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RADIO AGE

The Magazine of the Hour



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November
1925

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SILVER SIX



FACTS THE "WHY OF THE SIX"

as described in *Radio Broadcast* of November and December

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RADIO AGE

The Magazine of the Hour

Established March, 1922

WITH WHICH IS COMBINED RADIO TOPICS

Volume 4

November, 1925

Number 11

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Radio Age is published monthly by RADIO AGE, Inc.
Member: **Audit Bureau of Circulations.**

Publication Office, Mount Morris, Ill.
Address all communications to RADIO AGE, INC.
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500 N. Dearborn Street, Chicago, Ill.

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Los Angeles, Cal.

Final Advertising forms close on the 20th of the 2nd month
preceding date of issue

Vol. 4, No. 11. Issued monthly. Subscription price \$2.50 a year. November, 1925.
Entered as second-class matter at post office at Mount Morris, Illinois, under the
Act of March 3, 1879.

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A Chat With the Editor

EDITORS, engineers and manufacturers have combined their efforts toward making "The Radio Age Model Receiver" a truly valuable aid to the home set-maker. The description of the circuit, with drawings, photographs and blueprints, will be published in the December issue. We are giving the circuit a name which clearly shows that back of this outfit is the indorsement of our engineers and editors. We do not claim this circuit is a departure from present approved lines of design and construction. We do not claim that it involves any radical improvements. We merely assert our confident belief that this December feature will be the best illustrated how-to-make article this magazine has ever published.

All parts used in the construction of this set will be listed under their trade names. This, in itself, is a departure for Radio Age. Our policy heretofore has been to let the reader make his own selections of apparatus and accessories. In this feature article, however, we are going to try to make the instructions so complete that no reader will have to ask a single question further after he has read the directions.

Realizing that in choosing good parts for a five-tube-tuned radio frequency receiver, such as this set, it will be impossible to include all the really good parts which would give satisfaction for a given purpose, it is our purpose to follow the original article with others, one each month, in which there will be changes in various details of the circuit and in which the list of parts again will contain trade names, probably quite a different list in a majority of its items from the December suggestions.

Tuned radio frequency is popular now. We suggest that set-makers make sure of getting the December issue and follow the series carefully.

Frederick Smith

Editor of RADIO AGE

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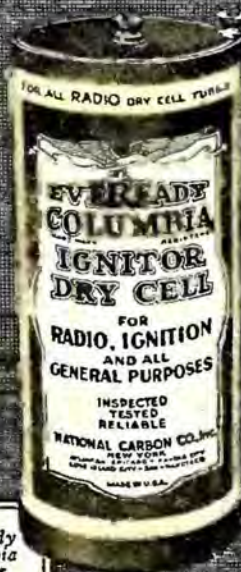
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RADIO EDITORIALS

CHICAGO'S experience with silent Monday nights is one which supplies plenty of evidence that the radio public is really the boss of broadcasting. During the recent summer a dozen Chicago stations were on the air on Monday nights, in spite of the fact that that night was theoretically silent. The mayor's radio commission and the broadcasters had attempted to get together on a plan which would make Monday night silent in fact as well as in theory. But several of the broadcasters refused to abandon their place at the microphone on those nights and as a result other broadcasters announced that they also would broadcast on Monday nights.

We do not know that a silent night for Chicago stations is an unmixed blessing. We suspect that there are thousands of listeners in the great middle west city who would prefer to have Chicago stations broadcast seven nights the week. This is true chiefly because there are many fans who do not aspire to get distance for its own sake. Many others have receiving equipment that is not designed for distance work.

However, there are tens of thousands of fans in the Chicago district who prefer to have Monday nights for travelling from state to state and from station to station. It was not realized how numerous these fans were until they became articulate through the Broadcast Listeners' Association of America.

The B. L. A., which announces it has branches in twenty-two states, organized a listeners' strike. Members of the association were urged to write to the broadcasters who did not observe silence on Monday nights and tell the station owners that the individual signing the letter would not listen in on the offending station at any time unless the station became silent on Monday nights. How many of these protests were received by broadcasters is not known. There must have been an impressive number judging from the immediate results. One after another the stations shut off their generators on Monday nights, put a dust cloth over the microphones and turned out the lights in the studios. Charles E. Erbstein, owner of WTAS, Elgin, Ill., was the latest to announce that he will be silent on Monday nights. That leaves only one station on the air in the Chicago district during the forbidden period.

It really appears that the fans accomplished an object which the mayor of Chicago, several of his aldermen and representatives of stations had failed to do. Truly the radio fan is a power in the land. It

only goes to prove the ancient impression that a good listener is about as great an institution as a good broadcaster.

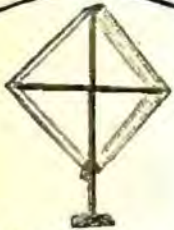
CHARLES E. ERBSTEIN, owner of stations WTAS and WCEE on the hill top near Elgin, Ill., is the stormy petrel of radio broadcasting. He is unique. There have been reports that his stations were to be taken over by the owners of the Chicago Tribune and negotiations may be completed before this gets into type. If the sale of his stations means that Charlie Erbstein is not to continue regularly as an announcer the news will cause a pang of regret in the hearts of literally millions of listening fans.

Erbstein is an extremely successful lawyer. He is a gifted pleader before juries. He is quick witted; he is a satirist of parts; he is a master of repartee. He has courage to say what he chooses to say. He follows no rule of ethics or conduct in a station studio unless he thinks that rule should apply.

The lawyer-announcer-broadcaster picked up his vast enthusiasm for radio several years ago, before broadcasting was born. He found that experimenting with radio transmission and reception devices was a fascinating relaxation for him and he spent much of his time during long winter evenings making his own stuff, winding coils, testing resistances, measuring capacities and soldering joints. Soon after broadcasting arrived Mr. Erbstein spent a small fortune on broadcasting equipment and erected a station that is easily one of the best in the United States.

Ever since he started Mr. Erbstein has been making the country listen. Fans have called him eccentric, but he is not. He is simply natural. He recites "The Face on the Barroom Floor" and "The Shooting of Dan McGrew." He quotes James Whitcomb Riley while "The Boss' Own Orchestra" plays creepy, weepy music. He calls for contributions for a relief fund for the victims of a devastating tornado and with tears glistening in his eyes and emotion choking his voice he acknowledges the checks that pour in. He talks politics, religion, international economy. He sings "You Can't Fool an Old Horse Fly" and forgets that he is working fifteen hours out of twenty-four. In distant parts of the country they have acquired the habit of listening in for Charlie. He pays the bills himself and they are large bills, frequent and continuous bills.

If broadcasting loses the Erbstein drollery and philosophy it loses a studio character whose like is not to be found.



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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

A New Super-Het Design that BANISHES Intermediate Stages

By ROSCOE BUNDY

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No Loop or Matched Parts Required in This Unusual Super

ONE of the most interesting and original types of superheterodynes recently developed takes full advantage of the regenerative principle in both the radio frequency and detector stages, and the great amplification thus attained is further augmented by a cascade coupling between the two regenerative elements which imparts extraordinary sensitivity and selective properties to the circuit without the necessity for the conventional intermediate radio stages. As with the standard radio frequency circuits, the radio frequency stage precedes the detector. The radio stage is heterodyned by an oscillator and complete rectification is performed by the single regenerative detector tube. This is all there is to the proposition except for the three succeeding audio frequency stages.

By employing regeneration in the radio frequency tube and detector, and by the use of a "flat-top" or outdoor antenna in place of the usual loop aerial, the intermediate transformers and tubes are done away with, and the difficulties experienced in properly matching these parts is also eliminated. Selectivity is now purely a function of the tuning units combined with the oscillator, with no dependence upon the directional properties of a loop aerial or other similar external auxiliary to tuning. By actual test on the circuit, it was found that really distant stations

could be tuned in perfectly through strong local stations, differing in wavelength by only a few meters, and that such stations came in without the slightest suggestion of interference. The added complication of manipulating the loop during tuning no longer exists so that the two dials are really the only wavelength adjustments necessary.

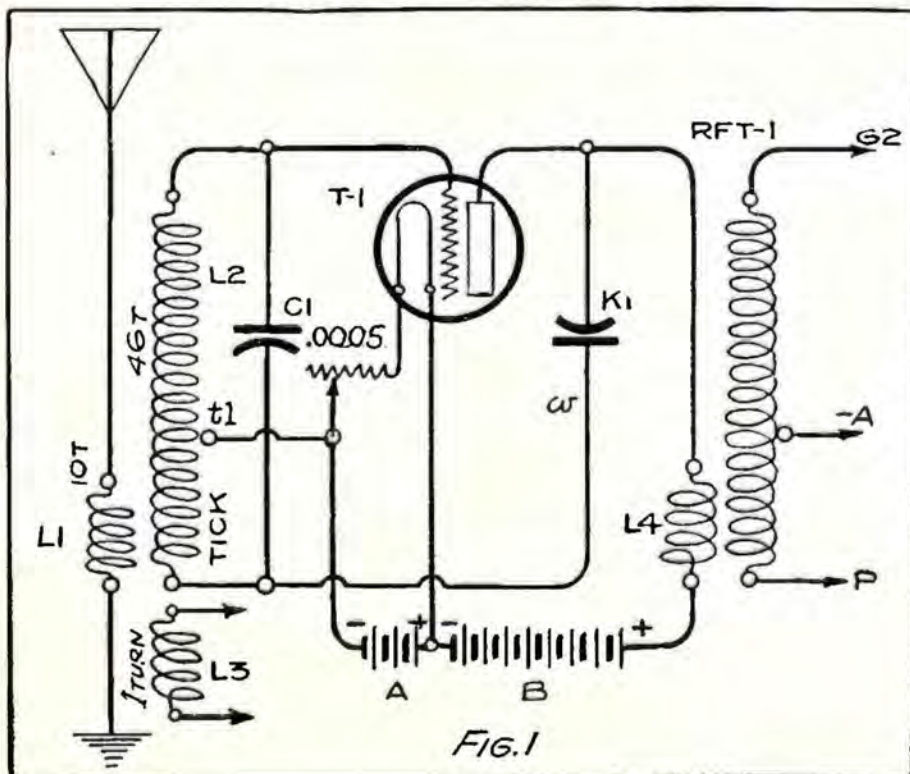
A THIRD, but no less important feature of the circuit is the ability to heterodyne to a very low wavelength, much lower than commonly used in the intermediate stages of other super-hets. This reduces the number of "repeat stations" on the dials to a point where "repeating" is at an absolute minimum with a corresponding gain in effective tuning, and simplicity in operation for the novice.

One of the principal objections to the standard type of superheterodyne has been the repeating of the same station at two or more dial positions, and in the elimination of this objectionable feature the new circuit stands unique. Even strong locals rarely repeat, while the duplication of distant stations is practically unknown.

The Circuit Explained

Because of the many functions performed by each of the tubes and the relations existing between the various stages, it will probably be easier to explain each stage by itself and then show them completely assembled in their proper relative positions. In Fig. 1 we have isolated the first or radio frequency amplifying stage from the balance of the circuit in order to show how the regenerative feature is attained and how the oscillator coupling is effected.

In many ways, the radio frequency stage is very similar to the



Weagent regenerative circuit when the feedback is considered. We have the aperiodic primary (L1) in the antenna circuit and the secondary coil (L2) tuned to wavelength by the 0.0005 mf. variable condenser (C1). At (t1) is a tap which goes to (-A) so that the portion of the coil (TICK) below the tap point is really the tickler coil for obtaining regeneration. A wire (w1) connected to the plate of the radio frequency tube (T1) feeds back the plate current to the tickler coil through the three-plate variable regenerative control condenser (K1). This is not a very critical control and is used for clearing up the signals and for controlling the volume.

Below the coil (L2), and inductively coupled with it, is the single turn pick-up coil (L3) connected to the oscillator circuit. All coils (L1), (L2) and (L3) are in inductive relation to one another and are wound solenoid fashion on an insulating tube. It is through (L3) that the heterodyne effect is obtained by impressing the oscillations of the external oscillator tube upon the incoming waves. At (L4) is the primary coil of the radio frequency transformer or filter (RFT-1) through which the putput of the tube (T1) is coupled to the following detector tube. This completes the radio frequency circuit. Primary coil (L1) = 10 turns of No. 22 wire, secondary (L2) = 46 turns of No. 22 wire, and (L3) = 1 turn of No. 22.

Following the radio frequency circuit is the detector circuit of Fig. 2, coupled by means of the air-core radio frequency transformer or filter (RFT-1). The primary (L4) carries the putput of tube (T1) as previously explained and acts inductively on the secondary (L5). As before, the secondary is tapped at (t2) with a connection to the (-A) line, and the lower portion of the coil (TICK) again acts as the tickler coil for securing regeneration. At (GC) and (GL) are the usual grid condenser and leak used with a detector circuit, but now variable condenser is used for tuning the system to wavelength. Coil (L4) = 330 turns of No. 26, coil (L5) = 90 turns, and (TICK) = 330 turns of same wire.

By means of the wire (w2) connected to the plate circuit, plate feedback is led to the tickler coil through the variable regenerative control condenser (K2). The latter is a very small condenser of the "midget" type, and when once adjusted seldom needs attention. It is evident that this is a Weagent type

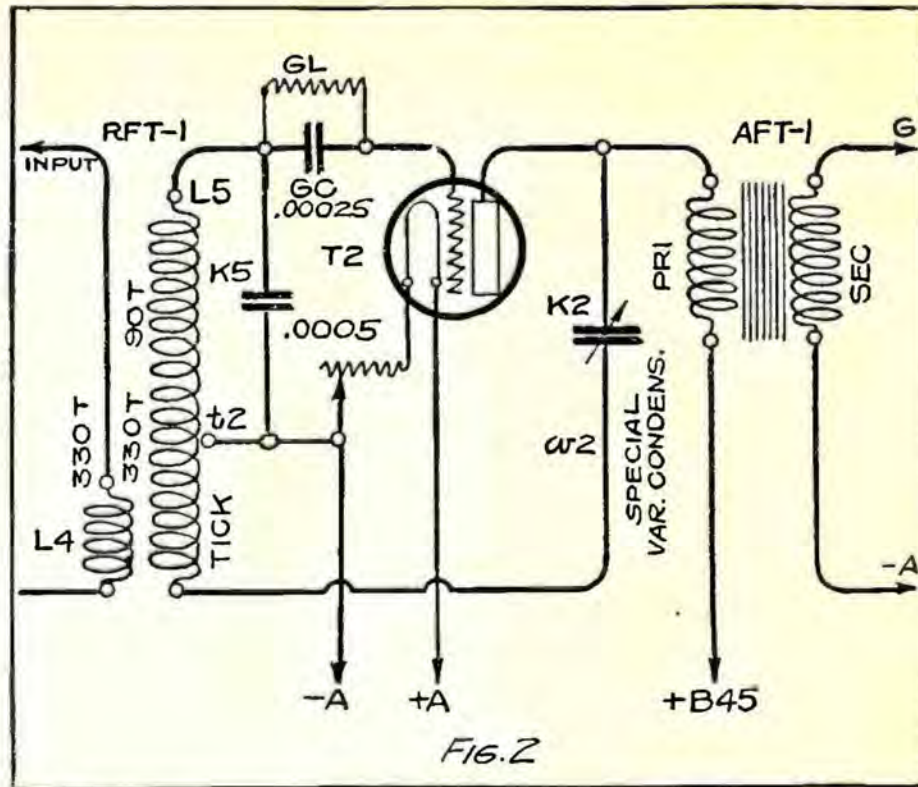


FIG. 2

regenerative similar to the first stage, except for the addition of the grid condenser and leak. With the two circuits coupled together, we have a cascade regenerative circuit with its output connected to the first audio frequency transformer (AFT-1). Following the detector are three audio stages of the usual type for increasing the audio volume of the detector.

A 0.0005 fixed condenser (K5) is connected across the coil section (90 turns) marked (L5) for sharpening the tuning.

Oscillator Circuit

NOW comes the third and last element of the radio frequency circuit, the oscillator circuit, which superposes the oscillations of an external oscillator tube upon the secondary circuit of the radio frequency stage. This is shown in detail by Fig. 3, where the oscillator tube (T3) is connected to the grid coil (L6) and the plate coil (L7) in the usual manner. The frequency of the oscillations is controlled by the second variable tuning condenser (C2) which has a capacity of 0.00025 mf. At (K3) is a 1.0 mf. fixed bypass condenser.

A rather unusual link coupling (M) is made between the oscillator circuit and the radio frequency secondary by coils (L3) and (L8). As before explained, coil (L3) forms a portion of the antenna tuning unit as shown in Fig. 1, but the coil (L8) consists of two turns of wire wound between the grid and plate coils (L6) and (L7) of the oscillator circuit. This arrangement gives the necessary loose coupling between the two circuits, and at the same time is mechanically advantageous in assembling the coils in the receiver. Coils (L6) and (L7) = 28 turns of No. 22 wire, (L8) = 2 turns of No. 22.

Complete Assembled Circuit

All of the elementary circuits are shown completely assembled in the proper relation by Fig. 4, where they will be recognized by a close examination. Identification is simplified by using the same letters in Fig. 4 as in the first three small diagrams, so that it should not be difficult for the novice to understand the functioning of the circuit. The three audio frequency stages are shown behind the detector circuit, by which the volume is brought up to loudspeaker requirements.

Impulses from the antenna are

led to tube (T1) and amplified at radio frequency with further amplification by the regenerative feature already explained. These waves are then heterodyned by the oscillations of tube (T3) coupled to the radio frequency circuit through the Marconi type link (M), and the output of the radio frequency tube is then coupled to the detector tube (T2). The detector rectifies the currents received from the first stage and develops the audio frequency phase so that the signals become audible. Regeneration in the detector stage still amplifies the signal so that the total amplification at the output of (T2) is unusually great, although only two tubes are employed.

Only two wavelength controls are needed, condensers (C1) and (C2). Condenser (K1) is not concerned in the wavelength adjustment, but is used for controlling the volume and for clearing up the signals when excessive regeneration tends to make them mushy. Condenser (K2) is seldom touched after the set is once adjusted. Tuning is surprisingly sharp, but with the coils properly adjusted, the two condensers can be so carefully logged and matched that little difficulty is experienced in picking up even the weakest of stations. Locals go in and out completely with one division of dial movement, and further, the set is not only sharp but is also perfectly selective with no "fringe" or "hangovers" after the given wavelength has been passed.

Some contribution is made to the sensitivity of the circuit by the oscillator tube and circuit, but its principle function is added selectivity and stability to the regenerative circuits. By the two condenser controls the range is from slightly below 200 meters to 555 meters with properly designed coils, and throughout this range the dials seldom if ever "repeat" a station owing to the

low wavelength of the heterodyned waves, made possible by this particular arrangement. Impressing the oscillator waves upon the first stage permits regeneration to be carried to a higher degree than with the ordinary type of regenerative circuit, so that the oscillator tube indirectly adds further amplification and is not to be considered as an idle tube as in the majority of super-heterodynes. It is possible that this stabilizing influence may be somewhat after the nature of the system employed in the old time super-regenerative circuit, where the amplifier is intermittently opened and closed by the oscillator tube so that tube "flopping" and squealing did not take place with the usual degree met with in feed-back coupling.

Audio Amplification

CONNECTED to the output of the detector tube are the three cascade audio frequency stages employing the audio tubes (T4- T5- T6). These stages are coupled together by the usual iron-core audio frequency transformers (AFT-1), (AFT-2) and (AFT-3) which must be perfectly matched to avoid howling and other troubles incident to the use of three audio stages. This audio amplification insures more than ample volume with the weakest stations passed by the detector tube and all broadcasting stations can be heard on the loud speaker with volume to spare.

Low ratio audio transformer are used with a ratio of from 2-to-1 to 3-to-1, and even with these low ratios, the three stages must be carefully handled to avoid overloading the last tube (T6). Again, the transformers must be perfectly shielded, and the shields grounded, to prevent the entrance of radio frequency strays into the audio circuit.

In Fig. 4, a variable resistance (r) is connected across the secondary of the last audio frequency transformer (AFT-3) to prevent overloading the tube on the last stage. This resistance is of the type that can be varied through a range of from 5,000 to 50,000 ohms, the exact resistance depending upon the other circuit contents. When in place, it is moved toward the low resistance position until the overload is reduced to the point where howling just ceases.

Dotted lines connected to the audio transformer

cores at (g-g-g) indicate that the transformer casings are grounded by a connection running to the ground binding post so that the transformers are effectively shielded from stray radio frequency fields. This is of the greatest importance to the proper operation of the receiver and the grounds should be carefully made to avoid distortion and noises. In some cases, improvement can be had by connecting a 0.00025 mf. fixed condenser between (-A) and the ground, but in the majority of sets a still better plan is to ground the (-A) line directly through a wire indicated by the dotted lined (Q) in the diagram.

In order to bypass the radio frequency currents around the primary coil of the first audio frequency transformer (AFT-1), a fixed condenser (K4) will sometimes be found advisable, while in other cases it may have no appreciable effect on the operation of the set. The exact size required can be best found by experiment but usually a 0.001 mf. or a 0.002 mf. fixed condenser will be found correct. This bypass is not critical. Bypassing various parts of the circuit by means of fixed condensers is largely a matter of experiment with the individual circuit, and varies with different types and makes of apparatus. What will be proper for one set of transformers may prove inadequate for another set, and the only way is to try out the effects of different bypass capacities.

When the overloading of the audio frequency tubes becomes excessive, it sometimes happens that the resistance (r) cannot take care of the overload when located in the manner shown. In such cases, it will be well to try the effect of connecting the variable resis-

tance across the plate (P) and grid (G) post of the last tube (T6), and thus deliberately short-circuit the energy output. On locals, tremendous volume is secured and some means is generally necessary for relieving the load on the tube.

Filament Control System

TWO rheostats are employed for the control of the filament current. A rheostat (R1) controls the emission of the radio frequency tube (T1) and the detector tube (T2). A second rheostat (R2) controls the audio frequency tubes, for the latter are not critical and can be worked nicely with a single rheostat. Experiment has demonstrated the advisability of separate control of the first two tubes according to the degree of amplification required and the regenerative effect. Regeneration in this circuit is directly influenced by the filament emission, and therefore filament control is essential. The Oscillator tube is provided with an amperite control (R3).

A full 90 volts of "B" battery is used on the oscillator, radio frequency and audio frequency tubes, but the battery is tapped at the 45 volt post for connection to the detector tube plate. This assumes the use of the 201A storage battery tubes, which are normally used with this circuit and which give the best all around results. The "199" tubes can be used, but with a considerable loss of volume and range.

There are some conditions, however, where the use of 45 volts on the first radio frequency tube and detector may bring in better distance than with the 90 volts recommended above, but it

will be well to try the high voltage first, and then if it is thought that the lower plate voltage will be of benefit, to try the 45 volts.

Tuning the Circuit

Owing to the sharpness of the tuning, it will be necessary to employ vernier variable condensers at (C1) and (C2), and to prevent bunching of the 200 meter stations, the condensers should be of the straight-line-wavelength type or equivalent. These condensers should preferably be of the recording vernier order by which fractional parts of a single dial division can be accurately recorded when the set is being logged or retuned on the same stations. The

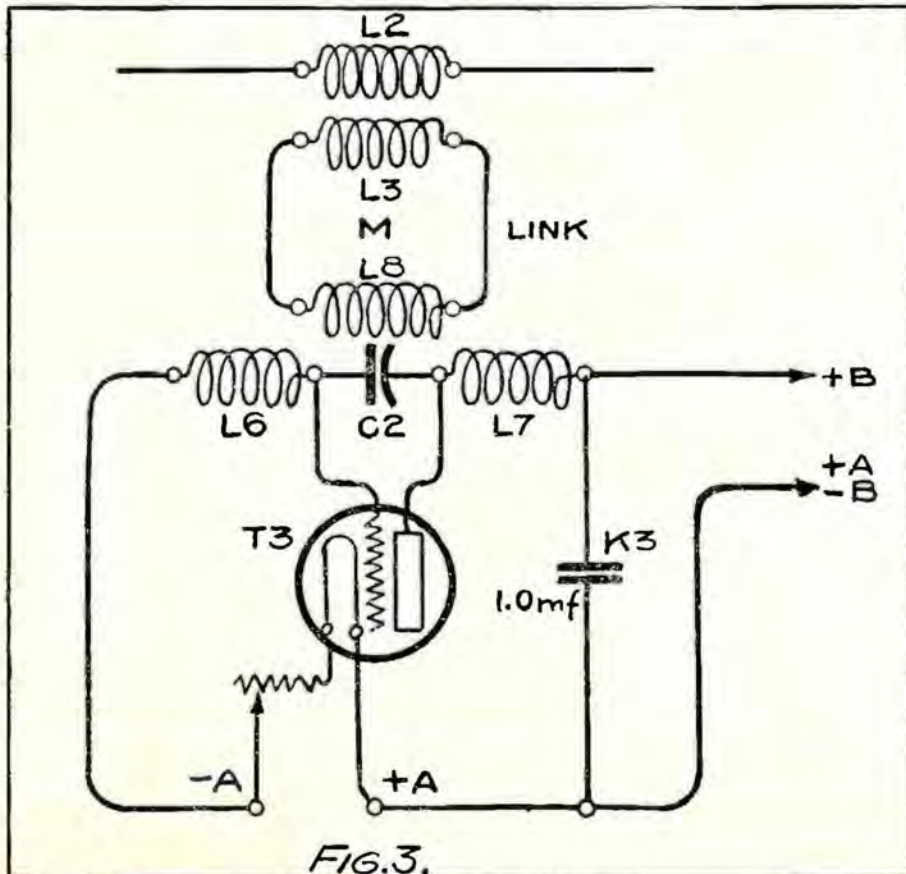


FIG. 3.

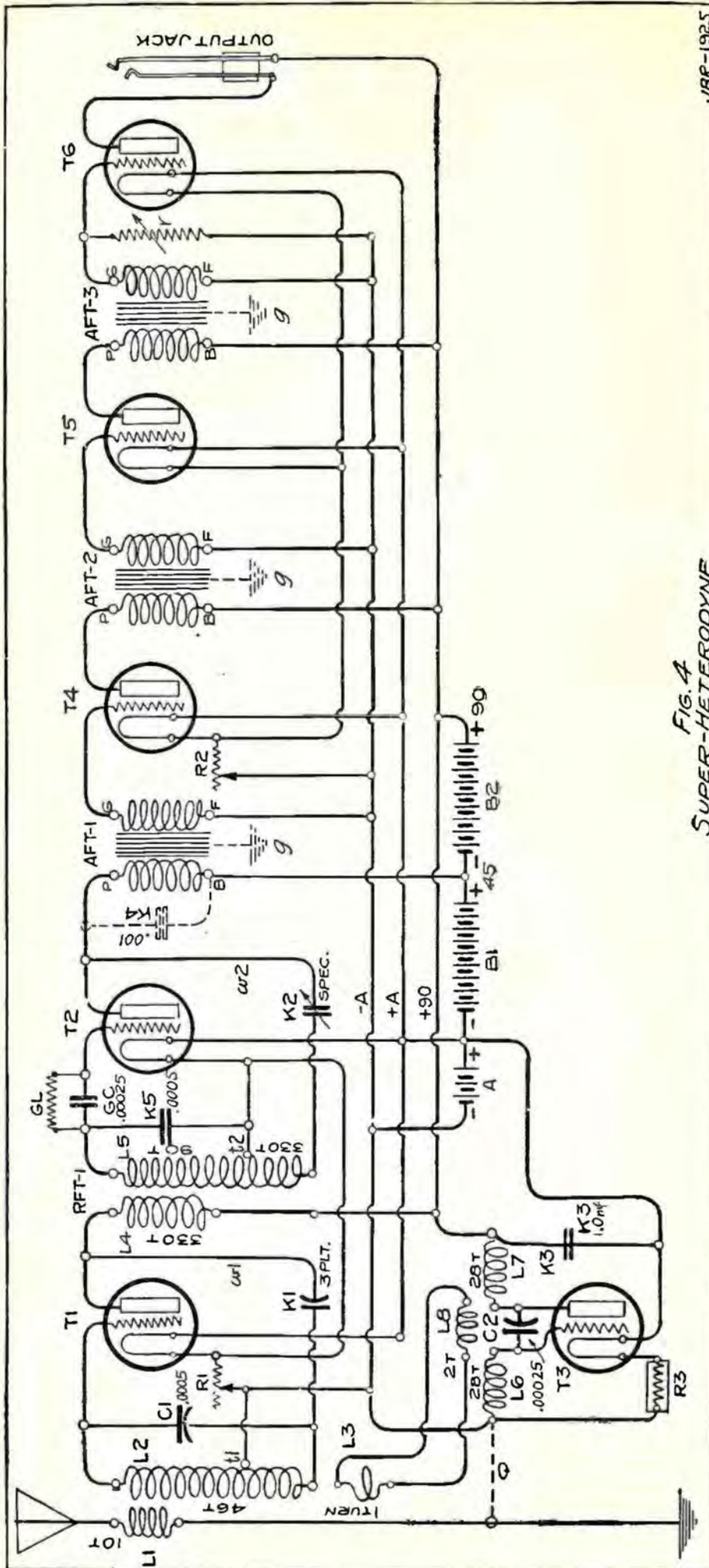


FIG. 4
SUPER-HETERODYNE

JBR-1925

regenerative control condensers and the audio resistance (r) are not so sharp and almost any low loss condenser will be satisfactory at these points.

Rheostat adjustments are not critical but should be turned on far enough to insure that the tubes are sensitive, say about $\frac{3}{4}$ on for the detector rheostat and nearly full on for the audio and oscillator tubes. The position of the rheostat knobs varies with the condition of the storage battery, as well as the tubes, and with a partly charged battery it will be necessary to turn the rheostats farther than when the battery is fully charged. It is not necessary to use the rheostats in tuning, nor is it desirable.

Condenser (K2), used to control regeneration in the detector tube (T2) is set slightly below the point where it causes excessive regeneration or howling. The closer this is brought to the howling point, after the set is tuned in by the main condensers (C1) and (C2), the greater will be the amplification and volume. It is not necessary to handle this control frequently, except when special conditions of selectivity and sensitivity make such adjustments necessary. With the plates fully meshed and at full capacity, the detector tube (T2) is in an oscillating condition, and in turning the condenser dial of (C2), a series of clicks will be heard. Stopping at any of these clicks will show them to be whistles due to the oscillations produced by the heterodyne oscillator, and when in this condition, signals cannot be heard. The condenser must be adjusted so that the tube is just below this oscillating point by moving the adjustment toward minimum position gradually until the whistles have all disappeared.

