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RADIO WORLD

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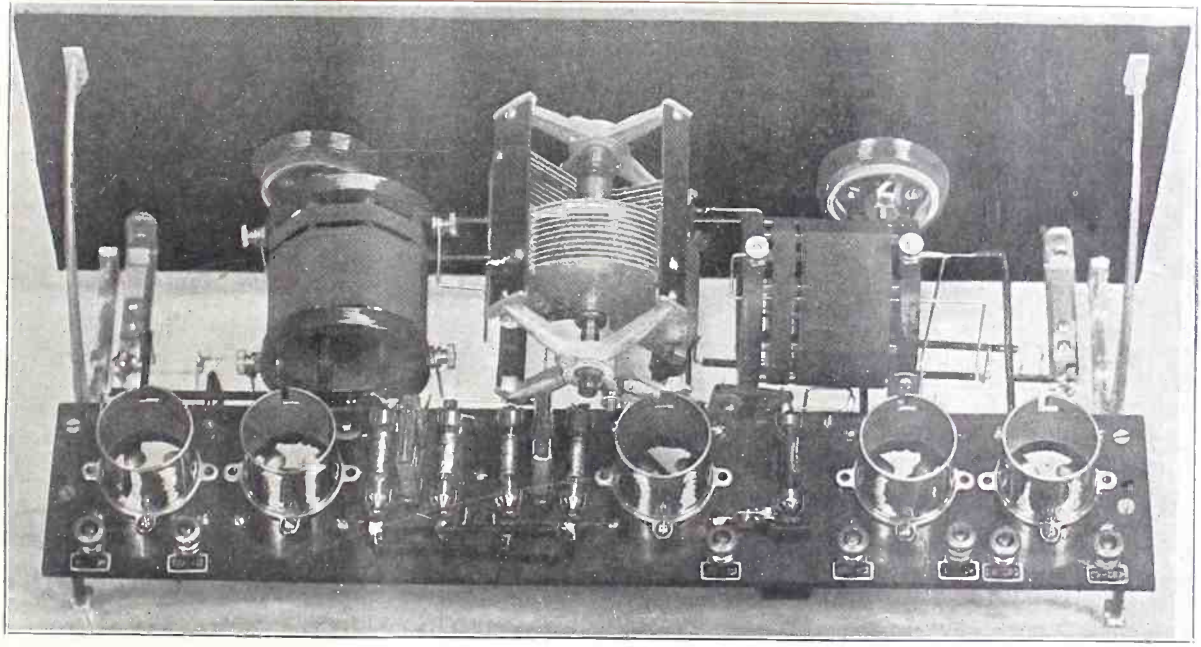
155-180

THE LOOP MODEL POWERTONE

(See "Blueprint in Black" on page 7)



(Kadel & Herbert)

TOP ANGULAR VIEW of the 1-Dial Powertone (Fig. 4). Right to left the tubes are: RF, detector, transformer audio, two resistance audio. See page 6.

THE DIAMOND WITH UX-120 AF

A Geared 5-Tube Receiver for DX

THE LOUDEST 1-TUBE SET

RADIO WORLD

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How to Connect Coil Terminals

A Study of Stray Couplings and Phase Relations

Short Leads in Set Wiring, If Close Together, Are Inefficient, Whereas Long Scrambled Ones May Produce Splendid Results—Number of Tubes in Set a Vital Factor in Determining How Coils Should Be Connected. The 180° Change of Phase Per Tube Explained—How to Achieve Zero Coupling — Correct Coil Connection Minimizes the Effective Capacity Coupling Due to Adjacent Windings.

By J. E. Anderson

Consulting Engineer

FREQUENTLY a novice will build a circuit in exact accordance with some description but he does not attain the success that the author of the article claimed for it. Sometimes an experienced radio engineer will hook up a circuit with temporary leads, which may be long and tangled, with the apparatus strung out on the table. The circuit may work perfectly and he decides to put it in permanent form on a panel and in a cabinet. He observes every tenet of good design, especially as to placing the coils and making all leads as short and direct as posible. The job may be excellent mechanically yet it turns out to be an electrical flivver. The set squeals if he points his finger at it; it howls if he doesn't; and generally it is in a highly excitable condition. Or it may be a dud as compared with the original test circuit, giving signals which are barely audible on a headset, where they should be audible on a speaker.

The Cause of Stray Coupling

The trouble is usually due to stray couplings between the various parts of the circuit. In the test set the distances between these parts were large, and hence both capacity and magnetic couplings were small and negligible, and they were probably scrambled due to the tangled wires. But when the circuit was installed in a cabinet the distances were decreased, thus increasing both capacity and magnetic coupling; and the leads and parts were placed in an orderly manner, thus eliminating any possible good effects of scrambled feed-back coupling.

The magnitude of stray coupling does not depend alone on the distances between the various units of a circuit, but also on their angular orientation, on the number of tubes used in the circuit and especially on the manner of connecting tranformers, tuned and untuned. The following discussion will be mainly confined to the effects of the different methods of connecting inductance coils and transformers.

It is well known that a vacuum tube changes the phase 180°. Consider an instant when the potential of the grid is increasing, that is, when current tends to flow into it. The effective potential between the plate and the filament is then increasing. Hence the current into the plate is also increasing. Hence at the plate and grid, or at the common point of the filament, the currents in the grid and plate circuits tend to flow in opposite directions. This is equivalent to a change of phase of 180°.

Connections Govern Phase

In a transformer having two windings the change of phase may be either zero or 180°, depending on the manner of connecting it. If, as is ordinarily the case, the two windings are put on in the same direction, and if the inside terminal of one winding is connected to the outside of the other, then the potentials of the remaining terminals will be 180° out of phase. Thus in an audio-frequency tranformer the inside terminal of the primary is connected to the plate and the outside terminal of the primary toward the filament. The inside terminal of the secondary is connected to the filament and the outside

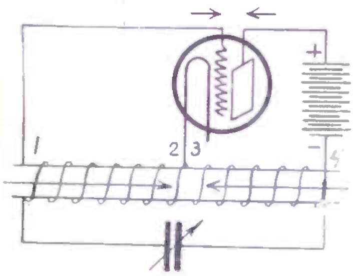


FIG. 1, the Hartley circuit. The short arrows show the direction of the grid potential and of the plate current. The large arrows indicate the direction of the magnetic fields of the coil.

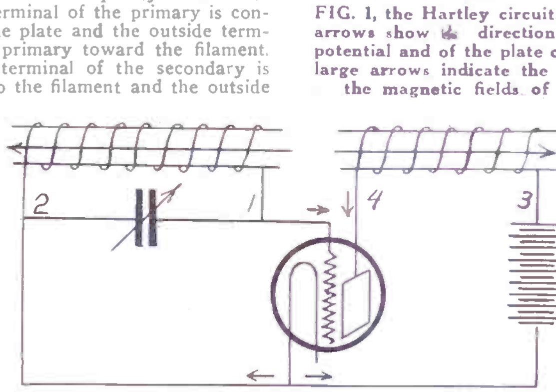


FIG. 2, tickler feedback. Note the great similarity of the coils with the coil in the Hartley system. The Hartley coil has been severed, the halves turned 180°. The directions of the windings and of the grid and plate currents are the same as in Fig. 1, but the magnetic field direction has been reversed.

to the grid. This causes the plate and grid to be 180° out of phase.

If, instead of connecting a transformer in this manner between the plate circuit of one tube and the grid circuit of the next it is connected in a similar manner between the plate and grid circuits of the same tube, the conditions are right for oscillation because the tube causes one shift of 180° in phase and the transformer another, so that the energy is returned to the grid in phase.

The Hartley Circuit

This may be illustrated very simply in connection with well known oscillators. Consider first the Hartley circuit shown in Fig 1. A single inductance coil is connected between the grid and plate of the tube and a tap near the middle of the coil is connected to the filament. A condenser is also connected between the grid and plate or across the coil. This circuit will oscillate when the filament is lighted and the plate potential is applied. Consider an instant when the grid potential is increasing, that is, when the plate current is increasing. The directions of the grid potential and of the plate current are indicated by the short arrows. Now if the oscillating coil is wound like a left-handed screw the direction of the magnetic field in the plate portion of the coil will be from right to left as shown by the long arrow in that portion of the coil. The induced current in the grid portion of the coil will, according to Lentz law, be such as to oppose the change in the plate portion, that is, it will be from left to right. This direction of the magnetic field re-

Hookup for Direct Coupling

How to Determine When Circuit is Out of Phase

Stray Coupling Produces Over-Oscillation If Coils Are Connected Similarly, But If There Is a Reversal of Winding or Connection Then Control Exists, But May Be Overdone—Reason Given Why the Superdyne Can Easily Become Inefficient.

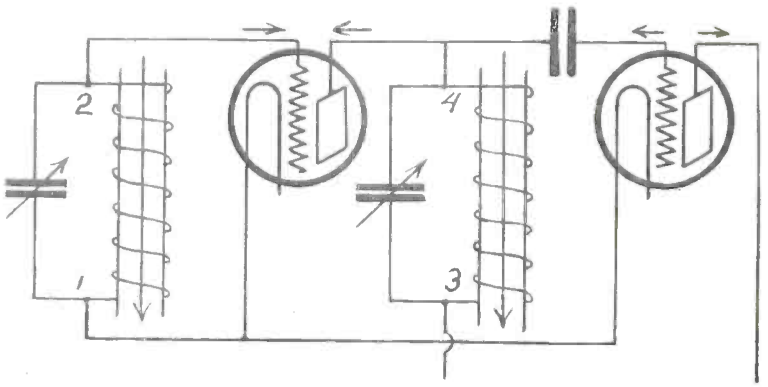


FIG. 4, showing how corresponding points in two successive stages are always opposite in phase.

quires that the current in that portion of the coil should flow from the filament to the grid. But that is the same direction as was originally assumed. That is the energy is fed back to the grid in phase, thus adding to the original input, and maintaining oscillations. The tube changes the phase 180° and the transformer another 180°, so that there is no net change.

This is not to be regarded as a complete picture of the mechanism of oscillation, but merely as a convenient mnemonic rule which may be applied to any inductively-coupled circuit to determine whether the phase relations are right for oscillation.

The Tickler Feedback

Another well-known oscillating circuit is shown in Fig. 2. This is the standard tickler feed-back arrangement with tuned grid. It will be seen that as far as the coils are concerned this circuit is almost identical with the Hartley oscillator. The coil has been cut in the middle and the halves each turned through an angle of 180°. The directions of windings and the currents in the grid and plate circuits are exactly the same, but the direction of the magnetic fields is now reversed.

The coupling in these two oscillators may be called internal, or end-to-end, because it is the direct magnetic field of the one that threads the other coil. This is the usual type of coupling where it is intentional.

The coupling may also be external, or side-by-side. In this type the return magnetic field of one coil threads the other. This is illustrated in Fig. 3. As in the previous circuits the coils are wound in the left-handed screw fashion, and the directions of the currents are assumed to be the same. The tickler coil is also connected in the same manner. The magnetic field in the tickler therefore points upward, or from 4 to 3. Lentz law now requires that the magnetic field in the secondary also be upward, since it is the return field of the primary that the field of the secondary must oppose. This requires that the leads to the secondary coil be reversed in order that the induced potential shall be in the proper phase. Hence terminal No. 1 is connected to the filament and termnial No. 2 to the grid. This is the only necessary change from the previous two circuits.

When Both Exist

The stray inductive coupling between any two coils in a circuit is either one or the other of these types, or a combination of the two, in which case one usually predominates. If the axes of the two coils are effectively at right angles, or if the effective axis of one coil is at right angles to the field of the other anywhere in that field, the two types of coupling are equal in magnitude, and since they are in opposite phase, the net coupling is zero. This of course rarely happens, but may readily be brought about experimentally. The widely divergent results given by two circuits connected in accordance with the same schematic diagram depend largely on the kind of coupling that predominates and on its magnitude. By carefully observing the phase relations in a circuit it is posible to control not only the inductive stray coupling but also to a large extent the capacity coupling existing between the various parts of a circuit, and this is very valuable indeed.

In all direct coupled tube circuits, that is, circuits coupled by means of resistances, choke coils, tuned impedances and auto-transformers, the successive tubes alternate in phase. The odd-numbered tubes change the phase from positive to negative and the even-numbered from negative to positive. Hence the corresponding points in two consecutive stages are always in opposite phase. This is illustrated in Fig. 4. The two grids are 180° out of phase, as are also the two plates. This figure illustrates a section of a tuned impedance coupled circuit in which the coupling between the two tuning coils is external, as was explained in connection with Fig. 3. By comparing these two figures it is seen that the stray coupling in Fig. 4 is such as to tend to produce oscillations in the first tube. If the connections to one of the coils were reversed, or if one coil were turned around without changing the leads, so that the two fields were in opposite directions, the stray feedback would be negative, and the circuit would, in effect, be an example of what is now called a superdyne. If this reversed stray feed-back were too great it would cut down the efficiency of the circuit to a serious degree.

How the Neutrodyne is Affected

If the two tuning coils were placed as in Fig. 2, with the magnetic fields opposing, the conditions would be right for oscillation. The stray magnetic coupling would either increase the signals or else set the tube into oscillation which would drown out the signals. Reversing the leads so that the two magnetic fields would be in the same direction for this type of coupling would produce negative feed-back.

If a circuit which employs some type of direct coupling between the different stages is to be neutralized as is done in a Neutrodyne receiver, the neutralizing condenser cannot be connected between two successive grids as is done in the transformer-coupled circuit because the

The Way to Kill Squeals in a Set

Coil Polarities Must Be Right or There's Trouble

"In All Direct-Coupled Tube Circuits the Successive Tubes Alternate in Phase"—"The Odd-Numbered Tubes Change the Phase from Positive to Negative and the Even-Numbered from Negative to Positive"—"If a Circuit Which Employs Some Type of Direct Coupling Is to Be Neutralized, the Neutralizing Condenser Can Not Be Connected Between Two Successive Grids."

phases of the grids are such that the trouble would be aggravated. The condenser must be connected between one grid and the plate of the next tube, or between the grid of the first and the grid of the third. That is, one tube must be skipped.

If a transformer is used between two consecutive tubes the phase relations are the same as for direct coupling provided the leads to the transformer are so connected that there is no change of phase in the transformer. This method of connection is not common, however, because of the undesirable effect of the capacity between the windings. **The best method is shown in Fig. 5. The terminals, which are physically adjacent are at the same potential, namely ground potential; and the terminals which are physically at the greatest distance apart are also at the greatest potential separation. Hence the capacity between the windings is the least. This holds also for an audio-frequency transformer, in which the layers which are at nearly the same potential are physically close together and the extreme layers are at the greatest difference of potential. If the two windings are wound in the same direction this will change the phase 180° as may readily be seen from the figure. The two grids are in the same phase, as are the two plates.**

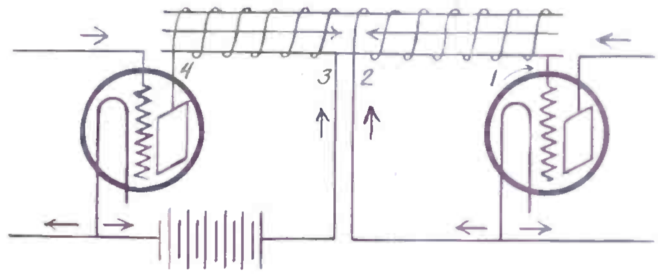
The method of connecting the interstage transformer shown in Fig. 5 is the proper way also for a Neutrodyne circuit. If the neutralizing condenser is connected between the first grid and the second, or between the first grid and some point on the secondary winding, the energy reaching the first grid through that condenser will be out of phase with the energy reaching the grid through the plate-to-grid capacity of the tube.

The effect of stray coupling between transformers in a multi-tube set may be determined in the same manner as was done for oscillating circuits and for tuned impedance-coupled circuits. It is necessary to determine which of the two windings causes the stray field in order to know the direction of the field. It is safe to say that the winding having the greatest number of ampere-turns will determine the stray field. In an untuned transformer this is the primary, since the secondary carries no current. If either of the windings is tuned it is that winding which causes the stray field. If both windings are tuned it is probably the most highly resonant winding.

In the circuits illustrated in the preceding paragraphs the coils were all wound in the left-handed screw fashion. If all had been wound in the opposite direction, that is, like a right-handed screw, the phases would have been the same, but the magnetic fields would all have been turned around. If one of a pair of coils had been left-handed and the other right-handed, the effect would have been the same as if two of the leads to one of two similar coils had been reversed.

[Mr. Anderson is preparing other articles on phase and coupling problems, including expert advice on making connections.]

The Best Way to Connect An Interstage Transformer



J. E. Anderson, noted radio engineer, in his masterful treatise on phase relations and stray couplings, cites the above method (Fig. 5) as the best one for interstage transformer coupling. The phase-turning effect of the tube is offset by the phase change produced by the transformer. The low potentials are kept together, the terminals farther apart are also at greatest potential separation. This is the same manner of connection prescribed by Herman Bernard in The Powertone and in The Diamond of the Air articles. It is likewise the proper way to connect for a Neutrodyne. If an RF transformer were placed on a table on one circumference, the primary winding on top, ¼" space left, the secondary being below, then top (beginning) of primary would go to plate (4), end of primary (3) to B+, beginning of secondary (2, adjoining end of primary) to A battery, and end of secondary (bottom terminal) to grid. In the diagram the small arrows denote the directions of the grid potential and the plate current. Note that these plate and grid arrows point in the same direction on both tubes. This is due to the phase change accomplished in the transformer, by the long arrows showing the opposition of phase.

THE coil (at right) used as an inter-stage RF transformer, with windings numbered to correspond with Fig. 5 (above). No. 4 goes to the plate of the preceding tube, No. 3 to BT, No. 2 to negative A and No. 1 to grid. The same effect would be possible by other connections if windings were reversed.

NOTHING BUT WOMEN TO ANNOUNCE AT TOKIO

TOKIO.

Women are to be employed exclusively as announcers in the new government broadcasting studio.

They are being chosen by examination, and only those with excellent enunciatory ability will be employed. One of the requirements is that the announcer have the pure Tokio dialect, so that the station will not be mistaken for the one at Osaka.

Marvelous Response Claimed for Diaphragm of Thin Gold

BERLIN.

Sounds not heard on present radio sets, due to diaphragm construction, can be heard if "transpareno gold" is used, says Dr. Carl Mueller, its inventor. A sheet of Mueller's gold two five-millionths of an inch thick can be used in radio to register sounds heretofore inaudible in ordinary radios which contain a membrane too thick to register the faintest sounds, he insists.

He has caused a sensation.

The Loop Model Powertone

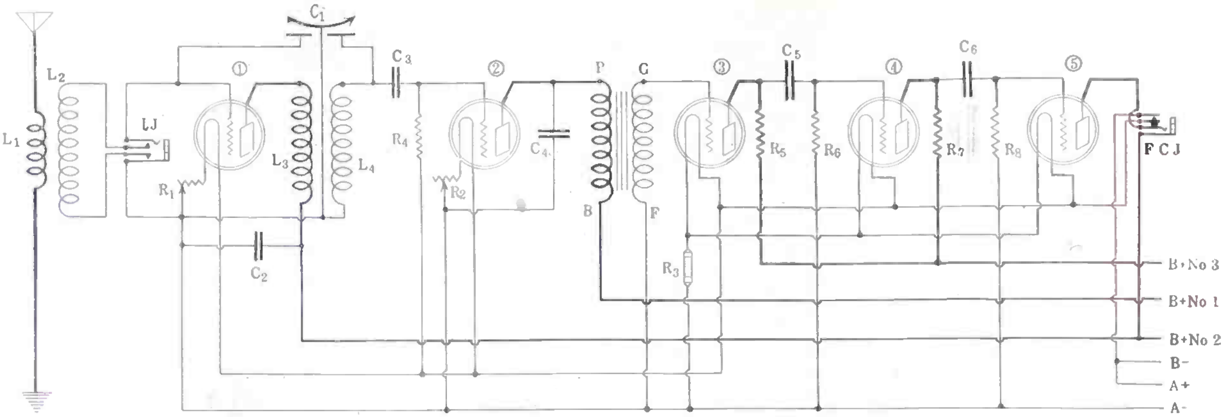


FIG. 1, the Powertone, a 5-tube, 1-dial DX set of rich and pure tonal quality, shown schematically for operation on either outdoor antenna or loop. The change from either kind of service to the other may be made in a moment. The loop terminal tips are connected to a jack plug. When the plug is inserted in the loop jack LJ the RF input transformer L1L2 is out of the circuit. The wiring as shown puts a master's finishing touch to the circuit as presented in last week's issue. The above diagram is connectively the same as the picture diagram, Fig. 2.

Only One Stage of Radio-Frequency Amplification, Yet This Circuit Works Splendidly on a Loop, Says Bernard, Opposing Accepted Beliefs of Radio Engineers—Surprising Diagram Presented to the Public for the First Time—Slight Modifications Made in B Battery Voltage, Compared with Exclusive Outdoor Aerial Receiver Described Last Week.

By Herman Bernard

Associate, Institute of Radio Engineers

A FEW nights ago I sauntered into a Broadway restaurant. Seated at a table were three radio engineers, one of them chief consultant of a large set manufacturing company. They invited me to join them. We had a delightful meal. While sipping coffee we naturally turned toward a discussion of the 1926 model receivers and easily drifted into a general debate on the merits and possibilities of hook-ups. I chanced a remark that brought forth a protest from the chief consultant.

What I said was:

"Just one stage of tuned RF, with a variable oscillation control, is better than the two stages balanced the way your company does it."

It was not sheer loyalty to his company that stirred his blood, but an intense belief in the foolhardiness of what I had said. He dared me to prove it. So I took him and the two other engineers to RADIO WORLD's laboratories. There I operated the Powertone. Near it was the newest model of the set manufactured by the chief consultant's company. The circumstances were very inviting for a fair comparison of the two sets. Volume, clarity, DX, ease of tuning and selectivity were noted. The same outdoor aerial was used in both cases, also the same A and B batteries and the same five tubes in the same relative positions. When the test had reached what I thought was completion the chief consultant said:

"Did you use the same ground connection in both cases? I didn't notice."

"Yes," I assured him.

"You know what a big difference in reception may result by substituting a poor ground."

Again I gave him a positive assurance.

"Well," I remarked, "you don't see any secret ground clamp up my sleeve, do you?"

Suspicion in Evidence

He laughed. Nevertheless he started to look about the laboratories in a most suspicious manner. Whether he thought the Powertone or his receiver had shown up the better in the comparative test was best proved by his actions. Finally when his scouting expedition was about over one of the two other men remarked:

"You're not seriously claiming that you successfully control oscillation with the rheostat, are you?" (He was referring to R1). "If you succeed on the low waves you can't have enough oscillation on the high waves to get the maximum efficiency you claim."

I invited him to apply the meters. There were sixteen varieties of them about the laboratories. Also I told him to tune the set himself. Moreover I asked him if the production of the whistle on the highest wavelength station within reach—WNYC, 526 meters—didn't answer his question. I tuned the set again, then bade him to do so, but he wouldn't touch it. He said the very idea of such success in oscillation control was inconsistent with the best radio thought of the day. Then the third man chimed in with some doubting remarks. For a while I half assumed all three were joking, for they, on the basis of mere theory, were denying what was proved before their own eyes and ears.

The third man started to look for some secret C battery. Maybe he thought I was varying the grid bias by pressing some secret switches with my foot!

After a long pause the chief consultant pointed to a jack on the panel.

"What's that?" he asked.

"That's a loop jack," I replied.

He burst into laughter.

"Ridiculous!" he said emphatically. "How on earth do you expect to work a 1-RF-stage set on a loop when you haven't a straight regenerative RF or detector tube? Moreover, you'd have to tune the loop and the secondary of the interstage transformer with one motion on that 1-control set. Come, now! That's claiming the impossible!"

I invited him to do the tuning. He plugged in a loop. The stations came in as well as on the outdoor aerial. Then we tried a loop on the set his firm manufactures. The feeblest sort of reception was possible, and even then only on stations within the city limits. Obviously his set would never do for loop reception.

"You haven't got an auxiliary loop somewhere, have you?" asked the third member of the party.

The Indifferent Handshake

By this time I was beginning to feel amused and flattered. The question just put to me referred, of course, to the trick of having an outdoor aerial hooked up to a secreted loop, so that some auxiliary radio energy would be passed on to the loop that was attached to the set under test. The thought was that I had used the auxiliary loop to help work the Powertone, but denied that advantage to the other set.

My three visitors and guests left me, each giving me a most indifferent handshake.

Nevertheless I could not understand very well why they should be so doubtful. It is true indeed that you seldom, if ever, see a hook-up where only one RF stage is used and where any claim is made that loop operation can be successful, where the set is of the so-called non-regenerative type. It is of course conceivable that many, even experienced engineers, may doubt the feasibility of such operation. The double condenser used to tune two inductances that seem to have somewhat different characteristics might well serve to fortify the doubts of any who based their assumptions on theories. But proof positive in one's own

The Blackprint Picture Diagram of the Loop Model Powertone, Exactly the Same in Every Particular as the Schematic Diagram

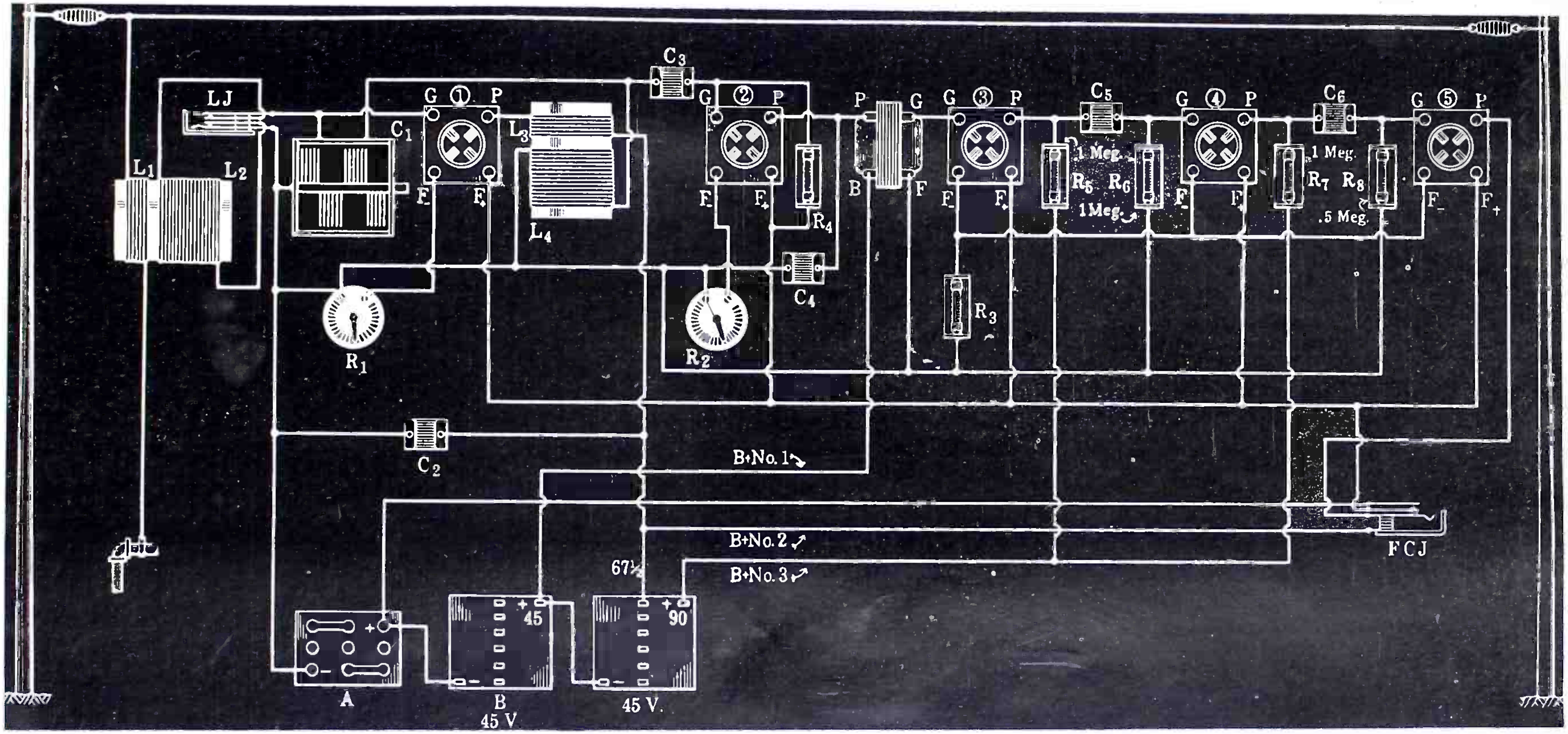


FIG. 2, a blackprint picture diagram of the wiring of the loop model Powertone. This is the same as a blueprint, except that it is printed in black. The connections shown are just like those diagrammed in Fig. 1. L1 is wound reverse to all other windings.

