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The Magazine of the Hour

APRIL
1924

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RADIO AGE

The Magazine of the Hour

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FREDERICK SMITH, *Editor*
FRANK D. PEARNE, *Technical Editor*
M. B. SMITH, *Business Manager*
LOUIS L. LEVY, *Circulation Director*

Western Advertising Representatives
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First National Bank Building, Chicago
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A Chat With the Editor

THERE are two departments in this issue of RADIO AGE which demonstrate what we have said repeatedly. That is: This is essentially a readers' magazine. In the section devoted to letters from readers on sets they have built and results they have obtained there is a generous store of useful information for other readers. We want all readers to understand that we are interested in these letters, especially the ones suggesting new hook-ups and new kinks.

Also in the columns in which appear the letters from readers who tell us why they read RADIO AGE there will be found some information that will interest the craft generally. Those readers who write to express approval of certain methods of presenting radio subjects may not find it hard to believe that so many other fans are pleased with RADIO AGE drawings and articles and are buying so many of our magazines that we have been forced to put the print order up to 70,000. That was the March figure. The press run for this issue cannot be definitely estimated as orders from wholesale distributors are still coming in as we are preparing to put the plates on the press.

While we are discussing circulation we may as well call attention to the fact that we are applicants for membership in the Audit Bureau of Circulations, which furnishes verified figures on total number of magazines printed, distributed and sold.

We notice that Canadian readers are increasing in number with gratifying rapidity. Many of them are writing us just the sort of constructive letters we like to get.

For all of you we want to suggest that you do not permit the Spring days to lure you away from attention to several good features that we know are in store for you in early issues.

Frederick Smith

—Editor, RADIO AGE

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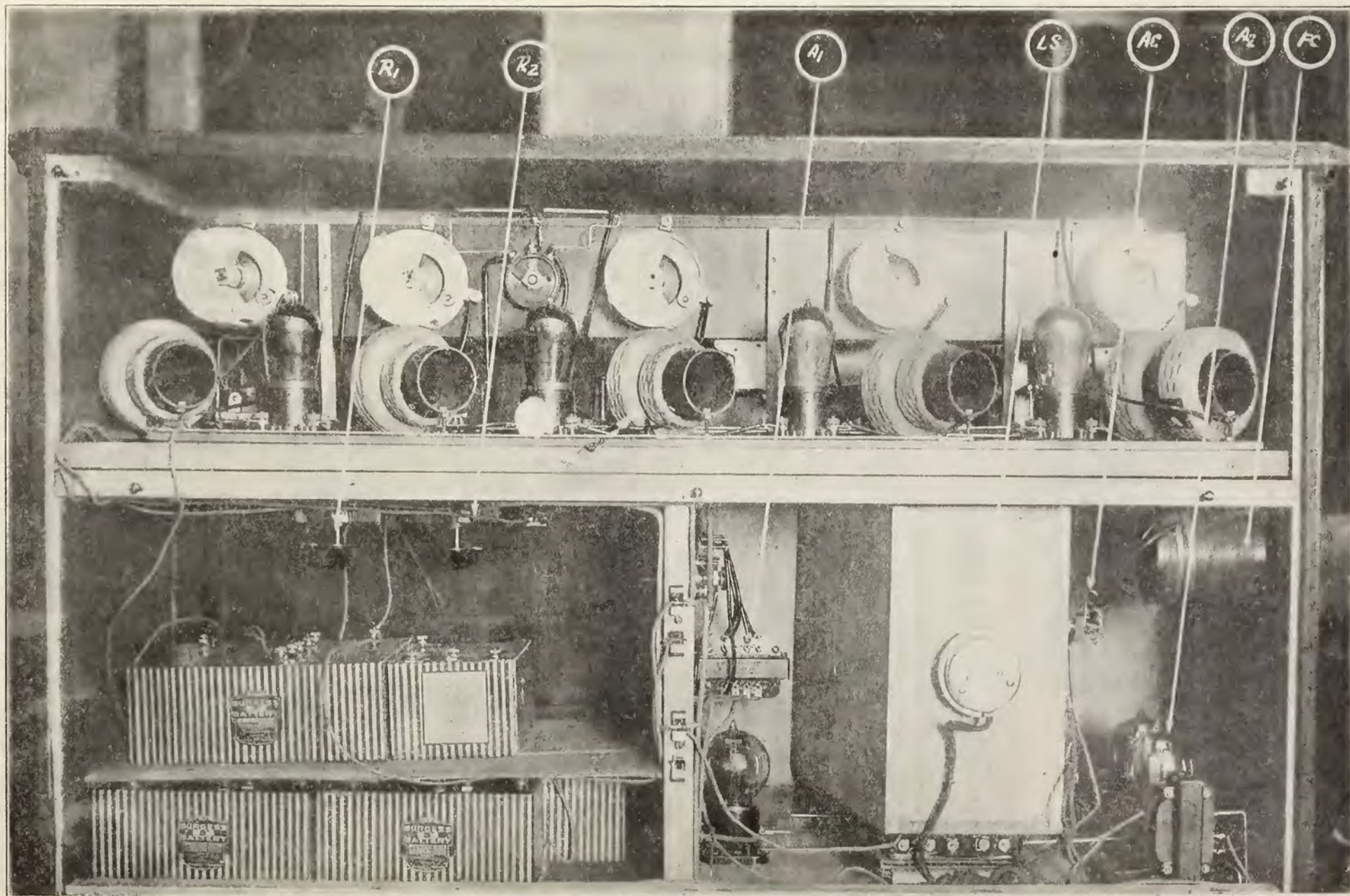
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R1 is the detector rheostat, R2 the filament control for all the other tubes, A1 the single stage of audio frequency amplification, LS the loud speaker, AC the antenna connections for either loop or outdoor aerial, A2 the push-pull amplifier used as a second stage, giving the utmost clarity of signals, and FC the fixed coupler, used when an outdoor antenna is connected to the set. The C battery is shown directly under the loud speaker which is built into the cabinet.

RADIO AGE

The Magazine of the Hour

M. B. Smith
Business Manager

A Monthly Publication
Devoted to Practical
Radio

Frederick A. Smith
Editor

An Efficient Super-Heterodyne

By ARTHUR B. McCULLAH

DELIVERS in physical and scientific research have established enviable reputation for their zeal in pushing ahead beyond the confines of their fields. Obstacles have been surmounted by patient toil; perfection has been sought and surpassed and sought again, and the finished task has been only a task begun. In the field of radio research we have been zealous enough and the world is witness to the wonders accomplished; yet it is a fact that our search for an instrument that would prove a practical receiver for the layman, we have attempted to single out the simplest type of set without regard to the fundamentals and sensitivity and quality, and have shied away from the greatest and most efficient of all systems—the super-heterodyne, because of its supposed difficulties in construction and control.

Contrary to general belief, the super-heterodyne is a simple and easily controlled receiver, if built right. Tuning is much more easily done than on a one-tube receiver. This is because of the fact that the signal of a transmitting station is made to fit the set rather than the set made to fit the signal, the procedure followed out in small sets.

It is possible to construct a super-heterodyne in which the control centers around two dials, the tuner and the heterodyne, or oscillator. In constructing a set of this type, one must adhere closely to the constructional details that follow. If this is done, no difficulty will be experienced in building a really super-set, and one that will meet all of the expectations as to selectivity, distance, and quality of reproduction.

Theory of Amplification

Before going into the explanation of the actual construction of the receiver, it might be well to review the theory of operation. Let us first, as a matter of primary importance, consider the common short wave receiver with both radio and audio frequency amplification.

It will be found that one stage of audio frequency amplification will give by far more amplification than two stages of radio frequency amplification. This is due to three factors, viz.: (1) the alternating

current losses are much greater at high frequencies due to the increase of eddy currents and dielectric absorption (losses); (2) leakage through stray capacity is greater at high frequencies than at low frequencies; (3) it is more difficult to control tube oscillations at high frequencies than at low frequencies. These three factors show concisely that the low frequencies can be amplified best, and the logical thing to do therefore would be to amplify them at the low frequencies (long waves) instead of the high frequencies where all these losses have to be contended with.

Unfortunately, however, broadcasting is done on extremely high frequencies (short waves) and in order to obtain the desired results, it is necessary to lower the frequency so that it may be amplified more efficiently. Although this was accomplished during the war by Major Armstrong with his super-heterodyne receiver,

radio designers have shunned this system as being impracticable for the layman. The very term "super-heterodyne" conjured all sorts of difficulties, and designers left the construction and use of the system to only a genius like Mr. Armstrong himself.

Three Units

Instead of building the super on one large panel of large dimensions, we shall build it in a more serviceable size. In doing this, we must think of the set as being in three component parts. These units will be referred to as follows: Unit one, wave-changer; Unit two, the long wave amplifier and detector; Unit three, the audio frequency amplifier. Reference to Figure 00 will show the subdivision of these units, illustrating the heterodyne or wave-changer mounted on the main control panel, the intermediate amplifiers and

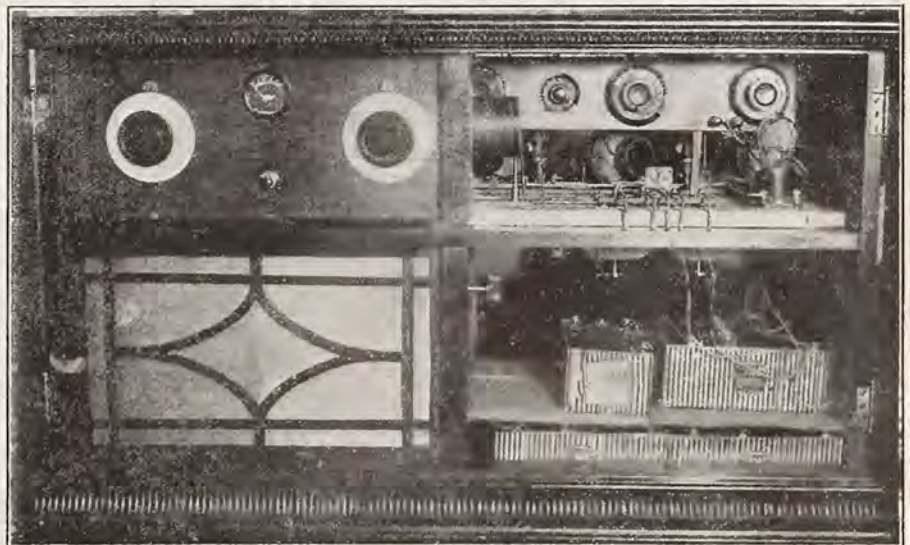


Figure 2

CONSOLE ARRANGEMENT

A front elevation of the beautiful console type of super-heterodyne receiver, its design making it a desirable furnishing for the most elaborate drawing room. The music and programs from broadcast stations issue from the loud speaker with more volume than can be obtained from a phonograph, and with clarity that has not been excelled. The switch-knob directly to the right of the loud speaker enables the operator to control the volume of the signals, from the smoothest and softest intensity, to a deafening roar. The set when not in use presents the appearance of a phonograph.

their controls on a sub-panel, and the audio frequency unit in another section of the receiver.

Why Units Are Separated

By doing this, two things may be accomplished. The units may be arranged attractively and artistically in such a manner that it will not be necessary to have a specially constructed piece of furniture in which to house it. The wiring will be short and direct in the units themselves, and it enables the constructor to exercise his own taste as to the location of the units, so long as the connecting leads are kept within the bounds of reason.

Construction

The coupler and oscillator coils are both wound on the same size tube. The coupler is wound on a bakelite tube $2\frac{3}{4}$ inches in diameter, which should be 3 inches in length. Two coils are wound, the secondary being wound first, which consists of 60 turns of D. C. G. S. wire. A layer of empire cloth is then wound over the one end of this coil, and directly

over the empire cloth, another coil, forming the primary of the coupler is wound. This consists of 4 turns of the same size wire. The construction of this coupler is illustrated in Figure 00, and is the medium used to couple the receiver to the antenna, which can be of the ordinary outdoor type, not over 80 feet overall length, including lead-in.

The Oscillator

On another piece of tubing, the same size as before mentioned the oscillator coils are wound. Starting at the left end, wind 27 turns of the No. 20 D. C. G. S. wire, and fasten the end. One-eighth of an inch to the right, start another coil and wind 36 turns of the same size wire. The first coil mentioned is L3 and the latter bears the term L4, and together, they form the oscillator unit of the receiver.

The tubing holding these coils may be mounted on pillars or other suitable mountings; they are a matter of appearance only. The oscillator coil must be mounted near the oscillator bulb and condenser, while the secondary coil may be

mounted a good distance away from the secondary condenser if desired. (Note: The oscillator may be mounted in the same manner as described in the super-heterodyne article of the March, 1924, issue of RADIO AGE to advantage, by omitting the smaller tubing and using the larger outside one only. This form of mounting is exceedingly effective. While it is possible to use long leads on the secondary circuit, be reasonable, and make them as short as you conveniently can. It is a tuned circuit, and you can add materially to the effectiveness of the receiver by keeping the resistance of this circuit as low as possible.—Tech. Ed.)

The design of the front panel is left to the builder's taste. The only thing that is necessary to have on the main operating panel is the secondary and oscillator condensers, and a filament control switch, which enables the operator to turn the filament current off at will without having to remove one of the battery leads from the battery.

Follow out the detail and wiring diagram of the oscillator very closely, and

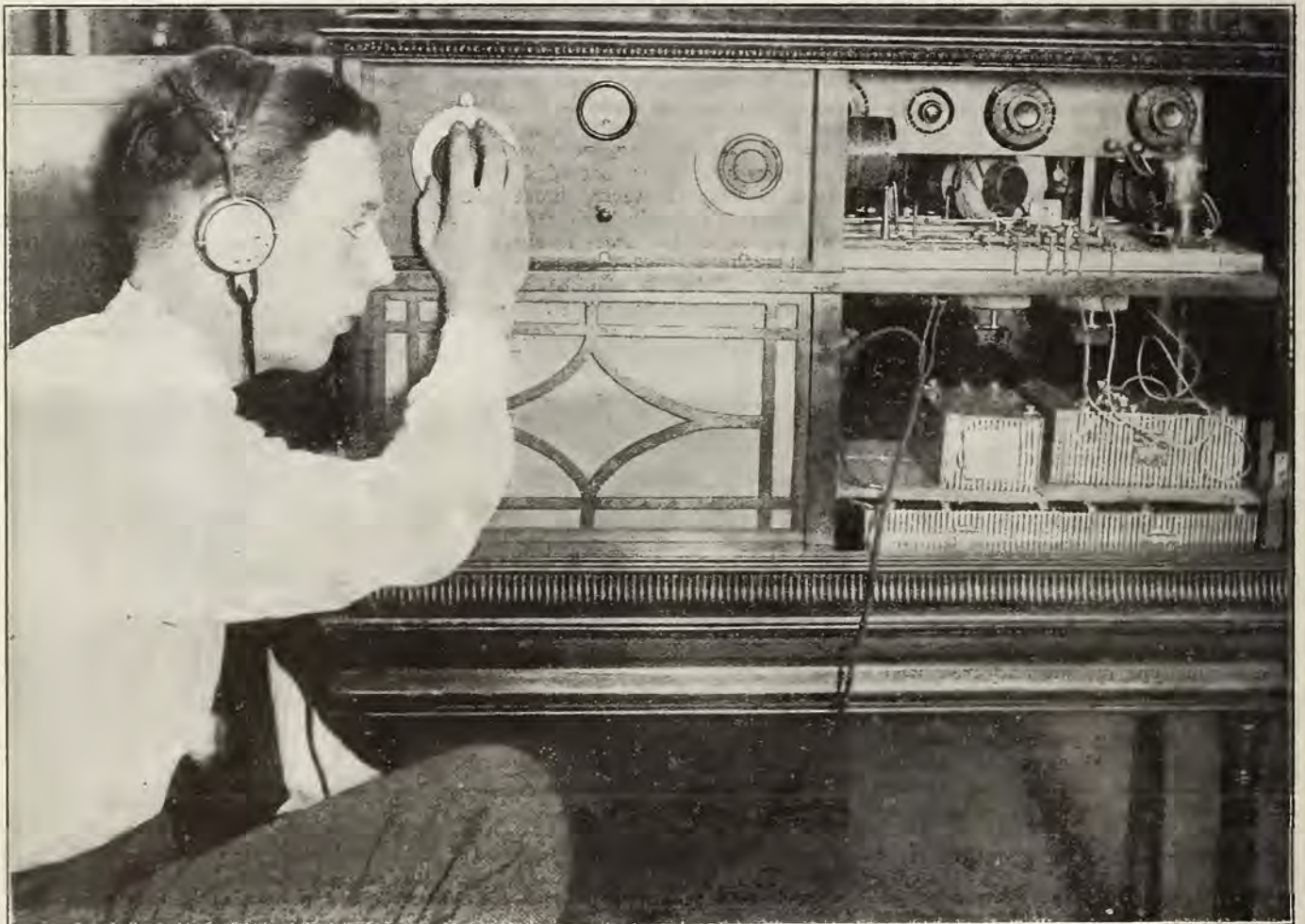
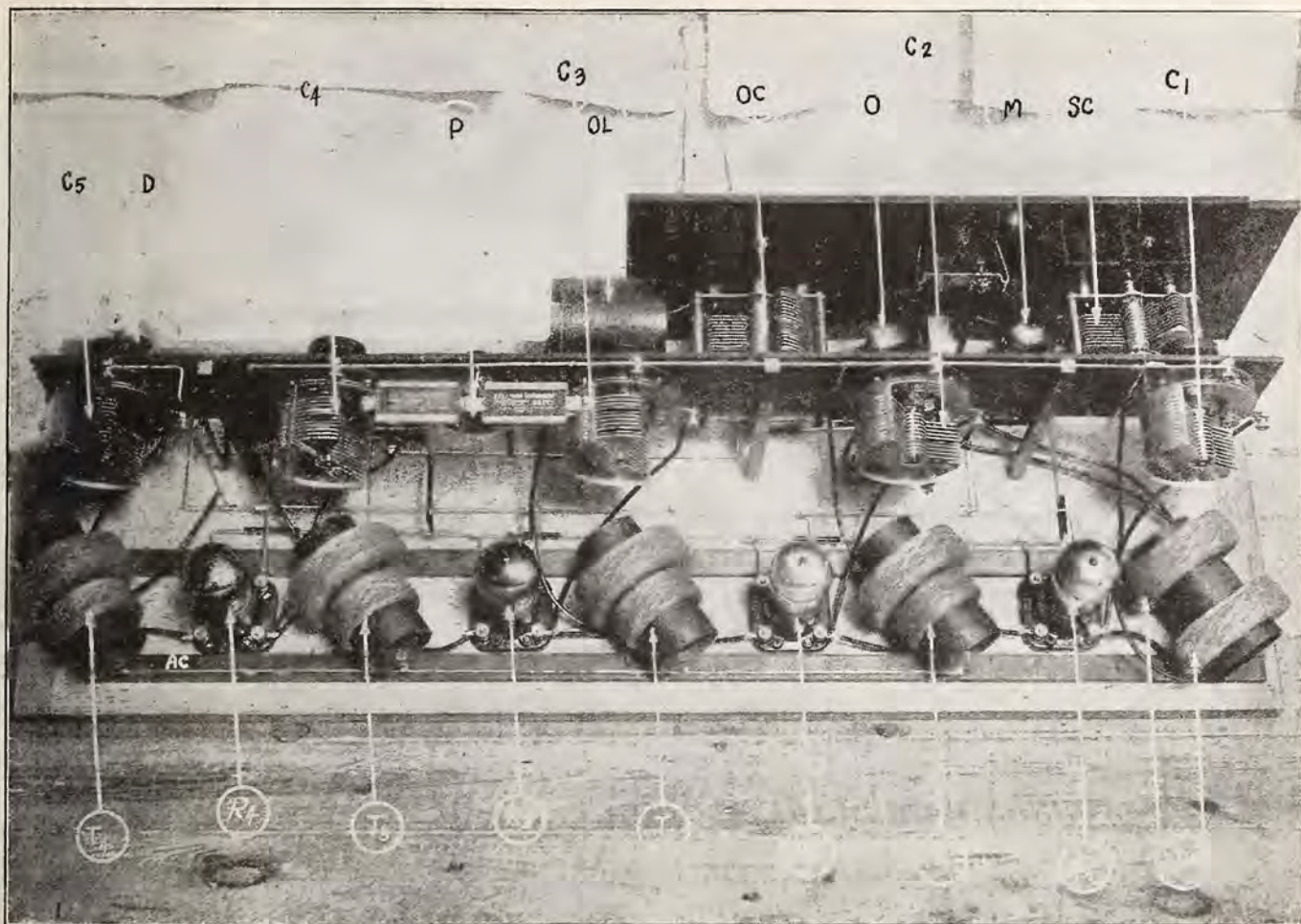


Figure 1
HETERODYNE CRAFTSMANSHIP

Arthur B. McCullah, a student of Lane Technical High School of Chicago, operating the ten-tube super-heterodyne receiver designed and built by himself. The set is a rare example of careful engineering and painstaking workmanship. Stations from every part of the country are received on the loud speaker with unbelievable consistency and volume. The photo shows Mr. McCullah making some preliminary adjustments with the receiver, before plugging in on the loud speaker, which is operated by two stages of audio amplification, consisting of one cascade amplifier and one push-pull type. Operation of this receiver is comparatively simple, the only two controls used being the two shown with the white dials, once the set is adjusted to proper operating conditions. The stations come in on two places on the oscillator condenser dial, and the tuning is so sharp that care must be taken not to pass over the spot where the signal is received.



SNAPPY RADIO ENGINEERING

The back panel view of the oscillator-radio frequency-detector panel of the super-heterodyne receiver. The legends refer to the following units of the receiver: C5 condenser, used to tune the radio frequency transformer T4; C4, used to tune T3; C3 tunes T2, and C2 tunes T1. The primary of the long wave coils LWC is tuned by fixed condensers hidden behind the mounting panel, and the secondary is tuned with condenser C1. OC is the oscillator condenser, OL the oscillator coils, and O the generating tube. M is the frequency changer or modulator tube, and D is the detector. R1, 2, 3 and 4 are the tubes furnishing the radio frequency amplification, while P is the potentiometer used to bias them. SC, the secondary condenser, used for tuning in the signals from the loop or other antenna, and the oscillator condenser OC are the only controls used for tuning, once the set is adjusted. The output from the detector tube D is transferred to an audio frequency amplifier shown in Figure 5. The bakelite strip AC is the angle changer, which changes the angles of all the coils simultaneously. All the controls which require preliminary adjustment are mounted on a separate panel immediately back of the operating panel, which contains only the secondary and oscillator condensers, a meter and a filament control switch.

no trouble in making the heterodyne unit oscillate will be experienced.

Intermediate Amplifier

The long wave (low frequency) amplifier is of the tuned type which gives greater amplification per stage than any other known type. The construction of such an amplifier is very simple.

Ten Giblin-Remler inductance coils are mounted on five pieces of bakelite tubing, two coils on a tubing, which is in turn mounted on two strips of bakelite which, when pulled back and forth, change the angle of the coils simultaneously to a common base. This feature alone adds to the general efficiency of the set due to the fact that the inductive coupling between the air core transformers is minimized.

Two strips of bakelite 3/4x34x1/4 inch are used to mount the coils. In drilling the hole through the strips it is necessary to place one strip on top of the other that the holes will be the same distance apart. One-inch 6-32 brass bolts are put

through the holes in the strip, and three nuts are put on the bolt. The lower one is tightened down while the others are left near the top of the bolt and are clamped through a hole in the tubing as shown in Figure 00.

From the list of materials needed it can be seen that six (6) 400 turn Giblin-Remler inductance coils are needed; four (4) 100 turn coils of the same make so that the coils will all have the same inside diameter.

These ten coils are arranged into five air core transformers. Transformer No. 1 has two of the 400 turn inductance coils mounted on a piece of bakelite tubing just large enough to slide into the small hole in the inductance coil, and 5 inches long. These two 400 turn coils are placed on the extreme end of the 5-inch tube. Transformers 2, 3, 4 and 5 are placed with one 400 turn coil and a 100 turn coil on each tube placed in the center, 1/8 inch apart. The accompanying photograph illustrates the method of mounting them clearly. The opposite ends of the tubing

are anchored to the mounting board. When the one strip is moved it changes the angles of all of the coils, and the coupling can be varied, until the lowest possible interaction is obtained.

The secondary of the five air core transformers are tuned with .0005 MF variable condensers and are mounted on a sub-panel. This is done so that after the condensers are once adjusted they will be out of reach and not tempt one to turn them. This sub-panel is 3 1/2x32x3/16, has also a potentiometer mounted between condenser 3 and 4. After the condensers and potentiometer is mounted on the sub-panel this whole sub-panel is mounted on three brass uprights 3/8 inch square and 7 inches long. Their uses are illustrated in the accompanying photos.

Tubes

The four radio frequency tube sockets are placed between their respective transformers. This will make the grid and plate leads shorter and prevent the leads from running parallel. The tubes should

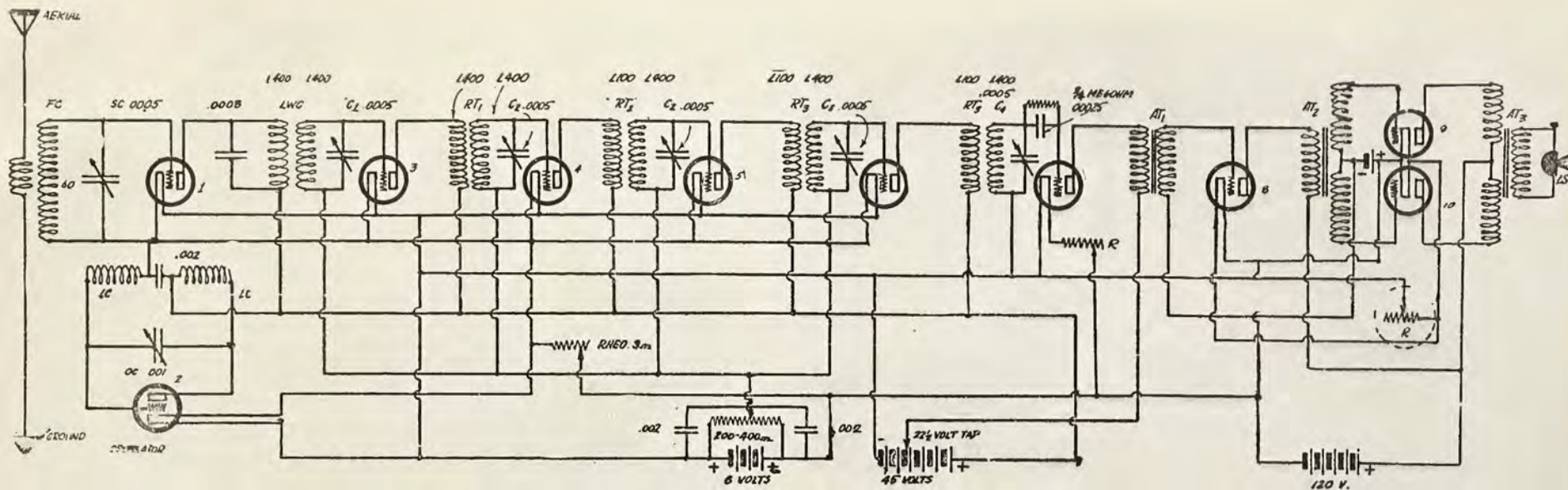


Figure 4—A diagram of the super-heterodyne receiver described and illustrated in detail in the accompanying article. Mr. McCullah describes the construction of this receiver in a clear and concise manner, which should enable the builder to construct it without difficulty.

The transformers are home made, using honeycomb coils, and are tuned with condensers placed across the secondaries. The units bear the following legend:

- FC—Fixed coupler.
 SC—Secondary condenser, .0005 MF, 23 plates.
 LWC—Long wave coils, 400-turn honeycombs.
 C1, 2, 3, 4 and 5—23 plate condensers, .0005 MF capacity.
 RT1, 2, 3 and 4—Radio transformers primary, 100 turns, secondary 400.
 OC—Oscillator condenser, .001 MF, 43 plates.
 AT1—Audio frequency amplifying transformer, 4:1 ratio.
 AT2—3 Push pull audio transformers.
 1—Modulator tube.
 2—Oscillator tube.
 3, 4, 5, 6—Radio frequency amplifiers.
 7—Detector.
 8, 9, 10—Audio frequency amplifying tubes.
 R—Shown in dotted lines not necessary when 216 A tubes are used.
 LS—Loud speaker.

