

Blueprint Section Every Month

RADIO AGE

Magazine of the Home



How to Make—

- A Tube-Tester
- A Power-Supply Receiver
- An Improved Reinartz
- A Six-Tube Portable Set
- Other Up-to-the-Minute
Articles

MAY-1925
25 CENTS

MEET YOUR
BROADCAST
FAVORITES

ZENITH RADIO

*They Cost More
But They Do More*



*Super-Zenith X—
the ideal radio set
for the fine home*

Zenith—
*the exclusive choice
of MacMillan for his
North Polar
Expedition*



Zenith Supremacy will be Maintained

This message brings to radio enthusiasts the announcement of an *advance in Zenith prices* on all models. The new prices are shown in the panel at the right.

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An imposing name and an intensive advertising campaign—when they back a radio product which does not deliver equally impressive results—soon lose their fictitious values.

By that same token, performance which is literally *outstanding* fixes

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All present models are guaranteed against price reduction.

Dealers and Jobbers: Write or wire for our exclusive territorial franchise.

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332 S. Michigan Ave. Chicago, Ill.

The complete Zenith line ranges in price from \$100 to \$475.

With either Zenith 3R or Zenith 4R, satisfactory reception over distances of 2,000 to 3,000 miles is readily accomplished, using any ordinary loud speaker. Models 3R and 4R licensed under Armstrong U. S. Pat. No. 1,113,149. They are NON-RADIATING.

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The new Super-Zenith is a six-tube set with a new, unique, and really different patented circuit, controlled exclusively by the Zenith Radio Corporation. It is NOT regenerative.

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G. E. Rogers,
Troy, N. Y.

Do short hours, big money and easy work appeal to you?

RIGHT now thousands of men are "cleaning up" in Radio. Right on this page you can read the signed statements of men who have made big money in this "wonder-field." Men, who, a few months ago, knew nothing about electricity or Radio now hold fine positions and earn more money in one week than they used to get in a month!

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You can train for this "big-money" field in your own home—in a little spare time. No electrical experience is necessary. Men and boys of all ages—14 to 60, have mastered this famous course in a few months. What others have done, you can do.

Radio has come to stay. It is the fastest growing industry in the world today. But remember—the "cream" will go to the shrewd fellows who get in on the "ground floor." Employers are constantly writing to the National Radio Institute asking for Radio Operators, Salesmen, Radio Engineers, Radio Mechanics, Broadcasters, etc. Many of our students, even before completing their course have received offers of fine positions at twice their former salary. In fact, most students make so much money in their spare time on Radio work that this Course Becomes Practically Free.

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best obtainable at any price. The whole success of the Institute is based on its advanced methods. This is the absolutely complete course now being offered which will qualify you for a government first-class commercial license and really get you one of the bigger paying jobs in Radio.

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Send for "Rich Rewards in Radio" and Special Short-Time Offer

This interesting book will tell you the full story about the wonderful opportunities in Radio. You will see for yourself just how much you can expect to earn in this great profession. It will tell you of the adventure and big money that awaits the ambitious man in this fascinating field. Those who mail the coupon at once will be offered a *special reduced rate*. Act promptly and save money! Send today for this *free book* and our special short-time offer.



NATIONAL RADIO INSTITUTE
Dept. 53GB
Washington, D. C.

FREE Instruments for practical training at home



This is the world-famous Natrometer—one of the three instruments given for scientific and practical home training in mastering the code.



These parts with instructions are given for experience and practical training in making and operating regenerative receiving apparatus.



These parts with complete instructions are given for practice in building a receiving set of the more simple kind.

National Radio Institute, Dept. 53 GB,
Washington, D. C.

Send me the book, "Rich Rewards in Radio," which tells all about the opportunities in Radio, how spare time study at home will qualify me quickly as a Certified Radio-trician so I can get one of these splendid positions, and how your free Employment Service helps me to secure a good position. Also, details of your Special Short Time offer.

Name _____ Age _____

Address _____

City _____ State _____

RADIO AGE

The Magazine of the Hour

Established March, 1922

WITH WHICH IS COMBINED RADIO TOPICS

Volume 4

May, 1925

Number 5

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A Chat With the Editor

RADIO Corporation of America, it appears, is not at all in a hurry to submit proof that this magazine is not entitled to the use of the name which we have been using for more than three years. Radio Corporation, with great show of moral indignation, went into the United States Patent Office at Washington last Fall and made formal protest against the registration of the title "Radio Age," which name we had sought to have officially enrolled as our trade mark. Radio Corporation claimed that the use of the name "Radio Age" was causing damage to "Wireless Age," the organ of the Corporation, owned and controlled by the Corporation.

Radio Corporation was to have submitted proof to substantiate its objections to the use of our name. The Patent Office said this proof must be submitted on or before March 21. Instead of offering proof, Radio Corporation asked for a continuance. Our counsel consented once more. The case will not come up until late in April, when there likely will be another request for delay.

Meanwhile RADIO AGE moves on smoothly. It broke all its own records for circulation and advertising in the March, 1925, issue. We continue to receive many letters from fans wishing us success in our defense against the \$33,000,000 band of Broadway radio patriots.

Radio Corporation is fortunate in obtaining delays. The Corporation was to have appeared before the Federal Trade Commission on March 18 to answer the charge that it is involved in a trust conspiracy. Radio Corporation wanted delay. Although the charges were filed a year ago, Radio Corporation obtained more time to present its defense.

Changes have been made recently in the personnel of the Federal Trade Commission. We venture to suggest the hope that the Commission still will be courageous, fair, persistent, and diligent in pushing this radio trust inquiry. Why should it not?

If there is a radio monopoly—*burst it now!*

Frederick Smith

Editor of RADIO AGE

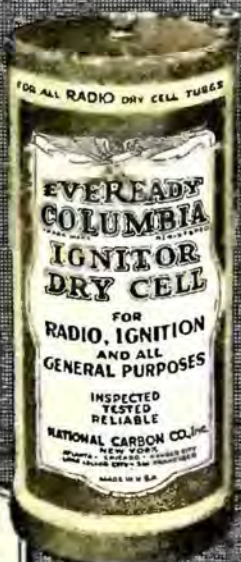
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Dry Cell for all
Radio Dry Cell
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Eveready Columbia Ignitor Dry Cell "A" Battery for all Dry Cell Tubes 1½ volts

Recommend good batteries

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There is an Eveready Radio Battery for every radio use.

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No. 770 45-volt Extra Large Vertical Price \$4.75 For use on multi-tube sets



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RADIO EDITORIALS

HEBER MacDONALD, writer of publicity for the Grebe radio people down at Richmond Hill, N. Y., has written a classic commentary on the radio trust. It is so good we are printing it in full. Know ye all men that we agree with every statement in the editorial. RADIO AGE has had some direct experience with the Radio Corporation of America and the radio public now knows pretty definitely what we think of the patriots who have just been favored with another delay in their hearing before the Federal Trade Commission on the charge of being involved in a conspiracy to gobble up the radio industry.

Mr. MacDonald's editorial follows:

RADIO fans—come out of the past—it's haunted. At least it looks that way, especially since history repeats itself. You may have noticed the Selden patent crowd passed into the cold and unrelenting grasp of a receiver the other day. If you have any recollection of the early days of the automobile business, you must recall Selden and his patent. It was a wonderful patent. It worked day and night. No time off for good behavior. No one could make any money with it and Selden said no one would be allowed to make any money without it. And in those olden, golden days, Selden was all-powerful. He even admitted it on high days and holidays.

About the country like a roaring lion went Selden seeking whom he might devour. Courage sprang from his clenched fist. He shook his patent at every auto-maker and collected much largess. They were taxed to live. And this tax was a heavy drain on the then infant motor-car industry. But once on a day a young manufacturer in Detroit, H. Ford, by name, told the Selden gang where they could go and he strongly advised them to take their leech-like patent with them.

Such a patent octopus is considerably like an over-inflated balloon; along comes some one armed with the spear of common sense and the balloon is bust. 'Most any man with back-bone has a good chance to deflate an octopus. An octopus is always an evil. Thrice armed is he whose cause is just. The octopus trembles at the very mention of justice.

And what has all this dissertation to do with radio? Nothing much except that there is another patent octopus trying to suck the life-blood out of the independent radio manufacturers who have not bowed the knee to Baal. The independent radio manufacturers believe they have the right to live without paying tribute to the radio trust. This right to live is denied to the independent radio manufacturers by the minions of the fat and over-fed radio trust. A brilliant array of expensive legal talent do the daily bidding of the Four Horsemen of Destruction.

But the little band of independents know not fear. They have forgotten the Trust and its threats. The Trust belongs to the stolid past. The Independents look to the plastic future. In the words of the Apostle

Paul they seem to speak as one man: "This one thing I do, forgetting those things which are behind and reaching forward unto those things which are before; I press toward the mark." This valiant little group of independents have a fixed image in mind from which all this extraneous and non-essential patent hokum has been extracted or subtracted.

Meanwhile, in the ranks of the Four Horsemen there is much gnashing of teeth. This great radio Goliath of Greed may have its day of reckoning put off again and again—as instanced by the recent delay on March 18—but the end is not afar off. The Trust-buster is just around the corner. Some one had better summon a Daniel, for there surely is a hand-writing on the wall: "MENE, MENE, TEKEL, UPHARSIN." The free translation seems to be "Thy kingdom is numbered. Thou art weighed in the balances and found wanting. Thy kingdom is divided and given to the Medes and Persians."

Uncle Trusty, they have your number. The bearers are at the door.

THE use of radio broadcasting stations as advertising machines is the greatest peril the new art is facing today. The eager listener who hopes to hear good music and who instead gets a dissertation on Jones' pills or Brown's sausage is not going to remain a devotee of the dials. In promoting advertising as a means of financing stations, the broadcasters who have succumbed to the commercial influence are building up a monster who, like Frankenstein, will slay its creator.

Chicago has three advertising broadcasting stations and is about to acquire more. New York has a big advertising station in WEA, and the saddest part of that story is that the ballyhoo was organized by the American Telephone and Telegraph Company. The Pacific coast has its advertising problem. "Radio," the San Francisco monthly, says in its April issue:

"Radio is too fine a thing, it has too great possibilities in the advancement of human welfare, to be prostituted to such base ends. If this practice continues to increase, and, if the warnings are not heeded, the public will realize that it is being imposed upon and turn to other forms of entertainment."

The writer was discussing the advertising peril with a conspicuous leader of radio activity and thought recently, and suggested the desirability of vigorous agitation against such misuse of the air. The radio man said there was no question about the danger of advertising propaganda to the radio industry and the radio art **IF SUCH ADVERTISING WAS CONTINUED**. But, he said, the disease would cure itself.

He confidently expressed the opinion that the public would solve this problem, as it has solved other radio problems. The public would calmly tune out the advertisers until the "broadcaster - for - business - only" found that he had no audience and then he would have to quit for want of contracts. A consummation devoutly to be wished, and may it come speedily.

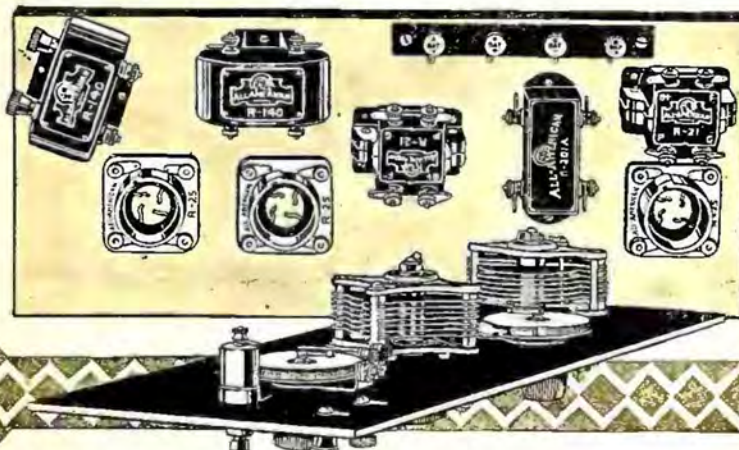


Radio at its Finest

Now Within Your Reach

MEMBER
RMA

This is Not a Kit!



Semi-Finished — Factory-Mounted

YOU buy this set with the ALL-AMERICAN parts properly mounted on the panel and baseboard. Without knowledge of blueprints, circuits or names of radio parts, you can wire up an ALL-AMAX SENIOR in *one delightful evening* and know that it is right. It was inevitable that sooner or later this *reliable*—and still *economical*—method of getting a high-grade radio set should be discovered. ALL-AMERICAN manufacturing ingenuity has found the solution and offers this completely mounted, highly efficient three-tube set at no more than you would pay for a kit of parts. Price, \$42

Ten cents will bring you the new Radio Key Book, and upon request we will include, free, a complete wiring blueprint of either ALL-AMAX SENIOR or ALL-AMAX JUNIOR.

ALL-AMERICAN RADIO CORP.
E. N. Rauland, President
2680 Coyne Street, Chicago



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The same unique manufacturing methods that created ALL-AMAX SENIOR have brought forth ALL-AMAX JUNIOR—a one-tube set that brings in the local stations on the loud speaker, or tunes them out and gets real distance. All parts are mounted on panel and baseboard, and clear *photographic* wiring directions are included. Price . . . \$22

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* AN
ALL-AMAX
RECEIVER

At your favorite
Radio Store

Ask them about
the great
ALL-AMERICAN
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You can win
a set by
submitting a
SLOGAN

Everybody can
enter. It costs
nothing

ALL-AMERICAN



Mr. Manufacturer

Would you write 100 letters
to 100 people
to reach just two men?

Then, before you invest your advertising dollars—**THINK!**

*This Association
is comprised of
the leading Ra-
dio Magazines.*

An analysis shows that publications of general circulation, newspapers and magazines, devote less than 2% of their reading columns to Radio—proving that in the opinion of their own Editors less than 2% of their readers are interested in Radio. In fact, many general publications carry no Radio editorial matter. Therefore—98% of your investment is lost!

On the contrary, the Radio magazine offers 100% Radio editorial—attracts 100% potential buyers.

Spend your advertising appropriation in Radio Magazines. Be sure of the greatest possible return on your advertising dollar.

Radio Magazine Publishers' Association, Inc.

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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

Self-Oscillations in R.F. Circuits— Where The HOWLS Come from

By FRANK D. PEARNE

Control of Feedback is Vital for Clarity

IT IS a well known fact that in order to get good long distance reception, radio frequency amplification must be used. This type of amplification strengthens the incoming signal, amplifying it to such a value that it becomes strong enough to make enough impression on the detector to make audible those signals which otherwise could not be heard with the ordinary receiving sets.

No jacks are included in the different stages of radio amplification for the reason that they pass through all of these stages at a frequency which is much too high to be heard by the human ear. They are not made audible until they pass through the detector, where they are brought down to audible frequency. Therefore, jacks are of no consequence at any point preceding the detector. After reaching this point, however, the signals may be passed through various stages of audio frequency amplification for the purpose of increasing the volume of the rectified signal, and jacks may be inserted between any of these stages, making it possible to vary the volume as desired. Most all long distance receivers operate on the basis of both radio and audio frequency amplification, and no matter what type of radio frequency amplification is used, there will always be a great tendency towards self oscillations in these circuits.

Cause of Howls and Squeals

WHEN self oscillation occurs, howls and squeals of all kinds are produced in the phones and if these oscillations cannot be controlled, the benefits derived from radio frequency amplification are of no value whatever, and the set might better be used without it. Fortunately, however, there are several ways of eliminating the self oscillations, and if this is properly done, the receiver may be made extremely sensitive and practically noiseless so far as these oscillations are concerned. In order that one may fully understand just what causes this trouble, it will be necessary to explain briefly the principle of regeneration. The well known regenerative set makes use of what is

known as a feedback, in which part of the amplified energy is fed back from the plate circuit to the grid of the tube. In this case, either a tuned plate circuit or an inductive coupling of the plate and grid circuit is used. Here we have a signal impressed upon the grid and amplified by the relay action of the tube in the plate circuit. When a change takes place in this plate circuit, part of the energy is re-impressed upon the grid circuit by induction, which again affects the grid, making a still greater change in the current flowing in the plate circuit. This change or increase reacts upon the grid again, making still more changes in the plate circuit, which effect keeps building up the charge upon the grid

until it reaches a point where it becomes stabilized and no further increase takes place. Aside from building up the signal on the grid, it has the effect of prolonging the signal to a certain extent, the result being a considerable amplification of the signal by this regenerative method.

This is known as a feedback, and because it may be controlled, it becomes a useful and valuable adjunct to the receiver. Thus we have a case where controllable oscillation is a benefit, but those self oscillations which are set up in many sources of feedback which are not under control are the cause of the many howls and squeals so often encountered in radio frequency amplification. Where several stages of radio frequency amplification are used, some of the energy of the plate circuit may be fed back to the grid circuit to the same tube, or to preceding tubes by induction or capacity in the circuits themselves.

Coupling Causes Trouble

FEEDBACKS of this kind are undesirable, and unless some method of controlling them is used, self oscillation of the tubes will cause an aggravating howl in the phones or loud speaker. Now this action is caused by an unintended coupling somewhere between the grid and plate circuits of the tubes. Perhaps in the wiring of the set the wire connected to the plate of one tube may be too close to the wire connected to the grid of that, or some other tube, or perhaps these two wires may parallel each other for some distance, in which case one will be affected by the other and self oscillations will be set up.

This, however, will not always occur, for the reason that if the feedback occurs in one direction, it may tend to oppose or neutralize the grid effect, having a tendency to dampen out the grid effect instead of building it up. Where many stages of radio frequency amplification are used, coupling between the plate and grid circuits may occur in many ways. There will always be a capacity coupling between the plate and grid of any tube, because these two

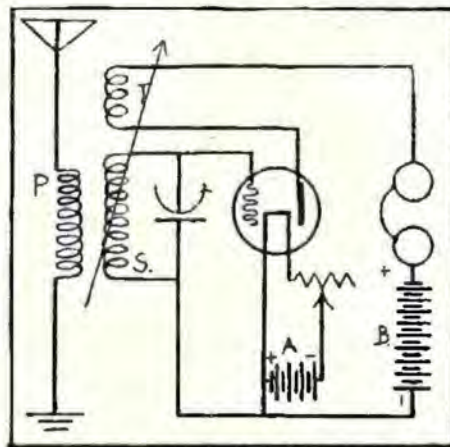


Fig. 1. Here current is induced in the secondary by a primary circuit. This secondary current acts upon the grid, which varies the current in the plate circuit. This varying current passes through the tickler coil which again causes an induced current in secondary, thereby affecting the grid once more, making a greater change in the plate circuit.

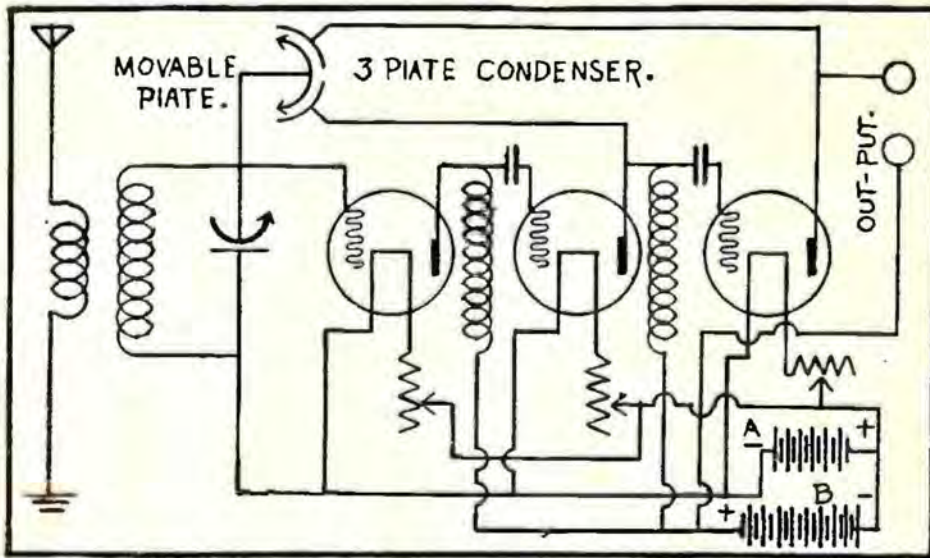


Fig. 2. Controlling the feedback from one stage to another by means of a special 3-plate condenser.

elements act just as though they were the plates of a condenser. This capacity coupling is always present and cannot be avoided, and the only way to overcome it is by neutralizing its effect in a manner similar to that of the neutrodyne circuit in which neutralizing condensers are used.

The coupling may be caused by magnetic action between transformers which are too close together, and again it may be caused by resistance coupling where the internal resistance of the plate batteries is high. Now the energy which is fed back in any of these cases may be either positive or negative, and if it happens to be positive in its direction, or if a positive feedback is strong enough to overcome any negative feedback which may be taking place, continuous oscillations will be set up and howling will usually result.

One method devised to overcome a positive coupling between two circuits is to provide a separate source of negative feedback to overcome or neutralize the effect of any positive feedback which may be taking place between two circuits.

In this method a small, three-plate variable condenser is so arranged that one movable plate may be moved in front of one or the other of the stationary plates which are insulated from each other, or it may be moved partly in front of one and partly in front of the other. The movable plate is connected to the grid of the first amplifying tube and the stationary plates are connected to the plates of the second and third tubes, respectively. This arrangement is used in resistance coupled amplifiers, as in this type, and each succeeding stage is reversed in phase. By changing the position of the movable plate of the condenser, one point of adjustment may be found where the feedback effect will be absolutely neutralized. Other positions of the movable plate may be found where the feedback may be either made negative or positive as desired, which makes it possible to control the feedback at will. In the same way, this method may be applied to trans-

former amplification, providing the secondary connections of the transformers are reversed in relation to the primary connections and a small variable condenser connected between the plate circuits of two tubes.

The Potentiometer Method

ANOTHER arrangement, and the one which seems to be most popular among the manufacturers of radio frequency sets, is the potentiometer method. In most cases the grid return circuits of all the tubes are connected to the negative side of the filament battery. This tends to prevent oscillations taking place in the tubes, but is not adjustable. By connecting a high resistance potentiometer across the terminals of the filament battery and connecting the grid return circuits to the movable arm of the potentiometer, the grid bias may be varied from a negative to a positive value, making it possible to obtain any adjustment between the extreme negative and positive which may be desired. By this arrangement, the grids may be made either negative or positive with respect to the negative

end of the tube filaments. If it is found that the tubes oscillate when the potentiometer is set at the negative side, the oscillations may be damped by moving the arm towards the positive end.

Making the grids of the tubes positive with respect to the filaments will naturally reduce the impedances of the grid filament circuits, and if this is carried too far, the grid filament circuit begins to be conductive, and some of the plate current will be wasted; but if the grid circuit is carefully balanced against the feed-back, then the self oscillations of the tubes may be easily controlled. The one bad feature of the potentiometer method is the fact that controlling the oscillations in this manner is absolute, but it increases the resistance of the circuits and naturally the amplification is reduced. It will be noted for example, in the use of a superheterodyne circuit, that at certain adjustments of the potentiometer the set will oscillate in a disagreeable manner, but the volume of the signal is wonderful. However, in order to clear up the reception and make it quiet, the position of the arm on the potentiometer must be changed, and as the oscillations begin to disappear, the volume drops off to a considerable extent due to the increased resistance. If some method could be devised by which the oscillations could be damped out and the volume still retained, then great amplification might be had, with the use of less tubes than are now necessary. More stages of radio frequency amplification are required, of course, to make up for the loss occasioned by getting rid of the self oscillations in the tubes. There is a limit to the number of tubes which may be used, for the reason that tube noises are always present, and with each successive stage of amplification these noises are amplified as well as the signal.

Audio Frequency Amplification

AUDIO frequency amplification, as before mentioned, is used to increase the volume of the signals after they have passed through the detector. (Turn to page 67)

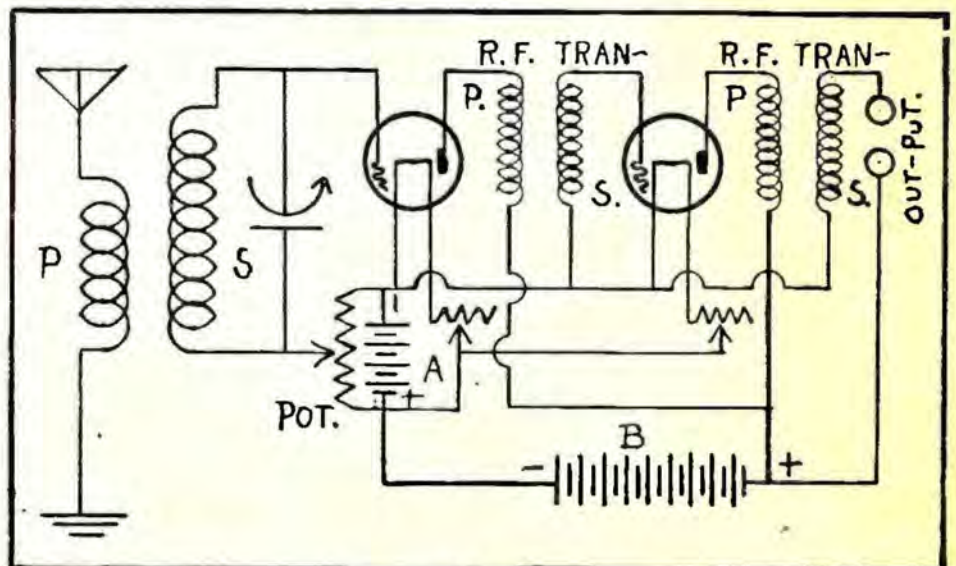


Fig. 3. The potentiometer method of controlling the feedback is shown in the diagram above.

Consider your Neighbors with This "QUIET" REGENERATOR

BY ARTHUR B. McCULLAH



A front view of Mr. McCullah's much-discussed radiation-minimizing receiver. After a series of tests, Mr. McCullah believes he has nearly approached the ideal regenerative set with this four-tube hookup.

THE purpose of this article is not to introduce a new circuit into the radio folds for no good reason, but to introduce an old circuit with some of its disadvantages overcome.

The regenerative set can truly be called the "Old Reliable." However, conditions have grown up around it that have made it a burden to the community at large. Our last trans-atlantic test proved that the radiating receivers were doomed. Not only is the regenerative set a menace to society, but the many varieties of radio frequency amplifiers that go into the state of oscillation cause more trouble than a great many regenerative sets.

Some have prophesied that in a short space of time the owners of regenerative sets will learn how to manipulate them in such a manner as not to cause any undue hardship to their neighbors. Time has not borne out this prophecy, and some method must be presented to the fans so they can build sets that will not radiate and at the same time be electrically efficient, as well as easy to tune. The users of most regenerative sets know that by making their sets oscillate they will cause interference, but they continue to use such a practice because it is easy to find stations by the beat note that is produced in their sets, as well as in every other set in the neighborhood.

Some Criticism Undeserved

AS SAID, before, the regenerative set comes in for a lot of criticism that it is not entitled to. The super-heterodyne causes a great amount of trouble that the much abused regenerative set is accused of. The radio frequency amplifiers in many sets radiate more energy than regenerative detectors, because of

A Step Toward a Non-Radiating Set

the high plate voltage as compared to the plate voltage of a detector tube. This, of course, makes for a more powerful oscillator. A general rule may be stated that any set that goes into the state of oscillation will radiate energy unless some method is used to prevent the energy from leaving the set; i. e., in the super-heterodyne receiver the second harmonic system of wave-changing or the Pressley system of preventing radiation to a negligible quantity.

Circuit Analysis

In the set to be described, the antenna coil has (53) turns of Number twenty-four double-covered green silk wire. There is a tap taken out in the exact electrical center which is at the (26½) turn. This is the antenna tap. The purpose of such close coupling is to prevent the first radio frequency amplifier from oscillating. There is a second method that is not always needed, but it is put in for the few that might find it necessary. It will be noticed that there is a .0005 variable condenser tuning the antenna coil and a .00035 condenser tuning the detector circuit. The reason for this is that in designing a set, practically every builder will have an antenna of a different capacity, which would change the wavelength of the secondary of the first radio frequency transformer to a great extent if the tuning condenser were a .00035 condenser; hence the .0005 variable.

The second radio frequency transformer consists of two coils, a (24) turn

primary and a secondary of (95) turns and the same size wire with which the antenna coil is wound. There is also a tap taken out at the center of this winding. Regeneration is obtained with a small variable condenser. It is sometimes known as the Rice Circuit. The primary coil is wound on a smaller bakelite tubing so it will make a snug fit when it has a winding on it. In the circuit diagram it will be noticed that there is a small fixed condenser in series with the regenerative condenser. This is because of the fact that the so-called regenerative condenser has too high a zero capacity to prevent the detector tube from oscillating at the lower end of the scale.

The Choke Coil

AS THIS circuit is what is called a parallel plate supply, some method must be used to keep the radio frequency energy out of the plate supply. This can easily be done by inserting a small honeycomb coil in series with the plate lead of the detector. A coil of one hundred turns or more will do the trick. It might be added that this choke may be made by winding one hundred turns of the same size wire with which the other coils are wound, or if some smaller wire is handy, use it because it will make a more compact coil. The form for winding such a coil can be had from an old spool.

The usual precautions should be taken in selecting the audio transformers. We need not go into the details about them, as they have been discussed at length in these pages before. If the builder wants to go to considerable work, he may use filament control jacks and put a jack in the plate circuit of each tube with the exception of the radio frequency amplifier.



Panel view of the "Quiet Regenerator." There are two major controls; a .0005 variable condenser tunes the antenna coil while a .00035 condenser tunes the detector circuit.

The much important "C" battery is left out of many sets. This is not the case here, however, for it is particularly advantageous when using 199 tubes as we do in this set.

Only one rheostat is used, as 199 tubes work best at three volts. It does not take four rheostats to adjust the tubes to three volts, as the tubes have the same characteristic.

List of Materials

- 1 7 x 14 inch panel.
- 1 7 x 13 inch panel.
- 1 .0005 variable condenser.
- 1 .00035 variable condenser.
- 2 Low ratio audio frequency transformers.
- 4 199 tube sockets.
- 1 Grid leak and condenser.
- 1 Rheostat.
- 1 4 spring jack.
- 1 2 spring jack.
- 1 On-off switch.
- 1 Chelton variable condenser.
- 1 .0001 fixed condenser.
- 2 Bakelite tubing 3½ inch long, 2 inch in diameter.
- 2 Bakelite tubing 1 inch long, 1¼ inch in diameter.
- 2 Dials.
- 7 Binding posts.

- 1 ¼ lb. No. 24 D. C. G. S.
- 1 Neutralizing condenser.

Construction

IT IS an old Chinese proverb that "One Picture is Worth 10,000 Words." The picture will tell in the best way how to lay out the set.

The antenna coil should be wound on the center of the bakelite. The most accurate way to do this is to drill a small hole in the tube, equidistant from both ends of the tube and wind on two coils, using this as the starting point for both windings; that is, 26½ turns on both sides of the center. If the same type of condenser is used, the coil will be mounted on the back of the condenser. This first coil should be at right angles to the baseboard.

The second radio frequency transformer is mounted on the back of the condenser in the same manner as the first, except that it is parallel to the baseboard. In other words, it is at right angles to the other coil. The primary coil is wound on the small coil that is one inch long, and it has twenty turns of wire on it. The secondary coil, as said before, has a tap and may be wound the same as the primary coil, only it has 53 turns, or 26½ each side of the center tap.

While the choke coil is very easy to build, to make the entire job one of simple assembly, it would be easy to purchase one 100-turns honey-comb coil. For those who want to build their own choke coil, a very nice job can be made of an ordinary thread spool. Wind on one-hundred turns of No. 24 wire in most any fashion. The ends of the wire can be brought out to two screws at one end of the spool.

No trouble should be experienced in constructing this set, as there are no "trick" parts, nor are there any moving coils that would cause the builder with a limited number of tools any difficulty.

Oscillation On First Tube

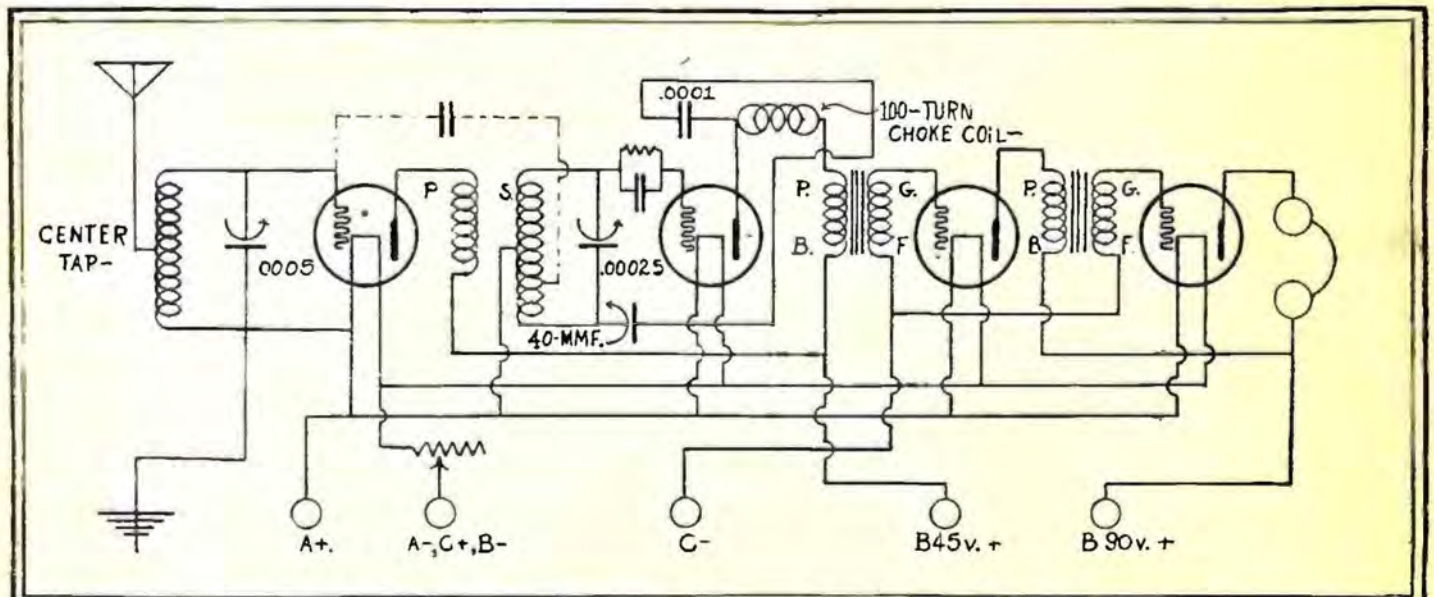
SOME trouble has been experienced with this circuit on some antennas, due to the first tube oscillating. The first tube on some occasions broke into oscillation in sympathy with the detector tube when it oscillates or is about to oscillate.

The only remedy for such a trouble is to neutralize the radio frequency tube. Neutralization is very easy in this circuit, as there is only one tube to neutralize. The first thing to do is to disconnect the antenna from the set. Set the first dial at about thirty on the dial, and then turn the second dial until the click is heard in the headphones, which indicates the first tube is oscillating.

This, of course, is done with the regenerative condenser set at zero. Now, by adjusting the neutralizing condenser, the first tube can be made to stop oscillating.

A test to see whether the first tube is oscillating or not is to turn the regenerative condenser a slight amount and then turn the second dial back and forth over the point where the tube oscillated before.

Note by Technical Editor—Builders of this circuit should remember that any improperly neutralized circuit, regardless of the means adopted for neutralization, can send a weak current into the antenna circuit and at close range prove bothersome to a neighbor. Be sure the r. f. tubes are completely neutralized before going ahead.



The wiring layout of Mr. McCullah's four tube receiver. Regeneration is obtained with a small variable condenser. In the diagram above it will be noticed that there is a small fixed condenser in series with the regenerative condenser, for the reason the so-called regenerative condenser has too high a zero capacity to prevent the detector tube from oscillating at the lower end of the scale.

How to Make a Vacuum Tube Tester

By H. FRANK HOPKINS



Fig 1. A front view of the vacuum tube tester, which can be made by any fan. Each part is so placed to give maximum efficiency, and no parts are used that will not be necessary. The tester is compact as well as attractive, and may be constructed for portable or stationary use.

Proper Knowledge of Tubes' Capacity and Worth Will Save Fan Much Trouble in Operation of His Set; Many Ways of Operating Tester Shown

A GREAT many radio fans of today are constantly asking how they can improve on their equipment and how they can reach out and bring in the distant stations strong enough to work the loud speaker and yet maintain maximum tone quality. Knowing that to add amplifying units tends to distort the signal and produce excessive local noises, therefore other means to attain efficiency with the present equipment are constantly in demand.

Efficiency with matched parts is a big step toward getting the utmost out of a set. A way to match and measure the various parts of a receiving set was described by the writer in the February RADIO AGE, when a slide wire bridge was outlined. From the number of inquiries and reports of results obtained with that instrument, it is evident that the set-builder of the present is more interested in the art and theory of radio than in just putting a bunch of parts together to build a receiver and listen to a few programs.

He is an experimenter, gaining knowledge in addition to amusement. Often-times he contributes valuable information to the radio science. It is to this type of radio fan that we look to for the future development of radio, for he accomplishes as much as the professional radio engineer.

A Little Study Necessary

IT is not necessary that one have an advanced education in electricity or radio engineering to apply science in his experiments, or to know why he gets certain results. With a little study and a

few instruments, he has a great field open to him, and the writer is sure that when he meets problems beyond his capacity, which will be few, he need only seek the counsel of authors of technical radio articles, and they will be only too pleased to help him out.

The most vital parts of a receiving set are the vacuum tubes. They are the heart of the system. When they cease to function efficiently, all of our other efforts are in vain, our matched parts cannot produce that which is not applied to them and they can only pass and produce

results equal in quality as that applied to them. If the vacuum tube fails to deliver, the output will suffer in both quality and volume. If the tubes do not match up; that is, if they do not have characteristics similar to one another, they cannot be expected to pull together and produce satisfactory results.

The tube problem becomes more complicated day by day as new tubes are put on the market. Not that these new tubes are inferior, for their quality is every bit as good as can be obtained, but their characteristics are not the same. One brand may not have as great an impedance as another; maximum amplification may be obtained on one make of tube at a different plate voltage or grid bias than on another. Such tubes cannot be expected to "co-operate" when the same plate voltage and grid bias are applied to them. Therefore, some method of matching tubes or determining just where their critical point lies is obviously necessary.

Pulls Others Down

VACUUM tubes wear out, too. The same as everything else, and as it passes its efficient stage, it pulls all of the others down with it by making it necessary to increase the filament voltage to obtain a satisfactory output. The others consequently age very rapidly, making it necessary to replace all of them in a short time instead of replacing just one of them when it passes its useful period. This was described in the article entitled "Regulating Filament Energy" in the April RADIO AGE.

One such case would cost the fan

WIRING TABLE	
Run One Lead from	TO—
Binding Post B90	Switch point No. 4
Binding Post B 67½	Switch point No. 3
Binding Post B45	Switch point No. 2
Binding Post B22½	Switch point No. 1
Binding Post B—	Binding Post A +
Binding Post B—	Terminal 100 on PF
Binding Post B—	Switch point +
Binding Post A +	Terminal F + on T
Binding Post A—	Switch point—
Binding Post A—	Terminal No. 10 on PF
Binding Post C +	Terminal No.1 on GP
Binding Post C +	Terminal No.0 on BS
Binding Post C—	Terminal No.3 on GP
Terminal No.0 on PS	Terminal No.1 on BR
Terminal No.0 on BS	Terminal + on GM
Terminal No.2 on GP	Terminal G on T
Terminal G on T	Terminal No.2 on GS
Terminal No.2 on BR	Terminal + on MA
Terminal No.2 on BR	Terminal No.4 on TS
Terminal — on GM	Terminal No.1 on GS
Terminal — on MA	Terminal P on T
Terminal No. 2 on R	Terminal No. 10 on PF
Terminal F— on T	Terminal 1 on R
Terminal F + on T	Terminal No.3 on TS
Terminal + on TS	Terminal + on PF

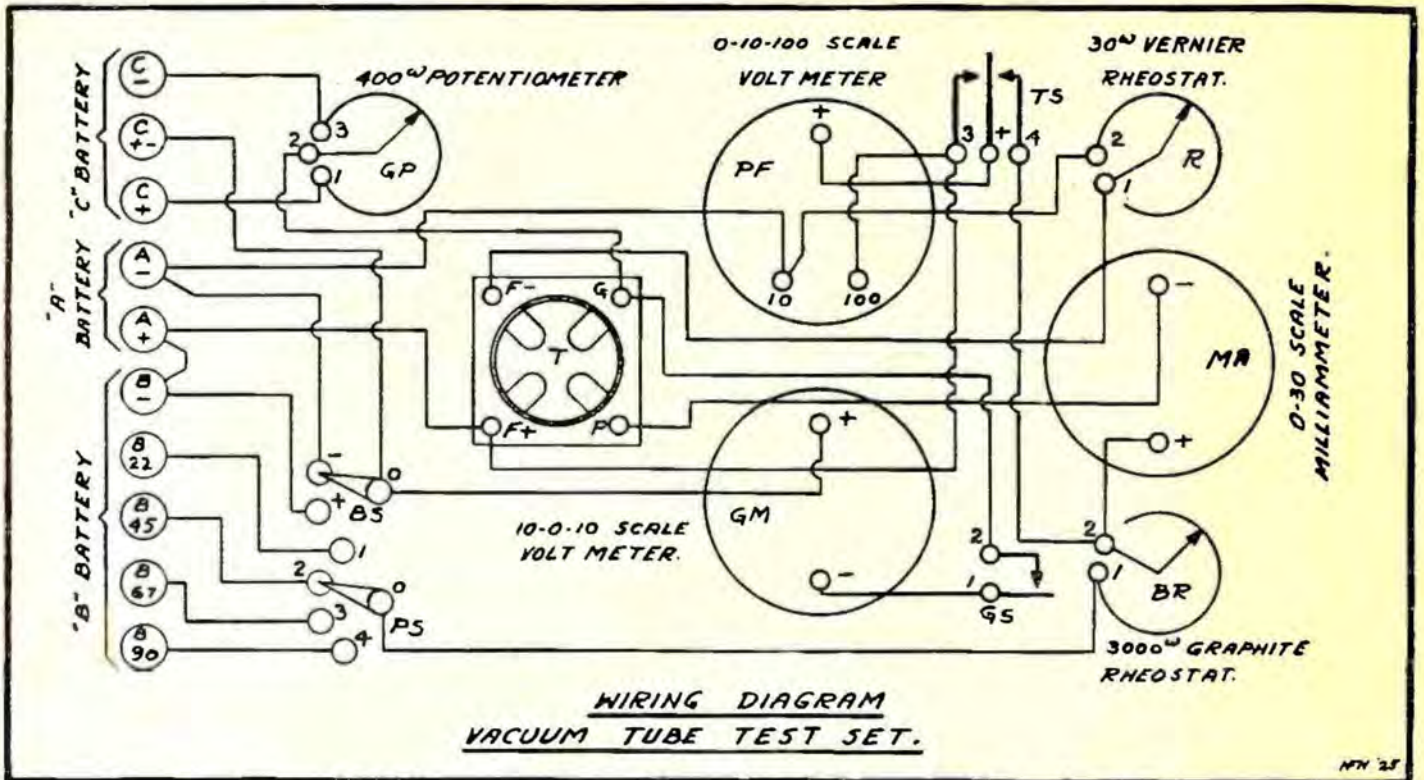


Fig. 2. Wiring diagram for Mr. Hopkins' tube tester. This layout is so simple any radio fan can follow it, and yet its efficiency and worth are unlimited. Voltmeters of the highest rating were used in this unit.

almost as much, if not more, than a good tube tester. This would not be so inconvenient if it would only happen once, but it continues to happen, while the investment in a tube-tester is like insurance on your tubes, in addition to the benefits you will reap in acquiring more knowledge about your equipment. In this way you will be able to weed out the weak, inefficient tubes and match the good ones for efficient operation.