Why a Loop May Be Best Aerial

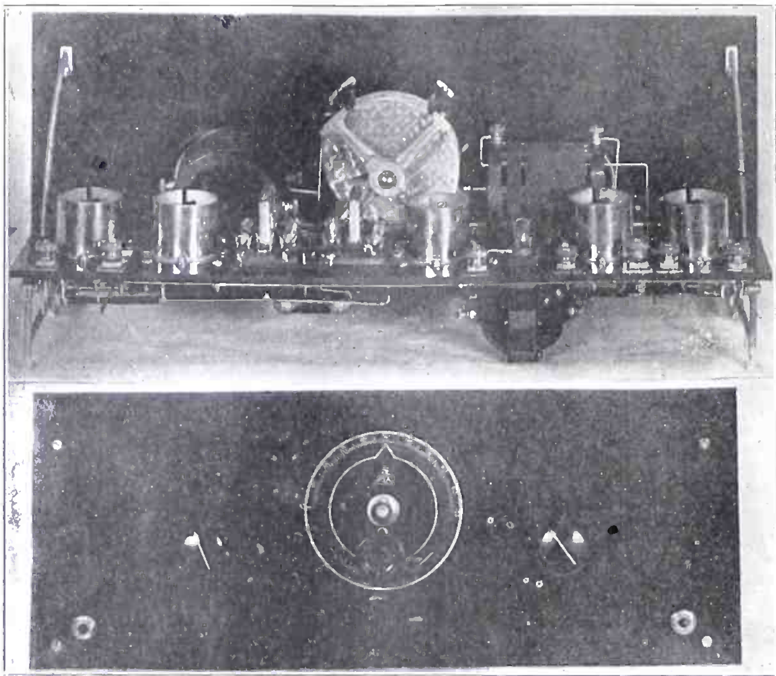


FIG. 3, the rear view (on top) shows the double condenser centrally mounted, also one way of mounting the coils. Notice where the AFT is placed, under the socket shelf. The building posts (left to right) are A+, B+ No. 3, B+ No. 2, B+ No. 1, A—, ground and aerial. Fig. 4 is the panel view, loop jack at left, speaker jack at right. (Kadel & Herbert.)

presence I believe should have imbued anyone with some form of credulity.

Radio Fakers

The three seemed afraid to touch the Powertone, lest perchance some of their choice theories be destroyed. True enough, the claims made were counter to the generally accepted beliefs in radio, but—there was the proof! As for the personal equation, had I not described in RADIO WORLD the construction of 62 different sets (up to August 15), never an error appearing in any of the diagrams, and every one of the sets being efficient? My idea of radio engineers or any others who try to resist proven facts with mere theories, based largely on calculations embodying false premises, is that they are radio fakers, in a class with nature fakers. Too lazy to build, they read instead.

The surprising diagram is shown in schematic form in Fig. 1 and is exactly duplicated, as to every single connection or item, in Fig. 2, which is a blackprint picture diagram. The chief consultant might try the picture diagram if the schematic one seems baffling to him!

But let's get along with our own work and leave him to his dreamy aspects of science.

Loop Sometimes Even Better

Not only does the set work on a loop, but under some circumstances it works better on a loop than on an outdoor antenna. Much has been said against loop operation, on the ground that it brings in only a trifling percentage of the energy collected by a good outdoor antenna system. The premise is a fact, but the criticism is well-founded only when made in regard to weak circuits. It is not true where great amplification is obtained at radio frequencies. The objective in every case is to confine the load to that which the tubes can safely bear. The outdoor antenna, in respect to the efficient circuits made today, delivers too much energy, because the tubes are called upon to amplify this hundreds or thousands of times. Overloading results. This means impaired efficiency. Granting that the circuit is very sensitive and the amplification is high, very often the loop, even with its much smaller energy collection, comes very much closer than the outdoor aerial to providing the most suitable input force consistent with quality.

Not only does distortion result from overloading audio tubes, but much of it is occasioned by overtaxed radio-frequency and detector tubes. The Powertone keeps the load down to what the tubes can handle best. This enables the tubes to operate at their most efficient points. Hence sometimes more net volume will result from loop operation and greater distance reception be enjoyed. This is not the rule, but the phenomenon occurs when the antenna serves to overload the tubes and thus prevent their operation at the most sensitive points. A somewhat similar condition is familiar to all in the case of a regenerative set in which the tickler is too tightly coupled to the secondary, causing even an utter failure of audibility.

Will Work on Four Tubes

If the set is operated on a loop of course the five tubes must be lighted, but on an outdoor aerial for reception of local stations it may not be necessary to keep the RF tube lighted. This is particularly true if, in mounting the coils at right angles, L1L2 is placed perpendicular to the table and L3L4 is horizontal. That accentuates the loop effect of L3L4, the windings being in the plane of the incoming signal. However, that method of mounting perhaps had better be avoided and the one followed that is suggested in Fig. 2, where the RF input transformer, L1L2, is horizontal and the L3L4 is upright. The difference is slight. Also, local stations may still be heard, with the RF tube unlighted, if the Fig. 2 method of coil mounting is followed.

Angle Mounting

The delivery of the signal current to the detector tube when the RF tube is out is accomplished more by capacity than by inductive method. The right-angle manner of coil mounting is supposed to prevent magnetic interplay, and it does, to a successful extent, provided the comparative level of the coils is correct. In other words, not only should right-angle mounting be observed, but the height of the horizontal coil from the panel bottom line is a factor. Normally the coils would be so placed that an imaginary line through the center length of the horizontal coil would meet the central diametrical axis of the perpendicular coil so as to constitute the continuation of a straight line. A slight shift up or down will prevent magnetic interplay that might exist. Move whichever coil is more convenient. It is safe, if enough distance between coils is preserved, to follow the standard practice, for there is little likelihood of trouble, and if it should be encountered, the remedy may be applied then. If one of the coils is mounted with right angle brackets on the panel, by means of machine screws and nuts, then obviously the other coil would be easier to move, since no new visible drillholes need be made.

The two coils may be mounted side by side at right angles, or even one atop the other, not at right angles, with opposite points of the diameters meeting. It is preferable, however, to mount the RF transformer to the left of the tuning condenser C1 and the inter-stage coupler to the right. This tends to make leads shorter.

The Capacity Coupling

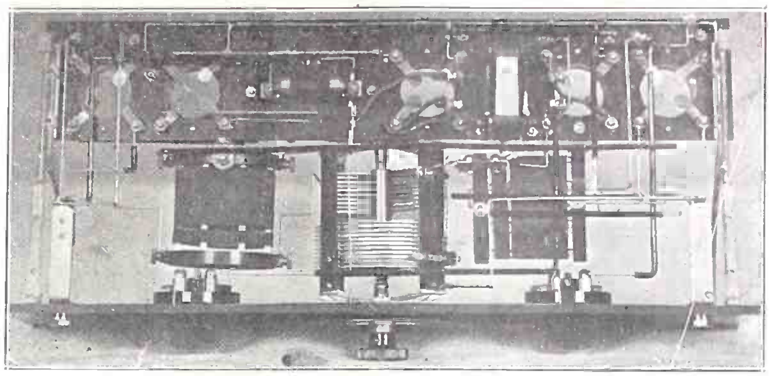
Supposing no magnetic interplay to exist, the coupling to the antenna circuit, with the RF tube out, may be accounted for in part by the double condenser. The aperiodic primary L1 is in the aerial system, L2 is magnetically coupled thereto and also conductively joined to one of the two sections of C1. Energy flows from one part of the double condenser to the other. Also the RF tube capacity may contribute a slight coupling, but it must be very slight indeed, since even with the RF tube completely removed locals may be heard. This is an economical feature of the set, enabling 4-tube operation at will, the rheostat R1 simply being turned off. The selectivity is just as good on four tubes as on five, which tends to corroborate the fact of coupling in the double condenser, for if there were no benefit from the tuning effect on L2, even with its tube "dead," then broadness of tuning almost necessarily would result. This condition of excellent operation on only four tubes (one for the detector, three for the AF) prompted the idea of embodying optional loop operation.

The circuit corresponds generally with the one published last week. The loop jack is a new feature. The B battery binding posts are altered. Last week's circuit diagram showed the RF and detector plates both joined to a common B plus lead, normally 45 volts, because that is good for both purposes. This is true if the RF tube is readily oscillatory. A tube that is in good condition for oscillation will require no more than 45 plate

The Bias on the AF Circuit

volts as a radio-frequency amplifier. Also the 45-volt lead will give more volume than the conventional 22½ volts on the detector plate, except for those detector tubes that require special low plate voltages, as the UV200 and C300. Anyone who constructed the set pursuant to the diagram published last week, and who is obtaining good oscillatory functioning of the RF tube, need not make the suggested change, which is to have a separate B plus lead for the detector plate, a common B plus lead for the RF and final audio tube, and a common B plus lead for the first and second audio stages, as shown in Figs. 1 and 2.

The common RF-final audio B plus lead affords opportunity to increase the plate voltage on the RF to make some sluggish tubes oscillate desirably. While the plate of the last audio tube likewise gets a higher voltage at the same time, this is a good compromise.



BOTTOM VIEW of the set (Fig. 5). Note where the ¾-amp. fixed resistance, R3, is placed, on a mounting underneath. (Kadel & Herbert.)

The Bias Question

As no C battery is included the question of grid bias has to be settled. On the RF side, assuming that less than 60 volts are used, there is no need for any special bias, the rheostat R1 accounting suitably for those biasing needs that arise.

In the audio stages, where resistance coupling is included, it is usual to show the same B plus lead for the plate of the last audio tube as for the plates of the tubes coupled to the resistance stages. Such was done last week, but there is at least a theoretical advantage in the B plus wiring as shown in Figs. 1 and 2 this week.

Assume that the tubes with the resistors in the plate circuit, and the final audio tube, are connected to a common B plus lead. This would be at least 90 volts. Assume that much voltage at the battery. The voltage drop in the resistors is very considerable, at least 40 per cent, figuring the internal resistance in the plate circuit of a 201A tube and adding to that the 100,000 ohms of the resistor (R5 or R7). The speaker normally would not have a resistance anything like that (probably about 4,000 ohms), hence there is a great disparity of effective B voltage applied at the plates of the audio tubes, while about the same bias exists on all the tubes. R3 accounts for 1 volt negative bias. This does not numerically include the bias resulting from the grid leaks R6 and R8 being connected to negative A, but it may be assumed that such biasing is equal for the respective stages, hence there still remains an equal bias with an unequal applied net voltage at the plates.

Unless a special biasing method, such as a C battery, were introduced in the grid circuit of the last audio tube the equality of the voltage source is theoretically wrong, because of the resulting inequality of the resistance. There is wide divergence of effective voltage on the plate. Using the taps most readily at hand, if 90 volts were employed on the battery side of the plate resistors, 67½ would be plenty for the common RF—last audio B plus lead.

Hence five battery leads and two antenna-ground leads are necessary in the set as shown this week. The common connection of A plus and B minus may be made directly at the batteries, thus enabling the use of a B minus binding post on a 7-post terminal strip for one of the B plus leads. A scratch will convert the "—" sign to "+".

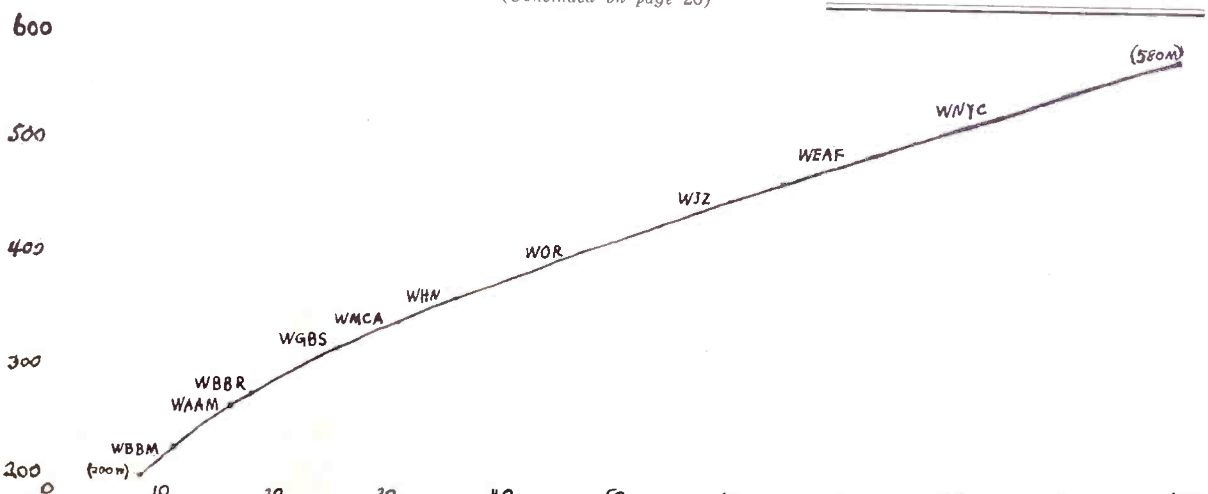
The set will work if the outdoor antenna and ground are disconnected from the binding posts and the loop terminals connected to them instead. Then there is no

(*Concluded on page 26*)

LIST OF PARTS

Two RF transformers, L1L2, L3L4.
One .001 mfd. double condenser, two sections, each .0005 mfd.; C1.
One 7x18" panel.
Two 20-ohm rheostats, R1, R2.
One ballast resistor, ¾ amp., R3.
Two .1 megohm resistors, R5 and R7.
Three grid leaks: R4, 2 megohms; R6, 1.0 megohm; R8, .5 megohm.
Five fixed condensers: C2, C4, .001 mfd. each; C5, C6, .006 mfd. each; C3 (grid condenser), .00025 mfd.
One 4" dial with pointer.
One audio-frequency transformer, PBGF.
One single open-circuit filament-control jack, FCJ.
Five sockets.
One socket shelf.
One terminal strip or six separate terminal binding posts.

Accessories: Five storage battery tubes, one storage battery of 100 ampere-hours or more, three 45-volt B batteries, one speaker, 100 feet of aerial wire, 50 feet of lead-in wire, one loop, ground clamp, lightning arrestor, two jack plugs (for speaker tips and for loop), cabinet. R3, R5, R6, R7 and R8 are Veby products.



A GRAPH showing the wavelength (at left, vertical) plotted against the dial settings (at bottom, horizontal), using a .0005 mfd. double condenser and two matched RF transformers. The entire wavelength band may be tuned in, and more. Thus 8 on the dial represents 200 meters and 100 represents 580 meters. In practice, therefore, all tuning would be done above 10, thus facilitating tuning in the low-wave stations, rather than having all the excess capacity at the upper end. (Fig. 7).

A 5-Tube Geared Receiver

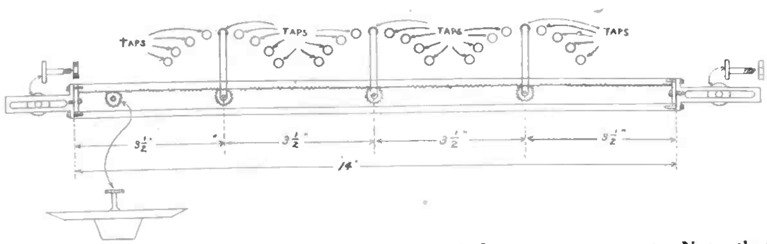


FIG. 1, showing the picture diagram of the switch tap arrangement. Note that all the switch arms are turned at once by the pinion-rack gearing system.

By Lewis Winner

Associate, Institute of Radio Engineers

PART I.

THE 1-dial set is coming in for greater popularity every day. Most of these sets employ variable condensers as tuning elements. The condensers all have a common rotor and individual stators. Another type is the variometer tuned set. The sets that employ condensers shunted across the secondaries of the RFT are known as capacity-tuned sets. The other type of set also employs condensers across the secondaries of the RFT, but they have nothing to do with the actual tuning. They are just used as balancers. The coils in the set do the tuning.

LEWIS WINNER

As you will note next week in the diagram (Fig. 3) there is no regeneration used. However, there are some ingenious ideas incorporated in this receiver, which make it very sensitive and voluminous. Instead of employing the direct coupling back of the grid and the plate in the detector tube we do something on the same order but in the second RF tube. More turns are put on the primary of the RFT used here than in the other one. For instance, if the primary of the first RFT has 10 turns, then the primary of the second RFT has 16 turns. In this way it is possible to get a large amount of close coupling between the plate of tube No. 1 and the grid of tube No. 2, which gives a feedback effect through the electrode capacity of the tube.

A peculiar thing here is that a rheostat controls the oscillatory action of the second RF tube to such a great degree that a distant station can be brought in louder. The adjustment of this rheostat varies the temperature of the filament of that tube. There are five rheostats, but only two are of any tuning value. The detector and the two audio-frequency amplifier stages need no varied control. The rheostat of the first RF tube is important, although not as important as the second rheostat.

The mechanical construction of the set is difficult. That is something one can not get away from. The difficulty lies in the gearing of the coupling coils. Mechanical ability is necessary.

What to Obtain

The stationary coils are wound on forms 3½" in diameter and 4" high. The rotary coils are wound on forms 2½" in diameter and 3" high. There are 3 stationary coils and 3 rotary coils. For winding the coils use No. 22 DCC wire. One pound of this wire will be necessary to wind all the coils. Three variable condensers, each having a capacity of .0005 mfd., are also required. See that they have their rated capacity on the front of the box. Disregard the number of plates.

Five 10-ohm durably-constructed rheostats also are needed. Five standard sockets, two low-ratio audio-frequency transformers, three sets of taps (each set consisting of 9 taps with screws and nuts), one terminal strip, a single-circuit jack, two 4" dials, two 2" dials, a 1.0 mfd. fixed condenser, a .00025 grid condenser, a 2-megohm grid leak and a 400-ohm potentiometer are among the other necessities for building of the set.

The panel should be 7x24".

The cabinet should be of a larger size than is usually seen. It is 7" high, 24" long, and 10" wide. The difficulty lies in procuring a cabinet 10" wide. The cabinet should be so wide because of the space required by the geared coils and the "fixed" variable condensers. The baseboard should be 9" wide and 22" long. The board should have a thickness of 3/16".

For internal wiring of the set use No. 14 bare hard-drawn copper wire. Try to get wire which is soft. Hookup wire is excellent. It is made in all lengths and has a clip on the beginning and on the end for connecting purposes. It is soft. One of the objections done away with is soldering. Many a person keeps away from building a radio set because of soldering. A great deal of skill is required in handling a soldering iron. This knack is not very easy to obtain.

Usually 12 lengths of various sizes of the hookup wire will fill the bill. The lengths are made in sizes including 2, 4, 6, 8, 10", etc.

There are two racks required. One is 20" long and one is 16" long. Eight pinions are also required. The pitch of all these is 32. There are two long pieces of stock brass tubing needed. One should be 20" long and the other 16" long. One-half dozen small size angles are also necessary. Various sizes of brass tubing will be cut from one length 24" long. Two slot holders 1" in length, plenty of all sizes of wood, with a thickness of ½" (square), set screws, solder, bolts, nuts, tapswitch mountings, etc., conclude the list of mechanical material needed.

How to Wind the Coils

The coils are wound in a bit different fashion than usual. Procure a form 3½" in diameter. Close to the edge wind 16 turns, (L1). Leave out two terminals, (beginning and the end of the winding), for connecting purposes. Leave ⅛" space. Wind 45 turns tapped at every fifth turn. Tap the 45th turn, too, and put on three more turns, this being a continuation of the secondary winding, and anchor the last turn in the form. Be sure that when you wind this secondary there is plenty of wire left, because the secondary winding is continued on the rotor form.

Procure the two other 3½" diameter forms. The primary winding (L3) contains 26 turns for L3, but 16 for L5. Wind the secondaries without taps.

They are all alike.

There will be some difficulty in winding the rotors of the coils. Procure the forms 2½" in diameter. Wind 13 turns. Leave about 5" of wire out before beginning to wind the coil. Connect the long lead from the end of L2 to the beginning of this rotary winding. In the same way the other rotary coils are wound and connected.

Do not place any material which will act as a holder on the coils. If you do this you may note that your receiver when completed will be able to receive the high wavelengths only.

After you have wound the coils assemble them. Three and one-quarter inches from the bottom of each coil on both sides make a mark. The marks should be so that the holes which are to be drilled, will be diametrically opposite each other. The marks are in the stator coils. One and one-half inches from the top and the bottom of the rotor, and also opposite each other, make marks. Drill a 3/16" hole in both the stator and the rotor forms where the markings were made. Now place the forms in such position that you can look right through the holes just drilled. Lay both the forms on the table, with their circumferences perpendicular to the table. Follow the same procedure with all the other stationary and secondary coils. Now get some stock brass tubing, 3/16" in diameter. Cut three lengths 4" long. Run the tubing through one of the stator forms and just before it enters the rotary form slit a piece of soft spring coil (⅛" inside diameter x ½" long) in the tubing. Push the shaft in until 1" protrudes. Now press the spring against the inside of the stator by slipping the rotor on the shaft. Now insert another spring coil at the opposite shaft end in the same manner. Continue the run of the shaft to the outside of the stationary coil. At this point solder on a lock screw. When the brass shaft is completely run through the both forms there should be ⅛" left out at the back which is for soldering the pinion.

At points inside and outside the respective forms drop some solder, enough so that there will be no room for the shaft to wabble. See Fig. 4 in next week's issue. Insert the rotor forms in the stator forms of the other two coils. That is, follow the same procedure in the soldering and setting of the lock screws as you did in this form.

On the beginning of all the shafts solder on a pinion, which is of the 32 pitch standard stock size.

In Fig. 4 you will note that the panel is very simple to drill. However, the holes

(Continued on page 30)

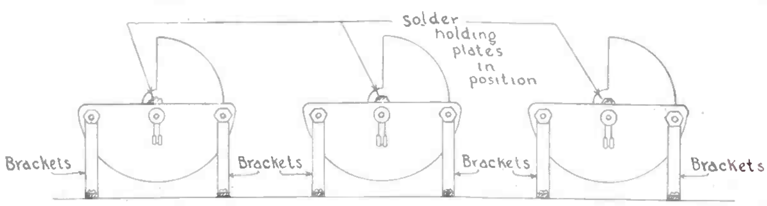


FIG. 2, showing the picture diagram of how the three variable condensers are mounted. Note the solder on the rotary plates.

The UX120 Model Diamond

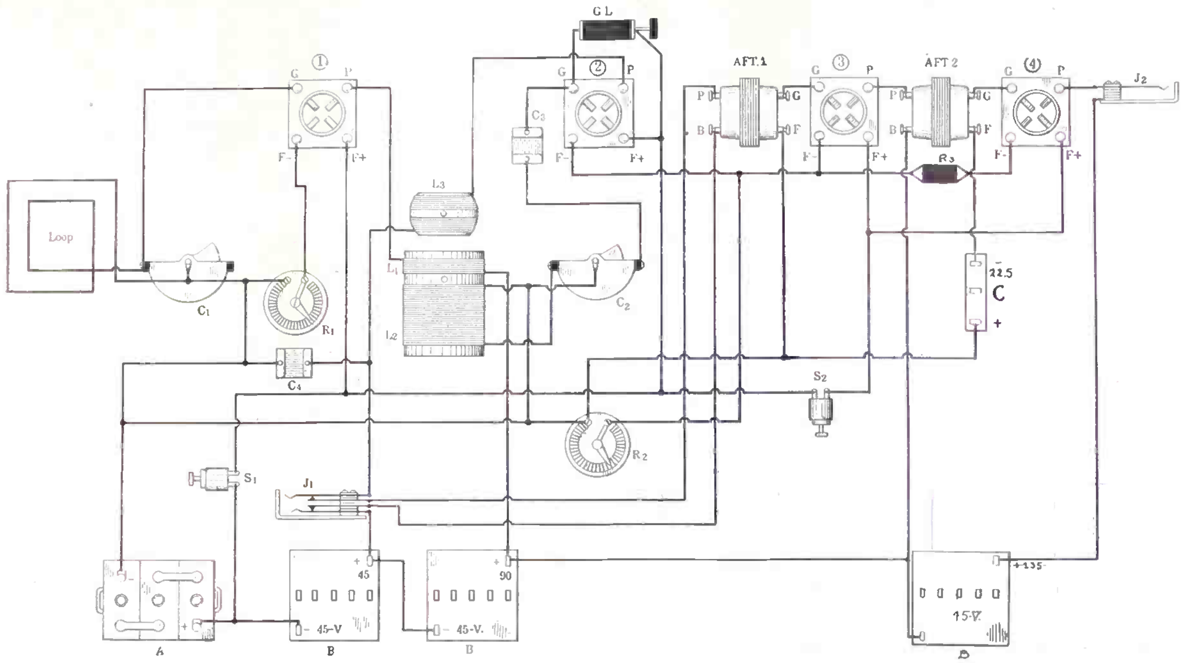


FIG. 1, a picture diagram of The Diamond, with the last stage of audio-frequency amplification changed to suit the new Corporation of America UX120 tube, on the market Sept. 1. Note R3, the 40-ohm fixed resistance, or 199-6V. Amperite. Note also that the C battery voltage is 22.5 and that it is used only on the last AF stage. The last socket shows the exact connecting posts, although the socket pictured does not resemble the small UX type needed. The connecting posts on Navy standard socket shown and on the UX sockets are the same, but the distance of the pin from the bottom of the base and the circumference of circular portion of the terminals are different. There is no pin on the base of the UX 120.

By Capt. P. V. O'Rourke

TO KEEP up with the trend of the radio science the last audio-frequency stage of amplification in The Diamond of the Air was made for the new Radio Corporation of America audio-frequency amplifier, UX120. Fig. 1 shows the receiver, with the new last stage.

CAPT. PETER V. O'ROURKE

The UX120 tube works on dry batteries (4.5 volts A battery supply). The filament terminal voltage is about 3. This resembles the 199 voltage. The UX120 tube doubles the volume output of the last stage. However to obtain that volume their output posts preferably should be connected to a speaker of low impedance.

The filament current consumption is remarkably small, only .125 ampere. The 199 uses .06 ampere.

To obtain best volume it is a good policy to use about 135 volts on the plate of the last tube, although this is not vital for less than full volume. That is one of the changes made in the hookup, that is, a 45-volt B battery was added. Also, the C battery of 4.5 volts was taken away from the two audio-frequency amplifier tubes and inserted one C battery used, this for only the last stage. The bias voltage was increased to 22.5, an old B battery was used for this purpose.

The drain on the actual B battery (not the C) is 6.5 milliamperes. This is at normal negative grid bias voltage. To use this tube in The Diamond, which was designed for 6-volt tubes, a ballast resistance was inserted in the F minus lead of the last tube. The resistance of this instrument is 50 ohms. A 199-6V amperite was used.

Use With 6-Volt Storage Batteries

Those who wish to use a 5-volt tube, in order to do away with the inserting of the large resistance, can use the UX112, but will get less volume. The filament current consumption is .5 amperes.

There are four B battery voltages that this can be made to operate successfully on the UX112. The maximum voltage that can be applied to the plate is 157.5. the grid bias (C battery) voltage for this B battery voltage is 10.5 for the UX112. The plate current is 7.9 milliamperes. When employing 135 volts on the plate, the grid bias is 9 volts, and the drain on the B battery is 5.3 milliamperes. At 112.5 volts on the plate, the C battery voltage is 7.5 volts and the plate current is 2.5 milliamperes. When using 90 volts on the plate the grid voltage is 6 and the plate current is 2.4 milliamperes.

These tubes may not be inserted in the standard bases used now. The standard bases are known as the Navy type. The following are the data on the large UX base, e.g., UX112:

At the top of the base the diameter is 1.357". At the bottom, it is 1.337". Thus the top is a tiny bit smaller than at the bottom. The total length of the base is 1.342". The filament terminals have a diameter of .156", while the grid and the plate terminals have a diameter of .125". The total length of the terminal is .552". From the bottom of the terminals to the pin is 1.226". As you will note, the differences exist in the special width of the filament prongs. This is called the large UX base.

The small UX base—as for the UX120—has the following dimensions:—The top of the base is 1.031" in diameter. The bottom of the base is 1.094" in diameter. The total length of the base is .848". However, from the top of the base to a small head the length is only .656". The space between the bottom of the base and the top of the head is .192". The filament, the grid and the plate terminals have the same dimensions as the other base.

The Socket Problem

The RCA is putting out a special adapter for the UX120, so that it may be inserted in the UV199 sockets. Hence get an adapter (if you use 199 sockets) or a small UX socket, like Pacent's.

The voltage amplification factor of the UX120 is 3.3. The voltage amplification factor of the UX112 is 8, when using 157.5 volts on the plate. For all the other B battery voltages the factor is 7.9.