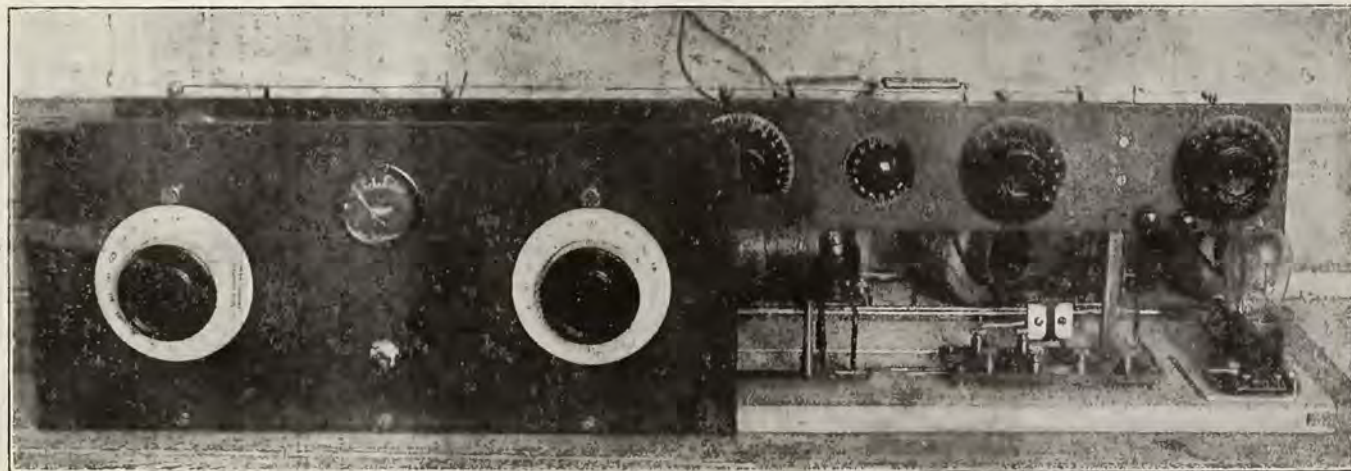
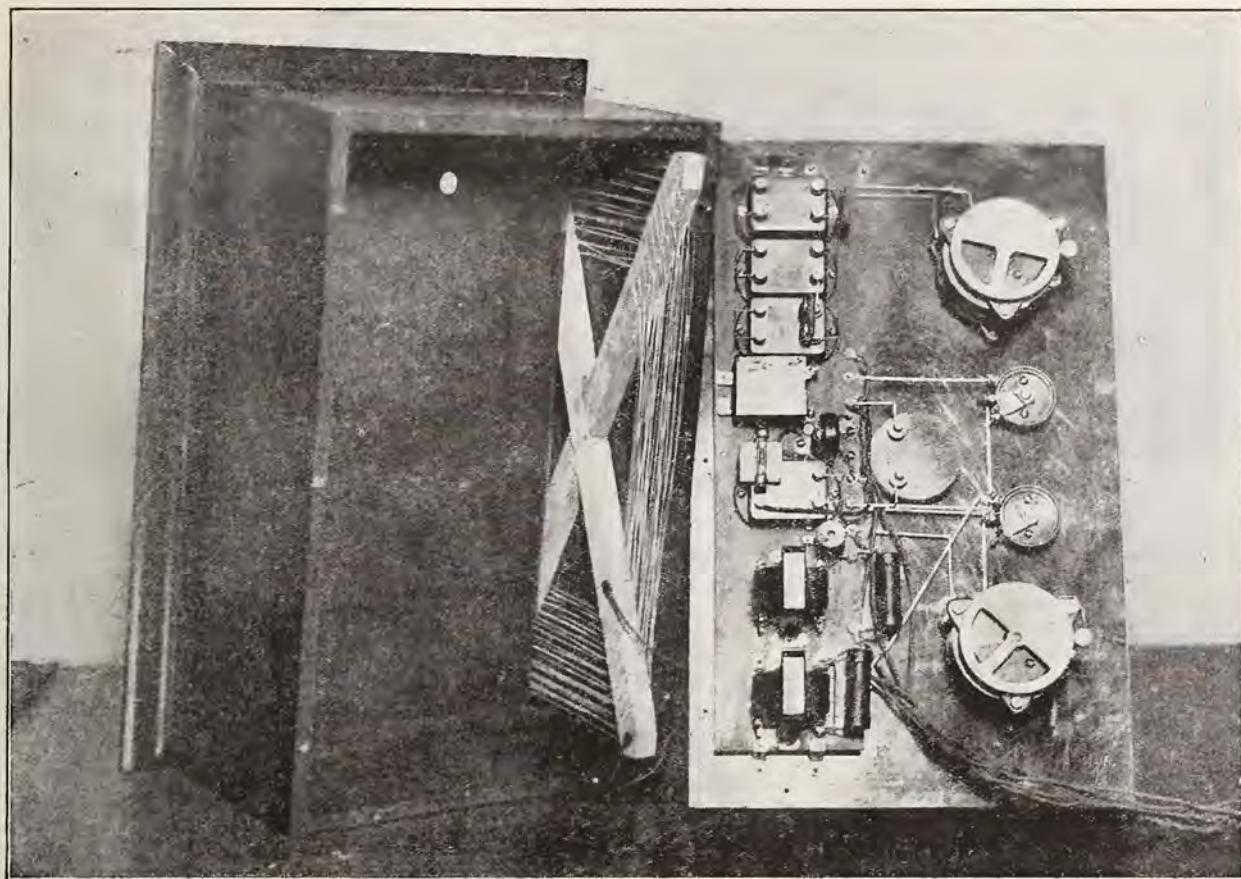


Figure 3
 CONTROLS ON SEPARATE PANELS

A front panel view of the McCullah super-heterodyne showing the simple appearance of the receiver. The set is so designed that all the controls which need to be adjusted only once are contained on a separate panel placed immediately behind the operating panel, which mounts only three controls, the secondary tuning condenser, the oscillator condenser, and the filament control switch. The meter is a voltmeter, enabling the operator to keep careful check on the voltage of the filament circuit. The oscillator coils can be seen immediately to the right of the oscillator condenser. Notice the method of mounting this set of inductances.



ARMSTRONG'S SUPER-HETERODYNE

The back-panel and interior of the cabinet of Maj. E. H. Armstrong's super-heterodyne six-tube set, with which he picks up London. It will be observed that the tubes are on the front of the panel. See other photograph.

be UV 201 A amplifying type with the exception of the oscillator, detector and audio frequency amplifiers, which should be WE 216 A, UV 200 and WE 216 A respectively.

On the first radio frequency long wave coils designated LWC, the coil towards the front is called the input coil. This input coil is shunted with a .0003 fixed condenser of the mica type. The coil towards the back of the set is connected to the first variable condenser on the sub-panel. If the baseboard is not long enough the detector tube and socket may be mounted in front of the fifth condenser. It might be well to state here that the grid leak must be of a very low value (about a 1 or $\frac{3}{4}$ megohm leak will do), to prevent the detector tube from disturbing.

Audio Frequency Unit

The audio frequency amplifying unit is mounted on the same base with the other two units or it may be mounted on another small base near the loud speaker. The audio frequency amplifier is a two-stage the first stage being a common cascade type while the second stage is of the multiple or push-pull type. These are nothing out of the ordinary about this amplifier, and it is not necessary to dwell on the subject of its construction. (Full details were published in the January, 1924, issue on the Push-Pull amplifier. Tech. Ed.)

Tuning Intermediate Unit

The tuning of the long wave radio frequency amplifier is very easy. A small buzzer that gives an 800-cycle note is best for this job. It is connected in series with an ordinary dry cell, and connected across the input coil. The note of the buzzer is then adjusted so as to give a clear note, and to make the least sparking possible. Connect a crystal detector and headset across the secondary or the condenser of the other 400 turn LWC. The first condenser is varied until the buzz is heard at its loudest point. Turn on the current of the first tube (first radio frequency amplifier) and connect the headset and crystal detector across the terminals of the second condenser. Proceed in the same manner by tuning the condenser until the loudest signal from the buzzer is heard; though this time it will be louder, due to the fact that it is amplified by the first RF tube. This process is continued until the entire intermediate amplifier is tuned.

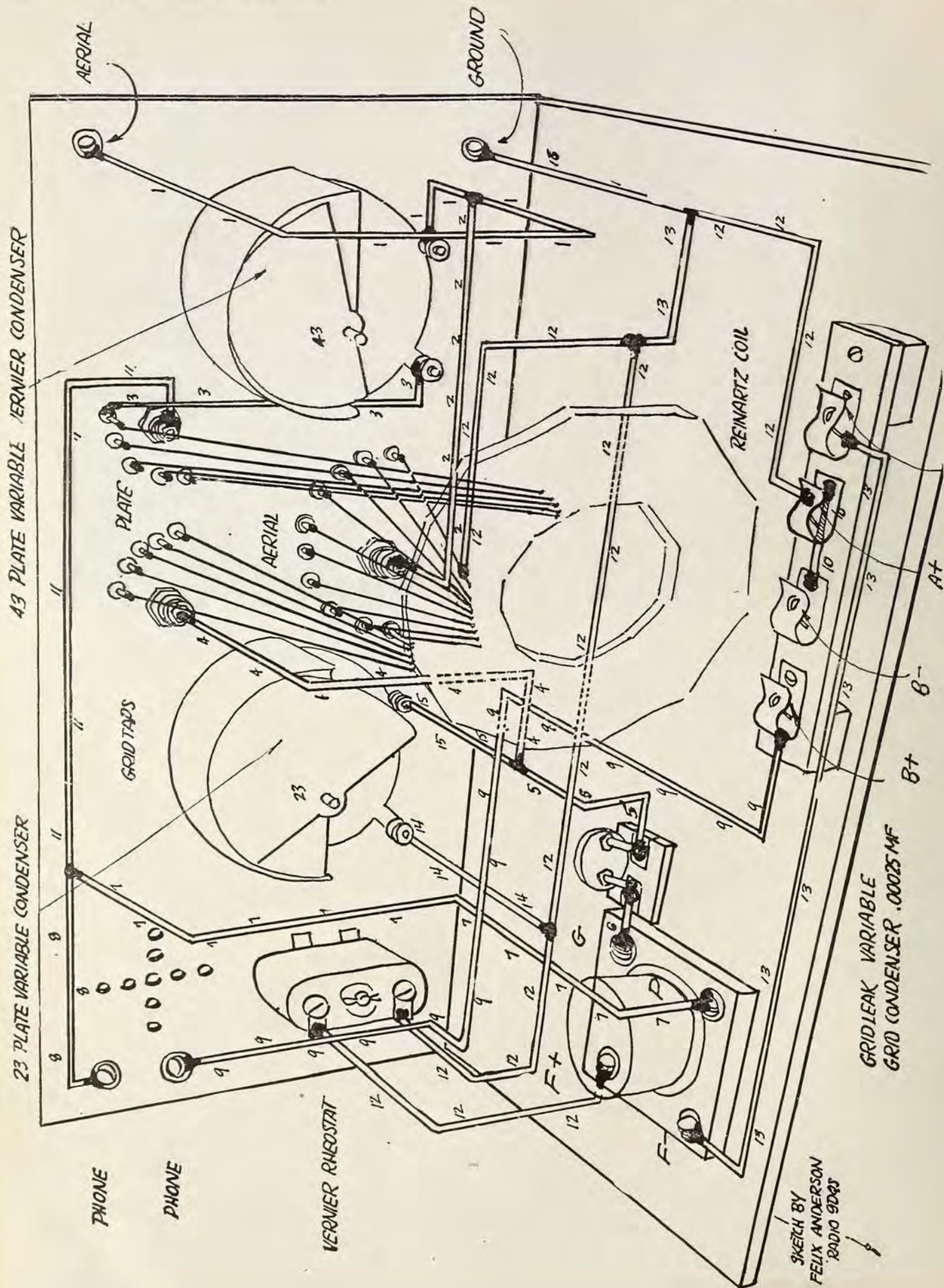
Tuning the Set

Your receiver is now ready for use. Upon tuning in, one will find that there will be two points on the heterodyne dial where the stations come in if everything is adjusted properly. If, however, there are more than two points, the amplifier should be retuned.

List of Materials

- 2 Dials.
- 1 Voltmeter, 0-10, Jewell.
- 5 .0005 variable condensers.
- 1 .0005 variable condenser.
- 1 .001 variable condenser.
- 6 400-turn inductance coils.
- 4 100-turn inductance coils.
- 1 Potentiometer.
- 3 .002 fixed condensers, mica type.
- 5 pieces of bakelite, 2 inches in diameter, 5 inches long.
- 2 pieces of bakelite, 3 inches in diameter, 4 inches long
- 1 $\frac{1}{2}$ -pound spool D. C. G. S.
- 10 Sockets.
- 2 $\frac{3}{4}$ x34x $\frac{1}{4}$ -inch bakelite strip.
- 1 $3\frac{1}{2}$ x32x $\frac{1}{4}$ -inch bakelite strip.
- 1 8x18x $\frac{1}{4}$ -inch front panel, bakelite.
- 1 .00025 grid condenser.
- 1 1-megohm grid leak.
- 3 Brass rods, $\frac{3}{8}$ x7 inches.
- 1 Carter on-off switch.
- 1 Audio frequency transformer (4 to 1).
- 1 Audio frequency transformer, push-pull.
- 1 Loud speaker unit.
- 2 Rheostats, power type, 3 ohms.
- 6 201A or 301A tubes.
- 4 216A tubes.

EDITOR'S NOTE: Only the very highest quality equipment should be selected in making the set described in the foregoing.



SKETCH BY
FELIX ANDERSON
RADIO 9045

Selecting the Right Receiver

By FRANK D. PEARNE

THE question of selecting the proper radio receiver to suit his particular case, is more serious to the beginner than one would at first suppose. So many things enter into this problem that it is no wonder that the poor fellow makes an appeal for guidance in this matter, to those who have gone before and have learned by hard and expensive experience, what the uninitiated are up against when they blindly grope about in the purchase of their first radio set.

The number of radio enthusiasts is growing rapidly, so rapidly, in fact, that the manufacturers of radio sets and parts cannot keep the pace, some of them being several thousand behind in their orders for sets, and this, in the face of day and night operation of their factories, proves beyond a doubt that the interest in radio is increasing so fast that it is destined to become one of the greatest industries in the history of our country.

But what of the poor beginner? On every side he hears about this and that wonderful set. He hears about radio frequency, audio frequency, detectors, condensers, all new to him, and he starts out to see what he can get for a reasonable expenditure of good cold cash that will put him in this ever increasing multitude of broadcast listeners.

Buyer Is Bewildered

Here is where his real trouble begins. Every store he enters will show him something different, all being the best that

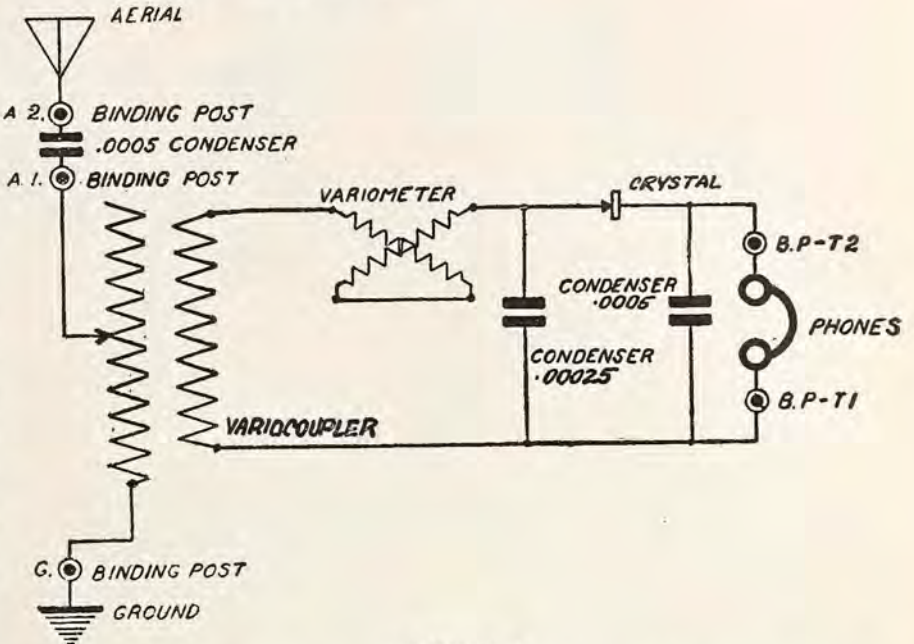


FIGURE 1

A diagram of the Long Distance Crystal receiver, which is a desirable receiver for the new beginner in the radio pastime. The set is easily constructed, requires little or no knowledge of radio, and gives surprising results. The binding posts, A-1 and A-2, are used as part of the tuning system, the A-2 post being used for the lower waves and the A-1 for the higher. This applies especially where the antenna used is a long one.

money can buy. His eyes will suddenly be opened to the fact that there are more different types of radio receivers than he

ever dreamed of and the farther he goes, the more discouraging it looks to him. If he does find something which looks interesting, some fellow is sure to suggest that he is all wrong and point out to him the numerous defects in this particular set and will probably rave about his own wonderful set, finally convincing the would-be purchaser that he has not yet discovered what he wants.

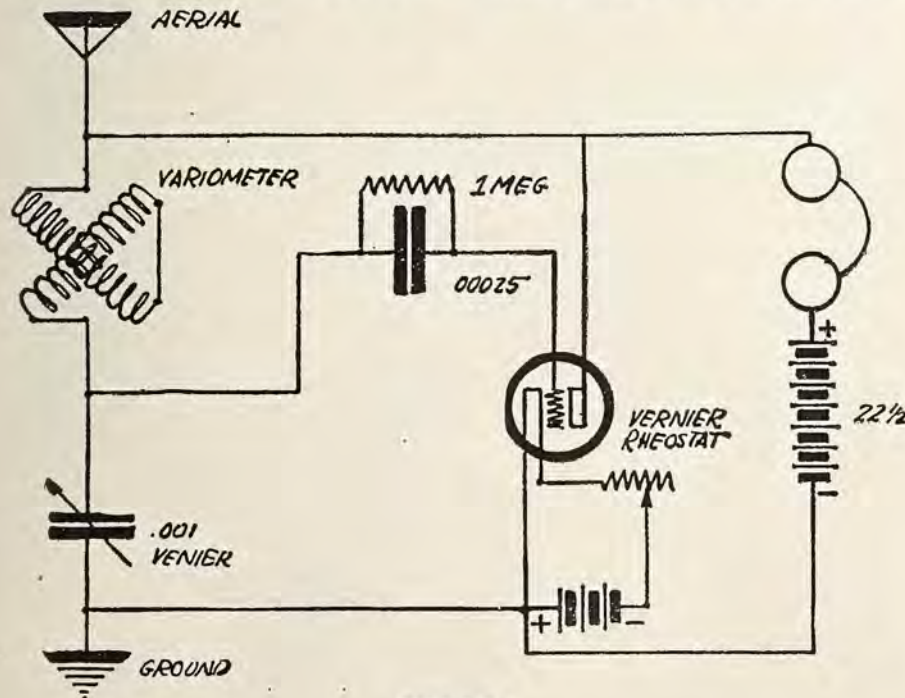


FIGURE 2

A diagram of the type of set which would make a desirable receiver for one who is making his first steps in the art of building a tube receiver. This set was described in detail in the October, 1923, issue of RADIO AGE, together with instructions for the conversion of crystal receivers into tube units. It has a consistent long distance range, and has often accomplished 2,000-mile receptions.

First of all one should understand that hardly any two fans have the same experience with the same set. An outfit which will work very well in one location with a certain aerial, will act entirely different when used in a different location with a different aerial. This fact probably is responsible for so many differences of opinion expressed by those who have had experience.

Then, too, much discontent is caused by the fan who exaggerates the number of long distance stations which he has heard and the beginner, after installing a fairly good set, is much disappointed when he doesn't get these results. As a matter of fact it is very hard to say just what anyone can do with a certain set, until it has been proven by actual practice. As stated before, the selection of the proper set is a question which is really hard for even an expert to answer, for the reason that location has much to do with the results obtained.

Aside from location, there are many other points to consider. It is a well known fact that about 50 per cent of the prospective radio purchasers are governed to some extent by the amount of money

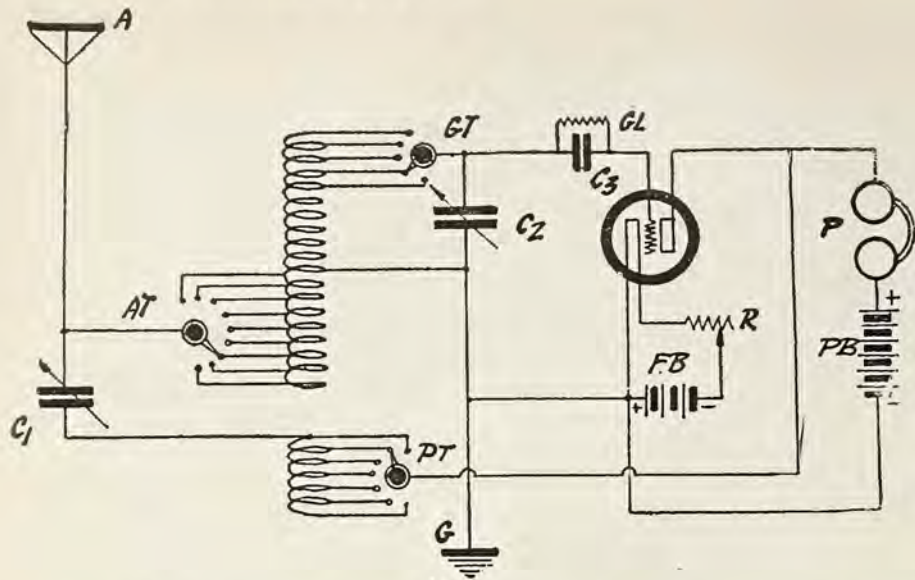


FIGURE 3

A more complicated and very efficient receiver is the Reinartz, illustrated in the above cut. A is the antenna, C1 a 43-plate condenser, C2 a 23-plate (both should be vernier), and C3 is a fixed .00025 MF grid condenser. AT are the antenna taps, GT the grid taps and PT the plate taps on the spiderweb inductance. R is a vernier rheostat, P the phones, and the batteries, PB for plate batteries, 22½ volts, and FB the A battery for the filament of the tube of sufficient pressure for the tube used. G is the ground connection.

involved, while the other 50 per cent care nothing about the cost, but are only interested in getting the best apparatus that money can buy.

Aerial Is Important

There are many beginners who live in apartment in which the set is to be used to put an aerial on the roof and must, of course, have recourse to some kind of inside aerial, such as a loop or a wire stretched around the room, or in an attic. This also requires consideration.

Contrary to the general idea that any kind of an aerial will suffice for an ordinary crystal set, these sets should have the best possible antenna system, so that the already low efficiency of such a receiver will not be hampered with a poor antenna system. It is much easier for a high powered tube set to function with a poor aerial than is the case with the weaker crystal set. The location of the apartment in which the set is to be used will also have to be considered.

If one lives in an apartment on the first floor and must resort to an inside aerial, he cannot expect to get the results which he could get if he lived in a third floor apartment, as the height of the aerial makes an enormous difference in the reception obtained. First, let us consider the beginner who is limited to a cheap set and wants to learn something about local broadcast reception. If it is a case where children are expected to handle it, it would be foolish to invest in a tube set until such a time that they learn something about the general operation of such instruments.

The crystal set, while not so powerful as a tube set, will give one an idea of tuning and the delicate adjustments which must be obtained and at the same time will bring in broadcast entertainment very nicely.

Outside Aerial Best

But right here the beginner should understand that simply because he has a set which is inexpensive and can be roughly treated that any kind of an aerial and ground connection will do. He must bear in mind the fact that in order to get the most out of it, that he should have the

best aerial which he can make, in order that the efficiency, which is naturally low anyway in sets of this kind, will not be further reduced.

If one has access to an outside aerial he should take advantage of it by all means. If this is not possible, he must, of course, resort to some kind of an inside aerial. Of course, the higher this is placed the better will be the reception, and one of the best aerials for this work is made by running an insulated wire around the room behind a picture molding. It should encircle the entire room once only, one end being left open and the other brought down to the set and connected to the aerial post and a wire connected to the ground binding post of the instrument should be run along the baseboard to some convenient water or steam pipe, where, after being careful to clean both the wire and the pipe until it is bright, it should be twisted around several times and fastened securely. This connection can also be made with a ground clamp which may

be obtained at any radio store.

Crystal Efficiency

Now as to the type of crystal set to be used; one should select something that is good and substantial and has the best kind of tuning apparatus. If he builds the set himself, the arrangement shown in circuit No. 1 will be ideal for the purpose. With this arrangement, on account of its excellent tuning qualities, he may, if he is fortunate enough to have a fairly good aerial, be able to get not only the local broadcasting stations, but some of the distant ones as well. It is generally understood that a crystal set will only receive from distances of from twenty-five to forty miles, and this is true in regard to most of them, because of the poor tuning arrangements which they usually have, but the circuit shown has been designed to give the closest possible tuning and has proven worthy of the name of long distance crystal set.

After one has become somewhat familiar (Continued on page 36.)

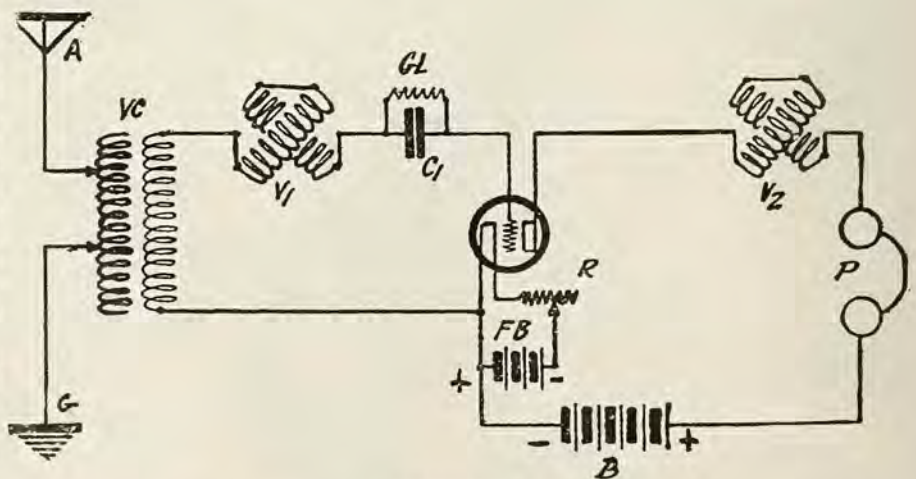


FIGURE 4

An exceptionally close tuning receiver, a type highly desirable in sections where a powerful local station operates nearby. The tuning of this set is an art, and requires much patience, due to the fact that it is so sharp. The circuit is known as the Armstrong, also the Three-circuit regenerative, and sometimes is called the Two Variometer, Variocoupler circuit. The letters bear the following values: A antenna, G ground, V1 grid variometer, GL grid leak, 1-5 meg., C1 grid condenser, .00025 MF, fixed, V2 plate variometer, FB filament battery, B plate battery and P the phones.

The Wizard Ten Dollar Receiver

By JOHN B. RATHBUN

ABOUT two months ago, the writer was called upon to design a simple low priced set. A set which would have all the range of the Ultra-Audion and yet one which would have greater selectivity and which would be less noisy in operation. The controls were to be limited to two, the tuning control and the filament control of the tube, and the retail price of the unassembled parts was to be ten dollars or less. The result was a modified "jammer" or "Man-Day" circuit with new trimmings, and this was given the trade name "Wizard."

The original Man-Day circuit employed a standard variocoupler which introduced an extra control dial for moving the rotor and two tap switches for varying the inductance of the primary in addition to the tuning condenser. By employing a special fixed coupler with two stationary windings, somewhat similar to the neutrodyne type transformer, the tuning control was reduced to one unit—the variable condenser. This at once simplified the control and greatly reduced the expense of building the receiver, all without loss of selectivity or volume. The primary coil of the coupler is of the aperiodic type, while the secondary coil is alone tuned by the variable condenser. A potentiometer was added later as a means of more accurately controlling regeneration on faint signals and has proved its worth repeatedly.

What Drawings Show

In Figure 1 we have the circuit dia-

gram of the modified Wizard circuit together with a Bill of Materials which gives the names and sizes of the various units. Each of the binding posts is located in approximately the position that they occupy on the panel, and all of the wires are numbered to correspond with the numbered wires on the isometric drawing, Figure 3, of the assembled set. The binding posts are indicated by the small circles enclosing a solid black dot, and their arrangement is such that one or more stages of audio amplification can be added easily.

Starting at the left of the diagram we see the fixed coupler having the primary coil (L1) and the secondary coil (L2). The primary coil consists of 28 turns of No. 26 D. S. C. wire and the secondary contains 66 turns of the same wire. Both coils are wound on the same tube and are separated from each other by 5/8 inch as shown in Figure 2. The ends of the primary coil go to the aerial and ground posts, while the ends of the secondary connect respectively with the grid condenser and moving arm of the potentiometer (PO). Full details of the coil are shown by Figure 2.

Across the secondary coil (L2) is connected the vernier variable condenser (C) by which the circuit is tuned to the required wave length. The tuning is very sharp and critical and a vernier condenser is therefore necessary for the best results. The whole arrangement is exceedingly selective for so simple a set, and like the neutrodyne, the condenser dial can be

"Logged" or marked accurately for each wave length. To avoid trouble from body capacity it will be necessary to connect the stator or stationary plates of the condenser (C) to the grid line (4), while the rotor connection goes to the potentiometer arm wire (5). For the sake of compactness, the coil (L1-L2) is attached to the condenser terminals by means of small sheet brass brackets in a manner familiar to those who have seen certain types of the neutrodyne.

Best Condenser

While a 17 plate condenser can be used at (C), Figure 1, in many cases, yet it is safest to use a 23 plate (0.0005) condenser for this purpose in order that the full band of broadcasting wave lengths can be covered. With a larger condenser than this, the tuning is altogether too critical for comfort, even when equipped with a vernier.

Experiments have shown that a value of 0.00025 mf is best for the grid condenser (GC), and that the grid leak (GL) should be a variable leak, preferably of the lead pencil mark type. The lead pencil mark grid leak is adjusted by varying the thickness of a lead pencil mark drawn between two screws on the leak, and is the most effective and cheapest of all leaks for this purpose. The tube is quite sensitive to grid leak values and a fixed leak does not give the best results. Tubes vary among the same makes, and a different leak value must be determined by experiment for each individual tube.