The tube tester to be described is not expensive. Its total cost is not much more than six dollars more than the cost of the meters, and these instruments may be purchased from any reliable dealer at about seven dollars each.

The meters used in the set to be described were the best that could be obtained for this purpose, and they are standard equipment. In listing the bill of materials for this set, all of the parts are given a designating letter or sign, which is used throughout the article to enable

the prospective builder to understand the place of the parts in the circuit and to simplify the wiring.

A case or cabinet 8 1-2 inches by 11 inches and 5 inches deep will be required if this is to be a portable set; or just a panel 10 inches by 14 inches by 3-16 inches thick with the necessary mounting brackets if it is to be used as a permanent fixture. The panel for the case will be 8 1-2 inches by 11 inches by 3-16 inch in thickness. It will be drilled to mount the equipment as shown in the photograph accompanying this article. No dimensions are given for drilling the panel, as there is a large selection of equipment, all different in shape, and all can be used with equal success. Accordingly, the size of the holes may vary, but the layout of the panel is not altered, nor is it difficult.

The Parts of the Instrument

- 1 Two scale voltmeter. (0 to 10 and 0 to 100 scale.) PF for plate and filament voltage.
- 1 Voltmeter (10-0-10 scale) GM for measuring grid bias voltage.
- 1 Milliammeter (0 to 30 scale) MA for measuring plate current.
- 1 Jack switch, GS, for grid voltmeter.
- 1 Two way transfer switch, TS, for PF meter.
- 1 30-ohm vernier rheostat, R, for filament control.
- 1 3000-ohm graphite resistance, BR, for "B" or plate battery control.
- 1 400 ohm potentiometer, GP, for grid bias control.
- 1 201 type socket, T, with metal shell.
- 1 Adapter for 199 tubes (If required.)
- 1 Adapter for WD type tubes (If required.)
- 2 Induction switch levers and knobs, BS, and PS.

- 6 Switch points, BS 1, 2, 3, and 4. PS+and-.

- 10 Binding posts, B90, B67 1-2, B45, B22 1-2. B-, A+, A-, C+, C+-, and C-.

- Miscellaneous mounting screws, terminals, wire and solder.

Wiring the Set

WHEN all of the instruments have been secured and the panel laid out and drilled with the instruments mounted on it, the next step will be to wire it up. The method to do this is with Number 14 B and S gauge rubber-covered stranded wire, each wire having a terminal soldered to each end. These terminals will be securely bolted to the posts on the instruments. Care should be taken to see that the soldering is secure and makes a good connection, and that the lugs and terminals are clean and have
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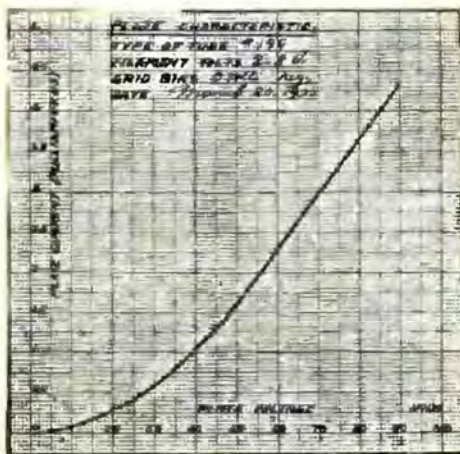


Fig. 3. A typical plate characteristic curve for the 199 type (3 volt) tube.

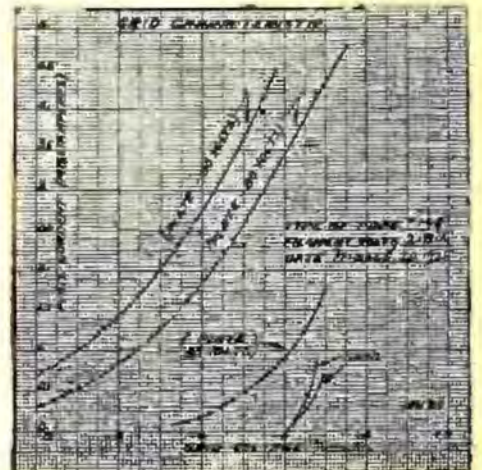
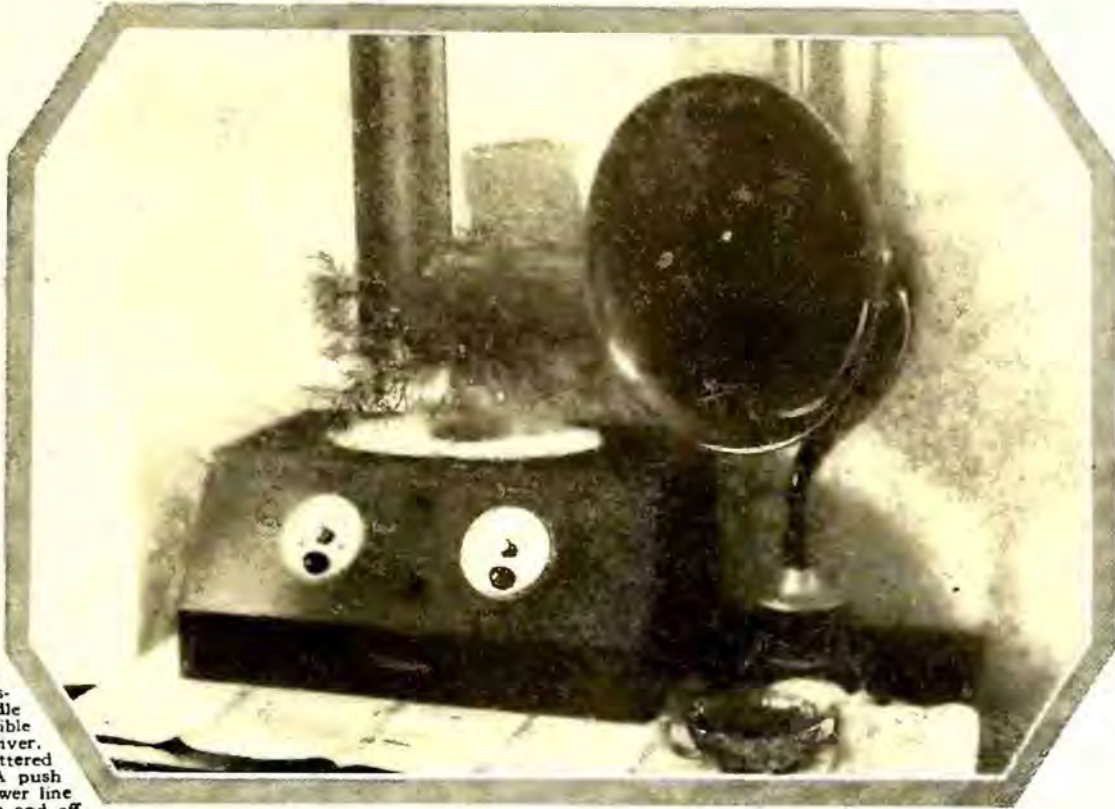


Fig. 4. Typical grid characteristics for 199 type (3 volt) tubes at 45-80 and 90 volts "B" battery.

A POWER SUPPLY Receiver

By BRAINARD FOOTE



Does the appearance please you? "Two hand" tuning control, with vernier dials, an R. F. coupling adjustment for sensitivity and the crystal control-handle form the only visible parts of the receiver. Station calls are lettered on the dials. A push switch in the power line turns the set on and off.

How to Make a Receiver that Draws Both Plate and Filament Voltage from Lighting System; Not for DX

THE application of alternating current for supplying energy for both filament and plate circuits of a receiving set is distinctly new and rather "tricky." It is comparatively easy to devise a rectifying system for furnishing satisfactory plate voltage to replace the dry cell type of "B" batteries, but the addition of the house lighting system for lighting the tubes as well is a more complicated matter.

However, the incomparable convenience of a never-failing power supply appeals to everyone. Dead batteries usually show up just when you've invited the next-door neighbors in for a special program of Metropolitan singers, or during the Sunday evening concert. And "B" batteries must be frequently replaced as they become exhausted.

Inasmuch as the alternating current can easily be changed to direct current of any desired voltage for the "B" circuit, the "B" voltage supply is composed of direct current, as usual, with a battery. But for the filament, on the other hand, rectification of sufficient current for tube illumination would entail a large amount of rectifier and filter apparatus that would make the storage battery and charger the more logical and convenient filament power supply system, to say nothing of the cost of such equipment.

Pictures by the Author

HOWEVER, by correctly arranging the "grid return" leads, the hum ordinarily caused by 60 cycle lines is balanced out to such an extent that it is scarcely noticeable. There are, however, some limitations upon the types of circuit which may be successfully used with the A. C. supply system, and moreover, upon the extent of the set's receiving range. These requirements tend to restrict the use of the system to listeners who care more about the reception of programs from the nearer stations and who are more interested in perfection of musical reproduction than they are in the search after far away broadcasts.

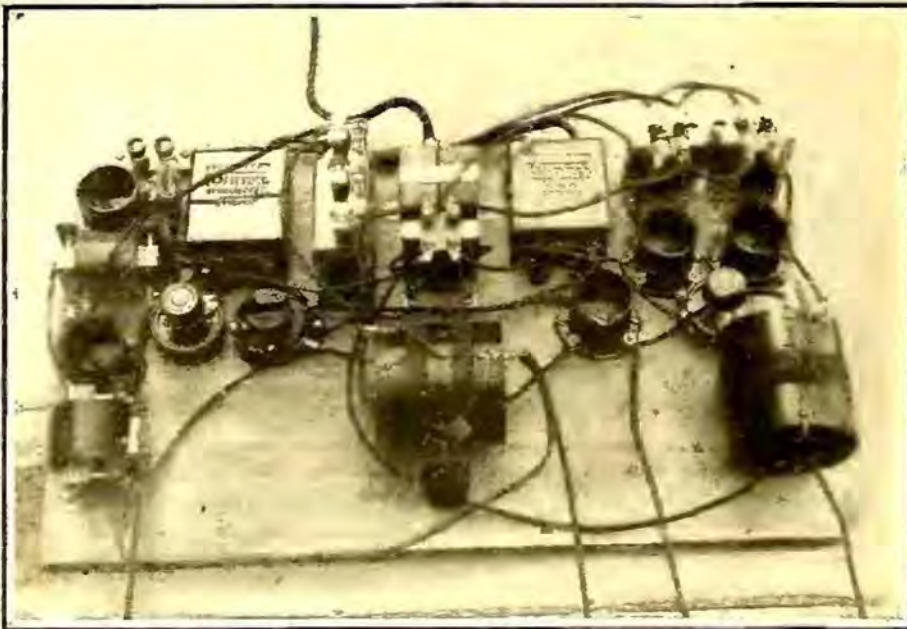
A tube detector, unless it be supplied with filament current by a storage battery or separate dry cell, is ruled out from the start. This means that a crystal detector is essential. From the standpoint of extreme sensitivity, this is certainly a handicap, but for clarity of reception no one can question the crystal's superiority over the tube for detection purposes. And with the plentiful supply of new crystal detector stands comprising either zincite and bornite

or zincite and tellurium, a detector that is rugged and long-lasting may be easily obtained. The dual mineral type of detector is ideal for such a receiving set, inasmuch as its adjustment is made in a second and that adjustment is held for long periods of time—often several weeks on end.

The amplifying tubes can, with perfect success, be lighted on A. C., so that the set may employ tubes for amplifying purposes in practically any combination, provided the detector be a crystal. To gain the best results, the circuit should not be reflexed, since there are certain uncertainties about reflex sets that often cause trouble when run on alternating current. The most satisfactory all-around circuit is a combination of one step of radio frequency, a crystal detector and two steps of audio frequency, with no provision for headphones.

For Loud Speaker Only

IN OTHER words, the completed set is one intended solely for loud speaker reproduction. It is a simple set to operate, with two tuning controls and one sensitivity control. There is also the crystal detector adjustment knob which must be touched occasionally. Stations within fifty miles are considered "locals" when received on a fair outside



How the baseboard is laid out, showing the wiring completed except for the coils. The layout isn't so large, when you consider the fact that no external "A" or "B" batteries are necessary. The base measures 12 by 20 inches.

capacity plate on which the house telephone is placed. The sloping type of cabinet is chosen for reasons of tuning convenience and better illumination of the dials, and for the better appearance as well.

To house the necessary apparatus, the baseboard measures 20 inches long by 12 inches deep. On it are the tuning apparatus, except condensers and detector, the audio amplifier, the "B" voltage rectifier and the filament current supply system. Thus, the only external connections or parts needed are 1, The aerial; 2, The ground; 3, The loud speaker; 4, A cord and plug to the base receptacle or other lighting socket.

To avoid ugly wires in front, the speaker leads are inserted through the rear and at the left end of the board, the flexible cord is placed at the rear center, while the aerial and ground wires emerge at the rear right. A push switch is inserted in the flexible cord at about a twelve-inch distance from the cabinet, for turning the power on and off.

antenna, and those within twenty-five miles are "locals" when a small indoor aerial is used. The selectivity is very satisfactory, so that some distant stations may be heard while locals are on the air, and quite a lot of pleasing DX work can be accomplished when locals do not interfere seriously. This means that while the set is chiefly meant for local reception with perfect clarity and plenty of "pep," DX stations are also within reach, though not to the same extent as with a receiver expressly intended

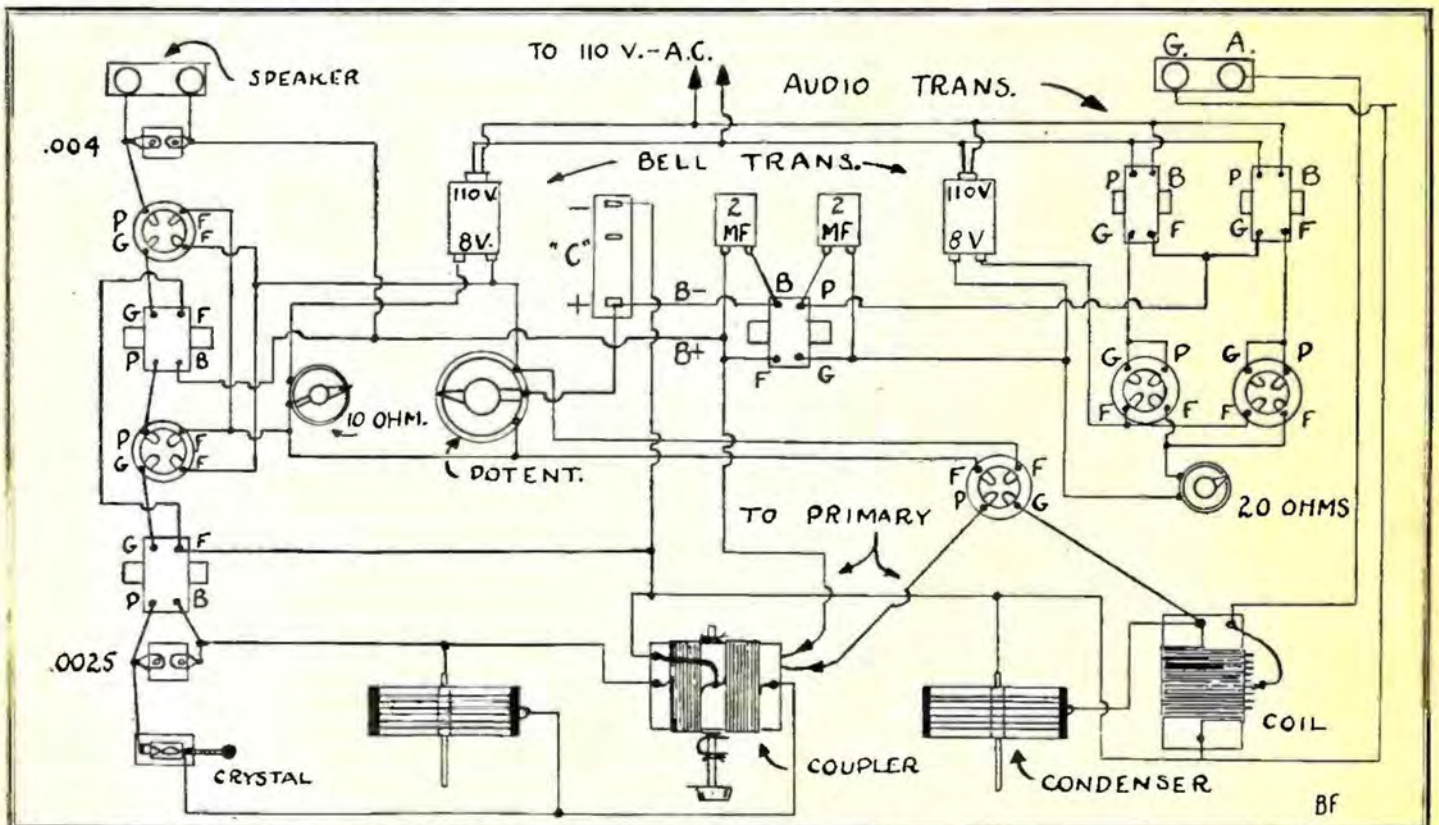
for DX work like the super-heterodyne and various other "dynes."

One illustration shows the baseboard of a power supply receiver built for use with a cabinet. Another view shows how the completed set appears and gives some idea of its attractiveness and simple control. The circuit selected is presented as a result of a great deal of experimenting in search of a circuit with plenty of sensitiveness and adaptable to all sorts of aerials, from a long high wire over 150 feet from end to end down to a mere

The Parts Necessary

SO LONG as high grade apparatus is selected, there are no special requirements as to the parts selected, with the exception of the A. F. transformers. Three of these are used in the "B" rectifying system and they must be rigidly assembled, with clamps or machine screws tightly holding the laminations of the core at several points. If you can wiggle the core pieces with your finger, they cannot be used for the "B" part of the set, though they may be used for the audio amplifier well enough.

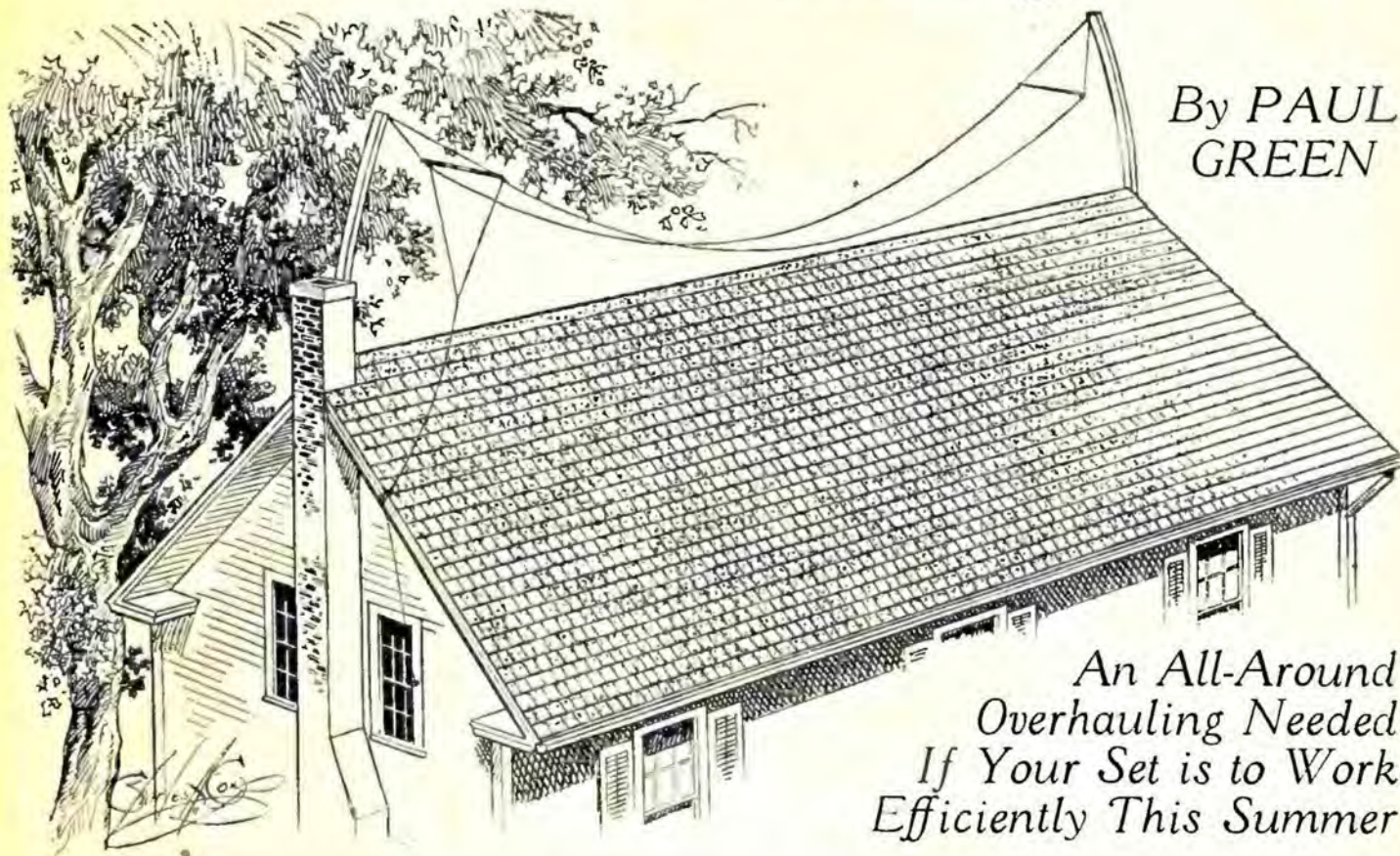
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Complete wiring for a receiver operated on the A. C. house current. The only battery used is a $\pm 1-2$ volt "C" battery—this being included in the set. There are five tubes in all; it's a three tube and crystal detector set, the extra two tubes furnishing the rectified current for the "B" voltage.

Now's the Time for a Radio House-Cleaning

By PAUL GREEN



An All-Around Overhauling Needed If Your Set is to Work Efficiently This Summer

FOR FIVE months or more, radio reception has been good. Aside from charging the "A" battery, most of us have given our sets little or no attention since last Fall. Now, however, we hear on every hand complaints of reception falling off. By this time next month a large majority of radio listeners will have pessimistically accepted the situation as unalterable and let it go at that.

In spite of this, broadcasting stations have been for many months planning wonderful programs and greater power for the coming Summer. If reception continues to grow poorer as the season advances, will all this planning accomplish anything? Isn't it just so much wasted effort? you ask. Well, perhaps we have formed hasty conclusions as to the effect of warmer weather on reception. Let us see.

Do you recall, last Fall, when you put the old set in trim for the Winter, how among the things you did, perhaps you purchased a new set of "B" batteries and a tube or two and just for luck re-soldered some of the joints. You knew that others were getting results; therefore, your failure to do so argued the need of attention to your set. Well, anyway, you got the set to "perk up"—and it has continued to do so for several months. Well, here we are "at the end of our radio season," and what do you

propose doing? Desert your old stand-by? And just when it needs your attention, too.

Weather Gets the Blame

THE average set has seen a total of not less than six hundred hours' service since last it received any real attention. During that time batteries, contacts, joints and tubes have undergone changes. Even if Winter were to continue, these parts would need attention. But, in common with many other fans, you probably have overlooked examining your set, charging the weather with the "falling off" instead.

Certainly, with all these wonderful radio programs ahead of us, it is very worth while to do what we can to assist our sets to give us their best. Following are some of the complaints to which a set may be subject at this time of year, with hints for remedying the complaints.

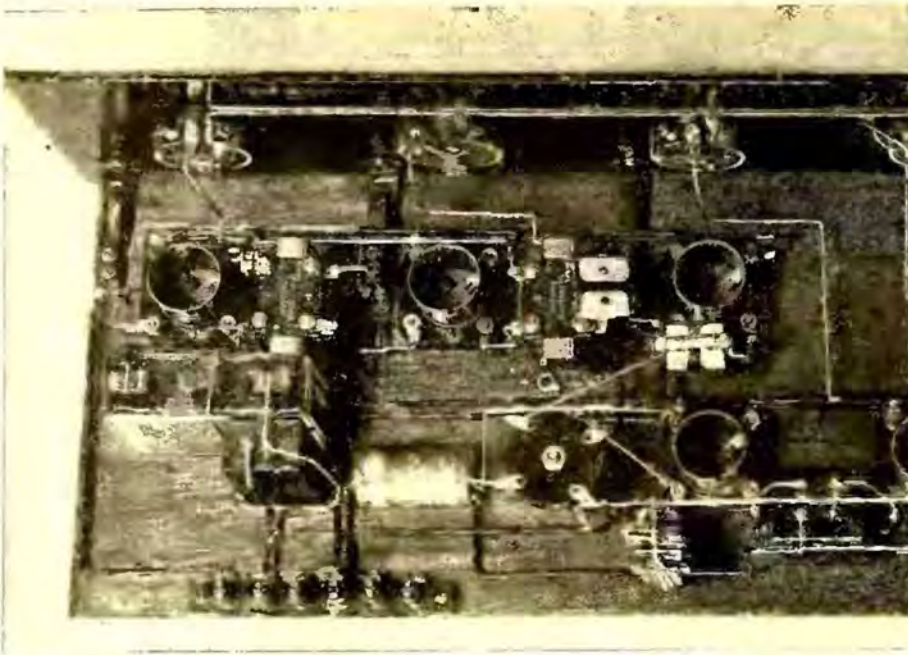
An aerial which, perhaps, gave very good service all Winter long may now hang too close to trees and shrubbery. As the foliage comes out, the absorption problem grows more serious and the aerial must be given more clearance. An examination will usually show that it can be rehung more advantageously. While doing so, see that the insulators are clean and free from carbon deposit. If they are of a porous design, change them for the glazed type. The lead-in

should hang free and clear of other objects. It must be well insulated where it enters the building. Be sure that the joint between the lead-in and aerial is a good one.

There are a number of changes that may have taken place in the set since last Fall. Unless the joints were soldered with rosin core solder or carefully wiped after soldering, many of them will be found corroded or coated with a copper salt. Flux often spreads to the panel and forms a partial short circuit, the effect of which becomes more and more apparent as warmer and damper weather approaches. Clean such parts with benzine and alcohol. Unless the rotors of your condensers are provided with flexible "pig tails," it is well to clean the points of contact with fine emery cloth. Dust between the plates with a pipe cleaner to remove dust particles and lint. If left in, they tend to collect moisture and cause leakage between plates. This cuts down volume and makes the set noisy.

Look for Broken Joints

WITH a pair of phones on your ears and the set in operation, go over it for broken joints. Tap each point separately with a lead pencil. With the head-set still on, test each movable part. If sudden clicks are heard, it is a sure indication of broken joints or loose con-



The picture shows a good example of how neat wiring should be accomplished. A compact wiring job like the above will withstand the tests of time. Unless your set joints were carefully soldered, the chances are that warm weather will have corroded them. The remedy is to clean such parts with benzine and alcohol. Brush between plates to remove dust, which will cause leakage if you do not watch out.

tacts. In case of loose joints, re-soldering will correct the trouble. Tightening nuts will usually correct the other.

Those of us who are using storage "A" batteries know that they must be recharged at intervals. We have come to recognize the symptoms which say—"low battery," and so little need be said on this score. But it is usually a fact that "B" batteries are allowed to get low before new ones are purchased. They should be tested frequently and as soon as the voltage has dropped ten or twelve per cent, thrown away. Under such conditions it will usually be found that the amperage has dropped to a very low figure. For this reason, it is not safe to allow the "B" battery to fall off much more, especially if yours is a set having more than two tubes.

Like the storage battery, the tube becomes run down and after a Winter's use it is in no condition to detect properly and amplify the weaker signals of summer-time. The tubes are responsible for much of the falling off that we have attributed to the weather.

The effective life of a tube is not determined by the length of time it can be used without burning out. Long before this occurs, most tubes cease to be efficient. To offset this gradual falling off, the filament is burned brighter. This still further hastens the tube's demise. Is it at all strange, then, that as Spring passes and Summer comes we find our sets almost useless so far as coping with the more difficult broadcast conditions is concerned?

So much for cause and effect—we have remedied the other troubles; now what can we do for the tubes?

When it was said that the tube, like the battery, runs low, the analogy should have been carried one step farther and the statement made that the tube, like the battery, can be recharged.

PRACTICALLY everyone of us has noted the instructions which come with tubes, for rejuvenating them. A few of us have tried these instructions, but so far as the writer's experience goes, no one ever "brought his tubes back" by such a procedure. This is accounted for by the fact that very few fans have the proper instruments for regulating or measuring the applied filament current.

A Step Forward

Within a short time instruments will be made available to all fans for re-

juvenating their tubes. Tests with this equipment reveal some very interesting facts. Tubes which have long since passed their period of usefulness can be brought back to apparently full normal. This also applies to tubes which have been paralyzed by excess filament voltage.

Frequently brand new tubes will show a marked improvement after treatment. In a number of tests, rejuvenation has made the tube noticeably superior to new tubes. Paralyzing a tube and bringing it back to life has been repeated as high as thirty or forty times without noticeably ill effects of any kind.

Heretofore, our tubes, like dry batteries, were discarded when their effective life had passed. Now that we can recharge them just like storage batteries. Let's make this a real radio Spring and Summer and enjoy the wonderful programs planned for us.

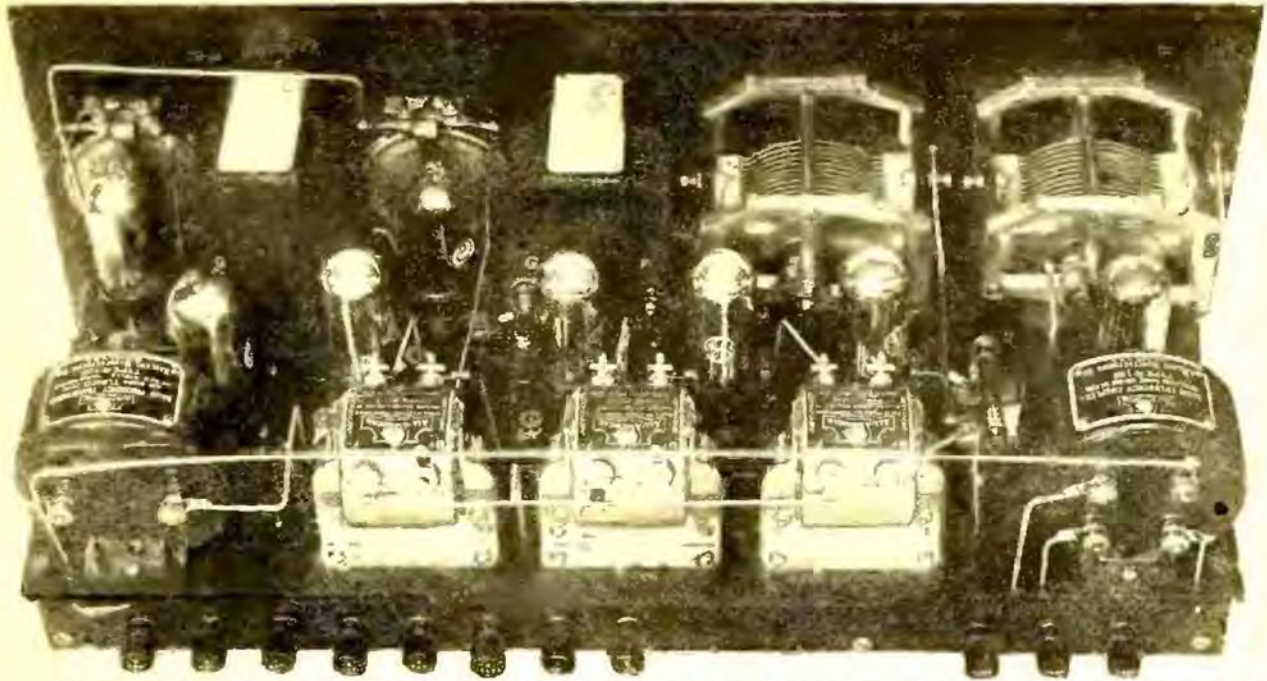
And while you're cleaning up and tightening up your set, you might cast an eye around the room in which it is located and tidy that up a bit. Nothing so irks a well-meaning housewife as to find hubby's or son's radio apparatus strung all over the bedroom, dining room, kitchen, or wherever the set happens to be located.

So for the good of all dispositions concerned, clean out all unnecessary parts and stow them away for future use. And while you're doing that, see that your aerial lead-in from the set to the window, and the ground connection are in good shape, for these vital factors of a set's operation, when not inspected from time to time, may develop faults that do serious damage to the receiver.

(Note: Mr. Green will be glad to supply detailed information regarding the tube rejuvenator to all readers of RADIO AGE who will address him care of this magazine.)



How a tube rejuvenator works. Such an instrument will renew the 201A and 301A as well as the UV199 and C-299 tubes in less than eleven minutes, it is claimed. As no meters are necessary, hosts of fans will find this set easy to build.



An unusual photo showing a rear panel view of Mr. Calcaterra's 8-tube super-heterodyne. Note the compact arrangement, which though utilizing every inch of space, is not crowded.

A PRACTICAL SUPER-HET

A UNIQUE 8-TUBE OUTFIT ON AN 18-INCH PANEL

GOSSIP for months past has been to the effect that the super-heterodyne circuit, the "king of all radio receivers," has been taken out of the mystic precincts of the laboratory and made into a practical proposition for the average set user. Yet it cannot be said that all of this gossip has been accompanied by any too much definite information in the way of diagrams and panel layouts which would enable set builders to turn out a super to grace the parlor rather than the laboratory—with respect to consistent reliability as well as appearance.

Supers have been in general great eaters of battery current, as well as occupiers of an ungainly amount of space. In the attempt to cut down the battery consumption, complications have been introduced, such as reflexing, which are hardly improvements from the standpoint of simplicity.

The super here described is unique in at least some of these respects. Embodying the full eight tubes of the standard Armstrong circuit, with each transformer separate so that it can be tested and interchanged independent of any other part, the entire set mounts neatly on a 7x18 inch panel and a 7x17 inch sub-panel, so that it fits any standard 18-inch cabinet. And if some of the veterans of supers of former years are inclined to look askance at the "crowded" arrangement of instruments and ask questions about inter-stage coupling, the writer can only answer that such inter-stage coupling has simply not put in appearance.

By Joseph Calcaterra

BILL OF MATERIALS FOR THE SET

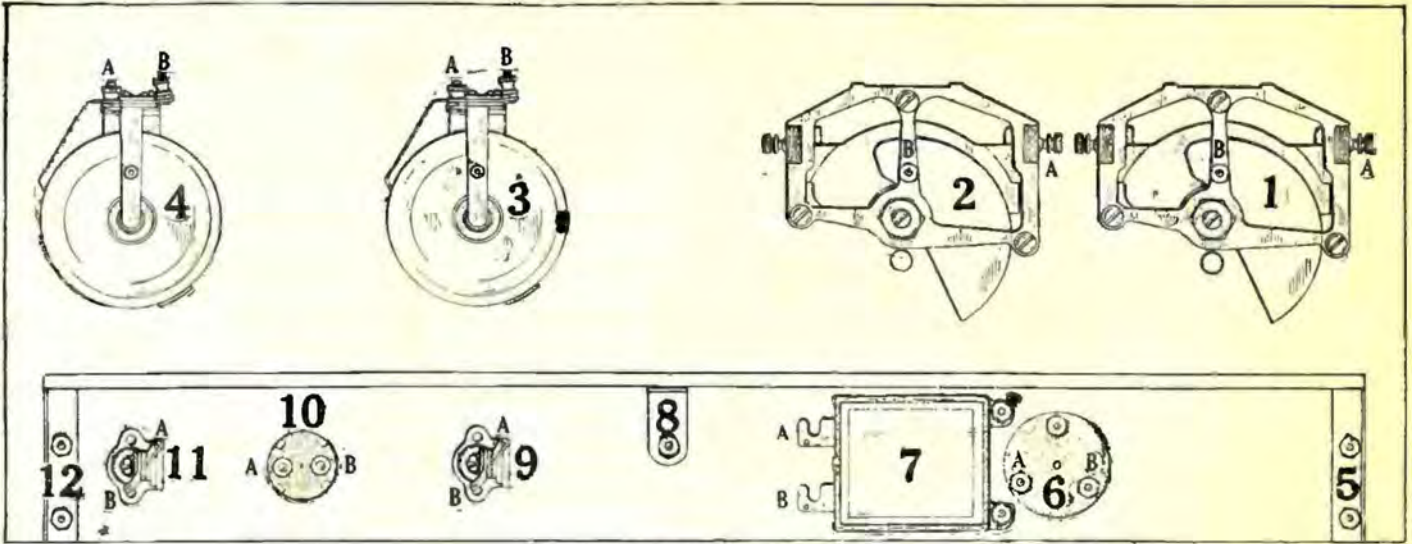
Reference Numbers	Materials
	1 Front Panel, 7"x18"x3-16".
	1 Sub Panel, 7"x17"x1-8"
	1 Binding-Post Panel, 1 3/4"x17"x3-16"
	1 Cabinet for 7"x18" Panel, 7 or 8 inches deep.
1, 2	2 Low-loss Variable Condensers, .0005 mfd.
3	1 Rheostat, 30 Ohm.
4	1 Rheostat, 6 Ohm.
5, 12	1 pair Shelf-Supporting Brackets.
6	1 Midget Variable Condenser, .000045 mfd.
7, 42	2 By-pass Fixed Condensers, 1 mfd.
8	1 Brass Angle Bracket, each leg 1 inch long; hole in each leg 3/8 inch from the bend. (Standard brass bracket obtainable at most radio or hardware stores.)
9, 11	2 Single-Circuit Jacks.
10	1 A Battery Switch.
13	1 Fixed Condenser, .005 mfd.
14, 16	2 Laboratory-grade Audio Transformers.
15, 17, 18, 20, 21, 22, 23, 24	8 Sockets for UV-199 or C-299 tubes.
19, 25	2 Fixed condensers with grid leak mounting clips. 0.0025 mfd.
19	1, 2 megohm grid leak.
25	1, 5 megohm grid leak.
26	1 Type R-130 Radio Frequency Coupler.
27, 28, 29	3 Type R-110 Long Wave Radio Frequency Transformers.
30	1 Type R-120 10,000 Meter Tuned Radio Frequency Transformer.
	2 Vernier Dials.
31, 32, 33	3 Binding Posts with "Loop" marking.
34, 35	2 Binding Posts with "C Batt—" marking.
36, 37, 38	6 Binding Posts, one of each of following:
39, 40, 41	Markings: "C Batt—"; "A Batt—"; "A Batt +"; "B Batt—"; "B Det +"; "B Amp. +"

THE instruments have been very carefully designed to permit mounting in a small space, without interfering electrically with each other, and the creditable performance in this respect is, therefore, not to be considered surprising. It must not be forgotten, either, that even in super-heterodynes, short wires are better than long ones, and close mounting permits short wires. Add to this technical advantage the great usefulness of an 18-inch set as compared with a 40-inch one for traveling purposes in the Summer time, and the set here described needs no further recommendation.