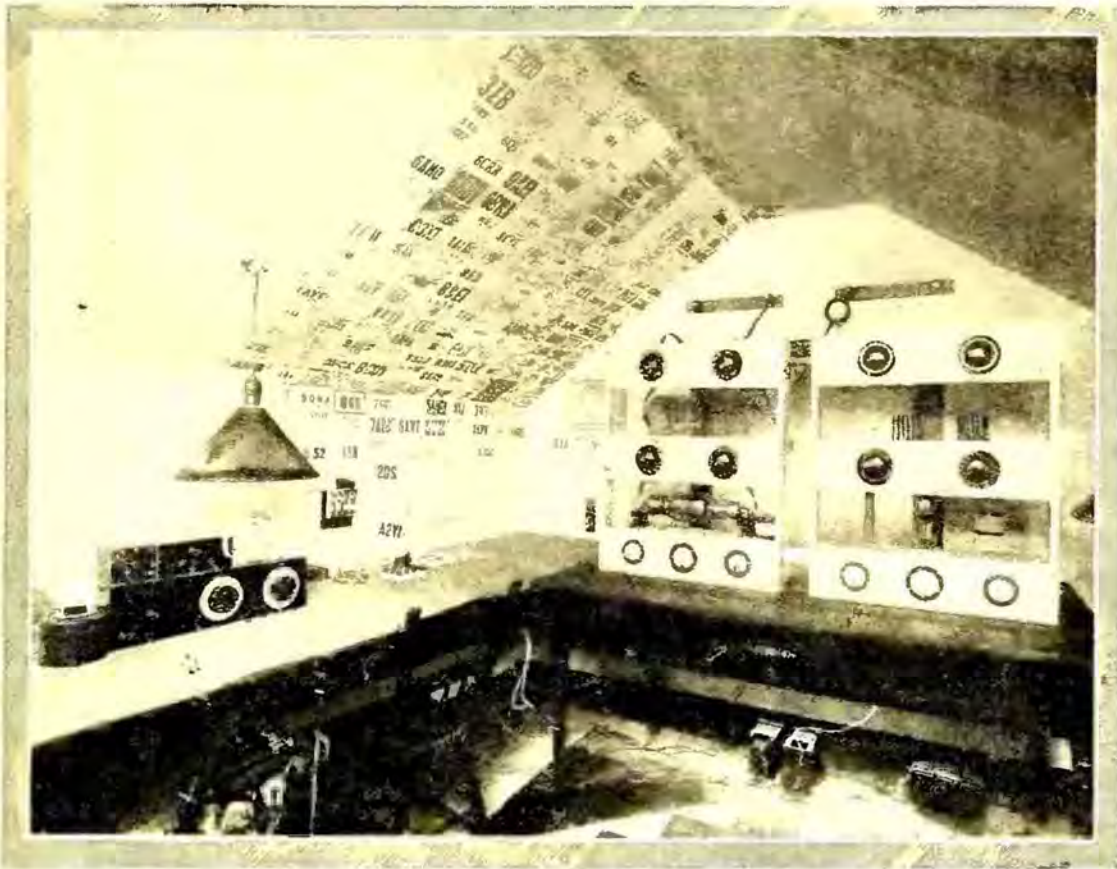
With the condenser (K2) adjusted as above, the tuning is performed by means of the dials attached to (C1), (C2) and (K1), the latter being the regenerative control for the radio frequency tube (T1) and is used for volume control. The control (K1) shows no effect until it is turned nearly to the point where tube (T1) is thrown into oscillation which is evidenced by a knock or thud when the dial passes the position. For each position of the two main condensers (C1) and (C2), the control (K1) should be turned up to the thud point, and then turned slightly back just below it.

The two large dials of (C1) and (C2) turn practically together, say within a point or two on the dial divisions, for any particular wavelength or station on that wavelength. To tune in, set both dials at the same dial division number, usually a low number in learning to tune, and then turn (C1) through a few divisions, following this adjustment by an equal rotation of dial (C2). Condenser (K1) should be kept as nearly to the thud point as possible during this time. Turning the main dials in this way, a distinct "shushing" sound will be heard when the two dials are at the resonant point for a given wavelength, and when there is a station operating on this wavelength, the carrier wave of the station will be heard as a muffled whistle. On hearing the whistle,

(Turn to page 61)

Riding the SHORT WAVES

BY ARMSTRONG PERRY



Amateur Radio Station 9CXX, owned by Arthur A. Collins of Cedar Rapids, Ia. Note the efficient equipment and "calls heard" on the wall.

Work of Young Amateurs is Responsible for Remarkable Development in Short Wave Work; Many Records Made by U. S. Boys

SOME TIME ago it was discovered that extremely short radio waves, from five to forty meters in length, would cover distances far greater than those in common use. Their range was discovered to be practically as great in daylight as in darkness and static did not materially interfere with their reception.

Radio amateurs were prompt in following up this discovery, as they have been in developing many new things in radio. One of the best known members of the American Radio Relay League, which includes most of the amateur experimenters, went as a Naval Reserve officer on the *Seattle*, during the recent cruise of our Pacific fleet. This was F. H. Schnell, traffic manager. A Navy officer reported, after Schnell and his short wave set had established communication with amateurs in many countries, that all Schnell had to do was to press the key of his short-wave transmitter and he would be heard in any part of the world.

Then John L. Reinartz, known to all amateurs as well as in professional radio circles, went with the MacMillan Arctic expedition in the summer of 1925, taking

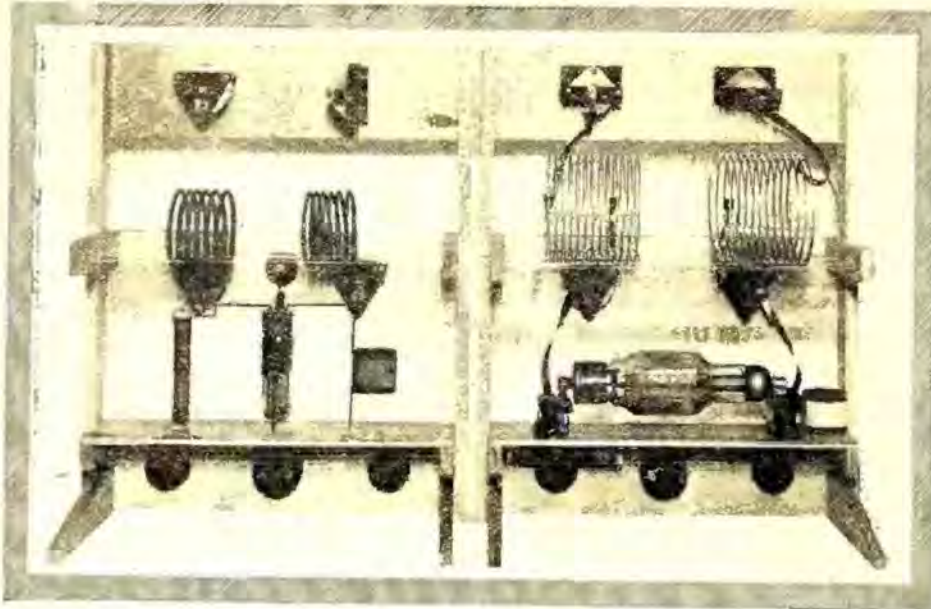
short-wave apparatus. On the last previous Arctic expedition conducted by MacMillan, which sailed in the summer of 1923 and spent the winter within eleven degrees of the North Pole, a prominent amateur named Donald Mix represented the American Radio Relay League and kept the expedition in touch with the world most of the time. He was out of communication for two months at one time, when a fifteen-year-old boy, Everett Sutton, of Port Angeles, Washington, picked up his signals and took scores of messages, which were delivered per instructions, to friends and relatives of the officers and crew, to the press and organizations interested in the expedition. Again in the Summer of 1925 it was a fifteen-year-old boy, Arthur A. Collins of Cedar Rapids, Iowa, who succeeded in keeping in touch with the Arctic expedition, using the shorter wavelengths, when older and more experienced radio men were unable to keep up communication.

Age Is No Barrier

THE fact that in two successive years mere boys should have been able to render such noteworthy service, indi-

cates that amateurs of any age have a most attractive field for investigation in short-wave work. A visit to the station of Arthur Collins, at Cedar Rapids, showed me that his apparatus is simpler and less expensive than the average radio lug would think possible. Convincing proof of its efficiency is shown by hundreds of reports from brother hams who have received his signals in all parts of the United States and in Mexico, Hawaii, Cuba, Porto Rico, Scotland, England, Belgium, Chile, Guam, Tahiti, India, New Zealand and Australia.

While broadcast listeners are using receivers with five to nine tubes, Collins hears signals from distant countries with three tubes. He made his receiver. The inductance coils have each a few turns of rather large wire, insulated by double cotton covering. The ends go directly to binding posts on the panel. There is no mounting, knob, dial or other device for changing the coupling. If Collins wants to put the primary nearer the secondary, or the tickler nearer either, he bends them over with his fingers. The coils were wound on a square box. When taken off, the wire had a tendency to uncoil. It was per-



1 KW (left) and 50-watt (right) transmitters of Arthur A. Collins, 9CXX, of Cedar Rapids. It is with this equipment that the young amateur is achieving remarkable distance records.

mitted to relax far enough so that the corners alternated. Thus coils that would have been square, like the box, became circular with humps at regular intervals. This caused the turns to pass each other at an angle instead of being parallel, and reduced the capacity between turns. Collins says, however, that straight-wound coils would serve as well, that is, coils wound turn after turn on a cylindrical form but removed from the form in order to avoid the effects its material might produce.

The condensers, he says, should be of the very best material and workmanship available. Of course, the capacities used must be nicely adjusted to the inductances in order to cover the desired wavelengths. The tuning condenser has seven plates.

The circuit, shown in figure 1, is a conventional one known by various names. The term "low loss," originated at the headquarters of the American Radio Relay League, has been applied to many types of apparatus but does not always describe accurately the characteristics of the apparatus or the financial result to the purchaser. The receiver for very short waves, however, must be a low-loss receiver to be efficient. Collins uses his without a ground connection, sacrificing volume of sound in the phones for greater selectivity. He has eliminated everything that can be dispensed with, in order to get rid of inductive and capacity effects that are undesirable. He has no vernier controls, except a rubber on the end of a lead pencil which he uses at times as a friction gear in turning a dial. His theory is that if a clear signal, however faint, can be brought in, it can be amplified.

Using two stages of audio-frequency amplification he brought in the voices of the men on the Bowdoin when they were broad-

casting from north of Greenland. They were so loud and distinct that they could be heard ten feet from the phones and all over his radio room. As will be seen in the diagram, turning the dial that controls regeneration does not change the wavelength. The tuning is done with one dial and the only other one is that which controls the regeneration. The whole receiver is simplicity simplified and it can be built and operated by anyone who can construct and operate any type of receiver.

Has Two Transmitters

COLLINS has two transmitters, one rated at 50 watts and the other at 1,000 watts. Even the 50-watt outfit was used successfully in working the *Bowdoin*. Both were designed for high electrical efficiency, convenience and flexibility of operation, as he likes experimental work.

It was the day after the tube for the big set was installed and tested that

Collins became the only connecting link between the explorers and the folks back home. For twenty-two days he was the only operator in communication with the expedition. He worked from 8 a. m. to 5 p. m. daily and handled a great volume of traffic, including personal and official messages and articles for the newspapers. The National Geographic Society, which sponsored the expedition, sent and received numerous messages through this station, built and operated by a boy, with complete satisfaction.

The 1KW tube uses 4,000 volts on the plate. The only source of supply was the circuit which supplied light and power for the house. That carried raw AC, which is not ideal. Pulling 4,000 volts from the lighting circuit every time the transmitting key was pressed stole most of the juice from the lamps around the house and the family led a flickering existence until Arthur ran a heavy 3-wire BX cable up from the main entrance box and thus put the 21-ampere load of the transmitter on a separate circuit.

The 1KW transmitter uses what is known as the 1XAM circuit. (Described in *QST*, January, 1924.) When working amateur stations in Australia and New Zealand, as he frequently does, Collins tunes it to 40 meters. While working WNP, MacMillan's flagship *Bowdoin*, he used wavelengths of 15, 16 and 21 meters. Both transmitters look even simpler than the receiver, as the photograph shows.

His antenna, during the time he was handling the traffic with the Arctic, was a single wire inefficiently lying in a tree. Having built a dream of a house, on Colonial lines, his parents were thinking more of architectural beauty than of scientific achievement, and poles are likely to be unsightly. But since Arthur established his remarkable record there have been erected on the roof two thirty-foot masts. At the top is a 50-foot single-wire aerial and twenty feet lower a 48-foot counterpoise. There is not much radio territory left for Arthur to reach, unless it might be the moon and Mars,

but with this increase in the efficiency of his station he should be able to dig up a few hams in Africa, Thibet and Corea, if there are any there.

It is just such experimenters as Arthur Collins who make the amateur radio game one of the most interesting and beneficial hobbies for the rising generation to ride. Men of mature years could profitably emulate the young ones, too, and many of them do.

With the low-priced and efficient equipment now available, there is certain to be a big increase in the number of radio students, or "bugs" this winter.

Anyone feeling the urge to get into the game, but uncertain just what are the beginners' first steps, will do well to confer with the technical staff of Radio Age. Information cheerfully given upon any phase of radio.

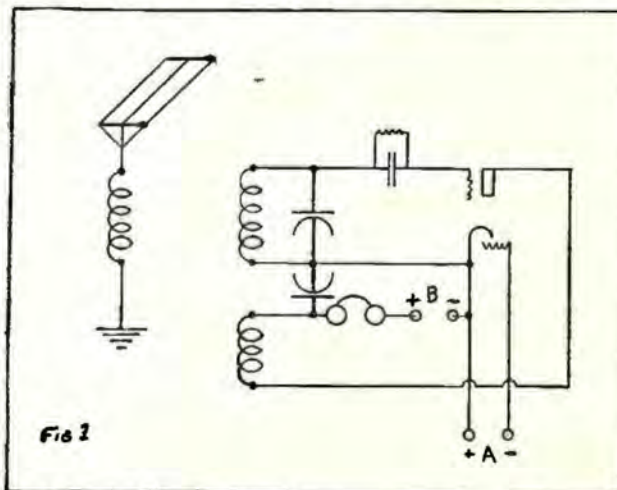


Fig. 1. Wiring diagram of short wave receiver used by Arthur A. Collins for receiving messages and broadcasts from WNP, the *Bowdoin* of the MacMillan Arctic expedition. The two stage amplifier when used is added in the usual fashion. The circuit is the conventional regenerative patterned after Armstrong.

DIRECTING THE NIGHT AIR MAIL BY RADIO

Radio Beacons Take the Place of Searchlights in U. S. Service

BY S. R. WINTERS

be varied. The two coils could also be rotated simultaneously about the telegraph pole as an axis. This arrangement facilitated these novel experiments, as it enabled the receiving operator to stand still while the angular positions of the coils were transmitted to him as they were rotated.

A 2-kilowatt quenched spark transmitter was employed with these two coil antenna, a double-pole-double-throw switch being used in alternating from one coil to the other. As previously stated, this alternation occurred once each second. The coils were so tuned that the wavelength thus used was 1,000 meters or 300 kilocycles, and the antenna current in each coil was 9 amperes.

Characteristic radio-telegraph signals—in this case, the letters "A" and "T"—were radiated from each coil or loop antenna. This will be the method of procedure when the "Air Mail" is guided by radio between Chicago and New York—that is, arbitrary letters from the International Morse telegraph code will be selected and alternately transmitted from a governed station. Thus a sector or course of travel is established and any deviation therefrom is indicated by an inequality of the radio signals from the two respective coils.

Test Proves Successful

EXPERIMENTS initiated at the Bureau of Standards have been continued by the United States Air Service at McCook Field, Dayton, Ohio, and results have been so satisfactory that recently an airplane was guided from Dayton to Washington, D. C., by means of a radio beacon. The crossed-coil antenna used at McCook Field consisted of two single-turn coil antennae, 50 by 120 feet in dimensions, and which were supported by three masts so placed that the angle between the coils was 135 degrees. An automatic change-over switch alternately connected each coil to a 5-kilowatt, 500-cycle quenched spark transmitter. The transmitting wavelength was 1,000 meters and from 15 to 18 amperes of current were used.

The radio receiving apparatus used on

DIRECTING mail-carrying airplanes by radio, flying between New York City and Chicago after nightfall, is foreshadowed as a reality in the light of recent successful experiments. The *invisible* radio waves, which seem to be a misnomer in this instance, are to be employed in charting the correct course of Uncle Sam's "Air Mail."

Radio beacons will supplement their powerful visible beacons, which project their beams of light for miles along the airway, as a means of insuring an unerring course of navigation.

The United States Post Office Department, in co-operation with the Radio Laboratory of the Bureau of Standards, recently conducted successful tests in guiding aircraft between Maywood and Monmouth, Illinois, the latter point being the location of the experimental radio and aircraft laboratory of the Post Office Department. These experiments were productive of such gratifying results as to warrant the experimental installation of radio direction-finders on mail-carrying aircraft operating between New York and Chicago. Then, airplanes can fly in darkness with safety by means of radio just as now ships ply the seas in foggy weather by virtue of radio beacons.

The use of radio signals in guiding airplanes over distances of several hundred miles is the result of a refinement or modification of a principle developed by Francis W. Dunmore of the Radio Laboratory of the Bureau of Standards. It is described as a directive type of radio beacon and may be applied in guiding an airplane, ship, or other mobile unit. The sea-going vessel or airplane whose course is thus charted is not dependent upon landmarks or the magnetic compass for guidance. Furthermore, no elaborate equipment is required on the mobile unit, the primary requirement being a radio direction-finder or loop antenna and a radio receiving set, of no special design.

How It Is Done

THE principle of operation implies the use of two transmitting coil

antennae on the ground, arranged at an angle of 135 degrees with respect to each other. Signals from a radio transmitter—a quenched spark transmitting set being used in the original experiments—are first impinged on one coil antenna and then the other, alternating once every second. Radio waves are thus intermittently dispersed in a certain direction from each coil, the intensity of the emitted signal with respect to the plane of each coil varying in accordance with what the radio engineer terms the figure-of-eight. A mail-carrying airplane, for instance, flying from Chicago to New York, is assured that it is navigating along an appointed course if the signals from these two transmitting coils are received with equal intensity. If, however, an inequality of signals develops, the aviator realizes that he is deviating either to the right or left, depending upon which arbitrary signal has lessened its intensity.

The experimental type of equi-signal double-coil antenna, illustrated by a photograph reproduced with this article, was designed to rotate about a telegraph pole as an axis. Each coil was composed of two turns of wire wound on a frame 20 feet square. While under ordinary operating conditions these coils were arranged at angle of 135 degrees with respect to each other, they were stationed so that their relative angles could



Figure 1. The photo, made by the Bureau of Standards, shows a double-coil transmitting device used for sending out radio signals whereby an airplane or ship may be guided along a straight course, thus taking the place of less reliable methods.

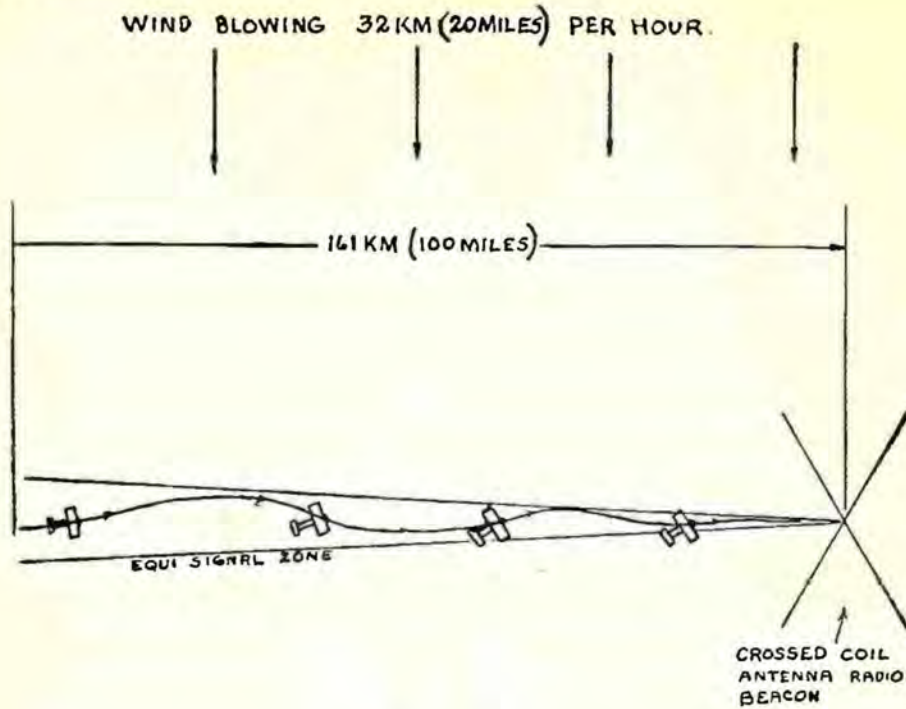


Fig. 2

METHOD OF ELIMINATING EFFECT OF WIND DRIFT ON AN AIRPLANE SHOWING COURSE FLOWN BY AIRPLANE AT 161 KM (100 MILES) PER HOUR IN EQUI-SIGNAL ZONE.

the airplane was installed in the rear or gunner's cockpit. This consisted of antenna reel and wire, inductively-coupled tuner, 7-tube Signal Corps amplifier, and batteries. The fair lead projected through the flooring of the cockpit, thus permitting a wire to trail on the left side of the fuselage looking forward. In addition to the trailing wire, a coil of two turns of insulated wire extending from the trailing edge of the upper wing and landing gear to the rudder post could be connected to the radio amplifying unit and coupler by a double-pole-double-throw switch.

"One of the great advantages of this system," reports Francis W. Dunmore of the Radio Laboratory of the Bureau of Standards, "over the method of employing a radio direction finder on the airplane or on shipboard is that the effect of side drift may be immediately noticed and corrected by heading the airplane at the correct angle in to the wind, thus enabling a pilot to maintain a straight course along the line of direction to the transmitting-coil beacons.

"In aerial navigation this is much more important than in marine navigation, as the effect of side drift due to crosswinds is often very marked. The effect of cross winds on an airplane navigating by means of magnetic or ordinary radio direction finder bearings is illustrated in one of the diagrams reproduced with this article. It will be seen that under these conditions the airplane may deviate considerably from its true course. By means of an equi-signal

crossed-coil radio beacon, an airplane may maintain a straight course regardless of cross winds and visibility conditions."

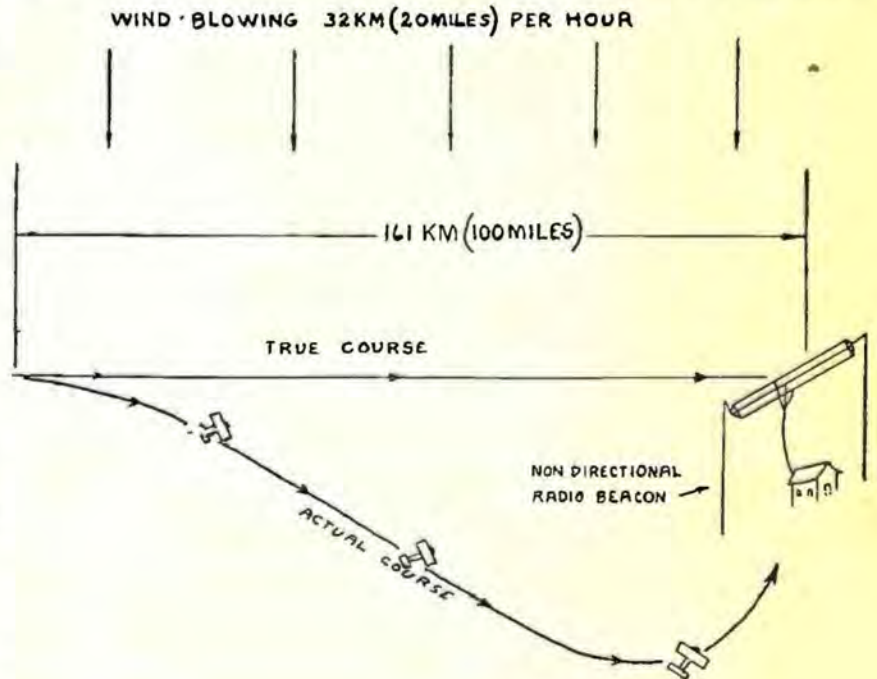


Fig. 3

EFFECT OF WIND DRIFT ON AIRPLANE, SHOWING COURSE TAKEN BY AIRPLANE WHEN FLYING AT 161 KM (100 MILES) PER HOUR AND NAVIGATING BY MEANS OF DIRECTION FINDER BEARINGS ONLY.

THE value of direction-indicating beacons for use of airplane pilots cannot be over-estimated. The increasing air travel, together with the frequent low visibility during storms or other atmospheric disturbances, makes it almost imperative that some definite, safe and constant means be adopted to guide the air traveler on his way.

The navigators of old were practically helpless without beacons, although the radio compass has now practically made navigation error-proof. The adaptation of the radio compass to air work, with particular emphasis laid on the beacon scheme, should do a great deal to iron out difficulties which aviators have had to encounter in their flights.

Naturally, the radio compass aboard an air machine is too bulky a proposition to be considered, so the beacon after all seems to be the most feasible project yet developed.

Guiding Steamships

Old timers will probably compare the aerial method of holding to a course to the buried cable in New York Harbor some years ago when underwater oscillators, one located on the port and the other on the starboard, were used to keep track of a signal being emitted by the cable laying on the floor of the harbor. By noting the intensity of the signal received in the port and starboard receivers the pilot (the skipper) was enabled to hold the vessel to a true course. This was exceptionally valuable in foggy or heavy weather when there was a possibility of a collision if the vessel strayed far from her beaten path.

A New Use for 3-Element Tubes

A WINDLESS, PIPELESS, PIPE ORGAN

By J. C. JENSEN

Dept. of Physics, Nebraska Wesleyan University

The primary coil consists of 3000 turns of No. 26 enameled wire insulated from the core and between layers with empire cloth.

A tap is taken out at the 1800th turn for the filament connection, and if the transformer is intended for general experimental purposes, it is a good plan to take out a tap for each 300 turns, beginning with the 1200th. The secondary is wound in a similar way with 300 turns of wire. Any hard amplifier tube will serve in that position. The UV201A gives very good results, while for maximum volume the UV202 may be used.

Only One Octave

IN THE experimental outfit here described, one octave only was provided for. The condenser, C, is a 43-plate variable in a metal case, the latter being filled with transformer oil so as to increase the maximum capacity to about .003 Mfds. The fixed condensers C₁, C₂, C₃, etc. were

made out of an old high-voltage paper condenser. Trials with small laboratory units showed that the value of C₁ should be about .01 Mfd. to give a pitch of C — 256 vibrations per second. A paper condenser of that magnitude was connected in and the pitch tested against a tuning fork. Approximate adjustment was made by trimming the tinfoil between layers of paper, and final tuning to the exact note was obtained by the use of the variable condenser.

To keep C₁ constant, the paper and tinfoil parts were tightly clamped between two pieces of bakelite. C₂, C₃, etc., were constructed in a similar manner. With all the key-switches open, the apparatus would still give out a high-pitched note due to the variable conden-

core transformer, T. The core is built up of laminated steel with outside dimensions 4x5 inches and 1 inch deep. The width of each piece of steel is 1 inch, which leaves a rectangular hole, 2x3 inches in the center. To facilitate winding, the steel plates, taken from a burnt-out power transformer, were cut into the shape of an L, 5x3x1 inches, and piled for each half so that alternate layers extend in the directions a and b as shown in the drawing.

After the coils have been wound on the resulting U shaped forms, the laminations at the ends are slipped over each other so as to form a solid mass of steel, and pushed into place by the use of a bench vise. Holes were then drilled in each end of the core and bolts through these holes held the entire structure together.

IN THE twenty years since the invention of the audion by DeForest, the three-element vacuum tube has been put to a large variety of uses and new applications are constantly being made. Besides its well-known functions as a detector and amplifier, it is used to drive oscillators of every description from the small experimental units of the radio laboratory to the large powerful types which furnish the carrier-wave for broadcasting purposes.

The pitch of a musical instrument depends on certain properties of the substances whose vibrations produce the various notes. In the piano it varies with the length, tension and weight of the string. In the pipe-organ it depends chiefly on the length of the pipe and on whether one end is open or closed. In the case of an oscillating electrical circuit the controlling factors are the capacity and inductance as given by the equation,

$$n = \frac{1}{2\pi\sqrt{LC}}$$

where n is the number of oscillations per second, L the inductance of the circuit in henries and C its capacity in farads. Since this equation holds for all values of L and C, it follows that if their values are properly chosen a vacuum-tube circuit may be made to oscillate with frequencies within the range of the human ear.

A Vacuum Tube Oscillator

THE vacuum tube oscillator described herein is the outgrowth of considerable laboratory experimentation on low-frequency circuits. As will be noted from Fig. 1, the Hartley circuit is used, although some of the others could also be made to serve the purpose. The most difficult part of the apparatus to construct is the iron-

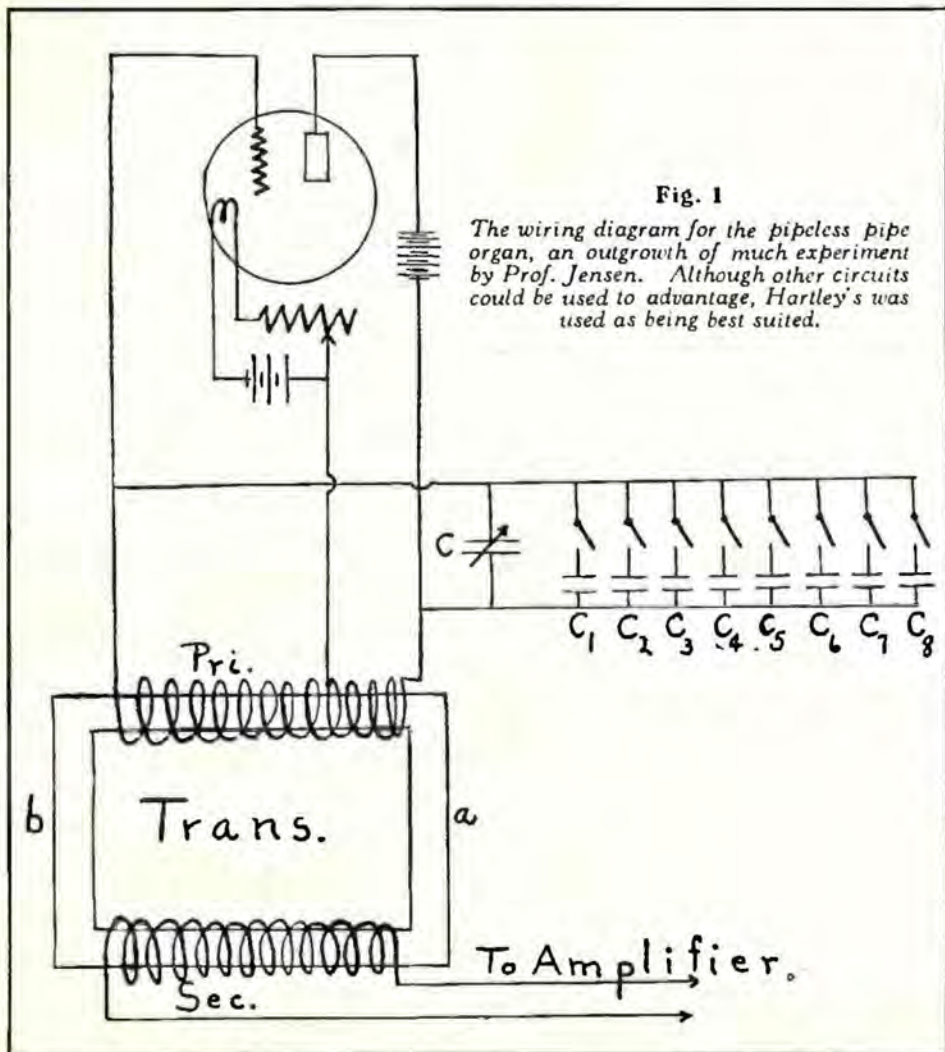


Fig. 1

The wiring diagram for the pipeless pipe organ, an outgrowth of much experiment by Prof. Jensen. Although other circuits could be used to advantage, Hartley's was used as being best suited.

