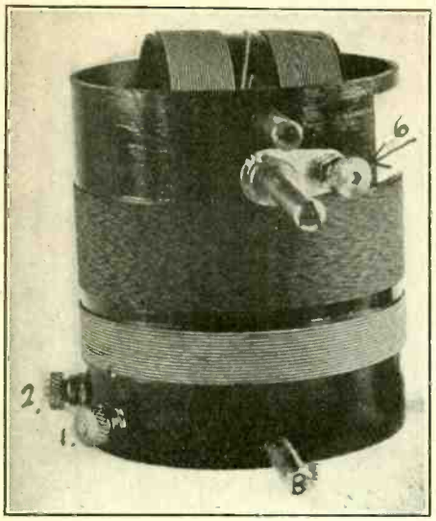


FIG. 3—A 3-circuit tuning coil, on familiar tubing, and not designed along low-loss lines, although a circuit in which it is used will function well. Binding posts, so far as shown, are numbered 1, 2 and 6, and the shafts A, B and C. How connections are made thereto is explained in the text.

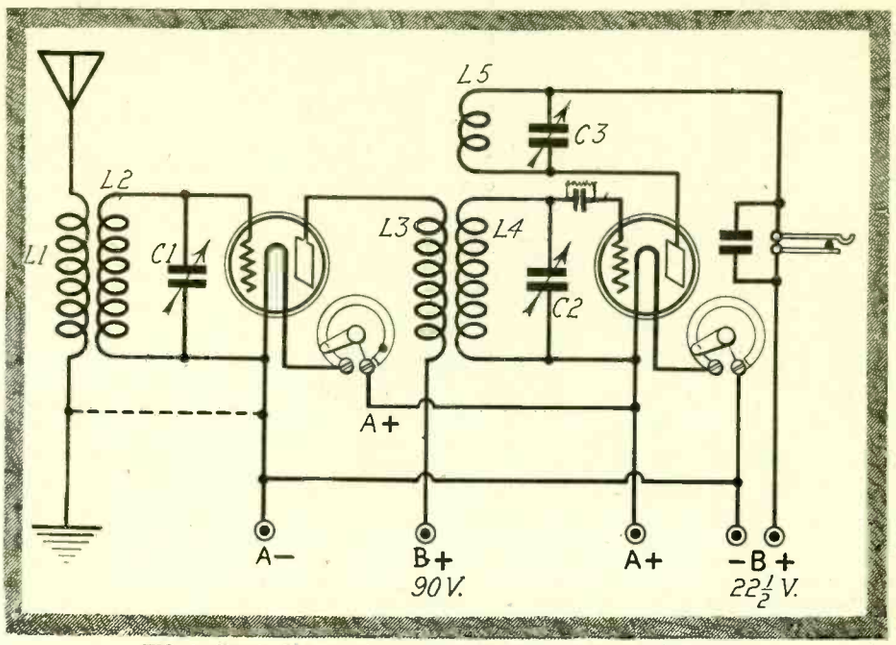


FIG. 1—Circuit diagram of a stage of RF ahead of the 3-circuit tuner.

work its way loose. The correct post is farther from the shaft than the one that would be unsafe to use.

Panel

As for the panel, if no AF is to be added, a 7x14″ panel will be sufficient, with a 7x13″ baseboard mounted thereon. For this circuit and two stages of AF use a 7x20″ panel and 7x18″ baseboard. The panel is lined across the center and the shaft for the RF stage is drilled 4″ from the left end of the panel. The shaft for the tickler is 5″ from the other shaft. Then, 5″ to the right of the tickler shaft is the variable condenser shaft. The RF tube is placed behind the RF shaft (extreme left), the detector tube to the right of the coupler. The RF rheostat is placed under the RF dial, on the panel, and the detector rheostat under between the variable condenser dial and the tickler dial, on bottom. The jack is placed to the right of the condenser dial, far enough away to permit a 4″ dial to rotate without striking the jack on the panel side. If two AF stages are used be sure to include the detector jack, for locals may be heard, up to 10 miles away, on the loud speaker with plenty of volume, without AF, the two AF stages being preferably "jacked" for each stage.

Optional Diagram

A glance at the circuit diagram will show that a variable condenser is across the tertiary lead (C3 tuning L5). For those who are using a commercial coupler the condenser C3 may be disregarded, L3 being the primary, L4 the secondary and L5 the tickler of the variocoupler. For those desiring to make all the coils themselves, and who have not the material with which to make a coupler, the diagram is given in a form convenient for this procedure.

As the coupler shown in Fig. 2, bottom, is not to be used, I need only say that the secondary is low-loss, but the primary, and tertiary or tickler, are wound on the familiar insulation tubing, so this device is a compromise between low-loss and the other. It is a step in the right direction, however. The view of this bottom coupler is taken from the top, while that of the coil above it is a side view.

The coil question is the most important, because losses are much higher in coils than in condensers. In selecting condensers perhaps you will prefer the low-loss type that use pigtail (soldered braided wire) connections to the rotary plates. Most condensers have a friction contact and while some folk may inveigh against this kind it is difficult to say that theoretically there will be some moments of defective connections, but in practice I find that even the friction type is a worthy one. The pigtail sort is safer, but the other is still safe. A low-loss condenser may be distinguished from the others because of the absence of minimizing of insulation used, such as hard rubber or the like, particularly on the end plates. Many low-loss condensers have no end plate insulation at all, the last stator plate being the back of the condenser.

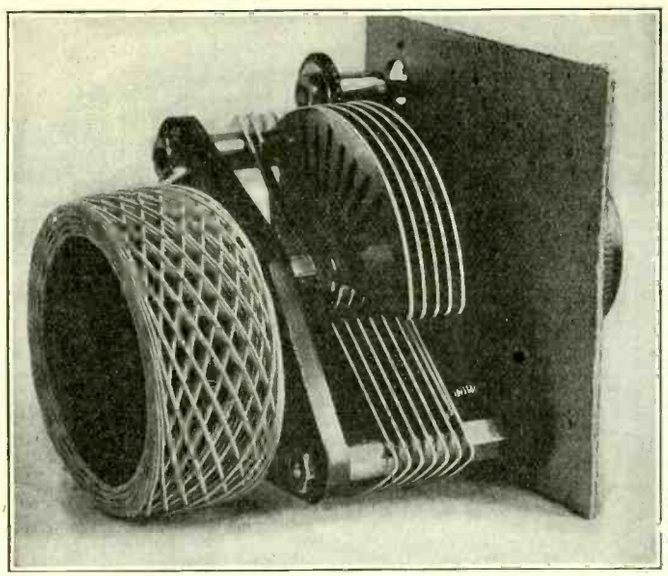
Tubes

Now, as for the tubes. The 201A and 301A type work best. The 199 and 299 work excellently, but you must be lucky to get one that is the best possible detector. The 11 and 12 are great detectors. The 199 and 299 are fine RF tubes, the 11 and 12 not so good, and the 201A and 301A are best. Hence I compromise, using 199 for both RF and detector; also, in fact, in the AF stages, since they're good volume producers. However, success is obtainable if any of the above-named tubes are used throughout.

Making the Coil

L1L2 is a radio-frequency transformer. If a tubing is used it should be cardboard, 3½″ diameter, 4″ high, and the wire wound thereon, for cardboard has the lowest losses among tubings. But if you wind a spider-web RF transformer, as described hereafter, you will have a coil in which the losses are so low that scientists are baffled in trying to compute them. Also the magnetic fields will be restricted, thus minimizing stray coupling from this source. Also the coil will take up less room. In either case—tubing or spider-web—use the same amount of wire. Measure off 13 feet of No. 20 double cotton covered wire. Cut it. Using a spool on which is at least 60 feet of the same wire, start winding. One foot slack is left for connections and the two stretches of wire are wound simultaneously, side by side, until you come to within a foot of the end of the shorter stretch. Leave that foot for later connections, meanwhile coiling it up or otherwise getting it out of harm's way while you continue winding the secondary until you have wound a total of 55 turns. This 55 includes the wire wound

Using Condenser-Tuned Plate



FOR A CONDENSER-TUNED PLATE a honeycomb coil may be used in this fashion, mounted on back of a variable condenser. If a 23-plate condenser is used the coil may be 50 turns. A duo-lateral coil and the spider-web described in text are of about equal efficiency.

with the shorter stretch. The total is 55, not about 65, as it would be if you mistakenly added 55 after to the point where the shorter winding ended. The smaller coil is L1, the primary of the RFT, and the larger one is the secondary. Now, using linen thread, for it resists the temptation of moisture best, cut as many pieces of thread as there are apertures between the spokes or arms of the form. Wrap two turns around the winding, in a direction at right angles to that of the wire. Tie a thread securely to the coil and knot the thread. Thus you will have nine or eleven or thirteen separate bindings on the coil, depending on the number of spokes on the form. Now you may cut away the spokes where they join the hub of the form and when you have cut away the last one the hub will fall out and you will have a coil that is both self-supporting and low-loss, having no insulation on it save that of the cotton covering on the wire itself. This coil is mounted on the back of a 23-plate low-loss condenser (C1). Use a brass angle, to which you attach a small strip of hard rubber, one part of the coil's circumference being laid on the hard rubber, or just use two bus bar lengths fastened to the stator and rotor plate posts of the condenser and bent upward, the shortened terminals of the coil's secondary being soldered to this bus-bar. Any method convenient to the experimenter will do, so long as little insulation is used, and the coil is kept more than an inch from the panel and more than 2" away from any part of the condenser. The coil may be mounted at a fancy angle or perpendicular or horizontal. The beginning of the coil goes to the stator terminal of the condenser, the end to the rotor terminal. The beginning is where you started to wind the secondary. The primary is connected, beginning to aerial, end to ground. The stator lead of the secondary goes to the grid of the RF tube. The condenser rotor goes to the A—, which, at your option, may also go to the ground.

Commercial Couplers

If you are using a commercial 3-circuit tuner coupler, the primary is represented by L3, the secondary by L4 and the tertiary by L5, the variable condenser C3 being ignored. Referring to Fig. 3, post 1 goes to the plate of the RF tube, the one at left in Fig. 1, and post 2 goes to B+ 90 volts. The next post, continuing around the circle, goes to one side of the grid condenser and to the stator plates of C2, a 23-plate low-loss condenser, preferably with some vernier device, other than the "extra plate" kind. The rotor plates go to the next succeeding terminal on the bottom of the Fig. 3 coupler and to the F+. Note that this lead, known as the grid return, is to the F— in the RF stage and to the F+ in the detector stage. In all amplifier stages, RF or AF, the grid return is to the minus. The plate of the detector tube goes to the post diametrically opposite No. 6 in Fig. 3, and post 6 goes to the phones, or, if a jack is used, to a single-circuit jack. If AF is to be added now or later, make this a double-circuit jack. If any commercial 3-circuit tuning coil is used the connections are comparable to those outlined.

Condenser Tuned Plate

Now suppose you want to make all the coils yourself. You've made one. Make another just like it. Then still another, but unlike its fellows, in that it consists of only 60 feet of No. 20 wire, nothing else. The third coil (L5) is not necessarily mounted in inductive relationship to L3L4, the second RFT you just made. Preferably mount it at right angles to C3 and to right of C3, panel view. The shaft that otherwise was for the tickler now accommodates C3, a 17-plate low-loss variable condenser. With a condenser-tuned plate you have a set you can log.

Which Works Better?

Now you may wonder with just what combination I got the results outlined. The answer is—

I got the same results with the condenser-tuned plate as I did with the tickler-tuned plate.

Facts for Users of 201A Tubes

201A

Rating

Filament volts, 5.0. Filament amperes, .25. Plate volts, 20 to 120.

General

Filaments should always be operated at the lowest voltage which will give satisfactory results.

If by accident excessive filament or plate voltage is applied to the tube, it may be damaged temporarily. Its normal action may be restored by lighting the filament at rated voltage for 20 minutes or longer with the B battery disconnected.

Failure of the tube to function is seldom due to burnout of the filament unless a very high voltage has accidentally been applied. The end of the useful life of the tube is indicated by a rather sudden decrease in its operating efficiency which cannot be explained by other causes.

Great care should be taken to prevent the plate voltage from being applied accidentally to filaments. Tubes should be removed from sockets when connections are changed.

Tubes should be mounted on cushion or spring supports to prevent noise from vibration. It is preferable to mount tubes vertically.

As An Amplifier

When the 201A tube is used as an amplifier, it is important that the filament rheostat should be placed on the negative side of the battery and the return lead from the grid circuit should be connected to the negative side of the battery and not to the negative side of the filament. This places a negative bias on the grid. For plate voltages above 40, a negative grid biasing battery (C battery) should be used as follows:

Plate Voltage	Neg. Grid Bias
60 Volts	1.5-3.0 Volts
80 Volts	3.0-4.5 Volts
100 Volts	4.5-6.0 Volts
120 Volts	6.0-9.0 Volts

As a Detector

When the tube is used as a detector it is usually preferable to connect the grid return to the positive side of the filament. A grid leak resistance between 2 and 5 megohms is satisfactory for average work. High resistance aids weak signals.

Trouble Shooting

An Expert's Valuable Advice

By Herbert E. Hayden

THE time to start trouble shooting is not after you have completed the wiring of an entire set. A better idea is to check each piece of apparatus before it is connected in the circuit, and on some occasions before you buy. Most wiring jobs call for careful soldering and this seems to be a frequent obstacle.

An electric soldering iron is good, but not necessary. The size of the iron is very important. For radio construction it is not possible to use No. 1 size, as the nature of the work makes it necessary frequently to work in small spaces where the heat of a big iron causes annoyance. Therefore, do not buy an iron with a tip as big as the one shown in Fig. 1 and expect to solder in between the springs of a jack. It is a better plan to buy "regular" soldering irons, purchasing several sizes, starting with the little Jewelers' Iron as shown over the alcohol lamp in Fig. 2.

The alcohol lamp will deliver a very hot flame, just enough to heat the iron, and when the lamp is not in use the thimble cap is placed over the wick. Rosin soldering flux has made many a fan tear his hair out because it is a hard proposition for a beginner to use, and generally develops a sticky mess. The jewelers' soldering salts, the container of which is also shown in Fig. 2, is a very simple and highly satisfactory soldering flux when mixed with plain water (it comes packed dry).

Mix a pint of solution, then pour a small quantity in an empty drawing ink bottle and use the special stopper-cork to place a drop on the work to be soldered.

There are many pastes on the market that also make for neat work and these, or salts, are far better than rosin core solder.

Fig. 3 illustrates a very poor method of bringing out the leads from the rotor. It will be noticed that the wires constantly twist up against the sharp edge of the shaft tubing and after a time the insulator is worn off and noisy signals result. The B Battery and the Vacuum tube have been blamed for this many, many times. A much better way of bringing out the connections is shown also in Fig. 3. This happens to be a 180° coupler, but the arrangement is very good. The better method is the split shaft type, and the "pig-tail" connections.

Condensers frequently cause trouble because they develop loose bearings and many other disorders, aside from an electrical standpoint. For instance, (Fig. 4) the pressure spring on the rear plate works loose and causes weak signals and peculiar tuning.

Dirt and dust will collect in between the plates of condensers and the easiest way to remove this is to swab it out with a pipe cleaner dipped in alcohol and followed by dry cleaning. Do this periodically and the set will keep top-notch. If your loud speaker unit squawks, perhaps the unit is chattering, and this can be smoothed out if you will place a small piece of beeswax on the diaphragm just at the point where the connecting link comes through. Next heat a small soldering iron over the little alcohol lamp and quickly touch the wax, allowing it to run in under the link. You will find that it now gives a smooth tone and the rattle has vanished. Don't use a big soldering iron as this causes the heat to spread into the permanent magnets which in turn has a very damaging effect on the magnetism.

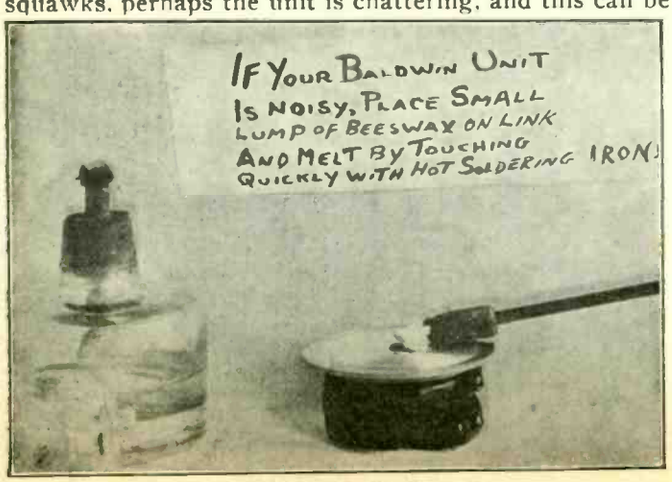
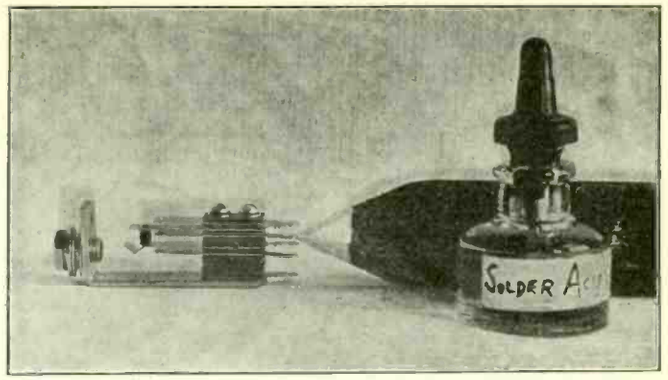
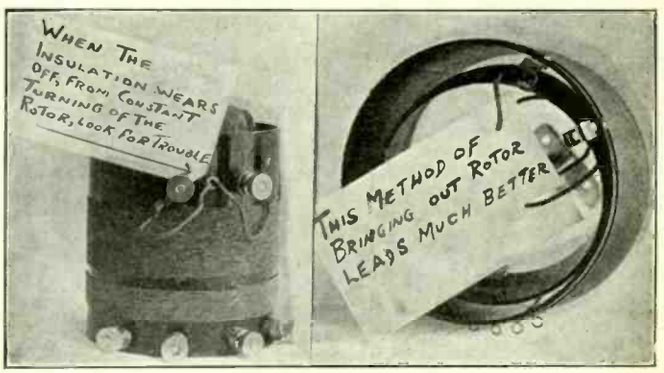
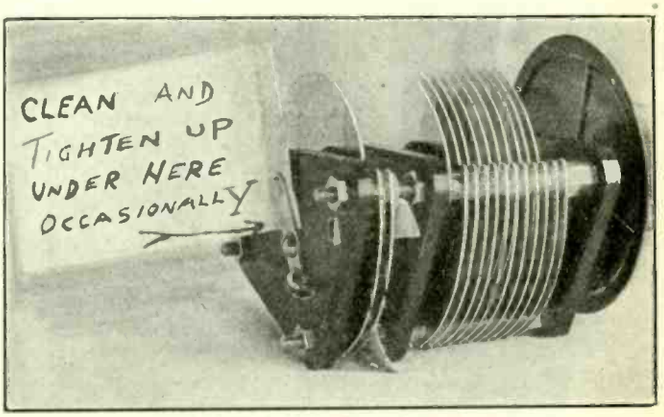


FIG. 5, repairing loudspeaker unit.







TOP TO BOTTOM, Figs. 1, 2, 3 and 4.

Adding One Stage of AF

By Brewster Lee

OFTEN it is possible to work locals on a speaker on one stage of transformer-coupled audio-frequency amplification.

The circuit diagram, Fig. 1, shows how the connections are made. The beginning of the primary of the AFT is marked P1 or just P on the transformer, the end of the primary P2 or B, the beginning of the secondary, S1 or G and the end of the secondary S2 or F. G always goes to the grid of the next tube and F always goes to the A— on the battery or on the battery side of the rheostat if the A— goes through the rheostat. In Fig. 1 the A+ goes through the rheostat. The point to remember is that the F never goes to the socket side of any rheostat.

P1 is the connection to the plate of the detector tube and P2 the connection to B+ 22½ volts. If a 199 or 299 is used, as shown in the assembly plan (Fig. 2), 45 volts work better. The transformer G or S1 goes to the grid of the amplifying tube, that is, the tube shown in Fig. 1. The detector tube is not shown, because the detector circuit is taken for granted. Connect the end of the secondary, F or S2, to the A— on the battery. Be sure this connection is made to the A battery, not to the B battery.

In Fig. 1 the rheostat controls the A+. One side of the rheostat goes to the + post on the A battery, the other side of the rheostat to the F+ post on the socket. A— is connected directly to the F— on the socket.

The plate of the AF tube goes to one spring of the single-circuit jack. The other spring goes to B+ 90 volts.

If you use two 45-volt B batteries, connect the B— of one to the B+ of the other. That leaves two open posts or terminals, sometimes called poles. One is — on one battery and the other + on the second battery. For 22½ volts +, connect to the 22½-volt post on the battery with the open minus terminal. If, instead, 45 volts are desired, tap from this same battery. Anything above 45, up to 90, is tapped from the + posts on the next battery. You start reading upwards from the battery with the open minus post. If 45 volts are tapped, the connection is the 45+, which already is joined to the minus of the next battery, but this common connection is quite right.

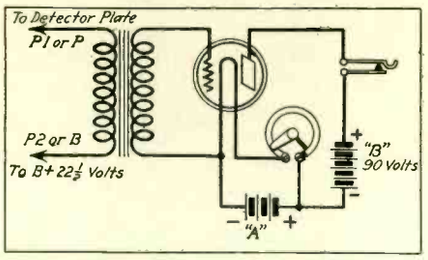


FIG. 1—Circuit diagram of one stage of transformer-coupled audio-frequency amplification. This is often enough to work locals on a speaker and makes DX reception more audible.

Now turn on the rheostat. If the tube lights, then connect the B— 90 volts to the A+. If the same A battery is used for detector and amplifier, then B— is joined to the same A post for the amplifier as in the case of the detector. If B— goes to A+ in the detector it must be joined likewise in the amplifier; if in the detector A— goes to B—, then follow suit in the amplifier. Most persons use the same B battery block for detector and amplifier, taking the taps at the proper B battery posts.