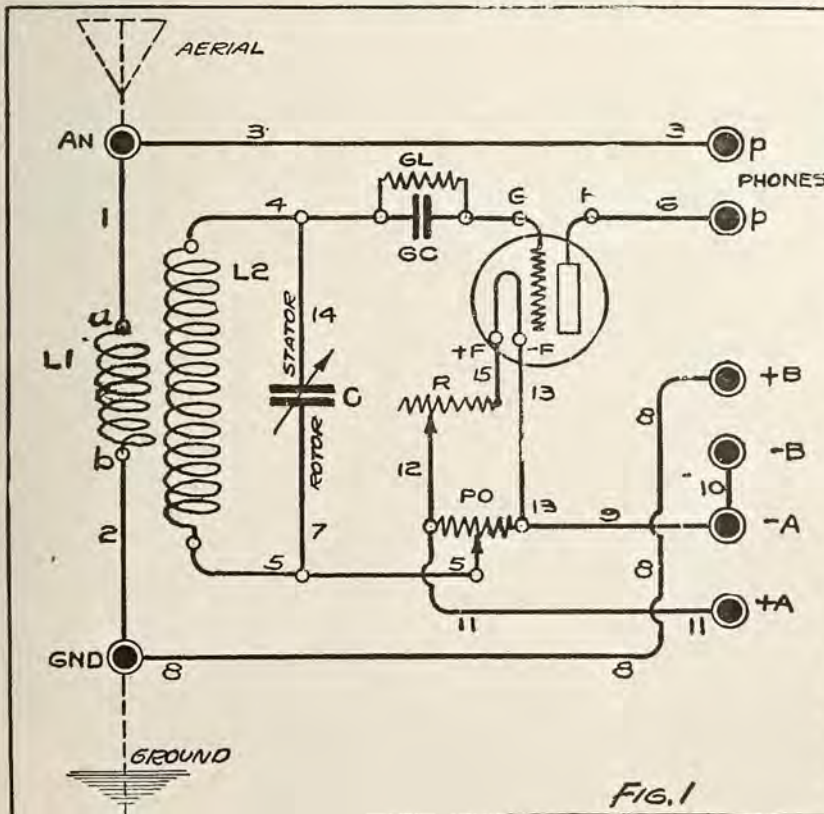


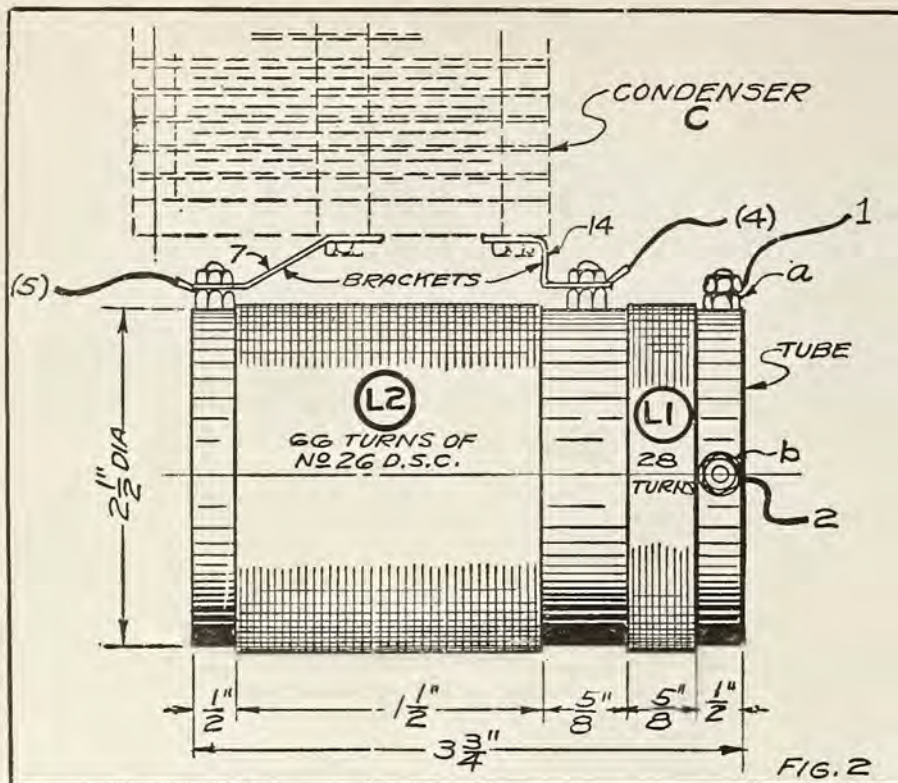
FIG. 1

BILL OF MATERIALS

PART	NAME	SIZE
A	"A" BATTERY	TO SUIT TUBE
B	"B" BATTERY	22.5-67 V.
C	VERNIER VAR. CONDENS.	23 PLT. (0.0005)
GC	GRID CONDENSER	0.00025
GL	GRID LEAK	VARIABLE
L1-L2	COMPLETE FIXED COUPL.	SPECIAL
p-p	HEADSET (PHONES)	STANDARD
PO	POTENTIOMETER	200 OHM
R	RHEOSTAT (VERNIER)	TO SUIT TUBE
S	SOCKET	TO SUIT TUBE
T	TUBE, UV-201A, UV-199	UV-200.
⊙	BINDING POSTS	STANDARD
—	HOOK-UP BUS WIRE	NO. 14
AN	COMPLETE AERIAL	50-60 FT.
U	PANEL	7" x 9" x 3/16"
V	CABINET	7" x 9"
W	BASE-BOARD	FOR CABINET

WIZARD CIRCUIT (FB-12B)

THE FIXED COUPLER L1-L2 CONSISTS OF TWO COILS OF NO. 26 D. S. S. WOUND ON A 2.5" TUBE. THE PRIMARY L1 HAS 35 TURNS, AND THE SECONDARY L2 HAS 60 TURNS. COILS SPACED 5/8".



A potentiometer (PO) acts like a vernier on the control of the regeneration and is necessary to clear up weak signals and to get the maximum signal strength. As originally designed, the potentiometer was omitted on the score of expense, but it is certain that it justifies the additional cost, particularly for those seeking distance on their sets. An ordinary 200 ohm potentiometer is sufficient for this purpose, although a 400 ohm instrument gives still finer tuning.

Rheostat

At (R) is a vernier filament rheostat, the resistance of which depends upon the tube. For a UV-200 or C-300 detector tube, a 6 to 7 ohm rheostat is best. The UV-201A or C-301A tube a 25 ohm rheostat is best, although a 15 ohm rheostat can be made to answer. The UV-199 or C-299 tube calls for a 30 to 40 ohm rheostat. In circuits of this sort, the control of regeneration is controlled principally by the rheostat and potentiometer, hence a vernier type gives the closest tuning and the greater distance. With a plain rheostat the change in resistance between two turns of wire is too great for proper control.

Of course a six volt power tube is the best, the writer having the best results with the C-301A or UV-201A. Next comes the UV-199 or C-299 tube, which operates on three dry cells. Good results can be had with the WD-11 or WD-12, but as these tubes tend to broaden the tuning the set is not so selective when they are used. The same rheostat is used with the WD-11 as with the C-300 or UV-200 detector tubes. Soft detector tubes such as the UV-200 or C-300 work quite well at plate voltages ranging between 16 and 22.5, but are not suited for the higher "B" battery voltages, which are instrumental in long distance work and loud local signals.

With a hard tube such as the C-301A or UV-199, we can carry a "B" battery voltage of from 45 to 90 volts with great success. With the average tube, maximum signal strength is attained at about 67 volts or with three 22.5 volt "B" battery blocks connected in series. This gives tremendous volume on local stations, but cannot be used on the soft detector tubes. High plate voltages increase the sharpness of the tuning, but at the same time increase the noise and the tendency for the tube to "tip" over when the rheostat is adjusted. In radio there is never any gain without some corresponding loss.

Follow Instructions

On carefully following the circuit diagram, *Figure 1*, it will be seen that the coupler coil (L1) acts not only as a primary coil in the aerial circuit, but that it acts as a tickler coil as well since it is in series with the "B" battery and plate (P) of the tube. This means that the spacing between the primary and secondary coils (L1) and (L2) is of importance in order that we gain the maximum regeneration without excessive sensitiveness on the part of the rheostat adjustment. Again, the spacing of the coils controls the degree of "loose coupling" between the primary and secondary and therefore the degree of selectivity. If fewer turns are used in (L1) than shown, we will have increased our selectivity, but will have to burn the tube brighter to make up for the loss in feed-back. The proportions are a compromise arrived at by experiment, and should not be changed.

The tube ordinarily supplied for this circuit has an internal diameter of 2.5 inches or an external diameter of 2 1/16 inches. This may be either a bakelite tube or plain cardboard, but a bakelite tube is best as it does not shrink and loosen the windings. When a 3-inch tube is used, take off two turns on both the coils (L1)

and (L2) because of the increased length of wire and the greater inductance and wave length. If you cannot reach the lower wave lengths at any adjustment of the condenser (C), then remove a few turns from the coil (L2) at the outer end. This will reduce the wave length. Much depends upon the length of your aerial as to the wave length range, a long aerial requiring fewer turns than a short aerial. A very long aerial, exceeding 100 feet in length, has a decided tendency toward reducing the selectivity and therefore should be avoided. The ideal length for locations where there is much trouble from interference is about 60 feet.

Direction of Windings

About the only trouble that has been experienced by amateurs in building this set is that of "Bucking" or reversed coils. Both coils (L1) and (L2) must be wound in the same direction around the tube, and must then be connected up so that the primary current, feed-back current and secondary currents all flow in the same direction. If the set does not prove sharply selective when hooked up, or if the signals are weak, then try the effect of reversing the primary coil connections (a) and (b). This should immediately improve the performance if the coils were opposed or bucking each other. Best connect up (a) and (b) temporarily at first until we determine the proper connection to make by experiment. The direction of winding, whether right hand or left hand, makes no difference as long as both coils are wound in the same direction.

A panel 7 inches by 9 inches by 3/16 inch will be amply large for this set, and it has been mounted on a panel as small as 6 inches by 7 inches. Both of these panels are standard sizes and are easily obtained at a radio store. Cabinet and baseboards are easily found for these sizes of panels.

To reduce the cost of building to a minimum, we can omit the potentiometer (PO) and then connect the end of the wire (5) to the point where the ends of wires (9) and (13) are connected. Thus, without the potentiometer, the wires (5), (9) and (13) are all connected together at a common point, leaving wires (12) and (11) as before.

Radio's Expansion

Educational institutions and newspapers have recognized the value of broadcasting, it is indicated by the February Radio Service *Bulletin*, issued by the Bureau of Navigation of the Department of Commerce. And there is an increasing number of churches which have found the radio an effective aid in their work.

The latest list of stations broadcasting weather reports, music concerts and lectures shows ninety-five broadcasting stations connected with universities, colleges and other schools. The same directory lists forty-six newspapers or publishing houses, which have their broadcasting stations; while twenty churches are shown in the lists. This does not, however, include a number of churches whose services are broadcasted through some other station, it was pointed out.

NOTE!

AS SEVERAL OF THE WIRES AND CONNECTIONS ARE HIDDEN BEHIND THE COIL AND CONDENSER IT IS SAFEST TO CHECK UP THE WIRINGS BELOW BY MEANS OF THE WIRING DIAGRAM SHOWN ELSEWHERE. SOLDER ALL JOINTS.

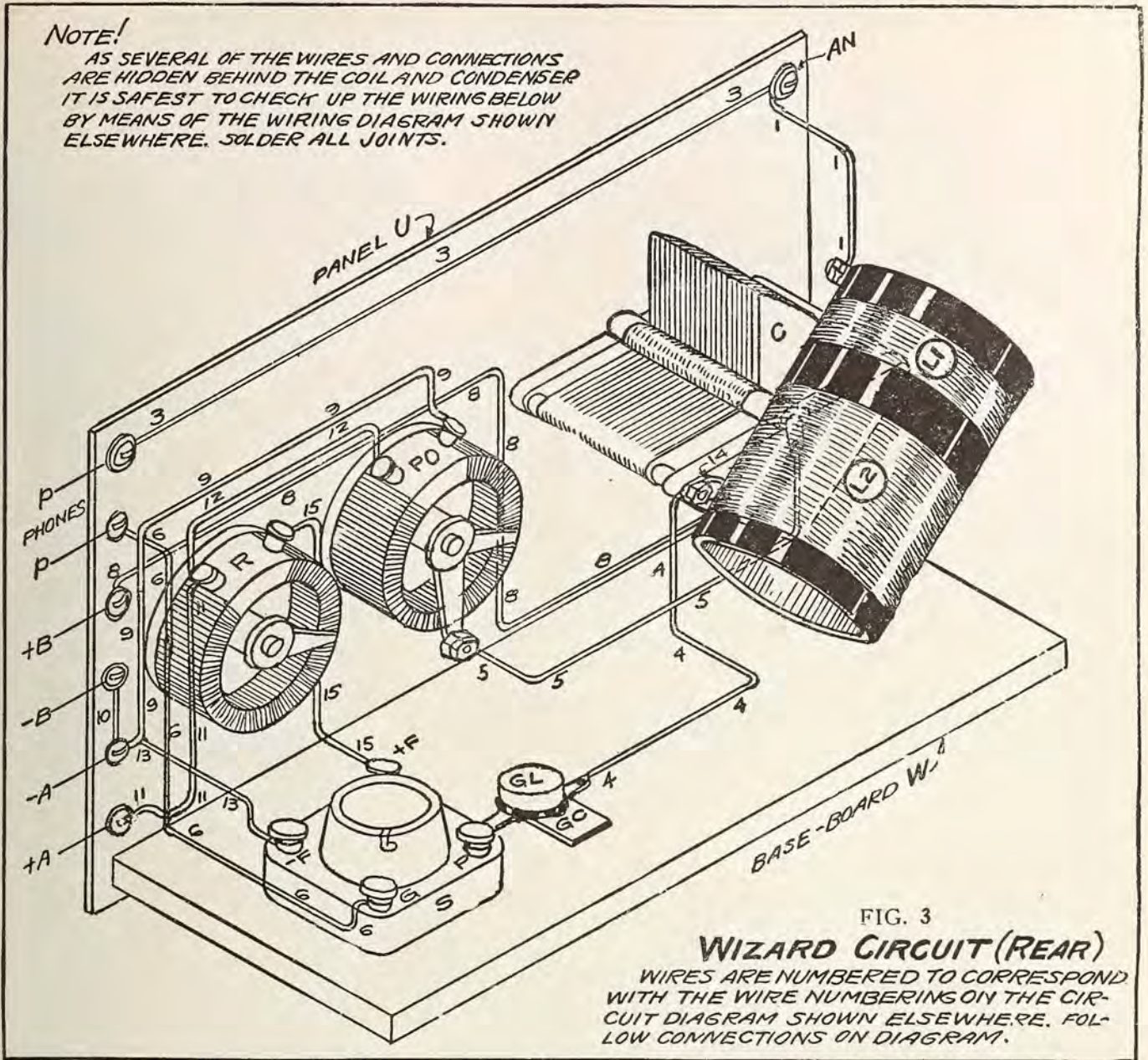


FIG. 3
WIZARD CIRCUIT (REAR)
WIRES ARE NUMBERED TO CORRESPOND WITH THE WIRE NUMBERING ON THE CIRCUIT DIAGRAM SHOWN ELSEWHERE. FOLLOW CONNECTIONS ON DIAGRAM.

Guarding Against Body Capacity Effect

By ROSCOE BUNDY

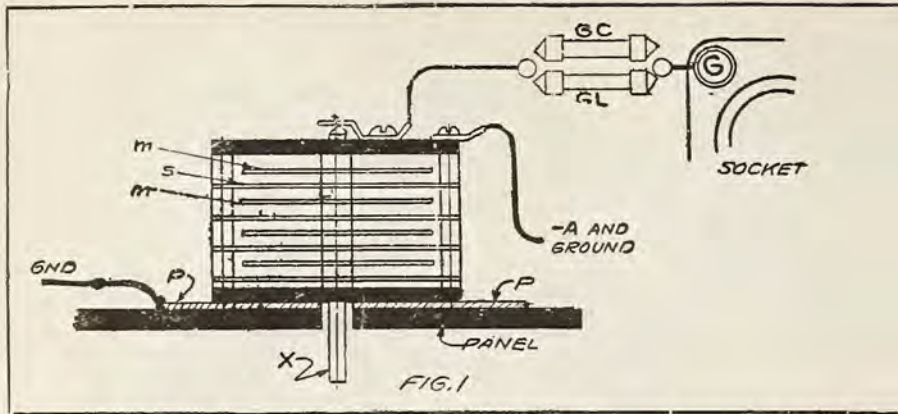
WHEN the grid line or other parts connected with the grid post of the vacuum tube socket are raised to a relatively high potential by regeneration or radio frequency amplification, when a very noticeable electrostatic field is set up about these parts which seriously interferes with the operation of the receiving set. Moving the hand or any other conductor in the electrostatic zone causes momentary variations in the capacity of the circuit which may completely detune the receiver or cause it to shriek badly. This effect is not confined to the immediate vicinity of the grid circuit, but may even extend for several feet around the set under extreme conditions so that a person walk-

ing past may cause the set to become completely detuned. This effect is called "body capacity" and is one of the most troublesome diseases to which a set may fall heir.

In the milder forms, body capacity is confined to the tuning controls, the tuning being affected only when the hand is removed from the variable condenser or variometer knobs. A station can be tuned in very accurately while the hand is on the dial, but as soon as the hand is removed, the signals disappear or the set will begin to howl. As a rule, this is most noticeable on faint signals from distant stations, and is not always in evidence on strong local signals where regeneration or amplification is not being pushed to

the limit. In the more severe cases, the body capacity effect may extend to other parts of the circuit, causing still more trouble and trouble that is far more difficult to cure. Certain single circuit receivers, such as the Ultra-audio or Flewelling, frequently develop "phone cord capacity" in which a strong electrostatic field exists in the head set and phone cords. Every time that we move our head or touch the earpieces or cord, the set is either detuned or else it starts to howl. Any circuit in which the plate is conductively connected with the grid is likely to have this trouble to a greater or less extent.

To reduce body capacity in the control system, we must first keep all parts

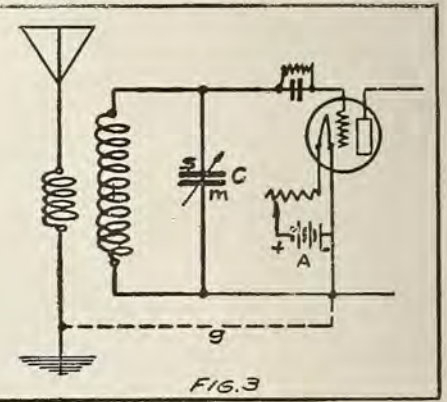
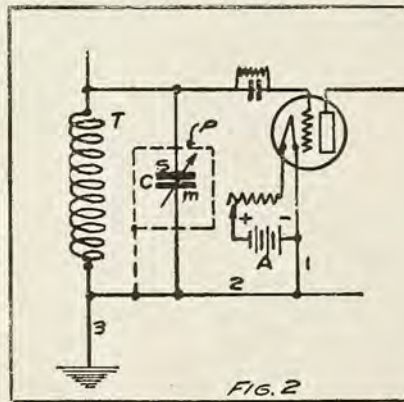


connected with the grid as far back of the panel as possible. This is rule No. 1. This refers not only to the wiring of the grid lines but to the grid condenser, leak and variable tuning condenser parts as well. Where a grid variometer is used it is of particular importance to keep this instrument as far in the background as possible, and to arrange matters so that the charged shaft does not bring the charge up as far as the panel. That part of the shaft which carries the dial and which projects in front of the panel will bring the electrostatic field forward just as surely as the windings or body of the instrument itself. Further, the charged shaft comes right into the dial where it is directly subjected to the condenser effect of the fingers and where it is in exactly the right position to cause trouble. It should be remembered that any amount of dial insulation surrounding the shaft will have no effect on the electrostatic field. We cannot insulate against an electrostatic charge in the same way that we insulate a current carrying part, but we can prevent the charge from coming forward by using a shaft of insulating material such as a rod of bakelite or hard rubber.

It is a far simpler matter to reduce the body capacity effect with the variable tuning condenser in the secondary circuit than with a variometer for the reason that the two halves of the condenser are well insulated from one another. With a condenser, the stator should be connected to the grid line, while the rotor and shaft are connected to the grounded part of the circuit. This follows from the fact that the stator or stationary plates are located well back of the panel, while the rotor is mounted on the shaft and hence would bring the grid charge

forward were the rotor connected to the grid line.

Figure 1 shows a variable condenser having the rotor or movable plates (m) mounted directly on the shaft with the shaft stub (X) projecting beyond the front of the panel. If the rotor and shaft are connected to the grid post (G) through the grid condenser (GC) and the grid leak (GL), then it is certain that the front end of the shaft (X) will be at grid potential and that there will be



trouble with body capacity if a sufficient potential is established on the grid by regeneration. If the grid line is connected to the stationary plates or stator (S), then all parts at grid potential will be located well back of the panel and the tendency toward body capacity on the controls will be reduced by this amount. Again, connecting the stator to the grid allows us to connect the rotor to the ground or to (-A), which still further protects against trouble.

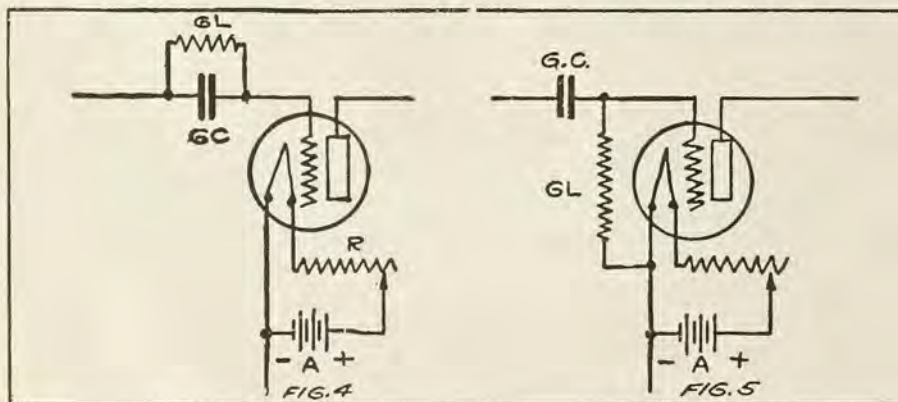
It should be noted at this point that

metal ungrounded simply affords an excellent means of carrying the field still further to the front, just as with any other conductor. Placing a disc of metal on the inside of the dial and then grounding the disc through a brush is still another method of shielding employed by makers of certain condensers.

As a rule, the shield should be installed as far away from the charged surfaces of the condenser plates or variometer windings as possible, so as to reduce losses which take place to the grounded plate. Where possible the condenser should be moved back from the panel as far as the length of the shaft will permit, and then the shield will be at least 1/2 inch from the plates. Care must also be taken to cut out the plate for some distance around the shaft hole and condenser screws so that the condenser will not be short-circuited or grounded.

Figure 2 is a diagram of a single circuit tuner where the (-A) is grounded naturally by the arrangement of the circuit. The stator plates (S) of the condenser (C) are connected to the grid while the rotor plates (m) go to the (-A) and ground as should be the case. Dotted lines represent the shielding and shield

(Continued on page 51.)



Radio Frequency Amplification

With Interstage Transformers

By P. E. Edelman

RADIO frequency amplification ahead of detection is used to boost the radio frequency current to sufficient value so that good operation results on distant signals. The general methods are:

1. Combined with regeneration.
2. Transformer interstage coupling, tuned or untuned.
3. Impedance or resistance coupling
4. Frequency conversion plus method (2) or (3), as in superheterodyne, etc.
5. Modifications of method (2) with means to stabilize.

Radio amplification before detection avoids distortion such as is liable to occur when two or three stages of audio ampli-

fication are used, and permits very weak incoming energy to be built up so that the detector will operate as well as on strong radio signals. Unless the rectifying ability of the detector is also increased there is little advantage in increasing the number of stages of radio frequency amplification beyond the point which gives sufficient radio frequency output to fully operate the detector. That is why with usual radio amplifiers, local stations are only heard as loud as the detector output with full radio input permits. Sometimes radio amplification is said to increase range but not volume, but if means are provided to use all the radio output of the amplifier it is possible to get loud volume without further audio amplification or with only one additional stage of it.

To get full benefit of radio amplification on strong incoming radio energy it is necessary to increase the ability of the detector to handle the increased energy and rectify all of it. The usual detector tube will not do this, as its output is limited. It is customary to employ enough radio amplification to operate the detector on distant signals and reduce the radio input or turn down the amplifier tube filaments when listening to local stations.

Transformer Interstage Coupling

The most popular and generally used interstage coupling for radio amplifiers is afforded by transformers and will now be discussed. Special forms of coils are

often used but are not essential. Ordinary coils in the form of variocouplers, inductance coils, spiderwebs, honeycombs, etc., may be used. The essential features are to minimize capacity effects, and secure good inductive transfer of energy from one out-put to the next input circuit.

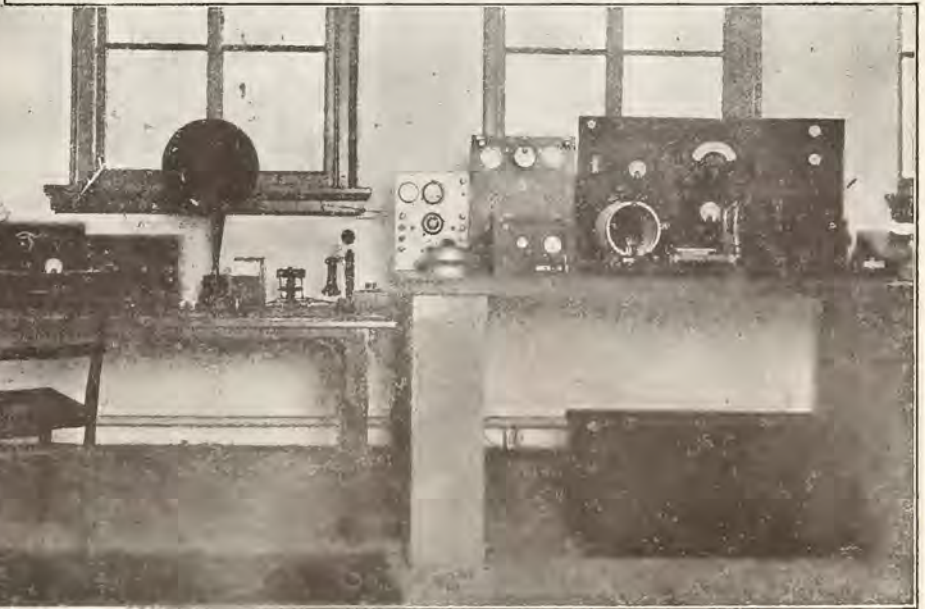
Tuned Transformer Circuits

Tuned transformer circuits afford very good frequency selection for tuning purposes. This is noticeable when only one stage is used and very marked when two tuned stages are employed. Some sets use three or more tuned stages but even when two stages are thus used, the control is complicated for a beginner's use unless some mechanical means is used to adjust two or more circuits simultaneously. A good design may use two or more stages of radio amplification with only the input circuit tuned or perhaps with one stage only tuned. The latter arrangement can be made sufficiently selective to work through local stations.

Stabilizing Circuits

Transformer coupled radio amplifying circuits require some stabilizing means to avoid oscillating effects. This is particularly true of tuned interstage coupling. Some methods used are:

1. Resistance (50 to 400 ohms) inserted in grid or plate circuit or



YOUNGEST STATION MAN

The interior of Station WABQ, broadcasting station of the HAVERFORD COLLEGE RADIO CLUB, Haverford, Pa. and (left inset) William S. Halstead, station manager and designer. Although only 20 years old, Mr. Halstead designed and personally supervised the building of this station. Mr. Halstead started in 1912, experimenting with spark coils when 8 years of age, he is member Institute Radio Engineers. He is, no doubt, the youngest Radio Broadcasting manager in the world. Photo shows receiving table, speech amplifiers, and short wave transmitter (amateur call 3 BVN.) Left to right, main receiver and 2 stage amplifier used as "stand by" set for S.O.S. calls. The short wave receiver has brought in seven foreign amateurs, French 8AB on loud speaker, as well as eight Pacific Coast stations. Power amplifier, Horn, A. R. L. message file, change-over switch, telephone and wave-trap.

incorporated in windings of transformers.

2. Grid current established by applying small positive operating potential to grid of one or more tubes used. Potentiometers are much used for this purpose. A resistance of 50,000 ohms upwards might also be shunted across the grid and filament.

3. Absorbing circuits in grid or plate circuit. These work like a wavetrap or provide a parallel current path.

4. Reflex audio input, setting up variation potential in grid circuit.

5. Counter electromotive force applied to grid circuit. Reversed regeneration coupling does this.

6. Shunt resistance by establishing a separate energy using circuit between plate and grid circuits.

7. Critical adjustment of coupling values used.

8. Use of loose coupling with untuned primary and tuned secondary usually 7 to 10 turns primary and 50 to 60 turns in the secondary coil.

9. Divided circuits.

10. Neutralizing by sending oppos-

ing potential through small condenser to either grid or plate from either plate or grid circuit.

Some of these methods, as is obvious, are automatic and others require adjustment to fit different frequency values.

Air Core Transformers

Tuned transformers will usually be air core type and have variometer or shunted condenser form of tuning. It is usual to keep them of small size to avoid establishment of extensive radio frequency fields. Sometimes this point is not regarded and interferences result from intercoupling between transformers or a transformer and a loop coil used with the set. It is desirable in reflex circuits to keep the capacity effect between the windings very small, so as not to pass considerable audio currents by condenser action. This is usually accomplished by separating the two windings. Air core transformers are sometimes used without adjustable tuning means and can be made to cover limited frequency bands efficiently. They are wound to have minimum self capacity and are made of small dimensions.

Iron Core Transformers

Iron core transformers based on the suggestion of Mr. Latour use very thin laminated soft steel for a core. The iron is of tissue thinness. Its effect is to both concentrate the field and prevent external leakage, thus increasing the impedance for a range of frequencies, and also to supply a capacity effect for the coils. Some types of untuned transformers use powdered iron or powdered iron held in wax as a core. The effect is to broaden out the range of frequency response, but usually such transformers are better at one or two narrow bands of frequency than others. Some transformers are wound with fine or resistance wire to further broaden out the frequency range but this may reduce the energy transfer and mitigate against high amplification. The best results with such transformers are obtained when correct balance of the windings is obtained to fit in with the characteristics of the amplifying tube used.

The use of iron core transformers or other types of untuned transformers is seldom carried on beyond two or three stages. Combinations of one stage tuned transformer coupling with one or two untuned stages afford a simple and selective design.

Continuously Variable Couplings

The primary and secondary windings, one or both, can be made adjustable to fit different frequencies while maintaining good coupling for efficient transfer of energy. This is accomplished by double coupled variometers or sometimes by use of tapped coils.

Transformers also find use in complex circuits on the super-heterodyne principle, where amplification is cascaded at a particular frequency such as 100,000 cycles to which incoming frequencies are transferred by heterodyne methods.

Regenerating Effect

As used in some circuits, fixed or tunable transformers have regenerating circuit effects. Sometimes the non-regenerative amplification is mentioned as distinguishable from the combined amplification possible at radio frequencies.