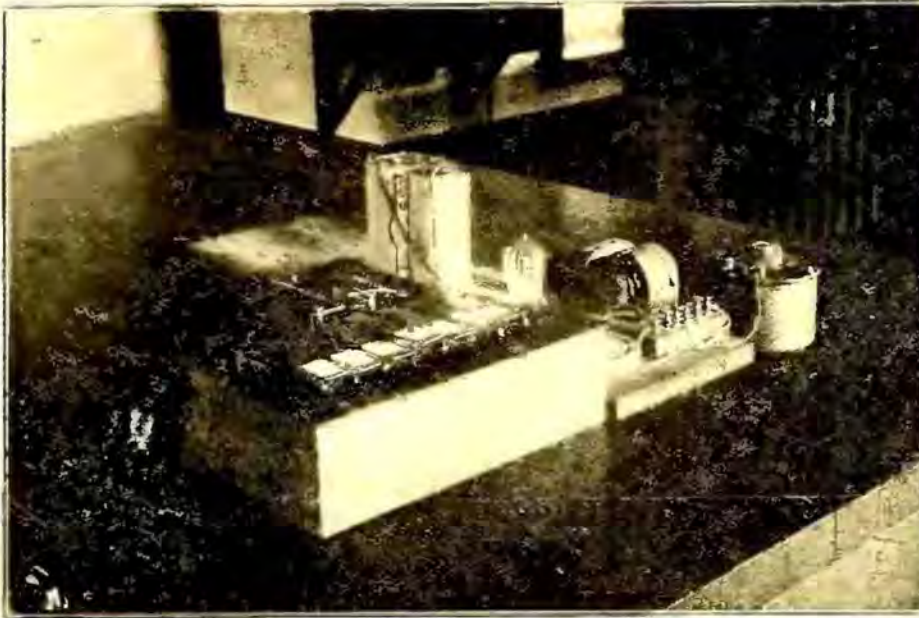


Fig. 2. A close-up of the remarkable key-board for the organ devised by Prof. Jensen. The transformer and oscillator tube are also shown in this photo.

ser. This can be obviated in either of two ways. Instead of the permanent connection from C to the condenser-transformer leads, a separate wire can be run from its upper side to the contact points of the switches C₁, C₂, C₃, so that the variable condenser is in circuit only when a key is struck.

Another plan is to connect a 1 Mfd. condenser to the upper side of a bar, joining all the keys in such a way that this large condenser is in circuit only when all keys are up, its capacity being sufficient to make the note of the oscillator too low to be audible.

The output of the transformer is put into an amplifier of two or three stages. Fig. 2 shows a close-up view of the key-board, transformer and oscillator tube, while Fig. 3 illustrates the entire apparatus including a two-stage power amplifier. With a little care in adjusting, the notes produced may be made true to pitch and of good quality. The volume of sound depends wholly on the amount of amplification applied, and it is obvious that greater ranges in pitch can be added at will.

Similar to Pipe Organ

THE action of the keys in this device is the same as that of any electrically controlled pipe organ, except that each key has a set of contacts which opens and closes its respective condenser circuits, instead of a relay circuit, as is the case with the usual electrically controlled pipe organ.

The keyboard of this radio organ is nothing more than a number of hinged pieces of wood, each having a set of contacts and a spring to hold the key switch open.

In the event that the experimenter desires to work with the lower notes of the piano or organ scale, it may be necessary to use one of the newly developed cone type loud speakers in the output switch, as it is often the case that the usual type of horn speaker will not respond to the lower notes of the scale.

The cone type of speaker will also give better satisfaction if a wide range of frequencies is to be made use of. There is practically no limit as to the quality of the tones which a device of this kind can be called upon to produce, since a resistance or impedance coupled amplifier and cone type speaker can be connected to the output circuit of the oscillator tube. This form of amplifier and speaker will faithfully reproduce all the tones generated without the slightest distortion.

It may be found that while operating this tube organ that a slight disturbance occurs in the radio receiving set when both are operated at the same time. If this interference of disturbance is troublesome, it can be eliminated by completely shielding the oscillator-circuit, (Fig. 1) with a copper or tin foil cover box.



Fig. 3. The entire apparatus, including the two stage power amplifier. Fans who build this novel organ are asked to write in concerning the results obtained.

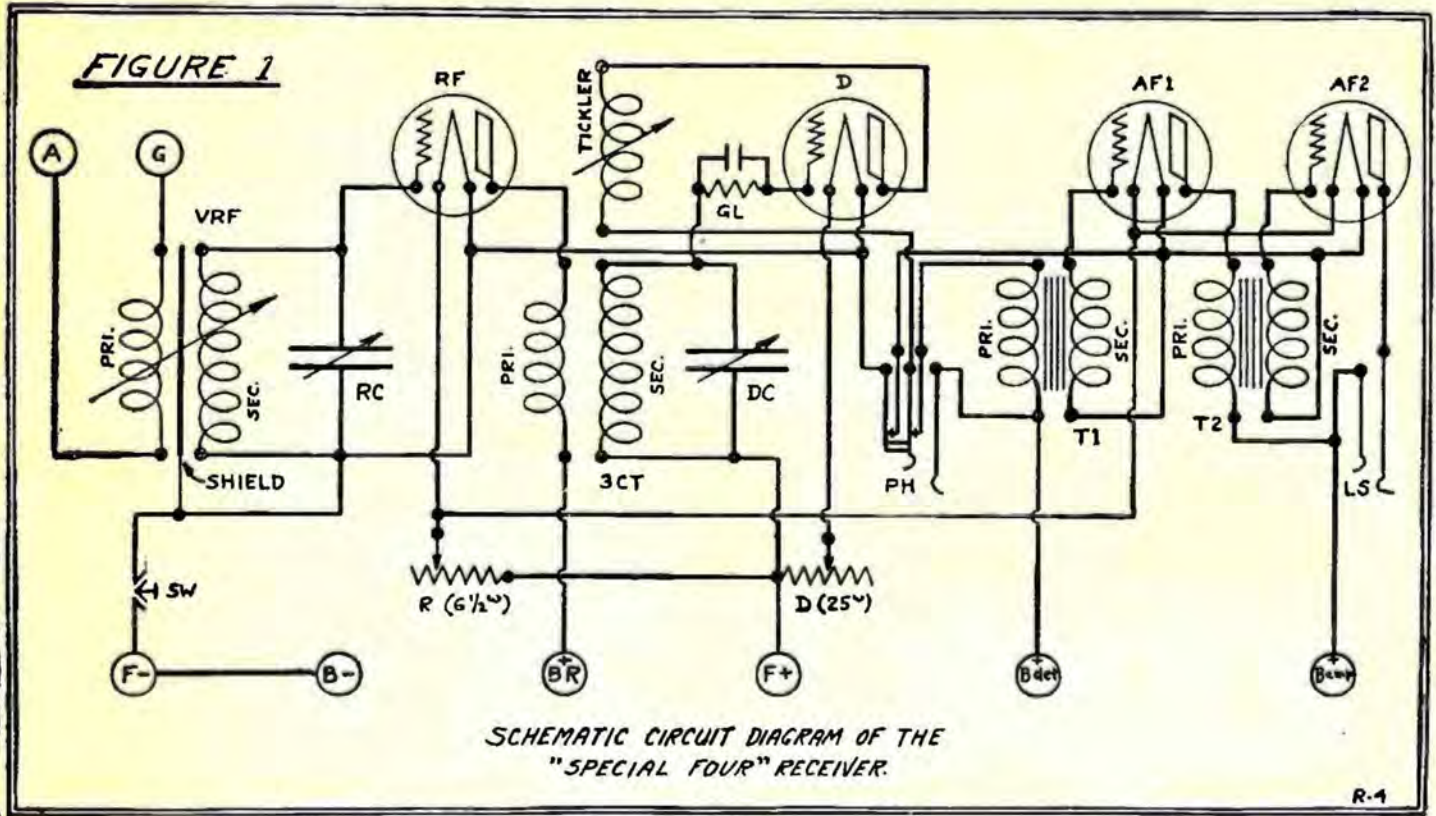
Establishing Octaves

CONDENSER C₁, of approximately .01 mfd. capacity gave a pitch of C, or -256 vibrations per second, the lowest note of the particular octave for which this device was made. The remaining condensers, C₂, C₃, etc., will naturally have to be of a smaller capacity than .01 mfd. The capacities of these condensers can be altered until the resultant pitch is obtained. This can be accomplished by altering the capacity of each of the condensers, C₂ and C₃ until the note produced is similar to that given when the corresponding keys of the piano are sounded.

By employing the method of establishing the octave, described above, several other octaves can be included by providing additional keys and corresponding condensers and adjusting them by comparison with the piano or by ear until the desired notes are produced.

There has been quite an insistent demand on the part of a certain type of radio experimenters for an article on an audio oscillator. The scheme outlined by Prof. Jensen seems to cover the subject quite well and we believe his article will enable many of our readers so inclined to go ahead with their own work on an audio oscillator. The range of frequencies can of course be determined at will by the selection of different sized condensers as outlined by Prof. Jensen and with the trimming process employed one may get the various capacities down to a nicety.

Don't miss the December number of RADIO AGE. Chock full of inspiration and topped off with the "Radio Age Model Receiver." On the stands November 15.



A New LOW LOSS "Special Four"

AS THE cold weather approaches, all of the DX hounds start polishing up the old soldering iron and looking for new ideas in receiving circuits, and here is one right off the fire. A combination of the old reliable DX regenerative set, less the troublesome howls and squeals, with a stage of "adjustable" tuned radio frequency amplification that will reach out and bring home the distant stations to your heart's content, and two stages of audio frequency amplification to rattle the window panes.

This circuit has shown surprising selectivity while being worked within a mile and a half of two 1500-watt broadcasting stations and one-half of a city block from station WIBO, which is sending out 1000 watts. During the first part of September, it reached out almost two thousand miles and brought in signals on the loud speaker—and that is going some for that time of the year. In fact, for distance on a seventy foot antenna, it beat an eight tube super-heterodyne using a loop and being operated at the same time.

Cost Is Not Great

THE cost of building this set is comparatively small when one considers that the popular trend is for five, six and even eight tube sets, and it will stand up and bring them in alongside of the best of them.

In selecting a receiver, it is always a good plan to find out how it works, so

An Efficient Long-Distance Set Combining Regeneration and a Stage of Adjustable Tuned RF

By H. FRANK HOPKINS

let us analyze the circuit. We will start at the incoming or radio frequency end and see what takes place. By radio frequency amplification, the incoming signal is amplified at radio frequency, or at a frequency above audibility, depending on the wavelength of the incoming signal. By tuned radio frequency, we mean that the radio frequency transformer is capable of being tuned to filter signals of various frequencies and block all other signals of different frequencies. The most common tuned radio frequency circuits have a two-circuit, air core transformer, one winding acting as an aperiodic primary. This winding usually has from eight to fifteen turns of insulated copper magnet wire, about No. 22 gauge, and the other winding as a tuned secondary usually consisting of from forty-five to sixty turns of the same size wire, when a .00035 Mf. variable condenser is shunted across its winding. By changing the capacity of this condenser, the circuit is tuned to filter various frequencies or to pass signals of a given wavelength to the grid of the radio frequency tube, where they are amplified, or strengthened. This coil is shown in the schematic circuit diagram, Figure 1, as VRF. and

the variable condenser as RC.

The Two-Circuit Coil

BY AN adjustable stage of tuned radio frequency, we mean a two circuit coil with the variable condenser as described above, with the windings mounted so that they can be moved to various distances from one another, as shown in Figure 2. This feature enables one to increase or decrease the antenna coupling as desired. When this is once set, it need not be changed, unless the operator desires to sharpen the tuning so as to cut out some nearby station. This is accomplished by reducing the coupling or moving the coils farther apart, or he may increase volume and distance by closer coupling, which is obtained by moving the coils closer together. This, however, reduces the selectivity of the set and it is suggested that when once a good setting has been obtained, the coils be locked in that position, or that position marked so as to be able to go back to it as desired.

In this circuit, we have all of the above features, with the addition of a brass shield between the primary and secondary coils of the transformer VRF. This shield was found to reduce most of the strong induced currents that were responsible for considerable foreign noises in the receiver. This shield is grounded to the negative side of the filament, or "A" battery, and is kept in about the center of the air gap between the two coils. (Turn the page)

The plate element or output terminal of the radio frequency tube RF in this circuit is then connected to the primary side of a three circuit tuner, designated 3CT in Figure 1. A three-circuit tuner is a set of three coils, two stationary and one movable. The first coil is known as the primary and has about twelve turns of No. 22 insulated copper magnet wire; the second coil is known as the secondary and has about fifty-five turns of the same size wire. A variable condenser is shunted across this secondary coil and the combination works the same as the radio frequency unit just described. The third coil is movable and is located inside of the other windings. It is known as a tickler coil and has about twenty-five turns of the same size wire; this coil is what produces regeneration and is a volume control.

The Secondary Connection

THE secondary side of this three circuit tuner is connected to the grid of the detector tube D, through a grid leak resistance and small fixed condenser GL. This grid leak and condenser is used to insure an even grid bias potential or grid voltage. The plate of the detector tube is connected to one side of the tickler coil; the other side of the tickler coil is connected to the positive side of a forty-five volt plate or B battery through a set of head phones or the primary coil of an audio frequency transformer, thus producing regeneration, or strengthening the output of the detector tube, which has rectified the incoming signal from the inaudible radio frequency to an audible frequency, or a frequency that will produce sound in the head phones or loud speaker.

This output is usually connected to the primary winding of an audio frequency transformer. By audio frequency amplification, we mean amplification of the signal which has been rectified, or changed to a frequency low enough

to produce an audible vibration of the diaphragm in the receivers of the loud speaker. By adding stages of audio frequency amplification, we increase the output strength of the set and consequently get more volume.

Two such stages of audio frequency amplification are usually employed, and sometimes three, but more than three stages tend to distort the signal and are therefore not desirable.

All that remains to be described are the batteries and the ground and antenna connections. The filament or "A" battery, as we all know, is used to heat the filament of the tubes, causing an emission of electrons to take place within the tube, the flow of which is regulated by the grid element of the tube. The plate or B battery is connected to the plate element of the tube through the receivers or the secondary of a transformer. The battery furnishes the high voltage necessary to pass a current from the filament to the plate element of the tube, making a completed circuit through the phones or loud speaker so that the current will flow and the variations will be reproduced by sound.

The Materials

NOW that we have analyzed the circuit, let us go about getting the materials ready to build the set. Everything that will be required is listed below. Each part bears a designation. The same designation is shown on the circuit diagram and is used throughout the article so as to enable the reader to more easily distinguish each part and to properly place it in the circuit. The parts are as follows:

One—Adjustable radio frequency transformer (VRF). Described later in this article.

One—Three circuit tuner (3CT).

Two—.00035 Mfd. variable, straight line-wavelength condensers (RC and DC).

Three—4" composition dials (for 3CT, RC and DC).

Two—3 to 1 audio frequency transformers (T1 and T2).

One—.00025 Mfd. grid leak condenser (GL).

One—2 megohm, tubular grid leak resistance (GL).

Four—UV tube sockets (RF, D, AF1 and AF2).

One—6 1-2 ohm rheostat (R).

One—25 ohm rheostat (D).

One—Two circuit phone jack, with filament cut off (HP).

One—Single circuit phone jack (LS).

Seven—Binding posts (A, G, B amp B det, BR, F+, and F-).

One—A battery switch (SW).

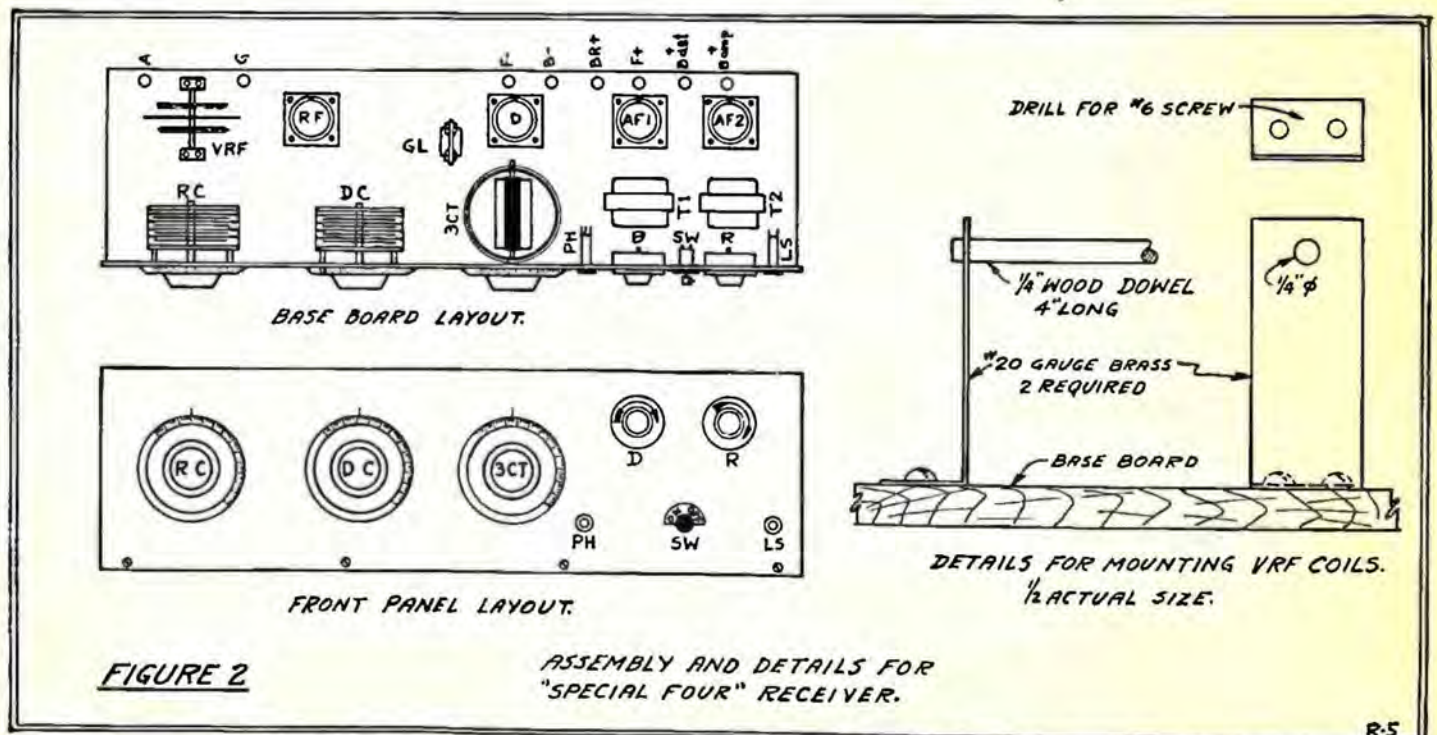
One—Composition panel, 7"x2"x3-16".

One—Base board, 7"x23"x1/2".

XXX—Miscellaneous mounting screws, wire, solder, etc.

The first step in the assembly of the set will be to lay out and drill the panel and shelf. This is usually done by placing the parts around until a satisfactory arrangement has been found. Starting with the shelf, the holes for mounting each piece are then marked with a sharp instrument, the parts removed and the holes drilled. It would be well to drill the holes that pass the movable shafts through the panel at least one-half of an inch in diameter, to prevent them from binding against the panel and turning hard. Oftentimes it saves a great deal of time in fitting.

When the holes for mounting the parts have all been located and drilled, it would be well to give the panel a velvet finish, by rubbing it lengthwise with a piece of fine sand paper that has been dipped in oil. All of the marks and scratches will disappear and the panel will have a soft, dull finish that will not



mark up as easily as the highly polished surface.

A great deal could be written about the placing of the parts in relation to each other, but there are only a few pointers necessary, and they are: Keep the radio frequency transformer as far away from the three circuit tuner as is convenient. In no case let it come within five inches of the tuner; also, keep the three circuit tuner as far away from any unshielded audio frequency transformer as possible, and at least five inches. If the audio frequency transformers are not shielded, that is, if they are not encased in a metal shell, they will have to be separated and mounted at right angles to one another. All of the above points should be followed out, as if these parts fall within the inductive or magnetic fields of one another, howls and squeals will result and the set will be practically worthless.

Wiring the Set

WHEN all of the parts have been mounted and the shelf fastened to the panel, the set will be ready to be wired, but before we start to wire the set, it may be well to consider just what the wiring accomplishes or is meant to accomplish in a receiver. Many radio fans who

make their own receivers, have a great feeling of relief when the panel has been drilled and the instruments all mounted. They say, "Now all I have to do is wire it up," and that is about all they do; just wire it up in a slipshod manner and with the nice square bus bar wiring, with long runs and nice square corners, a nice-looking job, but a very inefficient piece of work, as this type of wiring usually has enough length in the leads to wire up two sets.

Many sets wired up in this manner work poorly, because the wiring does not accomplish what it is supposed to. The wiring of a set is supposed to connect the instruments into the circuit so that they will all work together with as little resistance or interference as possible. From this it is found that the shorter the leads the less the resistance and internal capacity of the set, so let us go about wiring the set with rubber covered, stranded copper wire, or cotton covered will do, making the runs as short as possible.

All leads carrying high frequency currents should be run separately and away from one another. Never run a lead carrying high frequency current parallel to another lead. By high frequency leads, we mean the grid, plate

and antenna leads. All other connections are considered power or low frequency leads and are not as liable to interference as are the others. Solder all connections and see that the terminal nuts are turned down as tight as possible. A loose connection is often a hard thing to find and is the cause of much noise in the receiver.

For those who like to wind their own coils, the construction of the adjustable radio frequency transformer is explained. The construction of a good three circuit tuner has been described often and by referring to a back number of RADIO AGE, or to the RADIO AGE ANNUAL, a suitable unit can be found very easily.

The material required for making this

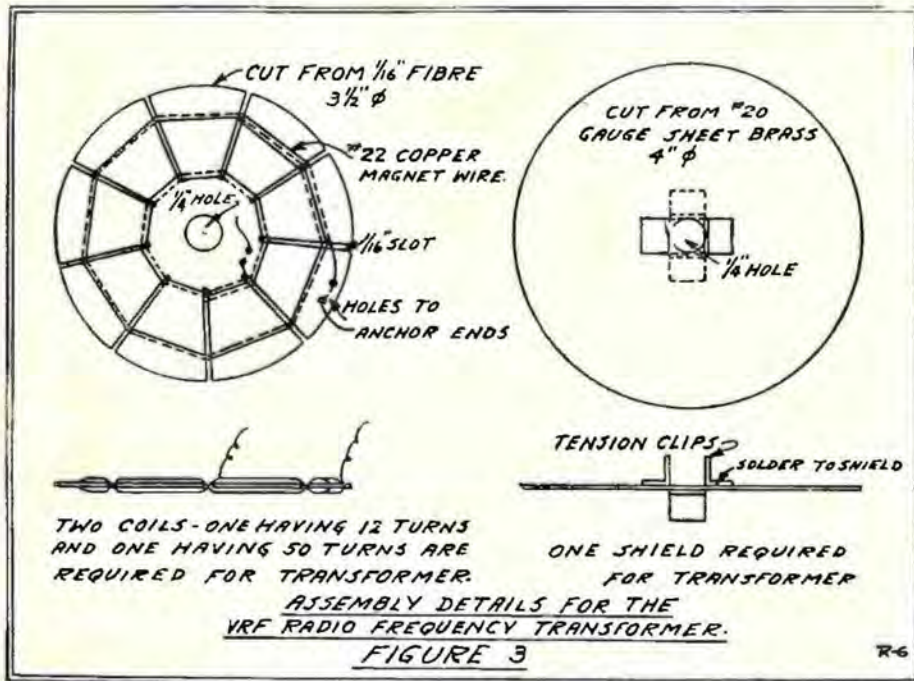
to the negative filament lead of the set at the binding post F—.

The tuning of this set is comparatively simple. The condensers RC and DC control the wavelength and the tickler coil of the three circuit tuner (3CT) control the volume. The filament current for the detector tube is controlled by the rheostat D and the rheostat R controls the filaments of the radio frequency and audio frequency tubes (RF, AF1 and AF2).

If the set does not tune sharply enough at the start, move the coils of the transformer (VRF) farther apart, until the desired selectivity is obtained. When the distance results do not seem to be all that should be expected, move the coils of this same transformer closer together, until maximum coupling is obtained. This will make the set tune more broadly, but will bring in the distant signals loud and clear.

The set may be logged, if the coils of the radio frequency transformer are set; that is, if a good average setting is obtained, and the coils locked in this position. By moving these coils, the setting of the condenser RC is changed, and would fall a little off from that which was obtained at another setting.

The writer would be very interested in hearing of the results obtained with this set in various parts of the country and under various conditions and would appreciate hearing from those who build it.



ASSEMBLY DETAILS FOR THE VRF RADIO FREQUENCY TRANSFORMER. FIGURE 3

radio frequency transformer (VRF) is shown in figures 2 and 3, together with the assembly of the completed unit.

In winding the coils, care should be taken to see that the primary and secondary units have the windings in the same direction; that is, the wire should be wound upon the forms in a clockwise direction. This is accomplished by holding the form in a vertical position, at right angles to the body and winding the wire over the top, away from the body and back on the under side toward the body. Twelve turns of No. 22 Double silk or cotton covered, copper magnet wire will be wound on the primary form and fifty turns of No. 22 double silk or cotton covered, copper magnet wire will be wound on the secondary coil. This wire should be wound as tight as possible without affecting the shape of the form. Each end of the coils should be securely fastened to the form by passing the wire through two small holes made for this purpose. This will keep the wire from coming loose when the coils are moved around on the spindle.

The brass shield shown in Figure 3 is cut from 20 gauge stock and is four inches in diameter. A flexible lead is soldered to this shield and connected

THE technical staff of RADIO AGE, together with the engineers of several leading radio manufacturers, have devised another efficient receiver for RADIO AGE readers to experiment with. Like the receiver described in the foregoing article, it will reach out for great distance at all times of the year, besides being about as selective as it is possible to make a receiver. This receiver, of the tuned radio frequency type, has just been perfected after several months of experimenting, and will be presented to our readers with full size RADIO AGE BLUEPRINTS, in the December issue. Watch for this gala number, and if you are not a subscriber, order from your news dealer NOW!

Coming in Our December Issue—"The Radio Age Model Receiver"

READERS who make their own sets will welcome this most complete how-to-make article this magazine has ever published.

The receiver will be a five-tube tuned radio frequency outfit. Every part will be listed under the name of the manufacturer or the trade name so that you will not have to ask a question as to what apparatus to select.

The article will be illustrated with line drawings, a wiring diagram and several full page size blueprints.

Even the accessories, such as loud speaker, batteries, etc., will be suggested.

If you are planning to build another set this Winter you will make no mistake in investing your time and money in this "Radio Age Model Receiver."

The complete working model of this beautiful set will be on exhibition in the Radio Age booth at the Fourth Annual Chicago Radio Show, Coliseum Building, which opens on Nov. 23. See it there! This de luxe set will be given away to one of the lucky fans who visit our booth.

THIS superior how-to-make feature will not only have the imprint of the skill of our own technical staff—one of the very best in the radio field—but the editor of Radio Age has enlisted manufacturers of quality apparatus to assist us in making this receiver what its name implies—a model outfit.

John B. Rathbun, whose blueprints and articles in each issue of RADIO AGE are followed by fans all over the world, will write the description of this model receiver and he will cover the story down to the very last detail.

Frank D. Pearne, technical editor of Radio Age and chief instructor in electricity at Lane Technical High School, Chicago, will assist in the tests that will be made before any part or accessory is included in the apparatus recommended to the set-makers.

Fred Hill, veteran radio amateur, writer, technical editor and accomplished engineer, now conducting several important departments in the technical sections of this magazine, will work with Mr. Rathbun and Mr. Pearne in producing the best construction article we have ever published.

Why The "Radio Age Receiver" Was Designed

THE reason for thus announcing the description of a new receiver, down to the last detail, is our desire to impress upon you that this feature in the December issue will set a new mark in the presentation of "how-to-make" information.

We publish blueprints and many other helpful illustrations in each issue of Radio Age. In the "Model Receiver" we go a step farther and offer instructions and advice in selecting parts, and we place behind this receiver the name of our magazine as evidence that it has our unqualified approval and indorsement.

To Insure Getting the December Issue, Order
From Your Newsdealer or
Subscribe Now!

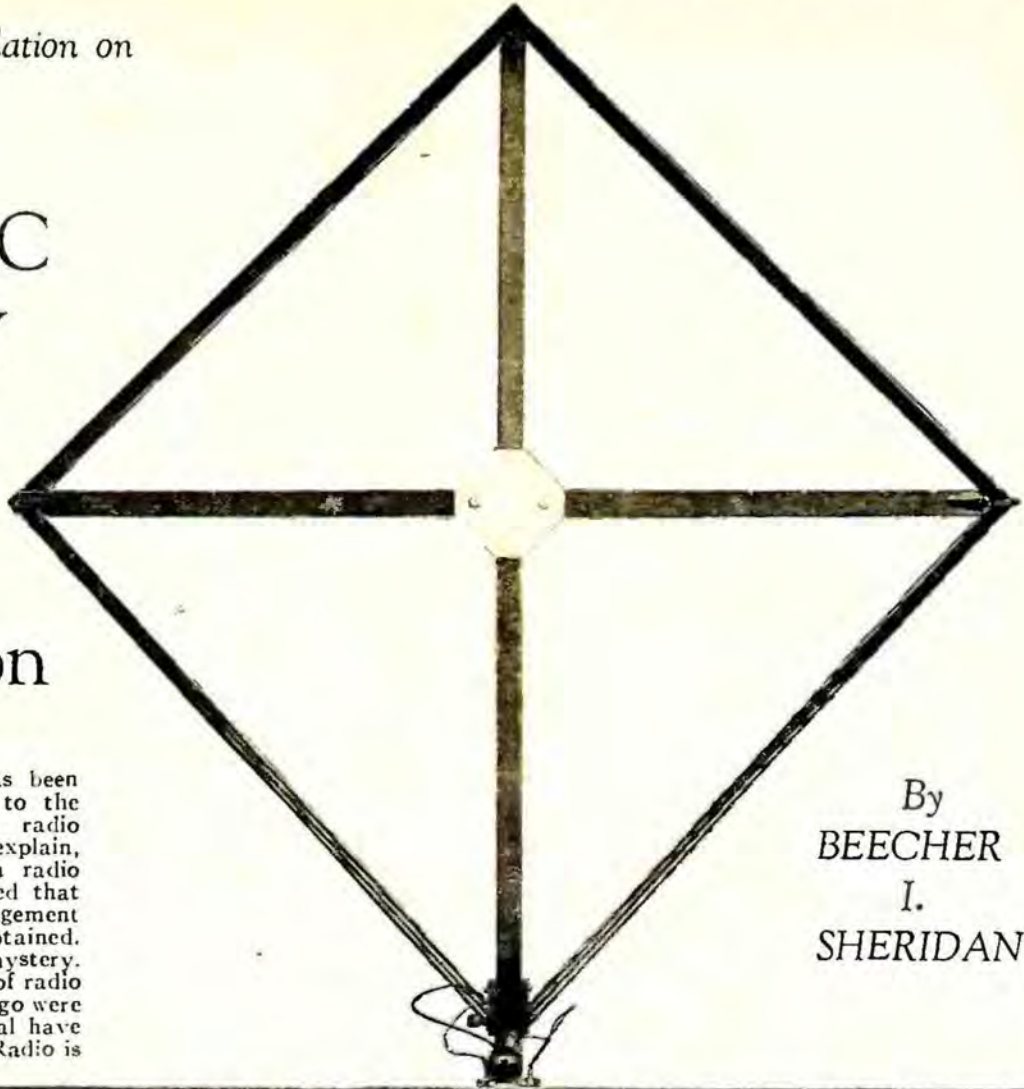
RADIO AGE, Inc.

