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RADIO AGE

The Magazine of the Hour

Established March, 1922

WITH WHICH IS COMBINED RADIO TOPICS

Volume 3

October, 1924

Number 10

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A Chat With the Editor

THE "BIG GAME" season for Radio has opened. Armed with better receiving sets, America's army of radio fans is prepared to go into the present season with more technical knowledge and ability and *real interest* than ever before. If radio had millions of followers last year, just imagine how many will follow its progress during the Fall and Winter of 1924 and '25!

RADIO AGE is not making an over-confident prediction when it forecasts the season which is getting under way with the coming of cool weather and the elimination of Summer static. Its optimism is based on hundreds of actual predictions from the fans themselves.

Thus assured, RADIO AGE is prepared to publish the sort of material the fans want.

We have arranged with some of the best known radio experts in the country to print their contributions during the coming months.

Armstrong Perry, known to a million Americans for his work in pioneering the radio field, is the latest addition to our technical staff. One of the most interesting and authoritative articles he has written begins in this issue. Frank D. Pearne, known to every radio fan in the Middle West, will be on hand monthly with the latest in radio hookups and theories, told as only Frank Pearne can do it. And John B. Rathbun, who draws the RADIO AGE blueprints, has a bag of surprises that will keep fans "fishing" with their sets long after the bedtime stories have signed off. Beginning with this issue, every conceivable kind of set from the simplest crystal and one-tube hookups to the most complicated "Ultradynne" will be given due attention.

There you have RADIO AGE'S promise for radio's biggest season. It is RADIO AGE'S ability to fulfill its promises to its readers that makes it a reliable radio magazine—and the *only* radio magazine that gives you \$5 worth of real blueprints in every issue—for 25c.

Frederick Smith

Editor of RADIO AGE



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RADIO AGE

The Magazine of the Hour

M. B. Smith
Business Manager

A Monthly Publication
Devoted to Practical
Radio

Frederick A. Smith
Editor

An Unusual Discourse on RHEOSTATS and AUDIBILITY

By ARMSTRONG PERRY

THE radio manufacturer and dealer have never yet given the radio user any definite method by which he can determine what apparatus gives the best results in audibility, so far as I can discover. Yet audibility—the amount of sound that comes out of the phones or loud speaker—is the thing in which the user is most interested.

Even my search for a unit of audibility has been unsuccessful, and I have learned that the "audibility meter" does not measure audibility. There is a definition, formulated by The American Institute of Radio Engineers, which states that "audibility is a measure of the ratio of the telephone current producing a signal in a telephone receiver to that producing a barely audible signal," and that "a barely audible signal is that which permits the differentiation of the dot and dash elements of the letter." In practical application, that definition works out like this:

I put on my Baldwin 'phones and bring in a signal that I can just hear. According to the definition, that is where audibility begins. Then I change, putting on the 75-ohm 'phone that I began with as a radio novice and that is of a type still purchased by some beginners. I find that audibility, with it, has not begun yet and never will begin on that signal with that 'phone. Next, I find an opportunity for an octogenarian friend to hear a concert brought in with six stages of amplification and a loud speaker, and I find that for him audibility does not begin even with that amount of sound and never will begin unless he hears through his false teeth like a man whose picture has been in the magazines. If ten stages of radio-frequency and ten of audio could just make him hear, then that would be the beginning of audibility in his case, according to the definition.

Need Basis of Comparison

IT ought to be possible to establish a basis of comparison such as vibrations of specified frequency and amplitude in a standard diaphragm. Radio users might not understand it, but it would give a

How the Radio Fan May Determine What Apparatus Gives the Best Signal Strength

manufacturer of a filament rheostat, for example, a chance to make claims that could not be criticized on the ground that some 'phones and ears were more sensitive than others. Anyone who wanted to pursue the subject could then refer it to an engineer and have the claims verified or disproved by actual tests.

Eventually, I ran across a manufacturer who had tested his filament rheostat with a view to finding out whether his device would make a radio user hear any better than he would if the receiver were equipped with a different type of filament control, but with all other parts and adjustments exactly the same. If his rheostat was not better than all the others, he intended to make it so.

How Tests Were Made

The tests were made by a physicist, F. R. Hoyt, who has a laboratory and all the equipment needed in radio experimentation. It cost the manufacturer a lot of money and he ran the chance of having to begin all over again after having spent two years in expensive development, but he said it was worth while.

With a copy of the report in my possession, I sought an interview with Mr. Hoyt. If there is one person whom Mr. Hoyt dislikes to meet, it is a newspaper reporter or a magazine writer. His latest invention, the phusiform circuit, was written up by a New York daily paper without his name being mentioned, which was the condition on which he gave out the story.

When I got to Mr. Hoyt, he disclaimed any desire to appear modest or retiring. He said that he disliked publicity and had avoided it merely as a business proposition. He is a scientist and has no organization through which he can capi-

talize public interest in his work. He has all the work he can do, is making all the money he wants, and does not want to be pestered by inquiring reporters and admiring letter writers who want to know whether his invention is going to revolutionize radio.

Mr. Hoyt confessed, when I asked him if there was a real unit of audibility, that he had never heard of one. That made me believe in him. Many experts, in dealing with a non-technical man who cannot trip them up when they try to duck a question that they cannot answer, will bring out something that they do know rather than to acknowledge that there is something they do not know. He went over his report with me.

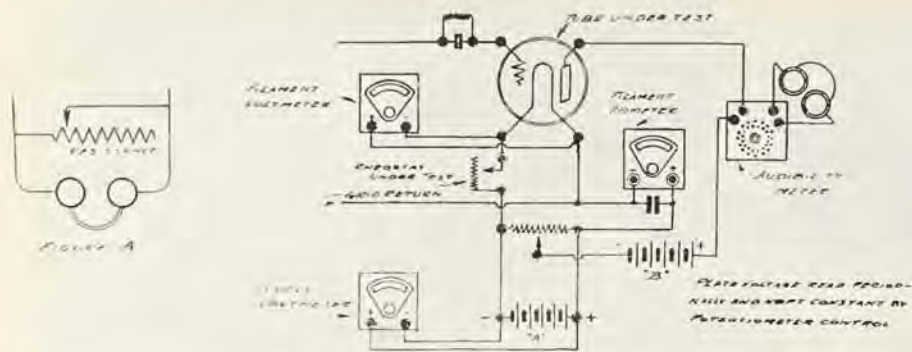
Circuit for Testing Audibility

FIRST, we examined the circuit with which he made his tests. (See diagram.) It can be used by anyone who wants to test for audibility. It consisted of a radio receiver—any type that employs vacuum tubes will answer the purpose—a filament voltmeter, a filament ammeter, a supply voltmeter shunted across the "A" battery, and an audibility meter, so-called, between the output terminals of the receiver and the 'phones.

The audibility meter maintained a constant impedance across the detector. If an audibility meter is not available, Mr. Hoyt says that a fairly accurate approximation can be had by shunting a variable resistance across the 'phones that will balance out the signal, and ignoring the impedance. He read the plate voltage periodically and kept it constant by potentiometer control.

For purposes of comparison he tested four types of filament rheostats, with three types of electron tubes. One of the other types that Mr. Hoyt tested employed graphite and mica; another employed discs of carbon and the third was the familiar wire rheostat. Four different kinds of wire rheostats were tested, but they all gave such similar results that their performances were reported under the name "wire rheostats" instead of being given separately.

(Continued on next page)



The accompanying diagram shows the meters, and apparatus, and their connections for testing out the current curves for maximum audibility. The meters across the A battery and tube socket terminals are used to measure the current and voltage going to and being consumed by the tube when the loudest signal value is obtained by adjusting the filament rheostat for the proper electron flow.

All of these rheostats carried satisfactorily a steady load of six watts without excessive heating. Two of the wire rheostats showed an appreciable increase in resistance when they became heated. The carbon disc rheostat showed a slightly decreased resistance under the same circumstances. These changes produced a voltage variation at the terminals of the vacuum tube and a corresponding change of audibility in the headphones.

Several of the wire rheostats showed slight mounting difficulties that might trouble a user who did not have the knowledge or the tools for adjusting them. The graphite and mica rheostat turned in its mounting bushing when the knob was turned forcibly enough to raise the filament voltage to the point of maximum audibility.

Some of the devices showed that the manufacturers had overlooked the value of convenient terminal facilities, evidently assuming that the amateur constructor could stand on his or her head, or tie himself in a bow-knot for the purpose of attaching the wires.

Is Filament Control Important?

EXPERTS have been telling me for a year or more that the filament rheostat should not be used for tuning purposes. They assert convincingly that if the filament voltage is once adjusted properly maximum audibility and freedom from distortion can then be obtained by adjusting inductance and capacity only. Fine adjustment, they say, does not affect the flow of electrons in modern vacuum tubes. My own experience is contrary to what these experts say and I have shamelessly twisted the rheostat knob whenever it did any good, though with a feeling that if I were as smart as the experts I could get results the same way they say they do. It pleased me, therefore, to find in Mr. Hoyt's report the following:

"Too little importance has been placed in the past on the precision necessary in the control of the filament voltage of vacuum tubes used in radio reception where efficient operation is the objective, and too much importance has been given to plate voltage regulation

by potentiometer control. Since the tendency toward the latter will of necessity obscure the desirability of the former (filament voltage control), and since potentiometer control of the plate voltage can in no way compensate for improper filament regulation, a brief discussion of these two forms of regulation will not be amiss.

What the Positive Does

"The vacuum tube used in radio reception functions primarily as a result of the ability of certain materials, when heated, to emit electrons—carriers of electricity—and thereby to permit a flow of current from the positively charged plate to this heated material or filament across the inter-electrode space. The positive potential of this plate determines the number of these electrons which it can attract per unit of time.

"This electron flow is generally referred to as the electron stream and determines the plate current. The operating efficiency of a radio tube depends entirely on the electron emitting properties of the filament or cathode material when heated, and the ratio between this electron stream or plate current and the filament energy required to emit the necessary electrons, is the measure of relative efficiency of the tube.

"It must be seen from the foregoing, therefore, that plate voltage regulation (control of electron attraction) can in no way compensate for inefficient filament voltage regulation (control of electron emission), and both are of tremendous importance to the efficient operation of the radio tube.

"The introduction of potentiometers having inductance into the plate circuit of a detector tube may bring about a regenerative action (feed back) and thus exaggerate (to the uninitiated) the importance of what they believe to be plate voltage regulation."

As I understand it, this means that you cannot pull through the tube any electrons that are not there, no matter how strong a pull you may have through the plate, and that the number of electrons in the tube will depend on how you control the pressure, called voltage, that pushes the electrons off the filament. The thing that controls that pressure

is the filament rheostat. So I shall continue to "tune" with the rheostat, even if the effect I produce may not be properly called "tuning," for what I want is more sound.

Results With Different Tubes

MR. HOYT tested the rheostats on three types of radio tubes, taking six stock samples of each type of tube and plotting his curves on the average of the tests. The typical tubes selected were: UV 200, a detector; UV 201-A and C 301-A, amplifiers (three of each); and the UV 199 dry cell tube.

The first tests were made with the UV 200. (See Curve Sheet No. 1).

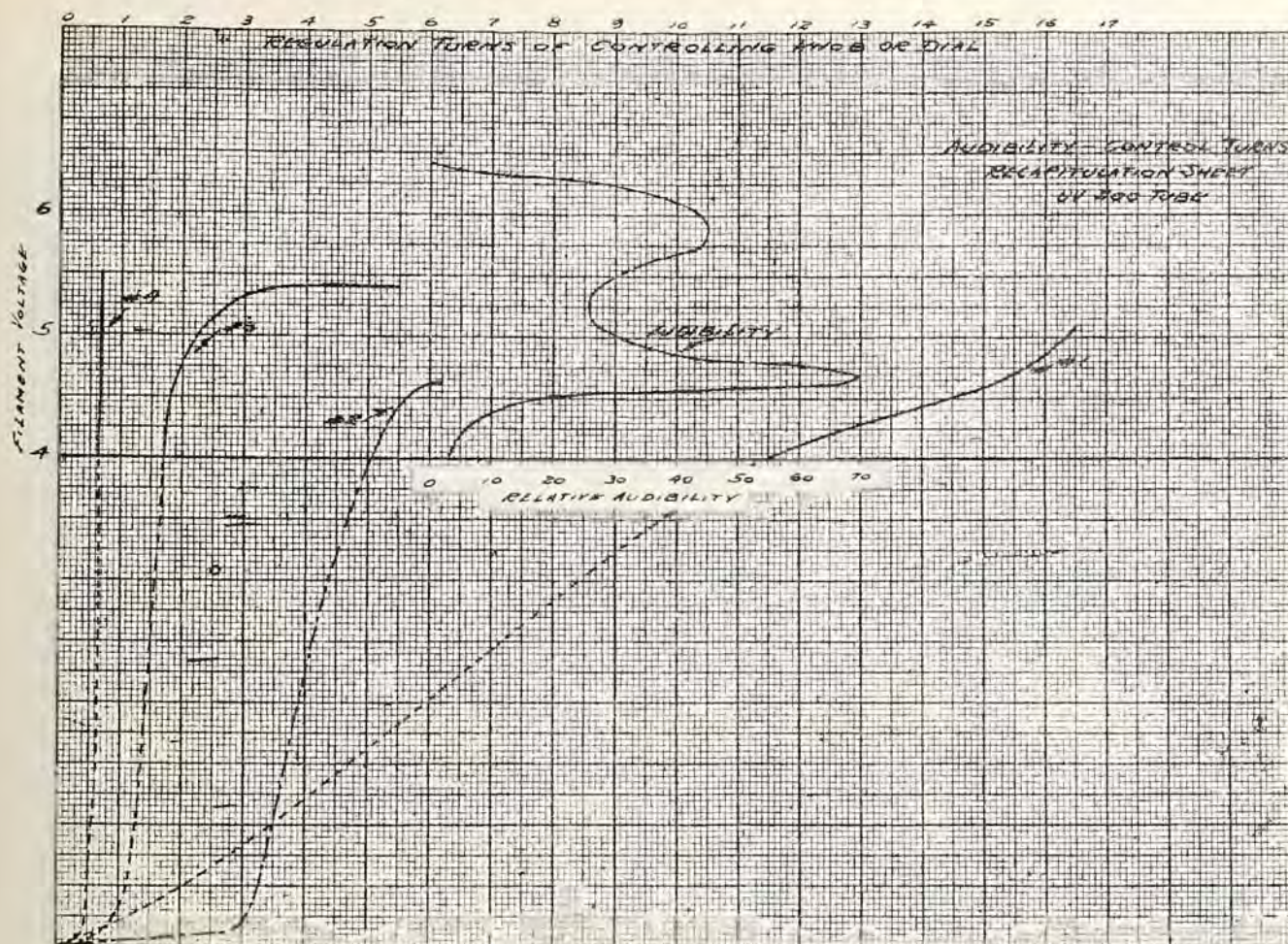
In making the curves, the voltage at the filament was indicated by figures at the left of the curve sheet and the filament amperes by figures at the right of the sheet. At the top, the numbers of turns of the rheostat knob are shown as related to the filament amperes; at the bottom the turns are shown in relation to the voltage of the filament.

The number of turns of the rheostat knob is important. The human hand is not sensitive enough to make minute changes with a knob that makes a very small number of turns, or only a fraction of one turn, in passing from the "off" position, in which no current should flow, to the maximum position, in which the entire battery voltage takes effect on the filament. It is a common fault, not only with rheostats but also with condensers and inductances, that the fine adjustments needed to bring in weak or distant stations cannot be made by a person of average temperament and experience. I have frequently passed a station without hearing it, even when turning a dial slowly and carefully, and discovered later that it could be heard distinctly if the tuning dials were placed in exactly the right positions.

In the tests the voltage and amperage of the filaments rose abruptly from zero to maximum, of course, with half or three-quarters of a turn of the knob of the ordinary type of wire rheostat, since it covers its entire range in that space. The carbon disc rheostat admitted a very small amount of current during the first three turns, then in three more turns it shot the voltage up to maximum. The rheostat using graphite and mica had a different tendency, sending the current to maximum values in the first three turns and showing practically no change during two and a half turns more. The rheostat employing carbon and metal, in powder form and under pressure from the beginning, raised the filament voltage and amperage gradually and evenly from zero to maximum while the knob made sixteen and one-half turns.

A Circuit Adapted to Tube

THE audibility obtained by using the UV 200 tube was taken as the arbitrary standard for comparison. In the hook-up with this tube, the grid condenser had .00025 mf capacity; the grid leak 2 megohms resistance; the plate potential averaged 21 volts; the grid return was to the positive terminal of the filament. In the circuit with the amplifier tubes, UV 201-A and C 301-A,



The above graph shows the relation of the filament voltage to the audibility obtained in the phones, and also shows the various voltages at which maximum results were obtained with respect to loud signals. Each tube has a definite point with respect to filament current incidental to maximum signal strength, and the graph shows that different types of rheostats provide this value of current with varying degrees of effectiveness.

which were of course used as detectors in this test, were: a .0005 mf grid condenser, a 2 1-2 megohm grid leak, and a "B" battery that delivered 40 volts on the average. The grid return was to the positive terminal of the filament. The circuit for the UV 199 included: .00025 grid condenser, 2-megohm grid leak and "B" battery averaging 40 volts. The grid return was to the positive terminal of the filament. The "A" battery voltage, which was 4.5 at the battery terminals, showed a drop in the leads of .2 at one-half ampere.

Audibility, in terms of the UV 200 tube from zero to 80. Filament voltage is shown by figures at the bottom of the sheet. The numbers of turns of the rheostat knobs are shown at the right of each group of curves.

The curve showing the audibility that can be obtained from the UV 200 tube has two peaks, one at 4.7 volts and the other, a little more than half as high, at about 5.9 volts. The wire rheostats reached the first peak, of course, somewhere within the half or three quarters of a turn of the knob that is the limit of their motion. As the peak is very sharp, it was easy to turn past it without finding it. It seems probable that many radio users, having the impression that the more juice you use the more sound you

get, never hit the right spot for maximum results. The device using graphite and mica barely reached the principal peak in the one turn that was left in it after arriving at the minimum voltage at which the tube would operate. The carbon disc rheostat had two turns to go after the tube began to deliver sound at four volts, and it passed the main audibility peak and the bottom of the hollow between it and the secondary peak. The rheostat employing carbon and metal under pressure required five full turns to cover the same range of audibility, giving twice as fine control as its nearest rival. No hand could turn its knob fast enough to pass the peak of maximum audibility without knowing it.

Audibility Curve Has Broad Peak

THE audibility curve of the UV 201-A and the C 301-A has but one peak. Audibility begins at 2.5 volts, rises abruptly to maximum at about 3.5 volts and remains there until the voltage passes 5. The broad top of this curve gives the wire rheostat a better chance to establish a reputation, though even here it has less than one-tenth of a circle to traverse in covering the peak. The knob of the carbon disc rheostat can make .8 of a turn and that of the graphite and mica device a whole turn in crossing this peak; but the knob of the rheostat

with carbon and metal powder under pressure can be turned six times around without sliding off the peak.

The audibility curve of the UV 199 is somewhat similar to that of the UV 201-A and C 301-A tubes. It starts at 2. volts, rises abruptly to 2.5, then more gradually to maximum at 3.8. Its maximum falls eleven points below that of the amplifier tubes and 21 points below that of the UV 200 detector, illustrating the difficulty of getting equal output from lower input. In passing the peak of this curve, the rheostat with the carbon and metal powder under pressure takes 1.7 turns, the graphite and mica rheostat 1.2 turns, the carbon disc device .7 of a turn, and the wire rheostats .05 of a turn.

It should be understood that the audibility curve of the UV 200 which was arbitrarily taken as the standard because this tube showed greater audibility than any other that was tested, was worked out with each of the rheostats. Below the region of audibility in this tube, the wire rheostats had .7 of a turn, the carbon disc device 1.7 turns, the graphite and mica device 5 full turns, and the rheostat with carbon and metal powder under pressure 11.5 turns. These superfluous turns are valueless in connection with this type of

(Continued on page 62.)

Blazing The Trail

FOR RADIO BEGINNERS

In the belief that radio will win thousands of new adherents this coming season, RADIO AGE is beginning in this issue a new section for "greenhorns" just breaking into the fascinating sport of radio building and reception. We have asked Edmund H. Eitel, a well known radio engineer, to start off this interesting series. He has chosen to explain the most simple theory and practice of radio building by presenting a list of comprehensive questions and answers dealing with every conceivable topic apt to creep into the mind of the beginner who wants to know "what it's all about." Mr. Eitel has not been too technical in answering the questions, for he knows the beginners know little if anything about "the inside" of radio. And his questions were compiled after studying the sort of queries sent by perplexed radio fans to radio manufacturers, dealers and engineers. Watch for the Beginners' Section in every issue of RADIO AGE.

By EDMUND H. EITEL

MR. RADIO FAN, as you lean over the radio counter and ask the patient clerk foolish question No. 18,510, did you ever ask yourself "Why radio clerks go mad"?

And again, when you write that longwinded message to the manufacturer, telling him the names of each part of that wonderful set of yours which won't work, and inquiring of him "Why not?" did you ever consider how you are placing "silver threads among the gold" over the angelic brow of the man who has to read that letter?

Once a fan asked me what was the worst trial and tribulation suffered by the radio seller. I want the reply to go into the public record. The greatest trial is to try to answer a question and to realize that before you can possibly do so adequately, you will first have to give the questioner about two hours of education in the elements of radio.

The Editor of RADIO AGE, who has had his trials, agrees with me that there ought to be a limit to the questions a fan could legitimately ask, a kind of set of regulations—you might say a sort of Marquis of Queensbury rules to the game. If the fan asked "What will happen, sir, if I hitch my filament up to my B-Battery," he should be led gently over to the rule board and told that he is "out of bounds." He must first review the questions and answers set down on such a board and representing what any respectable fan should know.

I gathered most of the questions and answers submitted below from the experience of a large selling and distributing company. Their unique value lies in the fact that they represent the boiled-down queries of thousands of letters. P. C. Cloyd, old radio "ham," and expert and head of the radio department of Babson Brothers, K. C. Smith, of Matteson, Fogarty and Jordan & Company, one of the best-informed radio merchandizers in the game, contributed their analysis and system, and Mr. Carl Pfanstiehl and the writer have both reviewed the answers and questions contributed from their experience.

I believe it will be a service to Radio to publish this system of fundamental questions for use and reference of fans and clerks. Mr. Fan, could you pass 100% in this test? Mr. Clerk, why not cut out these 35 questions and answers, paste them on a board where customers may read them? You will observe these questions are practical answers to the questions which arise in operation rather than any attempt to answer the million possible, and for the most part foolish questionings, as to theory.

For this reason this system will prove convenient, if reprinted, for those who are burdened with the duty of answering radio mail and want some convenient insert to return checked for the question asked and its answer.

ANTENNA

1. How long should my antenna be to get the best results?

Antenna, including lead in, should be about 125 ft. long. If you make it longer, you increase your set's volume, and distance somewhat, but it makes your set less selective.

2. How high should my antenna be above ground?

From 25 to 30 feet. If you stretch it higher, you gain some volume and distance; also you will very likely gather in more "static" and you will certainly decrease selectivity

3. Of what kind of material should antenna be made?

Single copper wire solid preferred, is customary. The ribbon aerial is a little more effective.

4. Will a short multiple-wire aerial give the same results as a longer wire aerial?

No. The best type of aerial for receiving is a single wire. Where you can possibly find room for a single aerial of 100 ft. in length there is no advantage whatever in going to the work and expense of erecting a multiple wire aerial.

5. When there are other antennae about, how near to them may I stretch mine?

Keep it as far away as possible and certainly not less than three feet distant. Have it run as nearly as possible at right angles to any other antenna. Having done this, you will not be likely to experience any lack of efficiency in reception due to antenna interference.

6. Will a building between me and a broadcasting station affect the efficiency of my antenna?

Not unless it be a steel-frame building.

7. Should I be able to operate my set on an indoor aerial?

Try it. If you have powerful nearby stations, you will probably get them satisfactorily on an indoor aerial. Do not expect to receive distant stations on an indoor aerial. The use of a short indoor aerial greatly increases the selectivity of a receiver but at the same time cuts down the range and volume very decidedly.

8. Should I get satisfactory reception on a loop?

Loop aerials are sometimes unsatisfactory, used in connection with anything less than a six tube set designed particularly for loop reception. In effect, a loop and a straight wire antenna are essentially different. The former is an inductance; the latter makes with the ground, a condenser. A large loop is to be preferred to a small one, since it will gather more energy. A 5-tube set will often give fair results if a 23 plate condenser is used in series with the loop and the condenser varied for best results. The condenser need be set only once.

9. Are light-socket aerial plugs satisfactory?

In general, no; but this depends upon the electrical wiring about the house and other conditions. A light-socket aerial plug will seldom give as satisfactory results as a well planned antenna. If there is any reason why you can not erect an antenna, try the plug and see how it works.

10. Is it absolutely necessary to solder the connection between the ground wire and the pipe to which it is connected?

Not necessarily; soldering may be the best means of making the connection, because it not only insures an absolutely perfect contact, but it also prevents corrosion—thus keeping this contact permanently perfect. The use of a ground-pipe clamp will be perfectly satisfactory, providing the pipe is cleaned before the clamp is put into it, and that the joint is inspected from time to time to see that corrosion has not set in.

11. If it is impossible to reach a cold water pipe with my ground wire, will a connection to a radiator serve the purpose?

In theory, radiator connection is not so effective, but in actual practice many people use radiator connection without apparent loss of efficiency. Make sure that your radiator pipe is not separated from the system by a rubber connection, however.

(Continued on page 63.)

THE THEORY of the super-heterodyne is rather generally recognized as answering a long felt want. However, some place between theory and practice most super-heterodynes seem to have slipped most woefully. This is true to such a degree that it is extremely rare to hear of a super-heterodyne that is producing results anything like in keeping with the theory.

With this thought in mind, the purpose of this article is to point out some of the pitfalls that are to be avoided. Also, it is the intention to give instructions for the building of this circuit in the simplest possible language—devoid of technical pyrotechnics.

We have long been accustomed to consider crystal reception as the standard of perfection so far as clearness of reception goes. On the other hand, the radio frequency circuit has perhaps come nearest to answering the needs for distance reception. Therefore, to be of any additional advantage the super-heterodyne must combine the advantages of these two circuits, giving at least as good quality as the crystal and greater range than the radio frequency circuit.

What a "Super" Does

THE super-heterodyne overcomes the faults characteristic to radio-frequency amplification and gives greater selectivity. It provides for radio-frequency amplification at a frequency at which the intermediate transformers function to best advantage with least possible distortion, and with the smallest possible circuit losses. The difficulties of radio-frequency amplification at radio-cast wave length are overcome by heterodyning or transferring the voice modulation from the incoming wave to a new wave of a frequency at which the internal capacity and inter-coupling effects disappear. The super-heterodyne amplifies all radio-frequency at a fixed frequency irrespective of the incoming impulses. Full amplification, however, can only be obtained when the intermediate-frequency transformers have been built to function at highest efficiency at the selected frequency and when the input impedance matches the output impedance of the tube.

Owing to the fact that this circuit is extremely powerful, while at the same time extremely sensitive, greatest care must be exercised in the selection of the component parts. There are certain of these parts around which most of the

Here's Something Unusual AN EASILY MADE SUPER-HET

BY PAUL GREEN



Photograph of the assembled super-heterodyne. Note the absence of numerous controls as commonly found on other eight tube Super-Heterodynes. Mr. Green has made the set simplicity itself and uses but two controls in the operation of the whole set.

trouble experienced seems to have centered. The effort as above suggested then will be to indicate how any such difficulties that may arise may be overcome by adjustments or changes in these parts.

The set described has been carefully worked out in every detail, and the illustrations are so clear that the average fan should have no great difficulty in building it or of securing satisfactory operation from the outset, providing the parts are of the best.

A Combination Circuit

NO particular originality is claimed for this circuit, it being a combination of several. It will be noted that the wiring diagram coincides almost perfectly in general baseboard arrangement with the manner in which the set is wired. This is done to simplify the wiring of the set, and to eliminate as far as possible the chances of making wrong connections.

The loop condenser and the oscillator condenser are shown for the sake of clearness in their respective positions in the circuit, rather than as regards their relation to other apparatus on the panel. The only portions of the circuit that might give the average fan any trouble are the oscillator and amplifying circuits. The construction of the input transformer and the oscillator coupler is clearly shown in diagrams 4 and 5.

Output Coil

THE output is of the air-core type, consisting of 200 turns on the primary, using No. 28 silk covered wire, and for the secondary, 1500 turns of No. 36 silk covered wire. It is important to use materials for the bobbin of this transformer which will not absorb moisture. For this purpose bakelite seems best suited. In the writer's work, he has made the core of a one inch cylinder of bakelite, two inches square by three-sixteenths of an inch in thickness, for the

essary to turn the handle of the drill about 380 times to put on the 200 turns on the primary and 1500 turns on the secondary. As an example, if your hand drill is geared in the ratio of 5-1, then it will be necessary for you to turn the handle 40 times in winding the primary and 300 times in winding the secondary.

Provide four small holes in one of the sides for bringing out the primary and secondary terminals.

After winding this coil, dry it out thoroughly in an oven heated to a temperature not to exceed 110 to 115 degrees Fahrenheit. This drying-out process should take from 6 to 8 hours. After the coil is dry, impregnate it by immersing it in molten paraffin. In doing so, however, be careful that the temperature of the paraffin is not high enough to cause the paraffin to smoke, as it then would scorch the insulation on the wire and render the coil inoperative. After the air bubbles have stopped coming off the coil, it is a pretty safe indication that it is saturated. It is now removed from the paraffin and allowed to harden. Soldering lugs or binding posts can now be put on four corners of this coil, to which the leads from the primary and secondary are run.

The ratio of the average hand drill is about $4\frac{1}{2}$ to 1 and therefore, it will only be necessary to turn the handle of the drill

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Oscillator Coupler

THE oscillator coil is wound in two sections of 43 turns each on a bakelite or cardboard tube of two inches in diameter. The primary is one straight winding of 12 turns on a tube of one inch in diameter and of the same material as used for the secondary.

If the tubes are not of these sizes, it will be found necessary, in order that proper coupling and range may be secured, to add or take off turns, depending on whether larger or smaller tubing than specified is used. For instance, if the primary tubing is too large, fewer turns

Oscillator Coupler

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(Continued on next page.)

can be used on this tube. A fairly loose coupling rather than tight coupling is usually to be desired, and accordingly a larger primary tubing is not recommended. The two secondary coils are wound in reverse directions. This is most easily done by winding both coils from middle of tube outward, turning tube in the same direction in both cases.

It will be noted that the inner and outer ends of one of these coils go to the soldering lugs on one end of the tube. The ends of the other secondary coil go to the lugs on the opposite end of the tube. Care should be taken to see that inner ends go to opposite lugs and outer ends likewise go to opposite lugs. In case soldering lugs are not obtainable, small brass machine screws with washers and nuts may be substituted if the nuts are turned down tight on the buss wire and soldered.

Now, regarding intermediate-frequency transformers and fixed condensers: a great deal has been said relative to matched construction, etc. Matched construction, of course, is to be assumed in the first place, or otherwise satisfactory operation cannot be secured. The most painstaking care must be taken in the construction of these transformers. They must work in unison.

Watch Fixed Condensers

IN the writer's experience, a great deal of trouble has been found in securing fixed condensers which can be relied upon to have the capacities at which they are rated. Not only that, but frequently it is found that fixed condensers have such a high conductance that they cease to function as condensers and function instead as high resistances. It is well, therefore, when buying condensers, to buy an extra one, at least, of each of the capacities required, so that you can change condensers in case your circuit refuses to remain stable. A condenser having high conductance characteristics will be found to cause the circuit to change its characteristics entirely, depending upon weather conditions.

This is also true of the output coil unless it is well impregnated. A poorly seasoned base board will give trouble in the same way. A friend of the writer's recently built a super, but found that under certain weather conditions the set oscillated

furiously. The output coil was found to have taken up an untold amount of moisture. A new coil with better impregnation eliminated the trouble and brought in San Francisco, on the loud speaker with one stage of audio. This is a pretty fair record for Summertime, considering that Chicago stations were on at the time.

Do not use soldering paste or flux, especially when soldering to condenser lugs, since by so doing the condenser is almost certain to be rendered useless, or partially so, depending upon weather conditions. Too much cannot be said as regards the importance of building your set so that weather conditions will not change its operation, and anything which will tend toward excluding this variable factor is to be recommended by all means.

Reliable "Super-Hets" Combine Clearness of Crystal Circuit with Radio Frequency's "DX"

Get Low Loss Condensers

In the purchase of variable condensers it is necessary to obtain those of low loss. The condensers play a very important part in the reception of radio signals.

Condensers that contain a great deal of moulding for the supports and insulation are examples of high loss. The low loss condensers of today have but a few strips of insulating material to separate the plates. If possible, avoid the use of a separate vernier condenser, as this may cause losses equal to the main condenser.

Throughout the construction of the super-heterodyne, remember to keep the losses down.

The U. V. 199 tube has been selected for the circuit owing to its sturdiness, low current consumption, and compactness. The entire eight tubes consume a total of between 1-4 and 1-2 an ampere, using a four and one half volt "A" battery. There is no particular advantage in using larger tubes, in view of the fact that the smaller tubes will be found to give more than sufficient volume when operated at full efficiency. In fact, in the average home it is rather rare to find a second stage of audio used.

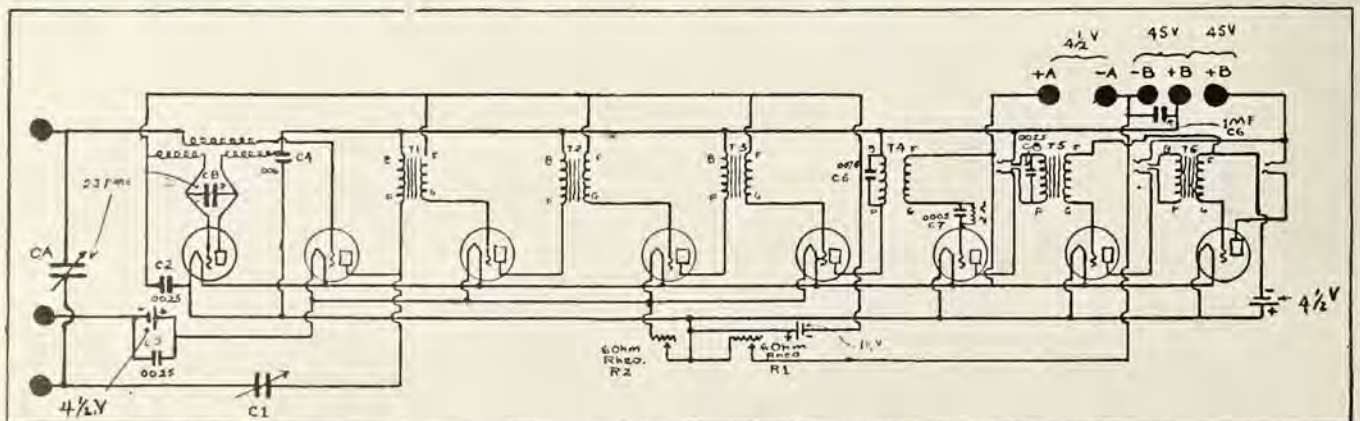
PRACTICALLY all tuning can be done with the loud speaker instead of head phones. All of the fixed condensers should be fairly close to rated capacities, especially condenser C-4 and C-8, the former being .00025. The large condenser, C-6, is not critical, but should by all means be at least 1 mfg. Plate voltage of 45 is used on all tubes except the amplifying tubes which take 90 volts. It should be noted in this connection, however, that a first indication that the condensers used are defective, or that the input transformer is absorbing moisture, will be evidenced by the set oscillating or fading, or showing body capacity, in which case it may be necessary to reduce temporarily, the effective plate voltage on the negative B post. This will have the effect of reducing the body capacity, while at the same time cutting down on distance reception.

As the filament circuit is divided into two parts, the rheostats should each be of 6 Ohms resistance. The rheostat R-1 is used to regulate filament voltage of all the tubes; R-2 governing the filament of the first detector and the three intermediate Amplifying tubes control the volume. Instead of the conventional loop of two taps, the one used with this circuit is one having 12 turns and three taps; the center tap being taken at a point equidistant from the two outer ends of the loop.

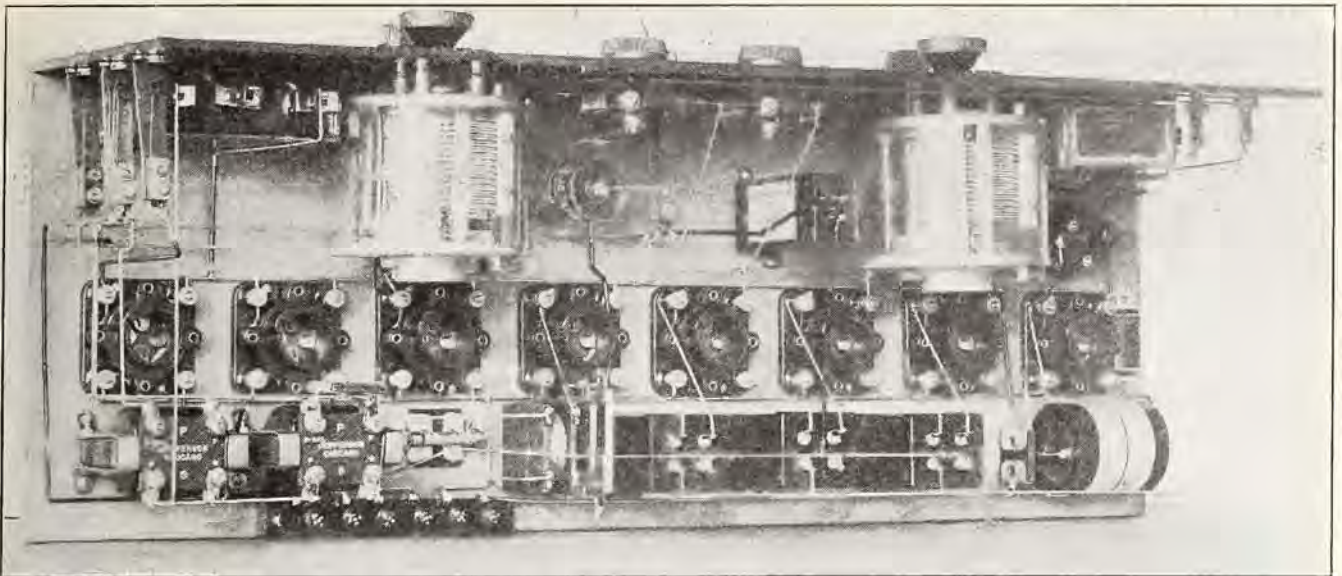
A panel layout is not given, owing to the fact that it is extremely simple and not an especially critical consideration. Most radio fans who are thinking of building supers will have had enough previous experience in laying out and drilling panels that this will not be found to be difficult at all. The panel dimensions should not be less than 26x7". In fact, 28x7" will be found to give rather better apparatus arrangement.

The baseboard should be one inch shorter than the panel and 9 inches wide. While a kiln-dried wood baseboard was used in the set shown in the illustration, it is to be earnestly recommended that a bakelite baseboard be used instead, as it will prevent the absorption of moisture.

Considering the requirements of this particular circuit, the writer has found the best No. 23 plate covered condensers with vernier control very satisfactory,



Wiring diagram pictured above shows the simple but efficient way in which the super-heterodyne is wired up. The filament jack shown in the photograph is omitted in the diagram as it is not necessary in the operation of the set



The above photograph illustrates very clearly the wiring and general layout of the super-heterodyne described in the accompanying article.

Note the two condensers that are used as the main tuning units. As may be seen, the layout is extremely simple, and will be of great advantage to the beginner who wants to start on a super-heterodyne.

UV 199 or C 199 tubes are used throughout the set, which makes it possible to use dry cells for filament lighting. Practically all the tuning can be done with the loud speaker.

although there are a number of other low loss condensers on the market which will be found to tune equally as well. Condensers having solid end plates of insulating material should be avoided by all means, as dielectric losses will tend to broaden the tuning and cut down the efficiency considerably. With a good pair of condensers the writer has frequently tuned past Chicago stations bringing in outside stations with less than two degrees separation.

A Sponge Rubber Support

If the set is to be operated fairly close to a loud speaker, it will be found advisable to mount the first detector tube and audio-frequency amplifiers on a strip of insulating material supported on the two ends by sponge rubber; otherwise the tubes may take up and reamplify the sound vibrations from the loud speaker, causing troublesome distortion of the signals. In wiring this set, it is good practice to wire the filament circuit first. The first detector circuit and oscillator circuit can then be wired. After this, the long wave or intermediate-frequency circuit can be wired, followed by the last detector and the audio-frequency units. In wiring up to this point, the leads running to the panel are omitted. The panel is now fastened to the front of the baseboard by means of brass angles and brass machine screws, and the connections are made to imp jacks, loud speaker jacks, loop jacks, and rheostats, as well as "C" batteries. A filament jack is shown in the photos of this set, but may be easily omitted; hence is not shown in diagram. The photos also show a separate "B" battery binding post for the oscillator circuit. This also is not necessary, five binding posts being sufficient to cover all of the requirements.

"Test Before Using!"

BEFORE inserting the tubes or connecting the batteries, turn rheostats

on full. Now, connect the "A" and "B" batteries to their respective binding posts, making sure that no short circuits exist. When the batteries are fully connected, test across the filament binding posts of each tube separately with a voltmeter so that there can be no possibility of excessive "B" battery voltage on the filaments and also so that you are sure of your joints. Insert a 50 watt, 110 volt lamp in the positive "B" battery lead, so that it is placed between the positive end of (45 volt), battery and the plus binding post. This will prevent any possibility of the tubes burning out through accidental short circuit. Unlike most super heterodyne circuits, it will be found impossible to burn out the filaments by shorting the condenser plates either variable or fixed (unless the rheostats are turned off). The 50 watt lamp will insure protection in this case.

Now, insert the tubes after first turning the rheostats off. Turn the rheostats up about half way, work the two dials simultaneously, picking up the stations with the left hand condenser and bringing them to a better modulation with the right hand dial (loop condenser). On distant stations, it will be found necessary to use vernier adjustment as the tuning will be very sharp, indeed. If the by-pass condenser values and the input transformer and oscillator coil are correct, it will be found that by working the two condensers simultaneously, extremely sharp tuning can be secured even on local stations.

How to Tune

A GOOD procedure when tuning in is to place the loop condenser at five degrees, gradually turning the oscillator condenser. If no station is heard, move about two degrees farther and repeat the operation. On very distant reception, it usually is found necessary to change the loop condenser

one degree each time in making the adjustments. It will be noted that each station comes in on two dial settings instead of one, as on other circuits.

Signals are usually received with about equal intensity on either of the two settings. However, sometimes radio-cast conditions are such that one setting is superior to the other. From the very outset the logging of stations should be carefully kept, as it will greatly assist in future tuning and prevent confusion. With a good assortment of stations logged you will have little difficulty in proving the superiority of the circuit over even the best of radio frequency sets.

The condenser C-1 should be adjusted when receiving some distant station of wave length of about 300 meters. Increasing the capacity setting of this condenser will increase the signal strength. This capacity should be increased to the highest possible point that can be reached without causing distortion.

Once found, the setting need not be changed. The failure of tube to oscillate can be detected by touching the oscillator tube grid post. If a click is not heard when the finger touches and again when the finger is removed, the tube is not oscillating and an error should be looked for in the wiring of the circuit. As there are eight tubes in the circuit, it is highly imperative that every one of them should make perfect contact with the prongs.