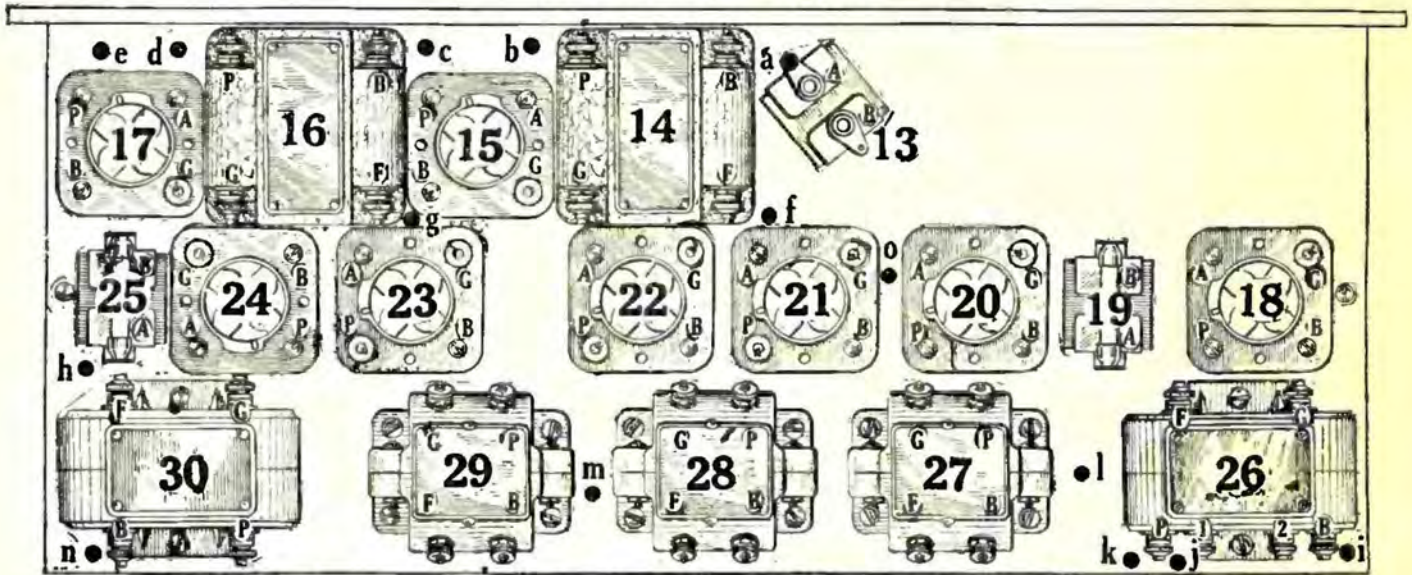
Tone is Paramount

It should be remarked, however, that tone quality has been considered paramount throughout this design, while the selectivity noted is fully up to the best super-heterodyne practice, it is believed that the tone quality obtainable, even with distant stations, is a distinct advance. Two features contribute largely to this—the use of broadtuned transformers in the intermediate stages, eliminating the necessity of delicate "matching," and the use of laboratory-grade audio transformers. In spite of this use of some rather high-priced parts, the entire set can be built at an expenditure for parts (not including tubes, batteries, etc.) of not to exceed \$75.00.

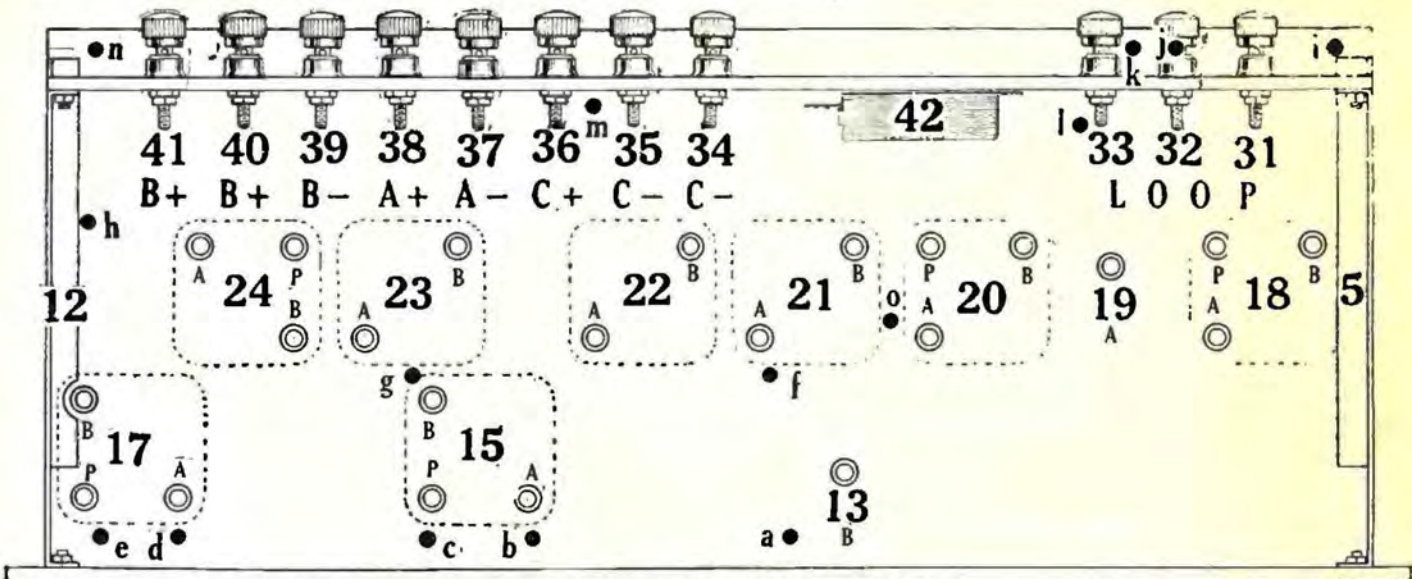
Simplicity of control is another point which has been carefully worked out in this design. Besides the two familiar major controls, there are only three minor ones. Yet the sensitiveness is not perceptibly less than that of any of the



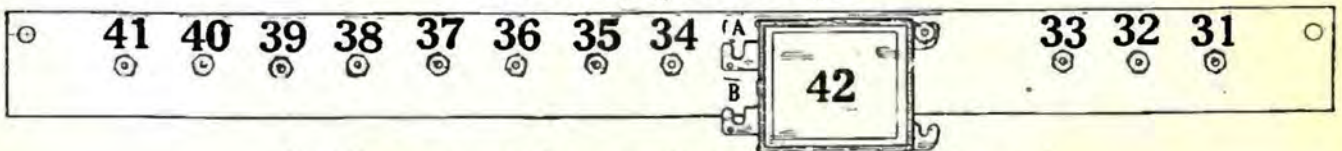
Rear view, layout of panel



Top view, layout of sub-panel



Bottom view, layout of sub-panel



Building post panel layout—view from front of set, inverted

well-known, complicated supers; a loop antenna not more than 18 inches in diameter will bring in distant stations.

The two photographs show the appearance respectively of the top and bottom of the set, and drawings are given which show the layouts respectively of the back of the panel, top and bottom of sub-panel, and binding-post panel. (See note at end of article.)

Parts Shown by Numbers

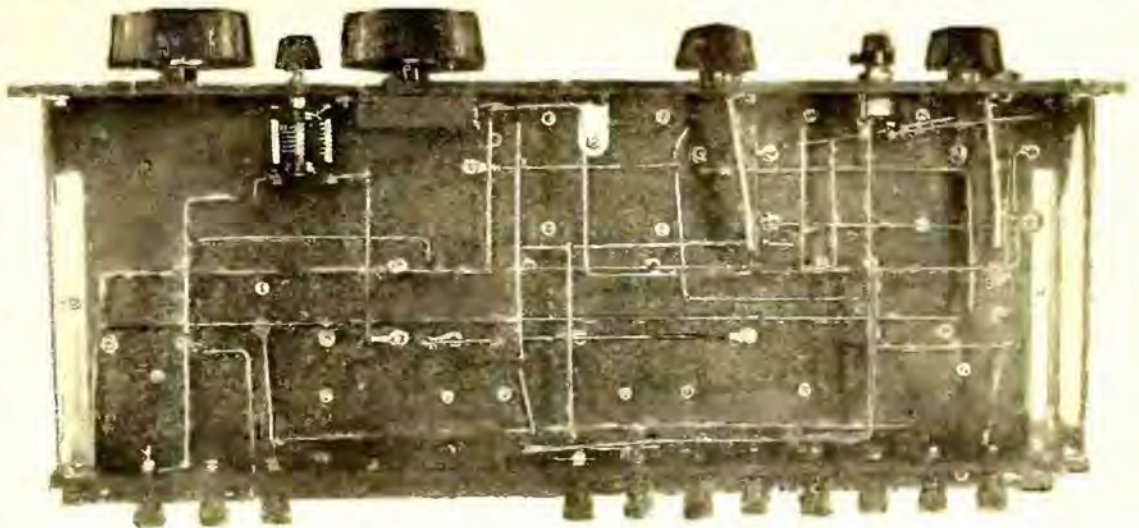
A WIRING diagram is also given, on which the parts are identified by the same numbers used in the drawings.

This circuit does not differ very much from the standard circuit; it has a special method of loop connection by which a certain amount of regeneration is introduced, under control of a small variable condenser (No. 6 in drawing). This sharpens the tuning to a marked degree.

All of the parts used in a super-heterodyne must, of course, be high-grade in order to get the results one expects from the circuit. It is not necessary to use the laboratory-grade audio transformers shown in the pictures, but since these are larger than standard transformers, the latter can be mounted in the same space with no difficulty whatever.

The holes in the sub-panel, through which wires are passed when making connections between terminals located above the sub-panel and others below the sub-panel, have been made conspicuous by being blackened. These holes are marked by lower case or "small" letters to distinguish them from terminal markings. These holes are not all shown in exactly the best position in the drawings here given, as a few have been shifted slightly to bring them into view.

It will be noticed in the photographs that there are very few wires visible from the top of the set, and this feature adds greatly to its appearance. The effect is obtained chiefly through the device of



A bottom view of the super-heterodyne receiver, showing the wiring arrangement before the parts are installed. After studying this diagram and the others in this article, the fan should have no trouble in placing the parts. Every part is clearly marked by a number in the diagrams on the opposite page.

reversing some of the binding post screws on the sockets. All of these posts which are shown on the sub-panel by slotted screw heads instead of by knurled nuts are thus reversed, and the wires are attached below the sub-panel. In some cases other connections are made also on top of the sub-panel, a soldering lug being here inserted under the screw head for that purpose. The reversed terminal screws going through the sub-panel are sufficient to fasten the socket to the panel without using additional screws for the purpose.

After all of the parts and binding posts are connected to the three panels, and the binding-post panel is attached by metal brackets to the sub-panel, the greater part of the wiring can be completed to best advantage before attaching the front panel. It is best to begin with all of the wires which can be connected on top of the sub-panel assembly. Next the wiring on the underside of the sub-panel should be completed, and then the wires which run through the sub-panel, between terminals located on opposite sides of it. The front panel is then attached and the remaining wires connected.

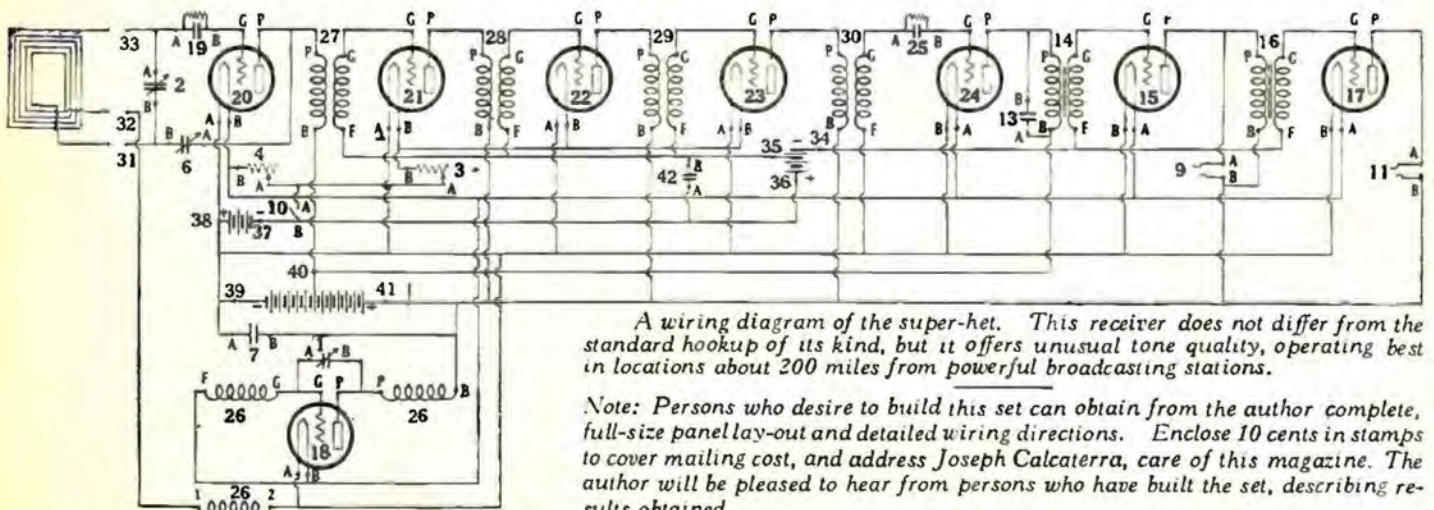
At one end of the sub-panel are the eight battery terminals. The A battery may be either six dry cells connected

three in series, or preferably a four-volt storage battery. Binding post 40 should be connected to the 45-volt B battery terminal for the first and second detector tubes, and binding post 41 to the 90-volt end of the B battery for the amplifier tubes. Binding post 34 carries a 4½-volt negative C battery voltage to the grids of the two audio tubes, while post 35 carries a 3-volt grid bias to the intermediate frequency tubes.

At the other end of the binding post panel are the three posts for loop connections. Post 32 should connect to a tap on the loop such that one-fourth of the total turns on the loop are included between posts 31 and 32.

To operate the set, turn on the battery switch and turn the rheostats about three-fourths of the way on. Set the small condenser, No. 6, at its minimum capacity and begin tuning with the two large variable condensers. When the set is working, gradually increase the capacity of condenser No. 6 to sharpen up the tuning, but not enough to throw the detector into oscillation. Rheostat 3 should be turned on as far as possible without causing loss of clearness of tone, and rheostat 4 should be turned down as low as possible without losing volume.

(See note below)



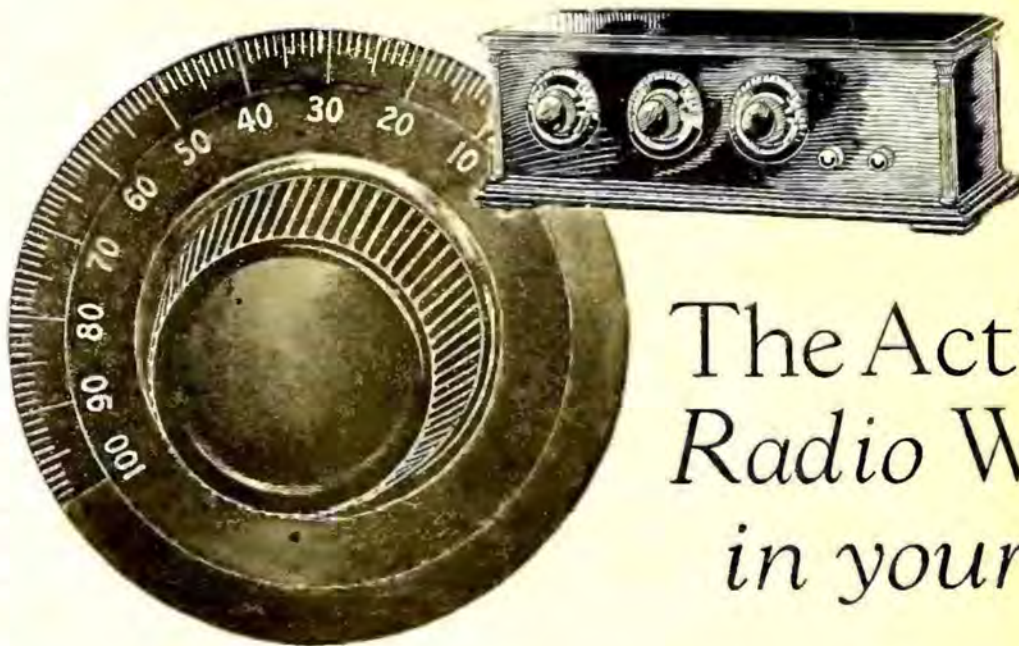
A wiring diagram of the super-het. This receiver does not differ from the standard hookup of its kind, but it offers unusual tone quality, operating best in locations about 200 miles from powerful broadcasting stations.

Note: Persons who desire to build this set can obtain from the author complete, full-size panel lay-out and detailed wiring directions. Enclose 10 cents in stamps to cover mailing cost, and address Joseph Calcaterra, care of this magazine. The author will be pleased to hear from persons who have built the set, describing results obtained.

The Physical Significance of Tuning

By Dr.
Frederick
W.
Grover

Who is a prominent Member of the Department of Electrical Engineering of Union College, Schenectady, N. Y., and recognized authority on the subject of radio waves.



The Action of Radio Waves in your Set

EVERY radio fan knows what is meant by tuning-in. You turn a dial on the receiving set until the sound is loudest. Without tuning, only the local stations come in, and it is impossible to separate one station from another. We tune our sets as a matter of course and naturally give little thought to the actual significance of what may be regarded as perhaps the most basic of radio adjustments.

I am asking your consideration of certain analogies which may be pointed out between the actions in a radio circuit and those in the more familiar cases of sounding or vibrating bodies. Analogies are helpful in that they illustrate unfamiliar things by pointing their likeness to things better known. However, when we liken an electric oscillation of current to the vibration of a sounding body, or an electromotive force to a mechanical force, it must be remembered that they are not identical things. We must use our imaginations subject to common sense, and make some allowance for points of difference.

Pitch Decides Wavelength

A STRING instrument is tuned by carefully tightening a string until, when it is sounded, it gives off the desired pitch. The pitch of the sound is, however, the same whether it is struck, plucked or bowed. We say that the string vibrates in its *natural period*. The same is true of any sounding body. Sound waves go off from it through the air and the pitch of the sound determines the wavelength; that is, the distance by which one pulse travels ahead of the next. Likewise a radio circuit may be set into oscillation by various means, but gives off electrical waves whose wavelength bears no relation to the method by which the oscillation is produced. The transmitting circuit has a natural

period just as in the case of the string. Whereas the pitch of the sound given by the string (so many vibrations per second) depends upon its length and tension, so the pitch of the electrical wave (so many kilocycles per second) depends upon the amount of inductance in its coil and the capacity of its condenser.

The analogy between a sounding body and an oscillating electrical circuit, used for broadcasting, may be extended to the case of a receiving circuit also. If you sing a single note forcibly into the top of a piano, you will observe that one of the strings faintly sings the same note after you. Investigation shows that the single string involved, if struck in the usual way, gives out this note and no other. Of the multitude of strings in the piano, all are practically unaffected, except the single string whose natural period of vibration agrees with the period of the sound vibrations sung. Shout another musical note, and another string responds, while the previous one joins the throng of silent strings. Evidently the sound waves of your voice have beat upon all of the strings of the piano, but are powerless to produce a noticeable vibration except in the case of the string which is tuned to the incoming sound waves.

How It's Done

LIKELIKE, the electrical waves passing out from a broadcasting station produce no appreciable oscillations in a receiving circuit, unless its natural period of oscillation is the same as that of the incoming electrical waves. When we tune a circuit to the electrical waves, it is just the same as though in the piano experiment we had worked upon a single string by tightening it or loosening it, until it responded with greatest loudness to the note sung against it.

To get a clear idea of the actions in-

involved in the vibrations of a sounding body, let us consider the simple case of a thin strip of steel, a foot long, clamped at one end in a vise. If the free end is pulled aside, we feel an elastic force resisting us, and this gets greater the farther we pull it from the original position. If now we let the spring go, the elastic force causes it to return toward the undisturbed position, and we observe that it will vibrate for a short time, sending out pulses into the air. If we try a much shorter and stiffer spring, suitable for a harmonica, the vibrations are more rapid and we hear a musical sound.

An explanation of the vibrations of the spring is briefly as follows:—The spring is bent aside at the start, and when released, the elastic force causes it to move. As it returns, the elastic force diminishes, and by the time the spring has reached the original undisturbed position, it has become zero. However, the spring keeps on moving because of its momentum, and as it passes the undisturbed position it begins to bend the spring in a direction opposite to the first, thus setting up an elastic force which works against the motion of the spring, slowing it down more and more until it comes to rest. The spring then moves back, and the sequence of events is repeated. If there were no friction, the spring would make equal excursions on both sides of the undisturbed position, and once started, the vibrations would never cease. Of course, this is never the case; the vibrations die down gradually and the spring comes to rest, since with each excursion the effect of friction is to reduce the distance traveled from the central position.

The original work done on the spring in bending it aside is the sole source of energy the spring possesses, and when this has been dissipated in overcoming the

(Turn to page 52)



Photo Copyright by Drake Studio

REMINISCENT OF THE FAR EAST—

were the intimate, quaint talks broadcast recently from KNX, Hollywood, Calif., by Anna May Wong, diminutive Chinese movie actress who has made such a "hit" with the cinema fans throughout the country. Despite the fact she's a native Chinese, Miss Wong talks like a typical New Yorker. However, she is able to convey real Oriental atmosphere by lapsing into Chinese dialect and crooning the weird songs of her native land.



What the Broadcasters are Doing



WEBW Quartet Gains Host of Friends

THE four imposing young men who are shown in the photograph on this page compose the famous Fairbanks, Morse & Co., Quartet at Beloit, Wisconsin, who broadcast almost every Tuesday evening from WEBW, in conjunction with the Fairbanks-Morse Concert Band. The quartet recently sang a noon hour concert from WMAQ, Chicago, which many readers may remember having enjoyed.

Three Lees and a Dave make up this musical four. They are: Dave McCullough, Leland Forman, LeGrande Warriner and LeGrande Brannen.

The first of the Lees is Leland Forman, who sings second tenor and who directs the quartet. The other two Lees are LeGrande Warriner and LeGrande Brannen, singing baritone and bass parts. Dave McCullough, the Scotchman who sings like an Irish tenor, is the fourth member and ably handles the top tenor notes.

"Our Dave," as his colleagues and thousands of listeners all over the country are calling him, sings more popular numbers than the other members of the quartet, who confine themselves almost entirely to classical compositions. Dave is one of the most popular entertainers in southern Wisconsin. Flappers who have been charmed by his sweet voice over the air will no doubt be disappointed and stop sending the station mash notes when they learn that McCullough is a happily married man. He admits it himself.

Brannen Popular Reader

LeGrande Brannen, the splendid bass singer, is also an accomplished musical reader. When the quartet recently entertained from Chicago, he gave a reading called, "The Game of Life."



"Dream Daddy" On Air for Uncle Bob

"DREAM DADDY" Harry Davis, one of radio's pioneer entertainers and one of the most popular jazz artists on the air today, is now enjoying a new role as "pinch hitter" for "Uncle Bob," (Walter Wilson), who has been delighting the kiddies during Bedtime Story Hour at KYW for the past few years.

Uncle Bob was ordered to take a prolonged rest by his physician, and Harry Davis volunteered to take his place while the kiddies' popular "Uncle" is regaining his strength in California.

And Harry, who made the song "Dream Daddy" famous several months ago, is doing well as the little tots' lullaby man from KYW, every evening between 6:30 and 7.

Davis has been with KYW ever since it went on the air and his method of presenting popular airs is known from coast to coast for its originality.

WJZ Requests Second "Best Announcer" Rating

BECAUSE of the large amount of public interest in the findings of the Radio Voice Technique Committee at its recent meeting, Station WJZ has requested that the committee hold another meeting for the purpose of comparing the announcers of all stations in and near New York City. The committee recently listened to wax records of a representative number of announcers and voted Herbert B. Glover, of WJZ, as the best of those announcers.

Great public interest has been shown in regard to that decision, and station WJZ feels that the term "Best Announcer" should be applied only to the winner of research in which every announcer has been examined. Charles B. Popenoe, manager of Stations WJZ and WJY, has forwarded the following letter to the committee:

"I am naturally most pleased that an announcer of Station WJZ should have received the highest rating at the recent meeting of the committee. The fact that the winning percentage was only 66 out of a possible 100 shows, however, that there is still much room for improvement in the announcing profession.

Not a Competition

"In view of the unexpectedly large amount of public interest in this question of who is the best announcer, I should like to suggest that the Radio Voice Technique Committee conduct another and more comprehensive rating of the announcers of stations in and near New York City. I realize that the committee, at its recent meeting, had no thought of identifying the holder of the highest percentage as the "Best Announcer" and that the findings were of a purely scientific nature."



Here is the famous Fairbanks-Morse Quartet which entertains the fans regularly from WEBW at Beloit, Wis. From left to right: Leland Forman, LeGrande Warriner, Dave McCullough and LeGrande Brannen. Dave McCullough, the Scotchman who sings like an Irish tenor, sang on the Radio Age program from KYW, Saturday, April 4.

Here is a Station That Realizes
That Many Listeners-in Are Women

Radio for Milady at WNAC

The First Aerial Millinery Show from
This Popular Boston Station Results in
A Flood of Letters from Devotees of Style

By OLIVER JENKINS



The demure hat shown above was one of the "hits" of the Millinery Show broadcast from the Copley-Plaza Hotel recently by WNAC.

WOMAN has been long accorded the privilege of changing her mind at a moment's notice. There are some people of the opposite sex who have little patience with this whimsical trait of womankind, asserting that it is merely a convenient refuge.

It goes deeper than that, however. A woman's life from beginning to end has a great deal to do with the word, "adaptability." She must be ready to adapt herself to all sorts of changes, even to that of changing her name. It is natural, therefore, that she yields easily to the tyranny of that most fickle of gods—the God of Style.

Perhaps you are wondering what all this has to do with radio. Well, Station WNAC, at Boston, claims that it has a lot to do with it. And Station WNAC ought to know something about it, for this station was the pioneer among the radio stations in the Hub of the universe.

Long ago this popular Boston station decided that the woman radio-fan was not being catered to as was fitting, and plans were made for doing something along this line. Miss Jean Sargent, whose voice is familiar to every New England listener-in, probably about a year ago hit upon a novel idea. She went to John Shepard, Jr., owner of the station, and outlined the scheme sketchily.

"Today," she said, "radio stations seem to have the belief that they must present programs which will please every variety of listener-in. All the way from jazz to grand opera must be traveled on each day's program. This cannot last. Sooner or later stations are going to realize that specialization will do the trick much better."

Women Have Radio Needs

SHE knew that there were many women becoming interested in radio. Furthermore, she knew that graphic descriptions of boxing bouts, business talks and stock reports contained little interest for the women members of most families. Something ought to be done about this.

"Why not a special period devoted to women each day?" she demanded.

"And what could you put into that period?" was the question asked her.

"Oh, all sorts of things. Cooking classes, style talks, advice on interior decorating, gardening—the subjects would be endless."

So the idea was tried out one morning over the radio. The result was surprising. Letters poured in from all over New England, filled with praise and demanding more such periods. It was too popular to remain cramped in an hour's period, however, and soon several hours a day were given over to the women fans. Even so, the station was handicapped in being able to cover only comparatively small territory with its 100 watts; imagine the joy and excitement, then, when news

was received last December that WNAC was going up to 500 watts.

The improvement in the station's power now makes it possible for it to thoroughly blanket the New England states.

Programs for women have been constantly on the increase. Each week saw a more elaborate progress in this direction. It was the day of March 4 that the crowning triumph thus far was reached. WNAC, on that day and evening, broadcast for the first time in radio history, a real, honest-to-goodness millinery show. The latest millinery for the coming Spring and Summer season was talked over at length, and vivid descriptions were given. All of the finest millinery artists of America and Europe were represented at this greatest of all millinery shows.

All the Styles by Radio

THE place was at the famous Copley-Plaza hotel, and in the spacious salon during the afternoon and evening, more than two thousand of the best-known hat designers looked over the models, discussed unusual creations and
(Continued on Page 55)



Here is one of those latest broad-brimmed hats which Miss Jean Sargent described from the style show microphone for the New England flappers.

How Station WCCO

Super-
for the
NORTH

AS TOLD BY

& Commerce Association. A brief history of how the station came into existence is as follows:

One morning late in July, 1924, the Northwest awoke to discover that it was to be without broadcasting service. This condition was brought about by the closing of the Twin City Station WLAG, operated by the Cutting & Washington Radio Corporation, and the closing of the Dayton Company's Station, WBAH.

Everywhere discussion was rife as to what the solution of the problem should be. This condition continued until August 5, when Washburn Crosby Company submitted a proposal to the Minneapolis Civic & Commerce Association and the Saint Paul Association. This proposal was as follows:

A Co-operative Plan

WASHBURN CROSBY COMPANY offered to buy the physical properties of WLAG and to contribute \$50,000 a year towards the support of the Twin City Station for a three-year period, providing the business men of Saint Paul and Minneapolis together would contribute a like amount for the same period. The station was to be known as the Gold Medal Station, and was to be credited both to Saint Paul and Minneapolis. Washburn Crosby Company also offered, if their proposition was accepted, to immediately place an order for a new 5,000 watt broadcasting equipment to take the place of the old equipment.

The proposition was accepted, and on September 12 the station became a reality. Carrying out the original agreement, Washburn Crosby Company placed an order for one of the new 5,000 watt broadcasting sets, which was designed especially for that territory.

On March 4 the new broadcasting equipment of WCCO was formally introduced to the public when it broadcast the inaugural ceremonies from Washington by remote control.

Wednesday evening, March 4, WCCO opened its new Minneapolis studios on top of the Nicollet Hotel with what was unquestionably one of the finest programs ever broadcast by a radio station. The program opened at 8:00 p. m., with a short talk by Governor Theodore Christianson of Minnesota, in which he outlined the value of radio to the public. The staff of the station was then intro-



Opening a new broadcasting station is a rather strenuous feat. The pair above, Paul Johnson, (seated,) WCCO's announcer, and Harry Wilburn, station manager, were jagged out after five and a half hours of steady announcing. In fact, Paul insisted that the microphone be brought to him. Wilburn tried to oblige.

WCCO—a broadcasting station with a purpose—that's the Gold Medal Station, Saint Paul-Minneapolis. Its purpose is to serve the Northwest, and twelve hours a day, seven days a week, they work at it enthusiastically.

Incidentally, you have probably noted their earnest endeavors in the last week or two, even if you are not a resident of the Northwest, for on March 4 WCCO blossomed out with its new 5,000-Watt transmitting equipment, and also on that evening inaugurated its new Minneapolis studios on top of the Nicollet Hotel.

The new transmitter is one of the super broadcasting units, and the Minneapolis studios are said to be the equal both in equipment and elegance of anything in the country.

New St. Paul Studios

NOT satisfied with this, the management of WCCO announced that they would immediately begin building

studios in Saint Paul. These will probably have the most unique location of any studios in the world, for they will be in Saint Paul's handsome new Union Depot used by nine railroads.

For, you must remember, the Gold Medal Station represents both Saint Paul and Minneapolis. It is not the toy of any group or class, but a big service unit representing two large cities and the huge territory which they serve.

The Gold Medal Station is also unique in the manner in which it is supported. The physical properties, including the transmitting station located on the east bank of the Mississippi, 18 miles northwest of Saint Paul and Minneapolis, the new studios on top of the Nicollet Hotel, and the new studios, construction of which has just begun in Saint Paul, are all the property of the Washburn Crosby Company, who also operate the station jointly with the Saint Paul Association and the Minneapolis Civic

Is Keeping Up-to-Date

Power Growing WEST

E. H. GAMMONS

duced over the air. At 8:30 began a musical program which continued for five hours. Included on this were the leading artists, orchestras, glee clubs, and quartets of the Northwest, the band of the famous Third Infantry, oldest regiment in the United States Army, now stationed at Fort Snelling.

Invitations were sent to approximately 5,000 residents of the Twin Cities to attend the opening and view the broadcasts. The result was a tremendous crowd, which jammed the hotel, elevators, hallways, and the studios themselves all evening, and gave ample evidence of the interest which Minneapolis and Saint Paul have in radio.

Towers 18 Miles Away

THE transmitting equipment of Station WCCO is located 18 miles northwest of the Twin Cities on the east bank of the Mississippi. There are the two 200-foot

aerial towers and the power house. Programs are received over specially built telephone wires from studios in Minneapolis and Saint Paul.



Carlo Fischer, noted musician and member of Minneapolis Symphony Orchestra, likes broadcasting because he can smoke his cigarette and enjoy playing.



Visitors at the Minneapolis studios of WCCO on the Nicollet Hotel may view the broadcasting through glass panels, as shown in the photograph. Roominess is one of the outstanding features of this novel station.

The new studios on top of the Nicollet Hotel are housed in a structure built especially for them. There is a small studio for individuals and a large studio for groups. Between them are the announcer's and operators' rooms. Glass panels in the walls of the studios make possible a view of the broadcasting by persons in the reception room and in the promenade along one side of the large studio. These studios are literally "hung in the air," the ceilings being suspended, the floors built upon cork, and the walls deadened by heavy drapes which are adjustable. They are luxuriously furnished and have been pronounced by those who have seen practically all of the broadcasting studios as being surpassed by none.

With "Service to the Northwest" as its slogan, the Gold Medal Station is now ready to provide the Northwest with programs to equal any.

New Director for WCCO

HENRY A. BELLOWS, well known magazine editor and musical critic of the Northwest, will become associated with WCCO soon as director, according to an announcement made by the management.

Mr. Bellows in the position of director will have complete charge of the arrangements for and all the broadcasts from the station.

He is nationally known as a writer, editor and an authority on music. For thirteen years he has been associated with the "Northwestern Miller," Minneapolis, as managing editor, associate editor and director. Prior to that he was editor of "The Bellman."

The West Proclaims a Champion

☞ "Uncle John" Daggett of KHJ, Los Angeles, is Contest Winner for March

By Harry Aldine

☞ Intensive Campaign May Upset Popularity Leaders at Any Moment

*"For East is East and West is West, And Ne'er the twain shall meet."
—With apologies to radio.*

RADIO, the great annihilator of distance, has reached out its mighty arm and placed its finger on a spot amid the orange blossoms and has sought out the Master of Ceremonies of the broadcasting station known as KHJ, at Los Angeles. And, meeting on common ground, the East has turned West to proclaim a new champion in the person of our beloved "Uncle John" S. Daggett, the winner of RADIO AGE'S popularity contest for the month of March.

A newspaper man for many years, Uncle John has long since learned what constitute the fundamental elements of human interest. And by carrying his unassuming geniality from the editorial offices to the broadcasting studio of the Los Angeles Times, he was at once accepted as one of the foremost announcers of this country. For he is anything but supercilious.

Step into the studio of KHJ and you will there find a tall man with sparkling, kindly eyes, rumpled gray hair and a winning smile. Look into his heart and you will discover a fatherly personality that radiates through the microphone, bringing cheer to the sickroom, the children, the house-wife and the business man alike. Just such a man is Uncle John.

A Suitable Inspiration

SURROUNDED as he is by singing canaries, the studio forms a fitting setting from which to gather inspiration in entertaining the little folks. In this he instantly gained popular favor, particularly in introducing Queen Titania, the golden haired tot of the "movies," and the Sandman, O. G. Pirie, her father. This trio has done much to entertain and at the same time teach the kiddies the proper way of living.

For John Daggett believes that the voice of radio should do more than merely entertain. Versatile as he is dynamic, he feels that the public is betrayed if a



Here is "Uncle John" himself, the beloved friend of the grownups and children at the station of "Kindness, Happiness and Joy," where the orange blossoms come from.

performer is not inspiring to better things of life and likewise educational. The entertainment must be wholesome, and above all it should appeal to the masses.

Religion is given its place in the schedule of KHJ, and here, too, Uncle John has shown his keen understanding by offering the microphone to all sects and denominations.

In observing the spirit of close harmony ever prevailing between the director and his many artists, one at once understands why Uncle John has little difficulty in securing real talent for the delight of his many listeners. Despite his portrayal of diligence itself, he always has time for a pleasant sally or kind remark for all who come in contact with him. The studio houses one large "happy family."

And the radio artists are not the only ones present. John Daggett extends the hand of cordiality to all visitors to the

capacity of his studio. Those of his vast audience who desire a "close-up" of what happens behind the scenes are assured a genuine treat of true western hospitality.

KHJ, the visitor is told, means Kindness, Happiness and Joy, and if you have not already been convinced, just give

your dials a twirl some night to the 405 meter wave and stand by to be washed overboard by the joyful, "KHJ, Los Angeles, California."

THE WINNER FOR MARCH

John S. Daggett—Announcer.....KHJ, Los Angeles

WINNERS OF PRECEDING MONTHS

July.....Duncan Sisters, KYW
August.....Bill Hay, KFKX
September.....Karl Bonawitz, WIP
October.....H. W. Arlin, KDKA
November.....Bert Davis, WQJ
December.....Jack Nelson, WJJD
January.....Art Linick, KYW
February.....Coon-Sanders Orchestra, KYW

STANDING TO MARCH 15

Name and Classification	Where Heard
Karl Bonawitz, Organist	WIP, Philadelphia
Bill Hay, Announcer	KFKX, Hastings
H. W. Arlin, Announcer	KDKA, Pittsburgh
Coon-Sanders' Nighthawks, Orchestra	KYW, Chi.
Harry M. Snodgrass, Entertainer	WOS, Jefferson City
Jack Nelson, Announcer	WJJD, Mooseheart
Bert Davis, Entertainer	WQJ, Chicago
John S. Daggett, Announcer	KHJ, Los Angeles
Art Linick, Entertainer	KYW, Chicago
Ford & Glenn, Entertainers	WLS, Chicago
Duncan Sisters, Entertainers	KYW, Chicago
Lambdin Kay, Announcer	WSB, Atlanta
J. Remington Welsh, Organist	KYW, Chicago
Fred Smith, Announcer	WLW, Cincinnati
E. L. Tyson, Announcer	WWJ, Detroit
Hired Hand, Announcer	WBAP, Fort Worth
"Sen" Kaney, Announcer	KYW, Chicago
Nick B. Harris, Entertainer	KFI, Los Angeles
Jerry Sullivan, Announcer-Entertainer	WQJ, Chi.
Edward H. Smith, Director-Player	WGY, Schenectady
Charles E. Erbstein, Announcer	WTAS, Elgin
Lee Sims, Pianist	KYW, Chicago
Wendell Hall, Entertainer	WDAF, Kansas City
Howard Milholland, Announcer	KGO, Oakland
Scottish Rite Orchestra	KGO, Oakland
Banks Kennedy, Entertainer	WEBH, Chicago
S. Hastings, Announcer	KFI, Los Angeles
Robert Boniel, Announcer	WEBH, Chicago
Arion Trio, Instrumental	KGO, Oakland

Deadline Is Near

THE contest is rapidly drawing to a close. At midnight, June 15, RADIO AGE will accept the last of the ballots cast for the many favorites in the Popularity Contest.

During the period from February 16 to March 15, John Daggett by virtue of having garnered the greatest number of votes through the thirty days, advanced his position from twelfth to eighth place. It will also be noted that H. W. Arlin, Harry Snodgrass, Jack Nelson, Fred Smith and "Sen" Kaney have all strengthened their positions in "Standing to March 15." Charles Erbstein, Lee Sims and Arion Trio are newcomers to the list.

Up to now, the candidates at the head of the list have been fairly consistent in their leadership, but in spite of the short time that the contest has yet to run, victory is by no means assured to any one of them. Many a race is won or lost by clever jockeying near the finish.

So now for the smashing drive! Your opportunities to say it with ballots for your favorite are limited. Clip the coupon and send it in now while the contest is fresh in your mind.

POPULARITY CONTEST COUPON

Harry Aldine, 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].....



Children like to hear children broadcast. Ford and Glenn discovered that fact, and today their popularity is tremendous. Above is shown Tiny Violet Sileo listening into the WLS microphone for admiring youngsters. At the left, Dorothy Blackwell of WEEI, Boston, is introducing a new "pal" to the 7,000 members of the "Big Brothers" Club.

Common Sense Replaces Nursery Rhyme Methods

THE BEDTIME story is coming into its own. Not so very long ago the "queer" ladies and gentlemen who furnished the entertainment for the kiddies by radio had quite a hard time getting the radio public to take them seriously. In fact, they had a hard time taking themselves seriously, and as a result the great American sport of radio bedtime story-telling failed to rise above the level of crude humor for several months after the popular advent of the broadcasting art.

The originators of the bedtime story idea thought that to amuse the kiddies they had to adhere strictly to nursery rhyme psychology. They never thought for a moment that maybe their childish listeners could rise above the moron plane and enjoy some real common-sense Children's Hours.

The entrance of a new form of Bedtime Story material occurred almost simultaneously in Boston and Chicago. The owners of Station WEEI in Boston decided to form a "Big Brother" Club along the lines of the well-known organization of that name, and to appeal to boys and girls of all ages by the radio. No silly Bedtime Stories, mind you; no childish prattle on how this little brown bear came home with his folks and found his meal absorbed by an unknown mouth. The Big Brothers of radio set out to do some real work among the children, and to substitute this brotherhood movement for the meaningless kindergarten material that persisted in remaining part and parcel of every radio station.

7000 Child-Members

WEEI'S idea was an immediate success. In a little over a year membership in the Big Brother Club has jumped



"Uncle Bob" (Walter Wilson) of KYW, who is known to millions of children who listen to him every night at Bedtime Story Hour

to 7000 child members, ranging from 1 to 14 years. "Bob" Emery and Dorothy Blackwell are the guiding lights of this juvenile institution, and it is through their efforts that the Big Brother Club is today one of the strongest children's organizations in the country.