510 N. Dearborn Street

Chicago, Illinois

Some Interesting Speculation on

The MAGNETIC THEORY of Radio Transmission



By
BEECHER
I.
SHERIDAN

RADIO, since its birth, has been somewhat of a mystery to the world. Even our best radio engineers cannot account for, nor explain, many of the results obtained in radio transmission. They have learned that under certain conditions, or arrangement of apparatus, certain results are obtained.

Why or how still remains a mystery. Many of the theories and laws of radio engineering which a year or two ago were considered up-to-date and practical have been proven false or obsolete. Radio is making rapid strides in spite of the mystery surrounding its transmission.

How are we able to transmit messages or music half way round our globe? What prevents them from being cast into space and lost? The Heaviside theory seems to be rather generally accepted, but at its best a great deal is left to the imagination. There is no means of proving the theory. It is not the intention here to disprove that which is now accepted, but to present to the radio interested public what may be called "the magnetic theory of radio transmission."

How Impulses Travel

THE Magnetic Theory of Radio

Transmission is just what the name implies. The magnetic field surrounding our earth is the medium through which our radio impulses are transmitted. Several hundred years ago the magnetism of the earth was known, studied, and used. Columbus, in his voyage of discovery, used a magnetic compass as an aid in sailing his three small ships. In recent years, since the discovery of electricity, it was learned that a current through a coil of wire created a magnetic field



In the set above is shown the proper arrangement of coils to prevent inductive coupling. Engineers have made a study of the effect of the magnetic fields of adjacent coils upon each other, and efforts have been made to so place the coils in the receiver that the effect is reduced to a minimum. Radio experience also has shown that better results are obtained in reception if the aerial is pointing toward or away from the sending station sought. This is especially true of the loop aerial.

around the coil very similar to the earth's magnetic field and which attracted the compass needle in the same way within a small area surrounding the coil. Any magnetic field constructed by man is very small when compared with the magnetic field of the earth, the extent of which no one knows. We do know, however, that it extends into the earth and into the air beyond any point penetrated or reached by man. This giant force has never been used by man,

knowingly at least, except as an aid in navigation or direction finding. The earth's magnetic field has the same characteristic as the field surrounding a simple coil, the north pole of which is near the north pole of the earth and the south pole nearly opposite in the region of the southern axis of the earth.

Since the advent of radio, engineers have made quite a study of the effect of the magnetic fields of adjacent coils
(Turn to page 50)

On Inductive Radio Interference—

CLEARING UP THE ETHER

Man-Made Interference a Big Problem in Establishing Good Radio Reception; How Some Scientists are Classifying Radio Bug-Bears

AN ADDRESS was delivered by Prof. C. M. Jansky, Jr., before the North Central Electric Association at Duluth, recently. Prof. Jansky, who is in charge of radio instruction at the University of Minnesota, is Chairman of the Technical Committee of the Northwest Radio Trade Association and Consulting Engineer of the Gold Medal Station WCCO. About 300 electrical engineers attended the annual convention of the North Central Electric Association which is the Northwest Branch of the N. E. I. A. in Minnesota and the Dakotas.

His address follows:

"Within the past ten years the public has become tremendously interested in a comparatively new field of electricity—radio communication, more particularly radio telephone broadcasting. This interest has in the past and will continue to develop problems affecting those interested in the other electrical sciences in common with those interested in radio communication. Not the least of these problems is the problem of inductive radio interference. Inductive radio interference may be defined as interference to radio reception resulting from the operation by man of other devices, using or attended by electrical phenomena.

"Radio communication is carried on by the aid of electro-magnetic waves. Electro-magnetic waves are generated by high frequency alternating currents. For the purposes of radio transmission high frequency alternating currents are produced in the familiar antenna system seen at any broadcasting station. A fixed relationship exists between the frequencies of the alternating currents in the radiating system, and the wave lengths of the electro-magnetic disturbance produced. Since electro-magnetic waves are identical with light waves, and therefore travel with the velocity of light, this relationship is—wavelength in meters equals 299,000,000 divided by the frequency in cycles per second.

"The wavelengths used for radio broadcasting ranged approximately from 200 to 600 meters, that is, the frequencies used to produce these waves range from 1,500,000 cycles per second down to 500,000 cycles per second.

How Frequencies Are Made

"SINCE the frequencies used by electric power companies and by electrical communication companies are much lower than those used for radio

communication, it might seem at first thought that the operation of other electric equipment could not possibly produce wavelengths within the broadcasting range. This would be true were it not for the production of other frequencies in electrical systems by the interruption or disturbance of those systems from one cause or another. Such interruptions or disturbances may cause the generation of high frequencies, which may be radiated as electro-magnetic waves at the point of generation, or may be carried as electric currents along the adjacent wiring and radiated from other points on the system. Sometimes the effect of the disturbance may be accentuated by the fact that the distributed capacitance and inductance of the wiring may be such that oscillatory currents having natural frequencies within the broadcasting band exist and damped sine waves may be produced at these frequencies. The difference between radiation and induction, or the question whether or not there is a difference between them will not be discussed here. The effect in the receiving set is the same.

"Many assume that if electrical devices or systems produce interference to radio reception such devices or systems are not operating properly. While this may be true in many cases there are in common use today many electrical devices the normal operation of which will cause tremendous inductive radio interference. An excellent example is the synchronous motor driven high voltage rectifier used with X-ray tubes. The sparking discharge produced in this device will interfere with radio reception at points within a radius of several miles although the operation of the rectifier may be entirely satisfactory from an electrical and medical standpoint. The above, is of course, an extreme example.

"Time is too short and the subject too complex to permit a more detailed discussion of the sources of inductive radio interference. The immediate problem is the co-ordination of effort in the determination of what in specific cases is causing interference and its elimination or minimization after the source has been found. In Canada every receiving set owner must pay a license fee of \$2.00 per year. Because of this fact, the Canadian Government feels under obligation to study and eliminate radio interference wherever possible. Accordingly

the Canadian Radio Service has interference squads continually at work. In our own country, some attention has been paid to the elimination of interference by our Radio Supervisors. However, the Department of Commerce has been criticized by some for the small amount of work which they have done on this problem, on the grounds that the Radio Act of 1912 under which Radio communication is regulated does not provide for the licensing of receiving sets, and therefore, the Department should not concern itself with anything which does not directly affect transmitting sets.

"It is an interesting fact, worthy of special emphasis, that more study of the problem of inductive radio interference and its elimination has been done by the privately owned Electrical Public Utilities, individually and collectively, than by any other agency. This fact is greatly to the credit of our public utilities and is added proof of their desire to give satisfactory, efficient service to the public. However, the public utilities cannot and should not assume the entire burden of eliminating interference.

"I firmly believe that satisfactory results cannot be obtained without the co-operative aid of all those involved. This problem concerns the power companies, telephone and telegraph companies, electric railway companies, electrical and radio dealers and jobbers, transmitting radio amateurs, and last but not least, broadcast listeners themselves. I can best describe what I mean by co-operative effort, by giving a brief description of radio interference now being organized in St. Paul and Minneapolis.

"The Northwest Radio Trade Association is an organization of radio dealers, jobbers, manufacturers and others interested in radio, which has been in existence for only two years, but in this time has grown to a point where its membership includes practically every radio dealer and jobber of importance in the Northwest. A full time paid secretary is employed to look after the interests of its members and to help improve radio conditions generally.

A Step Forward

"LAST spring the Association undertook to foster the organization of a Twin City Radio Interference Committee for the purpose of co-ordinating work on radio interferences. The membership includes representatives from

(Turn to page 53)



Spanning the U. S. with Low-Power Transmission

A Low-Power Station that Anyone Can Build and Which Provides Maximum Interest



By **BRAINARD FOOTE**

IN THE days when radio amateurs used a wavelength of 200 meters the spark transmitter was the most popular and almost the only type of equipment. Communication over a few miles was established with an ordinary 1 inch spark coil, and with a huge and noisy outfit comprising a 1 kilowatt transformer and a rotary gap, distances up to a thousand or more miles were occasionally covered.

The application of the tube to the sending set greatly simplified the apparatus and reduced the power necessary for a given distance. With a five watt tube, the continent was spanned once in a while and the amateur had a fairly reliable outfit for night-time DX work. With the use of short waves nowadays, down to 20 and 40 meters, low power tubes "eat up" the miles with startling ability, and five watt transmitters today frequently are heard one-half way round the earth.

The five watt sending set is usually operated from the 110 volt alternating current mains, obtaining both its filament and plate voltage from this source through transformers. The plate voltage is best rectified to approximate a direct current, to improve the transmitted tone and make the signals easier to "copy."

Still Less Power

HOWEVER, on short wavelengths, power less than that of a five watt tube is surprisingly successful. The peculiar thing about 20 and 40 meter work is that waves sent out on the earth's surface don't get very far, being absorbed by metal objects, hills, houses, wires and the like. But waves which are sent upward at the proper angle are reflected by the Heaviside layer or refracted by the upper limit of the earth's atmosphere, as different theories have it, and come down to earth at distant points with their initial strength. Thus we have a condition which is superb for distance work—local sending stations being unable to communicate with each other easily, whereas distant stations are received strongly. For short distance work of the order of 1 to 50 miles, however, the

longer waves between 150 and 200 meters are superior.

The writer is going to give a brief description of a low power station he has set up at a Summer bungalow, located at Stanhope, New Jersey. The transmitting tube used is a single C 301A, lighted from a storage battery and supplied with plate voltage by ordinary "Heavy-Duty" "B" batteries. Five such "B" batteries were obtained for the plate source, making 225 volts in all, but in most of the experiments and communications, only three of these were used, making 135 volts. The radiated energy is extremely minute, of course, but reports from stations within an 800 mile radius indicate that such slight energy gets "out" just the same. At the present writing only a single day's work is included, but the few stations "worked" listed below indicate that a single "A" tube ruffles the ether to an appreciable extent.

- | | |
|------------------------------|---------------------------------------------|
| 1UE Wollaston, Mass. | c3XI Sarnia, Can. |
| 8DRI Reliance, Ohio | 2ABA New York City |
| 3AFT Schwenks- ville, Pa. | 8AFQ Brockport, N. Y. |
| 2CVJ Hartsdale, N. Y. | 8NT Buffalo, N. Y. |
| 8DPL Buffalo, N. Y. | 8CSR Portable Station, Alliance, Ohio |

In contemplating the use of "B" batteries for plate voltage supply, one might inquire as to the life of the batteries in such use. When more than 90 volts is applied to the plate, the plate current is naturally somewhat higher than in ordinary amplifier use. However, in C. W. transmission, the current is not drawn continuously from the battery, but only while the key is depressed. The effective drain on the batteries is therefore probably a good deal less than with receiving batteries, since they are not used constantly as in reception, nor is the current steadily drawn when they are used, but in interrupted service. The dry cells thus have an opportunity to recuperate, which is not given them in receiving set use. The same amount of power used in run-

ning a spark coil or in obtaining voltage through transformers from house current would be much less effective in distance work, for the simple reason that a pure continuous wave, as results when batteries are employed, consists of a steady stream of impulses at radio frequency while in A. C. use the radio frequency impulses reach a maximum periodically and then decline to a low point. A pure D. C. "note" will carry much farther than an A. C. note of even more power on this account. All the stations reporting on the signals gave a good account of the signals, stating reception as "R5 to R6," meaning signals moderately strong or strong. All seemed astonished when informed that a single "A" tube on "B" batteries was being used at the writer's station 3MT.

Antenna System

THE aerial in use is absurdly simple. A counterpoise four feet above ground consists of about 35 feet of solid wire, No. 12, running between the house and a low tree. A mast only 4 feet high supports one end of the antenna, while the other end runs to the roof, 20 feet away. The lead-in runs to the mast and measures approximately 25 feet to the apparatus, making the aerial, 45 feet long in all—a single No. 12 wire. Results probably would be better were the aerial entirely vertical, running to a higher pole. This will be tried.

The entire receiving and sending hook-up is given in the circuit, showing how the same "A" and "B" batteries serve for both purposes. The antenna is employed with ground for reception, but with the counterpoise for transmitting. This particular outfit is operated on 40 meters, and the description is given for this wavelength. It can easily be applied to 20 meters or to the 80 meter band by altering the coil and condensers described for the other wave length.

The changeover switch is a small double pole double throw switch with a porcelain base. It is connected so as to light the receiving tubes only when receiving and the transmitting tube only

when transmitting. Of course, the receiving tubes may be kept lighted during transmission if one wishes to, but the key clicks are so loud that they are annoying. Moreover, there is some saving involved by turning them off when sending. Where the receiver and transmitter are situated some distance apart and separate aeri-als are used, it is possible to work "break-in," that is, to receive while transmitting, so that the other communicant may break in and stop the sender when interference is encountered or a word is not understood. For simplicity, in this simple circuit, the usual send-receive system is given.

The transmitting apparatus is located to the right in the diagram. The set itself employs a C 301A or UV 201A tube, used in a nonmetallic and low-loss socket. The rheostat R-1 has about 15 ohms resistance. Coil L-3 is the grid coil, consisting of 9 or 10 turns of No. 16 wire on a 3 inch diameter tubing. The turns are spaced about 1-8 inch apart. The tuning condenser C-4 should be a very small instrument, and a midget variable condenser is just the thing. Its maximum capacity is about .000022 mfd. A regular unmounted variable, with 2 plates left, will also answer. The plate coil, from which power is fed to the antenna circuit, is L-2, also having 9 or 10 turns of No. 16 wire and tuned by a similar small condenser C-3. C-6 is a .001 mfd. fixed condenser of good make for insulating the plate battery from the filament through coil L-2.

The plate current is supplied through the radio frequency choke coil RFC-1, which is a piece of tubing 1 inch in diameter and about 6 or 7 inches long, having 150 turns of small wire (about No. 28) wound on it. The turns should be slightly spaced. Coils L-3 and L-2 must be at right angles to each other

for zero coupling, and may best be placed on opposite sides of the tube, in line, but at right angles. The "open oscillating circuit" is composed of the antenna and counterpoise and coupling coil L-1, together with two variable condensers. These can be regular 17 to 23 plate condensers used near zero capacity, or smaller variables (not less than 10 or 11 plates, regular size). L-1 has from five to seven turns of No. 16 wire, spaced 1-8 inch and wound on a tubing that will slip inside of L-2. In case one hasn't a low scale radiation ammeter, a good indicator may be made of a flash-light lamp of about 2.5 volt rating, dimly lighted by a 1.5 volt battery, with a small switch for opening the circuit. The battery partially lights the lamp and the slight amount of energy radiated is shown by a noticeable brightening of the bulb. When the set is carefully tuned up, the lamp will be lighted faintly without the "biasing" battery. In tuning the transmitter, it will be found that maximum radiation cannot be maintained, because the circuit is too unstable when adjusted for greatest output. Coil L-1 is slipped inside of L-2 to provide high percentage of coupling.

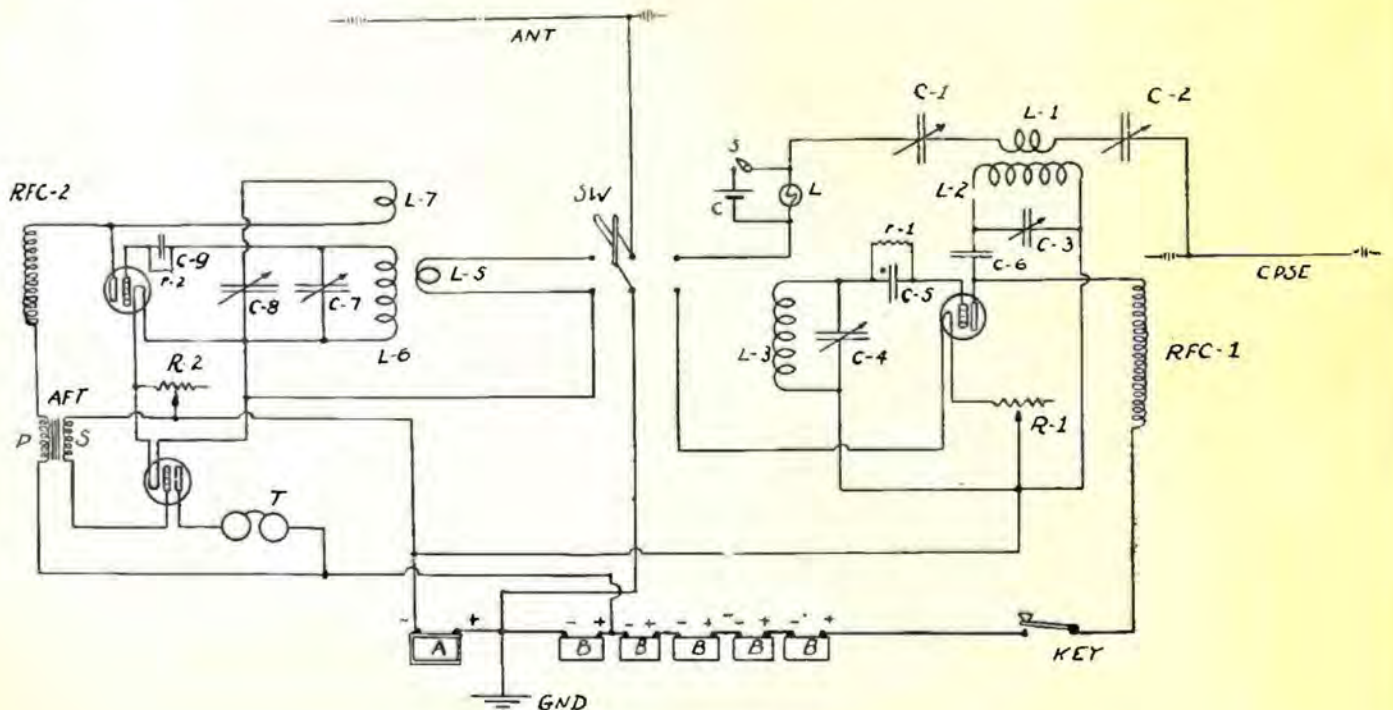
The set may be tuned by listening in on the receiver (making a connection from the "A" battery plus to light the receiving tubes) and using only 45 volts on the transmitter. When the wavelength is within the 40 meter band as found by a strong whistle in the receiver, the voltage may be increased to maximum without altering the tuning dials of the transmitter. Then, condensers C-1 and C-2 are varied near a low scale reading until radiation is shown. If the antenna circuit is tuned too closely to the maximum point, the set will suddenly stop oscillating or will shift wavelength suddenly. The antenna is then left off tune very slightly, so that the same brilliancy

of the lamp or the same radiation (in case of an ammeter) is indicated every time the key is pressed.

Receiving Set

THE receiver is the usual regenerator with one step of audio. L-5 is the primary and consists of 1 or 2 turns of No. 18 or 20 wire wound on the same tubing as L-6, the secondary, with about half-inch clearance. L-6 has 9 to 13 turns—if as many as 13 can be used, so much the better. C-7 is the tuning condenser and should be a small variable as described for C-4 and C-3. A regular condenser cut down to one movable and one fixed plate will do also. When the set is in use, and the 40 meter band is tuned in, it is easy to tell whether L-6 is too large or too small to cover the band well. If C-7 is small enough, the 40 meter band will require about one-half to two-thirds its scale. L-7 is the tickler and should be wound on a form about half the diameter of L-6, or 1 1-2 inches. It should have from ten to fifteen turns of small wire: No. 28 will do. C-8 may be a regular 17 to 23 plate condenser for control of regeneration. There should be sufficient turns on L-7 to maintain oscillation with C-8 near maximum. If no regeneration is had at first, reverse L-7. C-9 is the grid condenser and should be very small. An XL Vario-denser, made for neutralizing purposes and screwed to maximum capacity, makes an excellent low capacity grid condenser for 40 meter work. The leak should be one that is not noisy and of about 4 megohms resistance. In the case of the transmitter, the grid condenser is .00025 mfd. and the leak a regular transmitting leak of about 10,000 ohms resistance.

The radio frequency choke RFC-2 for the receiver is made exactly like that for (Turn to page 53)



LOW POWER C.W. SYSTEM

Radio's "Prettiest Announcer"



JUNE MARLOWE, a distinguished actress and dramatic reader, has been won over to radio, because, as she expresses it, "It is so vast and awe-inspiring." She puts such a feeling of interest in her radio presentations that her listeners acclaimed her from the start. Recently she acted as announcer for an entire evening at Station KFWB.

(C. Heighon Monroe Photo.)



What the Broadcasters are Doing



Story of KWKH an Example of Perseverance

DOWN in Shreveport, Louisiana, in the extreme Northwestern corner of the State, where Texas, Arkansas and Louisiana meet, there is a city called "Shreveport."

The community having for its assets three very important industries, viz: Oil, lumber and cotton, it is seldom continued prosperity is not felt in this city for, as a rule, one commodity is always good, even if the other two are suffering a slight depression.

Doubtless a great many of our readers throughout the country have heard at various times programs from KWKH—The W. K. Henderson Iron Works & Supply Company, Shreveport, Louisiana. This station is probably the only one in the United States of America owned and operated by a concern engaged in the iron and steel and manufacturing trade and the history of the acquisition of this station by the W. K. Henderson Iron Works & Supply Company provides an interesting story.

Mr. W. K. Henderson, president of this Company—a man of large interests in his community, in addition to his other activities, is President of the Chamber of Commerce and, visualizing the great benefit in an advertising way that could come to the community, became interested in the local station when it was very small, of low wavelength, poorly powered and under-financed.

The credit for the origin of radio broadcasting in Shreveport must be given to W. G. Patterson, who operated the station first of all with a very small set and had for his call letters WGAQ. When this station was about to be discontinued for lack of proper finance, Mr. Henderson intervened and having interested the Hotel Youree and the Shreveport Times, together with himself and Mr. Patterson, reorganized, refinanced the station and started it off on a better footing. In time, however, Mr. Henderson became so much interested in this station and its possibilities, he decided to purchase the interest of the Hotel Youree and the Shreveport Times, changing the call letters, with the authorization of the proper authorities, to KWKH, increasing the wavelength to 273 meters and increasing the power to something over 500 watts and is now contemplating increasing the power to a greater extent.



A radio editor and announcer—combined, is Corley W. Kirby, of WJL, Detroit. With such a fund of knowledge, Mr. Kirby "knows his stuff" as far as being up-to-date in radio matters is concerned. Added to that, he has an unusually clear voice for announcing.

WRR, New Station, Opens in Dallas, Oct. 1

WRR is the municipal station of the city of Dallas. It was first established in 1920 and is the second oldest broadcasting station in the world and the first in Texas. It was closed down by order of the Government in 1925 because of the obsolete equipment.

The City appropriated \$6,000 toward new equipment, while contributions from citizens brought the fund up to \$15,000.

Modern 500-watt, 101 B broadcasting equipment is being installed in Fair Park in a special built building for the new station and two 150-foot steel towers are being built for the station.



Urbine J. Herrmann, managing director, and Clayton Irwin, general manager, of the New York Radio World's Fair and the Fourth Annual Chicago Radio Show, to be held in November, are shown in a friendly pose above before broadcasting greetings to the radio public at the Fair in New York, Monday, September 14. (P. and A. Photo)

"Merry Old Chief" Fitzpatrick Joins WJR

THE "Merry Old Chief" is packing his bag and good cheer and moving Eastward. He is leaving the Kansas City Star's station where as one of the real pioneers he helped to put broadcasting on the map and during October he will join the staff of the new Jewett station, WJR, of Detroit and Pontiac, Mich.

The "Merry Old Chief," or Leo Fitzpatrick as he is known outside the radio world, has personality that has endeared itself to millions of listeners-in. To him is due the amazing growth of that popular radio organization known as the Nighthawks. There are now 250,000 of them and the membership keeps on growing. He organized the Nighthawks and his merry good nature has been the food on which the membership grew.

Mr. Fitzpatrick is a graduate of Kansas University, a newspaperman of many years experience, and one of the best known radio announcers in the world. He organized the radio department of the Kansas City Star and has been in continuous charge of the station there from the time it was started four years ago. He is president of the Central States Announcers' Association. His radio popularity is easily understood when you read the following description of the "Merry Old Chief." He wrote it himself:

"To begin with, I was born in Kansas. So were many others—Carrie Nation, 'Bill' White, Henry Allen, Sockless Jerry Simpson and sunflowers and grasshoppers.

"Early in life I became a broadcaster. My mother claims the distinction of being the first Nighthawk that I kept awake until dawn with my howling.

"I survived the first eighteen years and decided that I should write the great American novel or try for the O'Henry prize. So I took up journalism by enrolling in the engineering school of the Kansas University. Finally I landed on The Star. When I started, the Star had a circulation of 200,000. It has now more than 250,000, in spite of my being here all the time.

"My ambition is to get eight hours sleep all at one time. Aversions—alarm clocks and hook-up fanatics. Description—five feet eight and one-half inches perpendicular; thirty-six inches circular; thirty years old."

Why do They Call Him RADIO'S Luckiest Devil?



The years may pass, but Banks Kennedy still retains the youthful glow and dynamic personality. Of course, he's only 27, but he's a "vet" as far as broadcasting goes. Above he is shown at the console of the mighty WOK organ, where he officiates daily from the Terrace Garden of the Hotel Morrison, Chicago.

Luck Played
No Part in Banks
Kennedy's
Meteoric Rise
to Fame in
the Studio
World

By HARRY ALDINE

HE HAS been dubbed "Radio's Luckiest Devil," but that is truly a misnomer for Banks Kennedy, radio staff organist at Station WOK, Chicago. For if anyone ever worked to deserve fame, it was Banks of the silken locks.

Readers of RADIO AGE, and especially those who listen in on Chicago stations, are all familiar with Banks Kennedy's music, his pianologues, and his foolish monologues. He has appeared over nearly every station of importance in Chicago, and vicinity, and also at a few unimportant ones. But the real story of his career—the story that will prove he is not lucky—but just persevering, has rarely been brought to light. It is because Banks' admirers are so busy listening to his dynamic songs and organ recitals that they never find the time to inquire into his spotless past.

A Small Beginning

BANKS was born in Tuskaloosa, Alabama, where he obtained his southern drawl and his love of mint juleps. It was at the age of five that he persuaded his mother not to throw away the old grand piano, but to put it in the basement for him to play with. The dear

lady, anxious to please her youngest son's slightest whim, conceded his request, and before he reached the mature age of six, Banks had composed a song, which he dubbed "Ethel."

Either the name was a handicap because of its impression of tameness, or Banks couldn't work up enough enthusiasm, for the initial masterpiece died aborning and Banks decided to content himself with learning to play, rather than learning to compose. At that time he was working his way through grammar school by delivering groceries at the enormous sum of four dollars (\$4) per week, which, however, was not enough to provide for his modest needs.

So Banks made it a custom to furnish a musical rendition with each delivery of groceries. The idea functioned better than he expected, and he picked up considerable small change. The reaction on the grocer, however, was more or less disastrous, for the musically inclined customers refused to buy groceries unless Banks delivered them and hesitated long enough to play "Narcissus" once more.

With such a background of groceries, it is small wonder Banks never lost his love for food. When our correspondent

called upon him at the Terrace Garden of the Morrison Hotel, Chicago, where the glass studio of WOK is located, Banks was holding true to his boyhood by surrounding a chicken dinner.

Banks Objects

I DON'T like this stuff about being called "Radio's Luckiest Devil," Banks protested. "Here I've told the natives of Tuskaloosa that my success is the result of years of hard labor, and now the newspaper writers say I'm lucky."

"It's probably because you work so little, accomplish so much, and get paid so highly," we interjected. Banks accepted the explanation and attacked another layer of fruit cake.

So, after a victorious career at the organs of the Tivoli and Capitol theaters, Banks is now back in radio's arms again, broadcasting from the organ and the piano three times a day, and in general spreading good cheer and apple sauce.

Once he wrote a song called "If I Can Arrange It," and the best explanation of his phenomenal success as a song writer and general good fellow can best be expressed in one phrase—"He arranged it, somehow."

Getting the Farmer to Buy a Radio Set

Only One Farmer in Forty Has a Receiver, According to Census of Big Territory

By A. O. PROCTOR



The American Farmer is one of the greatest—if not THE greatest factor in our national life. And yet the radio has not reached him as it should. This article tells what an extensive survey revealed in the farmer market.

VALUABLE information of interest to radio dealers, listeners and manufacturers alike, has been brought to light by the recent survey of the farm market for radio, made by the Capper-Farm Publications, of Chicago, Ill. The area covered by the survey includes a 50-mile radius of these four towns: Lima, Ohio; Mason City, Ia.; Salina, Kansas, and Wichita Falls, Texas.

The most outstanding point in the report of the survey is the discovery that no particular type of store is the leader in selling radio to the farmer. "It is difficult to determine the desirability of any special type of store from the standpoint of developing farm trade," the report says. "On the contrary, it seems evident that the development of farm as compared with town trade depends entirely upon the dealer himself, regardless of whether he is a music, automobile, special radio or hardware dealer. In other words, any good dealer making an effort to sell, has been about as successful in developing farm trade as any other type of dealer."

Statistics taken from the survey

disclose that there are approximately five sets for every 200 farmers, which, if it may be taken as an average, for the entire country, shows the farmer market is but one-fortieth saturated. The report also discloses that, in the area surveyed, there are 1.3 dealers per 1,000 families and that each dealer's average sales per 1,000 families were 18.1.

Volume of radio business done by types of dealers—The exclusive radio dealer is evidently by far the most successful in building up a volume of business, his sales averaging very much higher than any other class as a whole. In towns over 10,000, hardware dealers achieve the second largest volume, but in towns of less than 10,000, electric appliance dealers are substantially more successful. Practically all types of dealers in all sizes of towns carry parts, accessories and tubes. Between 67 per cent and 85 per cent of their total sales were in complete sets, 3 per cent to 13 per cent in parts, and 5 per cent to 11 per cent in accessories. It is very interesting to note that at least 75 per cent or more of dealers in all sizes of towns reported the business profitable.

Guaranteed service as an aid to sales—Definite guarantees and assurances on the part of the dealer, of service, is apparently necessary and is used as a sales argument in 91 per cent of the sales. Forty-nine per cent of sales required follow-up service. Dealers who are most generous in making installations and giving service have achieved the largest sales volume to farm families.

When present set owners will buy another set—More than one-fourth of the set owners answering this question said they would buy another set soon. The same number reported they would buy within less than a year, the same in one or two years, and the balance in four years. Evidently the replacement of sets, if this data can be depended on, is going to be a substantial business. Since investigators reported that some dealers were already giving "trade-in" values on old sets, this factor must be operating quite strongly now in rural districts. The maximum price which present set owners would pay if they were to buy a new set, ranged between \$153 and \$190, complete.

Status of exposure to radio—Of the 408 non-radio owning farm families interviewed, 29 per cent had never listened in. The balance had listened in one or more times. Twenty-three per cent had listened in frequently. Forty-six per cent reported they had listened in on radio sets in their own or neighbors' homes. Fifty-four per cent reported they had been interviewed by salesmen or had priced sets themselves. Thirty-three per cent reported that radio salesmen had visited them in their homes.