In the assembly plan (Fig. 2) the AFT is placed farthest back from the panel. Note the position of the AFT, the F and G posts facing the same posts on the socket. If 11, 12, 201A, 301A, or other similar tubes are used the F posts on the sockets will not be diagonally opposite each other, but F— and F+ will be consecutive as you read from left to right.

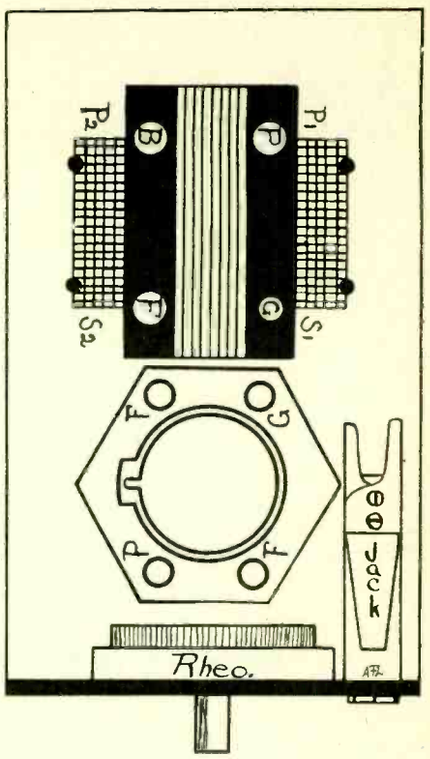
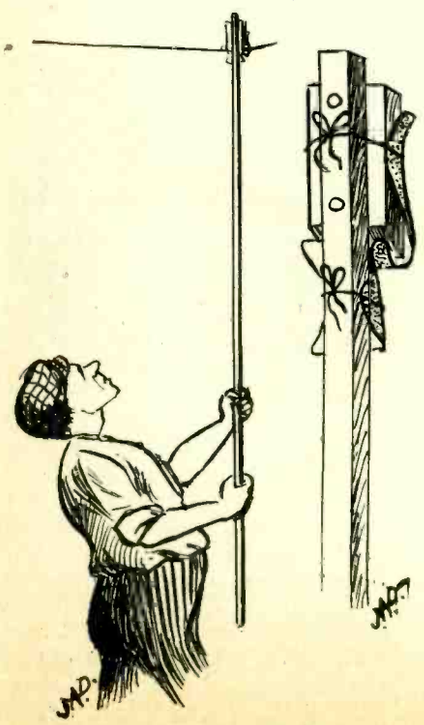


FIG. 2—Assembly plan of one stage of AF. The diagram is for 199 or 299 tube, but the text explains what to do if some other tube is used.

The 199 or 299 tube has its tips and sockets reading in a different order, as shown in Fig. 2. If other than 199 or 299 tube is used, place the socket so that its G post is right close to the G post of the AFT.

[*"How to Construct Two Stages of AF" was fully explained in the August 30 issue of* RADIO WORLD.]

Keeping an Aerial Clean



Cleaning aerial (left) and the device.

By J. A. Dooris

SOME aerials are not easily lowered because of the surrounding foliage or shrubbery. Sometimes the rope sticks, the pulley becomes rusted or something else is wrong and it is not easy to lower the aerial. The wires must be renewed or cleaned from time to time. Many radio fans, because of lack of time, tolerate corroded aerial wires, which are naturally very unsatisfactory. For those who desire a rapid method of cleaning an aerial, without lowering it to the ground, the following is suggested. The writer has found it to be a practical plan.

Nail a block of wood on or near the end of a long pole, as is indicated at left in the sketch. Note how the bottom of the block has been sawed at an angle. Tie or wire a piece of emery paper to the block of wood, as shown at right in sketch, with the smooth surface next to the wood. Before tying the emery paper to the pole tuck or fold the paper in the space between the block and the pole. This is important, as it is this particular fold that cleans the wires. If the paper is a little wider than the block of wood it will not slip out of place while the work is being done. Should you decide to use sandpaper it may be necessary to shift the paper several times before the wires are polished. Catch or rest the lower end of the block on the wire and move it backwards and forwards several times. This method will keep the aerial in perfect condition.

Avoid Shield Losses

SHIELDS are used to eliminate the effects of body capacity. The shield on the back of the panel is connected to the ground to prevent variation in capacity produced by the hands when tuning the set. Shielding is seldom necessary except in multi-stage sets employing radio frequency amplification. By connecting variable condensers so that the movable plates are nearest the ground and by keeping the grid wires away from the face of the panel body capacity effects can be minimized without shielding. When shielding is used losses occur unless the instruments are mounted several niches away from the shield. Shielding is necessary in a superheterodyne between the various stages of amplification. Sheet copper, sheet brass or aluminum should be used on a shield for best results.

Build Your 1-Tube DX Set for $14, Complete

By Wainwright Astor

A TUNED primary is better than an aperiodic one. The advantage of the aperiodic primary is the simplification of controls. Where the total is only two there is no need for simplification. Where it reduces three controls to two it is an advantage. The circuit presented herewith is a finely controlled regenerator. A variable condenser, C1, of 23 plates, if low-loss, otherwise 43 plates, is in series with the aerial lead. R and S stand for rotor and stator. C2 is a 15 or 17-plate low-loss condenser.

This set was actually made, of good parts, for $14, including aerial and earphones, also tube (199) and batteries. It is of particular interest to the beginner in radio, as the connections are simple and the set is sure to work. Try it. If you are in a congested area where greater selectivity is necessary you will discover that. The solution is simple. It will be published in a later article. But try the accompanying circuit first.

Winding the Coil

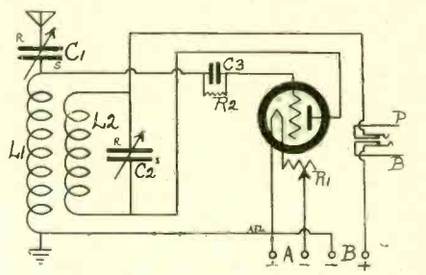
Use No. 22 single cotton covered wire or, if you can get it, double cotton covered. Wind 50 feet of this as the primary L1 and 30 feet as the secondary, on a spider-web form, 6" diameter. Wind primary and secondary together, side by side, as if they were one piece of wire, until you reach the end of the secondary. Then continue on with the primary. If a cardboard or hard rubber tube is used, wind the primary on top in a given direction, leave ¼" space, then begin winding the secondary in the same direction. The tube should be 3" or 3½" diameter, 5" high. If honeycomb coils are used L1 is 75 turns, L2 35 or 50 turns. The best way to solve the problem of matching condenser and honeycomb coil is to get the higher coil and remove turns, one by one, until the highest wavelength station comes in from 85 to 90 for L1 and regeneration is best for L2. If HC is used be sure to couple the coils together. They may be tied with linen thread, then mounted flat on the back of the condenser, i. e., the stator end-plate if the condenser is low-loss; otherwise on the insulation.

In this circuit selectivity is fair. Fine volume and quality are assured. In winter great DX may be expected, since in August this set got 1,000 miles on a speaker when two AF stages were added.

Wiring Directions

Connect the aerial to the rotor of C1 and the stator to the beginning of L1 and to the grid condenser. The end of L1 goes to the ground and to A+ and B—. The other side of the grid condenser, C3, goes to G on socket. A+ goes direct from battery to F+ post on socket. A— goes through the rheostat R1 to F—on socket. The beginning of L2 goes to the plate and to the rotor of C2, the end of L2 going to the stator of C2 and to one of the phones. The beginning of L2 is at bottom on diagram. Connect the other phone to B+ 22½ volts, unless 199 or 299 tube is used, when this voltage should be 45. A jack is shown, double-circuit kind, also P and B, representing connections to the AF circuit, should loud speaker operation be desired. C3 is the grid condenser, .00025 mfd. Preferably get a variable one; also a compression type rheostat, like Fil-ko-stat or Bradleystat, for fine control, or some other vernier sort. This aids regulation of regeneration. The tuned plate circuit gives excellent regeneration control, comparable to the Superdyne principle, though here capacitative variation is used, and no varied inductance or reversed feedback.

Any tube works well, except Sodion, which doesn't regenerate. The 201A, 301A, 200, 300, 199, 299, 11 and 12 are fine in this circuit.



CAPACITATIVELY TUNED PLATE circuit affords fine control of regeneration. This circuit is splendid for those not living very close to a powerful radiocasting station, say 6 to 10 miles. It is fairly selective and has performed good DX work.

Low-Loss Coils or Extra Tubes?

Efficient Inductances Greatly Improve Tuned RF

By Byrt C. Caldwell

AT the radiocast wavelengths the efficient method of RF amplification is tuned RF, with good low-loss condensers and transformers.

This article is written for the person who has a Neutrodyne or any other type of set which employs the regulation tuned RF transformers. The transformers which are described may be constructed and installed in place of neutroformers or in place of any other kind of tuned transformer.

The form for winding the coils is made out of a block of wood, marked with a 3" circle. This circle is divided into 15 equal divisions, and 3/16" holes are drilled on these divisions. Metal or hard rubber rods are placed upright in these holes, and the coils are then wound on the form thus constructed.

There are two methods of winding these coils. These two methods are shown in Figs. 1 and 2. In the first method the wire is wound around every peg, and in the second method it is wound around every two pegs.

As far as electrical efficiency is concerned, the two methods of winding are about the same, but the winding shown in Fig. 2 is more solid and has a much better appearance, in addition to being more compact.

No. 20 or 22 double cotton covered wire must be used for these coils. Wind 60 turns. Then put collodion on the wires where they cross both inside and out, and when this is dry, remove the pegs. Wind a single layer of paper, ½" wide over this coil, and on top of this wind 5 to 7 turns of the same kinds of wire. This is the primary. Fasten this winding with collodion also. Do not use much.

When mounting these coils, place them as far as possible from any solid, especially a metal. If they must be placed close to the condensers, place them so that the plane of the coil is at right angles to the plates of the condenser.

The good thing about low-loss parts is that when they are installed there is immense improvement. One can hardly believe that his receiver is the same machine. The writer built a 4 and a 5-tube set, both of the same design, except that the 5-tube machine had one more stage of tuned RF amplification. Ordinary transformers were used. With the 4-tube machine and a short indoor antenna it was possible to get a Chicago station on the phones, or with faint volume on the loudspeaker. When the low loss coils were substituted, stations came in on almost every division of the dials, and that Chicago station came in so loud that it could be heard plainly several hundred feet from the loud speaker, while even WNAC and the other locals came in with better volume. Selectivity was greatly improved. Results on the 4-tube set were now much better than results on the five-tube set!

If you desire distance and selectivity, use low-loss parts.

A LOW-LOSS 3-CIRCUIT TUNER, by Neal Fitzalan, Sept. 13 issue. Send 15 cents or start your subscription with that number. Radio World, 1493 Broadway, N. Y. C.

FIG. 1, how the coil may be wound in and out of each succeeding peg. Fig. 2 shows winding on alternate pegs.

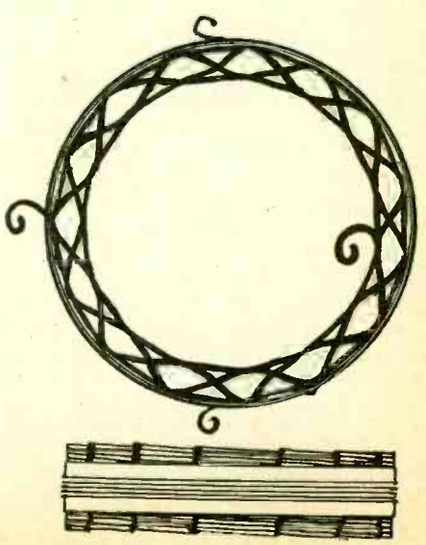


FIG. 3, top and side views of the completed RF transformer. The top view shows the terminals. The heavy zig-zag lines are the secondary. The circular lines on the outside are the primary.

Official List of Stations

Complete and Accurate—Revised up to October 9

HEREWITH is published a complete list of all the broadcasting stations in the United States. This list contains 473 stations, the number holding licenses on October 9, the date to which the list was compiled.

The call letters are given, the name of the station owner, the location of the station and the wavelength in meters.

Station	Owner	Location	Meters
KDKA	Westinghouse Co.,	E. Pittsb'gh, Pa.	326
KDPM	Westinghouse Co.,	Cleveland, O.	270
KDPT	Southern Elec. Co.,	San Diego, Cal.	244
KDYL	Newhouse Hotel,	Salt Lake City, U.	360
KDYM	Savoy Theatre,	San Diego, Cal.	280
KDYQ	Oregon Inst. Tech.,	Portland, Ore.	360
KDZB	F. E. Siefert,	Bakersfield, Cal.	240
KDZE	Rhodes Co.,	Seattle, Wash.	270
KDZR	Bell'gham Co.,	Bell'gham, Wash.	261
KFAD	M'Arthur Bros. Merc. Co.,	Phoenix, Arizona	360
KFAE	State College,	Pullman, Wash.	330
KFAF	Western Radio Corp.,	Denver, Col.	278
KFAJ	Univ. of Col.,	Boulder, Col.	261
KFAR	Studio Light. Co.,	Hollywood, Cal.	280
KFAW	Radio Den,	Santa Ana, Cal.	280
KFAY	W. T. Virgin Co.,	Medford, Ore.	283
KFBB	F. A. Buttrey Co.,	Havre, Mont.	360
KFBC	W. K. Azbill,	San Diego, Cal.	278
KFBE	R. Horn,	San Luis Obispo, Cal.	242
KFBG	1st Pres. Church,	Tacoma, Wash.	360
KFBK	K'ball-Upson Co.,	Sacramento, Cal.	283
KFBL	Leise Bros.,	Everett, Wash.	224
KFBS	Trinidad G·E Co.,	Trinidad, Col.	280
KFBU	The Cathedral,	Laramie, Wyo.	283
KFCB	Nielson Radio Co.,	Phoenix, Ariz.	238
KFCF	F. A. Moore,	Walla Walla, Wash.	360
KFCP	R. W. Flygare,	Ogden, Utah	360
KFCV	F. Mahaffey,	Houston, Texas	360
KFCZ	Omaha Cen. H. S.,	Omaha, Neb.	258
KFDD	St. Michael's Cath.,	Boise, Ida.	252
KFDH	Univ. of Ariz.,	Tucson, Ariz.	268
KFDJ	Oregon Agri. Col.,	Corvallis, Ore.	360
KFDX	1st Baptist Ch.,	Shreveport, La.	360
KFDY	S. D. State College of Ag.,	Brookins, South Dakota	360
KFDZ	H. O. Iverson,	Minneapolis, Minn.	231
KFEC	Meier & Frank Co.,	Portland, Ore.	248
KFEL	Winner Radio Corp.,	Denver, Col.	254
KFEQ	J. L. Scroggin,	Oak., Neb.	268
KFER	Auto E. S. Co.,	Ft. Dodge, Ia.	231
KFEV	Thompson Rad.,	Casper, Wyo.	263
KFEX	Augsburg Sem.,	Minneapolis, Minn.	261
KFEY	Bunker Hill & Sull. Mng. Co.,	Kellogg, Idaho	360
KFFB	Jenkins Furn. Co.,	Boise, Idaho.	240
KFFE	East. Ore. R. Co.,	Pendleton, Ore.	360
KFFP	1st Bapt. Church,	Moberly, Mo.	266
KFFR	State Journal,	Sparks, Nev.	226
KFFV	Graceland Coll.,	Lamoni, Ia.	280
KFFX	M'Graw Co.,	Omaha, Neb.	278
KFFY	Pincus & Murphy,	Alexandria, La.	275
KFGC	La. State Univ.,	Baton Rouge, La.	254
KFGD	Chickasha Radio & Elec. Co.,	Chickasha, Okla.	248
KFGH	Leland Stanford, Jr., Univ.,	Stanford University, Cal.	273
KFGL	Snell & Irby,	Arlington, Ore.	234
KFGQ	Crary Co.,	Boone, Ia.	226
KFCX	1st Pres. Church,	Orange, Tex.	250
KFGZ	Emmanuel Missionary College,	Berrien Springs, Mich.	286
KFHA	Western State College,	Gunnison, Col.	252
KFHD	Utz Elec. Co.,	St. Joseph, Mo.	226
KFHJ	Fallon & Co.,	Santa Barbara, Cal.	360
KFHR	Star Elec & Radio Co.,	Seattle, Wash.	283
KFI	E. C. Anthony, Inc.,	Los Angeles	469
KFID	Arbuckle Garage,	Iola, Kan.	246
KFIF	Benson Insti.,	Portland, Ore.	360
KFIL	Windisch Co.,	Louisburg, Kan.	234
KFIO	N. Cen. H. S.,	Spokane, Wash.	252
KFIQ	1st Mth. Church,	Yakima, Wash.	242
KFIU	Alaska Elec. Co.,	Juneau, Alaska	226
KFIX	Church of Latter Day Saints,	Independence, Mo.	240
KFIZ	Daily Commonwealth,	Fond du Lac, Wisconsin	273
KFJB	Marshall Elec. Co.,	Marshalltown, Ia.	248
KFJC	Post-Intelligencer,	Seattle, Wash.	270
KFJF	National Radio Co.,	Oklahoma City, Oklahoma	252
KFJI	Liberty Theatre,	Astoria, Ore.	252
KFJK	Delano Radio & Elec. Co.,	Bristow, Oklahoma	233
KFJM	Univ. of N. D.,	Grand Forks, N. D.	280
KFJQ	Electric Const. Co.,	Grand Forks, N. D	250
KFJR	Dixon & Son,	Stevensville, Mont.	258
KFJX	State Teacher's College,	Cedar Falls, Iowa	280
KFJY	Trenwall Radio Co.,	Fort Dodge, Iowa	246
KFJZ	Texas Natl. Gd. (112th Cav.),	Fort Worth, Texas	254
KFKA	State Teach. Coll.,	Greeley, Col.	273
KFKB	Brinkley-Jones Hosp.,	Milford, Kan.	286
KFKQ	Conway Radio Lab.,	Conway, Ark.	250
KFKV	F. Gray,	Butte, Mont.	263
KFKX	Westinghouse E. & M. Co.,	Hastings, Nebraska	241
KFKZ	Nassour Bros.,	Colorado Springs, Colo.	234
KFLA	A. R. Wilson,	Butte, Mont.	283
KFLB	Signal Mfg. Co.,	Menominee, Mich.	248
KFLE	Nat'l Educational Serv.,	Denver	368
KFLQ	Bizzell Radio Co.,	Little Rock, Ark.	261
KFLU	Rio Grande Radio Co.,	San Benito, Texas	236
KFLV	Swedish Evang. Church,	Rockford, Ill.	229
KFLX	Geo. R. Clough,	Galveston, Texas	240
KFLZ	Atlantic Auto Co.,	Atlantic, Iowa	273
KFMB	Christian Churches,	Little Rock, Ark.	254
KFMQ	Univ. of Ark.,	Fayetteville, Ark.	263
KFMR	Morningside Col.,	Sioux City, Ia.	261
KFMT	Dr. G. W. Young,	Minneapolis	231
KFMW	M. G. Sateren,	Houghton, Mich.	266
KFMX	Carleton Col.,	Northfield, Minn.	283
KFNF	H. Field Seed Co.,	Shenandoah, Iowa	266
KFNG	Wooten Radio Shop,	Coldwater, Miss.	254
KFNL	Radio Broadcast Association,	Paso Robles, Cal.	240
KFNV	L. A. Drake,	Santa Rosa, Cal.	234
KFNY	Montana Phono. Co.,	Helena, Mont.	261
KFNZ	Royal Radio,	Burlingame, Cal.	231
KFOA	Rhodes Co.,	Seattle, Wash.	455
KFOC	First Christian Church,	Whittier, Cal.	236
KFOD	Radio Shop,	Wallace, Idaho	224
KFOJ	Moberly H. S. Radio Club,	Moberly, Missouri	246
KFON	Echophone Radio Shop,	Long Beach, California	234
KFOO	Latter Day Saints Univ.,	Salt Lake City, Utah	261
KFOQ	Ora W. Chancellor,	Galveston, Texas	240
KFOR	David City Tire & Elec. Co.,	David City, Nebraska	226
KFOT	College Hill Radio Club,	Wichita, Kan.	231
KFOU	Hommell Mfg. Co.,	Richmond, Cal.	254
KFOX	Bd. of Ed. Tech. H. S.,	Omaha, Nebr.	248
KFOY	Beacon Radio Soc.,	St. Paul, Minn.	226
KFOZ	Hudson Real Estate Co.,	Fort Smith, Arkansas	233
KFPB	E. J. Brown,	Seattle, Wash.	224
KFPG	Garrettson & Dennis,	Los Angeles	238
KFPH	H. C. Mailander,	Salt Lake City	242
KFPL	C. C. Baxter,	Dublin, Texas	242
KFPM	New Furn. Co.,	Greenville, Tex.	242
KFPN	Missouri Nat'l Guard,	Jefferson City, Missouri	242
KFPO	Col. Nat. Guard,	Denver, Col.	231
KFPP	G. & G. Radio & Elec. Shop,	Olympia, Washington	236
KFPR	Forestry Dept.,	Los Angeles, Cal.	231
KFPS	Ross Motor Co.,	Casper, Wyo.	242
KFPT	Cope & Johnson,	Salt Lake City, Utah	268
KFPV	Heintz & Kohlmoos,	San Francisco, California	236
KFPW	M. E. Church,	S. Carterville, Mo.	268
KFPX	1st Pres. Church,	Pine Bluff, Ark.	242
KFPY	Symonds Inv. Co.,	Spokane, Wash.	283
KFQA	The Principia,	St. Louis	261
KFQB	Searchlight Pub. Co.,	Ft. Worth, Tex.	254
KFQC	Kidd Bros.,	Taft, Cal.	227
KFQD	Chovin Sup. Co.,	Anchorage, Alaska	280
KFQE	Dickinson-Henry Radio Lab.,	Colorado Springs, Col.	224
KFQF	D. A. Boult,	Minneapolis, Minn.	224
KFQG	So. Cal. Radio Ass.,	Los Angeles	226
KFQH	Albert Sherman,	Hillsbourgh, Cal.	231
KFQI	Thos. H. Ince Co.,	Culver City, Cal.	234
KFQJ	Harbour-Longmire Co.,	Oklahoma City, Okla.	236
KFQK	Democrat Leader,	Fayette, Mo.	236
KFQL	State Fair Assn.,	Muskogee, Okla.	252
KFQM	Tex. Highway Bulletin,	Austin, Tex.	268
KFQN	Third Bap. Church,	Portland, Ore.	283
KFQO	Meier Radio Shop,	Russell, Kans.	261
KFQP	G. S. Carson, Jr.,	Iowa City, Ia.	224
KFQR	W. L. Ellis,	Oklahoma City, Okla.	250
KFQS	Dickenson-Henry Radio Lab.,	Manitou, Colorado	246
KFQT	National Guard, 36th Sig.,	Denison, Texas	252
KFRC	Radicart Studio,	San Francisco, Cal.	285
KFRF	W. R. Brown,	Alexandria, La.	242
KFRG	Cleveland H. S.,	St. Louis, Mo.	236
KFRH	Radio Shop,	Grafton, N. D.	268
KFSG	Echo Park Evang. Assn.,	Los Angeles	278
KGB	Ledger,	Tacoma, Wash.	252
KGG	Hallock & Watson,	Portland, Ore.	360
KGO	Gen. Elec. Co.,	Oakland, Cal.	312
KGU	M. A. Mulrony,	Honolulu, Hawaii	360
KGW	Oregonian,	Portland, Ore.	492
KGY	St. Martin's College,	Lacey, Wash.	258
KHJ	Times,	Los Angeles	395
KHQ	Louis Wasmer,	Seattle, Wash.	360
KJQ	C. O. Gould,	Stockton, Cal.	273
KJR	Northwest Radio,	Seattle, Wash.	283
KJS	Bible Inst. of L. A.,	Los Angeles	360
KLS	Warner Bros. Rad. Co.,	Oakland, Cal.	360
KLX	Tribune Pub. Co.,	Oakland, Cal.	509
KLZ	Reynolds Rad. Co.,	Denver, Colo.	283
KMJ	San Joaquin Lt. & Pr. Corp.,	Fresno, California	248
KMO	Love Elec. Co.,	Tacoma, Wash.	360
KNT	Walt. Hemrichi,	Kukah, Alaska	263
KNX	Express,	Los Angeles	360
KOB	N. M. Col. of Ag. & Mec. Arts,	State College, N. M.	360
KOP	Detroit Police Dept.,	Detroit, Mich.	286
KPO	Hale Bros.,	San Francisco	423
KQP	Apple City Rad. Club,	Hood River, Ore.	360
KQV	Doubleday-Hill,	Pittsburgh, Pa.	270
KOW	C. D. Herrold,	San Jose, Cal.	360
KRE	Gazette,	Berkeley, Cal.	275
KSD	Post Dispatch,	St. Louis	546
KTW	1st Presb. Church,	Seattle, Wash.	360
KUO	Examiner Ptg. Co.,	San Francisco	360
KUY	Coast Radio Co.,	El Monte, Cal.	256
KWG	Portable Wireless Tel.,	Stockton, Cal.	360
KWH	Examiner,	Los Angeles	360
KYQ	Electric Shop,	Honolulu	270
KYW	Westinghouse Co.,	Chicago	536
KZM	P. D. Allen,	Oakland, Cal.	360
WAAB	Jensen,	New Orleans	268
WAAC	Tulane Univ.,	New Orleans	360
WAAD	Ohio Mech. Inst.,	Cincinnati	360
WAAF	Drovers Journal,	Chicago	286
WAAK	Gimbel Bros.,	Milwaukee, Wis.	280
WAAM	I. R. Nelson Co.,	Newark, N. J.	263
WAAN	Univ. of Mo.,	Columbia, Mo.	254
WAAW	Omaha Grain Ex.,	Omaha, Neb.	286
WABB	Har. Sptg. Gds.	Harrisburg, Pa.	266
WABD	Parker High School,	Dayton, O.	283
WABE	Y. M. C. A.,	Washington, D. C.	283
WABH	Lake Shore Tire Co.,	Sandusky, O.	240
WABI	Bangor Rail. & Elec. Co.,	Bangor, Me.	240
WABL	Agric. Coll.,	Storrs, Conn.	283
WABM	F. E. Doherty Rad. Sup. Co.,	Saginaw, Mich.	254
WABO	Lake Ave. Bap. Church,	Rochester, N. Y.	283
WABP	R. F. Weinig,	Dover, O.	266
WABQ	Haverford Col. Rad. Club,	Haverford, Pennsylvania	261
WABR	Scott H. S.,	Toledo, Ohio	270
WABT	Holliday-Hall,	Washington, Pa.	252
WABU	Victor Talking Mach. Co.,	Camden, N. J.	226
WABW	College of Wooster,	Wooster, O.	234
WABX	H. B. Joy,	Mt. Clemens, Mich.	270
WABY	John Magaldi,	Philadelphia	242
WABZ	Coliseum Pl. Bap. Church,	New Orleans	263
WAHG	A. H. Grebe Co.,	Richmond Hill, N. Y.	316
WBAA	Purdue Univ.,	W. Lafayette, Ind.	283
WBAN	Wireless Phone Corp.,	Paterson, N. J.	246
WBAO	James Millikin Univ.,	Decatur, Ill.	275
WBAP	Star-Telegram,	Fort Worth, Tex.	476
WBAV	Erner & Hopkins Co.,	Columbus, O.	423
WBAX	J. H. Stenger, Jr.,	Wilkes-Barre, Pa.	254
WBAY	Western Electric Co.,	N. Y. C.	492
WBBA	Radio Lab.,	Newark, O.	240
WBBD	Barbey Bat. Ser.,	Reading, Pa.	234
WBBG	Irving Vermilya,	Mattapoisett, Mass.	248
WBBH	J. Irving Bell,	Port Huron, Mich.	246
WBBL	Grace Covenant Presbyterian Church,	Richmond, Va.	283
WBBP	High School,	Petoskey, Mich.	246
WBBR	People's Pulpit Asso.,	Rossville, N. Y.	273
WBBT	Lloyd Bros.,	Philadelphia	234
WBBU	Jenks Motor Co.,	Monmouth, Ill.	224
WBBV	Johnstown Rad. Co.,	Johnstown, Pa.	248
WBBW	Ruffner Jr. H. S.,	Norfolk, Va.	222
WBBY	Washington Light Infantry,	Charleston, S. C.	268
WBBZ	N. B. Watson,	Indianapolis, Ind.	227
WBL	T. & H. Rad. Co.,	Anthony, Kan.	254
WBS	D. W. May, Inc.,	Newark, N. J.	360
WBT	Southern Radio,	Charlotte, N. C.	360
WBZ	Westinghouse,	Springfield, Mass.	337
WCAD	St. Lawrence Univ.,	Canton, N. Y.	280
WCAE	Kaufman & Baer,	Pittsburgh	462
WCAG	C. R. Randall,	New Orleans	268
WCAH	Entrekin Elec. Co.,	Columbus, O.	286
WCAJ	Neb. Wesleyan Univ.,	University Place, Neb.	283
WCAK	A. P. Daniel,	Houston, Texas	263
WCAL	St. Olaf Col.,	Northfield, Minn.	360
WCAO	Sanders & Stayman Co.,	Baltimore, Maryland	360
WCAP	Chesapeake & Potomac Tel. Co.,	Washington, D. C.	469
WCAR	Southern Radio,	San Antonio, Tex.	360
WCAS	Dunwoody Inst.,	Minneapolis	280
WCAT	South Dakota School of Mines,	Rapid City, S. D.	240
WCAU	Durham & Co.,	Philadelphia, Pa.	286
WCAV	Dice Elec. Co.,	Little Rock, Ark.	360
WCAX	Univ. of Vt.,	Burlington, Vt.	360
WCAY	Civic Broadcasting Station,	Milwaukee	266
WCBA	C. W. Heimbach,	Allentown, Pa.	280
WCBC	Univ. of Mich.,	Ann Arbor, Mich.	280
WCBD	W. G. Voliva,	Zion, Ill.	345
WCBE	Uhalt Radio,	New Orleans	263
WCBG	H. S. Williams,	Pacagoula, Miss.	268
WCBH	Univ. of Mississippi,	Oxford, Miss.	242
WCBI	Nicoll, Duncan & Rush,	Bemis, Tenn.	340
WCBJ	J. C. Mans,	Jennings, La.	344
WCBK	E. R. Hall,	St. Petersburgh, Fla.	266
WCBL	N. Radio Mfg. Co.,	Houlton, Me.	280
WCBM	Charles Schwarz,	Baltimore	229
WCBO	Radio Shop, Inc.,	Memphis, Tenn.	250
WCBQ	1st Baptist Ch.,	Nashville, Tenn.	236
WCBR	C. H. Messter,	Providence, R. I.	246
WCBT	Clark Univ.,	Worcester, Mass.	238
WCBU	Arnold Wire Co.,	Arnold, Pa.	254
WCBV	Tullah'a R. C.,	Tullahoma, Tenn.	252
WCBW	G. P. Rankin, Jr.,	Macon, Ga.	226
WCBX	Radio Shop,	Newark, N. J.	233
WCBY	Forks Elec. Shop,	Buck Hill Falls, Pennsylvania	268
WCBZ	Copotelli Bros.,	Chicago Hts., Ill.	348
WCCO	Washburn-Crosby Co.,	Minneapolis	417
WCK	Stix-Baer & Co. & Fuller Co.,	St. Louis, Mo.	360
WCX	Detroit Free Press,	Detroit	517
WDAE	Tampa Daily Times,	Tampa, Fla.	360
WDAF	Kan. City Star,	Kan. City, Mo.	411
WDAG	J. L. Martin,	Amarillo, Texas	263
WDAH	Trinity Meth. Church (So.)	El Paso, Texas	268