How to Make the Coils

If the coils are to be made at home, L1L2 may consist of 53 turns of No. 20 single cotton covered wire, tapped at the tenth turn. The tubing is 3½" diameter, 4" high, and may be cardboard, fiber bakelite, quartzite rods, etc. This coil is more conveniently made as a single winding, tapped at the right point, the ground and negative A battery going to the tap, this connection being continued to the rotor of the double condenser. In that way, too, you can't get your polarities wrong at the coil terminals.

L3L4L5, the 3-circuit coupler, is wound with the same kind of wire, L3 consisting of seven turns on a 3½" diameter tubing or other form. Anchor the coil terminals through pinholes punctured in the form. Leave ½" space, then wind 43 turns for the secondary, L4, as a distinctly separate winding. Leave about 10" of slack wire and cut. Thus if you find that by connecting the end of the long tailpiece you have not enough inductance, you can put on two more turns, using the slack wire. In that case push up the secondary wind-

Complete Chart of Tube Line

MODEL	USE	BASE	GRID CONDENSER M.F.D.	GRID LEAK (See Note 6)	DETECTOR GRID RETURN LEAD	"A" BATTERY VOLTS (SUPPLY)	FILAMENT TERMINAL VOLTS	"A" BATTERY CURRENT AMPERES	"B" BATTERY VOLTS DETECTOR	"B" BATTERY VOLTS AMPLIFIER	NEGATIVE "C" BATTERY VOLTS	PLATE CURRENT MILLIAMPERES NORMAL OPERATING (See Note 1 & 5)	OUTPUT RESISTANCE OHMS (See Note 1)	MUTUAL CONDUCTANCE MICRO MHOS (See Note 1)	VOLTAGE AMPLIFICATION FACTOR (See Note 1)	MAXIMUM DIAMETER OVERALL	MAXIMUM HEIGHT OVERALL
RADIOTRON UV-199	Detector Amplifier	UV 199 Base	.00025	2 to 9	+F	4.5	3.0	.06	45	90	4.5	2.5	15,000	415	6.25	1 1/16"	3 1/2"
RADIOTRON UX-199	Detector Amplifier	R C A Small Standard UX Base	.00025	2 to 9	+F	4.5	3.0	.06	45	90	4.5	2.5	15,000	415	6.25	1 1/16"	4 5/8"
RADIOTRON UV-200	Detector Only	Navy Base	.00025	1/2 to 2	-F	6	5	1.0	16 to 22 1/2	—	—	—	—	—	—	1 3/4"	4 5/16"
RADIOTRON UX-200	Detector Only	R C A Large Standard UX Base	.00025	1/2 to 2	-F	6	5	1.0	16 to 22 1/2	—	—	—	—	—	—	1 13/16"	4 7/16"
RADIOTRON UV-201-A	Detector Amplifier	Navy Base	.00025	2 to 9	+F	6	5	.25	45	90 135	4.5 9.0	3 4	12,000 11,000	675 725	8 8	1 13/16"	4 5/16"
RADIOTRON UX-201-A	Detector Amplifier	R C A Large Standard UX Base	.00025	2 to 9	+F	6	5	.25	45	90 135	4.5 9.0	3 4	12,000 11,000	675 725	8 8	1 13/16	4 7/16"
RADIOTRON WD-11	Detector Amplifier	WD 11 Base	.00025	3 to 5	+F	1.5	1.1	.25	22 1/2	90	4.5	2.8	14,000	400	5.6	1 5/32"	3 3/4"
RADIOTRON WD-12	Detector Amplifier	Navy Base	.00025	3 to 5	+F	1.5	1.1	.25	22 1/2	90	4.5	2.8	14,000	400	5.6	1 7/16"	4 7/16"
RADIOTRON WX-12	Detector Amplifier	R C A Large Standard UX Base	.00025	3 to 5	+F	1.5	1.1	.25	22 1/2	90	4.5	2.8	14,000	400	5.6	1 7/16"	4 7/16"
RADIOTRON UX-112	Detector Amplifier	R C A Large Standard UX Base	.00025	3 to 5	+F	6	5	0.5	22 1/2 to 45	157.5 135 (See Note 2) 112.5 90	10.5 9 7.5 6	7.9 5.8 2.5 2.4	4800 5500 8400 8800	1670 1435 940 890	8.0 7.9 7.9 7.9	1 13/16"	4 11/16"
RADIOTRON UX-120	Audio Amplifier Last Stage Only	R C A Small Standard UX Base	—	—	—	4.5	3.0	.125	—	135	22.5	6.5	6,600	500	3.3	1 3/16"	4 1/8"
RADIOTRON UX-210	Amplifier Oscillator	R C A Large Standard UX Base	—	—	—	8 8 8 6 6 6 6	7.5 7.5 7.5 (See Note 7) 6.0 6.0 6.0 6.0	1.25 1.25 1.25 1.1 1.1 1.1 1.1		425 350 250 157.5 135 112.5 90	35 27 18 10.5 9 7.5 4.5	22 18 12 6 4.5 3 3	5000 5100 5600 7400 8000 9700 9700	1550 1500 1330 1020 940 775 775	7.75 7.65 7.5 7.5 7.5 7.5 7.5	2 3/16"	5 5/8"
RADIOTRON UX-874	Voltage Regulator Tube	R C A Large Standard UX Base	Rated Voltage: 90 Volts D.C. Starting Voltage: 125 Volts D.C. Maximum D. C. Current: 50 Milliamperes													2 3/16"	5 5/8"
RADIOTRON UV-876	Ballast Tube	Standard Mogul Type Screw Base	Current Rating: 1.7 Amperes Voltage Range: 40 to 60 Volts													2 1/16"	8"
RADIOTRON UV-877 (See Note 4)	Protective Tube	Double Contact Bayonet Automobile Type	Voltage Drop Across: Half Filament 2.5, Entire Filament 5 — At 20 Milliamperes D. C.; Half Filament 45.0, Entire Filament 90 — At 90 Milliamperes D. C.													1 7/16"	2 1/2"
RECTRON UX-213	Full Wave Rectifier	R C A Large Standard UX Base	Filament Terminal Voltage: 5.0 Volts Filament Current: 2.0 Amperes Max. A. C. Input Voltage per Anode: 220 A. C. (R. M. S.) or 440 across both Anodes (See Note 3) Max. D. C. Load Current: 65 Milliamperes													2 3/16"	5 5/8"
RECTRON UX-216-B	Half Wave Rectifier	R C A Large Standard UX Base	Filament Terminal Voltage: 7.5 Volts Filament Current: 1.25 Amperes Max. A. C. Input Voltage: 550 A. C. (R. M. S.) (See Note 3) Max. D. C. Load Current: 65 Milliamperes													2 3/16"	5 5/8"

NOTE 1 At normal operating grid voltage. (Not at zero grid)
NOTE 2 Plate voltage for average use is 90 to 135 volts.
NOTE 3 R. M. S. Indicates "Root Mean Square" as indicated on an A. C. voltmeter.
NOTE 4 Connection to shell of base for third terminal which is the lead to mid-point of filament.
NOTE 5 The plate current values given are less than those obtained with zero grid, but are the currents actually obtained when the tube is operated at indicated values of plate voltage and grid bias voltage.
NOTE 6 The symbol —◇— indicates megohms
NOTE 7 When 6 volt supply is used, no rheostat is required.

ing so that the new terminal may be inserted through the previously made pinholes for anchorage.

The rotary coil or tickler may consist of 26 turns of No. 26 single silk covered wire, 13 turns on each side of where the rotor shaft will protrude. The form is 2¾" in diameter and 2½" high. Place the tickler as far away from the stator form as is conveniently possible, so that little of the tickler form will dip into the stator form. If a panel-mounted tickler, with stator underneath, is not objectionable, the tickler form will dip into the stator form, the nearest possible points. In the great preponderance of instances, however, commercial products will be used.

No concern need be felt if any commercial coil, either RFT or coupler, shows a variance between the number of turns on the primaries thereof and the number prescribed in this article, so long as aperiodic primaries are used (not primaries about as large as the secondaries). Nor need the kind of wire used be of material concern, since the circuit was tried out with all manner of coils and performed splendidly.

If forms of other sizes are on hand, they may be used, although 3" diameter is about as small as can be recommended for this set. If 4" diameters are used, decrease turns 25 per cent.

HEAVISIDE THEORY CONFIRMED

Layer Height Is Measured; Key to Fading

All Transmission Found to Embody Two Waves, One Horizontal That Travels Via the Earth, the Other Vertical and Moving Only in the Air.

PROBLEMS REDUCED TO FORMULAS NOW

Dead Spots in Short-Wave Work Caused by Relation Between Earth's Magnate Field, Layer Height and Frequency—May Account for Program Fading.

Experiments by the Naval Research Laboratory at Bellevue, D. C., in conjunction with the Carnegie Institution, developed the following:

(1) Confirmation of the Heaviside layer theory.

(2) Fading may be caused by this layer.

(3) Two waves are used in broadcasting: a horizontal wave, traveling through earth, and a vertical wave, traveling through the air.

WASHINGTON.

The Heaviside layer theory was established as a fact, the Navy Department announced, disclosing the results of radio tests made by it and the Department of Tenestral Magnetism of the Carnegie Institution. The layer is a deflecting roof in the upper levels of the atmosphere. Secretary of the Navy Wilbur made the announcement.

Another theory confirmed was the existence of radio waves in two forms, horizontal and vertical, as set forth by E. F. W. Alexanderson, chief consulting engineer of the Radio Corporation of America, in the July 25 issue of Radio World.

The horizontal wave is earth-bound, the other being a space wave, and only the vertical wave is affected by the Heaviside layer. The height of the layer was measured. It varied under different conditions, but usually was about 100 miles up. The variation in height and density accounted for fading, at least the "skip distance" phenomenon on short waves.

The horizontal wave moves along the earth's surface till it slides off tangentially into the ether. The vertical wave, striking the undersurface of the sky ceiling, is deflected downward, hitting the earth at distances which depend upon the angle of impact upon the ceiling.

After striking the earth again, these rebounded waves are deflected upward at an angle, again strike the sky ceiling, rebound and continue this process around the world. It is this process that creates the so-called "skip distance."

Secretary Wilbur said that the Navy Department was not yet ready to announce in detail the result of the experiments, but that with the confirmation of the "radio roof" theory he felt, because of its importance to the radio world, scientists and radio engineers should have the benefit of a preliminary announcement immediately.

The experiments are continuing, he said, but the results already stand as "the nearest approach to the key to unsolved problems of radio that has yet been made." Though the chief benefit at present will be to commercial radio telegraphy, the eventual achievement will be the building of a high frequency transmitting station for $60,000 "that will give better service and longer range than the present high-power stations costing $2,000,000, while the cost of operation will be correspondingly reduced."

Wilbur Describes Experiments of Navy With Short Waves

By Curtis D. Wilbur
Secretary of the Navy

Investigations conducted by the Naval Research Labratory, in association with the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, have resulted in confirming the theory of an ionized region in the higher levels of the earth's atmosphere.

From observations made, it appears that the plane of maximum density, in popular language the ceiling of the sky, lies at a varying distance above the surface of the earth, rising and falling as atmospheic conditions vary.

This layer, the conception of which originated independently with Heaviside in England and Kennelly in the United States, is known in the scientific world as the Kennelly-Heaviside layer. It acts as a deflecting surface to electro-magnetic waves, under which they are guided around the world in a very similar way to that in which whispered sound waves run under the domes of the Capitol at Washington and of Saint Paul's Cathedral in London.

The results attained are based upon an analysis of the phenomenon known as the "skip distance," checked by a simple mechanical device by means of which the effective distance of the deflecting layer may be actually measured.

In the pioneer work of short wavelength transmission it was the experience that signals could be picked up at distances forty or fifty miles, after which they disappeared. They were again picked up at points hundreds of miles distant. The intervening of dead space of non-reception became known as the "skip distance."

In seeking to account for this, a theory was developed at the research laboratory that there was a relation between the earth's magnetic field, the frequency of the waves used, "skip distances" observed, and the height of the Heaviside layer.

This relation could be, and was, worked out methematically, using data contributed by the members of the American Radio Relay League, and their co-workers in foreign countries.

The joint experiments with the Carnegie Institution of Washington approached the solution of the problem from a different angle, demonstrating definitely the existence of two waves, one of them arriving by way of the earth and the other by way of the layer. From these experiments estimates of effective height of the layer were made, these estimates being essentially in agreement with the estimates derived from observations on the "skip distance."

Other peculiarities of the action of the layer have been investigated by the Carnegie Institution of Washington in collaboration with the Radio Corporation of America and the Westinghouse Manufacturing Company. The knowledge now gained will play an important part in further advancing the radio art.

The Naval Research Laboratory is now in communication with practically every country using short wavelength (high frequencies). Understanding of the principles involved has progressed to the point where it can be definitely stated that a high frequency transmitting station can be built at a cost of $60,000 that will give better and longer range than the present high power stations costing $2,000,000, and the cost of operation will be correspondingly reduced.

Simple Mechanism Measured the Layer

BELLEVUE, D. C.

In the experiments at Bellevue, conducted under the direction of Dr. A. H. Taylor, a simple mechanical device has been used by means of which it has been possible to easily and accurately measure the effective distance of the "deflecting layer" or ceiling from the surface of the earth.

This has determined that the layer, generally speaking, is more than 100 miles high.

In confirming the radio roof theory, the laboratory has been communicating great distances by short wavelength transmission, reaching countries throughout the world. It has demonstrated its ability to talk with the American fleet in Australia, Samoa and New Zealand and send messages to the MacMillan Arctic expedition in Greenland the same day.

It was in these experiments that proof was developed that the ionized region in the upper air strata acts as a deflecting surface to the electro-magnetic waves, under which they rebound downward and reach all parts of the earth.

BENEVOLENT TORTURE

Stout persons are thinking deeply about the announcer who conducts setting-up exercises daily through stations WCAP, Washington; WEAF, New York, and WEEI, Boston. The announcer seems to take a fiendish delight in requesting exercises particularly difficult for fat people to perform.

A 5-Tube Geared Receiver

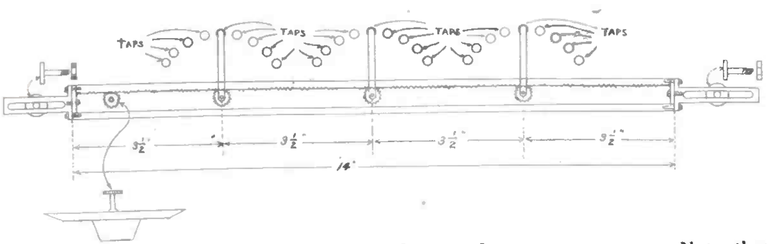


FIG. 1, showing the picture diagram of the switch tap arrangement. Note that all the switch arms are turned at once by the pinion-rack gearing system.

By Lewis Winner

Associate, Institute of Radio Engineers

PART I.

THE 1-dial set is coming in for greater popularity every day. Most of these sets employ variable condensers as tuning elements. The condensers all have a common rotor and individual stators. Another type is the variometer tuned set. The sets that employ condensers shunted across the secondaries of the RFT are known as capacity-tuned sets. The other type of set also employs condensers across the secondaries of the RFT, but they have nothing to do with the actual tuning. They are just used as balancers. The coils in the set do the tuning.

LEWIS WINNER

As you will note next week in the diagram (Fig. 3) there is no regeneration used. However, there are some ingenious ideas incorporated in this receiver, which make it very sensitive and voluminous. Instead of employing the direct coupling back of the grid and the plate in the detector tube we do something on the same order but in the second RF tube. More turns are put on the primary of the RFT used here than in the other one. For instance, if the primary of the first RFT has 10 turns, then the primary of the second RFT has 16 turns. In this way it is possible to get a large amount of close coupling between the plate of tube No. 1 and the grid of tube No. 2, which gives a feedback effect through the electrode capacity of the tube.

A peculiar thing here is that a rheostat controls the oscillatory action of the second RF tube to such a great degree that a distant station can be brought in louder. The adjustment of this rheostat varies the temperature of the filament of that tube. There are five rheostats, but only two are of any tuning value. The detector and the two audio-frequency amplifier stages need no varied control. The rheostat of the first RF tube is important, although not as important as the second rheostat.

The mechanical construction of the set is difficult. That is something one can not get away from. The difficulty lies in the gearing of the coupling coils. Mechanical ability is necessary.

What to Obtain

The stationary coils are wound on forms 3½" in diameter and 4" high. The rotary coils are wound on forms 2½" in diameter and 3" high. There are 3 stationary coils and 3 rotary coils. For winding the coils use No. 22 DCC wire. One pound of this wire will be necessary to wind all the coils. Three variable condensers, each having a capacity of .0005 mfd., are also required. See that they have their rated capacity on the front of the box. Disregard the number of plates.

Five 10-ohm durably-constructed rheostats also are needed. Five standard sockets, two low-ratio audio-frequency transformers, three sets of taps (each set consisting of 9 taps with screws and nuts), one terminal strip, a single-circuit jack, two 4" dials, two 2" dials, a 1.0 mfd. fixed condenser, a .00025 grid condenser, a 2-megohm grid leak and a 400-ohm potentiometer are among the other necessities for building of the set.

The panel should be 7x24".

The cabinet should be of a larger size than is usually seen. It is 7" high, 24" long, and 10" wide. The difficulty lies in procuring a cabinet 10" wide. The cabinet should be so wide because of the space required by the geared coils and the "fixed" variable condensers. The baseboard should be 9" wide and 22" long. The board should have a thickness of 3/16".

For internal wiring of the set use No. 14 bare hard-drawn copper wire. Try to get wire which is soft. Hookup wire is excellent. It is made in all lengths and has a clip on the beginning and on the end for connecting purposes. It is soft. One of the objections done away with is soldering. Many a person keeps away from building a radio set because of soldering. A great deal of skill is required in handling a soldering iron. This knack is not very easy to obtain.

Usually 12 lengths of various sizes of the hookup wire will fill the bill. The lengths are made in sizes including 2, 4, 6, 8, 10", etc.

There are two racks required. One is 20" long and one is 16" long. Eight pinions are also required. The pitch of all these is 32. There are two long pieces of stock brass tubing needed. One should be 20" long and the other 16" long. One-half dozen small size angles are also necessary. Various sizes of brass tubing will be cut from one length 24" long. Two slot holders 1" in length, plenty of all sizes of wood, with a thickness of ½" (square), set screws, solder, bolts, nuts, tapswitch mountings, etc., conclude the list of mechanical material needed.

How to Wind the Coils

The coils are wound in a bit different fashion than usual. Procure a form 3½" in diameter. Close to the edge wind 16 turns, (L1). Leave out two terminals, (beginning and the end of the winding), for connecting purposes. Leave ⅛" space. Wind 45 turns tapped at every fifth turn. Tap the 45th turn, too, and put on three more turns, this being a continuation of the secondary winding, and anchor the last turn in the form. Be sure that when you wind this secondary there is plenty of wire left, because the secondary winding is continued on the rotor form.

Procure the two other 3½" diameter forms. The primary winding (L3) contains 26 turns for L3, but 16 for L5. Wind the secondaries without taps.

They are all alike.

There will be some difficulty in winding the rotors of the coils. Procure the forms 2½" in diameter. Wind 13 turns. Leave about 5" of wire out before beginning to wind the coil. Connect the long lead from the end of L2 to the beginning of this rotary winding. In the same way the other rotary coils are wound and connected.

Do not place any material which will act as a holder on the coils. If you do this you may note that your receiver when completed will be able to receive the high wavelengths only.

After you have wound the coils assemble them. Three and one-quarter inches from the bottom of each coil on both sides make a mark. The marks should be so that the holes which are to be drilled, will be diametrically opposite each other. The marks are in the stator coils. One and one-half inches from the top and the bottom of the rotor, and also opposite each other, make marks. Drill a 3/16" hole in both the stator and the rotor forms where the markings were made. Now place the forms in such position that you can look right through the holes just drilled. Lay both the forms on the table, with their circumferences perpendicular to the table. Follow the same procedure with all the other stationary and secondary coils. Now get some stock brass tubing, 3/16" in diameter. Cut three lengths 4" long. Run the tubing through one of the stator forms and just before it enters the rotary form slit a piece of soft spring coil (⅛" inside diameter x ½" long) in the tubing. Push the shaft in until 1" protrudes. Now press the spring against the inside of the stator by slipping the rotor on the shaft. Now insert another spring coil at the opposite shaft end in the same manner. Continue the run of the shaft to the outside of the stationary coil. At this point solder on a lock screw. When the brass shaft is completely run through the both forms there should be ⅛" left out at the back which is for soldering the pinion.

At points inside and outside the respective forms drop some solder, enough so that there will be no room for the shaft to wabble. See Fig. 4 in next week's issue. Insert the rotor forms in the stator forms of the other two coils. That is, follow the same procedure in the soldering and setting of the lock screws as you did in this form.

On the beginning of all the shafts solder on a pinion, which is of the 32 pitch standard stock size.

In Fig. 4 you will note that the panel is very simple to drill. However, the holes

(Continued on page 30)

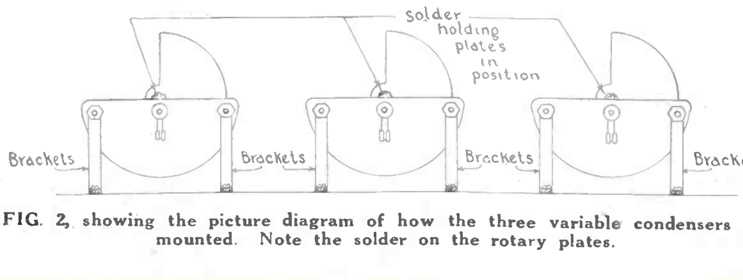


FIG. 2, showing the picture diagram of how the three variable condensers are mounted. Note the solder on the rotary plates.

The UX120 Model Diamond

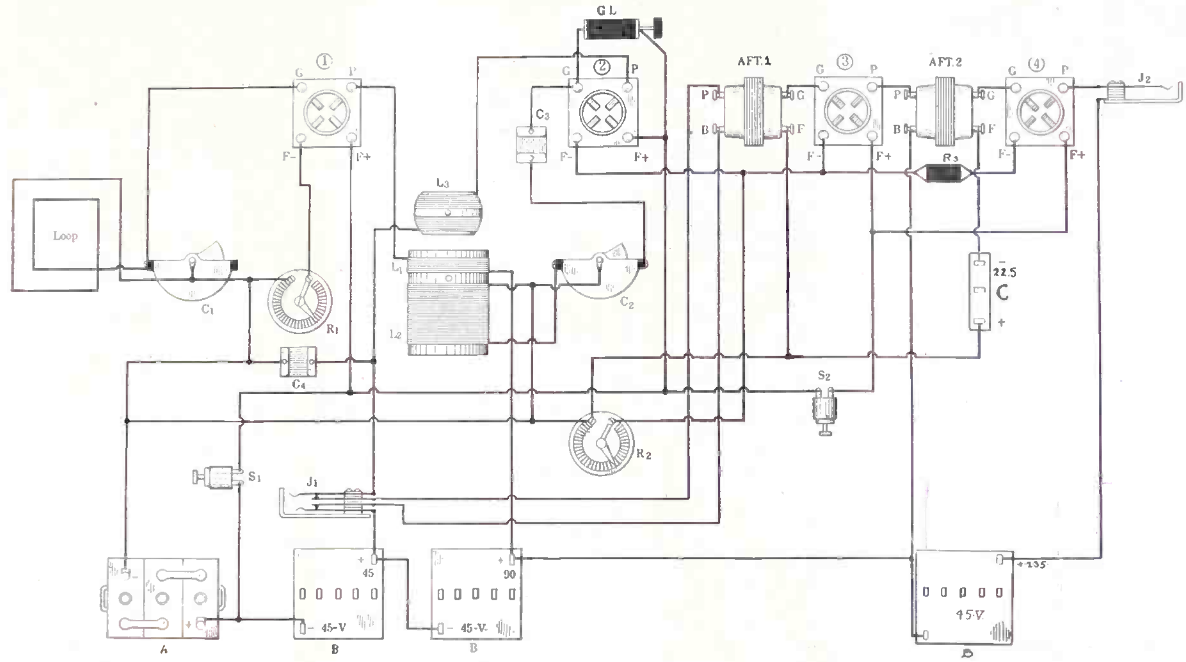


FIG. 1, a picture diagram of The Diamond, with the last stage of audio-frequency amplification changed to suit the new Corporation of America UX120 tube, on the market Sept. 1. Note R3, the 40-ohm fixed resistance, or 199-6V. Amperite. Note also that the C battery voltage is 22.5 and that it is used only on the last AF stage. The last socket shows the exact connecting posts, although the socket pictured does not resemble the small UX type needed. The connecting posts on Navy standard socket shown and on the UX sockets are the same, but the distance of the pin from the bottom of the base and the circumference of circular portion of the terminals are different. There is no pin on the base of the UX 120.

By Capt. P. V. O'Rourke

TO KEEP up with the trend of the radio science the last audio-frequency stage of amplification in The Diamond of the Air was made for the new Radio Corporation of America audio-frequency amplifier, UX120. Fig. 1 shows the receiver, with the new last stage.

CAPT. PETER V. O'ROURKE

The UX120 tube works on dry batteries (4.5 volts A battery supply). The filament terminal voltage is about 3. This resembles the 199 voltage. The UX120 tube doubles the volume output of the last stage. However to obtain that volume their output posts preferably should be connected to a speaker of low impedance.

The filament current consumption is remarkably small, only .125 ampere. The 199 uses .06 ampere.

To obtain best volume it is a good policy to use about 135 volts on the plate of the last tube, although this is not vital for less than full volume. That is one of the changes made in the hookup, that is, a 45-volt B battery was added. Also, the C battery of 4.5 volts was taken away from the two audio-frequency amplifier tubes and inserted one C battery used, this for only the last stage. The bias voltage was increased to 22.5, an old B battery was used for this purpose.

The drain on the actual B battery (not the C) is 6.5 milliamperes. This is at normal negative grid bias voltage. To use this tube in The Diamond, which was designed for 6-volt tubes, a ballast resistance was inserted in the F minus lead of the last tube. The resistance of this instrument is 50 ohms. A 199-6V amperite was used.

Use With 6-Volt Storage Batteries

Those who wish to use a 5-volt tube, in order to do away with the inserting of the large resistance, can use the UX112, but will get less volume. The filament current consumption is .5 amperes.

There are four B battery voltages that this can be made to operate successfully on the UX112. The maximum voltage that can be applied to the plate is 157.5. the grid bias (C battery) voltage for this B battery voltage is 10.5 for the UX112. The plate current is 7.9 milliamperes. When employing 135 volts on the plate, the grid bias is 9 volts, and the drain on the B battery is 5.3 milliamperes. At 112.5 volts on the plate, the C battery voltage is 7.5 volts and the plate current is 2.5 milliamperes. When using 90 volts on the plate the grid voltage is 6 and the plate current is 2.4 milliamperes.

These tubes may not be inserted in the standard bases used now. The standard bases are known as the Navy type. The following are the data on the large UX base, e.g., UX112:

At the top of the base the diameter is 1.357". At the bottom, it is 1.337". Thus the top is a tiny bit smaller than at the bottom. The total length of the base is 1.342". The filament terminals have a diameter of .156", while the grid and the plate terminals have a diameter of .125". The total length of the terminal is .552". From the bottom of the terminals to the pin is 1.226". As you will note, the differences exist in the special width of the filament prongs. This is called the large UX base.

The small UX base—as for the UX120—has the following dimensions:—The top of the base is 1.031" in diameter. The bottom of the base is 1.094" in diameter. The total length of the base is .848". However, from the top of the base to a small head the length is only .656". The space between the bottom of the base and the top of the head is .192". The filament, the grid and the plate terminals have the same dimensions as the other base.

The Socket Problem

The RCA is putting out a special adapter for the UX120, so that it may be inserted in the UV199 sockets. Hence get an adapter (if you use 199 sockets) or a small UX socket, like Pacent's.

The voltage amplification factor of the UX120 is 3.3. The voltage amplification factor of the UX112 is 8, when using 157.5 volts on the plate. For all the other B battery voltages the factor is 7.9.

How to Make the Coils

If the coils are to be made at home, L1L2 may consist of 53 turns of No. 20 single cotton covered wire, tapped at the tenth turn. The tubing is 3½" diameter, 4" high, and may be cardboard, fiber bakelite, quartzite rods, etc. This coil is more conveniently made as a single winding, tapped at the right point, the ground and negative A battery going to the tap, this connection being continued to the rotor of the double condenser. In that way, too, you can't get your polarities wrong at the coil terminals.