When non-owners expect to buy—Nearly one-half, 49 per cent, to be exact, report that they anticipate buying a set within the next twelve months. Texas led by far in this figure, 82 per cent expressing a determination to buy this season. Ohio was lowest, about

(Turn to page 52)

What Kind of Radio Sets Do Farm Customers Demand?

| PRICE REQUIREMENTS | | AERIAL REQUIREMENTS | |
|--------------------|----------|-------------------------------|----------|
| | Per Cent | | Per Cent |
| Under \$50..... | 4.9 | Outdoor..... | 82.2 |
| \$ 50 100..... | 17.8 | Indoor..... | 5.5 |
| \$100 150..... | 41.1 | Loop..... | 6.8 |
| \$150 200..... | 25.2 | Enclosed..... | 5.5 |
| \$200 250..... | 6.1 | | |
| \$250 300..... | 4.4 | | |
| Over \$300..... | 2.6 | | |
| TUBE REQUIREMENTS | | KIND OF A BATTERY | |
| | Per Cent | | Per Cent |
| 1 tube..... | 2.4 | Dry cell..... | 38.3 |
| 2 tubes..... | 5.0 | Storage..... | 61.7 |
| 3 tubes..... | 16.4 | | |
| 4 tubes..... | 26.4 | | |
| 5 tubes..... | 42.2 | | |
| 6 or over..... | 7.6 | | |
| | | PLACE OF LOUD SPEAKER | |
| | | | Per Cent |
| | | Want enclosed in set..... | 29.4 |
| | | PLACE OF BATTERIES | |
| | | | Per Cent |
| | | Want enclosed in cabinet..... | 49.2 |

Out Where the Newsboys Sing!



It's hardly necessary to tell you, but the above gleaming visages belong to the newsboys' radio quartet, which is one of KNX's surprise features for the impending radio season. Don't they look as though they could wield a lusty lung?

KNX Adds "Newsboys' Quartet" As Latest Radio Feature; Ralph L. Power Gives Impressions of California Radiodom

RADIO fans who tune in on Southern California broadcast stations with any degree of frequency know that they can expect almost anything from stations in and around Los Angeles. Of course, they have their set musical menus via the ether waves, but they are always offering something new to listeners.

For instance, KFI has just put on a series of talks by Dr. William E. Balsinger, famous plastic surgeon who maintains offices in Chicago and Hollywood. Dr. Balsinger, who was a major in the reserve during war days, is the surgeon who re-made Dempsey's nasal appendage and he told listeners in all about the new nose. Fans had heard lectures on topics ranging from dandruff to birth control, but never anything about how to acquire a new nose as fashions in facial expressions change.

The Newsboy Warblers

THEN there is the Newsboys' Quartet often heard from KNX in Hollywood. The youthful vendors of newsprint have warbled their way into the homes of thousands of radio families everywhere and their graduation from the barber shop group to the newsboys' quartet could never have been accomplished without the magic of radio. From singing on the street corner to their present engagements at banquets and clubs, made possible through radio, was a big forward step in their lives.

Señora Alma Real is an old time favorite in the grand opera field and she has made numerous personal appearances in California this year, notably in the Hollywood Bowl Concerts and at the Theatre of the Stars at Big Bear Lake, where radio KFXD is located at an elevation of more than a mile.

Señora Real, with her repertoire of

Mexican and Spanish love songs has won instant applause in radio fields, and she has appeared at KHJ, Los Angeles, many times. Special programs for the Mexican Day of Independence and separate programs of Spanish folk songs have

been particularly applauded by fan mail and personal telephone calls.

Then there is Louise Santschi Katzenberger, Swiss yodeler, who brings to receiving sets everywhere the plaintive melodies of the Alps region. She has been a favorite at KFWB, Hollywood, in solo work as well as with the Tyroler Zither Club, whose soft, sweet music has brought as many as 4,500 applause cards for a single concert. The organization has gathered together a unique library of original melodies from their native land and each program is a gem in artistic and musical setting.

Mrs. Katzenberger, in native costume, takes great delight in singing the quaint yodel songs and the soft lullabies brought to us from the land across the sea.

The poet laureate of the Los Angeles police department is Sergeant Cyrus Johnson, of the Hollywood station, and he is a frequent orator at KNX. As a purveyor of romantic sonnets and tales of romance, Officer Johnson has made an enviable record and, while he remains a guardian of the law by necessity he is a poet at heart and radioland gains thereby.

Duane Thompson Enters Radio

AND of course you can hear any number of film and stage stars talk or present some kind of musical talent from Southern California transmitting stations.

Duane Thompson, one of filmland's celebrities, has entertained from various Los Angeles stations. Others who have entertained from the film colony include Lew Cody, Walter Hiers, Creighton Hale, Renee Adoree, Lewis Stone, Monte Blue, Percy Marmont, Marie Prevost, John Bowers, Marguerite de la Motte, Johnny Fox, Jr., Baby Peggy, Carmel Myers, Katherine McGuire and scores of others equally as well known.



After seeing Duane Thompson, film star, in this pose, we don't care whether she can sing over radio or not. She appears consistently at KFI—but—what were we saying?

Q The Only "Mammy"
Writer Born in Dixie!

Jumping from LAW to JAZZ

*It's a Long Jump,
According to Charlie
Garland*



Charlie Garland appears staid and dignified only when posing for photographs like the above. You ought to see—and hear—him when he directs WBBM's famous "Nut Club" every Sunday at midnight.

CHARLIE GARLAND, writer of blues and popular songs, radio musical comedy producer, movie organist, baritone and pianist, and program and studio director of radio station WBBM—

That's the best introduction we can think of regarding the young man in the horn rimmed specs and "soup and fish" who controls the goings on over WBBM's microphone. Incidentally, however, it may be of interest that Charlie is the only known writer of southern melodies that ever came from the Dixie country.

Charlie, in fact, was born in Water Valley, Miss., where mummies are mammys, front porches are galleries and ordinary sweet potatoes are yams. This was in 1894 and he stayed there until he grew up and was lured up north by a jazz band.

If it hadn't been for the jazz band, however, he might have been a lawyer. Despite the fact that he could read music before he knew his A B C's, and could play the piano when he started to school at the age of eight, in what, even the neighbors admitted, was an entertaining way, the future that was planned for him called for Blackstone and a lot of him.

AFTER graduating from high school at 17, Garland entered the University of Mississippi and studied law for two years. He failed, however, to find romance in musty briefs, citations and life began to loom in his mind as an endless path of subpoenas and amended petitions to make more definite and certain.

He left the legal profession flat and became leader of an orchestra known as the Grunwald syncopators, indirectly starting his trek north. After the orchestra made quite a name for itself in the south, Charlie joined the regular army in 1916, and was assigned to the rank of the 155th Infantry.

In 1917 he was commissioned a second lieutenant, and after a rather eventful army career he was discharged, and decided to give the business world another whirl. This time he tried selling life insurance. The "whirl" was short.

In 1919 he married Miss Lela Mercier, of McComb, Miss., and came to Chicago where he took up movie organ work. He gained considerable reputation at this and in 1921 heard the call of the radio.

After appearing over KYW and several other local stations he became connected

with WBBM in 1925 and remained there since. He was appointed studio director at WBBM in June, this year, and has just been made program director.

In addition to his other varied activities, Mr. Garland has left a trail of popular song hits behind him. Some of his latest are "Sweet Mother Mine," "Want a Little Love?" and "Mississippi Blues," the latter being the twentieth that he has published.

The ability to sing in rich baritone, and the nimbleness of his fingers over the piano keys, has made Charlie better known to the radio fans of the country than the average studio or program director. He does his own stuff as well as directing others.

Radio Comedies, Too!

HIS latest contribution to radio is a series of radio musical comedies which he is writing to be put on the air over WBBM. The productions—each 45 minutes long—will be adapted especially to microphone effects and be "produced" over WBBM.

Garland, incidentally, is the instigator of an interesting experiment being carried out over WBBM—a newly inaugurated rule that the program must be 95 per cent musical and entertainment.

"The rule means just what it says," said Charlie. "Basing our actions on the requests and written desires of fans we are barring all lengthy "educational" talks and addresses. Anything in the line of talks that go on over our "mike" must be short and snappy, in the nature of 'spot' information or authoritative opinions voiced by nationally accepted authorities."

Garland's hobbies are golf and swimming and a young son.

DO YOU WANT SPEECHES OR MUSIC?

RADIO AGE wants to know whether its readers agree with Charlie Garland, Program Director of WBBM, in his contention that radio programs should be at least 95 per cent musical.

If you agree with Mr. Garland, or take exception to his views, you can use the pages of RADIO AGE to air your ideas. Just send us your viewpoint and we'll print the best arguments—pro and con—in an early issue.

Which shall it be—Music or Speeches—jazz or farm talks—educational or amusing discourses? Take your pen in hand NOW and start the sparks a-flying!

Are You Temperamental?

Radio Stars, More Than Any Other Class of Public Entertainers, Are The Hardest to Handle

SAYS GEORGE GRAHAM



(Witzel Photo)

Of all radio stars, Raquel Nieto, coloratura radio soprano, has a right to be temperamental, for it is her temperament that makes her performance unusual—different, and refreshing.

TEMPERAMENT! It is the bugbear of the stage—the movies—business—and everywhere that high strung personalities can be found. But nowhere is it more evident, more harder to cope with, as Willis Arnold used to say—than in this intricate game of radio broadcasting.

David Belasco can dismiss the temperamental actress who refuses to put the proper fire in the soul-kiss bestowed on the Barrymore playing opposite her; or Griffith can always get another cinema performer to take the place of the sulking Valentino. And even in the best advertising agencies, those outstanding examples of business efficiency, the long-haired copy writers find themselves perusing the want-ad columns following an unwise burst of temperamental disagreement.

Radio Stars Can't Be Bossed

RADIO entertainers, however, can do as they please. There are enough of them to sink a good sized ship, and yet each is so confident of finding a place to broadcast his or her wares, that the slightest provocation on the part of the studio director causes a sudden flareup and an equally sudden departure on the part of the "hurt" artist. As a result, a studio director, careless with his comment, might find himself at the beginning of a three-hours' program with nothing but the staff accompanist on hand. It has been known to happen, and it is

happening nightly in radio studios where tact does not prevail. Announcers and directors are known to be among the "transient" class of employment, for they possess an uncanny ability to lose their positions with amazing rapidity; chiefly because of their untimely remarks to the tender feelings of artists who think they are good and will never be convinced that they aren't.

One of the best examples of handling temperament can be seen in the case of Miss Raquel Nieto, coloratura soprano with the Chicago Opera Company, the San Carlos Opera Company, and others. She appears over nearly all the Western radiophones, such as KFI, KGO, KNX, KOA, WBAP and others too numerous to mention. And because the facts of her temperament have been broadcast far and wide, directors of the stations where she appears are forewarned of her coming and treat her accordingly—which is successfully.

Miss Nieto is not purposely temperamental, such as the majority of self-styled radio stars. She gained her temperament by birth, as you will discern by her French-Italian name. Unusual as it may seem, she considers her temperament as a valuable asset, for, as she puts it, she "really means" the words of a song when she aims them at the microphone. Temperament is her

excuse for having a fiery, passionate expression in her musical renditions. Without temperament, her songs would be listless, uninteresting and mechanical.

And directors and announcers cater to her whims—for she is really a great artist—by giving her soft lights, soft music—an absence of spectators, and a general atmosphere of refinement and quiet. It takes very little effort on the part of the station—and it makes Mlle. Nieto feel at home.

"If a few more announcers would adopt the policy of broad-mindedness in handling artists, there would be less flareups and broken-up programs," according to Pat Barnes, announcer-director of WHT. "These artists are furnishing free programs, so the best the station can do is to cater to their temperaments."

Pat Barnes, more than any other announcer, perhaps, has known what it is to be temperamental, and it is this common bond of feeling that causes him to sympathize with temperamental artists and treat them as they should be treated.

"Temperament is usually inborn or unconsciously assumed," Pat explained, and it should be handled as a malady and not as a disgusting condition. I have tried to follow that policy in arranging my artists, and I am proud to say that temperamental outbursts are a thing of the past at our station."

A Real Task Confronts Mr. Hoover



Annual Radio Confab to be Called this Winter Must Over-ride Industry's Obstacles

BY CARL H. BUTMAN

THE remarkable growth of radio during the past five years was eulogized by Secretary of Commerce Herbert Hoover last month, when he spoke through Stations WRC, WJZ and WGY, in conjunction with the National Radio Exposition in New York.

During the course of his talk Secretary Hoover announced he would probably call the Fourth Annual Radio Conference some time during November. He admitted he was fully aware of the importance of the problems confronting the Conference, and urged the American radio public to pay a patriotic interest in the outcome of the Conference.

The high-lights of Mr. Hoover's address follow:

Radio—Its Influence and Growth

Radio has already become so imbedded in American life that we forget that the development of this great scientific discovery is but five years old. Five years ago we had not a single broadcasting station. Today we have over 572 stations and probably 6,000,000 homes with receiving sets. Five years ago the total expenditure in the industry was less than a million dollars for the year. It will probably exceed \$400,000,000 this year.

I do not believe any other generation in history has had the privilege of witnessing the progress from birth to adolescence of a discovery so profoundly affecting the social and economic life of the peoples of the world. You who attended your first radio expositions four years ago, and who have the privilege of being present again tonight, can see marvelous advances in the art. No other invention in all time invaded the home so rapidly and entrenched itself so securely as radio, and though it is still far from maturity, we see great advances every year. Every year brings additional scientific discovery, and there follows upon it new invention and new application to service. Your annual expositions serve as milestones to disclose these advances.

Service is the Keynote

EVERY radio activity exists finally and lastly to serve the listening public. The keystone of the industry is to maintain their interest by service. That is the motive of the broadcaster

who gives us better programs and better quality of transmission, and is the object of the manufacturers of receiving sets that they should give more reliable and more perfect reception. It is the object of the Department of Commerce, which has the very difficult job of keeping the traffic lanes clear so that the voice over the radio may reach the listener. It is, therefore, the listener in whom we are primarily interested, not only as an industry but as a public service. There is no industry so dependent upon public good will and interest. I take it that it is in realization of the fact and the wish to demonstrate the efficiency of the service, both present and to come.

Now, it is often said that the listener in the United States receives an extraordinary service without paying for it. This is not entirely true, for he pays indirectly for some of it. But in the fashion we have developed the organization of radio in the United States the listener is free from any direct charge for programs. And in this we differ from the methods of foreign countries who seek to support broadcasting by tax on the listener. A few years ago much anxiety was expressed that we could not maintain good programs of entertainment and the delivery of public information without devising some system of tax upon the listeners. It has been my aspiration that we should keep the home free from constant annoyance of any attempt to assess the cost of broadcasting upon each receiving instrument. And I have believed that the industry would develop far more rapidly in this matter than if we pursued the European plan. But beyond this, support by taxation means a limited number of government controlled broadcasting stations, and therefore much less variety of program, much less competitive endeavor to please the listener and above all constant dangers of censorship.

I am today confident in the announcement that our policy, that there shall be on the air every broadcasting station for which there is an available channel and that the cost shall be borne indirectly or by public service institutions, has proved far and away the most successful and has finally settled our policies for all time. It is a great accomplishment and one for which the manufacturers, the

broadcasters, and even the staff of the Department of Commerce deserve some credit.

But whether the listener pays directly or indirectly or not at all, it is the listener in the American home who is the foundation and furnishes the support for the whole industry. For if he relaxes or his interest fails, the whole radio structure will fall as quickly as it has grown.

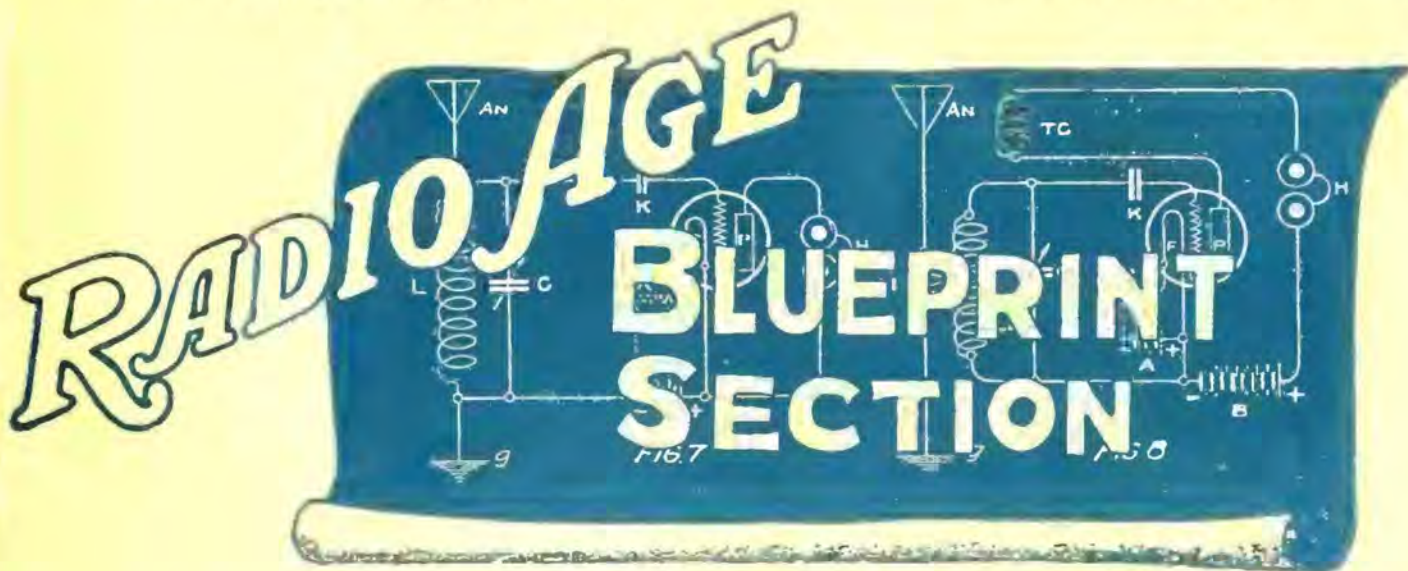
In the course of another month I am summoning the Fourth Annual Radio Conference in Washington, in which all elements—the listeners, the manufacturer, the broadcasters, the radio press, the distributor and the government—will come around a common table for the fourth time to discuss the mutual problems of this industry. This is the only industry where everybody agrees that there must be regulation. Without regulation we should have complete chaos in the air. And as every word by radio is an interstate performance we cannot avoid Federal regulation. Attempt to regulate rigidly by law without the cooperation of the industry and the public would, I believe, stifle progress. And this manner of regulation by which all parties sit in for solution of problems is unique in our relations of government and industry.

U. S. Leads Them All

WE are far in advance of all other countries and I feel it has been in large measure due to the cooperation worked out in these conferences. But with the fine cooperation which we have developed we have done something new in the whole development of relations between the industry at large and the public.

We still have plenty of unsolved problems. The number of radio channels is limited. They are already so overcrowded that there is little room for the new comers. They jostle each other a good deal. More legislation for solution of our difficulties is being frequently suggested and we must sooner or later determine the major issue whether we will continue to allow every new broadcasting station access to radio paths or whether every applicant entering must first show

(turn to page 52)



More Selectivity, Less Losses, by Adding Radio Frequency Stages

By JOHN B. RATHBUN

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R. F. Addition Will Help Suppress Squeals

THERE are a number of advantages obtained in adding one or two steps of radio frequency amplification to a detector tube outside of simply increasing the sensitivity and distance getting qualities of the set. In the first place, the addition of one or two stages of R. F. amplification increases the selectivity of a receiver without introducing additional losses as is the case with the average wave-trap or auxiliary tuner. Secondly, the radio frequency stages act like check valves and prevent the detector tube oscillations from passing out to the aerial, thus suppressing the emission of annoying waves and squeals in a neighboring receiving set. Thirdly, the great degree of amplification attained by the radio stages permits the use of a loop aerial or else a very short indoor aerial in place of the more common outdoor "flat top" type.

Radio frequency amplification can be applied to any sort of a detector, a crystal detector or vacuum tube detector of either the regenerative or non-regenerative order, and to each of these detector types it imparts the virtues of sensitivity, selectivity, and reduced radiation from the antenna. It should be noted, however, that the degree of selectivity varies with the properties of the detector circuit, the selectivity being the least with a crystal detector and at a maximum with a regenerative detector just as with the detectors themselves when used direct connected to the antenna in the usual way. With a crystal detector, very loose coupling is required to obtain satisfactory selectivity, and the same is true of the non-oscillating type sodion tubes and diode tubes. Regeneration in either the detector or the radio frequency tubes very greatly increases the selective properties of the circuit, and when more than one radio frequency stage is employed, it may cause excessively sharp tuning and so critical adjustment that the set is difficult to handle.

In regard to sensitivity, the effect of the radio frequency tubes is to amplify or

magnify the weak antenna impulses before they reach the detector tube so that the detector can more effectively rectify the incoming impulses. In other words, the output of the radio frequency tube forms a second aerial in which the radio waves are much stronger than in the true antenna, and with the detector connected to the radio frequency output it is evident that stronger signals can be obtained at the detector, that is, up to the saturation point of the tube. Radio frequency amplification very greatly increases the signal strength of weak distant stations, but has very much less effect in amplifying strong signals from local stations for the reason that the R. F. tubes reach their saturation point very quickly with even moderately strong incoming waves, and therefore, any further increase of the antenna impulse strength will have no effect on the detector output.

A Periodic R. F. Stage

ONE of the simplest radio frequency stages employed is the "Aperiodic" or "Untuned" type of stage shown in Fig. 1 of the Blueprint Section. In this case, the radio frequency tube (RF1), is connected directly to the antenna and ground with the grid (G) going to the antenna without any attempt at tuning. When connected in this way, all wavelengths are amplified indiscriminately within the range of the circuit constants and the selectivity of the stage of course is zero. All tuning controls must be included in the following radio stages, if any, or in the detector circuit which follows the tube (RF1). The output of

the amplifier is at the plate connection (P) which goes to the succeeding portions of the circuit.

With short aeriels a loading coil (L.C.) will be necessary to bring the system up to broadcasting wavelengths. Generally about 20 turns of wire on a three-inch tube will be sufficient. This causes no losses as there can be no leakage to ground through the distributed capacity.

The principal advantage of this sort of radio frequency amplification lies in the fact that all of the energy collected by the antenna is led directly to the grid of the tube where it is amplified without loss, and this is of the greatest importance when working very weak distant stations. The customary losses due to the tuning inductances, tuning condensers, etc., are eliminated with the result that radio frequency amplification is at a maximum.

A considerable amount of radio frequency energy is dissipated by leakage, losses through the distributed capacity of the coil winding, and by other paths when a tuning unit is used between the antenna and the tube, hence by the aperiodic stage we conserve every bit of the precious energy for amplification. The output of the tube is tuned to wavelength, and the undesired waves are rejected after this amplification takes place, hence with less loss and better distance than can be attained in any other way.

By means of the coupler or air-core transformer (CPLR) in Fig. 2, the first radio frequency stage can be tuned to the desired wavelength in the usual manner, thus attaining selectivity from the start. The primary coil (P) is connected to the antenna (ANT) at one end and to the ground at the other, only a few turns of wire being employed in this coil so that the lower wavelengths will pass through as easily as the long waves. By placing (P) in inductive relation to the secondary coil (S), radio frequency currents are induced in the

(Turn to page 36)

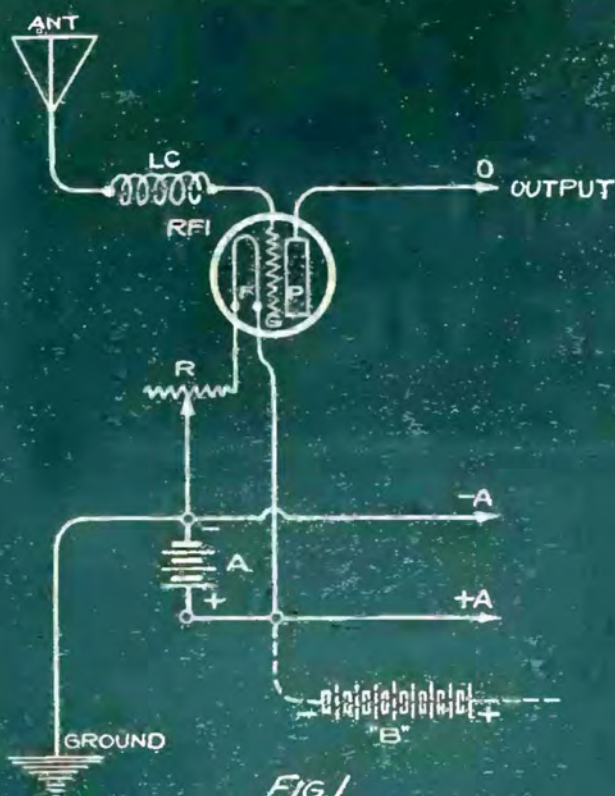


FIG. 1
AN APERIODIC STAGE

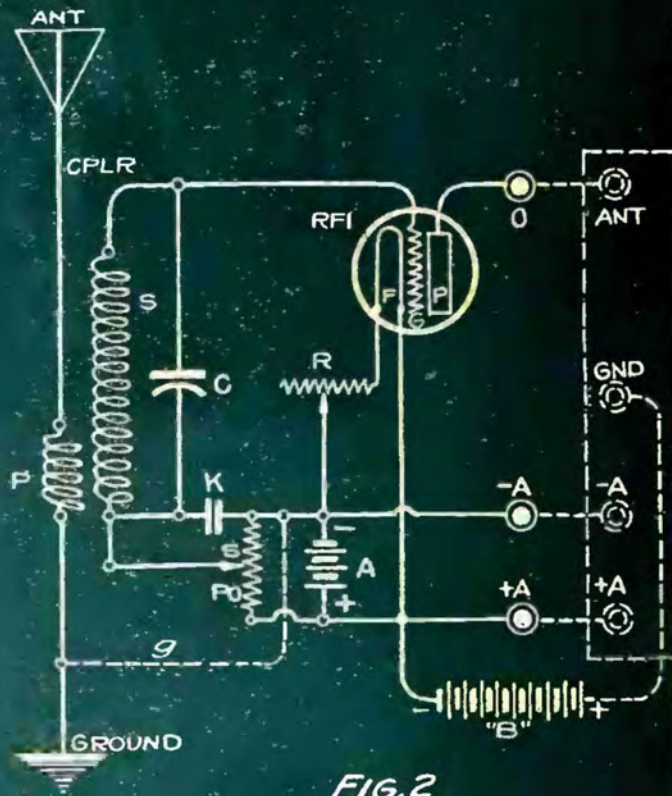


FIG. 2
TUNED R.F. STAGE

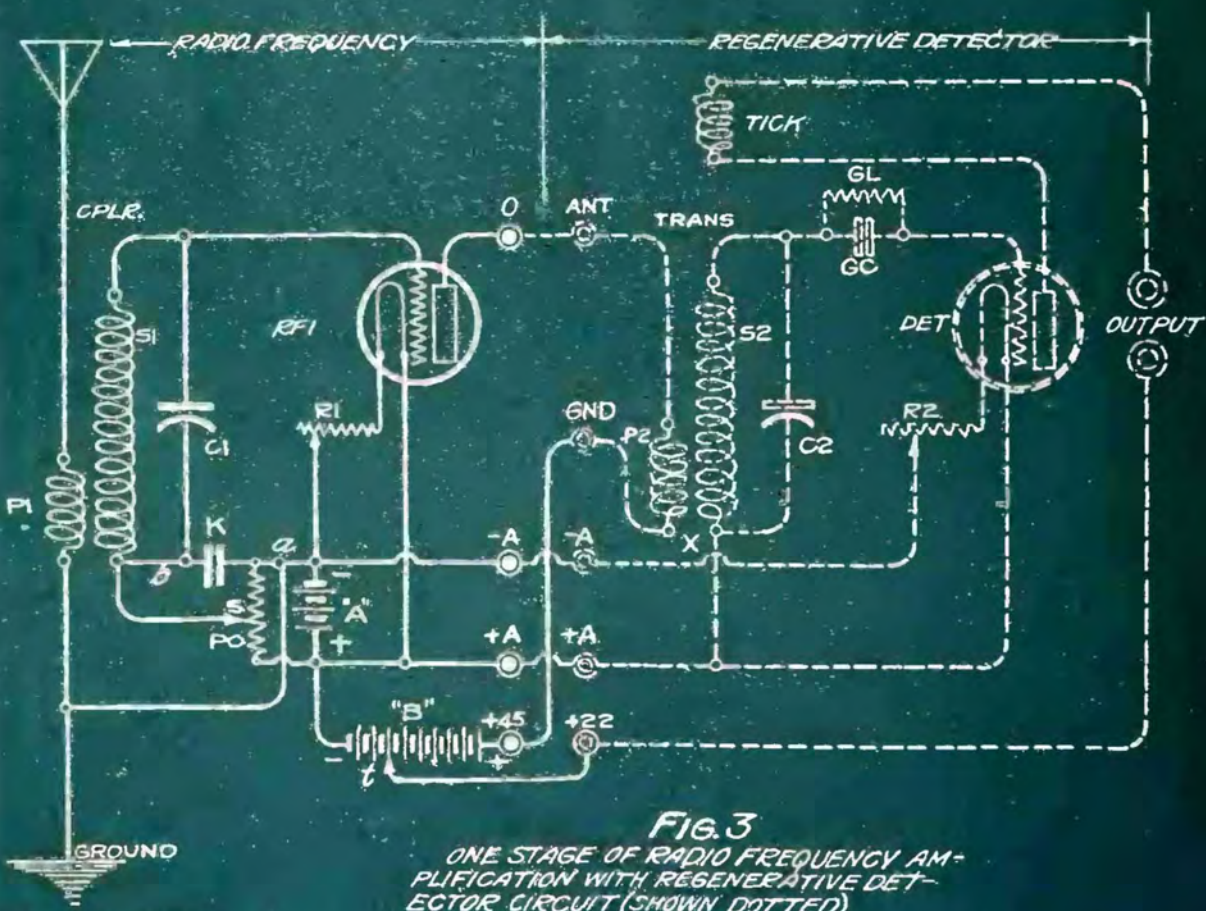


FIG. 3
ONE STAGE OF RADIO FREQUENCY AMPLIFICATION WITH REGENERATIVE DETECTOR CIRCUIT (SHOWN DOTTED)