Station	Owner	Location	Meters
WDAK		Courant, Hartford, Conn.	261
WDAR		Lit Bros., Philadelphia	395
WDAS		S. A. Waite, Worcester, Mass.	360
WDAU		Slocum & Kilburn, New Bedford, Mass.	360
WDAY		Fargo Radio Co., Fargo, N. D.	244
WDBA		Fred Ray, Columbus, Ga.	226
WDBB		A. H. White Co., Taunton, Mass.	229
WDBC		Kirk, Johnson & Co., Lancaster, Pa.	258
WDBD		H. E. Burns, Martinsb'g, W. Va.	268
WDBE		Gilham-Schoen Co., Atlanta, Ga.	252
WDBF		R. G. Philips, Youngstown, O.	246
WDBH		C. T. Sherer Co., Worcester, Mass.	268
WDBI		Radio Spec. Co., St. Petersburg, Fla.	226
WDBJ		Richardson-Wayland Elec. Co., Roanoke, Va.	229
WDBK		Broz Burn. Co., Cleveland	248
WDBN		Elec. Light & Power Co., Bangor, Maine	252
WDBO		Rollins College, Winter Park, Fla.	240
WDBP		State Normal School, Superior, Wisc.	261
WDBQ		Morton Radio Sup. Co., Salem, N. J.	234
WDBR		Tremont Temple, Boston, Mass.	256
WDBS		S. M. K. Radio Corp., Dayton, Ohio	283
WDBT		Taylor's Book Store, Hattiesburg, Mississippi	236
WDBU		Somerset Radio Co., Skowhegan, Me.	258
WDBW		Radio Den, Columbia, Tenn.	268
WDBX		Otto Baur, New York City	233
WDBY		No. Shore Cong. Ch'ch., Chicago	258
WDBZ		Boy Scouts Ama., Kingston, N. Y.	233
WDM		Ch. of Covenant, Washington, D. C.	234
WDZ		J. L. Bush, Tuscola, Ill.	278
WEAA		F. D. Fallain, Flint, Mich.	280
WEAF		A. T. & T., N. Y. C.	492
WEAH		Wichita B. of T., Wichita, Kan.	280
WEAI		Cornell Univ., Ithaca, N. Y.	286
WEAJ		Univ. of S. D., Vermillion, S. D.	280
WEAM		Borough, North Plainfield, N. J.	286
WEAN		Shepard Co., Providence, R. I.	273
WEAO		State Univ., Columbus, O.	294
WEAP		Mobile Radio Co., Mobile, Ala.	360
WEAR		Evening News, Baltimore	261
WEAU		Davidson Bros. Co., Sioux City, Iowa	275
WEAY		Iris Theatre, Houston, Texas	360
WEB		Benwood Co., St. Louis, Mo.	273
WEBA		Electric Shop, Highland Park, N. J.	233
WEBC		W. C. Bridges, Superior, Wisc.	242
WEBD		Elec. Equip. & Svc. Co., Anderson, Indiana	246
WEBH		Edgewater Beach Hotel, Chicago	370
WEBJ		Third Ave. R. R. Co., N. Y. C.	273
WEBK		Grand Rapids Radio Co., Grand Rapids, Mich.	261
WEBL		Radio Corp. of Am. (portable)	226
WEBO		Radio Co., Hamilton, O.	250
WEBP		E. B. Peddicord, New Orleans	280
WEBQ		Tate Radio Co., Harrisburg, Ill.	226
WEBR		H. H. Howell, Buffalo, N. Y.	240
WEEI		Edison Co., Boston	303
WEV		Hurlburt-Still Elec. Co., Houston	263
WEW		St. Louis Univ., St. Louis, Mo.	280
WFAA		Dallas News & J'r'l, Dallas, Tex.	476
WFAB		C. F. Woese, Syracuse, N. Y.	234
WFAH		Elec. Supply Co., Port Arthur, Tex.	236
WFAM		Times, St. Cloud, Minn.	273
WFAN		Hutchinson Elec. Ser. Co., Hutchinson, Minn.	360
WFAV		U. of Neb. Dept. of Elec. Eng., Lincoln, Neb.	275
WFBH		Hotel Majestic, N. Y. C.	273
WFBI		Galvin Radio Co., Camden, N. J.	236
WFBJ		St. Johns Univ., Collegeville, Minn.	236
WFI		Strawbridge & Clothier, Philadelphia	395
WGAL		Lancaster Elec. Sup. Co., Lancaster, Pennsylvania	248
WGAN		C. E. Lloyd, Pensacola, Fla.	360
WGAQ		Youree Hotel, Shreveport, La.	252
WGAZ		Tribune, South Bend, Ind.	360
WGI		Amer. Radio Res. Corp., Medford Hillside, Mass.	360
WGL		Thos. Howlett, Philadelphia	360
WGN		Tribune, Drake Hotel, Chicago	370
WGR		Fed. T. & T. Co., Buffalo, N. Y.	319
WGY		Gen. Elec. Co., Schenectady, N. Y.	380
WHAA		State Univ. of Iowa, Iowa City, Ia.	484
WHAD		Marquette Univ., Milwaukee, Wis.	280
WHAG		Univ. of Cin., Cincinnati, O.	222
WHAK		Roberts Hdw. Co., Clarksburg, West Virginia	258
WHAM		Univ. of Rochester, Rochester, N. Y.	283
WHAR		Seaside Hotel, Atlantic City	275
WHAS		Courier-Journal Times, Louisville, Kentucky	400
WHAV		Wilmington Elec. Spec. Co., Wilmington, Del.	360
WHAZ		Rensselaer Pol. Inst., Troy, N. Y.	380
WHB		Sweeney Sch. Co., Kan. City, Mo.	411
WHK		Radio Box Co., Cleveland, Ohio	283
WHN		Loew's State Theatre, N. Y. C.	360
WHO		Bankers Life Co., Des Moines, Ia.	526
WIAB		Joslyn Auto Co., Rockford, Ill.	252
WIAC		Gal'ston Tribune, Galveston, Tex.	360
WIAD		H. R. Miller, Philadelphia, Pa.	254
WIAK		Jour'l-Stock'n Co., Omaha, Neb.	278
WIK		K. & L. Elec. Sup. Co., McKeesport, Pennsylvania	234
WIL		Cont. Elec. Supp. Co., Wash., D. C.	360
WIP		Gimbel Bros., Philadelphia, Pa.	509
WJAB		Amn. Elec. Co., Lincoln, Neb.	229
WJAD		Jackson's R. E. L., Waco, Tex.	360
WJAG		Norfolk D'ly News, Norfolk, Neb.	283
WJAK		C. L. White, Greentown, Ind.	254
WJAM		D. M. Perham, Cedar Rapids, Ia.	268
WJAN		Peoria Star, Peoria, Ill.	280
WJAR		Outlet Co., Providence, R. I.	360
WJAS		Pittsburgh Radio Sup. House, Pittsburgh, Pa.	286
WJAX		Union Trust Co., Cleveland, Ohio	390
WJAZ		Chicago Rad. Lab., Chicago	268
WJD		Dennison Univ., Granville, O.	229
WJY		Radio Corp. of Am., N. Y. C.	405
WJZ		Radio Corp. of Am., N. Y. C.	455
WKAA		H. F. Paar, Cedar Rapids, Ia.	278
WKAD		Chas. Looff, E. Providence, R. I.	240
WKAF		U. S. Radio Sup. Co., Wichita Falls, Texas	360
WKAN		Un. Bat. Co., Montgomery, Ala.	226
WKAP		D. W. Flint, Cranston, R. I.	360
WKAQ		Radio Corp. of P. R., San Juan, Porto Rico	360
WKAR		Mich. Agr. Col., E. Lansing, Mich.	280
WKAV		Laconia R. C., Laconia, N. H.	254
WKBF		D. W. Flint, Cranston, R. I.	286
WKY		Radio Shop, Oklahoma City, Okla.	360
WLAH		S. Woodworth, Syracuse, N. Y.	234
WLAL		Naylor Elec. Co., Tulsa, Okla.	360
WLAP		W. V. Jordan, Louisville, Ky.	286
WLAX		Putnam E. Co., Greencastle, Ind.	231
WLBL		Wisconsin Markets Dept., Stevens Pt., Wis.	278
WLS		Sears Roebuck Co., Chicago, Ill.	345
WLW		Crosley Mfg. Co., Cincinnati, O.	423
WMAC		C. B. Meredith, Cazenovia, N. Y.	261
WMAF		Round Hills Radio Corp., Dartmouth, Mass.	360
WMAH		Gen. Sup. Co., Lincoln, Neb.	254
WMAK		Norton Lab., Lockport, N. Y.	273
WMAN		Broad St. Bap. Ch., Columbia, O.	286
WMAQ		Chicago Daily News, Chicago	448
WMAV		Ala. Poly. Inst., Auburn, Ala.	250
WMAY		Kingshighway Presbyterian Church, St. Louis, Mo.	280
WMAZ		Mercer Univ., Macon, Ga.	261
WMC		Com. Appeal, Memphis, Tenn.	500
WMH		Ainsworth-Gates Radio, Cincinnati	309
WMU		Doubleday-Hill Elec. Co., Washington, D. C.	261
WNAC		Shepard Stores, Boston, Mass.	278
WNAD		Univ. of Okla., Norman, Okla.	360
WNAP		Wittenberg Col., Springfield, O.	275
WNAR		1st Christian Church, Butler, Mo.	231
WNAT		Lenning Bros. Co., Philadelphia	360
WNAW		Henry Kunzmann, Ft. Monroe, Va.	360
WNAX		Dakota Radio Ap. Co., Yankton, South Dakota	244
WNYC		Municipal Station, N. Y. C.	526
WOAB		Val. Radio, Grand Forks, N. D.	280
WOAC		Page Organ Co., Lima, Ohio	266
WOAE		Midland Col., Fremont, Neb.	280
WOAF		Tyler Com. Col., Tyler, Tex.	360
WOAG		Apollo Theatre, Belvidere, Ill.	273
WOAH		Palmetto Radio, Charleston, S. C.	360
WOAI		Evening News & Express, San Antonio, Texas	385
WOAJ		Ervins Elec. Co., Parsons, Kan.	258
WOAN		Vaughn Cons. of Music, Lawrenceburg, Tenn.	360
WOAR		H. P. Lundskow	229
WOAV		Penn. Nat. Guard, Erie, Pa.	242
WOAW		W'dmen of World, Omaha, Neb.	526
WOAX		F. J. Wolff, Trenton, N. J.	240
WOC		Palmer Sch. of Chiro., Davenport, Ia.	484
WOI		Iowa State College, Ames, Iowa	360
WOO		John Wanamaker, Philadelphia	509
WOQ		West. Radio Co., Kansas City, Mo.	360
WOR		Bamberger & Co., Newark, N. J.	405
WOS		Mo. State Market Bureau, Jefferson City, Mo.	441
WPAB		Penn. State Col., State Col., Pa.	283
WPAC		Donaldson Radio, Okmulgee, Okla.	360
WPAJ		Doolittle Radio Corp., New Haven, Connecticut	268
WPAK		North Dakota Agricultural College, Agricultural College, N. D.	283
WPAM		Auerbach & Guettel, Topeka, Kan.	275
WPAR		Ward Bat. Co., Beloit, Kan.	236
WPAU		Concordia Col., Moorhead, Minn.	286
WPAZ		Dr. J. R. Koch, Charleston, W. Va.	273
WQAA		H. A. Beale, Parkesburg, Pa.	360
WQAC		E. B. Gish, Amarillo, Texas	360
WQAE		Moore Radio, Springfield, Vt.	275
WQAF		Sandusky Register, Sandusky, O.	240
WQAM		Elec. Equip. Co., Miami, Fla.	283
WQAN		Scranton Times, Scranton, Pa.	280
WQAO		Calvary Baptist Chr., N. Y. C.	360
WQAQ		W. Tex. Rad. Co., Abilene, Tex.	360
WQAS		Prince-Walter Co., Lowell, Mass.	266
WQAX		Rad. Equip. Co., Peoria, Ill.	248
WQJ		Calumet Bak Co., Chicago	448
WRAF		Radio Club, Inc., Laporte, Ind.	224
WRAL		Nor. S. P. Co., St. Croix Falls, Wis.	248
WRAM		Lombard College, Galesburg, Ill.	244
WRAN		Black Hawk Elec. Co., Waterloo, Ia.	236
WRAO		Radio Ser. Co., St. Louis, Mo.	360
WRAV		Antioch Col., Yellow Springs, O.	242
WRAW		Ave. Radio Shop, Reading, Pa.	238
WRAX		Flexon's Garage, Gloucester City, N. J.	268
WRBC		Emmanuel Lutheran Church, Valparaiso, Ind.	278
WRC		Radio Corp. of Am., Washington	469
WRK		Doron Bros. E. Co., Hamilton, O.	360
WRL		Union Col., Schenectady, N. Y.	360
WRM		Univ. of Ill., Urbana, Ill.	360
WRR		City of Dallas, Dallas, Tex.	360
WRW		Tarrytown Radio Res., Tarrytown, N. Y.	273
WSAB		S. E. Mo. State Teachers Col., Cape Girardeau, Mo.	360
WSAC		Clemson Agr. College, Clemson College, S. C.	360
WSAD		J. A. Foster Co., Providence, R. I.	261
WSAI		U. S. Play. Card Co., Cincinnati	309
WSAJ		Grove City Col., Grove City, Pa.	258
WSAN		Radio Club, Allentown, Pa.	229
WSAP		7th Day Ad. Chr., N. Y. C.	263
WSAR		Doughty & Welch Elec. Co., Fall River, Mass.	254
WSAU		C. Marienfeld, Chesham, N. H.	229
WSAV		Vick Radio, Houston, Tex.	360
WSAY		Irv. Austin, Portchester, N. Y.	233
WSAZ		Chase Radio Co., Pomeroy, O.	258
WSB		Atlanta Journal, Atlanta, Ga.	429
WSL		J. & M. Elec. Co., Utica, N. Y.	273
WJOE		School of Engin., Milwaukee	246
WSY		Ala. Pow. Co., Birmingham, Ala.	360
WTAB		Fall River Daily Herald, Fall River, Mass.	266
WTAC		Penn. Traf. Co., Johnstown, Pa.	275
WTAF		L. J. Gallo, New Orleans, La.	268
WTAG		Kern Mus. Co., Providence, R. I.	258
WTAJ		The Radio Shop, Portland, Me.	236
WTAL		Toledo Rad. & Elec. Co., Toledo	252
WTAM		Willard Stge. Bat. Co., Cleveland	390
WTAP		Cambridge Rad. Elec. Co., Cambridge, Ill.	243
WTAQ		S. Van Gorden, Osco, Wis.	254
WTAR		Reliance Rad. & Elec. Co., Norfolk, Virginia	230
WTAS		Chas. E. Erbstein, Elgin, Ill.	286
WTAT		Edison Co. (portable)	244
WTAU		Ruegg Bat. & Elec. Co., Tecumseh, Nebraska	243
WTAW		Agr. & Mech. College, College Stations, Tex.	280
WTAX		Williams Hdwe. Mfg. Co., Streator, Ill.	231
WTAY		The Oak Leaves, Oak Park, Ill.	283
WTAZ		T. J. McGuire, Lambertville, N. J.	283
WTG		Kans. State Agr. College, Manhattan, Kansas	273
WTL		H. G. Saal Co., Chicago	268
WWAB		Hoenig, Swern, Trenton, N. J.	226
WWAD		Wright & Wright, Inc., Philadelphia, Pa.	360
WWAE		L. J. Crowley, Joliet, Ill.	227
WWAO		Coll. of Mines, Houghton, Mich.	244
WWI		Ford Motor Co., Dearborn, Mich.	273
WWJ		Detroit News, Detroit	517
WWL		Loyola Univ., New Orleans	280

Pocket Set Used in Paris

PARIS.