Relative Value of Stages

One good stage of tuned radio amplification will sometimes equal two untuned stages. When two stages give good detector response on distant signals, a further stage is often no advantage. Just now, transformer coupled stages are performing fairly well but there is room for improvement. This may be in the transformers, the circuits, or the tubes used, one or all.

Practical Use of Transformers

The practical use of transformers requires care in wiring with minimum lengths of carefully insulated or spaced wiring. Very small condenser effects in adjacent wires can transfer radio energy away from the transformer. That is another reason why small dimensioned transformers are desirable, as the length of connecting wires is smaller.

Impedance Coupling

Impedance coupling as used in many sets is a form of transformer coupling in which only one winding is required. Re-



PORTO RICO IS BITTEN

Radio is fast becoming popular in Porto Rico. These native society girls are seen listening-in to concerts from the States. Left to right—Miss Lydia Rexach, Miss Adela Gomez, Miss Emilia Rexach.



BROADCASTING PICTURES

Stewart W. Jenks, Radio Engineer, is seen at work in the C. Francis Jenkins studios, broadcasting radio pictures. This broadcasting station has a range of thirty-five miles and will transmit motion pictures, still pictures, and music. This is the latest development by Mr. Jenkins, after ten years of research.

Reflexing the R. F. Variometer Addition

By BRAINARD FOOTE

STILL further advantage may be taken of the radio frequency addition to the standard variometer regenerative set by means of employing reflex action on the radio frequency tube. This plan has a good many desirable features, although there is a drawback as well. The item of expense is not so serious, inasmuch as the reflex change-over merely means the insertion of an audio frequency transformer and another by-pass condenser.

In point of operation, several improvements are derived. In the first place, the volume received will be many times what it was with the straight radio frequency tube, sufficient in the case of most of the local stations to put on a loud speaker. The volume, it is true, is not quite as great as it would be were the first tube used straight, and an extra tube as plain audio frequency added after the detector. However, it is nearly so, and a worth-while saving in expense is the result.

Operating Characteristics

The reflex is not quite as stable a circuit as the straight radio addition, and when pushed past the oscillating point, is prone to howl quite unmercifully. The howl is caused by an audio frequency feed-back from the plate circuit of the R. F. tube to its grid circuit because of the fact that the tube is used not only as the R. F. amplifier but as the A. F. amplifier as well. The tendency to squeal is lessened by the use of a low ratio transformer—3 to 1 or 4 to 1.

However, there is really no need to force the set into oscillation, for very little is gained in the way of sensitivity by so doing, and all the DX stations that are heard without reflexing the circuit come in a good deal louder with the reflex added.

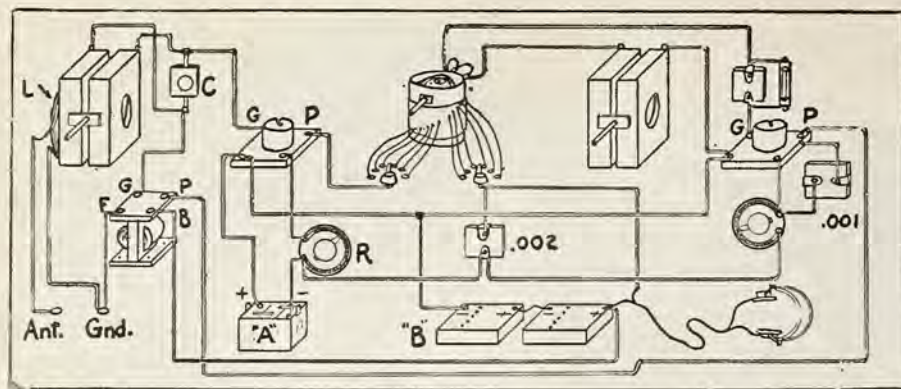
Little room is needed inside the set, and the audio transformer can be mounted somewhere in the vicinity of the left hand variometer—right behind it, perhaps. Besides the transformer, a .002

fixed condenser is needed. Figure 4 gives the complete wiring diagram, and points out the differences between the plain circuit of Figure 3. The phones are taken out of the plate circuit of the detector tube and are replaced by the primary connections of the audio transformer. The .001 by-pass condenser is just as necessary as ever.

Then the lead running from the switch lever of the coupler to the "B" battery positive is disconnected, and the phones inserted between these two points. Inasmuch as the phone windings offer a high impedance to the radio frequency currents flowing through the primary of the coupler, it is necessary to shunt them by a .002 fixed condenser, connected between the above-mentioned switch lever and the negative side of the filament.

How It Works

Then the "grid return" lead from the left hand variometer to the negative of the "A" battery is removed, and the secondary connections of the transfer sub-



stituted instead. Many reflex circuits show a large fixed condenser across the "G" and "P" posts of the transformer, but the experience of the writer is that this is poor practice in a single reflexed tube. It acts as a shunt condenser and lowers the voltage of the energy released from the secondary winding, thereby reducing the volume very noticeably.

It is usually stated that this condenser is required in order to cause oscillation. But with a vario-coupler as the R. F. transformer, there are so many extra turns available for feeding back the energy causing oscillating that it is easy to set the circuit very close to the oscillating point or in fact to cause it to oscillate. This is seldom done because of the howling spoken about already.

The energy traversing the antenna coupling coil (seven turns of bell wire—coil L of Figs. 3 and 4—coupled to the first variometer) is transferred to the variometer, whose effective wave range has been raised by a small shunt capacity "C" of the order of .0002 mfd. The voltage is applied to the grid, where it sets up a much stronger fluctuation of the plate current supplied by the 90 volt "B" battery. This in turn, passes through a portion of the vario-coupler's primary winding, from which energy is transferred to the rotor. The grid circuit of the detector is tuned by another variometer.

The Tuning Method

The actual tuning is done by the two variometers, and the scale readings of one of them should be noted down for reference. There is only one position of the other variometer which corresponds to any particular setting of the first one, so that the adjustment of the set is easy enough. The switches are set to include enough turns of the coupler's primary winding to bring the set to the verge of oscillation without really allowing oscillations to begin. The rotor is left at maximum coupling all of the time.

The best method for tuning the set, once a list of the dial settings for the stations most ordinarily heard has been written down, is to work from a simple graph. This is made on a sheet of cross-section paper, drawing a horizontal line near the bottom and dividing that into equally spaced divisions for the dial readings, and then drawing a vertical line at the left border. This latter is used for the wave length indications, from about 250 to 550 meters. The points of intersection for all the stations heard are

marked down on the proper places, and a SMOOTH curve drawn passing through the points as evenly as possible.

Then it becomes easy to look up the dial setting for any other wave length and to tune for a desired station whose wave length is listed in the evening's programs, but which has not previously been heard. The graph also aids in the identification of an unknown station because it will tell the wave length of a station tuned in at some particular dial degree. Such a method of tuning cannot, of course, be followed with the ordinary double or triple circuit set because of the fact that the coupling variations upset the other dial readings, but with tuned radio frequency, the plan is highly satisfactory.

R C A Finances

Maj. Gen. G. Harbord, president of The Radio Corporation of America, has made the following statement:

"The Radio Corporation will, this year, pay the 7 per cent dividend on its preferred stock, which is cumulative from the first of January, 1924.

"It is anticipated that at the meeting of the stockholders to be held in May, the charter of the corporation will be amended so as to reduce the number of shares of authorized preferred stock from 5,000,000 to 500,000 and the authorized no par value common stock from 7,500,000 to 1,500,000 shares. The plan is to retain the capitalization of the corporation as at present authorized, but to create a par value of \$50 for the preferred stock, to be known as 'A' preferred stock, for which the present preferred stock will be exchangeable at ten shares of the present for one share of the new stock and to exchange the present common stock at the ratio of five shares of the present stock for one share of the new or 'A' common stock.

"The exchange in cases where the present stock is not held in multiples of ten and five shares will be facilitated by the issuance of fractional shares of the new stock.

"The 'A' preferred stock will be entitled to receive 7 per cent dividends, payable quarterly, cumulative from January 1, 1924, the payment for the first two quarters of 1924 to be made in July. Shares of the present preferred stock not converted into the new, and fractional shares resulting from uneven multiples, will receive the 7 per cent dividend, payable, as may be determined by the board

of directors, but cumulative from January 1, 1924. Stockholders who have not exchanged their preferred stock in time for a particular dividend date on the 'A' preferred stock, will be entitled to any accrued and declared dividends on said 'A' preferred stock after they make such conversion.

"The dividend rights of the preferred stock over the common stock, and the voting rights of each, will be preserved in this arrangement.

"After this change is effected, application will be made to list the 'A' preferred and the 'A' common stock on the New York Stock Exchange."

Spotting Interference

Hartford, Conn.—As the interruptions to broadcast programs from defective lighting circuits are common in nearly every city, the difficulties recently overcome here by radio amateurs in cooperation with the city electric light company, are of more than local interest. Complaints from listeners became so pronounced that the Radio Club of Hartford named a special committee to run down the source of trouble by means of a loop receiver.

This committee set out upon its task in a businesslike manner by preparing first a map of the section of the city from which it was believed most of the interference came. On the map pins were placed with numbered flags glued to them. Perry O. Briggs, local amateur, who devised the system, then placed a small loop set in an automobile and directed its movements.

These flags were shifted as the "buzzing" sounds came and went until all of the bad spots had been plotted out. When the results were given to the Hartford Electric Light Company it went so far in one case as to replace the entire circuit in one street. The improvement since this was done has been very gratifying.

Slogans for WAAW

The Omaha Grain Exchange put on a slogan contest at WAAW recently, the slogan consisting of words beginning with the call letters of the station. The contest was not announced until 8 p. m. and a large stack of telegrams was on hand at 10 p. m., when the contest closed. First prize of \$10 was won by Harvey C. Dendall, Lincoln, Neb., with the slogan: "Where Agriculture Accumulates Wealth." For the most amusing slogan a special prize of \$10 was awarded to J. B. Fickel, of Hastings, Ia. His slogan was: "Was Adam's Apple Wormy?"

Bradleystat Chosen

The American Radio Research Corp., Medford Hillside, Mass., has adopted the Bradleystat and Bradleyleak as standard equipment in all their expensive console and table models. These two Allen-Bradley products were selected and adopted after extensive research by the Amrad engineers.



Pick-ups and Hook-ups by our Readers



In the February, 1924, issue we published a couple of photographs of Mr. T. J. Kennedy showing his trans-Atlantic receiver, and gave his address in the caption underlining the photograph. Permit us to direct your attention to the following letter, a reply to our publication of the photographs

1923, made and operated my first honeycomb receiver.

Since then I have stuck pretty closely to this one outfit, perfecting it, making little changes here and there, with the object of making a more efficient receiver.

I use three honeycombs in the following manner: For the antenna I find that an L35 is effective, with an L50 for the secondary and I75 for the tickler. These honeycomb coils are seldom if ever touched, but are placed at a certain distance from each other and left there. The secondary is in the middle, with the primary on the left and the tickler on the right. The primary is just a little further away from the secondary than is the tickler coil. I use a 23-

plate vernier condenser of General Radio make in both ground and secondary circuits. The ground condenser is used very little in tuning after being once adjusted. The secondary condenser and the filament rheostat for the detector are the major controls which I manipulate, once the preliminary adjustments have been made. The detector is a C301A and despite the general belief to the contrary, I find that it is highly efficient.

I have placed a 3-inch dial on the shaft of the detector rheostat which is of the best quality, and operate upon the dial, a vernier of the friction type, which gives me the closest possible control over the detector tube current. With this filament control and extremely accurate tuning with the secondary condenser, I am able to build up DX signals to the most astonishing volume. Occasionally a slight adjustment is necessary on the potentiometer, and less frequently a slight movement of one or two of the other controls. The potentiometer, by the way, is 400-ohm, graphite type, which I think is superior to the wire types, the latter causing noises in the headset.

I am absolutely averse to jacks, feeling that they are responsible for nearly nine-tenths of the noises in circuits. I am even contemplating the removal of the jack in the last stage, as I feel confident that I can further improve the general efficiency

RADIO AGE,
Gentlemen:

Since you published a photo of my honeycomb receiver, I have been swamped with letters from your readers, and I am unable to answer all the inquiries, which would require several stenographers to attend to the mail.

I am enclosing herewith a complete account of the reception and set. If

CONTRIBUTORS

T. J. Kennedy F. Robert Zeit Joseph W. Pfister

DIAL TWISTERS

Name	Address	Circuit
C. R. Williams	433 Milton Ave., Janesville, Wis.	Zenith
H. G. Ende	1301 Sedgwick St. Chicago, Ill.	Single Circuit
Joseph J. Oswald	433 Emory Ave., Trenton, N. J.	Not Stated
Bennie Sivesind	Decorah, Iowa	Single Circuit
H. F. Willis	1200 Fairfield Ave., Shreveport, La.	Single Circuit
J. H. Kulp	223 Clifford Ct., Madison, Wis.	Three Circuit
John Tomlin	303 Madison Ave., Atlantic City, N. J.	Not Stated
Bireley Ross	806 Brazos St., Graham, Texas	Not Stated
R. B. Hamilton	674 S. Capital St., Salem, Ore.	Cockaday
Robert Signaigo	4170 Connecticut St., St. Louis, Mo.	Crystal

you care to publish same for the sake of your readers, you sure are welcome to it.

Yours for good radio,
THOMAS J. KENNEDY.

232 West 55th St., New York, N. Y.

The length of Mr. Kennedy's account of the set and record breaking reception is too great for our use, but we take pleasure in presenting herewith some of the high lights and pointers which seem to be the leading factors in Mr. Kennedy's accomplishment.

Mr. Kennedy, in contending that London and Los Angeles can be tuned in on an old-fashioned honeycomb coil set, using a detector and two stages of audio frequency amplification, points out that among the chief reasons for his remarkable success are the following:

After my first experiments with the customary crystal sets, which I soon found to be too limited, I made a three-circuit regenerative set, which consisted of two variometers and a variocoupler. I found that this too had limitations, and around February,



A DISTANCE GETTER

Thomas J. Kennedy, 470 West 159th Street, N. Y., regularly receives 2-LO, of London, Eng., and KHJ, Los Angeles, with this simple three-circuit honeycomb regenerative set. He tunes with the secondary condenser and the rheostat of the detector tube, without moving the honeycomb coils or the ground condenser. Note how he uses condensers and grid leaks across the transformer secondaries to clear up signals. (Kadel & Herbert.)



A DISTINGUISHED RADIO FAN

HUDSON MAXIM, noted inventor, whose nephew Hiram Percy Maxim is President of the American Radio Relay League, listening in to the address of President Coolidge, from Hotel Belclaire.

of the receiver by making this change. I entirely disclaim this high ratio first stage transformer propaganda, and think that two low ratio transformers are better.

My main object in building and experimenting with this receiver was to eliminate all the usual set noises, and I went to a lot of trouble and expense to accomplish this. I found that a .00025 MF fixed condenser across the secondaries of each of the transformers assisted materially in this respect. I further found that by placing grid leaks across these condensers I was further able to eliminate noises, and in the course of my experiments found that a $2\frac{1}{2}$ megohm leak on the first transformer and a 3 megohm leak on the second seemed to work best. This is, however, a matter of individual experiment, and is entirely up to the builder as to which is the most effective. Variable grid leaks are absolutely useless in any part of the circuit. The C battery should also be carefully adjusted

Another place which contributed to the noises in the set was located in the B battery leads and connections, so I ended them by soldering the leads directly to the posts on the batteries.

The set is not in a cabinet, being placed upon a table so that I have easy access to any unit should I decide to make experimental changes. Only the finest materials are used, and I considered the cost a secondary matter, because I knew that to get results, it was imperative that I procure reliable and low loss apparatus.

I always keep a log book, and jot down the settings of the secondary condenser dial for every station I hear. I attribute my success with the set to careful and long experiments, and contend that the only way to realize the utmost of any circuit is to learn every secret of its operation.

Mr. Kennedy on Sunday, Nov. 25, 1923, while amusing himself at the set around 10:10 in the evening caught the London, England, broadcasting stations which operates under the call of 2LO. The only

thing which impeded his continued reception was the interference created by some nearby single circuit receiver which was being improperly operated. In the accompanying photograph, we are publishing views of Mr. Kennedy's set and himself.

Mr. F. Robert Zeit of 643 Garland Ave., Winnetka, Ill., sends in a list of data and specifications on a super-regenerative circuit which he has devised, which should be of interest to any fan who possesses a collection of miscellaneous apparatus with which to experiment. He would be pleased to have letters from fans who construct this circuit.

RADIO AGE, Gentlemen:

The writer has been experimenting for some time with the various published hook-ups and simplifications of Armstrong's super-regenerative receivers with a view of using this wonderful discovery in a moderate way in a set which the uninitiated could use successfully.

All the published simplified circuits have taken one element after another away until Mr. Muhleman of the *Radio News* left only one 1250 turn inductance coil and two variometers as the result of long and laborious research.

This encourages me in submitting this modest and easily operated super, which tunes well to all the current broadcasting wave lengths, from 200 to 600 meters.

My hook-up removes even the last large element of the original circuit, which Mr. Muhleman (Autoplex) retained, the 1250 turn coil, requiring neither a power tube nor a very high plate voltage.

I enclose the circuit diagram of my single tube super-regenerative receiver which has tremendous volume and excellent selectivity. It outdoes any three-tube set I have used in volume and clear reception, tuning to all wave lengths from 200 to 600 meters with the greatest ease.

Any fan with two variometers and a hard, high vacuum tube (I use U. V. 201), can rig up a trial circuit in a few minutes and hear the music or talk many times louder than if he sat in the broadcasting studio; in fact, the amplification is simply tremendous.

Although I use a 0.006 M. F. fixed condenser across the tube any other value will do from 0.002 M. F. up.

It is important that the rheostat be connected in the negative filament lead, as per diagram of circuit, or the super-effect is lost.

No more than 45 volts should be used on the plate "B" battery unless the negative bias on the grid is increased by using a few cells of "C" battery in the grid return, but this is unnecessary because the volume with the 45-volt "B" battery is simply tremendous, providing sufficient filament current is used to heat the filament.

No ground wire should be used.

The aerial I used is an outside single wire 50 feet long.

An inside single wire 35 feet worked as well, even 10 to 15 feet single wire inside aerial works effectively.

Many different variometers were used and all worked but the loudest and clearest reception is obtained with variometers of large sized wire and about 60 turns on rotor and the same on stator. (High ratio of inductance.)

Variometers with a minimum insulating material will probably do better.

A standard Freshman variable grid leak with 0.00025 M. F. condenser was used and must be tried out for best results with the tube used. The pointer with my U. V. 201 between the fifth and sixth division line from the left worked best.

Operation is extremely simple. The tube filament is heated to give a bright light, about one-half of the 6-ohm resistance wire is used with a 6-volt storage battery.

The variometer dials (4-inch) are turned simultaneously and very slowly. After picking up a station the slightest move only is required to produce the super-effect. There is not much difference in the two dial settings when the super-effect is obtained and the same station can always be picked up again if these dial settings are logged.

All howls and whistles abate completely when a station is tuned in properly by very slowly moving both dials. A little practice on local stations is necessary before attempting to tune in distant stations. Local stations come in strong enough for a loud speaker. Distant stations come in with the volume of local stations on the regular regenerative set.

Body effects vary a great deal and may be entirely absent, sometimes very marked.

There are only two controls, the two variometers. Both hands are used. The super-effect is produced mainly by proper tuning with the grid variometer but the plate variometer is used at the same time, increasing the volume, finding thus with both dials the best position for the super-effect. It is very easy to pick up a station after which a very slight manipulation of both dials will produce terrific amplification with the utmost clearness. Failure to produce this super-effect means that the filament is not heated sufficiently.

The filament current, however, is not critical. After it has once been adjusted to give the super-effect it needs no further change for the whole range of wave length.

Tuning is sharp, and nearby, powerful home stations may be heard faintly until the station wanted is tuned in and super-amplification reached.

Not the slightest interference was noted by alternately tuning in a 345-meter station 40 miles away and a powerful 360-meter station 15 miles away and another 360-meter station 600 miles away.

Stations 1,000 miles away come in with fair volume. Five hundred-mile stations come in with the volume of a home station with the average regenerative set.

Two variometers with large sized wire and about 60 turns on rotors and stators.

6-ohm rheostat (without vernier.) U. V. 201 tube.

Freshman variable grid leak and 0.00025 grid condenser.

Fixed mica condenser, 0.006.

Storage "A" battery, 6 volts.

"B" battery, 45 volts.

50-inch single wire aerial.

No ground wire.

Now that we have some of the choicest kinks and experiences, we will pass on to some of the most unusual pickup records that we yet have had. The following letters will, from inspection, reveal that some of the most unusual permutations with radio sets were used, and also some of the longest average records of any ever yet printed in this department.

RADIO AGE,

Gentlemen:

Noticing your "DIAL TWISTERS" column in the March issue, I thought I'd send in part of my log.

I have a single tube set of my own construction, using a modified Zenith hookup, and with it I have accomplished some unusual reception. Only the most distant stations are listed here:

KHJ, KFI, KPO, KGW, KGO, KLX, KFAE, WKAQ, PWX, CFCN, CKCK, CKY, CFCA, CFCF, CJCM, KFAF, KFEL, KFFQ, and 156 others positively identified. The first five and WKAQ are heard regularly.

A friend of mine has a similar set with an additional two-stage audio frequency amplifier, and among other DX stations he logged 2BD at Aberdeen, Scotland, on the last night of the tests.

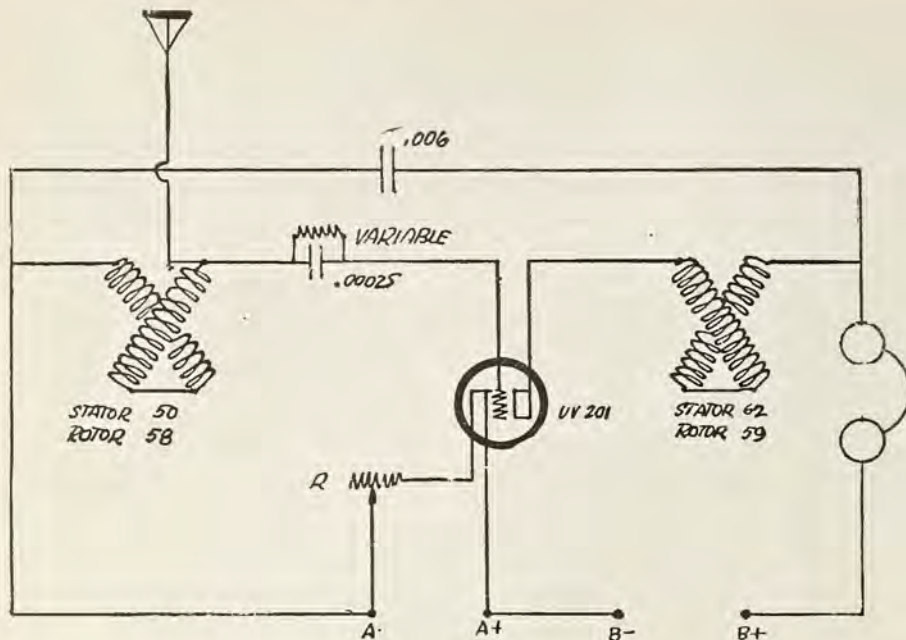
I am using a U. V. 201A for detector and 22½ volts on the plate. I find that it is the most sensitive and selective regenerative set I've ever tried, the stations coming in very loudly. At times WBZ and several others are heard with the phones off. KHJ, KFI, KGO, KLX, KPO, KGW, CFCN, CKCK, CFCF, and WKAQ were all heard on the same night recently. I hear KFI and KHJ very consistently.

Sincerely yours,
CLARENCE R. WILLIAMS,
433 Milton Ave., Janesville, Wis.



AN EXPERT'S SUPER-HET

Photo shows Arthur H. Lynch, radio expert, placing a variable grid leak in the second detector tube which helps clear up the quality of the reception of a super-heterodyne receiving set he has built according to his own plans.



Mr. Williams seems to cater to foreign stations if we are to judge from his list. It looks to us as though he is the holder of a most enviable one-tube DX record. Good work.

From Wisconsin we jump to New Jersey with the following:

RADIO AGE,

Gentlemen:

I was looking over your fine little magazine, the RADIO AGE, and saw some of the lists of stations heard. I would like to see my list scanned, and incidentally wish to say that there may be a lot of skeptical fans when they see this list, but I can swear it is a bona fide one. I use a one-tube single circuit receiver. Enclosed herewith is the list of stations:

WGAD, Essinada, P. R.
WKAQ, San Juan, P. R.
SPC, Rio de Janeiro, Brazil.
2LO, London, England.
PWX, Havana, Cuba.
6KW, Tuninucu, Cuba.
CFCN, Calgary, Alta., Can.
CJCE, Calgary, Alta., Can.
CHOC, Vancouver, B. C.,

and some station operating under the call of PWB. My American receptions are:

KFIU, KFZ, KGW, KFAD, KGO, KPO, KFI, KHJ, KFIO, KLS, KFDJ, KLP, KDYL, KFCY, KLZ, KFKZ, KFIX, KFDL.

In all I have received 247 stations, about 73 being over 100 miles away.

Yours very truly,

JOSEPH J. OSWALD.

433 Emory Ave., Trenton, N. J.

Mr. Oswald's letter contains reception that by many would be deemed impossible. We would suggest that hereafter if reception of stations as distant as those of Mr. Oswald is accomplished, that fans imme-

diately verify the log, as the stations operating are in search of data of that nature. It also is a means of producing evidence of actual long distance reception to those who are incredulous. The list covers tremendous distances, and is certainly a remarkable one. We congratulate Mr. Oswald on his unusual feat.

RADIO AGE.

Gentlemen:

After reading over my list of "stations heard" I think that you, too, will feel that I should be admitted to your Royal Order of Dial Twisters.

I have Q. S. L. cards from most of the stations listed and can vouch for the authenticity of my list.

I use a single circuit regenerative set—detector and one step. Local stuff comes in on the speaker, and last week when I picked up KGO for the second time in a week, I pulled him in on the speaker loud enough to make out what he was saying at five feet from the loud speaker. Remember—I use only two tubes!!!

Guess that's all now, and hoping to be a Dial Twister next month, here's my best.

73's OM,

H. G. ENDE

1801 Sedgwick St., Chicago, Ill.

Here's the list: WSY, KFAD, KYI, KFI, KPO, KHJ, KGO, KFAF, DN4, 9ZAF, WDAL, WDAJ, WSB, WGM, KYW, WDAP, WGAS, WAAF, WJAZ, WBU, WMAQ, WWAY, WOAJ, WJAN, WTAS, WCBBD, WTAY, WABA, WWAE, WBAA, WOH, WGAZ, WOC, WOI, WHAA, WBL, KFKB, WHAS, WGI, WBZ, WCX, WIVJ, WWI, KOP, WLB, WLAG, WCAL, WMAT, WHB, WDAF, KSD, WOS, WOAL, WNAR, WOO, WOAW, KFKX, WOR, WIZ, WGY, WGR, WHAZ, 2XI, WHN, WCAD, WHAM, WJY,

The Magazine of the Hour

WBT, WLW, WEAQ, WSAI, WTAM, WJAX, WLAL, WKY, KDKA, WQAA, WCAE, WBAK, WDAR, WFAT, WDAA, WOAN, WMC, WBAP, WFAA, WOAI, WKAL, WPA, KZN, WHA, WAAK, WIAO, WPAH, PWX, CJCG, CFA, CFCN, CKCK.

Yea, verily, do we inscribe thy name on the Dial Twisters list, for it is no small thing in these days to receive Los Angeles in Chicago on a loud speaker, with two tubes. Keep up the good work.

And, Mr. Printer, while ye are busily engaged in inscribing the name of Mr. Ende, stay thy hand and place also the name of the writer of the following letter, for he hath also done reception that commandeth great admiration:

RADIO AGE, Inc.

Dear Sirs:

I am a subscriber to RADIO AGE and always read the section "Pickups by Readers." I am sending in a list of the stations that I heard on Monday, February 11. I have a single circuit two-tube A. F. A. set. The stations I heard and logged were: WOC, WLAG, WBAH, WOAW, WFAF, WGY, WCBBD, WSB, WDAF, WOS, WHN, WOR, WKY, KFKX, 5XW, KFKB, WBAP, WBAV, WHAZ, WTAS, KFFQ, KLZ, WGR, KFI, KFGD. I think this is a good "coast to coast" record for a set of this kind.

Yours truly,

BENNIE SIVESIND.

712 Maiden Lane, Decorah, Iowa.

HAW! HAW! ha, ha, ha, eh—

Y' know, fellows, Mr. Rathbun just stepped into the office and told us a good one about that little "Baby Heterodyne" of his. He says he's been chuckling for a week about it. It goes something like this:

Mr. Rathbun asked an editor of a well known daily newspaper as to how and what results he was getting with the Baby Heterodyne which had been built for him.

The editor replied: "Nothing can beat it. I did some of the most remarkable long distance last silent (Monday is silent in Chicago) night; you wouldn't believe it, but I got Louisville, Tenn., WHAS, on a loud speaker that night, and for one tube, it's sure some reception!"

Now, Mr. Rathbun, the inventor of the "Heterodyne Baby," waited for us to laugh—but, to tell the truth, he couldn't see the joke at all. After a period of strained looks and highly charged air he said:

"The joke is this: Monday night is certainly a fine night to do that kind of work. The only trouble is that it's silent night in Louisville on Monday, and believe me it sure is some reception when you get a station that's not operating at all. An' on the loud speaker to boot!"

Also, a fellow came in to this office and informed us that he wanted a back number of the August issue. We told him we were all sold out, but that he could get the information from the RADIO AGE

ANNUAL, and he promptly bought the book, saying:

"I had a copy of the August issue, from which I was building the Cockaday set, and when I turned my back the baby grabbed the most priceless radio periodical in the world and tore the thing into so many pieces that a whole Saturday afternoon and Sunday couldn't piece it together."

RADIO AGE,
Gentlemen:

I'm back again; this time with an SOS call. For goshsakes help me—! Since my address appeared in the March issue, I've been swamped with letters. I can't answer them, they are countless. If they come in as fast as they did this week alone, I'll be in a padded cell. I enclose my hookup and a set of rules for building and operating the set, hoping that you will find room enough to publish both.