A failure of any one of these tubes to make a contact will render the set inoperative. If upon connecting up the set and making all preliminary tests, you are unable to receive stations at first, do not be discouraged. Many a super-heterodyne owner has had a similar experience when first testing his set.

It will usually be found that the stations are there all right, but that the operator has not yet learned how to find them.

[Mr. Green will be glad to answer fans' questions regarding his super-heterodyne.]

Trouble-Shooting with your Neutrodyne

By CHARLES MANLEY

THE location and correction of faults in a radio receiver are greatly simplified if done in a systematic and logical manner. It is not the purpose herein to outline all causes of trouble which may confront the man who builds his own, but rather to enable the man who has purchased a factory-built set to find the bug in his installation, and perhaps in a number of cases to save the mutual inconvenience of having to call upon the manufacturers or their representatives for aid.

In the broadest sense, the trouble in a neutrodyne may usually be listed under one of the following heads:

1. Receiver does not operate, or signals are very faint.
2. Receiver squeals or oscillates.
3. Receiver tunes broadly.

We will endeavor to take up the various causes and corrections of these faults in order.

First, we will assume that all external battery, aerial and ground connections have been properly made, and before proceeding farther we will check these against the diagram furnished with set. Some means must also be had of knowing that "A" and "B" batteries are in proper condition, for without this information we can establish nothing. Every set owner, then, should have a hydrometer for the purpose of testing his "A" battery, and a pocket voltmeter reading up to 100 volts to determine the condition of his "B" battery. A "B" battery which gives a reading of less than two-thirds of its rated voltage is of little value, and should be discarded.

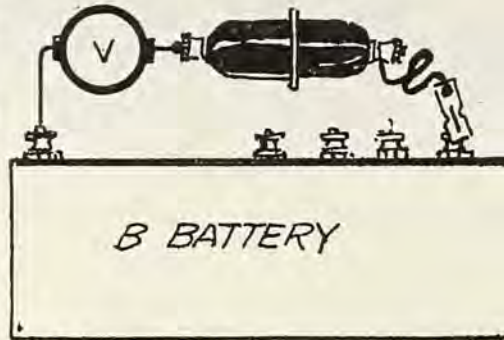
Now we have come to the actual trouble shooting and shall take up case (1) where the receiver is inoperative, or signals weak.

Tubes Cause Trouble

DEFECTIVE tubes are the most frequent cause to which trouble of this nature may be attributed, and therefore the first operation is to place the phone plug in the detector jack, removing audio amplifier tubes from their sockets and interchange them with the tubes in the other sockets in all possible combinations, checking results as to audibility in the head phones. (Or, better still, use a couple of new and tested tubes in radio frequency and detector sockets, comparing results.) We can now check up on the audio amplifier tubes in like manner, inserting plug in first and second audio jacks in turn and noting volume secured using different tubes.

Another frequent cause of weak signals is traceable to a short in the lightning arrester. This condition can easily be ascertained by connecting the voltmeter and battery in series around the terminals of the lightning arrester, as in the accompanying diagram. A short circuit, of course, will produce a voltmeter read-

ing. Another method is to remove the ground wire from the arrester, and listen in for results. The same connection of battery and voltmeter may be used to test all suspected short or open circuits



The sketch above shows how to test your lightning arrester for short circuits or leakage. The high voltage terminals of a B battery are shunted by a voltmeter (left) and the lightning arrester in question (right). If the voltmeter shows a current flowing through this circuit, the arrester is defective.

as in the neutralizing coils, or audio transformers.

A neutrodyne, while exceedingly sensitive in some locations and under certain conditions, will not produce satisfying results on out of town stations when using a small indoor antenna. This particularly holds true when the installation is on a lower floor of a large metallic structure. The remedy in this case is obvious.

We have practically covered all troubles of this nature that are external to the set. For the benefit of those who have the mechanical knowledge to look from trouble in the set itself, we may add the following tests.

It may be possible that one or more tubes does not light, even though it is not burned out. In this case it should be determined by pressing on tubes that each one is making proper contact in its socket. If this test indicates that tubes are not making good connection, the contact prongs of sockets may be bent upward, though making sure first to disconnect batteries. Another cause of failure of tubes to light is due to failure of one or more jacks to make contact. To determine this, the set must be taken from cabinet, by removing panel screws, after which the set slides out as a unit. The operation of the jacks should be noted by inserting and withdrawing the plug, and any contacts, the spring tension of which is weak, should be suspected, and carefully bent in shape.

When a neutrodyne oscillates, which condition is manifested by clicks when

the dials are tuned, and by loud squeals which vary in pitch as the dials are turned, it is the impression of the average owner that the set is "out of balance." This is seldom true, since a carefully built set has a considerable latitude of balance. In an inspection of over two hundred neutrodyne receivers in owners' homes, only two cases were found where the sets were out of balance, and these had been tampered with by well meaning friends or "radio experts," so it is safe to say that your set is probably not out of balance.

Poor Aerial Hinders

THE most frequent cause of an oscillating receiver is an aerial lead which runs near or parallel to the cabinet, or is bunched with the battery or ground wires. This is easily remedied, and it is surprising what a vast difference in results such a mere detail may produce. The aerial lead should always be well separated from the set and from all other wires. Location and weather have a marked effect upon the stability of a neutrodyne. On some days any neutrodyne will show a pronounced tendency towards oscillation, or may even oscillate vigorously. This may be overcome frequently by making a better ground connection or by using a longer aerial. A proper ground connection is always necessary for the successful operation of a neutrodyne receiver, and a poor ground is a frequent cause of oscillation.

Many instances have been found where this type of set will not operate without oscillation in a steel building when using an indoor aerial about the molding of a room. In this case it will be found preferable to use an outdoor wire, even if only a short one, parallel to the wall of the building, and an indoor wire, if used, should be kept well away from the walls of the room, to avoid effects set up between this wire and the steel girders of the building. Other less frequent causes of oscillating receivers include too high a "B" battery voltage, a tube for which the set was not designed, and which does not possess the proper capacity.

For best results, it is not sufficient to insulate the lead-in from the building, but it should always be kept as far away from it as possible. If this wire is run down the side of the building, wooden supports from two to three feet long may be used at the top and bottom. If it drops through a courtyard, it is a simple matter to run it diagonally. It should be kept in mind that the lead-in is part of the aerial system, and as such should act as an energy collector and not as a dampener. The interior of the cabinet should be kept free from dust, as dust on the parts will cause leakage and damping of signals. A pipe cleaner may be used to clean between the tuning condenser plates occasionally.

Two Radio and Two Audio for Volume, Distance and PURE TONE

EVERYBODY wants volume. Everybody wants distance. And everybody wants selectivity. Besides these three sterling attributes of the "best" receiving set, folks are coming to realize that perfection in tonal quality and faithful reproduction of occurrences at the broadcast studio are just as essential; indeed, perhaps more necessary than some of the others.

The necessary volume to operate one's loud speaker may be readily obtained by enough audio frequency amplification, two stages doing the trick easily. Distance may likewise be secured by using sufficient stages of radio frequency amplification, two usually sufficing. The use of two or three tuning circuits of fair sharpness brings the desired selectivity. But beautifully clear and unadulterated musical quality is not so easily attained. It is by a proper combination of good circuit and good apparatus that we may have good quality.

The Detector

To the ordinary ear, broadcasting as received with a single tube detector, not too close to the regeneration point, and that received with a crystal detector, may seem to be equal so far as clarity is concerned. Yet, if we add two steps of audio amplification, the difference immediately shows up, the crystal winning by a most pronounced margin. Many builders of sets and well-known circuit designers are announcing that to be good for quality, "a circuit must have a crystal in it somewhere."

By *BRAINARD FOOTE*
Beautiful and Clear Music Attained by Using a Good Circuit and Good Apparatus

OF COURSE, the crystal as a detector isn't as sensitive as a tube. In fact, it's quite a bit inferior to one, even though it does surpass the tube in clearness. Hence, to compensate for this difference in sensitivity, radio frequency amplification must be tacked on ahead of the detector. Thus, our musically ideal receiving set, which incidentally does some satisfying stunts in DX reception, requires four tubes, two of them audio, two others radio, and a crystal as the detector.

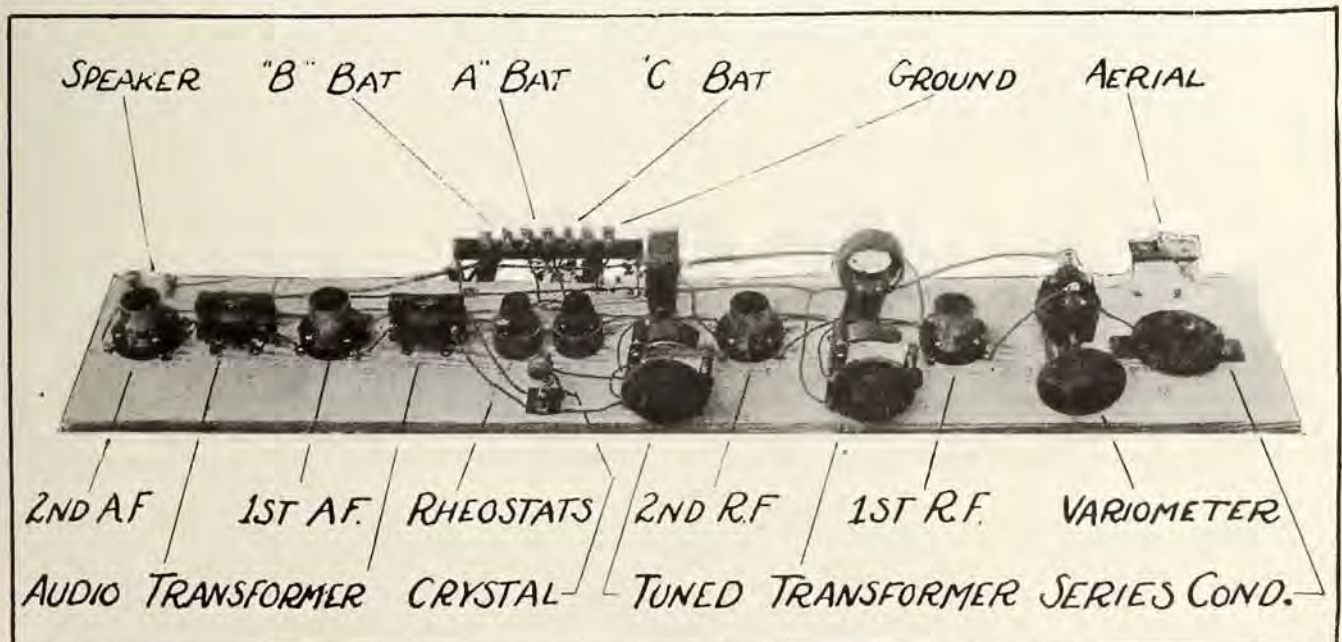
Another angle of the constructional problem, and perhaps a novel one, may be found in the method of arranging and wiring the components. Although it seems to be a rigid rule that radio sets must be laid out with the antenna at the left and the loud speaker at the right, most of us have overlooked the fact that something may be gained by swinging things around the other way, from right to left. And in the case of a set of the type under discussion, where two rheostats serve for all tubes, there is considerable gain in wiring simplicity by running it "backwards" as shown in the photo. Normally, as sets are

built, the sockets are placed with the grid and plate terminals at the rear and the filament posts in front; that is, nearest to the panel. With all the binding posts for batteries, aerial, etc., placed at the rear, the leads to the filament posts must cross under or over the grid and plate leads of the tuning circuits.

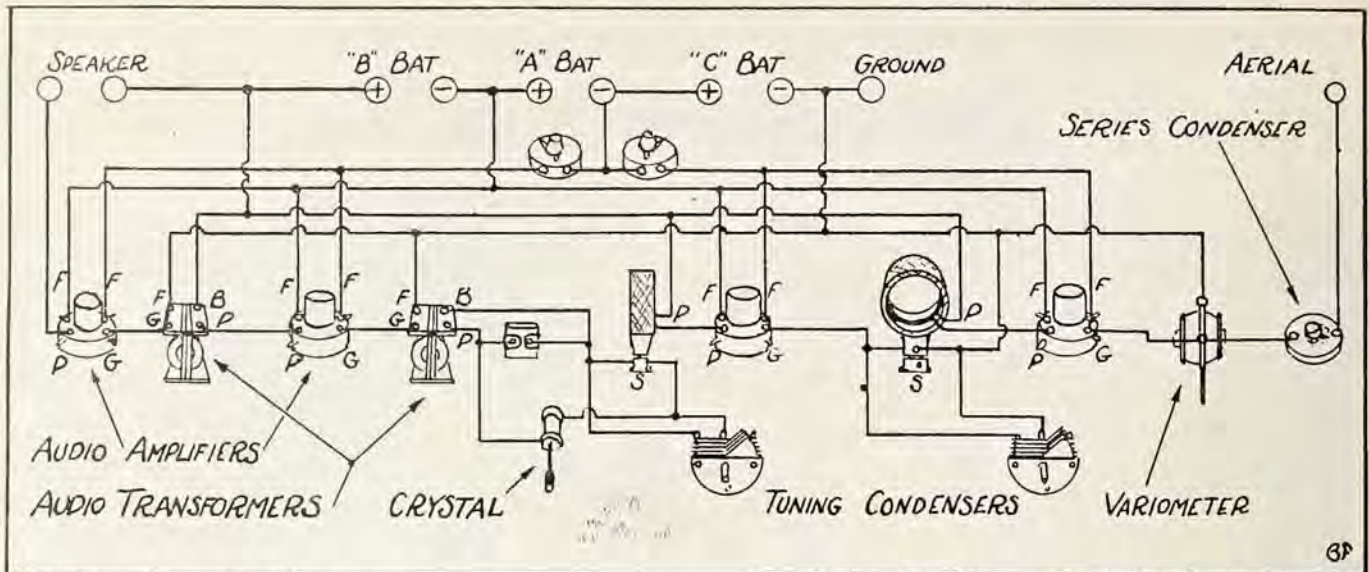
This increases undesired coupling to these grid and plate leads and also lengthens the filament connections. Now if the sockets are turned about, the grid posts are to the right instead of to the left. Hence, to keep grid and plate leads short and direct, the wiring and assembly procedure must be run in the opposite direction.

The board layout of the set in question is made in this way. The wiring diagram is similarly drawn, for easy comparison. The antenna post is placed on a little sub-panel all its own, at the extreme right end of the baseboard. The grid circuit of the first tube is tuned by a variometer, a variable condenser of the semi-variable style being inserted in series with this variometer. Hence the grid circuit of the first R. F. tube is included in the tuned antenna circuit, something which would broaden the tuning were it done with only a single stage of radio. But with two stages, the selectivity is maintained, and far greater volume secured than in cases where the grid circuit of the first tube is merely coupled by the untuned antenna coil method.

(Continued on next page)



While satisfactory for limited DX, this outfit is intended for clear and pure loud speaker operation. It has two steps of radio, crystal detector and two of audio. Wiring proceeds from right left to facilitate connections and shorten the leads.



The circuit is laid out in accordance with the actual arrangement of the parts. Note how direct grid and plate connections become when the sockets are turned about, with filament posts at the rear.

THE tube at the extreme right is the first R. F. amplifier, and it is coupled to the next or second R. F. amplifier tube through a tuned transformer whose secondary consists of a 50-turn honeycomb coil shunted by a .0005 mfd. variable condenser. The primary coil by which the plate of the first R. F. tube is coupled to this tuned secondary is made by winding 15 turns of No. 20 wire into a "doughnut" coil—just the right size to fit inside the honeycomb coil. The next R. F. transformer is made in a similar manner, having 20 turns instead of 15 on its primary. The secondary of the second R. F. transformer is also a 50-turn honeycomb coil, in its usual mounting.

The tuning instrument at the extreme right is a variable condenser; not necessarily a regular plate condenser like the other two. It may be a mica variable or other form of compact condenser, inasmuch as its dial readings need not be recorded nor a great deal of tuning done with it. The variometer, next in order, may be a small instrument, since the capacity of the antenna is in shunt to it through the series condenser. Following the two tuned stages of radio frequency comes the crystal detector. The very best sort of mineral is a combination of zincite and bornite, such detectors being fairly numerous in the radio market. Other detectors having cat-whisker contacts are very easily upset and the mineral surface quickly oxidized or "burned" by the heavy discharges released by the second R. F. amplifier tube. The zincite-bornite detector holds its adjustment for hours and sometimes days on end. Moreover, a heavy pressure is required, so that the setting is rugged and very difficult to upset.

Low Ratio Transformers

Low ratio transformers are advised for the two audio stages, to conserve the good quality of tone that the crystal delivers. To still further improve the clarity, and to cut the drain on the "B" battery practically in two, a $4\frac{1}{2}$ volt "C" battery is inserted in the grid

return leads from all four tubes. Moreover, the receiver is intended altogether for loud speaker operation, and complications in wiring and in excess contacts are avoided by omitting jacks and providing but two output binding posts for the speaker at the left end of the board.

Sensitivity

A 90 to 120 volt "B" battery is employed, together with four UV201A or C301A amplifier tubes and a 6 volt storage battery. The antenna need not be especially large because the tuned antenna circuit adapts the set to very short antennas. Sixteen-ohm rheostats are used, one for the two radio tubes and the other for the audio amplifiers. In mounting the parts, good separation between adjacent instruments is advisable, and the R. F. transformers are set at right angles to each other. Connections are indicated in the circuit diagram. The R. F. transformers may require further explanation, however. The primary windings are inserted between the plate of the tube and the positive "B" battery in each case. The secondary connections, running to the 50 turn honeycomb coils, are brought to the usual binding posts on the honeycomb coil mounts, the two tuning condensers being connected in shunt to the secondaries. Primary connections are marked "P," and secondaries "S."

IN ACTUAL operation, the position of the series condenser exerts great control over the sensitivity of the outfit. Inasmuch as the variometer and the series condenser are in series with each other, it is possible to tune to the same wavelength, by any number of combinations of these two. For instance, 360 meters might be heard with a low value of inductance on the variometer and a high value of capacity on the series condenser. On the other hand, 360 meters could also be tuned in with a high value of variometer and a low value of condenser. When the capacity of the condenser is high, the antenna absorbs energy to a large extent and prevents the R. F. tubes from oscillating. But with

a low value of capacity, the antenna's absorbing effect is very little, and the tubes can be made to oscillate. Hence, the sensitive point is found with such a combination of series condenser and variometer that the circuit is near, but not actually at the point of oscillation. When this point is found, signals are loud, selectivity is good, tuning is easily done and the series condenser may be left alone.

Tuning

As previously stated, the sensitivity of the circuit is greatly influenced by the series condenser. As a result, great care should be exercised in the manipulation of this particular part of the set.

As the condenser is not a part of the closed circuit, there will be no noticeable effect in body capacity. In view of the fact that a station may always be found on the combination of the condenser and variometer, a chart or graph may be drawn and notations made as to the dial settings.

In this way the operator will not have any trouble finding the desired station.

The adjustment of the tuning condenser connected to the detector will not be found very critical, but that of the variometer and also of the first tuning condenser is sharp in adjustment. In case difficulty is met in stopping oscillation of the R. F. tubes, as may be the case with a very small aerial, the series condenser may be omitted or several turns removed from the primary windings of the R. F. transformers.

The crystal is perhaps more than anything else responsible for the clear and pleasing quality of speech and music which such a receiver is capable of delivering. Properly amplified before and after detection, the entire unit becomes a receiving outfit which will grow in the esteem of all members of the family. More suited to unusually clear reception of the nearer stations than to extreme DX, the set fills a demand on the part of those who appreciate true musical tone for a receiver reproducing events at the broadcast studio with utmost fidelity.

A Simple Regenerative Receiver

That Minimizes

SQUEALING and RADIATION

By FRANK D. PEARNE

FORGETTING for the present the late deluge of complicated circuits with their equally complicated "dynes," super and otherwise, and getting back to the good old "sure fire" sets which come within the scope of understanding of the ordinary beginner, I am explaining in this issue a circuit which is quite simple and efficient, although not decorated with a fancy name.

It is of the regenerative type, but not one which will disturb your neighbor by producing whistles and other noises, if carefully handled. There are three separate and distinct circuits employed in its construction; the primary, secondary and tickler. The primary inductance is fixed and does not require any taps, or switches. The secondary is also a fixed inductance shunted by a 23 plate condenser by means of which it is tuned; and a tickler coil supplies the regeneration.

Tuning units of this kind are now for sale in all radio stores, but as many of our readers get considerable enjoyment out of constructing their own apparatus, details of the construction will be given.

FIRST, procure an old vario-coupler and strip it of all winding. The tube on which the tapped primary was wound will be from 3 to 3 1-2 inches in diameter. Beginning at the lower end of the tube at approximately 3-4 of an inch from the bottom, wind 15 turns of No. 22 double silk insulated wire. Anchor the ends of this coil by drilling small holes in the tube in the proper position to take the end down through one hole and up through the other.

These holes should be about 1-4 inch apart and in line with the winding. At a distance of 1-8 of an inch from this coil, start the secondary winding, which consists of 40 turns of the same kind of wire used in making the first coil. Both the starting and finishing ends of this coil are anchored in the same way. Next, the rotor is to be wound with 42 turns of No. 26 double silk insulated wire and the ends fastened to the same terminals to which the unwound coil was fastened. This completes the tuner.

It might be well to state that the two coils wound upon the tube must be wound in the same direction. When mounted in the set, the top end of the 15 turn coil is connected to the aerial binding post and the lower end to the ground binding post. This forms the primary winding. The top end of the 40 turn coil is connected to the grid leak and condenser and to the stationary plates of the 23 plate condenser, and the other end to the junction of the negative "B" and positive "A" batteries, and also to the rotating plates of the 23 plate condenser, as shown on the circuit.

One of the rotor terminals is connected

to the top spring of the detector jack and the other one to the plate binding post on the detector tube socket.

THE other end of the grid leak and condenser is connected to the grid binding post on the socket. Now, as this set is to be equipped with two stages of audio frequency amplification, we will temporarily leave the filament circuit and trace the connections through the amplifier. The second spring from the top on the detector jack is connected to the post "P" of the first audio frequency transformer and the third spring from the top connects to the post marked "B positive" on the first transformer. The bottom spring on this jack is connected to the positive binding post of the 22 1-2 volt "B" battery. The post marked "G" on the first transformer is connected to the grid binding post on the first amplifier tube socket, while the post marked "F negative" on both of the transformers is connected to the negative side of the filament battery as shown.

Connect the top spring of the first amplifier jack to the post marked "P" on the socket of the first amplifier tube, the second spring of this jack being connected to the post marked "P" on the second transformer.

The third spring from the top on the first amplifier jack is connected to the post marked "B positive" on the second transformer and the bottom spring, as well as the bottom spring of the second amplifier jack is connected to the positive terminal of the 90 volt plate battery. The post "G" of the second transformer is connected to the post "G" on the second amplifier tube socket. The top spring on the second amplifier jack should be connected to the post "P" on the second amplifier tube socket. Now the filament circuit should be controlled by a switch, so that the battery current may be conveniently switched off when the set is not in use. From the negative terminal of the filament battery, a wire leads to this switch and the other switch terminal is connected to the "negative F" posts on the two transformers, as before mentioned, and to one side of each of the rheostats.

Each of the other rheostat terminals

is connected to its respective "F" binding post on the socket of the tube which it is to control. The other "F" posts on all the sockets are connected together and to the "A positive" and "B" negative terminal as shown. The aerial, ground and all battery binding posts should be mounted at some convenient place on the back of the baseboard. The sockets should be of good substantial manufacture, preferably with a bakelite base and a metal sleeve, with good strong springs for making contact with the tube terminals.

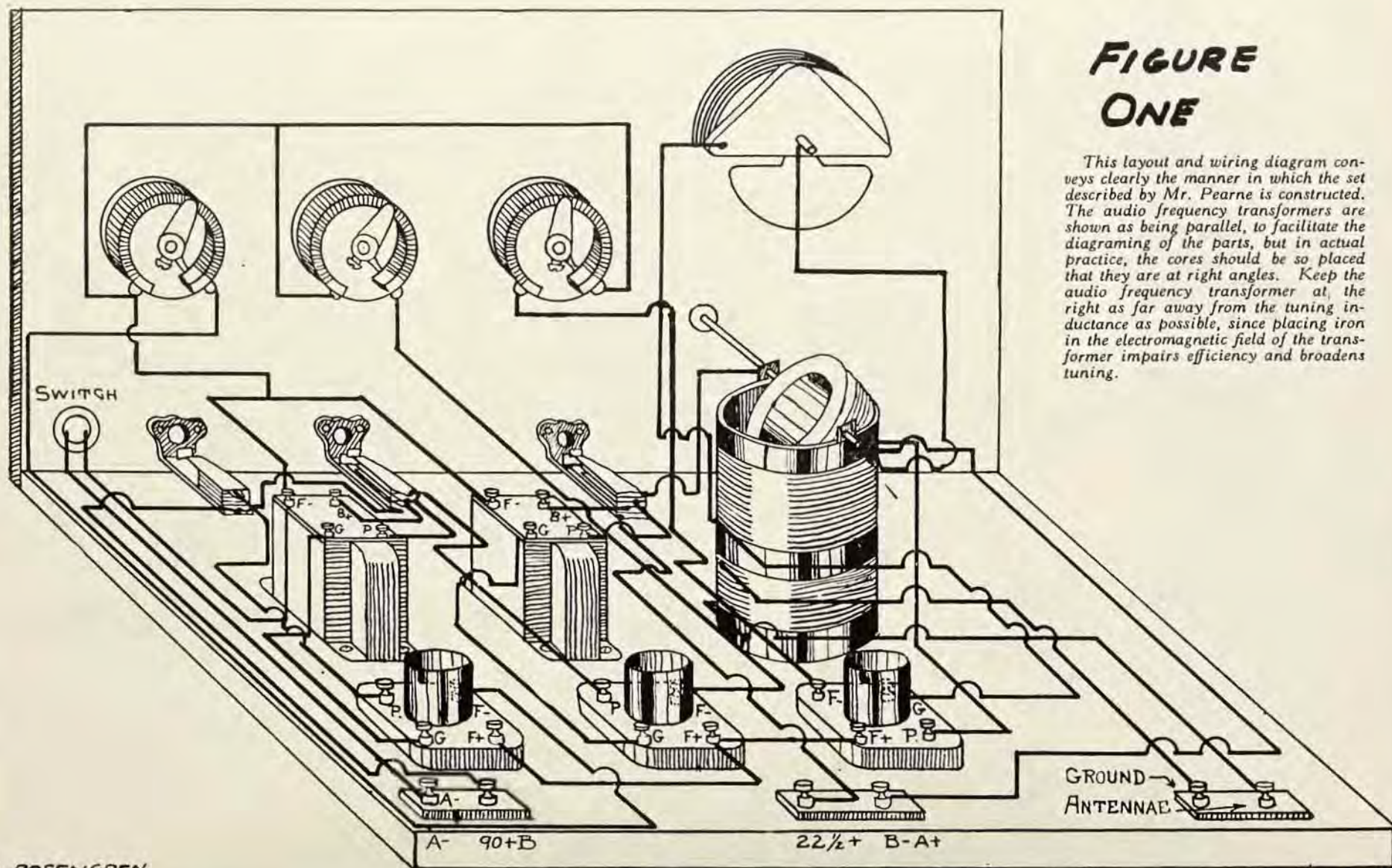
The grid condenser should be of the fixed mica type, having a capacity of .00025 M. F. The grid leak has a resistance of 1 1-2 megohms. These should be mounted as close as possible to the grid binding post on the detector tube socket. This is important, as a difference of one inch in the length of the grid leak, after passing through the condenser, may cause the set to howl. No mistake will be made if it is soldered directly to the binding post. For the detector tube, use either a UV-200, or a C-300 and the amplifier tubes may be either UV-201-A, or C-301-A. The rheostat which controls the detector tube should have a resistance of 6 or 8 ohms and those used to control the amplifier tubes must have a resistance of 25 ohms. The selection of the transformers is left to the judgment of the builder, but these should be of some standard, well known make which are known to be good.

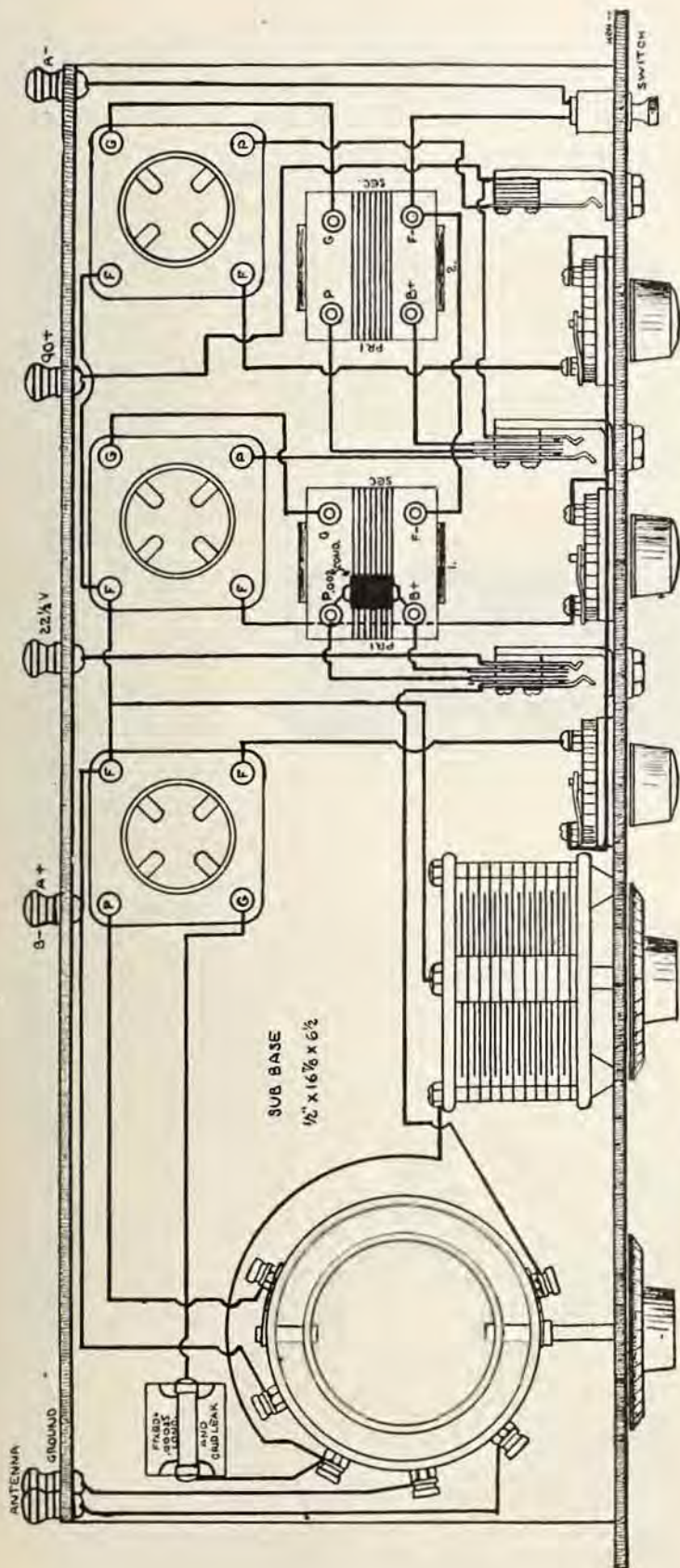
IF VOLUME is desired, in preference to good tone quality without distortion, then one having a ratio of 10 to 1 should be used in the first stage and that of the second stage should be of a lower ratio, of from 3 1-2 to 1, to 4 to 1. Two low ratio transformers of about 4 to 1 ratio will, however, give much better musical quality to the reception, although perhaps with a little less volume.

Any of the standard jacks will answer the purpose, two of which should be of the double circuit type and one of the single, as shown in the drawing. In some cases better reception is obtained if a fixed mica condenser having a capacity of .002 M. F. is connected across the posts marked "P" and "B" positive

FIGURE ONE

This layout and wiring diagram conveys clearly the manner in which the set described by Mr. Pearne is constructed. The audio frequency transformers are shown as being parallel, to facilitate the diagramming of the parts, but in actual practice, the cores should be so placed that they are at right angles. Keep the audio frequency transformer at the right as far away from the tuning inductance as possible, since placing iron in the electromagnetic field of the transformer impairs efficiency and broadens tuning.





A schematic wiring diagram of the receiver isometrically illustrated on page 16. This is the diagram which should be followed out, should any of the connections of the isometric sketch puzzle you. This receiver is an old reliable circuit with several new trimmings added, making it just about as efficient a three tube set as any "bug" can build. The antenna or primary coil is fixed, making only two adjustments necessary in the process of tuning. The secondary condenser dial (second dial from the left) can be calibrated in terms of wavelengths after the tickler coil readings have been ascertained.

on the first transformer, but whether or not this will be of any use will depend upon the particular transformer used. This entire set is mounted on a bakelite panel 18 inches long, 7 inches high and 3-16 of an inch thick, with a baseboard 17 1-2 inches long, 6 1-2 inches wide and 1-2 inch thick mounted at the base of the panel.

All parts should be mounted as compact as possible to avoid the necessity of long lead wires between the different parts. Standard cabinets to fit the size of panel described may be obtained at any radio store. The list of material required is as follows: one bakelite panel 18x7x3-16 inches, one base-board 17 1-2x6 1-2x1-2 inches, two 3-inch dials, one tuning coil as described, one fixed mica grid condenser having a capacity of .00025 M. F. one grid leak having a resistance of 1 1-2 megohms, 3 standard sockets, one UV-200 detector tube, 2 UV-201-A amplifier tubes, 2 audio frequency transformers as described, one 23 plate vernier variable condenser, one 6 ohm rheostat, two 25 ohm rheostats, two double circuit jacks, one single circuit jack, one toggle switch, six binding posts, 20 feet of No. 14 tinned copper bus bar wire, one 6 volt storage battery, two 45 volt plate batteries with taps, so that a lead may be taken off at 22 1-2 volts, one pair of head phones and a loud speaker.

Solder all connections well and use a good aerial at least 40 feet in length and place as high as possible. Connect the ground binding post to the water pipe by means of a ground clamp. This set, if properly constructed, will give good loud speaker volume on long distance stations.

"Big Bill" Off for South Seas

Having penetrated the polar regions with MacMillan, amateur radio is now about to take the opposite extreme and set forth on an adventure in the South Sea.

The auxiliary yacht "Big Bill," which sailed recently from Chicago in the interest of the Deep Waterways Commission on a two year trip that will ultimately go around the world, has as its radio operator E. C. Page of Evanston, Ill., a young amateur and member of the American Radio Relay League.

The selection of Page was approved by Captain A. J. Dukan, who is in command of the vessel, following his recommendation by local radio representatives. He has for his equipment a Zenith radio apparatus capable of working on both commercial and amateur wave lengths including the shorter waves.

On a trial trip to Great Lakes Naval Training Station, the transmitter reached the East coast on low power, and reception of both East and West coasts were recorded on a special Zenith low loss receiver.

The Big Bill has been constantly in touch with Chicago amateur stations since its departure from Chicago several weeks ago.

Page expects to communicate regularly with amateurs. The official radio call assigned to the vessel is WHU.

Doing An Old Thing in a New Way

The ULTRADYNE

The LAST WORD in

By HERBERT H. STEINKAMP

CLAIMS to the contrary notwithstanding, practically every popular circuit used in receiving sets today is but an improvement or a modification of some long established, universally accepted method of reception which has been recorded in the Patent Office for years.

It has been the degree or the scope of these improvements that has kept the fires of interest alive and made each slight change in these fundamental circuits appear as some new and revolutionary method of bringing in signals destined to consign all the old principles to the scrap heap.

There has been nothing fundamentally new. Names have been changed, the trimmings have changed, some of the units have changed, but whether the set possesses one tube or twenty, the process of detection and amplification is still accomplished by one of the several tried and proven methods.

No such foolish claim is made for the ultradyne circuit, which has been developed by R. E. Lacault, formerly Radio Research Engineer of the French Signal Corps. It is merely a new way of doing an old thing better. Essentially it is the super-heterodyne system with modification, carried through to its ultimate.

Consequently those who understand the super-heterodyne in its original form will easily comprehend the beneficial changes that have been incorporated in its outgrowth—the ultradyne.

This same basic principle is employed in the ultradyne circuit, except that instead of employing the first tube as a detector, an arrangement known as the modulation system is used. This is the nerve center of the ultradyne.

Let us see how this unique modulation system functions. For enlightenment we turn to the broadcast station. The system employed there to transmit speech and music consists mainly of a generator of radio-frequency oscillations, a modulator system and a microphone.

When the transmitter is turned on, but no one is speaking into the microphone, a continuous stream of waves leaves the aerial, and this train of waves is known as the "carrier." When some one speaks into the microphone the carrier wave is varied in accordance with the voice, and if the carrier could be

seen, small ripples would appear on its crest. In short, the voice waves are impressed on the carrier wave so as to modulate it.

Employs Modulation

THE ultradyne modulation system functions in precisely the same manner, except that it is the incoming modulated carrier wave that modulates the oscillations produced locally. The first tube in the ultradyne circuit, therefore, is the modulator, and the second tube

latter, the second the oscillator, the third, fourth and fifth the radio-frequency amplifiers, the sixth the detector and the seventh and eighth the audio-frequency amplifiers.

The potentiometer in this circuit has a resistance of 300 ohms and controls the grids of all three radio-frequency amplifier tubes. The first rheostat has a resistance of six ohms and regulates the current flow of the filaments of the modulator, the three radio-frequency amplifiers and the detector tube. The second and third rheostats have a resistance of thirty ohms each and regulate the current flow through the filaments of the respective audio-frequency amplifier tubes.

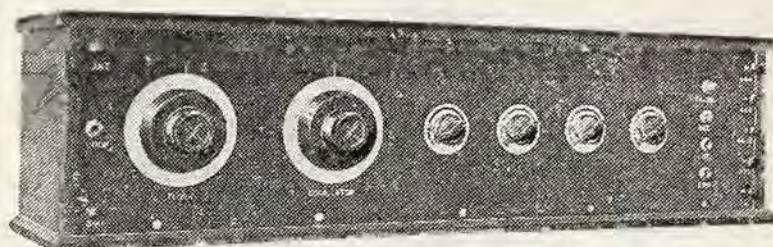
No rheostat is employed in the filament circuit of the oscillator tube, as it is of no advantage. With the other tubes lit, there is a drop of potential so that the voltage across the filament of the oscillator tube is approximately correct. Consequently, the filament cannot be harmed.

Three jacks are provided so that the detector, first or second audio-stage can be plugged in at will. A fourth jack, placed on the extreme left of the panel, is automatically disconnected from the secondary of the tuning coil and connected across the loop. At the same time the aerial and ground circuits are opened.

The Tuning Unit

The tuning unit or the aerial tuning inductance employs an untuned primary. Necessity of an aerial tuning condenser is thus dispensed with. Tuning, however, is made sharp by utilizing loose coupling between the primary and secondary of the aerial tuning inductance.

A radion tube three inches in diameter constitutes the support for this coil, which is wound with eight turns of No. 20 dec wire on the lower portion for the primary. The secondary consists of sixty turns of the same size wire wound on the upper portion of the same tube and so placed that there is a spacing between the two coils, thus formed, of 1 1-2 inches. The secondary coil is shunted by a variable twenty-three plate condenser of .0005 mfd. capacity. This forms the tuning control.



A front panel view of the completed Ultradyne Receiver. The tuning of this receiver is the same as that of any other super-heterodyne receiver, the secondary and oscillator controls with an occasional adjustment of the potentiometer being the only controls needing adjusting.

the oscillator. Any wave picked up by the aerial system is, of course, impressed on the modulator tube first. This tube, being connected to the oscillator through the plate, has a direct effect on the local oscillations.

There is no "B" Battery voltage on the plate of the modulator tube, the plate being connected to the grid of the oscillator tube.

Consequently, the oscillator impresses a radio frequency current on the plate circuit of the modulator tube. Since an incoming wave will vary the resistance existing between the grid and filament of the modulator tube, the flow of the radio-frequency plate current furnished by the oscillator will likewise be varied. Hence, the local oscillations are modulated in accordance with the incoming wave.

The modulated radio-frequency "beat" produced by the conflict of the incoming wave with the local oscillations and with the modulation of the beat by means of the modulator tube is then passed through the long-wave radio-frequency amplifiers for further magnification. Here the signal is increased thousands of times in amplitude. From the radio-frequency amplifier the signal passes into the detector tube, where it is rectified. It is then, if desirable, amplified at audio-frequency. The first tube is the modu-

for Real "DX" Super-Heterodynes

Inductance of the oscillator unit consists of thirty-two turns of No. 20 dec wire wound on the lower portion of a radion cylinder, three inches in diameter. This is the plate coil. A second coil is wound on the upper portion of the tubing with thirty turns of the same size wire. This is the grid coil. A spacing of one-quarter of an inch to provide coupling is left between these two coils. This may be seen in the wiring diagram.

The grid coil of the oscillator inductance is shunted by a variable condenser having a capacity of .001 mfd. This condenser is employed for varying the radio-frequency oscillations produced by the oscillator tube. A fixed condenser having a capacity of .001 mfd. is connected from the grid to the plate coil and in this position functions as a by-pass for the radio-frequency currents.

IN ADDITION, there are the necessary ultraformers. These are long-wave radio-frequency amplifying transformers, designed, as explained before, to amplify

at one frequency or wave-length only. The first or input transformer is slightly different in design from the other three, and has both its primary and secondary coils tuned.

They are tuned to such a wave-length that no interference is experienced from the long-wave trans-atlantic stations, nor from the lower-wave navy stations. The frequency band to which they are tuned is just wide enough to avoid cutting off any portion of the frequencies covered by speech and music.

In order to make the ultraformers resonant at one frequency only, small, fixed .00025 condensers are shunted across the secondary of each, as shown in the wiring diagram, Fig. 1. It is important that the capacity of each of these condensers be exact, so they should be tested on a capacity bridge for accuracy. The input transformer is even more sharply tuned, having a fixed condenser of .001 mfd. shunted across its primary coil, aside from the .00025 mfd. condenser across its secondary.

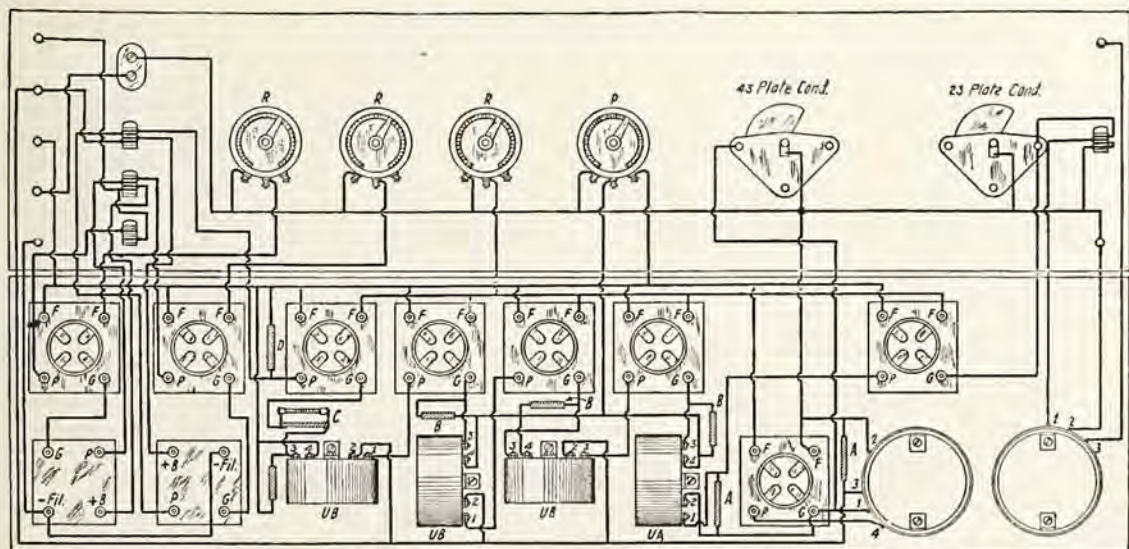
The sketch shows the layout of an eight tube ultradyne receiver and the photograph gives an idea of the appearance of a complete set constructed after the same layout.