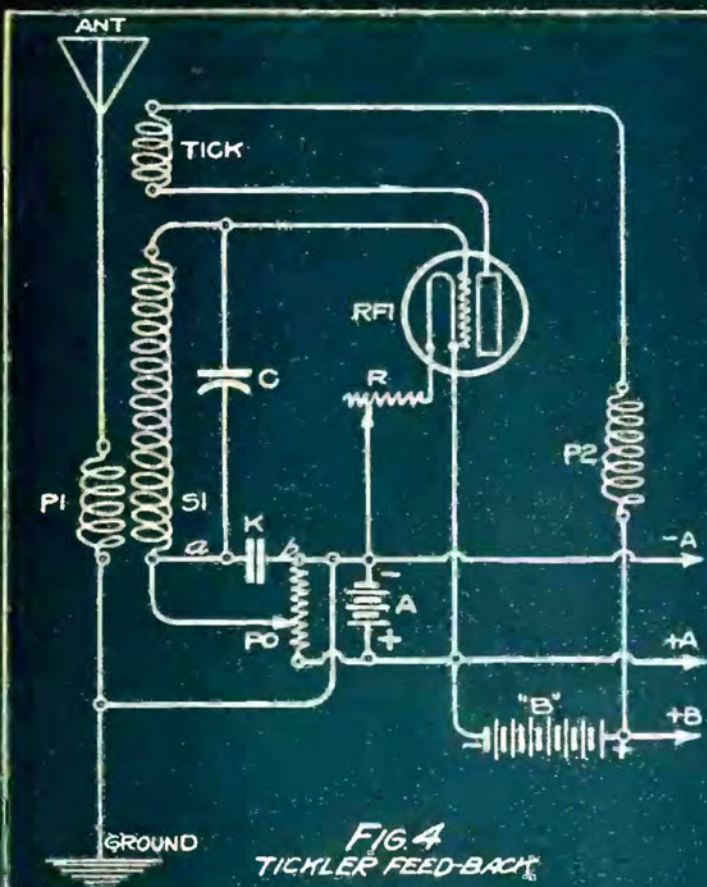


FIG. 4
TICKLER FEED-BACK

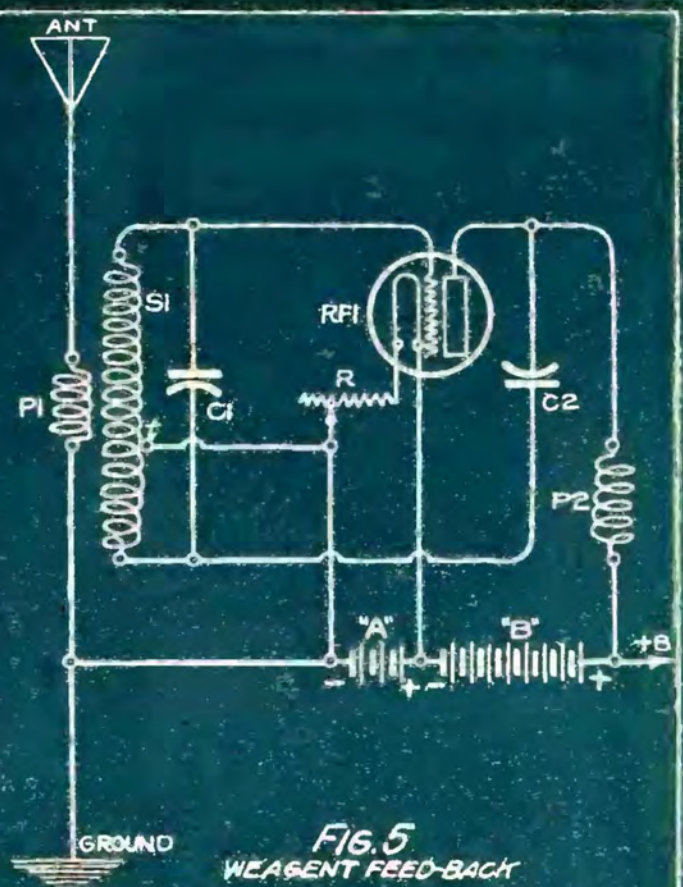


FIG. 5
WEAGENT FEED-BACK

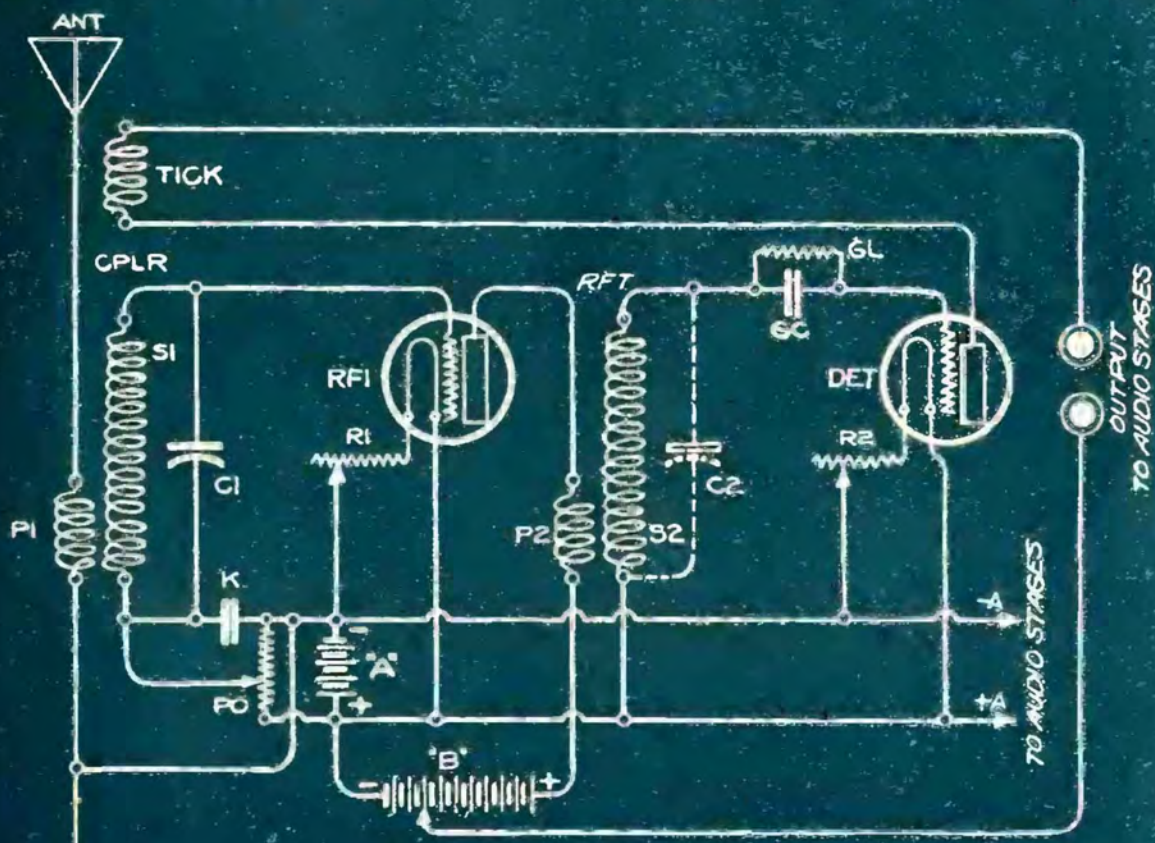


FIG. 6
ONE STAGE OF REGENERATIVE RADIO FREQUENCY AND NON-REGENERATIVE DETECTOR COUPLED BY AIR-CORE R.F. TRANSFORMER.

(Continued from page 33)

secondary circuit which correspond exactly to those in the antenna and primary coil, and from the coupler the impulses are led to the grid of the tube (G) where they are amplified and then pass out through the plate (P) to the following circuit.

A variable condenser (C) is connected across the secondary (S) to tune the radio circuit to the required wavelength. The selectivity or sharpness of this adjustment depends largely upon the degree of "Coupling" existing between the two coils (P) and (S), that is, the distance between the coils and the percentage of inductive effect resulting from this separation. With the coils close together, the tuning is "broader" and the set is not so selective as when the coils are separated by a greater distance. For example, with coil (P) within 1-8 inch of coil (S) it may require 20 dial divisions or more to tune out a station, but when the coils are separated by 1-2 inch or more, the same station can be completely and sharply tuned out by turning the dial through only a small fraction of a dial division. This adjustment must be made carefully so that the set will be sufficiently selective and yet not unduly sharp or critical.

Primary coil (P) may consist of from six to ten turns of No. 24 D. C. C. copper wire wound on a three inch cardboard or bakelite tube. The secondary coil (S) has about 55 turns of the same size wire, and is separated approximately 1-2 inch or 5-8 inch from the end of the primary coil. This coil is tuned through the range of broadcasting wavelengths by a 0.00035 mf. variable condenser (C) connected across the secondary coil as shown. There are other and more efficient coils than this on the market, but the dimensions above will give data for a home built coil that will give fair results.

A potentiometer (PO) is shown connected across the "A" battery circuit with its sliding member or contactor (s) connected to the lower end of the coil and variable condenser, but this is not always included in all radio frequency amplifiers. Its purpose is to vary the potential or voltage on the grid of the tube so that regeneration can be controlled in the first tube and hence forms a means of eliminating howling or muffled-indistinct reception when the regeneration is excessive. Moving (s) upwards toward (-A) causes an increasing negative potential on the grid of the tube which tends to reduce regeneration and to suppress free oscillations and howling. Moving (s) toward (+A) gives an increasing positive potential on the grid and increases the sensitivity by allowing increased regeneration. There are other methods of control but this has the virtue of simplicity and ease of operation and installation.

A fixed condenser (K) varying from 0.0005 mf. to 0.006 mf. is connected between the slider and the (-A) wire of the potentiometer to reduce the inductive effect of a wire wound potentiometer. It bypasses the radio frequency current across the windings of the potentiometer so that the potentiometer does not upset the tuning adjustments every time that it is moved. This is not necessary with carbon-pile potentiometers or similar types where coil windings are not used. A ground connection (G) running from the (-A) line to ground is always an advantage and is sometimes an absolute necessity. It greatly reduces any tendency toward body capacity effect in

THE RADIO AGE RECEIVER

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ON THE STANDS
NOVEMBER 15

handling the variable condenser and usually increases the amplification.

By connecting the output (O) to the (ANT) post of a detector set, in which a two-circuit coupler is employed, and connecting in the "B" battery to the ground post of the detector circuit as indicated by the dotted lines, the stage of radio frequency can be added to a regenerative set with good results. The coupler of the detector set must be of the two-circuit type with a primary coil electrically separated from the secondary. Special arrangements will be required with single circuit detectors as we must avoid making any connections likely to cause circuits in the "B" battery line. This amplification cannot be used with ultra-audions in the form shown nor with similar circuits of the single circuit type.

With One Stage of Radio

THE application of one stage of radio frequency amplifications to an existing regenerative receiver is shown more clearly in the completed diagram of Fig. 3. In order to make a more prominent distinction between the radio frequency circuit and the regenerative detector circuit to which the radio stage has been added, the radio frequency amplifier circuit is drawn in heavy full lines while the original detector circuit is drawn in dotted lines. The radio frequency circuit is as before with its plate output post at (O), the "B" battery connection posts at (+B), and the "A" battery leads at (-A) and (+A). There are now two wavelength tuning controls, the radio frequency condenser (C1) and the original detector condenser (C2) which of course adds greatly to the selectivity of the circuits. Audio amplifying stages can be added at the detector output marked "Phones" but they are not shown as they would add needlessly to the complication in describing the radio frequency end of the circuit.

As will be seen, this regenerative detector circuit at the right is of the two circuit coupled type with the addition of a third coil (TICK) known as the "Tickler" used for regeneration in the detector stage. The primary coil is at (P2) and the secondary at (S2), all three coils being coupled inductively in the usual manner. In some receivers, the tickler coil (TICK) is adjustable from the front of the panel so that the plate coupling can be varied by turning a dial, while in other receivers the tickler coil is wound in fixed relation to the other coils. However, this makes no difference in the connection of the radio frequency stage as long as the primary coil

(P2) is electrically independent of the secondary coil (S2). If the primary is connected with the secondary in any way, then there is likely to be a short circuit through the "B" batteries and this means trouble. Carefully examine the tuner-coupler of the regenerative circuit that you intend to use for the detector to see whether the primary coil is isolated from the rest of the circuit, for in many cases you will find a short connection between the primary (P2) and secondary (S2) as at (X) which must be removed before going further.

At (GC) is the grid condenser and at (GL) is the grid leak which need not be tampered with as a rule, although increasing the value of the leak (GL) is sometimes advisable in order to secure stronger signals. Leaks having a resistance higher than 1.0 megohm are seldom used in straight regenerative circuits alone, as higher values increase the tendency toward antenna radiations, but when a stage of radio is added in front of the detector, this can be increased to 2.0 megohms with improved signal strength and with no danger of radiation. Independent filament rheostats for the radio frequency stage at (R1) and for the detector at (R2) must be used as the detector rheostat adjustment is much more critical than that of the R. F. tube, particularly when a fixed tickler coil is used. The old rheostat used in the detector circuit should not be changed.

Plate voltages depend upon conditions. For the radio frequency tube (RF1) a "B" battery voltage of 45, 67.5 or 90 volts can be used, but with ordinary apparatus 45 volts on the R. F. tube is generally best for bringing in distance. "B" battery potentials of 67.5 and 90 volts may give stronger signals on local stations or stations at a moderate distance but this does not necessarily indicate that these voltages are best for distance. Further, high voltages make the set more critical, more difficult to tune and noisier, so that we should use the lowest possible voltage that will "bring in the stuff."

Usually, the detector tube (DET) works best on 22.5 volts of "B" battery, the voltage being obtained by tapping the "B" battery as at (t). Convenient taps are provided on most "B" batteries so that this voltage control can be easily made. In any event, the detector voltage should not be higher than 45 volts. A full 90 volts will be required for the audio frequency stages, if any, so that almost any combination of voltages for the R. F. and detector tubes can be carried out experimentally up to 90 volts without purchasing unnecessary equipment.

It will be noted that the tuner unit of the regenerative detector circuit now becomes a radio frequency transformer having a primary coil (P2) and a secondary (S2). A radio frequency transformer of the air-core type can be substituted for the tuner unit if provision is also made for the tickler coil. Some form of coupling must always exist between the output of the R. F. tube and the detector which will prevent the plate current (O) from being directly connected to the grid of the following detector tube. If the "B" battery potential is applied to the detector tube in any way, it will give such a strong positive bias that the tube will be inoperative or paralyzed as long as the voltage continues. In the case of single circuit regeneratives, it is usually necessary to use a 0.0005 stopping condenser between the plate of the R. F. and the detector tubes, or in other

cases to connect the outer end of the grid leak to the (+A) line instead of leaving it in the position shown by Fig. 3. However, nothing of this sort is required in Fig. 2 where the plate and grid circuits are effectually separated by the air space between coils.

In cases where a potentiometer is not desirable, and when other means of controlling self-oscillations have been employed, the wiring in the diagram can be altered so that the (-A) line at (a) is connected directly to the grid-return line at (b). This places a negative bias on the first tube which tends to suppress self-oscillations but which may interfere with the sensitivity to some extent by the reduction of regeneration.

Regenerative Radio Frequency Circuit

By applying the regenerative principle to the radio frequency circuit, a very much greater amplification can be obtained with correspondingly greater sensitivity and distance getting qualities. There is as much difference between a regenerative and non-regenerative radio frequency circuit as there is between a regenerative and non-regenerative detector. The radio wave from the antenna receives amplification by the manner already explained, and the amplifier output of the tube is then returned to the grid circuit where the strengthened impulse is again impressed on the tube resulting in a second and greater amplification. The radio frequency waves are greatly intensified before they pass to the detector for rectification.

A straight tickler (inductive) feed-back can be applied to the radio stages as in Fig. 4, where (P1) is the primary of the antenna coupler, (S1) is the secondary coil of the coupler and (TICK) is the tickler coil feeding plate current back to the secondary. Plate current also passes through the transformer primary (P2) through which the radio stage is inductively coupled to the succeeding detector or to a second stage of radio frequency. When the tickler coil (TICK) is adjustable in regard to the other coils a very close control of the regeneration can be had, and when it is excessive through any means, the direction of the coil can be suppressed so that opposing or "negative feed-back" is had which suppresses the free oscillations in the circuit. With an adjustable tickler, the potentiometer (PO) is omitted, and direct connection is made between the (-A) line at (a) and the grid return line at (b).

With a fixed tickler coil wound directly on the same tube with the other two coils, no such feed-back control is possible, hence some other means of oscillation control is employed—generally by the combined adjustments of the rheostat (R) and the potentiometer (PO).

Much closer control of the oscillations is had by the revamped "Weagent" regenerative circuit of Fig. 5 where a tap (t) divides the secondary coil (S1) into a tuner and a tickler coil. Plate current is fed back into the lower end of (S1) through the small variable condenser (C2) while the variable condenser (C1) tunes the system to wavelength as before. Regeneration is very accurately controlled by condenser (C2) which regulates the feed-back to the grid circuit. Tap (t) connects with the (-A) line so that a negative grid potential is impressed at all times, and in effect this is the grid return circuit as well.

SOMETHING TO BE PROUD OF!

—is the Radio Age Receiver, to be described in detail for our readers in the December issue, out November 15. Illustrated with clear blueprints by John B. Rathbun.

A tuned r. f. receiver with all the latest improvements in the radio art.

THE LAST WORD in Radio Engineering—a set that will last for years.

Further particulars on page 20, this issue.

Extended Detector Regeneration

BOTH radio frequency and audio frequency currents exist in the plate circuit of the detector tube, and on passing through the tube the radio frequency currents are highly amplified. In one very effective radio frequency circuit the plate current from the detector tube is led to a tickler located in the first stage coupler so that radio frequency regeneration is obtained together with some audio frequency feed-back. The radio frequency tube is not regenerative within itself as shown by the two preceding diagrams.

A typical circuit of this sort is shown by Fig. 6 where the radio frequency tube is located at (RF1) and the detector at (DET). Plate current from the detector is led toward the tickler (TICK) above the secondary (S1) of the coupler and is arranged so that regeneration is controlled by turning the tickler in relation to the other coils. This circuit is very efficient and is highly recommended where one stage of radio frequency is to be added to a regenerative set or for a new regenerative set.

A radio frequency transformer (RFT) couples the radio frequency circuit to the detector with the primary (P2) in the plate circuit of (RF1) and the secondary (S2) connected to the detector. This transformer can be of the fixed self-tuned type or else the typical tuned air-core type can be employed with the variable condenser (C2) shown in dotted lines. An iron-core (untuned) radio frequency transformer is desirable at this point and avoids the use of a second tuning control when a high degree of selectivity is not required. Where there is a great deal of local interference, a tuned transformer with the condenser (C2) may become necessary.

A potentiometer (PO) with the fixed bypass condenser (K) affords a means of oscillation control, and it will be noted that both tubes are provided with independent rheostats (R1) and (R2) for the individual control of the tubes. The conventional 0.00025 mf. grid condenser (GC) and the 2 meg. leak (GL) are employed as before, care being taken to connect the filament end of the secondary (S2) to the (+A) line so that there is a positive bias on the grid of the detector.

In adapting this circuit to an existing regenerative set, it will of course be necessary to move the coupler and tickler of the regenerative circuit to its new position in front of the radio frequency tube (RF1). The radio frequency transformer (RFT) is then substituted for the coupler

in the old location in front of the detector tube. Phones or an audio amplifier can be connected at the output of the detector, and the "B" battery is shown tapped at the point (t) to obtain 22.5 volts for the detector tube although the full 45 volts can also be used successfully with the majority of tubes now on the market. The output is cleaner and the set is more stable when 22.5 is employed on the detector plate, but the volume is greater on weak signals with 45 volts. For the radio frequency tube (RF1) a plate potential of 45 volts generally gives better distance reception while 67.5 to 90 volts gives better volume on locals and moderate distances.

By adding two radio frequency stages instead of one, much better distance getting qualities are obtained and the set is made more selective because of the greater number of tuning controls. This is the arrangement adopted in the popular five tube radio frequency receivers having two radio frequency stages, detector, and two audio frequency stages, the latter being for the purpose of gaining loud speaker volume. Adding radio frequency stages does not greatly increase the sound volume and audio amplification is usually necessary with any number of radio frequency tubes except with rather strong locals.

Fig. 7 shows two stages of radio frequency added to a non-regenerative detector circuit, the coupling point of the radio and detector circuits being at the line (X-X) and indicated by the small circles representing binding posts between the additional stages and the old set. At (1) and (2) are the two radio frequency tubes controlled by one rheostat (R1). The detector tube is shown at (DET) with the usual grid condenser (GC) of 0.00025 mf. capacity and the 2 megohm grid leak (GL). This tube is controlled by the rheostat (R2), acting independently of the R. F. tube rheostat and also independently of the rheostat used for the audio frequency tubes when an audio stage is used. (Not shown in Fig. 7.)

A single circuit coupler (CPLR) is used for tuning the antenna circuit to wavelength instead of the more usual two circuit coupler shown up to this point. It consists of a single coil of wire connected at the grid (G) and (F) ends, tapped at (a) and (b) for the connection to the antenna. By connecting at (b) as shown, a very selective condition is had while connection further up the coil near the grid end at (a) broadens the tuning for locations where there is not much local interference. A single circuit coupler in the first stage has a number of advantages when three tuning controls are used.

- (1) The circuit is more stable and is less likely to break into self-oscillations than with a two circuit coupler.
- (2) When very selective transformers are used, the use of the single circuit coupler eliminates the split-hair dial adjustments and the sharp peaking of resonance that so greatly interferes with the reception of distant stations.
- (3) There is less loss with the single circuit type, since the grid of the tube is directly connected to the antenna, and distance is obtained more consistently.

A 0.00035 mf. variable condenser is connected across the coupler as with the secondary of the two circuit coil, and a potentiometer (PO) provides the grid potential variation necessary for the control of self-oscillations and the regen-

(Turn to page 40)

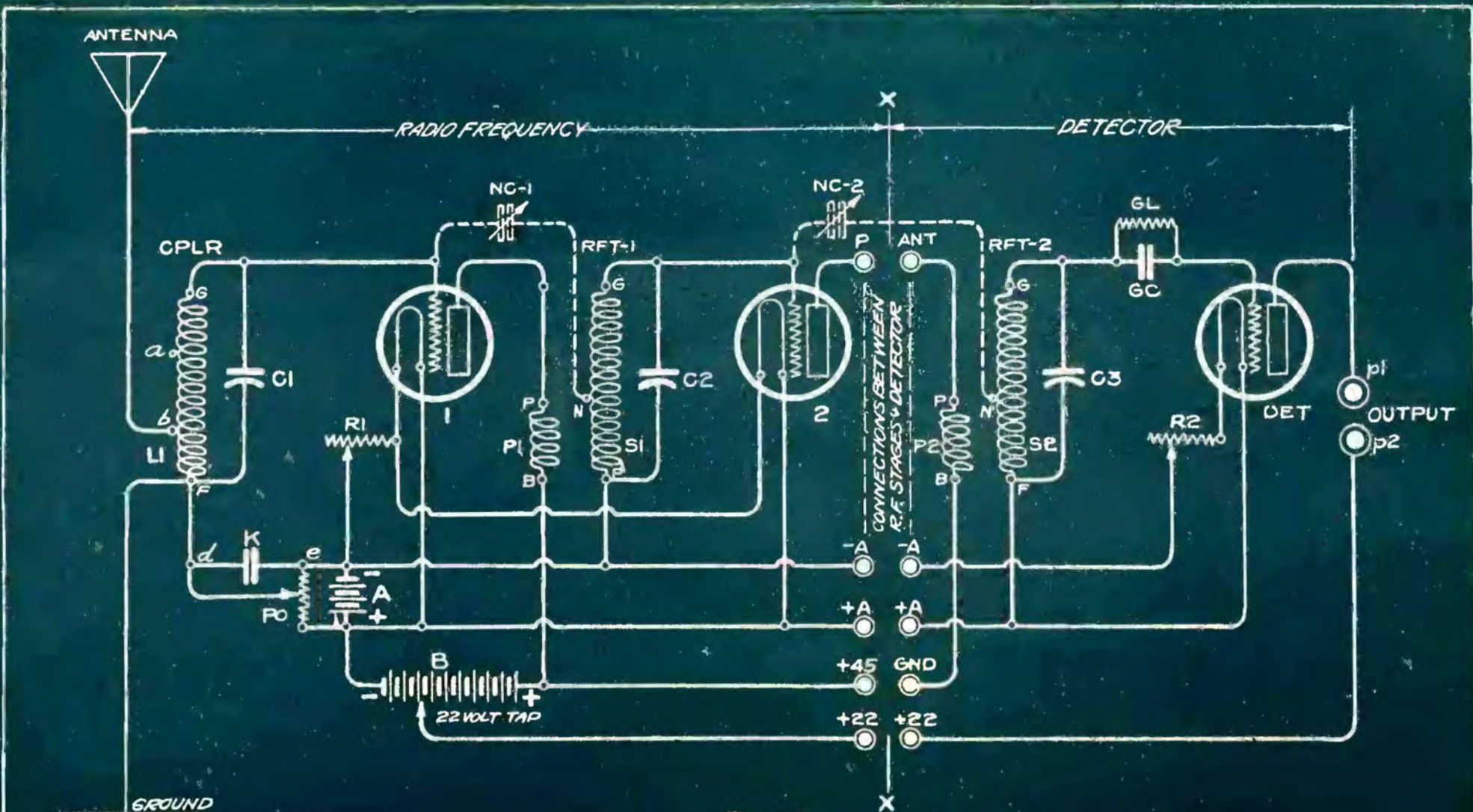


FIG. 7.

TWO STAGES OF R.F. AND DETECTOR

SHOWING HOW TWO STAGES OF RADIO FREQUENCY AMPLIFICATION CAN BE ADDED TO AN EXISTING NON-REGENERATIVE DETECTOR CIRCUIT. AUDIO FREQUENCY STAGES CAN BE ADDED AT "OUTPUT."

A FIXED OR UNTUNED RADIO FREQUENCY TRANSFORMER CAN BE USED AT RFT-2, IN WHICH CASE THE VARIABLE CONDENSER C3 IS OMITTED. NEUTRODONS NC-1 AND NC-2 ARE OPTIONAL.

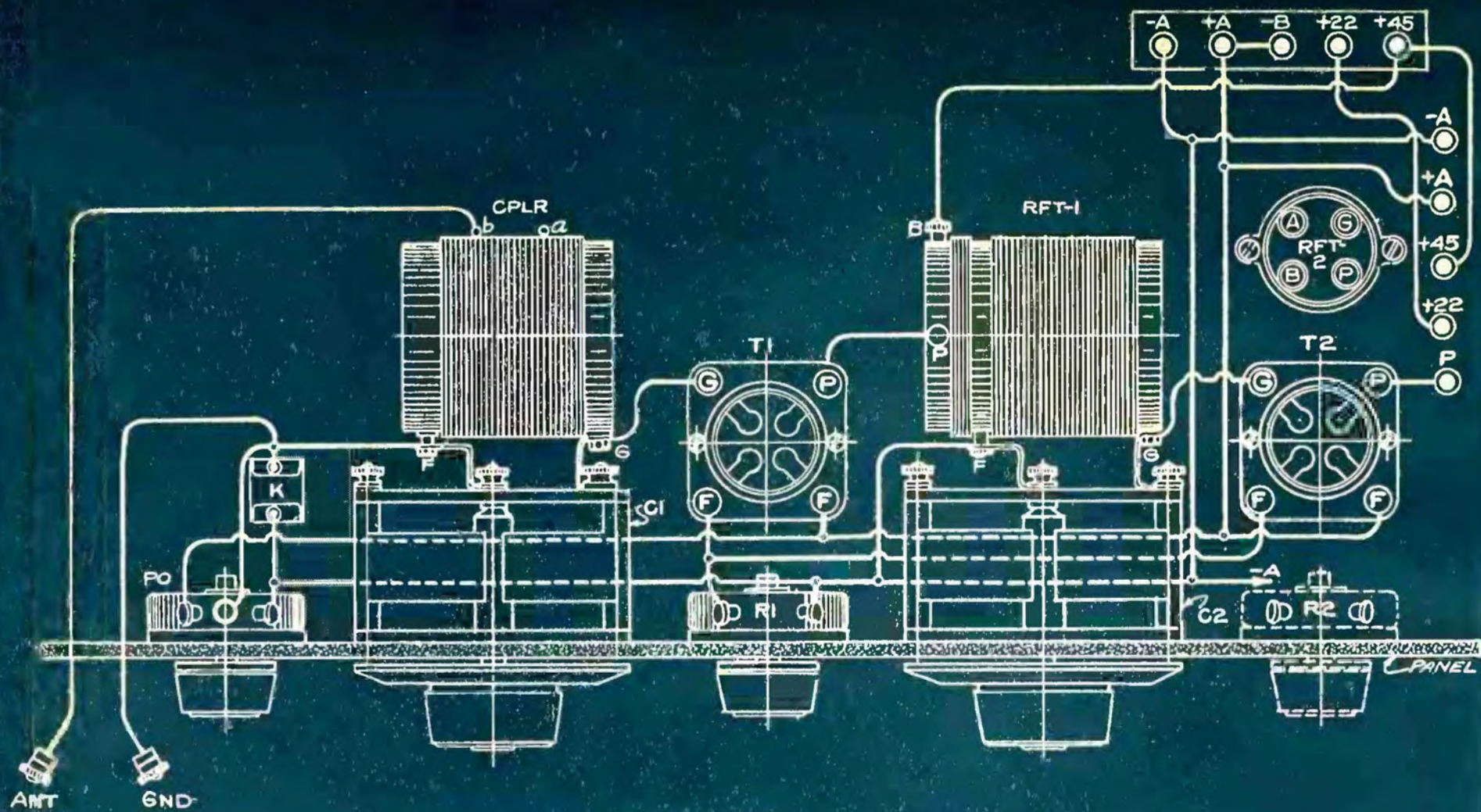


FIG. 8
TWO STAGES OF R.F. & DETECTOR

WHEN TRANSFORMER RFT-2 IS OF THE FIXED UNTUNED TYPE
 IT IS LOCATED IN THE RADIO FREQUENCY CABINET AS SHOWN ABOVE,
 TOGETHER WITH THE DETECTOR RHEOSTAT R-2.

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J.B. RATHBUN
 RFT-1050

(Continued from page 37)

eration. Across the slider of the potentiometer and the (-A) line is a 0.005 mf. fixed bypass condenser and from the inner end of this condenser is the ground line (g) which connects the (-A) line to ground. This first stage is coupled to the second radio frequency stage by means of the radio frequency transformer (RFT1) with the primary coil (P1) in the plate circuit of the first tube and the secondary (S1) going to the grid circuit of the second radio tube (2). The secondary may be tuned by the 0.00035 mf. variable condenser (C2) when the transformer is of the tuned air-core type, or this condenser can be omitted with the self-tuned air-core or iron core transformers often used with radio frequency additions in this sort. Iron core transformers reduce the number of controls and only slightly reduce the efficiency of the stages.

When two stages of radio frequency amplification are added to an existing regenerative circuit, the number of tuning controls is likely to be inconveniently large unless the iron-core untuned radio frequency transformers are used in at least one stage, and this is particularly the case where the detector circuit is of the regenerative type with a tickler control and two variable condensers. Further, the small fixed untuned transformers take up less room and the radio frequency cabinet can be of smaller dimensions than when tuned air-core transformers with their variable condensers are mounted on the panel. With a good iron-core transformer there is not much less in amplification, but the circuit must have at least three tuning controls (including those in the detector circuit), for the necessary selectivity.

The output of the second radio frequency tube (2) is coupled to the detector tube (DET) through the second radio frequency transformer (RFT2) which may be either a tuned or untuned type. If tuned, then the secondary (S2) is tuned by the 0.00035 mf. variable condenser (C3), and if untuned, this variable condenser is omitted. Note that the grid leak and grid condenser are connected into circuit just as with the foregoing circuits, and that the detector tube is fed with 22.5 volt "B" battery current as before explained. From 45 to 67.5 volts is preferable for the radio tubes (1) and (2) rather than 90 volts.

Great stability can be added to this circuit when all transformers are of the air-core tuned type by the use of grid neutralizing condensers shown in dotted lines at (NC), and the circuit is also much quieter when the tubes are neutralized in this manner. As will be seen from Fig. 7, the neutralizing condensers are connected between the grids of the radio frequency tubes and suitable taps (N) in the transformer secondaries. When the grids are neutralized, the potentiometer (PO) is no longer necessary and after it is removed, the grid return line is closed by connecting the (-A) at (e) to the ground line at (d). Owing to the high resistance of untuned radio frequency transformers and the damping influence of the resistance on self-oscillations, it is not necessary to use neutralizing condensers when these transformers are in the circuit.

The output of the detector tube can go to the phones, or else to the input of a two stage audio frequency amplifier when loud speaker operation is desired on distant stations. Connecting a loud speaker to the output of the circuit shown will give soft low volumes with local stations but this soon falls off as the

distance of the station is increased so that the speaker is not practical without audio amplification at distances much greater than 50 miles. It seems hardly necessary to describe the audio stages in detail at this point for they have been published time and time again in the blueprint section of Radio Age as well as in other portions of the book.