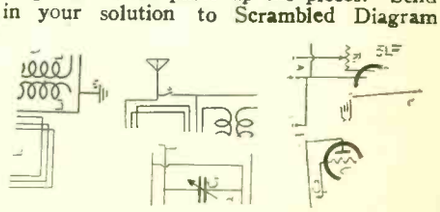
FRENCH wireless inventors have been devoting their attention to devices for cheapening and popularizing wireless receiving sets in forms which will be useful in ordinary life.

A new crystal set for short distances has been placed on the market. The set is enclosed in a case four inches in diameter, for carrying in the pocket like a watch. The aerial is in the form of a chain reaching from the left pocket of the waistcoat to the right. One end of the chain is attached to two terminals inside the watch, while the other remains in the pocket. When the wearer wishes to listen in he takes out a compact set of ear pieces which fit in a case about the same size as that for the crystal. Tuning in is like winding a watch.

Tests with such a set show it can receive over a distance of eleven miles. Its principal use, so far, has been to obtain exchange rates on the franc and dollar which are broadcast every half hour from the Eiffel Tower. Manipulators on the Bourse can sit in a cafe and obtain exchange rates as well as on the Bourse.

Scrambled Diagram

CUT out the sections of the diagram and piece them together to make a circuit diagram. Then paste up the pieces. Send in your solution to Scrambled Diagram



Editor, RADIO WORLD, 1493 Broadway, New York City. The names of those sending in the correct solution will be published.

How Radio Cures Disease

Kinship of the Sciences Proven by the Analogy of Frequencies in Radio, Color, Heat and Bacilli Destruction

By George Lewis
of the Crosley Radio Corporation

SCIENTISTS believe but unfortunately have no means of measuring that a stick of wood has frequencies. It is known that sound waves have an audio frequency of from sixteen cycles to twenty thousand cycles and therefore these are placed in the first band of frequencies. Longer waves than 25,000 meters cannot be utilized for radio transmission as the waves overlap into the audio-frequency zone. The commercial stations send in the zone of wavelengths from 600 upward to the 25,000. From 600 down to 200 meters are used by stations while the meters below 200 are given over to the amateur radio operator although the radio conference this month is to give some of this zone to the better-class experimental stations.

Radio, as it is known today, is continually adding to the electro-medical dawn of the new science and affords an unexplored fied for the experimenters. The medical scientists are just beginning to realize the possibility of using the frequencies in the treatment of disease.

The first manifestation of human nerves of the body, as a whole, detecting waves, is found in the molecular motion or oscillation of heat waves. The amplitude of the oscillation is a function of temperature. A young scientist, Samuel Ruben, has worked out with great success a method of treating dermal infections with heat waves.

Light waves have their frequencies and each distinct sensation of color conveyed to the brain is but the registration of a different frequency or wavelength. When they are all projected together a white light results. The proof of this may be confirmed by painting the seven primary colors on a disc, which when rotated at a high speed results in white.

An interesting experiment may be made with a piece of iron. Cold, the iron emits a frequency above the audible range, but undetected by our human nerves. Increase the temperature and our nerves detect the waves in the form of heat. Increase this temperature still further and our eyes begin to detect the higher frequencies or longer waves and so on through the visible spectrum.

There is a band of waves which I call the blue violet and which are found just beyond the ultra-violet waves. These waves or frequencies are used in medical and photographic work and the ones which also give life to plants. It is here that a second advance of electro-medical science is unveiled, only to be followed by a dark, unknown zone. It is a fact that the X-ray zone of frequencies is the great servant of mankind. At the Crocker laboratory there is a tremendous modern machine capable of utilizing a potential of 200,000 volts. The X-rays are transmitted between the atoms of the flesh. The first chapter of the wonderful story of the X-ray in modern science is well known as applied to medical diagnosis and the treatment of diseased tissue.

The newer application of the X-ray frequencies is found in the destruction of bacteria in food, such as oatmeal. A far more important factor in this work was disclosed by the application of this high voltage X-ray to the lung of a person having pneumonia. A five-second application of this great force was sufficient to dislodge the pneumonia bacilli. The experiment was successful as have been several which have followed it. What the subsequent application of the X-ray will be can best be imagined by the results of the past astounding discoveries.

Science is familiar with frequencies some three hundred times smaller than the X-ray, for example, the electron, used in radio work. As progress is made in understanding of electric waves the small zone occupied by the radio art today will be greatly enlarged.

RADIO LOG DISTRIBUTED BY WESTERN UNION

KEEPING a radio log is like writing a diary. It is mighty interesting to look back on and not only that, but the log serves as a guide for the location of stations which you might ordinarily skip altogether.

The newest log for radio sets is put out by the Western Union Telegraph Company and it is one of the best yet. The stations are all arranged ready for you to simply put the dial readings opposite them. Not only that, but the list of stations reads so that the first ones are on the highest wave-lengths and go from there down to those on the low waves. This will help considerably in tuning. The log sheets may be secured from any office of the company.

Here Is a Good DX List

From Ed. B. Street, 615 Cooper St., Beverly, N. J.

I am a regular reader of the RADIO WORLD and noticed some good DX records, but I believe I have a good one, also.

KOP, KDZF, KFDU, KFI, KHJ, KFIZ, KFKB, KSD, KYW, KDKA, WOAW, WRAA, WOQ, WOAI, PWX, WHB, WBAP, WFAA, WLAG, WOS, WOC, WMC, WJAN, WSY, WPAH, WTAS, WCBD, WDAP, WPAD, WJAZ, WMAQ, WSAI, WLW, WBAA, WHAS, WWJ, WCX, WSAD, WEAN, WNAC, WGR, CFCA, CHYC, CKAC, CFCF, CFCN, CHBC, CHCD, 6KW, also one at Monterey, Mexico.

I use a five-tube neutrodyne. Most of the stations were brought in with local stations going. I have received over a hundred stations. I use a separate rheostat for each tube.

A NEW TYPE of submarine cable employing the newly-invented electric conductor, permalloy, permits the transmission of signals under water at 5 times the speed heretofore accomplished by cable. The new Western Union lines connect the United States direct to Italy and to Germany. This is an effort to meet the competition offered by radiograms.

ON A TRIPOD, just like a camera, this radio set is mounted by a fan who goes on the roof to get best DX reception. The aerial hangs over the coping, as does the ground wire.

A THOUGHT FOR THE WEEK

—Radio has passed from the field of an adventure to that of a public utility.—HERBERT HOOVER.

GOOD RESULTS FROM USE OF GROUND ALONE

THE recent experiment at the University of Illinois which utilized the ground as a better means of radio communication shows that obstacles are of temporary duration in the progress of radio, says George Lewis, of the Crosley Radio Corporation.

Experiments in ground transmission have received the serious attention of American, British and French scientists and while they were conducted privately, the results showed a big advance since the discovery of the coherer as a detector of electro-magnetic waves and the discovery of the rectification of a particular family of crystals.

HAVING communicated in both directions with amateur radio telegraph operators in South America, amateurs of the United States and Canada recently turned their attention to the Pacific ocean for the purpose of engaging in a two-way radio contest with the experimenters in Australia and New Zealand. Two ten-day periods had been set aside. The first transmitting period was from August 10 to 20, and the second from September 7 to 16, both inclusive. Australian and New Zealand amateurs listened in from 3 to 3:30 A. M., E. S. T., and they transmitted from 3:30 to 4 A. M., E. S. T. Two-way work was attempted daily starting at 4 A. M., E. S. T.

THE AEOLIAN COMPANY, phonograph firm that recently obtained an agency from the Radio Corporation of America for the sale of their sets, has sold its building in West 42nd Street to the Schulte Retail Stores Corporation. WJZ and WJY are in this building.

LOSSES ON SHORT WAVES

SHORT waves are high frequencies and the losses are great if shielding is employed.

Wiring Two Stages of AF

The Radio University

A Question and Answer Department conducted by RADIO WORLD for its Readers by its Staff of Experts. Address Letters to Radio University Department, RADIO WORLD, 1493 Broadway, New York City.

RADIO WORLD'S

Broadcast University

Questions and Answers On the Air Every Wednesday Evening at WLS, the Sears-Roebuck Station, Chicago — Department Conducted by Mat H. Friedman, RADIO WORLD'S *Chicago Representative.*

HAVING BEEN a reader of your magazine from the first issue I wish to express my appreciation of it very much, for I think it is one of the very best published for the non-technical man. I will buy your magazine as long as it is published. I have built several sets from your magazine and the best of it is they all worked.

1. In your issue of June 28 you describe a 4-tube Super-Heterodyne, by B. J. Bongart. In your issue of Aug. 9, you show a 3-tube Super-Heterodyne, and an illustration in this article shows what appears to me to be the same honeycomb coil layout that is used in your set of June 28, connections in both cases seem to me to be the same, but under the coils shown in your Aug. 9 issue, among other reading matter, appears the following: "Your honeycomb coils may be hooked up as shown above. If so, you have made a mistake. The two honeycomb coils constituting the primary and the two comprising the secondary are bucking each other, if arranged as shown in the diagram, and the set will not work." I do not understand this. 2. How would this set compare with a well-built Neutrodyne, in distance, selectivity and volume? Does this set compare with the 8-tube Super-Heterodynes? What kind of tubes would you recommend to use in this set? How does this set compare with the 6-tube Super-Heterodyne described in Radio World, May 17, by Charles H. M. White? Is the 4-tube Super-Heterodyne a hard set to build? 3. Suppose I wish to use an aerial, what kind of a coil would be best to use in place of the loop?—P. J. Henderson, 1918 Indiana Ave., Cleveland, O.

1. After we had published the article on the 4-tube Super-Heterodyne on June 28, we found that improved results were obtained by hooking up the honeycoils as shown in the August 9 issue. This is the same Super-Heterodyne, only reflexed. 2. As this set is rather for experiment than for standard use, a 5-tube Neutrodyne would be much better, as to distance, selectivity and volume. Use 201A or 301A tubes. The best Neutrodyne we know of for the home constructor is the Magnadyne, a low-loss receiver described in Radio World, August 16 and 23. Unless you are greatly experienced, select the Neutrodyne for construction, rather than any Super-Heterodyne. 3. If an aerial is to be used instead of a loop on a set designed for loop operation, wind an RF transformer, tune the secondary with a 23-plate condenser, connect the secondary to grid and A—, and join the primary to aerial and ground. The primary has 15 turns, the secondary 55 turns, all No. 20 DCC wire on a 3½" tubing, 4" high.

* * *

HAVE MADE up Bongart's 4-tube Super-Heterodyne as shown in issues of June 28 and July 12, but am unable to get anything out of it. Have followed instructions closely with the exception that I used a 23-plate in place of a 17-plate condenser. Am using low-loss condensers, but with no results.—Edward Heckman, 125 W. 104 St., N. Y. C.

The hook-up of the oscillator as shown in the June 28 and July 12 issues is not the best. See our issue of August 9 for the best way to hook up this oscillator. In fact you can easily eliminate one tube by using the hook-up in the August 9 issue. This circuit is difficult to get working right, but it has functioned well in our laboratory. The market is flooded with 1,200-turn honeycomb coils, the type used in the Super-Regenerative, and if by chance your coils are 1,200 turns instead of 1,500, the set will not work at all.

* * *

IF I USE a low-loss coil, instead of one which is wound on insulation tubing, would I get better DX?—Wm. Jantzen, 4376 Katonah Avenue, N. Y. C.

More volume, greater distance and increased selectivity may be expected to attend the substitution of a low-loss coil for the other kind. The reason is that a low-loss coil prevents, as near as may be, the escape of the precious radio currents, such as are dissipated in the insulation on the tubing. Especially when tuned radio-frequency is under consideration, say two stages, the improvement is marked. In fact, it may even have the effect that could be obtained otherwise only by adding an extra tube. When the coils used in the circuit are all low-loss, the gain is most pronounced because it is in the coils that most of the losses occur. It is important also to have low-loss condensers, but see to your coils first.

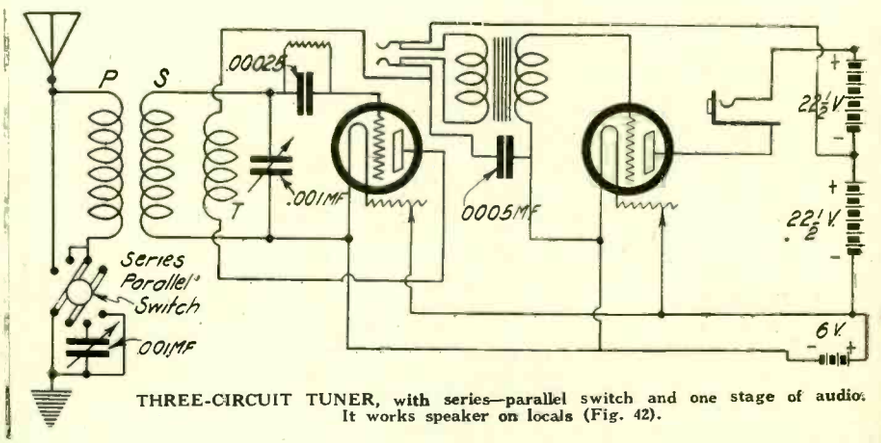
* * *

IS IT better to put a lightning protector outside or inside the house?—Wm. Busch, 118 So. 4th St., Mankato, Minn.

Preferably outside and away from anything inflammable.

I WOULD LIKE to have a diagram of a 3-honeycomb coil circuit, using a condenser for the primary which may switch around so as to be either in series or parallel. Also I would like to have one stage of audio-frequency amplification added. Morris Gordon, 276 Junius St., Brooklyn, N. Y.

Fig. 42 shows how to wire the series-parallel switch so as to use the variable condenser in two ways. The .001 mfd. condenser is used with a 25-turn honeycomb, but many prefer to use a 50-turn coil with a 23-plate condenser there.



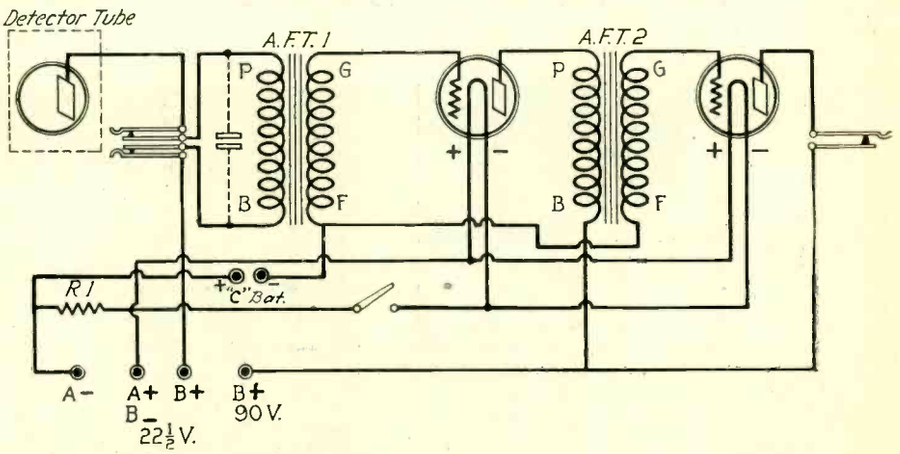
THREE-CIRCUIT TUNER, with series—parallel switch and one stage of audio. It works speaker on locals (Fig. 42).

DOES RF add to volume?—C. J. Jones, Peoria, Ill.

Yes, a little. The RF tubes detect, too.

WOULD like your advice on a good 3-tube receiving set.—Joseph Landa, 2337 So. 61st Avenue, Cicero, Ill.

One of the best 3-tube sets that can be built,



CIRCUIT DIAGRAM (Fig. 43) for two stages of audio-frequency amplification.

HOW LONG should my antenna be for a 3-circuit tuner?—P. Kenwood, Homelaun Avenue, Jamaica, N. Y.

This circuit will stand 150 feet.

considering DX capabilities and tone quality, is the variocoupler and variometer set described in RADIO WORLD, Oct. 11.

It can reach out 1,500 miles.

Join RADIO WORLD'S University Club

And Get Full Question and Answer Service for the Coming 52 Weeks.

RADIO WORLD, 1493 Broadway, New York City:

Enclosed find $6.00 for RADIO WORLD for one year (52 Nos.) and also consider this as an application to join RADIO WORLD'S University Club, which gives me free information in your Radio University Department for the coming year.

Name .....

Street .....

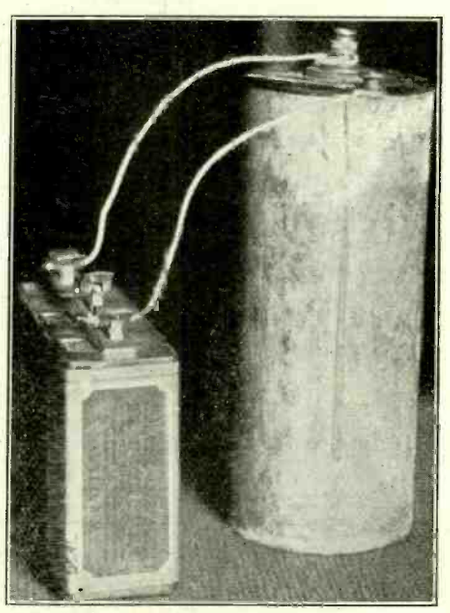
City and State .....

Telegraphed queries will be answered collect the same day as received. Be sure to direct in your query that the answer be sent collect.

This is the Life En Route

ON HIS WAY to and from school, James Scull has a chance to listen to programs, because he uses his bicycle, equipped with regular antenna and an honest-to-goodness receiving set. The circuit is a 3-tube reflex, and it gets him all the DX his heart craves. (Atlantic Photo.)

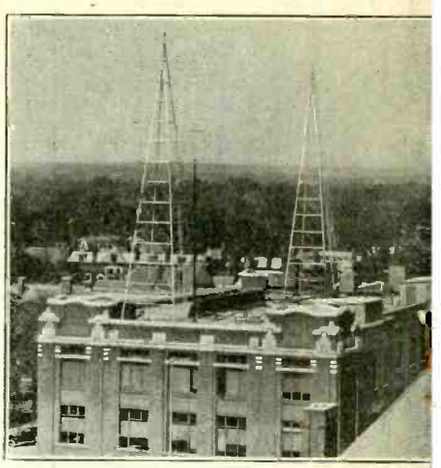
HERE you have Crosley products in one, meaning the Go-Bi-Bi and the set attached thereto. Frank Richard Norton, fourteen months, is shown in the interesting get-up that won him special prize in a toy vehicle parade at Chester Park, Cincinnati. While being pulled along in the parade Frank was listening to Crosley Station, WLW.



(Foto Topics)

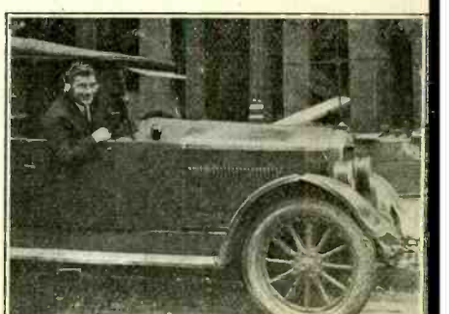
TWO BATTERIES of different voltage and amperage should not be connected either in series or in parallel. The photo shows a 1½-volt dry cell connected in parallel with 4½-volt dry battery, the kind used as the A battery for the 199 and 299 tubes and as a C battery in amplifier circuits. The total voltage here is only 4½. The objection to hooking up two such different kinds of batteries is that eddy currents arise, seriously impairing the life of both batteries and giving low efficiency. The positive terminal of the 1½-volt battery, the cell at right, is in the center. The negative pole is on the periphery.