Materials Required

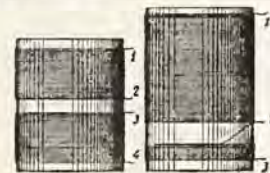
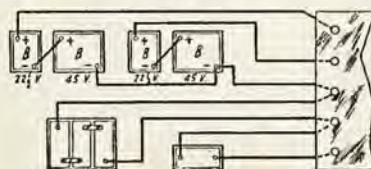
The parts required for the construction of an eight-tube ultradyne are:—
One 7 by 30-inch cabinet with base-board.

- One 7 by 30 panel.
- One .0005 mfd. variable condenser.
- One .001 mfd. variable condenser.
- Two vernier knobs and dials.
- One tuning unit.
- One oscillator unit.
- One ultraformer, Type A.
- Three ultraformers, Type B.
- Eight vacuum tube sockets.
- One potentiometer (300 ohm).
- One 6-ohm rheostat.
- Two 30-ohm rheostats.
- Three double-circuit jacks.
- One single-circuit jack.
- One filament switch.
- Two audio-frequency transformers.
- One variable grid leak.
- Seven binding posts.
- One .00025 mfd. grid condenser with grid leak mounting.
- Four .00025 mfd. mica condensers.
- Two .001 mfd. mica condensers.
- One .005 mfd. mica condenser.
- Thirty-six feet No. 14 Copper tinned bus bar wire.

It will be best for the constructor to follow the layout given, as each part is



- P = Potentiometer
- R = Rheostat
- A = .001 M.F. Condenser
- B = .00025 M.F. Condenser
- C = .00025 M.F. Condenser with clips
- D = .005 M.F. Condenser



A wiring diagram of the Ultradyne Receiver as described by Mr. Steinkamp in the accompanying text. This illustration may also be used as a baseboard layout for the apparatus, as the arrangement of the apparatus coincides with the front panel and back panel views of the set shown in other photographs.

FIGURE 1

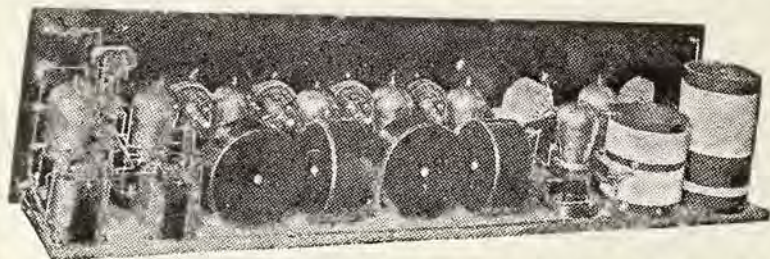
located so that all leads from one instrument to another are as short as possible. A deviation from this arrangement may bring about disagreeable complications in actual operation which would eventually be traced to capacity coupling between the successive radio-frequency amplifier stages.

It is to be noted that the ultraformers are mounted directly behind the radio-frequency amplifier tubes to which they are connected, and that each ultraformer is placed at right angles to the next. Be sure you mount them all uniformly. Nothing more need be said

found, and then turn it back slightly.

With both the tuner and oscillator dials set at zero, start working toward 180 degrees, moving the oscillator dial one degree at a time only. For each degree change of the oscillator dial, the tuning dial should be varied through ten or fifteen degrees. It will be found that a slight hissing noise is heard at certain points on the oscillator dial adjustment. This denotes that the tuner and oscillator are in resonance with each other. It is at such settings that stations will be picked up.

As soon as a station is heard, no



The accompanying back panel view gives an excellent idea of the way in which a compact and effective super-heterodyne receiver should be constructed. Note especially the short distances between the tubes and transformers, and the right angle mounting used. This set is truly a distance getter.

concerning the layout, as the sketch is complete enough for the constructor.

Although any type of vacuum tube may be used in conjunction with the circuit, it is advised that either UV-201-A or C-301-A tubes be used throughout. Since these tubes draw but one-quarter of an ampere each, the drain on the storage "A" battery is not so excessive as it would be with such tubes as the UV-201 or C-301. Furthermore, the electrical characteristics of the UV-201-A's and C-301-A's are quite uniform and they prove to be good oscillators, radio-frequency amplifiers, audio-frequency amplifiers and detectors.

To Bring in Stations

THIS receiver is very easy to tune. After connecting up the "A" and "B" batteries after the manner shown in the lower portion of the sketch, Fig. 1, pull the filament switch and plug in the headphones or loud speaker. Move the knob of the potentiometer toward the right until the oscillation point is

matter how weakly, the tuning dial should be set for maximum volume, and not until this has been accomplished should the adjustment of the oscillator dial be made. The final adjustment will consist of moving the potentiometer knob toward the right until a point is reached where maximum volume is had without distortion.

It is to be remembered that a broadcast station cannot be located by the carrier wave in the manner usual to a regenerative set in a state of oscillation; hence one is apt to pass by a station that is "on the air" but not broadcasting. However, one can usually tell that there is a station on the air by a hissing noise that will disappear as soon as that point on the tuning dial is passed.

The ultradyne, like the neutrodyne, can be calibrated and a chart or a graph made with the dial settings on the tuner and oscillator plotted against the wave length or marked down for each individual broadcast station.

A. R. R. L. Endorses Esperanto as Radio Lingo

Hartford, Conn.—After a two years' survey of the international language situation, the American Radio Relay League has decided in favor of Esperanto as its official international auxiliary language, this action having been taken by the A. R. R. L. board of directors at their annual meeting in this city.

This decision was made on the ground that Esperanto is easily the chief of the auxiliary languages and has by far the greatest number of followers, with hundreds of thousands of users. Not wishing to enter upon the subject unadvisedly, the League first communicated with all of the national amateur radio societies of the world and all of these which ex-

pressed an opinion in favor of any artificial language recommended Esperanto.

Interest in an international language developed rapidly among members of the A. R. R. L. following the successful communication in radio telegraph code between transmitting amateurs in the United States and Canada and those in many foreign countries. The necessity for the endorsement of an auxiliary language has become particularly apparent as a result of the increasing interest of amateurs in international communication during the past year.

There is every reason to suppose, the A. R. R. L. believes, that radio communication in code between the private citizens of one country and those of another will become even more popular the coming Winter.

International Radio Week in November

International Radio Week will be held November 23d to 30th, inclusive, according to announcement by the Radio Week committee of the National Radio Trade Association, who conducted this event last year and who are making plans for an even greater international exposition of radio progress this season.

In addition to the activities in the United States among broadcasters and the radio trade in general, Great Britain, France, Australia, Canada and Cuba will join in the celebration.

In England the various trade associations already organized will have complete charge of the English part of the celebration, while in the other countries special committees appointed by the trade bodies in the radio field will handle the details to make all the special programs dovetail so as to insure the success of this world-wide movement.

Henry M. Shaw, president of the National Radio Trade Association, in announcing the committee report for dates, also announced the appointment of Powel Crosley, Jr., president of the Crosley Radio Corporation, as executive chairman; Arthur H. Lynch as international broadcasting chairman; Paul B. Klugh, executive chairman of the National Association of Broadcasters, as chairman of the broadcasting committee, and Clyde P. Steen, secretary of the Window Display Advertising Association of Cincinnati, as chairman of the window display committee for Radio Week.

Announcements of other committees and special features for Radio Week will doubtless be made in a short time, Mr. Shaw explained.

Special postal cards for radio fans to use in inviting friends to Radio Week parties will be prepared. Other features of public interest will also be announced.

Radio Week originally started as a national affair, rapidly spread to Canada and England, proving the world-wide power of wireless communication. The spontaneous co-operation of the entire radio world in the 1924 event gives considerable foundation to the claim of Paul Weil, prominent New York advertising man, who expresses the belief that "Radio Week for the promotion of better understanding between all nations" would be more expressive of the possibilities of Radio Week.

"Dream Girl" from WGY

The entire performance of "The Dream Girl" was broadcast by WGY, Schenectady, from the stage of the Ambassador Theatre, New York, on September 1.

This musical comedy of Messrs J. J. and Lee Shubert was put on the air in place of the program originally scheduled by WGY for that evening. The Schenectady station is able to offer the entire performance as a result of the co-operation of station WHAZ of Troy, N. Y., which is ordinarily scheduled to go on the air at 10 o'clock.

Now Come the Radio Politicians

Best Radio Candidate Will Be Victor at National Elections, Is Prediction

WASHINGTON—Well, "it's all over but the shouting," but there is sure to be a lot of that before the polls close November 4th, and much of the shouting will be over the radio broadcasting circuits of the country.

With the broadcasting of the political conventions this year, a new slogan was born. It no longer holds "That he who runs may read," but rather, "He who listens in may hear." Blase politicians, and even those who still believe something new is possible, were astounded at the interest displayed in broadcasts which carried to every city and farm the very words of the nominators and seconders, the votes of delegations and the stentorian tones of the chairmen. The radio listeners were on the inside for the first time. Through them the public at large had its ear to the air.

Newspapers were aided in their stories and editorials through radio. Some carried a daily ringside, or round-by-round resume of the sessions. Many people read these running accounts which were not dissimilar to the inning-by-inning baseball stories found on the sport pages.

Democrats Thank Broadcasters

AT THE final session of the Democratic Convention in New York, a resolution was passed thanking the twenty broadcasting stations and the Bell System, together with their associates, for service rendered the convention and the public throughout fifteen days and nights of broadcasting. The convention so phrased the resolution as to include the thanks of the fans themselves, knowing the interest and appreciation in that quarter.

Before the campaigns are fully launched we shall see that campaign managers have laid plans for broadcasting the speeches of their candidates and auxiliary speakers, wherever arrangements can be made with broadcasting stations, and again we will tune in to hear what we shall hear.

Every fan in the country will also prepare to listen in when the polls close on November 4th. The returns will be gathered directly from precincts in all the states. It is foreseen that broadcasters will co-operate with local papers or precinct headquarters and election boards so as to carry minute-by-minute bulletins on returns. Those who do not possess sets of their own will join the crowds in front of newspaper offices where loud speakers will be active.

The presidential campaign this year is fraught with a new and exceedingly interesting question; Who will get



John W. Davis was one of the first candidates for the presidency to take the "radio stump" last month. His voice already has been heard over several big radio stations, and he plans intensive use of radio before the polls close.

the vote of some 25,000,000 radio fans? Undoubtedly the host of listeners will be influenced in their voting by spellbinders of each party as soon as the candidates for president and vice-president are named. The candidates themselves, will soon be on the air, voicing their platforms and aims.

Some of those mentioned as possible candidates and others more certain to be nominated have already been heard in practically all the states of the Union. They have impressed the millions of fans one way or another, and it is the first time in political history, that as many citizens have come into contact in any way with aspirants for high national honors. To be sure, not many fans have seen the men who will be selected to stand for election in the fall, but many have heard, or will hear them speak before they vote. It is estimated that the broadcasts from the conventions at Cleveland and New York, will be carried by as many as twenty broadcasting stations and that these announcements and speeches will reach 25,000,000 fans.

President Coolidge is far better known today in radio land than any other man who entered a campaign. Hundreds of thousands of fans in many states have already heard him.

Coolidge and Davis Evenly Matched In Contest to Win Favor of Fans

What Will Happen?

THE question of the effect of the radio vote is especially interesting because it is new and because it may break down party lines. It is certain that voters, otherwise uninfluenced, will cast their ballots for their friends of the air whom they feel they are acquainted with better than an individual whose voice and ideas they have never heard.

Two candidates could hardly be more evenly matched over the radio than President Coolidge and John W. Davis. They are about the same height and weight, Mr. Davis perhaps being a trifle heavier and taller.

Both stand squarely up to the microphone, both are almost motionless when speaking, both speaking an ordinary conversational tone. Both talk along easily and evenly, never lacking for a word, both are deliberate, both are lawyers and of a legal turn of mind, both are men of unusual refinement of speech, both are college graduates, both are experienced speakers, both firmly believe in short speeches, and both are exceedingly careful in what they say, one having served as a governor, vice president, and president, and the other as a congressman, solicitor-general, ambassador extraordinary and minister plenipotentiary to Great Britain.

"And," adds James D. Preston, sage of the Senate press gallery and newest of radio experts, "both Mr. Coolidge and Mr. Davis have remarkably good radio voices."

Which seems to make it unanimous. Not one person in a thousand who hears President Coolidge over the radio has ever had the opportunity of seeing him, but so faithful has been the reproduction of his voice that should they ever actually get within earshot, it is reasonable to believe they would recognize him.

How Radio Converted Coolidge

And just as the listener-in is getting better acquainted with the President, the President is becoming more and more at his ease with his newly-found friend, the microphone.

It may be remembered how for years President Roosevelt fought the automobile, but finally yielded and became a real enthusiast. Just so, it is said, President Coolidge did not warm up to the radio. After each address, however, like other popular broadcasters, he has received an avalanche of commendatory letters. These have increased in number as the President has become more at ease and really himself in the

(Continued on page 49.)

Hazardous Adventures as a Commercial Operator

By ARTHUR LEECH

IT WAS not more than two weeks after I had started to "post up" at the "BX" station, (Bellevue-Stratford Hotel, Philadelphia, later "BS"), that I was called on to go to sea.

The fast-growing need for operators could only be supplied by encouraging amateurs and wire men to "break in" at the land stations, as there were no radio "ham factories" (telegraph schools) in those days. Examinations and licenses were unknown.

At that time I was a proper "lid" on receiving stuff where every letter counted. Sitting at home quietly piecing out press and weather reports, et cetera, I found it to be a different bit of business from having the stuff slapped directly at me thirty a minute by a Morse hound bent only on getting my OK and sine on a flock of real messages. Continental was at that time a novelty, being used only by the Navy. American Morse is at least a third faster.

On the third or fourth night of my course, Dave Heilig, station manager, was called out and left me in charge. I was so scared I could barely lift up the phones, and as I got them on I was immediately paralyzed from ears to fingers. My worst fears were realized—"NY" WAS CALLING "BX" LIKE A HOUSE AFIRE! By the time I had gotten my palsied muscles to functioning "NY" was on his fourth call, four times as mad and sending four times as fast. I was faintly slapping the key in reply when Dave returned.

"Good gosh! What's the matter?" he asked, after a look at my haggard countenance.

"Nothing," I managed to reply. "MIN," I said on the key, then to Dave, "Here, take 'em."

I handed him the phones and staggered to the roof for air.

One of the first messages gave me my second big thrill from the commercial slant. After I had reread it for the tenth time to be sure it sounded right—it was a SVC (service) and had no check, or number of words to assuage my doubts as to whether or not I really had it all—when I finally assured myself that I had been justified in OK'ing the message, I noted its contents. It advised the station manager that on the following Saturday New York would need two operators to sail to parts not mentioned. I did not take the allusion "operator" as referring to me, but after Dave had looked the SVC over, he said: "Well, Art—what say? Want to go?"

With the big chance suddenly looming up before me, I waxed weak in the knees and home and Mother seemed a lot more desirable than steamships and foreign ports. Maybe my scant fifteen years had something to do with it. However, Dave SVC'd "NY" that "Operators" Killie and Leech would report. On the way home I spent a hectic time, hot and cold



Once outside and flattened against the deckhouse by the wind, I was ses of wind-whipped foam, towered all about us, threatening to wipe tions, was a mighty unimportant speck in the tumult. . . . Looking

in turns, one minute on a pinnacle of joy and the next in the slough of despond, and by the time I got to Camden I was well nigh gibbering. Mother was as concerned as I had been at the news, but after a conference we decided to see it through.

What a pathetic little figure I must have been, trudging aboard the Camden-Philly ferry before daylight Saturday morning, October 9, 1909, in a dense fog that symbolized perfectly what I was facing.

Meeting friend Kille as arranged, I looked him over anxiously, but vainly, for any traces of such excitement as was surging through my breast.

In New York we repaired immediate-

ly to the roof of 42 Broadway, headquarters of the United Wireless Telephone and Telegraph Company, and crawling under and over and around a host of pipes, tanks, wires and similar devices common to the attics of New York's office buildings, we shortly stood before the arbiter of our destinies in the form of H. J. Hughes, Operating Superintendent, absolutely one of the finest gentlemen I have ever met—in spite of his being an operator. H. J. H. I shall always remember as a medium-sized gent whose face was always smiling, even when he was serious. I must certainly have looked like a tender sapling to trust with the safety of an ocean-going steamer and her precious cargo of human lives. However, reassured by H. J. H.'s kindly presence, I gradually regained some measure of the last ounce of poise which had trickled out of my system as we had ascended in the elevator.

Kille, quickly assigned to a vessel, briefly took leave and passed out of my life. I was bade to stand by while H. J. H. disposed of routine duties. After an hour I began to get anxious again. Anxiety shortly turned to panic and I spent some minutes picturing my dire circumstances—with no ship, alone, penniless and forgotten in New York, a fifteen-year-old wanderer with an enormously heavy suitcase, buffeted about

Being the Second of a Series of Unusual Memoirs

send a "Leaving dock" "OS" (position), a practise long ago discontinued on account of the unnecessary interference caused. Listening carefully for a break in the fearful jam of stations on the air, I finally got a clear minute and with generator running I threw down the aerial switch and—lost my nerve. Having faltered for a few seconds I knew I was too late, and sure enough on throwing up the switch "NY" was working with another ship. At the next break I slammed the switch bravely and called "NY NY VJ" Back he snapped with "VJ NY Ga" and I was into my first ship to shore communication. Outside of the key sticking every other letter and the fact that I said "1:55 A. M. VJ left dock" instead of "1:55 P. M." I got it over. "NY" had quite a job on his hands getting me corrected, but I finally savvied and made it "1:55 P. M."

A Rude Awakening

About 7 a. m. the next morning I suddenly "came to" compactly piled up in one end of the berth. Before I could get unwound, and the ole bean to work doping out this unusual situation, my end of the berth elevated itself to the top of a perpendicular and I shot down to the foot, plus pillows, bedding and some clinging, snapping, troublesome articles which I shortly discovered to be the phones. Now thoroughly awakened, I could hear a tremendous whistling which I took to be the wind, accompanied by much splashing and running of water. Recalling a storm warning I had pieced together the night before we sailed, I gathered that this was it.

This much understood, I next turned my attention to a strange tumult raging nearer at home—somewhere between the heart and liver, to be as specific as I was able. Two guesses as to what was the trouble. Not wishing to dwell on such personal matters, I watched my chance between leaps and vigorously swung my feet out of the berth and plunked them down hard—right into my suitcase on top of the clean shirts. I then perceived that practically everything but the set had broken adrift and was mixing it merrily on the floor at each gallop of our laboring steed. A sudden lurch shot me into an upright position and into another surprise, which was that this business of standing up had to be learned all over again. Three good wallops put me where I would be safe while I formulated plans.

I had wound my arms desperately around the tuner. My efforts were fully



Drawn for RADIO AGE by T. R. Braithwaite

appalled at the sight around me. Waves higher than I had ever imagined, topped by mast-out our little craft. The ship, which at dock had impressed me as a mass of sizeable porpoise forward I saw a monster wave headed directly at us. . . . and I thought the end had come.

by the careless crowd. Despairingly I looked into H. J. H.'s room, to see him apparently at ease as if the docket were clear. As a reminder that the most important piece of business in the world was still on the boards, I stepped in.

Hope—Then Despair!

"Heavens," said H. J. H., (or was it the other place), "we have forgotten Leech."

And by the way he looked vacantly at his list of ships I instinctively knew that I had been left out somehow. "Everything that sails today seems to be filled up."

I felt too forlorn to reply.

"Ah," said H. J. H., "here's one—but she does not sail until next Wednesday." I was so immensely relieved at having something that it was a few minutes before I started to wonder how I was to live until Wednesday with about two dollars in my jeans. H. J. H. evidently saw my predicament.

"I think," he said, "that you can live aboard, but they don't keep house in port on that line, so you will have to eat ashore."

Everything was in process of overhaul when I arrived aboard the "Seminole" at Pier 31, South Brooklyn, and a heavy, depressing smell of fresh paint mixed with the usual dock odors prevailed everywhere. To this day similar smells around a dock remind me of that day

and give me a momentary fit of the blues. The wireless room, a 6x8 converted stateroom on the upper deck, was a wreck. Steamfitters had installed a new radiator and had departed leaving the usual mess. And on this detail hangs an important later development. As to furnishings, the upper berth contained the big coffin-like 1 K. W. transformer, a case of leyden jars and the helix and spark gap. A shelf over the motor generator was large enough for the tuner and a pad of message blanks. The lower berth held mattress, blanket and one pillow, but, of course, no linen. The washstand contained nary water, soap nor towels. I could not get any bed linen, but I did get a towel, some soap and a clue to a fresh water tap. The stewards informed me that the ship was out of commission and that there was nothing doing on any service before sailing day. However, the berth, linen or none, was better than a bench in the park, so I dug in for a lonesome wait.

The three days and nights before sailing I spent in cleaning up the set, copying for practise and wandering around Brooklyn. I was already so homesick that I nearly deserted ship, but I stuck it out and finally the big day arrived. As I watched the dock receding I had to admit a grand exhilaration now that the "great adventure" had commenced.

The first duty in those days was to

rewarded as this instrument accompanied us on the backward crash and I kept it close to my bosom for the complete cycle back across the washstand and return to the table. Only—we missed the table by several feet of altitude and joined ourselves freely with the motor-generator and the oil can. There we stuck. Forsaking my first love, the tuner, I firmly embraced the motor-generator and with face resting comfortably among the collector ring brushes, I thought this thing over calmly.

The disturbance in the neighborhood of my floating ribs becoming serious, I determined to return to bed. Spreading arms and legs so as to give myself a stable wheelbase, I cautiously sat up and quietly studied the strange contortions of our gallant vessel for some sign of system or sequence, but I could detect neither. I had just given it up when a heavy, regular tramping approached on the deck outside. At this sign of life aboard I felt better and with the knowledge that here at least was one person who could not only stand up but make excellent time in a predetermined direction.

But the tramping stopped outside my cabin, a firm hand seized the knob and opened the door. In rushed a large section of salty gale, mixed with a dash of spray and Captain McKenzie. Slamming the door behind him, the skipper dashed the brine from his eyes, took one look at the wreckage, burst into a flow of language that started like a prayer but wasn't, and stamped out of the room. Five minutes later Carey, the First Mate, came in and not unkindly offered to lend a hand to get matters straightened around. Shortly we had everything made fast and the room took on a business-like aspect.

"Fishing" for Signals

Carey had brought our 8 a. m. "OS," also a request from the Captain to rustle up a weather report. As I was about to reply my stomach turned end for end and did not immediately return. Carey instinctively ducked, but it was a false alarm that time and by a herculean effort I forced my digestive organs back into place. Agreeing to have the engineers start up the dynamo—we normally only had juice during the night—Carey left, after advising me that I would feel better in bed.

Then started a session which paralleled my first siege of listening at my first set in 1907. Not a sig could I hear; not a soul could I raise, although we were but 250 miles from New York and in easy range of "AX" and "HA," Cape Hatteras. As often as I could marshal strength I continued calling "AX" and "HA" for hours, then "CQ"—general call. Hearing no response I started broadcasting my "OS," "8 A. M. VJ 210 South Hook," keeping this up steadily until without notice the juice suddenly went off.

In the forenoon I attempted the trip below to ask for power again. The wireless room was on the windward side and I soon found that I had a lot more stuff to learn about conduct in general with relation to the roll of the ship, wind direction, et cetera, nearly breaking a

complete set of arms and legs in the first battle with the cabin door. Once outside and flattened against the deckhouse by the wind, I was appalled at the sight around me. Waves higher than I had ever imagined, topped by masses of wind-whipped foam, towered all about us, threatening to wipe out our little craft. The ship, which at dock had impressed me as a mass of sizeable proportions, was a mighty unimportant speck in the tumult. I was first surprised, then relieved, at the quick response of our ship to the necessities of the raging waters. Looking forward I saw a monster wave headed directly at us and I thought the end had come. But the old "Seminole" climbed that hill like a duck and in an instant we were right on top—all ready for the dizzy slide down the other side. I proceeded on my way, slowly slipping, sliding, down the deck.

For the next three days, fighting sea-

BEG YOUR PARDON!

In introducing the author of this series last month, RADIO AGE erroneously referred to him as "Arthur Lynch" instead of "Arthur Leech." Mr. Leech is a veteran operator known to thousands of fans throughout the country, and his adventures will be appreciated by those who know the true facts of the early days of radio. We hope the impression created last month will be corrected by this explanation.

sickness, homesickness and general disgust, I doggedly hammered that key by the hour, whenever I could get juice, calling "CQ" and broadcasting our latest "OS."

Then, Saturday night, (October 16, my diary says), with weather moderating, I decided something was wrong with the set, and I discovered that I had been working without a receiving ground, absolutely no soap for any distance in those pre-R. F. amplification days. You recall my allusion to the steamfitters installing a new radiator so as to furnish me with material to write about fifteen years later? My receiving ground had run to the steampipe and those gentlemen of the wrench and red lead had cut the wire and stuffed the end inside the partition while proceeding with their dirty work!

Touching the wire to the radiator, I immediately heard about eighteen sparks with different tones, sounding like the lost (and found) chord on a church organ. Making hasty connection, I heard in five minutes enough ships and stations to fill two log sheets. While rejoicing at thus solving the problem, my blood suddenly froze ice as I realized what I had been doing for the last three days and nights. I had dumbly been jamming the whole coast. I must have done especially heroic execution on the second day out when, while only 150 miles from "AX" and "HA" I had been on the key steadily during those hours when said stations were normally overtaxed clearing the flock of ships that had left New York the day before. And at night, during the freak range of the set, which might be anything. What a mess

I had made of the wireless communication of the Atlantic seaboard! Appalled, I decided to remain silent on the up-trip, sneak off the ship to avoid the lynching party sure to be waiting, change my personal sine, develop a new style of sending and ask for a transfer.

Another "Faux Pas"

However, that was borrowing trouble. I still had enough for the immediate present, what with a skipper absolutely convinced that I was purely excess baggage. Next day we were to pass the "VK," S. S. "Cherokee," northbound, which was something of an event to the skippers anxious to exchange long messages regarding general conditions. I made a complete daub of this deal too, and my stock went from .00 to .0000 with the Boss. Due to a comedy of errors in which "VK" called while I had no juice, and I had juice while "VK" was off the job, in connection with real tropical static when we both had juice, we missed each other entirely. After this had been going on about a day, "VK" called me, and in response to my impassioned plea to the Chief that "VK" was calling, he forced his crew to reassemble the dynamo right in the middle of some delicate repair work. The fact that it was twenty minutes before I could answer, during which time "VK" had given up and gone off the job, meant nothing to the Chief. As my pilot light died down, my last hope went with it, for in my diary under Sunday, October 17, 1909, I wrote: "Have decided to resign. Wrote letter to Ma."

Tomorrow was another day and I felt better when we saw our first land—Turk's Island, a British possession. Although producing only one thing, salt made from evaporated sea water, and anything but beautiful in form, it was my first view of a foreign land and for a time my troubles were banished in the activities attendant upon lightering the cargo to shore. The lightermen were British negroes, a different type from our American negro, and as they worked on some kind of a piece work scale, much competition was engendered in maneuvering for a place at the ship's side.

The outstanding point of interest on my first trip was the arrival at Monte Christi the next morning. I looked over the ship's rail at the most colorful panorama I had ever seen and it remains with me to this day as a peer of my travels. The water about the ship was a transparent blue as deep as laundry bluing and as it approached shore, it shaded off to a light blue, then through all shades of green to a line of foam on a white beach of coral sand. Clumps of palms, picturesque native huts, and a deep purple background of snow-capped mountains in the distance from which the morning mists were melting in ever-changing halos of gorgeous coloring, completed the picture.

The glamor of the extended excursion from port to port among an old world atmosphere so different from what we knew at home, kept me free from worry until the day we took the aerial down looking for a loose joint that had de-

(Continued on page 60.)

Our Hall of Fame



"DOUG AND MARY" LISTENING IN



What the Broadcasters are Doing

"Husk" O'Hare Captures Radio Hearts

RADIO orchestras are many, but very few are remembered after the rheostat is turned off. On the fingers of one hand radio fans can name the orchestras that they've heard and would really like to hear again.

And if Summer fans have been tuning in on WLS, the Sears-Roebuck Station at Chicago, during the past three months, they will undoubtedly devote one of the fingers of the aforementioned hand to "Husk" O'Hare and his inimitable band of syncopators who have been broadcasting over WLS from the College Inn of the Hotel Sherman.

"Husk" prides himself that his dance orchestra is just as intriguing over the ether as it is 'midst the rattle of Chicken a la King dishes in the College Inn. To prove it he exhibits a bushel of telegrams and letters he has received since his boys began furnishing the jazz music for WLS and Chicago's dance lovers.

"It's all in taking music as an art," "Husk" explains.

"We don't play a piece unless we know it is musically perfect and able to withstand the ravages static causes. For we know if our music is good 'radio music,' it will certainly be the best there is out on the dance floor."

New Chicago Station

Chicago now has another broadcasting station operating under the call letters of WTL, located at the Webster Hotel at Webster Avenue and Lake Shore Drive, only a mile or so away from the Drake Hotel station.

The station operates on 258 meters, and uses 10 watts power. It is owned by the H. G. Saal Co., radio manufacturers.

A new and larger station is pending, the plans being nearly completed

Washington Bishop Preaches on Radio

Washington, D. C.—Radio will shortly rank with printing as a great medium for spreading the gospel of Christianity. That is the conviction of friends of the National Episcopal Cathedral in Washington, where former President Wilson is buried and from which special services have been broadcast every Sunday afternoon at four o'clock during the last year. It is estimated that from 250,000 to 400,000 persons listen in every Sunday and the services have been picked up as far West as the Mississippi Valley.

Almost letter-perfect transcriptions of sermons are received by the Right Reverend James E. Freeman, D. D., Bishop of Washington. Hundreds of letters indicate enthusiastic appreciation of the choral services by one of the finest male choirs in the United States.

Improving School by Radio

A thorough and comprehensive plan to adapt radio to the public school is now being tried out under the supervision of the research director of the Oakland, California, public schools with the assistance of KGO, popular Pacific Coast station.

From tests thus far made it is expected that through the medium of radio more voluntary attention may be obtained from a child in school.

Dr. Virgil Dickson, research director of the Oakland Public Schools, announced recently that a committee working on the radio problem is divided into two groups differing in opinions. One group believes that a lesson by radio will be limited to a message of special importance by some special speaker who is able to give it better than anybody else. This is the lecture type of lessons and will be limited to specialists.

The opinion of "group two" is that findings point to radio as a means for giving actual classroom lessons. It is their belief that the radio teacher may take the place of the classroom teacher and give the same kind of lesson; however, the regular classroom teacher will listen in and point out upon maps, globes or charts topics referred to by the radio teacher. The regular classroom teacher will also direct operations of the class and see that pupils make proper notes required by the radio instructor.

The lecture plan as advocated by group one of the committee has been tried out by broadcasting one lesson in music and another on Indian customs. Returns from various schools listening in indicate that both lessons were successful. Opinions of group two of the committee have not yet been verified, as the test lessons on geography, Shakespeare, and commercial arithmetic have not yet been fully tabulated. Under both systems the radio teacher was assisted by pupils also speaking into the microphone, creating classroom atmosphere.



"Husk" O'Hare

What's Going On in Radio Land



Photo from U. and D.
 Army radio operators thruout the country "listened in" to messages from Mars last month—without much success. Corp. John H. Sadler of the Signal Corps is shown at a radio station of the War Department.



Photo from Atlantic Photo Service
 Snuggled in a diving suit, C. A. Jackson of Philadelphia is shown being lowered into the Atlantic Ocean at Atlantic City, where he conducted the first underwater radio broadcast in history. His story was transmitted through WIP.



Mary Jane and Catherine Tompkins "did their stuff" for the ether fans of WLS recently, singing and dancing to the accompaniment of the famed "How D'ye Do Boys," Ford Rush and Glen Rowell. The Youngsters were attired for a regular performance and won many encores.



Photo from P. and A.
 Senator "Bob" La Follette, third party choice for president, is making intensive use of the radio to win the voters to his cause. Here he is shown making a campaign speech before the new machine designed to synchronize voice and action. It is called the DeForest Phono-Film.

The Sunny Side of Running a Radio Station

ABOUT the closest escape from complete annihilation our studio and my job ever had was when we held an 'amateur night.'

"It was a riot. Tracey Drake, owner of the Drake Hotel, the elevator men, and all of the guests in the hotel threatened to get out en masse or throw us out. The day was saved, however, with very small loss of life."

Jack Nelson, until recently the announcer of WGN, the Chicago Tribune radio station in the Drake Hotel, Chicago, was telling some of the highlights in the history of the famous station.

"We had announced for several days that a certain night would be set aside for amateurs," he continued. "Anybody in Chicago or whoever else might care to, could come up to the studio and 'do his stuff' before the microphone. The crush started early. With little deviation from the truth, it might be said that traffic was blocked for a half-mile down on 'Boul Mich.' Everybody who aspired fame before the microphone, from infant prodigies with a fiddle under one arm and a roll of music under the other, to elderly ladies who had tried to get into opera all their lives, but were 'never understood,' came.

On They Crushed

THEY mobbed the lobby; they crushed the dignified guests in elevators; they paraded down the halls; they brought essence of the stockyards to the perfumed corridors, and they found their way up here to the studio and took it like the Smith cheer-boys took the Democratic Convention.

"While guards fought them off to give me breathing room, I announced the great event to the invisible audience, and told them that, to make it interesting, they should send in their votes and the most popular entertainer would get a prize—the wonderful high silk hat of Tracey Drake's!

"Well, with a prize like that to work for, the entertainers got down to real business. Little Clarence tweaked his bow and fiddle in the fashion that his dollar-an-hour professor had taught him. Mademoiselle McCarthy, who had studied abroad from the best vocal teachers to train her for the operatic stage, shrieked her songs of love as she never did before, and the one-man orchestra pepped up the evening with an orgy of music. Telegrams and telephone calls came in like bullets from a

By MILTON LIEBERMAN

machine gun, and the favorites were soon picked.

"Then came the time of picking out the winner and awarding Tracey Drake's silk hat. The most coveted of prizes



Above is Jack Nelson, who until recently was announcer and musical director of WGN, the radio station on the Drake Hotel, Chicago. He is shown above composing one of his song hits.

was about to be awarded to the gasping genius, when Tracey flatly refused to give up his crowning glory.

"'S'pose I'm going to let that classy stove-pipe rest on the flat head of some ham musician? I should say not. That hat stays in the box that still has the \$25 mark on it,' said Tracey.

"And so the prize was not awarded and amateur nights have been discontinued."

All in a Day's Work

Lots of funny things happen in radio studios, some of which the fan gets in on and some that he never hears about. For instance, Jack Nelson tells of the time when a dog escaped from the kennels on the roof directly above the broadcasting room and found its way in.

That time the radio audience heard more than they should have. Everyone was chasing for the hound, which was pedigreed and very valuable, and there was great fear that it would step on one of the high-tension wires in the operating room. While all this was going on, the microphone was open and Jack Nelson was announcing the evening's program.

Suddenly a terrible howl came from the power room, just next to the studio, and Nelson asked, excitedly, if the dog

had been killed, or what had happened. Elliot Jenkins, one of the original owners of the station, shouted back, not knowing that the microphone was connected: "The blankety-blank-blank confounded mutt got mixed up in the furniture."

Blankety-blank-blank in themselves are innocent words, but the real speech which they hid is not the sort of thing that should be heard by children who had just turned off the bedtime stories. However, Jack's more careful now.

WGN has a humorous side, as you have seen, but it is really one of the most seriously important stations in the world. It has served its worthy purpose in entertaining listeners in all parts of the globe, and by dispensing the market reports from the Chicago Board of Trade with fresh news-items furnished by the Chicago Tribune. And its shining star, Jack Nelson, has become as necessary to his listeners as the most famous movie actor is to his fan.

Jack Leaves WGN

Jack's history reads like a book. When at Northwestern University, he wrote five plays which were acted by the "Hermit and Crowe" student men's dramatic body. His voice, now so popular with radio listeners, won him honor and distinction when the Northwestern University Glee club, of which he was president-director, was sent by the federal government to the Panama Canal zone to entertain Americans. This was the largest body of its kind ever sent. He was also an ensign in the navy during the world war.

Since this story was written, Jack has left the employ of Station WGN (formerly WDAP) for a much needed rest. Already the contest manager of RADIO AGE, Harry Aldyne, has been in receipt of numerous requests asking where Jack has gone and why, and the nature of these letters plainly tells the story of Mr. Nelson's popularity.

Jack tells us that he will again reappear on the air on or about October 27th, when he will open a brand new broadcasting station at Mooseheart, Illinois, a small town located between Aurora and Batavia, with studios both at Mooseheart and Chicago.

Composer of Song Hits

As a music composer he is nationally famous. Among the song hits credited to him are "Foolish Child," "I've Got

A Song For Sale," "After the Storm," "You Are Too Sweet For A Dream," "Carolina," and "Sleepy Head." Two new songs by him have just been placed on the market. One is "I Do" and the other, "May You Laugh In Your Dreams." The inspiration for the latter is his catchword "May you laugh in your dreams, dear listeners," with which he signs off the program each night.

First Radio Courtship

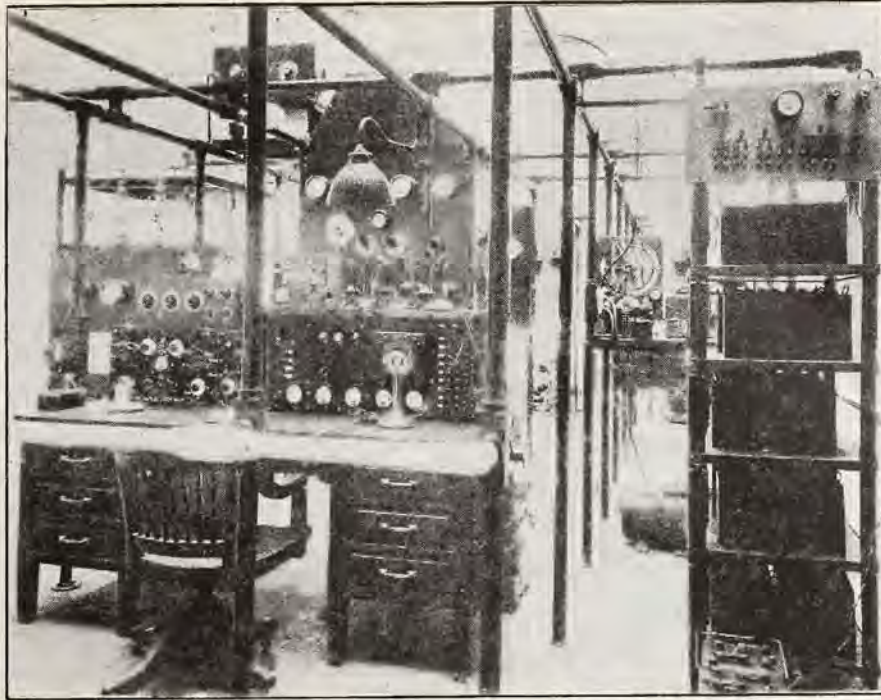
THERE was considerable mention in the newspapers about a year ago when he married a Detroit girl as the culmination of a "radio courtship."

It was said that the girl admired his voice and corresponded with him. However, she wasn't the only one. Jack received—and still receives, although he is married—more "mash" letters than Milton Sills or any other movie star. He is humorous, has a clever and interest-compelling personality, and his voice and interesting talk grips his female listeners. The reception room next to the studio has the walls covered with caricatures of himself as the desert sheik with worshipping women at his feet.

He became program director and announcer of WGN July 1, 1923, after he had been coming up to the studio to play the piano. He replaced Ralph Shugart, who had also earned for himself the title "sheik of the Drake."

The birth of the now famous station, which has made records for distant sending equaled by few other stations in the world, was in the Wrigley Building, on Michigan Boulevard, in the Spring of 1921.

Two wealthy young society men and radio fans, Elliot Jenkins and Thorne Donnelly, created amateur station 9CT. This became quite well known and they moved to larger quarters in the Drake Hotel about a year later. The station was given the call letters WDAP which it retained when it was purchased by the Chicago Board of Trade as its official station some time later. The change in ownership which gave it the present call letters, WGN, came when the Chicago Tribune moved from the Edgewater Beach hotel, where it operated a station with the Zenith Radio Corporation and came to the Drake Hotel, replacing the Board of Trade. This was only a few months ago.



Here is the control panel and generator room of WGN, the new Drake Hotel broadcasting station at Chicago. From the desk in the foreground all the mechanical details of the broadcasting are manipulated. The receiving set at the left is used fifteen minutes out of every hour to "stand by" for possible distress signals from ships on Lake Michigan.

Features of the station's regular programs are the Drake Concert Ensemble, under the direction of Henry Selinger, the Blackstone String Quintette, directed by Irving Margraff, and Jack Chapman's orchestra, in the main dining room of the Drake Hotel. Jack Nelson gives much of the regular entertaining as does Bert Davis, known as the "Clown of the Air."

And Here's Kaney

ANOTHER famous character of the station is "Sen" Kaney, who announces part of the time. He started his career with KYW, and became so popular that the Chicago Tribune took him over while they were still at the Edgewater Beach Hotel. He stayed with them when they moved to the Drake Hotel. "Sen" is no singer, as so many of the announcers are, but he has his admirers, too. His "Well, folks,

station.

Jack Nelson tells another anecdote about the station. There was a Scotchman who had come up to the studio to sing songs about his native highlands. It was calculated that many a heart covered over with the feudal plaid would beat double time after hearing his voice, but when Jack announced that they were ready for him to take the microphone, it was found that he had disappeared. A great search started for him, and fans heard through their headsets: "Paging the Scotchman, paging for Scotch."

"Would you believe it," said Jack, "that not many minutes had passed before we had Scotch—five cases of it. But the saddest part of the story is that drinking liquor is against the rules of the studio, so we had to abstain. It might interest you to know that we created another record that night—that of closing the studio early."

Eskimos Turn Radio "Fans"

When an interesting radio program is being received in their home, Eskimo children are just as hard to keep in bed as any other children.

Discovering this in an orphanage for Eskimo children at Teller, Alaska, the matron has reported that during a recent broadcast she found several of the girls out of bed with their ears to the floor just above the loud speaker, enjoying the program.

"We have thirty-six Eskimo children here," writes E. H. Dahl, manager of the orphanage. "You cannot imagine the pleasure we get from air programs. We live at Port Clarence, the only harbor on Seward Peninsula. Only ships going into the Arctic stop at our door. They get fresh water from our creek."



THE SMALLEST LOUD SPEAKER

What is said to be the world's smallest loud speaker is shown in the photo. It weighs seven ounces and consists of a special type of loud speaking unit in a celluloid receptacle.