While all this was going on in the East, Walter Wilson, the original bedtime story man known as "Uncle Bob" from KYW, Chicago, was changing his mode of "approach" also.

Uncle Bob had been with radio from the start, and he had tried every known means of gaining the favor of the kiddies. Of course, his nursery rhyme method was successful, for he had the knack of conveying his personality from the studio to the children listening in, but like the few keen-minded radiologists of two years ago, Wilson realized the children must have something better or they would soon outgrow his daily Bedtime Story Hour.

So Uncle Bob formulated a standard Children's Hour program that not only interested all children—everywhere—but their parents as well! His method today consists largely of singing and playing the piano, intermingling modernized children's songs with the well known popular melodies. And this new method has been so successful that KYW's bedtime story listeners have doubled during the past year.

A New Kind of Bedtime Story

By RUSSELL H. HOPKINS

"Uncle Bob" Wilson believes in personal contact, and his immense popularity can be largely attributed to his making periodic "personal" appearances in towns where his Bedtime Hours are most popular. Both Wilson and KYW realize that this is an invaluable aid in holding the station's young friends.

Children Help, Too

FORD RUSH and Glenn Rowell, the Bedtime Story Boys of WLS, Chicago, get closest to the children's hearts by introducing the policy of having children do broadcasting during "Lullaby Hour" from WLS. On certain days of the week Ford and Glenn invite ambitious Lullaby Listeners to participate in their intimate talks with the radio listeners, and as a result, thousands of children who are WLS "fans" are competing among themselves to be chosen to help "Big Ford and Little Glenn." The popularity of their Lullaby Club has resulted in a tide of correspondence that nearly equals that received from all other programs combined.

And Ford and Glenn abandoned story-telling long ago. Instead, they talk to each other in a personal way and talk to the kiddies as if they were in the same room.

Truly, this is an era of new things in radio and especially in the gentle art of winning juvenile listeners and holding them as they grow older.

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Some Radio Programs and Personalities

Behind the Scenes

at KFI

Where Broadcasting Is an "Art"

By MARGOT LYON

Program Director, KFI,
Los Angeles, Cal.

THE phonograph and the camera introduced the surprising fact to many people that other people did not see and hear them as they saw and heard themselves. The latest development of science in disillusioning some and enchanting others is the radio. As has been often said of other things, you never can tell who's who over the radio until you have heard them over the radio.

Many of KFI's artists have sung but rarely elsewhere, some of them coming to KFI with friends just to see what went on behind the scenes, and, singing just once at the request of some of the regular artists, have made such a success that they have come again and again.

It is peculiar to witness the reaction of those who hear singers in the studio and then walk out to the loud speaker and hear the same voice as it comes off the air. A tenor whose voice in the studio seems to lack resonance and purity will broadcast with the utmost clarity and sweetness, his broadcast voice leaving nothing to be desired, whereas a trained voice, that from the concert stage has delighted thousands, will not "radiate" well at all.

It's Not a "Cinch"

DUE to the difficulty in judging a good radio voice and to other reasons not so easy to illustrate, the position of a program director is no sinecure. However, the vast KFI audience seems to be pleased with the station's efforts, to judge by the many letters they send.

The demand of radio broadcasting has developed a supply of radio entertainers. The field of broadcast entertainment is being widened by the sincere efforts of the studio managers and the artists.

As in the early days of vaudeville, the first effort toward entertainment has been the attempt to present novelties and unusual stunts. However, more and more over the radio, as over the footlights, the combined effort of artist and station has developed a sincere and worth-while form of entertainment eminently fitted for the needs of radio.

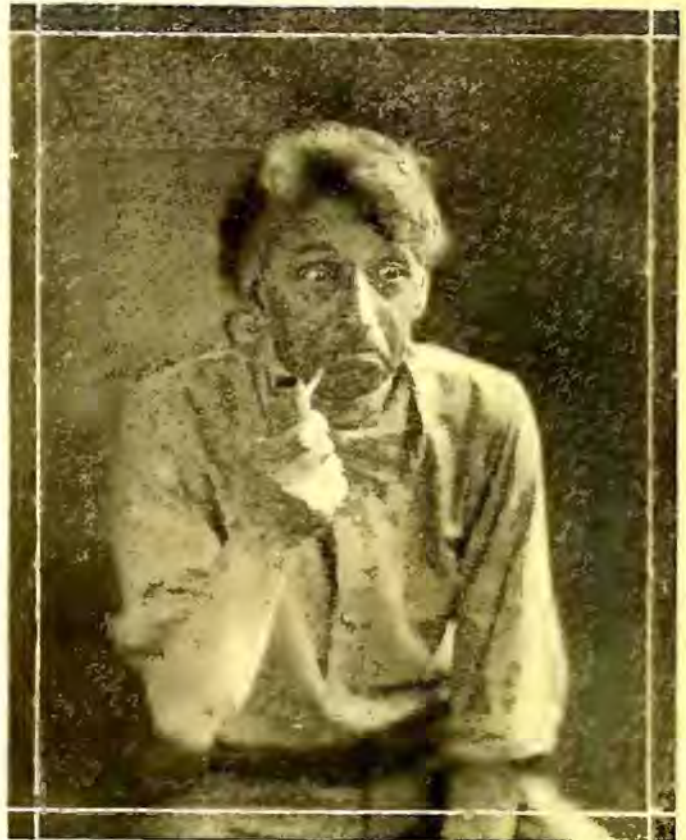
The audience, listening with headphones or with loud speaker, are blind as far as the studio and what is broadcast from the studio are concerned. Every program must be planned from the start as though it were being played before a theater with the lights off. Although this may seem self-evident it is not generally considered. Every trick of the human voice, every intonation, inflection and articulation must be polished to the last point before the audience can attain the maximum enjoyment from the program.

By letters and by broadcast requests for information, KFI has made up charts of the type of program most enjoyed by the public and finds that almost every kind of program has its adherents. For the humorous monologue to the classic string quartette come letters from isolated farms and from yachts and country estates. Strange to say, the letter in favor of the string quartette is more than likely to come from the tired wife of the farmer, who washes dishes or irons her clothes a thousand miles away from KFI, while listening to Mozart or Haydn.

Letters come in from the blind whose only comfort is the radio and from the deaf who perhaps have never heard a sound from the great silent world until with ear-phones they have picked up a program from KFI.

Phone Lines Always Busy

ONE of the most interesting things to be met with in the broadcasting station is the number of telephone calls that come in during the various programs, ranging from requests for various numbers to inquiries as to the proper feeding of a baby and what are the ten points of a prize winning Airedale.



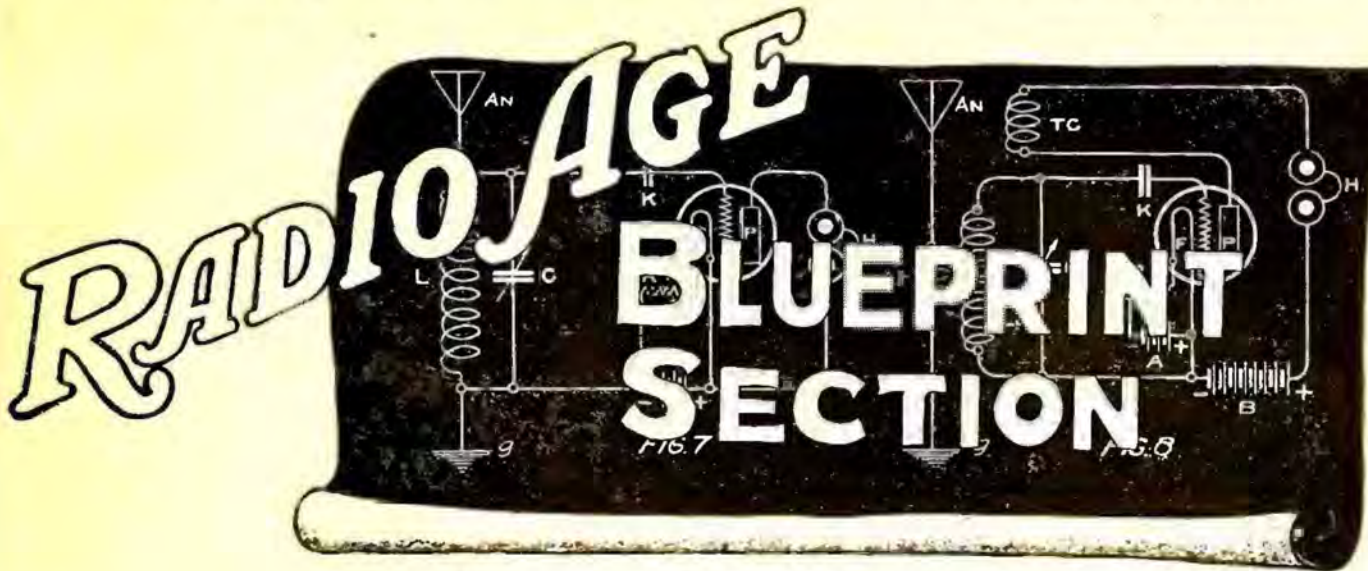
Frank Oliver, a traveling radio dramatist, is one of those rare artists who believe that they must dress and act the personality they seek to portray in the studio itself, if they hope to convey that same personality to the listener, who can only "visualize" through his ears.

Somewhat peculiar are the requests for songs. A singer may just have finished "Pace pace mio dio" when an ingratiating voice will ask, over the phone of course, if the lady who just sang could please render "Charley, My Boy."

Sometimes there is a great deal of pathos in the requests. One particular night a frantic mother called asking if we could not in some way help her to locate her little boy who had strayed away. It had to be explained to her that the laws of broadcasting did not permit such announcements to be made. Other times an old time number will be asked for, to please some one who is ill or shut in. Then the artists will scurry about and among themselves refresh their memories and the most daring of them will attempt to "fake" a piano accompaniment.

It is not possible to grant all the requests asked for during the actual broadcasting hour, and it is the habit of KFI at certain times to ask those who wish to hear their favorites sing certain numbers to be sure to write in their requests so that the artists may plan on pleasing their friends. When the fact is known that as many as thirty requests have been phoned in during one hour for one artist, such as Starr

(Continued on page 54)



A Compact Traveling Set The 6-Tube "Portatron"

By JOHN B. RATHBUN

Copyright: 1925

Controls are Simple and Operation Quiet

COMPACT portable radio receivers, having sufficient power to operate on either loop or flat top aerial, are desirable for home use as well as for camping and motoring trips. Provided with self-contained batteries, such outfits can be easily moved about from room to room in the house or can be carried to the home of a friend to provide music for a dance or for other similar occasions. The portable has a much wider field of application than the conventional, cumbersome cabinet with external batteries, and should be seriously considered by those who desire a receiver of the all-round type.

For the sake of simplicity, such an outfit should be of the single control type, or should not have more than two controls at the most. It should have at least two radio frequency stages for distance and for operation on a loop aerial, and at least two audio frequency stages for loud speaker operation. With transformer coupling this means at least five tubes, if the tubes are not reflexed, and we must therefore carefully consider the methods of coupling the stages to conserve space and to minimize the number of controls.

Dry batteries must be used for the filament "A" battery, and the type of tube must be such that not more than three or four No. 6 dry cells will be required. This, of course, suggests the "199" tube, which is ideal for a portable rig because of its low filament current consumption and small size. Five "199" tubes will take $5 \times 0.06 = 0.30$ ampere which is not prohibitive for dry cell service, and the cells will last for a considerable length of time on such work. Six tubes will take: $6 \times 0.06 = 0.36$ ampere which is within reason.

Transformer coupling between either the radio frequency or audio frequency stages takes up considerable room. If the R. F. transformers are of the "tuned" type then they must be spaced well apart to prevent coupling back between stages,

and this system must therefore be discarded right at this point, both for the reason that it takes up much room, and also for the reason that a separate dial control will be required for each radio stage (and for the tuner unit in addition) which will bring the total number of controls up to three or more. This is out of the question in a portable outfit; hence we must look farther for a means of radio frequency stage coupling. We should have only a single selective control for the tuner unit, and no variable controls after the first stage that are represented by dials or knobs on the front of the panel.

Resistance Coupling

Resistance coupling for the radio frequency and audio frequency coup-

ling requires no separate interstage controls, but unfortunately, resistance coupling in the radio frequency stages is only efficient on long wavelengths, say on wavelengths above 1,000 meters. This resistance coupling method will be fine for the audio stages, and is just what will be used for the output, but we will have to guess again in regard to the coupling on the R. F. end of the hookup. The untuned or fixed radio frequency transformer at once suggests itself, but for this time it must be rejected because of the space occupied and for the reason that such transformers are likely to "back-couple" between stages if crowded together as closely as we intend to crowd the stages of this outfit.

THERE is only one other coupling possible on the R. F. end, and that is by means of inductances of the "choke coil" order, which are connected into circuit just like the resistance units of a resistance coupled stages. One end of the choke coil is connected to the plate of the tube, while the other end goes to the (+B). The connection between the first tube plate and the grid of the following tube is made through a fixed condenser just as in the case of the resistance coupling scheme. The choke coils must have a very much higher inductance than commonly used with radio frequency tuning units. They should consist of several thousand turns of very fine wire. The secondary coil of an audio frequency transformer will be just about right for this purpose when standard 100 Millihenry chokes cannot be obtained. The inductive value must be sufficient to choke back the high frequency plate current so that it will not short circuit back through the "B" battery connections, and at the same time the coil resistance should not be sufficient to interfere with the supply

(Turn to page 34)

THE RECEIVER FOR YOUR NEEDS

This Summer's tendency will be for simplified radio receivers, with compact parts and ease of operation and control. A radio, set without these characteristics cannot be called up-to-date.

THE RADIO AGE ANNUAL for 1925 contains several of these wonder hookups that are easy to build, easy to operate and pleasant to hear. The latest in portable sets as well as the larger models are all in this new ANNUAL, which is yours for \$1. Send your remittance now if you want to have this radio handbook with you on your vacation this year as an ever-ready radio guide.

\$1 while they last.

Blueprints of the Six-Tube "Portatron" on Two Pages Following

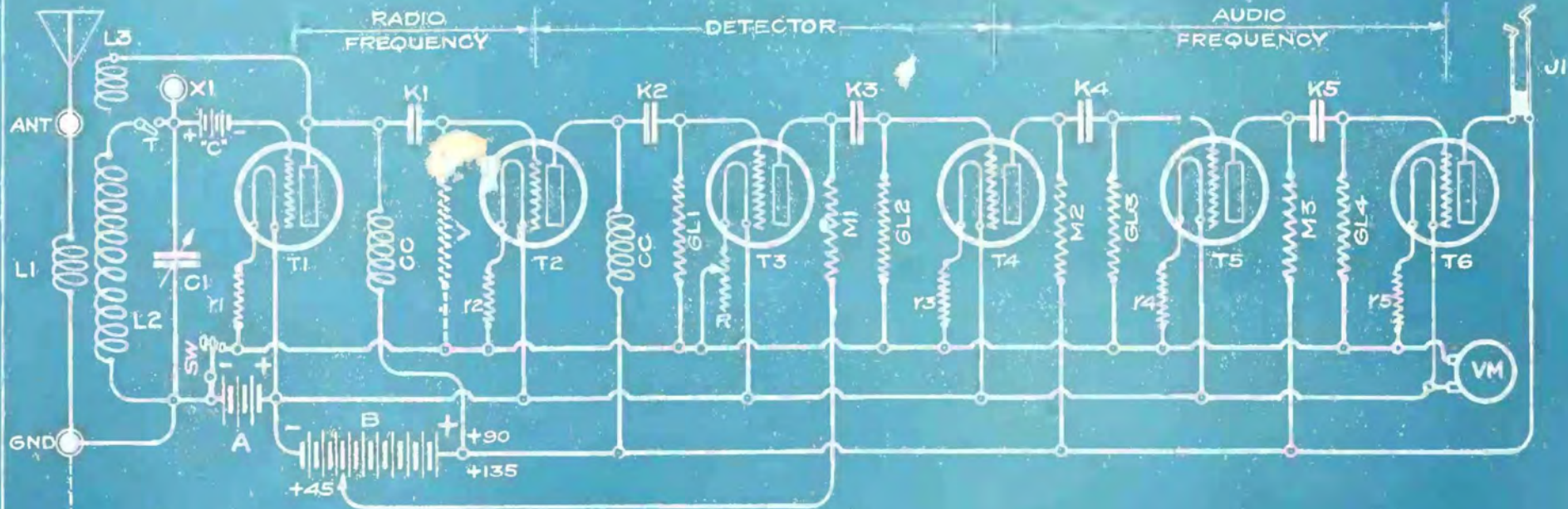
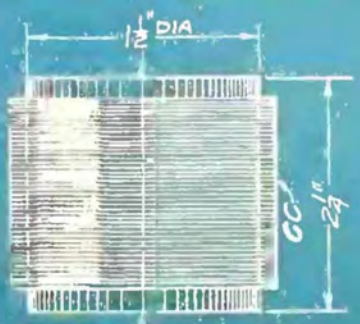


FIG. 1
SCHEMATIC DIAGRAM OF SIX TUBE PORTABLE SET WITH
COMBINED IMPEDANCE AND RESISTANCE COUPLING.



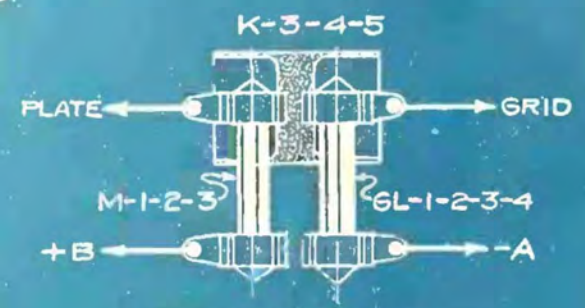
DETAIL OF COUPLER

PRIMARY AND SECONDARY COILS (L1-L2) ARE THE COUPLER TUNER COILS, WHILE COIL (L3) IS TO CHECK FREE TUBE OSCILLATIONS. ONE END OF (L3) IS LEFT OPEN AND OTHER END IS CONNECTED TO PLATE AS SHOWN IN DIAGRAM ABOVE.



DETAIL OF CHOKE

ABOVE COIL CAN BE USED IN PLACE OF TRANSFORMER SECONDARY. WIND 450 TURNS OF NO. 36 D.S.C. WIRE ON TUBE.



RESISTOR COUPLING

SHOWING ASSEMBLY OF RESISTORS, COUP. CONDENSER, AND GRID LEAK, ETC. SEE DIAGRAM ABOVE FOR CONNECTIONS.

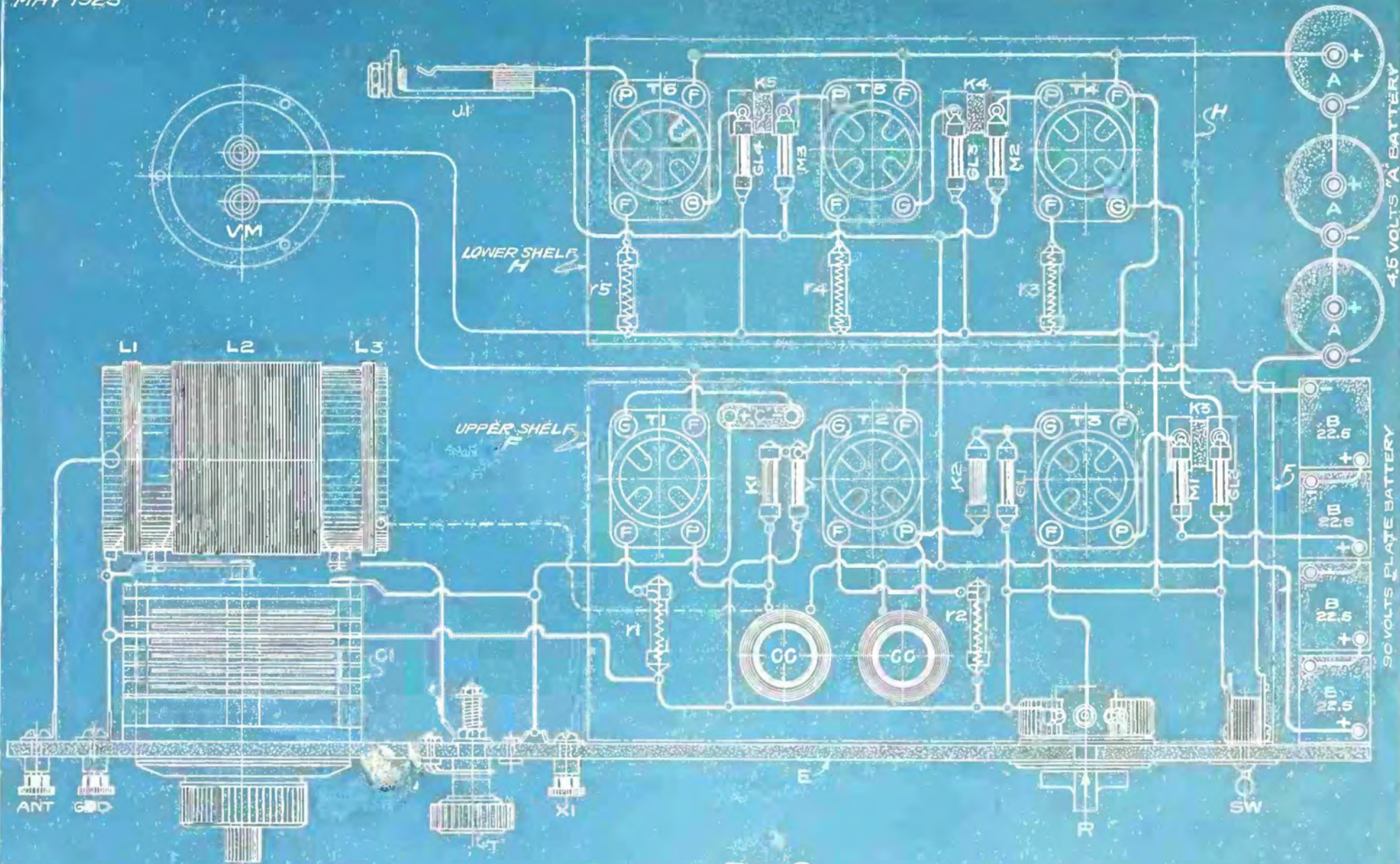


FIG. 2
SIX TUBE PORTABLE SET

"PICTURE DIAGRAM" OF WIRING AND CONNECTIONS SPREAD OUT IN ONE PLANE OR LEVEL. DUE TO THIS ARRANGEMENT, THE TWO CHOKE COILS (CC) APPEAR CLOSER TOGETHER THAN THEY SHOULD. SEE FIG. 4.

(Continued from page 31)

of continuous "B" battery current to the plate of the tube. The choke coil permits the "B" battery current to pass to the plate, but chokes back the R. F. current.

Radio Frequency Amplification

THE application of the choke system to the first three tubes will be seen in Fig. 1 and Fig. 2, where Fig. 1 is a schematic diagram using symbols, and Fig. 2 is a picture wiring diagram. The first will be of more service to the experienced builder in "doping out" the circuit, while the latter will show the novice how the wiring connections are actually made to the parts. Fig. 3 is a front elevation of the panel and cabinet, while Fig. 4 is a rear elevation showing the parts assembled at the rear of the panel. Fig. 3A is a sectional view as seen from one side of the assemblage.

Taking Figs. 1-2, we see that an aperiodic type coupler is used at (L1-L2) which is tuned by vernier variable condenser (C1) connected across the secondary coil (L2) of the coupler. This can be a home-made coupler such as has been described many times in these columns; it can be a standard neodyne transformer or else a standard adjustable aperiodic tuner. In any event, the primary coil, (L1) is untuned. When the usual flat top aerial is used, the aerial lead-in wire is connected to (ANT) and the ground wire at (GND), a system which gives the greatest range and signal strength. By connecting the ends of a loop aerial at (X1) and (GND), and then opening the grid switch (T), we can operate on the loop aerial. The tap switch (T) cuts out the secondary coil (L2) which is necessary on loop reception. Coil (L3) suppresses oscillations.

When operating on the flat top aerial, or a type similar to the usual outdoor aerial, the coupling between the primary (L1) and the secondary (L2) must be very "loose;" that is, there must be a considerable space between the two coils. For this reason, it is best to adopt a ready-made coupler in which the coupling gap can be easily adjusted until the proper degree is found by experiment. We have only one control, and to obtain the proper selectivity in local jams we must have the proper "looseness" between the coils. The home-made coil generally contains from 12 to 15 turns of No. 26 D. S. C. wire on the primary (L1), and from 55 to 60 turns on the secondary coil (L2), using the same size wire. The distance between the two coils, or the coupling, may be from $\frac{5}{8}$ inch or even greater.

By using a 4.5 volt three cell "C" battery at (C), we usually get greater sensitivity and signal strength, and the battery also reduces the tendency towards free oscillations in the circuit. However, the "C" battery can be omitted in many cases without serious loss. The switch (T) can be the usual form of tap switch with one active contact point, and one dead contact.

The first radio frequency tube (T1), which follows the tuning inductance, is provided with the choke coil (CC) connected to the plate at one end and to the (+B) line at the other, so that from 90

to 135 volts of "B" battery will be maintained on the plate. The plate of tube (T1) is coupled to the grid of the second R. F. tube (T2) through the fixed coupling condenser (K1) which is ordinarily of 0.002 mf. capacity. This condenser prevents the application of the plate voltage to the grid of (T2) and thus prevents the high "B" voltage from paralyzing this tube. The choke coil (CC) can be the secondary winding of an audio transformer, and as will be seen, prevents the R. F. plate output from short circuit-

YOU PORTABLE FANS!

If you want a smaller and even more compact portable receiver than is described in the RADIO AGE Blueprint section this month, you'll find another in the JUNE ISSUE, out May 15. It will be

A 3-TUBE PORTABLE REFLEX

"THE BABY OF THEM ALL."

Just the thing to put in your suitcase for that vacation trip.

By John B. Rathbun

IN JUNE RADIO AGE

ing through the "B" battery. It allows the "B" battery to go to the plate of the first tube, however, but stops the high frequency current from backing out. This requires no control.

Filament Controls

ALL of the amplifying tubes, five in number, are provided with automatic filament controls which maintain the amplifying tube current at the proper intensity without rheostats or other manual controls. This is a decided step toward simplicity and compactness, and prolongs the life of the tubes by holding the filaments constantly at the proper temperature. A manual rheostat (R) of the usual form must be provided for the detector tube (T3) as this has a rather critical filament adjustment that cannot be automatically controlled. The rheostat (R) is represented on the front of the panel by a knob as shown by Fig. 3, and is the only control outside of the condenser dial (C1). A switch (SW) must be provided for shutting off the filament current when the set is not in use. It is no longer possible to turn off the amplifying tubes independently as when the usual form of rheostat is used. This can be an ordinary battery switch of the type to be found at any radio store.

A second choke coil (CC) is shown connected to the plate circuit of the second radio tube (T2), and as this is exactly similar to the first, there will be no further comment. The output of tube (T2) leads to the detector tube through the 0.00025 mf. grid condenser (K2). It should be noted that a one megohm grid leak (V), shown dotted on the grid of tube (T2), will often prove of advantage. It should at least be tried out in the position indicated by the dotted lines before completing the set, for it sometimes stabilizes the first

tubes and increases their effectiveness.

At tube (T3) we have the detector tube which is connected into circuit by the 0.00025 mf. fixed grid condenser (K2), and the one megohm grid leak (GL1). As with all the other tubes, this is a "199" tube, but to prevent critical rheostat adjustments the plate is supplied with 45 volts by an intermediate tap at the "B" battery. From the detector tube on, all of the stages are resistance coupled by the 50,000 ohm resistances (M1-M2-M3) and the grid leaks (GL2-GL3-GL4). The hand controlled rheostat is shown at (R) by which the detector filament can be controlled accurately for any conditions. For use with "199" tubes, the resistance of (R) should be from 30 to 40 ohms, the former for dry cell operation and the latter for use with storage cells.

Resistance Coupled Audio

ALL of the three audio frequency tubes (T4-T5-T6) are supplied with the full "B" battery voltage through the fixed resistances (M1-M2-M3) which have a resistance of 50,000 ohms. The plates and grids of the tubes are connected by means of the fixed condensers (K3-K4-K5) of 0.005 mf. capacity. This value is not critical, and 0.006 mf. fixed condensers can also be used if this is the only capacity to be found in stock at your radio store. They must be of the mica dielectric type, or condensers in which the plates are separated by thin sheets of mica insulation.

The grid leaks (GL2, GL3, GL4) of the audio tubes "taper" toward the rear; that is, the last tube has a higher leak resistance than that of the first audio amplifying tube. (GL2)=1.0 megohm, (GL3)=5.00 megohm, and (GL4)=25.00 megohm. This arrangement gives a stronger bias to the grids on the tubes which are most heavily loaded, and therefore results in a better distribution of amplification through the three stages. The output of the sixth tube (T6) leads to the output jack (J1).

A full 90 volts must be maintained on the plates of all amplifier tubes, and where possible, this should be increased to 112.5 volts as the choke and resistance coupling demands a higher voltage than the straight transformer coupling ordinarily used. Two vertical type 45 volt blocks will take up the minimum amount of space in the cabinet when the batteries are carried in the cabinet, but a third small 22.5 volt block will greatly improve the performance by raising the voltage to 112.5 volts. The great trouble with a portable set is to get the batteries into place without monopolizing all of the cabinet space. When the set is built for ordinary stationary service, then we can use three 45 volt blocks of "B" battery, giving 135 volts, and will thus obtain the maximum output of the tubes. The small size "B" batteries must be used for the portable set.

Filament or "A" batteries are to be No. 6 cells and are connected up in series to give a total of 4.5 volts across the rheostat. When possible, these should be square batteries so that the maximum amount of battery material can be put into a minimum of space. The demand

of the six tubes is slightly greater than that ordinarily recommended for continuous service (0.36 ampere), but with careful handling they can be made to last for a long time before replacement becomes necessary.

Reason for Six Tubes

WITH transformer coupling on both radio frequency and audio frequency stages, a five tube set is commonly built with two radio stages, detector, and two audio stages. With choke coils in the radio stages and resistance coupling in the audio stages, the amplifying power of the tubes is somewhat reduced so that one more tube will be required to give the same results. However, this is more than compensated for by the simplicity of the controls and the clear toned, noiseless operation of the set. It has a far better tone than with the usual arrangements and can be handled by the rawest novice in radio.

Fig. 3, showing the front elevation of the panel and cabinet, gives a good idea of the general arrangement of the receiver when designed as a portable set. The cabinet is really divided into two parts, (1) the upper portion covered by the panel being for the radio circuit proper while (2) the lower compartment houses the "A" and "B" batteries. As this is a special arrangement, the cabinet and panel will have to be made specially for the job and it is not likely that a ready-made cabinet or panel can be found which will exactly fit the conditions.

In the front view of Fig. 3 we see that the panel contains all of the controls, and also the three binding posts for the aerial (ANT-X1-GND). The dial of the tuning condenser is at (C1), and for accuracy this should be a four-inch dial with some sort of vernier arrangement, as the tuning is exceedingly sharp. The rheostat control (R) for the detector tube is at the right of the condenser dial. The battery switch for turning the "A" battery current on and off is at "SW" and the output jack is (J1). In the upper right hand corner of the panel is the grid switch (T) by which the set can be thrown over from flat top aerial to loop operation. This is all there is to the control of the set and its external connections.

As will be seen from the side sectional view, Fig. 3A, the panel is set back from the front edge of the cabinet so that the front door will clear the knobs and dials.

The door swings on two hinges (h) and is just large enough to cover the panel, the top of the battery compartment being at the lower edge of the door. Any suitable catch or lock (I) can be used on the left hand edge of the cabinet for fastening the door, and a lock is not a bad idea even in the home, as it prevents children from tampering with the set. At the top is a leather handle (G) fastened to the cabinet by standard hardware that can easily be obtained from a trunk or suitcase house or from some hardware stores. The lower battery compartment door, just below the panel, is shown closed. It is through this opening that we replace the batteries.

THE finish of the cabinet depends upon the taste and ingenuity of the builder. It can be polished with wax or varnished in natural wood finish, or it can be covered with leatherette or similar black grained covering material. If leatherette is used, then all of the corners must be well rounded off so that the material will not get loose or buckle along the edges. The front face of the battery compartment door comes flush with the face of the cabinet and panel door; hence this part is given the same finish as the outside of the cabinet. Rubber pads or feet (i) prevent the set

bakelite panels should not be less than 3-16 inch and this also covers the shelves which should be of the same material as the panels; that is, hard rubber, bakelite or formica. The shelves carry the wiring and many of the current carrying parts so that their insulating value should be fully equal to that of the panels.

We cannot go further into the details of the cabinet construction, but the construction will be clearly seen by those who are competent to undertake work of this sort, and if one is not sure of being able to build this cabinet, the drawings are amply dimensioned for a practical cabinet maker. If you give the job to a cabinet maker, I suggest that you also give him the panels and shelves so that he can get a good fit between the edges of the panel and the rabbet of the cabinet.

Arrangement of Apparatus

FIG. 4 shows the arrangement of the apparatus as seen from the rear of the panel. The six tube sockets (U) are placed in groups of three on the two shelves (F) and (H), and the outlines of the tubes are indicated by thin dot and dash lines so that the allowance for shelf clearance can be easily seen. The tubes are numbered so that their relation to the circuit drawings of Figs. 1 and 2 can be easily followed, and the sockets can be located in the same way. Fig. 3A and Fig. 4 can be used in combination, thus obtaining the side and rear elevations of the assembly.

It will be seen that the shelves are cut off at the right in Fig. 4 to accommodate the variable tuning condenser (C1) and the tuning inductance (L1-L2). On the lower sides of the shelves will be seen the coupling resistances, grid condenser, gridleaks and the wiring. In making allowance for the space between shelves, measure the height of the tube plus the height of the socket, plus a little more clearance so that the tubes can be taken out of the sockets and replaced without tearing the set to pieces. In other words, the true height of the socket assembly is the sum of the tube height, plus the socket height, plus 1/2 inch clearance between the lower end of the tube and the top of the socket.

The arrangement of the battery compartment in general with the batteries in place is marked. Strong flat springs made from flat spring brass plates bear on one side of the batteries and hold them in place against jolts and jars when the set is being carried. Connections between the apparatus and batteries are made by means of flexible fixture wire which can be obtained from any electrical store. This is very flexible and well insulated, and makes an ideal connection. The ends of the fixture wire should be provided with "spade" type tips soldered to the copper strands, and these make a permanent contact with the connection screws which is easily attached and which does not loosen under ordinary conditions. Do not attempt placing the strands of wire directly under the binding screws, for when connected up in this way they are almost certain to get undone.

(Turn to page 38)

BILL OF MATERIALS USED

The following list will give the materials used and their sizes. The parts are listed according to the same reference letters used on the drawings so that their relation can be seen at a glance.

PORTABLE RECEIVER MATERIALS

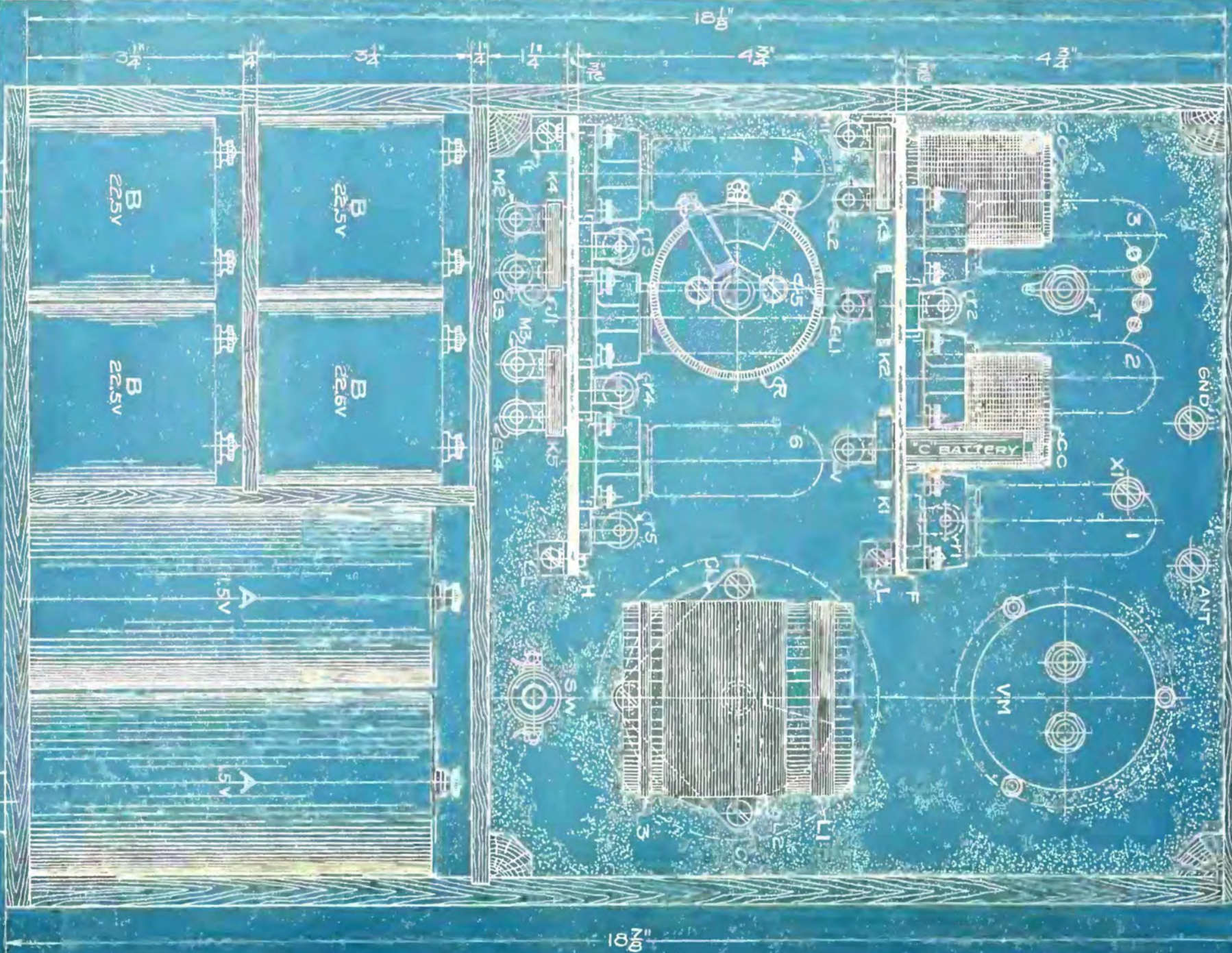
- A—3 Filament "A" Dry Batteries, 1.5 volt, No. 6.
- ANT—1 Loop aerial (optional), 2 Ft. Square.
- B—2 "B" Plate Batteries, Vertical type, 45 Volt
- C—1 "C" Bias Battery, Three coil, small, 4.5 volts
- C1—1 Vernier Variable Condenser (23 plate), 0.0005 mf
- CC—2 100 Millihenry Choke coils, or audio transformer secondary coils.
- D—1 Special cabinet, as specified in drawings.
- E—1 Special Panel, as specified in drawings, 3/16-inch Bakelite.
- F—11—2 Special Shelves, as specified in drawings, 3-16 inch Bakelite 5"x6 1/2".
- G—1 Carrying Handle Complete, Standard.
- G1—1 Grid Leak, 1.00 Megohm.
- G2—1 Grid Leak, 1.00 Megohm.
- G3—1 Grid Leak, 3.00 Megohm.
- G4—1 Grid Leak, 25.00 Megohm.
- h—4 Hinges or butts, Standard.
- I—2 Lock Catch, Standard.
- i—4 Rubber pads or feet, Medium Size.
- J1—1 Single Circuit Jack, Standard.
- K1—1 Fixed Condenser, Mica dielectric, 0.002 mf.
- K2—1 Fixed Condenser, Mica dielectric, Grid clips, 0.00025 mf.
- K3—1 Fixed Condenser, Mica dielectric, 0.005 or 0.006 mf.
- K4—1 Fixed Condenser, Mica dielectric, 0.005 or 0.006 mf.
- K5—1 Fixed Condenser, Mica dielectric, 0.005 or 0.006 mf.
- L—4 Brass Angle Brackets, Standard.
- L1-L2—1 Aperiodic Type Coupler, Standard.
- M1-M2-M3—350,000 ohm Resistor Units.
- R—1 Filament Rheostat, 30-40 ohms.
- h-2, etc.—5 Automatic Fla. Controls (Amperites) 199-4.5 volts.
- SW—1 Battery Switch, Standard.
- T—1 Tap Switch, Standard.
- t—2 Contact points, with two stops, Standard.
- T1-T2, etc.—6 Tubes, "199".
- U—6 Absorber Base Tube Sockets, "199" Type.
- 40 Tinned Square Copper Bus Wire, No. 14.
- 75 Solder Clips, Tinned, Standard.
- 3 Binding Posts, Composition Caps, Standard.
- Z—4 Brass angle connections, Standard.
- V—1 Leak, 1 megohm.
- VM—1 Filament voltmeter, 0.8 volts.

from scratching finished surfaces on which it may be placed, and further, they prevent or help to prevent, the ringing microphonic noises experienced with "199" tubes.

Shelf for Tubes

The side sectional view of Fig. 3A shows that a shelf (F) is used for carrying the first three tubes, and that this shelf is attached to the panel (E) by means of brass angle brackets (L). The shelf (F) carries the first two tubes (T1-T2) of the radio frequency circuit and also the detector tube (T3). Below the upper shelf is the lower shelf (H) which carries the three audio tubes (T4-T5-T6). As the resistance units and other parts of the circuit are carried on the underside of the shelves with the sockets on top, we must be sure to leave room to accommodate the height of the tubes over their sockets, plus the thickness or height of the resistance units and the condensers, plus clearance.