L3L4L5, the 3-circuit coupler, is wound with the same kind of wire, L3 consisting of seven turns on a 3½" diameter tubing or other form. Anchor the coil terminals through pinholes punctured in the form. Leave ½" space, then wind 43 turns for the secondary, L4, as a distinctly separate winding. Leave about 10" of slack wire and cut. Thus if you find that by connecting the end of the long tailpiece you have not enough inductance, you can put on two more turns, using the slack wire. In that case push up the secondary wind-

Complete Chart of Tube Line

MODEL	USE	BASE	GRID CONDENSER M.F.D	GRID LEAK (See Note 6)	DETECTOR GRID RETURN LEAD	"A" BATTERY VOLTS (SUPPLY)	FILAMENT TERMINAL VOLTS	"A" BATTERY CURRENT AMPERES	"B" BATTERY VOLTS DETECTOR	"B" BATTERY VOLTS AMPLIFIER	NEGATIVE "C" BATTERY VOLTS	PLATE CURRENT MILLIAMPERES NORMAL OPERATING (See Note 3 & 5)	OUTPUT RESISTANCE OHMS (See Note 1)	MUTUAL CONDUCTANCE MICRO-MHOS (See Note 1)	VOLTAGE AMPLIFICATION FACTOR (See Note 1)	MAXIMUM DIAMETER OVERALL	MAXIMUM HEIGHT OVERALL
RADIOTRON UV-199	Detector Amplifier	UV 199 Base	.00025	2 to 9	+F	4.5	3.0	.06	45	90	4.5	2.5	15,000	415	6.25	1 1/16"	3 1/2"
RADIOTRON UX-199	Detector Amplifier	R C A Small Standard UX Base	.00025	2 to 9	+F	4.5	3.0	.06	45	90	4.5	2.5	15,000	415	6.25	1 1/16"	4 5/8"
RADIOTRON UV-200	Detector Only	Navy Base	.00025	1/2 to 2	-F	6	5	1.0	16 to 22 1/2	—	—	—	—	—	—	1 3/4"	4 5/16"
RADIOTRON UX-200	Detector Only	R C A Large Standard UX Base	.00025	1/2 to 2	-F	6	5	1.0	16 to 22 1/2	—	—	—	—	—	—	1 13/16"	4 7/16"
RADIOTRON UV-201-A	Detector Amplifier	Navy Base	.00025	2 to 9	+F	6	5	.25	45	90 135	4.5 9.0	3 4	12,000 11,000	675 725	8 8	1 13/16"	4 5/16"
RADIOTRON UX-201-A	Detector Amplifier	R C A Large Standard UX Base	.00025	2 to 9	+F	6	5	.25	45	90 135	4.5 9.0	3 4	12,000 11,000	675 725	8 8	1 13/16"	4 7/16"
RADIOTRON WD-11	Detector Amplifier	WD 11 Base	.00025	3 to 5	+F	1.5	1.1	.25	22 1/2	90	4.5	2.8	14,000	400	5.6	1 5/32"	3 3/4"
RADIOTRON WD-12	Detector Amplifier	Navy Base	.00025	3 to 5	+F	1.5	1.1	.25	22 1/2	90	4.5	2.8	14,000	400	5.6	1 7/16"	4 7/16"
RADIOTRON WX-12	Detector Amplifier	R C A Large Standard UX Base	.00025	3 to 5	+F	1.5	1.1	.25	22 1/2	90	4.5	2.8	14,000	400	5.6	1 7/16"	4 7/16"
RADIOTRON UX-112	Detector Amplifier	R C A Large Standard UX Base	.00025	3 to 5	+F	6	5	0.5	22 1/2 to 45	157.5 135 (See Note 2) 112.5 90	10.5 9. 7.5 6.	7.9 5.8 2.5 2.4	4800 5500 8400 8800	1670 1435 940 890	8.0 7.9 7.9 7.9	1 13/16"	4 11/16"
RADIOTRON UX-120	Audio Amplifier Last Stage Only	R C A Small Standard UX Base	—	—	—	4.5	3.0	.125	—	135	22.5	6.5	6,600	500	3.3	1 3/16"	4 1/8"
RADIOTRON UX-210	Amplifier Oscillator	R C A Large Standard UX Base	—	—	—	8 8 8 6 6 6 6	7.5 7.5 7.5 (See Note 7) 6.0 6.0 6.0 6.0	1.25 1.25 1.25 1.1 1.1 1.1 1.1		425 350 250 157.5 135 112.5 90	35 27 18 10.5 9 7.5 4.5	22 18 12 6 4.5 3 3	5000 5100 5600 7400 8000 9700 9700	1550 1500 1330 1020 940 775 775	7.75 7.65 7.5 7.5 7.5 7.5 7.5	2 3/16"	5 5/8"
RADIOTRON UX-874	Voltage Regulator Tube	R C A Large Standard UX Base	Rated Voltage: 90 Volts D.C. Starting Voltage: 125 Volts D.C. Maximum D. C. Current: 50 Milliamperes													2 3/16"	5 5/8"
RADIOTRON UV-876	Ballast Tube	Standard Mogul Type Screw Base	Current Rating: 1.7 Amperes Voltage Range: 40 to 60 Volts													2 1/16"	8"
RADIOTRON UV-877 (See Note 4)	Protective Tube	Double Contact Bayonet Automobile Type	Voltage Drop Across: Half Filament 2.5, Entire Filament 5 — At 20 Milliamperes D. C. Half Filament 45.0, Entire Filament 90 — At 90 Milliamperes D. C.													1 7/16"	2 1/2"
RECTRON UX-213	Full Wave Rectifier	R C A Large Standard UX Base	Filament Terminal Voltage: 5.0 Volts Filament Current : 2.0 Amperes Max. A. C. Input Voltage per Anode: 220 A. C. (R. M. S.) or 440 across both Anodes. (See Note 8) Max. D. C. Load Current : 65 Milliamperes													2 3/16"	5 5/8"
RECTRON UX-216-B	Half Wave Rectifier	R C A Large Standard UX Base	Filament Terminal Voltage: 7.5 Volts Filament Current : 1.25 Amperes Max. A. C. Input Voltage : 550 A. C. (R. M. S.) (See Note 8) Max. D. C. Load Current : 65 Milliamperes													2 3/16"	5 5/8"

NOTE 1 At normal operating grid voltage. (Not at zero grid)
NOTE 2 Plate voltage for average use is 90 to 135 volts.
NOTE 3 R. M. S. Indicates "Root Mean Square" as indicated on an A. C. voltmeter.
NOTE 4 Connection to shell of base for third terminal which is the lead to mid-point of filament.
NOTE 5 The plate current values given are less than those obtained with zero grid, but are the currents actually obtained when the tube is operated at indicated values of plate voltage and grid bias voltage.
NOTE 6 The symbol —◇— Indicates megohms.
NOTE 7 When 6 volt supply is used, no rheostat is required.

ing so that the new terminal may be inserted through the previously made pin-holes for anchorage.

The rotary coil or tickler may consist of 26 turns of No. 26 single silk covered wire, 13 turns on each side of where the rotor shaft will protrude. The form is 2¾" in diameter and 2½" high. Place the tickler as far away from the stator form as is conveniently possible, so that little of the tickler form will dip into the stator form. If a panel-mounted tickler, with stator underneath, is not objectionable, the tickler form will dip into the stator form, the nearest possible points. In the great preponderance of instances, however, commercial products will be used.

No concern need be felt if any commercial coil, either RFT or coupler, shows a variance between the number of turns on the primaries thereof and the number prescribed in this article, so long as aperiodic primaries are used (not primaries about as large as the secondaries). Nor need the kind of wire used be of material concern, since the circuit was tried out with all manner of coils and performed splendidly.

If forms of other sizes are on hand, they may be used, although 3" diameter is about as small as can be recommended for this set. If 4" diameters are used, decrease turns 25 per cent.

HEAVISIDE THEORY CONFIRMED

Layer Height Is Measured; Key to Fading

All Transmission Found to Embody Two Waves, One Horizontal That Travels Via the Earth, the Other Vertical and Moving Only in the Air.

PROBLEMS REDUCED TO FORMULAS NOW

Dead Spots in Short-Wave Work Caused by Relation Between Earth's Magnate Field, Layer Height and Frequency—May Account for Program Fading.

Experiments by the Naval Research Laboratory at Bellevue, D. C., in conjunction with the Carnegie Institution, developed the following:

(1) Confirmation of the Heaviside layer theory.

(2) Fading may be caused by this layer.

(3) Two waves are used in broadcasting: a horizontal wave, traveling through earth, and a vertical wave, traveling through the air.

WASHINGTON.

The Heaviside layer theory was established as a fact, the Navy Department announced, disclosing the results of radio tests made by it and the Department of Tenestral Magnetism of the Carnegie Institution. The layer is a deflecting roof in the upper levels of the atmosphere. Secretary of the Navy Wilbur made the announcement.

Another theory confirmed was the existence of radio waves in two forms, horizontal and vertical, as set forth by E. F. W. Alexanderson, chief consulting engineer of the Radio Corporation of America, in the July 25 issue of Radio World.

The horizontal wave is earth-bound, the other being a space wave, and only the vertical wave is affected by the Heaviside layer. The height of the layer was measured. It varied under different conditions, but usually was about 100 miles up. The variation in height and density accounted for fading, at least the "skip distance" phenomenon on short waves.

The horizontal wave moves along the earth's surface till it slides off tangentially into the ether. The vertical wave, striking the undersurface of the sky ceiling, is deflected downward, hitting the earth at distances which depend upon the angle of impact upon the ceiling.

After striking the earth again, these rebounded waves are deflected upward at an angle, again strike the sky ceiling, rebound and continue this process around the world. It is this process that creates the so-called "skip distance."

Secretary Wilbur said that the Navy Department was not yet ready to announce in detail the result of the experiments, but that with the confirmation of the "radio roof" theory he felt, because of its importance to the radio world, scientists and radio engineers should have the benefit of a preliminary announcement immediately.

The experiments are continuing, he said, but the results already stand as "the nearest approach to the key to unsolved problems of radio that has yet been made." Though the chief benefit at present will be to commercial radio telegraphy, the eventual achievement will be the building of a high frequency transmitting station for $60,000 "that will give better service and longer range than the present high-power stations costing $2,000,000, while the cost of operation will be correspondingly reduced."

Wilbur Describes Experiments of Navy With Short Waves

By Curtis D. Wilbur

Secretary of the Navy

Investigations conducted by the Naval Research Labratory, in association with the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, have resulted in confirming the theory of an ionized region in the higher levels of the earth's atmosphere.

From observations made, it appears that the plane of maximum density, in popular language the ceiling of the sky, lies at a varying distance above the surface of the earth, rising and falling as atmospheic conditions vary.

This layer, the conception of which originated independently with Heaviside in England and Kennelly in the United States, is known in the scientific world as the Kennelly-Heaviside layer. It acts as a deflecting surface to electro-magnetic waves, under which they are guided around the world in a very similar way to that in which whispered sound waves run under the domes of the Capitol at Washington and of Saint Paul's Cathedral in London.

The results attained are based upon an analysis of the phenomenon known as the "skip distance," checked by a simple mechanical device by means of which the effective distance of the deflecting layer may be actually measured.

In the pioneer work of short wavelength transmission it was the experience that signals could be picked up at distances forty or fifty miles, after which they disappeared. They were again picked up at points hundreds of miles distant. The intervening of dead space of non-reception became known as the "skip distance."

In seeking to account for this, a theory was developed at the research laboratory that there was a relation between the earth's magnetic field, the frequency of the waves used, "skip distances" observed, and the height of the Heaviside layer.

This relation could be, and was, worked out methematically, using data contributed by the members of the American Radio Relay League, and their co-workers in foreign countries.

The joint experiments with the Carnegie Institution of Washington approached the solution of the problem from a different angle, demonstrating definitely the existence of two waves, one of them arriving by way of the earth and the other by way of the layer. From these experiments estimates of effective height of the layer were made, these estimates being essentially in agreement with the estimates derived from observations on the "skip distance."

Other peculiarities of the action of the layer have been investigated by the Carnegie Institution of Washington in collaboration with the Radio Corporation of America and the Westinghouse Manufacturing Company. The knowledge now gained will play an important part in further advancing the radio art.

The Naval Research Laboratory is now in communication with practically every country using short wavelength (high frequencies). Understanding of the principles involved has progressed to the point where it can be definitely stated that a high frequency transmitting station can be built at a cost of $60,000 that will give better and longer range than the present high power stations costing $2,000,000, and the cost of operation will be correspondingly reduced.

Simple Mechanism Measured the Layer

BELLEVUE, D. C.

In the experiments at Bellevue, conducted under the direction of Dr. A. H. Taylor, a simple mechanical device has been used by means of which it has been possible to easily and accurately measure the effective distance of the "deflecting layer" or ceiling from the surface of the earth.

This has determined that the layer, generally speaking, is more than 100 miles high.

In confirming the radio roof theory, the laboratory has been communicating great distances by short wavelength transmission, reaching countries throughout the world. It has demonstrated its ability to talk with the American fleet in Australia, Samoa and New Zealand and send messages to the MacMillan Arctic expedition in Greenland the same day.

It was in these experiments that proof was developed that the ionized region in the upper air strata acts as a deflecting surface to the electro-magnetic waves, under which they rebound downward and reach all parts of the earth.

BENEVOLENT TORTURE

Stout persons are thinking deeply about the announcer who conducts setting-up exercises daily through stations WCAP, Washington; WEAF, New York, and WEEI, Boston. The announcer seems to take a fiendish delight in requesting exercises particularly difficult for fat people to perform.

THE RADIO UNIVERSITY

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

FIG. 195, panel view of a 7x21" panel for the Powertone.

PLEASE show a 7x21" panel view for a Powertone, with the dial at left, the rheostats at right.—J. E. Spencer, Dubuque, Ia.

See Fig. 195.

* * *

PLEASE GIVE me a diagram of a 2-Tube regenerative reflex, which does not radiate.—F. G. Glampson, Light Bend, Tex.

See Fig. 196.

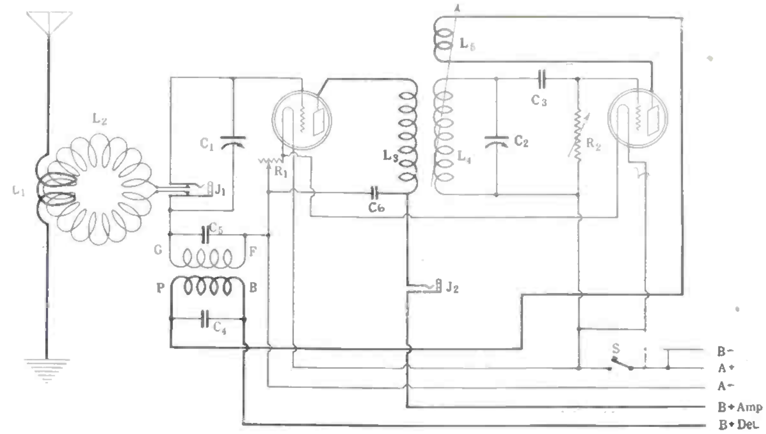


FIG. 196, the diagram of the 2-tube regenerative reflex L3 is a 10-turn primary wound on a 3½" tubing using No. 22 DCC wire for winding. Leave ¼" and wind 45 turns for L4. L5 is the tickler, wound on a 2½" diameter tubing, 2½" high and contains 35 turns. L1L2 is a commercial toroidal coil. C1, C2 are both .0005 mfd. variable condensers. C3, C4 and C5 are both .001 mfd. fixed condensers. The AFT is of a high ratio type. C6 is a .00025 grid condenser. R2 is a variable grid leak. R1 is the rheostat (6 ohms) and controls both the tubes which are the UV201A type. If you wish to listen in on the detector tube insert the phone plug in J2.

* * *

REFERRING TO Brewster Lee's 2-Tube Reflex in Aug. 15 issue of RADIO WORLD, I would like to ask a few questions. (1) Will the UV199 or UV200 tubes work as well as WD11 and WD12? (2) How far will the set reach out for speaker use? (3) I have an audio-transformer, ratio 10-1. What ratio would you suggest for the other transformer?—John J. Cherry, 19 W. 15th St., Tyrone, Pa.

(1) Both will work practically the same. The only substantial difference will be the applied voltage to the filament terminals. (2) This depends upon your location, type of material used. when making the set, type of antenna and ground, physical surroundings, etc. (3) A 6 to 1 will serve for the final stage.

* * *

I AM building The Diamond. (1) I am using a 20-ohm rheostat on the three UV 199 tubes. Would a 10-ohm make much difference? (2) I am using a Freshman variable grid leak and .00025 condenser combined. Would I get better results with the condenser and leak separate? (3) Should the AF transformers be placed at right angles? (4) Would a Lopez Jr. Low-loss 3- circuit tuner work in this circuit? If so, what size coil would be necessary for the aerial coil.—F. J. Kelery, Box 42, Barrie, Ontario, Canada.

(1) No. (2) No. (3) Yes. (4) Yes.

* * *

WITH reference to the simple 1-Tube DX Set published on page 10 in the May 23 issue of RADIO WORLD I have two 17-plate condensers of .00035 mfd. capacity on hand and would very much like to use them in building this circuit. Kindly advise the number of turns of wire necessary on a 3" tubing to enable me to use the above condensers. I only have No. 24 DCC wire.—James D. Bourne, Havana, Cuba.

There are 50 turns on the plate coil and 65 turns on the grid coil, using the 3" tubing to wind these on and using No. 24 DCC wire.

* * *

WILL you please answer the following questions regarding The Diamond? (1) Can I use the Uncle Sam coil as the 3-circuit tuner? (2) Can I use a Cardwell .001 mfd. variable condenser to tune the secondary of the RFT? If I can, give the number of turns on a 3" tubing. (3) Please give the windings for a 2-foot loop to match this 001 condenser. (4) What ratio is the RCA model UV712 AFT?—George G. Fabel, 7024 W. Lafayette Blvd., Detroit, Mich.

(1) Yes. (2) Yes. There are 6 turns wound on a 3" tubing using No. 22 DCC wire for the primary. There are 30 turns on the secondary, using same wire. No spacing between turns. (3) Procure a form 18" on a side. Wind 15 turns, using No. 18 annunciator wire. There is a ½" space between the turns. (4) 3 to 1.

* * *

I HAVE built The Diamond of the Air and I find that I do not get very good volume. I am using three WD11 tubes with a plate voltage of 90 volts and one WD12 tube with a voltage of 45 on the plate. The tickler dial does not make any difference whatsoever, no matter how I turn it around.—John B. Quinn, 118 Randolph Ave., Jersey City, N. J.

Reverse the tickler leads, put more voltage on detector tube, change tubes around, reverse the A battery leads, add more turns to tickler coil. Your tubes seem to be weak.

* * *

I AM very much interested in Mr. Hostetter's article on Toroidal Coils, in the Aug. 22 issue of RADIO WORLD. Are all 3" coils wound alike? (2) Are those capacities as given in the article all right for 13-plate condensers?—W. B. McCloud, 474 Vermont Pl., Columbus, O.

(1) No. (2) Yes.

* * *

WOULD The Diamond of the Air as a 5-tube set give more volume? (2) Is The Diamond selective?—Howard M. Dash, Gen Co., Box 42, Elba, N. Y.

(1) This is dependent on type of tubes used, voltages applied to plate, etc. They are both good sets. (2) Yes, very.

* * *

IN REGARD to Brewster Lee's "One Tube More for Quality" receiver in May 11 issue of RADIO WORLD. (1) Do you use a detector tube? (2) What will stop it from howling when the station comes in? (3) Will the set cover the wavelength band? (4) Is The Diamond with Five Tubes, by Sidney E. Finkelstein, in the Aug. 22 issue of RADIO WORLD better than this set?—E. F. Wilson, 1830 Evelyn Ave., Memphis, Tenn.

(1) Yes. It is the second tube from the left. (2) Decrease plate voltage. Insert a grid condenser between the stator plates of C2 and the grid terminal connection of the grid leak (before the grid resistance goes to the grid post). (3) Yes. (4) There is much more volume obtained from the circuit Mr. Finkelstein described.

* * *

I AM anxious to build The Diamond of the Air, but would like to know if I could use peanut tube R215A, using a 1½-volt dry cell?—I. Hampton, 962 Gertrude St., Verdun, P. Q., Canada.

Yes, but the volume will be less.

* * *

I WISH to build The Diamond of the Air. I have two Kelcoils, 3-circuit tuners. (1) Can I use these in The Diamond by removing the tickler from one of the coils and use that one for the Radio RF stage? (2) Which would you advise, the straight line frequency or the straight line wavelength variable condensers. (3) Please state which is the best set to build, the 4-tube or the 5-tube which is featured in the Aug. 22 issue of RADIO WORLD? (4) Can the baby coil made by the Bruno Co. be used?—Jack White, 824 W. 23rd St., South Oklahoma City, Okla.

(1) Yes. (2) Straight line frequency variable condensers, other things being equal. (3) Matter of taste. (4) Yes.

* * *

I INTEND to build either The Diamond of the Air or The Power House Set described in June 27 issue of RADIO WORLD and wish you would kindly advise which set you consider the better.—F. W. Elliott, 4220 Summit St., Kansas City, Mo.

The Diamond.

* * *

I AM going to build the 1925 Model DX Wonder published in the March 28 issue of RADIO WORLD and use 199 tubes. Will this tube work as a detector with negative grid return or could it be used in positive grid return if two .0005 condensers were used instead of the double condenser? (2) Can these tubes also be used in the resistance amplifier and what should the resistances be? (3) Will one Bradly stat control three tubes?—August Scheidet, 38th So. 14th St., College Point, N. Y.

(1) The detector takes a positive grid return, regardless of type of condenser used. As an amplifier, it takes a negative grid return. See Powertone hookup in this issue for good leak connection. (2)

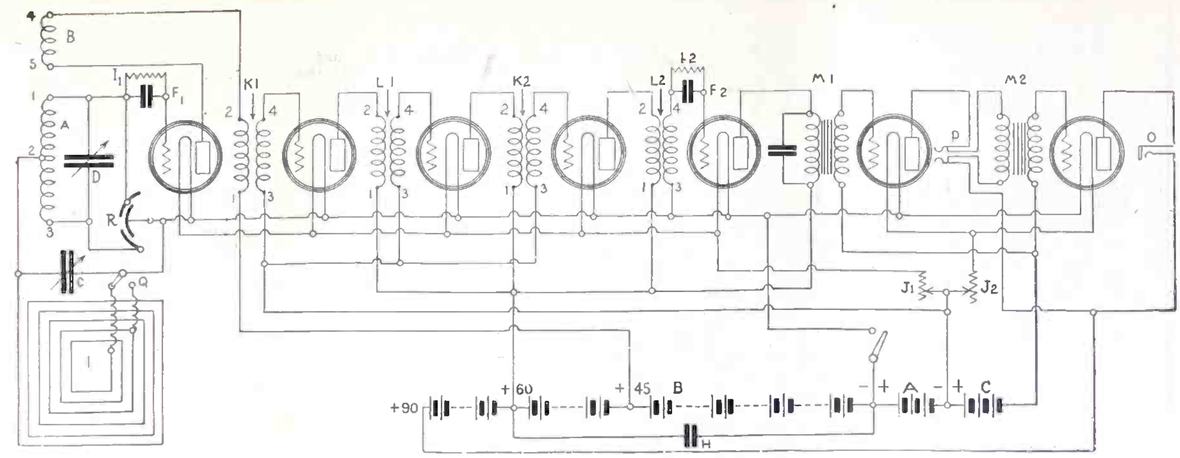


FIG. 197, showing the electrical diagram of the Pressley. A is a 45-turn coil, wound on a 3½" diameter tubing, with No. 22 DCC wire and B is a 38-turn coil wound on the same sized tubing, with some kind of wire. C and D are both .0005 mfd. variable condensers. R is the balancing condenser. The intermediate frequency transformers are of commercial make and cannot successfully be made at home. UV201A or UV199 tubes may be employed.

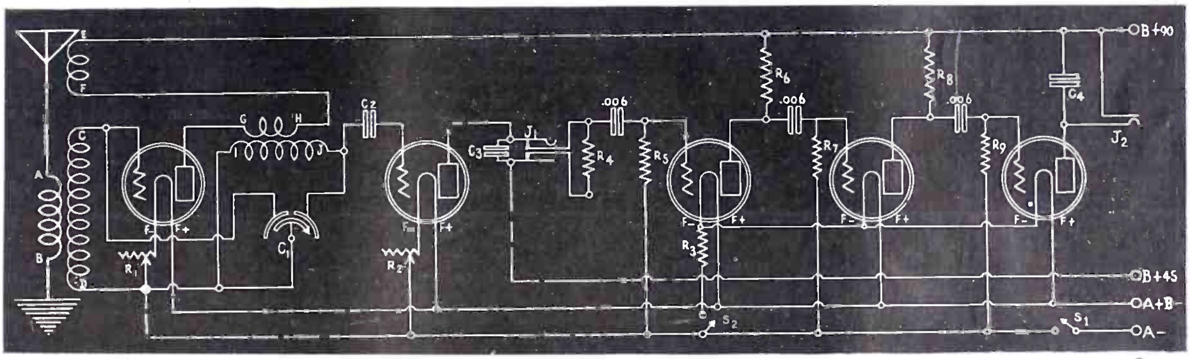


FIG. 198, showing the diagram requested by Mr. Plancey. The data for winding the coils are as per:—Using a 4" outside diameter tubing, 2" high, wind eight turns of No. 20 DCC for the primary of the variocoupler, AB, terminate; then leaving the least space possible, wind 31 turns of the same kind of wire in the same direction for the secondary, CD, terminate. The tickler EF, should consist of 20 turns of No. 26 SSC on a 3" diameter, 2¼" high. The RFT, GHIJ, consists of the same kind of winding as the primary of the coupler, except that the secondary, IJ, has one turn less, or 30 turns. C1 is a .0005 mfd. double condenser. R4, R6, R8 are 1 megohm in value. R5 is 1 megohm, R7 is ½ megohm, R9 is a ¼ megohm. C4 is a .001 mfd. condenser. C3 is a .002 mfd. fixed condenser. C2 is a .001 mfd. fixed condenser. R3 is a 6-ohm Amperite resistance. R1, R2 are 6-ohm rheostats. Five UV201A tubes are used or a Sodion D21 will serve as a detector. Other detectors require a grid leak.

Yes. The plate resistances are all the same value, 0.1 megohm. The grid resistance for the first AF tube is 1.0 megohm, the grid resistance for the second AF is 0.5 megohm and the grid resistance of the third AF is 0.25 megohm. (3) Yes, but it may heat up slightly.

* * *

A DIAGRAM of the Pressley Super-Heterodyne is desired.—T. B. O'Brien, Klancville, Tenn.

See Fig. 197.

* * *

PLEASE GIVE me a hookup of a 5-Tube receiver, employing a regenerative RF tube, detector and 3 stages of resistance coupled amplification.—I. P. Plancey, Pittsfield, Mass.

See Fig. 198.

* * *

PLEASE LET me know if it's all right to make The Diamond of the Air, using The Ambassador Coil.—G. Iglesias, 340 W. 21st St., N. Y. City.

Yes.

* * *

I BUILT the 4-tube DX Set by Capt. Peter V. O'Rourke in the Mar. 21 issue of RADIO WORLD and would like to ask a few questions. (1) I get one station all over the dial on both variable condensers. Kindly tell me what I can do to remedy this. I can hear stations when I take the first tube out of the socket, and turn rheostat off.—C. E. Boucher, 4 Bailey Ave., Mt. Washington, Pittsburgh, Pa.

(1) Shorten your antenna, reverse the secondary of your RFT, reverse the tickler leads, increase the plate voltage. Reverse your A battery leads. Push up the prongs of the sockets. Add more turns to plate coil.

CORRECTION OF AN ERROR

Eimer and Amend, 18th Street and Third Avenue, New York City, called RADIO WORLD'S attention to an inaccurate statement published in the August 15 issue. This statement gave erroneous information regarding the firm selling "tantalum lead" and also regarding the method of determining the strength of the so-called "tantalum lead." The firm points out there is no recognized commercial "tantalum lead" and that there is no tantalum available for sale at present. RADIO WORLD exceedingly regrets the publication of this misinformation.

Waves of 5 to 3,000 Meters Tested on 5 to 100,000 Watts

A radio development laboratory for research on wavelengths from 5 meters to 3,000 meters with power from 5 watts to 100 kilowatts has been constructed on a 54 acre plot, two miles southwest of Schenectady, by the General Electric Company.

This work of radio development is undertaken for the purpose of making a systematic study of transmission phenomenon. Because of meager data there is one group of scientists advocating super power as the remedy for existing broadcasting defects; another, low power short wave transmission to accomplish the same results; another medium power, long wave transmission and many different types of antenna systems are recommended, including the reflector, vertical, horizontal and angular.