How Radio Is Taming Temperament In Hollywood



LOS ANGELES.—The Movies, the scientific world's crowning achievement until the advent of radio, have at last realized the importance of radio as an aid in filming motion picture productions. Latest reports reveal that several prominent movie directors have taken up radio as one of the prime methods of "taming" stars who are inclined to be temperamental.

Not many months ago some movie stars thought it novel to install a radio set on the "lot" or in the dressing rooms while waiting to "shoot" a picture. This piqued the directors a bit, for they wanted their charges to pay strict attention to the business of making movies and not to what happened to be flitting about the ether at the moment.

But, as many of you know, some movie stars, and especially the highly paid, temperamental ones, like to have their own way. So the directors hit a stone wall when they tried to break down the instant approval won by efficient radio sets which enabled the movie workers to pick up messages at any time and place.

Turning the Tables

SO the directors decided to make the best of the radio craze and put it to work for them, instead of letting it serve as a means of promoting animosity between actor and director.

In other words, such directors as Cecil B. De Mille, James Cruze, Tom Forman, Eric Von Stroheim and Fred Niblo, all of whom enjoy flattering reputations here in California, installed high priced radio receivers on their production lots and used them to supply "temperamental music" for their equally temperamental stars.

Instead of hiring an expensive violinist or pianist to coax tears to the eyes of a heart-broken maiden, these directors let the radio do it. They even went to the extent of paying broadcasting stations to play certain numbers at certain times of the day, when they knew a certain high-priced star would be trying to "emote" for all she was worth.

When the emoting began, the broadcasting station was tuned in, with its "End of a Perfect Day," "Souvenir," "Just A' Wearyin' for You," and other sentimental pieces ready to start a natural flow of emotion.

Practically every motion picture star of note in Hollywood is equipped with his or her radio set. The story tells how the movie directors made radio an ally instead of the foe it first threatened to be. Above, Viola Dana, popular movie actress, is tuning in between "shots" at her studio. In the oval "Baby Peggy" Montgomery is finding she can hear the bedtime songs better in close proximity to the loud speaker. Even at that, it's quite a lot of music for one youngster to handle.

Then, again, radio was found to be cheaper than orchestras in furnishing the incidental music so essential to big scenes of cafes, ballrooms, theatres, and the like. Why not let the radio jazz orchestra furnish the music for the movie dancers? These high-toned orchestras were getting too expensive, anyway. So the idea of letting radio orchestras furnish the jazz was born.

They All Like Radio

THE stars who rely on radio for "temperament" are as numerous as would be expected, what with a radio in nearly every home and hotel in Hollywood and Los Angeles. "Baby Peggy" Montgomery likes to cry to soft radio music, while Viola Dana believes a radio jazz orchestra makes dancing more fun than ever. Pola Negri was one of the first to be converted to radio music; and of all the temperamental stars, she's about the most particular.

Hal Roach, director of the "Our Gang" comedies, keeps his kids quiet (when such occasions are necessary,) by letting them listen to distant broadcast programs.

Pat O'Malley, a serial star, would rather listen to a radio while filming scenes out on the Californian deserts than hear a hundred Montmartre Cafe bands.

So you see radio and the movies are already united and ready for the time when they shall be merged into one by means of "radio movies."



The girls who have risen to fame since they licked the whole police force of Cicero, Ill., single-handed, are equally famous over the ether waves. Vivian and Rosetta Duncan, shown above, are better known as "Topsy and Eva" from the musical show of the same name. Twice a week from 7:30 to 8 p. m. they may be heard from KYW singing the syncopated lullabies that made them the favorites of thousands of radio fans. Incidentally, they won RADIO AGE'S first radio popularity contest for July and August.

Endearing TOPSY and EVA to Radio

INTRODUCING OUR FIRST RADIO SWEETHEARTS

THE girls who once snubbed Mrs. Vanderbilt, licked the whole police force of Cicero, Ill., and got more square inches of space in newspapers and publicity agents' hearts than anybody else ever did, are Vivian and Rosetta Duncan, well-known to radio fans.

Vivian and Rosetta, perhaps better known as "Topsy and Eva" from their show by that name now in Chicago, have their own broadcasting studio. It is located in the Garrick Building, Chicago, and is part of the suite of rooms occupied by their own music publishing house. In addition to their other accomplishments, they are composers, and their songs are sold by their own company. Many songs other than their own are also sold by the company, which is managed by John Conrad.

KYW, the Westinghouse radiophone

in Chicago, broadcasts the Duncan Sisters through a special wire from their studio. They go on the air every Wednesday and Friday from 7:30 to 8 p. m., Chicago daylight saving time, and sing many hits from their famous musical comedy and songs composed by themselves.

Among these are "Tom Boy Blues," "Some Time Ago," "Stick In The Mud," "In Sweet Onion Time," "Moonlight and You," "Keep On Dancing," and "Topsy."

Just Like Real Thing

THEY usually come up to the studio with their stage make-up on, for the show starts right after they finish broadcasting. "Topsy," or Rosetta Duncan, comes all blacked up, in her disreputable costume as the famous character from "Uncle Tom's Cabin." Their play is a parody on Harriet Beecher

Stowe's classic, and for getting laughs holds the world's record.

One night the Duncan Sisters were heartbroken. They had lost their pet dog. He was sired by the famous movie hound "Strongheart," and he had run away. His name was "Cicero," a lovable name, and they did like him so! In an attempt to get him back they broadcast an appeal to all radio listeners and a great search was started all over the country, which finally resulted in his recovery.

Of course, many people wondered about the request. Maybe "Cissie" was a good dog, and all that, but they wondered why on earth the girls should want anything back with that name. For all they remembered the incident which made the Cicero police force famous. Cicero is a suburb of Chicago, and one day when the girls were auto

(Continued on page 53.)

"Th' Top o' The Morning," Says Bill Hay

By JUDGE L. B. STINER
Ex-Mayor of Hastings, Neb.

"Guid Nicht Tae Ye All," the signing-off message of the announcer of Westinghouse Station KFKX, Hastings, Nebraska, is known by radio fans all over the continent.

W. G. Hay, called by his friends "Bill," was born in Scotland, coming to the United States when he was twenty-two years of age. His quaint Scotch accent is recognized in his conversation and enables him to acquaint the radio public with the peculiar sweetness and charm of that dialect.

Bill came to Hastings about four years ago, and is employed as treasurer and sales manager of the piano department of the Gaston Music & Furniture Company. Since the Westinghouse Electric Company opened their broadcasting station, KFKX, Bill has been the announcer, and with very few exceptions has announced all the programs over that station.

"A Reg'lar Guy!"

Bill is a real fellow. His friends here, including all the citizens of Hastings, are unanimous in their loyal support of Bill, and can vouch for his being an exemplary young man, sober, industrious and honest. He is a veritable dynamo of human action. Aside from the duties of his position, he is leader of the choir in the First Methodist Episcopal Church in this city, which is one of the largest



W. G. Hay

"Bill" Hay, popular announcer from KFKX, Hastings, Nebraska, is the winner of the RADIO AGE radio favorite popularity contest for the month of September, leading all other candidates—announcers as well as entertainers, by a safe margin. Strange to say, just as many votes came from Bill's admirers in the East as those nearer KFKX in the West. The accompanying article tells all about Hastings' favorite son.

choirs in the State of Nebraska; he is conductor of the Hastings Lyric Glee Club, a popular and well known organization of more than twenty Hastings business men who devote a great share of their time to the musical interests of the city; and has also a large class of voice students, and many of the programs have been made up by them.

He has a splendid baritone voice, and whenever an artist scheduled to appear is unable to keep his engagement, Bill fills in, and the old Scotch melodies are now familiar to the radio public. He is also connected with various local activities, like the Chamber of Commerce, and he and his wife are constantly in demand at all social functions.

Aside from all of this, he finds time to arrange programs for KFKX, and to act as announcer, which takes a great deal of his time and energy.

He has become very popular with the radio public because his clear enunciation and pronunciation makes him easily understood under all conditions. His popularity as an announcer is proven by the hundreds of letters received daily by KFKX from all parts of the continent, and without exception these letters tell of the fine impression Bill makes as an announcer, and in the part he plays in the programs.

Bill has really but two fads, or inherited "vices," he is passionately fond of golf, and he is never seen without his trusty pipe.

Two Young Ladies—



Koehne Photo

Miss Elizabeth Berry

APPLAUSE CARDS for programs recently broadcast by RADIO AGE have been received from all parts of the country. Perhaps the best programs of all, judging from the response from

fans, have come from Station WLS, operated by Sears, Roebuck and Co., from the Hotel Sherman, Chicago, and WTAY, the Oak Park, Ill., station of the Pioneer Publishing Co.

Early in July, RADIO AGE decided to broadcast once a week from WTAY, adhering strictly to technical talks. This policy continued for a while, and then it was decided to broadcast a feature program once a month or oftener. The first of these programs "took the air" from WTAY on July 25, and the latest and equally successful was broadcast Tuesday evening, September 9, from WLS, Chicago.

They're All Popular

The response has been instantaneous. RADIO AGE'S young lady vocalists, Miss Tillie Thorpe, Miss Elizabeth M. Berry and Miss Anna Leeb have been deluged with requests from stations at which they have already appeared, as well as from stations who "listened in" for possible talent. Miss Thorpe has been kept busy traveling from one microphone to another ever since her debut on July 25.

Arthur W. Hickman, a baritone of note who has had considerable experience as a church soloist in Evanston, Ill., has captured many feminine hearts with his inimitable singing of such sentimental pieces as "At Dawning." He has been accompanied at WTAY by Miss Helen Rauh and at WLS by

—You Should Know

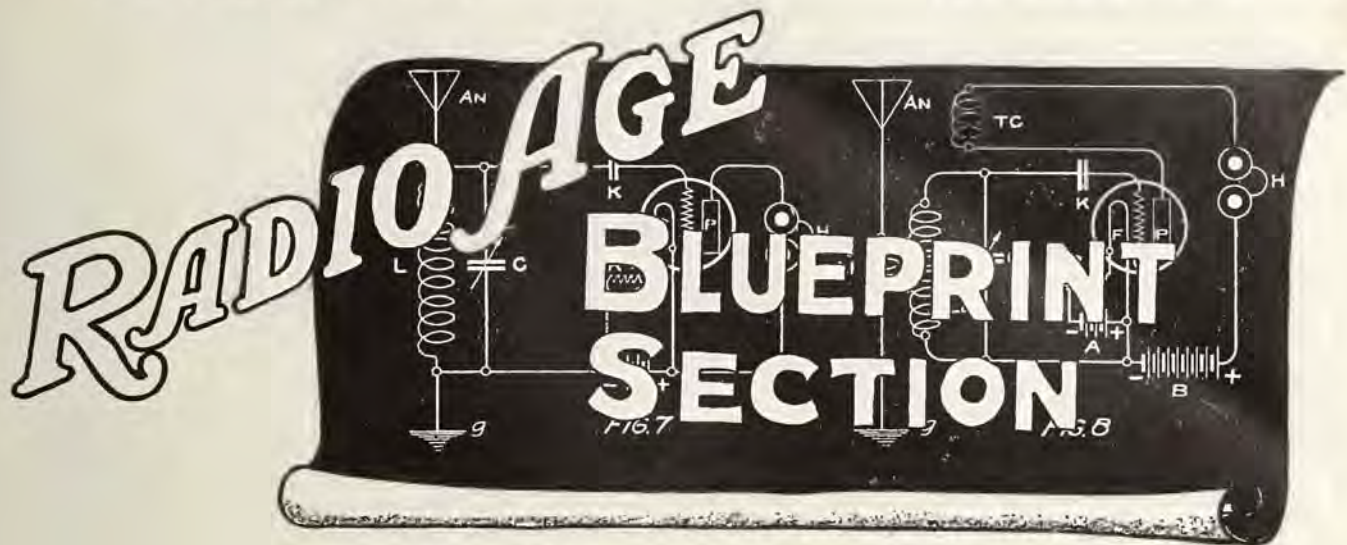


Photo by Drake Studio

Miss Helen Rauh

Glen Rowell, one of the famed "How do You Do?" boys.

RADIO AGE wishes publicly to thank WLS and WTAY for the courtesies extended its artists.



Selectivity and Tone With A Three-Tube Neutrodyne

By JOHN B. RATHBUN

PROBABLY the most popular multi-tube circuit of the present time is the tuned radio frequency type, of which the neutrodyne is the most prominent example. In fact, the neutrodyne was one of the first radio receivers employing more than three tubes which became popular with the broadcast listener and therefore stands alone as being the representative long range circuit, at least in the minds of the average home builder. This popularity led to the development of a long series of "dynes" which bear more or less resemblance to the original neutrodyne and all of which are members of the tuned radio frequency family.

Tuned RF Arguments

In a tuned radio frequency circuit the distinguishing feature is the employment of tuned transformers (air core type) in the radio frequency stages. Each radio frequency transformer is individually tuned to wave length by means of a variable condenser connected across the secondary coil and by this means the maximum amplification or "peak" is obtained on all wavelengths within the range of the condenser and coils. Further, the tuning of the independent stages very greatly increases the selectivity, since each transformer is an additional tuning coupler which augments and corrects the selectivity of the first antenna coupler. With two stages of radio frequency amplification, we have three tuning controls, the antenna coupler condenser and the two variable condensers used in connection with the two radio transformers. Should the wave of an undesired station succeed in passing the antenna coupler, it will be eliminated in either the first or second transformer of the succeeding tuned radio transformers.

Because of the condenser effect between the grid and plate of the tube,

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Clear Tone Assured by a Crystal Detector

we cannot attain maximum amplification in the radio stages unless the feedback through this capacity is offset by some external device. Starting from the antenna end of the circuit, we find that some of the radio energy will feed straight through the internal capacity of the tube without any amplification. Starting at the output or plate end of the radio stages we can see that some of the plate current is fed back to the antenna through the tube capacity and thus produces regeneration with its annoying noises and re-radiations from the aerial. When regeneration in the radio stages occurs in this way, we cannot carry the electron emission to the point required without

also producing troublesome audio oscillations or squealing, and this of course limits the possible amplification.

MANY AMATEURS who have wished to work the neutrodyne circuit have been held back by the expense of the usual five tube standard set. It is for this reason that the writer has worked out a three tube neutrodyne which will give many of the advantages of the more elaborate circuit with only a slightly reduced output and range. A crystal detector is substituted for the more usual detector tube and only one stage of audio frequency amplification is employed, thus doing away with two of the tubes.

Fig. 1 is a picture diagram of the three tube neutrodyne, where it will be seen that we have two radio frequency stages, a crystal detector, and one audio stage. This will insure very good distance reception and loud speaker volume on all but the more distant stations. The crystal avoids the noises of the detector tube, thus giving a very pure natural tone that is unapproached by the standard five tube set. Further, when properly adjusted it will not squeal nor howl under any tuning conditions.

All Tubes Amplify

In Fig. 1 the two radio frequency tubes are at (T1) and (T2), the crystal detector is at (CD), and the audio tube at (T3). All tube filaments are controlled by the single rheostat (R), the resistance of which depends upon the type of tubes used, and as this carries the current for all tubes the resistance must be somewhat lower than when a single rheostat is used for each tube. It must be borne in mind that all of the tubes are amplifiers such as the UV-201A, C-301A, UV-199 or C-299 and that soft detector tubes will not give the necessary amplification.

(Continued on Page 40)

HOW TO USE RADIO AGE BLUEPRINTS

The blueprints printed in this section are so arranged as to form a complete unit with the explanatory articles when desired by the reader. For example, the center sheet consisting of pages 35, 36, 37 and 38 contains two blueprints and two pages about the Midget Reflex. Just follow this four-page sheet at the center and you will have a complete section to follow when you make the "Midget." Likewise the second center sheet, which also can be followed as one unit, is devoted to the three tube neutrodyne. The blueprints for this hookup are on pages 34 and 39, and the article on pages 33 and 40.

Blueprints appearing in future issues will be arranged in the same manner.

—The Editors.

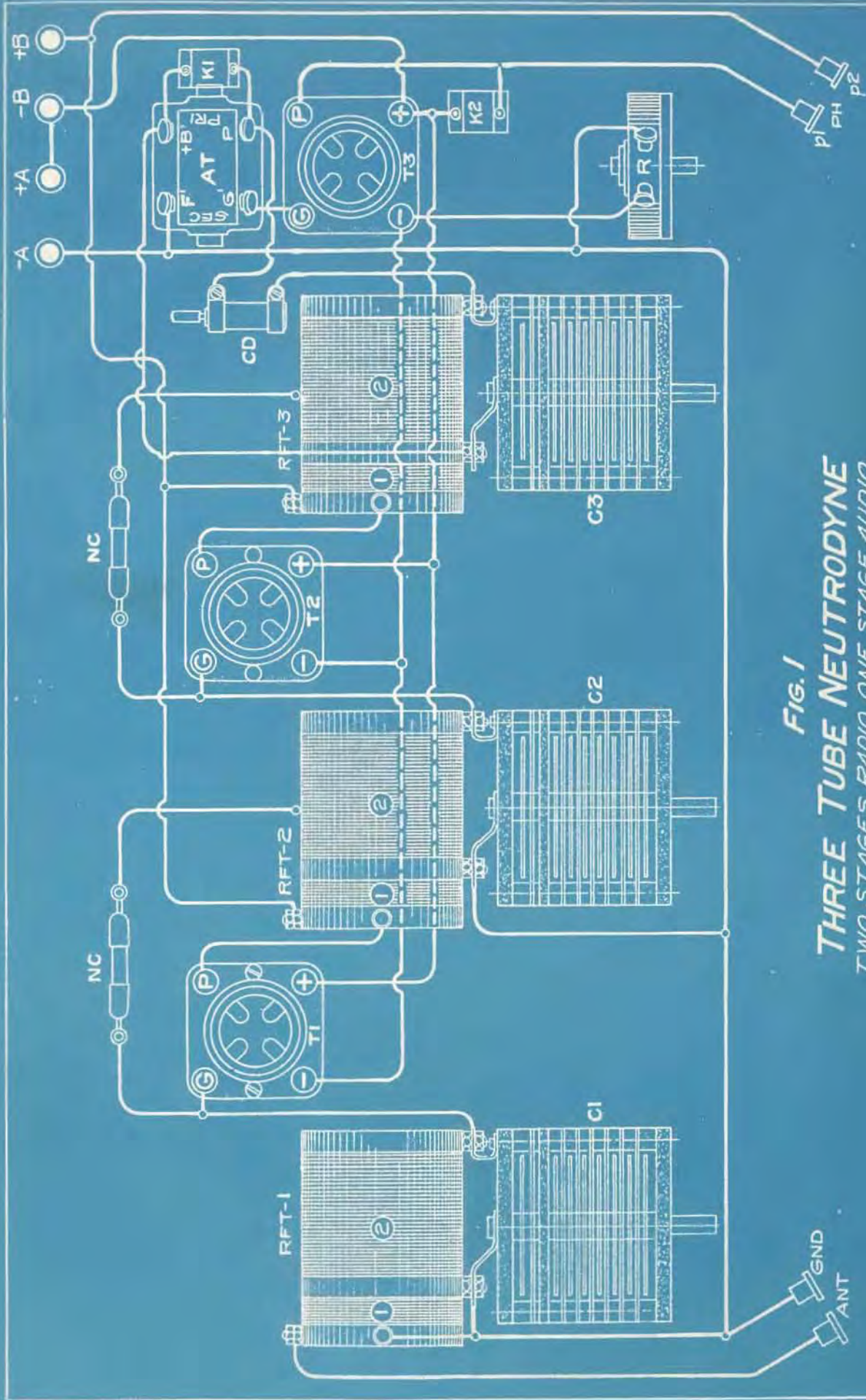


FIG. 1
THREE TUBE NEUTRODYNE
 TWO STAGES RADIO, ONE STAGE AUDIO

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PATENTS PENDING

J. B. RATHBUN
 ND-204

Getting Tube Economy With A One Control Midget Reflex

By JOHN B. RATHBUN

IT HAS been the constant endeavor of the writer to simplify the radio receiver to the point where maximum reception could be attained with a minimum of material and wiring and with the fewest possible controls.

Not only is such a receiver more practicable from the standpoint of the home builder, but it is also easier to handle and less likely to develop those annoying "bugs" which are so difficult for the novice to discover and remedy. The nearer we approach a parallel to Henry Ford's "Tin Lizzie" idea, the nearer we will come to developing the ideal all-round receiver.

Powell Crosley of The Crosley Radio Corporation has pursued this idea for years with great success and has long been acknowledged the "Ford of Radio."

Wiring complications in a circuit form the most objectionable feature of construction to the beginner and the first step in simplification should be made in reducing the number of wires. Nearly any circuit can be simplified without changing the performance, by proper arrangement of the parts, or by constructing the set so that the cabinet or supporting members are made a part of the circuit, thus doing away with the corresponding number of wires.

Thus, by using a metal cabinet instead of the more usual wood enclosure, we can make the metal cabinet take the place of all grounded connections and do away with a number of wires. At the same time the metal cabinet acts as a shield against body capacity effect and is of assistance in tuning. By similar expedients, arrived at by careful consideration before starting construction, we can make surprising economies in construction.

Simple But Efficient

FORTUNATELY, circuit simplification generally means increased effectiveness and better performance, for the smaller number of wires decrease the energy losses in the circuit, thus making the receiver more sensitive than a similar circuit with longer and more complicated wires. For a given energy input; that is, battery energy, the simpler set will show greater sensitivity and selectivity.

Probably the simplest regenerative circuits are the single circuit Ultra-Audion and the three circuit "Wizard." Both are highly efficient, cheap and easy to build, and simple to tune, and the more complicated regenerative circuits using variometers and other tuning elements have little on them except for tone quality. While regeneratives employing two or more tuning controls can be brought more closely into a condition of resonance than the Ultra-Audion type, yet the electrical losses due to the wiring

A Novel Hookup that Employs One Tube as a High and Low Frequency Amplifier

are so much greater that the Ultra-Audion puts up a better performance than would be imagined from a purely theoretical standpoint.

When greater volume is required for loud speaker operation or for the amplification of weak distant stations, one or more "Audio Amplification Stages" are added behind the detector tube of the regenerative set. This increases the volume but does not materially increase the range or receiving distance.

For greater distances, or where a loop aerial is to be used in place of an outdoor aerial, we must increase the sensitivity of the set by the addition of "Radio Frequency Stages" in front of the detector tube. While R. F. amplification does not necessarily increase the volume of the signals, yet it "magnifies" the weak impulses on the aerial so that the detector tube can work on them. Adding both radio and audio amplification gives both increased distance and volume, but of course enormously increases the amount of electrical energy that must be supplied by the battery to the tubes. Tube for tube, the single tube regenerative set is more efficient in the use of current for a given result than a set having many radio and audio stages.

For marked improvement in the results, at least two stages of radio and two stages of audio amplification must be used in addition to the detector tube. Hence, when each tube is used for a single definite purpose only, we have five tubes to which we must supply filament and plate current. We now have not only an increased demand for current, but also the additional expense of the five tubes, the transformers and sockets for these stages, and a tremendous increase in the number of wires. Such a combination is not to be thought of with a "flivver" set, and if we are to obtain the equivalent of radio and audio amplification with a few tubes we must apply some other principle than outlined above.

Reflex Permits Economy

FORTUNATELY, the "Reflex" system affords a means of attaining tube economy when amplification is to be employed in addition to the usual detector function. In this type of circuit each tube acts both as a radio and audio amplifying stage, while a crystal is employed as the detector or rectifying agent.

Theoretically, only half the number of tubes will be required in a reflex system for a given amplification, compared with the circuits in which each tube is used for a single purpose. The impulses from the aerial at radio frequency first go through the tubes, and then after this current is amplified, a second trip is made through the tubes for amplification at audio frequency. Only one tube would therefore be required for one stage of radio and one stage of audio amplification.

It is because of this tube economy and other resulting economies that the reflex principle has been adopted for the "flivver" radio set to be described in this article. While this is a single tube set, yet it gives results which are very nearly equivalent to more elaborate sets, arranged in the ordinary manner. A crystal detector takes the place of a detector tube and leaves the tube free for amplifying. A loud speaker can be used with local stations and in some cases the speaker has been operated with fair volume on stations 200 miles distant. The radio amplification increases the range considerably over that attained by the usual single tube regenerative while the audio amplification makes a marked improvement in the volume.

For a time I considered adopting a conventional reflex circuit, somewhat similar to the "99" circuit described in the August issue of RADIO AGE, but on further thought, it seemed possible to do away with the radio frequency transformer and hence with an additional control. Finally this saving was worked out satisfactorily. Actually, we still have a radio frequency transformer in effect, but as the fixed coupler now acts in a dual role, the expense and trouble of the independent transformer is done away with in this circuit. The wiring is simplified and we have an improvement in all around performance. Basically, this is the same thing as the "Wizard" to which a stage of radio and a stage of audio are added by the simple installation of an audio frequency transformer and a crystal detector.

Only One Control

FIG. 1 shows the simplicity of this circuit where the only tuning control is the variable condenser (C1). This is a 23 plate (0.0005 mf) vernier condenser of the standard type. The fixed coupler (L1-L2) not only acts as a tuning inductance but also as a radio frequency transformer in which the coil (L1) is the primary and coil (L2) is the secondary. Here we have a part which performs two distinct functions in the circuit and saves us from \$3.00 to \$5.00 in the construction of the set. The fixed coupler is attached to the variable condenser (C1)

(Continued on page 38.)

Blueprints of the Midget Reflex on Two Pages Following.

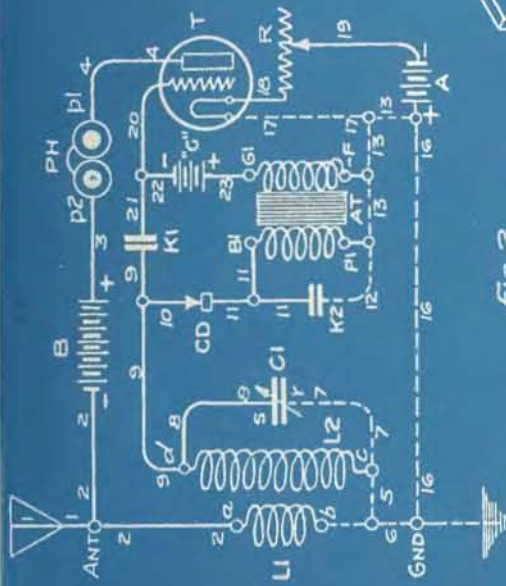


FIG. 2
SCHEMATIC DIAGRAM

NOTE!
 USE ONLY A HARD AMPLIFIER TUBE SUCH AS THE UV-201A, C-300A, UV-199, C-299. SOFT DETECTOR TUBES WILL NOT FUNCTION.
 AUDIO TRANSFORMER (AT) RATIO IS BEST AT 5 TO 1, BUT OTHER RATIOS CAN BE USED IF DESIRED.
 PLATE VOLTAGE (*8" BATTERY) TO BE FROM 67.5 TO 90 VOLTS, APPLIED BETWEEN +B AND -B.

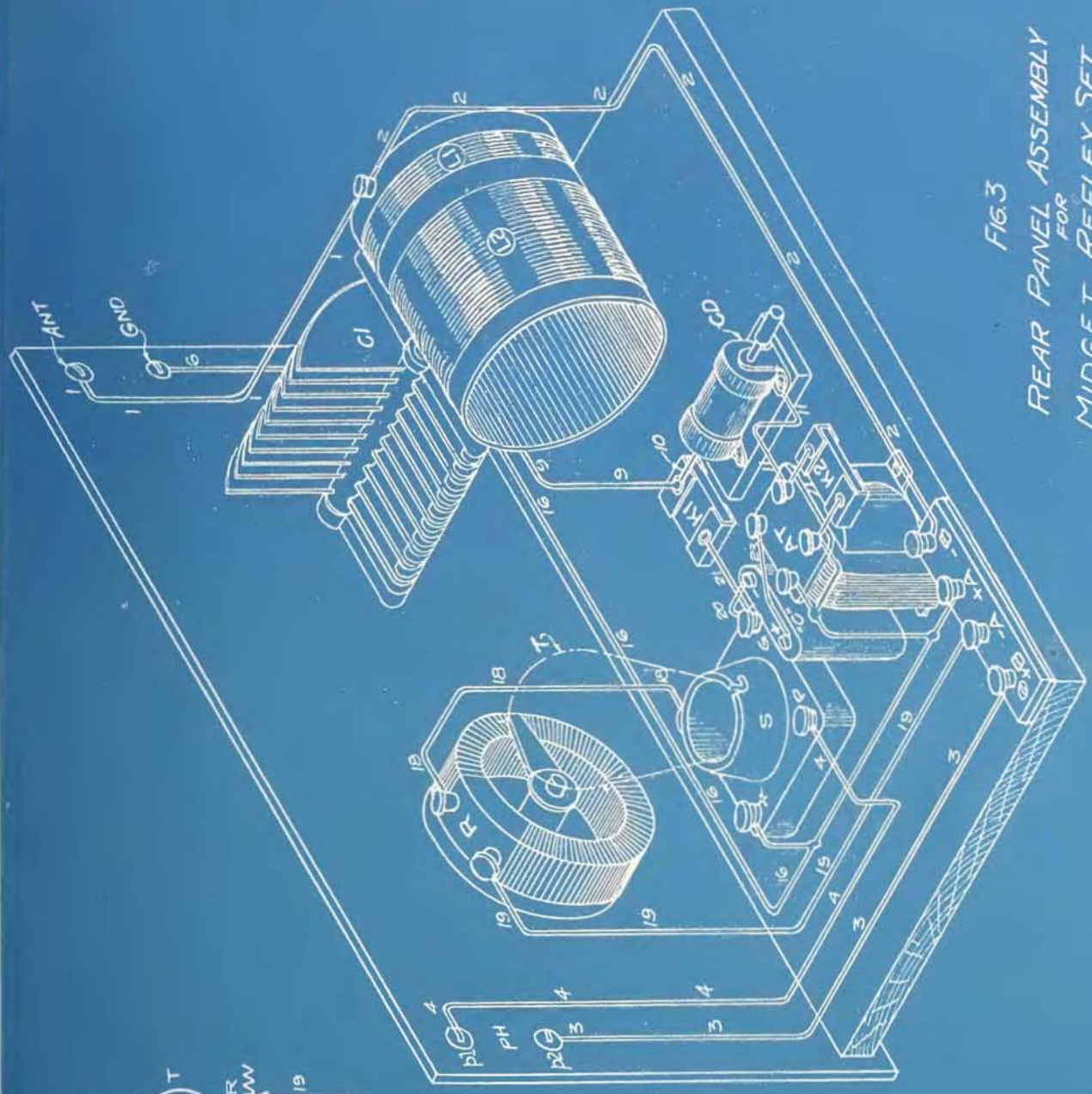


FIG. 3
 REAR PANEL ASSEMBLY
 FOR
 MIDGET REFLEX SET
 J.B. RATHBUN
 RFX-112

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 RADIO AGE, INC. CHICAGO, ILL.

A Midget Reflex Set

(Continued from page 35)

by means of the sheet brass brackets (7) and (8). For those used to reading electrical diagrams, the functioning of the circuit is clearly shown by the conventional diagram of Fig. 2, and as both Figs. 1 and 2 have the same lettering, the relation is easily followed.

Both the primary (L1) and the secondary (L2) are wound on the same 3" cardboard or bakelite tube and are separated from each other by 1-2" to 5-8" as shown. The primary contains 15 turns and the secondary (L2) has 60 turns, giving a ratio of four to one. If No. 26 double silk covered wire is used, the length of the tube will be about four inches. The diameter is three inches.

At (CD) we have the crystal detector.

However, we caution you not to use a common galena crystal, as this burns out quickly and does not stay in adjustment for any length of time owing to the heavy current passing through it. This detector crystal takes the place of one tube and of course requires no current.

An audio frequency transformer (AT) is used for the audio phase of the circuit, and connections must be made to the four binding posts (B-P-F-G) as shown. The fixed condenser (K2) bypasses the radio frequency component around the primary coil of the transformer. The capacity of this condenser may range from 0.0005 mf to 0.001 mf.

The fixed grid condenser (K1) is a 0.00025 mf condenser used as a stop in the grid line. The secondary (G-F) coil of the transformer acts like a leak so that an additional grid leak is not necessary. A 4.5 volt (3 cell) "C" battery is placed in series with the secondary of the transformer with its negative pole (-) toward the grid (G) of the tube as shown. This battery is effective in increasing the volume and quality of the audio component, and while it can be omitted if desired yet it adds considerably to the amplification and hence is highly desirable. Either a flashlight or standard "C" battery can be used.

A hard amplifying tube (T) must be used, such as the UV-201A, C-301A, UV-199 or C-299. This is carried in the socket (S) and is controlled by the filament rheostat (R). The resistance of (R) depends upon the type of tube and voltage of the battery. For the UV-201A and C-301A the resistance should be from 15 to 20 ohms. For the UV-199 and C-299 a resistance of from 30 to 40 ohms will be necessary. The "B" battery voltage will range from 67.5 to 90 volts for the maximum volume. The amplification at 67.5 volts is nearly as great as at 90 volts and the lower voltage is not so noisy.

Get Correct Polarity

THE head phones or loud speaker (PH) are connected at the posts (p1-p2) at the front and right of the panel (E). At the left of the panel are the antenna (Ant) and the ground posts (Gnd) respectively. The four battery posts are

mounted at the rear of the set on a small piece of bakelite,—where great care must be used in connecting up the batteries so that the polarity will be exactly as shown. The plate or "B" battery is connected to the posts (+B) and (-B) while the "A" or filament battery is connected to (+A) and (-A).

By examining Fig. 2 we see that the primary (L1) of the coupler is of the aperiodic type and carries both the impulses from the aerial and the amplified plate current. It is necessary to tune only the secondary (L2) by the variable condenser (C1). It will be seen that we tune both the grid and plate currents simultaneously by means of a single condenser. This arrangement eliminates the necessity of the two independent condensers used in the "99" Reflex and attains exactly the same results with less complication. The weak impulses from the aerial induce currents in the secondary (L2) which act on the grid of the tube through the stopping condenser (K1). Amplification takes place in the tube and the amplified plate current returns through the leads (2-2) to the primary coil (L1). The plate current now induces stronger currents in the secondary (L2) which augment those already received from the aerial, so had we have the amplified current at radio frequency, which acts on the primary (B-P) of the audio transformer (AT).

Before passing the primary of the audio transformer (AT) the current is rectified and reduced to audio frequency by the crystal detector (CD). Through (AT) the audio current acts on the grid (G) to produce audio frequency amplification in the tubes. By lifting the cat whisker off the crystal (CD) we have a straight regenerative circuit of the "Wizard" type. As soon as the cat whisker is replaced, we have a reflex circuit and two stages of amplification.

An outdoor aerial of from 50 to 60 feet in length will prove most satisfactory for this receiver. A longer aerial will do little more toward bringing in the stations and does reduce the selectivity to such a point that it is difficult to separate stations which are operating on nearly the same wavelength. The circuit under proper conditions tunes very sharply, and is highly selective for a single control set. In regard to selectivity remember that it is seldom possible to get as close tuning with a single control as with a properly designed radio frequency set with two or three controls. However, this factor will be perfectly satisfactory under ordinary conditions with the circuit shown and is fully as selective as a large number of the more complicated sets of the regenerative or reflex types.

If the set is not properly selective on the first trial, or if the signals are weak, it may be that the primary and secondary coils (L1) and (L2) are "bucking" each other. Try the effect of reversing the ground and aerial connections at (Ant) and (Gnd); that is, connect the aerial to the ground post and the ground wire to the aerial post. If this gives no improvement, it may be that the audio transformer connections are reversed.

Next try the effect of reversing the secondary winding of (AT) by connecting (G1) to the return wire (13) and the post (F1) to the positive (+) side of the (C) battery. If the audio transformer happens to be connected in such a way that the windings of (AT) oppose the windings of the coupler (L1-L2), then we will have weakened reception or even no reception at all.

Eliminating Capacities

TO ELIMINATE body capacity, the stator or stationary plates of the condenser (C) should be connected to the terminal (d) and the grid line marked (9). The rotatable plates or rotor of the condenser should be connected to (c) and (5) as shown. This is important, and on the diagram Fig. 2 the condenser stator is indicated by (S) while the rotor is shown by (r).

A sheet metal cabinet or sheet metal panel (E) can be used providing certain precautions are observed. This arrangement is sometimes desirable as it shields the set against the effects of body capacity and local interference. Again, the wiring is simplified as all of the grounded connections can be made directly to the metal cabinet. While the metal cabinet is not recommended for the beginner, owing to his lack of knowledge regarding proper insulation, yet a metal shielded set will give remarkable results when built by an experienced amateur.

At points where the connections are not grounded to the cabinet, as at (Ant), (p1) and (p2), the wires and binding posts should be carried by large rubber or bakelite washers (not fiber) which afford positive insulation. Paper or fiber are not suitable as they absorb moisture. The holes in the tin walls should be considerably larger than the screws of the binding posts, say 1-2" in diameter at least. If the holes are not large or if the insulation is not perfect at this point, there will be a loss of current and volume. Secondly, the coupler (L1-L2) should be kept at least one inch away from the tin sides of the box and preferably two inches away from the ends of the coil.

In Fig. 2 all of the grounded connections or parts of the circuit formed by the metal cabinet are shown by dotted lines, and it will be seen that this grounding arrangement does away with many wires. For sets to be built on a production basis this is a very good scheme, as assembly is simplified and the cost of labor much reduced.

Fig. 3 is an isometric view of the assembly showing the relative arrangement of the parts when viewed from the rear of the panel. All parts are lettered and numbered to correspond with the lettering and numbering of the parts and wires in the two diagrams. As several of the wires are concealed in the isometric view, it is a good plan to use the diagram in Fig. 1 when making the actual connections and in laying out the wiring.

Another set of original blueprint hook-ups in November RADIO AGE.

A Simple But Effective Neutrodyne

(Continued from page 33)

In the aerial circuit (ANT) we have the fixed coupler (RFT-1) with the aperiodic primary coil (1) and the secondary coil (2). The secondary (2) is tuned to wavelength by the variable condenser (C1) while the lower end of the primary (1) is grounded to the ground post (GND) and to the (-A) line. The plate output of tube (T1) is fed into the primary coil (1) of the radio frequency transformer (RFT-2) where it induces a current of higher voltage in the secondary coil (2) of RFT-2. The outer end of the secondary (2) is connected to the grid of the second tube (T2) where the next radio amplification takes place. The secondary of (RFT-2) is tuned to wavelength by the variable condenser (C2) which is the second control. In the same way, the output of the tube (T2) is fed into the crystal detector circuit (CD) by means of the third radio transformer (RFT-3). The crystal detector (CD) rectifies the radio current into the modulated audio frequency current.

ALL THREE units (RFT-1), (RFT-2) and (RFT-3) are standard air core radio frequency transformers commonly known as standard "Neutrodyne Transformers," and it is far better to buy these transformers ready made than to attempt making them at home. Unless properly made, such transformers will greatly reduce the effectiveness of the circuit and cause trouble in tuning. In the diagram of Fig. 1, the transformers are shown laid flat down in a horizontal position so that the connections can be more easily seen, but actually they are tilted up at an angle of about 60 degrees with the horizontal so that there will be no coupling between the adjacent stages. It is of the greatest importance that we avoid having the magnetic flux from one transformer feedback into the following transformer, hence, the arrangement must be made as in Fig. 2 where the transformers are shown tilted up at an angle of 60 degrees with the baseboard.

As shown by Fig. 3, the center to center spacing between the transformers and condensers is 5 1/2", and the transformers should not be closer than this if maximum results are to be obtained. With this spacing we can get the apparatus on a 7x18" panel without difficulty but if we consider adding a second stage of audio in the future it would be better to use a 7x21" or 7x24" panel.

Returning to Fig. 1, we see the neutralizing condensers (NC) used for neutralizing the internal capacity of the tubes. At one end they are connected to the grids (G) of the tubes while at the other end a connection is made to an intermediate tap in the secondary of the transformers. By adjusting these condensers (NC) we can completely offset the internal capacity so that maximum amplification is attained. The neutralizing condensers (NC) should be purchased ready made, and as they can be obtained

at a comparatively low cost we will not enter into their construction.

Tuning Condensers

The secondary tuning condensers (C1), (C2), (C3), should be a reliable make of variable condenser. Plain condensers are used and verniers are not necessary. The majority of the commercial neutrodyne transformers on the market require a condenser having a maximum capacity of 0.00035 mf or what is commonly known as a 17 plate condenser. Usually, a 23 plate condenser is too large for this purpose, and makes the tuning unnecessarily critical and difficult. The condensers can be connected to the transformer secondaries by the brackets shown or else by wires when the transformers are of the type which are fastened to the floor.

USE THE ORIGINAL RADIO AGE BLUEPRINTS

On Pages 34 and 39
to Make This

Three Tube Neutrodyne.

Another Group of Unrivalled
Blueprints in November RADIO AGE.

In connecting the condensers to the secondary coil of the transformers we should take particular care to have the stator or stationary plates connected to the wire which runs to the grid of the tube, as shown in the diagram. The rotor or movable plates should be connected to (-A) and ground. If this is not followed out, then we will be sure to have trouble with body capacity. The outside turn of the secondary coil (to the right), the stator of the condenser and the grid wire must be connected together for the best results. This is clearly shown in the diagram and should be followed out carefully by the builder.

Any Ratio Possible

At (AT) we have the usual iron core audio frequency transformer for the audio stage. Almost any ratio can be used with slightly varying results. With a ratio of 3-1 or 5-1 we obtain very clear amplification with a slight decrease in volume. With a 10-1 ratio we have a somewhat greater amplification but with slightly increased distortion. A ratio of 5-1 probably is the best compromise but this is not exactly the case with all makes of transformers. In any case there will be less distortion and noise with a crystal detector circuit than when a detector tube is used, and therefore we can probably use a higher ratio with this circuit than would be permissible with a circuit employing a detector tube.

A 0.001 mf. fixed condenser (K1) is connected across the primary (P'-B') of the transformer to bypass the radio frequency component. No jacks are used for the detector and final stages, since they introduce complications into the circuit. We have only three tubes

and the small additional current taken by the final tube doesn't make it practical to introduce jacks at this point. A fixed bypass condenser (K2) bypasses the radio current across the phones and "B" battery. The value of this condenser is not critical and may range from 0.0025 mf. to 0.005 mf.

Battery and Voltages

TO produce the maximum range and volume, we will require a 90 volt "B" battery for supplying the plate current. This is connected between the (-B) and (+B) battery binding posts. The audio amplification will be made somewhat greater if we introduce a 4.5 volt "C" battery between the secondary transformer post (G') and the grid (G) of the tube (T3). Full details of this arrangement were shown on Data sheets JJ-9-25 and JJ-9-26 of the September RADIO AGE. The installation in Fig. 1 of data sheet JJ-9-26 shows the installation exactly as it would be made. Be sure that the negative (-) post is connected to the (G) post of the socket.

After the circuit has been wired up according to the diagram in Fig. 1, with the apparatus located as in the isometric view of Fig. 3, we can connect the batteries, insert the tubes, and then make the neutralizing adjustments. With the tubes lighted up to normal brilliancy we can tune in some local station by means of the variable condensers until we obtain maximum volume. Now note the position of the dials on the condensers, and after loosening the dial, set the screws and turn them until the same number on each dial comes exactly opposite to its stationary pointer. This will save much time in tuning, as we are now able to get all three condensers in exact agreement by turning to the same number on each dial.