While the detector tube (DET) is shown connected up as a non-regenerative yet no changes are introduced into the circuit if it is supplied with a tickler coil mounted in inductive relation to the secondary coil (S2), as shown in the right hand dotted portion of Fig. 3. This introduces another control, but if a fixed untuned transformer is used at (RFT2) in place of a tuned transformer, we will still have three controls and the set can be easily tuned in and operated. With a movable tickler coil, the detector tube will no longer be so critical to filament current control which will simplify matters by allowing the use of fixed resistances at all points in place of the rheostats. Three Amperites (one at each tube) will entirely eliminate rheostatic control, and in this way the introduction of the tickler adjustment will effect an actual saving in the number of controls.

Complete Two Stage R. F. Unit

IN FIG. 8 is a picture diagram of a complete two stage radio frequency amplifier adapted for use with a detector unit. This is the same circuit as that in Fig. 7 with the exception that the detector tube is omitted, and for the convenience of the reader, both drawings are lettered and numbered the same so that the relation of the parts can be easily followed. It is arranged in a separate cabinet ready for connection to an existing circuit by means of output and battery posts marked at the left of the set. These posts correspond to the posts in Fig. 7 shown along the line (X-X).

Both the coupler (CPLR) and the first radio frequency transformer (RFT1) are tuned by the two variable condensers (C1) and (C1), both condensers having a capacity of 0.00035 mf. The second transformer (RFT2) is an untuned type, iron core preferred, which couples to the detector tube in the following unit. No condenser is used with this transformer. While the potentiometer (PO) is used for the control of the oscillations in the radio frequency stages and as shown on the drawing, it will be possible to use one neutralizing condenser connected to the first tube (1) in place of the potentiometer. My advice is, to use the potentiometer at least for a while, unless you are rather skilled in adjusting neutralized circuits.

There are many ready-made commercial coils more suitable for use than the solenoid types shown at (CPLR) and (RFT1) but these low-loss coils cannot be easily made at home. Examples of these coils will be found in the advertisements of the makers. However, for the benefit of those that prefer to "roll their own," the dimensions of the coils are shown in Fig. 8. They are wound with No. 26 D. C. C. or No. 24 D. C. C., with eight turns on the primary and 55 turns on the secondary of transformer (RFT1). The coupler (CPLR) is a continuous coil tapped at the 16th turn (b) and also at the 30th turn (a). These tapping points will generally give a sufficient range of selectivity under ordinary conditions, but there is no reason why more taps cannot be provided—say at every tenth turn or so. When once the proper tap point is found for the connection of the

antenna, the adjustment is fixed for that particular locality and no further change is needed at this point. The tubes are 3 inches in diameter.

Straight-line-wave-length or straight-line-frequency condensers add much to the ease of tuning, especially in bringing in stations in the 200 meter band of wave-lengths. There is more space between such stations when measured on the circumference of the dials, and their is more opportunity of tuning stations out that lie within a few meters of each other. Vernier type dials capable of very close adjustments are now almost a necessity.

Either the 201A type of tube or the "199" can be used successfully, but the storage battery tube 201A gives the maximum results. Being used for radio frequency amplification they are not particularly critical to filament current and can be used with fixed resistances of the amperite type in place of the rheostats.

Twenty Grand Opera Stars On the Air

Radio fans throughout the United States are now able to tune in regularly on some twenty grand opera stars and orchestras of international note through arrangements made by A. Atwater Kent with a New York musical bureau controlling these artists and the American Telephone and Telegraph Co.

Starting on Sunday night, October 4th, WEAf and a chain of the affiliated stations put the first of this series of high-class concerts on the air at 9:15 p.m. Eastern Standard Time. The appearance of these concert artists, all well known internationally, will continue every Sunday night from WEAf, New York during the present radio season. It is also hoped that many will sing and play from other stations located farther west and south, a little later in the year.

It is Mr. Kent's idea to demonstrate for the radio fans what can be done toward better radio programs, being the first step of the general movement toward a greater radio season, and perhaps continuous radio service for the listeners throughout the country.

The list of artists already signed up, many of whom will appear on early Sunday night programs, is as follows: Louise Homer, contralto; Mabel Garrison, Soprano; Frieda Hempel, Soprano; Maria Kurenko, Soprano of Russia; Florence Austral, soprano of Covent Garden, London; Julda Lashanska, soprano; Anna Case, soprano of the Metropolitan Opera Company; Reinald Werrenrath, baritone; Edward Johnson, tenor of the Metropolitan Opera Company; Albert Spalding, violinist; Alexander Brailowsky, pianist; the London String Quartet, England; the State Symphony Orchestra of New York, and Paul Althouse and Arthur Middleton of the Metropolitan Opera Company.

Other artists who will be heard on the air provided permission for broadcasting can be secured include the following:

Subject to permission from the Victor Talking Machine Company; Mme. Ernestine Schumann-Heink, Cecilia Hansen, Margaret Matzenauer, Olga Samaroff, Emilio de Gorgoza, Kathryn Meisle, of the Chicago Civic Opera Company and Giannini, of Europe.

Those subject to the Brunswick Company, are Joseph Hofmann, world's greatest pianist; Allen McQuhae and Mario Chamlee.

Subject to permission of the Metropolitan Opera Company are Lucrezia Bori, Merle Alcock, Joan Ruth, and, Marion Telva.

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This Set with All Accessories, Including The Famous American Bell Loud Speaker

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Our semi-finished sets come with all parts mounted on panel and baseboard ready for wiring. Do not fail to send for our catalog. Remember—we are the largest exclusive radio mail order dealers in the world and carry the best of everything in radio. We save you 1-3 to 1-2 on the following kits. Detailed description appear in our catalog.

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World's famous 8-tube Super-Heterodyne

Fully mounted on panel and baseboard. These pictures show interior set and how it looks when enclosed in cabinet. Comes completely assembled ready to wire and operate. We have testimonials from thousands of builders of this set. **Some Have Received Foreign Stations on Loop Aerial.** Unsurpassed in volume and tone quality. Low-loss straight line frequency condensers, vernier dials, finest quality rheostats. Matched Columbia long wave transformers. Requires only three screws for attaching panel and baseboard and set is ready to operate. 7x30 panel. Price of set only.

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Chicago, Illinois

Latest Models Displayed at Chicago Radio Show

THE radio industry has offered an abundance of new receivers and other apparatus for the season 1925-26. Many of these have been displayed at the National Radio Expositions in Chicago and New York, during the past month, and at the Radio World's Fair in New York. Now comes another show to be held during the month of November at the Coliseum in Chicago. Even more developments and improvements will be shown at this show, and a few of the latest to be introduced to the radio public are shown on this page.



THE new "Apex" Super-Five, with built-in loud speaker, is attracting attention at recent shows. It is the product of the Apex Electric Company of Chicago and is but one of their many interesting models for this season.



THE "Miraco" Ultra-5 Receiver, a product of the Midwest Radio Corporation of Cincinnati, Ohio, combines the latest innovation of engraving the dial readings on the panel. With "man-size" dials and attractive general appearance, this receiver presents an idea of the new trend in receiver design.



THE Logodyne Big Five, made by the Kodel Radio Corporation of Cincinnati, is a high type tuned radio frequency receiver, enclosed in an Adam Brown mahogany cabinet of massive proportions. The stations are already logged, and the panel is of the sloping variety, engraved in gold on Formica.



THE Diana "Big Six" comes in many shapes and sizes, but the console model shown at the right, with its attractive cabinet for batteries, etc., has proven the most popular. When closed the entire receiver has the aspect of a dignified piece of furniture, and when open, as shown in the photo, it harmonizes with any surroundings.

IN response to readers' requests, further pictures and descriptions of new receivers to be introduced at the Chicago Radio Show will be published in the Show Section of the December Radio Age, out November 15.



Pick-ups and Hook-ups by our Readers



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

Conducted by Fred Hill.

IF one were to judge from a casual perusal of the radio and trade magazines, it would appear that the doughnut coil, the form of winding old as the hills in the telephone game, but its radio application fairly new, is attracting quite a bit of attention from a host of manufacturers. Quite a number of the sets advertised for the 1925-1926 market are announced as being equipped with the doughnut coils, although traveling under many different names.

The single or double control also seems to be getting some attention and efforts are made by the manufacturers to arrange the tuning units so that single control will work out smoothly and accurately along the waveband covered by the different type of receivers. All of which seems to indicate that radio fans cannot be far from wrong in following out this general plan, at least for the sake of greater simplicity in tuning and the greater selectivity afforded by the inductances with enclosed fields. In our August Pickups and Hookups we detailed the description given by George B. Hostetter, Box 325, Freewater, Ore., of a simple means of making the toroid coil.

Now comes H. J. Hughes, of 2082 East Grand Blvd., Detroit, Mich., who elsewhere in these pages, presents a sketch and a description of the method in which he makes his doughnut coils. A reading of Mr. Hughes' description and that of Mr. Hostetter will probably prove very enlightening to the radio fan who wants to take a fling at the doughnut coil construction.

Readers of this department might find interesting dope in the September blueprint section where Mr. Rathbun gives audio amplifying circuits, both transformer and resistance coupled. Then in the October number he shows the single and double controlling of doughnut tuning units. Taking a composite of the September and October numbers of RADIO AGE, the reader should be able to fix up a dandy receiver that will follow more or less the latest practice in radio manufacture.

The data given by H. J. Hughes, referred to above, for winding doughnut coils, follows: Procure a piece of one and an eighth inch brass tubing ten inches long. Cut a slot its full length, slot to measure three-eighths of an inch.

CONTRIBUTORS

| | | |
|-----------------------|-------------------------------------------|-------------------|
| C. M. Thomas..... | Freight Traffic Dept. N and W. Ry..... | Roanoke, Va. |
| W. G. Bailey..... | 1315 Davenport Road..... | Toronto, Can. |
| Robt. A. DeVries..... | 114 8th Ave..... | New York City |
| H. J. Hughes..... | 2082 East Grand Blvd..... | Detroit, Mich. |
| A. W. Small..... | 1210 12th St., N. W..... | Washington, D. C. |
| Paul M. Hayes..... | | Pasadena, Calif. |

DIAL TWISTERS

| | | |
|-----------------------|------------------------|-------------------|
| Floyd E. Morris..... | Fort Saskatchewan..... | Alberta, Canada |
| Wm. F. Lauritzen..... | 275 Highland Ave..... | Somerville, Mass. |
| Frank Scudello..... | 83 Bay 44 St..... | Brooklyn, N. Y. |
| George B. Jones, Jr. | 75 Maiden Lane..... | New York City |

This can be done with a hacksaw by placing the tube on a board and nailing a strip at both ends that passes through the length of the tube, to hold it down on the bench while cutting and also prevents the tube from binding on the saw.

After slotting the tube, drill and tap two 6-32 holes in it to hold the wire. Tie one end of the wire to the screw and start winding your coil clockwise, fastening the other end to the other screw. Before winding, take the clips C and CC, shown in Fig. 3, and solder them at either end of the tube over the slot, keeping the slot three-eighths of an inch apart.

After winding the secondary, which consists of about 225 turns of No. 22 DSC or DCC wire, and the primary, which is made of 20 turns of the same wire wound over the secondary, unsolder the clips, take out the screws and press in at both ends of the tube to release the coil. Take a piece of adhesive tape 5-16 inch wide and bind it over the coil through the slot. Then bring the coil around, fasten the ends and the job is finished. The coil may be treated with a little airplane varnish, although untreated will do just as well.

In winding the primary it should be wound in four groups of five turns, as shown as the places marked X in Fig. 3. This is so the primary will follow the

secondary all the way around the doughnut and give coupling. The process related above may be repeated as often as necessary to give the number of doughnuts required.

Another r. f. unit to be added ahead of a standard receiver (providing the primary and secondary coils of the old set are thoroughly isolated) may be made from the diagram shown in this department, Fig. 1, and submitted by Robert A. DeVries, 114 8th Ave., New York City, N. Y. L 1 consists of 45 turns of 22 DCC spaced 5-8 inch from L 2 and wound on a three inch tube. L 1 consists of 15 turns of the same sized wire. L 3 is made up of 60 turns of 22 DCC, tapped at the fifteenth, thirtieth and 45th turn, on a three inch tube. The variable across L1 is a .0005 mfd., R1 is 30 ohms. R2 is a variable resistance. The two posts at the extreme right of Fig. 1 should go to the aerial and ground posts of the old set. (Be sure the primary of the old set is not in any way connected to the secondary.) The A battery connections may be carried over to the old set so the two units function off the same A and B batteries.

W. G. Bailey, 1315 Davenport Road, Toronto, Canada, who smashed his collar-bone and has been laid up all

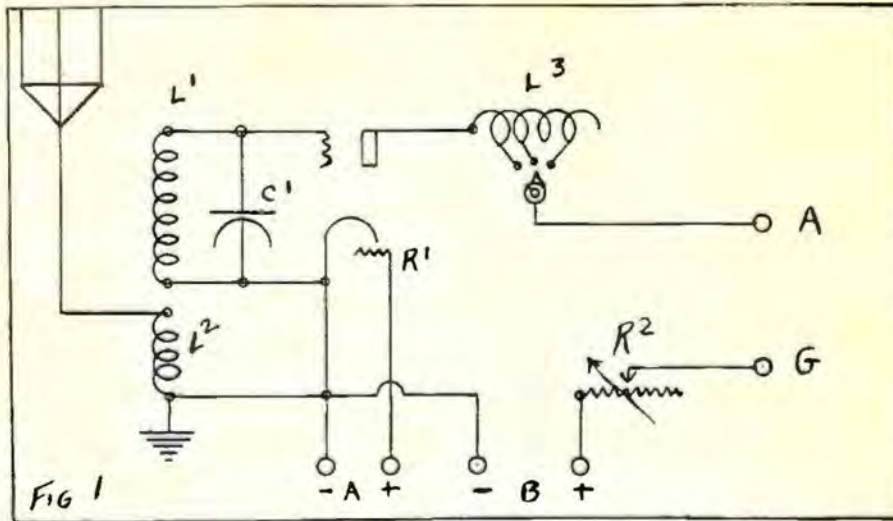


Fig. 1. In this r. f. unit, to go ahead of a regular set, submitted by Robert A. DeVries, 114 8th Ave., New York City, N. Y., readers may find a solution to their worries about the lack of signals. The variable resistance in series with a tapped plate coil allows the control of the plate potential and helps prevent undue regenerative effects in the first tube. The description is given elsewhere in this department.

Summer as a result, sends in the dope shown in Fig. 2 which is a loosely coupled regenerative set, using the Weagant variant for control of regeneration and oscillation. The primary coil consists of 10 turns of No. 24 DSC. The secondary is a straight winding of 60 turns of the same sized wire, with a center tap at the 30th turn, which goes to the filament. The wavelength control is the capacity from end to end of the coil and is a .0005 variable. The regeneration control which runs from the lower end of the secondary to the plate of the tube, is a three plate vernier condenser. The tube used is a WD-11. The entire set may be made up into portable form and furnishes good results under normal conditions. The grid condenser is .00025 and the leak, 3 megohms.

Pardon us, gentle readers, but we like to see letters like the following, and to think we have deserved them: "Desire to thank you for back numbers sent me due to various changes of address. You have without a doubt the finest publication in the radio field and I am particularly pleased not to have missed any of the numbers." The writer was George B. Jones, Jr., 75 Maiden Lane, New York City, N. Y.

Using the one lugger known as a single control, single tube set Frank Scudello, 83 Bay 44 St., Brooklyn, N. Y., manages to pull in the signals despite the Summer-time and the high power nest in New York.

Rosary-like, "The hours I spent with thee" is applied by William F. Lauritzen, Somerville, Mass., to the pursuit of the wily DX with the result that his one tuber has kept him hopping from ethereal pillar to post. His list is a staggering one and would entitle him to the button even if for no other reason than the amount of energy spent in compiling it.

Albert W. Small, 1210 12th St., N. W. Washington, D. C. rises to inquire

of any of our radio family has ever juggled the filaments of a burned out tube around while same was hooked to a 110 volt line. We'll say we did, sometimes disastrously and sometimes otherwise. Best way is to hook it to your battery and then lightly tap the burned out tube against your palm. If you are lucky you might have a new tube; otherwise trot down to the store and plunk down your hard earned kale for another glass hauble.

Wow—listen to this one. Its from C. M. Thomas, Freight Traffic Department, N. and W. Ry., Roanoke, Va., who relates as follows: "Read your magazine regularly and must say it is the best monthly on the market with no exceptions. It has more in it than all the rot of its class now sold. I've been reading your pages regularly and notice most of the hookups are single circuit or the like that squeal fearfully and make the

neighbors say things entirely un-holy. Would suggest you publish these contribution diagrams as to the changing sets so they won't radiate. There are many such plans now published."

Mr. Thomas then tells of adding a r. f. unit to his receiver with an increase of about 25 per cent in efficiency. The department this month has a scheme for making your own r. f. unit; we have also published these ideas from time to time, but it is a Herculean task to convert the world from a single to a loosely coupled circuit. If you don't believe it, try it on your friends.

Radio fans who are troubled with emaciated signals in the last stage of their amplifier, or else who are bothered with an overloaded last stage, might do well to try out the Radio Corporation's latest tube, known as the UX-112 which is designed for use in the last stage of audio and which will probably be equivalent, in results secured, to two of the 201-A type. The tube has an oxide filament, dull emitter type, and certainly does pep up your signals wonderfully. We have noted that the Daven Radio Corp., has also placed a tube designed for last stage work on the market, being known as the MU6. The use of a good power tube in the last stage generally recompenses the owner for his trouble, in increased volume.

Several fans have written this department lately for a good soldering flux to be used with rosin core solder. Our method is to take about a half glass of grain alcohol and dissolve into it enough powdered rosin to make a watery paste. Use this paste on joints to be soldered, just a little dot of the stuff being enough. It will clean the joint well, and when the iron is well tinned and hot, the soldering job can be made a thing of beauty instead of an awkward lump. Use wire rosin core solder. For the meticulous solderer, a wet rag will help to wipe off
(Turn to page 46)

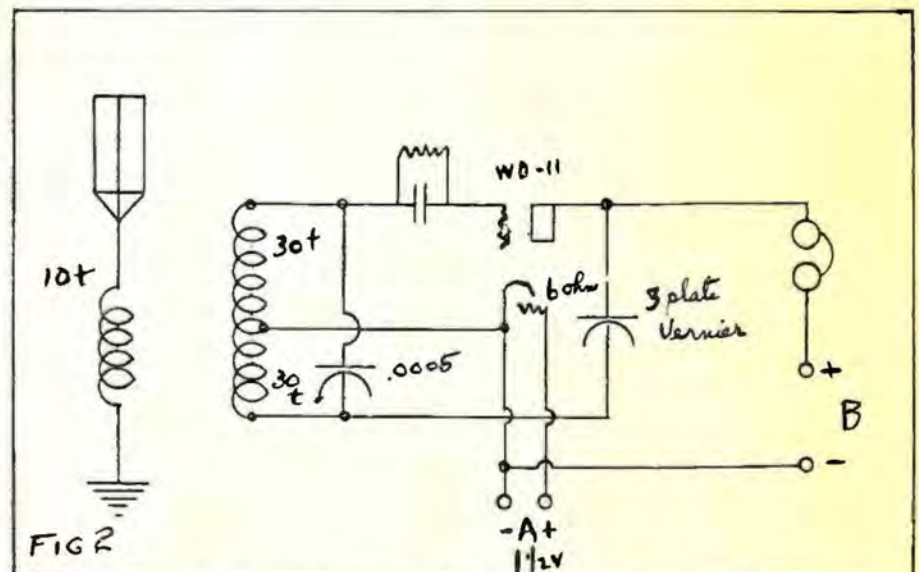


Fig. 2. Another variant of the Weagant sent in by W. G. Bailey, 1315 Davenport Road, Toronto, Canada, who uses WD-11 tubes and gets good results. Many of the Canadians use the dry cell type of tube on account of their economy and the portability of the set. The description of the circuit is found in these pages.



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THE DIFFERENCE in this receiver is no mere superficial difference. It is a distinction that you yourself and thousands of others made in discussing the "ideal Receiver." The Hammarlund-Roberts is a "composite receiver," the individual achievements of ten leading radio engineers.

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The skeleton or foundation for your HAMMARLUND-ROBERTS RECEIVER—bakelite panel, engraved; drilled bakelite sub-panel, brackets and wiring. The other specified parts are standard and can be purchased from any reliable radio dealer **\$9.40**

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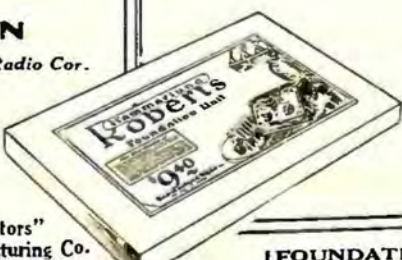
Write for this most complete book giving complete details on assembling, wiring and operating the Hammarlund-Roberts Receiver **25c**

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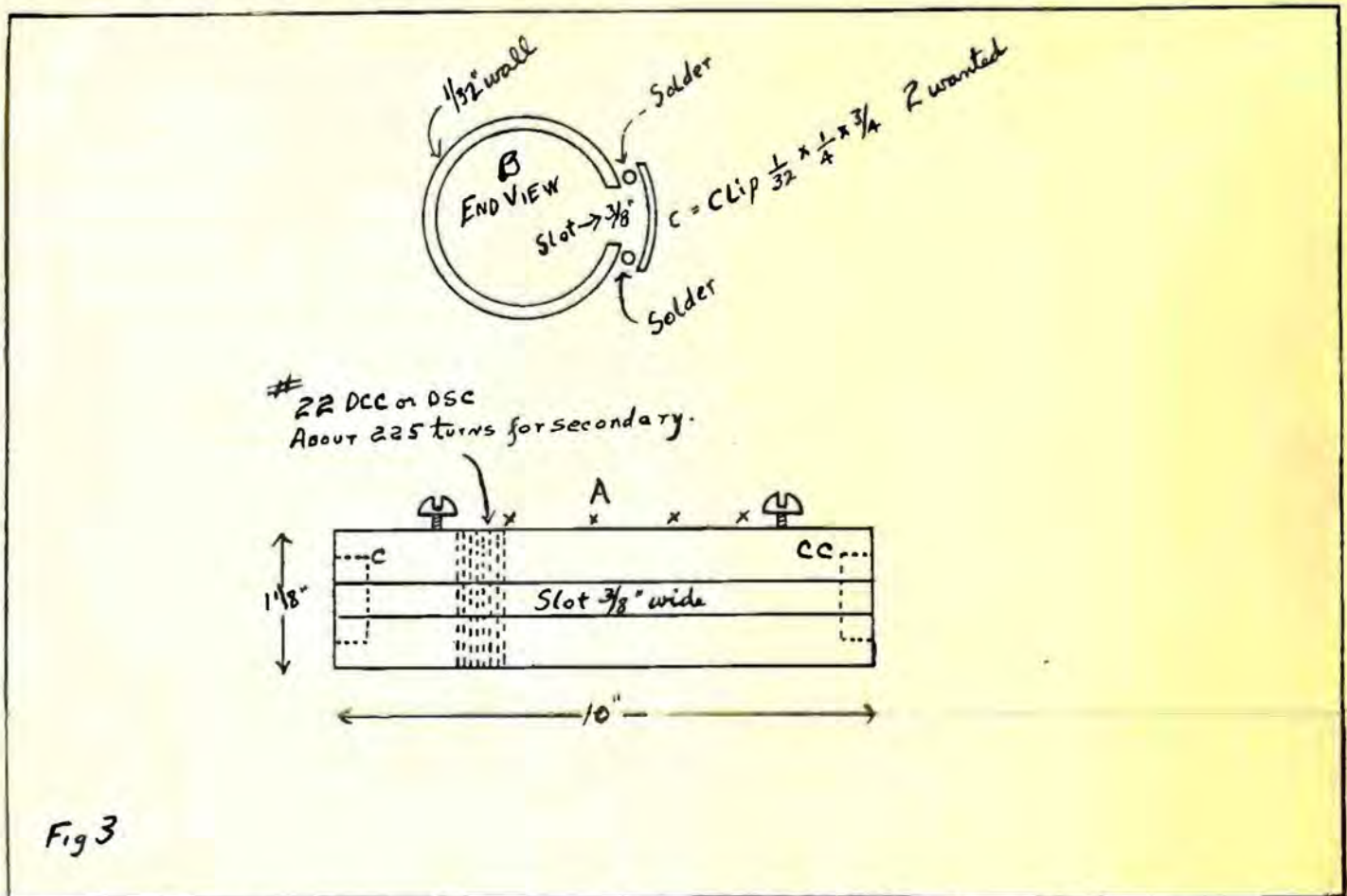


Fig. 3. The sketch shown above is furnished by H. J. Hughes and shows the manner of winding a doughnut coil. B is the end view. Full data is given in the text in this department. This data and that published in the August number should enable any of our readers to go into the subject thoroughly.

the joints after being soldered so no traces of rosin will remain.

Resistance coupled enthusiasts will find a world of opportunity for experimentation in the use of various values of leak resistances for the first, second and third stages of their resistance coupled amplifier. For this purpose a handy clip scheme may be employed, the clips being secured in sets from radio dealers. The clip idea may be used for the coupling condenser between the plate of one tube and the grid of the next, the value generally used being .006 mfd. Almost any of the square condensers will slip firmly into the clips. Then for the resistances there are clips into which you can put any desired value of resistor. The use of a bypass across the first 100,000 ohm plate resistor is advisable and for this purpose another clip may be used. Thus the whole affair can be changed in value at will and without the necessity of unscrewing binding posts or unsoldering lugs. The scheme is a handy one and should prove of real benefit to the insatiable radio tinkerer. We observe that Daven specifies 100,000 ohms for each of the plate resistors in the resistance coupled amplifier, while the grid biasing resistors are one megohm, 1-2 and 1-4 meg for the grids. Others have found that one megohm in the first, a half in the second and a quarter megohm in the third tube will work well. Rathbun, in his recent contribution on resistance coupled amplifiers, showed the 1 meg,

1-2 meg and 1-4 meg for the grid biasing. Generally the experimenter will arrive at his own conclusions regarding the values to be used. The use of a C battery in the last stage is generally advisable in order to bring the plate current value down to a reasonable figure. The biasing of the first and second stages is not absolutely necessary, though it may be done. The use of a small milliammeter in series with each plate as you advance across the amplifier will readily tell you the B battery current being used by each tube. This milliammeter may be rigged up with clips on a couple of wires so it may be clipped into any of the plate circuits of the amplifier and you readily tell what your plates are pulling. Too great a battery drain in the plate circuit is neither desirable nor economical.

After looking over patent papers granted by the U. S. Patent Office during the past few months we are convinced more than ever that the large companies in the radio combine are busy getting protection on everything that human ingenuity can devise. Judging from past performances there will be a number of battles-royal to finally determine the priority of certain ones, especially some of the patent applications made to cover schemes that have been in use for years but not actually protected by the inventor. In these cases it seems the judges take the attitude that if the original patentee has neglected to protect himself for any length of time in the past, he is

no longer entitled to protection so the invention may be used by all. The patent situation is one of the most complex ones in existence and the fact the radio game has gone into the billions merely makes the situation more intricate, involving vast sums of money to determine the worth of a contested patent. But we still need a good static eliminator or suppressor, so there is hope in the hearts of the experimenters regardless of the trials and tribulations of the inventor in search for adequate and complete protection.

Musically inclined fans might like to make a windless, pipeless, pipe organ, such as is described in this issue by J. C. Jensen. We have had several requests from readers for an audio oscillator and the article by Mr. Jensen fills the bill completely, we believe.

Work on short waves proves more and more the fact that eventually radio communication will be governed by wavelength for the various purposes desired. For example a 5 meter set is hard to hear across a city, or even a limited distance, yet it will put an awful signal into the ears of a listener a thousand miles away. So you may expect to see the longer waves used for the local or short distance communication and the shorter waves to drop your message into the lap of a listener at a distance without local interference. The study of short waves is quite interesting.

To unscramble
the stations



To get the
Finest Tuning



To
save your Tubes
and Batteries



AMSCO

The new AMSCO ALLOCATING CONDENSER

(STRAIGHT LINE FREQUENCY)

SPREADS the stations evenly around the dial according to their frequency in kilo-cycles. Eliminates the crowding on low waves and simplifies tuning.

And unlike previous S. L. F. designs, its "half-a-heart" rotor plates save space in the cabinet. Three sizes—single or Siamese.

The new AMSCO VERNIER DIAL

AS easily installed as an ordinary dial—and as easily manipulated. *But*—each turn of the dial is translated to 1/13th the motion—giving finesse to your fingers. A precision instrument, without momentum or back-lash. There is no vernier like it for distance-getting. Low in price.

The new AMSCO RHEOSTATS AND POTENTIOMETERS

NOTHING saves tubes and batteries like correctly designed, electrically efficient resistance instruments in the radio circuit.

Stromberg-Carlson, Freed-Eismann, Priess Radio and other builders of the highest type receivers have selected AMSCO. It will pay to investigate. Ask your dealer or write to the makers:

AMSCO PRODUCTS, Inc. Dept. P
Broome and Lafayette Sts., N. Y. City
Makers of the Melco Supreme Radio Receiver





No. 109

Save Your Tubes *

Don't burn them higher than the manufacturer's rated voltage: If you burn them too low you lose volume.

Use a Jewell High Resistance Volt Meter on Panel of your set and be safe. If you own a Radiola Portable Super-Heterodyne get our No. 109 Voltmeter Panel.

(Ask for our 15-B Radio Catalog)

Jewell Electrical Instrument Co.

1650 Walnut St. - Chicago
 "26 Years Making Good Instruments"

Reducing Electrical Interference

RADIO reception in some localities is seriously disturbed by interference arising from electrical apparatus in the vicinity. The only general remedy for electrical interference is cooperative effort, on the part of users of radio and owners of the electrical source's disturbance, to reduce or eliminate the causes of trouble, the Bureau of Standards points out.

Much of the work in reducing electrical interference also results in an improvement in the operation of the electrical devices or supply lines and is thus a double gain. There are, however, some electrical devices which, even when in perfect working order, cause disturbances resulting in interference with radio reception. But in many cases it is possible to provide filters, shields, chokes, etc., either at the source of disturbance or at the receiving set, which do much to relieve the difficulties.

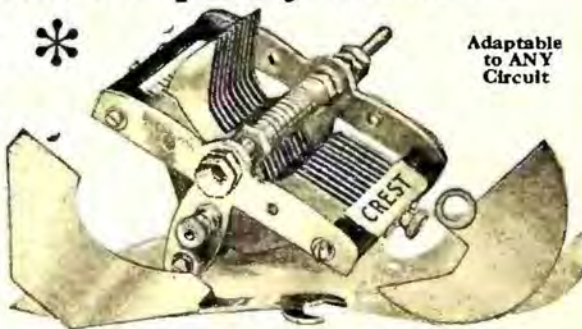
A frequent cause of interference is the presence of alternating-current power lines near the antenna or receiving set. Low-frequency voltages (usually 60 cycles) are induced and the resultant current flowing in the receiving circuit causes a "Humming" sound in the telephone receivers. A method of eliminating or at least reducing this interference is to place the antenna as far as possible from the lines and at right angles to them. When the interference can not be eliminated by such means, the choice of a receiving set may help. An inductively-coupled (two-circuit) receiving set may help. An inductively-coupled (two-circuit) receiving set is less susceptible to such interference than a single-circuit set. The use of one or more stages of radio-frequency amplification should also help to filter out the audio-frequency interference. It has been suggested that audio-frequency interference might be shunted around a receiving set having a series antenna condenser by connecting between the antenna and ground terminals of the set a high resistance, which will offer lower impedance to the audio frequency than will the receiving set itself.