The material used for the cabinet can be 5-16 inch or 3-8 inch thick, but if carefully constructed with dovetailed or matched corners, will be perfectly safe when built of 5-16 inch stock. The



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(PAT. PEND.)

FIG. 4
SIX TUBE PORTABLE SET
REAR ELEVATION

J.B. RATHBUN
RF-786

RADIO AGE
MAY-1925

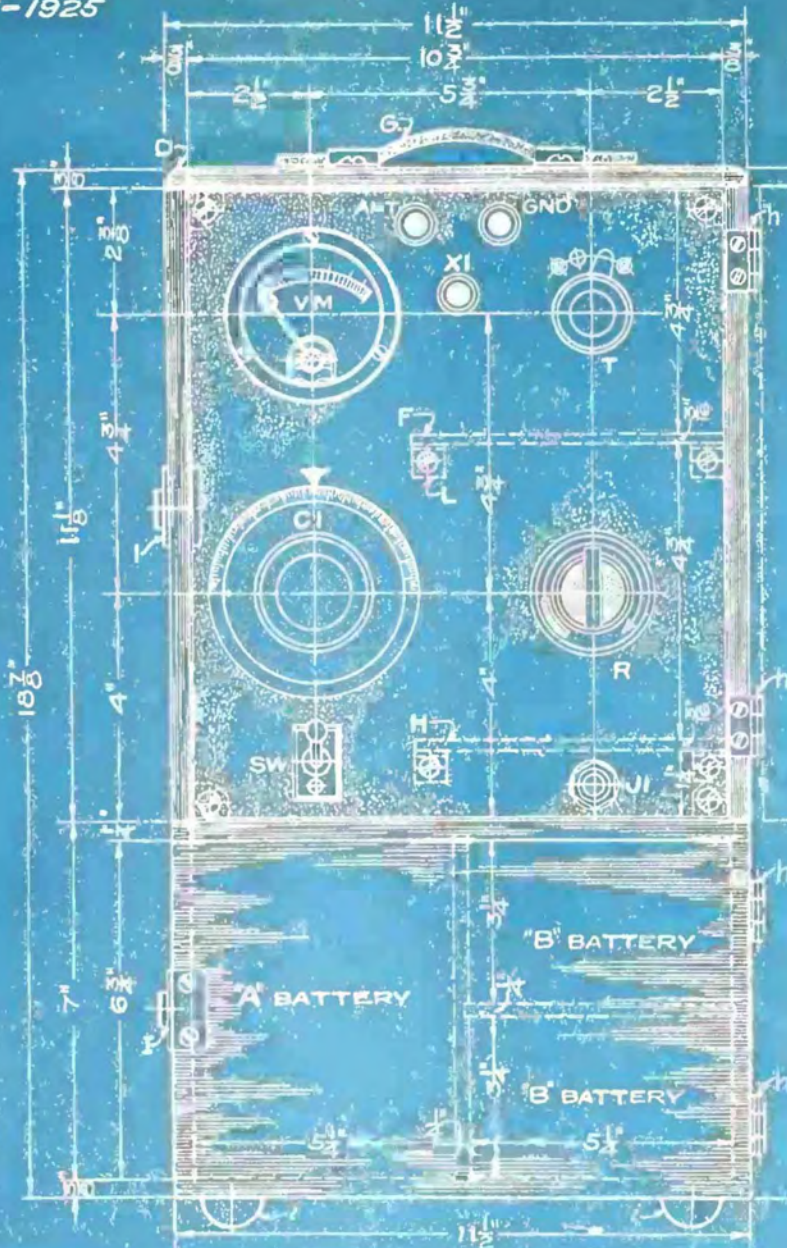


FIG. 3

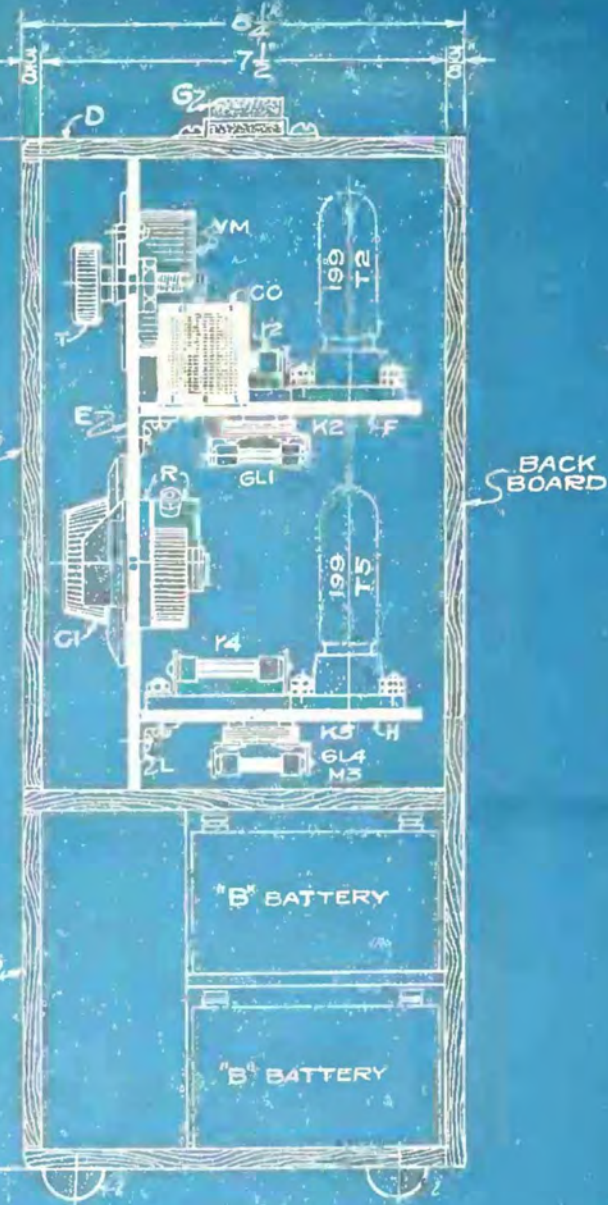


FIG. 3A

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CHICAGO, ILL.

SIX TUBE PORTABLE SET

J.B. RATHBUN
RF-786

Economy of Arrangement Is Vital

(Continued from page 35)

Alternative Arrangement

AS WILL be seen, the part of the assembly taken up by the receiver proper is very small, the panel measuring $10\frac{3}{4}$ long and $11\frac{1}{2}$ deep, but for some purposes the total height with the batteries included may be too great to be practicable. In such a case, the battery compartment can be made separate, terminating the receiver portion at the board shown running over the tops of the batteries. This, however, makes it necessary to reconnect the batteries every time that the receiver is set up and as a result it is a decided nuisance.

As laid out in the drawings, there is ample room for a fifth "B" battery if it is desired to operate with a plate voltage of $112\frac{1}{2}$ volts, or a sixth "B" battery if we wish to operate at 135 volts. Further, there is room for one spare "A" battery if it is desired to carry this replacement along on a trip.

The voltmeter (VM) is a very desirable instrument, particularly when dry cell "A" batteries are used, for it at once indicates the drop in voltage due to weakening batteries. Unless we have some means of testing the voltage occasionally, we are likely to believe that the set is out of order when the voltage drops, and waste much time chasing for trouble in the wiring when the difficulty actually exists in the cells. Just because automatic filament controls are installed for the regulation of the filament current is no reason why the voltmeter should be omitted.

Voltmeters must be connected properly according to polarity, and you must be guided by the markings on the instrument. If the polarity is wrong, then the needle indicator will be thrown against the wrong end of the scale. The size of the voltmeter should be so chosen that the full voltage will bring the needle near or slightly beyond the center of the graduated scale where

the divisions are the largest, and the battery voltage should not throw the needle to the far end of the scale.

Suppressing Oscillations

Free oscillations in the radio frequency stages are the greatest difficulty in the construction of a radio frequency or reflex type of receiver, and we must devise some system for stopping these oscillations if we expect to get the full output of the set. In fact, most of the trouble reported with sets having radio frequency stages can be traced to improper or imperfect methods of damping down the oscillations. There are a number of methods of stopping oscillations, among which are the potentiometer, neutralizing condensers, bias batteries, etc., but in this receiver we have simplified the problem by the use of a plate reactance coil marked (L3) on the diagrams.

Coil (L3) consists of four or five turns of wire wound on the end of the tuning coil. One end of this coil is connected to the plate of the first radio tube as shown, while the other end is left opened or is unconnected. As one end is opened, only capacitive current will flow from the plate into the coil, and the magnetic coupling is therefore very feeble, as it should be. Some little experimenting will be required in adjusting this coil before it just stops the oscillations. It may be that the plate connection must be connected to the other end of (L3), or that the whole coil must be wrapped on the other end of the tube. Varying the number of turns, or the distance of (L3) from (L2) may be required. Just because you have not hit the proper combination on the first trial is no proof that it will not work. The losses are at a minimum with this arrangement, and there are no separate controls as when a potentiometer is used.

In addition to the compensating coil (L3), the "C" battery will be an aid in keeping down oscillations and increasing the sensitivity of the first two tubes.

In the center, and at the bottom of Fig. 1, will be found a detail of a small radio frequency choke coil which can be used when an audio frequency transformer secondary is not available. This consists of about 450 turns of No. 36 D. S. C. wire wound on a cardboard or bakelite tube as shown, and is mounted on the upper shelf (F) of the set. Some little experimenting may be required to get the most effective number of turns, but the coil is not very critical to the turns, and for most apparatus the number of turns shown will come very close to the best effect. We must have enough turns so that the tubes will not paralyze on the higher wavelengths through leakage of the R. F. current to the "B" battery.

In the lower right hand corner of Fig. 1 is a detail of the resistor assembly used in the audio frequency stages. We can assemble the resistors and grid leaks on the shelves by means of clips as shown, or better yet, we can buy these completely assembled units from our advertisers, at a reasonable figure.

Summary

IN tuning this set, the adjustment of the detector rheostat (R) is of great importance, for there is one position of the rheostat where the detector tube is the most sensitive and gives the greatest volume. This generally occurs when the rheostat is about one-half on, and it is seldom necessary to turn on this tube to full brilliance as with the amplifier tubes.

In giving his Five Tube Radio Frequency Receiver in the April issue the name, "Amplex Receiver," our blue print editor inadvertently used the trade-name of a receiver manufactured by the Amplex Instrument Laboratories of New York City. RADIO AGE wishes to inform its readers that the set described in the blue-print section of April issue was in no way related to the receiver made by the Amplex concern.

End your Radio Troubles for 30c in Stamps

We have laid aside a limited number of back issues RADIO AGE for your use. Below are listed hookups to be found in these issues. Select the ones you want and enclose 30c in stamps for each desired. The supply is limited, so enrich your store of radio knowledge by laying in an ample stock of copies NOW!

January, 1924

- Tuning Out Interference—Wave Traps—Eliminators
- Filters.
- A Junior Super-Heterodyne.
- Push-Pull Amplifier.
- Rosenblum Circuit.

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 Capacity Hookups.
- Reflexing the Three-Circuit Tuner.
- Index and first two installments of Radio Age Data Sheets.

May, 1924

- 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 Itadio 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.
- One Tuning Control for Hair's Breadth Selectivity.
- Four Pages of Real Blueprints of a New Baby Heterodyne and an Aperiodic Variometer Set.
- Data Sheets.

October, 1924

- An Easily Made Super-Het.
- Two Itadio and Two Audio for Clear Tone.
- A Simple Regenerative Set.
- The Ultradyne for Real DX.
- Real Blueprints of a 3-Tube Neutrodyne and a Midget Reflex Set.

November, 1924

- Blueprints of a Single Tube Loop Set and a Capacity Feedback Receiver.
- A 3-Tube Low Loss Regenerator.
- Mastering the 3-Circuit Tuner.

December, 1924

- Blueprints of a New 8-Tube Super-Heterodyne.
- How to Make a Receiver that Minimizes Static.
- A Trans-Atlantic DX Receiver.
- How to Make a Home Made Battery Charger and a Loud Speaker at a Small Cost.

January, 1925

- A Reflexed Neutrodyne
- A Six Tube Super-Het.
- An Efficient Portable Set.
- A Tuned Plate Regenerator.
- Making a Station-Finder.

February, 1925

- A Sure Shot Super-Het.
- A Three Circuit Regenerator.
- A Real, Low Loss Set.
- Blueprints of a 3-tube Reflex.

March, 1925

- A Permanent Super-Het.
- A 5-Tube R. F. Receiver.
- How to Wind Low Loss Coils.
- A Short Wave Receiver
- Blue Prints of a Two-Tube Ultra Audion and a Regenerative Reflex.

April, 1925

- A 3-Tube Portable Set
- "B" Voltage from the A. C. Socket
- An Amplifier for the 3-Circuit Tuner
- Blueprints of a Five-Tube Radio Frequency Receiver

RADIO AGE, Inc.

500 N. Dearborn St., Chicago

Radio Age Institute

Manufacturers' Testing Service

MEMBERS of the staff of RADIO AGE will be pleased to test devices and materials for radio manufacturers with the object of determining their efficiency and worth. All apparatus which meets with the approval of various tests imposed by members of the technical staff of RADIO AGE will be awarded our endorsement, and the seal shown to the right will be furnished free of charge. Materials for testing should be sent to

RADIO AGE INSTITUTE
504 N. Dearborn Street, Chicago, Ill.



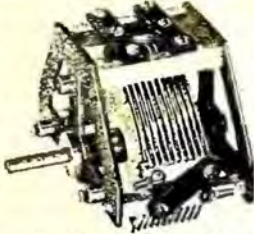
DEVICES

displaying this seal have been tested and approved by the RADIO AGE INSTITUTE.

Apparatus illustrated and described below has successfully passed our tests for May, 1925.

Test No. 47. THE QUAM CONDENSER. Submitted by the Quam Radio Corporation, of Chicago, Ill.

The manufacturers claim this condenser to be the lowest loss commercial condenser made. The radio frequency measurements taken of this condenser in our laboratories indicated they are not exaggerating in their claims. This condenser has a resistance at least as low as the standard to which it was compared, for the whole broadcast frequency range and for various values of capacity. The very low losses are attributed to the high leakage resistance and low dielectric losses, due to the use of the pyrex end plate, which is well out of the dense part of the field. Arrived in good condition and satisfactorily passed the tests and requirements of RADIO AGE Institute.



than any other crystal. When tested for selectivity, tuning was so sharpened that interference was cut to a minimum. While other crystals burned out by the application of repeatedly strong signals, the Carborundum detector stood up well for the period in which it was used. The detector comes marked so that in a single circuit crystal set one end, marked "A" is connected to the aerial, and the end marked "G" goes to the ground. For other sets, the "A" end connects directly to the grid connection on the secondary of the radio transformer or coupling coil, and the "G" end goes to the phones or to the plate connection on the primary of the audio transformer. Satisfactorily passed the tests and requirements of RADIO AGE Institute.

Test No. 51. NA-ALD SOCKETS. Manufactured and submitted by the Alden Manufacturing Co. of Springfield, Mass. These sockets are made of high grade moulded Bakelite by a special process. Accordingly the losses were very low. The finish on these sockets is permanent and stood up well over extensive use. Na-Ald sockets are guaranteed indefinitely. Satisfactorily passed the tests and requirements of the RADIO AGE Institute.

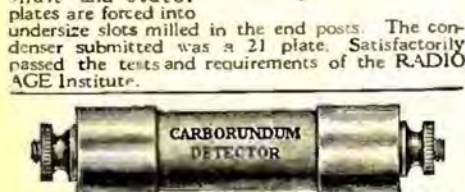


Test No. 48. The ULTRA VERNIER Tuning Control. Submitted by the Phenix Radio Corporation of 3-9 Beekman Street, New York City.

This tuning control was designed by the well-known radio engineer, R. E. LaCault, and it is geared low enough to give hair-splitting accuracy without making tuning tiresome. It is geared 20 to 1. The face of the dial remains rigid on the panel. The rotor or moving arm turns from the vernier knob at the bottom of the dial. The real usefulness of this dial in quick and accurate tuning is the provision made for the fan to indicate on the dial with pencil or ink the station he desires. These units are very attractive in appearance. Satisfactorily passed the tests and requirements of RADIO AGE Institute.

Test No. 49. DUPLEX MATCHED CONDENSERS. Submitted by the Duplex Condenser and Radio Corporation of 42 Flatbush Ave., Brooklyn, N.Y. These condensers come in sets of three, and their advantage lies in simplified logging, for their use affords uniform dial settings for neutrodyne and all other tuned r. f. receivers. Tests proved that Duplex condensers are accurately made and do not change capacity unless varied by the operator. Rotor plates are die-cast in their shaft and stator plates are forced into undersize slots milled in the end posts. The condenser submitted was a 21 plate. Satisfactorily passed the tests and requirements of the RADIO AGE Institute.

Test No. 50. THE CARBORUNDUM CRYSTAL DETECTOR. Submitted by the Carborundum Company, Niagara Falls, N. Y. This detector contains a special carborundum made for radio purposes. Tests in our laboratory revealed that this detector gives volume equal to any and in many cases more



Test No. 52. CRESCENT LAVITE RESISTANCES. Manufactured and submitted by the Crescent Radio Supply Co. of 9 Liberty St. Jamaica, N. Y. These resistances, when used in place of iron core transformers in audio amplification, were found to positively eliminate distortion. Besides giving pure tone quality, they reduce B battery consumption and make a C battery practically unnecessary in most cases. They were mounted in our tests under an ordinary gang socket. Satisfactorily passed the tests and requirements of the RADIO AGE Institute.

Test No. 53. NA-ALD SUPER DELUXE DIAL. Submitted by the Alden Manufacturing Company of Springfield, Mass. Dial No. 3044 for 1-4 inch shaft was tested in several RADIO AGE hookups and found efficient and attractive besides being economical in price. It was found that graduations in these dials have been carefully designed to make positive and rapid tuning possible. They are made of genuine Bakelite with brass bushing. Satisfactorily passed the tests and requirements of the RADIO AGE Institute.

Test No. 54. THE HANDY CONDENSER CLIP. Manufactured and submitted by the Ridge Manufacturing Company of 3818 N. Ridgeway Ave., Chicago, Ill. This clip was designed for the purpose of giving greater care to fixed condensers in radio receivers. This clip, for use with fixed condensers, was tested over a period of thirty days and it was found that signal strength was considerably augmented. It is useful for preventing the change of capacity in the fixed condenser, shorting the circuit or opening the circuit, and otherwise generally protecting the condenser from outside damage. Satisfactorily passed the tests and requirements of the RADIO AGE Institute.

Test No. 55. The GLOBE HEADSET. Manufactured and submitted by the Globe Phone Manufacturing Company of Reading, Mass. The Globe headset was tested both on local and distant stations in Chicago and in every instance clarity of tone as well as a surprising "sweetness" on high notes was evident. These receivers are super-sensitive, furnished with brass cases, high polish nickel finish, ore winding is shielded, magnets are of drop forged steel, rust proof and terminals are concealed. The adjustment on the head is comfortable. Tests for volume also produced remarkable results. Satisfactorily passed the tests and requirements of the RADIO AGE Institute.

Test No. 56. The TRI-JACK and BMS Jack. Submitted by the Brooklyn Metal Stamping Co. of 718 Atlantic Ave., Brooklyn, N. Y. The Tri-Jack, shown in the illustration, was found to eliminate capacity effects almost entirely. It is a single circuit and double circuit jack combined and the very latest in radio development. It is one-third the size of the ordinary jack. It is made of moulded, solid Bakelite and the overall dimensions are one inch by one inch. The terminals are clearly marked. The B. M. S. Jack, submitted with the Tri-Jack for test, was also found efficient for single open circuit work. It is designed for easy soldering. Lugs are spaced to be always accessible. The lug tips are cupped. Satisfactorily passed the tests and requirements of RADIO AGE Institute.

Test No. 57. AMPERITE. Manufactured by the Radial Co. 50 Franklin Street, New York, N.Y. An automatic resistance used in place of the customary rheostat. The small tube that contains this resistance element is equipped with two metal ends which are used as terminals when it is inserted in the base supplied with the instrument. Being automatic in action and needing no adjustment, it will be found very useful for controlling the filament temperature on amplifying tubes. Tested and approved by RADIO AGE Institute.

Test No. 58. THE CUTLER-HAMMER TOGGLE SWITCH. The Cutler-Hammer Manufacturing Company have recently added to their line of radio products a new Toggle Battery Switch. It has large wipe contacts, positive make-and-break mechanism, wide-spaced terminals and attractive appearance. It is so designed as to embody the best features of its type and also to eliminate every disadvantage. The mechanism is enclosed in a dust proof cover and the metal parts are attractively finished in polished nickel. The switch is easily mounted on any radio panel in a few minutes, and does not require any screws or measurements. A lock nut is provided for proper adjustment for panel thickness. When installed, a flip of the operating lever with the finger turns the current "on" or "off". An easy and convenient type of switch to operate. Manufactured by the Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Satisfactorily passed the tests and requirements of RADIO AGE Institute.

Test No. 51. NA-ALD SOCKETS. Manufactured and submitted by the Alden Manufacturing Co. of Springfield, Mass.

These sockets are made of high grade moulded Bakelite by a special process. Accordingly the losses were very low. The finish on these sockets is permanent and stood up well over extensive use. Na-Ald sockets are guaranteed indefinitely. Satisfactorily passed the tests and requirements of the RADIO AGE Institute.

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Test No. 56. The TRI-JACK and BMS Jack. Submitted by the Brooklyn Metal Stamping Co. of 718 Atlantic Ave., Brooklyn, N. Y. The Tri-Jack, shown in the illustration, was found to eliminate capacity effects almost entirely. It is a single circuit and double circuit jack combined and the very latest in radio development. It is one-third the size of the ordinary jack. It is made of moulded, solid Bakelite and the overall dimensions are one inch by one inch. The terminals are clearly marked. The B. M. S. Jack, submitted with the Tri-Jack for test, was also found efficient for single open circuit work. It is designed for easy soldering. Lugs are spaced to be always accessible. The lug tips are cupped. Satisfactorily passed the tests and requirements of RADIO AGE Institute.

Test No. 57. AMPERITE. Manufactured by the Radial Co. 50 Franklin Street, New York, N.Y. An automatic resistance used in place of the customary rheostat. The small tube that contains this resistance element is equipped with two metal ends which are used as terminals when it is inserted in the base supplied with the instrument. Being automatic in action and needing no adjustment, it will be found very useful for controlling the filament temperature on amplifying tubes. Tested and approved by RADIO AGE Institute.

Test No. 58. THE CUTLER-HAMMER TOGGLE SWITCH. The Cutler-Hammer Manufacturing Company have recently added to their line of radio products a new Toggle Battery Switch. It has large wipe contacts, positive make-and-break mechanism, wide-spaced terminals and attractive appearance. It is so designed as to embody the best features of its type and also to eliminate every disadvantage. The mechanism is enclosed in a dust proof cover and the metal parts are attractively finished in polished nickel. The switch is easily mounted on any radio panel in a few minutes, and does not require any screws or measurements. A lock nut is provided for proper adjustment for panel thickness. When installed, a flip of the operating lever with the finger turns the current "on" or "off". An easy and convenient type of switch to operate. Manufactured by the Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Satisfactorily passed the tests and requirements of RADIO AGE Institute.

World's Smallest Studio Now on the Air



Radio listeners cannot enjoy Flo Henry's bewitching gaze, as shown above, but they can hear her equally bewitching voice from WJJD's burlap studio at the Rendezvous.

(Photo by Connelly, Chicago.)

Gay Artists Perform from WJJD's Burlap Studio



Lillian Bernard is an expert at character songs and popular renditions. She has been a favorite among Chicago cafe fans for years, and now she's a favorite among WJJD's host of Sunday night listeners.

(Connelly Photo.)

AS a contrast to the many claims of various broadcasting stations throughout the country of having the largest and most elaborate studios for radio programs, there recently came the announcement from WJJD that the world's smallest and most informal studio was now on the air.

When arrangements for a Chicago studio were made by Jack Nelson, Managing Director and Announcer of the Loyal Order of Moose Station WJJD, and this studio was located in the Palmer House, Chicago, and called the Garod Studio, it was found that awaiting the completion of the new Palmer House, there was no orchestra music in the hotel. So Jack went scouting around and made arrangements with the Rendezvous Cafe management to broadcast Charley Straight and his Orchestra every night as a part of the Chicago program offered by WJJD at 10:30 p. m.

He then noticed that many of the entertainers there had voices which would broadcast exceptionally well and he "got the itch" to put them on for some "hot" programs. Their work, however, prevented their journeying down to the elaborate Garod Studio in the Palmer House, so the "back-stage studio" idea was conceived, and programs are now being broadcast every Sunday night beginning at midnight (Central Standard Time).

Dressing Room as Studio

THERE was not room to arrange for a studio which would be open to the guests of the Rendezvous, so a large dressing room back-stage was chosen; and because it would not be open for inspection, burlap was chosen for the material to deaden the room and make it available for broadcasting.

So "Potato Sack Studio" is an appropriate designation, both because of its hangings and size. Here the regular

entertainers, (and some of them have been there as long as two years), Lillian Bernard, Flo Henry, Frank Mason, Jack O'Malley, Billy Gerber, Margaret White, —the Red Head Gal with the Uke,— Wanda Goll, Jimmy Travers, etc., "do their stuff" between the dances played by Charley Straight and his Orchestra.

It is quite a trick to keep the "air" program running smoothly, because the entertainers must dress for one of their acts, change makeup, do their bit "on the floor" and then dash into the Potato



And here's Charley Straight, himself, whose syncopating music aggregation furnishes the jazz regularly from WJJD, beginning every night at 10:30 o'clock, Central time.

Sack to do a turn "on the air," rush out, change clothes again for the next show, and repeat three or four times a night. Perhaps that's what makes this program so peppy.

WJJD has received hundreds of letters of applause on this feature. It just happens there are few stations on the air at that time. Miners and other workers of late shifts applaud heartily because it gives them something late Sunday night which was not available before.

Inasmuch as this program is only once a week, it does not work the Rendezvous folks too hard. It certainly couldn't be done every night or they would all be

"wrecks," but once a week is a lot of fun and as Jack Nelson announces from the Potato Sack, "These weekly shows will be very informal. We'll let you in on all our secrets, our gayeties, and perhaps even some of our little quarrels, so that you will almost smell the grease paint and see all the costumes."

It is that informality that makes them just what they seem: a good time by a handful of stage folk, back stage. They seem to feel that they are not putting a program out, but all the folks listening in are really listening in,—sort of eavesdropping on their little weekly get-together.

Ralph Helps, Too

INCIDENTALLY, Ralph Shugart, the engineer of WJJD, deserves a good word for the excellent way in which he handles the Chicago broadcasting. Mooseheart is 37 miles west of its Chicago central (the Garod Studio in the Palmer House), and the Rendezvous Cafe is another four miles North from there, and the lines, amplifiers and microphones are certainly well handled.

While the "Potato Sack Studio" will be used according to the present plans but once a week, that does not mean that WJJD will not broadcast from the Rendezvous only once a week, for every night as a regular feature of the Chicago programs of the Mooseheart Station, Charley Straight and his famous dance orchestra will contribute to the entertainment.

We'll venture to say that if you have a player piano and will walk over to it now, you will find at least five rolls on your shelves bearing the signature of Charley Straight, for there is no one who has played piano records for as long a time as has Charley. Now is marked the inauguration of the broadcasting of the last of the really popular, big and famous dance orchestras of Chicago.



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 MAY issue of RADIO AGE! Gosh! How time does fly. It seems as though it were just yesterday that we picked up the September issue, said good-bye to Old Man Static and prepared for a Winter of ideal reception. Now we must prepare for a Summer of ideal reception. It is possible and it can be done, although it has not been done very successfully in the past.

However, developments in the radio line have been so good in the past Winter, that we no longer fear the Summer static, spoiling all our good DX records and pleasant concerts, popular and otherwise, from out-of-town-stations. When we look back and think of the giant strides made by radio in the past ten months, I am sure most of us will realize just why this is going to be a real radio Summer.

Take, for example, the super-heterodyne type of receiver, with its extreme selectivity, portability and last, but not least, the little energy collector or loop antenna, that they use. This will practically eliminate the old "distance eliminator"—static. The reason for this is obvious to all of us. In the past, large, flat-topped antennas were used, and would pick up disturbances from all directions. The loop antenna does not do this. Consequently most of the undesirable noises will not get through to the set, to be amplified many times.

One must not necessarily have a super-heterodyne to operate his circuit on a loop. Several sets employing the reflex principal are every bit as efficient, when using a loop antenna, as well as when they use a large out-door one. Regenerative sets can be made to operate on a loop also. In our blueprint section several months back one of these was shown, and it has given exceptionally fine results. It consisted of a detector tube and the customary two stages of audio frequency amplification. And there are plenty of other circuits that will work just as well.

Another thing that comes with Spring. House-cleaning. Don't you think it might be well for us to house-clean the radio set at this time? Of course, it will be inconvenient to have your home itself turned upside down and the radio set at the same time, but it has to be done, and there is no time like the present. Take a look inside the cabinet, clean out the dust, tighten up on the bolts and nuts, test the soldered connections carefully, and tighten up on the prong connections of the tube sockets. Little things like that all go to make the set work better, and after a hard Winter's service on the part of the radio set, I am sure it will be appreciated by it! It might be well to call your attention to your ground connection, which, being usually made in the basement, is never looked at. This might have become

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corroded to such an extent that you are not operating with a direct ground at all. Yes, I think we had better take a look.

I am going to ask you once more for information on portable receivers. Let us have the benefit of your experience.

I am sure that some of our thousands of readers could give us some very beneficial "dope" on these types of receiving sets. So don't be bashful. Let us have the results of your experiments.

Well—I guess that's that, for this time, and trusting that you will continue

to flood this department with your DX lists and reports, I shall let you go on to the rest of this department.

THE PICK-UPS EDITOR.

We have a circuit this month from Felix Frederiksen, of Delmar, Iowa. It is a variation of the well known "Ultra-Audion," and Mr. Frederiksen says it is a "bear" for DX work. This circuit is known as the Woods circuit, and possesses several distinct advantages over the ordinary ultra-audion.

It is very sharp in tuning and for that reason is capable of reaching out through heavy interference and doing real DX work. The disadvantage of the ordinary circuit lies in the fact that it is difficult to control the amount of regeneration secured. This is overcome in this circuit by the use of a plate variometer to secure an inductive feedback in addition to the usual connection from the plate of the detector tube to the grid circuit. An additional feature is the use of a variocoupler for the tuning inductance. By the use of a variocoupler in place of the tapped coil or the variometer commonly used, exceptional selectivity is secured in place of the usual broad tuning of the single circuit receiver.

Mr. Frederiksen advises us to use only the best parts in constructing the circuit. He says: "If poor parts are used, do not blame the circuit if it does not come up to expectations." This advice applies especially to the variable condenser, which should be of the straight line wavelength curve type. A twenty-three plate one, with a vernier dial attachment, is what you will need.

The aerial binding post is wired to the top tap of the variocoupler and to one of the switch levers. This arrangement shorts out the turns of wire on the top half of the variocoupler that are not in use and reduces the dead end losses, thus increasing the efficiency of the coupler.

In place of the variocoupler you can wind a fixed inductance, if you so desire. On a bakelite or cardboard tube three inches in diameter and four inches long,

wind twenty-five turns of No. 20 single cotton covered magnet wire on one end of the tube for the primary. Leave a space about one-quarter of an inch, and wind fifty turns in the same direction on the other end of the tube for the secondary, the same size wire being used. This inductance can then be mounted on thin strips of bakelite for supports and a very good substitute is obtained for the variocoupler. The variometer shown can be eliminated if you desire by winding a rotor on a small wooden form to fit inside one end of the inductance coil just described. It (the rotor) should be wound with seventy-five turns of No. 28 single cotton covered wire.

However, we think it would be best to use the variocoupler and variometer.

The following parts will be necessary for the construction of this circuit.

- 1 vario-coupler.
- 2 Switch Levers.
- Switch points, determined by number of taps on coupler.
- 1 23-plate condenser.
- 1 Fixed grid condenser, .00025.
- 1 Variable Grid Leak.
- 1 Variometer.
- 1 Double circuit jack.
- 1 Single circuit jack.
- 1 Audio frequency transformer.
- 1 Six ohm rheostat.
- 1 Twenty ohm rheostat.
- Bolts, nuts, wire, etc.

Mr. Frederiksen seems very well pleased with this type of set and those of us who are using the old type "singles" might try this improvement and see what's what. We have not quoted Mr. Frederiksen's letter, as it was quite long, he being so enthusiastic about his set. His DX list would "drag" most of us out of our chairs. It certainly is a "whiz."

So for the benefit of all concerned, we are going to pass this circuit along.

Mr. Joseph Larsen, of Boise, Idaho, gives us a suggestion for the mounting of spider-web coils behind the panel, which we think might prove of interest. His letter follows:

RADIO AGE,
Chicago, Ill.

Gentlemen:

Many of the readers of the Pick-ups and Hook-ups columns no doubt have refrained from using spider-web coils, a very efficient form of inductance, due to the fact that mounting them in the conventional way on the front of the panel, makes them clumsy and unsightly. This can be overcome, however, in a very simple and efficient manner; efficient because of the possible micrometer adjustment and the absence of body capacity.

The drawing explains the idea so clearly that there is little need for a detailed description.

The wood strips to which the coils are fastened are cut from a cigar box. They are glued to the inductance and to small blocks at the inside of the panel, to which are screwed small brass hinges obtainable from any hardware store.

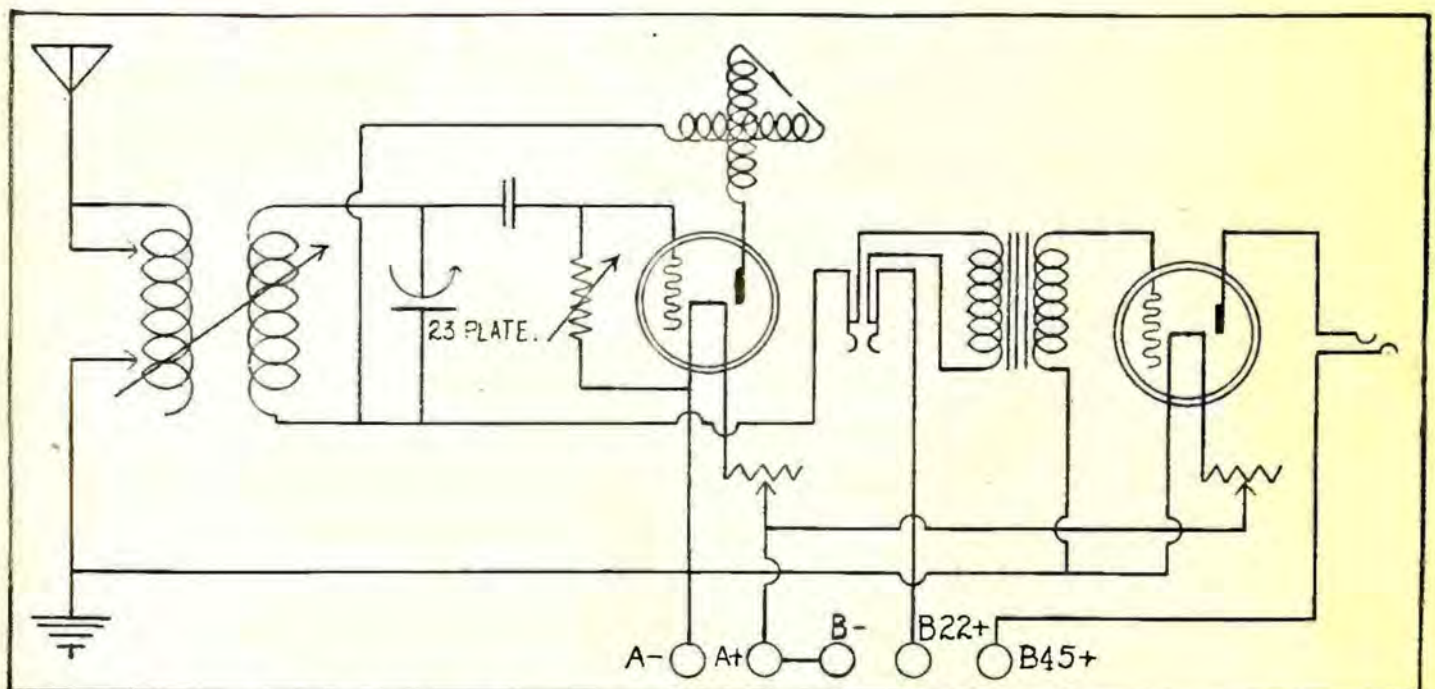
The brass rods threaded into the knobs and panel may be any convenient size and thread. The ends against the hinges should be filed round.

If, for the sake of appearance of dials, it is desired to separate the control knobs farther than shown in the sketch, this is easily done by gluing a small block of empty thread spool between each wooden arm and the coil.

Rubber bands supply the tension, tending to bring the coils into close inductive relation. By adjusting the bands on different prongs, the tension may be varied.

Honeycomb coils mounted in this manner will appeal to the experimenter using the three coil tickler regenerative circuit. Very efficient oscillator-couplers for the super-heterodyne can also be manufactured in this manner. For the latter I suggest a form having an odd number of spokes, say about seventeen, with a beginning or minimum diameter of one and a half inches. The pick-up, secondary and tickler coils should be wound with twenty-five, thirty-five and fifty turns of wire, respectively.

Yours very truly,
Boise, Idaho. JOSEPH LARSEN.



Circuit contributed by Mr. Frederiksen. It is a modified form of the Ultra-Audion. This circuit possesses all of the desirable qualities of the "single" plus the selectivity of the three circuit tuner.

It's a good stunt, Dial Twisters, and an easy one, too. Not only does it keep the coils out of sight, but it protects them from dust and dirt, preventing injury to them at the same time.

Thanks, Mr. Larsen, for your idea.

A letter this month from 91 Hamilton Road, Golden Green, London, England, N. W., as follows:

RADIO AGE,
Gentlemen:

May I, from the other side of the Atlantic, contribute my quota to your very interesting journal? It is always interesting to read of current radio opinions in your paper and it gives much information as to the trend of receiver design on your side.

In the attached list I give a number of stations I have heard on my present receiver, which consists of a detector valve, followed by one stage of audio frequency amplification. Over here, this is practically the standard set. Very few experimenters use radio frequency valves, being of the opinion that it complicates tuning and really only amplifies the "mush" which accompanies the weak signals. The only uncommon thing about the hook-up enclosed lies in the grid return lead.

The set is extremely simple to make and is most surprisingly selective. In fact, the local station 2LO, using a power of one and one-half K. W., and only five miles away, is completely cut out on two degrees of the condenser. It is well worth a trial by anyone desiring extreme selectivity, together with full volume. It is very sensitive to weak signals, as the enclosed list vouches for. By the way, do you think it will merit a D. T. Badge?

Now, I am going to ask a favor of you, or some of the readers of the Pick-Ups and Hook-Ups section. Will somebody let me have a circuit or hook-up, as I believe everyone calls them, of a super-heterodyne, using up to five valves, with the audio frequency amplification obtained by a reflex arrangement? I should be very grateful if anyone can do this for me, as such circuits are practically impossible to obtain in England.

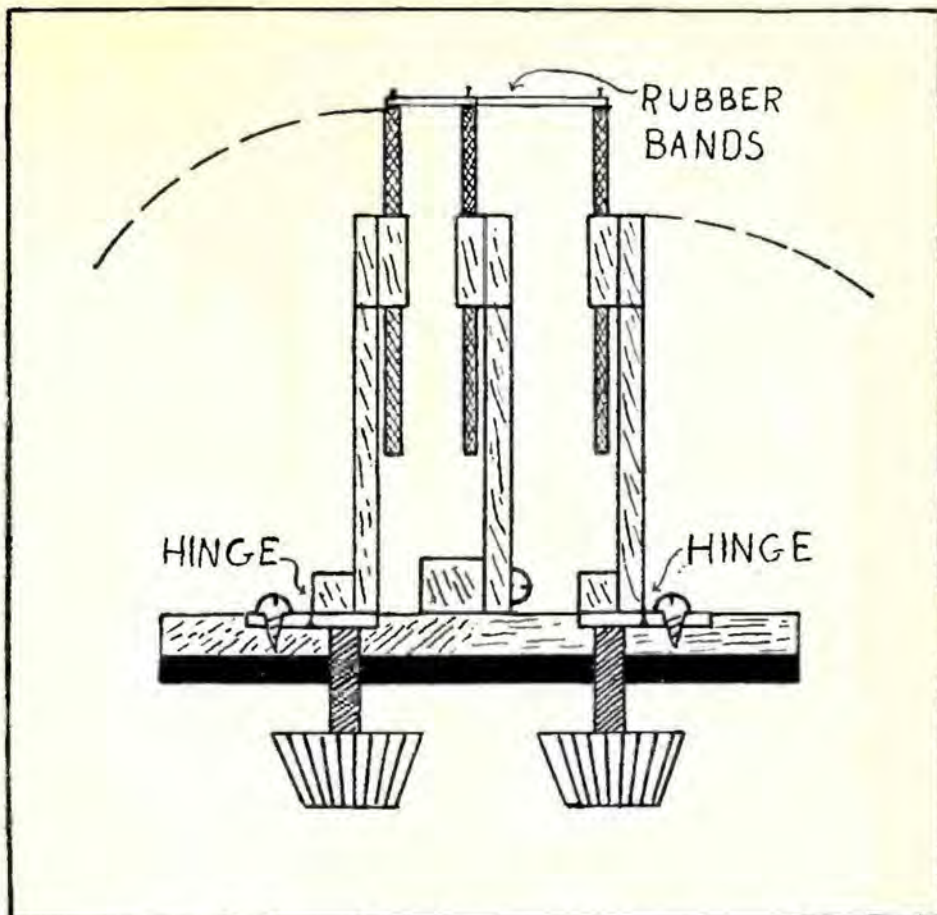
Yours very truly,
THOS. RODWAY, Jr.,
British G-2ADG.