With everything running at full pitch, remove the first radio tube (T1) from its socket and place a piece of paper across the "A" battery contacts so that the tube will not light when replaced in the socket. With this tube in place, but not lighted, see if you still hear the local station with the rest of the tubes at normal brilliancy. If you do, then adjust the first neutralizing condenser (NC) until you can no longer hear the signals. With this accomplished, take tube (T2) out of its socket, place a piece of paper across the battery springs as before, so that the filament of tube (T2) will not light. With the other tubes burning, try again to see if any signals are being heard through the capacity of the dead tube. If signals are still heard with (T2) dark, adjust the second neutralizing condenser (NC) until signals cease or are reduced to a minimum.

The set is now only partly neutralized at best and further adjustments of the neutralizers (NC) will probably be necessary until the best tone and volume, and the best all around reception is had. There should be no squealing or howling and the "tweet-tweet" of the carrier wave should be very faint when tuning into a station.

Watch for a new Rathbun hookup in
November RADIO AGE.

RADIOTORIALS

THE CANDIDATES who can convince the radio voters are the ones who will win," is the universal prediction of campaign managers on the eve of nation-wide elections, at which a President, governors and representatives will be chosen by the people.

They are not far from the truth. The exit of blah in the political life of the American people can be largely attributed to the influence of radio and the promotion of clean politics that it has effected. All three of the leading candidates for the Presidency of the United States have acknowledged the importance radio will play in the days preceding election day. No greater tribute to radio's importance as a national necessity could be paid.

American citizens do not need to be reminded that they are tired of the misleading power of the spoken word as it comes from the not too trustworthy mouths of unscrupulous politicians. Too often have ignorant voters been swayed to the wrong cause because they believed oratory, gestures and personalities, instead of the facts they should convey.

Radio has opened a new era in politics, for it puts its stress on the spoken word alone and not the gesticulations that accompany it. Some politicians would be apt to disregard radio as a campaign aid for this reason alone—but the convincing argument of "But look at the millions of people you can reach through radio," makes up for the lack of vision. No candidate for public office is going to pass up a chance to be heard by everyone, illiterate or learned—whom he could never possibly reach by the printed word or personal contact.

So the campaign which is now rounding into its final weeks will be a campaign of issues, and *facts*, and not of personalities. It will be a campaign of *truth*, because truth alone will stand up after all the tinsel of oratory and deception has been removed. The unseen listeners will turn their dials and listen in, and no politician or over-confident candidate, no matter what his telepathic powers, will be able to tell what those countless voters are thinking of until the polls have closed and the ballots counted.

Politics is just one of the many ways radio is being used to *serve* the people. Government watchfulness will prevent its being used as a political tool for selfish propagandists. An instrument of national good such as radio is becoming cannot afford to become the chattel of one man. Radio must remain as it is today—a medium through which public opinion may run freely, be dissected and digested wisely by the voting public. Then radio will have attained its maximum of efficiency; it will have become the world's greatest means of entertainment as well as a nation's safeguard against an illiterate and misinformed body of citizens.

While on the subject of political campaigns, it may be well to remind radio voters that they look up the position of their candidates as they stand on radio issues, before deciding to vote one way or the other. This pertains especially to candidates for governor, state and national representatives and senators, who will be called upon this Winter to decide issues affecting the future of radio in this country.

AFTER studying radio conditions in foreign lands, and particularly in the countries of Western Europe, it is only natural that we lean back and sigh with a relief possible only to an American citizen who is proud of his own country. Other nations may boast of the heights they have reached with radio, but none can approach anywhere near the dizzy altitudes reached by this miraculous industry in America. But most of all, disregarding commercial and inventive arguments, the outstanding reason for pride in American radio conditions lies in its freedom from paternalistic government control. The slight government watchfulness over American radio is a blessing compared to the strict restrictions placed on the industry abroad. Some foreigners wonder why people do not take to radio so enthusiastically in Europe. They need look no farther than their government's statutes against radio—the laws that place a financial burden on every owner of a receiving set and every broadcasting station, as well as limiting the number of broadcasters. America, with its nearly 700 stations, as well as hundreds of wireless amateurs, is enjoying a radio freedom that is nearly unlimited. With these thoughts in mind, those Americans closely connected with radio should appreciate what their government is doing for them, and not rise up in protest the minute Congress takes steps to clear the congested ether by adjusting broadcasting conditions.

AS THE veil of Summer static is being slowly removed, the fans who deserted radio during the warm months are brushing up their sets and looking forward to long Winter nights in gleeful search of elusive "DX" stations. Those thousands of fans who saw it through during the Summer will stick to their guns, of course, but their joy in tuning in distant stations will be all the more fruitful, for they have the advantage of a season of difficult tuning.

It is with pleasure that RADIO AGE welcomes into the fold any new members of the receiving fraternity, and we know that once they learn what set is best adapted to their needs, their evenings will be pleasant ones. And it is with pleasure that we offer all the technical and editorial resources of RADIO AGE toward aiding any prospective fans who would like to get established in America's fast-growing colony of listeners-in.

WELL, ONCE more Mars has slipped through our hands. More than any other time, Radio was called upon last month to establish communication with the "nearest" planet, which hovered only 35,000,000 miles away to give us a chance to "do our stuff." We believe—and personally, only—that the American public expects a little too much of radio so soon in its career. Remember, radio is an infant industry, and communication with distant planets is a thing that requires time and study, as well as patience. All we ask is that earthly mortals wait a few more decades and then perhaps radio will have become far enough advanced to permit inter-planetary communication.



Pick-ups and Hook-ups by our Readers



The material appearing under the title "Pickups and Hookups by Our Readers" in RADIO AGE, is contributed by our readers. It is a department wherein our readers exchange views on various circuits and the construction and operation thereof. Many times our readers disagree on technical points, and it should be understood that RADIO AGE is not responsible for the views presented herein by contributors, but publishes the letters and drawings merely as a means of permitting the fans to know what the other fellow is doing and thinking.

THE coming months promise to have a lot in store for the Dial Twisters. After a brief resumé of the Summer months, it looks as though Old Man Static didn't have very much effect on the reception outside of few short weeks that put a blanket on all kinds of reception.

With the approach of the clear, cold nights, some unbelievable records will be established with the simplest of receivers.

The average tendency seems to be towards the use of "Dynes," but there are a great many who are continuing to stick to the old circuits and are making numerous improvements on them. Personally, we believe, you have to hand it to the old stand-bys for pulling in the signals. Of course, we all know that these new circuits (and there are plenty of them) are improvements on the standard ones.

We get hundreds of circuits that are hopelessly scrambled, asking that we tell the writer if it is practical and if it wouldn't work better than Johnny Jones' if he made certain improvements and then after redrawing the circuit we find it to be one of the old regulars that has been used for years and is still in use.

As a suggestion in tuning for DX, be patient. Oftentimes you may come on a station that is fading badly, and you will be unfortunate to hear him on the point where he is the faintest. HOLD HIM, and you will in nine cases out of ten hear the station come back and sound like local stuff. This fading isn't the fault of your receiver, as is often thought the case; it is due to atmospheric conditions and cannot be overcome at the receiving end.

RADIO AGE,
Gentlemen:

I am sending a more complete description of my set. Many fans have asked if the primary condenser is necessary. For those bothered with local interference of near-by stations, the condenser is very helpful. However, if not, a fixed condenser of .001 mfd. is satisfactory. The other fixed condensers in the diagram are needed but the capacity is determined by the parts you use.

CONTRIBUTORS		
William Weightman	and Two Other Dial Twisters	Kenneth Glass
DIAL TWISTERS		
Name	Address	Circuit
Wilber Milnor	196 16th Ave., San Francisco, Cal.	Three Circuit
George Blood	2962 Bewick Ave., Detroit, Mich.	Not Stated
Oswald Faubel	Parma, Ohio	Not Stated
Merle Hough	545 Rose St., Springfield, Ohio	Not Stated
Ralph Lewis Link	Kirksville, Mo.	Baby Het
Dick Redding	505 Pine St., Lexington, Ill.	Atwater-Kent
Franklin Troutman	11304 Cotes Ave., Cleveland, Ohio	Not Stated
Clair McCormick	% Jensen Mercantile Co., Ewen, Mich.	Crosley
Albert C. Westphal	1667 Palmetto St., Brooklyn, N. Y.	Three Circuit
C. B. Hines	703 Central Bank Building, Memphis, Tenn.	Baby Het

Here are the most important points to be remembered.

(A) Space the apparatus well and keep the leads as short as possible. Do not run wiring too close. The panel I use is 28" by 8".

(B) Use number 12 or 14 bus bar wire in hooking up the set. Solder all connections well.

(C) Most of the tuning is done by the secondary condenser. Regeneration is controlled by the plate variometer. A 23 plate condenser is most advisable in the secondary circuit.

WILLIAM WEIGHTMAN,
Middletown, Ind.

A FEW BOUQUETS

"Your new blueprint section is one of the best magazine features I have ever seen. They are certainly worth keeping and will make a fine collection of hookups if you continue them. Keep it up—they need no improvement."

(Signed) J. S. Moore,
Kansas City, Mo.

"Boys—I You've got me this time! I always liked your great magazine—your Pickups Page is great. It was your blueprint section that made me a subscriber when I saw them in the September issue.

"Enclosed please find my subscription to cover cost of RADIO AGE for one year and also the copy of your AUNAL. I have read them all but yours is the best published. Your Pickups and Hookups Section is well worth a subscription alone. Start mine with the October issue."

Very truly,
(Signed) Michael J. Renehan,
New York City, N. Y.

RADIO AGE,
Gentlemen:

Since you published my hookup in RADIO AGE, I have received more requests for information than I have time or stamps to answer, so I am relying on you to give the fans the information they desire.

The hookup as published was slightly incorrect, as I control regeneration only with the condenser and not a tickler.

1. The coil consists of 70 turns of number 26 D. C. C. wire on 3 inch cardboard tube, and is tapped at 0, 20, and 70 turns. A double slide tuning coil will work very satisfactorily, in fact, it will give you a larger wave length band.

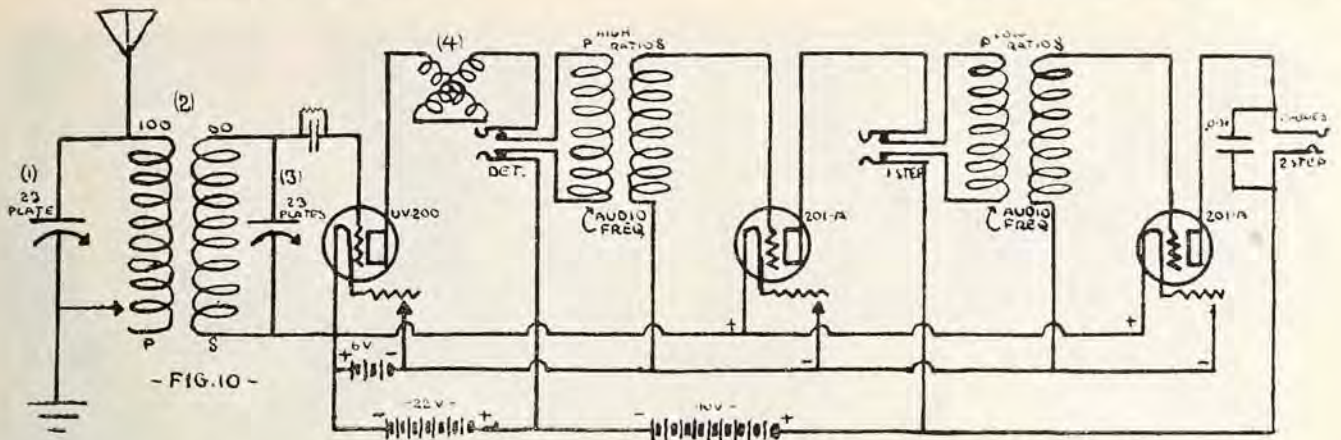
2. Condensers. The condenser in the plate is of the plain type and has 23 plates. Very little tuning is done with this condenser.

The secondary condenser is a 13 plate venier type. Careful adjustment of this condenser is necessary as it is the main tuning control.

3. Tube. The tube used in this set is either the UV-200 or the C-300.

I have no special panel arrangement as my set is experimental; however, when wiring, be sure and keep the grid and plate leads short and at right angles. Connecting the condensers as shown will keep down body capacity.

I got the idea of the circuit several years ago from a hookup which suggested the alternate of the two slide tuning coil or spider web,



No. (1) ACTS AS WAVE TRAP AND VERNIER.—INTERFERENCE ELIMINATOR.

No. (3) VERY CRITICAL.

No. (4) CONTROLS REGENERATION.

Believing your magazine better every issue,

I remain,

KENNETH GLASS.

144 S. Mt. Vernon,
Uniontown, Pa.

The following letter shows that all the Dial Twisters are not old fellows. Look what a 15 year old DT can do:

RADIO AGE,
Gentlemen:

I have read 'most every issue of RADIO AGE from cover to cover. I am 15 years old and have been interested in radio for about 3 years. I have a single tube, three-circuit receiver, consisting of a ten turn aperiodic primary, tuned secondary and tickler coil with an 11-plate condenser across the secondary. I think my list ought to admit me to the Loyal Order of Dial Twisters.

KPO, KLY, KLS, KGO, KZM, KHJ, KFI, KGG, KGW, CFCN, KZN, KFSG, KWG, KFBK, KOW, CICA, KFAU, KFBC, KEAC, KLZ, KDKA, WHB, WBC.

All of the above stations have been confirmed, and I have another list twice as long that has not been confirmed.

Sincerely yours,

WILBER MILNOR.

196 16th Ave.,
San Francisco, Calif.

George Blood seems to regard summer static as a minor detail in the reception of distant stations. Guess there isn't such a thing over in Michigan because Chicago appears to be the place where Old Man Static comes to spend his vacation. On some nights the air in Chicago sounds like a series of train wheels combined with fireworks.

RADIO AGE,
Gentlemen:

I am sending you my list of stations heard, in response to your request for reports on mid-Summer reception. All the stations were heard on a one tube set, using a C-301a tube.

KDKA, KFGZ, KFXX, KFKN, KFNE, KSD, KYW, NAA, WABD, WABN, WBAH, WABP, WBAV, WABN, WBAH, WBBK, WBZ, WCAE, WCAP, WCAY, WCBD, WCBU, WCK, WDAF, WDBR, WDBL, WEAF, WEAN, WEAD, WEB, WEBB, WEBJ, WEA, WGI, WGN, WGR, WGY, WHA, WHAA, WHAM, WHAS, SHAZ, WHB, WHK, WHN, WHO, WJAX, WJZ, WKAA, WLAG, WLS, WLW, WMAQ, WMC, WMH, WNAC, WOAG, WOAW, WOC, WOO, WOR, WOS, WQJ, WRC, WSAI, WSB, WTAB, WTAM, WTAS, WTAY, WWI, 2XBH. Our

local KOP, WCN, and WWJ on July 5, 14, 22, 24, 25, 26, 27 and 29.

All of the above were received on a single wire antenna about 20 ft. high at the ends and 15 ft. high in the center, where it is intersected by a tree. It is about 50 ft. long.

Hoping this will win me a DT button, I remain,

Yours till the trees bark,

GEO. BLOOD.

2962 Bewick Ave.,
Detroit, Mich.

The following Dial Twisters ought to publish a "Calls Heard" book all of their own. They take the prize on pulling down 200 stations, which isn't an easy job when you consider the drag that Old Man Static has in keeping you from running up a list of "out of towners."

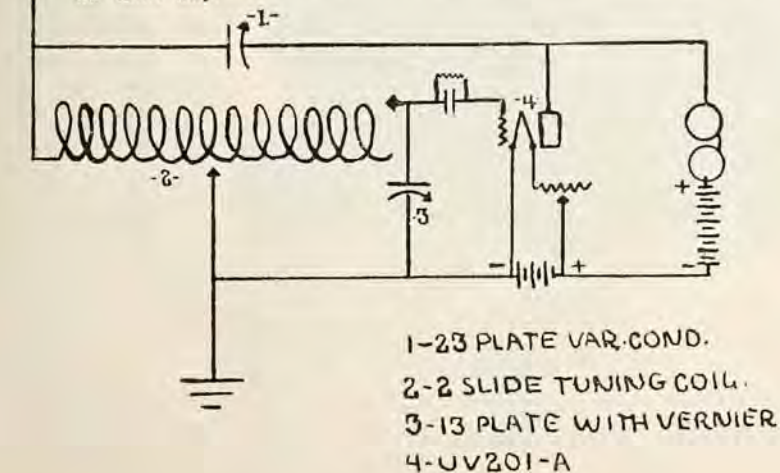
RADIO AGE,
Gentlemen:

I enjoy your magazine more than any other on the market. We get our quarter's worth of things that interest us, and not all advertisements. I take great interest in trying to beat the records sent to your "Pickups" page. Some I can smash, others I cannot touch—yet. I have experimented with many different hookups but have found the Flewelling super has them all beat for volume and distance. I have received exactly 200 stations on one tube. This list would be too long so will give them by states.

Ala. 3; Ark. 1; Cal. 6; Colo. 2; Conn. 1; D. of C., 2; Ga. 6; Ill. 20; Ind. 5; Iowa 11; Kans. 6; Ky. 1; La. 1; Maine 0; Mass. 8; Mich. 5; Mo. 13; Neb. 5; N. J. 6; N. Y. 16; N. Car. 1; N. Dak. 1; Ohio 13; Okla. 3; Ore. 1; Pa. 17; R. I. 3; S. Dak. 2; Tenn. 3; Tex. 3; Va. 1; Wis. 5; Canada 13; Cuba 2; Mexico 1. Could pick up CYL almost every Sunday night during the winter. I have picked up KGO three times during July and my reception has been confirmed.

(Continued on next page)

A diagram of the receiver used by Kenneth Glass in his DX work. This receiver is very similar to the Reinartz Audio Regenerator, since it uses the feedback condenser and aperiodic antenna idea in the same way.



- 1-23 PLATE VAR. COND.
- 2-2 SLIDE TUNING COIL.
- 3-13 PLATE WITH VERNIER
- 4-UV201-A

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Complete Guide
to the Parts
of Every
Radio
Set
Illustrations
and
Instructions
on Radio

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COMPLETE PARTS NEUTRODYNE RECEIVING SET FOR 3 AND 5-TUBE
Genuine Hazeltine Licensed Fada, Freed-Eiseman, or other Genuine Licensed Parts

PARTS FOR 5-TUBE SET:
1 7x28 1/2" Drilled Panel.
2 All American or Columbia Audio Transformers.
3 4" Bakelite Dials.
3 Filament Control Jacks.
1 Vernier Rheostat—30-ohm.
1 Plain Rheostat—6-ohm.
1 strip Bakelite, 6x1 1/2".

PARTS FOR 3-TUBE SET:
3-Gang Bakelite Socket.
35 feet Hook-up Wire.
1 Wave Control Neutrodyne.
2 R. F. Neutrodyne.
1 Baseboard.
2 Neutrodyne.
3 Bezels.

Complete blue-prints and working diagrams and instructions.

PRICE—3-Tube Set, \$26.45

Complete Parts for Two-Stage Amplifier
May Be Used in Connection With Any Receiving Set

1 7x9 or any standard Bakelite Panel.
1 Thordarson or Columbia High-ratio Transformer.
1 Thordarson or Columbia Low-ratio Transformer.
2 Bakelite Rheostats.
2 Bakelite Sockets.
2 2-circuit Jacks.
1 1-circuit Jack.
1 Baseboard.
1 Binding Posts.

\$10.90

Diagram and Instructions for wiring.



COMPLETE PARTS COCKADAY RECEIVING SET FOR 3-TUBE

1 Cockaday Coil.
1 23-plate Hy-Grade Cond.
1 Bakelite Rheostat, 30-ohm.
1 Bakelite Rheostat, 6-ohm.
3 Bakelite Sockets.
1 high ratio Columbia or All-American Transformer.
1 Single Circuit Jack.
1 low ratio Columbia or All-American Transformer.
Complete blue-prints and wiring diagrams.

2 Double Circuit Jacks.
3 3" Bakelite Dials.
1 Grid Leak and Mica Cond.
7 Switch Points, 2 stops.
1 Bakelite Binding Post Strip.
8 Binding Posts.
1 7x21 1/2" Drilled Bakelite Panel.
3 Bezels.
1 Baseboard.

3-TUBE SET \$19.95

Complete blue-prints and wiring diagrams. \$10.45

SUPER Heterodyne

Containing 3 Intermediate Frequency Transformers, Filter Transformer, Oscillator Coil and 2—1 M. F. Condensers.

\$19.75

with Audio frequency Trans. \$26.65



PARTS FOR ONE-TUBE REINARTZ RECEIVING SET

1 7x18 Bakelite Panel.
1 Vernier Bakelite Rheo.
1 Bakelite Socket.
1 23-plate Lo-loss Var. Cond.
1 11-plate Lo-loss Var. Cond.
2 Bakelite Dials.
Blue-print and Complete Instructions.

1 Genuine Reinartz Coil.
2 doz. Switch Points and Stops.
3 Switch Levers.
25 feet Busbar Wire.
1 Freshman Grid Leak and Condenser.
1 Baseboard.
9 Binding Posts.

1-TUBE SET \$10.45

3-Tube Set \$17.55

Complete Parts for ACME 4-TUBE REFLEX

3 Acme A-2 Transformers
1 Acme R-2 Transformer
1 Acme R-3 Transformer
1 Acme R-4 Transformer
4 Bakelite Tube Sockets
1 Duplex or Bremer-Tully Lo-loss 23-plate Condenser.
1 Frost Potentiometer-Rheostat.
1 .00025 Fixed Condenser with grid leak mounting.
1 .0025 Fixed Condenser.
2 .002 Fixed Condensers.
1 .005 Fixed Condenser.
1 RW Crystal Detector.
1 Binding Posts.
1 3" Bakelite Dial.
1 2-circuit Phone Jack.
1 length Spaghetti.
25" No. 14 Hook-up Wire.
1 50,000-ohm Grid Leak.
1 "C" Battery.
1 7x21 1/2" Bakelite Panel—drilled.
1 Baseboard.
Complete set blue-prints and instructions for wiring.

4-Tube Set \$39.85

1-Tube Set \$17.45



COMPLETE PARTS SUPER-HETERODYNE FOR 5-TUBE

1 23-plate Lo-loss Vernier Bremer-Tully or Duplex Condenser.
1 23-plate Lo-loss Vernier Bremer-Tully or Duplex Condenser.
1 400-ohm Frost Potentiometer.
2 6-ohm Rheostats.
2 20-ohm Bakelite Rheostats.
1 .00025 Fixed Condenser.
4 .002 Condensers.
1 .006 Condenser.
1 Bakelite Terminal Strip for Binding Posts.
1 Multicolored Cable for connecting batteries.

1 8x36 1/2" Dr'd. Bak. Pan.
8 Bakelite Sockets.
7 Binding Posts.
1 Filter Transformer.
1 Oscillator Coupler.
1 "C" Battery.
1 Battery Switch.

3 All-American or Columbia Long-wave Transformers.
2 All-American or Columbia Audio Transformers.

Instructions, blue-prints and complete layout.

\$59.75

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Every article exactly as represented. Every article is tested before shipping. Complete satisfaction guaranteed or money will be cheerfully refunded.

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containing a thousand bargains of everything on radio—parts, supplies, complete parts for sets, complete sets; etc., also a mine of very latest information on all different circuits, complete list of broadcasting stations, and other valuable up-to-the-minute radio data. Send your name and address on a card or letter. We will send catalog free.

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Our radio engineers will help you solve all your radio problems, and furnish up-to-date information on set construction, operation and improvement. This service is free to our customers.

RANDOLPH RADIO CORPORATION
159 N. Union Ave. Dept. 58 Chicago, Illinois

set, be sure to keep your leads as short as possible, and you will no doubt be surprised at the results in distance and volume this receiver will give.

Yours for improved radio,
"A DIAL TWISTER."
[Name on request to Editor.]

Specifications

T-1—Low Frequency—Primary, 150 Turns No. 36 Sec Wire; Secondary 600 Turns No. 36 Sec Wire.

T-2, T-4, F-5—High Fre.—Primary 220 Turns No. 36 Sec Wire; Secondary 1100 Turns No. 36 Sec Wire.

T-3—Oscillator—Primary 80 Turns No. 36 Sec Wire; Secondary 150 Turns No. 36 Sec Wire.

C-1, C-2—.0005 or 23 Plate Variable Condensers (low loss type).

G. L.—.00025 dielectric condenser, "Turn-it" Grid Leak 1 1-2 Meg.

J-1—3 Double Circuit Jacks.

J-2—1 Single Circuit Jack.

T-6—2 audio transformers ratio 5 to 1.

R-2 rheostats 20 Ohm.

O—Filament switch.

A-6—U. V. 199 Tubes.

Loop—Box Type—15 turns Electric Lamp Cord—18" Diameter.

Fixed Condensers—.0005 on Sec. of F-1, .05 on Pri. of T-4.

Panel—18"x7".

2 Vernier Dials.

Cabinet 30"x7" Supplies room for batteries.

In the following letter we have some data, as to what the Baby Heterodyne will do in the Summer-time.

RADIO AGE,

Gentlemen:

I have a list of stations received from July 25 to August 1. I think it is a good list for Summer reception. Enclosed is a self-addressed envelope

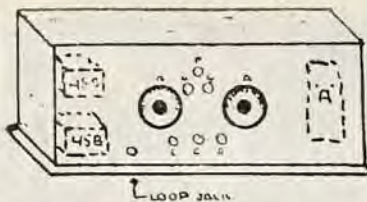
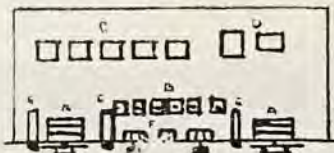


Figure 9 [above] The panel layout of the reflexed super-heterodyne receiver as described by one of our Dial Twisters.

Figure 8. (Below) The apparatus should be arranged on the mounting board and the panel as illustrated. The letters have the following significance: A-23 plate condenser, B-6 UV 199 sockets, C-Radio Reflex Transformers, D-Audio frequency transformer, E-Jacks, F-Filament Switch, G-Rheostats.



for an answer. The list is as follows:

- WOC, WOS, WOAW, WOI, KSD, WBB, WHAA, WDAF, WCAE, WHO, WMAQ, WEB, WOO, KPNF, WSAI, WLS, WEBB, LWL, KDKA, WEAF, WFAA, WSB, WBAP, WQJ, WIAH, WTAY, WTG, KPFV, WTAS, WCAL, WCAP, KFKB, KFKX, KYW, WHAS, WMC, WTAM, WJAX, WGY.

I am using the Baby Heterodyne in the February issue of RADIO AGE. I think this list entitles me to a Dial Twister's Pin.

RALPH LEWIS LINK.

Kirkville, Mo.

Dick Redding of Lexington, Ill., has a five-tube Atwater-Kent and seems very lucky in being able to keep the phones on with five tubes lit and stand the Summer static. However, by his report it looks as though Old Man Static was licked.

RADIO AGE,

I think that your magazine is the best radio publication on the market, and I think the Pickups Department is the best department in it.

I have a five-tube Atwater-Kent Radio set, and here is the list of the stations I have received since last January:

- WHAS, KSD, KYW, WLS, WMAQ, WGN, WQJ, WCBD, WEBB, WOC, KDKA, WBZ, WWJ, WBB, WMC, WBAA, WCK, WMB, WOS, WGY, WHO, WHAZ, WDAF, WLW, WTAS, WJAN, WTAM, WTAY, WGR, WCAE, WDAK, WCX, WOAW, WBAF, WOR, WHAA, WAAF, WOO, WEAF, WAAD, WKY, WLAG, WOI, WQG, WRC, WRM, WSAI, KFKX, WJAZ, WDAP KHX.

I hope you will send me one of your famous "Dial Twister" Buttons.

Yours very truly,

DICK REDDING.

505 N. Pine Street,
Lexington, Ill.

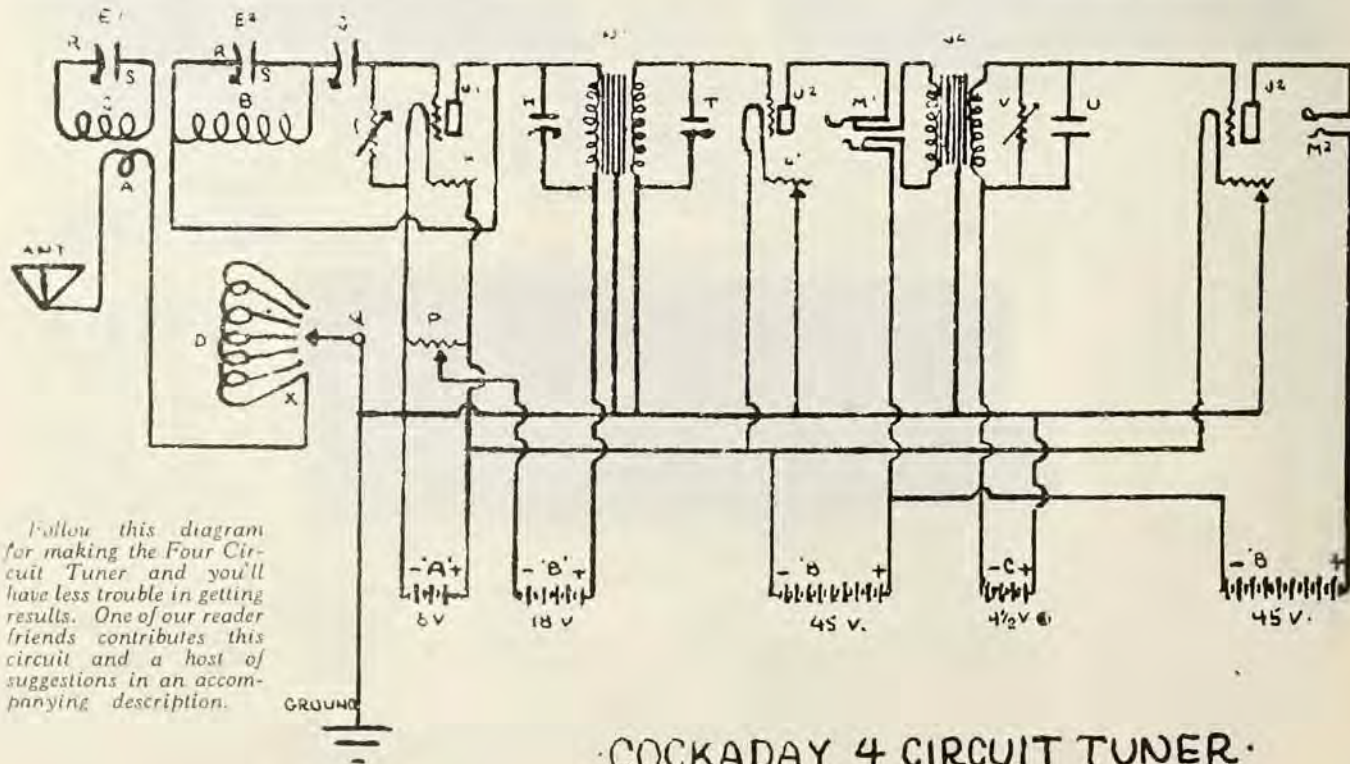
THE COCKADAY FOUR CIRCUIT TUNER

The following information on the Cockaday four circuit tuner was submitted by a reader in order that RADIO AGE might relieve him of the hundreds of inquiries received in regard to the circuit. We feel that by printing this information, it will at the same time help many other fans now using the Cockaday circuit.

The first thing to heed in the construction of the set is the use of good apparatus. Make all connections correctly and as near perfect as possible. In purchasing of the coils, those mounted or wound on very thin hard rubber or bakelite are most preferable.

Watch the condensers, as they play a large part in the efficiency of the receiver. Particular attention should be paid to the "low loss" condensers now on the market, which sell at the same price as those of the "moulded mud" type.

(Continued on page 54)



Follow this diagram for making the Four Circuit Tuner and you'll have less trouble in getting results. One of our reader friends contributes this circuit and a host of suggestions in an accompanying description.

COCKADAY 4 CIRCUIT TUNER.



\$26⁰⁰

ULTRADYNE KIT



To protect the public, all genuine Ultraformers bear Mr. Lacault's personal monogram seal (R. E. L.) and are guaranteed so long as this seal remains unbroken.



Send for 32-page illustrated book, giving latest authentic instructions on drilling, wiring, assembling and tuning 6 and 8 tube Ultradyne receivers.

50c

Now, the famous Ultradyne Receiver has been so simplified that anyone can successfully build it with the Ultradyne Kit.

This Kit includes all the special parts required to build the Ultradyne, designed by R. E. Lacault, the inventor—1 Type "A" Ultraformer, 3 Type "B" Ultraformers, 1 Tuning Coil, 1 Oscillator Coil, 4 Matched Fixed Condensers.

The Ultradyne incorporates the new "Modulation System"—a decided departure from the detector arrangement of radio reception, used in all other Super-Heterodynes. This "Modulation System" is the latest development of R. E. Lacault, A. M. I. R. E., Consulting Engineer of this company and formerly Radio Research Engineer with the French Radio Research Laboratories.

Even Super-Heterodyne Engineers marvel at Ultradyne performance—its unusual selectivity and great range on the loud speaker.

There is no greater receiver! Now you can build it yourself.

Write for descriptive folder

ULTRADYNE
The Improved
SUPER-HETERODYNE

PHENIX RADIO CORP.

3-9 Beekman Street

New York

WITH THE MANUFACTURERS



Grebe Synchrophase Receiver

Followers of radio development have become more or less accustomed to the advances in design and performance which have heretofore characterized each new Grebe Radio Receiver. However, it is doubtful whether any great number have anticipated such radical



departures in design as distinguish the new Grebe "Synchrophase" from the usual type of radio receiver. The changed external appearance is due mainly to the new type of dials, rotating in horizontal plane, projecting through ornamental gold-covered escutcheons. These plates in combination with mahogany toned bakelite panel and dark mahogany cabinet present a very pleasing appearance.

The original Grebe Tangent Wheel Verniers have been elaborated with similar escutcheon guide plates. No dial-twisting motion remains, the coarse tuning of the dial and hair's-breadth vernier action both being horizontal.

Binocular Coils in combination with (Straight-Line-Frequency) condensers constitute the backbone of the tuned stages. These Binocular Coils are entirely devoid of external field, shutting out the bothersome effects of powerful currents usually experienced with single cylindrical coils when operating a receiver close to a broadcasting station. These coils contribute largely to the extreme selectivity and stability of operation found in the Synchrophase receiver.

Non Directional Aerial

While great strides have been made in the radio field within the past two years, one of the outstanding features for 1924 is the perfection of the Non-Directional Aerial. Many enthusiastic radio fans who have been discouraged at times, owing to their inability to pick up certain stations, will be greatly encouraged from now on due to the fact that with this Non Directional Aerial the most distant stations can be picked up one after another depending, of course, upon the power of the receiving set used.

It matters not in what position a wire has to be to best pick up a message—the Portable Globe Aerial has a wire in that position and several more very similar.

Those who have tried it out are most enthusiastic. Even during the Summer months the Portable Globe Aerial worked remarkably well, and one particular instance is recorded where on a very



A view of the non-directional aerial when viewed

severe, hot, electric stormy night by merely turning the dial an individual in St. Louis was able to pick up in quick succession San Antonio, Davenport, Atlanta and Pittsburgh.

New Vacuum Tube Makes Debut

A new wrinkle has lately been added to the construction of vacuum tubes that are used in radio work. The familiar tip on the end of the tube is absent. This fact has a considerable value to all radio fans.



In the earlier type of tubes a tip of glass was left on the end of the globe. This was due to the fact that in pumping the air from the globe a glass tube was fastened to an opening on the surface of the globe. This glass tube was connected by means of a rubber hose to the pump.

When the air from the tube was exhausted the glass tube was melted off in a gas flame, thereby seal-

ing the tube. Part of the glass tube always remained and formed a sharp pointed tip that protruded from the most prominent part of the surface of the globe.

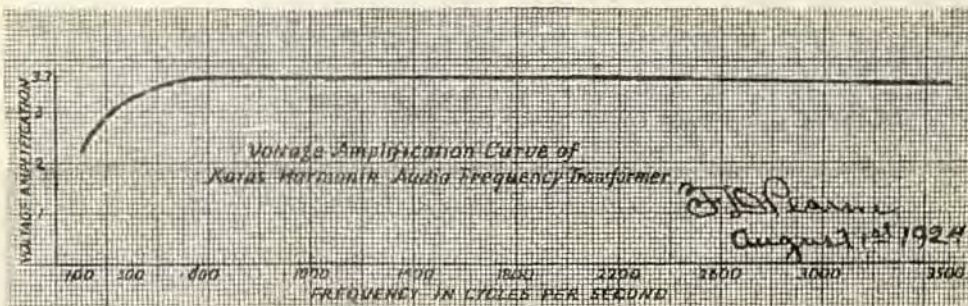
This tip is very easily broken off by a blow that would prove harmless to any other part of the instrument. A very light touch with a screw-driver or other tool when working in the set is often sufficient to break off the tip and allow air to enter and destroy the tube.

In the newer type of tubes the globe is evacuated from the bottom. The tip is then located beneath the metal socket of the tube and is out of sight and out of the way.

A new tube, called the Echotron, has been introduced that embodies the tipless feature as well as other improvements. The tube is of the 201-A type with a standard base and consumes but a quarter of an ampere of current at five volts and is used on a six volt storage battery.

Pfanstiehl Model 7

The Pfanstiehl Radio Co., Highland Park, Ill., are placing on the market their new "Model 7" five-tube receiver, which is one of the best developed and simplified sets ever produced. It embodies the Non-Oscillating system perfected by Carl Pfanstiehl. Another feature is the station-finder on the panel which enables one to locate any station desired, so long as the wave length is known.



The above chart is the voltage amplification curve obtained by Frank D. Pearne, Technical Editor of RADIO AGE, with the new Karas Harmonik Audio frequency amplifying transformer. Note how straight the curve is over the entire band of frequencies from 1000 to 3500 cycles, the band of frequencies covered by the average modulated signals from a broadcasting station. The transformer was approved in this test by the RADIO AGE Institute.

Now Come the Radio Politicians

(Continued from page 21.)

at first difficult experience of addressing unseen audiences.

Mr. Davis will travel considerably, probably going to every section of the country. Thus more people will meet him face to face, but he has already indicated that he will avail himself freely of the radio, both en route and at his home at Locust Valley, New York. He declares radio has completely transformed campaign methods, and has even gone so far as to counsel, perhaps for the benefit of his colleagues in the campaign, those who broadcast. His advice is simple and to the point, "Speak slowly, speak distinctly, and don't shout."

No 20 Minute Speech for "Bob"

ALTHOUGH a comparatively unknown quantity to the radio public, Senator La Follette will be heard frequently. As a movie star he would be a knockout, and doubtless as a radio speaker he will also prove a big drawing card. However, like Hiram Johnson, there will be much that is picturesque in his manner of speaking that must be seen as well as heard.

It is a foregone conclusion that he will not follow the warning of Mr. Davis that no political speech should be longer than twenty minutes. Twenty minutes, indeed! What does twenty minutes mean to this seasoned leader of Senate filibusters, a fighter who has spoken continuously, all day and all night and more, later, if necessary? Some years ago, in his effort to defeat the Aldrich-Vreeland currency bill, Senator La Follette talked for nineteen hours.

Senator La Follette is as different in action from Mr. Coolidge or Mr. Davis as day is from night. He is almost explosive. He shoots out his left hand in a way that Jack Dempsey might envy, he claps his hands together like pistol shots, he crouches, he jerks out his words, he shakes his marvelous head and hair violently, and he is all over the place.

Jewell Has Unique Line

One of the most unique and attractive lines of radio products ever offered has been placed on sale by the Jewell Electrical Instrument Co. of Chicago. After an exhaustive study of the radio and electrical field, several new articles have been put on the market. They include a radio test set, equipped for the taking of vacuum tube characteristics, voltage and miscellaneous tests.



Main Storage "B" Batteries

Soon save their cost, improve reception, and are more satisfactory. Rechargeable at home. Rubber tray. High Grade battery at popular price. Be fair to yourself, get our proposition before buying. Write now.

MAIN RADIO BATTERIES,

7016 Euclid Ave.

Cleveland, Ohio

A New Rathbun Hookup in November Radio Age.

SIX TUBES
 - a turn of the
Single Control
 to the desired wave length -
 the station **SNAPS IN**
 that's *Thermiodyne*
 Performance

TRADE MARK - LICENSE UNDER TRADE PATENTS PENDING
 (pronounced Ther-my-o-dine)

TF6

The first and only six tube radio receiver to bring in any desired station by a single turn of a single dial to a single pre-determined dial setting. Tone purity and clarity unmatched by any other receiver. May be used with any type antenna, or, under favorable conditions, with none; with dry or storage batteries and with any make tubes.

14 Points of Thermiodyne Supremacy

- | | |
|---|--|
| 1—Single Control | 10—No Logging of Stations; Nothing to Remember |
| 2—No Outdoor Antenna Necessary | 11—Stations of Different wavelengths Cannot Interfere |
| 3—No Directional Loop | 12—Three Stages Thermionic Frequency, Detector, Two Stages Audio Frequency |
| 4—Meter or Kilocycle Pickup of Stations instead of meaningless degrees or numbers | 13—Distance, Volume, Clear as a Bell, Without Fuss or Excuses |
| 5—CANNOT Squeal or Howl | 14—A 180 Degree Turn of the Single Control is Like an Instantaneous Tour of Dozens of Cities |
| 6—CANNOT Radiate | |
| 7—CANNOT Distort | |
| 8—Newspapers Give Time and Wavelength | |
| 9—Thermiodyne Picks Them at Exact Setting Every Time | |

Beautifully built, in exquisite genuine mahogany cabinet with space for all batteries for dry cell operation.

\$140

Made and Fully Guaranteed by

SHEPARD-POTTER CO., Inc.

Dept. A. 35 So. River St.

Plattsburgh, N. Y.

Insist on a Demonstration.



Eliminating Radio Frequency Losses

NO DOUBT the time will soon come when all this talk about poor reception of distant broadcast programs will cease and the fans will begin to realize that although atmospheric conditions are not the best, it is still possible to get programs from distant stations if they will only pay attention to the little things which, while they do not mean so much in the Winter time, when the conditions are ideal for DX work they do make a world of difference under adverse weather conditions. With our powerful local stations, almost any kind of a set may be thrown together and fairly good reception obtained, but the user will never realize the fact that he is too easily satisfied and has missed much of the pleasure to which he would be entitled were he to carefully consider the small things which are generally overlooked and which mean so much when weather conditions are at their worst.

In order to ascertain what could be done in the hot Summer months with a receiving set which was built in a scientific way and which was carefully constructed with the idea of eliminating all the small losses which many manufacturers consider too trivial, the writer started out to find what it was all about.

HAVING recently heard a lecture by Carl Pfanstiehl on this very subject, and learning that the Pfanstiehl Radio Co. was building sets which embodied some of the principles mentioned in his lecture, the Pfanstiehl Model 7 receiver was selected to prove or disprove the issue.

This receiver employs five UV-201-A tubes, two of which are used as radio frequency amplifiers, one as a detector and two as audio frequency amplifiers. All inductances and radio frequency transformers were made of specially constructed spider web coils similar to those indicated in Mr. Pfanstiehl's lecture and which from the nature of

By **FRANK D. PEARNE**

their construction were said to so concentrate the electro-magnetic and electro-static fields that interference of any kind from these two sources was entirely eliminated. That is, these fields were so concentrated that no stray lines of force could extend from one coil to another. With this arrangement and the method of wiring which was employed, it was claimed that it was impossible to make this receiver oscillate, thus doing away with all howling and squealing and the danger of causing interference with other receiving sets located nearby.