I have now heard 185 stations with an aggregate mileage of over 158,000 miles. I have heard 40 stations 1,000 miles away; 11 of them over 2,000, the farthest being CYL of Mexico City, Mexico.

Mr. Boyenga is all wrong! The single circuit coupler condenser is by far the best receiver. Look at Kenneth Fischer's, Curtis Springer's and my record (ahem!). We single circuit boosters gotta' hang together. Just to show you what a single circuit will do—my friend Jack Gray of this burg got 80 stations in two and one-half months with about 60 feet of wire coiled up and hung on a nail in his room. If you don't believe it, write him. His address is West Ohio Street, Bay City, Michigan. By the way—he's using my hookup too.

Well, single circuiters, let's show 'em that we don't have to take dust from the Reinartz or any other receiver, including the "Super-het."

Yours truly,

RICHARD JONES.

300 N. Warner Ave., Bay City, Mich.
P. S.—Wise comeback, Pickups Editor, that was one on me! HI!

Dick gives us a list of rules to follow out with the set shown in the accompanying diagram. They are:

1. A good grid leak is the key to success. Use a good grid leak and experiment until you find the one that gives the loudest signals.
2. Solder all connections.
3. Do not permit your set to whistle. If it is built right it should pick up clear music within 200 miles. If you let it whistle you'll spoil your neighbors concerts. Keep the coupling near the spilling point, but don't let it spill over.
4. Be patient. If you can't pick up Hong Kong or Iceland the first night, don't be alarmed. Stick to it. (Think of the postage stamp—it goes a long way but sticks to the job until it gets there—The Ed.)
5. Use standard well made parts; not cheap stuff.
6. See RADIO AGE for January,

1924, page 21, about causing squeals. You can get just as good results by not letting the set oscillate as by making it do so. (Last night KGO could be heard with the phones several inches from the ears, without tuning with the set oscillating.)

7. If bothered by interference, build one of the wave traps in the January issue of RADIO AGE.

Good Luck!

RICHARD JONES.

And now that we've gotten this nonsense out of our systems—let's read on:

RADIO AGE,
Pick-Ups and Hook-Ups Editor,
Dear Sir:

I read the pick-ups by readers in your magazine each month and enjoy reading them very much.

I am especially interested in the single circuit receivers, as I own one from which I obtain very good results.

The following is a list of exactly forty stations received from 7 p. m. February 9 until about 1:30 a. m. February 10.

I am omitting perhaps a half dozen or more of whose location or call letters I am not sure:

- WDAF, Kansas City, Mo.
- KDKA, Pittsburgh, Pa.
- WTAM, Cleveland, Ohio.
- WTAY, Oak Park, Ill.
- KFJW, Towanda, Kansas.
- WOQ, Kansas City, Mo.
- WJAM, Cedar Rapids, Iowa
- PWX, Havana, Cuba.
- WLAG, Minneapolis, Minn.
- WSB, Atlanta, Ga.
- WHAS, Louisville, Ky.
- WSAI, Cincinnati, Ohio.
- WMAQ, Chicago, Ill.
- WCAE, Pittsburgh, Pa.

- WFAA, Dallas, Texas.
- WMC, Memphis, Tenn.
- KYW, Chicago, Ill.
- WEAF, New York, N. Y.
- WGY, Schenectady, N. Y.
- WTAS, Elgin, Ill.
- KFMZ, Roswell, N. M.
- WOAI, San Antonio, Texas.
- KFKB, Milford, Kansas.
- WCAR, San Antonio, Texas.
- WFAH, Port Arthur, Texas.
- WDAP, Chicago, Ill.
- KFMG, Coldwater, Miss.
- KGO, Oakland, Cal.
- KFLZ, Atlantic, Iowa.
- KFFG, Angeles Temple, Los Angeles, Cal.
- KFI, Los Angeles, Cal.
- WJAZ, Chicago, Ill.
- KHJ, Los Angeles, Cal.
- WGR, Buffalo, N. Y.
- WHAA, Iowa City, Iowa.
- WBL, Anthony, Kansas.
- WPAL, Columbus, Ohio.
- WRC, Washington, D. C.
- KPO, San Francisco, Cal.
- WHAH, Joplin, Mo.

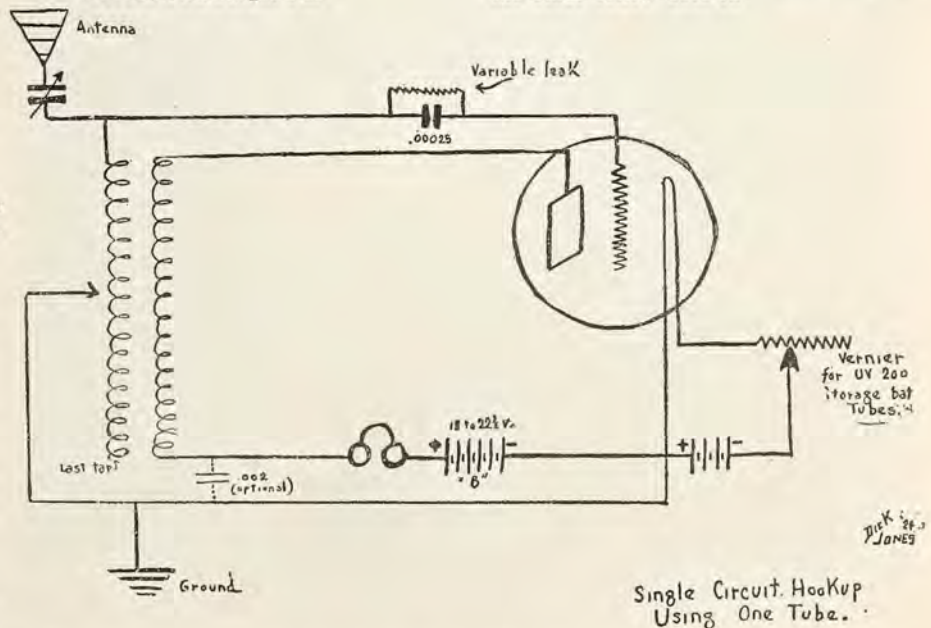
Please note that no stations were received in my home state, Louisiana, in the adjoining state of Arkansas and only one from the state of Mississippi and none from Alabama, making it necessary to receive stations from greater distances.

Sincerely,

H. F. WILLIS.

1200 Fairfield Ave., Shreveport, La.

We print herewith a copy of a log of one of our readers which is probably one of the most systematic and carefully arranged records of stations heard, as yet submitted by our readers. We certainly admire the method of Mr. Kulp's listing of the stations, and feel sure that our readers would be interested in seeing how the other fellow does it.



The above cut is an exact reproduction of the circuit as submitted by Mr. Jones, with which he gets such good results. It is nothing more than a simple single circuit hookup such as many of our readers are using with great success. Mr. Jones particularly warns against operating the set with the tube oscillating, as he contends that better results and signals can be heard without the set acting as a transmitter.

RADIO AGE,
Pick-Ups Department,
Gentlemen:

I have read several numbers of your magazine and have been especially interested in the records of the numbers of stations received in one night. Thinking that some of these records might be broken, I prepared to attempt this last night, February 14, with the result as shown on the appended sheet. From 6 p. m. until 1 a. m. a total of forty-five stations were heard, including ones from twenty different states and from two provinces in Canada, making up a total distance of twenty-five thousand three hundred and eighty (25,380) miles.

These were all heard on a three-tube set with no radio frequency amplification and practically all of them were audible on a loud speaker. My set is home-made and uses the regular Armstrong regenerative circuit. It is of the three-circuit type and consists of two variometers and variocoupler.

I am enclosing log of all stations received last night and the time that they were heard. This is no freak

pick-up, as most of these can be heard any night on my set.

Yours very truly,

JOHN H. KULP.

223 Clifford Court, Madison, Wis.

Station	Location	Distance	Time
WOR	..Newark, N. J...	805	6:00
WDAP	..Chicago, Ill....	120	6:03
WDAF	..Kans. City, Mo..	370	6:06
KDKA	..E. Pittsb'gh, Pa.	575	6:08
WGR	..Buffalo, N. Y...	490	6:10
WGY	..Schenectady, N. Y.....	800	6:20
WTAY	..Oak Park, Ill...	120	6:33
KYW	..Chicago, Ill....	120	6:38
WCX	..Detroit, Mich...	350	6:40
WCAP	..Wash., D. C...	720	6:56
WOAW	..Omaha, Neb....	370	7:00
WBZ	..Springf'd, Mass.	830	7:02
WOC	..Davenport, Ia..	125	7:10
KOP	..Detroit, Mich...	350	7:15
WHB	..Kans. City, Mo..	370	7:20
WCAE	..Pittsburgh, Pa..	575	7:30
WHAS	..Louisville, Ky..	370	7:35
WBAP	..Ft. Worth, Tex.	860	7:43
WJAX	..Cleveland, O...	420	7:46
WWJ	..Detroit, Mich...	350	7:55
WSB	..Atlanta, Ga....	715	8:02
WSAI	..Cincinnati, O...	400	8:07
KSD	..St. Louis, Mo..	310	8:33

WFAA	..Dallas, Tex....	825	8:40
WMC	..Memphis, Tenn.	560	8:45
WBT	..Charlottesville, N. C.	700	8:57
WTAS	..Elgin, Ill.....	120	9:06
KFIX	..Independence, Mo.	360	9:10
WEAF	..New York City.	820	9:20
WCAL	..Northfield, Minn.	230	9:24
KFKX	..Hastings, Neb..	480	9:45
CFCA	..Toronto, Ont., Can.	510	9:50
WMAQ	..Chicago, Ill....	120	9:54
WHN	..New York City.	820	10:00
WJAZ	..Chicago, Ill....	120	10:04
WLW	..Cincinnati, O...	370	10:15
KGO	..Oakland, Cal...	1,840	10:35
WFI	..Philadelphia, Pa.	800	10:50
WDAY	..Fargo, N. D...	460	10:56
WBAH	..Minneapolis, Minn.	130	11:15
CKY	..Winnipeg, Man., Can.	630	11:40
WKY	..Okla. City, Okla.	720	12:05
KHJ	..Los Angeles, Cal.	1,725	12:20
WIP	..Philadelphia, Pa.	800	12:50
KFI	..Los Angeles, Cal.	1,725	12:58

Total number
of miles...25,380

RADIO AGE,
Gentlemen:

After reading in your February issue the wonderful DX-ing done by the Dial Twisters, I find myself a bit discouraged. However, reviewing the circumstances I really can't say that my DX is so bad; hence this letter.

It is interesting to note that I am using the same fundamental hook-up employed by E. L. Laudell. I stumbled upon this circuit about nine months ago, and have been using it ever since with excellent results. During the summer months, I consistently logged Chicago, Atlanta and St. Louis in a location where other sets I had made refused to DX. During the campaign against reradiation, I "junked" this set, and have revamped it in the following manner. I use as an untuned primary coil a coil of 10 turns, a secondary of 60 turns shunted by a variable .0005 condenser, and a tickler of 50 turns, which is shunted by a .00025 variable condenser. All the coils are spider-web coils made by clamping the ends of 15 toothpicks between two circular discs as per the accompanying illustration (Figure 5) wound with No. 26 SC. The primary and secondary are permanently coupled to each other, while the tickler is adjustable. My record is as follows:

Using this set in an experimental state, with a C301A tube with 21 volts on the plate, an aerial of 40 feet flat top, with a 35-foot lead-in, and located in a comparatively poor spot for DX reception, I contrived to log the following stations with the locals all going full blast between 9:30 and 11 p. m.: WOO, WOS, WSB, WGY, WTAM, WDAP, KDKA, WLW, WKAR, PWX. The latter is my crowning achievement for both long distance and selectivity, as PWX operates on 400 meters and WOR operates on 405.



GENTLEMAN JIM'S MISTAKE

When James J. Corbett recently spent an afternoon with Willie Hoppe, the champion billiardist, the veteran fighter inspected Willie's radio set. Willie patiently explained to Jim that the little bulbs when lighted brought in the old DX, which gave Corbett an inspiration. If a little tube does distance, what will a big one do? Our photo shows James J. Corbett with his idea of a real "DX'er" while Willie tried to show him his mistake.

I don't know whether the above is sufficient to land me among the Dial Twisters this month, but if it is not then I'll have to try again with a different set.

Very truly yours,
JOS. W. PFISTER.
 43 Menohan St., Brooklyn, N. Y.

To tell the truth, Mr. Pfister, I don't quite feel that your list warrants your name being put on the DT list—but I do find that your letter contains a valuable hint as to the winding of coils, and also the little circuit (Figure 6) which will show the fans how their single circuit sets can be made more efficient by the addition of this 10-turn coil which is used as a collector. This circuit is very much like that of the Simplifon shown in the March issue in that respect, and does not radiate so violently. I am therefore putting your name on a list which I feel will carry more weight with readers, viz., the contributors' list, and hope that if you come across any other little kinks in the course of your experiments that you will let us hear from you. Come again.

Now the Pick-Ups Editor has a soft spot for "kids" and when a young chappy sends in a scrawl telling of his record he just gloats, especially if it beats some fellow about 45 years old with a 10-tube super-heterodyne. It seems that the young bloods have the patience to sit into the wee hours of the a. m.—if their indulgent parents permit them to—and then the next day they sit down and painfully write up the list—they probably get more sport out of the list and letter than the preparation of their next day's homework in 'rithmetic, and send it into the Pick-Ups Editor. And if he possibly can, he publishes them. Sometimes he has to, as in the case of Kenneth Fischer and Curtis Springer of Indianapolis, Ind. Anyhow—here's a list from another bug in his teens:

RADIO AGE,

Gentlemen:

I get your RADIO AGE every month, and I looked over your lists and I think I can better some of them. I am fifteen years of age, and in a little over three weeks that we have had our set I have received 103 different stations, some of which are nearly three thousand miles away, such as KPO, CFCI.

In one night I received these 45 stations: WCAD, WHAM, WTAY, WNAC, WIP, WDAR, WFI, WOO, WOR, WOC, WOS, WFAA, WHAS, PWX, KDKA, WCAE, WBZ, KYW, WHB, WGR, WHAZ, WEA, WDAP, WGY, WJAR, WJAX, WSAI, WSB, WPAB, WJZ, WLW, WABB, WPS, WTAS, CHYC, WRC, WWJ, WCAB, KPO, WJAZ, WHN, WHK, WTAM, WDAF, WJAN.

Sincerely yours,

JOHN TOMLIN.

303 Madison Ave., Atlantic City, N. J.

From Atlantic City and its boardwalk we jump to the sunny clime of Texas in the following:

RADIO AGE,



ARMSTRONG'S SUPER-HETERODYNE

Maj. E. H. Armstrong, designer of the famous regenerative radio circuit, is here shown with the six-tube super-heterodyne outfit which he demonstrated at the Engineers Society of New York. The outfit uses dry cells and a tiny loop enclosed in the cabinet. He has heard 2LO, London, with the receiver. See other photograph.

Gentlemen:

I have been reading the Hook-Ups and Pick-Ups in your magazine and thought I would send in my records. All stations have been picked up in the last week and a half.

PWX, KFI, KDKA, KFFQ, KFKA, KFKX, KFKZ, KFKL, KGO, KHJ, KLZ, WAAW, WBAP, WLB, WCAL, WCAR, WCB, WDAF, WDAP, WGY, WHAS, WHAZ, WHB, WJAM, WKY, WLW, WNAD, WOAI, WOAW, WOQ, WOS, WPAM, WSB, WTAM, WTAS, WTAY.

I am using one WD12 tube, and light socket for aerial. All stations heard more than twice and with enough volume to hear them plainly with one receiver.

The set I am using is one of my own make.

Yours truly,

BIRELEY ROSS.

RADIO AGE,

Gentlemen:

I have a crystal set of my own make, and here is a list of stations I picked up: KYW, WDAP, KFKX, WSAI, WLW, WCK, WJAZ, WJAM, WRAO, WSB, KSD, KDKA, WOAW and WMAV.

I think that makes me a Dial Twister—don't you?

Very truly,

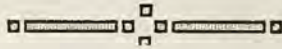
ROBERT SIGNAIGO.

4170 Connecticut St., St. Louis, Mo.

P. S.—I can prove this any time you are in doubt.

And that's that. Now before signing off, we want to again come into the Pick-Ups department. C'mon in; the waves are fine.

RADIOTORIALS



SUBSCRIBERS, buyers of back numbers and buyers of our RADIO AGE ANNUAL, are hereby reminded that there are abroad in the land, a band of radio freebooters who pick up and carry off any good radio literature and illustrations they can find. They steal radio magazines from their neighbor's mail box in the apartment building vestibule. They pick them up from desks before the man to whom it was addressed can get even a glance at it. We mention this for the very good reason that many of our readers have been forced to ask us to change the address to which their magazine was mailed in order that they might be sure of getting it from the postman in person. All readers who miss an issue of the magazine or fail to receive their annual in a reasonable time are requested to investigate conditions under which the mail is delivered and guard against theft by radio-klepto-maniacs.

WE OWE apologies to Thomas J. Kennedy, 470 West 159th Street, N. Y. In our February issue we published a photograph of Mr. Kennedy and his famous three-tube honeycomb regenerative receiver. We also published a photographic back-panel view of the set. About three weeks after that issue of RADIO AGE was distributed over the United States and Canada we had a letter from Mr. Kennedy, saying that he was literally swamped with letters from RADIO AGE readers who wanted more information about his receiver. Mr. Kennedy said he could not possibly answer all these inquiries without a staff of stenographers. He sent us the wiring diagram of the circuit and you will find it in this issue of RADIO AGE. Just another of those incidents that prove we have a keenly alert and very extensive circle of readers.

RADIO comes so near being a public utility at the present moment that it is doubtful whether great financial interests could monopolize manufactures and broadcasting if they so desired and if they tried their level best to do so. With millions of Americans owning receiving sets for which they have paid a good round sum it is likely that it would be about as easy to take away their entertainment, or their free access to tubes, as it would be to deprive the babies of our American households of their milk bottles. When an art or an industry becomes so universal that conservative leaders estimate that about a quarter billion of dollars will be spent over the retail radio counters this year the business has outgrown private control.

It is a national utility. It is an international necessity. It is the source of entertainment and education for all peoples. It guides the mariner on his dangerous way in storm-swept sea lanes; it carries the message of the gospel on Sunday; it flashes news around the world when cables and telegraph wires, fail; it is the dancing master for rural swains and lassies; it tells the farmer when to get his hay in and when to sell his hogs at the top of the market. It signals the time to the punctual minded and it puts the children to sleep with bedtime stories.

Now how can you monopolize a force like that?

The American Telephone and Telegraph Company, one of the component parts of the giant Radio Corporation, denies it is attempting to control broadcasting. The company insists, however, upon its ownership of various patent rights on devices essential to broadcasting equipment. And the American Telephone and Telegraph Company demands certain fees from those of the broadcasters, whom it chooses to select as defendants to suits of injunction.

Taking the A. T. & T. at its word, the company's statement that it does not seek a monopoly of broadcasting, is reassuring. The agitation caused by the company's two lawsuits against broadcasters in the East, became so general that it was discussed officially by Secretary Herbert Hoover, of the Department of Commerce. Mr. Hoover said, "I believe it safe to say, irrespective of claims under patent rights on apparatus, that broadcasting will not cease and neither will our public policy allow it to become monopolized."

We are betraying no secret when we repeat that any effort to divert or control sales of tubes that are essential to several different makes of standard receiving sets is in restraint of the full development of what Mr. Hoover terms "an important incident of life." The Radio Corporation of America assures us that every effort is being made to keep ahead of the tremendous demand for UV-201 A tubes and that unfilled orders will be taken care of by April 1. That also will be reassuring to many thousands of fans who have been unable to go on with their operating and constructive work because they could not buy the necessary type of tube.

It is possible that the radio public is too nervous—that it shrinks at shadows. That very public apprehension, which has called forth these recent avowals from high places, is proof of the firm hold that radio has taken on our national life. As this magazine has said for two years: "Whoever is a friend of radio monopoly is no friend of radio."



White Radio Bill and Some Shadows



(C) Henry Miller News Picture Service, Inc.

PLANNING RADIO REGULATIONS

Congress has again undertaken the passage of a radio law that will take the place of the inadequate regulations in effect since 1912, when the radio art of today was scarcely dreamed of. Those in the picture, left to right, are the following members of the House of Representatives: Ladislav Lazaro, Louisiana; Schuyler Otis Bland, Virginia; Oscar J. Larson, Minnesota; George W. Lindsay, New York; Frederick R. Lehlbach, New Jersey; Wallace H. White, Maine, and Edwin L. Davis, Tennessee.

By FREDERICK SMITH

THERE is one vigorous objection raised by broadcasters, newspapers and radio fans to the new radio bill introduced in Congress by Representative Wallace White, of Maine. The point against which this opposition is aimed is the provision which would grant to the Secretary of Commerce full authority to regulate radio communication in the United States and its possessions.

With perfect faith in the fairness of Herbert Hoover, the present Secretary, it is still objected that nobody knows who his successors will be and that it is placing too much power in the hands of an individual.

A recent radio referendum on the wet and dry controversy, conducted by E. F. McDonald, Jr., at the Zenith-Edgewater Beach Hotel, Chicago, brought almost 50,000 paid telegrams into the station within about twenty-four hours. This

remarkable incident is pointed to as an indication of the power of broadcast stations to reach the people.

It is held out as proof that such tremendous power, multiplied by 561, representing the number of stations now licensed, should not be placed in the hands of any individual. It is contended that the regulation of the vast force brought into being with the advent of radiotelephony, should be given over for regulation by a commission, just as railroad affairs are governed by the Interstate Commerce Commission.

Suing the "Independents"

Interest in the control of broadcasting has been centralized recently by the apparent effort of the American Telephone & Telegraph Company to demonstrate to the public that it alone controls patent rights that justify that company in de-

manding that all broadcasting stations shall, at the will of the A. T. & T., either pay the license fee demanded by A. T. & T. or be liable to suit for injunction to restrain those stations from broadcasting.

A. T. & T. has sued Station WHN, the jazzy entertainment center which holds forth in Broadway, N. Y. An injunction has been asked on the ground that WHN is using apparatus (as are all other broadcasters) on which A. T. & T. holds patent rights.

In addition to attempting to stop "independent" broadcasters from using the air the American Telephone & Telegraph Company proposes that broadcasters shall not use power or light wires for the transmission of "wired wireless." The telephone and telegraph giant therefore sued the North American Company in the New Jersey courts, contending that that \$40,000,000 company had no right to serve

No Monopoly in Broadcasting Says Secretary Hoover

I AM in receipt of many requests for my views as to issues now before the courts bearing on the control of radio broadcasting. While it is impossible for me to express any opinion on particular issues that are before the courts or the Federal Trade Commission I can state emphatically that it would be most unfortunate for the people of this country to whom broadcasting has become an important incident of life if its control should come into the hands of any single corporation, individual, or combination. It would be in principle the same as though the entire press of the country was so controlled. The effect would be identical whether this control arose under a patent monopoly or under any form of combination, and from the standpoint of the people's interest the question of whether or not the broadcasting is for profit is immaterial. In the licensing system put in force by this department the life of broadcasting licenses is limited to three months so that no vested right can be obtained either in a wave length or a license. I believe it is safe to say, irrespective of claims under patent rights on apparatus, that broadcasting will not cease and neither will our public policy allow it to become monopolized.

"wired wireless" to those radio fans who preferred to get their radio joy by simply inserting a plug into the electric light socket and letting the big stations of the public utility corporation do the rest. In the latter suit A. T. & T. has a fight on its hands, if the fact that the North American Company has hired the best patent attorneys in the United States to contest the suit, may be taken as significant.

In New York City it is proposed to build a municipal station in defiance of A. T. & T., which company, it is claimed has persistently put obstacles in the way of the establishment of such a station. The new station is to cost \$50,000 and the municipal authorities promise a "fight to the finish."

A Newspaper Opinion

The danger in the situation is pointed out by the *Chicago Daily News* in an editorial published on March 13, in which it says:

Though the world may not owe any man a living, it does provide him with free radio concerts here in the United States. The bedtime story, the military band and other messages from the loud speaker, like air and sunshine, have escaped translation into the language of dollars and cents.

Nevertheless, certain kinds of radio entertainment are expensive. The waves in the ether set in motion by the golden voice of a famous operatic star may travel no farther than any other waves or exhibit superiority in any respect from a scientific point of view; still, they are costly, as a rule. Consequently an organization among radio listeners in New York is gathering a music fund for the purpose of making accessible the most expensive style of ether waves. In England it is necessary for a radio enthusiast to buy a license before acquiring his set.

The radio public numbers now about ten millions. The ability of radio enthusiasts to pay for their

concerts is a fact well considered by those interests which aspire to a monopoly of the air. If efforts strictly to limit or squeeze out the independent broadcasters should succeed these radio listeners doubtless would prove a richer concession than the famous Teapot Dome to any corporation obtaining control of the ether whether by patent rights or by other means.

The White radio bill, now before Congress, upon which hearings are being held, must be carefully scrutinized and the public's rights against monopoly amply safeguarded if the measure is to pass. The people must demand protection against monopoly gained through bureaucratic favor and denial of the right of appeal. Here is a danger that apparently exists in the bill as it now stands.

Mr. Hoover's Views

As this issue of RADIO AGE goes to press the White bill is before the Merchant Marine and Fisheries Committee of the House. On March 11 Secretary Hoover made an address before this committee which sets forth his own views of the proposed methods of regulating radio communication and his attitude toward monopolization of the industry and his opinions about centralized private control of broadcasting. Because of its importance to all radio interests we publish the statement:

"It is urgent that we have an early and vigorous reorganization of the law in federal regulation of radio. Not only are there questions of orderly conduct between the multitude of radio activities in which more authority must be exerted in the interest of every user whether sender or receiver, but the question of monopoly in radio communication must be squarely met.

"It is not conceivable that the American people will allow this new born system of communication to fall exclusively into the power of any individual group or combination. Great as the development of radio distribution has been, we are probably only at the threshold of the

development of one of the most important of human discoveries bearing on education, amusement, culture and business communication. It cannot be thought that any single person or group shall ever have the right to determine what communication may be made to the American people. I am not making this statement in criticism of the great agencies who have contributed and are contributing so much to the development of the art and who themselves have been well seized with the necessities of its development and proper use, but I am stating it as a general principle which must be dealt with as an assurance of public interest for all time.

"Broadly, radio communication falls into two groups—that is, telegraphic communication by the use of the Morse code, and telephonic broadcasting.

"Telegraphic communication may be conducted from individual to individual and is highly adapted for personal communication parallel with and competing with our other forms of electrical communication. It may be found that some areas of communication can be best carried on by one single unit as experience has also shown to be the case in some other public utilities, but such cases should be conducted under Government control and supervision. Telephonic communication, however, is impossible between individuals from the point of view of public interest, as there are a very limited number of wave lengths which can be applied for this purpose and the greater usefulness of the available wave bands for broadcasting communication inhibits their use for personal communication. We cannot allow any single person or group to place themselves in position where they can censor the material which shall be broadcast to the public, nor do I believe that the Government should ever be placed in the position of censoring this material.

New Laws Needed

"The problems involved in Government regulation of radio are the most complex and technical that have yet confronted Congress. We must preserve this gradually expanding art in full and free development, but for this very purpose of protecting and enabling this development and its successful use, further legislation is absolutely necessary.

"How profound the changes in this method of communication have been since the regulatory Act of Congress approved in August, 1912, is indicated by the fact that the whole telephonic application is practically a discovery since the act was passed. At that time radio was in considerable use as a telegraphic method of communication, more especially with ships, but there was not a single telephone broadcasting station in the United States.

"Some indication of the development of the art is shown by the fact that at the time the act was passed 485 American vessels were equipped for transmission of telegraphic messages. There were 123 land stations, of which one was transoceanic. There were 1,224 amateur stations as I have said, all engaged in transmission of telegraphic signals. Today

(Continued on page 38)

What the Broadcasters are Doing

Inside the Studio

Battling in the ring amid the cries of thousands and attempting to deliver a short address over the radio amid the quiet surroundings of a broadcasting studio, are altogether different, according to Mike McTigue, world's light heavy-weight champion boxer, who recently visited WGY, the General Electric broadcasting station at Schenectady.

Kolin Hager, chief announcer at the station, recalls it as one of the outstanding humorous events of the two years that the station has been in existence.

"He was scheduled to deliver a few words on boxing," explained Mr. Hager. "Naturally, he was the last man in the world that we expected would suffer a case of 'microphone fright,' but he did. He stepped up to the pick-up device, but he could not talk. 'I would rather face Dempsey than talk into that thing,' he

said. "The result was that his trainer, who accompanied him to the studio, was compelled to read the written address."

WGY is celebrating the second year of its existence. Mr. Hager has been in charge of the announcement since the institution of the station.

"I made my first announcement on the night of February 21, 1922—with many misgivings," said Mr. Hager. "I had rehearsed just what I was going to say, twenty-five or thirty times, and then, when the time for the announcement arrived I said something altogether different from that which I had intended."

The WGY studio is a comfortably furnished suite of rooms on the first floor of a new office building. The room from which come the songs and selections, the speeches and the readings, the comedies and the dramas, is furnished with nothing in the way of scenery such as is found in theaters, yet it was only a few days ago

that the studio officials received a call from a traveling scenic artist who had been told that he might land a job at WGY painting scenery for the radio.

"One day the phone rang rather vigorously," said Mr. Hager. "I answered it and received this message: 'My husband is dead, thank God, and I wish you would broadcast the fact.'"

Not so long ago the WGY players, a dramatic organization, built up for the broadcasting of plays, delivered the comedy, "Get Rich Quick Wallingford," in a most excellent manner. The story of the play has to do with the exploiting of an invention for "carpet covered carpet tacks" and it is really amusing, as all Wallingford stories are. Not long after the play was broadcast the studio received a visit from a woman who appeared very much excited.

"You have exposed my secret," she said. "I have been working for a considerable length of time on this proposition



Photo Topics.

N. Y. SCHOOLS ADOPT RADIO

Children of Public School 76, Manhattan, who gave vocal selections over the radio under the direction of Miss May O'Conner from the Board of Education Building.



SO THIS IS LONDON!