We are printing Tom's letter and the diagram of the circuit that he says most of the English radio fans use. L-1 is the primary and consists of twelve turns of wire wound over L-2, the secondary, which consists of eighty-five turns of fairly heavy wire. L-3 is the tickler and consists of seventy turns.

As can be seen, this circuit is one of our "old time" favorites, and gives very good results. Below you will find the DX list, that Tom thinks will get him a DT button:

2LO, 6BM, 5SC, 5IT, 2EH, 5PY, 2ZY, 5NG, 2BD, 5NO, Ecole Supr, Paris, "Petit Parisien", Radiola, Eiffel Tower, Radio Electricque, Brussels, Radio Iberica, Madrid, Berlin, Frankfurt, Hamburg, Radio Wien, Vienna, Bremen, WGY, KDKA, WBZ, CKAC and WEA.

How many of us would love to have our log read like that? What could be sweeter? But, then, I suppose perhaps Tom should like to have our KFIs and KPOs, on his log. Anyway, we think it is just fine and we shall ship him a DT button, "right quick." Is it all right, fellows? Absolutely, Mr. Kelly.



Showing method of mounting honey-comb or spider-web coils behind the panel. This is quite a novel idea, contributed by Mr. Larsen.

Jos. M. Kloss, of Oakland, Calif., has a set using the Roberts circuit, with which he is "knocking 'em dead." KDKA was heard the other day on it, and he held them over an hour and a half. This is pretty good, as it was only 5:30 p. m., Pacific Coast time. Some of the other stations that he has listened to in the past few weeks are KFHR, CFCN, KFNV, KDYL, KFSG, CHBC, WOC, WOAW, WIP, KYW and KTHS. His set is only a two "tuber" and we think this is pretty good work.

Howard B. Hooping, Muncie, Ind., is doing some mighty fine DX work on his "Hopwood" set built according to RADIO AGE specifications. Such stations as KPO, KGO, KOA, and WQAM are received by him regularly. He also has a crystal set on which he has received KDKA and WGY.

Arthur J. F. Roth, 634 No. Law St., Allentown, Pa., is having a fine time "pulling in the long ones" on his three-circuit outfit. His DX list runs up into the "house" numbers.

We have a letter from one of the fans on the Eastern Coast who is using one of RADIO AGE's latest Reinartz hook-ups, with which he is getting wonderful results. Any of you fellows who are in doubt as to the practicability of the Reinartz circuit might drop him a line and get his opinion.

J. A. Myers, Jr., says: "I have read the article on the two tube 'Ultra-Audion' and I would like to say for the benefit of those readers who are interested that I have done quite a bit of experimenting with the Ultra-Audion as de-

scribed in the March issue of RADIO AGE. I have tried coils of all sizes, shapes and forms and have come to the conclusion that the spider web form of inductance is the most efficient. Any of the readers of this section who want 'dope' on this circuit might get in touch with me."

As J. A. was good enough to offer his services, let's see that some of us mail him a card. He lives at 944 W. Capitol St., Jackson, Miss.

T. F. O'Connell, from "out where the West begins" wants to know if any of us have ever thought of using a breast drill for coil or radio frequency (long wave) transformer winding. This is a good stunt, and quite a few of the "old timers" use it all the time. Nevertheless, we are going to pass it along for the benefit of the newcomers in this radio business. Some breast drills are geared as high as six to one, and you can easily see that your work is reduced fully 75 per cent when you wind by this method. All you have to do is to fasten the form, or core, to the end that takes the drill. The usual method is to insert a reamer a trifle larger in the bit than in the hole. You will have drilled in the core of the transformer, force the core over the bit, fasten the starting end of the coil, and "let her ride." Try it, fans. It works very well.

We have a letter from Robert E. Blose, of Allentown, Pa., who has had a receiving set just three weeks, and has a list of stations heard so long that it reads like a broadcasting station list. To print it would be impossible, so we will have to award him a DT button without disclosing his log. (Turn the page)

recommending this publication in no uncertain terms.

Thanking you again, I am
Yours very truly,
RALPH E. RILEY,
1711 Fifth Street,
Oakland, Calif.

Letters like this make us feel real "chesty." And they prove conclusively that our slogan is correct: "Let Our Hook-Ups be Your Guide."

Radio Age, Inc.,
Chicago, Ill.

Dear Sirs:

I am sending herein a list of stations which I have received during the months of November, December and January. All of these stations were received on a two tube Reinartz Tuner, using peanut tubes. This set has given loud speaker volume on locals, and on some of the distant stations the announcer can be understood with the phones lying on the table. Hoping that my list will win a Dial Twister Button, I remain,

Yours truly,
JAMES SQUIRE.

22 Drake St.,
Cote St. Paul,
Montreal, P. Q.

KDKA, WBZ, WTAS, WIP, WMAC, WEAM, WLAW, WDAP, WWAD, WAAF, WGY, WCBBD, WJAR, WHAZ, WTAM, KYW, WFI, WDAR, IXAD, WDAL, WOS, 9XM, WDAE, WBAY, WJZ, WDAF, WCAL, WABD, WJAX, WSAJ, WJAS, WWJ, WHN, WREQ, WEBH, CNRO, WCAP, WHAS, WGN, WGR, WOC, WRC, WSAJ, WQJ, WEO, KSD, WEAR, WHAR, WLW, CFCA.

Quite a nice list, isn't it, fellows? We think he well deserves a Dial Twister Button. The lads up in Canada all seem to have ideal reception.

RADIO AGE,
Chicago, Ill.,
Gentlemen:

My being somewhat of an experimenter with the regenerative principle has resulted in a modification of the so-called three circuit arrangement that really does what I consider creditable work considering the number of tubes used.

And having built and tested several of these modified sets and found the circuit to be no freak, I am sending in a diagram of the hookup and hope you will pass it on, through your columns.

Results show that it will give loud-speaker volume on two tubes for a considerable range, and in selectivity I think I may safely say that it is on an equal footing with any neut or superhet, when using a short antenna. Rather strong, that, but—quite true, by test.

Along with the hookup I am sending a list of stations heard on each of two sets using this hookup, each being at different locations. I only give the most consistent of distant stations and only a few of the nearer ones, as they are too numerous to list conveniently.

Set No. 1, two tubes: WREQ, WTAS, KOA, WSAJ, WLS, WDAF, WEBH, WTAM, KHJ, CFCA, WLW, KPO, WCAE, KFI, WFAA, WOL, KGW, KYW. Class A's too numerous.
Set No. 2, one tube: KPON, KFAB, WABM, WEEI, WMH, KGO, KOA, WBZ, CHYC, KHJ, PWX, WHAS, CFCA, WJY, CKAC, CRY, KFI, WOC, CYL, WCN. Class A's too numerous.

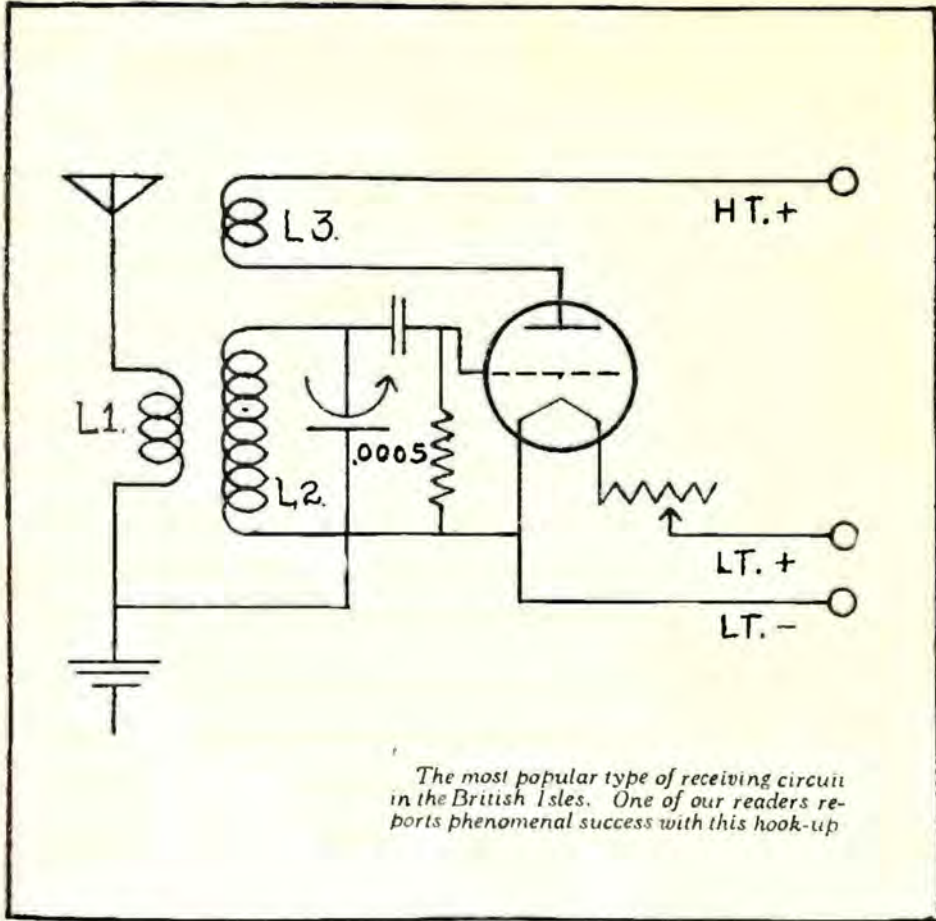
A record was made several nights ago when 45 stations were tuned in and identified (on one tube) within 3½ hours, the total combined mileage being 37,000.

I am a constant reader of RADIO AGE, which is always interesting.

Hoping for a DT button,
V. H. MILLER.

R. F. D., No. 8, Box 34.

This is a pretty good list, and will give some of you DT's a mark to shoot at. Space will prohibit our publishing the
(Turn to page 56)



The most popular type of receiving circuit in the British Isles. One of our readers reports phenomenal success with this hook-up

Hugh M. Clark writes us to let us know he thinks that RADIO AGE is the best on the market. He has a Clapp-Eastman, three-tube regenerative set, with which he has received WSB, PWX, KWAQ, KFOM, CYL, KOA, KFKX, CFCN, KSD, WFAA, KFRU, KFI and others too numerous to mention. We call this pretty good reception, considering that he is in the most eastern state in the union, and we will award him his DT button. He lives in Auburn, Maine.

Kenneth Wyatt, 51 Cast St., Fitchburg, Mass., writes us as follows:
RADIO AGE,
Chicago, Ill.,
Gentlemen:

Looking over back issues of RADIO AGE, I noticed a record made with a "Cockaday" receiver, of thirteen stations in thirty-nine minutes. Deciding to beat this, I sat down and received twenty-nine stations in thirty minutes. Am I entitled to become a Dial Twister? All stations were heard on my two tube Cockaday.

Yours very truly,
KENNETH WYATT.

What do you think, fellows? Pretty good. Can any one do better? We shall see. Meanwhile this will stand as a record and Kenneth will be awarded the DT button.

Another Interesting Letter

RADIO AGE,
Chicago, Ill.,
Gentlemen:

Glancing over a copy of RADIO AGE which I purchased yesterday for the first time, I noticed your "Pick-Ups and Hook-Ups" department, which interested me very much, and as I have done some rather good DX work myself, I thought I should like to see if it would

merit a DT button. My list is not a very long one, but what I take the greatest pride in is the fact that I can get these stations at will, and hold them as long as I want to listen. The circuit is nothing phenomenal, being quite common. Here is the list: WGR, WBZ, KDKA, WGY, WEAJ, WNYC, WCAE, WFI, WSAI, WLW, WOC, KYW, KSD, WHAZ, WMAK, WJY, WLS, WAHG, CFCA, WEBH, WCBBD, WWJ, WQJ, WHAS, WEAR and KDKA.

Yours very truly,
ROBERT C. POTTER.

R. R. No. 3,
Beamsville, Ont., Can.

Your list, Bob, as you say, is not very long, but considering the fact that you receive these stations at will, we think it is a very good one and will award you your DT button. Also, we are welcoming you to the RADIO AGE family.

Valdan Blatz, of Wheeling, W. Va., has a set using UV199 tubes, with which he has received over 75 stations in the past month. He wants to know if this will admit him to the Dial Twisters. It certainly will, and we shall send him his button at once. His circuit is the regular old "stand by," the three circuit outfit.

Here is a letter from an ardent booster of RADIO AGE.

RADIO AGE,
Chicago, Ill.,
Gentlemen:

Just completed building a wave trap from a diagram published in the RADIO AGE ANNUAL for 1925, page 66, figure 4. And with the usual RADIO AGE reliability, it works wonderfully well.

RADIO AGE ANNUAL is worth many times the purchase price to any experimenter and I take pleasure in

Lacault Scores Again!



PATENT
PENDING

\$5⁰⁰

.0005 mfd. Capacity

The new Ultra-Lowloss condenser is the latest improved radio device designed by R. E. Lacault, formerly Associate Editor of Radio News, the originator of Ultradyne Receivers and now Chief Engineer of Phenix Radio Corporation.

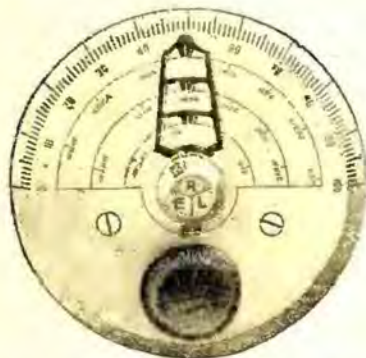
ULTRA-LOWLOSS CONDENSER

LIKE every Lacault development, this new Ultra-Lowloss Condenser represents the pinnacle of ultra efficiency—overcomes losses usually experienced in other condensers.

Special design and cut of stator plates produces a straight line frequency curve, separates the stations of various wave lengths evenly over the dial range, making close tuning positive and easy.

With one station of known frequency located on the dial, other stations separated by the same number of kilocycles are the same number of degrees apart on the dial.

In the Lacault Ultra-Lowloss Condenser losses are reduced to a minimum by use of only one small strip of insulation, by the small amount of high resistance metal in the field and frame, and by a special monoblock mounting of fixed and movable plates.



ULTRA-VERNIER TUNING CONTROL

Simplifies radio tuning. Pencil-record a station on the dial—thereafter, simply turn the finder to your pencil mark to get that station instantly. Easy—quick to mount. Eliminates fumbling, guessing. Furnished clockwise or anti-clockwise in gold or silver finish. Gear ratio 20 to 1.

Silver \$2.50 Gold \$3.50



This seal on a radio product is your assurance of satisfaction and guarantee of Lacault design.

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

Design of low loss coils furnished free with each condenser for amateur and broadcast frequencies showing which will function most efficiently with the condenser.

To Manufacturers Who Wish to Improve Their Sets

The Ultra-Lowloss Condenser offers manufacturers the opportunity to greatly improve the present operation of their receiving sets.

Mr. Lacault will gladly consult with any manufacturer regarding the application of this condenser to any circuit for obtaining maximum efficiency.

PHENIX RADIO CORPORATION, 116-B EAST 25th ST., NEW YORK

* Tested and Approved by RADIO AGE *

Standard Radio Receivers

Last month RADIO AGE inaugurated a new department called "Know Before You Buy," to serve as a guide to the prospective radio purchaser in deciding on the receiver best suited to his individual needs. Fans throughout the country have shown an instantaneous response to this new feature, and accordingly it is continued in this issue and will be a feature of all forthcoming numbers of RADIO AGE. Readers are invited to write us concerning the sets in which they are interested, and manufacturers also are asked to send us material describing their sets.

Telmaco Receiver Useful for Summer Trips

The Telmaco Acme Type P-1 Receiver, shown in the photograph, is manufactured by the Telephone Maintenance Company of Chicago and contains some new features in portable radio construction that will undoubtedly prove popular with the Summer radio fans this year.

The Telmaco Acme is a four-tube reflex receiver designed to assure selectivity, distance, clarity and volume, with minimum battery consumption, even under the stress of Summer conditions. The set retails at \$125, and weighs only 26 pounds in its complete carrying case for traveling. The loop aerial and loud speaker are built into the set. The loop is the only aerial needed.

The size of the case when closed is 8 inches wide, 10 inches high and 18 inches long. The set can be put into operation instantly without any hooking up other than that already contained in the outfit. The upper portion of the lid is lowered when the set is ready to be operated.



The lettering and decorations on the inside of the set are done in silver tone by the new Telmaco Pyrogravure process. The loop is contained in the walls of the case, being concealed from view and protected from mechanical injury. The panel is so assembled that it allows instant transfer from carrying case to a mahogany cabinet made by the Telmaco concern. Likewise the mahogany case may be transferred to the portable arrangement.

Three stages of r. f. amplification, three stages of audio frequency amplification and crystal detector are used. Four UV199 or C299 tubes are used with a combined B battery consumption of .24 amp.

Practically all tuning is done with one 4-inch control.

"Marwol Baby Grand" is Ready for Vacations

A new receiver that is particularly light and compact and easily convertible into a portable set for Summer use has been placed on the market by the Marwol Radio Corporation, 85 Mercer street, New York City.



This is known as the "Marwol Baby Grand," and comes equipped for storage battery use, but may be changed to operate on dry cell tubes.

While the Marwol Baby Grand is much smaller than the well known Marwol Model A-1, it contains identically the same 5-tube tuned radio frequency circuit that is known for selectivity, range and ease of operation. The Baby Grand retails for \$40.

A loop or outside aerial may be used, the latter, of course, giving the best distance. The Baby Grand has been found to produce results similar and favor-

Records of Distance and Volume with Howard Set



The Howard 5-tube Neutrodyne, made by the Howard Radio Company of Chicago, has been developed during the past several months until at present it is a highly efficient receiver and a very popular one among the DX fans.

The Howard Neutrodyne was designed primarily to eliminate annoyances which sometimes exist in radio reception, such as restricted range, howling, indistinct reception, and interference of local broadcasting stations.

The cabinet of this improved receiver is of 3-4 inch black walnut, high polished. It is fitted with a nickel-plated hinge, cover stop, and felt pads. The entire set can be removed from the cabinet by disconnecting the wires from the nine binding posts, removing two machine screws from the bottom of the cabinet, and sliding the panel upward in its slots.

Neutroformers, which are radio frequency transformers especially designed for Neutrodyne use, are wound on hard rubber tubing. The primary winding is invisible, the wires resting in grooves cut in the rubber with rigid accuracy, by specially constructed machines.

Neutrodons, variable condensers of minute capacity between plate and grid in the tube, are easily adjusted to perfect neutralization. This adjustment is carried out at the factory and need not be repeated. To attain the last degree of clarity in sound, three neutrodons are used instead of the customary two.

Heavy phosphor bronze contact arms, spring reinforced, insure contact on sides of the tube terminal pins in the Howard sockets, giving maximum tube efficiency. Panels and sub-panels are made of flawless Formica, or Bakelite, no wood being used except in the enclosing cabinet. Wiring is squared bus-wire.

The Howard set is designed to use five tubes, all alike, of the "A" type. It operates satisfactorily on either indoor or outdoor antenna, and for bringing in coast to coast stations on a loud speaker, a single outdoor wire fifty feet long is advisable. The Howard set will receive with uniform efficiency over a minimum range of 190 to 610 meters.

The price of the Howard five-tube Neutrodyne is now \$200.

ably comparable with any five-tube receiver of the same type. It was designed by R. H. Martin, general sales manager of the company, to eliminate oscillation over the entire wave-length range, and this it can be said to accomplish satisfactorily.

The Marwol is small and accordingly is easy to carry and handle, while not taking up much room if used in the home as a permanent fixture. The Marwol people decided that the 5-tube tuned radio frequency type of receiver was the best suited to portable needs and likewise one of the most popular circuits of the day, so these features were incorporated when the new Baby Grand was designed.

Operadio Set Entirely Self-Contained

For nearly three years the Operadio Corporation of Chicago has concentrated on one model, with a view to obtaining quality of tone, greater power and range and loop reception and big battery supply in a portable, entirely self-contained unit.

The 1925 Model Operadio, a six tube, tuned radio frequency set, with six "A" batteries, four big 22½ volt B batteries and a built in loud speaker, is particularly interesting in its design to obtain reduction of electrical losses. The longest wire lead is 2½ inches. The tubes are supported in aluminum containers which also house the transformers, grid leaks, etc., impregnated in special wax to eliminate atmospheric variance.

The cover serves as the aerial by a design patented by the Operadio Corporation.

The 199 type tube is used throughout, and a voltmeter operated by a convenient two-way switch shows the operator instantly his "A" battery draw or his "B" battery reserve. Two dials tune the set



through special condensers of Operadio design and make.

These condensers, which are of low loss design, have an eight-to-one reduction on the knob and back lash is eliminated by means of planetary drive. An exclusive feature is a fuse on the "B" battery circuit which prevents the tubes' burning out. The tone of the Operadio is clear and undistorted, and distance is equal to many eight-tube sets. All long range reception can be had on the loud speaker. The price, complete, is now \$189.00.

The Operadio can be used as an ornamental decoration to the home or it may be carried about easily.



Howard Five Tube Neutrodyne

To build the best—the ultimate—in radio receiving sets regardless of cost has always been our ideal and our aim.

That we have succeeded is best evidenced by the fact—not what we claim but what an actual demonstration will prove to you.

Hear the Howard Five Tube Neutrodyne at any Howard dealer and then decide.



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NEUTRODYNE
Pat. March 27, 1923 and April 1, 1924
Retel. Pat. Nos. 1,450,080 and 1,489,228
Other Patents Pending

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IF YOU ARE INTERESTED IN CUTTING DOWN YOUR PRODUCTION COSTS IT WILL PAY YOU TO COMMUNICATE WITH US. YEARS OF EXPERIENCE HAVE ENABLED US TO GIVE MANUFACTURERS THE BEST POSSIBLE PRICES CONSISTENT WITH HIGH QUALITY.

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All steel construction. Complete with guy wires and masthead pulley. We pay the freight.

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Whether you plan to build or to buy a receiving set, it will pay you to know something about the "insides" of radio. This booklet gives you the "inside dope" on some of the recent inventions embodying the latest ideas of radio engineers. In this bulletin is full information about the

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"HEGEHOG"
Audio
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Ratio 1 to 3, 1 to 4,
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This light weight audio transformer has earned a place in the very front rank for its remarkable volume, and pure, natural tone. It is 100% self shielded against foreign noises.

Its small size is a surprise to everyone. It cuts the space requirements for audio transformation in two. This is a big advantage in portables and makes it ideal for neat and compact wiring.

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Price \$1.10

The Fire Underwriters' Code requires that—

Each lead-in wire shall be provided with an approved protected device properly connected and located (inside or outside the building) as near as practicable to the point where the wire enters the building. The protector shall not be placed in the immediate vicinity of easily ignitable stuff, or where exposed to inflammable gases or dust or flyings of combustible materials. The protective device shall be an approved lightning arrester which will operate at a potential of five hundred (500) volts or less.

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Order from Dealer

Jewell Electrical Instrument Co.

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"25 Years Making Good Instruments"

A New Power Supply Receiver

(Continued from page 14)

Parts listed are given under headings that indicate their use in the receiver.

"B" Rectifier System

- 3 Audio Frequency Transformers
- 2 Two Mfids. Fixed Condensers
- 2 Tube Sockets
- 1 Bell Ringing Transformer—8 volt
- 1 20 ohm rheostat
- 10 feet flexible rubber covered lamp cord
- 1 push switch
- 1 separable plug

Audio Amplifier

- 2 Audio frequency transformers
- 2 tube sockets
- 1 .004 mfd. fixed condenser
- 1 .0025 mfd. fixed condenser
- 2 binding posts

Tuning Circuits

- 2 lengths of insulating tubing, 3 inch diameter, 3 inch length
- 1-2 lb. No. 22 double silk covered magnet wire
- 1 small clip connector or spring clip for tap adjustments
- 2 binding posts
- 1 tube socket
- 1 double mineral crystal detector
- 2 .0005 mfd. low-loss variable condensers

Filament Lightings

- 1 8 volt Bell ringing transformer
- 1 "C" battery
- 1 potentiometer
- 1 10 or 15 ohm rheostat

Extra Parts

- Aerial and ground equipment
- Loud speaker
- Bus bar or No. 16 fixture wire for set connections
- Cabinet and baseboard about 20 by 12 inches

The circuit diagram is laid out approximately as the parts are to be placed on the baseboard, and further suggestions may be had from the photos. The "B" apparatus should be compactly mounted at the rear, so as to allow plenty of room for the important tuning apparatus at the fore. The audio amplifier is located along the left edge of the board, starting at the front. Two binding posts are placed at the rear of the audio amplifier for the speaker and two others at the right hand rear corner for aerial and ground. The power lead is brought in at the rear center and is held down by a simple half-round clamp bent from a piece of iron or brass and fastened with two screws. A "U" shaped clamp is bent from a small sheet of iron or brass as a clamp to hold the "C" battery, and another clamp of smaller size made to fasten the 2 mfd. condensers. The shape of this clamp varies according to the make of condensers chosen—these being for the purpose of filtering the ripple out of the rectified "B" voltage.

Coil Construction

TO TUNE the grid of the R. F. tube and to couple it to the aerial, a special coil is built, 40 turns of the magnet wire are tightly wound on one of the lengths of tubing, taking "twist" taps at the 5th, 8th, 11th, 15th, 20th, 25th, 30th and 35th turns. The coil ends may best be connected to soldering lugs fastened at the edge of the tubing by short 6-32 machine screws. An extra screw and lug is provided at one end for the antenna wire. From this lug a short piece of flexible wire is brought to a clip connector, whereby contact from the aerial may be made to any one of the taps provided. The taps are merely twists in the wire, scraped as the winding goes on and twisted firmly. Before the coil is used, these are soldered for greater strength and better contact.

Next, a coupler is made for coupling the R. F. tube to the crystal. To control the sensitivity, its primary is made variable, and, most any coupler on the

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vibration is at one moment all energy of bending and at the next all energy of motion.

The effect of the impulses is cumulative. Each increases the energy of vibration by a little, until finally the vibration is large enough to set up frictional resistances which use up all the further impulses. Thus the small impulses give rise to enormous forces, but these are actually supplied by the elasticity and mass of the bridge. The bridge in a sense breaks itself.

Each Wave Adds to Energy

IN A similar manner the weak waves coming to a receiving antenna set up in its circuit only a tiny electromotive force, far too small, in fact, to pass the necessary current for an audible signal through either condenser or coil alone. If, however, the circuit is properly tuned, each wave adds to the charge on the condenser and thus to the current which flows in the circuit, until at length it is so great as to requisition all the weak electromotive force induced in the circuit by the waves.

The circuit then oscillates steadily, but with vastly greater electromotive forces upon the coil and the condenser than the tiny voltage directly induced by the waves. It is these relatively large electromotive forces which are analogous to the large bending force and the force associated with the momentum of the bridge vibration. It is these large electromotive forces which overcome the large oppositions of condenser and coil to the passage of the current. Taken around the circuit, they are nearly equal and opposite, their small difference being the electromotive force induced by the waves, but the detector circuit is connected to receive their full effect.

It follows from these considerations that, if we could make the resistance of our receiving circuits small enough, waves, however weak, could produce appreciable voltages upon the detector.

On the other hand, the effect of waves for which the receiving circuit is not in tune is to alternately aid and oppose the natural oscillations of the receiving circuit, with the result that very little current flows and the detector is practically unaffected.

A circuit may be tuned either by varying the capacity of its condenser (elasticity of the circuit) or by the varying its inductance (electrical mass of the circuit), and it is immaterial which, just as it is possible for a violinist to tune a string either by changing its tension or the length of the vibrating portion.

In conclusion, when you see your long distance radio friend silently turning a dial with a distraught air, you may feel sure that his anxious face does not indicate that he is afraid of losing a single word of the speaker. He is merely absorbed by the delicate task of so adjusting the electrical stiffness or electrical mass of his receiving circuits that they will allow the maximum current to flow and thus set up the greatest possible voltage across condenser, coil and grid.



KEEP reception clear!

Keep it clear. Keep it loud—with all the volume your set should have. Keep the battery at top notch—fully charged—peppy.

The Tungar charges your storage battery overnight while you sleep—and at a cost of hardly more than five cents. It's easy! Just two clips—and a plug for the house current. Or you can make a permanent connection, and just throw a switch. Keep your set at its best all the time—with a Tungar.



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The true low-loss inductance—95% air dielectric! Dopeless, air spaced windings. Pri. 6 1-4 turns. Sec. 60 turns—Greatly improves tuned R. F. or any set using a tuning inductance. More volume; better selectivity. At your dealer's or direct, \$8.50 each, \$10.50 the complete set of 3.

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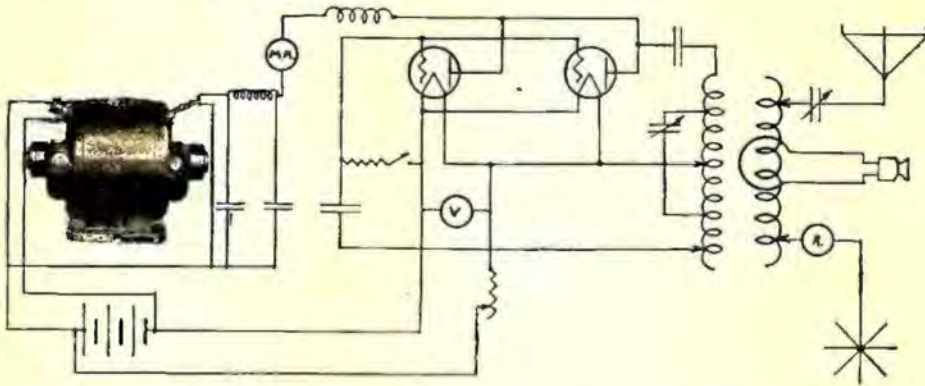
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Rebuild it to this Kladaq Coast to Coast Circuit, using same old panel, almost same parts, but no Nightmare of Neutralization! Twenty-two feet of gold sheathed wire, with only extra part and simple, complete instructions—\$5.00, prepaid anywhere. Nothing more to buy. Over a thousand "converted" Neuts are daily bringing in clean, resonant volume from Coast to Coast. Details in clean, resonant volume from Coast to Coast. Details in 10c, 48-page meaty catalog of PARTS ONLY—10c. Kladaq Radio Laboratories, Kent, Ohio

Clipped from Dec. Q. S. T.

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Item No. 68 6-12 volt primary, 500 volts, 40 watt secondary.
This little ten watt set can easily be constructed for less than \$100.
Requires a minimum of technical knowledge to effectively operate.
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Gentlemen: In order to get a free subscription to RADIO AGE, "The Magazine with Blueprints," for one year, I herewith send you the name of a dealer who will sell RADIO AGE in the city mentioned. It is understood that if you already have a dealer in this city that the offer of a free subscription does not hold good.

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4-25

Some Radio Programs and Personalities

(Continued from page 30)

Russell, Jimmy Kessell, Leonard Van Berg, Virginia Flohri or the Packard Six Orchestra, it will be seen that practically none of them can be granted. Yet the public seems to sense the willingness on the part of the station and the artists to co-operate in giving the public what it wants, as the requests increase week by week.

During the mysterious Double Voiced Octavos' first programs, the main studio of KFI was called from over 600 miles away. During the fifteen minute, one-act play given on Hallowe'en, a dozen long distance calls were made from outlying points in Southern California. Anything that arouses curiosity will produce telephone calls.

Many long lost friends have been brought together over the telephone at KFI. A singer's name will be announced, then someone who has known someone of that name will call in and hesitatingly ask if "Sophie Klotz, who just sang 'Sweetest Little Feller'—did she ever live maybe, in Oklahoma City about ten, twelve years ago?" Sometimes it is a different Sophie, but just as often it is the right one and then KFI is thanked with a box of oranges or a pair of bed-room slippers or something of the kind.

The hostess at KFI, who happens to be the writer of this story, is convinced that the perfect hostess at a broadcasting station should have an Encyclopaedia Britannica and a reference library at her elbow to be able to take care of the various questions that are asked on any one night.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC. REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of Radio Age, published monthly at Mount Morris, Illinois, for April 1, 1925.

State of Illinois, County of Cook, ss.
Before me, a Notary Public in and for the State and county aforesaid, personally appeared M. B. Smith, who, having been duly sworn according to law, deposes and says that he is the Business Manager of Radio Age and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and, if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 413, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Radio Age, Inc., Chicago, Ill.; Editor, Frederick Smith, Chicago, Ill.; Managing Editor, Frederick Smith, Chicago, Ill.; Business Manager, M. B. Smith, Chicago, Ill.
2. That the owner is: (If the publication is owned by an individual, his name and address, or if owned by more than one individual, the name and address of each, should be given below; if the publication is owned by a corporation the name of the corporation and the names and addresses of the stockholders owning or holding one per cent or more of the total amount of stock should be given). Radio Age, Inc., Chicago, Ill.; Frederick Smith, 500 N. Dearborn St., Chicago, Ill.; President; M. B. Smith, Secretary and Treasurer, 500 N. Dearborn St., Chicago, Ill.; John H. Lubbeck, Vice-President 6429 Cate, Ave., St. Louis, Mo.
3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state). None.
4. That the two paragraphs next above giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any person, association, or corporation has any interest direct or indirect, in the said stock, bonds, or other securities than as so stated by him.
5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise to paid subscribers during the six months preceding the date shown above is: (This information is required from daily publications only).

M. B. SMITH,
Business Manager.

Sworn to and subscribed before me this 1st day of April, 1925.

FLORENCE A. SMITH.

(My commission expires Sept. 21, 1926).

WNAC—The Popular Women's Station

(Continued from page 25)

prophesied the future in hatdom. And it must be remembered that this show was the real thing; in other words, inside stuff. Only milliners were allowed admittance, even though any American house-wife could hear the entire proceedings.

As the many beautiful models came down the run-way to the music of one of Boston's smart orchestras, Jean Sargent gave a remarkable word picture of each, describing the gowns in careful detail. And the men did not regret listening in on this colorful feature—even if the color could only be seen by proxy. For when one heard the announcer say: "And here comes a very beautiful girl with a straight-line gown of lip-stick hue, wearing a directoire hat of dull garnet satin," or, "There is a cute little blonde-haired lady making her entrance as the orchestra plays 'Blue-Eyed Sally'; she is wearing a gown of blue charmeuse edged with old silver and her hat is one of the new large designs in color to match; very chic!" Whose imagination would not flutter after all that vivid description?

This millinery show was referred to above as the crowning triumph of the women's section of WNAC, but anyone who knows Jean Sargent knows that she will not be content to rest upon her laurels. Take for instance, this statement made several weeks before the millinery show, in the home-like atmosphere of one of the station studios:

"Within the next few months," she said, "I am planning to give the women more and more; for, after all, the women are becoming just as ardent in this radio game as the men. For instance, after putting on a special program of any variety, we usually find women to be more responsive than men. A woman is quicker to criticise than a man, and criticism is essential in the life of any first-class radio station."

WNAC is a progressive station, and its sponsor, John Shepard, Jr., is an idol in many of the hearts of New England radio fans. Frequently, the programs for women are relayed from the Boston station through the Providence station of the same company, WEAN.

And as the genial and highly popular director of WNAC, Major John J. Fanning, says: "The 'W' in both cases might stand for 'woman'."

STATIC—THE RADIO BUGBEAR

How can it be best eliminated, or at least minimized to an unnoticeable degree? Roscoe Bundy, that famous radio analyst, has prepared an article on "Static" that will do away with the old fear of Summer reception. Look for it in the June RADIO AGE—out May 15th.

Silver-Marshall RADIO EQUIPMENT INC.

SILVER CIRCUIT DESIGNS



McMURDO SILVER
Assoc. I. R. E.

Have gained recognized supremacy for the SILVER 7-TUBE SUPERS and the SILVER 4-TUBE RECEIVERS. Sets built according to Silver Circuit Designs have been approved by the "WHO'S WHO" of Radio . . . have been lauded by thousands of successful builders as the most wonderful receivers for distance and loud speaker miles. . . . They have outperformed every promise and claim made for them, and have secured results no other set or design could offer.

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S-M Transformers are supplied in sets of two, or three TWO-TENS (iron-core interstage), and one TWO-ELEVEN (filter for input or output), with identical peaks and separate curves. Each curve is plotted in our laboratory and recorded directly on the tag tied to the transformer. Both peak at 5000 meters and pass an 11 kilocycle sideband without distortion. Price of either type.....EACH **\$8.00**



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The Traffic Cop of the Air

Make your set selective—separate the interfering stations by simply putting the Traffic Cop on guard. The Ferbend Wave Trap will tune out interfering stations, no matter how troublesome. Never reduces, but nearly always increases volume. Add a Ferbend Wave Trap to your set and "police" your reception. Regulate the traffic!

Designed and manufactured complete by us after years of careful experimenting. It is not to be confused with imitations, hastily assembled from ordinary parts. Price is \$8.50. Shipment is made Parcel Post C. O. D. plus postage, or post-paid on receipt of price. Order today.

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Send for FREE Booklet

Ferbend Wave Trap

Poughkeepsie N. Y. Gentlemen: The Wave Trap ordered from you some time ago is all that you claim for it and then some.

It not only keeps out the other station that is causing the interference, but it also seems to act as a clarifier of the incoming station. (Signed) W. E. Wiltse.

How to Make a Vacuum Tube Tester

(Continued from page 12)

been bolted down as tight as is safely possible.

A poor connection will add resistance to the circuit and may result in throwing the readings of the meters off quite a bit.

We will now turn to the wiring diagram and run the leads as indicated in the table on page 11. The panel will then be marked as desired and mounted in its cabinet or placed in its permanent location. Simple, isn't it? Only 25 leads to run. To connect the instrument for operation, the batteries will be connected as follows:

"B" or Plate Battery

Connect 90V of "B" grid battery from binding posts B—to B90, taking taps off at 22½ volts, 45 volts and 67½ volts, and connecting them to their respective binding posts B 22½, B45 and B 67½.

"A" or Filament Battery

Connect a 1½, 3 or 6 volt battery across binding posts A— and A+, the size to be according to the tube under test.

"C" or Grid Battery

Connect two 4½ Volt C batteries in series and across binding posts C+ and C—, taking a tap between the two batteries and connect it to binding post C+—.

Method of Operation

TO TEST a tube or plot a curve, there are several characteristics about a tube that can be put to good use, when known. They can be found by using this tube tester. Let us take a Number 199 type tube and plot a grid potential and plate current curve, for example.

When the batteries are all connected, put the tube into the socket (T) using the adapter. First move the switch (BS) to the negative point, then move the switch PS to the 45 volt tap. Now set the transfer switch (TS) for the 0-10 volt scale on the meter (PF.) Move the rheostat (R) until the meter shows 3 volts.

Adjust the potentiometer (GP) until the meter (GM) shows "0." Now throw the transfer switch (TS) for the 0-100 scale on meter (PF), and adjust the rheostat (BR) until a 45 volt reading is obtained. Then cut out meter (GM) by use of the switch (GS) and move the resistance (R) until the highest reading is obtained on the milliammeter (MA). This will be the normal plate current of the tube, at 45 volts on the plate with a grid bias of "0" volts, and whatever filament voltage the meter (PF) will show.

To plot a plate current curve (See Figures 3 and 4), move your switch (PS) to the 22½ volt tap and adjust your resistance (BR) until the voltmeter (PF) reads 20 volts. Adjust the filament rheostat (R) until the maximum reading is obtained on the milliammeter and spot this reading as shown on the chart. Now adjust your switch (PS) and your rheostat (BR) until the meter (PF) shows 25 volts, and spot the reading

of the meter (MA), repeating this operation in steps of 5 volts until you cover the desired range. Connect these points on the chart with a line and you will have a plate current chart at a "0" volt grid bias.

To plot a plate curve at various grid voltages, and for positive and negative grid biasing, move the switch (BS) to the positive or negative point and adjust the potentiometer (GP) until the desired grid voltage shows on the meter (GM).

Always cut the meter (GM) out of the circuit by use of the switch (GS) when reading the plate current on the meter (MA). A grid voltage curve for various plate currents and voltages will be made in the same manner, except by taking periodic readings from meter (GM), say about one-half volt apart and plotting the curve the same way.

Formulas and other data for testing and plotting curves will be published in an early issue of RADIO AGE, with a view to covering as much about tube characteristics as is useful to the fan. Tables for average computation will also be shown.

Pickups By Our Readers

(Continued from page 44)

circuit used by Mr. Miller, which is a variation of the three circuit principle. Any of you who are interested might drop him a line and get the desired information direct from him. Anyway, we are going to award him a DT degree for the splendid results he is having as a result of exhaustive experiment.

RADIO AGE,
Gentlemen:

I am a reader of RADIO AGE and I have learned many a thing from your magazine. I know the fans are after circuits that are simple and powerful and this sure will bring in DX as clear as a bell. This is Capacity Feed back circuit and here is a record of DX Saturday evening from 10 p. m. until 12 midnight at my friend's home in Woodhaven, L. I., Jerome Kupfer, 8411 94th Street.

KDKA, KYW, KFI, WSAI, KSD, PWX, HAVANA, WHAS, WOO, WIP, WTAM, WGAM, WWJ, WGR, and WREO.