A Show Place



THE antenna towers of WGAZ, Tribune, South Bend, Ind., 275 meters, are on top of the newspaper's own building. They are one of the proud sights of the town and all visitors to South Bend are conducted instantly to this scene of interesting doings.

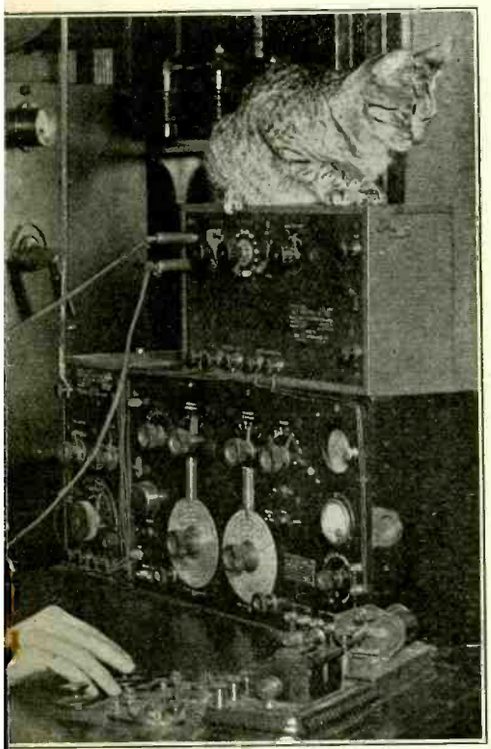
EVERYTHING is cozy. Little Betty Wiley is set for interpreting fast code and the cat is worrying much, as Sergeant E. A. Redding t Station WBP (sending room shown above) Fort Wood, under the shadow of the Statue Liberty. (United.)



A LOOP, while it never warns you when you have trouble in your cylinders, may nevertheless be installed for other purposes instead of a motor meter on your automobile. Thus was this happy individual able to hear stations. (Radio World.

Bottle Set

1-TUBE DX set built by Wm. D. Knapp, of Philadelphia. It works from a light socket. (Kadel & Herbert)



AN EXPEDITION to recover $3,000,000 in gold near the Virginia Capes, where the liner Merida sank, depends to an extent for its success on the radio shown above. The expedition is financed by big New York interests. The radio may be used for communication with the divers while they are on the ocean-bed. (Kadel & Herbert).

Easing Up an Ordeal

ENJOYING beautiful music, it is said, helps to make women more beautiful, but the man who said it is dead. However, while getting all dolled up in a beauty parlor in the modern way, the women folk find it charming to listen to the radio. (Atlantic Photo.)

THE RADIO TRIBE of Lone Scouts of America is the name of an organization being created through the Sears-Roebuck Agricultural Foundation, Station WLS, Chicago. Silver badges will be given to all youngsters who join this order. Here are three of the prime movers. Left to right: W. F. Morgan, Lone Scout No. 1; Armstrong Perry, Tribe Chief; Torkel Gundel, Assistant Tribe Chief. The movement is meeting with great success.

BROADCAST PROGRAMS

[The stations' wavelength is given in meters. The time is that of the time division in which the station is located—Eastern, Central, Mountain or Pacific.]

Thursday, October 16

WBAP, Fort Worth, Tex., 476m—10 A. M., 10, opening market quotations. 11, weather; livestock reports; cotton and grain quotations. 12 Noon, market. 1 P. M., market. 2, close on cotton, grain and cottonseed oil; Dun's and Bradstreet's financial reviews, 6, Port of Missing Men; baseball scores. 6:30, sport review. **(The above part of the program applies to all week days, except Saturday.)** 7:30-8:30 P. M., concert. 9:30-10:45, Dot Echols Frolics.

WFAA, Dallas, Tex., 476m—10:30 A. M., weather; highway bulletin; produce market report and Wall Street review. 12:30 P. M., Dr. Ellis W. Shuler, Southern Methodist University, on "Texas History in the Rocks." 2:30-3, Dallas livestock market, late general markets, sports, news. 3:30-4, 4:30-5, Agriograms, health bulletins, Texas market news, sports, news. 12:30-1 P. M., Charles E. Osborne, "Fit for Eevery Fight." 8:30-9:30, Walter J. Fried, violinist, and Dallas artists. 11-12 P. M., organ with orchestra.

WDAF, Kansas City, Mo., 411m—3:30 4, 4:30, 5 and 6 P. M., baseball. 3:30-4:30, trio. 5:50-6, marketgram; weather; time. 6-7, (School of the Air); piano; Edgar Allan Linton, talks on world travels; reading, Miss Cecile Burton, poems and essays; the Tell-Me-a-Story Lady; Hanlein's Trianon Ensemble. 11:45 P. M., 1 A. M., (Nighthawk Frolic), The "Merry Old Chief" and the Plantation Players, Hotel Muehlebach; Eddie and Bobbie Kuhn's K. C. A. C. orchestra.

KGO, Oakland, Cal., 312m—1:30 P. M., N. Y. and S. F. stock reports and weather. 4-5:30 P. M., concert orchestra, Hotel St. Francis. 6:45 stock reports; weather; S. F. produce news; baseball scores; news. 8:00, Mid-Pacific Hawaiian quartet; address, "The Bolshevism of the Bee," by Rev. George W. Phillips; songs; music. 10 P. M.,-1 A. M., dance, Halstead's orchestra, soloists, Hotel St. Francis, San Francisco.

WGY, Schenectady, N. Y., 380m—7:45 P. M., new books, by William F. Jacobs, 8:30, radio drama, "The Path of Glory," by Rabbi Goodman Lipkind, presented by WGY players; WGY orchestra. 11:20, organ.

KFI, Los Angeles, 469m—5-5:30 P. M., news. 5:30-6, news. 6:45-7:30, Y. M. C. A. lecture. 7:30-8, Harry Porter, baritone, and Sylvia Marotta. 8-9, orchestra. 9-10, studio. 10-11, Spanish program.

WCBD, Zion, Ill., 345m—8 P. M., male quartet, vocal Trio; John D. Thomas, Baritone; Hermann Becker, 'Cello; Esther Cook Rendall, Soprano; Hester Robinson, Reader.

WMOA, Chicago, 447.5m—12:30 P. M., skyline Serenaders. 8:30, Chisca Hotel Concert Orchestra.

KGW, Lacey, Wash., 258m—11:30 A. M., Weather. 12:30 P. M., Concert by Civic Music Club of Portland. 5, Children's program. 7:15, Markets, weather, news and police reports. After 8 silent.

CNRM, Montreal, Can., 430—8:00 P. M., song recitals, piano, violin; address, Dr. W. J. Black, European Manager, Colonization & Development, Canadian National Railways, London, "What the C. N. R. Are Doing to Attract British Settlers to Canada."

WEAF, New York City, 492—11:00 A. M. to 12 Noon, musical program and talks to housewives; market and weather reports. 4:00 to 5:00 P. M., Fay Milbar, pianist; lecture-recital opera "Thais" (Massenet) by Mme. Charlotte Lund and N. Val Peavey, pianist, direct from Columbia University. 6:00 to 12:00, dinner music from the Rose Room of the Hotel Waldorf-Astoria; mid-week services, Greater New York Federation of Churches; Smith dance orchestra; talk by the Bank of America; "Touring With the Packard" with George Elliott Cooley, tour director; Fred Ruzika, violinist; Joseph White, tenor; Helen Graves, mezzo soprano; Jimmie Clark, pianist; Vincent Lopez and his orchestra from the Hotel Pennsylvania.

WEBH, Chicago, 370—7:00 to 8:00 P. M., "Everyday Songs," Edgar A. Guest; Edgewater orchestra; musical bits from Balaban and Katz Riviera Theatre. 9:00 to 10:00, dance selections, Edgewater Beach Oriole orchestra; Edgewater Beach Trio, banjo, accordeon and piano; Dean Remick, pianist; musical bits from Balaban and Katz Riviera Theatre. 11:00 to 12:00, dance selections; Harry Davis, baritone; Nick Lucas, songs; late revue.

WEAO, Columbus, Ohio, 360—8:00 P. M., concert by the Faculty of Marguerite Manley Seidel School; talk, John F. Carlisle.

WOR, Newark, N. J., 405—7:00 A. M., gym class. 2:30 P. M., recital by Hazel Dudley, soprano. 2:45, Jean Lambert, contralto. 3:00, Hazel Dudley, soprano. 3:15, Marie Mattingly Meloney, chairman of the Curie Radium Fund, talk. 3:45, Winifred Moses, "Mayonnaise in Five Minutes." 6:15, Albert E. Sonn, "Radio for the Layman." 6:30, Jimmie Lent orchestra. 7:15, day's sports with "Jolly Bill" Steinke.

KYW, Chicago, 536—6:30 A. M., exercises by by physical director Y. M. C. A.; broadcast at 7 and 8 also. 9:30, news and comment of financial and commercial markets. 10:30, farm and home service. 11:35, table talk by Mrs. Anna J. Peterson of People's Gas Co. 2:35 to 4:00 P. M., "Afternoon Frolic" from studio. 4:00, financial news and market reports. 6:02 to 6:18, news, financial and final market. 6:35 to 7:00, children's bedtime story by Walter Wilson, "Uncle Bob." 7:00 to 7:30, concert, broadcast from Congress Hotel. 8:00 to 8:20, "Twenty Minutes of Good Reading," by Rev. C. J. Pernin, S. J., head of Dept. of English, Loyola University, Chicago. 8:20 to 8:30, talk on "Better Lighting," by W. A. Durgin, director of Public Relations, Commonwealth Edison Company. 8:30 to 9:15, musical program by Hinshaw Conservatory of Music. 9:15, "Safety First" talk by Z. C. Elkin of Chicago Motor Club. 10:00 to 11:30, "At Home" program from studio.

KDKA, East Pittsburgh, 326—9:45 A. M., livestock markets; general market review and agricultural items. 11:55, Arlington time signals. 12:00 M., Weather, livestock and wholesale produce markets. 12:15 P. M., Scalzo's Orchestra. 6:30, concert by Saudek's KDKA Little Symphony Orchestra. 7:15, Uncle Ed visits Radio Children. 7:30, talk by a representative of the Automobile Club of Pittsburgh. 7:40, primary livestock and produce markets. 8:00, farmer program. 8:30, Saudek's Orchestra and Mrs. Emma Albert Dean, soprano; Marian Deuel McDade, accompanist. 9:55, time, weather. 11:00, concert.

WEEI, Boston, Mass., 303—1:00 P. M., assembly luncheon, Boston Chamber of Commerce. 7:00, Boston Edison Big Brother Club. 7:30 to 9:00, musicale. 9:00 to 12:00, program from New York studio, WEAF.

WBZ, Boston, Mass., 337—11:55 A. M., time, market report. 6:30 P. M., songs by Violet Gridley and Frank Bernier. 6:40, Reisman Hotel Brunswick Orchestra. 7:00, market reports. 7:10, letter from the New England Homestead; "At the Theatres," with A. L. S. Wood, dramatic editor. 7:30, bedtime story. 7:45, musical program by Hector St. James Theatre Orchestra. 8:15, program from Amber studio of Chickering & Sons' Piano Co. 9:30, soprano, Katherine A. White, accompanied by Mrs. Louis S. Cox. 9:55, time, weather. 10:00, music.

WWJ, Detroit, Mich., 517—8:00 A. M., setting-up exercises by R. J. Horton, physical director of the Detroit Y. M. C. A. 9:30, "Tonight's Dinner" and a special talk by the Woman's Editor. 9:45, Public Health Service bulletins. 10:25, weather. 11:55, time. 12:00 M., music. 3:00 P. M., Detroit News Orchestra. 3:50, weather. 3:55, market reports. 7:00, Detroit News Orchestra; Wendell Hall; Wronski Male Quartet. 10:00, dance by Goldkette's Victor Recording Orchestra.

Friday, October 17

WOR, Newark, N. J., 405—7:00 A. M., gym class. 2:30 P. M., Charles Kindelberger, tenor. 2:45, Lafferty's orchestra. 3:15, Charles Kindelberger. 3:30, "My Work," by Lillian Wald, founder of the Henry Street Settlement. 3:45, Elise Bartlett, actress, talk, "The Artist vs. the Woman." 6:15, Alexander Harris and his musical saw. 6:30, "Man in the Moon" stories. 7:00, Alexander Harris. 7:15, the day's sports with "Jolly Bill" Steinke.

WOC, Davenport, Ia., 484—10:00 A. M., opening market quotations. 10:05, household hints. 10:55, time signals. 11:00, weather and river forecast. 11:05, market quotations. 12:00 M., chimes concert. 12:15 P. H., weather forecast (repeated). 2:00, closing stocks and markets. 6:45, sport news and weather forecast. 7:00, Sandman's Visit, bedtime stories by Miss Val McLaughlin. 7:20, educational lecture. 8:00, music (1 hour).

WEBH, Chicago, Ill., 370—7:00 to 8:00 P. M., Edgewater Beach Oriole Orchestra, Agatha Karlen, reader; musical bits from Balaban and Katz Riviera Theatre, "Everyday Songs," Edgar A. Guest. 9:00 to 10:00, John Stamford, tenor; Lillian Moyer, soprano; Edgewater Beach Oriole Orchestra; Frederick Agard, tenor; Rita McFawn, soprano. 11:00 to 12:00, dance selections, Edgewater Beach Oriole Orchestra; Winter Garden Four, songs; Sandy Meek, songs.

WEAF, New York City, N. Y., 492—11:00 to 12:00 A. M., musical program; health talk; market and weather reports, 4:00 to 5:00 P. M., club program for women, with music. 6:00 to 10:00, dinner music from the Rose Room of the Hotel Waldorf-Astoria; stories for children by Blanche Elizabeth Wade, the G. R. Kinney Company story teller; Frank Leithner, jazz pianist; the Happiness Boys; Zona Maie Griswold, Lyric soprano; "Astor Coffee Orchestra."

KDKA, East Pittsburgh, Pa., 366—9:45 A. M., livestock markets, general market review and agricultural items. 11:55, time. 12:00 M., weather, livestock and wholesale produce markets. 12:15 P. M., concert by Daugherty's Orchestra. 12:30, "The International Sunday School Lesson," presented by James C. Mace from the Central Y. M. C. A., Pittsburgh. 6:30, organ, by Samuel Winters Elletson. 7:15, Daddy Winkum, the Radio Rhymster. 7:30, "Some Questions Before the Electorate on November 4," Dr. Louis K. Manley of the University of Pittsburgh. 7:40, livestock and produce markets. 8:00, "Home Lighting Effects," prepared by the Educational Lighting Committee. 8:15, "Six Recent Novels," F. D. Mayer, Instructor in the Department of English. 8:30, MacDowell Quartet, consisting of Caroline Bracey, soprano; Mrs. L. Wallace Ohl, contralto; Arthur Ray Davis, tenor; Clair Anderson, basso; Lyman Almy Perkins, accompanist and director; assisted by Pierre de Backer, violinist. 9:55, time, weather.

WEEI, Boston, Mass., 303—7:00 P. M., Boston Edison Big Brother Club. 7:30 to 9:00, music. 9:00 to 11:00, program from New York Studio WEAF. 11:00 to 12:00, dance music by Dok-Eisenbourg and his Sinfonians.

WBAP, Fort Worth, Tex., 476—7:30 to 8:30 P. M., concert by the John Tarleton Agricultural College, Stephenville, Tex. 9:30 to 10:45, concert. "The Hired Hand."

WBZ, Boston, Mass., 337—11:55 A. M., time, weather, market report. 6:00 P. M., concert by Westinghouse Philharmonic Trio. 7:00, market report. 7:10, current book review. 7:30, bedtime story. 9:55, time, weather. 10:00, program arranged by Joseph C. MacKenzie, baritone, presenting Madeline Dwyer, Eleanor Dwyer, violinist, and Margaret Dwyer, reader. 11:00, concert by Mrs. Charles Reid, pianist; Mrs. Edith Sackett, soprano, and the Westinghouse Philharmonic Trio. 11:30, dance by McEnelly's Singing Orchestra.

WWJ, Detroit, Mich., 517—8:00 A. M., setting-up exercises by R. J. Horton, physical director of the Detroit Y. M. C. A. 9:30, "Tonight's Dinner" and a special talk by the Woman's Editor. 9:45, Public Health Service bulletins. 10:25, weather. 11:55, time. 12:00 M., music. 3:00 P. M., Detroit News Orchestra. 3:50, weather. 3:55, markets. 7:00, Detroit News Orchestra; Wendell Hall.

KYW, Chicago, 536—6:35 A. M., exercises, the physical director of the Y. M. C. A.; also broadcast at 7:00 and 8:00. 9:30, news and comment of the financial and commercial markets. 11:35, table talk by Mrs. Anna J. Peterson of People's Gas Co. 12:30 P. M., "The Progress of the World," furnished by Review of Reviews. 6:00 to 6:30, news, financial and final markets; Dun's review and Bradstreet's weekly review of Chicago trade. 6:35 to 7:00, bedtime story by Walter Wilson, "Uncle Bob." 7:00 to 7:30, concert from Congress Hotel. 7:30 to 8:00, program from studio. 8:20 to 8:45, speeches under the auspices of the American Farm Bureau Federation; "A Few Intimate Stories of Successful 4-H Club Girls," by A. D. Folker, Montgomery Ward & Co.; "What Cattle Feeders Are Talking About," by D. C. Waterman of the editorial staff, Orange Judd Illinois Farmer. 9:30 P. M. to 12:30 A. M., midnight revue.

WHO, Des Moines, Ia., 526—7:30 to 9:00 P. M., music by Mrs. Kate Miller, Whistler; Mrs. Maude L. Hughes, accompanist; Williamson Bros., banjo, guitar and mandolin; also artists from the Des Moines Conservatory of Music.

KGO, Oakland, Cal., 312—1:30 P. M., N. Y. and S. F. stock reports and weather. 3:00, music and speaker. 4:00 to 5:30, Concert Orchestra of the Hotel St. Francis. 6:45, stock reports, weather, S. F. produce news, baseball scores and news. "Silent Night."

KPO, San Francisco, 423—Noon, time. 12:45 P. M., Scripture.; speeches. 1:00 to 2:00, Seiger's Orchestra. 4:30 to 5:30, Seiger's Orchestra.

WFAA, Dallas, Tex., 476—12:30 to 1:00 P. M., address, Robert Stewart Hyer, president emeritus of Southern Methodist University, on the Sunday School lesson. 8:30 to 9:30, music by Mrs. Juanita Blair Price, soprano, with assisting Dallas artists.

WDAF, Kansas City, Mo., 411—3:30, 4:00, 4:30, 5:00 and 6:00 P. M., baseball. 3:30 to 4:30, The Star's, radio trio. 5:50 to 6:00, marketgram, weather, time and road report. 6:00 to 7:00, "School of the Air."; piano tuning-in number; address, speaker from the Kansas City Children's Bureau; the Tell-Me-a-Story Lady; music, Fritz Hanlein's Trianon Ensemble, Hotel Muehlebach. 8:00 to 9:30, popular program by The Star's radio orchestra and the WDAF minstrels. 11:45 P. M. to 1:00 A. M., "Nighthawk Frolic," the "Merry Old Chief" and the Plantation Players, Hotel Muehlebach.

WHAS, Louisville, Ky., 400—4:00 to 5:00 P. M., Alamo Theatre Orchestra; Harry S. Currie, conductor; police bulletins; weather, humorous column, readings, news. 4:55, local livestock, produce and grain market reports. 5:00, time. 7:30 to 9:00, concert under the auspices of Miss Grace Deppe; four-minute Civil Service talk by O. A. Beekman; news, time at 9 o'clock.

WGY, Schenectady, N. Y., 380—7:45 P. M., "The Darktown National Convention," presented by the Georgia Minstrel Boys (repeated on request). 10:30, WGY Orchestra.

KFI, Los Angeles, 469—5:00 to 5:30 P. M., news. 5:30 to 6:00, news. 6:45 to 8:00, organ. 8:00 to 9:00, Herald program. 9:00 to 10:00, studio. 10:00 to 11:00, vocal concert. 11:00 to 12:00, Ambassador Hotel Cocoanut Grove Orchestra.

Saturday, October 18

KDKA, East Pittsburgh, 326—9:45 A. M., livestock markets; general market review and agricultural items. 11:55, time. 12:00 M., weather, livestock and wholesale produce markets. 1:30 P. M., concert by Daugherty's Orchestra. 3:00, Pitt-Johns Hopkins football game, from Baltimore, Md., and Carnegie Tech-Washington Jefferson game, from Washington, Pa. 6:30, concert by the Westinghouse Band, T. J. Vastine, conductor. 7:15, "Wimble, the Wanderer," and his story-cap. 7:30, sport review by James L. Long, Sport Editor. 7:45, uniform Sunday School lesson, by C. C. Johnson, teacher and editor of the "Christian Outlook." 8:00, feature. 8:30, concert by the Westinghouse Band. 9:55, time, weather.

WBZ, Boston, Mass., 337—11:55 A. M., time, weather. 6:30 P. M., Reisman Orchestra. 7:00, market report. 7:30, bedtime story. 7:40, hotel Kimball trio; Jan Geerts, violinist and director; Arnold Janser, 'cellist; Lloyd Stoneman, pianist. 8:30, music by the Women's Philharmonic and L. S. Horticultural Hall Food Fair, Boston. 9:00, program by Marjorie Messer, violinist; Dorothy Morgan, soprano; Ruth Morse, pianist and assisting 'cellist from the Hotel Brunswick studio, Boston. 9:55, time, weather. 10:00, music.

KYW, Chicago, 536—6:30 A. M., exercises; instructions given by the physical director of the Y. M. C. A.; broadcast also at 7:00 and 8:00. 9:30, news and comment of the financial and com-

mercial markets. 10:30, farm and home service. 11:35, table talk by Mrs. Anna I. Peterson of People's Gas Co. 6:02 to 6:18 **P. M.**, news, financial and final markets. 6:35 to 7:00, bedtime story told by Walter Wilson, "Uncle Bob." 7:00 to 7:30, concert from Congress Hotel. 7:00 to 7:10, Joska DeBabary's Orchestra. 8:00 to 8:58, Chicago Harmony Mandolin Orchestra; Jacob Schatz, conductor. 9:05, Youth's Companion, including short stories, articles and humorous sketches. 9:30 to 11:30, late show.