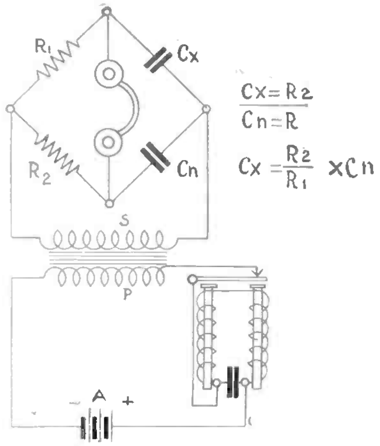
On the plot near Schenectady are one brick building, 60 x 100 feet, and four smaller frame buildings in which are housed transmitters. There are three steel towers each 300 feet high arranged in the form of a triangle. This arrangement permits the construction of many different types of antenna. A fourth steel tower 150 feet high is used for smaller antenna structures. Three 80-foot wood masts support the antenna now being used for the 109 meter transmitter.

The largest building houses the power equipment, high voltage rectifiers and amplifying and modulating equipment for the station. There are three rectifiers, each having a capacity of 150 kw. at 15,000 volts. These rectifiers convert the alternating current supplied to the station into direct current which is used for plate supply on the various transmitters. The modulating equipment may be connected with any of the smaller buildings by means of a system of overhead transmission lines. Speech and music to be broadcast are obtained from the studio of WGY over an aerial cable circuit. It is further amplified at the station before reaching the group of metal tubes known as modulators. The transmitter to be modulated obtains its plate supply in common with the modulator tubes through a group of reactors.

A dark room is provided in the main building for developing oscillograph films recording modulation. A circulating pump having a capacity of 150 gallons per minute supplies cooling water for all metal tubes. The water is piped to all of the smaller buildings. The underground pipe lines provide an excellent means of cooling the water. When tubes are being operated in the main building, however, it is necessary to use a blower for cooling. The water is forced through a large radiator similar to the radiator used in an automobile.

A blower forces a stream of air through the radiator thus keeping the temperature of the water below 35 or 40° F. The pressure of cooling water is approximately 55 pounds per square inch. Since the plates of the metal tubes operate at from twelve to fifteen thousand volts above ground it is necessary to use a long column of cooling water to obtain sufficient insulation for the high direct current and radio frequency potentials existing on the plates of the metal tubes. For this purpose a length of rubber hose is used between the plate of the tube and the pipe supplying the water. This is wound on a wooden hose reel. The wood used is maple, which has been given a special impregnating treatment to improve its insulating qualities.

In addition to the rectifiers, a 12,000 volt direct current generator is used for supplying plate voltage for master oscillators and other low powered equipment. Generators supplying 4,000 volts and 2,500 volts are used for plate supply to the smaller tubes. The filaments of all tubes are heated by direct current. These are several direct current generators of 300 ampere capacity at 33 volts and of 1,000 amperes capacity at this voltage. These machines are specially constructed for a minimum ripple.



AN ELECTRICAL DIAGRAM of the Capacity Bridge. In this circuit, we have a high-frequency buzzer, a small A battery to actuate the magnets of the buzzer, a small step-up transformer (P and S), a pair of phones, one condenser of known value (Cn), one condenser of unknown value (Cx), a resistance (R2) the value which is known and resistance (R1) with a known resistance value. By means of the formula, you may compute the capacity of CX.

At present there are two transmitters located in the main building—one is operated at 50 kw on 379.5 meters. This transmitter is of the master oscillator—intermediate amplifier—power amplifier type using 20 kw water cooled tubes in the high power stages. The second transmitter operating at 1560 (2XAH) meters has a maximum output of 40 kw and is of the same type as 2XAG except that push-pull amplifiers are used in the power stages.

The 109 meter transmitter is located in one of the smaller wooden buildings. Circuits for this equipment are the master oscillator intermediate amplifier power amplifier type in order to obtain constancy of frequency. The high voltage supply is carried from the main building to this transmitter by means of overhead lines. Modulation for the 109 meter transmitter is provided in Building No. 1 from the man bank of modulators.

The antenna system is supported by three wooden poles, each 80 feet high, arranged in the form of a triangle. This type of antenna structure has been employed in order to permit a study of the various types of antennas which may be suitable for operation at this wavelength.

In common with all the other low wavelength transmitters, the low voltage and high current machine equipment is located in a separate building adjacent to the transmitter house proper. With fairly long wavelength transmitters the machine equipment can be placed in the transmitter house; with short wavelength transmitters it is necessary to not only spring-suspend the tubes but remove the motor generator sets to a distant point in order to reduce the vibration to a minimum.

A Very I

By Franz von Stiefel

THE following data on the regenerativ receiver are well acknowledged b engineers:

1—The single-circuit receiver is th worst of interfering radio sets.

2—The single-circuit receiver is als the most voluminous, in fact the re ceiver employing, step of tuned radio frequency amplification, with a non regenerative detector will about equal set employing the above method of de tection on one tube.

3—The 3-circuit tuner was not a solu tion of the radiating nuisance, but helpe reduce it. The volume that the set em ploying this type of tuner delivered wa practically equal to the single circu type.

4—By coupling the grid and the pla very closely more regeneration can b obtained.

The latter idea was incorporated in th hookup shown in Fig. 1. This receiver a strong radiator. The country folk ou side cities will find a joy in this set, as costs very little to build and the volum on distance stations is wonderful. Th only objection is that it squeals to bea the band and in the city it would be wron to operate such a set.

There are only two major controls, ex cluding the rheostat, on the front of th panel. Those having a 3-circuit tuner ca easily change their present hookup to th one used here.

What Is Needed

A tubing with a 3½" diameter and 4 height is required for the primary and th secondary windings L1L2. The tickler L is wound on a tubing 3" in diameter an 2" high. A piece of brass tubing 4" i length will be needed as a control sha for the tickler coil. The diameter of th tubing is 3/16". There are 2 variable con densers used. Both have a capacity o .0005 mfd. (C1 and C2). C3 is the gri condenser and has a capacity of .000 mfd. The condenser joining L2 and L is as in Fig. 1 a .0005 mfd. fixed condense This should be of a very high quality, wit mica being used as the dielectric (insulat ing medium). R1 is the grid leak an has a resistance of 2 megohms. R2 is th rheostat and has a resistance of 10 ohm The tube used here is the UV200. If yo desire to use the UV201A tube, use a 20 ohm rheostat. The by-pass condens across the phones is not vital. If yo wish to use it be sure that it is of th best make that you can get, for a poo condenser inserted here is a detriment in stead of a help. A panel and cabinet 7x12 connecting wire (No. 14 hard-drawn cop per), a terminal strip, two 4" dials, nuts, socket, screws, baseboard, a single-circu jack, and some solder conclude the lis of parts.

How to Wind the Coil

Take the tubing which has the 3½ diameter. One-half inch from the edg (any one) punch two holes both of whic are separated from each other by a ½" Insert two binding posts in these hole Cut off 6 feet of the wire. Anchor th end of the wire in one of the bindin posts. Wind ten turns. Anchor the en in the other binding post. Mark th post, where the beginning of the wir went, Ant. Mark the other post, Gnd.

At the other end of the tubing punc two more holes, the separation of thes being ½". One-eighth inch from th primary winding (L1), start winding th secondary. There are 45 turns made here

Loud 1-Tube DX Set

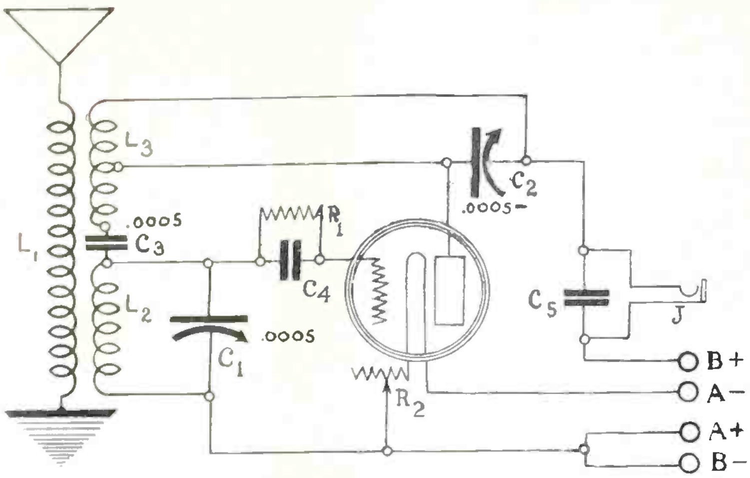


FIG. 1, showing the electrical diagram of a 1-tube DX volume set.

Anchor the beginning and the end in the two binding posts which are inserted in the holes punched for that purpose.

Before going any further, drill a hole on both sides of the above form, in between the primary and the secondary. The diameter of this hole is 1/8". In the exact center of the small form, which is 3" in diameter and 2" high, on both sides, drill a 1/8" hole. Punch two holes on any end of the tubing. These holes should 1/2" from each other. One-half inch from the edge, start winding the plate coil. There are 17 turns made, before you hit the hole, and 18 turns made after the hole wound. That makes 35 turns on the tickler. At the 6th turn from the beginning of the coil, make a tap. Take the brass tubing. Put this through the hole of the larger tubing. Now get some coil tubing, about 1/2" in length. Slip it over the tubing. Put the brass tubing through the smaller tubing. Now drop a piece of solder before the brass tubing enters the smaller tubing after it goes through the tubing close to the side of the tubing. The same is done on the opposite side.

Drilling the Panel

Three and one-third inches from the right-hand side of the panel and 3 1/2" from the top and the bottom drill a hole 3/16" in diameter for the shaft of the variable condenser shunted across L2. Five and one-third inches from this hole and 3 1/2" from the top and the bottom of the panel drill the hole for the shaft of the variable condenser shunted across plate coil. This should be also 3/16" in diameter. Six inches from the right and left hand side of the panel and 1" from the bottom drill a hole for the rheostat shaft. The dimensions for this hole will be dependent upon the type of rheostat used. The jack is placed anywhere according to the discretion of the builder. Do not jam any of the parts too close together. The socket should be placed between the condenser and the coil, or directly in back of the rheostat. The grid leak leads may be a trifle longer than is usually wanted, but that does no harm in this receiver. A phone jack may be used, but if the builder wants to have phone tips, the efficiency of the set will not be impaired in any way. The terminal strip is placed on the extreme end of the baseboard opposite the tuner.

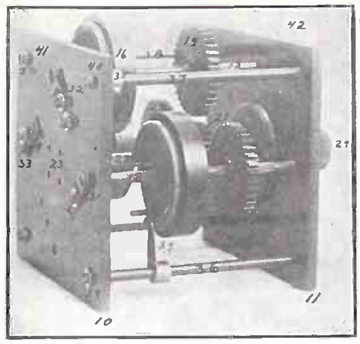
Bring the post marked Ant. to the antenna, and the post marked Gnd. to the ground. The beginning of L2 goes to the stator plates of C1 and to one terminal of R1 and C3. The other terminals of these two parts go to the grid post of the socket. The end of this coil, L2 goes to the rotary plates of C1. This also goes to the arm of the rheostat R2. The resistance of this rheostat goes to the F plus post on the socket. Bring the beginning of L2 to one terminal of the .0005 coupling condenser. Bring the other terminal of this condenser to the beginning of L3. Bring the end of L3 to the rotary plates of the variable condenser C2. The stator plates of this condenser goes to the tap point on L3. This tap point also goes to the plate post on the socket. The rotary plates of the condenser C2 goes to the top terminal of the phone jack. The other terminal goes to the B plus lead of the B battery. Bring the F minus lead to the A minus post of the battery. The A plus connects to the B minus. You will note that the rheostat is connected in the positive lead. It is in most cases connected in the negative lead and the grid return brought to the positive lead as in the case of the UV201A. In the case of the UV200 tube, it is brought to the negative lead.

How to Get Results

In case the set squeals to such an extent that it is uncontrollable, reverse the plate coil leads, or take off a few turns of the coil. If the tuning is broad, reverse the leads of the secondary winding L2. If you do not receive the low wavelengths, put a .001 mfd. fixed condenser in series with the antenna. In other words, disconnect the aerial from the set. Connect it to one terminal of the condenser. Connect the other terminal to the antenna post. In case you do not receive the high wavelengths, insert a .001 mfd. condenser across the antenna and the ground.

Do not turn the rheostats all the way on as the oscillations will be terriffic. The variable condenser C1 will do all the tuning in the set, with the condenser C2 controlling the regeneration. A very short aerial and a cold water pipe for a ground is that which insures positive success in this receiver. Don't forget to reverse the leads of the A battery, if you don't get loud signals, or if the set doesn't oscillate freely. You will note that L3 is stationary, even though it is wound as a variable tickler. If you wish to obtain more regeneration, vary the coil.

One Control



AN INVENTION of Edward Schwarze, 730 Crescent street, Astoria, N. Y. City, which uses one knob to turn multiples of rheostats, condensers, etc.

A plurality of parts on a radio set can be controlled by one manually operated element by use of a shiftable master control, as invented by Edward Schwarze.

The photograph shows the device used in connection with the controlling of the rheostats of a three-tube set. This same idea can be used to operate condensers, couplers, etc., all by means of the manipulation of one dial.

The invention comprises a dial shaft which is mounted for oscillatory movement, and has a gear thereon which is adapted to be moved successively and selectively to mesh with corresponding gears on various shafts located adjacent to the knob shaft. In this manner one knob shaft can be manipulated to various positions to be mechanically associated with the shafts on which the various elements to be operated are mounted.

In the accompanying photograph 10 and 11 are a pair of plates, preferably made of insulating material. Between these plates are a number of shafts 12, 13 and 14. On the shafts are mounted, as shown, a plurality of rheostats 15, 16 and 17. These rheostats are adopted to be moved by the rotation of the shafts. On these shafts are fastened a plurality of gears 18, 19 and 20. With these gears a single gear 21 is adopted to be selectively engaged. This gear 21 is fixed on a shaft 22 which at one end is provided with a ball head seated in a socket of a plate fixed to the insulating plate 10 (plate doesn't show in the photo) is fastened at the point 23. The other end of the shaft 22 is provided with a knob 24. The shaft 22 near the knob end passes through an opening 25 in the insulating plate 11. This opening is shaped to form a plurality of spaced slots such as 26, 27, 28 and 29. These slots are the same diameter as the shaft 22 and all open toward a common center so that the shaft can be moved from one slot to another as desired. The slots are beveled in such, a way that when the shaft is moved into one it is held tight in that position and the gear 21 is engaged with one or the other gears 18 to 20.

The snug fit of the shaft 22 is effected by providing a sliding sleeve. This sleeve is adopted to bear against the rear of the beveled slots.

Each of the shafts 12 to 14 has an indicator on it to show the exact position of the rheostat. Electrical contact is made with the shafts by means of the springs 31, 32 and 33, and through the spring 34 and 35 fastened to the bolts 36, 37 and 38 and through the terminal screw 39, 40 and 41.

The invention is along the modern trend of 1-control, which 1926 sets show.

THE KEY TO THE AIR

KEY

Abbreviations: EST, Eastern Standard Time; CST, Central Standard Time; MST, Mountain Standard Time; PST, Pacific Standard Time; DS, Daylight Saving Time.

How to tune in a desired distant station at just the right time—Choose your station from the list published herewith. See what time division the station is under (EST, CST, etc.); then consult the table below. Add to or subtract, as directed from the time as given on the PROGRAM. The result will be the same BY YOUR CLOCK that you should tune in, unless daylight saving time intervenes, as explained below.—The table:

If you are in	*And want a station in*	*Subtract*	*Add*
EST	CST	..	1 hr.
EST	MST	..	2 hrs.
EST	PST	..	3 hrs.
CST	EST	1 hr.	..
CST	MST	..	1 hr.
CST	PST	..	2 hrs.
MST	EST	2 hrs.	..
MST	CST	1 hr.	..
MST	PST	..	1 hr.
PST	EST	3 hrs.	..
PST	CST	2 hrs.	..
PST	DST	1 hr.	..

If you are under DST and the station you want is under that time, too, or if both are under ST, the above table will hold.

If you are under DST, and the station operates under ST, add one hour to the table result.

If the station uses DST, and you are under ST, subtract one hour from the table result.

FRIDAY, SEPTEMBER 4

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 to 1:05 PM; 8 to 12 PM.
WAMD, Minneapolis, Minn., 243.8 (SCT)—12 to 1 PM; 10 to 12.
WBBM, Chicago, Ill., 226 (CST)—8 to 10 PM.
WBBR, New York City, 272.6 (ESTDS)—8 PM to 10.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—7:30 PM to 11:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 to 4; 5:30 to 10.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 to 1:30 PM; 4:30 to 5:30; 6:30 to 11.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 to 7 M; 8 to 10; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 11 to 12; 4 PM to 5; 6 to 12.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 8 to 11.
WEAO, Ohio State University, 293.9 (EST)—8 PM to 10.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 7:45; 2 PM to 3:15; 5:30 to 10.
WEMC, Berrien Springs, Mich., 286 (CST)—9 PM to 11.
WFAA, Dallas, Texas, 475.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 6.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 4; 6 to 11.
WGCP, New York City, 252 (ESTDS)—2:30 PM to 5:15; 8 to 11.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 7; 10:30 to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 5:30 to 11:30.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:45 PM; 7:30 to 11.
WGY, Schenectady, N. Y., 379.5 (EST)—1 PM to 2; 5:30 to 10:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30; 8:30 to 10.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—12:30 PM to 1, 2:15 to 5; 7 to 11; 12 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—7 PM to 9; 11 to 12; 12:30 to 1:30; 4:30 to 5:30; 6:30 to 9:30.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 8:45 to 10:05; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 1 PM to 2; 3 to 4:50; 6 to 7.
WJY, New York City, 405 (ESTDS)—7:30 PM to 11:30.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 6; 7 to 10:30.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 12:30; 2 to 3; 4:30 to 6; 7:30 to 1 AM.
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 12:15; 1:30 PM to 2:30.
WMCA, New York City, 341 (ESTDS)—11 AM to 12M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:45 PM to 4:45; 6:20 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1; 5:45 to 7:10; 9 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 5:45 to 12.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7.
WPAK, Fargo, N. D., 283 (CST)—7:30 PM to 9.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 8:30; 10 to 12.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 2 AM.
WRC, Washington, D. C., 469 (EST)—4:30 PM to 5: 6:45 to 12.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 to 2 PM; 7:59 to 9:45.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 7:30 to 10; 12 PM to 1 AM.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30; 3 to 4; 6 to 7; 8 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—6 AM to 7; 9:45 to 12:20 PM; 1:30 to 3:20; 3:30 to 11.
KFAE, State College of Wash., 348.6 (PST)—7:30 PM to 9.
KFDY, Brookings, S. D., 273 (MST)—8 PM to 9.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 10.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 9:30 to 12.
KFNF, Shenandoah, Iowa, 266 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 11.
KGO, Oakland, Cal., 361.2 (PST)—11:10 AM to 1 PM; 1:30 to 3; 4 to 7.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 5 to 11.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 3:30 PM; 5:30 to 11:30.
KJR, Seattle, Wash., 484.4 (PST)—10:30 AM to 11:30 AM; 1 PM to 6:30; 8:30 to 11.
KNX, Hollywood, Cal., 337 (PST)—11:30 AM to 12:30 PM; 1 to 2; 4 to 5; 6:30 to 12.
KOB, State College of New Mexico, 348.6 (MST)—11:55 AM to 12:30 PM; 7:30 to 8:30; 9:55 to 10:10.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 8:45; 11 to 12 M.
KPO, San Francisco, Cal., 429 (PST)—7:30 AM to 8; 10:30 to 12 M; 1 PM to 2; 4:30 to 11.
KSD, St. Louis, Mo., 545.1 (CST)—4 PM to 5.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:20 to 10.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:55 to 1 PM; 2:25 to 3:30; 6:02 to 7:20; 9 to 1:30 AM.
CNRA, Moncton, Canada, 313 (EST)—8:30 PM to 10:30.
CNRE, Edmonton, Canada, 516.9 (MST)—8:30 PM to 10:30.
CNRS, Saskatoon, Canada, 400 (MST)—2:30 PM to 3.
CNRT, Toronto, Canada, 357 (EST)—6:30 PM to 11.

SATURDAY, SEPTEMBER 5

WAAM, Newark, N. J., 263 (EST)—7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 to 2 AM.
WAMD, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12.
WBBM, Chicago, Ill., 226 (CST)—8 PM to 1 AM.
WBBR, New York City, 272.6 (ESTDS)—8 PM to 9.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—11 AM to 12:30 PM; 7 to 9.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—10:45 AM to 12M; 3 PM to 4; 6:30 to 7:30.
WCBD, Zion, Ill., 344.6 (CST)—8 PM to 10.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12:30 PM; 2:30 to 5; 6 to 10.
WEAF, New York City 492 (ESTDS)—6:45 AM to 7:45; 4 PM to 5; 6 to 12.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 7 AM.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 7 to 8.
WEMC, Berrien Springs, Mich., 286 (CST)—11 AM to 12:30 PM; 8:15 to 11.
WFAA, Dallas, Texas, 475.9 (CST)—12:30 PM to 1; 6 to 7; 8:30 to 9:30; 11 to 12:30 AM.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 7:30; 11:30 to 12:30 AM.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 3; 6 to 12.
WGCP, New York City, 252 (ESTDS)—2:30 PM to 5:15.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 2:30 PM; 3 to 5:57; 6 to 11:30.
WGR, Buffalo, N. Y., 319 (ESTDS)—8:45 to 10:15 PM, U. S. Army Band.
WGY, Schenectady, N. Y., 379.5 (EST)—7:30 PM to 10.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:30 PM; 4 to 5; 6 to 7:30.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—2:15 PM to 5; 7:30 to 10.
WHO, Des Moines, Iowa, 526 (CST)—11 AM to 12:30 PM; 4 to 5:30; 7:30 to 8:30.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 10:20 to 11; 1 PM to 2; 3 to 4; 6 to 11:30.
WJY, New York City, 405 (ESTDS)—2:30 PM to 5; 8 to 10:30.
WJZ, New York City, 455 (ESTDS)—9 AM to 12:30 PM; 2:30 to 4; 7 to 10.
WKRC, Cincinnati, O., 326 (EST)—10 to 12 M.
WLWC, Cincinnati, O., 422.3 (EST)—9:30 AM to 12:30 PM; 7:30 to 10.
WMAK, Lockport, N. Y., 265.5 (EST)—10:25 AM to 12:30 PM.
WMCA, New York City, 341 (ESTDS)—3 to 5 PM; 6:30 to 2.
WNYC, New York City, 526 (ESTDS)—1 to 3 PM; 7 to 11.
WOAW, Omaha, Neb., 526 (CST)—10 AM to 1; 2:15 to 4; 9 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 5:45 to 7:10; 9 to 12.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—11 AM to 1 PM; 4:40 to 5; 10:55 to 11:02.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7:30; 8 to 11.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 3 AM.
WPG, Atlantic City, N. J., 299.8 (CST)—7 PM to 12.
WRC, Washington, D. C., 469 (EST)—4:30 to 5:30 PM; 6:45 to 12.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 12.
WRNY, New York City, 258.5 (ESTDS)—11:59 to 2 PM; 7:59 to 9:30; 12 M to 1 AM.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 3 to 4; 5 to 6; 10:45 to 12.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10; 11:55 to 1:30 PM; 3 to 4.
KDKA, Pittsburgh, Pa., 309 (EST)—10 AM to 12:30 PM; 1:30 to 6:30; 8:45 to 10.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 9:30 to 12:30.
KF..NF, Shenandoah, Iowa, 268 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10:30.
KFOA, Seattle, Wash., 455 (PST)—Silent.
KGO, Oakland, Cal., 361.2 (PST)—11 AM to 12:30 PM; 3:30 to 5:45; 7:30 to 9.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 6 to 7; 10 to 11.
KHJ, Los Angeles, Cal., 405.2 (ESTDS)—7 AM to 7:30; 10 to 1:30 PM; 2:30 to 3:30; 5:30 to 2 AM.
KJR, Seattle, Wash., 484.4 (PST)—1 PM to 2:45; 6 to 6:30; 8:30 to 10.
KNX, Hollywood, Cal., 337 (PST)—1 PM to 2; 6:30 to 2 AM.
KOA, Denver, Colo., 322.4 (MST)—11:30 AM to 1 PM; 7 to 10.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 9.
KPO, San Francisco, Cal., 429 (PST)—8 AM to 12M; 2 PM to 3; 6 to 10.
KSD, St. Louis, Mo., 545.1 (CST)—7 PM to 8:30.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:30 to 10:30.
KYW, Chicago, Ill., 536 (CSTDS)—11 AM to 12:30 PM; 4 to 5; 7 to 8.
CKAC, Montreal, Canada, 411 (EST)—4:30 PM to 5:30.
CNRO, Ottawa, Ontario, Canada, 435 (EST)—7:30 PM to 10.
PWX, Havana, Cuba, 400 (EST)—8:30 PM to 11:30.

SUNDAY, SEPTEMBER 6

WBBM, Chicago, Ill., 226 (CST)—4 PM to 6; 8 to 10.
WBBR, New York City, 272.6 (ESTDS)—10 AM to 12 M; 9 PM to 11.
WCCO, St. Paul and Minneapolis, Minn., 416 (CST)—11 AM to 12:30 PM; 4:10 to 5:10; 7:20 to 10.
WDAF, Kansas City, Kansas, 365.6 (CST)—4 PM to 5:30.
WEAF, New York City, 492 (ESTDS)—3 PM to 5; 7:20 to 10 15.
WEAR, Cleveland, O., 390 (EST)—3:30 PM to 5; 7 to 8; 9 to 10.
WFBH, New York City, 272.6 (ESTDS)—5 PM to 7.
WGBS, New York City, 316 (ESTDS)—3:30 PM to 4:30; 9.30 to 10:30.
WGCP, New York City, 252 (ESTDS)—8 PM to 11.
WGN, Chicago, Ill., 370 (CST)—11 AM to 12:45 PM; 2:30 to 5; 9 to 10.
WGR, Buffalo, N. Y., 379.5 (EST)—9:30 AM; 7:15 to 8 PM.
WGY, Schenectady, N. Y., 379.5 (EST)—9:30 AM to 12:30 PM; 2:35 to 3:45; 6:30 to 10:30.
WHAD, Milwaukee, Wis., 275 (CST)—3:15 PM to 4:15.
WHN, New York City, 360 (ESTDS)—1 PM to 1:30; 3 to 6; 10 to 12.
WHT, Chicago, Ill., 238 (CSTDS)—9:30 AM to 1:15 PM; 5 to 9.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—10:45 AM to 12:30 PM; 4:15 to 5:30.
WKRC, Cincinnati, O., 326 (EST)—6:45 PM to 11.
WMCA, New York City, 341 (ESTDS)—11 AM to 12:15 PM; 7 to 7:30.
WNYC, New York City, 526 (ESTDS)—9 PM to 11.
WOCL, Jamestown, N. Y., 275.1 (EST)—9 PM to 11.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—10:45 AM to 12:30 PM; 2:30 to 4.
WPG, Atlantic City, N. J., 209.8 (ESTDS)—3:15 PM to 5; 9 to 11.
WQJ, Chicago, Ill., 448 (CST)—10:30 AM to 12:30 PM; 3 PM to 4; 8 to 10.
WREO, Lansing, Michigan, 285.5 (EST)—10 AM to 11.
WRNY, New York City, 258.5 (ESTDS)—3 PM to 5; 7:59 to 10.
WSBF, St. Louis, Mo., 273 (CST)—9 to 11 PM.
WWJ, Detroit, Mich., 352.7 (EST)—11 AM to 12:30 PM; 2 to 4; 6:20 to 9.
KDKA, Pittsburgh, Pa., 309 (EST)—9:45 AM to 10:30; 11:55 to 12 M; 2:30 PM to 5:30; 7 to 11.
KFNF, Shenandoah, Iowa, 266 (CST)—10:45 AM to 12:30 PM; 2:30 to 4:30; 6:30 to 10.
KOA, Denver, Col., 322.4 (MST)—10:55 AM to 1 PM; 4 PM to 5:30; 7:45 to 10.
KOIL, Council Bluffs, Iowa, 278 (CST)—11 AM to 12:30 PM; 7:30 to 9.
KGW, Portland, Oregon, 491.5 (PST)—10:30 AM to 12:30 PM; 6 to 9.
KHJ, Los Angeles, Cal., 405.2 (ESTDS)—10 AM to 12:30 PM; 6 to 9.
KJR, Seattle, Wash., 384.4 (PST)—11 AM to 12:30 PM; 3 to 4:30; 7:15 to 9.
KTHS, Hot Springs, Ark., 374.8 (CST)—11 AM to 12:30 PM; 2:30 to 3:40; 8:40 to 11.

MONDAY, SEPTEMBER 7

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.

Features of the Week

FRIDAY, SEPTEMBER 4

WHT, Chicago, Ill., 238 (CSTDS)—8:45 to 10:15 PM. Elmer Kaiser's Review Park Ballroom orch.
WGBS, New York City, 315.6 (ESTDS)—7 PM to 7:10. Herman Bernard, "Your Radio Problem."
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.

SATURDAY, SEPTEMBER 5

WEAF, New York City, 492 (ESTDS)—11 PM to 12 PM. Vincent Lopez orch.
KGW, Portland, Ore., 491.5 (PST)—10 PM to 12 PM. dance music from Portland Hotel by Jackie Souders' orch.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.