This interesting photograph is the first to be taken at the studio of 2LO Broadcasting Station in London, showing the orchestra broadcasting. Note the disc-shaped microphone at the right. This station is frequently heard in the United States.

and just as I get it perfected I hear you broadcasting it to the world, telling everyone about it."

"Absolute silence in the studio is most essential," said Mr. Hager, "and it is with the utmost difficulty that we are able to impress this upon the artists or speakers who may be on the program. This silence must be maintained after the song or speech has been finished until the power has been cut off. But very often a vocalist will turn about, immediately after finishing a song, and while standing in front of the microphone say, 'Did I sing that all right?'"

New Canadian Station

An epoch marking event in the history of radio in Canada—and one which very closely concerns local radio fans—is the opening of the largest and most powerful radio station in Canada, which went on the air in Ottawa on Wednesday evening, February 27th, with a complete and varied program of musical selections and a talk to listeners by Sir Henry W. Thornton, K.B.E., chairman and president of the board of directors. The new station expects to have a range beyond that of any station in Canada, due not only to its up-to-date equipment, but also to the height of its aerial, which stands on the roof of the Jackson Building and reaches two hundred feet above the ground.

The new station signs CKCH and broadcasts on a wave length of 435 meters. The initial program was relayed by station CHYC, Northern Electric, Montreal, on a wave length of 341 meters, so that radio listeners everywhere in Canada and the United States had no difficulty in receiving the program.

Mr. W. H. Swift, Jr., radio engineer for the Canadian National Railways, is responsible for the installation of the new station, which will undoubtedly have the most varied and interesting programs in Canada. Broadcasting will take place Wednesday and Saturday evenings, with occasional church services on Sundays. It is the intention to make the Wednesday

evening programs of a serious nature, including music of the highest type, addresses, and possibly speeches in parliament, while the Saturday evening program will be in a lighter vein.

Station CKCH transmits news items as a part of its program, linking up with the radio receiving sets which have been installed in the observation-library cars of Canadian National Railways transcontinental trains. Arrangements have also been made whereby station CKCH will be at the disposal of the Canadian government at any time desired.

Longest Radio Program

It took only one concert, broadcast from the new studio of WJAX, Cleveland, Ohio, to prove to The Union Trust Company, which owns and operates this station, that WJAX was getting out over the entire country from its new station just as successfully, and perhaps more so, than from its old location in the Citizens Building.

The new studio is located upon the twentieth floor of the new 20-story Union Trust Building, the largest bank and office building in Cleveland, which is shortly to be occupied by The Union Trust Company itself.

The moving of the broadcasting station to the new building was simply the forerunner of the moving of the entire bank.

This first concert from the new studio, which was given upon the evening of Tuesday, February 26, was unique in many ways. In the first place, it probably set a record for length of any single radio concert. It began at 7:30 in the evening of Tuesday, February 26, and continued without interruption until about two minutes before 5:00 on the morning of the 27th.

This program was arranged entirely by the *Cleveland News*. About 125 performers appeared upon this program. Besides soloists of every description, both vocal and instrumental, there were four different dance orchestras, a male chorus of 35 voices, and an entire scene from a play,

"Abie's Irish Rose," given by the players themselves, who came up to the studio after the show was over at the Colonial Theater, Cleveland.

Henry Ford's Station

Station K DEN, Dearborn, northern terminus of the Detroit, Toledo & Iron-ton Railroad radio system, now is operating in a new home with an installation of advanced design setting new standards of efficiency for its rating. For the last three weeks, more than 400 messages per eight-hour day have been handled by this equipment with reliability and dispatch in conjunction with the company's radio offices at Springfield and Jackson, Ohio, 200 and 300 miles distant on an air line, respectively. Capacity will be increased within a few months to 2,000 messages in eight hours by additional apparatus. An efficient printer telegraph system for relaying messages to the River Rouge offices automatically as they are typed by the receiving operator will be ready for use within a few weeks. Innovations further to increase completeness of the system may be expected from the continuous experimental work in progress.

Commercial radio telegraphy for use by railroads is proving itself a practical and efficient means of business communication between widely separated stations. More than that, it demonstrated during a recent heavy snowstorm an emergency utility for train dispatching which made possible operations of D., T. & I. trains on certain sections when land wires were down and service was disorganized on many railroads in the central states.

Extensive use of radio for D., T. & I. commercial work has been in progress for about two years, the former equipment at Dearborn consisting of an antenna of 70-foot mean height and transmitting apparatus of 150-watt power (increased last May from 50 watts). Now the antenna is 165 feet above the ground and the present use of 80 watts is far more effective than the larger output of the old station. Equipment now being connected

will increase the total output capacity to 1,500 watts, this being divided between two separate sending equipments of 1,000 and 500 watts capacity, respectively. D., T. & I. stations, WNA at Springfield and WJQ at Jackson, Ohio, now have 500 and 100-watt installations respectively. With the new equipment at Dearborn, direct communication with Jackson is possible, although the Jackson station was designed for operation only as far as Springfield, whence the messages for Detroit have formerly been relayed north.

At Dearborn three towers approximately 450 feet apart and 165 feet above the base are placed in the form of a triangle. Stretched along two sides of this triangle are the antenna wires, in sets of five wires each, and 360 feet in length. These furnish two transmitting or receiving aerials which may be used simultaneously. If it is desired later to use triple equipment, the third side will be provided with wires. Antenna wires are of seven-strand No. 16 gauge phosphor bronze of superior strength and electrical efficiency. The an-

fact that the Ford stations cannot be heard on a crystal or non-regenerative vacuum tube receiving set. The wave lengths used, 1,713 meters for Dearborn, 1,875 for Springfield and 1,934 for Jackson, are such that they interfere with no other commercial stations operating at the same time and are inaudible to receiving sets tuned in for radio broadcasting concerts.

In the South Seas

The American radio broadcasting station will, in the near future, act as a powerful educational influence on the backward civilization of the islands of the Southern Pacific, predicts Maj. Gen. George S. Richardson, administrator of Western Samoa, under a mandate from the League of Nations to New Zealand. This statement was made in a letter from General Richardson to KGO, the Pacific Coast broadcasting station of the General Electric Company at Oakland, California, after he had listened to the entire program as the guest of Quincy F. Roberts, Amer-

thousands of others who are isolated from the outside world by their residence in the tropical islands of the Pacific."

WBZ Teaches Music

So successful were the courses in Radio and Household Management broadcast last fall from Westinghouse Radio Station WBZ through the co-operation of the Massachusetts of University Extension, that a new course in Musical Appreciation was commenced Thursday, March 6. The course consists of eight weekly lectures given by Prof. Elisha S. Olmsted of Smith College.

A feature of the course is the use of actual examples for the lectures. In other words, the radio students taking the course are not only told about the different forms of music with explanations of their characteristics but they actually hear music to illustrate such points.

In order that a definite reaction can be had regarding the course, a fee of one dollar is charged to those wishing to participate. Each student receives printed



CELEBRITIES AT A PARTY

Thomas A. Edison who celebrated his seventy-seventh birthday, February 11, was tendered a complimentary luncheon at the Ritz-Carlton Hotel, N. Y., by motion picture and other personalities. Photo shows, left to right—Will H. Hays, Thomas A. Edison, George Eastman, Senator Edward I. Edwards and Dr. Lee de Forest.

tenna is held from sagging by 400-pound take-up weights.

Under the water of the lake, encompassed by the towers, more than a ton of copper wire is sunk paralleling the antenna wires above. This provides the ground counterpoise of the antenna system and is connected with the sending equipment.

D., T. & I. commercial stations operate on the heterodyne principle—that is, the receiving tube must be oscillating at a frequency in cycles per second slightly different from the frequency of the waves received. The resultant combination of waves reduces the frequency from radio to audio. For instance, the incoming wave from Springfield station may be 175,300 cycles per second, the Dearborn receiving set detector tube is adjusted to oscillate at 174,300 cycles per second and the difference between the two, 1,000 cycles, results in a signal having a clear high-pitched whistle in the receiving telephones. The heterodyne principle accounts for the

ican consul at Apia, British Samoa, on January 12.

The entire program came in so clearly 5,000 miles from the sending station that "Vailima," the old home of Robert Louis Stevenson, now the residence of Major General Richardson, has been named a "listening station" of KGO. The governor has become a radio fan and will equip his residence with a radio set.

Consul Roberts, in a letter to KGO, stated that he invited General Richardson and his family to listen in the KGO and his excellency was astonished at the strength and clearness of the signals coming from a station 5,000 miles away.

Major General Richardson's letter follows:

"This evening I, with my wife and family, have been most pleasantly entertained by your company, and we feel very grateful to you and the excellent performers who so kindly gave their services to transmit their talent through the medium of your wireless installation to us, and to

information which assists him in learning the subject and in being able to differentiate between the different types of music that he hears over the radio, on the stage, and in the concert hall. The money received is given to the instructor for his time and effort and to defray the expense of sending the printed matter to the student.

In a course of this character that is broadcast, anyone having a receiving set can listen in but only those who send in the registration fee of one dollar will get the full benefit and receive credit at the end of the course.

Rome to Washington

Since February 20th, the Navy Communication Service at Washington has been in daily touch with the San Paolo radio station at Rome. This circuit, closed as unreliable some time ago, was recently reopened with "IDO," San Paolo, a new radio transmitting station in Italy.

Radio Age Data Sheets

By JOHN B. RATHBUN

THERE has been a great demand for some form of radio reference work in which the more important features of radio engineering can be assembled in compact and easily accessible form, a sort of radio "pocket book" so to speak, which can be kept up to date by the addition of standard size pages cut from the successive issues of RADIO AGE. The old method of filing clippings cut from the regular reading pages was attended by many difficulties, for the clippings were irregular in size and difficult to file systematically. Again, there were often two different subjects on opposites of the page which made proper classification an impossibility, and worst of all, the matter would not fit a standard size binder.

In this issue, RADIO AGE starts a new and valuable feature, a series of radio data sheets having standard size pages and which are printed only on one side so that they can easily be filed according to subject matter. They can be placed in standard binder covers, and when the series is completed the reader will have a very complete and up to date pocket book which thoroughly covers the various fields of radio. In order to conserve space and to be of value as a reference work, the text will be as concise and short as possible, a complete radio library within the limits of two covers.

Indexing and Classification

Owing to the many branches of radio subjects and the many subdivisions contained under each of these general subjects, a comprehensive indexing system was somewhat difficult to arrange. Much study was given to this problem before a suitable system was devised, and after going through the several library cataloging systems it was considered best to fall back on the old reliable lettering method in which each general subject is given a definite letter while the sub-subjects under this head are numbered.

On the page opposite this introduction is an index of the general subjects covered, the indexing letters referring to the subjects being in the left hand column. The sub-numbers are not yet shown as they will be of little interest to the reader except that they are of service in keeping the sheets filed in their proper order.

As an example, we see from the index sheets that the subject of inductances and inductance calculation is under (F), hence when all the (F) sheets are assembled we will have a complete chapter or section on the subject of inductances. Under (G) will be found everything relating to aerials and aerial calculations, and so on. The number immediately following the letter refers to the location of the sub-subject or division under this number.

Taking the subject of inductances as an example, and honeycomb coils in particular, we will find that all data given in regard to honeycomb coils will be given under the number (20). Thus, the index for honeycomb coils will read: F-20, and



SUIT CASE RECEIVER

Demand for good portable sets is going to be heavy from now on. The photograph shows Miss Claire Patton with a six-tube receiver which is exceptionally compact. A loop aerial is contained in the small case. With head phones this outfit picks up stations 800 miles distant. The receiver was exhibited at the recent radio show in New York.

all the F-20's must be collected together. Following the sub-number is the second number or page number by which the pages can be arranged to run in order under a given subject. Thus: F-20-8 indicates that the sheet is on the subject of inductances, that (20) shows that honeycomb coils are referred to, and that the page number (8) is located in the eighth place under the section number (20). This is easily understood after a little experience and is the only practicable method of filing.

Covers All Branches

In order to cover as wide a range of subjects as possible within the first few issues, the sheets will not be published in alphabetical order, but will be somewhat scattered in regard to subject. We cannot very well begin with the letter (A) and run through the list alphabetically, as this would prove tiresome and the sheets would have but little practical value until we got down to (G) or points beyond. We will attempt to give all branches as nearly equal representation as possible in the beginning so that the sheets will be of general interest.

Owing to the necessity for expansion, and for the addition of supplementary sheets made necessary by future develop-

ments, it will be necessary to allow for expansion gaps between the different sections. The radio industry is developing too fast to permit of running the sheets solidly in the order of their page numbers. Thus, if you receive sheets F-20-1 and then F-20-5, do not think that you have missed the pages 2, 3 and 4. It is likely that these pages have been left open for new matter that might develop later on and which was therefore not originally contemplated.

Beginners and Experts

It is our intention to include both technical and popular matter in these sheets, both for the engineer and student and for the reader who only has a general experimental interest in radio. Notes on "trouble shooting" in tabular form and practical hints on construction will be among the helpful data sheets issued for the novice in radio. For the advanced student and engineer will be formulae, tables and graphical charts for computations and laboratory test methods for determining the values of inductances, condensers, etc. We aim to cover the field thoroughly and in detail.

Starting with the letter (L) in the index and ending at (P) will be seen a very

(Continued on page 36.)

INDEX**RADIO AGE DATA SHEETS SUBJECT**

By John B. Rathbun

**RADIO AGE
DATA SHEETS**By **J. B. RATHBUN**

- A—Elementary Principles of Electricity.
- AA—Elements of Direct Current Circuits
- B—Elements of Magnetism.
- BB—Elements of Alternating Currents.
- C—Wire Tables.
- CC—Electromagnetic Waves, Radio Waves, Etc.
- D—Atmospheric Electricity, Static, Etc.
- DD—Batteries and Battery Chargers.
- E—Dynamos, Motor-generators, etc.
- EE—Summary of Advanced Electrical Calculations.
- F—Inductance Calculations, Impedance, Etc.
- FF—Capacitance, Condensers, Etc.
- G—Antenna and Aerial Calculations.
- GG—Transformers and Couplers.
- H—Radio Frequency Transformer Design.
- HH—Audio Frequency Design.
- I—Elements of Receiving Circuits.
- II—Miscellaneous Receiving Apparatus.
- J—Principles of the Detector, Crystals, Electrolytic Detectors, Etc.
- JJ—Principles of Vacuum Tubes, Detectors and Amplifiers.
- K—Vacuum Tube Oscillators and Modulators for Transmission.
- KK—Practical Crystal Detector Hook-ups.
- L—Practical Vacuum Tube Hook-ups—Regenerative and Simple.
- LL—Practical Vacuum Tube Hook-ups—Audio Frequency Amplification.
- M—Practical Vacuum Tube Hook-ups—Radio Frequency Amplification.
- MM—Practical Vacuum Tube Hook-ups—Reflex Circuits.
- N—Practical Vacuum Tube Hook-ups—Neutrodyne Circuits.
- NN—Practical Vacuum Tube Hook-ups—Super-Regenerative.
- O—Practical Vacuum Tube Hook-ups—Heterodyne Circuits.
- OO—Practical Vacuum Tube Hook-ups—Modulation Reception.
- P—Practical Vacuum Tube Hook-ups—Miscellaneous.
- PP—Filters, Wave Traps, Selectors, Etc.
- Q—TROUBLE SHOOTING CHARTS.
- QQ—Wave Meters.
- R—Laboratory Tests for Inductance, Capacity, Etc.
- RR—Loud Speakers, Sound Amplifiers, Etc.
- S—Construction Notes on Receiving Sets.
- SS—Installation Notes, Regulations, Fire Insurance Rules, Etc.
- T—Transmitting Apparatus, General Notes
- TT—Damped Wave Transmission.
- U—C. W., Interrupted C. W., Circuits, Apparatus, Etc.
- UU—Radiophone Transmitting Circuits and Apparatus.
- V—Standard Code, Transmitting Regulations, Etc.
- VV—Practical Design of Transmitting Stations.
- W—Power Plant, Operation on A. C., Filters, Etc.

(Letters X-Y-Z left open for future developments.)

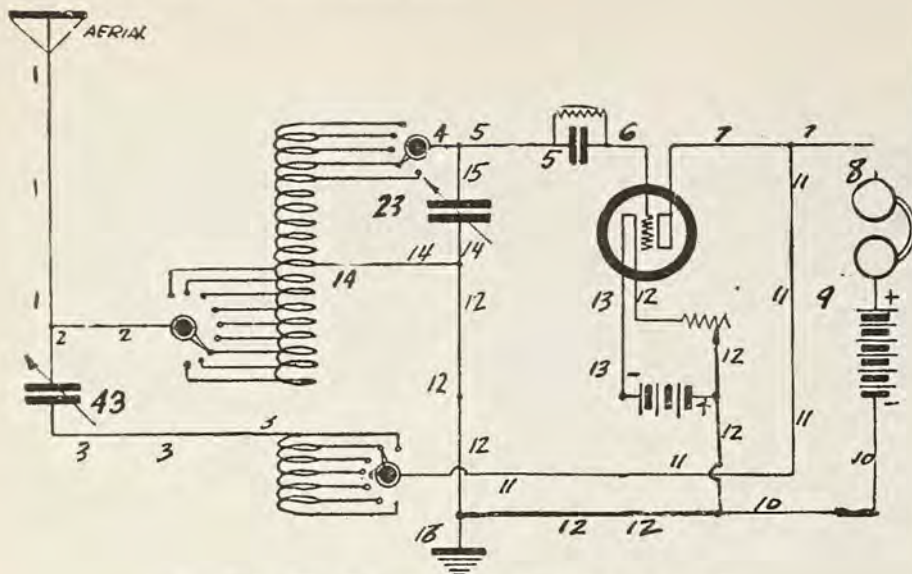


Figure 5. The Reinartz circuit illustrated on page 10.

(Continued from page 12.)

iar with tuning and has learned how to handle a set, or for other reasons wishes to go a little deeper into the subject, a single circuit tuner, using an audion detector, is suggested.

Ultra Audion Circuit

Many single circuit sets will be found on the market, but the most simple of these is perhaps that which is known as the "Ultra Audion." This set, instead of using a crystal detector, makes use of the vacuum tube, and is known to be extremely sensitive. Records show that distances of two thousand or more miles have been covered with it and the reception was good and clear. This also is a very inexpensive set and is very easily tuned. It must, however, be remembered that the same rule in regard to the aerial construction applies to this set as that of the crystal. Much will depend upon the location and the aerial. This arrangement will cost less than many other single circuit types, and if one wishes to assemble his own set, he will find it a very easy job. This circuit is shown in Figure 2, and for the benefit of those who wish to make their own set it is stated that instructions for its assembly have been published several times in previous numbers of this magazine.

If, however, one wishes to purchase the set complete he will find that there are several types of ultra audion receivers on the market. Some of these make use of a tapped coil for the inductance and some use a variometer. The purchaser is advised to select the latter for the reason that a much closer adjustment can be obtained with this form of inductance. He should also make sure that the variable condenser used has a vernier adjustment. This type of condenser and the variometer are not so important for local reception, but when tuning in long distance stations one will find them absolutely necessary.

Other single circuit tuners may be used, of course, but from actual experience, the ultra audion has proven to be the easiest to construct and the most satisfactory and reliable of the single circuit tuners. It

is of the regenerative type which assures one of more volume than can be obtained from a non-regenerative set. If volume enough for a loud speaker is desired, this can always be obtained by adding two stages of audio frequency amplification.

Reinartz Is Popular

The next set to be described should cost but little more than the ultra audio and has been proven out by thousands of radio fans. This is the Reinartz tuner as shown in circuits No. 3, 5 and 6. This also has a reputation for very long distance reception and probably the beginner will find it a little more complicated than the ultra audion, but, in fact, it is no more so than many others. A careful study of the circuit will soon convince one of this fact. Complete sets of this type are for sale in the radio stores and full instructions for making it have been published in former numbers of this magazine.

The performance of this set is about on a par with the ultra audion, although there are many who claim it is better. The inductance is usually wound in the spider-web form to cut down the effects of distributed capacity. Tuning is accomplished by means of two variable condensers and three switches as shown. This makes the tuning operation slightly more difficult because of the added number of controls, but these, of course, make it possible to get a much closer adjustment, although it may take a little more time to do it.

Regenerative Also Good

The standard three-circuit regenerative set is the next in line. In this set the aerial, grid and plate circuits are all adjustable and in this they are similar to the Reinartz. The standard three-circuit regenerative set is probably the oldest of all and there are many who consider it the best of the reasonably priced outfits.

The principal parts used are first the variocoupler, the primary winding of which is adjustable, and is connected in the aerial and ground circuit. The energy is transferred from this aerial coil to the grid circuit by induction and the induc-

tance in the grid circuit is controlled by a variometer. Another variometer is placed in the plate circuit and is used to control regeneration. A study of circuit No. 4 will give a good idea of the arrangement of these parts. The standard three honeycomb coil circuit is also a three-circuit regenerative set and has the additional advantage of substituting coils, having a different number of turns for the purpose of adapting it to different wave bands. These coils are so arranged that they may be changed instantly and the set can be so adjusted that it will give reception on wave lengths of any range. For the beginner who is interested in spark reception and can read the code, a set of this kind will be very interesting.

Reflex Circuit

Coming now to the higher priced receivers for the man who cares not for expense, but wants to get good reception, there are many which can be recommended. Among these are the different reflex arrangements in which the tubes are made to do double duty, thus giving much more powerful reception with practically half the number of tubes required in other sets. One noticeable feature about these receivers is the fact that while vacuum tubes are used for the amplification, a crystal detector is used.

This is because the crystal is known to be the best detector so far as clarity is concerned and because of the many steps of amplification used, the signal is greatly strengthened by the time it is ready to be rectified. As the crystal is very efficient on signals of great strength, it has been found to be the best for this class of service. Receiving sets of this type will bring in long distance broadcast programs on the loud speaker very nicely.

If one builds his own reflex set, however, he must use considerable care to get the proper apparatus and to see that the right condensers are used in the proper place, otherwise the balance of the different parts of the circuit will be destroyed and the set will not function as it should.

Data Sheets

(Continued from page 34.)

considerable amount of space that is devoted to radio circuits or "hook-ups." This material will cover a great variety of receiver types and is arranged according to the class of circuit, whether regenerative, radio frequency, etc. Preceding each of these sections devoted to hook-ups will be explanatory matter on the principles of the circuits and data on their successful construction and operation.

RADIO AGE and RADIO AGE ANNUAL

A year's subscription to this magazine and a copy of the famous handbook of drawings and instructions on how to make standard receiving sets. 112 pages.

All for \$3.00

Send today by check, registered mail or money order to

RADIO AGE, Inc.
500 N. Dearborn St. Chicago, Ill.

Two broadcasting stations are attempting to solve the problem as to making broadcasting self-sustaining. They are WEAF, the American Telephone & Telegraph station in New York, and WHB, the Sweeney School, Kansas City. In

New York a group of financially responsible gentlemen has undertaken the raising of a fund contributed by broadcast listeners with which to pay high class entertainers. A fund for the same purpose is sought by the Kansas City station through the medium of the sale of imaginary seats in an invisible theater. The school finances the station sufficiently to conduct it, under this plan, and the broadcast listeners are asked to pay for the entertainment. The price of "seats" is from \$1 to \$10. One of the inducements to buy "seats" is the proposal to send out advance programs to all those who pay more than the minimum of \$1 for their tickets.

VESTA Radio Batteries

You want a real battery; one that is guaranteed 100 to 120 amperes, 6 volts. Get a VESTA. It will give complete satisfaction.

6 Volts, 100 Amperes, \$21.65
6 Volts, 120 Amperes, 25.35

Recharging Service

In Chicago we have an established 24-hour service for battery recharging. We call for and deliver all makes of batteries

BRENNAN'S GARAGE and BATTERY STATION

2135 Lincoln Avenue,
Chicago, Illinois

Phones: Lincoln 0351; Diversey 1858



Each package contains enough material to engrave two complete sets of practically any circuit, including the Neutrodyne.

Send fifty cents for sample package now.

You will say it is worth many times the price.

Save your set by marking each instrument with an engraving that will become a permanent fixture on your set.

Ask for it at your dealers and mark those battery terminals and save burning out tubes.

Can be placed on bakelite, rubber, wood, glass or any painted surface. Send fifty cents now to insure early delivery.

ENGRAVO is the big liberal package. Just say ENGRAVO to your dealer and he knows what you mean.

Dealers and jobbers write for prices.

CHERINGTON RADIO INDUSTRIES
53 W. Jackson Blvd. Chicago, Ill.

The Music War

The National Association of Broadcasters gives out the following statement: "The controversy between the American Society of Composers, Authors and Publishers and the National Association of Broadcasters, has broken out afresh and rapidly reached an acute stage.

"The incident which renewed this fight was the forcing of a license to broadcast their music by the American Society upon the Edgewater Beach Hotel of Chicago, which they did not want and will not use. Full details are given in the attached letter addressed to the American Society.

"Aroused by these high handed methods, John and Tracy Drake, proprietors of the Blackstone and Drake hotels of Chicago, called a meeting on February 6th at the Blackstone Hotel, which was attended by the principal hotels, moving picture theater owners, dancing academies, music schools and broadcasting stations, in the Chicago district.

"It was the first time in any part of the country that the interests have met jointly for the purpose of resisting the American Society.

"The Chicago meeting adopted plans designed to more effectively combat the increasingly unfair demands and tactics of the American Society. It is now felt that the measures adopted will check their avarice, and hold them strictly within the zone of fairly and justly administered enterprises.

"The objectionable, coercive methods used by the American Society are not approved by their more representative members. This is shown by the resignations of Waterson, Berlin & Snyder of New York, one of the six big publisher members, and Will Rossiter of New York, one of the oldest men in the music business, immediately upon their learning the facts. Both letters of resignation are herewith attached. Henry Waterson sets forth his position in clear terms, and refuses to take part any longer.

"Radio listeners are intensely interested in this weakening of the American Society, indicating as it does the fast approaching time when five thousand American authors and composers and fifteen hundred American publishers will have an equal chance with the two hundred and seventy-seven combined foreign and American authors and composers, and the forty-six combined foreign and American publishers now constituting the American Society."



for SELECTIVITY

Add a Ferbend Wave Trap to Your Set

YOU can get "Distance." But can you keep it? Stop the interference. Don't let every Tom, Dick and Harry spoil the concert you are enjoying. Don't lose that DX Station so long "dialed for." Trap out the interfering Station with a Ferbend Wave Trap. Our guarantee plainly tells the story:

We guarantee that the Ferbend Wave Trap, when properly connected to any workable receiving set, will tune out any interfering station.

Mr. John F. Parsons, 109 North Avenue 19, Los Angeles, California, writes:

"I have installed the FERBEND WAVE TRAP I purchased from you some time ago and given it a thorough try-out. There are five broadcasting stations in this city, four of them I can trap out by moving dial ten points, the other KFI, the most powerful one, I can silence by changing the dial twenty points. This station is heard on the Atlantic coast and Hawaiian Islands."

Make Every Night "Silent Night"

The Ferbend Wave Trap is a valuable addition to any set. It is designed and manufactured complete by us, after years of careful experimenting. It is not to be confused with imitations hastily assembled from ordinary parts. The price is \$8.50. Shipment made parcel post C. O. D. plus a few cents postage. If you prefer, send cash in full with order and we will ship postage prepaid. Send us your order today.

Ferbend Electric Company
16 East South Water Street, Chicago

Descriptive Folder on Request



CLASSIFIED ADVERTISEMENTS

Six cents per word per insertion, in advance. Name and address must be counted. Each initial counts as one word. Copy must be received by the 15th of month for succeeding month's issue.

RADIO ODDS AND ENDS

No. 14 square tinned bus wire—2 ft. lengths—64 feet for \$1.00. \$1.20 set of 8 lettered binding posts—50c. Spaghetti—3 ft. lengths, red, yellow, green or black—7 lengths—21 ft.—\$1.00. 50 assorted brass screws, nuts, washers, lugs, etc.—50c. All four items prepaid return mail—\$3.00. Radio list for stamp—none free. Kladaq Radio Laboratories, Kent, Ohio.

BOOKS

If you have not bought your Reinartz Book, fully illustrated with hook-ups and clear description of how to make this popular circuit, send \$2.50 in money order or currency and we will send you the booklet "Reinartz Radio" and place you on the subscription list of Radio Age for one year. Address Radio Age, 500 N. Dearborn Street, Chicago, Ill.

15-20% DISCOUNT ON ALL STANDARD RECEIVERS, Fred Eisenmann Neutrodyne, \$125.00; New Radiolas, etc. Thomas Radio Co., 111 Dex St., Muncie, Ind.

RADIO BATTERIES

Super Radio A and B Circuit Batteries, which bring in long distance reception. Sold for cash or on payment plan. Write for prices and details. Radio Battery Corporation, 501-B Industrial Bank Bldg., Flint, Mich.

WITH THE MANUFACTURERS



CLE-RA-TONE SOCKET

The Benjamin Electric Mfg. Company, Chicago, is producing a socket for vacuum tubes called the Cle-Ra-Tone.

The tube-holding element of the socket floats on light springs which act as shock absorbers and neutralizes all interfering vibrations which ordinarily would cause "tube noises." The general effect is clearer reproduction.

Vibrations which interfere with clear reproduction by the radio tube are of two kinds: (1) that caused by jar such as might occur from striking the receiving set with the hand or clicking the switch lever from one point to another; and (2) probably the more offensive kind called microphonic. These microphonic vibrations might be produced by footsteps in the same or adjoining rooms or by street cars passing nearby or other such noises which are often



in large cities, noticeable only by their absence as in the stillness of the night. Noises of this kind set the tube filaments in motion and are reproduced as very offensive disturbances over the 'phone. It is the ability of the new Benjamin Cle-Ra-Tone Socket to eliminate these microphonic noises which makes it of great value.

This shock absorbing feature also protects the lamp and is therefore excellent for portable receiving sets which are subjected to shocks in moving from place to place. The shock absorbing feature is in no way interfered with by stiff bus wiring because the wiring terminal base is separated from the tube holding element by the tight springs mentioned above. The socket is made in two sizes—one for standard base tubes and the other for UV199 types.