WWJ, Detroit, Mich., 517—8:00 **A. M.**, setting-up exercises by R. J. Horton, physical director of the Detroit Y. M. C. A. 9:30, "Tonight's Dinner" and a special talk by the Woman's Editor. 9:45, Public Health Service bulletins. 10:25, weather. 11:55, time. 12:00 **M.**, music. 3:00 **P. M.**, the Detroit News Orchestra. 3:50, weather. 3:55, market reports and football scores. 5:00, football scores. 7:00, Detroit News Orchestra, Wendell Hall.

WEEI, Boston, Mass., 303—Silent.

WEAF, New York City, N. Y., 492—1:45 **P. M.**, play by play description of West Point-Notre Dame football game direct from Polo Grounds, New York City, Graham McNamee announcing. 4:00 to 5:00, Bruno Brothers Orchestra. 6:00 to 12:00, dinner music from Rose Room of the Hotel Waldorf-Astoria; boys' stories; joint recital by Dorothy Hoyle, violinist; Jessica Kenyon, soprano, James Haput, tenor and Mme. Florence Wessell, pianist; Dettbarn and Howard, Hawaiian guitar players; Ruth Friedman, pianist; talk by Lieut. R. E. Day of the U. S. Blind Veterans of the World War; Vincent Lopez and his Orchestra from Hotel Pennsylvania.

WOR, Newark, N. J., 405—7:00 **A. M.**, gym class. 2:30 **P. M.**, recital by Bertha E. Wallach, soprano. 2:45, concert by the Crescendo Mandolin Club. 3:15, recital by Bertha E. Wallach, soprano. 3:30, one-half hour program by the Cremonesi Trio. 6:15, Cinderella Wolverines (music). 7:15, the day's sports with "Jolly Bill" Steinke. 8:00, program under the direction of Mabelanna Corby; Catherine Tist Jones, leader; Harriet Hubbard, soprano; Florence Dethridge, contralto; Mabelanna Corby, at the piano. 8:30, Stephen Haweis, marine painter, "An Artist Adrift in Fiji." 8:45, Prof. Harry Jerome of the University of Wisconsin, "The Economic Importance of Statistics in Business and Public Affairs." 9:00, concert by the David Margulies Trio. 9:30, Sam Hellman, author, humorous talk. 9:45, program under the direction of Mabelanna Corby; Catherine Tist Jones, leader; Harriet Hubbard, soprano; Florence Dethridge, contralto; Mabelanna Corby, at the piano. 10:15, one-half program by the Orchestra of the S.S. President Harding. 10:45, Perry and Russell, the two-man singing orchestra.

WDAF, Kansas City, Mo., 411—3:30, 4:00, 4:30, 5:00 and 6:00 **P. M.**, baseball scores. 3:30 to 4:30, The Star's radio orchestra. 5:50 to 6:00, marketgram, weather, time and road report. 6:00 to 7:00 (School of the Air), piano tuning-in number; address, thirteenth of a series of talks by speakers from the editorial staff of The Star; the Tell-Me-a-Story Lady; Hanlein's Trianon Ensemble. 11:45 **P. M.** to 1:00 **A. M.** (Nighthawk Frolic), the "Merry Old Chief" and the Plantation Players, Hotel Muehlebach; Eddie and Bobbie Kuhn's K. C. A. C. orchestra.

KGO, Oakland, Cal., 312—12:30 **P. M.**, stock reports and weather. 4:00 to 5:30, concert orchestra, Hotel St. Francis. 8:00, comedy, "You and I," with prologue and three acts, presented by the KGO Players; music by Arion Trio. 10:00 **P. M.** to 1:00 **A. M.**, dance by Halstead's orchestra and solists.

WHAS, Louisville, Ky., 400—4:00 to 5:00 **P. M.**, Alamo Theatre orchestra, police bulletins, weather, humorous column, readings, news. 4:55, livestock, produce and grain market reports. 5:00, time. 7:30 to 9:00, Louisville Railway Inspectors' quartette; Albert Doerer, Andrew Anderson, Samuel Merrifield, George Haley; news, time at 9 o'clock.

WGY, Schenectady, N. Y., 380—2:00 **P. M.**, football game between Princeton and Notre Dame, at Princeton. 8:30, Kenmore Hotel orchestra, Albany, N. Y.; popular songs; football results.

WFAA, Dallas, Texas, 476—12:30 to 1:00 **P. M.**, address, Hugo Swan, manager Better Business League, Dallas. 8:30 to 9:30, Ralph's Red Hot Ramblers in orchestra recital of popular music. 11:00 to 12:00, Adolphus Hotel orchestra.

KFI, Los Angeles, 469—5:00 to 5:30 **P. M.**, news. 5:30 to 6:00, news. 6:45 to 8:00, dance orchestra. 8:00 to 9:00, Tilda Rohr recital. 9:00 to 10:00, program from studio. 10:00 to 11:00, Packard Radio Club. 11:00 to 12:00, Ambassador Hotel Cocoanut Grove orchestra.

KPO, San Francisco, 423—**Noon**, time, Scripture. 1:00 to 2:00 **P. M.**, Seiger's orchestra. 3:30 to 5:30, tea dansant, Bradfield's band. 8:00 to 12:00, Weidner's dance orchestra.

WBAP, Fort Worth, Texas, 476—Silent.

CNRO, Ottawa, Can., 435—8:00 **P. M.**, concert by Regimental Band of the Governor-General's Foot Guards: "Carillon," "Bohemian Girl," "Flowers and Smiles," "Little Nellie Kelly," "The Glow Worm," "Minuet," "Anvil Chorus," "Carmen," "Gloria"; H. H. Clarke, bass. Part II —Chateau Laurier orchestra, dance.

Sunday, October 19

WHAS, Louisville, Ky., 400m—9:57 **A. M.**, Service, Broadway Christian Church. Mrs. Harry W. Long, organist and choir director. 4-5 **P. M.**, Vesper song service, First Unitarian Church, Reginald Billin, organist.

KGO, Oakland, Cal., 312m—11 **A. M.**, Church service. 3:30 **P. M.**, Symphony Orchestra, Carl Rhodehamel conducting. 7:30. Church service.

KYW, Chicago, Ill., 566—11:00 **A. M.**, Central Church service; music. 2:30 **P. M.**, studio chapel

NELLIE REVELL, noted in theatrical circles, and whose long and plucky fight on an invalid's bed has been rewarded by her recovery, takes to the microphone to tell the world how happy she is, and incidentally just mention her new book, which she carries under her arm. Miss Revell is known to the theatrical profession all over the United States and now is gaining added fame as a newspaper feature writer.

service by Chicago Church Federation. 7:00, Chicago Sunday Evening Club service; special musical program under Edgar Nelson; the speaker of the evening will be announced by radiophone.

WWJ, Detroit, Mich., 517—7:30 **P. M.**, services at St. Paul's Episcopal Cathedral, from the cathedral. 5:00, Detroit News orchestra.

WEEI, Boston, Mass., 303—7:20 to 10:00 **P. M.**, music direct from the Mark Strand Theatre, New York City.

WDAF, Kansas City, Mo., 411—4:00 to 5:00 **P. M.**, classical and semi-classical musical recital broadcast from The Star's studio.

Monday, October 20

WHAS, Louisville, Ky., 400m—4-5 **P. M.**, Alamo Theatre Orchestra, Police bulletins, Weather. 4:55, Livestock, produce and grain reports. 5, Time, silent on Monday nights.

KPO, San Francisco, 423m—11:45 **A. M.**, Poultry report. noon, Time, Reading scripture. 1-2 **P. M.**, Seiger's Orchestra. 4:30-5:30, Seiger's Orchestra. 5:30-6:30, Children's hour. 7-7:30, Seiger's Orchestra. 8-9, Organ, Organist. 9-10, Soprano solos—Millicent Benioff, Piano solos—Alice McClelland. Program under the management of Mme. Caieau. 10-11, E. Ma Bradfield's Versatile Band, playing in the Palace Rose Room Bowl.

KGO, Oakland, Cal., 312m—1:30 **P. M.**,—N. Y. and S. F. stock reports and weather. 3:00, Studio music, Parent-Teacher Association speaker. 4-5:30, Henry Halstead's Dance Orchestra, Aunt Betty stories and KGO Kiddies' Club. 6:45, Final reading, stock reports, weather, S. F. produce, baseball scores, news. 8, Courses in Agriculture, Music, Economics, and Literature; Arion Trio. 10-1 **A. M.**, Dance by Halstead's Orchestra.

WDAF, Kansas City, Mo., 411—3:30 to 4:30 **P. M.**, The Star's radio trio. 5:00 to 5:30, weekly Boy Scout program, presented by Kansas City Council of Boy Scouts. 5:50 to 6:00, marketgram, weather, time and road report. 6:00 to 7:00 (School of the Air), piano tuning-in number; address, personal message from Roger W. Babson, statistical expert and "doctor of business"; the Tell-Me-a-Story Lady; Hanlein-Knutson Trianon Ensemble, Hotel Muehlebach. 8:00 to 10:00, popular program by the WDAF minstrels and The Star's radio orchestra. 11:45 **P. M.** to 1:00 **A. M.** (Nighthawk Frolic), the "Merry Old Chief" and the Plantation Players, Hotel Muehlebach.

Tuesday, October 21

WMC, Memphis, Tenn., 500m—12:30 **P. M.**, Skyline Serenaders. 8:30. Program arranged by Geo. W. Hughes, Bluff City Quartet. 11, Harry O. Nichols, organ.

WHAS, Louisville, Ky., 400m—4-5 **P. M.**, Alamo Theatre Orchestra, Weather. 4:55, Livestock, produce and grain market, time. 7:30-9, Concert by Carl Zoeller's Melodists.

KPO, San Francisco, 423m—11:45 **A. M.**, Poultry report. Noon, Time. 1-2 **P. M.**, Seiger's Orchestra. 4:30-5:30, Seiger's Orchestra. 5:30-6:30, Children's hour. 7-7:50 Seiger's Orchestra. 8-10, Program of Mrs. Bruner. 10-11, Bradfield's Band.

KGO, Oakland, Cal., 312m—1:30 **P. M.**, N.Y. and S. F. stock reports and weather. 4:00-5:30, Concert Orchestra. 6:45, Final reading, stock reports, weather, S. F. produce news. baseball scores, news. 8:00, Part One: "A Night In Naples." given under the direction of Professor Laurie A. de Graca. "Naples, Pompeii and Rome." by J. E. Barnes. Employees General Electric Company. 10:00-1:00 **A. M.**, Dance by Halstead's Orchestra.

WDAF, Kansas City, Mo., 411—3:30 to 4:30 **P. M.**, The Star's radio trio. 5:00 to 5:30, third twice-monthly child program by the second division of the Missouri Federated Music Clubs. 5:50 to 6:00, marketgram, weather, time. 6:00 to 7:00 (School of the Air), piano tuning-in number; the Tell-Me-a-Story Lady; the Hanlein-Knutson Trianon Ensemble, Hotel Muehlebach. 11:45 **P. M.** to 1:00 **A. M.** (Nighthawk Frolic), the "Merry Old Chief" and the Plantation Players, Hotel Muehlebach.

Wednesday, October 22

WMC, Memphis, Tenn., 500m—12:30 **P. M.**, concert from Shrine Roof. Silent night.

WHAS, Louisville, Ky., 400m—4-5 **P. M.**, Alamo Theatre Orchestra, Police bulletins, Weather, humor, news. 4:55, Livestock produce and grain market. 5, Time. 7:30-9, Concert by the K. & I. Terminal Railroad Orchestra, news, time, at 9 **P. M.**

KPO, San Francisco, 423m—11:45 **A. M.**, Poultry report. Noon, Time. 1-2, **P. M.**, Seiger's Orchestra. 4:30-5:30, Seiger's Orchestra. 5:30-6:30, Children's hour. 7-7:30, Seiger's Orchestra. 8-11, Bradfield's Band, Lesson in conversational French, Edna K. Barker, Marie L. Boutin, Soprano solos—Eleanore Stadtegger, Mrs. Clyde White, accompanist. Banjo duets by Frank Moore and Charles Payne.

KGO, Oakland, Cal., 312m—1:30 **P. M.**, N. Y. and S. F. stock reports and weather. 3, Music, Williams Institute speaker. 4-5:30, Concert Orchestra, Hotel St. Francis. 6:45, Stock reports, weather, S. F. produce, baseball scores, news. Silent night.

CNRM, Montreal, Can., 341m—8 **P. M.**, Vocal; recitation; talks on forests; instrumental trio.

WDAF, Kansas City, Mo., 411—3:30 to 4:30 **P. M.**, The Star's radio trio. 5:50 to 6:00, marketgram, weather, time and road report. 6:00 to 7:00 (School of the Air), piano tuning-in number; address, speaker under the auspices of the Health Conservation Association; address, speaker from the Meat Council of Greater Kansas City; the Tell-Me-a-Story Lady; Hanlein-Knutson Trianon Ensemble, Hotel Muehlebach. 8:00 to 9:15, string instrument pupils of Anton Seufert. 11:45 **P. M.** to 1:00 **A. M.** (Nighthawk Frolic), the "Merry Old Chief" and the Plantation Players, Hotel Muehlebach; Eddie and Bobbie Kuhn's K. C. A. C. orchestra.

Thursday, October 23

WMC, Memphis, Tenn., 500m—12:30 **P. M.**, Program from Shrine Roof. 8:30, Program by Mrs. Louise Bowen.

WHAS, Louisville, Ky., 400m—4-5 **P. M.**, Alamo Theatre Orchestra, Police bulletins, Weather, humor, Readings. 4:55, Livestock, produce and grain market. 5, Time. 7:30-9, Concert. Helen I. Mitchell; International Sunday-school lesson, by Dr. Harris Mallinchrodt, welfare talk, news, time 9 o'clock **P. M.**

KPO, San Francisco, 423m—11:45 **A. M.**, Poultry report. Noon, Time. 1-2 **P. M.**, Seiger's Orchestra. 4:30-5:30, Seiger's Orchestra. 5:30-6:30, Children's hour. 7-7:30, Seiger's Orchestra. 8-9, Organ by Theodore J. Irwin. 9-10, Music and readings. 10-11, Bradfield's Band.

KGO, Oakland, Cal., 312m—1:30 **P. M.**, N. Y. and S. F. stock reports and weather. 4:00-5:30, Concert Orchestra, Hotel St. Francis. 6:45, stock reports, weather, S. F. produce news, baseball scores. 8, Piano duets, Grace Hendricks and Mabel Jones; Judith Reusch Scott, soprano; Erwin W. Wentz, 'cellist; travel talk, "Italy, Switzerland, and the Battlefields," by J. E. Barnes. The Orley See Violin Ensemble, assisted by Wandszetta Biers, soprano. 100-1:00 **A. M.**, Dance. by Halstead's Orchestra.

WDAF, Kansas City, Mo., 411—3:30 to 4:30 **P. M.**, The Star's radio trio. 5:50 to 6:00, marketgram, weather, time and road report. 6:00 (School of the Air); Hanlein-Knutson Trianon Ensemble, Hotel Muehlebach. 11:45 **P. M.** to 1:00 **A. M.** (Nighthawk Frolic), the "Merry Old Chief" and the Plantation Players, Hotel Muehlebach; Eddie and Bobbie Kuhn's K. C. A. C. orchestra.

CNRM, Montreal, Can., 341—8:00 **P. M.**, intrumental trio; soprano solo, Frances James; recitation, Mildred Page; cello solo, P. Vander Haeghe; address by Elwood Wilson, manager, Forestry Division, Laurentide Co., Ld. Grand Mere, Quebec. "Forests as a Basis of National Development"; violin solo, A. Vander Haeghe; Queenie Gibson, accompanist.

Friday, October 24

WMC, Memphis, Tenn., 500m—12:30 **P. M.**, Concert from Shrine Roof. 8:30, Program by Britling's Cafeteria Orchestra. 11, Midnight Frolic.

WHAS, Louisville, Ky., 400m—4-5 **P. M.** Alamo Theatre Orchestra, Police bulletins, Weather, humor, news. 4:55, Livestock, produce and grain market. 5, Time. 7:30-9, Concert of Mrs. Jane Webster Murrell, news, time at 9 o'clock.

KPO, San Francisco, 423m—11:45 **A. M.**, Poultry reports. Noon, Time, Scripture. 12:45 **P. M.**, Talk. 1-2, Seiger's Orchestra. 4:30-5:30 Seiger's Orchestra.

KGO, Oakland, 312m—1:30 **P. M.**, N. Y. and S. F. stock reports and weather. 3, Studio musical program and speaker. 4-5:30, Concert Orchestra of Hotel St. Francis. 6:45, Stock reports, weather, S. F. produce news, baseball scores, news. Silent night.

WDAF, Kansas City, Mo., 411—3:30 to 4:30 **P. M.**, The Star's radio trio. 5:50 to 6:00, marketgram, weather, time and road report. 6:00 (School of the Air); the Tell-Me-a-Story Lady; Hanlein-Knutson Trianon Ensemble, Hotel Muehlebach. 8:00 to 9:30, popular program by The Star's radio orchestra and the WDAF minstrels. 11:45 **P. M.** to 1:00 **A. M.** (Nighthawk Frolic), the "Merry Old Chief" and the Plantation Players, Hotel Muehlebach.

RADIO WORLD
Title Reg. U. S. Pat. Off.

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PUBLISHED EVERY WEDNESDAY
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FROM PUBLICATION OFFICE
HENNESSY RADIO PUBLICATIONS CORPORATION
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M. B. HENNESSY, Vice-President
FRED S. CLARK, Secretary and Manager
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EDITOR, Roland Burke Hennessy
MANAGING EDITOR, Herman Bernard

SUBSCRIPTION RATES

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Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order, is automatic acknowledgment of their subscription order. Changes of address should be received at this office two weeks before date of publication. Always give old address also. State whether subscription is new or a renewal.

ADVERTISING RATES

RATES—Page, 7¼x11", $200.00; half page, 3¼ D. C. or 5⅛x8" col., $100.00; quarter page, 4⅛ D. C., $50.00; one col., 2¼x11", $66.66. $7.00 per inch. Per agate line, 50c. Times Discounts: 52 Consecutive Issues, 20%; 26 Times Consecutively, or R. O. W. One Year, 15%; 4 Consecutive Issues, 10%.

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Entered as second-class matter, March 28, 1922, at the Post Office at New York, N. Y., under the act of March 3, 1879.

OCTOBER 18, 1924

The Blunder at WNYC

THE maintenance and operation of a broadcasting station is well within the province of municipal functions and it is to be hoped that many cities will have their publicly-owned stations, but an unfortunate blow has been dealt to these happy prospects by the broadcasting of partisan political propaganda from WNYC, New York City's municipal station. Mayor Hylan, himself, has been the chief offender, for he used this station, which is under his control, though supported exclusively by public funds, to answer charges contained in the New York State Republican platform. Not satisfied, he returned unbidden to attack officials and others who dissent from his traction policy. When Major-General John F. O'Ryan, Transit Commissioner, a Democrat, and one of those attacked, subsequently sought the privilege of speaking before the WYNC microphone, the Mayor's Commissioner in charge of the station demanded a copy of the proposed speech, for admitted purposes of censorship. The use of public funds in this way is equivalent to making the public as such pay in taxes a part of the expenses of a political campaign.

Certainly such tactics as Mayor Hylan performs in this instance will be cited by opponents of municipal ownership of stations as an example of what inevitably follows. The Mayor's temptation proved too much. Maybe, by a boomerang effect, the course will prove injurious.

Index to Vol. V, Radio World

(Issues of March 25 to September 27, 1924, comprising Vol. 5; also indexed are issues January 5 to September 20)

(Concluded on next page)

*Out of print.

$20 a Minute Charged for Broadcast Ads

THE charge levied by New York broadcasting stations for "indirect advertising" over the air varies, depending upon the amount of entertainment listeners derive from the broadcast. The general charge for a ten-minute talk is $200 or $20 a minute. An orchestra playing for an hour is charged about $400, and not at the rate of $200 for ten minutes, because of the entertainment furnished.

KFDM, Beaumont, Tex., Goes on the Air

KFDM, the Magnolia Petroleum Company's Radio Station, at Beaumont, Texas, broadcast its first program recently. Station KFDM was inaugurated in response to the hearty demand.

REALISM

"Did you get the song recital in Paris last night, Mr. Frisco?"
"Magnificently! The coughing in the audience annoyed me as much as if I were present."

Valuable Service Articles

(*Concluded from preceding page*)

comb Coils, 3 Condensers, by Herman Bernard, July 26.
1-Tube Set That Works Without Any B Battery and Uses a Standard Tube, by Chester Charlton, Aug. 2.
Experiments With 1-Dial Sets, by Herman Bernard, Aug. 9.
An All-Around Portable for Home or Outdoor Use, by Herbert E. Hayden, Aug. 16.
A 1-Tube Super-Regenerative Set, by Byrt C. Caldwell, May 10.
A Single-Dial 1-Tube Set, by Neal Fitzalan, Aug. 9.
Distance Reception on a Loud Speaker Without an Aerial, by Laurence Blackhurst, Jan. 5.
A 2-Tube DX Set, 3 Controls, Using Regenerative RF, by Chas. H. M. White, June 28.
Good DX-Getter of the Reinartz Type, by Leroy Western, Feb. 2.
A Highly Selective 1-Tube Filter Circuit Set, by A. P. Peck, May 17.
A Selective Regenerative Set Which Controls Oscillation, 1 Tube, by Herman Bernard, June 28.
Low-Loss 1-Dial Set That Gets DX, Total Cost, Including Everything, $21.80, by Herman Bernard, Aug. 23.
Double-Range 3-Circuit Tuner, by Brainard Foote, June 12.
A 1-Tube Set That You Can Log; 2 Variable Condensers and Honeycomb Coils; Total Cost $25, Including Everything, by Herman Bernard, July 12.

Short Wave

A Short-Wave Adapter for Receivers, by J. E. Anderson, May 10.