SUNDAY, SEPTEMBER 6

WBBM, Chicago, Ill., 226 (CST)—12 PM to 2 AM—Sunday. Midnight Nut Club Feature, Sanovar Orch.

MONDAY, SEPTEMBER 7

WEAF, New York City, 492 (ESTDS)—9:15 PM to 10:15, Goldman Band concert, 11 to 12, Jack Alben and his Hotel Bossert orchestra.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.

TUESDAY, SEPTEMBER 8

WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WEAF, New York City, 492 (ESTDS)—9 PM to 10. "Everday Hour,"; 11 to 12 PM Vincent Lopez Hotel Pennsylvania orchestra.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.
WEEI, Boston, Mass., 476 (ESTDS)—10 PM to 11—From New York, WEAF Grand Opera Company.

WEDNESDAY, SEPTEMBER 9

WHO, Des Moines, Ia., 526 (CST)—10 to 11:30 PM—The Barret-Philbreck Orch.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.

THURSDAY, SEPTEMBER 10

WEAF, New York City, 492 (ESTDS)—11 PM to 12 PM. Vincent Lopez Hotel Pennsylvania orch.
WGR, Buffalo, N. Y., 319 (ESTDS)—8 to 11 PM—Joint broadcasting with WEAF, N. Y. City, Atwater Kent Radio Artists, and Goodrich Silvertown Chord Orch.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, under neath the breakers of Steel Pier at Atlantic City, N. J.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.

WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 M to 1:05 PM; 8 to 2 AM.
WAMB, Minneapolis, Minn., 243.8 (CST)—10 PM to 12.
WBBM, Chicago, Ill., 226 (CST)—6 PM to 7.
WBBR, New York City, 272.6 (ESTDS)—8 PM to 9.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM 11:30.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 12.
WCBD, Zion, Ill., 344.6 (CST)—8 PM to 10.
WCCO, St. Paul and Minneapolis, Minn., 416 (CST)—9:30 AM to 12 M; 1:30 PM to 6:15.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 PM to 7; 8 to 10; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 4 PM to 5; 6 to 11:30.
WEAR, Cleveland, O., 300 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 7 to 8.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 8; 3 PM to 4; 5:30 to 10.
WEMC, Berrien Springs, Mich., 286 (CST)—8:15 PM to 11.
WFAA, Dallas, Texas, 475.9 (EST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 6:30.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 to 3:10; 6 to 7:30.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8.
WGCP, New York City, 252 (ESTDS)—2:30 PM to 5:15; 8 to 10:45.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 3:30 to 5:57.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:30 PM; 2:30 to 4:30; 7:30 to 11.
WGY, Schenectady, N. Y., 379.5 (EST)—1 PM to 2; 5:30 to 8:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30; 8 to 10.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—2:15 PM to 5; 6:30 to 12.
WHO, Des Moines, Iowa, 526 (CST)—12:15 PM to 1:30; 7:30 to 9; 11:15 to 12.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30, 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 1 PM to 2; 3 to 8.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 5:30; 6 to 6:30; 7 to 11.
WKRC, Cincinnati, O., 326 (EST)—8 PM to 10.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 1; 2 to 3; 4:30 to 6; 7:30 to 11:30.
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 12:15 PM; 1:30 to 2:30; 3 to 5; 6 to 10.
WMAK, Lockport, N. Y., 265.5 (EST)—8 PM to 12.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:15 PM to 4:15; 6:20 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1:30; 5:45 to 10:30.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 5:45 to 6.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—11 AM to 1 PM; 4:40 to 6; 7:30 to 11.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 to 4; 6:15 to 11:30.
WPAK, Fargo, N. D., 283 (CST)—7:30 PM to 9.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 11.
WOJ, Chicago, Ill., 488 (CST)—11 AM to 12 M; 3 PM to 4.
WRC, Washington, D. C., 469 (EST)—1 PM to 2; 4 to 6.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 7:30 to 11.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 7:30 to 10:30; 12 to 1 AM.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30 PM; 3 to 4; 6 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—6 AM to 7; 9:45 to 12:15 PM; 2:30 to 3:20; 5:30 to 10.
KFAE, State College of Wash., 348.6 (PST)—7:30 PM to 9.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 5:15 to 6:15; 9:30 to 12:30.
KFNF, Shenandoah, Iowa, 266 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:45 PM to 1:30; 4 to 5:15; 6 to 10.
KGO, Oakland, Cal., 361.2 (PST)—9 AM to 10:30; 11:30 AM to 1 PM; 1:30 to 6; 6:45 to 7; 8 to 1 AM.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30; 5 to 8.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 1:30 PM; 5:30 to 10.
KJR, Seattle, Wash., 384.4 (PST)—1 PM to 2:45; 6 to 6:30; 7 to 11.
KNX, Hollywood, Cal., 337 (PST)—12 M to 1 PM; 4 to 5; 6:30 to 12.
KOB, State College of New Mexico, 348.6 (MST)—11:55 AM to 12:30 PM; 7:30 to 8:30; 9:55 to 10:10.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 10.
KPO, San Francisco, Cal., 429 (PST)—10:30 AM to 12 M; 1 PM to 2; 2:30 to 3:30; 4:30 to 10.
KSD, St. Louis, Mo., 545.1 (CST)—7:30 PM to 10.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:30 to 10.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:55 to 1 PM; 2:15 to 3:30; 6:02 to 7.

TUESDAY, SEPTEMBER 8

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 PM to 1:05 AM.
WAMB, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12.
WBBM, Chicago, Ill., 226 (CST)—8 PM to 12.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 11.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 PM to 4; 5:30 to 10.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 PM to 7; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 11 to 12 M; 4 PM to 5; 6 to 12.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 7 to 10; 10 to 11.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 8; 1 PM to 2; 6:30 to 10.
WFAA, Dallas, Texas, 457.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30; 11 to 12.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 6:30; 11:30 to 12:30 AM.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 3; 6 to 11:30.
WGCP, New York City, 252 (ESTDS)—2:30 PM to 5:15.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8; 10:30 to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 5:30 to 11:30.
WGR, Buffalo, N. Y., 319 (ESTDS)—11 AM to 12:45 PM; 7:30 to 11.
WGY, Schenectady, N. Y., 379.5 (EST)—11 PM to 2:30; 5:30 to 7:30; 9:15 to 11:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—12:30 PM to 1; 2:15 to 3:15; 4 to 5:30; 7:30 to 10:45; 11:30 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—12:15 PM to 1:30; 7:30 to 9; 11 to 12.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 1 PM to 2; 3 to 4:30; 6 to 11.
WTY, New York City, 405 (ESTDS)—7:30 PM to 1:30.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 6; 7 to 11.
WKRC, Cincinnati, O., 326 (EST)—6 PM to 12.
WLIT, Philadelphia, Pa., 395 (EST)—11 AM to 12:30 PM; 2 to 3; 4:30 to 7.
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 1 PM; 1:30 to 2:30; 3 to 5; 6 to 11.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:45 PM to 5; 6:50 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1:30; 5:45 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 5:45 to 10.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—11 AM to 1 PM; 4:40 to 5; 10:55 to 11:02.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7:30.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 11.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 2 AM.
WRC, Washington, D. C., 469 (EST)—4:30 PM to 5:30; 6:45 to 11.
WREO, Lansing, Michigan, 285.5 (EST)—8:15 PM to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 4:30 to 5; 8 to 11.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 8 to 10; 11:30 to 1 AM.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30 PM; 3 to 4; 6 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—9:45 PM to 12 M; 1:30 PM to 3:20; 5:30 to 10:45.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 5:15 to 6:15; 9:30 to 12:30.
KFMQ, Fayettville, Ark., 299.8 (CST)—9 PM to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 11.
KGO, Oakland, Cal., 361.2 (PST)—11:30 AM to 1 PM; 1:30 to 3; 4 to 6:45; 8 to 1 AM.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 5 to 11.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 3:20 PM; 5:30 to 11.
KJR, Seattle, Wash., 384.4 (PST)—9 AM to 6:30 PM; 8:30 to 1 AM.
KNX, Hollywood, Cal., 337 (PST)—9 AM to 10; 1 PM to 2; 4 to 5; 6:30 to 12.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 9; 11 to 12 M.
KPO, San Francisco, Cal., 429 (PST)—7 AM to 7:45; 10 to 12 M; 1 PM to 2; 3:30 to 11.
KSD, St. Louis, Mo., 541.1 (CST)—6 PM to 7.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:30 to 10:30.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:30 to 1 PM; 2:15 to 4; 6:02 to 11:30.
CNRA, Moncton, New Brunswick, Canada, 313 (EST)—9:30 PM to 11.
CNRR, Regina, Saskatchewan, Canada—8 PM to 11.

(Continued on page 24)

THE KEY TO THE AIR

KEY

Abbreviations: EST, Eastern Standard Time; CST, Central Standard Time; MST, Mountain Standard Time; PST, Pacific Standard Time; DS, Daylight Saving Time.

How to tune in a desired distant station at just the right time—Choose your station from the list published herewith. See what time division the station is under (EST, CST, etc.); then consult the table below. Add to or subtract, as directed from the time as given on the PROGRAM. The result will be the same BY YOUR CLOCK that you should tune in, unless daylight saving time intervenes, as explained below.—The table:

If you are in	*And want a station in*	*Subtract*	*Add*
EST	CST	..	1 hr.
EST	MST	..	2 hrs.
EST	PST	..	3 hrs.
CST	EST	1 hr.	..
CST	MST	..	1 hr.
CST	PST	..	2 hrs.
MST	EST	2 hrs.	..
MST	CST	1 hr.	..
MST	PST	..	1 hr.
PST	EST	3 hrs.	..
PST	CST	2 hrs.	..
PST	DST	1 hr.	..

If you are under DST and the station you want is under that time, too, or if both are under ST, the above table will hold.

If you are under DST, and the station operates under ST, add one hour to the table result.

If the station uses DST, and you are under ST, subtract one hour from the table result.

FRIDAY, SEPTEMBER 4

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 to 1:05 PM; 8 to 12 PM.
WAMD, Minneapolis, Minn., 243.8 (SCT)—12 to 1 PM; 10 to 12.
WBBM, Chicago, Ill., 226 (CST)—8 to 10 PM.
WBBR, New York City, 272.6 (ESTDS)—8 PM to 10.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—7:30 PM to 11:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 to 4; 5:30 to 10.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 to 1:30 PM; 4:30 to 5:30; 6:30 to 11.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 to 7 M; 8 to 10; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 11 to 12; 4 PM to 5; 6 to 12.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 8 to 11.
WEAO, Ohio State University, 293.9 (EST)—8 PM to 10.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 7:45; 2 PM to 3:15; 5:30 to 10.
WEMC, Berrien Springs, Mich., 286 (CST)—9 PM to 11.
WFAA, Dallas, Texas, 475.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 6.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 4; 6 to 11.
WGCP, New York City, 252 (ESTDS)—2:30 PM to 5:15; 8 to 11.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 7; 10:30 to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 5:30 to 11:30.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:45 PM; 7:30 to 11.
WGY, Schenectady, N. Y., 379.5 (EST)—1 PM to 2; 5:30 to 10:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30; 8:30 to 10.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—12:30 PM to 1; 2:15 to 5; 7 to 11; 12 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—7 PM to 9; 11 to 12; 12:30 to 1:30; 4:30 to 5:30; 6:30 to 9:30.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 8:45 to 10:05; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 1 PM to 2; 3 to 4:50; 6 to 7.
WJY, New York City, 405 (ESTDS)—7:30 PM to 11:30.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 6; 7 to 10:30.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 12:30; 2 to 3; 4:30 to 6; 7:30 to 1 AM.
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 12:15; 1:30 PM to 2:30.
WMCA, New York City, 341 (ESTDS)—11 AM to 12M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:45 PM to 4:45; 6:20 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1; 5:45 to 7:10; 9 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 5:45 to 12.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7.
WPAK, Fargo, N. D., 283 (CST)—7:30 PM to 9.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 8:30; 10 to 12.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 2 AM.
WRC, Washington, D. C., 469 (EST)—4:30 PM to 5; 6:45 to 12.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 to 2 PM; 7:59 to 9:45.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 7:30 to 10; 12 PM to 1 AM.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30; 3 to 4; 6 to 7; 8 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—6 AM to 7; 9:45 to 12:20 PM; 1:30 to 3:20; 3:30 to 11.
KFAE, State College of Wash., 348.6 (PST)—7:30 PM to 9.
KFDY, Brookings, S. D., 273 (MST)—8 PM to 9.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 10.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 9:30 to 12.
KFNF, Shenandoah, Iowa, 266 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 11.
KGO, Oakland, Cal., 361.2 (PST)—11:10 AM to 1 PM; 1:30 to 3; 4 to 7.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 5 to 11.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 3:30 PM; 5:30 to 11:30.
KJR, Seattle, Wash., 484.4 (PST)—10:30 AM to 11:30 AM; 1 PM to 6:30; 8:30 to 11.
KNX, Hollywood, Cal., 337 (PST)—11:30 AM to 12:30 PM; 1 to 2; 4 to 5; 6:30 to 12.
KOB, State College of New Mexico, 348.6 (MST)—11:55 AM to 12:30 PM; 7:30 to 8:30; 9:55 to 10:10.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 8:45; 11 to 12 M.
KPO, San Francisco, Cal., 429 (PST)—7:30 AM to 8; 10:30 to 12 M; 1 PM to 2; 4:30 to 11.
KSD, St. Louis, Mo., 545.1 (CST)—4 PM to 5.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:20 to 10.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:55 to 1 PM; 2:25 to 3:30; 6:02 to 7:20; 9 to 1:30 AM.
CNRA, Moncton, Canada, 313 (EST)—8:30 PM to 10:30.
CNRE, Edmonton, Canada, 516.9 (MST)—8:30 PM to 10:30.
CNRS, Saskatoon, Canada, 400 (MST)—2:30 PM to 3.
CNRT, Toronto, Canada, 357 (EST)—6:30 PM to 11.

SATURDAY, SEPTEMBER 5

WAAM, Newark, N. J., 263 (EST)—7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 to 2 AM.
WAMD, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12.
WBBM, Chicago, Ill., 226 (CST)—8 PM to 1 AM.
WBBR, New York City, 272.6 (ESTDS)—8 PM to 9.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—11 AM to 12:30 PM; 7 to 9.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—10:45 AM to 12M; 3 PM to 4; 6:30 to 7:30.
WCBD, Zion, Ill., 344.6 (CST)—8 PM to 10.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12:30 PM; 2:30 to 5; 6 to 10.
WEAF, New York City 492 (ESTDS)—6:45 AM to 7:45; 4 PM to 5; 6 to 12.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 7 AM.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 7 to 8.
WEMC, Berrien Springs, Mich., 286 (CST)—11 AM to 12:30 PM; 8:15 to 11.
WFAA, Dallas, Texas, 475.9 (CST)—12:30 PM to 1; 6 to 7; 8:30 to 9:30; 11 to 12:30 AM.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 7:30; 11:30 to 12:30 AM.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 3; 6 to 12.
WGCP, New York City, 252 (ESTDS)—2:30 PM to 5:15.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 2:30 PM; 3 to 5:57; 6 to 11:30.
WGR, Buffalo, N. Y., 319 (ESTDS)—8:45 to 10:15 PM, U. S. Army Band.
WGY, Schenectady, N. Y., 379.5 (EST)—7:30 PM to 10.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:30 PM; 4 to 5; 6 to 7:30.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—2:15 PM to 5; 7:30 to 10.
WHO, Des Moines, Iowa, 526 (CST)—11 AM to 12:30 PM; 4 to 5:30; 7:30 to 8:30.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 10:20 to 11; 1 PM to 2; 3 to 4; 6 to 11:30.
WJY, New York City, 405 (ESTDS)—2:30 PM to 5; 8 to 10:30.
WJZ, New York City, 455 (ESTDS)—9 AM to 12:30 PM; 2:30 to 4; 7 to 10.
WKRC, Cincinnati, O., 326 (EST)—10 to 12 M.
WLWC, Cincinnati, O., 422.3 (EST)—9:30 AM to 12:30 PM; 7:30 to 10.
WMAK, Lockport, N. Y., 265.5 (EST)—10:25 AM to 12:30 PM.
WMCA, New York City, 341 (ESTDS)—3 to 5 PM; 6:30 to 2.
WNYC, New York City, 526 (ESTDS)—1 to 3 PM; 7 to 11.
WOAW, Omaha, Neb., 526 (CST)—10 AM to 1; 2:15 to 4; 9 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 5:45 to 7:10; 9 to 12.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—11 AM to 1 PM; 4:40 to 5; 10:55 to 11:02.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7:30; 8 to 11.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 3 AM.
WPG, Atlantic City, N. J., 299.8 (CST)—7 PM to 12.
WRC, Washington, D. C., 469 (EST)—4:30 to 5:30 PM; 6:45 to 12.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 12.
WRNY, New York City, 258.5 (ESTDS)—11:59 to 2 PM; 7:59 to 9:30; 12 M to 1 AM.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 3 to 4; 5 to 6; 10:45 to 12.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10; 11:55 to 1:30 PM; 3 to 4.
KDKA, Pittsburgh, Pa., 309 (EST)—10 AM to 12:30 PM; 1:30 to 6:30; 8:45 to 10.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 9:30 to 12:30.
KFNF, Shenandoah, Iowa, 268 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10:30.
KFOA, Seattle, Wash., 455 (PST)—Silent.
KGO, Oakland, Cal., 361.2 (PST)—11 AM to 12:30 PM; 3:30 to 5:45; 7:30 to 9.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 6 to 7; 10 to 11.
KHJ, Los Angeles, Cal., 405.2 (ESTDS)—7 AM to 7:30; 10 to 1:30 PM; 2:30 to 3:30; 5:30 to 2 AM.
KJR, Seattle, Wash., 484.4 (PST)—1 PM to 2:45; 6 to 6:30; 8:30 to 10.
KNX, Hollywood, Cal., 337 (PST)—1 PM to 2; 6:30 to 2 AM.
KOA, Denver, Colo., 322.4 (MST)—11:30 AM to 1 PM; 7 to 10.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 9.
KPO, San Francisco, Cal., 429 (PST)—8 AM to 12M; 2 PM to 3; 6 to 10.
KSD, St. Louis, Mo., 545.1 (CST)—7 PM to 8:30.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:30 to 10:30.
KYW, Chicago, Ill., 536 (CSTDS)—11 AM to 12:30 PM; 4 to 5; 7 to 8.
CKAC, Montreal, Canada, 411 (EST)—4:30 PM to 5:30.
CNRO, Ottawa, Ontario, Canada, 435 (EST)—7:30 PM to 10.
PWX, Havana, Cuba, 400 (EST)—8:30 PM to 11:30.

SUNDAY, SEPTEMBER 6

WBBM, Chicago, Ill., 226 (CST)—4 PM to 6; 8 to 10.
WBBR, New York City, 272.6 (ESTDS)—10 AM to 12 M; 9 PM to 11.
WCCO, St. Paul and Minneapolis, Minn., 416 (CST)—11 AM to 12:30 PM; 4:10 to 5:10; 7:20 to 10.
WDAF, Kansas City, Kansas, 365.6 (CST)—4 PM to 5:30.
WEAF, New York City, 492 (ESTDS)—3 PM to 5; 7:20 to 10 15.
WEAR, Cleveland, O., 390 (EST)—3:30 PM to 5; 7 to 8; 9 to 10.
WFBH, New York City, 272.6 (ESTDS)—5 PM to 7.
WGBS, New York City, 316 (ESTDS)—3:30 PM to 4:30; 9:30 to 10:30.
WGCP, New York City, 252 (ESTDS)—8 PM to 11.
WGN, Chicago, Ill., 370 (CST)—11 AM to 12:45 PM; 2:30 to 5; 9 to 10.
WGR, Buffalo, N. Y., 379.5 (EST)—9:30 AM; 7:15 to 8 PM
WGY, Schenectady, N. Y., 379.5 (EST)—9:30 AM to 12:30 PM, 2:35 to 3:45; 6:30 to 10:30.
WHAD, Milwaukee, Wis., 275 (CST)—3:15 PM to 4:15.
WHN, New York City, 360 (ESTDS)—1 PM to 1:30; 3 to 6; 10 to 12.
WHT, Chicago, Ill., 238 (CSTDS)—9:30 AM to 1:15 PM; 5 to 9.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—10:45 AM to 12:30 PM; 4:15 to 5:30.
WKRC, Cincinnati, O., 326 (EST)—6:45 PM to 11.
WMCA, New York City, 341 (ESTDS)—11 AM to 12:15 PM; 7 to 7:30.
WNYC, New York City, 526 (ESTDS)—9 PM to 11.
WOCL, Jamestown, N. Y., 275.1 (EST)—9 PM to 11.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—10:45 AM to 12:30 PM; 2:30 to 4.
WPG, Atlantic City, N. J., 209.8 (ESTDS)—3:15 PM to 5; 9 to 11.
WQJ, Chicago, Ill., 448 (CST)—10:30 AM to 12:30 PM; 3 PM to 4; 8 to 10.
WREO, Lansing, Michigan, 285.5 (EST)—10 AM to 11.
WRNY, New York City, 258.5 (ESTDS)—3 PM to 5; 7:59 to 10.
WSBF, St. Louis, Mo., 273 (CST)—9 to 11 PM.
WWJ, Detroit, Mich., 352.7 (EST)—11 AM to 12:30 PM; 2 to 4; 6:20 to 9.
KDKA, Pittsburgh, Pa., 309 (EST)—9:45 AM to 10:30; 11:55 to 12 M; 2:30 PM to 5:30; 7 to 11.
KFNF, Shenandoah, Iowa, 266 (CST)—10:45 AM to 12:30 PM; 2:30 to 4:30; 6:30 to 10.
KOA, Denver, Col., 322.4 (MST)—10:55 AM to 1 PM; 4 PM to 5:30; 7:45 to 10.
KOIL, Council Bluffs, Iowa, 278 (CST)—11 AM to 12:30 PM; 7:30 to 9.
KGW, Portland, Oregon, 491.5 (PST)—10:30 AM to 12:30 PM; 6 to 9.
KHJ, Los Angeles, Cal., 405.2 (ESTDS)—10 AM to 12:30 PM; 6 to 9.
KJR, Seattle, Wash., 384.4 (PST)—11 AM to 12:30 PM; 3 to 4:30; 7:15 to 9.
KTHS, Hot Springs, Ark., 374.8 (CST)—11 AM to 12:30 PM; 2:30 to 3:40; 8:40 to 11.

MONDAY, SEPTEMBER 7

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.

WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 M to 1:05 PM; 8 to 2 AM.
WAMB, Minneapolis, Minn., 243.8 (CST)—10 PM to 12.
WBBM, Chicago, Ill., 226 (CST)—6 PM to 7.
WBBR, New York City, 272.6 (ESTDS)—8 PM to 9.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM 11:30.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 12.
WCBD, Zion, Ill., 344.6 (CST)—8 PM to 10.
WCCO, St. Paul and Minneapolis, Minn., 416 (CST)—9:30 AM to 12 M; 1:30 PM to 6:15.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 PM to 7; 8 to 10; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 4 PM to 5; 6 to 11:30.
WEAR, Cleveland, O., 300 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 7 to 8.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 8; 3 PM to 4; 5:30 to 10.
WEMC, Berrien Springs, Mich., 286 (CST)—8:15 PM to 11.
WFAA, Dallas, Texas, 475.9 (EST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 6:30.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 to 3:10; 6 to 7:30.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8.
WGCP, New York City, 252 (ESTDS)—2:30 PM to 5:18; 8 to 10:45.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 3:30 to 5:57.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:30 PM; 2:30 to 4:30; 7:30 to 11.
WGY, Schenectady, N. Y., 379.5 (EST)—1 PM to 2; 5:30 to 8:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30; 8 to 10.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—2:15 PM to 5; 6:30 to 12.
WHO, Des Moines, Iowa, 526 (CST)—12:15 PM to 1:30; 7:30 to 9; 11:15 to 12.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30, 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 1 PM to 2; 3 to 8.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 5:30; 6 to 6:30; 7 to 11.
WKRC, Cincinnati, O., 326 (EST)—8 PM to 10.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 1; 2 to 3; 4:30 to 6; 7:30 to 11:30.
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 12:15 PM; 1:30 to 2:30; 3 to 5; 6 to 10.
WMAK, Lockport, N. Y., 265.5 (EST)—8 PM to 12.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:15 PM to 4:15; 6:20 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1:30; 5:45 to 10:30.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 5:45 to 6.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—11 AM to 1 PM; 4:40 to 6; 7:30 to 11.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 to 4; 6:15 to 11:30.
WPAK, Fargo, N. D., 283 (CST)—7:30 PM to 9.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 11.
WOJ, Chicago, Ill., 488 (CST)—11 AM to 12 M; 3 PM to 4.
WRC, Washington, D. C., 469 (EST)—1 PM to 2; 4 to 6.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 7:30 to 11.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 7:30 to 10:30; 12 to 1 AM.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30 PM; 3 to 4; 6 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—6 AM to 7; 9:45 to 12:15 PM; 2:30 to 3:20; 5:30 to 10.
KFAE, State College of Wash., 348.6 (PST)—7:30 PM to 9.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 5:15 to 6:15; 9:30 to 12:30.
KFNF, Shenandoah, Iowa, 266 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:45 PM to 1:30; 4 to 5:15; 6 to 10.
KGO, Oakland, Cal., 361.2 (PST)—9 AM to 10:30; 11:30 AM to 1 PM; 1:30 to 6; 6:45 to 7; 8 to 1 AM.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30; 5 to 8.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 1:30 PM; 5:30 to 10.
KJR, Seattle, Wash., 384.4 (PST)—1 PM to 2:45; 6 to 6:30; 7 to 11.
KNX, Hollywood, Cal., 337 (PST)—12 M to 1 PM; 4 to 5; 6:30 to 12.
KOB, State College of New Mexico, 348.6 (MST)—11:55 AM to 12:30 PM; 7:30 to 8:30; 9:55 to 10:10.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 10.
KPO, San Francisco, Cal., 429 (PST)—10:30 AM to 12 M; 1 PM to 2; 2:30 to 3:30; 4:30 to 10.
KSD, St. Louis, Mo., 545.1 (CST)—7:30 PM to 10.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:30 to 10.

Features of the Week

FRIDAY, SEPTEMBER 4

WHT, Chicago, Ill., 238 (CSTDS)—8:45 to 10:15 PM, Elmer Kaiser's Review Park Ballroom orch.
WGBS, New York City, 315.6 (ESTDS)—7 PM to 7:10, Herman Bernard, "Your Radio Problem."
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.

SATURDAY, SEPTEMBER 5

WEAF, New York City, 492 (ESTDS)—11 PM to 12 PM. Vincent Lopez orch.
KGW, Portland, Ore., 491.5 (PST)—10 PM to 12 PM. dance music from Portland Hotel by Jackie Souders' orch.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.

SUNDAY, SEPTEMBER 6

WBBM, Chicago, Ill., 226 (CST)—12 PM to 2 AM—Sunday, Midnight Nut Club Feature, Sanovar Orch.

MONDAY, SEPTEMBER 7

WEAF, New York City, 492 (ESTDS)—9:15 PM to 10:15, Goldman Band concert, 11 to 12, Jack Alben and his Hotel Bossert orchestra.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.

TUESDAY, SEPTEMBER 8

WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WEAF, New York City, 492 (ESTDS)—9 PM to 10. "Everday Hour,"; 11 to 12 PM Vincent Lopez Hotel Pennsylvania orchestra.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.
WEEI, Boston, Mass., 476 (ESTDS)—10 PM to 11—From New York, WEAF Grand Opera Company.

WEDNESDAY, SEPTEMBER 9

WHO, Des Moines, Ia., 526 (CST)—10 to 11:30 PM—The Barret-Philbreck Orch.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.

THURSDAY, SEPTEMBER 10

WEAF, New York City, 492 (ESTDS)—11 PM to 12 PM. Vincent Lopez Hotel Pennsylvania orch.
WGR, Buffalo, N. Y., 319 (ESTDS)—8 to 11 PM—Joint broadcasting with WEAF, N. Y. City, Atwater Kent Radio Artists, and Goodrich Silvertown Chord Orch.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.

KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:55 to 1 PM; 2:15 to 3:30; 6:02 to 7.