These were all heard on a loud speaker all over the house and clear. If any of you fans can show me something better, well, go to it, boys, I am on the job to learn any time. If you will write to me I will gladly join you working out circuits with my favorite RADIO AGE Magazine.

Yours very truly,
William Bentner.

304 Park Ave.,
Brooklyn, N. Y.

Here is a good offer, fellows. Any of you who want information on circuits of this type should get in touch with "Bill." The circuit he describes we are unable to print this month, but will use it in the near future. It must be very efficient, judging from his DX log and the offer he makes.

(Turn to next page)

RADIO AGE, Inc.,
Chicago, Ill.

Dear Sirs:

Herewith find list of broadcasting stations picked up on a one tube radio set on the evening of February 21, 1925.

I hope that this will entitle me to become a Dial Twister and in anticipation of receiving your button by return mail.

I remain,

Yours very truly,
Nicholas G. Hart.

Bienville,
Levis, P. Q.

Here is his list, and we think it is one of the best ever submitted to these columns, considering distance.

KYW, CKAC, WREO, WEAJ, WEBB, WGN, WTAM, WSAI, WBZ, WGY, KDKA, WCAI, WLW, WTAS, WOL, WBBB, CFCA, CNRO.

As "Sen" Kaney of KYW would say, "Yes Sir, Yes Sir," indeed, you do get your D. T. button.

RADIO AGE,
Gentlemen:

I am sending a list of stations that I received on a two tube home made Harkness. I am located a half a square from a transforming electric station and have a lot of interference. I hope that this list entitles me to a DIAL TWISTER'S button.

KYW, KDKA, KFNF, KFGZ, KFDM, KFIX, KFRB, KFKX, KSD, PWX, WJY, WBZ, WLW, WSAI, WCAI, WMH, WDAF, WGY, WTAM, WHAZ, WJAR, WCBF, WEEL, WGN, WGBS, WOR, WBN, WHAS, WRK, WOC, WEAJ, WEBB, WOS, WJAX, WBAV, WREO, WQJ, WCCO, WTAS, WGR, WJJD, WLS, WOAW, WWJ, WHO, WMAZ, WFAA, WHB, WQQ, WHA, WMC, WFSN, WJAS, WCBF, WNAC, WSH, WAHG, WHAM, WCAI, WGAN, WEAL, WOAI, WBCN, WJAD, WDAF, WOK, WBBB, WBLL, WHK, WTC, WCBF, WVAE, WTAY, KOP.

Yours very truly,
Robert Drake.

23 East Spruce St.,
Elmwood Place, Ohio.

This is a very fine DX list, and we are sure that you will agree with us in awarding Bob his D. T. Button. He must have sat up "plenty" nights to get such a fine record together.

WARM-WEATHER SURPRISES FOR RADIO AGE FANS!

As warm weather and Summer approach, there will be no let-up in interest in RADIO AGE's monthly articles. In the June number, on the stands May 15, there will be countless agreeable surprises, among which will be:

"Outdoors with Radio," by Armstrong Perry.

"Getting Rid of Static," by Roscoe Bundy.

"A Portable Super-Heterodyne," by H. Frank Hopkins.

The Browning-Drake Circuit.
More About the Double Grid Tube and Its Circuits.

How to Make This a Radio Summer.

A Big Pickups Section—
And Many Other Features.
Order your JUNE RADIO AGE Now!

Don't forget to send your DX lists to—
THE PICKUPS EDITOR



Better Than a Laboratory Standard

The usual method of measuring condenser resistances is by comparison of readings obtained when the condenser to be measured is interchanged with a precision, laboratory "standard" in the same circuit.

Professor G. M. Wilcox, of Armour Institute of Technology, recently conducted tests on two B-T Lifetime Condensers taken from stock and found they were of lower resistance than his laboratory standard.

Part of Professor Wilcox's letter reads as follows:

"When the B-T Condensers were in the circuit the current was 1 to 2 per cent greater than that obtained with the Laboratory Standard."

Condensers, "Better than Laboratory Standard," are representative of the efficiency of B-T products generally.

Such apparatus in combination with a specially designed circuit made possible the B-T "NAMELESS," now known nation wide for its selectivity and range.

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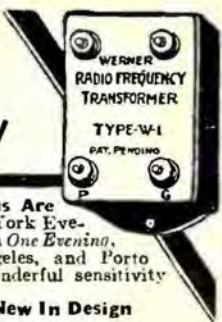
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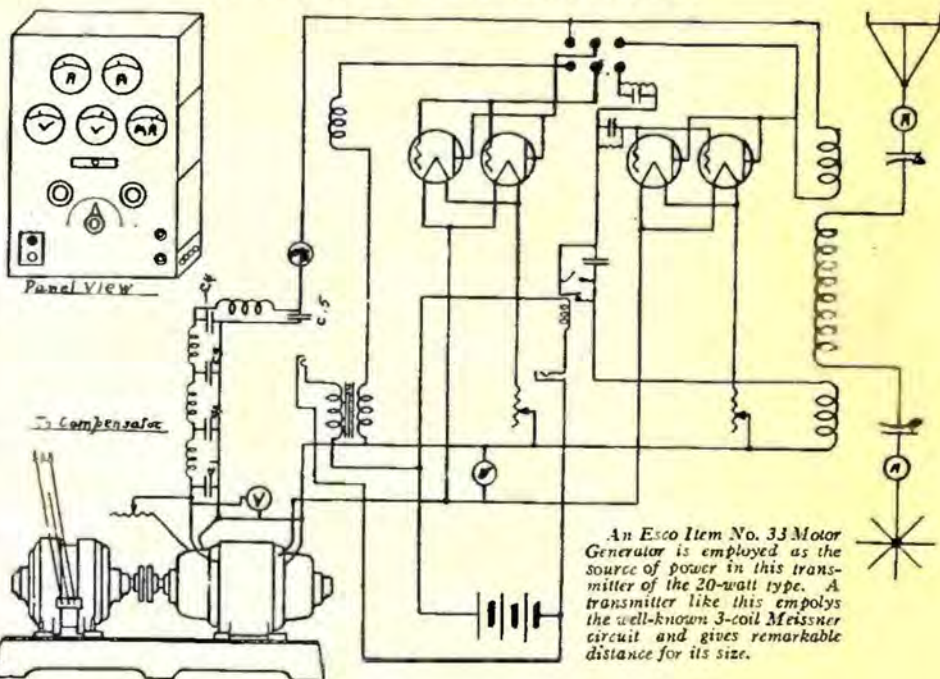


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Big Money-Saving Radio Catalog containing a thousand bargains of everything in radio, parts, supplies, complete parts for sets, complete sets, etc., also a mine of very latest information on all different circuits, complete list of broadcasting stations and other valuable data. Easy to build your own radio set. All complete parts of sets consist of standard advertised guaranteed parts and include drilled bakelite panels and wiring diagrams for easy assembling. Everything guaranteed on money-back basis. Our Free Service Department helps you solve all your radio problems. Send name, address for free catalog. Send names of friends; we will mail them catalogs. RAOULPH. RADIO CORPORATION CHICAGO 189 North Union Avenue, Dept. 444

Radio is going to take tremendous strides during the next few months. The up-to-date radio fan cannot afford to lose interest during the warm months if he expects to be acquainted with the newest developments next Fall. A subscription to RADIO AGE, at \$2.50 a year, postpaid, will insure your being constantly informed of the latest in the ethereal art. DO IT NOW.

Maximum Miles Per Watt with This Transmitter



An Esco Item No. 33 Motor Generator is employed as the source of power in this transmitter of the 20-watt type. A transformer like this employs the well-known 3-coil Meissner circuit and gives remarkable distance for its size.

TO THE man who has a limited amount of capital to invest and wants to obtain the maximum miles per dollar, which is essentially the maximum miles per watt, this efficient little set should appeal. The set is a 20 watt transmitter using 4-5 watt tubes. By means of a double throw, double pole switch, the set may be used for either phone or continuous wave telegraphy. The circuit is the well-known three coil Meissner.

Power Supply. Telephony has today reached such a state of development that not only must the voice be carried in an intelligent manner, but it must be a true reproduction of the original, free from distortion and unaccompanied by stray noises and hums. The "pure wave" is also an important factor in telegraphy efficiency and the reduction of interference. The nearest practical approach to this "pure wave" is the current delivered by a properly designed motor generator set. From the viewpoint of good telephony, efficiency, flexibility and convenience, an "Esco" Item No. 33 has been chosen as the source of power supply. This type is a four bearing two unit set. The generator is of the double commutator type, supplying 100 watts at 10 volts for the filaments and 200 watts at 500 volts for the plates. Regulation of the output power is obtained by means of a rheostat in the field of the generator.

Filter. The filter is the conventional three section "pi" type. The inductances should all be equal and from 10 to 30 henries each. The condensers should be from 2 to 4 henries each. The rules for combining filter sections should be strictly adhered to; i. e., C₁ equals C₄, and C₂ equals C₃, and under all conditions C₁ equals one half C₂. Were it not for the use of telephone, the modulation choke could be omitted. The omission of this choke would permit the large condensers of the filter system to by-pass the modulating frequencies and all attempt at telephony would result in an unintelligible gurgle. A five to ten henry choke will be sufficient. Due to the by-pass effect of the larger

condenser for audio frequency, the radio frequency by-pass condenser C₅ should not be larger than .01 mfd.

Meters. Upon the intelligent use of the meters depends the efficiency of the set. A properly operated set will work rings around an improperly operated set of much larger power. The plate milliammeter should be of 0-300 milli-ampere capacity. The filament voltmeter from 0-12 volts. The antenna ammeter should be of the thermocouple type from 0-3 amperes. The above meters are essential to the practical operation of the set. Two additional meters will be of great help. A plate voltmeter of from 0-600 volts and an additional thermocouple meter to put in the antenna circuit. With an ammeter in the antenna lead and one in the counterpoise lead, it will be impossible to obtain a balanced condition with a resulting greater efficiency.

General. The three coils may be of either the helix or pan-cake type. The hinged pan-cake type is to be preferred, as the coupling may be easily varied and part turn taps are more easily effected. The aerial and counterpoise condensers should be of the transmitting type, capable of withstanding radio frequency of high voltage. The use of two is not essential if a balanced condition is not sought. The usual condensers across the grid and plate coils have been omitted. While they are a slight aid in tuning, they constitute a constant loss and often cause the radiation of other waves than the fundamental. Keying is accomplished by means of a relay which may easily be made from a telegraph sounder. As this relay is in the grid circuit, it should be mounted as near the tubes as possible, and be connected with short leads. Both the relay and the current through the modulating transformer are controlled from jacks on the panel. A small knife switch should be used to shunt the relay when telephony is being used. A 4-8 volt battery should be used for modulation and may also be used to operate the relay.

International Radio Problems Come to Fore

WASHINGTON, D. C.—With the passage of the bill carrying the State Department's budget of \$75,000, plans for the International Radio Conference to be held here in September are being formulated. The actual agenda depends somewhat upon what action the world telegraph conference at Paris takes this Summer. The United States will not be officially represented as it is not a party to the conventions. A careful study of the action taken there, especially with reference to the attitude of the World Powers, will be made by American Governmental officials and radio experts, in order that the general trend of opinion on electrical communications may be followed.

It may be found more practical to eliminate discussion on strictly technical matters, such as specific wave channels, power limitation and such matters, as they might tie up development in a mass of technicalities, which could not be changed for three or four years.

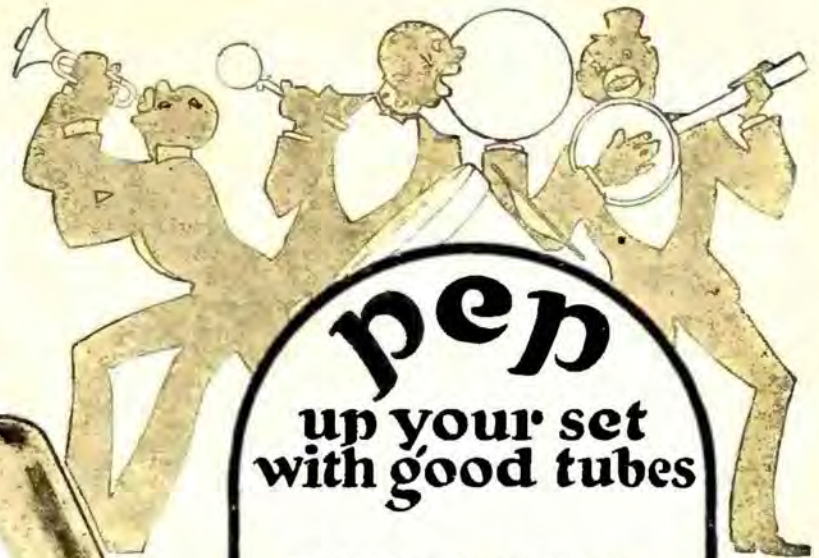
The essentials of world-wide radio communication will be covered in the Paris Conference, since they are incorporated under the clause of the old telegraph convention of 1908, covering ship-to-shore radio communication. It is believed that the Paris conference will extend these regulations to cover trans-oceanic radio services. If this is the case, radio service in general, licenses, classification of messages, accounts and rates may be outlined at Paris prior to the American conference.

It is quite probable that a broader conception may be placed upon the old plan for allocating high-power commercial stations throughout the world. Advanced thinkers on this subject believe that the location of commercial stations within the boundaries of a country is a matter for the particular country to determine. The international allocation of signals, such as distress and general calls, as well as the assignment of high-powered station call letters, will be discussed, although it is believed that this matter will continue to be handled by the central bureau at Berne. International broadcasting by amateurs may be considered, as recently the amateur has come into world prominence, and his call letters, although national, have no definite significance in another foreign country, and may be duplicated.

As most of the countries of the world are parties to either the telegraph or the radio conventions, it is likely that more than fifty separate governments will send delegates to the United States this fall to participate in the deliberations on radio regulations.

The 1920 Conference

In October, 1920, about a year before America in general became vitally interested in radio, a preliminary radio conference was held in Washington, where representatives of Great Britain, France, Japan and Italy met to draw up an outline program for future discussion. Most of the visiting delegation were headed by the respective an-



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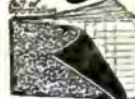
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Send No Money Pay postman after log arrives. Post-fund if not DELIGHTED. Order today—NOW. Postal will do RADIO PRINTERS, Dept. 9025 Mendota, Illinois

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PATENTS

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bassadors and ministers, and the United States was represented by Under Secretary of State Davis, Postmaster General Burleson, Admiral Benson of the Shipping Board and Walter Rogers.

The conferees laid down proposals under the following subdivisions: The radio protocol of the Peace Conference; a universal communication union, composed of telegraph and a radio sections; International telegraph, radio and cable laws; and improvements in the communication facilities between the five great Powers.

The British submitted a plan for the amalgamation of all electrical communication rules and regulations to be submitted to a world's congress on communications, which, however, never materialized.

The old international code system, a method of communicating between stations or ships of different nations, was pronounced out of date and not adapted for radio. Provision for transmitting messages intelligible to all operators, regardless of the language they spoke, was planned for use in sea and aerial navigation; covering damages, sickness, stores, fuel, meteorology, ship and aircraft business, and other special needs.

Although the State Department has made no official move toward calling the nations of the world to this conference, it is understood that formal invitations will soon be sent out, and the working up of a program begun.

"What is Radio?"

"Wish I knew something about radio—not the technical part, you know, just enough to understand what it's all about."

Yes, and the people you hear say this are only a small part of the thousands who think it.

Lack of knowledge and consequent diffidence or uncertainty are the greatest handicaps of the radio industry today. Untold thousands of people are not buying radio sets simply because they are afraid. They don't know.

It is to meet this need that the makers of the Somerset radio receivers have published a unique booklet for beginners—the Somerset Radio Primer, "a little book for the man who knows nothing about radio," telling him what radio is, and how to choose a radio receiver.

It is written for people who are not familiar with electrical or mechanical terms and principles but who would like to know the general idea for radio reception.

Leaving out the technicalities and refinements, it tells the story briefly, clearly and interestingly. Difficult points are explained by analogy with familiar objects.

For example, the action of a rheostat is compared with that of an ordinary faucet in its control of the following stream of water.

There are many illustrations showing the principal parts of radioreceiving outfits, with a brief description of each part.

The Somerset Radio Primer has caused enthusiastic approval wherever shown. The Primer is intended for distribution by Somerset dealers and is furnished with the dealer's name imprinted on the cover. Sample copies may be had by writing direct to the makers of Somerset receivers, the National Airphone Corporation, 22 Hudson St., New York.

Europeans Seek Protection for Radio News

RECOGNIZING radio as a modern means of transmitting news, the members of about twenty-five press associations in Europe have taken steps to protect their property when it is en route through the air. Resolutions signed by such well-known news agencies as Havas of France, Continental of Germany, Fabra of Spain, Reuters of Great Britain, Stefani of Italy and Rosta of Russia have been filed with the International Telegraphic Union at Berne. Other suggestions will be submitted to the International Convention for the Protection of Industrial Property, which meets at the Hague in October.

What amounts to radio censorship is suggested, broadcast transmission would be controlled, receiving sets limited and many phases of radio operation definitely regulated, if the plan is carried out internationally.

Essentially, the foreign press associations insist on ethereal property rights, patent protection, and punishment when their copy is picked up and used without permission. They recommend that a technical means which will prevent the reception and use by unauthorized persons of press matter transmitted by radio, be developed. Simple methods of ciphering and deciphering, insuring rapidity of handling, have been devised, and partially secret radio apparatus has been perfected but not adopted generally. In Europe the governments control and operate radio as they do practically all communication systems; therefore, it might be a practical possibility. But in the United States, where private companies handle communications, great difficulties would be encountered in this connection.

It was also recommended that national governments agree not to authorize the establishment or maintenance of any private radio receiving stations until the authorities have taken all precautions to strictly limit the capacity of the receiving set. That is, receivers would be constructed or set so as to pick up only matter broadcast on certain wave bands and not on those channels carrying news. This sealing of sets has been attempted in some countries unsuccessfully, and certainly would be a tremendous undertaking in the United States with several million unlicensed receiving sets to locate and adjust, even if it became a law.

Strong Ban Asked

Positive legislation against violation of secrecy and illicit use of press matter is urged. As penalties for the use of unauthorized radio news, these organizations desire imprisonment, confiscation and damages, as well as forfeiture of licenses, if illicit use is proven.

Reduced telegraph rates for press matter are asked, and assurance that delayed messages will go forward at press rates, despite the lapse of time fixed for press rates to apply.

Further, the signatories ask that if broadcast concessions are made, the con-

cessionaires be required not to send out political, commercial, financial or other news except that which is submitted and filed by recognized news agencies. This is a curious reversal of the situation in the United States, where the Associated Press has refused to permit its news items to be broadcast. The property value of press news has never been established internationally, it is pointed out, except that in some instances protection after publication is afforded, which would not benefit the news collecting and distributing agencies. In other countries, only what are considered literary works are protected by law.

The members of the foreign press associations claim that radio broadcasting is a menace to them as well as to the public, on account of "the ease thereby given to the spread of uncontrolled news."

How these suggestions will affect the news associations and the private communication companies in this country, as well as the broadcasters and listeners, is unknown, but as American representatives will be present at the conferences, it is assumed that all interests will be protected in the event international agreements are drawn up.

Market for Tapped "B" Batteries Falling Off

The waning popularity of the "soft" tube has greatly reduced the demand for tapped "B" batteries, according to manufacturers of dry cells for plate current supply.

Until the development of satisfactory methods of radio frequency amplification, sensitiveness in the detector was a highly important requirement for long distance reception. The great disadvantage of the "soft" tube is the precise adjustment of plate and filament voltage which is required to operate it at the most sensitive point. Very few users of "soft" tubes, on account of this difficulty, ever secure the added sensitiveness which it gives only under the most favorable circumstances.

The adjustment problem is further complicated by the fact that the most sensitive combination of plate and filament voltage, once found, does not remain fixed. Sometimes a new adjustment in order to "hold" a distant station is required in the midst of a program.

The more modern types of high vacuum tubes, utilizing but a fourth of the filament current required by "soft" tubes, give as good results as those obtained with the "soft" detector tube, for sets using radio frequency amplification.

Dealers selling tubes perform a service to their customers if they make sure that the type passed over the counter is best adapted to the use for which it is intended. In any receiver employing radio frequency amplification, the saving in filament current and the availability of more compact and more economical "B" batteries, make it advisable to recommend high vacuum tubes instead of the obsolescent "soft" detector tube.

IS IT JAZZ?

It is! Anything you hear on RADIO AGE'S Congress Carnival from KYW, Chicago on Saturday, May 2, from 11:30 p. m. to 1 a. m., is going to be jazz and then some. Tune in for a good time!



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THAT trait of thoroughness which merits confidence is always met with high regard. For there is deep satisfaction in knowing that the task in hand is being done as well as it is possible to do it.

This appreciation for reliability has established the leadership enjoyed by Jefferson Transformers. Sheer quality and performance have won the favor of unbiased radio authorities the world over.

Full, rounded amplification over the entire musical range—a constant delight to radio listeners. Such splendid performance is the result of 20 years' specialization in the manufacture of transformers. Replace the transformers now in your set with genuine Jeffersons and see how your set will improve.

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* Tested and Approved by RADIO AGE *



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Britain's greatest engineers in designing receiving equipment for his Majesty KING GEORGE V. chose Resistance Coupled Amplification. None other would do.

THE DAVEN RESISTANCE COUPLED SUPER AMPLIFIER

will give to your favorite tuner, that finesse in quality amplification desired for the Chambers of Buckingham Palace. With Resistance Coupling the most delicate shadings in musical compositions, either with instruments or the voice, are reproduced with a faithfulness not obtainable with any other method of audio amplification.

Your Dealer will be glad to show you the Super Amplifier which can be attached to your favorite tuner in but a few moments. It costs less to install than other methods of amplification and adds greatly to the life of your "B" Batteries.

DAVEN RESISTANCE COUPLED KITS are put up in three and four stages and are for those who would rather assemble their own than buy the complete, ready to attach, Super Amplifier. Obtain from your Dealer the RESISTOR MANUAL, our complete handbook on Resistance Coupled Amplification. Price 25c, Postpaid 35c.



The Aristocrat of Amplifiers

DAVEN RADIO CORPORATION
 "Resistor Specialists"
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IF readers wish to show their approval of RADIO AGE'S stand against the Radio Corporation of America, they can do it in the most practical way by sending in \$2.50 for a year's subscription or if they are already subscribers, urge a friend to subscribe. We believe the fans are with us. Address RADIO AGE, Inc., 500 N. Dearborn St., Chicago, Ill.

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| 15 Battery plates | 109 Horns, fibre | 200 Sets, receiving—crystal |
| 16 Battery substitutes | 110 Horns, mache | 201 Sets, receiving—knock-down |
| 17 Bezels | 111 Horns, metal | 202 Sets, receiving—Neutrodyne |
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| 25 Bushings | 119 Insulators, composition | 210 Sets, receiving—super-regenerative |
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| 28 Cabinets, battery | 122 Insulators, cloth | 213 Slicac |
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| 30 Carbons, battery | 124 Insulators, hard rubber | 215 Socket adapters |
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| 33 Coils | 127 Jacks | 218 Soldering irons, electric |
| 34 Coils, choke | 128 Filament control | 219 Soldering paste |
| 35 Coils, coupling | 129 Jars, battery | 220 Solder flux |
| 36 Coils, filter | 130 Keys, transmitting | 221 Solder salts |
| 37 Coils, grid | 131 Knobs | 222 Solder solution |
| 38 Coils, honeycomb | 132 Knock-down panel units | 223 Spaghetti tubing |
| 39 Coils, inductance | 133 Laboratories, testing | 224 Spark coils |
| 40 Coils, Reinartz | 134 Lever, switch | 225 Spark gaps |
| 41 Coils, stabilizer | 135 Lightning arresters | 226 Stampings |
| 42 Coils, tuning | 136 Loosecouplers | 227 Stators |
| 43 Condenser parts | 137 Loud speakers | 228 Stop points |
| 44 Condenser plates | 138 Loud speaker units | 229 Switch arms |
| 45 Condensers, antenna coupling | 139 Lugs, battery | 230 Switch levers |
| 46 Condensers, by-pass | 140 Lugs, terminal | 231 Switch points |
| 47 Condensers, coupling | 141 Measuring instruments | 232 Switch stops |
| 48 Condensers, filter | 142 Megohmmeters | 233 Switches, aerial |
| 49 Condensers, fixed (paper, grid, or phone) | 143 Meters, A. C. | 234 Switches, battery |
| 50 Condensers, variable grid | 144 Meters, D. C. | 235 Switches, filament |
| 51 Condensers, variable mica | 145 Mica | 236 Switches, ground |
| 52 Condensers, vernier | 146 Mica sheets | 237 Switches, inductance |
| 53 Contact points | 147 Milliammeters | 238 Switches, panel |
| 54 Contacts, switch | 148 Minerals | 239 Switches, single and double throw |
| 55 Cord tips | 149 Molded insulation | 240 Tone wheels |
| 56 Cords, for head sets | 50 Molybdenum | 241 Towers, aerial |
| 57 Couplers, loose | 151 Mountings, coil | 242 Transformers, audio frequency |
| 58 Couplers, molded | 152 Mountings, condenser leak | 243 Transformers, filament |
| 59 Couplers, vario | 153 Mountings, end | 244 Transformers, modulation |
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| 61 Crystal holders | 155 Mountings, honeycomb coil | 246 Transformers, push-pull |
| 62 Crystals, rough | 156 Mountings, inductance switch | 247 Transformers, radio frequency |
| 63 Crystals, mineral | 157 Name plates | 248 Transformers, variable |
| 64 Crystals, synthetic | 158 Neutrodyne set parts | 249 Transmitters |
| 65 Crystals, unmounted | 159 Nuts | 250 Tubes, vacuum—peanut |
| 66 Crystals, mounted | 160 Ohmmeters | 251 Tubes, vacuum—two element |
| 67 Decks, radio | 161 Oscillators | 252 Tubes, vacuum—three element |
| 68 Detector units | 162 Panel cutting and drilling | 253 Tuners |
| 69 Detectors, crystal | 163 Panels, drilled and undrilled | 254 Variocouplers, hard rubber |
| 70 Detectors, fixed crystal | 164 Panels, fibre | 255 Variocouplers, molded |
| 71 Dial, adjusters | 165 Panels, hard rubber | 256 Variocouplers, wooden |
| 72 Dials, composition | 166 Parts | 257 Variometers, hard rubber |
| 73 Dials, hard rubber | 167 Paste, soldering | 258 Variometers, molded |
| 74 Dials, rheostat | 168 Patent attorneys | 259 Variometers, wooden |
| 75 Dials, metal | 169 Phone connectors, multiple | 260 Varnish, insulating |
| 76 Dials, vernier | 170 Phonograph adapters | 261 Voltmeters |
| 77 Dials with knobs | 171 Plates, condenser | 262 Washers |
| 78 Dies | 172 Plugs, coil | 263 Wave meters |
| 79 Drills, electric | 173 Plugs, telephone | 264 Wave traps |
| 80 Dry cells | 174 Pointers, dial and knob | 265 Wire, aerial |
| 81 Earth grounds | 175 Poles, aerial | 266 Wire, braided and stranded |
| 82 Electrolyte | 176 Potentiometers | 267 Wire, copper |
| 83 Enamels, battery | 177 Punching machines | 268 Wire, insulated |
| 84 Enamels, metal | 178 Reinartz set parts | 269 Wire, Litz |
| 85 End stops | 179 Regenerative set parts | 270 Wire, magnet |
| 86 Eyelets | 180 Receiver caps | 271 Wire, platinum |
| 87 Experimental work | 181 Rectifiers, battery | 272 Wire, tungsten |
| 88 Fibre sheet, vulcanized | 182 Resistance leaks | |
| 89 Filter reactors | 183 Resistance units | |
| 90 Fixtures | 184 Rheostat bases | |
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KYW Heard Regularly in Samoa

SOUTH Sea nights,—a languid tropical moon,—the cool of the seaward veranda and the ever-present shimmering glass on the table, with its attendant tinkle, have always been regarded as the white man's paradise, especially for those rovers who dot the spacious Pacific and who prefer to think of the United States as a haven 7,000 miles or so away.

But radio, with its magic wand, has annihilated distance and although the nights, the moon and the refreshments are still part and parcel of the colonials' lives, yet a new attraction has been added.


All of which should serve as a prelude to the letter of ecstasy received from A. F. Dunwoodie, of Apia, Samoa, a mere seven or eight thousand miles from Chicago, in which it is stated that the programs broadcast by KYW from the Balloon Room of the Congress Hotel, where Coon and Sanders play,—which music and fun goes under the name of the "Insomnia Club," is heard nearly every night out in Apia, Samoa.

This is not the first time that KYW has been heard in Samoa, for last year Mr. Dunwoodie also wrote the station regarding his reception of its programs. But the thing which appeals to Mr. Dunwoodie is the fact the Insomnia Club feature broadcast by KYW from the Congress Hotel every morning from 1 a. m. to 2 a. m. and on Sunday morning from 1 a. m. to 3 a. m., reaches Samoa about seven o'clock in the evening and serves as an excellent *aperitif* for the evening meal of many a radio enthusiast. Between Chicago and Samoa, the latter being in the one hundred and eightieth parallel, there is approximately six hours difference in time, making it possible for Mr. Dunwoodie to sit down to his supper table in Samoa and hear radio jazz music broadcast by KYW from the Balloon Room where the original Nighthawks, Coon and Sanders, play at a time that is fairly close to the breakfast hour of the residents of the Middle West of the United States.

Apparently there is little interference developing in the South Seas, although thousands of ships on the Pacific are transmitting on 600 meters and KYW's wavelength is 535.4 meters, for Mr. Dunwoodie does not report any trouble in picking up KYW's carrier wave and holding it until he has extracted all the pleasure and fun from its Insomnia Club.

Banks Kennedy Now a Radio Age Star

Banks Kennedy, who has amused countless thousands through his radio antics from KYW and WEBH, Chicago, has been "signed up" permanently as a RADIO AGE performer from those and other broadcasting stations. Kennedy first started to twinkle when he introduced his famous "If I can Arrange It" song, and he has been at it ever since. He may be heard from WEBH Tuesdays and Thursdays after 11 p. m., and at KYW the first Saturday in every month beginning at 11:30 p. m. on the Congress Hotel Jazz Carnival.



Everyone Interested in RADIO Should Write for this FREE Radio Book

80 pages, profusely illustrated and "chock-full" of interesting data for the Radio Fan; Trouble Shooting Chart, Complete and Authentic List of Broadcasting Stations, Log Chart and Hundreds of Exceptional Values in High Grade, GUARANTEED Equipment. A Postal brings it to you—NO EXPENSE—NO OBLIGATION.

FREE EXAMINATION—MONEY BACK, GUARANTEED!
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ULTRADYNE

MODEL L-2



The "W. R. S." Ultradyne Kit is the *ONLY* complete kit. It is the result of the cooperation of the manufacturer of all its parts used in the Ultradyne circuit, R. E. Lacault, the designer of this famous circuit, and our own research engineers. W. R. S. Knockdown Kits contain everything for building the circuit. Everything is included down to the last screw, nut and wire. Packed in sealed cartons that eliminate all difficulty and doubt for the purchase and assembly of proper materials.

Ultradyne Model L-2 Phenix Ultradyne Kit as follows:

- 1 Special Low Loss 180 degrees Sensitizing Coupler with Copper shield.
- 1 Oscillator Coupler Low Loss
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- 4 Ultraformers. New improved long wave radio frequency transformer
- 4 Phenix matched transformers
- 2 Hammarlund .0065 new type Low Loss Cond.
- 2 Ultra vernier dials. New type
- 1 Accuratum control for coupler
- 8 Na-aid De Luxe sockets
- 1 Patent Potentiometer
- 8 Amperites
- 2 Patent Double Circuit Jacks
- 1 Patent double Filament Control Jack
- 1 Cutler-Hammer switch
- 2 Thordarson Audio transformers
- 1 Variable Grid Leak
- 7 Eby Binding Posts
- 2 Bakelite Binding post mountings
- 1 Dubilier .0065 with Grid leak mounts
- 4 Dubilier .00025 Mica Cond.
- 2 Dubilier .001 Mica Cond.
- 1 Dubilier .005 Mica Cond.
- 1 7x30 Bakelite Drilled and Engraved Panel
- 1 7x30 mahogany baseboard
- 1 Ultradyne book of instructions and blue prints
- 1 Box of assorted screws, nuts, nuts
- 40 feet of tinned bus wire

Our Kit, Price Postpaid, \$73.50

Built to Your Order


The Genuine Ultradyne Model L2 built of the exact parts as specified by R. E. Lacault in a beautiful solid mahogany piano hinged cabinet wired by expert engineers in accordance with the inventor's specifications, \$110.00.

Every Set is Guaranteed to arrive in your home in exactly perfect condition

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Low Loss Tuner



GREAT FOR DX
Selectivity Unexcelled, ask the user
Broadcast and Amateur Types
Price \$10

You should read its advantages in detail. Drop us a postcard today for "Tuner Facts".

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RADIO Storage "B" Battery

22 Cells Lasts Indefinitely—Pays for Itself

Economy and performance unheard of before. Recharged at a negligible cost. Approved and listed as Standard by leading Radio Authorities, including Pop. Radio Laboratories, Pop. Sci. Inst. Standards, Radio News Lab., Letax, Inc. and other important institutions. Equipped with Solid Rubber Case, an insurance against acid and leakage. Extra heavy glass jars. Heavy rugged plates. Order yours today!

SEND NO MONEY Just state number of batteries wanted and we will ship day order is received. Extra Offer: 4 batteries 12 series (66 volts), \$13. Pay expressman after examining batteries. 6 per cent discount for cash with order. Mail your order now!

WORLD BATTERY COMPANY
1219 So. Wabash Ave., Dept. 81, Chicago, Ill.
Makers of the Famous World Radio "A" Storage Battery
Prices: 6-volt, 100 Amp. \$12.50; 150 Amp. \$14.50; 140 Amp. \$16.00.
All equipped with Solid Rubber Base.

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Corrected List of Broadcasting Stations

Table listing broadcasting stations across various states including West Virginia, Ohio, California, Texas, and others. Columns include station call letters, station name, location, and frequency.

A Little Ray of Sunshine Where It's Needed



"Listen in!"

President A. J. Griffin of the Albany Park Kiwanis club, Chicago, is showing one of the Salvation Army nurses and a baby how to run the new radio set, a gift to Salvation Army's Women's Home and Hospital, 5040 N. Crawford ave., by the north-west Kiwanians.

The radio set was presented at a luncheon served recently in the dining room of the institution and attended by fifty members of the Kiwanis club. Music for the luncheon was furnished by a

part of the Salvation Army band. Commissioner William Peart made the address of acceptance. Before they left, the Kiwanians took a trip of inspection through the building.

The Women's Home and Hospital, a refuge for unfortunate mothers, completed by the Salvation Army last April, is located on an excellent site with woods and a pretty neighborhood about it. The grounds of the Home are being improved and when finished promise to make the place one of the beauty spots of Chicago.

"Congress Classic" at KYW

One of the most popular of the classic type of entertainments put on by Station KYW is given each Saturday night at the Congress Hotel, Chicago, where KYW broadcasts a good portion of its programs.

The Congress Classic, as it is known on Saturday nights from 9:30 to 11:30 p. m., is booked by Frank Florentine, general manager of the Congress Hotel, and is announced by Eddie Borroff, who also does the announcing on the Congress Carnival which runs on Saturday nights from 12 to 1 a. m.

During the week there is dinner music broadcast from the Congress, made up of selections played by Joska DeBabary and his Continental quartet, playing in the Louis XVI room from 7 to 7:10; then a journey to the Pompeian room to hear the Coon and Sanders Original Nighthawks from 7:10 to 7:20, and then back to the Louis XVI room where Joska DeBabary finishes off with classical selections from 7:20 to 7:30. This concludes the early broadcasting from the Congress, but at 1 a. m., the Insomnia Club goes back on the air from the Balloon Room, Coon and Sanders original Nighthawks playing until 2 a. m.

Free Sets for Slogans

Radio sets with a total value of \$64,000 will be given to fans all over the United States by the All-American Radio Corporation of Chicago. The gifts will be given in return for suggestions for a new slogan for the corporation's products. All the fan has to do is to go to his nearest dealer, get a blank and fill it in with his name, address and suggestion for the slogan.

For some time past, the All-American has been using the slogan "The Largest Selling Transformer in the World." The production of other lines of radio apparatus, such as the All-Amax Junior and Senior semi-finished sets, has made necessary a change. The slogan should apply to the complete line of transformers, sockets, semi-finished sets, etc.

Each dealer will award either a Senior or a Junior All-Amax set to the winner. The contest will end the last of April.

IF readers wish to show their approval of RADIO AGE'S stand against the Radio Corporation of America, they can do it in the most practical way by sending in \$2.50 for a year's subscription or if they are already subscribers, urge a friend to subscribe. We believe the fans are with us. Address Radio Age, Inc.

* Tested and Approved by RADIO AGE *

DUPLEX Standard Condensers
"None other so good"

MATCHED DUPLEX STANDARD CONDENSERS
(IN SETS OF 3)

DUPLEX STANDARD CONDENSERS
SERIES 7A

DUPLEX JUNIOR CONDENSERS
SERIES DR

DUPLEX Junior Condensers
"Best at the price"

In
Matched Sets for Uniform Dial Settings!

This most recent Duplex achievement—Duplex Standard condensers, specially tested, matched and guaranteed to have identical capacity curves, packed in sealed kits of three—has been enthusiastically welcomed everywhere by radio set builders, both professional and amateur. It is the **only** kit that affords uniform dial settings for Neutrodyne and all other tuned radio frequency circuits. Only one number to log—not three—when you use a Duplex Matched Kit!

Folders telling how to make tuning easier and reception better sent free on request.

Duplex Condenser & Radio Corp.
42 Flatbush Ave. Extension
Brooklyn, New York

This green, black and white package identifies the genuine. Make sure the seal is intact.

Where the HOWLS Come From

(Continued from page 8)

No great trouble is experienced here, unless the amplification is carried too far. Usually two stages will suffice and if more are added, the tube noises, static and vibrations of the set are so magnified that the clearness of reception is impossible, although some set manufacturers have succeeded in so carefully balancing their circuits that three stages are used in some cases.

There are two popular methods of obtaining audio frequency amplification, both of which have their advantages and disadvantages. One is the transformer coupled type and the other is the resistance coupled arrangement, and at this time there is considerable talk about which is the better of the two. In resistance coupled amplification, very high resistances are used between the plate battery and the plate, which makes it necessary to use extremely high voltages on the plate circuits. It is not uncommon to use from 150 to 300 volts, according to the amount of resistance used. This high pressure is necessary in order to force the proper amount of plate current through the high resistance.

In this case there is no amplification with the exception of that due to the tube, and in order to get any great amount of volume, more stages must be used than would be necessary with transformer amplification. With more tubes, we are sure to find more tube noises in the final stage.

Taking for example a two stage resistance coupled amplifier, using the standard UV-201-A tubes with an amplification constant of approximately 8, we would have 8x8, or roughly speaking, an amplification of 64, while with a two-stage, transformer coupled amplifier using transformers having a ratio of 4 to 1, we would have 8x4x8x4, or 1024. In this case, also, much less plate voltage would be required to pro-

duce this great difference in amplification value. It is claimed by many that resistance coupled amplification is better, because there will be no distortion, but there is more or less distortion every time the signal is passed through a tube and there is no reason why a carefully designed transformer should increase this distortion, although it is true that because of the greater amplification afforded by the transformer method, the inherent noises from the tubes and other sources will be amplified in proportion to the signal amplification. For this reason we may get the impression of more distortion. The original cost of installation of the resistance type is necessarily greater, due to the fact that more tubes, sockets and batteries are required to get the same volume which may be obtained by the transformer arrangement.

Amateurs Get New Waves

Secretary Hoover today authorized the amateurs to use waves less than one meter in length in addition to their previous assignment. The permission covers the channels between .7477 and .7496 of a meter, in other words, a band at about the 3-4 meter wavelength. Few people realize the immense number of possible operating channels that lie in the low wavelengths. While the band now assigned to amateurs is only nineteen one-thousandths of one meter in width, its extremes are separated by one thousand kilocycles. The secretary pointed out that if it ever became feasible to conduct broadcasting on these frequencies, it would be possible to place within this band 100 broadcasting stations and give to each the present separation of ten kilocycles, and said further that all the stations in the world could operate in the upper half of the one meter band. The art has, of course, not developed to make this possible, but the amateurs now have an opportunity to see what they can do.