Superdyne

The Application of the Superdyne Principle, by C. Bucher, March 8.
The Superdyne Principle in a 3-Tube Set; 2 Stages of Radio, 2 Stages of AF and Crystal Detector, by Lester Hutter, Aug. 16.
A Low-Loss Superdyne, 5 Tubes, Including 3 Stages of Resistance AF, by N. N. Bernstein, Aug. 23 and 30.
The Sensitive Double Superdyne, 4 Tubes, by Fennimore Feene, June 14.
Making the Superdyne Work Right, by Brewster Lee, July 5.
The Superdyne, 4 Tubes, by N. N. Bernstein, May 17, 24 and 31.*

Super-Heterodyne

An Improved Super-Heterodyne, Costing About $150 Complete—4-Part Article, by J. E. Anderson, May 31, June 7, 14 and 21.
A 4-Tube Reflex Super-Heterodyne, Using the Crystal as the Second Detector, by Chas. H. M. White, July 26.
A Portable Super-Heterodyne, 8 Tubes, by A. P. Peck, Aug. 2.
The New Super-Heterodyne, the First Published Analysis of the 6-Tube Regenoflex; Circuit Diagram and Photographs Revealing the Secrets of This R. C. A. Set, by Walter Scott, Jr., Sept. 6.
Super-Autodyne, a 5-Tube DX-Getter, by Chas. H. M. White, April 5.
The Principle of the Super-Heterodyne Fully Explained, by Walt S. Thompson, Jr., May 3.
Lacault's Ultradyne, by Byrt C. Caldwell, Aug. 30 and Sept. 6.

Three-Circuit Tuner

A Low-Loss 3-Circuit Tuner, 1 Tube, by Neal Fitzalan, Sept. 13.
Adding 500 Miles, Total Cost $00.00; How to Use Any Coupler for 3-Circuit Tuner, 1 Tube, by Herman Bernard, Aug 2.
3-Circuit Tuner and a Stage of RF, 2 Tubes, by Herman Bernard, July 26.
A Double-Range Set, by Brainard Foote, June 21.

Transformers

Low-Loss RFT, which see.
Making a Fixed RFT.
"Miscellaneous, Const.," which see.
What Happens in the Transformer, March 22.*

Tubes

How to Solve Your Tube Problems. "Vacuum Tubes," which see.

Vacuum Tubes

How to Solve Your Tube Problems—What A and B Battery Voltage to Use; Which Tubes Are Best for Detectors and Amplifiers; What Size C Battery to Use, by P. E. Edelman, June 7.
Characteristics of Vacuum Tubes, by Walt S. Thompson, Jr., Feb. 9.
Protection Against Blowouts, by Chas. H. M. White, March 15.*

Wavemeter

See "Miscellaneous, Constructional."

Wave Trap

See "Miscellaneous, Constructional."

Miscellaneous, Constructional

How to Make a Fixed RF Transformer, by A. F. Laplerre, Sept. 20.
A Handsome Home-Made Radio Cabinet, by E. E. Gibboney, Feb. 2.
Setting the Stage for Circuit Tryouts, by Brainard Foote, May 10.
Making a Low-Loss Coil, by Neal Fitzalan, Sept. 6.
How to Make a Current Supply Unit to Light Your Amplifier Tubes on AC, by Brainard Foote, Aug. 16.
Construction of A Battery Charger, by Walt S. Thompson. In Two Parts, March 29 and April 5.
Making Your Own Variable Grid Leak, by Brainard Foote, May 17.
Simple Coil That Makes Any Set Tune Sharply and Adds to DX; Total Cost Not More Than $1.50, by N. N. Bernstein, Aug. 2.
One Hand Tunes 2 Dials at Same Time, by Philip E. Edelman, April 19.
Reducing Losses Due to Insulation; How to Make Your Present Coils and Condensers Low-Loss, by Dennis J. O'Flaherty, July 5.
How to Make a Telephone Relay for Tubeless AF, by A. F. Lapierre, Sept. 27.
A Layout for Testing Hook-Ups, by Herman Bernard, Sept. 20.
An Easy Way to Make Your Own Wavemeter, by Brainard Foote, Aug. 30.
Inductively-Coupled Wave Traps for Eliminating Interference, by Leroy Western, Jan. 26.
An Easily Made Semi-Power Loud Speaker, by Byrt C. Caldwell, Jan. 26.
Bank Winding, by Leroy Western, April 5.
How to Make a CW or Radiophone Transformer, by Leroy Western, Feb. 16.
Making a Variable Grid Condenser, by Brainard Foote, May 17.*

Miscellaneous, Non-Constructional

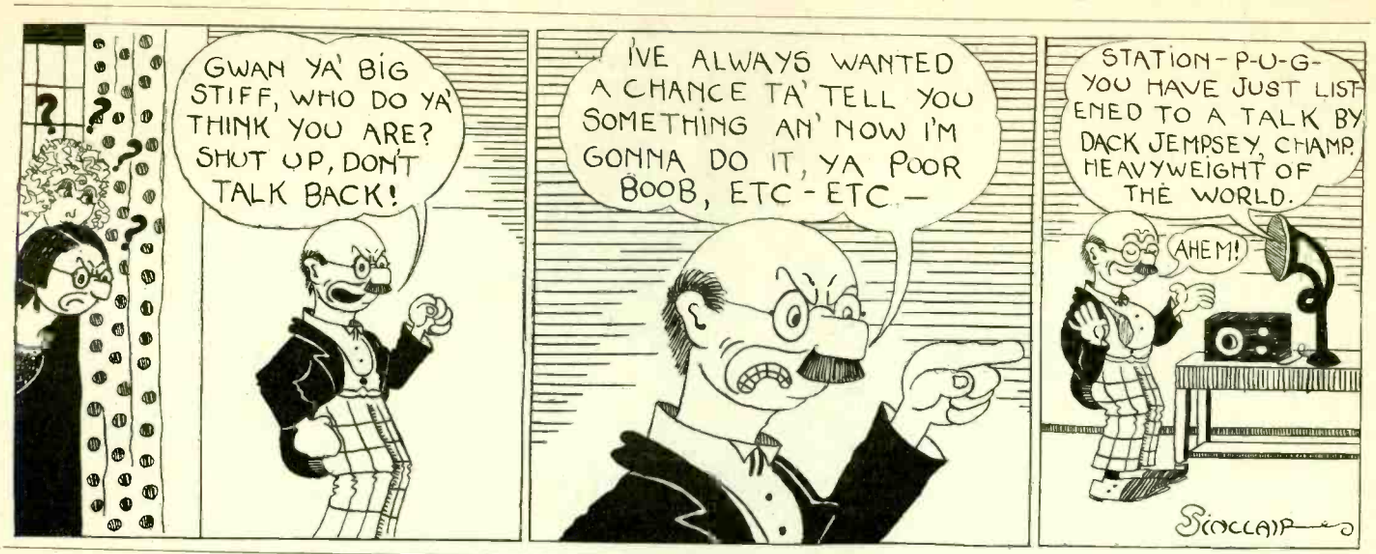
Why Radio Signals Fade, by Roger H. Bryant, Jan. 5.
The Best Set for Your Location, by N. N. Bernstein, Sept. 27.
Why You Should Favor Inductance Against Capacity, by N. N. Bernstein, July 12.
The Use and Care of the Storage Battery, With Table of How Often You Should Recharge, by N. N. Bernstein, Sept. 6.
How to Care for Your Storage Battery, by Leonard West, April 12.
Why Some Receiving Tuners Are Not Selective, by John V. L. Hogan, Jan. 19.
Tools and How You Should Use Them, by A. F. Lapierre, Sept. 6.
How to Calibrate Your Set for All Broadcast Waves, by Brainard Foote, Feb. 2.
How the C Battery Works, by Brainard Foote, March 29.
How to Install Charger and Batteries in Cabinet With Set on Top, by Brewster Lee, Aug. 16.
Silencing the Parasite Noises in Your Set, by Chas. H. M. White, July 5.
The Journey of a Broadcast Signal, by Neal Fitzalan, July 5.

*Out of print.

MR. D. X. HOUND

A Character Created by RADIO WORLD *Artist*

By HAL SINCLAIR



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.

Service Editor,
Radio World,
1493 Broadway, New York City.
I desire to receive radio literature.

Name .....

City or town .....

State .....

Henry Burns, India Wharf, E. E. E. L., Inc., Boston, Mass.

H. A. Aldrich, 276 Sheldrake Bldg., Toronto, Can.

Raymond Wagner, 707 E. 5th St., Erie, Pa.

Clarence N. Voss, 2001 N. 15th St., St. Louis, Mo.

Frank Weeks, Northport, N. Y.

J. Goldstein, 3215 Monument Ave., Philadelphia.

Walter H. Andreson. 45 New St., East Orange, N. J.

Geo. R. Beyer, 1228 4th Ave., Astoria, N. Y.

Isidor Goldberg, 179 Heyward St., Brooklyn, N. Y.

F. W. Broege, 314 Union Ave., Mt. Vernon, N. Y.

R. J. Aitken, 4137 20th St., San Francisco.

C. R. Jenks, Stillwater, Minn.

Wm. J. Shartle, 448 New St., Lebanon, Pa.

H. A. Sparks, 156 Day Ave., Toronto, Can.

Merle Medhurst, Abingdon, Ill. (Dealer)

Stuart J. Myers, 415 Woodland Ave., Grove City, Pa.

A. M. Howard, Jersey City, N. J.

J. Chernow, 102 E. 96 St., Brooklyn, N. Y.

J. E. Bender, 3716 Wobernon Ave., Cleveland.

Floyd F. Umbarger, 3743 Auburn Dr., E. San Diego, Cal.

Earl De Vaughn, 505 Lincoln Way, Ames, Ia.

A. Kobrin, 179 Ferry st., Newark, N. J.

Jack Stotesbury, 6 Rockcliffe Way, Ottawa, Can.

Otto Roganetsky, 110 Delancey St., N. Y. C.

Clark Thomson, Clackamas, Ore.

F. S. Andreu, Bailenstr. 190, Barcelona, Spain.

Walter M. Trego (repairs), Sherrard, Ill.

Jerome W. Knight, 23 Mt. Vernon St., Somerville, Mass.

Frank Milanowski, 2512 N. Ashland Ave., Chicago.

G. W. Strominger, 218 Dorland St., San Francisco.

W. S. Curdy, 102 W. 80th St., N. Y. C.

A. G. Dooley, Bloomfield, Iowa.

Clifford Osborn, 1144 Seymour Ave., Utica, N. Y.

S. B. Folkman, 12977 Cedar Rd., Cleveland.

F. H. Maybury, 623 Poydras St., New Orleans.

Jas. F. McEvoy, 37 4th St., New Brighton, N. Y.

Walter W. Meyer, 117 Du Bois Ave., West New Brighton, N. Y.

Michael D. Murphy, 134 Tremont St., Melrose, Mass.

Emmett Coulter, 812 Aten Ave., Wellsville, O.

F. H. Ameel, 135 North Ave., Mt. Clemens, Mich.

Flynn's Shop, Ft. Dodge, Ia. (dealer).

Earl Snay, Wellsville, O.

The Radio Trade

New Corporations

Amber Sales Corp., N. Y. C., $5,000; M. Kelly, E. Bensamon, I. F. Bergen. (Attorneys, Engel Brothers, 154 Nassau St.)

Gross-Brennan, N. Y. C., sales agents, $10,000; B. Gross, H. A. & D. L. Brennan. (Attorney, V. F. Lanza, 32 Court St., Brooklyn, N. Y.)

King Quality Products, Buffalo, N. Y., 100 shares common stock, no par value; W. G. King, H. G. Haugh and R. C. Brouck. (Attorneys, Kellogg, Babcock and Sullivan.)

Tompkins Electric Corp., Brooklyn, N. Y., $5,000; S. C. Binder, B. Wirth, E. Afsensky. (Attorney, N. H. Kramer, 51 Chambers St., N. Y. C.)

CAPITAL INCREASE

DeForest Radio Tel. & Tel. Co. to DeForest Company, Jersey City, N. J., $2,500,000 to $25,000,000.

Radiofold News, N. Y. C., $10,000 to $25,000.

Trade Review

Federal Air Condenser

THE Federal variable air condenser, manufactured by the Federal Telephone & Telegraph Co., Buffalo, N. Y., is a firmly made and highly efficient product. The dielectric is maintained evenly between any two plates, the alignment being kept by virtue of the 3-point suspension of the end plates and the firm locking of the rotor plates by a brass jam nut. The minimum capacity of the 11-plate and 21-plate models does not exceed 10 micro-microfarads, while that of the 43-plate model is less than 15.

(Tested and approved by RADIO WORLD)

Eveready B Battery

THE new Eveready heavy-duty B battery, No. 770, is designed for specially efficient service and long life. It is made by the National Carbon Co., whose factory in the East is at 200 Orton Street, Long Island City, N. Y. The batteries are provided with Fahnestock clips, making connections easier, yet amply secure. These batteries may be used in any set requiring a B battery. They are especially good where heavy B battery current is used, when the B batteries are connected in series. The batteries are of larger size than the usual run.

(Tested and approved by RADIO WORLD)

Acme RF Transformer

THE fixed or so-called untuned radio-frequency transformers made by the Acme Apparatus Co., Cambridge, Mass., judging by the stock sample tested by RADIO WORLD, are exceptionally efficient, getting about all that it is possible to obtain out of RF when the fixed type of transformer is used. The binding posts are plainly marked for connections, and they are arranged in alignment on an oblong shaped housing. The wire used in the windings is of excellent, durable quality. RF transformers simplify the addition of a stage of RF to any circuit, since no extra control is needed, the transformer amplifying over the entire broadcast band, while the tuning for the desired station is left to the usual tuning controls.

(Tested and approved by RADIO WORLD)

Coming Events

OCT. 18-25—Radio Show, Philadelphia.

OCT. 20-27—Radio Show, Montreal, Can.

NOV. 3-8—Third Annual National Radio Exposition, Grand Central Palace, New York City, under auspices of American Radio Exposition Co., 522 Fifth Ave., N. Y. C. Annual National Radio Convention in conjunction with show.

NOV. 11-14—Wisconsin Radio Exposition, Milwaukee.

NOV. 18-23—Chicago Radio Fair.

NOV. 24 TO 30, INCLUSIVE—International Radio Week.

DEC. 1-7—Newark Radio Fair.

DEC. 1 TO 8, INCLUSIVE—Boston Radio Exposition, Mechanics Building, Boston.

Business Opportunities Radio and Electrical

Rates: 40c a line; Minimum, 3 lines.

LIVE ENERGETIC MAN REQUIRED TO join New York incorporated branch well established responsible foreign firm enjoying sole distribution rights for European radio tube; splendid proposition good executive with sales experience preferred; must be able to invest $5,000-$10,000. Write James, care Reliance Shipping Service, 11 Moore St., N. Y. City.

MR. SMALL MANUFACTURER. Are you handicapped for want of immediate sales distribution, also some financing? Big, successful sales executive is open for right connection. The article or product must be legitimate, have merit, repeat possibilities. Full information wanted or no attention given. XX. Radio World.

RADIO BUSINESS, LONG ESTABLISHED, 10,819 Liberty Av., Brooklyn, N. Y.

HAVE INVENTED USEFUL RADIO TOOL kit, retail 25c; has 100 purposes for sets, more for shops and around houses; manufacturer; make terms. John Verhoeven, care Radio World.

R. C. A. Demand for Enormous Power Station Meets Rebuff

R. C. A. Presents Its Plan at Hoover's Conference, but Smaller Stations and Publishers Voice Opposition—Sarnoff Tries to Pacify Objectors but Fails.

WASHINGTON.

OPPOSITION was expressed at the annual radio conference when an announcement was made that the Radio Corporation of America purposed to establish a superpower broadcasting station near New York City as the experimental forerunner of a nation-wide major system. The announcement was made by David Sarnoff, Vice-President and General Manager of the corporation, in an address.

Mr. Sarnoff declared that the proposed station might have a power rating of as much as 50 kilowatts, if no regulatory proposals are adopted that would limit it.

The opposition to the Radio Corporations' plan was expressed by C. E. Erbstein, operator of a station at Elgin, Ill., and Walter A. Strong, representing the American Newspaper Publishers' Association.

Fears Effect on Smaller Operators

The erection of super-power systems by radio concerns, Mr. Erbstein charged at a meeting of a committee named to consider the problem of power limitation, was in the interest of the concerns themselves rather than of the public. The construction of such stations, he asserted, would force smaller operators to increase the power of their equipment.

The plan was opposed by Mr. Strong, because, he declared, no proof has been advanced that the present power of stations cannot be utilized to reach the distances designed as the range of the proposed super-power units. He maintained that the development of the present equipment to its fullest capacity should be carried out first.

Apprehensions that a super-broadcasting system would interfere with the effectiveness of local stations were dismissed by Mr. Sarnoff with the comment that national highways never obviated the need for local roads.

"When the range and usefulness of this station have been proved experimentally," he said, speaking of the station to be placed near New York City, "the Radio Corporation of America would begin the construction of another super-power station at some point where the limit of reliable effectiveness had been reached by the initial station. Thereafter, in close technical and practical cooperation with its associates, the system would be extended to cover every nook and corner of the United States.

"Our plans are to add vastly to the facilities which now exist in order that any organized broadcast program yet to be organized might reach ultimately to every home in the United States, and even make our voice heard in countries beyond the seas. To those who observed the trend of the art, it seemed apparent, even in the early stages of broadcasting, that power was the driving force of radio development.

Would Connect With Local Stations

"Not only is it proposed eventually to interconnect this great group of super-broadcasting stations, but inter-connection would also be made with local stations in various parts of the country.

"The Radio Corporation of America has every interest to encourage the maintenance of the local stations. The local broadcasting stations operated by the corporation and its associates stretch from coast to coast and represent the investment of many hundreds of thousands of dollars. In embarking upon super-power broadcasting development we are only following the progress already made in radio reception, and purpose to increase rather than diminish the value and usefulness of the receivers in the homes."

In opening the conference, Secretary Hoover announced the membership of seven committees. From these committees a co-ordinating committee of seven will be named. Later the committees will present reports on the subjects assigned to them, namely: Allocation of frequency wave length bands; allocation for frequencies for wave lengths to broadcasting stations; general problems of radio broadcasting; problems of marine communication; amateur problems; interference problems; interconnection. The committees are made up of the most eminent men in the professional and amateur radio world.

Besides Mr. Sarnoff, other speakers were George K. Burgess, Director of the Bureau of Standards; W. D. Terrell, Chief Radio Supervisor; C. P. Edwards, Chief of the Canadian Radio Service, and C. W. Hough of the Wired Radio Corporation, which has a service on Staten Island.

When a B Battery Discharges

SOME radio fans have the idea that B batteries are used up whether or not the set is in use. This is not so, and examination of any radio diagram will show you at once that there cannot possibly be any battery consumption when the tubes are turned off. It is not necessary to have a switch in the B battery circuit. With good B batteries and ordinary use of the set, it is possible to sometimes go six months or even a year without having to buy new batteries. The larger sizes are more economical in the long run. Also, a C battery in the amplifier circuit doubles normal life of a B battery.

R. C. A. Opens Short-Wave Station

WASHINGTON.

THE first commercial short-wave, low-powered trans-oceanic radio station has been licensed, indicating the recognition of this means of communication by the commercial radio interest, following the successful long-distance experiments of engineers and amateurs. Station WGH, of the Radio Corporation of America, at Tuckerton, N. J., has been licensed provisionally to operate on 90, 93, 97, 100 and 103 meters by the Department of Commerce. With this new transmitter rated at 20 kilowatts, the corporation expects to establish auxiliary long-distance commercial circuits to Buenos Aires, Berlin and Paris, in addition to their seven high-powered, long wave circuits operated from New York City. When compared with the power and wave length of the main transmitter WGG, at Tuckerton, which are respectively 200 kilowatts and 15,900 meters, the radical step is obvious; only one-tenth the power is to be used. It is possible, if this circulit operates successfully, that short-wave low-power stations may eventually supercede the expensive high-powered stations previously believed essential in long-transmission circuits. The range of WGG is approximately 4,500 miles.

Civil Service Commission Lauds Co-operation

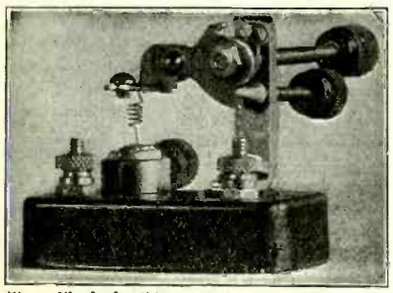
United States Civil Service Commission
Washington, D. C.

Editor, RADIO WORLD:

THE Commission has purchased a copy of RADIO WORLD for September 27 and notes that on page 29 of that issue there is printed a notice of an examination recently announced to fill positions of junior engineer qualified in radio engineering. The Commission appreciates the cooperation of RADIO WORLD in its effort to recruit the Federal civil service with qualified men for this work.

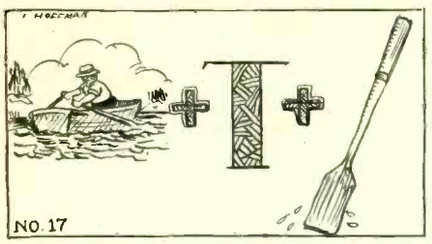
By direction of the Commission:

Very respectfully,
JOHN T. DOYLE,
Secretary.



The Weekly Rebus

TRY to solve this rebus. Send your answer to Rebus Editor, RADIO WORLD, 1493 Broadway, New York City.



The names of those sending in the correct solution will be published.

Ideal Antenna Length

THE ideal length of antenna for reception of broadcasting stations is about 125 feet. An increase in the size of the antenna would not improve the selectivity.

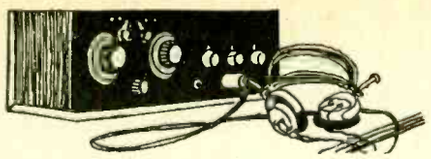
A DISPATCH from England claims enormous progress in the control of pilotless planes by wireless through experiments carried out at the Royal Aircraft establishment. Great secrecy is being observed by the Air Ministry regarding the experiments which are regarded as of the highest importance.

WINDING A LOOP ON A PHONOGRAPH RECORD, by Herbert E. Hayden, Sept. 13 issue. Radio World, 15 cents.

NEW PATENTS GRANTED

1,502,831. Samuel M. Kintner, Pittsburgh, Pa., assignor to Westinghouse Electric and Manufacturing Co. Invention relates to radio telegraphy and more particularly to signaling systems that may be employed in connection with arc-converter systems.