TUESDAY, SEPTEMBER 8

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 PM to 1:05 AM.
WAMB, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12.
WBBM, Chicago, Ill., 226 (CST)—8 PM to 12.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 11.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 PM to 4; 5:30 to 10.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 PM to 7; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 11 to 12 M; 4 PM to 5; 6 to 12.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 7 to 10; 10 to 11.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 8; 1 PM to 2; 6:30 to 10.
WFAA, Dallas, Texas, 457.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30; 11 to 12.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 6:30; 11:30 to 12:30 AM.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 3; 6 to 11:30.
WGCP, New York City, 252 (ESTDS)—2:30 PM to 5:15.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8; 10:30 to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 5:30 to 11:30.
WGR, Buffalo, N. Y., 319 (ESTDS)—11 AM to 12:45 PM; 7:30 to 11.
WGY, Schenectady, N. Y., 379.5 (EST)—11 PM to 2:30; 5:30 to 7:30; 9:15 to 11:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—12:30 PM to 1; 2:15 to 3:15; 4 to 5:30; 7:30 to 10:45; 11:30 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—12:15 PM to 1:30; 7:30 to 9; 11 to 12.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 1 PM to 2; 3 to 4:30; 6 to 11.
WTY, New York City, 405 (ESTDS)—7:30 PM to 1:30.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 6; 7 to 11.
WKRC, Cincinnati, O., 326 (EST)—6 PM to 12.
WLIT, Philadelphia, Pa., 395 (EST)—11 AM to 12:30 PM; 2 to 3; 4:30 to 7.
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 1 PM; 1:30 to 2:30; 3 to 5; 6 to 11.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:45 PM to 5; 6:50 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1:30; 5:45 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 5:45 to 10.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—11 AM to 1 PM; 4.40 to 5; 10:55 to 11:02.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7:30.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 11.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4: 7 to 8; 10 to 2 AM.
WRC, Washington, D. C., 469 (EST)—4:30 PM to 5:30; 6:45 to 11.
WREO, Lansing, Michigan, 285.5 (EST)—8:15 PM to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 4:30 to 5; 8 to 11.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 8 to 10: 11:30 to 1 AM.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9.30 to 10:30; 11:55 to 1:30 PM; 3 to 4; 6 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—9:45 PM to 12 M; 1:30 PM to 3:20; 5:30 to 10:45.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 5:15 to 6:15; 9:30 to 12:30.
KFMQ, Fayettville, Ark., 299.8 (CST)—9 PM to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 11.
KGO, Oakland, Cal., 361.2 (PST)—11:30 AM to 1 PM; 1:30 to 3; 4 to 6:45; 8 to 1 AM.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 5 to 11.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 3:20 PM; 5:30 to 11.
KJR, Seattle, Wash., 384.4 (PST)—9 AM to 6:30 PM; 8:30 to 1 AM.
KNX, Hollywood, Cal., 337 (PST)—9 AM to 10; 1 PM to 2; 4 to 5; 6:30 to 12.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 9; 11 to 12 M.
KPO, San Francisco, Cal., 429 (PST)—7 AM to 7:45; 10 to 12 M; 1 PM to 2; 3:30 to 11.
KSD, St. Louis, Mo., 541.1 (CST)—6 PM to 7.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:30 to 10:30.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:30 to 1 PM; 2:15 to 4; 6:02 to 11:30.
CNRA, Moncton, New Brunswick, Canada, 313 (EST)—9:30 PM to 11.
CNRR, Regina, Saskatchewan, Canada—8 PM to 11.

(Continued on page 24)

A THOUGHT FOR THE WEEK—Our idea of the original 5-tube super optimist is the 300-pound radio enthusiast who takes the reducing exercises every morning with a set equipped with headphones only.

RADIO WORLD

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

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SEPTEMBER 5, 1925

New York's Big Show Week Starts an Auspicious Season

Expositions at the Grand Central Palace and the 258th Field Artillery Armory Constitute a Double-Header for New York Radioists and Out-of-town Visitors—Biggest Crowds in History of Radio Expected to Flock to Both Shows.

Never before since radio first showed on the horizon has it been so widely exploited in New York City as it will be from September 12 to 19.

From September 12 to 19 the Fourth Annual National Radio Exposition will be held at the Grand Central Palace, Lexington Avenue and 45th St., and from September 14 to 19 the Second Radio World's Fair will be held at the 258th Field Artillery Armory, Kingsbridge Road and Jerome Ave.

Some of the biggest manufacturers and distributors of radio sets and parts will be represented at both expositions, while some others will take their choice of the two shows and exhibit where their judgment leads them.

It might seem to those who have not given the subject close attention that the holding of these two shows during practically the same period will lead to a mixup on the part of the radio public. As a matter of plain fact, there seems to be no doubt that the management of each of these two shows will do their level best to attract public patronage. This keen competition should mean unquestionably that the publicity campaigns to be carried out will so interest and hold the public that the biggest crowds in the history of radio will turn out and make glad the hearts of the exposition managers and the trade exhibitors.

Both these shows open after Labor Day when the country at large has enjoyed its summer vacation and when hundreds of thousands are turning their thoughts to the purchasing of new sets and parts for the first time, and other countless thousands are getting ready to change their equipment and try something new.

These two shows will be held at points far distant from each other. They can be readily reached through New York's numerous underground, surface and elevated systems. The managers of each exposition have planned such an extensive and comprehensive publicity campaign that only the deaf, dumb or blind can remain unaware of the entertainment and exhibits that have been prepared for the amusement and enlightment of the millions of natives in the metropolitan zone, to say nothing of the army of visitors that are bound to visit New York during this period for the distinct purpose of seing either of the shows, or both of them.

Radio World is glad of the opportunity to give extended text and pictorial attention to New York's biggest Radio Week, and does so with the assurance that this double-header is going to mean an increase in the number of radioists, and more sales by those who have shown their enterprise by exhibiting during this period.

Our readers will note that there appear in this week's issue of Radio World complete lists of the exhibitors at the Fourth Annual National Radio Exposition and the Second Radio World's Fair.

In our next week's issue, dated September 12, there will appear detailed information regarding the outstanding features of the various exhibits from information collected by our Editorial Staff, thus making our issue of September 12 a ready reference for those who want to visit special booths at both expositions. This September 12 copy of Radio World should be taken to either or both shows, so that you will know just where to find the most important things that you are looking for in sets or parts.

Letters to the Editor

Favors Tax on Sets

Editor Radio World:

It was indeed quite amusing to read your editorial, "What Inspired the Hon. Sol." in Radio World, but we cannot quite understand why your paper opposes a small tax on radio receiving sets. So far as I can see radio set makers have fed the people up on that "free stuff" so the public generally believes that with a set they can receive the world's best entertainment. Song publishers, too, in many cases have been deprived of just compensation for their efforts; also many fine bands and musical organizations do not play over the air, as they, too, realize the advertising feature of radio does not compensate them for their best efforts. We are informed that in Germany sets are taxed $25 per year, and they give the public the best music and entertainment that the country affords, as they have the funds to pay talent what it is worth. It appears singers, musicians, orchestras, etc., are the very foundation stones that have held up radio, and why should the public expect so much for nothing, thereby depriving musicians and artists of a just recompense? Music dealers admit that there has been lately a big falling off in the sale of records and also sheet music, and if the public want entertainment in a different form why should it not be willing to pay something? Regardless of Hon. Sol. Bloom's former affiliations, I think if he can get a bill legislated through Congress whereby each listener-in is required to pay a small license fee annually, he will be the proven friend of high-class radio entertainment, and he will receive the plaudits of the public in putting radio on a more commercial basis.

BLACE A. MORRIS,
109 Spring Street,
Newton, N. J.

THE RADIO TRADE

Lists of the Exhibitors At Two New York Shows

Two radio shows are about to be held in New York City. The first one to open will be the Fourth Annual National Radio Exposition. It will be held in Grand Central Palace. The dates are Saturday, Sept. 12, to Saturday, Sept. 19, inclusive, or eight days in all. On Monday, Sept. 14, the Second Annual Radio World's Fair will open at the 258th Field Artillery Armory, Kingsbridge Road and Jerome Avenue. Following are lists of exhibitors, incomplete because they represent early contracts for space.

(Continued on next page)

The Fourth Annual

The following is a partial list of space reservations for the Fourth Annual National Radio Exposition to be held at Grand Central Palace, New York City:

A. C. Electrical Mfg. Co., Adams Morgan Co., Inc., Adler Mfg. Co., Aluminum Company of America, Amber Mfg. Co., Amplion Corp. of America, Amsco Products, Inc., Atwater Kent Mfg. Co., Audak Co., Bakelite Corp., Benjamin Electric Mfg. Co., Blandin Phonograph Co., G. Boissonnault Corp., C. Brandes, Inc., Brightson Laboratories, Inc., Bristol Co., Brooklyn Metal & Stamping Co., Brunswick-Balke-Collender Co., D. K. Bullens Co., Burton-Rogers Co., Colonial Radio Corp., Continental Fibre Co., Corning Glass Works, Cornish Wire Co., C. T. Radio Co., Daven Radio Co., Dayton Fan & Motor Co., DeForest Radio Co., Diamond Electric Spec. Co., Diamond State Fibre Co., Dictograph Products Co., L. R. Donahue Co., Dubilier Cond. & Radio Corp., E. I. DuPont DeNemours & Co., Eagle Radio Co., Edison Storage Battery Co., Eisemann Magneto Corp., The Electric Storage & Battery Co., Engravers & Printers Mchy. Corp., Equitable Radio Corp., Experimenter Pub. Co., Fansteel Products Co., Farrand Mfg. Co., Inc., Federal Tel. & Tel. Mfg. Co., Federated Radio Corp., J. B. Ferguson, Inc., Formica Insulation Co., Freed-Eisemann Radio Corp., Chas. A. Freshman Co., Funk & Shore, Gross-Brennan, Inc., General Radio Co., Gilfillan Bros., Inc., Goldschmidt Corp., Geo. Gorton Machine Co., Gould Storage Battery Co., David Grimes, Inc., Lenford, Inc., Hatheway & Co., Inc., Hoffman Type & Engraving Co., Hoosick Falls Radio Parts Mfg. Co., King Quality Products, Inc., Jos. W. Jones Radio Mfg. Co., E. B. Lund, Magnavox Co., Manhattan Electrical Supply Co., Marko Storage Battery Co., Marwol Radio Corp., Musical Products Dist. Co., National Carbon Co., Newport Radio Corp., N. Y. Evening Journal, New York Sun, New York Times, Olney Tube Co., Pacent Electrical Co., Inc., Pathe Phono. & Radio Corp., PeQuot Mfg. Corp., Phenix Radio Corp., Philadelphia Storage Bat. Co., Pilot Elec. Mfg. Co., Zoltan H. Polachek, Popular Radio, Inc., Progressive Musical Inst. Co. Precise Mfg. Co., Radio Corp. of America, Radio Digest Pub. Co., Radio Industries Corp., Radio Panel & Parts Corp., Radio Retailing, Radio World, Radio Engineering, Radiotive Corp., Ramstone Corp., Richardson Radio, Inc., Scranton Button Co., H. B. Shontz Co., Signal Electric Mfg. Co., Sonora Phonograph Co., Spaulding Fibre Co., Splitdorf Electric Co., Stanley & Patterson, Inc., Stormproof Insulator Co., Supertron Mfg. Co., Thermiodyne Radio Co., R. E. Thompson Mfg. Co., Twentieth Century Radio Corp., C. D. Tuska Co., Timmons Talker, United Radio Corp., Valley Electric Co., Ware Radio Corp., Westinghouse Elec. & Mfg. Co., Western Electric Co., Weston Elec. Inst. Co., "X" Laboratories. Meissner Radio Corp., Amer. Bosch Magneto Co., Blair Radio Laboratory, Berg Auto Trunk & Spec. Co., Bemco Mfg. Co., Eureka Battery Co., Electrotype Blocking Co., Fibroc Insulation Co., Feri Radio Mfg.

(Continued on page 22)

GOV. SMITH TO BROADCAST AS NEW YORK SHOW OPENS

Gov. Alfred E. Smith will deliver an address on radio's role in developing public opinion and obtaining the co-operation of an enlightened constituency in the problems of government, in connection with the opening of the Radio World's Fair, New York City, on the night of September 14. Gov. Smith's address will be broadcast by a chain of stations when he officially opens the fair. More than any other state executive and even President Coolidge, Gov. Smith has used the radio for presenting statements of importance to the public and secured popular reaction on controversial questions.

Coming Events

AUG. 23 to SEPT. 6—Canadian National Expos., Exposition Coliseum, Toronto, Can.

SEPT. 5 to 12—Third Annual National Radio Exposition, Ambassador Auditorium, Los Angeles, Cal. Address Waldo K. Tupper.

SEPT. 9 to 20—International Wireless Exposition, Geneva, Switzerland.

SEPT. 12 to 19—Fourth Annual National Radio Exposition, Grand Central Palace, N. Y. C. Write American Radio Exp. Co., 522 Fifth Ave., N. Y. C.

SEPT. 14 to 19—Second Radio World's Fair, 258th Field Artillery Armory, Kingsbridge Road and Jerome Ave., N. Y. C. Write Radio World's Fair, Times Bldg., N. Y. C.

SEPT. 14 to 19—Pittsburgh Radio Show, Motor Square Garden. Write J. A. Simpson, 420 Bessemer Bldg., Pittsburgh, Pa.

SEPT. 14 to 19—Radio Show, Winnipeg, Can., Canadian Expos. Co.

SEPT. 21 to 26—First Annual Radio Expos., Broadcast Listeners' Association, Cadle Tabernacle, Indianapolis, Ind. Write Claude S. Wallin, Hotel Severin.

SEPT. 21 to 29—International Radio Exposition, Steel Pier, Atlantic City, N. J.

SEPT. 28 to Oct. 3—National Radio Exposition, American Exp. Palace, Chicago. Write N. R. E., 440 S. Dearnborn St., Chicago, Ill.

SEPT. 28 to OCT. 3—Midwest Radio Week.

OCT. 3 to 10—Radio Exposition, Arena, 46th and Market Streets, Philadelphia, Pa., G. B. Bodenhof, manager, auspices Philadelphia Public Ledger.

OCT. 5 to 10—Second Annual Northwest Radio Exposition, Auditorium, St. Paul, Minn. Write 515 Tribune Annex.

OCT. 5 to 11—Second Annual Radio Show, Convention Hall, Washington, D. C. Write Radio Merchants' Association, 233 Woodward Bldg.

OCT. 10 to 16—National Radio Show, City Auditorium, Denver, Colo.

OCT. 12 to 15—Radio exposition, Post-Dispatch (KPRC), Houston, Tex.

OCT. 12 to 17—Boston Radio Show, Mechanics' Hall. Write to B. R. S., 209 Massachusetts Ave., Boston, Mass.

OCT. 12 to 17—St. Louis Radio Show, Coliseum. Write Thos. P. Convey, manager, 737 Frisco Bldg., St. Louis, Mo.

OCT. 12 to 17—Radio Show, Montreal, Can., Canadian Expos. Co.

OCT. 17 to 24—Brooklyn Radio Show, 23d Regt. Armory. Write Jos. O'Malley, 1157 Atlantic Ave., Brooklyn, N. Y.

OCT. 19 to 25—Second Annual Cincinnati Radio Exposition, Music Hall. Write to G. B. Bodenhof, care Cincinnati Enquirer.

OCT. 26 to 31—First Annual Rochester Times-Union Radio Exposition, Convention Hall, Rochester, N. Y. Write Howard H. Smith, care Times-Union.

NOV. 2 to 7—Radio Show, Toronto, Can., Canadian Expos. Co.

NOV. 3 to 8—Radio Trade Association Exposition, Arena Gardens, Detroit. Write Robt. J. Kirschner, chairman.

NOV. 19 to 25—Milwaukee Radio Exp., Civic Auditorium. Write Sidney Neu, of J. Andrae & Sons, Milwaukee, Wis.

NOV. 17 to 22—4th Annual Chicago Radio Exp., Coliseum. Write Herrmann & Kerr, Cort Theatre Bldg., Chicago, Ill.

INDUSTRIES BANQUET TO BE HELD SEPT. 16

The fourth annual convention of the National Radio Trade Association will be held at the Hotel Commodore, in New York City, the week of September 14. The convention will begin with a meeting of the officers and directors at 6 p. m. on September 14 at the Hotel Commodore. The meeting of the Radio Week Committees will be held at the Commodore at 12:30 p. m. September 15. Luncheon will be served. The meeting will be open to the trade at large. A charge of $3 a cover will be made for the luncheon.

On the 16th the second annual banquet will be held.

Literature Wanted

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

Trade Service Editor,
RADIO WORLD,
1493 Broadway, New York City.

I desire to receive radio literature.

Name ....

City or town..............................

State ....

Are you a dealer?..............................

If not who is your dealer?

His Name ....

His Address ....

Vincent W. Barry, Palisades Park, N. J.
Edwin Suuronen, 91 Pine St., Gardner, Mass.
Reinaldo Diaz, Havana City, Havana, Cuba.
Forest Nave, Lexington, Mo. (Dealer).
George Fend, 3574 East 135th St., Cleveland, O.
F. C. Hoffman, Box 285, Sparkill, Rockland Co., N. Y.
W. A. League, P. O. Box 885, Richmond, Va.
C. E. Davenport, Pottsville, Pa.
J. A. Graves, 45 Nassau St., N. Y. City.
Glen C. Ridgway, 1620 Lister Ave., Kansas City, Mo. (Dealer).
Robert C. Olds, 522 S. E. 8th St., Des Moines, Iowa. (Dealer).
Joseph Currey, Franklin, Texas.
Albert C. King, 671 Danforth Ave., Toronto, Canada.
H. I. Humphreys, Jr., 41 Park St., Binghampton, N. Y.
Robert H. Jones, 1206 East 33rd St., Spokane, Washington.
D. E. Merriot, 3915 State Line St., Kansas City, Mo.
Harold Fairley, 121 Gilmour Ave., Toronto, Ontario, Canada.
Edward Calhoun, Anderson, Mo.
J. P. Dunne, 229 Divisaders St., San Francisco, Cal.
John R. Campbell, 441 Rose Lane, Ft. Wayne, Ind.
James C. McDowell, 5845 South Green St., Chicago, Ill.
Max D. Kreidel, Jr., 176 Easton Ave., Waterbury, Conn.
Wilbur Bardin, Waucaula, Fla.

JOIN THE A. B. C.

A. B. C. Editor, RADIO WORLD,
1493 Broadway, New York City.

Please enroll me as a member of the American Broadcast Club.

Name ....
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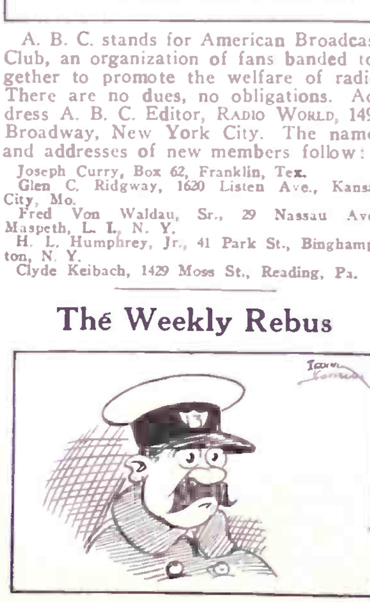
State ....

A. B. C. stands for American Broadcast Club, an organization of fans banded together to promote the welfare of radio. There are no dues, no obligations. Address A. B. C. Editor, RADIO WORLD, 1493 Broadway, New York City. The names and addresses of new members follow:

Joseph Curry, Box 62, Franklin, Tex.
Glen C. Ridgway, 1620 Listen Ave., Kansas City, Mo.
Fred Von Waldau, Sr., 29 Nassau Ave., Maspeth, L. I., N. Y.
H. L. Humphrey, Jr., 41 Park St., Binghampton, N. Y.
Clyde Keibach, 1429 Moss St., Reading, Pa.

The Weekly Rebus



America's Leading Concerns to Exhibit at Big Shows

(Concluded from preceding page)

Co., Paul Goldstein & Co., Garod Corp., Guide Corp., Hammalund, Kadel & Herbert, McGraw-Hill Pub. Co., Mulitple Elec. Products Co., Mica-mold Radio Corp., Montrose Mfg. Co., N. Y. Daily Mirror, Radio News, Ritcab Corp. of America, Radio Foundation, Inc., Stewart-Warner Speedometer Co., Sound Wave Corp., Sampter Radio Corp., Silver-Marshall, Inc., Standard Radio Corp., Studner Cumming Co., Shaw Insulator Co., Triplex Machine Tool Co., Twin Dry Cell Battery Co., Twinantaleak Aerial Insulator Mfg. Co., Voluma Products Corp., W. B. Mfg. Co.

The Radio World's Fair

The following is the list of exhibitors who had signed contracts for the second Radio World's Fair, 258 Field Artillery Armory, Kings Bridge Road and Jerome Avenue, New York City, September 14th to 19th:

A. C. Elec. Mfg. Co.........Dayton, Ohio
Acme Apparatus Co.........Cambridge, Mass.
Acme Wire Co..............New Haven, Conn.
Advance Battery Corp.......New York City
Air-Way Elec. App. Corp....New York City
All-American Radio Corp....Chicago
Amber Mfg. Co..............New York City
American Electric Co........Chicago
American Wireless Corp......New York City
Amsco Products, Inc.........New York City
Ando Inst. Radio Research..Tokio, Japan
Andrews Radio Co...........Chicago
Apex Elec. Mfg. Co..........Chicago
Atlas-Colonial Corp..........L. I. City, N. Y.
Atwater Kent Mfg. Co........Philadelphia
Auburn Button Works.......Auburn, N. Y.

Baldwin Int. Radio Inc......New York City
Bel-Canto R. & T. Equip. Co.New York City
Bell Mfg. Co.................Boston
Brach, L. S. Mfg. Co........Newark, N. J.
Branston, C. A., Inc.........Buffalo, N. Y.
Bremer-Tully Mfg. Co.......Chicago

Caswell-Runyan Co..........Chicago
Cardwell, The A. D. Mfg. Co.Brooklyn, N. Y.
Carter Radio Co............Chicago
Chicago Solder Co...........Chicago
Colonial Radio Corp..........L. I. City, N. Y.
Cooper Corp., The...........Cincinnati, Ohio
Coto Coil Co................Providence, R. I.
Citizens' Radio Serv. Bureau.Chicago
Crosley Radio Corp., The....Cincinnati, Ohio
Curtis-Leger Fixture Co.....Chicago.

Dayton Fan & Motor Co....Dayton, Ohio
De Forest Radio Co.........Jersey City, N. J.
Distantone Radios, Inc.......Lynbrook, L. I., N. Y.
Dubilier Cond. & Radio Corp.New York City
DX Instrument Co..........Harrisburg, Pa.

Electrical Record............New York City
Elec. Research Laboratories.Chicago
Electric Storage Battery Co.Philadelphia
Electrical Products Corp.....Cleveland, Ohio
Ekko Co., The...............Chicago
Experimenter Pub. Co.......New York City
Express Body Corp.........Crystal Lake, Ill.
E-Z-Toon Radio Co.........Indianapolis, Ind.

Fansteel Products Co., Inc...North Chicago, Ill.
Federal Telegraph Co.......New York City.
Fore Electrical Mfg. Co.....St. Louis, Mo.
France Mfg. Co., The........Cleveland, Ohio.
Freed-Eisemann Radio Corp.Brooklyn, N. Y.
French Battery Co..........Madison, Wis.
Freshman Co., Chas..........New York City.
Frost, Herbert H., Inc......Chicago
Furnell Mfg. Corp.........Newark, N. J.

Gage Publishing Co., Inc....New York City
Gale Radio Laboratories....Chicago
Garod Corp..................Newark, N. J.
Globe Phone Mfg. Co.......Reading, Mass.
Goertz, Aug. & Co., Inc.....Newark, N. J.
Goodrich, B. F. Rubber Co..Akron, Ohio.
Graymie Corporation.........Chicago
Grebe, A. H. & Co., Inc....Richmond Hill, L. I.
Grigsby-Grunow-Hinds Co..Chicago
Gwonda Company...........New York City

Hyman, Henry & Co., Inc...New York City

Jefferson Electric Mfg. Co...Chicago

Jewell Elec. Instrument Co..Chicago
Jewett Radio & Phono. Co...Detroit
Jones, Howard B...........Chicago

Kellogg Switchboard & Supply Co................Chicago
Kennedy, Colin B., Corp.....St. Louis
Kodel Radio Corp...........Cincinnati, Ohio
Kurz-Kasch Co..............Dayton, Ohio

Liberty Elec. Corp. of N. Y..New York City

Magnus Electric & Radio Mfg. Co..................New York City
Martin Radio Elec. Co.......New York City
McCullough Sales Co........Pittsburgh, Pa.
McGraw-Hill Co., Inc........New York City
Miller Rubber Co. of N. Y...Akron, Ohio
M. L. Magneto Syndicate....Coventry, England
Mohawk Electric Corp.......Chicago, Ill.
Multiple Elec. Products Co..L. I. City, L. I.
Music Master Corp...........Philadelphia

Muter, Leslie F., Co........Chicago
Mydar Radio Co.............Newark, N. J.

National Carbon Co..........L. I. City, L. I.
National Co., Inc............Cambridge, Mass.
Neely, Henry M., Pub. Co...Philadelphia
Nelson Tool Co., Inc.........New York City
N. Y. Evening Journal, Inc..New York City
N. Y. Herald-Tribune.......New York City
New York Sun..............New York City
N. Y. Telegram & Evening Mail.................New York City
New York Times...........New York City

Operadio Corp., The........Chicago

Pathe Phono. & Radio Co...Brooklyn, N. Y.
Pequot Mfg. Co.............L. I. City, N. Y.
Pfanstiehl Radio Co.........Chicago
Phenix Radio Corp.........New York City
Philmore Mfg. Co...........New York City
Pooley Co., Inc., The......Philadelphia
Prest-O-Lite Co., Inc., The.Indianapolis, Ind.
Priess Radio Corp..........New York City

Radio Industry.............New York City
Radio News of Canada......Toronto, Canada
Radio Retailing.............New York City
R. B. Radio Co.............New York City
Rathbun Mfg. Co............Jamestown, N. Y.
Reichmann Co...............Chicago
Remler Radio Mfg. Co......San Francisco, Cal.
Remo Corp., The...........Meriden, Conn.
Runzel-Lenz Elec. Mfg. Co...Chicago
Saal, R. G., Company........Chicago
Samson Electric Co..........Canton, Mass.
Schickerling Products Corp..Newark, N. J.
Sherman Radio Mfg. Corp...New York City
Sleeper, M. B., Inc.........New York City
Sleeper Radio Corp..........L. I. City, L. I.
Sonora Phono. Co., Inc......New York City
Spartan Electric Corp.......New York City
Splitdorf Electrical Co.......Newark, N. J.
Sterling Mfg. Co...........Cleveland, Ohio
Stettner Phonograph Corp...New York City
Stewart-Warner Speedometer Corp..............Chicago
Stromberg-Carlson Tel. Mfg. Co.................Rochester, N. Y.
Sunbeam Radio Corp........New York City

Thermiodyne Radio Corp....New York City
Thordarson Elec. Mfg. Co...Chicago
Trimm Radio Mfg. Co.......Chicago
T. S. F. Moderne..........Paris, France

United Scientific Lab., Inc...New York City
Utah Products Co..........Chicago
Valley Electric Co...........St. Louis
Veby Radio Co.............Newark, N. J.

Walbert Mfg. Co............Chicago
Western Coil & Elec. Co....Racine, Wisconsin
Willard Storage Bat. Co....Cleveland, Ohio
Wireless Export Trader.....London, England

Yai & Company.............Tokio, Japan
Zenith Radio Corp...........Chicago

Song Composers Sue WGY Over Copyright

Suit for infringement of copyright was begun in Federal Court, New York, by Gene Buck, president of the American Society of Composers, Authors and Publishers, and Leo Feist, Inc., against the General Electric Company, which operates WGY, the radio broadcasting station at Schenectady, N. Y.

It was charged that the songs "I'll See You in My Dreams" and "Honest and Truly" were broadcast from WGY in violation of copyright held by Feist, Inc., and some rights held by the society. Injunctions restraining WGY from future violations were demanded.

U. S. Warship Hears Concert Transmitted Half 'Round World

A radio concert program has been sent 14,000 miles from Caterham, a London suburb, to the American warship Seattle in Wellington Harbor, New Zealand, by Gerald Marcuse, a radio amateur, says the N. Y. Times.

Mr. Marcuse was transmitting by telegraphy to the American wireless operator on the Seattle when the latter asked him to change to the voice. He did so, transmitting a program including several phonography records by Caruso and violin solos by Heifetz and some jazz.

All were heard excellently aboard the American warship.

BIG FALL BUSINESS PROPHESIED BY MITCHELL

Charles E. Mitchell, president of the National City Bank, sailed for France from New York. He said:

"I have been optimistic over business conditions this year and I look for an increasing activity this fall. We are turning over a far larger volume of business than the American people realize, and this is nation-wide, which shows there are no bad spots in the country. Bank deposits are steadily increasing and there is no occasion to worry. The business horizon is without a cloud."

SIGNALS TO BE MEASURED

Extensive measurements of signals of European stations are being planned for this winter by Dr. L. W. Austin, of the Bureau of Standards. Dr. Austin will attempt to determine just what effect certain temperatures have on radio signals at given distances.