The plate circuit of the detector tube was supplied with 45 volts and the plate circuits of the amplifiers, both radio and audio, were operated at 90 volts. The filament circuit was supplied with a 6 volt storage battery, having a capacity of 120 ampere hours. The filament current of each tube was .25 ampere making a total discharge of 1 1-4 amperes to supply all the tubes. A logging chart was engraved upon the front of the panel, which directed the operator just where to turn the dials to receive any given wave length. The aerial used in the test consisted of 120 feet of Shinn braided aerial cable about 3 feet from the roof, connected to the set by approximately 60 feet of lead-in wire. The ground was obtained by a 15 foot lead to the radiator. This aerial arrangement, while entirely too long for ordinary good Summer reception, might be considered fairly good for long distance reception when the weather conditions were right, and was used principally to make the test a hard one, so far as selectivity was concerned.

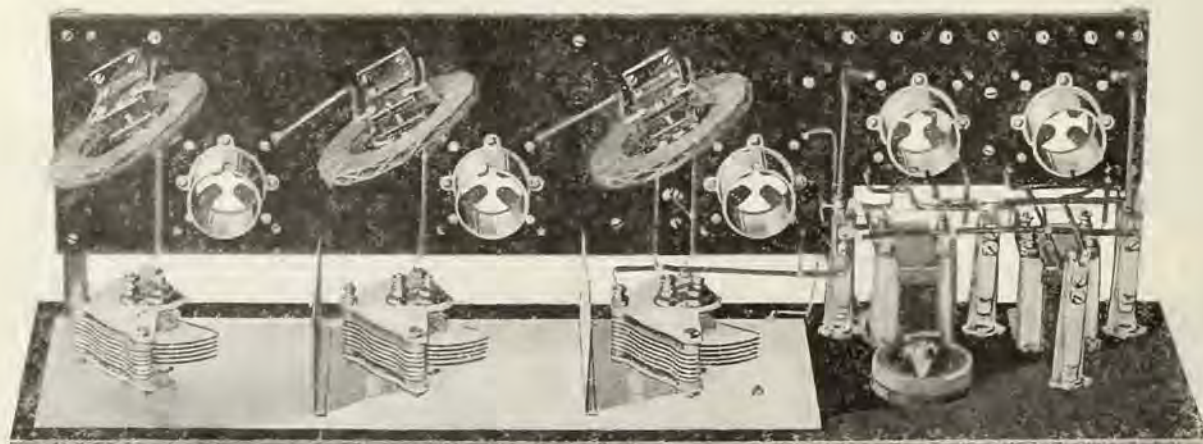
THUS prepared to find out just what a carefully constructed receiver would do as compared to others which were built in the ordinary way, and with a grim determination to see just what difference one might find with many of the little leaks eliminated, a thorough test was made.

This test was made at Chicago, Ill., and was carried on from June 1 until August 20, during which time almost all conceivable kinds of weather conditions occurred, with the exception of extreme cold. Naturally, at times static was very bad, but even when at its worst it was often possible to get stations more than 1,000 miles away on the loud speaker, which, were it not for the slam-bang of static, would lead one to believe that it was a local station coming in; and in fact Schenectady, New York, was often mistaken for Zion, Ill., until the announcement was made. New York City, Troy, N. Y., Fort Worth and Dallas, Texas, were, when the set was properly tuned, brought in with considerable volume at times when it was impossible to get them on the three circuit regenerative set with which the comparison was made.

As the Pfanstiehl set was non-oscillating, no sound other than that of the signals was heard, and by consulting the chart and moving the dials to the wave length indicated, the stations could be picked up immediately without any howling or squealing or any other sound except that caused by static.

THE selectivity was excellent, considering the long aerial used at this time of the year and many stations such as Davenport, Ia., Des Moines, Ia., and WEAJ of New York were picked up occasionally through the local broadcasting which was going on at the same time. Several other types of receivers were compared, all stations first being located by the Model 7 and then the other sets switched on. Whenever it was possible to pick the stations up on the other sets, the reception was not so good, bearing out the fact that the little things are of far more importance than one would suspect and if in the construction of a set, one will take the trouble to prevent all the little leaks and losses, he will be very well repaid by greatly improved reception.

(Continued on page 52)



A top elevation of the new Pfanstiehl receiver which embodies a new principle in construction to offset the oscillations usually present in radio frequency receivers of the tuned type. Note the method of placing the coils to counter any stray inductance. It is claimed that this is only possible with a coil of the spider-web type.



Howard Standard Parts For Clear Reception

Howard Rheostat With Dial Control

Carrying capacity 1-5 amperes; beautiful 2½ in. dial with 100 point markings covering full sweep of contact arm. Made in resistances of 6½, 25, 40 and 60 ohms. Each **\$1.10**

Write for catalogue and information on

- Howard Potentiometers
- Howard Multi-Terminal Plugs
- Howard Positive Contact Sockets

If your dealer cannot supply you with Howard Parts send remittance direct to us.

THE HOWARD RADIO COMPANY, Inc.
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on behalf of the Principal Radio Manufacturers and
Dealers of America
Presents —

This greatest radio show
ever held will be profit-
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Election Week
Program Features

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**NATIONAL
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EXPOSITION
GRAND CENTRAL
PALACE
NOV. 3rd. to 9th. 1924**

Featuring, in advance, the
most striking develop-
ments in the Radio art and
the Radio industry for the
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- Receiving Set Models for 1925
- Phonograph Radio Combinations for 1925
- Improved Equipment for 1925

(Main and Mezzanine Floors)
NEW YORK CITY
"The World and his Girl will be there"

American Radio Exposition Co.

Director: HAROLD BOLSTER
522 FIFTH AVENUE,

General Manager: J. C. JOHNSON
NEW YORK Telephone: Vanderbilt 0068

The Radio Frequency Problem

(Continued from page 50)

Radio engineers have been perfecting tuned radio frequency amplification. This circuit has stimulated the efforts of the best engineers because it offers so much. It fulfills the demands of those who want a high degree of selectivity,



The chart or station-finder gives the wave-length for the various degrees on the tuning dials.

distance and volume, and who desire to avoid reradiation. It has, in fact, but one defect; a supposed inherent tendency of the tubes to oscillate. These oscillations make themselves known as squeals, howls and distortion, and defeat the high degree of amplification obtained.

Until recently it was assumed that these oscillations were unavoidable, and therefore all efforts were made to choke them down or to compensate for them. To this end resistances were used, then the potentiometer and finally and most successful of all, neutralizing condensers. All these devices do two things; they cut down efficiency and they require expert adjustment.

Carl Pfanstiehl has attacked the problem from a new and different point of view. Instead of assuming that these oscillations are inherent in the circuit, he has traced the disturbing oscillations to their various sources, ascertained exactly how they are generated, and built up a system which altogether avoids producing them.

These oscillations are generally supposed to be due to capacity effects between the elements of the tube. Pfanstiehl doubted this commonly accepted belief. Such small surfaces were insufficient to explain the oscillations, and such a theory did not seem reasonable in view of which he had deemed in his laboratory about electrostatic and electromagnetic fields at high frequencies. He set himself to the task of tracing to their sources, with delicate measuring instruments, all oscillations generated. Tube capacities proved to be significant, but electromagnetic and electrostatic coupling developed an important bearing on the subject.

The Pfanstiehl non-oscillating system shows that the capacity effects inside the audion tube are not sufficient to produce oscillations in a properly designed tuned radio frequency circuit, on the present wave lengths used for broadcasting. It analyzes the generation of oscillations into two kinds; those due to electromagnetic coupling and those due to electrostatic effects. In other words, this system does not aim to neutralize, or choke down undesired oscillations after they have arisen, but to avoid generating them.

Mfd. under U. S. Pats. No. 1,185,987 1,272,843 Other Patents pending



© 1924, by H. B. Wheelau



Have You Heard This Wonderful Loud Speaker

If you walked into a room where a *Radialamp* is reproducing a concert you would wonder where the remarkable loud speaker was hidden. Certainly you would never suspect the superb table lamp, a matchless piece of lighting art, of being a Radio Loud Speaker as well.

Floods Room with Beautiful Music

And yet that is just what the *Radialamp* is. In the base of this wonder lamp is the latest perfected microphone. Up thru the long graceful metal cast stem, the sound vibrations are amplified to be reflected from the "sound mirror" in the top of the shade. This clarifies the extra high and low notes. Then the sound is carried thru the light-heated air chamber inside the parchment shade which further purifies it. This combination reproduces

radio music as it has never been done before. "It is simply wonderful," agree Radio Experts.

You Bathe in the Soft Mellow Light

And when you consider too, the soft mellow light that the *Radialamp* sheds—when you see what an ornament it is even to the most magnificently furnished interior, you wonder that the *Radialamp* can be sold for the astonishingly low price. *Radialamp* has come to stay—even if you have an old type loud speaker you can attach the *Radialamp* to a long wire and use it in a room many feet from your Radio set. For sale at any good Radio Dealer. If he hasn't a *Radialamp* in stock you can get complete description and information if you write to the

RADIALAMP CO.

Dept. 810 334 Fifth Ave., N. Y. C.

RADIALAMP

TRADE MARK

LOUD SPEAKER

ELECTRIC RADIO SOLDERING IRON \$1

Send \$1.00 now for this regular \$2.50 value, postpaid anywhere in U. S. A. Write for Big Free Radio Catalog. Atwood King, Inc., Dept. P. 105, 163 W. Washington St., Chicago

ATWOOD KING INC.

ONLY POST PAID

- 1 No losses through di-electric hysteresis of fiber covers.
- 2 No insulating binder to melt at the application of heat and by releasing pressure, change the capacity.
- 3 Capacity fixed and invariable.
- 4 Metal case protects against accidental injury.
- 5 Direct connection to copper plates avoids losses through inefficient eyelet contact.
- 6 Application of soldering iron does not affect condenser.

All capacities from 35c up. At all dealers
CHAS. FRESHMAN CO.
106-7th Ave., N. Y.

IS YOUR NEUT RIGHT?

To revitalize unneutralizable Neutrodyne, we devised this Kladyag Coast-to-Coast circuit. Uses same panel, etc., as Neut, except three less parts. Merely rewire. Success certain. Necessary stabilizer, 22 feet gold sheathed wire, circuit and complete, simple instructions—\$5.00 prepaid. Many have already rebuilt their Neuts and written us wonderful testimonials. Thousands will do it. Be FIRST—have the finest, liveable set in your neighborhood and revitalize others' Neuts. Description, etc., 10c. Radio list, 2c. Stamps accepted. KLADYAG RADIO LABORATORIES, Kent, Ohio.

6 Exclusive Features

FRESHMAN NOISELESS TESTED MICA CONDENSER

CHAS. FRESHMAN CO. 106-7th Ave., N. Y.

Have You Met Our Radio Sweethearts?

(Continued from page 31)

riding they got into a friendly squabble with the cops of that town. As a result, little "Topsy" came out with a broken rib, nose and minor other bruises and hurts which laid her up for some time. Suit for damages and counter suits came up later which filled the newspapers of the country. The Cicero police force said they wanted her restrained, for she had nearly disabled one of their cops, a 225-pounder. And "Topsy" tips the scales at about 110! So that's why the radio fans wondered why she wanted the dog "Cicero" back.

There is another interesting story about the girls, regarding the time they upset all precedent which governs the society of royalty and near-royalty in England. It was the time they played the game "snubbing Mrs. Vanderbilt." They had been invited to Mrs. Vanderbilt's home in London by the Prince of Wales, a guest of hers, and they came—with all their song and mischief along. The King of Spain and the Duke of York were there also. They went up in the music room and sang songs, played the piano, and told the Prince how to put pep into his music.

THEN the dinner bell called them. and it called and called but without much result. The guests were impatient, as was Mrs. Vanderbilt, who was much more so, for the girls were not only delaying the "eats" but they were occupying their beloved Prince! But Topsy and Eva sort of liked it up in the music room, and the Prince came to like it too, so he made the suggestion that the guests should rather come up there to eat! My, what a hub-bub that did cause. The society ladies and gentlemen never heard of such a thing, and they branded it scandalous. But they did come, after all.

Radio has played a very important part in the lives of Vivian and Rosetta Duncan, and even helped make their show the tremendous success that it is; so they feel that they owe it a debt. When they go to New York, which they will late in October, they are going to have another studio there from which the Westinghouse Company will again broadcast their songs, as they did through their station KYW in Chicago.

KYW will rebroadcast the music, so Chicago and the West will have a chance to hear them.

"PUTTING A SOUNDER HEART IN RADIO"



You be the Judge!

ALREADY the most notable jury of experts known to the radio world have given this much talked of new tube their hearty endorsement.

SUCH SPONTANEOUS enthusiasm has rarely greeted any new device before.

A TUBE CAN BE AS good as its filament only—and there is the great secret of W. Harrison Cole's latest achievement.

WITH PERFECT OSCILLATION in all circuits, it brings to radio perfection of reception never before known.

Unique in Clarity
Immense Volume

WITH GUARANTEE THAT MEANS SOMETHING

\$3.50 AT YOUR DEALER'S
OR SENT PREPAID
ANYWHERE

BACKED BY A MILLION DOLLAR CORPORATION



The Factory behind the BRENDONNE Tube

Never before such a tube—never before such a policy!

Your money back or tubes replaced by your dealer or ourselves immediately upon receipt of such tubes—without question.

Agents Wanted

BRENDONNE

CORPORATION

ORANGE NEW JERSEY

Makers of the Brendonne Radiometer Precision Tube Certifier

ELECTRIC SOLDERING IRONS



OVER 100,000 IN USE

It's what the whole radio world has been looking for and wanting—a real, practical electric soldering iron at a reasonable price.

At \$1.50 complete with handle, Solderette is the biggest value ever offered in a soldering iron.

THE BEEHLER CO.
1441 North 13th Street St. Louis, Mo.

For continuous work, Solderette Senior is recommended. Most simple construction of all large irons. Heating element of Nichrome wire, easily renewable. Made with the grip that a real mechanic demands. Solderette Senior comes packed single iron in carton, with cord and plug complete as illustrated, for only \$3.

Distance, Selectivity

Build Your Own Neutrodyne
Easy to Build—Easy to Operate

- | | |
|---------------------------|----------------------------------|
| 1 7x27 Drilled Panel | 1 Double circuit Jack |
| 10 Lengths Bus Wire | 1 Filament Switch |
| 3 RMS 17 plate condensers | 1 6 ohm rheostat |
| 3 Neutro-coils | 1 30 Ohm rheostat |
| 2 Audio transformers | 1 Mica Grid condenser .00025 Mf. |
| 3 4 inch Dials | 1 Grid leak, 2 megohms |
| 5 Composition sockets | 1 Set marked binding post |
| 2 Neutralizing condensers | 2 .006 Fixed condensers |
| 1 Single circuit Jack | 1 Wiring plan. |

Price \$34.75

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CHICAGO, ILLINOIS

HUDSON-ROSS

Wholesale radio only.
One of the first and still in the lead.
Write for discounts.

123 W. Madison St. Chicago



CABINETS

If you are interested in a radio cabinet in which is combined both beauty and practicability, just write

LAKESIDE SUPPLY CO.,
Dept. R
73 West Van Buren St.
CHICAGO, ILL.
Telephone, Harrison 3840

It Isn't Often That a Dollar Can Buy So Much!

The profound technical problems to be encountered in the study of Radio are all very interesting to the expert, but the great majority of "fans" are vitally concerned in the building of simple sets that really will work and produce effective results.



To supply this demand for practical, simple and efficient sets, RADIO AGE compiled THE RADIO AGE ANNUAL for 1924 in the belief that it contains more real help and meaty material than any other book on this subject ever published.

The supply is rapidly becoming exhausted, so we are making this last appeal to the fans to order their ANNUAL now if they have not already done so. 120 pages of diagrams and articles.

Full of Hookups That Are Guaranteed to Work!

A Few of the Features

- | | | |
|---------------------------|-----------------------|------------------------|
| Simple Crystal Set | Baby Heterodyne I | Reinartz |
| Long Distance Crystal Set | One Tube Loop Aerial | Haynes |
| Your First Tube Set | Wave Trap, Filter and | Hopwood |
| Erla Reflex | Eliminator | Cockaday |
| Kaufman Tuner | Loading Coils | Neutrodyne |
| Grimes Inverse Duplex | Transformers | 3-Circuit Tuner |
| Two Stage Amplifier | Battery Charger | Super-Heterodyne |
| Rosenbloom | Wave Meters | Simple Radio Frequency |
| Push-Pull Amplifier | Two-Circuit Crystal | Ultra Audion |
| Portable Reinartz | | |

The principal articles are illustrated with the well-known RADIO AGE isometric drawings, reputed by countless experts as the clearest construction diagrams ever put on the market.

You cannot afford to be without this wonderful radio "guide book." Send your dollar today for this gold-mine of radio ideas.

USE THIS COUPON NOW!

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

Gentlemen: Attached find One Dollar (\$1) for which kindly forward me by return mail one copy of RADIO AGE ANNUAL FOR 1924. If not satisfied with it I will return it to you within three days and you will refund my money.

Name.....

Address.....

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

This Coupon Pinned to a Dollar Bill Will Bring* You The ANNUAL by Return Mail!

Pickups

By Our Readers

(Continued from page 46.)

The grid leak and grid condensers are common places to experience trouble when poor ones are used. Many times the average builder, when soldering the leads on the condensers, allows the flux to run in between the metal or mica separators, making them practically useless.

Make all connections as short and direct as possible. Always avoid running the grid and plate leads parallel to each other. Also mount transformers at right angles.

Use tube sockets of low loss such as porcelain and mount them on a hard rubber or bakelite strip. The transformers may be mounted directly beneath the tubes.

The plate voltage of the tube is given as 18 volts. However, the voltage will have to be adjusted to suit the characteristics of the particular tube. It is advisable to use a separate B battery for the detector tube, connected as shown in diagram, B, to center arm of potentiometer, B+ to B+, on first audio transformer.

The C battery has a maximum voltage of about 4 1-2 volts. This also will have to be varied according to the plate voltage.

This hook-up may be used with either C-199 or UV-199 tubes, by omitting the potentiometer and connecting the B- of the detector B battery to the A+ and connecting the B- of the first 45 volt B battery to the B+ of the detector B battery, and substituting the 6 ohm rheostat for a 25 ohm rheostat. However, dry cell tubes will not deliver the volume that may be obtained from the larger tubes.

As to the antenna, ordinarily a single wire 100 ft. long, seven strand copper, 40 or 50 ft. high, exclusive of the lead-in, will give excellent results. The antenna may be supported at each end by strain insulators brought down through a lead-in insulator. Try to make the antenna all one wire so as to avoid connections.

When soldering, take your time and make a good clean job of it, clean your joints well and use as little paste as possible. It is not advisable to use spaghetti; it's good to look at and that's all. Pull it off your old set and notice the difference. Of course, in the instance where one wire crosses another it will be found necessary to use some form of insulation.

If you wish to use push-pull amplification, be careful or you will "bust a speaker," especially on stations within 500 miles.

LEGEND

A. A single turn of bus wire around coil C, 1-4 of an inch from beginning of winding, running in same direction as wire in coil.

B. Secondary winding, 65 turns, No. 18 D. S. C.

C. Reaction stabilizer winding, 34 turns No. 18, D. S. C.

D. Antenna tuning coil, double bank wound, 43 turns of No. 18, D. S. C. mounted at right angles to coils B and C.

The above coils may be purchased wound on thin bakelite, made for the 4 circuit tuners.

E-1, E-2. .0005 mfd. vernier variable condenser, low loss.

F. Variable grid lead, 1-4 to 10 meg.

G. Variable grid condenser .0005 mfd.

J-1 C-300 or UV 200 vacuum tube.

J-2 C-301A or UV 201A vacuum tube.

K6-. ohm vernier type rheostat.

L-1, L-2. 25 ohm rheostat.

M-1. Double circuit jack.

M-2. Single circuit jack.

N-1, N-2. Audio frequency transformers, preferably of low ratio. Mount directly under tubes to have short leads.

9. 400 ohm potentiometer.

Q. Switch arm.

R. Rotary plates of condensers.

S. Stationary plates of condensers.

T. Mica fixed condenser .0005 mfd.

U. Mica fixed condenser .00025 mfd.

V. A Resistance, 25,000 to 200,000 ohms.

X. Starting of bank wound coil, or end on which taps are close together.

In the following letter, the writer shows how, by inserting a loading coil in the antenna, he was able to get many more stations than he did before. The use of small coils in the antenna circuit has hindered many from getting the stations on the higher wave lengths.

RADIO AGE,
Gentlemen:

After reading your magazine for several months, I decided to contribute my list of stations received. Looking over my list, I feel that it's not so bad when one considers that Summer shortens your range and static occasionally prevents DX reception.

At first my set would not work right. I could not tune above 390 meters, but I built a loading coil, and now I get them all.

KFKX comes in like a local some nights. The rest of the list is:

WTAM, WJAZ, WHK, KDKA, WHAZ, WBZ, KFKX, WTAS, WLW, WGY, WTAZ, WDAF, WGY, WEAM, WDAF, WDAF, KYW, WLAQ, WTAY, WCK, WSAL, WCAD, WFAF, WCAE, WCX, WWJ, WTAZ, KOP, WOC, WEH, WQJ, WOS, WSB, WLS, WHN, WOAR, KSD, WCAY, WEAN, WNAC.

Some of these stations were heard during the month of June, but I have heard many of them since then.

Very truly yours,

FRANKLIN TROUTMAN

11304 Cotes Ave.,
Cleveland, Ohio.

Many of the letters contain reports for months at a time. The following shows what a DT did in one night. By the looks of things, Old Man Static doesn't rate very high in Michigan. Anyway, read this:

RADIO AGE,
Gentlemen:

I have been a subscriber to RADIO AGE for a little over a year,

(Continued on page 57.)

Latest Radio Science by the Box— Builds Best Circuit Best



With marked improvement in ease of control, Erla Selectoformer assures maximum range and volume. Cost and complication are reduced. \$5 each



Distortionless amplification of 3 stages, exclusive in Erla Audio Transformers, indicates their vast superiority. Price \$5.00



Millions of Erla Bezels are in use, enhancing beauty and utility in any set. 1" and 1 1/2" diameter for 3/8" to 1/2" panels, Nickel, black and gold. Price 20c-30c

Actual construction of Erla Duo-Reflex Circuits now is vested with advantages paralleled only by the matchless reception that is assured.

So much more powerful, tube for tube, these extra-efficient circuits now, too, are easiest to build.

Under warranty, factory sealed, the Erla blue-and-white protective carton brings every last thing needed for success. From synchronizing reflex and audio transformers, tested capacity condensers, balanced crystals, clear through to the drilled and lettered panel, stenciled baseboard and full size blueprint, nothing is lacking for correct, confident, precision assembly by any amateur.

Typifying the perfect simplicity to be expected, are Erla ingenious solderless connectors, which banish soldering; so that the only needed tools are screwdriver and pliers.

The completed receiver is bound to represent in their most intensive, accumulated form, all those superiorities of tone quality, selectivity, range, volume and ease of control, which makes Erla units preferred in any set. Ask your dealer about Erla knock-down receivers, factory sealed in the blue-and-white carton, fully warranted. Or write direct, supplying your dealer's name.

Electrical Research Laboratories
Dept. M, 2500 Cottage Grove Avenue, CHICAGO



B-METAL CRYSTALS



Standard The World Over.

Don't accept a substitute.

B-Metal Refining Company
Western Branch

Price 50c

53 W Jackson Bldg., Chicago, Ill.

FREE DIAGRAM

and complete instructions for making
Freshman Masterpiece

5 TUBE TUNED
RADIO FREQUENCY SET

Please send name of your dealer

THE BARSOOK CO.

53 W. Jackson

Chicago

SOLDERING AND CONNECTIONS

PURPOSE OF SOLDERING. Whenever possible, wires should be soldered to each other and to the connection posts of the apparatus which they connect. This not only insures a tight joint which will not rattle loose, but also a clean joint in which the contacting surfaces cannot become corroded or oxidized by the air. Wires simply twisted together without soldering soon become coated with a film of oxide or "rust," and as this film is a non-conductor of electricity, the film increases the resistance of the joint or may even cause an open circuit. Soldering is of particular necessity in portable sets where jarring and vibration are likely to cause loose screw terminals or loosened wires.

At points where wire connects to another wire, solder should always be used. At binding posts it is sometimes a question as to whether soldering is desirable, especially if the wires are to be disconnected frequently at these points, but for safety's sake soldering is always better. In extreme cases, it is the practice of many very particular experimenters to solder the lugs of the tubes (prongs) to the socket springs, but while this is advantageous from an electrical standpoint, we do not recommend the practice for beginners. This makes the tubes difficult to remove, and unless one is skilled in handling the soldering copper, damage to the tube is likely to result.

It is good practice, however, to solder the wires to the terminals of rheostats and potentiometers, and where there is not much likelihood of the wires being disturbed, to the four socket posts as well. After the connections to the aerial and ground binding posts have been well tightened up, a drop of solder at this point will prevent the connections from jarring open, and in addition will prevent the screws from turning when the aerial and ground wires are being attached to the set.

The wire connections to the phone jacks must always be soldered under all conditions, care being taken not to use any more solder than absolutely necessary at this point. By lumps of solder on the jacks, the use of acid flux at this point or small pellets gathering under the springs will cause a lot of trouble that is very difficult to locate.

WHAT TO AVOID. The small fixed condensers and grid leaks used in various parts of the circuit are easily damaged by excessive heat applied by the soldering copper, and great care should be taken to prevent the heat from traveling along the wire and into these parts. The heat of the iron will cause the varaffin to run out of the condensers or will cause the grid leaks to pack and change their value. The same precautions should be taken in soldering wires to parts that are already soldered, for it is an easy matter to unsolder the first joints and cause all sorts of trouble. To prevent the heat from traveling along the wire into points where heat is not desired, lay the corner of a damp cloth on the wire between the joint being soldered and the part to be protected. Be careful not to have the cloth so wet that it will drip and destroy the insulation.

Another thing to observe in soldering is the "flux" or soldering cleaners used to clean the surfaces of the metal. Soldering acids and a great many of the soldering pastes should be avoided, since they never completely dry out after soldering, and therefore often result in annoying short circuits and noisy operation. Rosin is the best flux and will not cause short circuits, but as the rosin is an excellent insulator, care should be taken not to get it in between contact points or between parts which are supposed to be in electrical contact. In soldering jacks, the rosin must be kept from flowing into the jack contacts.

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RADIO AGE

COMPILED BY
I. B. RATHBUN

S-10-20

CONSTRUCTION NOTES (S-10-21)
SOLDERING AND CONNECTIONS

When a soldering acid is used on parts which are closely spaced, the acid is likely to cause a short circuit as before explained, and still further causes a continuous cracking, snapping noise like a good dose of old fashioned static. This noise can be distinguished from static by disconnecting the aerial and ground wires. If the noise now still goes on you can be quite sure that the acid is still damp and is generating current at each of the joints like a series of small batteries. A pair of wires soldered together and wet with acid forms a small "couple" or battery which is capable of generating enough current to make an awful noise in the headset. Eventually the wires will become so corroded that they will break off or introduce unnecessary resistance into the circuit.

FLUX. Rosin core solder, which is a hollow wire of solder with rosin in the central hole, is very convenient and is used by practically all large telephone manufacturing companies, in their assembling departments. It is rather difficult to handle at first, but one soon gets the knack of handling it. The joints to be soldered must be made quite hot by means of the soldering copper before the rosin will flow freely into all the crevices.

There are a number of rosin solutions on the market which are very good and which make it easy for the beginner to spread the flux uniformly over the surfaces. The rosin is dissolved in alcohol, acetone or other non-acid solvent and there is no danger of causing short circuits as with acid and certain soldering pastes.

THE SOLDERING COPPER. The common soldering copper is so common that an extended description seems unnecessary. Generally it consists of a cylindrical copper bolt with a pointed end which is provided with an iron wire shank and a wooden handle. The electrical soldering irons are much more convenient, as they remain hot continuously as long as they are in use without the necessity of stopping work while the copper is being heated over the gas as with the old simple tool.

For radio work a small iron with a sharp point is the most desirable, as it is necessary to work in small spaces. The great objection to a very small iron of the common type is that it cools off rapidly and must be reheated at very frequent intervals. The point should preferably be of a sharp chisel point type sharp along the edge and with an edge about one-quarter inch wide. The point must be filed off and sandpapered bright and clean before using, and then heated quite hot and "tinned" by rubbing it into flux and solder alternately. The point must always be provided with a bright clean coat of solder, or soldering cannot be properly performed. Should this coat of tin be burned off, then the end of the copper should be filed or scraped and the tinning operation should be repeated.

When the copper is accidentally overheated by heating it to a red heat, it will no longer hold its tin coating and must be given a treatment. Plunge the copper into cold water while it is still red hot, and then hammer the end thoroughly with a steel hammer while cold to readjust the fibers. After hammering the copper will be found to take its tinning as before. If the iron is burned so bad that there are deep pits in the end, then it must be filed into shape with a coarse file before attempting to do any soldering.

A hot iron, held at just the temperature where a play of colors starts to run across its surface, must be had if soldering is to be properly performed. The solder must be heated so that it becomes thin and runs freely into all openings on the parts to be joined. Cold pasty solder forms a poor weak joint and you must be careful that the copper is not allowed to cool down to the point where the solder has a milky granular appearance.

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RADIO AGE

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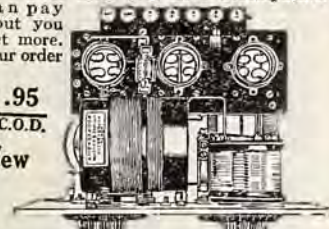
S-10-21

OH! BOY!

Here are two of the most remarkable kits ever offered. Distance a plenty! Clear! Ask for free proofs of what these sets have accomplished. You can pay more, but you can't get more. Send your order today!

\$27.95
C.O.D.

The New
De
Luxe



AMBASSADOR

- SET CONSISTS OF
- 1 DRILLED 7x10 Radion Mahoganite Panel, engraved in Gold.
 - 1 Genuine Ambassador Master 3-Circuit Litzendracht Tuning Coil.
 - 1 Genuine Cosmo Bakelite-End Condenser.
 - 1 Triploid Mounting Socket.
 - 2 Premier Hegehog Audio Transformers.
 - 4 Brunswick Underjung Foundation Brackets.
 - 2 Brunswick Jacks with Cold-Plated Fronts: 1 for phones; 1 for loud speaker.
 - 1 Freshman Mica Grid Condenser.
 - 1 Standard Glass-Enclosed Grid Leak.
 - 2 30-Ohm Shackton Bakelite Rheostats.
 - 2 Moulded Mahogany Dials, grained to match panel.
 - 5 Lengths Professional Round Bus-Bar.
 - 1 Set of 7 Moulded Engraved Binding Posts completely mounted.
 - 1 Special Blue Print for this circuit. Not an ordinary hook-up, but in clear picture form child can understand and make. Assembled ready to wire, and packed in handsome box, complete.
- Only \$27.95
C. O. D. Send no money.

ACCESSORIES

Everything needed to operate after building, including 3 tubes, 60 amp. Battery 2 45-hr. "B" Batteries, 1 pr. phones, phone plug, antenna, only \$35.00. Parts sold separately. Fine mahogany finish cabinet FREE when building kit and accessory outfit ordered together.

THE DE LUXE
NEUTRODYNE **\$34.49**
C.O.D.



A five tube assembly kit which includes everything necessary to build a genuine Hazelitine 5 tube set.

WHAT THIS GENUINE STANDARD SET CONSISTS OF—

- 1 Drilled Mahoganite Panel, polished mahogany effect, engraved in gold.
- 3 Four-inch Mahogany Dials, gold engraved.
- 2 Cold Plated Jacks.
- 3 Genuine Hazelitine Neutrodyne mounted on the famous Cosmo-Bakelite End Condensers. Positively the only Neutrodyne kit including them.
- 2 Hazelitine Neutrodyne.
- 5 Heavy Bakelite Sockets.
- 16-Ohm Rheostat with plated knob to match panel.
- 1 30-Ohm Rheostat with gold plated knob to match panel.
- 2 Genuine Killark Completely Shielded Audio Transformers.
- 1 Baseboard.
- 20 Feet Tinned Bus-bar.
- 1 .0025 Freshman Grid Condenser.
- 1 Tubular Class Grid Leak.
- 1 Set Engraved Binding Posts.
- 1 .002 Micon Condenser.
- 1 .006 Micon Condenser. Exact size special blue print and instructions. All packed in attractive box Complete Building Kit, \$34.49 C. O. D.

OPERATING OUTFIT

- 5 Tested Tubes (Type 201A)..... \$19.50
 - 2 45-Volt Extra Large Variable "B" Batteries for Neutrodyne..... 6.50
 - 1 60-Ampere Hour Storage Battery, guaranteed 2 years..... 11.25
 - 1 pr. 3000-ohm Head Phones and Cord..... 3.75
 - 1 Phone Plug, double..... \$.90
 - 1 Antenna Equipment..... 1.50
- Complete Outfit, \$43.40, C. O. D.
(Parts Also Sold Separately)

If you order Building Kit and Operating Outfit both together, we will include Fine Mahogany Finish CABINET FREE.



SEND NO MONEY
We ship C. O. D. When shipment arrives pay your postman. Then enjoy your purchase under our WRITTEN MONEY - BACK GUARANTEE. Just send name and address and state kit you want—Now!

THE RADIO SHACK
Executive Offices
Dept. RA 10
55 Vesey St., New York
Largest Radio Dealers in America. Every article sold on Written Money-Back Guarantee.

(Continued from page 55.)

and I find, as have thousands of others, that this magazine is just the dope for a radio "nut."

I have been particularly interested in your Dial Twisters, as I haven't had a list which I considered long enough to warrant your attention.

On the night of July 1st, from 9:15 until 12:00 midnight, I received the following: WWAE, WWJ, WCX, KYW, WRC, WLW, WHB, WEBH, WLS, KDKA, WOAW, WQJ, WTAF, KFKX, WMC, WFAA, WCAY.

The reception was perfect and so loud that persons several blocks away heard the music distinctly, through the loud speaker.

I am using a Crosley Trirdyn receiver on a 150 foot L-type aerial.

I consider this somewhat of a record for Summer reception, as the weather conditions have been anything but favorable for radio.

I am located at a point midway between Duluth, Minn., and Marquette, Mich.

The Crosley Trirdyn receiver is in my estimation the most easily operated and the loudest receiver for the price on the market.

This may or may not reach the printed page, but you have my list.

Does this warrant a D. T.?

Very truly yours,

CLAIR McCORMICK.

% Jenson Mercantile Co.,
Ewen, Mich.

Albert Westphal's letter will make those that live in out-of-town locations appreciate it. By this time we all know what the location surrounding the receiving set means to reception.

Considering the noise and sparking of the electric line, combined with a power house located a block away, Mr. Westphal hands in a very good list

RADIO AGE,

Gentlemen:

As a candidate for the Royal Order of Dial Twisters, I would like to submit the following:

KDKA, KYW, WAAM, WBAF, WBAY, WBBR, WBS, WBT, WBZ, WEAF, WDAF, WDAF, WEAF, WFAF, WGI, WGY, WGR, WHAZ, WHN, WIP, WJAX, WJY, WJZ, WJZ, WMAC, WMAF, WMAK, WOC, WOO, WOR, WOAO, WRW, WSAI, WTAM, WWJ, WWI

Please note that I live in a block where there are elevated and surface lines in front of my house. A power house is a block away. I use an indoor aerial about 40 ft. long, bending several times.

My set is a single circuit three tube receiver as described in the Consolidated Call Book.

Not so bad, eh?

Respectfully submitted,

ALBERT C. WESTPHAL.

1667 Palmetto St.,

Brooklyn, New York.

RADIO AGE,

Gentlemen:

I have built the Baby Heterodyne as modified by A. F. Van Louven, of Los Angeles, using coils wound like

Now you can UNDERSTAND RADIO!

Take the mystery out of it—build and repair sets—explain the vacuum tube—operate a transmitter—be a radio expert!



1 VOLUME
514 PAGES

Compiled by
HARRY F. DART
E.E.

Formerly with the
Western Electric
Co., and U. S.
Army Instructor
of Radio.

Technically Edited by F. H. Doane
100,000 ALREADY SOLD

This practical and authoritative Handbook is considered the biggest dollar's worth in radio to-day. Over 100,000 homes rely on the I. C. S. Radio Handbook to take the mystery out of radio. Why experiment in the dark when you can quickly learn the things that insure success? Hundreds of illustrations and diagrams explain everything so you can get the most out of whatever receiver you build or buy.

It contains: Electrical terms and circuits, antennas, batteries, generators and motors, electron (vacuum) tubes, many receiving hook-ups, radio and audio frequency amplification, broadcast and commercial transmitters and receivers, wave meters, super-regeneration, codes, license rules. Many other features.

A practical book. Written and edited by experienced engineers, in plain language. Something useful on every one of its 514 pages. The authority that covers every phase of radio, all under one cover in one book for one dollar. Don't spend another cent for parts, turn a dial or touch a tool until you have mailed \$1 for this I. C. S. Radio Handbook.

Send \$1 at once and get this 514-page
I.C.S. Radio Handbook—the biggest value in
radio to-day. Money back if not satisfied.

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INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 8784-B, Scranton, Penna.

I enclose One Dollar. Please send me—postpaid—the 514-page I. C. S. Radio Handbook. It is understood that if I am not entirely satisfied I may return this book within five days and you will refund my money.

Name.....

Address.....

Make \$100 Weekly—sell RADIO

Demonstrate once—results mean sure sale. Coast to Coast, lowest prices, attractive four tube instrument \$39.50. Big commission to you. Exclusive territory to proven salesmen. Territory going fast.. Write today for large illustrated book No. 100. Don't fail to give name of your colony.

OSZARKA, INC.
829 Washington Blvd., Chicago, Ill.



Big Profit

The World's Largest Store is
Radio Headquarters

No matter what you need for your radio—whether it's a complete set or the smallest part—it can be had from RADIO HEADQUARTERS at prices that save you money.

Our new RADIO Catalog is ready. Your copy is waiting for you; so fill in and mail the coupon below. We would like you to see the many radio bargains that the World's Largest Store has to offer. We don't think there is a store in America that has a more complete line.

We would like to have you see the famous SILVERTONE Neutrodyne, the most perfect radio set yet built. Get all the comfort and enjoyment that a good radio set can deliver. Make sure of your satisfaction. You can do it if you deal with RADIO HEADQUARTERS.

Reduced Prices on Radio Tubes.

Radio tubes—standard equipment—can be had from us at the new low price of \$3.65. This is just an example of the values that our RADIO catalog offers. Get your copy. Mail the coupon TODAY.

Mail the coupon TODAY to the store nearest you.

Sears, Roebuck and Co. 90R87
 Chicago Philadelphia Dallas Seattle

Send Latest Radio Catalog.

Name
 Postoffice
 Rural Route.....Box No.....
 State
 Street and No.....

Pfanstiehl, two low loss condensers and W. D. 11 tube.

To my amazement the set worked right off the reel, giving wonderful volume on our local station. I have also heard three or four out-of-town stations four or five hundred miles distant with the best volume I have ever heard on a one-tube set, and that in the month of August. The set is easy to tune. I agree with Mr. Van Louven that it is a wonder, and I want to thank Mr. Rathbun for giving us the hook-up. See if you can't induce Mr. Rathbun to work out one or two more stages on this set for the average man who only wants two or three tubes. I am sure he can do it, notwithstanding his opposition to W. D. 11 tubes.

With thanks to the best magazine published, I am,

Very respectfully,

C. E. HINES.

703 Central Bank Bldg.,
 Memphis, Tenn.

The PICKUPS SECTION with the coming months promises to be one of the greatest features of RADIO AGE. So come on, all you "space annihilators" and make up for all the trouble Old Man Static has caused you.

Our goal this Winter is DISTANCE—get that? DX!

Hang a card up in front of your set with "DX" painted on it, and every time you put the "cans" on, think of the million and one stations that you are going to receive. Keep an accurate list and don't forget to send them in.

The Pickups department is growing fast and we're waiting for your lists. LET'S GO, GANG!—THE PICKUPS EDITOR.

Zenith With Radio Stores

A deal of considerable importance to dealers in the New York metropolitan area was consummated recently, whereby the Radio Stores Corporation, of 218-222 West 34th Street, New York City, have secured a jobbing franchise from the Zenith Radio Corporation, of Chicago, through the Eastern Office, located at 1269 Broadway, New York City.

Mr. Gross, when interviewed, stated: "We have been endeavoring for some time to become jobbers of Zenith products, having become convinced that Zenith is one of the best selling radio lines obtainable.

KENNEDY TUNER

Enables the whole family to operate Receiver. Only two dials used to tune in stations all over the whole U. S. A.

Volume, Distance, and Selectivity will surprise everyone; even the doubting Thomases.

KENNEDY TUNER, \$5.00
 Including Globe Trotter Diagram Delivered to Your Door.

T. J. KENNEDY

RADIO GLOBE TROTTER
 1360 University Ave., New York, N. Y.

Send for Free Diagrams and List of Satisfied Users.

Guaranteed! If not satisfied after 30 days, we will cheerfully refund your money.

Sears Roebuck and Co.

The World's Largest Store owns and operates Broadcasting Station W.L.S. Wavelength 345 Meters. Tune in.

The 1925 Operadio

The Original Self-Contained Radio Set With Many Revolutionary Improvements

The 1925 Operadio is a complete, self-contained set without external wires or connections.

Introduced last year, the Operadio created a country-wide sensation. Many thousands now in use. In the new model all the former features are retained—the loud speaker, six tubes, dry cells and all parts are fitted into a compact cabinet.

This new set is marked by extreme beauty of appearance and efficiency of performance and has many new and exclusive features. Write at once for particulars

THE OPERADIO CORP.
 8 So. Dearborn St. Chicago, Ill.

OPERADIO



Who's Who In The Radio Industry

Various men of importance in the radio industry will be reviewed from month to month in this newly created department of RADIO AGE. Material for this department is solicited from corporations and manufacturers who have in their personnel men of prominence and who deserve publicity for some accomplishment or work which benefits the radio field as a whole.

The "Early Bird" in Radio Caught the Business

Plodding the heat-baked pavements of Chicago during the hot summer days of 1922 when radio dealers were few, far between and equally far from optimistic, due to the terrific slump that had hit radio at that time, was a man who had a vision to spur him on.



Robert Himmel

This man was then representing certain radio manufacturers. But that Summer, while he disposed of optimism in large lots, he sold goods in small parcels.

Today this same man heads a large radio house, which he personally founded that same Fall. And all because he foresaw and believed in the tremendous possibilities in radio and was not to be sidetracked by temporary unfavorable conditions.

He is Robert Himmel, president and general manager of Hudson-Ross at Chicago. In the short space of two years his company has become a recognized national factor in the radio distributing field.

"Quality Goods" Only

A stout believer in quality products backed by national advertising, he conceived the plan of creating a wholesale organization that would take the goods of reliable radio manufacturers who advertise, and by proper merchandising place these goods in the hands of progressive dealers to be sold to the public.

Instead of treating radio as a side-line, this organization would handle nothing but radio. Moreover, it would sell to dealers only.

He advocated that dealers buy well-advertised lines, lines that the public knew, and the dealers quickly disposed of what they purchased. They "turned over" their investments with speed, and as they grew and succeeded, Hudson-Ross expanded with them. "Turnover" is Mr. Himmel's explanation of his success.

Soon Mr. Himmel found it necessary to have more space, and to add to his force. He multiplied the size of his stocks to be able always promptly to accommodate his customers. Again and again was it necessary to enlarge the offices, the warehouse space, and stocks and the organization, until today, at the original address—the firm of Hudson-Ross occupies quarters fifty times the size of the first office.