1,501,543. L. A. Hammarlund, New York, assignor to Hammarlund Mfg. Co. of New York. The invention is to provide not only the usual primary means for bringing the condenser into approximate adjustment, but also to provide a secondary means for bringing the condenser into a more accurate adjustment to the minutest degree, which is so especially desirable in radio work.



The RADIO PRIMER

Information and Instruction for the Beginner

Making Your Own Templates

SOME manufacturers somehow omit the very important service of including templates. But if they make good parts it would be folly not to patronize them just because they ignore this need of the experimenter.

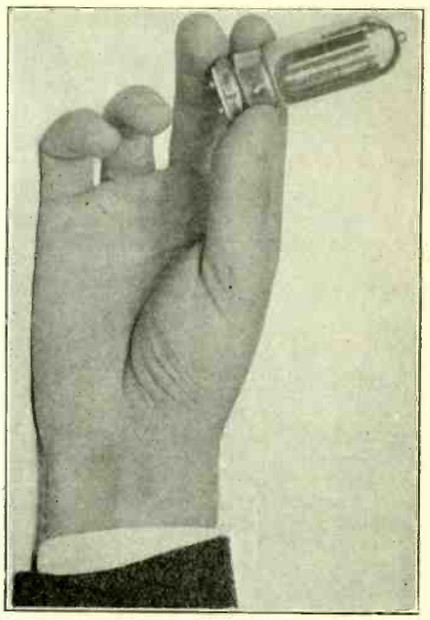
One method sometimes used to atone for this omission by the manufacturer is to insert the machine screws in their proper holes in the condenser, making sure that each screw is inserted the same depth, that is, the flat heads of the screws are level. A piece of cardboard is drilled for the ¼" center shaft and the shaft is passed through the hole. Then the cardboard is pressed against the screw heads. This results in circular impressions or at least the notch in the screwhead. The cardboard is removed and the centers of these impressions are punctured with a pin. After the shaft hole is drilled in the panel the shaft is passed through the panel hole from back to front. The cardboard is held against the panel front, the shaft sticking through the hole in the cardboard. Both condenser and cardboard must be held firmly. The pin points, the guides to where the machine screws are to go, are then registered on the panel. Use an awl to make the impression. It is advisable to have some one help you when you are doing this piece of work, as it takes one person to hold condenser and cardboard firmly, the other to wield the awl. Remove condenser and cardboard and center-punch the points marked by the awl.

Then drill one of the screw holes. Replace the condenser as formerly and see whether the screw passes easily through the hole in the panel and through the thread in the condenser without necessitating any shifting of the condenser from the level. If you find you have been successful, drill the other holes in the same manner. Then, after you have proven to your satisfaction that the screws meet the condenser holes properly, countersink the screw holes in the panel. This will bring the screwheads on a level with the panel, or just a trifle farther back than the level, and will prevent the dial scraping against the screwheads. Such scraping is never to be tolerated, because it not only interferes with the free rotation of the dial and the condenser plates to which it is attached, but adds the danger of forcing the condenser shaft out of alignment, causing the shaft to bind because of contact against the panel. For the same reason be sure that the dial you buy is not warped. Cut-price dials sometimes are warped ones. Put the dial on a flat surface in the store and see that the dial is flat.

Perhaps a better way of getting the screw holes in just the right place is to drill the hole for the center shaft of the condenser, insert the screws in the condenser as outlined before, and put the shaft through the hole in the panel, so that the screwheads are flush against the back of the panel. With a scriber draw a circle around one of the screwheads. Remove the condenser, locate the center of the circle, and drill the hole, starting from the back of the panel. If using as a panel some material in danger of chipping, use a very fine drill for the hole, when working from back panel to front, then use the regular size drill from front to back. Now remove all screws from the condenser and see whether a screw through the panel meets the screwhole on the condenser. Ten to one it will! If you've been as lucky as your carefulness entitles you to you will go ahead with the other screwholes in the same fashion, being sure, however, to sink the screws for which no holes have been drilled in the panel far enough into the condenser to make up for the thickness of the panel. In other words the screwheads still on test must be kept flush with the back of the panel.

LOW CURRENT TUBE

Secret lies in the XL filament, one-quarter the diameter of a human hair, but very strong; lowest consumption on record.



A NEW tube, perfected by the General Electric Co., is about to be marketed. The claim is made that it can be operated from an ordinary flashlight cell and that it consumes 70% less current than any tube now on the market. The Schickerling tube draws 1/10 ampere, so if the claim proves correct, the new tube would draw 3/100 ampere. The filament contains the principal secret of the new tube. It is XL filament, which is one-quarter the diameter of a human hair, yet said to be very strong. What the performance of this tube is has not been announced yet.

Marching Onward

"OSCILLATORS, Their Functions and Uses," by J. E. Anderson, noted radio engineer and one of the most authoritative authors in the country, will be published in RADIO WORLD next week, issue of October 25, on sale Wednesday, October 23. As the oscillator is the heart of the Super-Heterodyne, and as some experimenters have experienced trouble with this part of the circuit, the article will be of intensely practical service. Something will be told of the history and development of oscillator hookups and there will be a plenitude of diagrams.

Charles H. M. White, consulting engineer, one of the most popular contributors, will furnish an important trouble-shooting article, with categorical advice regarding the Neutrodyne, other radio-frequency circuits, the Super-Heterodyne, the standard regenerator and the reflex. If your set does not work, or if its performance is not up to the standard that you have a right to expect, consult Mr. White, via his article.

More in the photograph line will be furnished along with an article by Herman Bernard, showing how to connect a loop in any circuit to get directional effect; how to make several kinds of radio-frequency transformers and mount them; how to connect RF coils and, what is of equal importance, how not to make certain connections which are frequently made by builders of sets, much to their disgust when they try to get good results and don't know why they fail.

Besides these there will be a variety of other service articles as well as text and photographs attractive to those to whom the technical side of radio has not yet made its appeal.

TUBELESS SET WORKS LOUD SPEAKER, by the Rev. Henry A. Judge, S. J., in two parts, issues of Sept. 13 and 20. Send 30 cents for both or start your subscription with the Sept. 13 issue. Radio World, 1493 Broadway, N. Y. C.

8 Weeks' Trial Subscription for Radio World for $1.00

For New Subscribers Only:— Clip out this offer, send to publication office with $1.00, and your name will be placed on our mailing list for 8 issues. Radio World, 1493 Broadway, N. Y. C.

The Aerial Problem

WHAT kind of an aerial have you? What kind of a set? What results do you get? Do you use an indoor aerial? Comparisons will be beneficial to readers. Write your experiences to Aerial Editor, RADIO WORLD, 1493 *Broadway, New York City.*

AN ALL-AROUND PORTABLE for Home or Outdoor Use, by Herbert E. Hayden. Three tubes. Send 15 cents for copy of Aug. 16 issue, or start your subscription with that number. Radio World, 1493 Broadway, New York City.

COPIES OF THAT GREAT SUPERDYNE CIRCUIT—In RADIO WORLD July 5, August 23 and 30. Sent on receipt of 45c.

Wants Low-Loss Sockets

EDITOR, RADIO WORLD:

AFTER having paid two visits to the wonderful First Annual Radio World's Fair, and having inspected many of the receivers on exhibition at Madison Square Garden, I am impelled to write you my views concerning the shortsightedness of some radio engineers. I do not want to be misconstrued as saying that even most of the receivers were not superb. They were. But some of them did not measure up to the best engineering standards and I wonder why.

Altogether cited by few, one outstanding fact of the Fair was the very numerous display of radio-frequency receivers that do not use any external balancing devices. Fair enough. This is an attempt to achieve the same result as the Neutrodyne, without the use of neutraliing condensers, potentiometer and the like. This feat can be accomplished, in fact has been accomplished, even on the low waves, by the use of low-loss parts, particularly low-loss coils, and, incidentally, low-loss condensers, because it is well-known, I think, that the coils will cause the larger losses, probably five or six times as great losses as the condensers, granting neither is low-loss.

What amazed me, however, was that in some of the sets that seek to parallel the Neutrodyne in results, without neutralization in the usual way, much insulation was permitted either on a sub-panel or on a gang socket. For instance, one 5-tube set, two stages of RF, detector and two of AF, had fine low-loss coils, excellent low-loss condensers, but ——

The five sockets were on one solid, thick block of hard rubber and the grid condenser was lying flat against this rubber. All the radio-frequency impulses focus on the grid condenser, as after the currents have reached this point they become audible. Who can explain the state of mind of the engineer who pays such strict regard to the conservation of losses in the coils and condensers, yet permits heavy losses to be sustained at this critical point? What of the RF currents that are running riot along this insulating block? It is hardly an alibi to say that hard rubber is the best insulator in its class. It is, if we do not pay too much attention to its susceptibility to moisture, a condition which some poorer insulators do not suffer from. I advise a campaign for low-loss sockets.

STANLEY FURBISHER.

Cornwall, N. Y.

$25 FOR THE BEST JOKE

HERE is a joke published in RADIO WORLD, issue of April 5:

A novice in radio entered a store to buy a set.

"What kind would you prefer?" asked the salesman.

"I don't know," replied the novice. "I'm in the dark when its comes to radio, but I've been told I'd better buy a Page and Shaw."

Yes, the novice was a woman.

One reader wrote a letter to the editor, saying he laughed so much at that joke that he nearly fell out of his chair.

Another reader chided the editor for publishing it, saying she didn't see anything funny in it, and "could invent a joke" ten times funnier without half trying. We believe her to be that ingenious and hereby offer her—and all our thousands on thousands of other readers—an opportunity to earn $25 by sending in a joke. For a joke, $25 is a high price. But seriously, an uproarious one is worth it. Only the funniest one submitted will get the $25.

Send in the best radio joke you ever heard. Or, if, like the chiding lady, you prefer to "invent" one of your own, go to it! We know how ingenious radio fans are and we encourage and welcome their efforts.

But remember this—

The joke MUST pertain to radio.

The test is not restricted to written jokes. Drawings will be welcome. *But all drawings must be original.*

The joke will be judged on its humor alone, irrespective of whether it is illustrated. The fact that it is an artist's drawing does not improve its chances, nor does it hinder them. All submissions will be judged by their "funniness" alone.

The test closes November 15. Your submission must be received at our office by that time. The judges will be S. A. Rothafel, (Roxy), WEAF, New York City; Ben Garetson, station director, WGN, Chicago; N. T. Granlund, station director, WHN, New York City; Arthur T. Nelson, Commissioner, State Marketing Bureau, WOS, Jefferson City, Mo., and George D. Hay, assistant station director, WLS, Chicago.

Send in your jokes NOW! Send in as many as you want. Be sure to write only on one side of the paper and to give your name and address. Send jokes to Best Joke Editor, RADIO WORLD, 1493 Broadway, New York City.

Hazeltine Invented Neutrodyne with Pencil and Paper Alone

TWO years ago the Neutrodyne did not exist. To-day it is one of the most popular receivers.

In the latter part of 1922 Professor Louis A. Hazeltine, of the Stevens Institute of Technology, concentrated on a theoretical consideration of radio-frequency amplification and its difficulties. He realized, as did all other engineers, that such form of amplification was the soundest practice that could be applied to a radio receiver.

The reasons were obvious to the expert. First, it was possible to obtain high amplification of the signal before it was impressed upon the detector, and, second, each tuned stage employed acted as a wave filter, preventing any unwanted signal from passing through the entire set. In other words, tuned radio frequency offered the maximum amount of sensitivity with increased selectivity. This was recognized as exceedingly important because of the increasing number of broadcasting stations that were being erected.

The drawbacks to its use were its tendency to oscillate and the regenerative effect produced by intercircuit coupling through the internal capacity of the vacuum tube. Both these conditions are related. The former transforms a receiving set into a transmitter, while the latter, unless carefully controlled, causes distortion.

Several attempts had been made to control these two disadvantages, but none to eliminate them. The most common practice was to control the vacuum tube grids by means of a potentiometer, but, since this added resistance to the tuned circuits, it tended to destroy their chief asset—selectivity.

It was at this time that Professor Hazeltine decided that if all electromagnetic and electrostatic coupling could be eliminated it would be possible to employ tuned radio frequency circuits to full advantage.

Taking a piece of paper, he worked out mathematically the correct angle at which coils of wire should be set so that their electromagnetic coupling would be zero.

All of this work was on paper! Not a single instrument had been used. He next determined, after mathematical calculations, that a small condenser (smaller than any hitherto constructed) would balance out the internal capacity of the tube and prevent regeneration or oscillation from electrostatic coupling, provided the polarity was correct.

Proceeding further, he calculated the necessary degree of coupling between the primary and secondary coils of the transformers in such way that a step-up ratio between them was obtained for the first time in radio-frequency circuits. The small primary also increased the selectivity.

He next worked out a novel means whereby the correct polarity could be applied to the balancing condenser by taking a tap off the lower end of the secondary coil at a certain position.

He now had a complete revolutionary receiving system—on paper! Would it work in practice? That was the question. The professor was certain; he had checked and rechecked his calculations.

A radio concern was commissioned to construct the first model according to the professor's specifications. When it was completed a group gathered around to witness the first test. All were breathless with excitement. Would it work? After a few minor adjustments, the model soon gave a perfect answer, and a new system was born, the first in which all traces of radiation were completely subdued.

RADIO WORLD'S QUICK-ACTION CLASSIFIED ADS.

10 CENTS A WORD. 10 WORDS MINIMUM. TELEPHONE YOUR CLASSIFIED IF IN A HURRY.

Why the Best Loud Speakers Behave Like Educated People

BUYING a loudspeaker should be treated with the same consideration and care as buying a phonograph, piano or other musical instrument. The speaker is the voice of the radio and cannot be too good. Manufacturers constantly strive to attain the most exact production of the original voice or music. Before the signal gets to the loudspeaker it must pass through the tuning unit of the receiver, the tubes, and usually one or two audio-frequency amplifiers. During this travel the signal may lose some of its quality, which, although the loss be very slight, would be augmented by a poor loudspeaker.

In a radio store facilities are usually provided to permit the selection of loudspeakers by connecting them in succession to a receiving set in operation. Although they all work more or less the same, yet you will find that the tone of one pleases you better than that of any of the others. This is the loudspeaker for you, because after all, human beings have different tastes.

The location of the speaker in the home is important. In most homes the set is in the parlor or living room, and the loud speaker placed immediately next to, or on top of, the set. The tendency is to put it right next to the amplifiers. This is bad practice because should the speaker be placed very close to the last tube, though the tube and transformer be enclosed in a cabinet, an audio-frequency howl may result. Preferably the speaker should be placed on a piano, bookcase or other similar object which will raise the loudspeaker over the average person's height. Thus there will be an even distribution of sound throughout the room.

Phonographs are used to some extent as loudspeakers by attaching a sensitive earphone to the tone arm in place of the vibrating soundbox. This does not give as much volume as a speaker.

Enough signal strength should be delivered to the speaker to allow volume of comfortable intensity without straining the ears.

The flexible connection cord on every loud speaker has two different colored wires, or if they are of the same color one has a mark or stripe, usually red. The red cord denotes that it should go to the positive terminal of the B battery, or high potential lead. On all commercial sets it develops that this lead comes out on the long jack blade in the set.

DID YOU GET RADIO WORLD'S FALL BUYER'S NUMBER

Sept. 27 issue of Radio World contained the following important features: "A New 1-Tube Reflex," by A. P. Peck; "The Best Set for Your Location," by N. N. Bernstein, Technical Editor; "Three Stages of Resistance-Coupled AF," by Wainwright Astor; "A 2-Tube-and-Crystal Reflex Using Only One Control," etc. Full list of Broadcasting Stations. 15c. per copy, or start your subscription with that number.
RADIO WORLD, 1493 Broadway, New York

ANY "DYNE" YOU WANT

The Dynoflex, one stage of tuned RF, crystal detector and one stage of reflexed AF, Aug. 9 issue.

The Magnadyne, a Low-Loss Neutrodyne. Issues of Aug. 16 and 23.

A Low-Loss Superdyne, 5 tubes, including 3 stages of resistance-coupled AF. Issues of Aug. 23 and 30.

Pastor Calls Superdyne Best

RESULTS EDITOR:

I AM enjoying my Superdyne, made from plans published in your valuable paper.

It is by far the best set I have made. I have heard sixty different stations the short time I have used it, and that in the Summer time. I heard just a few nights ago KGO at California, the first time I have succeeded in getting a station in that state. The farthest I have reached prior to this was Dallas and Hastings. You say the Superdyne will not work satisfactorily unless the very best parts are used. Now, I am a preacher and therefore not able to buy the best, so I undertook to patch up this radio out of cast-off material. I have nothing but pasteboard tubes on which I wound my coils of patched up wire. My condensers are the very cheapest available and have been used before. The tubes are all repaired. And yet I am furnishing music for homes nearby. In fact, it is being heard a block away on clear, cool nights. It is full of melody and furnishes all the volume one could wish for for home use. I find it just a little hard to tune at first but when tuned properly it is no trouble to change from one station to another, without radiation. I have added a crystal as well as an extra coil, both of which have added volume as well as clear reception. I am sure it would be better for one to purchase the very best material in building this set, but it will work with poorer parts.

R. E. PITTMAN,
La Grange, N. C.

RESULTS

WHAT Results Did You Obtain from Constructing Sets or Parts Following Data Published in Radio World? Write to Results Editor, Radio World, 1493 Broadway, New York City

Still to be had at the old price if you act now!

RADIO BROADCAST

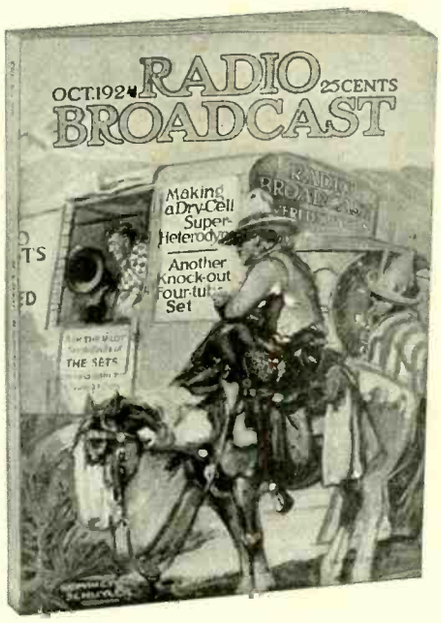
advances to 35 cents a copy, $4.00 a year with the November issue. Until Nov. 10th you may subscribe to the improved magazine at current low prices by mailing the coupon NOW

The Reason Why

We have organized a unique laboratory service for the assistance of our subscribers; we have built and tested dozens of sets described in every issue of the magazine; we have made it a principle to dig up and verify ourselves every bit of information we publish; we have printed only the articles of the best writers, and illustrated them only with the highest grade of photos and diagrams.

All this means that we have spent a lot of money to put RADIO BROADCAST in the forefront of radio magazines. We now purpose to spend even more to put RADIO BROADCAST still further in front. Our policy is to turn out at all times, regardless of expense, the most up-to-date, the most reliable, and the most interesting radio magazine that can conceivably be produced. But if we are to publish the magazine without a loss, we must increase the price.

RADIO BROADCAST still sells at 25 cents a copy, $3.00 a year. Effective November 10th, 1924, the price advances to 35 cents a copy, $4.00 a year. The price advances, but not for you if you act now. You can have RADIO BROADCAST for the next year, two years, three years, or five years, at present prices if you send in your order on the coupon below without delay.



How Our Testing Laboratory Helps You

The well-equipped RADIO BROADCAST Laboratory is typical of the magazine's service to readers. The Laboratory Staff has not only tested hundreds of existing sets and thousands of manufactured parts, but it has designed many original sets, notably the "Knock Out" series now justly famous. The scope of the work has so widened that the R. B. Lab has become a Designing as well as a Testing Laboratory. By reading the "Lab" reports month by month, the reader receives what is in effect a current course in radio, enabling him to equip or improve his own laboratory, improve or alter his set, or build a new set, everything having been worked down to its simplest form by repeated tests and experiments.

The March of Radio

J. H. Morecroft, Professor of Electricity at Columbia University, President of the Institute of Radio Engineers, and author of perhaps the best radio textbook that has ever been published, is another distinguished member of the RADIO BROADCAST staff. He is a man who is constantly generating ideas, so his March of Radio each month has become a feature to which many readers turn first of all when they receive their copy of the magazine. To read this feature alone is to be well-informed on radio progress.

Questions Answered

RADIO BROADCAST answers free the questions asked by subscribers. Whether you are building a set, operating one, or making changes in your outfit, the Laboratory Staff will help straighten out any tangles you may submit.

Some Distinctive Features

"The Listener's Point of View," conducted by Jennie Irene Mix, one of the nation's leading musical critics, is a unique musical department in which you will find entertaining criticisms of radio programs broadcast from all over the country, as well as inside information about broadcasting events, programs, and personalities. There are also large, clear photos of new material together with descriptions; stories of big men in radio; authentic accounts of radio adventures; and many other articles.

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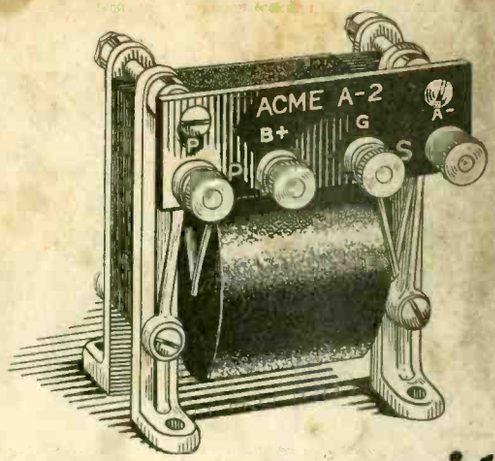

After distance, what do you want?

Amplification without distortion,

OF COURSE, you want to hear the distant stations but you want these loud and clear so a whole room full of people can understand.

And when you listen to a fine musical program from your local station it certainly is fascinating to get all the notes, all the words, and to be able to close your eyes and just be content.

If you use Acme Transformers in the set you build and insist on their use in the set you buy, you are giving your loudspeaker a chance to reproduce the singer's voice, the violin's notes, the orchestra or lecture, loud and clear, without distortion.

Send 10 cents today for 36-page book, "Amplification without Distortion," containing many practical wiring diagrams and many hints for getting the best out of your set.

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