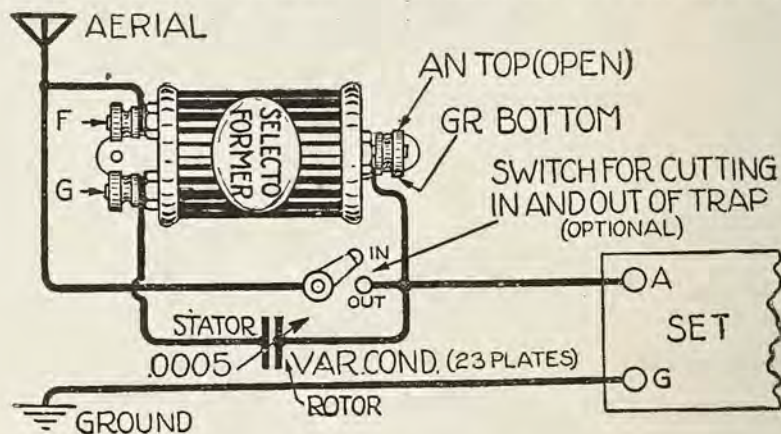
Variocoupler-Wave Trap

The Electrical Research Laboratories, better known as the ERLA Company, have placed on the market a unit of the same standard of engineering as prevails in their reflex sets and accessories.

This unit, known as the Selectoformer, is entirely in keeping with the general trend toward low loss, high grade tuning units which are now being marketed.

The unusual feature of the Selectoformer lies in the fact that it not only serves the purpose of a variocoupler, but also can be used effectively as a wave trap, enabling the owner to minimize the interference and cross talk caused by the many high power stations now in operation.

yet this absorption must not be so great as to absorb desired signals. Therefore, a different coupling co-efficient, as well as a different antenna coil constant, is necessary to get an efficient wave trap effect. Two separate and distinct requirements of a coupler and wave trap have been em-



Due to the fact that this unit operates without taps, which every engineer knows causes losses in tuning circuits, its efficiency is very high both as an eliminator of interference and as a tuner. When used as a tuner, the connections are made much in the same manner as that of the fixed coupler of the Neutrodyne circuit, and when the operator desires to use the unit as a trap circuit for interference, the unit is shunted by a .0005 MF variable condenser, which should be of good design and low loss. The manufacturers claim that it increases the strength of the incoming signals when it is so used.

In the accompanying illustration the connections for using this unit as a preventer of interference are shown. W. J. Schnell, A. E., with the Erla Company, tells how this unit functions most effectively in the above circuit:

"In perfecting the Selectoformer, the engineering staff found that the design required also provided the means for an efficient rejector, or wave trap. It is not difficult to put an absorbing device in the antenna system to stop certain ranges of frequencies, but if such an absorbing device is not carefully designed it will, like the old variocoupler, add its resistance to the input circuit.

"As has already been demonstrated, this effect is found where very close inductive or conductive coupling is used. But in a wave trap closer coupling is necessary than would be used if the only object was the coupling of the two circuits for the transfer of energy, because it is desired to absorb energy from the antenna circuit,

bodied in the Selectoformer by using two separate designs in one assembly."

Two-Tube Sets for \$18.50

Simplicity of operation makes the new Crosley Model 51 Receiving Set very popular. It has detector and one-stage of audio frequency amplification, utilizing the Armstrong regenerative circuit. One multistat operates both tubes. It sells for \$18.50 and is made by The Crosley Radio Corporation.

Reports have already been received from owners of this new set, one man going so far as to testify that he has re-



ceived 68 stations so far and many of them came in so loud he was able to use a loud speaker. This little set is built in a handsome mahogany cabinet and makes an ideal receiver for placing in the living room or any other part of the home. Its operation is so simple that children can use it with ease and any type of vacuum tube may be used with perfect results.

Farm Radio Figures

REPLIES from 73 Illinois county farm bureaus in a radio survey just completed by the Illinois Agricultural Association, revealed that there are 20,845 radio receiving sets on farms in these counties. The survey would indicate that between 7 and 10 per cent of the rural population of the state have installed receiving sets.

"The survey was made for the purpose of determining the extent of the use of radio on farms, the type of programs most desired, practical benefits of the radio, and for the planning of programs to meet the demands of the constantly growing army of farm radio fans," state I. A. A. officials.

These farm radio sets tune in nightly on stations all over the United States.

Chicago, Davenport and St. Louis are mentioned most frequently, because they are near and easy for a small set to pick up, but many reports were given stating that farmers tune in on Kansas City, Dallas, Ft. Worth, Jefferson City, Omaha, Pittsburgh, Philadelphia, New York and other broadcasting stations.

The counties near broadcasting stations naturally show the most sets. Madison county, in the vicinity of St. Louis, has 2,550 sets; Rock Island county, near Davenport, has 900, and in Henry county, also near Davenport, the report shows that nearly one-third of the entire farm population has sets.

Only about 25 per cent of the farmers owning radio sets make their own, the rest being manufactured sets, the survey shows.

One of the questions asked in the survey was, "What sort of radio programs do such gatherings use the most and like the best?" The almost invariable reply to this was, "Musical programs and occasionally good lectures."

Replies from most of the counties indicate that many farmers tune in on the weekly farm lectures broadcasted each Tuesday night from station KYW, Chicago, under the auspices of the American Farm Bureau Federation.

Individual farmers, farm bureaus and banks tell of practical benefits from the daily market and weather reports. Montgomery county, near St. Louis, furnishes this example:

"The First National Bank of Raymond, Illinois, has a radio set and gets the opening livestock market at 9:30 a. m. The manager of the co-operative shipping association keeps in close touch with the market report at East St. Louis, and several times has received the market report at 9:30, called in one or two cars of hogs and hit a good market at East St. Louis the next day. On several occasions this

made the farmers from \$50 to \$100 per car more money for their hogs."

The returns from Madison county state: "The reports keep the farmers in closer touch with the markets and they are not the prey of buyers who may come along and offer below the market for hogs or cattle."

One point that was stressed was the necessity of having farm programs early in the evening, since the 10 o'clock programs are rather late for farmers

Lakeside Radio Cabinets

Many sets are unsightly in the homes without proper facilities for equipment. They undoubtedly are good sets but why not make your set a real piece of parlor furniture. We specialize in radio cabinet work and if you have a problem in beautifying your set we can correct it for you.



No. 500 Floor Cabinet Wood Mounting Panel can be removed if complete set is to be installed or wood panel can be cut out to take Bakelite Panel up to 10x32 inches.

List price, \$70.00. Mahogany or Walnut. Two Tone Finish.

Style B Table Cabinets Prices are on imitation Mahogany or Walnut.

Cases 7" deep for 7" high panels.

Length	List	Length	List
9 inches	\$3.20	24 inches	\$5.30
12 inches	3.60	26 inches	5.70
14 inches	4.00	28 inches	6.10
18 inches	4.40	30 inches	6.60
21 inches	4.90		

Special Case 8 inches deep for panel 8 inches high, 40 inches long. Imitation Mahogany, \$10.50. Genuine Mahogany, \$17.50.

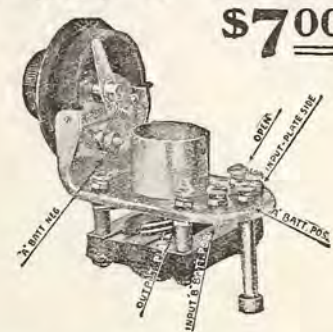
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73 West Van Buren St., Chicago, Ill.

3-in-1 Unit \$7.00



This wonderfully efficient Audio-Amplifying Unit consists of—Transformer—Rheostat and Socket all ready for panel mounting. Will save you time, trouble, expense and space in building your set. Gives most efficient results. Every 3-in-1 Unit fully tested and guaranteed. One Unit will amplify your crystal set for loud speaker use. Specially wired Unit for Reflex work. Mail orders promptly filled.

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Ask Your Dealer for Howard Parts. He Will Be Glad to Show Them. JOBBERS WRITE FOR DISCOUNT

No. 1004

Multi Terminal Receiver Plug, instantaneous connection for as many as six pairs of standard receiver tips.....\$2.00



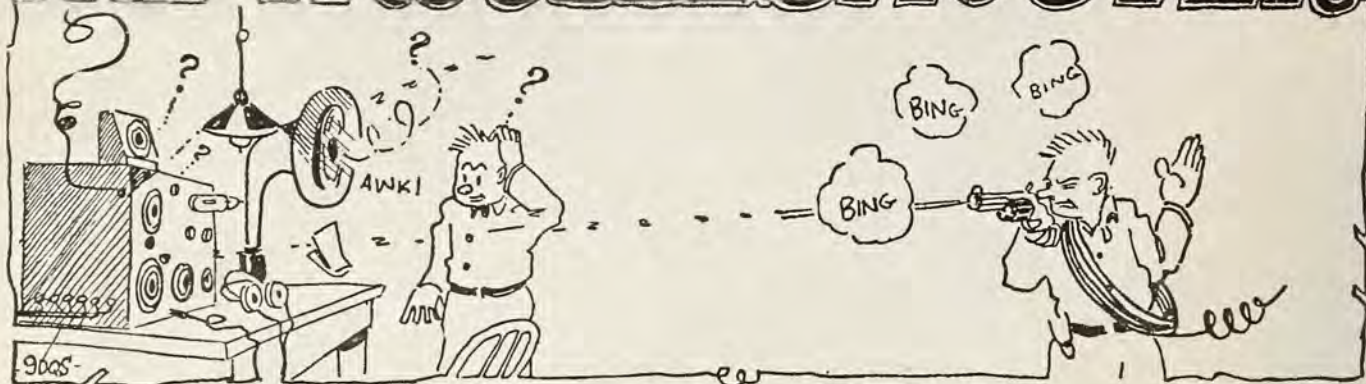
Patd. Aug. 28, 1923

HOWARD RADIO COMPANY, Inc.

4248 North Western Avenue, Dept. A CHICAGO, ILL.

Always Mention RADIO AGE When Writing to Advertisers

THE TROUBLESHOOTER



B. C. L. Everywhere, USA.

Question: I desire to write your department for information, and would like to know the best way to go about it. Kindly inform me if there is a charge for this information. How many questions shall I ask in one letter? Is a stamped addressed envelope necessary with my inquiry? Please give me some information on the proper way to request the services of your technical department.

Answer: The Technical Office will be glad to answer inquiries of subscribers free of charge; if you are a non-subscriber we must request that you enclose fifty cents for each such inquiry as you send in, together with a stamped addressed envelope. We find that it is necessary to do this in order to assure proper attention to our regular subscribers. When writing, don't put down everything that comes into your head—stick to the particular subject you are asking about. If your question is about a set, enclose a diagram of the receiver to get the most accurate answer. Don't ask questions about commercial manufactured sets—write the manufacturer for that information. Before writing, always look back into your past issues of RADIO AGE (if you don't have them, you can get the ANNUAL to look them up) to see if your question has not been answered before. Write your questions on a separate sheet if they are to be sent to this magazine with a subscription or an order. Isometric sketches outside of those appearing in the RADIO AGE and the ANNUAL are not available. We will print popular circuits in isometric form from time to time. Write your inquiries on one side of the paper only; don't forget to enclose a stamped addressed envelope, and make them as brief as possible. We'll both save time that way, and you'll get your answer sooner. Address all your inquiries to RADIO AGE, Inc., Technical Office, Room 730—510 N. Dearborn St., Chicago, Ill.

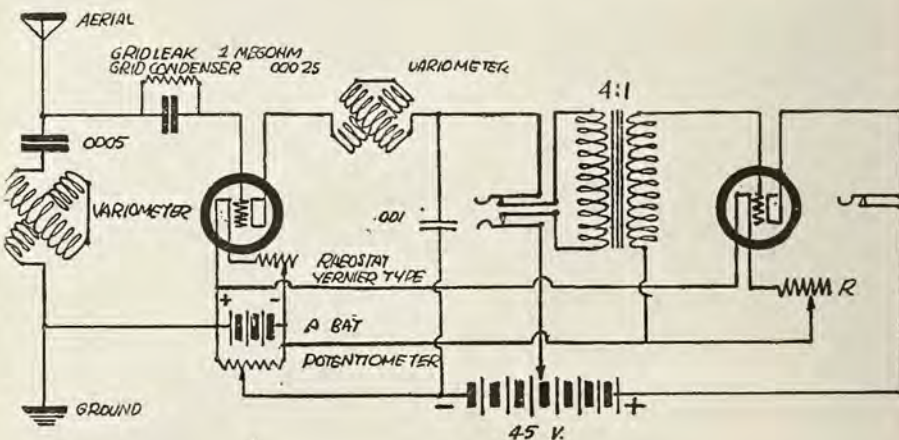
Now, let's go!

C. S. Chicago, Ill.

Question: I made the Rosenbloom Circuit which was printed in the January issue of the RADIO AGE. I have received good results with respect to vol-

ume, but have not received distant stations. This does not bother me, however, as I am not interested in reception. The volume is so great that I think if I add one tube I could get at least the local stations on a loud speaker. Kindly show how this addition is made.

Answer: Inasmuch as so many fans are asking for this circuit amplification, I am showing in Figure 1, the proper connections for the addition of a one stage amplifier.



N. C. C., Ogden, Utah

Question: In your February issue of RADIO AGE, on pages 27 and 28, there are instructions on the making of a home made battery charger. This battery charger calls for a solution of phosphate of ammonium. Could not this be substituted for by common borax? How many lamps of what wattage should be used on a 6 volt storage battery? Can this rectifier charge B batteries?

Answer: I have used common household borax for rectifiers of this type myself, and would say that while the phosphate of ammonium (chemically as pure as procurable) is more desirable, the borax will do the work. The mixture should be made with distilled water only. The number of lamps used is to be determined on how fast you wish to charge your battery. It is not a wise policy, however, to overload the cells, as they will only overheat and boil. The more

lamps used, the more current is passed, and consequently the faster your battery will charge. Would suggest that you start out with two lamps of about 60 watts apiece. Remember that it requires about 1.33 amperes current to put 1 ampere back into the battery. The charging of a battery with the Noden valve is a slow but effective method of charging your battery, so don't be impatient if the charge doesn't show in the hydrometer at once. The rectifier can be used to

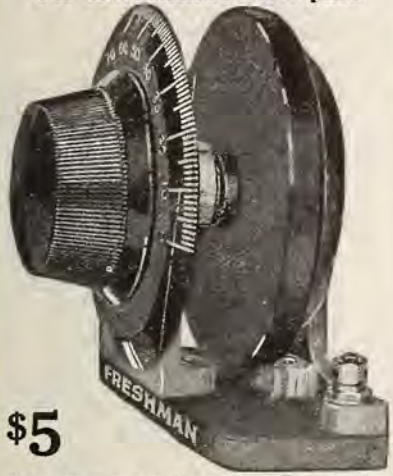
charge the B batteries, but smaller lamps should be used in the circuit so a less current is passed through the unit. The trouble with the fellows using this charger is that they think that the higher the number of lamps used the smaller the charging current. Be sure that the plates are well polarized before connecting the battery to the DC terminals.

J. J. H., Chicago, Ill.

Question: My neighbor has a key transmitter, and keeps the thing buzzing from 4:30 to 1:00 a. m. I would like to know if there is any way that I could stop him from transmitting. I have tried your best wave traps, but that will not kill the interference. I would appreciate hearing from you.

Answer: If your transmitting neighbor sends during the voluntary quiet hours (from 8 to 10:30) we would suggest that

**"FRESHMAN SELECTIVE"
VARIABLE CONDENSER
For Transmission or Reception**



\$5

It is the only variable condenser the plates of which vary in area—an engineering feat never accomplished before—making it most efficient for fine adjustment and selective tuning.

The "Freshman Selective" is attractively compact, quiet in operation and will withstand 5,000 volts without leakage or danger of short circuiting.

.003 m. f. (equivalent to 17 plate)
.005 m. f. (equivalent to 23 plate) **Each, \$5**
.001 m. f. (equivalent to 43 plate)

At your dealers', otherwise send purchase price and you will be supplied postpaid.

Ask your dealer or write for our free diagrams of Neutrodyne, Tri-Flex, Kaufman and other good circuits.

Chas. Freshman Co. Inc.
Radio Condenser Products
106 SEVENTH AVE. NEW YORK

you report his case to the Central Division Manager, American Radio Relay League, Mr. R. H. G. Mathews, 332 S. Michigan Ave., Chicago, Ill. If he observes the quiet periods, and transmits at other times there is nothing that you can do except ask him to co-operate with you, and if he is a *real* radio man he will be glad to do so, providing you don't ask him to stay silent all the time

W. M. E., Mansfield, Ohio

Question: In the February number of RADIO AGE I noticed your drawing of a home made battery charger, and have built one. I gave it 10 hours' work on the forming of the plates. Used 4 one-quart jars, 2 lamps and was very particular in the wiring of same. Have used 2½ pounds of ammonium phosphate, and have tried it out. It fails to put any charge in my battery at all. Can you give me any suggestions as to what I should do? The charger cost me \$3.02 to construct.

Answer: I would suggest that you use lamps of higher wattage to pass more current through the rectifier. You do not say what amperage your battery happens to be, but we would suggest that if it is one of the large type of storage batteries that it would take quite a long time to charge it if it is completely discharged. No other chemicals are needed, and if you have followed out the instructions, you should get results.

J. V., Chicago, Ill.

Question: Please send a hookup and all the data that can be obtained on the miniature receiver, built by Raymond Chassevent. Your magazine is great.

Answer: The photograph you mention was taken by our New York photographic service. For information concerning any of the photographs which appear in RADIO AGE which have the notation under them "Kadel & Herbert" we would like to suggest to you and others that you write these people direct at Kadel & Herbert, 153 West 42nd St., New York City, N. Y., for information. On other news items and features, your inquiry direct to this office will be forwarded to the source.

R. B., Racine, Wis.

Question: I have built an Eliminator as described in the January number, and I am experiencing a little trouble with it. It works quite well when connected in the aerial, but when connected across the A and G posts of my receiver, I cannot get a thing through the set. It cuts out everything. What is the reason for this?

Answer: I would suggest that your trouble lies in the fact that you are not tuning the Eliminator properly when you use it as an acceptor. The filter when used across the antenna and ground posts as shown in Figure 9 of the January, 1924, issue should be *tuned to the wave you desire to listen to*. The filter acts as a trigger, figuratively speaking, and pushes the desired signal into the set, while all the other frequencies are passed



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in RADIO**

THE amazing expansion of Radio has opened up hundreds of wonderful new positions on land and sea. Big salaries, fascinating, easy work, short hours, and a wonderful future are offered to ambitious men who get into Radio now.

Take advantage of these wonderful opportunities to step into a big paying position in this great new field. Radio offers you an opportunity to travel and see the world, with all expenses paid, and a fine salary besides. Or you can stay at home and work up to a position paying up to \$10,000 a year. One of our recent graduates secured a position one week after graduating, paying a salary of \$300 per month. Hundreds of others report equal success

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Thousands of Certified Radio-tricians are wanted to design Radio sets; to make new Radio improvements; to manufacture Radio equipment and to install it; to maintain and operate great broadcasting stations and home Radio sets; to repair and sell Radio apparatus to go into business for themselves; to operate aboard ship and at land stations.

You can easily and quickly qualify in your spare time at home through the help of the National Radio Institute, first school to teach radio successfully by mail, established 1914. No previous experience or training needed. Prominent Radio experts will help you. Free, with course—circuits and parts for building latest receiving set, also three instruments loaned to students, making the work thoroughly practical. The same plan that has already helped hundreds of our graduates to real success and real money in Radio is open to you.

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Clearer tone, greater volume, increased distance and selectivity guaranteed or your money refunded! Improves any set, tube or crystal. A laboratory product, with capacity, resistance and strength calculated to give better results.

Try It Without Risk! If your dealers cannot supply you, order direct from manufacturer, enclosing price. 100-foot length most generally used. Money-back guarantee protects you.

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Cards: Red call, black printing.
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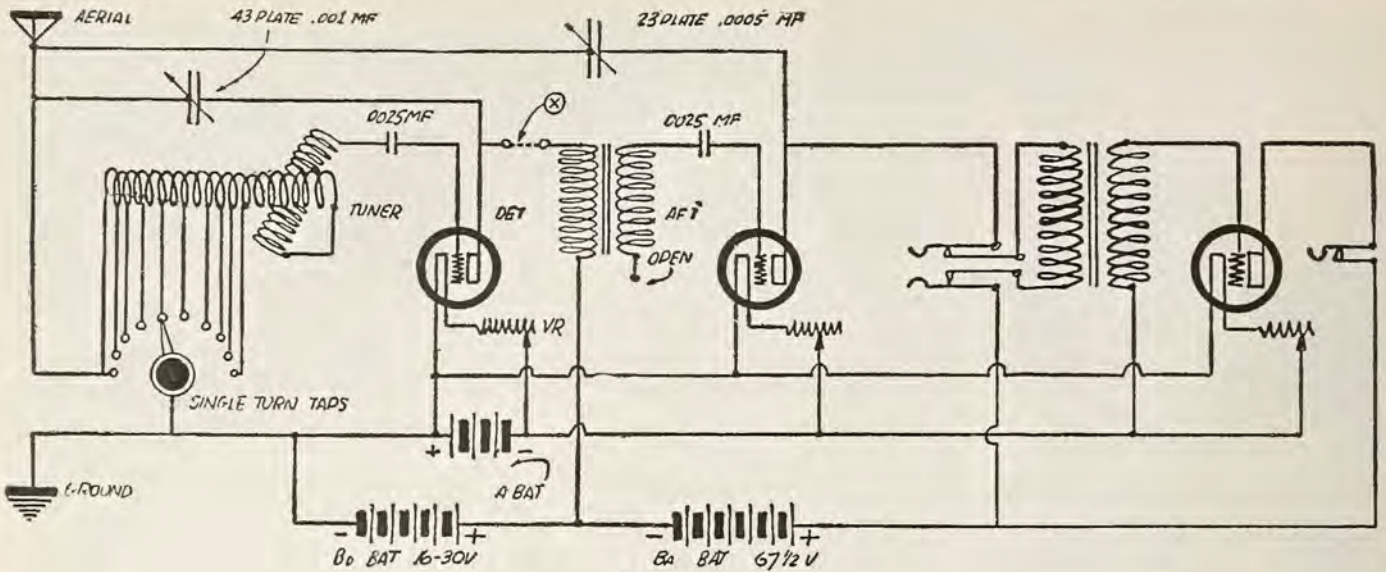


Figure 2.

off to the ground without entering the tuner.

B. J. G., Ostego, Mich.

Question: Kindly let me have some information regarding the super-heterodyne. If the first detector and oscillator tubes reduce the signal to audibility, what is the duty of the second detector. Also kindly tell me if a fully charged battery will discharge into a half charged battery when connected in parallel, the half charged battery being in the circuit.

Answer: You apparently do not understand the action of the super-heterodyne receiver with regard to the method of handling the signals and their rectification. In a super-heterodyne receiver, the incoming frequency is merely modulated or changed in frequency by the action of the first tube. The oscillator frequency is then superimposed upon or added to the frequency of the incoming wave, which is by no means audible. The two frequencies result in what is known as a "beat" frequency, the difference between the two, which is much lower in number of cycles, and which is by no means audio frequency, usually being around 60,000 cycles, which is much above the range of

the ear. This beat frequency is passed on to the intermediate or radio frequency amplifiers, and is amplified. Amplification can be carried on more readily at higher wave lengths (lower frequencies) in radio frequency because there is less possibility of tube oscillations, and electrical losses caused by the use of these high frequency oscillations. When the signal has been put through the radio amplification factor of the receiver, it is passed on to the second detector where it is rectified and brought down to within range of hearing. If your ears were sensitive enough to respond to a frequency of 60,000 cycles, you would not need this second detector, but unfortunately we're not built that way. I would not recommend that you connect a charged and half charged battery in series, because electricity always seeks its own level in the same way as water, and the efficiency of the two would not be as great, due to the fact that the half charged battery really would act as a resistance.

V. P. M., Holyoke, Mass.

Question: In the February issue, you publish a new permutation for the Reinartz circuit under the title "Reinartz Audio Regenerator." I am tearing down

my old Reinartz circuit to try out this new receiver, and am wondering if you could furnish me with a little additional information. I would like to install an additional lamp in this circuit, and would like to have you print a diagram showing how this is done.

Answer: I am printing in Figure 2 a circuit diagram showing how another tube can be added to the Regenerator as published in the February issue.

R. L. G., San Angelo, Tex.

Question: Please send me a spark transmitter hookup of a set that I could use on a ranch, with a source of power from storage batteries.

Answer: I am sorry to inform you that RADIO AGE does not handle transmitting questions, and would refer your inquiry to the American Radio Relay Leagues periodical QST at Hartford, Conn. We feel that this organization and publication amply covers the field of radio transmission, and do not desire to devote space to transmitting problems outside of general interest in RADIO AGE.

L. R. K., Bethlehem, Pa.

Question: I am about to build the

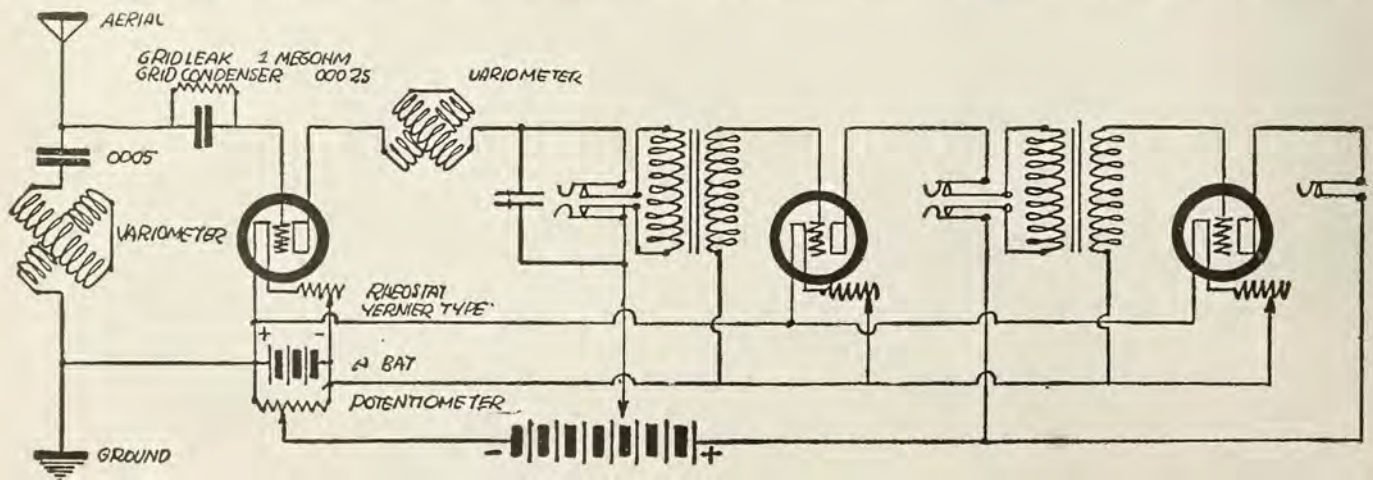


Figure 3.

super-heterodyne described in the March issue. Kindly advise me if No. 22 DCC wire would answer for the silk covered in the oscillator coils. I also find in my town that a .00015 MF condenser is hard to get. Will a .00025 condenser answer as well? Is it necessary to shield the panel?

Answer: The DCC wire can be substituted for the silk covered without loss of efficiency in the coils you mention, but it is necessary to carefully observe the condenser capacities as specified to get the best results. Stick closely to the specifications. If you observe the precaution of connecting the rotary plates of the condensers in the circuit to wires of ground potential shielding will not be necessary. By ground potential, I mean that the rotary plates of the condenser in the secondary and oscillator circuits should be connected to wires that do not go to the grids of the tubes. If this is done, no shielding is necessary.

K. W. M., Chicago, Ill.

Question: In your article on an "Inexpensive Battery Charger" appearing in the February issue, you mention a toy transformer. May I ask what this article is, and where it may be obtained, and under what name? How often does the solution of the charger have to be changed?

Answer: The transformer specified should be of the type used to operate toy electrical trains and motors; one with a variable voltage control switch mounted thereon, to enable you to control the input voltage to the rectifier. These transformers can be obtained at practically any electrical or hardware store, under various popular trade names. The primary is connected directly to the 110 volt source, while the secondary is connected to the rectifying jars.

D. C. T., Warren, Ariz.

Question: I have constructed a Reinartz Receiver (single tube) and have had some very good results, as Chicago and stations come in fine or rather did until a few days ago when a scratching and crackling in the phones at times completely drown out the signal. I am using a Bradleystat, but find it very critical to reduce the whistling and still hold enough volume to enjoy the programs. I neglected to say that Chicago is about 2500 miles distant. I am using a WD 11 tube on this set. Kindly tell me if a UV 199 could be used to more satisfaction, or if a 6 volt battery would give very much better results. Please give me your opinion about the noise in the phones. I am enclosing a diagram which I wish you would pass opinion upon and advise me if it is a good hookup for DX work. needless to say I am very much pleased with your magazine, especially the treatise on the Reinartz which found me a ready and eager reader. Also wish to thank you for your help in this case and all others.

Answer: Your limitations are without doubt caused by an incorrect value of grid leak, an important matter in the operation of vacuum tubes at their highest efficiency. Would suggest that you experiment with different values, starting with

A NEW CONDENSER



A variable condenser of an entirely new construction has been invented and developed by the Chas. Freshman Co., Inc., New York City. It has long been conceded by the foremost radio engineers that a variable condenser with mercury plates and a mica dielectric would be the most efficient and compact condenser made. This can be readily understood, as the mercury plates make very intimate contact with the mica dielectric. The inventor has not only achieved this fact but has also evolved a construction wherein the plates of the variable condenser actually vary in area. This is an engineering feat never accomplished before and is the basis of the patent application.

The dielectric is a heavy piece of India rubber mica and the housing is made entirely of bakelite. The variation in capacity is accomplished by

rotating the entire structure on two shafts, which act as the terminals. The reservoir or chamber, which contains the mercury, is at the extreme lower portion, when the condenser is set for zero capacity. As the condenser is rotated, the mercury rides out of this reservoir into a thin circular chamber about one-sixteenth of an inch thick, forming a thin wall of mercury, which increases in size, until the reservoir is at the top part of the casing. At this point maximum capacity is attained, due to the fact that you have a complete circular plate of mercury which is opposite to the circular plate of mercury on the other side of the mica dielectric.