NEW INCORPORATIONS

Atlantic Appliance Co., radio supplies, $10,000; G. Abrams, N. E. Spielholz. (Atty., S. I. Golieb, 1,440 B'way, N. Y. City).

Cut Rate Auto Supply Co., radio and auto equipment, 100 common, no par; L. Dworkin, A. Simmons, A. Kaufman. (Atty, M. Simmons, 25 West 43d St., N. Y City).

RESULTS

RESULTS EDITOR:

I built the spare parts 2-Tube Reflex described by Herbert E. Hayden in the June 20 issue of RADIO WORLD. This set is fine. I get Chicago nightly, also many other stations.—F. L. Hutchins, Tumbledown Mt., (Forestry Service), Skinner, Maine.

* * *

RESULTS EDITOR:

I have about 200 copies of RADIO WORLD and I expect to have that many more in a couple of years as I would not miss one for double the price.—J. K. Krueger, 710 Camp St., McKees Rocks, Pa.

* * *

RESULTS EDITOR:

After having read the "sin and shame" letter I thought a bit of acknowledgment due you and your staff.

I have hooked up a number of sets from the descriptions in RADIO WORLD and have failed to get results from two only, and I believe this was due to the work being done hurriedly. I have used sets by Capt. O'Rourke, Herman Bernard, Brewster Lee and others and I want to say that when I got them going right they surpassed my expectations.

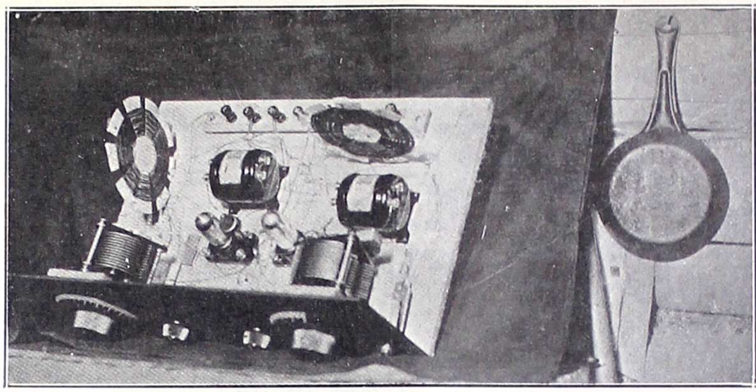
I am now using Brewster Lee's Tone Beauty with two steps of AF.

I thank RADIO WORLD and its many contributors for the valuable information and many pleasant evenings I have enjoyed.—Lewis B. Hill, Route No. 3, Woodburn, Ky.

* * *

RESULTS EDITOR:

I have constructed the 4-tube set by Brewster Lee in May 16 issue and find it the best of any I ever had.—Chas. J. Miller, 196 Holmes Street, Belleville, N. J.



UP IN THE MAINE WOODS Hayden's 2-Tube Spare Parts Reflex is as important to F. L. Hutchins as the frying pan. Mr. Hutchins, who took this photo, gets Chicago regularly. The set was described in the June 20 issue, profusely illustrated.

HOOK-UPS!—A lot of them, some of which are sure to suit your purpose, appeared in RADIO WORLD dated Aug. 15. 15c. a copy, or start your subscription with that number. RADIO WORLD, 1493 Broadway, New York.

THE KEY TO THE AIR

(*Continued from page 19*)

WEDNESDAY, SEPTEMBER 9

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 M to 1:05 PM; 8 to 12.
WAMB, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12.
WBBM, Chicago, Ill., 226 (CST)—8 PM to 10.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 11.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 to 4; 5:30 to 11.
WDAF Kansas City, Kansas, 365.6 (CST)—3:30 PM to 7; 8 to 9:15; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 11 to 12 M; 4 PM to 5; 6 to 12.
WEAO, Ohio State University, 293.9 (EST)—8 PM to 10.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 6:45 to 7:45.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 8; 3 PM to 4; 5:30 to 10.
WEMC, Berrien Spring, Mich., 266 (CST)—8:15 PM to 11.
WFAA, Dallas, Texas, 475.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1.
WFBH, New York City, 270.6 (ESTDS)—2 PM to 7:30; 12 M to 1 AM.
WGCP, New York City, 252 (ESTDS)—2:30 PM to 5:18; 8 to 10.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 7; 10:30 to 1 AM.
WGBS, New York City, 316 (ESTDS)—10 AM to 11 PM; 1:30 to 4; 6 to 7.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 5:30 to 11:30.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:45 PM; 2:30 to 4:30; 6:30 to 11.
WGY, Schenectady, N. Y., 379.5 (CST)—5:30 PM to 7:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30; 8 to 10; 11:30 to 12:30 AM.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 368 (ESTDS)—2:15 PM to 5:30; 7:30 to 11; 11:30 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—12:15 PM to 1:30; 6:30 to 12 M.
WHT, Chicago, Ill., 400 CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508 (ESTDS)—7 AM to 8; 10:20 to 11; 1 PM to 2; 3 to 4; 6 to 8.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 6; 6 to 11:30.
WKRC, Cincinnati, Ohio, 326 (EST)—8 PM to 10.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 12:30; 2 to 3; 4:30 to 6; 7:30 to 9.
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 12:15 PM; 1:30 to 2:30; 3 to 5; 6 to 11.
WMCA, New York City, 341 (EST)—10:45 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—6:30 PM to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 4 to 7:05; 9 to 11.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 12 M.
WPAK, Fargo, N. D., 283 (CST)—7:30 PM to 9.
WOJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 2 AM.
WRC, Washington, D. C., 469 (EST)—1 PM to 2; 4 to 6:30.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 7:59 to 9:55.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 7:30 to 9.
WWJ, Detroit, Mich., 352.7 (EST)—6 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30 PM; 3 to 4; 6 to 7; 8 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—6 AM to 7; 9:45 to 12:15 PM; 2:30 to 3:20; 5:30 to 11.
KFAE, State College of Wash., 348.6 (PST)—7:30 PM to 9.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 5:15 to 6:15; 9:30 to 12:30 AM.
KFMQ, Fayettville, Ark., 299.8 (CST)—7:30 PM to 9.
KFNF, Shenandoah, Iowa, 266 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 10.
KGO, Oakland, Cal., 361.2 (PST)—11:30 AM to 1 PM; 1:30 to 2:30; 3 to 6:45.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 5 to 10.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 1:30 PM; 5:30 to 12.
KJR, Seattle, Wash., 484.4 (PST)—9 AM to 1 AM.
KNX, Hollywood, Cal., 337 (PST)—1 PM to 2; 7 to 12.
CNRO, Ottawa, Ontario, Canada, 435 (EST)—7 PM to 11.

THURSDAY, SEPTEMBER 10

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (EST)—12 PM to 1:05.
WAMB, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12 M.
WBBM, Chicago, Ill., 226 (CST)—8 PM to 10.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11:45.
WCAE, Pittsburgh, Pa., 461.3 (CSTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 11.
WCBD, Zion, Ill., 344.6 (CST)—8 PM to 10.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 PM to 4; 5:50 to 10.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 11 to 12 M; 4 PM to 5; 6 to 12.
WEAR, Cleveland, O., 390 (EST)—10:30 AM to 12:10 PM; 3:30 to 4:15; 7 to 11.
WEEI, Boston, Mass., 467 (ESTDS)—6:45 AM to 7:45; 1 PM to 2; 2:30 to 10.
WFAA, Dallas, Texas, 475.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30; 11 to 1 AM.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 7:30.

(*Continued on next page*)

THE KEY TO THE AIR

(Continued from preceding page)

WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 4; 6 to 7:30.
WGCP, New York City, 252 (ESTDS)—2:30 PM to 5:15.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8; 10:30 to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 5:30 to 11:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 11:30; 6 PM to 7:15; 8:30 to 11.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:45 PM; 2 to 4; 7:30 to 11.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30; 8 to 10.
WHAS, Louisville, Ky., 399.6 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—2:15 PM to 5; 7:30 to 11; 11:30 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—7:30 PM to 9; 11 to 12.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WJY, New York City, 405 (ESTDS)—7:30 PM to 11:30.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 6; 7 to 12 M.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 12:30; 2 to 3; 4:30 to 6; 8:30 to 9.
WLW, Cincinnati, O., 422.3 (EST)—10:40 AM to 12:15 PM; 1:30 to 5; 6 to 8; 10 to 11.
WMAK, Lockport, N. Y., 265.5 (EST)—11 PM to 1 AM.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:15 PM to 4:15; 6:50 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1:30; 5:45 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 AM to 2 PM; 3 to 3:30; 4 to 7:10; 8 to 9.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 11.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 2 AM.
WRC, Washington, D. C., 469 (EST)—1 PM to 2; 4 to 6:30.
WREO, Lansing, Michigan, 285.5 (EST)—8:15 PM to 9:45; 10 to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 7:39 to 10.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 8 to 9.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30; 3 to 4; 6 to 7; 8 to 9.
KDKA, Pittsburgh, Pa., 309 (EST)—9:45 AM to 12:15 PM; 2:30 to 3:30; 5:30 to 10:15.
KFAE, State College of Washington, 348.6 (PST)—7:30 PM to 9.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 5:15 to 6:15; 9:30 to 12:30.
KFNF, Shenandoah, Iowa, 266 (CST)—12:15 to 1:15 PM; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 7.
KGO, Oakland, Cal., 361.2 (PST)—11:30 AM to 1 PM; 1:30 to 3; 4 to 6:45; 7:15 to 10
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 5 to 11.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 3:20; 5:30 to 11:30.
KJR, Seattle, Wash., 484.4 (PST)—9 AM to 1 AM.
KNX, Hollywood, Cal., 337 (PST)—11 AM to 12:05 PM; 4 to 5; 6 to 12.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 9.
KPO, San Francisco, Cal., 429 (PST)—7 AM to 8; 10:30 to 12 M; 1 PM to 2; 3:30 to 11.
KSD, St. Louis, Mo., 595.1 (CST)—7:30 PM to 9.
CNRA, Calgary, Alberta, Canada, 435.8 (MST)—9 PM to 11.

HOW TO BECOME AN AMATEUR OPERATOR—A comprehensive, illustrated article appeared in issue of June 27, 1925. 15c per copy, or start your subscription with this number. RADIO WORLD, 1493 Broadway, N. Y. C.

How to Wind the Coils for the Loop Powertone

(*Concluded from page 9*)

need for concern whether the loop inductance is proper for one section of the condenser, because the secondary L2 is being tuned, not the loop, and both L2 and L4 are matched, any given dial setting representing only one wavelength. The energy supplied by the loop is conductively delivered to L1, which transfers it electromagnetically to L2. This is not the authentic manner of hooking up a loop, but the fact that reception is possible at all is a tribute to the sensitivity of the receiver. Try this method on any set. In most cases satisfactory results will not be obtained.

The double condenser used had two separate sections of .0005 mfd. each. The coils L1L2 and L3L4 were indentical in number of turns. L1 and L3 each had 10 turns, ¼" space being left, then the secondary (L2 or L4) wound with 52 turns. The wire was No. 24 silk over cotton, the form 2½" diameter, 2½" high, consisting of two insulated rings, with quartzite rods supported by them. L1 was wound reverse. L2 and L3L4 were wound in the direction opposite to that of L1. The L1 reversed connection could not be shown conveniently in the diagrams (Figs. 1 and 2). If it is easier, wind all coils in the same direction, but in Fig. 2 reverse the aerial and ground leads.

Goldsmith Disagrees on Commercial Station Cost

Dr. Alfred N. Goldsmith, chief broadcast engineer of the Radio Corporation of America and past president of the Institute of Radio Engineers, differed with the report issued by the Naval Research Laboratory, through Secretary Wilbur, that inexpensive low wave commercial stations will replace the present high-power transatlantic stations.

Dr. Goldsmith agreed that short-wave stations require much less power to cover a given distance and that they can be built much cheaper, but he was not in accord with the Navy's conclusions that the big commercial stations talking to and from Europe on high wave lengths are doomed to be scrapped.

"It is not possible to replace the present stations with short-wave transmitters," he said.

ORCHESTRAL MUSIC BETTER

The quality of orchestral music now broadcast is far ahead of that of a year ago. Then there were few organizations on the air of real musical ability. Now it is easy to find a number of stations which require a high standard of effort from musical performers.

DIAMOND SO LOUD IT WRECKS PHONES

Diamond Editor:

I have built The Diamond. I am now using the new DeForest Tubes. It sure is a wonderful set. It can't be beat for clearness. I only have to use 60 volts on the plate of the tubes. I am not after distant stations, for I want clearness and volume and I obtain it. I wrecked a set of phones on The Diamond, due to the great amount of volume. I use the cone type of speaker. Herman Bernard was right when he said to look to a set for distortion, not the cone speaker. I am not going to rebuild this set, for it is mine forever. I don't see what benefit one gets when he hears distant stations. All that he gets is the benefit of telling his neighbor what stations he listened to last night.

It may be a pleasure to sit up all night and get these stations but I pride my health first. I ask you to give my thanks and appreciation for The Diamond to Mr. Bernard. I think this set has made RADIO WORLD the most popular magazine published.—Leo Wolf, 140 Fairview Ave., W. E. Pittsburgh, Pa.

Radio Movies Worked by Student, 18, Using a Short Indoor Antenna System

MADISON, WIS.

Radio movies have been sent by him from his radio station to his home, a distance of seven miles, Douglas F. Coffey, eighteen, announced. He is a University of Wisconsin student and has a radio job at a theatre. He admits the results are crude so far.

A light is thrown through a strip of rotating movie film at the sending station and transmitted into electrical vibrations which, sent with an especially devised radio transmitter without microphone or key, is in turn changed to light rays which at the receiving end reproduce the moving picture on a screen.

It is declared that Coffey is the first inventor to do this in the way in which he does it, although C. F. Jenkins of Washington has been working on a process calculated for the same results.

He is confident that eventually the process devised by him will make possible the reproduction of moving pictures by radio at long distances.

The State Department of markets has offered Coffey the use of its Waupaca and Stevens Point radio stations for further experimental operations, in which he will have the advantage of longer distances.

It is considered an interesting feature of Coffey's apparatus that the entire transmission and the entire reception of the radio pictures are effected by employing a short indoor antenna system.

His Radio Movies That Talk Are a Success, Asserts C. F. Jenkins

WASHINGTON.

Success for his radio talking movies is claimed by C. Francis Jenkins, inventor. He said his apparatus had transmitted motion pictures to a screen and a simultaneous vocal description of them to a loud speaker on a single wavelength.

For the experiment, Mr. Jenkins said, he moved about before the picture transmitting set and described his actions, an audience in another room viewing the reproduced picture and listening to the inventor's voice coming through the speaker.

Predicting that general use of the apparatus might be made feasible through low cost of production, Mr. Jenkins said he had designed it as an attachment to standard radio receiving sets.

WJR AND WCX SHARE 580-METER WAVELENGTH

A license has been issued to WJR and WCX, Pontiac, Mich., to operate jointly on one wavelength as Class B stations. The new listing follows:

Call	Owner and Location	Meters	Kcy	Watts
WJR	Jewett Radio & Phonograph Co. and the Detroit Free Press	580	516.9	1500
WCX	Telegraph Road, Pontiac, Michigan	580	516.9	1500

WCX operating jointly with WJR.

Telepathy Due to Radio Waves Emitted by Mind, Says Professor

PARIS.

Some spooky aspects of radio are presented by the Italian scientist Ferdinando Cazzamali, professor of neurology and psychiatry at the University of Milan. Writing in the Revue Metaphysique, he says the human brain, if properly excited, may emit radio waves, and that another brain, even far distant, if in tune with the sender, can pick up the messages. This is his explanation of the phenomenon of telepathy. He even insists that a code can be used and regular messages thus transmitted and received. The announcement did not cause a "break" in the stock of the commercial radio companies.

The professor did not seem very clear on this modulation system or on the measurement of the "brain power" used instead of the usual wattage.

He says the human body radiates waves. He put some "hypnotized" persons in a metallic chamber (thus shielding them) and then erected three or four regular radio sets.

Professor Cazzamali declares that he heard in the earphones sound waves similar to radiotelegraphic transmission sounds which ceased immediately upon the awakening of the subject from the hypnotic state and recommenced each time that the subject was put to sleep again.

42 Nations Invited By U. S. to Attend Radio Conference

WASHINGTON.

Invitations have been issued by the American Government to forty-two countries to participate in an international radio telegraph conference to be held at Washington in the Spring of 1926. At the close of the International Radiotelegraph Conference at London in 1912 the American delegates extended an invitation to hold the next conference at Washington in 1917. Later proposals were made with a view to holding a joint conference of parties to the International Telegraph Convention and of parties to the International Radiotelegraph Convention.

As unanimity could not be obtained for these proposals, the French Government has proceeded to hold the International Telegraph Conference at Paris, beginning September 1, 1925, and the United States has taken the necessary steps to hold the International Radiotelegraph Conference at Washington in the Spring of 1926. Congressional authorization for the holding of the Radiotelegraph Conference in Washington was contained in the Second Deficiency Act approved by the President on March 4, 1925, and $92,000 was appropriated by Congress to defray the expenses of the conference.

The subjects to be discussed at the conference will include the revision of the International Radiotelegraph Convention and Regulations, signed at London on July 5, 1912, and the discussion of measures for the international supervision of communication by radio between the large fixed stations, broadcasting, including the handling of press messages; radio telephony; measures for the elimination of interference; distress messages so as to take cognizance of increased uses and classes of service; radio aids to navigation; and other purposes for which radio has been used since 1912.

AUSTRALIA'S STATION ATTACKS BRITISH POLICY

The Australian official Queensland station at Queensland broadcast an attack on the British government, alleging that the Washington Arms Treaty is not being carried out by the signatory nations. The policy of the Far East was condemned.

Attention, Readers and Newsdealers!

READERS: If you are going away on your vacation, and wish to have a complete file of RADIO WORLD, be sure to tell your newsdealer to put aside a copy of each issue until you return.

NEWSDEALERS: Your regular RADIO WORLD customers will undoubtedly want for file copies that they have missed while away on their vacations. The publisher suggests that each week you put aside copies of RADIO WORLD for these customers. They will consider this service.

Readers and newsdealers can get back numbers of any issue for the summer of 1925 at our regular price; or a subscription can be started with any back number published during the summer.

Circulation Manager, RADIO WORLD, 1493 Broadway, New York City.

RECENT BACK NUMBERS of RADIO WORLD, 15 cents each, or any seven for $1. Address Circulation Manager, RADIO WORLD, 1493 Broadway, New York City.

Federal Inquiry Requested By Brookhart as Station Charges A. T. & T. Monopoly

WASHINGTON.

Data on the practices of the American Telephone & Telegraph Co. in the broadcasting field were requested by Senator Brookhart's office in a letter to the Department of Justice.

Norman Baker, proprietor of a broadcasting station at Muscatine, Iowa, complained to the Senator that the company refused to give a license to him, although such a license would have been granted had he purchased his equipment from the company's subsidiaries. He charged the company was violating the anti-trust law and was operating in restraint of trade.

Senator Brookhart forwarded Baker's letter to the Attorney General.

* * *

MUSCATINE, IA.

Norman Baker, proprietor of the Tangley company and builder of KTNT, Muscatine's new radio station, accusing the A. T. & T. of monopoly, sent copies of his charges to the Department of Justice, with a demand for an investigation. The aid of Senators A. B. Cummins and Smith W. Brookhart has been requested.

The basis of Mr. Baker's complaint is the refusal of the A. T. & T. to grant him a broadcasting license, allegedly because he has not purchased his broadcasting outfit from a subsidiary of the A. T. & T. The combine, he declares, is composed of the A. T. & T., the Western Electric Company, the General Electric Company, the Radio Corporation of America, and the Westinghouse Electric & Manufacturing Company.

According to Mr. Baker, before a radio station can go on the air, it must obtain a license from the A. T. & T. as well as from the government because the company controls many patents covering radio transmitting apparatus.

"The Western Electric Company builds complete broadcasting stations and anyone who purchases a complete station from it is automatically licensed by the A. T. & T." Mr. Baker declares. "Anyone who builds an assembled station and does not purchase from the Western Electric Company, is termed a 'bootleg station.' There are hundreds of such stations in America. The A. T. & T. has repeatedly licensed such stations in all parts of the country, charging a fee of $4 per watt rating.

Directions for Mounting Parts in Geared Set

(*Continued from page* 10)

for the mounting of the taps and the ratchet were left out, as they are blocked out with some jet black indian ink and are not visible on the panel.

Three inches from the right-hand edge of the panel and 3½" from the top and the bottom of the panel drill a 3/16" hole for the brass rod or shaft that controls the rotary forms of the coils i.e., the secondary. Six inchces from this hole and 3½" from the top and the bottom drill another 3/16" hole. This one is for tap shaft tubing.

You will note that where the rheostat holes are the dials are not actually placed. If they were placed here the rack of the form of the tapped coil would hit the top of the rheostat mounting. Instead we place the rheostat dial ½" from the bottom of the panel. This leaves ½" play for the rack. The same policy is carried out for the other rheostat. Where the dotted lines are in the dial the rack will pass through. This serves to explain why we do not place the rheostats in line with other two dials. The separation between the two rheostat holes for the dials is 4½". The last rheostat hole is 3" from the extreme left-hand edge. The jack is 3" from the left-hand edge, or in the same vertical line as the hole for the last rheostat. It is 1" from the bottom. The first rheostat hole is 7½" from the tap hole mounting. The holes for the rack should not be drilled until you have mounted the complete unit. One inch from the tap hole drill a 1/16" hole for the screw which slides in and out the slot made in the special attachment to the rack. Sixteen inches from this hole drill another hole for the other screw. The tap unit is a commercially bought one. This, therefore, necessitates no drilling of the tap holes. The only other holes that are drilled are the main tap hole mountings. The 1st hole is 2½" from the main shaft hole. This is illustrated in Fig. 1. Three and one-half inches from this hole drill another hole for the other tap hole. Three and one-half inches from this hole drill another hole for the other tap mounting. The last hole is also 3½" from the last hole.

Mounting the Instruments

In the usual set there is nothing very particular to tell one in the mounting of the parts, as the drilling of the holes determines the position of most of the parts.

In this set it is a different proposition. Two and one-half inches back from the panel mount a piece of ½" square wood, 3¼" high. Screw this piece of wood down to the board. One inch from this piece of wood mount another piece of wood, the same thickness as the other one.

Four inches from the first piece of wood mount a small brass right angle (2" arms) on the baseboard. This angle bracket should be bent to a 45-degree angle. Mount the coil here. Six inches from this angle iron mount another angle iron on which the other coil should be mounted. This should also be at a 45-degree angle. Six inches from this point mount another brass angle, which is mounted at a 45-degree angle, and on which is mounted the last coil (stationary).

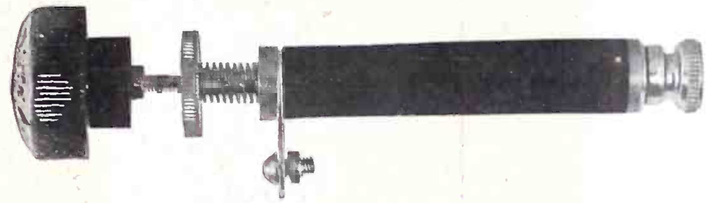
[*Part II, conclusion next week*]

RADIO WORLD'S QUICK-ACTION CLASSIFIED ADS.

10 CENTS A WORD. 10 WORDS MINIMUM

Improve Your Set By Installing The "BRETWOOD"

Pulls in inaudible stations



Eliminates tube noises

Range 300,000 to 10,000,000 ohms

Variable Grid Leak

Bretwood, Ltd., London, Eng., Sole Patentees and Owners.

Used in eighty per cent of all receiving sets in Great Britain

They Function Where Others Fail

The Bretwood Variable Grid Leak used in a detector tube circuit, strengthens weak signals, makes DX easier, eliminates tube noises and internal howling, due to incorrect leakage from the grid of the tube.

By simply turning the knob the carrier wave may be tuned from the silent point to maximum audibility.

The Bretwood is absolutely noiseless in operation and will hold any given setting indefinitely. It is a single-hole panel mount leak.

The Bretwood Variable Grid Leak, tested in the National Physical Laboratory (the official laboratory of Great Britain) and by RADIO WORLD'S Laboratory, proved to be a scientifically accurate instrument. The total range, 9,700,000 ohms, produced by 25 turns of the knob, make a minute adjustment very simple.

The Bretwood Variable Grid Leak is constructed on a different principle and produces better results than any other grid leak. In its specially-constructed barrel is a patented plastic, non-drying resistance material, in which there is a small movable plunger which again moves freely in an absorbent cartridge which gives the setting of the instrument great stability, making it far superior to the graphite, carbon or fibre, compressed or decompressed, resistance elements. It can be used in the most critical circuits with the greatest success.

Sent You on a Money Back Absolute Satisfaction Guarantee

The Bretwood Variable Grid Leak will be immediately shipped on receipt of order to any address in the United States, prepaid for $1.50. After 10 days' trial if it is not 100% better than any grid leak you have ever had and does not in every way substantiate all claims made for it, your money will be refunded without question.

The North American Bretwood Company

Sole Distributors for United States and Canada

1505 BROADWAY, NEW YORK CITY

Dealers and Jobbers Write for Special Trade Terms

THE NORTH AMERICAN BRETWOOD CO.
1505 Broadway, New York City
Room 326

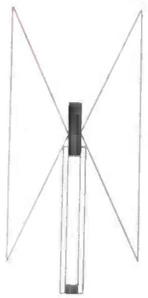
Gentlemen:

Enclosed find $1.50 for which you will please send me one Bretwood Variable Grid Leak prepaid. Satisfaction guaranteed or my money back after trial within ten days of receipt by me.

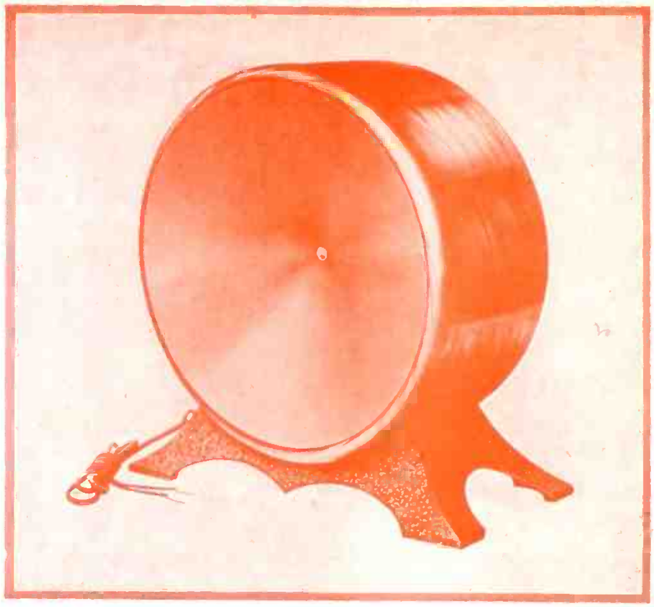
NAME..

STREET..

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



Section of the New Acme *Free-Edge Cone* Loud Speaker, showing the two *free-edge cones.*

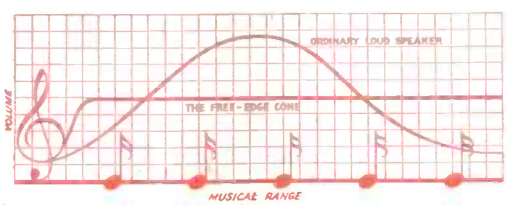


After 5 years and 256 experimental models

Acme is proud to put its name on this Loud Speaker

HERE in our laboratories at Cambridge, our radio engineers and sound experts have been at work, ever since broadcasting started, striving to perfect an ideal type loud speaker.

Two years ago, after having made, studied and tested 203 models, we obtained a very good horn type loud speaker.



NOTE the equal volume over the musical range with the *free-edge cone* in contrast to the ordinary loud speaker.

The latest development in radio reproduction is the cone type loud speaker but the double *free-edge cone* is a further advancement because resonance is eliminated and faithful reproduction obtained over the whole musical range.

ACME
~for amplification

But our radio and sound engineers determined to go *even further.* After 23 months more of experimenting; making and testing 53 additional loud speaker models they at last developed the ACME *Free-Edge Cone* Loud Speaker.

As far as it is humanly possible to judge we feel certain that we have the finest loud speaker ever produced. This new type loud speaker does away with inherent resonance common in other types. Because of this improvement the new Acme now brings out the low notes and soft over-tones never before obtainable in any loud speaker.

[signature]

President, Acme Apparatus Company.

SEND for the new edition of our famous book, "Amplification without Distortion," telling the why and the how of perfect radio reception.

ACME APPARATUS COMPANY,
Dept. L-5, Cambridge, Mass.
I am enclosing 10 cents (U. S. Coin or stamps) for your booklet "Amplification without Distortion."

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