The slogan of Hudson-Ross is "Legitimate Merchandise—Legitimately Merchandised."

"Radio Is Universal Entertainer," Says Powel Crosley, Jr.

The development of low-price deceiving sets capable of good all-year-round reception, as evidenced by the excellent equipment of this character now on the market, has placed the man of small means virtually on the same plane as the rich man, insofar as opportunity for enjoying life is concerned, Powel Crosley, Jr., one of the leading radio manufacturers of the United States, declared recently.

"I look forward to the time when radio will be regarded as an indispensable source of home entertainment," said Mr. Crosley. "Modern man cannot live without diversion—and how can he obtain as unending a variety of entertainment, day in and day out, and at such a small investment, as he now secures through radio?"

"To the family of sufficient means to enjoy the opera, the theater and other forms of entertainment at will, radio offers an additional source of diversion, information and culture, brought directly to the home," Mr. Crosley pointed out. "But to the family of moderate circumstances, to whom the more costly forms of entertainment come as a luxury, radio indeed is a universal source of entertainment."

"The city dweller, when he comes home oppressed with the care and routine of his life in office or factory, requires amusement of the sort which will divert his mind from the daily grind of activities. Radio has come to him as manna from the heavens.

"I consider that radio satisfies a definite spiritual need of the people, and that it is destined to have a profound effect on the life of the modern man. It will go far toward allaying the restlessness and discontent that is largely a product of overwrought nerves, insufficiently rested by amusement and mental diversion."



Far Better Reception Or your Money Back!

MAIL THE COUPON AT ONCE for a pair of these Marvelous, New, Karas Harmonik Audio Frequency Transformers. Put them in that new radio set you are building or put them in your old set in place of the transformers you are now using. Try them out—test them thoroughly for 60 days. IF YOU don't enthusiastically agree that they give you the most delightful radio reception you have ever heard send them back and we will return your money at once!

That's Our Special Introductory Offer!

KARAS HARMONIK \$7.00

Those who are now using Karas Harmonik Transformers in their radio sets tell us if we could REALLY describe to all radio enthusiasts the exquisite pleasure of hearing this wonderful reception, they would all want Karas Harmoniks in their sets, at once. But there is only one way to fully realize the delightfully rich, round, full clear-as-a-bell tones of Karas Harmoniks, and that is to actually HEAR them! That is why we make this amazing trial offer.

We are stocking the dealers with Karas Harmoniks just as fast as we can. In the meantime we are making this "Proof By Trial" offer direct to those discriminating and particular folks who are keen to enjoy radio reception at its very best. If your dealer already has secured his allotment of Karas Harmoniks he is authorized to make you this offer.

We might give pages to telling you WHY Karas Harmonik Transformers give purer, sweeter, more natural music than any transformers ever built before. But it is far better to hear with your own ears and judge for yourself! So mail the coupon today. Please write very plainly. DO IT NOW!

Karas Electric Co.
4040 N. Rockwell St.,
Dept 58-97
Chicago, Illinois

Send No Money With this Coupon

Karas Electric Co., 4040 N. Rockwell St., Dept. 58-97, Chicago
Please send me ... pair of Karas Harmonik All Stage Ratio Audio Frequency Transformers. I will pay the postman \$7 apiece, plus postage, on delivery. It is understood that I am privileged to return the transformers any time within 60 days if they do not prove entirely satisfactory to me, and my money will be refunded at once.

Name.....
Address.....
City.....
Dealer's Name.....
Dealer's Address.....
If you send cash with order we'll send transformers postpaid.

To Jobbers and Dealers

Distribution of Karas Harmonik Transformers through regular jobber and dealer channels is being carried out as rapidly as the output of our factory permits. Write us for test records, discounts, etc.

To Set Manufacturers

We positively prove that Karas Harmonik Audio Frequency Transformers will vastly improve the musical quality of your set by any form of test you wish to impose. Write or wire us and arrangements for tests will be made promptly.

Hazardous Adventures As a Young Operator

(Continued from page 24.)

veloped an annoying swing in received signals. The aerial had been up for three years and was badly corroded and oxidized, and when Carey and I started to lower the after end, the cable stuck in the block, despite vigorous prayerful remarks made by Carey at the aftermast. Carey gave a wrathful yank on the flimsy leads and—what follows sounds like slapstick, but it is gospel truth—one of the leads broke off, came sizzling down around us, and the end, an ugly snare of seven sharp, salty, smoke-covered barbs, caught right in Carey's nose and stayed there. With the wire still holding fast, and gouging at every little movement until the blood spurted all over, there was no comedy apparent at the moment. Carey's bellow brought help, and the doctor was quickly on the job, but, believe me, we had one hard time getting that wire out of Carey's nose and the old beak was fearfully lacerated when the delicate job was done.

The Fall of China

We left the calm waters of some port during breakfast, for a short run to the next stop. The meal had been served in calm weather style, with complete china and silver service, and of course without the racks which in rough weather persuade the stuff to stay on the tables. We steamed into a heavy swell, which struck us square on the beam for a few minutes, which was a disastrous thing for it to do to a ship all rigged out for fair weather. After one little, harmless roll, the "Seminole" laid right over flat on her starboard side just once. There was the grandest crash in all time from the pantry and only a slightly lesser one from the dining room itself, where the tables were stripped as clear as they had been before they were set. The principal comedians were some of the ship's officers sitting at the head of the thwartship tables. These young men were the glad recipients of ten complete covers, consisting of everything but the linen. Along with the china and cutlery came at least one portion of everything on the menu from grapefruit to coffee, and if there is anything that detracts from the dignity of a natty, gold-laced white uniform, it is several plates of oatmeal and half a dozen soft-boiled eggs spread thickly from shoulders to lap.

My interest in communications of all kinds, as well as wireless, let me in on a little comic opera which is far more amusing today than it was—at the time it was being staged.

One day I found myself pursued by two native sleuths in the inconspicuous garb of white army uniforms loaded with yards of glistening gold braid. Upon discovery, these actors went through an amusing scene to convince me that they were not interested in me, and if I had started in their direction they might have retreated. But I made the tactical blunder of trying to cut through an alley and beat it back to the ship,

New! Scientifically correct and guaranteed!



—its calibrated

Resistances can be read in terms of the megohm through panel peep-hole. (Also equipped for table mounting.) Set it for specified resistance—adjust it for best results. Accuracy assured. Each Fil-ko-leak hand calibrated (1/4 to 5 meg.—the operating range for all tubes) and doubly checked.

2.00

Terminal posts spaced to fit the standard grid condensers.

FIL-KO-LEAK
SCIENTIFICALLY CORRECT
VARIABLE GRID LEAK

You cannot get all that your set can give unless your grid leak resistance is precisely correct.

—with battery switch



And at no extra cost! Fil-ko-stat gives perfect control of any type tube in any hook-up—maximum signal strength—longer tube and battery life. Stops tube noise. Brings in DX stations you never heard before. Switch attaches to regular "Star" mounting screws.

2.00

FIL-KO-STAT
SCIENTIFICALLY CORRECT
RADIO RHEOSTAT

—with \$100 guarantee



Protects your set from lightning or we pay you \$100 or repair the set. That's our guarantee. "Umbrella" shield keeps dust, moisture, etc., from the hermetically sealed Bakelite insulation. Maximum reception assured, because all radio impulses reaching antenna reach your set. No leakage losses.

1.50

FIL-KO-ARRESTER
SCIENTIFICALLY CORRECT
RADIO LIGHTNING ARRESTER

Simple-Sure



Made entirely of non-magnetic metal. Wipe action contacts, assuring clean, sharp "make and break," are positively insulated from the nicked brass housing and knob. Scientifically correct to avoid current leakage and added capacity. It carries the usual Filko guarantee for Radio Parts.

50c

FIL-KO-SWITCH
SCIENTIFICALLY CORRECT



MADE AND GUARANTEED BY



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New York Office, 220 W. 34th Street
FOREIGN REPRESENTATIVES
Radio Stores Corp., New York

If dealer has none send his name and your remittance to Dept. R.A. 1024

Ingenious



The "SELF ADJUSTING" Rheostat

\$1.10

everywhere

Write for FREE Hook-ups

AMPERITE controls perfectly and automatically the current flow from battery to tube. No Rheostat knobs on panel to turn. No ammeter needed. No worry. One AMPERITE for each tube inside the set regulates current on thermo-electric principle. Simplifies wiring and operation. Facilitates tuning. Proven in use. Adopted by 50 set manufacturers. Be sure your set is equipped with AMPERITE.

RADIALL COMPANY
Dept. RA1 50 Franklin St., New York

AMPERITE

"means right amperes"



12 Cells
21 Volts
Solid Rubber Case

\$4.00 C.O.D.

SPECIAL

INTRODUCTORY PRICE

For a limited time only, and to introduce this new and superior Storage "B" Radio Battery to the Public, we are selling it for \$4.00. Regular Retail Price is \$6.00. You save \$2.00 by ordering NOW. A finer battery cannot be built than the

World Storage "B" Battery

(12 CELLS—24 VOLTS)

To ten million homes with Radio Sets—and to countless millions of prospective buyers—this WORLD Storage "B" Battery brings a new conception of battery economy and performance. Here is a battery that pays for itself in a few weeks—will last for years and can be recharged at a negligible cost. And you save \$2.00 by ordering now.

A Superior Battery Equipped With Solid Rubber Case

Has heavy duty 2-1/8 in. x 1 in. x 1-4 in. plates and plenty of acid circulation. Extra heavy glass jars allow ready observation of charge and prevent leakage and escape of current. It holds its charge, while idle, at constant voltage. You will find this battery a boon to long distance reception. It does away with a great many noises so often blamed on "static." Mail your order today.

SEND NO MONEY

Just state number of batteries wanted and we will ship day order is received. EXTRA OFFER: 4 batteries in series (96 volts), \$16.00. Pay Expressman after examining batteries. 5 per cent discount for cash in full with order. Send your order NOW and save \$2.00.

WORLD BATTERY COMPANY
Makers of the famous World Radio "A" Storage Battery
1219 S. Wabash Ave., Dept. 81, Chicago, Ill.

SAVE \$2.00 BY ORDERING NOW!

POLYMET PHONE PLUGS



Embodying the very latest scientific developments in a phone plug. Genuine Bakelite. Impossible to pull out phone Cord.

"BE SURE YOU GET—A POLYMET" "And you will never have to fret."

The Barsook Company
Factory Representatives
53 West Jackson Blvd., Chicago

Price 75c.

which bucked up their waning courage immensely. Assisted by several score of spectators, I was quickly rounded up. A slight hint of resistance on my part brought a show of sword play from the two braves and a yell of expectation from the audience. I suffered myself to be led to the Commandante's office. A lengthy speech in Spanish was delivered to me by an officer in a carriage starter's uniform. I attempted to explain that I did not understand Spanish, but at every interruption the orator folded his arms and waited, my captors drew their swords and the whole assembly arose in horrified protest. Finally an American merchant was sent for, and he explained (after I had tried to kiss him for joy) that a revolution was on and that my similar actions in several towns had excited suspicion. I was before the council to explain why I should not be executed as a rebel agent bent on destroying the Government's communication systems.

Adopting "Safety First"

My American friend advised me to get the Captain of the ship at once! I refused. This must have aroused the suspicions of the American himself, as he looked at me curiously for a moment. However, he agreed with the high moguls to be responsible for anything that I might do to the Government, and interpreted to me an order from the council to the effect that I was to go to the ship and never set foot ashore again. I did go ashore in Santo Domingo city, but on the way back I had another shock that kept me within running distance of the ship the rest of the time we were in the island. A dusky citizen speaking very good English approached me and asked if I had any small arms and ammunition to sell at a good price. To me this bird was one of the same gang that had me corralled before, probably trying me out on some more revolutionary bait. I did not even wait to say "No"—I yelled from a distance of about 100 feet, all the time making fast progress to the dear old "Seminole."

The trip back was uneventful. Arrived in New York after a beautiful northbound passage, I was on the fence about resigning, and by the time I was again ascending in the elevator to see dear H. J. H., with all the grief behind me as experience, I was a little ashamed of the boyish letter I had written Mother from Monte Christi.

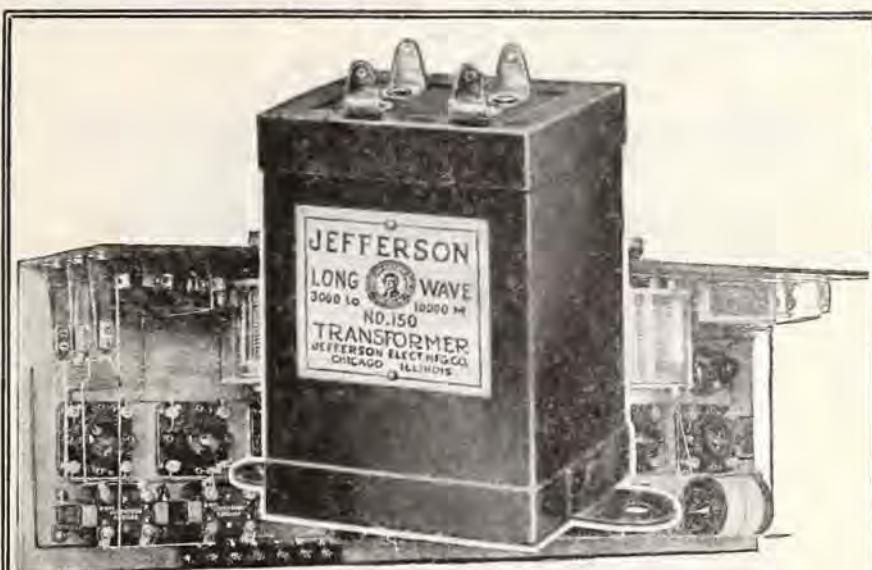
He looked up and—smiled broadly. "Why, hello, Leech," he said cheerily. "Hello," I responded in a smallish voice.

"How'd you make out?" he asked. I thought briefly of the million times a night that I had burned up the air with my "OS" and could only grin in reply.

"Guess you did fine," he returned approvingly. "We got your 'OS' every night."

"So did San Francisco, I'll bet," I thought. But I only said, very discreetly: "Yes, sir."

[In the November RADIO AGE Mr. Leech will narrate his thrilling adventures as an "Op" to Jamaica on the Steamers "Admiral Schley" and "Admiral Farragut."]



Jefferson's Are Chosen

Leading radio authorities choose Jefferson Intermediate long wave Transformers for their circuits because:

- They amplify equally over the entire useful band of frequencies.*
- They amplify fully.*
- They amplify without distortion.*
- They provide for a perfect mixed operation without requiring direct circuit adjustments.*
- They provide a practical transformer for practical every day use for radio fans and set builders who want actual results and not just theory.*
- Makes of the superheterodyne set a musical instrument of rare quality.*

What is said of Jefferson Intermediate Transformers is also true of Jefferson Audio-Frequency Transformers and Jefferson Radio-Frequency Transformers because:

- Jefferson's are backed by more than 20 years of practical and highly specialized transformer experience.*
- No Jefferson product is put on the market until after months of exhaustive laboratory tests.*
- All Jefferson Transformers are low ratio.*

Write for your copy of the Jefferson Circuit booklet now on the press.

JEFFERSON ELECTRIC MFG. CO.

438 So. Green St.

Chicago Ill.

20 FT MAST
 PREPAID \$10.
 Install this steel aerial mast for greater range and better results. Neat, substantial construction. 20 Ft. Mast, \$10. 40 Ft. Mast, \$25. 60 Ft. Mast, \$45. Freight prepaid if remittance is sent with order—otherwise C. O. D. Write for circular.
 S.W. HULL & CO., 2048 East 79th Street, CLEVELAND, O.

NEXT TIME INSIST ON "COMET" "B" BATTERIES
 At all good radio stores or write
ELECTRICAL MFG. AGENCY
 25 N. Dearborn St., Chicago, Ill.

The Traffic Cop of the Air FERBEND Wave Trap
 Add a Ferbend Wave Trap to your set and "Police" your reception. Regulate the traffic guaranteed to tune out any interfering station. Sent postpaid on receipt of \$8.50, or C. O. D. plus postage. Send for free booklet. Ferbend Electric Co. 16 E. South Water St., Chicago

Bound Volumes of Radio Age are available from the circulation department for the unusually low price of \$1.00, postpaid. Formerly sold at \$3.50. These volumes contain issues from May, 1922, to April, 1923, and are bound in a durable cloth, lettered with a handsome gold inscription. A welcome addition to any radio library.
RADIO AGE, Inc.
 Publishers
 500 N. Dearborn St., Chicago, Ill.

New Models

Bristol Radio Receivers

Incorporating the Patented Grimes
Inverse Duplex System

Watch for further announcements in all leading
radio publications.

Grimes' System Insures Natural
Tone Quality

Improved Bristol Audiophone Loud Speakers—give greater volume, are more sensitive and still maintain their round, full tone and their distinctive freedom from distortion.

Ask for Bulletin No. 3017-P.

Manufactured by

The Bristol Company

Waterbury, - - Conn.



SENIOR AUDIOPHONE
15 inch Bell
Price.....\$30.00



JUNIOR AUDIOPHONE
11 inch Bell
Price.....\$22.50



BABY AUDIOPHONE
With Fibre Horn
Price.....\$12.50

Rheostats: How They Affect Audibility

(Continued from page 7.)

tube, but most of them are useful when a low-voltage tube is in use. The fact that none of the curves shows the secondary peak of audibility of the UV 200 being reached by either of the rheostats, is not the fault of the rheostats. It is due to the failure of the ordinary "A" battery to supply the necessary voltage to reach the peak. The radio fan will have little if any interest in this secondary peak—what he wants is the high spot. The valley between the peaks is interesting, however, for it represents the "hissing point" which occurs at about 5.25 volts.

Mr. Hoyt goes on to say that the rheostat should not be blamed for all of the troubles that interfere with good audibility. The battery may be at fault. This is particularly true in the case of the WD 11 and WD 12 types, which operate on one dry cell. A dry cell is supposed to deliver 1.5 volts, but after a very short period of use, it drops considerably below that value. Mr. Hoyt advises using two No. 6 dry cells in parallel, or multiple, with these tubes. It is hoped the proportion of beginners who connect the batteries in series, thus doubling the voltage and burning out the tube, will become less and less as the fundamentals of electricity become more generally known.

The Wire Rheostat

HIS final analysis is rather hard on a device that all of us have used, and that some of us still buy and will continue buying, perhaps, for use with the non-critical tubes in amplifiers—namely, the wire rheostat. It has the great advantage, from the point of view of the fan with little money, of costing fifty cents or a dollar less than the newer devices that give finer control. Mr. Hoyt says of it: "We see that wire rheostats have their entire regulation range confined to within about three-fourths of a turn, with the additional disadvantage of depending on a slider which passes from convolution to convolution of the resistance wire, in contact at all times with two or three surface wires, while four-fifths or more of the total resistance represented by these surface turns is on that part of the convolution not available to the slider's regulation."

He did not mention the fact that some wire rheostats have a vernier control in which a separate glider reaches every point of several turns of wire. If he had done so, perhaps he would have mentioned also the fact that this wire sometimes wears out or burns off.

If anyone wishes to take exception to Mr. Hoyt's point of view on any of these matters, he has the physicist's permission. Mr. Hoyt has given us the diagram of his testing circuit so that anyone may make the same tests that he made or any others that the experimenter may wish to make. Neither he nor I is in the business of selling radio apparatus.

Another article by Armstrong Perry next month.

The Standard of the World



The base-type
Freshman Variable Grid Leak
is the standard for those who build their own sets. It is the most compact and being entirely sealed it always remains unaffected by any climatic conditions.
Complete with either .00625 or .0065 Freshman Condenser—**\$1.00**
without condenser.....**.75**
At your dealer's, otherwise send purchase price and you will be supplied postpaid

Chas. Freshman Company, Inc.
106-7th Ave., New York

Free Mailing Lists

Will help you increase sales
Send for FREE catalog giving counts and prices on thousands of classified names of your best prospective customers—National, State and Local, Individuals, Professions, Business Concerns.

99% Guaranteed by refund of 5¢ each

ROSS-GOULD CO. 878 N. 10th St. St. Louis

B-METAL



B-METAL Loud Talking Crystals make dead sets live wires.
See your dealer or us.
B-METAL REFINING CO.
5th Floor, 525 Woodward Ave.
DETROIT, MICH.

The advertisements in RADIO AGE are as carefully prepared as the articles. They are your guarantee of reliable Radio products.

"Blazing the Trail" for Beginners

(Continued from page 8)

But do not expect them to last that long if you sit up every night until 3 a. m. And by all means do not forget to turn off the current when you are through operating. Many a man has used up a new set of batteries in short order because he forgot to turn off his rheostats or circuit switch.

14. How do I know when my "A" batteries need replacing?

You can quickly detect the fact by the gradual decrease of volume. This can be overcome for a time by turning up your rheostats until you have finally cut out all the rheostat's resistance and are using the full voltage of your batteries. If the volume continues to decrease after you have done this, you will know that it is time to buy a new set of "A" batteries.

15. Will a storage "A" increase the efficiency of my set?

The current from a storage battery will not give you any better reception than the same current from a dry battery. The advantage of a storage battery is that it eliminates the expense of battery replacement and always gives full voltage on your tubes, assuring uniform reception. The use of a storage battery is more convenient and economical when you have electric current in the house so that you can charge it yourself. The current cost of charging is very low.

16. How long should "B" batteries last?

The life of your "B" Batteries depends upon the way you use your set. A conservative estimate, considering average use, would be six months. The life of a "B" battery depends first and foremost on the size of that battery. Remember the voltage of a battery is no indication whatever of its ampere-hour capacity. Desired voltage is obtained by connecting up a number of cells, each cell producing 1 1-2 volts, no more, no less. That cell may be a large one or a small one. The voltage is still 1 1-2. A 45-volt battery is composed of 30 cells and the life of any battery depends on how large these cells are.

17. How am I to know when my "B" batteries need replacing?

You may test them with a voltmeter, or better yet, test any 22 1-2 v. battery with a 25 or 50 volt electric light bulb. Place its base on one terminal of the battery and connect the side of it by wire to the other terminal. If the filament burns red, the battery is satisfactory. Run down "B" batteries sometimes create a noise similar to "static," but it is difficult to decide whether such noise is due to the batteries or outside causes.

18. Will the use of storage batteries improve the operation of my set?

With the proper voltage applied to the plate circuit of your set, it makes no difference whatever whether this voltage comes from dry batteries or storage batteries, but an advantage lies with the storage battery in that it enables you to keep your voltage entirely

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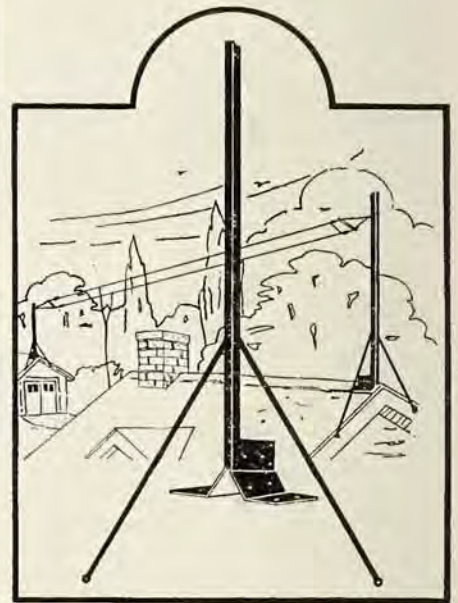


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—How to make a Tube Unit for \$23 to \$37.
—How to make an Audio Frequency Amplifier Transformer.
- November, 1922**
—Design of a portable short-wave radio wavemeter.
- May, 1923**
—How to make a portable Heinsartz set for summer use.
- June, 1923**
—How to build the new Kaufman receiver.
—What about your antenna?
- December, 1923**
—Building the Haynes Receiver.
—Combined Amplifier and Loud Speaker.
—A selective Crystal Receiver.
- January, 1924**
—Tuning Out Interference—Wave Traps—Eliminators—Filters.
—A Junior Super-Heterodyne.
—Push-Pull Amplifier.
—Rosenbloom Circuit.
- February, 1924**
—How to make a battery charger.
—Single Tube Heterodyne.
—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.
—A Tuned Radio Frequency Amplifier.
—Simple Reflex Set.
- April, 1924**
—An Efficient Super-Heterodyne (fully illustrated).
—A Ten-Dollar Receiver.
—Anti-Body Capacitors Hookups.
—Reflexing the Three-Circuit Tuner.
—Index and first two installments of Radio Age Data Sheets.
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—Construction of a Simple Portable Set.
—Radio Panels.
—Third Installment of Radio Age Data Sheets.
- June, 1924**
—Important Factors in Constructing a Super-Heterodyne.
—A Universal Amplifier.
—A Sure Fire Reflex Set.
—Adding Radio and Audio to Baby Heterodyne.
—Radio Age Data Sheets.
- July, 1924**
—A Portable Tuned Impedance Reflex.
—Operating Detector Tube by Grid Bias.
—A Three-Tube Wizard Circuit.
—Data Sheets.
- August, 1924**
—Breaking Into Radio Without a Diagram.
—The English 4-Element Tube.
—Filtered Heterodyne Audio Stages.
—An Audio Amplifier Without an "A" Battery.
—Data Sheets.
- September, 1924**
—How Careful Mounting Will Improve Reception.
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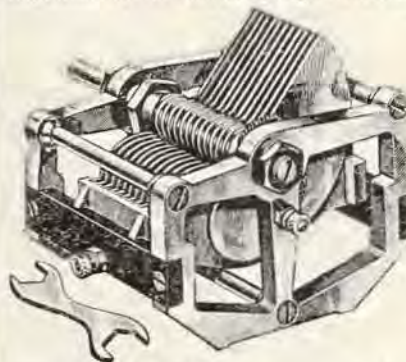
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KDPM	Westinghouse Electric & Mfg. Co.	Cleveland, Ohio	270	KFPS	Carter A. Ross Motor Service Co.	Carter, Wyo.	242
KDPT	Southern Electrical Co.	San Diego, Calif.	244	KFPV	Heints & Kahlmoos, Inc.	San Francisco, Calif.	236
KDYL	Telegram Publishing Co.	Salt Lake City, Utah	360	KFPW	St. Johns M. E. Church S.	Carterville, Mo.	268
KDYM	Savoy Theatre	San Diego, Calif.	244	KFPY	Syona Investment Co.	Spokane, Wash.	263
KDYQ	Oregon Institute of Technology	Portland, Ore.	240	KFOA	First Presbyterian Church	Five Bluff, Ark.	242
KDZB	Frank E. Siefert	Bakersfield, Calif.	240	KFOB	Crinidia Co.	St. Louis, Mo.	261
KDZE	Rhodes Department Store	Seattle, Wash.	270	KFOC	The Searchlight Publishing Co.	Fort Worth, Tex.	254
KDZI	Electric Supply Co.	Wenatchee, Wash.	360	KFOE	Kidd Brothers Radio Shop	Yuba City, Calif.	227
KDZR	Bellingham Publishing Co.	Bellingham, Wash.	261	KFOF	Chovin Supply Co.	Anchorage, Alaska	280
KFAD	McArthur Bros. Mercantile Co.	Phoenix, Ariz.	360	KFOG	Dickenson-Henry Radio Laboratories	Colorado Springs, Colo.	224
KFAE	State College of Washington	Pullman, Wash.	330	KFOH	Southern Calif. Radio Ass'n	Los Angeles, Calif.	226
KFAF	Western Radio Corporation	Denver, Colo.	276	KFOI	Albert Sherman	Hillsborough, Calif.	231
KFAR	Studio Lighter Service Co. (O. K. Olsen)	Hollywood, Calif.	280	KFOJ	The Thos. H. Ince Corp.	Culver City, Calif.	234
KFAW	The Radio Deu (W. B. Ashford)	Santa Ana, Calif.	280	KFOK	Harbour-Longmire Company	Oklahoma City, Okla.	236
KFAY	W. J. Virgin	Medford, Ore.	283	KFOK	Democrat Leader	Okemah, Okla.	236
KFBB	P. A. Butrey & Co.	Hyvre, Mont.	360	KFOI	Oklahoma Free State Fair Assn.	Muskogee, Okla.	252
KFBC	W. K. Azbill	San Diego, Calif.	278	KFOR	Walter LaFayette Ellis	Oklahoma City, Okla.	236
KFBE	Robert H. Barr	San Luis Obispo, Calif.	242	KFOS	Dickenson-Henry Radio Laboratories	Mantou, Colo.	246
KFBF	First Presbyterian Church	Tacoma, Wash.	250	KFTT	U.S. National Guard	Deason, Texas	252
KFBK	Kimball-Opson Co.	Sacramento, Calif.	283	KFOU	W. E. Riker	Holy City, Calif.	231
KFBL	Lesco Bros.	Everett, Wash.	224	KFQV	Omaha Grain Exchange (Portable)	Omaha, Neb.	236
KFBS	Trinidad Gas & Electric Supply Co. and the Chronicle News	Trinidad, Colo.	360	KFQW	C. F. Krierin	North Bend, Wash.	248
KFCB	The Cathedral (Bishop N. S. Thomas)	Laramie, Wyo.	263	KFOX	Alfred M. Hubbard	Seattle, Wash.	233
KFCB	Nielsen Radio Supply Co.	Phoenix, Ariz.	238	KFSG	Angelus Temple	Los Angeles, Calif.	273
KFCF	Frank A. Moore	Walla Walla, Wash.	360	KGB	Tacoma Daily Ledger	Tacoma, Wash.	252
KFCG	Electric Service Station (H. C. J.)	Bills, Idaho	250	KGB	Fallick & Watson Radio Service	Portland, Ore.	360
KFCH	Leslie E. Rice	Los Angeles, Cal.	236	KGC	General Electric Co.	Oakland, Calif.	312
KFCI	Ralph W. Flynn	Ogden, Utah	360	KGO	Marion A. Mulroy	Honolulu, Hawaii	263
KFCV	Fred Muhlfeld Jr.	Houston, Texas	360	KGW	Portland Morning Oregonian	Portland, Ore.	492
KFCZ	Omaha Central High School	Omaha, Nebr.	258	KGY	St. Martin's College (Rev. Sebastian Ruth)	Lacy, Wash.	258
KFDD	St. Michaels Cathedral	Boise, Idaho	252	KHJ	Times-Mirror Co.	Los Angeles, Calif.	395
KFDH	University of Arizona	Tucson, Ariz.	368	KJQ	Louis Wasmor	Seattle, Wash.	360
KFDI	Oregon Agricultural College	Corvallis, Ore.	360	KJQ	Lays Electric Co.	Stockton, Calif.	360
KFDR	Bullock's Hardware & Sporting Goods (H. G. Bullock)	York, Nebr.	360	KJR	Northwest Radio Service	Seattle, Wash.	276
KFDX	First Baptist Church	Shreveport, La.	360	KJS	Bible Institute of Los Angeles	Los Angeles, Calif.	360
KFDY	South Dakota State College of Agriculture and Mechanics Arts	Brookings, S. Dak.	360	KLS	Warner Brothers Radio Supplies Co.	Oakland, Calif.	360
KFDE	Harry O. Iverson	Brookings, S. Dak.	360	KLX	Tribune Publishing Co.	Oakland, Calif.	509
KFEE	Meyer & Frank Co.	Minneapolis, Minn.	231	KLZ	Reynolds Radio Co.	Denver, Colo.	283
KFEL	Winner Radio Corp.	Portland, Ore.	360	KM	San Joaquin Light & Power Corp.	Fresno, Calif.	273
KFEQ	Seregin & Company Bank	Denver, Colo.	254	KME	Lays Electric Co.	Tacoma, Wash.	360
KFER	Auto Electric Service Co.	Oak, Nebr.	268	KNT	Grays Harbor Radio Co. (Walter Hemmich)	Abertown, Wash.	263
KFEV	Radio Electric Shop	Fort Dodge, Iowa	231	KNX	Electric Lighting Supply Co.	Los Angeles, Calif.	360
KFEY	Augsburg Seminary	Daurias, Wyo.	263	KOB	New Mexico College of Agriculture & Mechanic Arts	State College, N. Mex.	360
KFF	Bunker Hill & Sullivan Mines and Concentrating Co.	Minneapolis, Minn.	261	KOP	Detroit Police Department	Detroit, Mich.	286
KFFZ	Pinets & Murray	Kellogg, Idaho	360	KPO	Hale Bros.	San Francisco, Calif.	423
KFFB	Jenkins Furniture Co.	St. Louis, Mo.	240	KQ	Apple City Radio Club	Hood River, Ore.	360
KFFE	Eastern Oregon Radio Co.	Boise, Idaho	240	KQV	Doublin-Hall Electric Co.	Fitzburg, Mo.	360
KFFP	First Baptist Church	Pendleton, Ore.	360	KR	Charles D. Herold	San Jo. Calif.	360
KFFR	Nevada State Journal (Jim Kirk)	Moberly, Mo.	266	KRE	V C Battery & Electric Co.	Berkeley, Calif.	278
KFFY	Greenland College	Sparks, Nev.	226	KSD	Post Dispatch (Pulitzer Publ. Co.)	St. Louis, Mo.	546
KFFZ	McGraw Co.	Lamoni, Iowa	280	KTW	First Presbyterian Church	Seattle, Wash.	360
KFG	Pinets & Murray	Omaha, Nebr.	278	KUO	Examiner Printing Co.	San Francisco, Calif.	360
KFGC	Louisiana State University	Baton Rouge, La.	254	KW	Coast Radio Co.	El Monte, Calif.	256
KFGD	Chickasha Radio & Electric Co.	Chickasha, Okla.	248	KWG	Portable Wireless Telephone Co.	Stockton, Calif.	360
KFGH	Leland Stanford University	Stanford University, Calif.	273	KYQ	Electric Shop	Honolulu, Hawaii	270
KFGL	Arlington Garage	Arlington, Ore.	234	KYW	Westinghouse Electric & Mfg. Co.	Chicago, Ill.	536
KFGO	Crory Hardware Co.	Boone, Iowa	226	KZM	Winton D. Allen	Oakland, Calif.	360
KFGX	First Presbyterian Church	Boone, Iowa	226	KZN	Cope and Johnson Co.	Salt Lake City, Utah	263
KFGZ	Emmanuel Missionary College	Berrien Springs, Mich.	246	WAAB	Valdemar Jensen	New Orleans, La.	263
KFHA	Western State College of Colorado	Gunnison, Colo.	252	WAAC	Yulius Ugorski	New Orleans, La.	263
KFHD	Utz Electric Shop Co.	St. Joseph, Mo.	226	WAAD	Otto Mechanics Institute	Cincinnati, Ohio	360
KFHH	Ambrose A. McCue	Neah Bay, Wash.	283	WAAF	Chicago Daily Drivers Journal	Chicago, Ill.	286
KFHH	Pallon & Co.	Santa Barbara, Calif.	360	WAAG	Gimbel Brothers	Milwaukee, Wis.	280
KFHJ	Star Electric & Radio Co.	Seattle, Wash.	270	WAAM	I. R. Nelson Co.	Newark, N. J.	263
KFHK	Earle K. Anthony, Inc.	Los Angeles, Calif.	246	WAAN	University of Missouri	Columbia, Mo.	251
KFID	Ed. Archuck's Garage	Los Angeles, Calif.	276	WAAP	Omaha Grain Exchange	Omaha, Nebr.	286
KFIF	Benson Polytechnic Institute	Portland, Oregon	360	WAAR	Harrisburg Sporting Goods Co.	Harrisburg, Pa.	283
KFII	Windisch Electric Farm Equipment Co.	Louisburg, Kans.	234	WARD	Parker High School	Dayton, Ohio	283
KFIO	North Central High School	Spokane, Wash.	252	WABE	Young Men's Christian Association	Washington, D. C.	283
KFIO	First Methodist Church	Yakima, Wash.	242	WABG	Arnold Edwards Piano Co.	Jacksonville, Fla.	248
KFIP	Alaska Electric Light & Power Co.	Juneau, Alaska	226	WABH	Lake Shore Tire Co.	Smoky, Okla.	240
KFIY	V. H. Borchert	Bismarck, Kan.	246	WABI	Bancor Railway & Electric Co.	Bancor, Me.	240
KFIX	Reorganized Church of Jesus Christ of Latter Day Saints	Independence, Mo.	240	WABM	Connecticut Agricultural College	Storrs, Conn.	281
KFIZ	Daily Commonwealth and Oscar A. Huelshman	Fon Du Lac, Wis.	248	WABN	E. E. Roberts Automotive and Radio Equipment Co.	St. Louis, Mo.	251
KFJB	Marshall Electrical Co.	Marshalltown, Iowa	273	WABO	Oto Radio, Inc.	LaCrosse, Wis.	241
KFJC	Seattle Post Intelligence	Seattle, Wash.	233	WABP	Luke Avenue Baptist Church	Rochester, N. Y.	252
KJFF	National Radio Manufacturing Co.	Seattle, Wash.	233	WABQ	Robert F. Weitz	Dover, Ohio	266
KFJJ	Liberty Theatre (E. E. Marsh)	Oklahoma City, Okla.	252	WABR	Haverford College, Radio Club	Haverford, Pa.	261
KFJK	Delans Radio and Electric Co.	Astoria, Ore.	242	WABS	Scott High School, N. W. B. Foley	Toledo, Ohio	270
KFJL	Hendrick Manufacturing Co.	Bristow, Okla.	242	WABT	Holliday-Hall, Radio Engineers	Washington, D. C.	270
KFJM	University of North Dakota	Ottumwa, Iowa	242	WABU	Victor Talking Machine Co.	Calden, N. J.	226
KFJQ	Valley Radio, Div. of Elec. Constr. Co.	Grand Forks, N. Dak.	229	WABV	College of Wooster	Wooster, Ohio	234
KFJR	Ashley C. Dixon & Son	Grand Forks, N. D.	280	WABX	Henry B. Joy	Mt. Clemens, Mich.	270
KFJX	Iowa State Teacher's College	Stevensville, Mont. (near)	258	WABY	John Mazaldi, Jr.	Philadelphia, Pa.	242
KFJY	Tunwall Radio Co.	Cedar Falls, Iowa	229	WABA	Coliseum Place Baptist Church	New Orleans, La.	263
KFJZ	Texas National Guard One hundred and Fourth Cavalry	Fort Dodge, Iowa	248	WABB	Purdue University	W Lafayette, Ind.	283
KFKA	Colorado State Teachers College	Fort Dodge, Iowa	248	WABB	The Dayton	Minneapolis, Minn.	283
KFKB	Brinkley-Jones Hospital Association	Greely, Colo.	248	WBAN	Wireless Phone Corp.	Paterson, N. J.	214
KFKC	Conway Radio Laboratories (Ben H. Woodruff)	Milford, Kans.	286	WBAO	James Millikin University	Decatur, Ill.	360
KFKV	F. F. Gray	Conway, Ark.	224	WBAP	Wortham-Carter Publishing Co. (Star Telegram)	Fort Worth, Tex.	476
KFKX	Westinghouse Electric & Manufacturing Co.	Butte, Mont.	283	WBAY	Erner & Hopkins Co.	Columbus, Ohio	360
KFKZ	Nassau Bros. Radio Co.	Haftians, Nebr.	286	WBAX	John H. Stenger, Jr.	Wilkes-Barre, Pa.	390
KFLA	Signal Electric Manufacturing Co.	Colorado Springs, Colo.	234	WBAY	Western Electric Co.	New York, N. Y.	492
KFLB	Signal Electric Manufacturing Co.	Butte, Mont.	283	WBBC	Newark Radio Laboratories	Newark, Ohio	240
KFLD	Paul E. Greenlaw	Menominee, Mich.	248	WBBD	Barbey Battery Service	Reading, Pa.	234
KFLE	National Educational Service	Franklinton, La.	234	WBBE	Alfred R. Marcy	Syracuse, N. Y.	246
KFLO	Bisaz Radio Shop	Deaver, Colo.	268	WBBG	Irvine Vermilya	Mattapoisett, Mass.	240
KFLR	University of New Mexico	Little Rock, Ark.	261	WBHH	J. Irvine Bell	Port Huron, Mich.	246
KFLU	Rio Grande Radio Supply House	Albuquerque, New Mexico	254	WBBI	Neal Electric Co., E. E. Neal	West Palm Beach, Fla.	238
KFLV	Levi F. Frykman	San Antonio, Texas	236	WBBL	Grace Covenant Presbyterian Church	Richmond, Va.	283
KFLW	Miscella Electric Supply Co.	Rockford, Ill.	229	WBBM	The Atlas Prods. Co.	Lincoln, Ill.	225
KFLX	George Roy Clough	Missoula, Mont.	248	WBBN	Blake A. B.	Wilmington, N. C.	275
KFLY	Burgo Radio Supply Co.	Galveston, Tex.	240	WBRR	Peoples Pulpit Assn.	Roseville, N. Y.	244
KFMQ	Atlantic Automobile Co.	Fargo, N. Dak.	231	WBRT	Lloyd Brothers	Philadelphia, Pa.	234
KFMR	University of Arkansas	Atlanta, Ga.	253	WBUB	Jenks Motor Sales Co.	Monmouth, Ill.	224
KFMT	Monmouth College	Fayetteville, Ark.	273	WBVV	Ruffner Junior High School	Johnstown, Pa.	248
KFMW	Dr. George W. Young	Sioux City, Iowa	261	WBW	Washington Light Infantry Co. 'B' 119th Inf.	Norfolk, Va.	222
KFMX	M. G. Satered	Minneapolis, Minn.	231	WBXY	Noble B. Watson	Charleston, S. C.	268
KFN	Carleton College	Houghton, Mich.	266	WBZ	T & H Radio Co.	Indianapolis, Ind.	227
KFN	Henry Field Seed Co.	Northfield, Minn.	283	WBR	Pennsylvania State Police	Butler, Pa.	286
KFN	Wooten's Radio Shop	Shenandoah, Iowa	266	WBS	D. W. May, Inc.	Newark, N. J.	360
KFNJ	Warrenburg Electric Shop	Colwallter, Miss.	244	WBT	Southern Radio Corp.	Newark, N. J.	360
KFNL	Radio Electric Club	Warrenburg, Mo.	240	WBZ	Westinghouse Elec. & Mfg. Co.	Springfield, Mass.	337
KFN	W. A. Drake Battery and Radio Supply Shop	Patuxent, Md.	240	WCAD	St. Lawrence University	Canton, N. Y.	280
KFN	Peabody Radio Service	Santa Rosa, Calif.	234	WCAG	Kaufmann & Beer Co.	Pittsburgh, Pa.	462
KFN	Montana Phonograph Co.	Peabody, Kansas	240	WCAH	Clyde R. Randall	New Orleans, La.	268
KFNZ	Loyal Radio Company	Helena, Montana	261	WCAI	Etrekin Electric Co.	Columbus, Ohio	286
KFOC	First Christian Church	Burlingame, Calif.	231	WCAJ	Nebraska Wesleyan University	University Park, Pa.	283
KFOE	Vera Peters	Whittier, Calif.	236	WCAK	Alfred F. Daniel	Houston, Texas	263
KFOJ	Holy Trinity High School Radio Club	Wellace, Idaho	224	WCAL	St. Olaf College	Northfield, Minn.	360
KFOL	Leslie M. Schaafsch	Marquette, Iowa	234	WCAP	Sanders & Stayman Co.	Baltimore, Md.	360
KFON	Ecliphone Radio Shop	Long Beach, Calif.	234	WCAR	Cheapeake & Potomac Telephone Co.	Washington, D. C.	469
KFOO	Latter Day Saints University	Salt Lake City, Utah	240	WCAT	Alamo Radio Electric Co.	San Antonio, Tex.	360
KFOQ	Ora William Chancellor	Galveston, Texas	261	WCAU	South Dakota State School of Mines	Rapid City, S. Dak.	240
KFOR	David City Tire & Electric Co.	David City, Nebraska	226	WCAX	Durham & Co.	Philadelphia, Pa.	286
KFOT	College Hill Club	David City, Nebraska	226	WCAY	J. C. Dies Electric Co.	Little Rock, Ark.	360
KFOX	Board of Education, Technical High School	Omaha, Nebraska	248	WCBA	University of Vermont	Burlington, Vt.	360
KFOY	Benson Radio Service	St. Paul, Minn.	226	WCBB	Milwaukee Civic Broadcasting Station	Milwaukee, Wis.	226
KFOZ	Leon Hudson Real Estate Co.	Fort Smith, Ark.	233	WCBC	The Milwaukee Civic Broadcasting Assn., Inc.	Milwaukee, Wis.	266
KFPB	Felena J. Brown	Seattle, Wash.	224	WCBD	Carthage College	Carthage, Ill.	246
KFPG	Garrison and Dennis	Los Angeles, Calif.	238	WCBE	Charles W. Heimbach	A. H. Hunt, Mich.	280
KFPH	Harold Chase, Mailorder	Salt Lake City, Utah	242	WCBF	University of Michigan	Zion, Ill.	345
KFPL	W. G. H. Radio Club	Dublin, Tex.	242	WCBG	W. H. G. Vetter	Pittsburgh, Pa.	236
KFPN	The New Furniture Co.	Greenville, Texas	242	WCBI	Howard S. Williams (Portable)	Pascagoula, Miss.	236
KFPD	Missouri National Guard	Jefferson City, Mo.	242	WCBL	Neon, Duncan & Rush	Bemis, Tenn.	226
KFPQ	Colorado National Guard	Denver, Colo.	231	WCBS	J. C. Maus	Jennings, Louisiana	244
KFPK	O. & G. Radio & Electric Shop	Olympia, Washington	236	WCBS	J. C. Maus	Jennings, Louisiana	244
KFPY	Clifford M. Eder	Deason, Texas	231	WCBS	J. C. Maus	Jennings, Louisiana	244



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Have you seen the original Blue-prints in this issue?