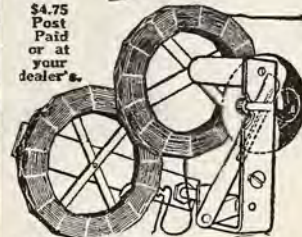
The workings of the condenser furnish a complete circular metallic plate, giving practically twice the capacity ever attained before in the same space, whereas in all other types of condensers only semi-circular plates are used.

In the official tests of the Electrical Testing Laboratories, 80th Street and East End Avenue, New York City, the condenser was found to withstand a voltage of 8,000 volts and to have a phase angle loss of less than one minute—the actual loss being too small to be measured accurately.

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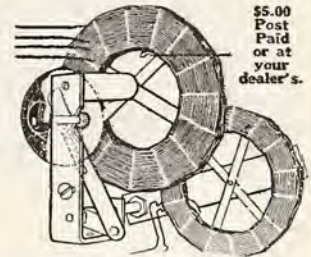
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Name

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HOLLANDER HEARS WGY ON ONE TUBE

Imagine yourself in a country where it is practically impossible to obtain a bit of CW equipment, and added to this, a law prohibiting amateur transmission. So it is in Holland, where amateurs must be content with listening in, and hoping for better times. Our photo shows the neat and efficient lay-out of J. C. Nonneken, who with his three sets has heard the signals of the Americans, using only RF and detector. WGY has been repeatedly received on one tube. Mr. Nonneken has heard from law, 1BCG, 1BCT, 2SZ, 2TJ, 3BT, 8TT, 8ATB, 9APE and Canadian 1AR and 3XN. With two AF stages many are heard clearly through the loud speaker. In the background to the left may be seen a set using 2RF and detector, regenerative, with tuned primaries. Philips double-grid tubes are used employing six volts on plate. In center, the "Marine" receiver built by Netherlands Radio Industrie. Lower cabinet contains tuning apparatus, upper cabinet controls and plate variometers for oscillation. All inductances are either bankwound or wound in slots. The little set at right is the one on which most stations are copied. It is a short wave type using Corona coils (also mfg. by N.R.I) and this is the set that consistently brings in WGY on one tube, when conditions are not too bad. Generally the standard 3-coil circuit is used.

about 1 megohm, and increasing the resistance to as high as 7. The correct value once found will not need readjustment until another tube is substituted. If the signal sounds mushy, and difficulty is experienced in getting the tube to oscillate, it is usually due to too low a grid leak resistance, and if the tube knocks, screeches or whistles, and difficulty is experienced in controlling the spill-over it may be remedied by decreasing the value of the leak. A potentiometer used as described in the Pickups Section is also of great assistance in controlling spill-over of tubes. The circuit you submitted is a good one for long distance if good apparatus is used, and the set is properly operated. However, if you mistreat it, and operate it incorrectly, you are likely to cause trouble, as it re-radiates quite violently if permitted to do so by incorrect operation. You do not mention how much B battery you are using, but I would suggest that you try voltages from 16 up to 30 on the plate, in an effort to find which

is the most effective working potential. The UV 199 and WD 11 are about the same in volume, with the exception that I prefer the WD 11 as detector. A six volt battery will without doubt be more desirable, due to the fact that louder signals can be obtained, and easier operation can be effected. When using a UV 200 as detector, a low value (about .75 megohm) grid leak can be used to advantage. These tubes are softer, and do not operate with high resistance leaks to good advantage.

J. F. R., Brooklyn, N. Y.

Question: Will you kindly print a circuit diagram of a two step amplifier in the next issue of RADIO AGE showing how two stages of audio amplification are added to the Rosenbloom circuit? Your Rosenbloom is a wonder.

Answer: I am showing the connections in Figure 3. The connections are made the same as in any other circuit.

W. R. M., Richmond, Ind.

Question: Will you please advise if there is any regulation concerning the use of spark sending sets?

Answer: I would not advise that you invest your time, money or efforts in the construction of any transmitter using damped (spark) waves for transmission, as they are considered obsolete, and a nuisance. There exists no regulation on spark other than public opinion and the feeling that spark sets are selfish because they hog the air when in operation. Spark sets in amateur hands are not allotted waves over 176 meters can operate with only 1 KW of input power. Even the ship stations are changing over to CW (undamped) waves. Would suggest that you refer to QST the amateur radio periodical dealing with transmitting problems, and get the information on the construction of a good low power tube transmitter (they actually cost less than spark) and save yourself the trouble of causing interference to broadcast listeners.

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DX stations you never heard before and silent tube operation is yours with a Filkostat in any hook-up, using any type of tube.

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Saving Micro-Watts

One of the indications of the progress of the radio art is the increased attention which is being paid to the design of the individual parts which are used in radio receiving sets. Until quite recently most of this care was focused on the design of the coils and condensers alone. However, it is now realized that there are mile-wasting losses in poorly designed tube bases, tube sockets and other parts, as well.

A modern fairly efficient radio receiver will receive signals which have as low a pressure as .001 volts. Even in a very good antenna this will not produce an energy of more than .0000001 watts. It is hard to imagine such a small quantity of energy, but forty million, receiving sets would produce just about power enough to light one ordinary 40-watt tungsten light.

The oldest manufacturer of vacuum tubes has recently greatly improved its product by eliminating the traditional metal shell which surrounds the base of their tube. This change reduces the internal capacity of the tube and at the same time eliminates the losses from eddy currents in the metal shell itself. While the saving of power thus accomplished is quite small when expressed in figures, it becomes of importance when compared with the minute currents received on the antenna.

Second only in importance to the vacuum tube itself, is the tube socket, for all the energy must pass through the socket before it reaches the tube. Indications are that the metal shell socket will soon become obsolete as the single slide tuning coil. The best radio engineering practice of today calls for the elimination of as much material as possible in the neighborhood of the parts of the radio set which carry the radio frequency current. This applies not only to metallic substances, but to insulating materials as well. The socket of the future will undoubtedly consist merely of a comparatively thin shell of some high grade insulating material, and a base only sufficiently large to accommodate the necessary contact springs and connecting posts.

Some manufacturers are already marketing sockets of this type. The necessary strength and durability is being secured by the use of Bakelite or similar material of uniform cross-section which assures thorough curing of the material, giving it the highest possible dielectric properties, as well as making it strong.

A further interesting fact that has been developed through research conducted by one of the largest battery manufacturers, is, that the "hissing" and "frying" noises often attributed to B batteries are, in reality, caused by poor connections, usually between tube terminals and the socket contacts. Their research shows that there are no noisy B batteries.

To prevent such noises and the shortening of many otherwise good concerts there are manufacturers who have not only provided sockets with the high insulating properties but have devised contacts that are of a wiping nature with dependable tension for each and every type of tube.

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New edition just off the press! The greatest book on radio ever written. Price only \$1. Filled with sound, practical, tested information for every radio fan, from beginner to hard-boiled owl. Written, compiled and edited by radio experts of national reputation.

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The two magazines, together, cover the radio field.

"QST" is the official organ of the American Radio Relay League. It is devoted entirely to amateur radio and is a standard publication on technical facts connected with radio.

Radio Age is in the front rank as a magazine for the set maker and the broadcast listener. It is the hand-book of thousands of experimenters in home workshops.

Best isometric drawings of standard circuits; clearly written, **complete** descriptions of construction details; complete corrected list of broadcasting stations **revised each month**; news of latest developments in radio; calls heard by amateurs; new designs and equipment; scientific data. All this for \$3.00 a year.

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Corrected List of U. S., Cuban and Canadian Broadcasting Stations

Table listing broadcasting stations with columns for call letters, station name, address, and city/state. Includes stations like WABM, WABN, WABP, etc., up to WHAM.

Body Capacity
(Continued from page 16)

ground. Figure 3 shows the arrangement with a three circuit tuner where a separate ground (g) is run from the (-A) line (Dotted). The stator (S) and rotor (m) of the condenser (C) are connected as before.

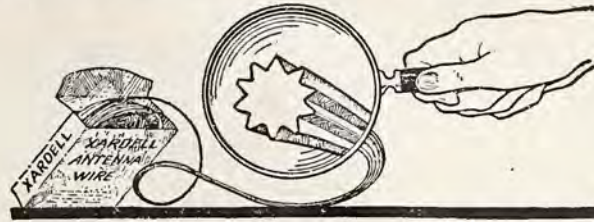
One of the gravest charges against the common type of multiplate rotary condenser is the connection of the shaft to the rotor plates with the consequent distribution of the plate potential in the front of the panel. The book type condenser with two small plates mounted on hinged plates of insulating material is free from body capacity effect. Further, the inherent capacity or initial capacity of such condensers is low and they can be reduced closer to zero capacity than the multiplate type. It is a wonder that more attention has not been paid to the development of the book condenser or equivalent types where the shaft does not form a part of the plate system or circuit. The Crosley book condenser is an extensively used device on the "store made" Crosley sets, but has not received the interest from home builders that it deserves.

Protection against phone cord capacity is had by means of a flexible wire shield around the cord conductors or by a third conductor woven into the cord and running parallel to the conductors. This shield or third wire is then grounded, and hence does away with the greater part of the capacity effect in this part of the circuit. At least one head set maker provides shielded cords as a regular part of his equipment. The home mechanic can wrap fine copper wire in the form of a coil around the outside of the cord to form a shield. One end of this coil is connected to the metal of the ear pieces while the other end is connected firmly to the ground post or to some other part of the circuit which is connected directly to the ground post. This shielding will prove quite a relief with Ultra-audions or similar circuits.

There is a little trick in tuning a set which often affords relief when one has not the time to make the necessary changes in the circuit, and while it is not always convenient yet the method reduces body capacity in the control system. Place the left hand in firm contact with the metal of the ground post or ground wire, and tune in with the right hand on the dial. When the station is tuned in, first remove the right hand from the dial and lastly remove the left hand from the ground post. By this procedure there is no change in the capacity conditions at the dial since we approached and left the dial at ground potential in both cases. Be sure that the hand is removed from the dial before you let go of the ground. This is not infallible, but it works in many cases.

Another stunt of the same sort is to place thin metal strips on the inside of the ear pieces so that they come into contact with the ears when the phones are put on. The strips are then grounded, and hence your body is also grounded as long as you wear the phones.

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Designed for long distance reception and is different and better than the usual make-shifts, being hard drawn from the finest copper, having a corrugated surface with ten collecting points on the circumference. This gives a greater collective surface to the high-frequency radio currents. The result is extremely sensitiveness and increase in range and clearness of any set from the simplest Crystal to the finest multiple tube receiver.

Use this antenna wire and enjoy the full possibilities of your set.

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Corrected List of U. S., Cuban and Canadian Broadcasting Stations

Table listing U.S., Cuban, and Canadian broadcasting stations with call letters, station names, and locations.

Canadian Stations

Table listing Canadian broadcasting stations with call letters, station names, and locations.

Cuban Stations

Table listing Cuban broadcasting stations with call letters, station names, and locations.

Turning On Our Loud Speaker

IT MAY be of interest to our readers to know that in every mail delivery that RADIO AGE gets...

Many contain not only a genuine expression of gratitude but they are crowded with interesting radio gossip.

Here is one reader who gets RESULTS. I am an ardent supporter of your wonderful magazine, RADIO AGE...

I am now contemplating the addition of two stages of amplification,

and hope to add to both range and volume of the set.

Respectfully yours, STEPHEN MOLNA, 420 Squire St., Cudahy, Wis.

And another writer who gets results from one of RADIO AGE'S hookups:

I am a constant reader of the RADIO AGE, and if I did not buy it each month, I would think I lost something valuable in my personal belongings.

Why I am writing this letter is because I want to tell you about the "Baby Heterodyne" set of February's issue.

The set does just as your publication said it does. On 25 feet of aerial wire consisting of No. 26 DCC...

feet of No. 26 DCC strung from dining room to kitchen.

Here's what I did in a friend of mine's house a block away. He has a two-variometer, variocoupler set with 2 stages of AF amplification.

I stood my "Baby" on top of his set and connected it to his two-step amplifier, and we got all the above stations and 6 or 7 more without ground or antenna.

I can tune out stations either with the antenna or without it, and I can entirely eliminate WJZ from WJY and WHN from the rest.

Very truly yours, RICHARD SHY, 253 W. 68th St., New York City.

Please let me congratulate your Mr. Anderson on his splendid article in February's RADIO AGE on audio regeneration, as applied to the Rei-

nartz tuner. It not only contains a good bit of information, but also has the real working principle. I applied this to the old Reinartz and can say that it increases the distance and audibility by at least 50 per cent.

In all experimental work, I use either WD 12 or UV 199 tubes. In trying your hookup of audio regeneration I reached Los Angeles, Calif., and was on their concert from 1:22 a. m. until 1:28 (EST). This principle has been tried out on other regenerative receivers but has not given the results.

Instead of using the variocoupler I used the old "spiderweb" in this test as I believe it more selective. For instance, I tuned out WJAX in Cleveland (390) and tuned in on Los Angeles (KHJ) (395). If the modifications I've made in the old set continue to give equal results in further tests, I will be glad to send you my complete hookup for the interest of your readers.

CLARENCE B. GANNON.

1713 Ensor St., Baltimore, Md.

A coast to coast reception on a test for a set is certainly not poor receiving. Another fan from Michigan has also been doing coast to coast work. The following testifies:

Some time ago, in about December, you have sent me a hookup for a Reinartz with one stage radio frequency. I have had, and am having, some wonderful success in results. I experimented in various ways and connections and found that when the secondary of the radio frequency was coupled to the middle arm of the potentiometer, instead of the negative A as called for, it gives exceptional higher results. The machine is more sensitive, more far reaching and more easily tuned.

The volume and clarity of tone, I must admit, has not yet been equaled, in my estimation, to numerous high priced machines, that I have personally operated and heard. I am using a UV 200 for detector and UV 201 A for amplifier. I have wound my own coil entirely a different way from from what the regular directions called for in the Reinartz.

I am able to bring in stations from 175 meters to 600 and over if necessary. I have listened to every principal transmitting station in the U. S., from coast to coast, also including several stations in Canada. I have on a loud speaker the volume from New York to Atlanta, Georgia, Fort Worth, Texas, comes in with remarkable loudness; in fact, a person not knowing that it was a radio would believe that the original orchestra or singer or speaker were within the house.

I am writing you this fully appreciating your valuable assistance, and expressing my thanks to the RADIO AGE in initiating me as a radio fan.

I remain, very sincerely,
J. J. DREY.

Care J. J. Drey Co., Iron River, Mich.



"The Loveliest Thing I've Ever Heard Over the Radio"—Mary Garden

Only the most flawless reproduction, free from distortion and parasitic noises, could earn a tribute so unreserved from America's queen of song.

The exquisite tone quality and purity of Duo-Reflex reception that appealed so irresistibly to Miss Garden is finding equally enthusiastic appreciation in the homes of super-critical radio lovers everywhere.

Not only in sheer tonal perfection, but in range and volume, have Erla Duo-Reflex receivers demonstrated decisive superiority. Tube for tube, they are the most powerful receivers known.

Complete Erla parts, including celebrated synchronizing radio and audio transformers that enable vacuum tubes to do triple duty, guarantee success to the amateur who "rolls his own." Easily understood blueprints guide every step of construction and assembly.

Ask your dealer for free Erla bulletin No. 20, giving latest Erla one, two and three-tube diagrams, or write direct, mentioning your dealer's name.



Increased range and volume, as well as elimination of distortion, follow installation of Erla transformers. Reflex and Cascade types, \$5



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"Comet"

B BATTERIES

At all good radio stores or write

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Your Radio Problems Solved for 30 Cents in Stamps

IF YOU are constructing a receiving set, and you need help in the way of clear diagrams and full detailed descriptions you may have it by return mail.

We have laid aside a limited number of back numbers of Radio Age for you. Below we are listing the hook-ups and circuit diagrams to be found in these magazines. Select the ones you want, enclose 30 cents in stamps for each one desired.

We advise immediate attention to this as the stock of back numbers of several issues already has been exhausted.

May, 1922

—How to make a simple Crystal Set for \$6.

October, 1922

—How to make a Tube Unit for \$23 to \$37.
—How to make an Audio Frequency Amplifying Transformer.

November, 1922

—Photo-electric Detector Tubes.
—Design of a portable short-wave radio wavemeter.

January, 1923

—How to make a sharp-tuning Crystal Detector.
—Fixed condensers in home-made receiving sets.

May, 1923

—How to make the Erla single-tube reflex receiver.
—How to make a portable Reinartz set for summer use

June, 1923

—How to build the new Kaufman receiver.
—What about your antenna?

July, 1923

—The Grimes inverse duplex system.
—How to read and follow symbols.
—Proper antenna for tuning.

September, 1923

—Simple Radio Frequency Receiver.

October, 1923

—Your First Tube Set.

November, 1923

—The Super-Heterodyne.
—A Three-Circuit Tuner.
—How to Learn Code.

December, 1923

—Building the Haynes Receiver.
—Combined Amplifier and Loud Speaker.
—A selective Crystal Receiver.

January, 1924

—Tuning Out Interference—Wave Traps—Eliminators—Filters.
The article which was announced from stations WJAZ, WOC and WOAW.
—A Junior Super-Heterodyne.
—Push-Pull Amplifier.
—Rosenbloom Circuit.

February, 1924

—How to make a battery charger.
—Improved Reinartz Circuit.
—Interference rejectors.
—Single Tube Heterodyne.
—How antenna functions.
—Adding two audio stages to selective receiver which began as a crystal set.
—Superdyne receiver.

March, 1924

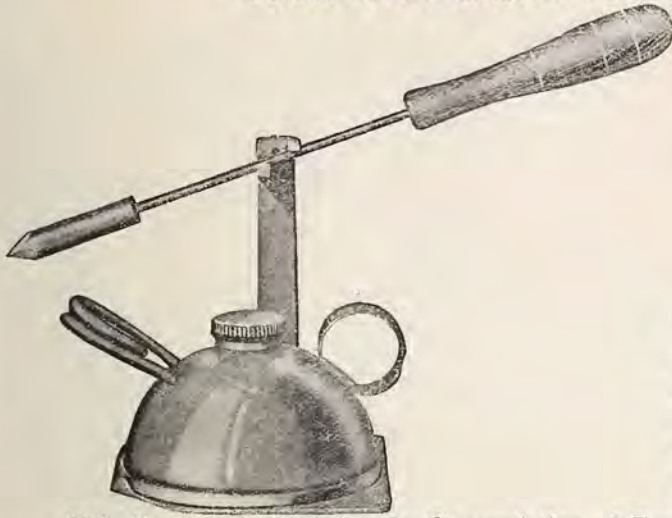
—An Eight-Tube Super-Heterodyne.
—A simple, low loss tuner.
—Junior Heterodyne Transformers.
—A Tuned Radio Frequency Amplifier.
—How to make the Kopprasch Receiver.
—Adding Radio Frequency to the Variometer Set
—Simple Reflex Set.

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So easy to construct that anyone who can handle a screw driver can build the set complete in a surprisingly short time—about 1½ hours. Everything is so simple and easy.

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The results from the Erla 3 tube is naturalness itself and cannot be improved upon. Actual size working diagrams make everything simple and easy. Every piece of apparatus and every wire is pictured in its exact place—every article needed is listed on the diagrams.

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829 Waveland Avenue, Chicago, Ill.

Dealers, Write for Quantity Prices

Always Mention RADIO AGE When Writing to Advertisers

Is Broadcasting Monopoly Possible?

IF THE American Telephone and Telegraph Company controls telegraph and telegraph wires throughout the United States, why cannot the company control rebroadcasting? All that is necessary, it seems, is to either refuse to permit the use of wires with which to transmit speech, song or music to the station desiring to rebroadcast.

There have been definite statements that the American Telephone and Telegraph Company seeks a broadcasting monopoly. The company has stations at New York, Washington and Providence, and these three stations were the only ones which broadcast President Coolidge's speech on Washington's birthday anniversary. Both broadcasters and broadcast listeners in the west and middle west complained loudly of this limitation of a national patriotic event.

One recourse for the independent broadcaster appears to be available. Through the use of equipment which will pick up broadcasts on one wave length and then retransmit it on another wave length it is expected that broadcasters at no distant day will be independent of the interests that control wires. More will be published on that subject later.

Newspapers all over the country printed the facts about the Coolidge speech incident. We reprint an article from the *New York Times*. Radio readers may judge for themselves of the justice of the complaints against the American Telephone and Telegraph Company and of the quality of their reply.

Following is the *Times* article:

"The complaint of Chicago radio listeners that they were barred from hearing President Coolidge's speech on Washington's birthday because the American Telephone and Telegraph Company quoted a \$2,500 price, which they called a prohibitive fee, for furnishing that service, was answered yesterday by William E. Harkness in charge of the radio division of the telephone company. He explained that the price quoted to Chicago was fixed on a cost and not a profit basis.

"The whole story is this," said Mr. Harkness. "Several weeks ago the Chicago Rotary Club announced to all its members that on February 22, if they listened at receiving sets they could hear the speech of the President broadcast all over the world. They then came to us and asked if we could arrange it.

"We informed their representative, I believe it was Mr. Treadwell, that it would be a physical impossibility to make the necessary connections to enable President Coolidge's talk to be heard in every part of the world. We did explain, however, that we had already arranged to broadcast the President's speech over practically all the states east of the Mississippi through three broadcasting stations—those at Washington, New York and Providence.

"Later they came back and said they wanted us to broadcast the President's speech also through Chicago. They asked

Hartford, Conn.—American operators report having heard thirty-seven European transmitters during the December tests in which Americans competed for prizes:

American prize winners have been announced as follows:

Grand Prize; Greatest Total Station Miles—R. B. Bourne, 1ANA, Chatham, Mass.
Group A: Greatest Mileage for Any Single Reception.
First—Norman S. Hurley, 5AC, Mobile, Alabama.....4750 miles
Second—William Moore, 9DES, Caney, Kansas.....4710 miles
Third—L. W. and T. E. Bryant, 4BL, Lakeland, Florida.....4540 miles
Fourth—Quentin Swigart, 9COL, Galesburg, Ill.....4310 miles
Fifth—Fred Marco, 9CD, Chicago.....4200 miles

Group B: Greatest French Mileage for Any Single Night.

First—Sheldon S. Heap, 1BDT, Atlantic, Mass.
Second—W. Coates Borrett, c1DD, Dartmouth, N. S.
Third—Lafayette College Radio Club, 3YO, Easton, Pa.
Fourth—Ed Scattergood, 3II, Cynwyd, Pa.
Fifth—M. H. Hammerly, 2BIS, Bronxville, N. Y.

Group C: Greatest British Mileage for Any Single Night.

First—J. L. Fenderson, c1AF, Jacquet River, N. B., Can.
Second—Bronx Radio Club, Bronx, N. Y.
Third—Robt. H. Sproul, 1GG, So. Hamilton, Mass.
Fourth—Richard S. Briggs, 1BVL, Dorchester, Mass.
Fifth—J. Van Riper, aAJF, Passaic, N. J.

Group D: Greatest Total French Mileage.

First—Levi G. Cushing, 1BCF, So. Duxbury, Mass.
Second—A. W. Greig, c1BQ, Halifax, Nova Scotia.
Third—R. W. Woodward, Hartford, Conn.
Fourth—Bernard J. Kroger, 3APV, Washington, D. C.
Fifth—Geo. H. Pinney, 1CKP, So. Manchester, Conn.

Group E: Greatest Total British Mileage.

First—A. A. Learned, Providence, R. I.
Second—A. R. Tabbut, Bar Harbor, Maine.
Third—Boardman H. Chace, 1BDU, Winthrop, Mass.
Fourth—Chester W. Sprague, 1AUC, Bar Harbor, Maine.
Fifth—Harold G. Riley, 1AUR, Livermore Falls, Maine.

us to quote them a price. Our figure was \$2,500. That was a cost proposition, not a profitmaking rate.

"We did not 'demand' an excessive rate from any other city that desired to broadcast the President's talk. We received an inquiry from St. Paul, Minn., desiring to know whether we would make them a low figure for broadcasting President Coolidge's speech. We advised them the cost of linking St. Paul to the broadcasting circuit would be prohibitive. That's all there was to it."

Radio Station Makes Charge

The Chicago complaint, which appeared in the *Brooklyn Eagle*, said in part:

"Chicago radio listeners were unable to hear President Coolidge's radio eulogy of George Washington last night because the American Telephone and Telegraph Company put a prohibitive charge on the use of a telephone wire between Chicago and Washington.

"This charge was made late last night over the air by the announcer of Station WJAZ, the Zenith-Edgewater Beach Hotel Broadcasting Station in Chicago.

"The cost of a ten-minute conversation between Washington and Chicago is about \$14. As President Coolidge spoke for fourteen minutes, the cost would be a few dollars more. We were quite willing to pay a reasonable fee for this service."

"Discussing the cost Mr. Harkness said: 'We have to disrupt all our normal

conditions and set up an entirely new service to broadcast. That can be done only when the normal service of the company is interrupted. We have to take certain circuits and disrupt them and set new circuits.

"Now to establish those circuits, special equipment has to be used. The installation must be done by special men. Special forces must be kept at all the repeating stations. In making the installations we have to wait until the lowest point of traffic of the day, which means after midnight. In turn that means that we have to pay our special men, who are high priced workers, for overtime.

"In undertaking to broadcast an important program we set up the circuits the day before. We must then take them out to make way for normal telephone service. When the time comes to broadcast we must put the circuits on again, and after the broadcasting is completed we must disrupt the special circuits."

1924 FORECAST

Did you dealers read what Roger Babson had to say about the radio business? His optimistic predictions deserve the greatest amount of consideration because he is known as one of the world's most noted authorities on business and financial conditions. Mr. Babson predicts that the radio business in 1924 will amount to more than \$350,000,000. You will reap part of this harvest of gold if you watch your "P's" and "Q's" carefully—Crosley Radio Weekly.

If You Sell Radio Merchandise By Mail

*Radio Age Covers the Continent.
183,000 copies printed and distributed
in the first three months of 1924.*

JANUARY.....50,000 FEBRUARY.....63,000 MARCH.....70,000

Radio Age is an applicant for membership in the Audit Bureau of Circulations, a fact that will interest advertisers who insist upon **verified** circulation.

Radio Age has wholesale distributors and news dealers in every important center in the United States and Canada.

Radio Age advertising produces results. National advertisers are signing up for time contracts. **They know.**

Rogers Radio Co., Pittsburgh, Pa., wrote us recently as follows:

"Enclosed please find check for \$2.50 to cover our February "ad." We received more inquiries from this "ad" than from the \$25.00 ones we have been running in (Here was named a magazine claiming to lead the field.) Therefore we want to run the enclosed "ad" in the next issue of Radio Age. We should have been in your January issue."

Advertising rates in Radio Age are based on 25 cents a line for 25,000 circulation. The rate is to be advanced to 40 cents a line, effective April 15, 1924.

Every buyer of Radio Age is a radio fan. The magazine offers a highly specialized circulation. Advertisers reach exactly the circulation they are paying to reach.

Can we send you a rate card?

RADIO AGE, Inc.

506 NORTH DEARBORN STREET

CHICAGO, ILLINOIS



Crosley Model 51
\$18.50

In 24 Days the Crosley Model 51 Became the Biggest Selling Radio Receiver in the World!

On Monday morning, February 4th, Powel Crosley, Jr., returned to his desk after a two weeks' hunting trip in Mississippi. He brought with him the idea of an entirely new Radio Receiving Set to be added to the Crosley line.

A short conference with his engineers followed. On Tuesday morning, February 5th, a model had been completed and tested. These sets were put into production immediately after the model was approved.

On Tuesday afternoon, February 5th, night letters were sent to the leading distributors of The Crosley Radio Corporation announcing this new model which had been called MODEL 51. Wednesday afternoon, the orders commenced coming in, showing the faith of the distributors in anything brought out by this Company. Announcements were made in leading metropolitan newspapers of the country

on Saturday and Sunday, February 9th and 10th. Shipments commenced about February 13th, and were immediately followed by an avalanche of complimentary letters and orders, and have increased steadily ever since.

Production started at 50 a day—was increased to 200—then 300—and on February 23th, just 24 days after the thought of this set had been put into being, the production reached 500 a day. Orders were received on February 26th for 1,115 of these sets—every effort being made to increase the production to 1,000 sets per day to supply the phenomenal demand for this new model.

This message was written on February 29th in the face of promises of an even greater record than is indicated here.

The demand for this set has not in any way lessened the sale but has increased the orders on various other models in the Crosley line.

Now what is this set that has made such an enviable record which in 24 days has, we believe, become the biggest selling Radio Receiving Set on the market?

It incorporated a tuning element made famous in the Crosley Model V, the \$16.00 set used by Leonard Weeks of Minot, N. D., in his consistent handling of traffic with the MacMillan Expedition at the North Pole; a genuine Armstrong regenerative tuning and detective circuit.

Now, to this has been added a one stage of audio frequency amplification. With the well-known Crosley Sheltran 9 to 1 ratio transformer, giving an unusual volume. Thus, this set uses two vacuum tubes.

It is the ideal all-around receiver. For local and nearby broadcasting stations, it will operate a loud speaker, giving phonograph volume in the home. Under reasonably good receiving conditions, it will bring in stations up

to 1,000 miles, with sufficient volume for the average size room.

When receiving conditions are bad, however, head phones should be used on distant stations.

This Receiver is unusually selective—it incorporates standard sockets so that all makes of tubes can be used. The various units are mounted on beautifully engraved grained panels, and mounted in a hardwood, mahogany finished cabinet, which completely encloses all parts and tubes.

A glance at this beautiful instrument sells it, and the results it gives creates many friends for it. Perhaps the most startling thing of all is its price—\$18.50. Add 10% west of the Rocky Mountains.

Licensed under Armstrong Regenerative U. S. Patent No. 1,113,149.

THE CROSLLEY RADIO CORPORATION

Powel Crosley, Jr., President

Formerly

The Precision Equipment Company and Crosley Manufacturing Company

463 Alfred Street

Cincinnati, Ohio

CROSLLEY
Better - Cost Less
Radio Products

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Please help in the preservation of old time radio by supporting legitimate organizations who strive to preserve and restore the programs and related information.