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WSAB	Southeast Missouri State Teachers College	Cape Girardeau, Mo.	275	WTAM	Willard Storage Battery Co.	Cleveland, Ohio	389
WSAC	Clemson Agricultural College	Clemson College, S. C.	336	WTAP	Cambridge Radio & Electric Co.	Cambridge, Ill.	242
WSAD	J. A. Foster Co.	Providence, R. I.	261	WTAQ	S. H. Van Gordon & Son	Oaseo, Wis.	220
WSAG	Loren Vanderbeck Davis	St. Petersburg, Fla.	264	WTAR	Reliance Electric Co.	Norfolk, Va.	280
WSAJ	United States Playing Cards Co.	Cincinnati, Ohio	225	WTAS	Charles E. Erbsstein	Elgin, Ill.	303
WSAK	Grove City College	Grove City, Pa.	258	WTAT	Edison Electric Illuminating Co.	Boston, Mass. (Dorchester)	242
WSAN	Allentown Call Publishing Co.	Allentown, Pa.	229	WTAU	Rugg Battery & Electric Co.	Tecumseh, Mich.	244
WSAP	Seventh Day Adventist Church	New York, N. Y.	263	WTAW	Agricultural & Mechanical College of Texas	College Station, Tex.	280
WSAR	Doughty & Welch Electrical Co.	Fall River, Mass.	254	WTAX	Williams Hardware Co.	Streator, Ill.	231
WSAU	Camp Marienfeld	Chesham, N. H.	229	WTAY	Oak Leaves Broadcast Station	Oak Park, Ill.	283
WSAV	C. W. Vick Radio Construction Co.	Houston, Tex.	360	WTAZ	Thomas J. McGuire	Lambertville, N. J.	283
WSAY	Irving Austin (Port Chester Chamber of Commerce)	Port Chester, N. Y.	258	WTB	Flint Senior High School	Flint, Mich.	218
WSAZ	Chas. Electric Shop	Pomeroy, Ohio	258	WTBC	Kansas State Agricultural College	Manhattan, Kans.	273
WSB	Atlanta Journal	Atlanta, Ga.	428	WTB	Travelers Insurance Co.	Hartford, Conn.	323
WSL	J. and M. Elec. Co.	Utica, N. Y.	273	WTB	H. C. Saal Co.	Chicago, Ill.	268
WSMH	Shattuck Music House	Owosso, Mich.	240	WWAD	Wright & Wright (Inc.)	Philadelphia, Pa.	360
WSOE	School of Engineering	Milwaukee, Wis.	246	WWAE	The Alamo Ball Room	Joliet, Ill.	242
WSRF	Hardem Sales and Service	Broadlands, Ill.	233	WWI	Ford Motor Co.	Dearborn, Mich.	273
WSUI	State University of Iowa	Iowa City, Iowa	498	WWJ	Detroit News (Evening News Assn.)	Detroit, Mich.	752
WTAB	Fall River Daily Herald Publishing Co.	Fall River, Mass.	248	WWL	Loyola University	New Orleans, La.	760
WTAC	Penn Traffic Co.	Johnstown, Pa.	360	WWOA	Michigan College of Mines	Houghton, Mich.	244
WTAF	Louis J. Callo	New Orleans, La.	242				

Canadian Stations

CFAC	Calgary Herald	Calgary, Alberta	430	CHXC	J. R. Booth	Ottawa, Ont.	435
CFCA	Star Pub. & Print. Co.	Toronto, Ontario	400	CHYB	Northern Electric Co.	Montreal, Quebec	410
CFCF	Marconi Wireless Tel. Co. Canada	Montreal, Quebec	440	CJBC	Jarvis Baptist Church	Toronto, Ont.	312
CFCH	Abitibi Power & Paper Co.	Iroquois Falls, Ont.	400	CJCA	Edmonton Journal	Edmonton, Alberta	455
CFCH	La Cie de L'Evenement	Quebec, Quebec	410	CJCD	London Free Press Print. Co.	London, Ont.	430
CFCK	Radio Supply Co.	Edmonton, Alberta	410	CJCE	T. Eaton Co.	Toronto, Ont.	410
CFCN	W. W. Grant Radio (Ltd.)	Calgary, Alberta	440	CJCF	Strott-Shaw Radio Co.	Vancouver, B. C.	420
CFCO	Radio Specialties (Ltd.)	Vancouver, B. C.	450	CJCI	The News Record	Kitchener, Ont.	295
CFCR	Laurentide Air Service	Sudbury, Ont.	410	CJCK	Maritime Radio Corp.	St. John, New Brunswick	410
CFCT	Victoria City Temple	Victoria, British Col.	410	CJCK	Radio Corp. of Calgary	Calgary, Alta.	306
CFCU	The Jack Elliott Radio Limited	Hamilton, Ont.	410	CJCM	J. L. Phillippe	Mont Joli, Quebec	430
CFCW	The Radio Shop	London, Ont.	420	CJCN	Simons Argue & Co.	Toronto, Ont.	410
CFDC	Sparks Co.	London, Ont.	420	CJSC	Evening Telegram	Toronto, Ont.	430
CFHC	Henry Birks & Sons	Nagaimo, B. C.	430	CKAC	La Presse Pub. Co.	Montreal, Quebec	430
CFHC	Chas. Guy Hunter	Calgary, Alta.	440	CKCD	Vancouver Daily Province	Vancouver, B. C.	410
CFHQ	The Electric Shop (Ltd.)	331 Adelaide St., London, Ont.	410	CKCE	Canadian Independent Telephone Co.	Toronto, Ont.	450
CFRC	Queens University	Saskatoon, Saskatchewan	400	CKCK	Leader Pub. Co.	Regina, Saskatchewan	420
CFUC	University of Montreal	Kinstonon, Ontario	450	CKCO	Ottawa Radio Association	Ottawa, Ont.	440
CFXC	Westminster Trust Co.	Montreal, Quebec	400	CKCX	P. Burns & Co.	Calgary, Alberta	440
CFYC	Victor Wentworth Odium	New Westminster, B. C.	440	CKLC	Wilkinson Electric Company	Calgary, Alberta	400
CHAC	Radio Engineers	Vancouver, B. C.	400	CKOC	Wentworth Radio Supply Co.	Hamilton, Ont.	410
CHBC	Albertan Publishing Co.	Halifax, Nova Scotia	400	CNRA	Canadian National Railways	Moncton, N. B.	313
CHCB	Marconi Company	Calgary, Alberta	410	CNRC	Canadian National Railways	Calgary, Canada	357
CHCD	Canadian Wireless & Elec. Co.	Toronto, Ont.	410	CNRE	Canadian National Railways	Edmonton, Alta.	455
CHCE	Western Canada Radio Sup. (Ltd.)	Quebec, Quebec	410	CNRM	Canadian National Railways	Montreal, P. Q.	410
CHCL	Vancouver Merchants Exchange	Victoria, B. C.	400	CNRO	Canadian National Railways	Ottawa, Ont.	430
CHCM	Piley & McCormack	Vancouver, B. C.	440	CNRR	Canadian National Railways	Regina, Sask.	312
CHCS	The Hamilton Spectator	Calgary, Alberta	415	CNRS	Canadian National Railways	Saskatoon, Sask.	329
CHIC	Northern Electric Co.	Hamilton, Ont.	420	CNRT	Canadian National Railways	Toronto, Ont.	357
CHNC	Toronto Radio Research	Toronto, Ont.	350	CNRW	Canadian National Railways	Winnipeg, Man.	384

Cuban Stations

PWX	Cuban Telephone Co.	Habana	400	2K	Alvara Daza	Habana	200
2DW	Pedro Zapas	Habana	300	2HS	Julio Pover	Habana	380
2AB	Alberto S. de Bustamante	Habana	240	20L	Oscar Collado	Habana	290
2OK	Mario Garcia Velez	Habana	360	2WW	Amadeo Suenz	Habana	210
2BY	Frederick W. Borton	Habana	260	5EV	Leonardo E. Figueroa	Colon	360
2CX	Frederick W. Borton	Habana	320	6KW	Frank H. Jones	Tuinuco	340
2EV	Westinghouse Elec. Co.	Habana	220	6KJ	Frank H. Jones	Tuinuco	275
2TW	Roberto E. Ramirez	Habana	230	6CX	Antonio T. Figueroa	Cienfuegos	170
2HC	Heraldo de Cuba	Habana	275	6DW	Eduardo Terry	Cienfuegos	225
2LC	Luis Casas	Habana	275	6BY	Jose Candure	Cienfuegos	300
2KD	E. Sanchez de Fuentes	Habana	250	6AZ	Valentin Ullivarri	Cienfuegos	200
2NN	Fausto Simon	Habana	270	8BY	Alberto Ravelo	Sigo. de Cuba	250
2NG	Manuel G. Sulas	Habana	280	8FU	Andre Vinnet	Sigo. de Cuba	225
2JD	Raul Perez Falcon	Habana	150	8DW	Pedro C. Anduz	Sigo. de Cuba	275

European Broadcasting Stations

British Stations

2LO	London	365	5NO	Newcastle	400
5IT	Birmingham	475	5SC	Glasgow	420
5WA	Cardiff	350	2BD	Aberdeen	492
6BM	Bournemouth	385	6SL	Sheffield (relay station)	303
2ZY	Manchester	375			

French Stations

YN	Lyons	740	8AJ	Paris	1,780
FL	Paris (Eiffel Tower)	2,600	8EP	Paris	950

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WITH THE MANUFACTURERS



Thorola "Doughnut Coil"

An important development in radio reception is announced by the Reichmann Company of Chicago, in connection with its production of the new Thorola Low Loss Doughnut Coil. This coil, subjected to the most rigid tests, will not pick up or absorb any signal other than that brought in through the antenna system. Its magnetic field is also entirely confined, so that there is no spray to cause interference and intercoupling between various parts of the set.



The new coil is of the toroid type, but differs greatly from all other coils of this type in that it shows extremely low losses. It was designed by Frank Reichmann, designer of the Thorola and Thorophone loud speakers, and marks the first step of the Reichmann Company into the general field of radio manufacture.

Two types of the new coil will be put on the market; one to be used as a coupler and the other as a radio frequency transformer. They will improve practically every kind of circuit and are a distinct advancement in radio.

Baby Grand Reproducer is Unique Speaker

The Grigsby-Grunow-Hinds Co. of Chicago announce the addition of a new "Baby Grand" Model to their line of Majestic Reproducer loud speakers. The Baby Grand is a compact loud speaker that retails for \$9.00, complete, for home use.



The tone quality of the Baby Grand reproducer is beyond compare, according to the makers, who use the well-known G-G-H Model WG Constant Tension Diaphragm unit. Volume is also said to be unusual in this unit. The horn is made of Du Pont Pyralin, which is said to eliminate harshness or metallic sounds.

Adjustable volume enables the user to

regulate the reproducer. The height of the Baby Grand is 13 inches overall. The diameter of the bell is 9 inches.

R. E. Lacault Joins Phenix as Chief Engineer

The Phenix Radio Corporation announces that Robert E. Lacault, E. E. A. M. I. R. E., designer of the Ultradyne, has become Chief Engineer for their Corporation, in which capacity he will further his inventive genius in behalf of the Phenix Ultra products. His entire time will be devoted to the design, development and perfection of certain radio devices that are destined to throw new light upon radio receiving apparatus in the future.

This work, like the famous Ultradyne, originated from and is an outgrowth of his four years as Radio Research Engineer with the French Signal Corps Laboratories, where he put to good use his previous intensive electrical studies, designing various types of radio apparatus and instruments, working on the first short-wave radio compass equipment used at the front in 1915, also on the earliest wired radio and aeroplane radio equipment.

Mr. Lacault was one of the first amateurs in France, his radio experiments dating back as far as 1911. In the Research Laboratory of the French Signal Corps—Mr. Lacault worked on the TPS Ground Telegraphy System, a wired radio system used for direct and instant communication between different radio compass stations, by means of which the positions of enemy stations were found.

In recent years, Mr. Lacault worked on radio telephotography, also on transmitting pictures by wire, while assisting Mr. Bolin, the French inventor. This experience, extending over a period of many years, gives Mr. Lacault a wonderful background for unusual development in his new connection as Chief Engineer of the Phenix Radio Corporation.

New Sales Manager for Crosley Corporation

Walter B. Fulghum has been appointed General Sales Manager of The Crosley Radio Corporation and began his duties March first. He comes to the organization with a broad knowledge of merchandising and sales methods, having been associated for many years with the Victor Talking Machine Company as head of their Order Department in Camden, N. J.

In addition to the experience in the manufacturing side of the business, he has had experience in the retail business and many will recall his record of boosting business in the sale of phonographs in the months of July and August and under other conditions. His broad experience will enable him to appreciate the problems of both distributor and dealer.

Radio Concerns Reorganize

Expansion and stabilizing of the radio industry have resulted in the reorganization of several of the leading manufacturing concerns and the issuing of stocks. These stocks have made sensational records in the New York and Chicago Stock Exchanges recently, due to the record volume of sales of radio apparatus.

The latest reorganization plan to be carried through is that following the formation of the All-American Radio Corporation, which has taken over the business of the Rauland Manufacturing Company, manufacturers of the largest selling line of radio transformers in the world. The new company is headed by E. N. Rauland, one of the pioneers in radio manufacturing and their application for a license to manufacture under the radio patents held by the United States Navy has been approved by Secretary Wilbur of the Navy Department.



E. N. Rauland

Important extensions in the business of the company are planned immediately. Especial attention will be given to the research laboratory work.

Forty thousand shares of All-American stock were offered to the public at \$26 a share. It was oversubscribed six times and before being listed on the Chicago Stock Exchange, it was bid up to \$36 a share. The statement of the company shows cash assets of nearly \$550,000.

Mr. Rauland started the business as the All-American Electrical Manufacturers. In 1922 it was incorporated as the Rauland Manufacturing Company. Its chief products have been audio and radio transformers, sockets, fixed couplings and the well-known All-Amax semi-finished one and three tube sets.

New Steinite Distributors

The radio world will be interested in knowing that arrangements have now been completed which enable the Steinite Laboratories, Atchison, Kans., to announce that the firm of E. O. Jackson & Company, 504 South State Street, Chicago, have been designated as exclusive distributors of their products throughout the United States and Canada.

The items manufactured by the Steinite people, and now made famous by extensive advertising, comprise the Steinite long distance crystal set, one, two and five tube receivers, two stage amplifier, crystal, crystal detector, and interference eliminator.

CLASSIFIED ADVERTISEMENTS

Don't overlook the value of RADIO AGE'S classified advertisements. Many such messages have paved the way to independent incomes.

The classified advertising rates are but ten cents per word for a single insertion. Liberal discounts are allowed on three, six and

twelve-time insertions, of five, fifteen and thirty per cent, respectively. Unless placed through an accredited advertising agency, cash should accompany all orders. Name and address must be included at foregoing rates and no advertisement of less than ten words will be accepted.

AGENTS WANTED

RADIO—Join our sales organization and make big money. We want a man in every county to sell well advertised sets and parts made by the leading manufacturers. Widener of Kansas City makes \$150.00 weekly. You can do as well or better. Write today for catalog and discounts. Name your county. Waveland Radio Company, Div. 52, 1027 No. State St., Chicago, Ill.

MANUFACTURER'S AGENT calling on Radio-Electrical Jobbers, Chicago and vicinity, has openings for 3 additional lines carrying volume business, as we cater to large jobbers. Edelstein, 1804 McCormick Bld., Chicago.

AGENTS—WRITE FOR FREE SAMPLES. Sell Madison "Better-Made" Shirts for large manufacturer direct to wearer. No capital or experience required. Many earn \$100 weekly and bonus. MADISON MFGRS., 501 Broadway, New York.

HELP WANTED

RADIO SALESMEN and SET BUILDERS—We need you and you need us. If you are reliable and well known in your community, we will appoint you our representative and furnish you with standard well advertised sets and parts at prices that will enable you to sell at a handsome profit. Write at once for catalog and sales plan. Waveland Radio Co., Div. 53, 1027 N. State St., Chicago, Ill.

MANUFACTURING FACILITIES

AN OLD AND WELL ESTABLISHED MANUFACTURING COMPANY IN THE MIDDLE WEST WITH LARGE WELL EQUIPPED PLANTS AND UNUSUAL FINANCIAL RESOURCES, DESIRING TO ENTER THE RADIO FIELD WILL CONSIDER THE MANUFACTURE AND SALE OF RADIO SETS OR DEVICES OF OUTSTANDING AND UNUSUAL MERIT ON A ROYALTY BASIS. ADDRESS BOX 1A, RADIO AGE.

RADIO

A PRACTICAL TUBE RECEIVING SET FOR \$10. Postpaid. Test phones and tube. Complete with phones, tube and battery. \$18.00. J. B. RATHBUN, 1067 Winona St., Chicago, Ill.

Standard solderless radio jacks. Binding post attachments. Double circuit. One dollar bill. Postpaid. Clinton Seward, Jr., New Paltz, New York, N. Y.

Three Cosmopolitan Phusiformers, each \$5.50, book of instructions included. F. A. Mall, Triopli, Iowa.

FOR SALE—3 Pfanatihl tuning units, 3 Cardwell Condensers, 1 Bradleyometer, 2 Bradleystata. All goods New. Earl Price, Lodi, Wis.

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BLUEPRINTS—Make your own set from proven original and up-to-the-minute blueprints. The following are merely three of a choice of almost one hundred different types:

HT-1-3—Five tube neodyne—50c.
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All three of above, for \$1.00.

These tested blueprints are all made up in easily read circuit drawings. MIDLAND PRODUCTS COMPANY, 1413 Hood Ave., Chicago, Ill. Ask for our complete list, No. R-31.

RADIO DEALERS

DEALERS—Write for our illustrated catalog of reliable Radio Merchandise. Rossiter-Manning Corporation, Dept. D, 1830 Wilson Ave., Chicago, Ill.

STAMPS AND COINS

158 Genuine Foreign Stamps. Mexico War Issues. Venezuela, Salvador and India Service. Guatemala, China, etc., only 5c. Finest approval sheets, 50 to 60 per cent. Agents Wanted. Big 72-p. Lists Free. We Buy Stamps. Established 20 Years. Hussman Stamp Co., Dept. 152, St. Louis, Mo.

WANTED

WANTED—To complete my set RADIO AGE need August, September, October, November, 1923, issues, bound or unbound. Advise price. Lloyd C. Henning, Hollbrook, Arizona.

WRITERS

NEW WRITERS WANTED—Articles, stories, poems, scenarios, etc. \$13,500 just paid to unknown writer. Entirely new field. (No. bunk.) NOT A CORRESPONDENCE COURSE. Moving picture industry and publishers crying for new original material. YOU CAN DO IT. We buy manuscripts for books and magazines. Send self addressed envelope for list of 100 subjects. CALIFORNIA STUDIOS, P. O. Box 697, Los Angeles, Calif.

INVENTIONS

WRITERS—Cash in on your knowledge of radio by writing for Radio Magazines and Newspaper Supplements. Write up your radio experiences, your new hook-up, your knowledge of broadcasting stations and artists. Experienced authors will correct and improve your manuscript—make them typically professional work. FREE Criticism and Advisory Service until your manuscript is sold! ALL Magazines and Papers demanding fiction and articles dealing with radio. Here is YOUR OPPORTUNITY to profit! Send for FREE booklet, "How You Can Sell Your Manuscripts." Willis Arnold and Associates, 210 East Ohio St., Chicago, Ill.

NEW IDEAS WANTED—Well known Radio Manufacturer whose products are nationally advertised and sold everywhere wants new Radio device to sell. Will pay outright or royalty for idea or invention which is really new and saleable. Address: Mr. R. F. Devine, Room 1101, 116 West 32nd St., New York, N. Y.

RADIO TUBES

SPECIAL Mastertone Radio tubes all sizes \$1.85 postpaid. Nansle Co., 601 Washington Boul. Oak Park, Ill.

AGENTS

90c an hour to advertise and distribute samples to consumer. Write quick for territory and particulars. American Products Co., 2130 American Building, Cincinnati, Ohio.

Man wanted for this territory to sell wonderful value men's, women's, Children's shoes direct, saving consumer over 40%. Experience unnecessary. Samples supplied. Big weekly permanent income. Write today Tanners Mfg. Co., 1334C. St., Boston, Mass.

"B" BATTERIES

100 VOLT EDISON TYPE "B" BATTERY, knocked down. Parts and plans—complete. \$12.50. Lane Mfg., 2937 W. Lake, Chicago.

BATTERIES FOR SALE—Four 24-volt "Main" Storage "B" Batteries, never used, shipped and ready to wire for \$38.00. First order gets the batteries. Address Box B, Radio Age, 500 N. Dearborn St., Chicago, Ill.

RADIO OFFERS

15 to 25 per cent discount on nationally advertised sets and parts. Every item guaranteed. Tell us your needs. IMPERIAL RADIO COMPANY, Delaware, Ohio.

RADIO SETS. Our prices save you money. Lists free. The Radio Shoppe, Box 615, East Liverpool, Ohio.

JOIN THE RADIO Parts Exchange Club. Your parts inspected (Fee 25c), and exchanged for the parts you need. What have you; what parts do you require? Write us for details. The Radio Parts Exchange Club, 112 So. Homan Ave., Chicago.

RADIO CIRCUITS

SPECIAL FOR MAY
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.

VOCATIONS

Make Big Money. Safe and Lock Expert. Wayne Strong, 3800 Lan Franco St., Los Angeles, Calif.

RADIO SUPPLIES

Ten per cent discount on all standard radio parts, from condensers to transformers to tubes, etc. Send for our latest price list, with special bargains on Static-eliminators, portable loud speakers, Radiotrons, German silver wire, etc. RADIOGRAPH LABORATORIES, 1234 Rosemont Ave., Dept. 4, Chicago, Ill.

Classified ad. copy for the June RADIO AGE must be sent in by May 1, 1925.

New "Fada" Announcement

The following is the substance of a recent letter sent to the distributors of F. A. D. Andrea, Inc., relative to their policy on maintenance of prices.

"Liquidation is being put into effect by a number of radio manufacturers. You have our unqualified assurance that no such move is contemplated by Fada. We have previously written you as regards guarantee on prices until July 15, 1925. We are prompted to write you again giving you full assurance on this matter because a number of concerns have had certain of their products advertised recently by large retail outlets and at an enormous price reduction. Among advertisements of this nature which have recently come to our attention, the names of a number of prominent radio manufacturers, who in our opinion should readily recognize the need for constructive action at this time rather than resort to dumping of surplus, merchandise, have been involved.

"It is our firm intention to continue to limit our sales, exclusively throughout authorized jobbers and to refrain absolutely from any price concessions to large retail outlets. We believe a jobber who has invested money in our stock and has merchandised our product along authorized lines is entitled to proper protection. We believe a dealer who has purchased our merchandise from our jobbers is entitled to a clear path in its sale to the user and should not be hampered by undue competition which must result from price reductions through large retail outlets. To the best of our ability we will guard against any such retail outlets offering our merchandise on a basis which will create any such unfair competition to our regular dealers."

Radio Show for St. Louis in October

Plans are already being formulated for the holding of the St. Louis Radio Show at the Coliseum in St. Louis, Mo., during the week of October 12, 1925. The show is under the direction of the St. Louis Radio Trades Association, of which Colin B. Kennedy, prominent radio manufacturer, is president. George Niekamp is to be director of the show.

The week of October 12 has been designated as "Radio Week" as a means of stimulating interest in the exposition. Radio stars and announcers from all over the country will attend the show, and broadcasting will be conducted direct from the Coliseum, where special studios will be equipped. Already scores of exhibitors have either signed up for booths or announced their intention of doing so.

According to plans now under way, this will be the "National Radio Show of the Great Southwest" for 1925.

IF readers wish to show their approval of the stand taken by RADIO AGE against the Radio Corporation of America, they can do it in the most practical way by sending \$2.50 for a year's subscription to our magazine, or if they are already subscribers, urge a friend to subscribe. We believe the fans are with us. Address Radio Age, Inc., 500 N. Dearborn St., Chicago.

With the Manufacturers

(Continued from page 69)

Care in Connecting Condensers Important

Fixed condensers, when used in radio receivers, are not always given the proper care which they need for the important work they have to perform.

The placing of hot soldering irons against a condenser will in most cases do one of three things; change the capacity; short the circuit or open the circuit.

Another thing that does not give the condenser an even chance is the using of soft iron bolts, which should be avoided for the reason that they will sometimes draw up too tightly and change the capacity. The use of soft iron builds up a temporary magnet circuit.

As a means of getting the utmost out of a circuit and to utilize all signal strength instead of weakening it, the Ridge Manufacturing Co., 3818 N. Ridgeway Ave., Chicago, has perfected the "Handy Condenser Clip" to eliminate the foregoing faults and to make the radio receiver just that much better.

H. H. Eby Mfg. Co.'s Patent

H. H. Eby Mfg. Co. of Philadelphia, the makers of Eby Binding Posts, make the following announcement:

"The United States Government has issued patent No. 1529244, dated March 10, 1925, to Hugh H. Eby, president of the H. H. Eby Mfg. Co. This patent fully covers the binding posts which we have manufactured and sold for the last five years. Our attorneys have advised us that if we intend to protect our customers and ourselves against infringing manufacturers, the legal technicalities of the case require an announcement of the issuance of the patent and the fact that we are prepared to defend our rights.

"We have gone a step farther and clearly marked the base of every post which leaves our factory with our name and patent number in order to make identification easy.

"We have felt very much gratified by the many instances which we have seen of the fairmindedness of the radio trade as a whole. After all, Americans hate a fraud. A large number of our jobbers and numerous manufacturers who are using our posts on their sets have sent us samples of various posts which have been offered to them by unscrupulous competitors. They have recognized the fact that we were the originators of this type of post and have assured us that they would continue to buy from us, no matter how many other companies tried to steal our ideas of design and construction."

Radio Loud Speaker Horn Good for Portables

The American Hard Rubber Company has come to the aid of the portable radio fan with a Radion horn and phone cap to use on a loud speaker and headphone or headphone unit. The horn is small enough to be placed in a radio cabinet, measuring but 10 inches high. It has excellent tone quality and amplifying possibilities. The horn and the cap are highly polished, and will make a miniature loud speaker out of a headset by simply screwing the cap over the unit of the headphone. The price of the horn is \$2.50.

Meco Introduces New Radio Sets

Simplified tuning obtained by two dial controls with only one dial to log are the principal features of the radio receivers announced by the Metropolitan Electric Company of Des Moines, manufacturers of the well known Meco Tubes.

The radio sets will be marketed under the brand name of "Meco" and will all be of five tubes.

Three different models are being manufactured. All of the sets are similar in operation, circuit and size. One model will retail at approximately \$60.00. Another cabinet model will retail at approximately \$100. And the period design console model will be priced at about \$250.00.

The Meco radio sets operate on radio frequency action, having two stages of radio frequency amplification, two stages of audio amplification and detector.

When ordered, Meco sets will be supplied with tubes matched to the set at the factory. This effects better reception and eliminates a great deal of trouble for purchasers and dealers alike.

The extreme selectivity of the Meco sets is attributed to the simplified tuning produced by two dial controls.

Mohawk Corporation to Expand

The Mohawk Electric Corporation is about to open a new branch office at 1400 Broadway, New York City. Appointment of H. G. Cisin as manager of this branch has also been announced. Mr. Cisin has been associated with the Mohawk organization in the capacity of sales and advertising manager since the company started manufacturing the Mohawk single dial 5-tube receiver, and his promotion to manager of this important New York post will not surprise his many friends in the radio industry. Besides being well-known in the trade, Mr. Cisin is also known to radio fans as the author of several technical works on radio and electricity. Besides the new metropolitan office being established in New York, the Mohawk Electric Corporation also maintains district sales branches in Boston, St. Louis, Los Angeles, San Francisco, Portland, Denver, Minneapolis, Detroit and Cedar Rapids. The main offices are located in Chicago.

The Liberty Radio Chain Stores

David Kanofsky, President of Liberty Radio Chain Stores, at a dinner given by him to his Metropolitan managers and salesmen, expressed great optimism for the future of Liberty. In his remarks Mr. Kanofsky hinted that an important consolidation was under consideration and called attention to the fact that the company plans to open additional stores and that it plans to open retail radio stores throughout the country.

Mr. Kanofsky expressed great satisfaction in the results thus far accomplished and stated that he looked forward to the new 6-Tube "Clearfield," which will be marketed through the Liberty organization, to prove an outstanding success, stating that already the radio buyer had evidenced a great interest in this new set, which is enclosed in plate glass; hence its name, Clearfield.



Solid Rubber Case

You Save 50%

World 6-Volt Storage Batteries are famous for their guaranteed quality and service. Backed by years of Successful Manufacture and Thousands of Satisfied Users. You save 50% and get a

2-Year Guarantee Bond In Writing

World Battery owners "tell their friends." That's our best proof of performance. Send your order in today.

RADIO BATTERIES	
6-Volt, 100-Amperes	\$12.25
6-Volt, 120-Amperes	14.25
6-Volt, 140-Amperes	16.00
AUTO BATTERIES	
6-Volt, 11-Plate	\$12.25
6-Volt, 13-Plate	14.25
12-Volt, 7-Plate	17.00

SEND NO MONEY

Just state battery wanted and we will ship day order is received, by Express C. O. D., subject to your examination on arrival.

Extra Offer: 5% discount for cash in full with order. Buy now and get a Guaranteed battery at 50% saving to you.

WORLD BATTERY COMPANY
1219 S. Wabash Ave., Dept. 36 Chicago, Ill.

World

Approved and Listed as Standard by Leading Authorities including Radio News Laboratories, Popular Science Institute of Standards, Popular Radio Laboratories, Radio Broadcast Laboratories and Lefax, Inc.

Solid Rubber Container

Now Standard equipment on all World Storage Batteries. No more leakage or breakage of jars or rotting of box.

WITH better and more powerful broadcasting—and with a sensitive, responsive Telomonic III receiver—the fascination of radio continues this year, regardless of the calendar.

Write to Danziger-Jones, Inc., Dept. C, 25 Waverly Place, New York, for booklet, "The Kit of a Thousand Possibilities."

TELOS RADIO

HUDSON-ROSS

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

123 W. Madison St. Chicago

All You Want to Know About Hookups!

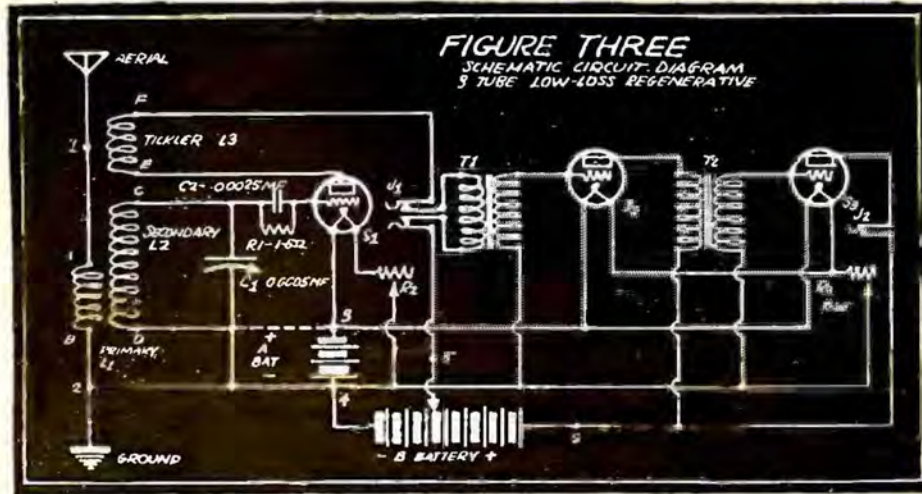


FIGURE THREE
SCHEMATIC CIRCUIT DIAGRAM
3 TUBE LOW-LOSS REGENERATIVE

Above is a circuit diagram of a hookup published in the RADIO AGE ANNUAL for 1925, and which has taken the radio fans by storm! Although it is but a three-tube affair, it consistently "pulled in" California stations on the loudspeaker while located less than a mile from two powerful Chicago broadcasting stations! Hookups such as these make the ANNUAL for 1925 a necessity in your store of radio knowledge.

Let the Radio Age Annual for 1925 Teach You Radio!

16 FULL PAGES OF
BLUEPRINTS!

in the 32-page blueprint section of the RADIO AGE ANNUAL for 1925, are worth many times the cost of the book alone. Yet these actual-color blueprints, printed as an integral part of the ANNUAL, will take you by clear, successive steps through every phase of radio development. An invaluable feature in itself!

IF YOU are going to build yourself a new radio this Spring and Summer, or if you want a new set for your Summer vacation, the RADIO AGE ANNUAL for 1925 will fulfill your every technical need. Scores of tried and true hookups, tested in every detail in the RADIO AGE Laboratory, are contained in this wonder hookup book of 120-pages, with its complete beginners' section, 32-page blueprint section for beginner and expert, and its wealth of material for the advanced radio fan and set-builder. You will find it a worthwhile investment if you get your copy of the new 1925 RADIO AGE ANNUAL and take it with you on that trip, no matter where you go. It will always be ready to serve as a handy radio hookup guide to solve your technical problems. The galaxy of clear pictures, wiring diagrams and isometric drawings makes the ANNUAL for 1925 the year's outstanding radio book! Clip the coupon now before the first edition is exhausted!

\$1.00 a
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RADIO AGE ANNUAL
FOR 1925

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Copy

Some of the Features

How to read and understand hookups.
How to understand radio phenomena
Building your first simple set.
How to select the right receiver.
Substituting a tube for a crystal—building the first tube set.
How to amplify any kind of set.
Making a reflex set.
Building your first Reinartz set.
The renowned Baby Heterodyne No. 1.
Adding audio and radio stages to the Baby Het.
How to make a battery charger.
How to make a loud speaker.
RADIO AGE ANNUAL BLUEPRINT SECTION with such popular hookups as the aperiodic variometer, loop sets, feed-

back receivers, neutrodynes, reflex hookups, Baby Het No. 2, a Wonder Super-Het, and others.
How to get rid of interference.
How to make an amplifying unit.
How to recognize and deal with every kind of tube trouble.
Another super-heterodyne for the super experimenters.
Hints on tracing troubles in super-heterodyne circuits.
A three-tube long distance regenerator.
A 3-tube set that easily receives KGO on the loud speaker from Ohio.
Improving the ever popular Reinartz.
AND MANY OTHER UP-TO-THE-MINUTE HOOKUPS AND ARTICLES.

RADIO AGE ANNUAL COUPON

RADIO AGE, INC.,
500 North Dearborn St., Chicago, Ill.

Gentlemen: I want to be one of the first to get the RADIO AGE ANNUAL FOR 1925. Enclosed find \$1.00. If I am not satisfied with the ANNUAL I will return it within five days and you will refund my dollar.

Name.....

Address.....

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

Prest-O-Lite

RADIO CHART

Voltage of Tubes	No. of Tubes	Type of Tubes (see foot-note)	Total Rated Ampere Drain	Recommended Prest-O-Lite "A" Batteries	
				Days of Full-time Use	Days between Charge
5-Volt Tubes C-300 and UV-200 are interchangeable C-301A, DV-2 and UV-201A are interchangeable	1	UV-200	1	69 WHR	22
	2	UV-201A	1/2	67 WHR	16
	2	1 UV-200 1 UV-201A	1 1/4	67 WHR	33
	3	UV-201A	3/4	611 WHR	22
	3	1 UV-200 2 UV-201A	1 1/2	69 WHR	17
	4	UV-201A	1	69 WHR	29
	4	1 UV-200 3 UV-201A	1 3/4	67 WHR	22
	5	UV-201A	1 1/4	611 RHR	21
	5	1 UV-200 4 UV-201A	2	69 WHR	14
	6	UV-201A	1 1/2	69 WHR	22
	8	UV-201A	2	67 WHR	16
				613 RHR	22
				611 WHR	15
				611 WHR	22
				69 WHR	17
				613 RHR	19
			611 WHR	13	
			611 RHR	21	
			69 WHR	14	
			69 KPR	21	
			67 KPR	15	
		2 1/4	69 KRL	22	
			67 KPR	13	
		2 1/2	69 KRL	19	
			69 KPR	15	

For sets using current at a rate higher than 2 amperes.

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The Prest-O-Lite Co., Inc.



Write today for this free booklet

Whether you have a one-tube set or most advanced multi-tube outfit, you'll find a fund of interesting information in our booklet, "How to fit a storage battery to your set—and how to charge it."

This booklet gives you the complete Prest-O-Lite Radio Chart—technically accurate recommendations covering both "A" and "B" storage batteries for every type of set.

In addition, there is much vitally important data on battery care and upkeep—information that any radio fan will find of real value in keeping his set at its maximum efficiency. Write for your copy right now.

How to fit storage batteries to your set

IT PAYS to buy wisely—to select batteries that bring out the best in your set and are of the right capacity to give fine reception at recharging intervals best suited to your convenience.

The new Prest-O-Lite Radio Chart tells you how to select such batteries. The part of the master chart shown here covers "A" Batteries for 5-volt tube sets. Use either of the two sizes recommended for your set, depending on the days of service you wish between rechargings (based on the average use of your set of three hours a day). You will find the larger capacity battery more desirable unless facilities are provided for frequent and easy re-

charging. For "B" Batteries, and "A" Batteries for peanut tubes, see the complete chart at your dealer's.

Special structure plates, high porosity separators and scientific internal construction make Prest-O-Lite Batteries dependable sources of the even, unvarying current also lutely necessary for volume, clarity and distance.

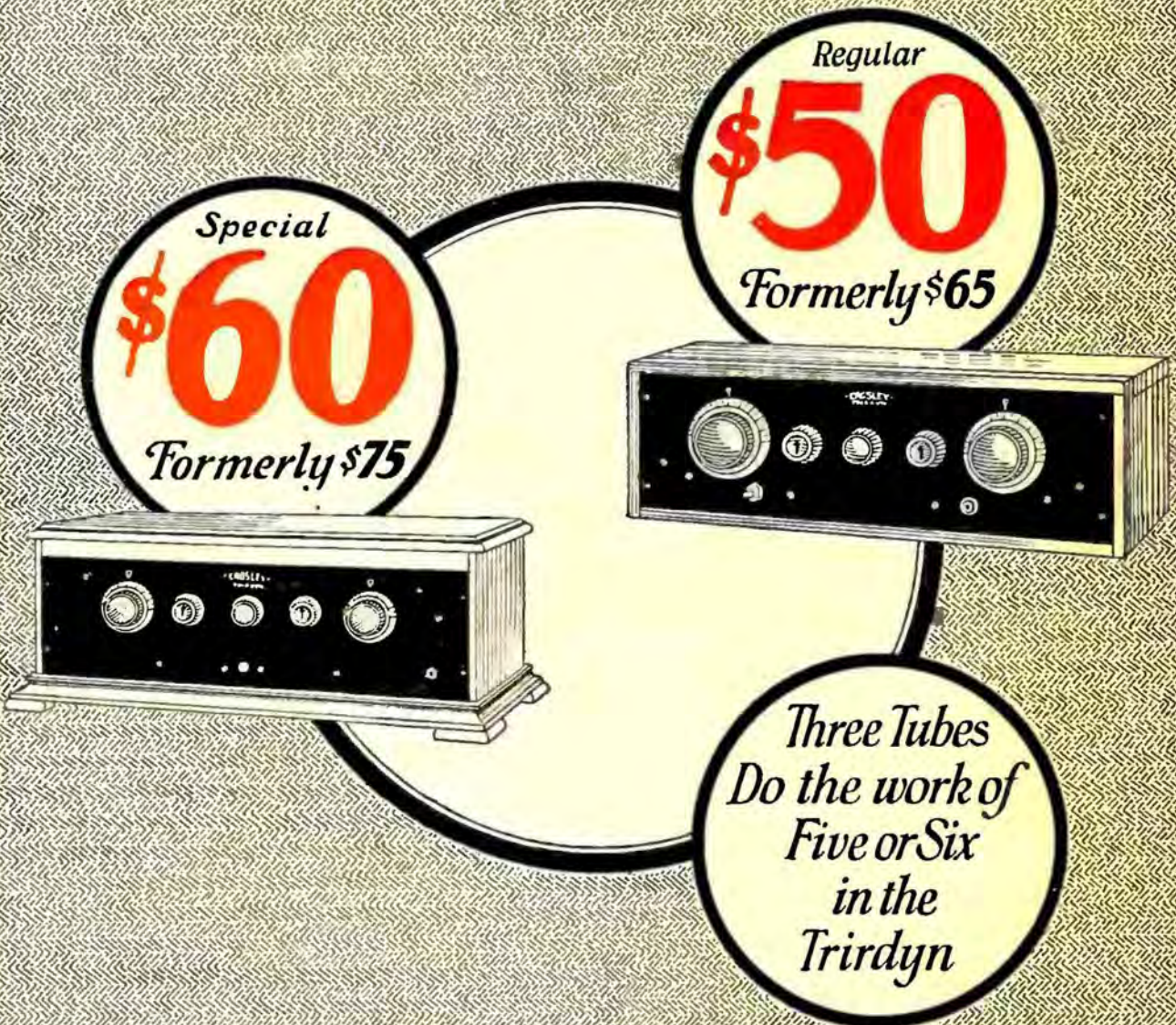
Prest-O-Lite Batteries are made to give long, faithful service. They're easy to recharge—and offer you truly remarkable savings. Though standard in every respect, they are priced as low as \$4.75 and up. See them at your dealer's—or write for "How to fit a storage battery to your set—and how to charge it."

THE PREST-O-LITE CO., INC., INDIANAPOLIS, IND.
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Prest-O-Lite



CROSLEY TRIRDYNS



The recognized outstanding achievement in radio is the Crosley Trirdyn. An overburdening amount of evidence proves that it is excelled by none and superior to most receivers costing many times more. It is a three tube radio combining one stage of tuned radio frequency, regenerative detector and reflex amplification. This combination enables three tubes to do the work of five or six. Brings in every large station in the country on the loud speaker. Is very selective, easy to tune and

economical to operate. The straight front Trirdyn Regular, formerly \$65; now \$50. The Trirdyn Special in large cabinet to house dry cell batteries formerly \$75; now \$60. To these have been added the new Trirdyn Regular with sloping panel at \$55 and the new Trirdyn Special in a beautiful cabinet with sloping panel at \$65. Demand a Crosley Trirdyn at any good dealer. All Crosley radios are licensed under Armstrong Regenerative U. S. Patent 1,113,149. Write for catalog.

Prices quoted without accessories. West of Rockies add 10%

THE CROSLEY RADIO CORPORATION

POWEL CROSLEY, JR., President

563 Sassafras Street - - - Cincinnati, Ohio

Crosley owns and operates Broadcasting Station WLW



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