WCBK	E. Richard Hall	St. Petersburg, Fla.	286	WKAS	L. E. Lane Music Co.	Springfield, Mo.	360
WCBL	Northern Radio Mfg. Co.	Houlton, Me.	280	WKAJ	Lacomb Radio Club	Lacomb, N. H.	254
WCBM	Charles Swartz	Baltimore, Md.	229	WKBF	Dutree Wireless Flat	Cranston Rhode Island	360
WCBN	James P. Boland	Fr. Benj. Harrison, Ind.	266	WKY	WEKY Radio Shop	Oklahoma	360
WCBO	The Radio Shop, Inc.	Memphis, Tenn.	250	WLAC	Smyth & Washington Radio Corp.	Minneapolis, Minn.	417
WCBO	First Baptist Church	Nashville, Tenn.	236	WLAH	Samuel Woodworth	Syracuse, N. Y.	234
WCBR	University of Mississippi	Near Oxford, Miss.	242	WLAL	Naylor Electrical Co.	Tulsa, Okla.	360
WCBS	Charles A. Mearns (Columbia Station)	Providence, R. I.	246	WLAP	Wm. V. Jordan	Louisville, Ky.	286
WCCT	Clark University, College Dept.	Worcester, Mass.	238	WLBO	Wm. G. Shilling	Kalamazoo, Mich.	283
WCBU	Arnold Wireless Supply Co.	Arnold, Pa.	252	WLAW	Electric Shop	New York, N. Y.	350
WCBV	Tullahoma Radio Club	Tullahoma, Tenn.	254	WLAX	Putnam Electric Co. (Greensboro New York Broadcasting Station)	Greensboro, N. Y.	231
WCBW	George P. Rankin, Jr. and Matilda Solomon	Macon, Ga.	226	WLB	University of Minnesota	Minneapolis, Minn.	360
WCBX	Radio Shop of Newark (Herman Labinsky)	Newark, N. J.	233	WLBL	Wisconsin State Dept. of Markets	Stevenspoint, Wis.	278
WCC	The Forks Electrical Shop	Back Hill Falls, Pa.	268	WLS	Seay, Robinson & Co.	Chicago, Ill.	345
WCCB	Copson Bros.	Chicago Heights, Ill.	268	WLW	Crosley Manufacturing Co.	Chicago, Ill.	423
WCK	Star, Bar & Fuller Dry Goods Co.	St. Louis, Mo.	310	WMAA	J. Eder, Paer (Olive B. Meredith)	Cazenovia, N. Y.	261
WCX	Detroit Erie Press	Detroit, Mich.	517	WMAF	Round Hills Radio Corp.	Dartmouth, Mass.	360
WDAE	Tampa Daily Times	Tampa, Fla.	360	WMAH	General Supply Co.	Lincoln, Neb.	254
WDAF	Kansas City Star	Kansas City, Mo.	411	WMAK	Norton Laboratories	Lockport, N. Y.	273
WDAJ	J. Lawrence Martin	Amarillo, Tex.	263	WMAK	First Baptist Church	Trenton, N. J.	256
WDAH	Trinity Methodist Church (South)	El Paso, Tex.	268	WMAN	Utility Battery Service	Columbus, Ohio	246
WDAR	The Council	Hartford, Conn.	395	WMAQ	Chicago Daily News	Chicago, Ill.	448
WDAS	Lis Brothers	Philadelphia, Pa.	360	WMAV	Alabama Polytechnic Institute	Auburn, Ala.	250
WDAS	Samuel A. Walter	Worcester, Mass.	360	WMAV	King-higway Presbyterian Church	St. Louis, Mo.	285
WDAU	Shoemur Killbuck	New Bedford, Mass.	360	WMAZ	Merced University (Commercial Publishing Co.)	Mason, Ga.	261
WDAY	Radio Equipment Corp.	Fargo, N. Dak.	244	WMAZ	Precision Equipment Co.	Memphis, Tenn.	500
WDBA	Fred Ray	Columbus, Ga.	236	WMH	Doubladay-Hill Electric Co.	Washington, D. C.	261
WDBB	A. H. White & Co., Inc.	Tamilton, Mass.	228	WMU	Shenard Stores	Boston, Mass.	278
WDBD	Kirk & Co.	Lancaster, Pa.	268	WMU	University of Oklahoma	Norman, Okla.	360
WDBE	Herman Edwin Burns	Martinsburg, W. Va.	259	WMU	Omaha Central High School	Omaha, Neb.	255
WDBF	Giffman-Schoen Electric Co.	Atlanta, Ga.	242	WMU	Ideal Apparatus Co.	Evansville, Ind.	360
WDBH	Robert G. Phillips	Youngstown, Ohio	256	WMU	Wittenberg College	Springfield, Ohio	231
WDBI	C. T. Scherer Co.	Worcester, Mass.	268	WMU	First Christian Church	Butler, Mo.	231
WDBJ	Radio Specialty Co.	St. Petersburg, Fla.	226	WMU	Lennig Brothers Co. (Frederick Lennig)	Philadelphia, Pa.	360
WDBK	Richardson-Vogelin Electric Corp.	Buonoville, Va.	278	WMU	Peninsular Radio Club (Henry Kanmann)	Ft. Monroe, Va.	360
WDBL	M. F. Ross Radio Co.	Cleveland, Ohio	248	WMU	Dakota Radio Apparatus Co.	Yankton, S. Dak.	244
WDBM	Wise, Dept. of Markets	Stevens Point, Wis.	278	WMU	Dept. of Plant and Structures	New York, N. Y.	526
WDBN	Electric Light & Power Co.	Bangor, Me.	252	WMU	De W. Walker, Jr.	Ardmore, Okla.	266
WDBO	Rollins College, Inc.	Winter Park, Fla.	240	WMU	Maus Radio Co.	Lima, Pa.	360
WDBP	Superior State Normal School	Superior, Wis.	261	WMU	Friday Battery & Electric Corp.	Sigourney, Iowa	360
WDBQ	Morton Radio Supply Co.	Salem, N. J.	234	WMU	Midland College	Fremont, Neb.	280
WDBR	Tremont Baptist Church	Boston, Mass.	256	WMU	Tyler Commercial College	Tyler, Texas	360
WDBS	E. M. R. Radio Co.	Dayton, Ohio	283	WMU	Apollo Theater (Belvidere Amusement Co.)	Belvidere, Ill.	224
WDBT	Taglor's Book Store	Hattiesburg, Miss.	236	WMU	Palmetto Radio Corp.	Charleston, S. C.	360
WDBU	Somerset Radio Co.	Skowhegan, Maine	258	WMU	Sound Equipment Co.	San Antonio, Tex.	385
WDBV	The Quimby Enterprises, The Strand Theatre	Fort Wayne, Ind.	258	WMU	Audley Conservatory of Music (James D. Vaughn)	Lawrence, Penn.	360
WDBW	The Radio Democrat	Columbia, Tenn.	268	WMU	Lyndon Mfg. Co.	Mishawaka, Ind.	360
WDBY	North Shore Congregational Church	Chicago, Ill.	258	WMU	Portsmouth Kiwanis Club	Portsmouth, Va.	360
WDBZ	Church of the Covenant	Washington, D. C.	268	WMU	Lansdown, Henry P.	Kenosha, Wis.	229
WDZ	Janur, L. Bush	Fuscola, Ill.	278	WMU	Boyd M. Hamp	Wilmington, Del.	360
WEAA	F. D. Fallain	Flint, Mich.	280	WMU	Pennsylvania National Guard, 2d Battalion, 112th Infantry	Erie, Pa.	242
WEAF	American Telephone & Telegraph Co.	New York, N. Y.	492	WMU	Franklyn J. Wolff	Trenton, N. J.	240
WEAH	White Board of Trade	Wichita, Kans.	244	WMU	Palmer School of Chiropractic	Davenport, Iowa	360
WEAJ	Cornell University	Ithaca, N. Y.	286	WMU	Iowa State College	Ames, Iowa	370
WEAL	University of South Dakota	Vermillion, S. Dak.	284	WMU	John Wanamaker	Philadelphia, Pa.	509
WEAN	Bureau of Patents (W. Ginnon Buttsold)	North Plainfield, N. J.	252	WMU	Western Radio Co.	Kansas City, Mo.	360
WEAO	Shepard Co.	Providence, R. I.	273	WMU	L. Bamberger & Co.	Newark, N. J.	405
WEAP	Ohio State University	Columbus, Ohio	350	WMU	Missouri State Marketing Bureau	Jefferson City, Mo.	441
WEAR	Mobile Radio Co.	Mobile, Ala.	360	WMU	Pennsylvania State College	State College, Pa.	283
WEAU	The Evening News Publishing Co.	Baltimore, Md.	261	WMU	Donaldson Radio Co.	Oklmulgee, Okla.	360
WEAV	Davidson Bros. Co.	Sioux City, Iowa	275	WMU	Doolittle Radio Corp.	New Haven, Conn.	268
WEAY	Iris Theatre (Will Horowitz, Jr.)	Houston, Texas	360	WMU	North Dakota Agricultural College	Agricultural College, N. D.	283
WEB	Beck's	St. Louis, Mo.	273	WMU	Superior Radio & Telephone Equipment Co.	Columbus, Ohio	286
WEBC	Walter Cecil Bridges	Superior, Wis.	242	WMU	Auerbach and Guestel	Topka, Kan.	275
WEBD	Electrical Equipment and Service Co.	Anderson, Ind.	246	WMU	Theodore D. E. Hild	Ky.	360
WEBE	Troy W. Waller	Cambridge, Ohio	248	WMU	Ward Battery and Radio Co.	Bellevue, Kans.	236
WEBH	Zenith-Edgewater Beach Broadcasting Station	Chicago, Ill.	380	WMU	Concordia College	Moorhead, Minn.	286
WEBI	Walter H. Gibbons	Salisbury, Md.	242	WMU	John R. Koeb (Dr.)	Charleston, W. Va.	273
WEBJ	Third Avenue Radio Co.	New York, N. Y.	273	WMU	Horace A. Besie, Jr.	Parkersburg, Pa.	360
WEBK	Hudson Hill Electrical Co.	Houston, Texas	242	WMU	E. B. Gish	Amarillo, Texas	234
WEW	St. Louis University	St. Louis, Mo.	261	WMU	Moore Radio News Station (Edmund B. Moore)	Springfield, Mo.	275
WEFA	Dallas News & Dallas Journal	Dallas, Texas	476	WMU	Sanjour State Telephone & Telegraph Co.	Sarasusky, Ohio	360
WEFB	Carl F. Womse	Syracuse, N. Y.	234	WMU	Colos County Telephone & Telegraph Co.	Mattison, Ill.	258
WEFH	Electric Supply Co.	Port Arthur, Texas	236	WMU	Seranton Times	Seranton, Pa.	280
WEFM	Times Publishing Co.	St. Cloud, Minn.	360	WMU	Calvary Baptist Church	New York, N. Y.	360
WEFN	Hudson Electric Service Co.	Hudson, Minn.	360	WMU	Ahliene Daily Reporter (West Texas Radio Co.)	Ahliene, Texas	360
WEFV	University of Nebraska, Department of Electrical Engineering	Lincoln, Neb.	275	WMU	Princes-Walter Co.	Lowell, Mass.	286
WFBB	Eureka College	Eureka, Ill.	240	WMU	Radio Equipment Company	Chicago, Ill.	448
WFBC	The Wm. F. Gable Co.	Altoona, Pa.	261	WMU	Cultural Radio Power—Hainlow Gardens Station	Chicago, Ill.	448
WFBD	Concourse Radio Corporation	New York, N. Y.	273	WMU	The Radio Club (Inc.)	Lagarto, Ind.	224
WFBE	Albright-Gibbs Radio Co.	Steinmetz, Ohio	309	WMU	Northern States Power Co.	St. Croix Falls, Wis.	248
WFBF	W. F. G. Radio Co.	Philadelphia, Pa.	309	WMU	Lombard College	Galesburg, Ill.	244
WFBL	Lancaster Electric Supply & Construction Co.	Lancaster, Pa.	245	WMU	Black Hawk Electrical Co.	Waterloo, Iowa	236
WFBN	Cecil E. Lloyd	Pensacola, Fla.	360	WMU	Radio Service Co.	St. Louis, Mo.	360
WFBO	Glenwood Radio Corp. (W. G. Patterson)	Shreveport, La.	252	WMU	Amroh Co. Inc.	Yellow Springs, Ohio	242
WFBP	Emur C. Albricht	Altoona, Pa.	261	WMU	Avenue Radio Shop (Horace D. Good)	Reading, Pa.	238
WFBS	South Bend Tribune	South Bend, Ind.	360	WMU	Flaxon's Garage	Gloucester City, N. J.	268
WFBT	American Radio & Research Corp.	Medford, Mass.	360	WMU	Inmanuel Lutheran Church	Valparaiso, Ind.	278
WFBU	Thomas E. J. Howells	Philadelphia, Pa.	360	WMU	Chicago Corporation of America	Washington, D. C.	469
WFBV	The Tribune Co.	Chicago, Ill.	270	WMU	Chicago Herald & Examiner	Chicago, Ill.	536
WFBW	Federal Telephone & Telegraph Co.	Buffalo, N. Y.	319	WMU	Duron Bros. Electric Co.	Hamilton, Ohio	360
WFBY	General Electric Co.	Schenectady, N. Y.	380	WMU	Union City	Schenectady, N. Y.	360
WFCA	University of Wisconsin	Madison, Wis.	360	WMU	University of Illinois	Urbana, Ill.	360
WFCH	State University of Iowa	Iowa City, Iowa	484	WMU	City of Dallas (police and fire signal department)	Dallas, Texas	360
WFCL	Marquette University	St. Ignace, Mich.	280	WMU	Tarrytown Radio Research Laboratory (Koenig Bros.)	Tarrytown, N. Y.	273
WFDM	University of Cincinnati	Cincinnati, Ohio	280	WMU	Southeast Missouri State Teachers College	Cape Girardeau, Mo.	360
WFDP	Hater Supply Co.	Joplin, Mo.	283	WMU	Clemson Agricultural College	Clemson College, S. C.	360
WFDR	Roberts Hardware Co.	Clarkburg, W. Va.	258	WMU	J. A. Foster Co.	Union City, Ohio	309
WFDS	University of Rochester (Eastman School of Music)	Rochester, N. Y.	283	WMU	United States Playing Cards Co.	Cincinnati, Ohio	309
WFDT	Otto & Kuhns	Decatur, Ill.	261	WMU	Grove City College	Grove City, Pa.	259
WFDU	Paramount Radio & Electric Co. (W. H. A. Polun)	Atlantic City, N. J.	231	WMU	Allentown Radio Club	Allentown, Pa.	229
WFDV	Courier-Journal and Daily Times	Louisville, Ky.	246	WMU	Seventh Day Adventist Church	New York, N. Y.	263
WFDE	Washington Electrical Specialty Co.	Wilmington, Del.	360	WMU	Doughty & Welch Electrical Co.	Fall River, Mass.	254
WFDF	Benneclear Polytechnic Institute	Troy, N. Y.	380	WMU	Camp Marfield	Chebanon, N. H.	229
WFDG	Sweeney School Co.	Kansas City, Mo.	411	WMU	Irving Austin (Port Chester Chamber of Commerce)	Port Chester, N. Y.	233
WFDD	Radiovox Co. (Warren R. Cox)	Cleveland, Ohio	360	WMU	Chas. Electric Shop	Pomeroy, Ohio	258
WFDE	George Schabel	New York, N. Y.	360	WMU	Atlanta Journal	Atlanta, Ga.	429
WFDF	Bakers Life Company	Des Moines, Iowa	526	WMU	J. & M. Electric Co.	Utica, N. Y.	273
WFDG	Boyle Automobile Co.	Rockford, Ill.	252	WMU	Alabama Power Co.	Birmingham, Ala.	360
WFDD	Galveston Tribune	Galveston, Texas	360	WMU	Fall River Daily Herald Publishing Co.	Fall River, Mass.	248
WFDE	Howard R. Miller	Philadelphia, Pa.	254	WMU	Franklin Co. Inc.	Johnston, Pa.	360
WFDF	Continental Radio & Mfg. Co.	Newton, Iowa	258	WMU	Louis J. Gallo	New Orleans, La.	212
WFDM	Journal-Stockman Co.	Omaha, Neb.	278	WMU	Kern Music Co.	Providence, R. I.	258
WFDN	School of Engineering of Milwaukee	Milwaukee, Wis.	226	WMU	Carmen Ferro	Belvidere, Ill.	236
WFDO	Chronicle Publishing Co.	Marion, Ind.	246	WMU	The Radio Shop	Portland, Me.	230
WFDP	Horn Electric Co.	Burlington, Iowa	246	WMU	Toledo Radio & Electric Co.	Toledo, Ohio	252
WFDR	Leon T. Noel & Raviner Bank	Tarkio, Mo.	360	WMU	Willard Storage Battery Co.	Cleveland, Ohio	390
WFDS	American Trust & Savings Bank	Le Mars, Iowa	360	WMU	Cardinal Radio & Electric Co.	Cambridge, Ill.	242
WFDT	Woodward & Lothrop	Washington, D. C.	273	WMU	S. H. Van Gordon & Son	Oasec, Wis.	220
WFDU	K. & L. Electric Co. (Harbert F. Kelso and Hunter J. Lohman)	McKeesport, Pa.	234	WMU	Heliance Electric Co.	Norfolk, Va.	280
WFEE	Continental Electric Supply Co.	Washington, D. C.	360	WMU	Charles E. Erbstein	Elgin, Ill.	286
WFEB	Gimbal Brothers	Philadelphia, Pa.	246	WMU	Edison Electric Illuminating Co.	Boston, Mass. (portable)	244
WFEC	American Electric Co.	Lincoln, Neb.	229	WMU	Ruess Battery & Electric Co.	Tecumseh, Neb.	360
WFED	Jacobson's Radio Engineering Laboratories	Waco, Texas	360	WMU	Ruess Battery & Electric Co.	Tecumseh, Neb.	360
WFEE	Norfolk Daily News	Norfolk, Neb.	283	WMU	Agricultural & Mechanical College of Tennessee	College Station, Tex.	280
WFEF	Clifford L. White	Greentown, Ind.	254	WMU	Williams Hardware Co.	Streator, Ill.	231
WFEG	D. M. Berham	Cedar Rapids, Iowa	268	WMU	Oak Leaves Broadcasting Station	Oak Park, Ill.	283
WFEG	Frank J. Sherrin	Rockford, Ill.	252	WMU	Thomas J. McGuire	Lambertville, N. J.	281
WFEG	Canner Publications	Topoka, Kans.	360	WMU	H. G. Hall Co. (Webster Hotel)	Manhattan, Kans.	273
WFEG	The Outlet Co. (J. Samuels & Bro.)	Providence, R. I.	360	WMU	Cardinal Radio & Electric Co.	Trenton, N. J.	229
WFEG	Pittsburgh Radio Supply House	Pittsburgh, Pa.	250	WMU	Wright & Wright (Inc.)	Philadelphia, Pa.	360
WFEG	Union Trust Co.	Cleveland, Ohio	390	WMU	Alamo Dance Hall, L. J. Crowley	Juliet, Ill.	227
WFEG	Chicago Radio Laboratories	Chicago, Ill.	448	WMU	Mechanic College of Minn.	Houghton, Mich.	244
WFEG	Richard H. Howe	Granville, Ohio	225	WMU	Ford Motor Co.	Dearborn, Mich.	273
WFEG	R. C. A.	New York, N. Y.	455	WMU	Detroit News (Evening News Assn.)	Detroit, Mich.	517
WFEG	H. F. Parr	Cedar Rapids, Iowa	268	WMU	Loyola University	New Orleans, La.	260
WFEG	Chas. Looff (Greenleaf Park)	East Providence, R. I.	240	WMU	Electrical Equipment Co.	Miami, Fla.	283
WFEG	W. A. Radio Supply Co.	Wichita Falls, Texas	360	WMU	Catholic University	Washington, D. C.	236
WFEG	United Battery Service Co.	Montgomery, Ala.	226	WMU			
WFEG	Dutree W. Hill	Cranston, R. I.	360	WMU			
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WFEG	Melissus Agriculture College	East Lansing, Mich.	280	WMU			



**LEGO WONDER
FIXED DETECTOR**
for
REFLEX & CRYSTAL SETS

Something entirely new.
100% SENSITIVE

**10 IMPORTANT FEATURES
READ THEM CAREFULLY**

- 1—No parts to replace or wear out.
- 2—The use of a NEW MATERIAL that effectively eliminates distorted and interrupted reception, and substitutes clarity and increased volume.
- 3—Absolutely 100% sensitive. No searching for sensitive spot.
- 4—Glass encased, it is immune from sun and dust.
- 5—Especially designed to withstand high voltage in reflex circuits.
- 6—Solidly constructed throughout, it is practically everlasting.
- 7—It is ALWAYS READY—no adjustments of ANY kind needed.
- 8—As good looking as it is efficient. Highly nickel-plated throughout and attractively designed. It enhances the appearance of any set.
- 9—Constructed so that it is thoroughly VIBRATION-PROOF.
- 10—Carefully tested, approved and unconditionally guaranteed by its makers.

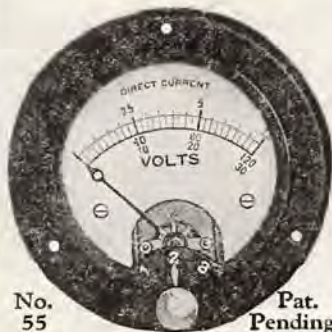
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Lego Corp., 225 W. 77th St., N. Y. C.



Radio Fans

—can thank Jewell for developing a small receiving set instrument with self contained switch for multiple readings.



No. 55

Pat. Pending

Multiple reading instrument with self contained switch

¶ SAVES—Space and cost of additional instruments.

¶ PERMITS—Testing of "A" and "B" batteries from panel of your set.

¶ Every Radio "Fan" should have our 15-A catalog.

Order from Dealer

Jewell Electrical Instrument Co.

1650 Walnut St. - Chicago

"25 Years Making Good Instruments"



Resistance Coupled Amplification

The tone quality from a Daven Resistance Coupled Amplifier is the most perfect known to the Radio Art.

The Daven Resisto-Coupler, illustrated, greatly simplifies the construction in building up one of these distortionless amplifiers.

Sold everywhere.....\$1.50

Read "Resistors—Their Application to Radio Reception" by Zeh Bouck.

Price 15c

Also read "The How and Why of Resistance Coupled Amplification." Price.....10c

DAVEN RADIO CORPORATION
"Resistor Specialists"
13 Campbell St. Newark, N.J.

INTERNATIONAL BABYDYNE RECEIVER



The last word in simplified radio! This set will tune in over 1,000 miles.

LIST PRICE: \$10 (Without the tube).

(Discount to dealers and distributors.)

SET COMPLETE \$15
With tube, phones, batteries, etc.

(No discount on complete set.)

This offer bears a real money-giving value, for we include in it only guaranteed articles!

Whether you are at home, in the camp, automobile, boat or railroad riding, the Babydyne will meet your requirements. Our present model is eight inches long by six wide and weighs one pound. It can be advantageously coupled with two stages of amplification.

**INTERNATIONAL
BABYDYNE
RADIO RECEIVER**

TRADE MARK

Manufactured by

A. @ T. RADIO COMPANY
Dept. B, DANVERS, MASS.

RADIO TUBES

Write today for descriptive literature and low prices of our guaranteed tubes.

"The Perfect Amplifier:" Something every DX fan needs—In November RADIO AGE

**5000
RADIO DEALERS
buy from
HUDSON-ROSS**
123 W. Madison St. Chicago
Send for dealers discount.

BAKELITE

TRADE MARK REG. U. S. PAT. OFF.



Crosley and Bakelite

The Crosley Radio Corporation of Cincinnati produces radiosets at reasonable prices, with no sacrifice of quality. The use of Bakelite not only provides dependable insulation but simplifies quantity production.

Bakelite is mechanically

strong, impervious to moisture and its color does not fade. Its properties are unaffected by climatic conditions and it does not deteriorate with age or use.

In both the laminated and molded form, Bakelite is standard insulation for radio.

Write for a Copy of our Radio Booklet H.



Send for our Radio Map

The Bakelite Radio Map lists the call letters, wave length and location of every broadcasting station in the world. Enclose 10 cents to cover the cost and we will send you this map. Address Map Department.

BAKELITE CORPORATION

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THE MATERIAL OF A THOUSAND USES

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Radio Age, Inc.,
500 North Dearborn Street,
Chicago

Gentlemen: Please enter my subscription for RADIO AGE, the Magazine of the Hour, for one year, beginning with your next issue, for which I enclose \$2.50.

Name

Street Address

City

State

If RADIO AGE for one year and RADIO AGE ANNUAL are desired at special price of \$3, mark cross here. Price of Annual alone is \$1.00 postpaid.

Send cash, money order or check.

The Radio Age POPULARITY CONTEST

By Harry Aldyne

ON ANOTHER page you will find a story about the winners of the July-August division of the Radio Favorite Popularity Contest conducted by RADIO AGE. To none other than the inimitable Duncan Sisters, ("Topsy and Eva") Chicago's radio sweethearts, goes the credit of cornering the most votes for that period.

In the November RADIO AGE, you will be introduced to the favorite receiving the greatest number of votes for the October contest.

Bill Hay, popular announcer from KFKX, Hastings, Neb., took first honors for the September contest. His life story will be found on page 32 of this issue.

It is interesting to note that while the Duncan Sisters got off to a flying start in July and August, Bill Hay and Lamkin Kay led them in the grand total for September.

This month the mischievous girls have fallen slightly below the leading positions. For, as Brutus said, "Not that I love Caesar less, but that I love Rome more." But the fans in back of Vivian and Rosetta Duncan will have their opportunity to restore them to favor again with their votes this month.

So don't forget to send in your coupon for your radio favorites. Those who have not made use of their coupons from back numbers of RADIO AGE since July are entitled to use them all at any time. You can vote as many times as you have coupons.

HOW THEY STAND FOR OCTOBER

Name	Classification	Where Heard
Bill Hay.....	Announcer.....	KFKX Hastings, Neb.
H. W. Arlin.....	Announcer.....	KDKA Pittsburgh, Pa.
Karl Bonawitz.....	Organist.....	WIP Philadelphia, Pa.
Jack Nelson.....	Announcer.....	WGN Chicago City, Mo.
Harry M. Snodgrass.....	Entertainer.....	WOS Jefferson City, Mo.
Lamkin Kay.....	Announcer.....	WSB Atlanta, Ga.
E. W. Tyson.....	Announcer.....	WWJ Detroit
Nicholis B. Harris.....	Entertainer.....	KFI Los Angeles, Calif.
Hired Hand.....	Announcer.....	WBAP Fort Worth, Tex.
Bert Davis.....	Entertainer.....	WGN Chicago

October contest closes October 15.
November contest closes November 15.
December contest closes December 15.

POPULARITY CONTEST COUPON

Harry Aldyne,
Contest Editor,
RADIO AGE,
500 N. Dearborn St., Chicago.

I wish to cast my vote for:

Name of favorite.....

Classification.....

Station.....

Date heard.....

Name (optional).....

Address (optional).....

CLASSIFIED ADVERTISEMENTS

Ten 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 5th of month for succeeding month's issue.

RADIO SALESMEN WANTED—Make \$50.00 weekly selling standard, well advertised radio sets and parts. No investment required. Write for free outfit. Desk 27, WAVELENGTH RADIO COMPANY, 1027 N. State St., Chicago.

FOR SALE

Silver Wire—Most perfect Conductor known. No Loss of Current. Easy to Solder. In 25-foot Coils. Per Coil \$1.25. Aragon Radio Co., 222 N. State St., Chicago.

RADIO JOBS

If you want to turn your knowledge of radio into dollars, insert an ad in the classified section of RADIO AGE at 10 cents a word. You will find that manufacturers and radio dealers are looking for radio men like you.

RADIO CIRCUITS

SPECIAL FOR OCTOBER

The Reinartz Radio Booklet, by Frank D. Pearne, fully illustrated, and RADIO AGE, for \$2.50. Price of booklet alone is 50c. Send check, currency or money order to RADIO AGE, 500 N. Dearborn Street, Chicago.

MISCELLANEOUS

158 Genuine Foreign Stamps. Mexico War Issues, Venezuela, Salvador and India Service. Guatemala, China, etc., only Sc. Finest approval sheets, 50 to 60 percent. Agents Wanted. Big 72-p. Lists Free. We Buy Stamps. Established 20 Years. Hussman Stamp Co., Dept. 152, St. Louis, Mo.

AGENTS WANTED

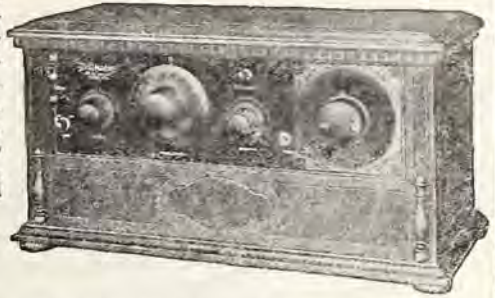
AGENTS WANTED TO ADVERTISE OUR GOODS and distribute free samples to consumers; 90c an hour; write for full particulars. American Products Co., 2129 American Bldg., Cincinnati, Ohio.

Telmaco Acme Receiver

The Ideal Receiver for all Seasons



The Telmaco Acme Receiver is truly portable. Entirely contained in beautiful traveling case. Tubes, batteries, loop, loud speaker, everything built into set. No outside loop, no aerial, no ground required.



Size of Case 8" x 10" x 18". Weighs only 27 pounds complete. Easily Carried.

Acme 4-Tube Reflex Circuit Used

securing selectivity, distance and volume with minimum battery consumption.

Complete in itself. Easily carried from room to room in your home or to office, neighbors, etc. Take it along and have music, entertainment, speeches, news, market reports wherever you happen to be.

Instantly ready for use as it is. You can use external antenna and ground, loop and loud speaker if desired. 4 tubes (fully protected by shock absorber sockets)—equal to 7 tubes, due to reflexing and use of crystal detector.

Reasonably Priced

Write for Free illustrated circular fully describing Telmaco Acme Receiver. Complete Telmaco 64 page catalog containing 20 circuits in blue and describing the best in radio sent postpaid for 10c.

Dealers! Catalog and Price List furnished to all bona fide dealers making request on their business stationery.

Radio Division

TELEPHONE MAINTENANCE CO.

20 South Wells Street

Dept. C

Chicago, Illinois



Quality Radio Exclusively Established 1918

T-100 Battery Charger



The Best and Lowest Priced on the Market

This battery charger operates on 110 volt, 60 cycle, A. C. circuit, charging a 6 volt battery at a 2 ampere rate. Standard 2 ampere charging tube is used. The T-100 is the lowest priced first-class charger on the market. Large numbers now in use have proved entirely satisfactory. No vibrating parts to get out of order. Absolutely noiseless in operation. Furnished with plug and cord for lamp socket. Battery leads marked. Fuse protects charger from accidental short circuit of 110 volt leads. Fully guaranteed.

Price complete, with 2 ampere tube, \$12.00

Radio Division



TELEPHONE MAINTENANCE CO.

Quality Radio Exclusively

20 So. Wells St., Dept. C Chicago, Ill.



FRESHMAN SUPERIOR

You can depend upon them to remain accurate at all times. Made of high resistance material impregnated throughout (not coated paper). Unaffected by climatic conditions. Will not deteriorate. Clamped between solid knurled ferrules assuring rigid construction and firm contact at all times.

At your dealer's, otherwise send purchase price and you will be supplied postpaid. Chas. Freshman Co., Inc., 106-7th Ave., N. Y.



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YOU GET absolutely free—the A-K "Library of Latest Radio Literature," written by foremost radio authorities. Contains HUNDREDS of valuable wiring diagrams, HOOK-UPS, illustrations, articles, data, etc.

EXPLAINS in clear, understandable language the popular new circuit: reflex, autodyne, pushover, "nameless," super-heterodyne, etc., and how to build sets. Covers long and short wave applications, push-pull and audio amplifiers. Latest information on multitude of other radio subjects. LOG BOOK INCLUDED FREE. Also our latest Radio TISED lines at attractive savings. Write today—offer limited. Address ATWOOD-KING, Inc. Dept. P-10163 W. Washington St., Chicago

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3 in 1 Amplifying Unit \$7

Transformer, Rheostat and Socket

All in one, completely wired, ready

to mount on panel, dial included.

Same unit without transformer \$2.50.

SIMPLEST AND CHEAPEST method for amplifying your present set or for construction of a one to five tube set receiver. Blue-print showing how to build five-tube autodyne using these units, 50c. Discount to dealers and builders.

WILLIAM A. WELTY & CO.
36 So. State St. Dept. 11 Chicago

HUDSON-ROSS

Sells only Guaranteed Radio Apparatus. Send for discounts.

123 W. Madison St. Chicago

ACTUAL 5 TUBE VOLUME from only TWO TUBES

using the wonderful inexpensive Harkness Reflex Circuit and EQUITY Low Loss Air Core Spiderweb Harkness Coils. By substituting these special Low Loss Coils for the old style, cylindrical coils, this simple Harkness receiver is made to give results almost beyond belief. Distance and volume are greatly increased; selectivity greatly improved. Nothing else like these coils. . . and they cost less than the old style high loss Bakelite tube kind. Only \$2.00 postpaid for the complete set of coils. Order today. Free blue print showing circuit. Money back if not satisfied.

NOTE: Manufacturers! Send in your blue prints for quotations on any inductance requirements you may have. No order too large.

THE REAL EQUITY SHOP
1331 N. Wells St. Dept. RA10 Chicago

2.00 PER SET Postpaid

Department of RADIO ENGINEERING

Radio Age Institute Tests



Look for the Approval Seal

The above approval seal will be furnished free of charge by RADIO AGE, and any article bearing this seal has been approved by the Institute Laboratory.

We will be pleased to receive and test any materials that are offered on the market and give them our endorsement where they meet all Institute tests. Send materials to RADIO AGE INSTITUTE, 504 N. Dearborn St., Chicago.

The following radio accessories have successfully passed RADIO AGE INSTITUTE tests for awards in October, 1924.



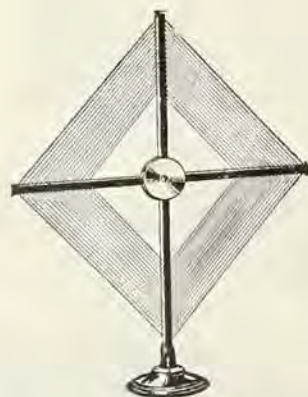
Test No. 7. The Pfanstiehl receiver, Model 7, which embodies a new principle in radio frequency amplification. The receiver is of the tuned type, and does not oscillate or radiate. One of its exceptional features is the station finder, which is really a calibration chart engraved on the panel. Made by the Pfanstiehl Radio Company, of Highland Park, Ill. Tested and approved by Frank D. Pearne, for RADIO AGE Institute.



Test No. 9. The Karas Harmonik Audio Frequency amplifying transformer. Especially designed for broadcasting frequencies. This transformer gives an exceptionally good curve which covers the range of audio frequencies commonly in use at broadcasting stations, and will give good amplification with a minimum of distortion. The transformer is larger in size than the average transformer, and is well constructed throughout. An all ratio winding is used, the actual ratio being in the vicinity of about 4 to 1. Manufactured and sold by the Karas Electric Company, Chicago, Illinois. Tested and approved by the RADIO AGE Institute.



Test No. 11. The Filkostat Lightning Arrester. Well made, and is guaranteed to stand up under the severest strain. Constructed so that short circuits are not possible. Tested and approved by RADIO AGE Institute. Made by the DX Instrument Company, Harrisburg, Pa.



Test No. 8. The Red Seal Collapsible Loop Aerial, No. 2580. The loop is of rigid construction throughout, and is thoroughly durable in spite of the fact that the average collapsible loop is so frail. The loop is mounted on an engraved scale, which can be referred to in finding stations once they have been logged. Special base provision for connections to set. Sufficient wire is wound on this loop to cover all the broadcast wave lengths with a good 23 plate condenser (.0005 Mf). Tested and approved by the RADIO AGE Institute.



Test No. 12. The International Babydyne Receiver, manufactured by the A. & T. Radio Co., Danvers, Mass. A receiver of good construction and a good circuit, assembled with simplicity as its keynote. Capable of satisfactory selectivity and substantial range. Tested and proved by the RADIO AGE Institute.



Test No. 10. Universal B Battery, type RB, 48 volts. Manufactured by the Universal Battery Company, 3410 S. LaSalle St., Chicago, Illinois. Durably and well constructed, and of excellent design electrically. Tested and approved by the RADIO AGE Institute.



Test No. 13. The Burgess B Battery, 22½ volt type. Of good construction and excellent life. Provision made for plate voltage variation so that it is adaptable to any tube. Tested and approved by the RADIO AGE Institute. Made by the Burgess Battery Company, Madison, Wis.

ANNOUNCING The New

Pfanstiehl

Model 7

*Embodying the Pfanstiehl
Non-Oscillating System of
Tuned Radio Frequency*

The Last
Word
in
Simplicity



The
Station-
Finder
Eliminates
All
Guess-Work
in Tuning

Frank D. Pearne, Noted Radio Expert, Reports the Following Test:

AFTER testing hundreds of radio sets, I decided upon the Pfanstiehl Model 7 for my own personal use, and I can recommend it because it produced the most satisfactory results I have yet attained with any set.

The test was carried on during all conceivable kinds of weather, but even when static was at its worst it was possible to get stations more than 1,000 miles away on the loud speaker, with all the volume of a local station.

As the Pfanstiehl Model 7 is Non-Oscillating, no sound other than signals was heard. The selectivity was excellent and many long distance stations were picked up when local broadcasting was going on at the same time, only a few miles away.

Several other types of receivers were compared with the Model 7, and whenever it was possible to pick up the same stations with other receivers, the reception was not so good."

The Pfanstiehl Non-Oscillating System.

RADIO FREQUENCY has had one serious obstacle to overcome; it has heretofore generated oscillations which caused howls, squeals and other disturbing noises, if not suppressed. Formerly these oscillations were considered as inevitable and were suppressed more or less effectively with resistances, potentiometers, neutralizing condensers, etc.

Pfanstiehl believed these oscillations could be avoided and traced them to their sources. Through his new system of controlling and shaping electro-magnetic and electrostatic fields, no disturbing oscillations are generated in the Pfanstiehl Model 7 Receiver. No neutralizing or adjusting is therefore necessary. In consequence a new simplicity of operation is attained. The effect of no mis-directed fields is to give a new purity of tone and a new efficiency which is reflected in great distance and volume.

A simple station-finder at the right of the panel tells you exactly at what number to set the dials for the station you want to receive.

Manufactured by

THE PFANSTIEHL RADIO CO.

Highland Park, Ill.

Chicago, Office:

1001 W. Washington Blvd.

Tel. Haymarket 8010

DEALER'S COUPON

You are invited to write for description of the Pfanstiehl Model 7.

Name.....

Dealer or Jobber.....

Send this coupon to Pfanstiehl Radio Co., Highland Park, Ill.

The PONY EXPRESS OF TODAY



DISTANCE covered in record time while all the world wondered. News received in one part of the country only a few weeks after it was sent from another. That was the pony express.

Today, news, messages, entertainment—all are instantly brought from all over the land right to your home by the Pony Express of the air—Crosley Radio Receivers. New York hears California. Florida listens to Hawaii. Canada converses with Mexico. North Dakota keeps in close touch with the MacMillan expedition at the North Pole. Such are the daily performances of Crosley Receivers as told by hundreds of unsolicited letters from happy users.

At bringing in distant stations in a clear, enjoyable manner, Crosley Instruments, each in its own class have proven themselves unexcelled. Yet they are the lowest priced radio receivers ever offered.

For satisfactory results, real radio value, you can't beat a Crosley.

Listen In On a Crosley Before You Buy.

For Sale By Good Dealers Everywhere.

The Crosley Radio Corporation

POWEL CROSLY, JR., President

1063 Alfred St.

Cincinnati, O.

CROSLY
Better-Cost Less
Radio Products



CROSLY TRIRDYN 3R3—\$85.00

The Trirdyn 3R3 incorporating radio frequency amplification, regeneration, reflex and additional audio frequency amplification will, with only three tubes, give performance equal to the customary four and five tube set. Will easily tune through local broadcasting to bring in long distant stations on the loud speaker.

Other Crosleys each a leader in its line

One tube Crosley 50. The regenerative set with which Leonard Weeks of Minot, N. D., kept in almost daily touch with the MacMillan Expedition at the North Pole. Money cannot buy better radio value.....\$14.50

Two tube Crosley 51. The little wonder regenerative set that in just 24 days became the biggest selling radio receiver in the world. Represents wonderful radio value.....\$ 20.00

Three tube Crosley 52. This regenerative set consists of regenerative detector and two stages of audio frequency amplification. Gives loud speaker volume on distant stations under practically all conditions.....\$30.00

Prices as Given Are Without Accessories

All Crosley Regenerative Receivers Licensed under Armstrong U. S. Pat. 1,113,149

The Crosley Radio Corporation owns and operates Broadcasting Station W L W



MAIL THIS COUPON TODAY

The Crosley Radio Corporation,
1063 Alfred St., Cincinnati, O.
Gentlemen: Please mail me free of charge your complete catalog of Crosley instruments and parts together with booklet entitled "The Simplicity of Radio"

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