Sparks are produced in the normal operation of many types of electrical apparatus such as motors, doorbells, buzzers, gasoline engines, x-ray apparatus, violet-ray machines, some forms of battery charges, rural telephone ringers, heating pad thermostats. They are also sometimes produced at defective insulators, transformers etc., of electric wire lines.

One remedy for such types of interference is to eliminate the spark. This is possible if the spark is an electrical leak and not necessary to the operation of the machine in which it occurs. Many very useful electrical machines, however, require for their operation the making and breaking of electrical circuits while they are carrying current and whenever this happens a spark is produced. It is impossible to eliminate these machines, so it is necessary to make the spark of such nature or so arrange the circuits that the radio-frequency current is reduced or prevented from radiating.

Straight Line Frequency with the exclusive convertible feature

The Crest is the *only* condenser which is convertible from 23 plates down to 2 plates; which is adaptable to *any* circuit; and which assists experimentation with short wave tuners and transmitters.



Adaptable to ANY Circuit

Crest Convertible Condenser

The following tests were made and approved by the Armour Institute and Popular Radio Laboratory.

Maximum capacity (with 23 plates) .0005
 Minimum capacity (with 13 plates) .000006
 Ohmic resistance .18 ohm above laboratory standards, due to special construction.
 The Crest is made of solid brass throughout.

and the quality and precision of workmanship is guaranteed.

If dealer cannot supply you, send your order direct to us with his name. Money refunded if not satisfactory.

Set manufacturers who wish to improve their sets should write for details and special proposition. Dealers and jobbers who have not investigated are invited to do so.

23 PLATE - - - \$5.00

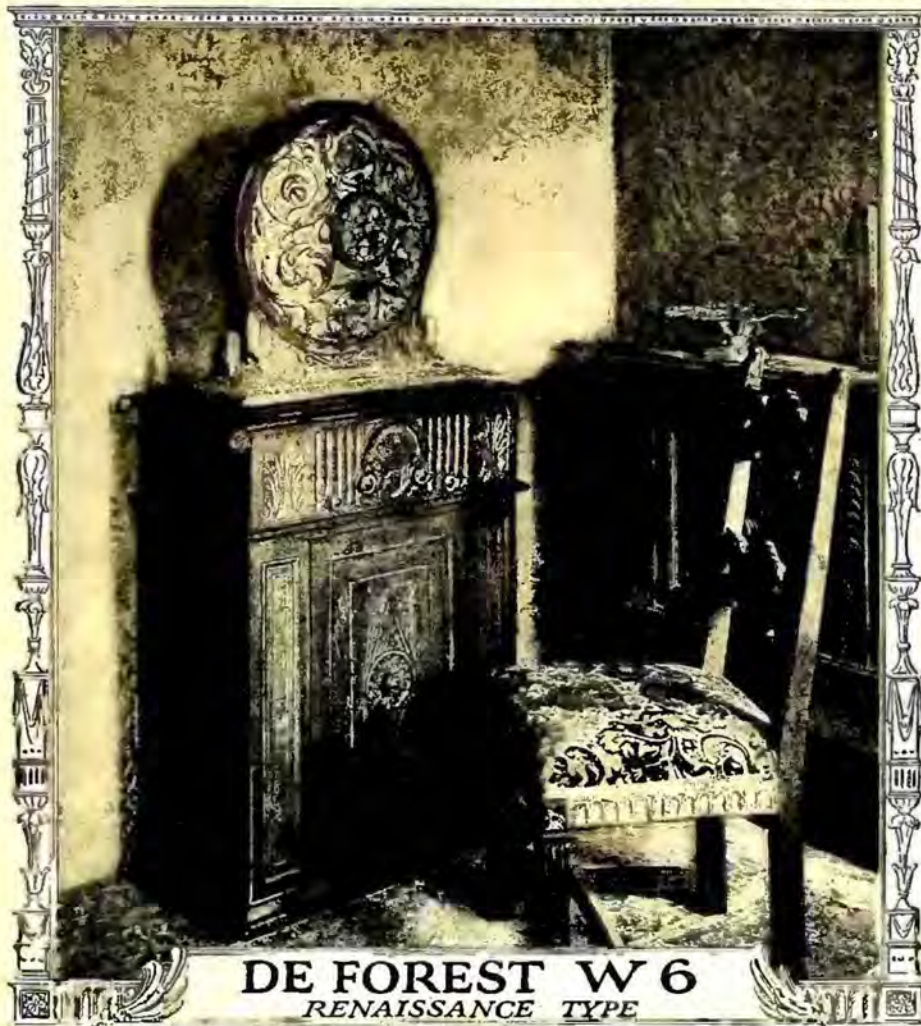
Nickel Silver Finish will never corrode

CREST RADIO CORPORATION 5 N. WABASH AVE. CHICAGO

\$3.50 Your Set will be Loud and Clear with **FLINT AUDIO TRANSFORMERS** From your Dealer or direct **FLINT RADIO CO.** 1872 Wilson Ave. Chicago

New radio catalog!! free **SAVE** on all the latest Standard Radio Merchandise. Our 1926 Beautifully illustrated Catalog—**JUST OFF THE PRESS** Rush your name and address and get also **LOG BOOK FREE** **ECONOMY RADIO SALES COMPANY** 288 6th Ave., Dept. C. New York, N. Y.

* Tested and Approved by RADIO AGE *



DE FOREST W 6
RENAISSANCE TYPE



DE FOREST AUDION
is the world standard in tubes. De Forest created the first successful radio tube, and his invention made broadcasting possible. The De Forest policy of a specific type tube for each socket insures finer reception and greater distance. Price, \$3.



DE FOREST F-5 AW
A compact, powerful set in polished walnut that will bring joy to many a household. Gives rich volume, and has the capacity to separate stations positively so that you can pick the broadcast gems without interference. Extremely easy to operate. Price (minus tubes, loud speaker and batteries) \$90.



DE FOREST F-5 M
A supreme 5-tube set in two color mahogany cabinet with built-in loud speaker and concealed compartments for "A" and "B" batteries. A great distance-getter, with uncanny power to tune in and out stations at will, and gifted with splendid tonal qualities. Extremely simple to operate. No howling or hissing in tuning in. An unsurpassed value at \$110.

De Forest Radio Sets can be bought at prices ranging from \$85 to \$450.

De Forest Genius now Humanizes Radio!

MARVELOUS new circuit, just perfected, reproduces flawlessly the mellow, soft modulations of the human voice and captures the hitherto elusive overtones of the musical register . . . tuning simplified . . . a new case in operation . . . all embodied in the new and beautiful De Forest W₅ or W₆ Radiophones.

The voice of radio is no longer flinty and metallic, but mellow, human and musical—thanks to the development by Roy A. Weagant, Vice-President and Chief Engineer of the De Forest Radio Company, of a new and marvelous circuit.

This ingenious circuit, and all the joy it means to radio lovers, makes its first public appearance in the De Forest W₅ and W₆ Radiophones, masterpieces of cabinet art worthy only of a scientific development so outstanding.

So wonderful is the reproduction of tone in the De Forest W₅ or W₆ that only the presence of the lovely instrument dispels the illusion that the living artist is in the rooms.

Piano chords come to you with their full rich resonance—true piano tone. High notes

dance, ripple and sparkle . . . clearly, distinctly . . . musically! Those brooding low notes, never caught in average reception, are heard distinctly—as though from the next room.

In the reproduction of orchestral music the full importance of the De Forest achievement stands out. For the first time you get the overtones as well as the middle tones . . . the majestic roll of the kettle drums, the crooning of the bass viols, the strident crash of the brasses and the piping heraldry of the cornets and trombones. A symphony orchestra heard over the De Forest W₅ or W₆ stirs the soul. No incoherence, no oscillating jumble of noise—every instrument, every octave, in its true value. *A magic achievement!*

To the lover of dance music the De Forest W₅ or W₆ brings more sprightliness, more beauties of syncopation . . . you should hear Vincent Lopez, Joseph Knecht, The Night Hawks, or any others over either of these instruments!

All the tenderness of song, every shading of the soprano's voice, all the pathos of the folk song—exquisite but elusive elements so much desired but lost in practically all present-day reception, are captured by these De Forest masterpieces.

To everything that is broadcast, the De Forest Radiophone gives animation, life and humanness.

But Tonal Supremacy is Not All—

Elbert McGran Jackson, renowned sculptor, architect and painter, put into this hand-wrought, hand-carved cabinet the spirit of radio, in design, in motif—it is not an adaptation of a phonograph. An image of charming individuality, it harmonizes with the setting of any home.

One unit, everything self-contained—not a wire in sight, nothing to connect . . . and portable; move it any place! Only charm and beauty for the eye.

The artistic conical reproducer is an inseparable part of the cabinet and its tonal mechanism peerlessly attuned to that of the Weagant circuit. There are just two controls for tuning, and these operate on one dial, which makes the normally perplexing task of "tuning in" extremely simple. There are special power tubes in the fifth and sixth sockets which can give you volume to flood an auditorium, if you desire it. And, at your fingers' tips, the means to tune in a far-distant station you want no matter how powerful nearby stations may be.

See the incomparable De Forest W₅ and W₆ at your De Forest dealer's or write for an interesting booklet describing these masterpieces in detail.

DE FOREST RADIO CO., Jersey City, N. J.

* DE FOREST The Greatest Name in Radio

DEALERS IN ALL CITIES AND RADIO COMMUNITIES
THE EPOCH-MAKING ACHIEVEMENT WHICH MAKES ORDINARY RADIO RECEPTION A THING OF YESTERDAY

For—
Real Enjoyment

No. 205



Burns
LOUD SPEAKER

Assures utmost in volume and clarity of tone—reaches full range of musical scale, giving a faithfulness of reproduction that equals hearing the original.

Flare in several handsome finishes.

Prices \$22.50 - \$25.00 - \$30.00

Manufacturers

American Electric

COMPANY
State and 64th Streets
CHICAGO, U. S. A.



\$3.25
per cell

RADIO
Storage "B" Battery

22 Cells Lasts Indefinitely—Pays for Itself
24 Cells 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., Lefax, Inc., and other important institutions. Equipped with Solid Rubber Case, an insurance against acid and leakage. Extra heavy glass jars. Heavy, rusted 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 in series (96 volts), \$12.75. 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. 112.55; 120 Amp. 114.55; 140 Amp. 118.00.
All equipped with Solid Rubber Case.

World FOR
STORAGE BATTERIES RADIO



KOKA - WEA - WGN - WJS - KHL - KSO - KFA - WJY - KOP

RADIO PARTS FREE!
Announcement in this
issue of RADIO AGE.

Some Facts on the Magnetic Theory

(Continued from page 21)

upon each other, and efforts have been made to so place the coils in the modern receiving set that the effect is reduced to a minimum. Various tests have proven that in two adjacent magnetic fields, the field of each is distorted, either pushed apart or drawn more closely together by the action of the other, depending on the polarity. An alternating current or varying current creates a vibration in the field.

In radio transmission the high frequency vibrations carried out by the transmitting aerial, located anywhere within the great magnetic field of the earth, tend to distort the field as in two small adjacent coils. This disturbance or vibration is carried out in all directions similar to the waves sent out from a disturbance on the quiet surface of a pond, or more nearly like sound waves radiating in all directions, even upward and downward through the magnetic lines of force. These vibrations cause a change in intensity of the earth's magnetic field in somewhat the same manner that sound waves cause a change in intensity of the air, each crest or wave being followed by a low or thin area.

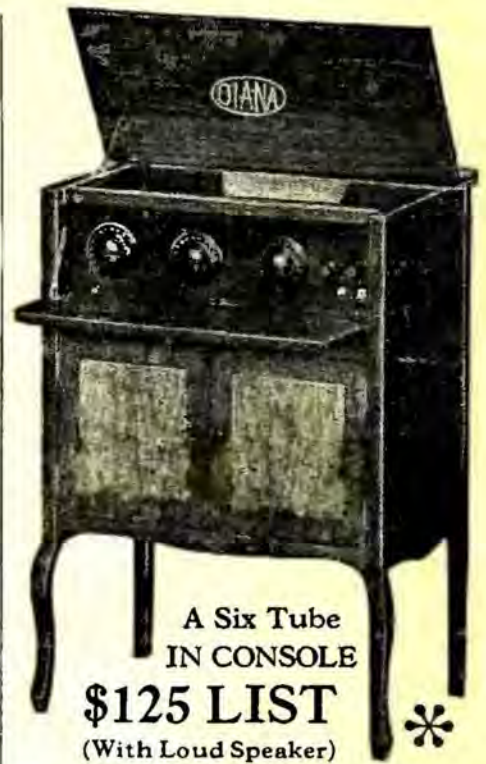
The magnetic field, like any other body, tends to remain at rest or in balance. As the wave progresses across any conductor, a small current is generated which tends to balance or overcome the effect of the waves, consequently the current generated is an exact duplicate of the originating current which started the disturbance. The aerial being a conductor is therefore charged with a current which tends to keep in balance the magnetic field surrounding it. This is the current detected by the receiving set and transformed into audible signals.

To Generate Electricity

IN generating electricity, engineers have learned that the coils in the generator must cut across or through the magnetic field of the generator in order to generate a current in the service lines. Radio experience has taught us that better results are obtained in reception if the aerial is strung pointing toward or away from the sending station sought. This is decidedly true of the loop aerial which must be in such a position that the oncoming wave or magnetic disturbance cuts directly into the plane of the aerial. If the loop were placed broadside to the oncoming wave, the change in intensity of the magnetic field surrounding the loop would be the same at all points around the loop; in other words, the magnetic field in the plane of the loop would at no time be out of balance; therefore no current would be generated.

A study of the earth's magnetic field discloses the fact that it is a constantly changing field due to outside influences, the principle one of which seems to be the sun. During the daylight hours we have the greatest changes. During any one hour between 8:00 a. m., and 5:00 p. m., there is a greater change in intensity and direction of the earth's magnetic field than during the whole of the night from 9:00 p. m., to 4:00 a. m. Every day there is a magnetic tide, or magnetic "wind" blowing, if it may be called such, which upon the setting of the sun calms down and almost ceases during the hours of darkness, only to rise again at dawn. We know by observation that sound is transmitted much easier and clearer on a

(Turn to page 62)



A Six Tube
IN CONSOLE

\$125 LIST

(With Loud Speaker)

DIANA "SIX"

A perfect set in a beautiful cabinet. A real six tube set. Two models. Cabinet Grand \$100 list. Console as shown above with loud speaker, \$125 list. A long distance set. Easy to tune.

Exclusive Territory Open

Write for Liberal Discount and splendid Sales Proposition. Booklet R-A upon request.

DIANA RADIO COMPANY
1429 So. Michigan Ave., Chicago

The Five Tube Set which startled the World!

FRESHMAN MASTERPIECE

The Greatest Value Ever Offered in A Radio Receiving Set

At Authorized Dealers

Read the Classified ads on page 79 for some real BARGAINS!

"Socket of Future" Claimed by Pacent

One of the interesting improvements in the development of radio reception is embodied in the new universal base that has been adopted for Radiotron vacuum tubes. It permits interchangeability, lowers the total capacity of any circuit, and increases the efficiency of the electrical contacting arrangement with the tube prongs.

The tube socket of the future will be a small bridge shaped article supporting a disc with four holes, similar to that which has been designed by the Pacent engineers. The contacts will be completely out of sight, but so arranged that they grip the sides of the tube prongs with firm side contact.

The new socket designed by the Pacent engineers is constructed of Isolantite. This material has been found practically ideal at radio frequencies with negligible dielectric loss, which, coupled with the small amount of metal required in the contacting devices of the socket, reduces the capacity effect between grid and plate thus making the radio frequency circuits far more stable in operation than has been the case with the older type of tubes.

Probably the most important advantage of the new type tube base is that it permits the design of a socket with a one piece contact in such manner that when the connecting wire is soldered, a continuous circuit connection throughout is established. This alone is a great advance in efficiency.

The Humble Rheostat is Worthy of Praise

Little and much can be said about the humble rheostat that hides behind the front panel of our receiving sets. Seldom seen, and soon forgotten, this important piece of apparatus opposes the flow of electricity to the filaments of the vacuum tubes while the set is in operation.

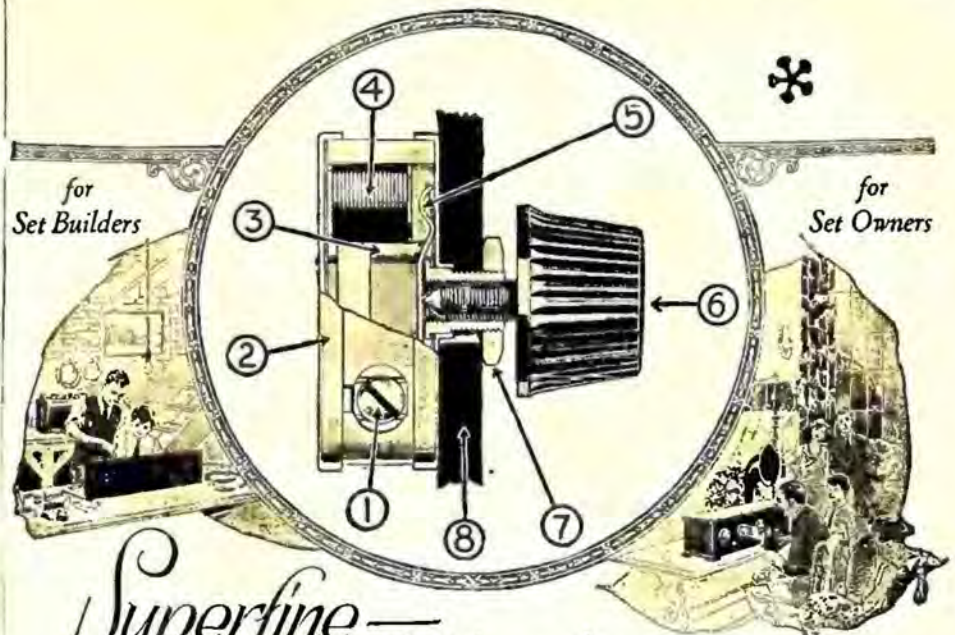
Without a rheostat the filaments would soon become damaged beyond repair, due to too much current passing through and causing the thorium coating to disintegrate and flake off. This is an every day occurrence where the rheostats are turned on too far and is the principal reason for so many tubes going "dead."

In the struggle to oppose the flow of current, the wire becomes warm, even hot if the tube requires considerable "juice." As the temperature of the rheostat rises it causes the wire to expand. If the wire becomes hot enough to char the insulation on which it is wound, it becomes loose, the wires touch each other, and the rheostat loses its smooth operation and trouble begins.

It is for these reasons that the new Frost rheostat has extra heavy wire on a strip of insulating material, the whole being in a moulded bakelite frame. Heat will not ruin the rheostat by changing the shape of the insulating strip of the frame, and one can be assured of faithful service from this part of a radio set.

WHO GETS IT?

The Radio Age Receiver—the most talked-of set of the year, will be given away at the Chicago Radio Show in November. Who will get it? You have a chance! See page 20!



Superfine — in finish and performance

WHETHER you build your own radio receiver or buy a factory-built set, you will improve your set by installing Allen-Bradley Perfect Radio Devices. Not only are Allen-Bradley Radio Devices strikingly beautiful in finish and design, but their marvelously silent, selective control never fails to amaze and delight you. The eight salient, unrivaled Allen-Bradley features are:

- 1 Terminals are readily accessible. Designed for bus bar wire or terminal lugs.
- 2 Metal parts are heavily nicked and buffed to a high polish.
- 3 Container is made of glazed porcelain that excludes moisture.
- 4 Specially-treated graphite discs give amazingly wide and noiseless control.
- 5 Internal switch opens battery circuit, if desired, by turning knob to the left.
- 6 Highly polished bakelite knob is removable if you prefer to match other dials.
- 7 One-hole mounting makes installation simple and easy on all sets.
- 8 Can be used with any panel thickness. Back panel extension is extremely small.

Mail the Coupon for Booklet

Allen-Bradley Co.

ELECTRIC CONTROLLING APPARATUS

289 Greenfield Ave. Milwaukee, Wis.

Mfrs. of Graphite Disc Rheostats for over 20 Years

Bradloystat—Perfect Filament Control for all Tubes



Bradloyleak—Perfect Gnd Leak 1/4 to 10 Megohms



Bradloyohm—Perfect Adjustable Resistor



Bradleyunit—Perfect Fixed Resistor



Bradloyometer—Perfect Potentiometer

USE ALLEN-BRADLEY PERFECT RADIO DEVICES

ALLEN-BRADLEY CO.,
289 Greenfield Avenue,
Milwaukee, Wisconsin

Please send me your latest literature on the complete Allen-Bradley line of Perfect Radio Devices.

Name

Address

Secretary Hoover Faces His Big Task

(Continued from page 32)

a legitimate and a valuable purpose to the listener before we allow him to further congest the overcrowded lanes.

But above all we must not crystallize things into law which will impede the development of the art. Any day may see discoveries which may simplify the whole of our problems of congestion. And in any event the undoubted improvement in our sending and receiving sets every year contributes to widen the paths through the air. We have great unsolved problems in the amount of power necessary to give real service to listeners even against opposition of static and summer conditions and without adding still further congestion and interference.

We have all watched this industry grow from the curiosity of a scientific toy to a communication system now well nigh universal. It is better and greater than it was a year ago.

So great has it become in service that I believe it would be almost possible in a great emergency for the President of the United States to address an audience of forty or fifty millions of our people. It is bringing a vast amount of educational and informative material into the household; it is bringing about a better understanding amongst all of our people of the many problems which confront us; it is improving the public taste for music and entertainment; it is bringing contentment into the home. We are at the threshold of international exchange of ideas by direct speech, and it will bring us better understanding of mutual world problems.

Only over-optimistic prophets would attempt to predict radio advance. One thing we are sure of—that the radio industry is only in its youth, that it will continue to grow with increasing strength. If it will succeed it must continue as in the past to devote itself to actual public service to which it is already dedicated.

Getting the Farmer to Buy a Radio

(Continued from page 28)

25 per cent being willing to buy. How owners make use of sets—83.97 per cent reported they make use of radio weather reports; 80.98 per cent use the market reports; 70.92 per cent said they did not object to advertising over the air, 94.96 per cent declared they were satisfied with local programs.

What kind of programs does the farm family like?—Market reports was voted for by 143 farmers out of 427 as the most popular program for the man of the house, and 114 voted for the crop service. Jazz orchestras came third, popular songs fourth, informative talks fifth and religious services sixth. Classical and operatic music are not in the running, so far as the man of the farm is concerned. Popular songs were voted first by the majority of farm women, with religious music second, informative talks third, religious services fourth, jazz orchestras fifth and classical music sixth. (Copyright by McGraw-Hill Co.)

MEETING POPULAR DEMAND



5 ampere
Tungar
in a new
model!

The new five ampere Tungar—at the same price as the old—means a quick charge of all kinds of storage batteries.

- It is more silent than ever.
- It cannot burn out Radiotrons.
- It cannot create radio interference.
- It is ideal for auto batteries—and charges 2 to 6 volt radio "A" batteries, or 24 to 96 volt "B" batteries, in series—all without attachments.



The Tungar is a G-E product developed in the great Research Laboratories of General Electric.

Two ampere Tungar
(East of the Rockies).
\$18.00

Five ampere Tungar
(East of the Rockies).
\$28.00

60 cycles—110 volts

Tungar
REG. U.S. PAT. OFF.
BATTERY CHARGER

TUNGAR—a registered trademark—is found only on the genuine. Look for it on the name plate.

Merchandise Division
General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

DEALERS BIG DISCOUNTS

Radio's biggest season is here. Get our new catalog showing huge stocks of radio parts, sets, kits at lowest rock-bottom prices. Quick service. Wonderful special offer on best sets, tubes, batteries. Write for free copy.

W. C. Braun Co., 34-50 S. Clinton St., Chicago, U. S. A.



NO MORE LOOSE CONNECTIONS X-L PUSH POSTS

A binding post that really does excel, looks, action, service, and convenience. Push it down—insert wire—cannot jar loose from vibration. No screwing or danger of shearing off wires. Furnished attractively plated with soldering lug and necessary markings.
Price Each 15 Cents
X-L RADIO LABORATORIES,
2424 Lincoln Avenue N. Chicago

Big Money in Radio

Demand for high pay radio men is so great that a big Kansas City wholesale concern is now fitting men free to get into the radio business for themselves and make \$60 to \$200 a week without any capital invested. Select territory open. Send today for free catalog and amazing offer. Write direct to Mr. H. J. Saizow, Standard Radio Co., 1424 Walnut St., Kansas City, Mo.

TO THE MAN WITH AN IDEA

I offer a comprehensive service. If you have a new invention, I will assist you in obtaining a patent. Write for further information: RICHARD N. OWEN, PATENT ATTORNEY, OWEN BUILDING, WASHINGTON, D. C.

* Tested and Approved by RADIO AGE *

Spanning the U. S. with Low Power

(Continued from page 24)

the transmitter. Rheostat R-2 has 10 ohms resistance, for the two "A" tubes employed in the receiver. Both tubes are supplied with voltage from the 45 volt tap on the "B" battery.

Such an outfit might well be laid out on a fairly large table, with plenty of separation between transmitter and receiver but with short leads to antenna and counterpoise. The batteries could be placed on the floor underneath the set. The "B" battery used for the sending outfit ought not to exceed five "heavy duties" and can well get along with three of them.

The constructional data is given in rather sketchy manner, but is sufficient for the man who has had some experience with amateur apparatus and who knows, for instance, which side to connect the rotor plates of the variables, that the tickler and primary go at the filament end of the receiver secondary coil, etc.

Other transmitting circuits may be used, of course. In getting results, most of the work must be done in daytime, as it is then that fewest stations are on the air. Patience is also necessary, but once the "ham" gets into communication with a few stations, more follow rapidly. It is best to answer "CQ" calls that are given on about the same wave as the transmitter, as it is in that wavelength vicinity that the distant fellow is going to listen first for a reply.

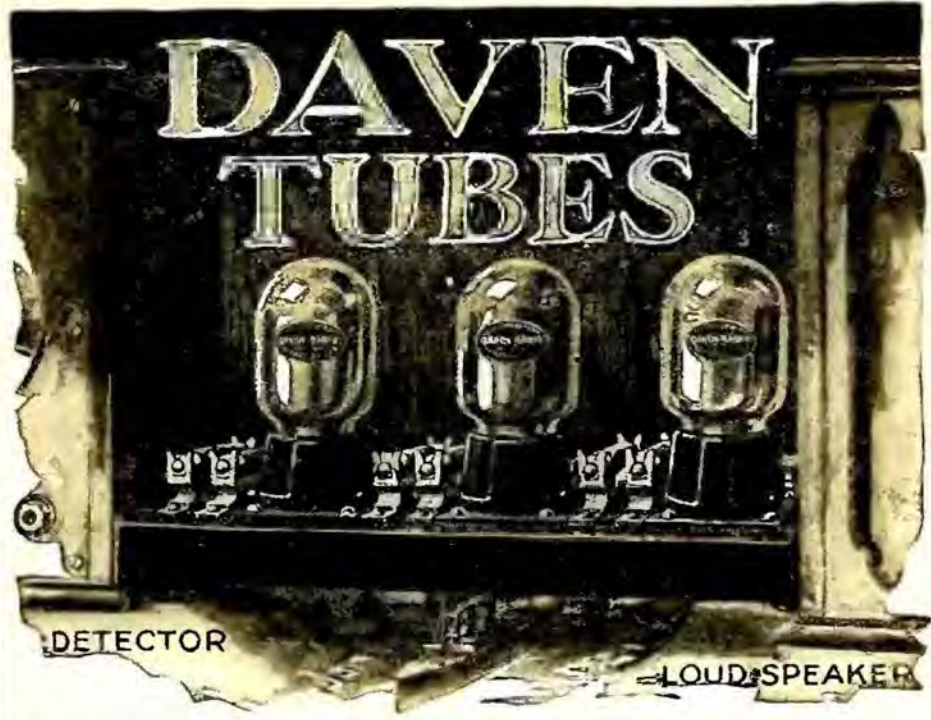
Clearing Up the Ether Started at Last

(Continued from page 22)

the St. Paul Gas Light Company, the Northern States Power Company, the Twin City Rapid Transit Company, the Northwestern Bell Telephone Company, the Tri-State Telephone Company, the Twin City Radio Club of Amateurs, the Chief Engineer of the Gold Medal Radio Station and the President and Secretary of the Northwest Trade Association. This committee has held six meetings. The speaker has acted as Chairman. So far, our effort has been concentrated on securing a classification of the various types of interference. This has been quite a task. In addition, the Northwest Radio Trade Association has circulated blanks among its members which may be used by broadcast listeners for reporting cases of interference. These blanks have been drawn up in such a way as to discourage indefinite, vague complaints, but to adequately take care of intelligent ones.

"Having taken steps to classify inductive interference, and to determine just what types of interference exist, the Twin City Inteferece Committee is now confronted with the task of finding means whereby interference can be minimized. Complete information giving location of specific cause of interference, caused by defective equipment, will of course be acted upon immediately by those owning and operating such equipment. How-

(Turn to page 55)



The Bridge to Amplification Without Distortion *

Daven engineers were pioneers. They blazed the way for others to follow. They designed and built the first Resistance Coupled Amplifier offered the public. They found resistance coupling in an experimental stage. They perfected it.

Daven Resistance Units, Amplifier Kits and Super-Amplifiers are accepted by the foremost authorities in Radio as standard. The Daven Super-Amplifier, for use in any known set or circuit, is priced at \$15.00.



RESISTOR MANUAL

Manufacturers of high grade sets are turning to Resistance Coupled Amplification. The authority is *The Resistor Manual*. At your dealer's, 25c; or by mail, 30c.

A NEW TUBE BY DAVEN

To meet the exacting requirements of Resistance-Coupled Amplification the Daven Radio Corporation has created a new product, the DAVEN HIGH MU VACUUM TUBE, Type MU 20. It is designed for one specific purpose only—to increase the amplification of the Daven Resistance Coupled Amplifier so as to exceed that of ordinary audio frequency coupling. *The Daven High Mu* is a 6 volt, 1-4 ampere tube with an amplification constant of 20. The price is \$4.00. *Daven Power Tube Type Mu 6* is recommended for last or output stage. Price \$5.00.

Daven products are sold only by good dealers

The Sine of Novel
DAVEN RADIO CORPORATION
Resistor Specialists
 NEWARK Reg. U. S. Pat. Off. NEW JERSEY

H-11-25

CLIP THIS COUPON

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THE BARAWIK CO.
RADIO TUBE
100-128 S. Canal St., Chicago, U. S. A.

Standard Radio Receivers

Some time ago 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 a keen interest in this new feature, and accordingly it is being made a feature of all 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.

The "Why" of The Audiola Receiver



Proper Balance of Parts a Feature



TO GIVE the best results, a radio set must be built of parts designed especially for use with each other, so that there will be a balance between them. This relationship between coils and condensers is especially important. Audiola manufactures their own low-loss, dust-proof condensers and low-loss coils, so that there will be a perfect balance between the two.

They also manufacture low-loss sockets which are used in all Audiola Radio Receiving Sets.

An efficient circuit, such as is used in the Audiola "Big Six" and the Audiola "Sealed Five," high grade balanced parts, skilled, conscientious workmanship, and careful inspection inevitably results in high grade radio receiving sets.

Specifications "Big Six"

Six tube tuned radio frequency set with power amplification.

Panel—seven by twenty-one inches, Walnut finish.

Sub Panel—Walnut finish covering practically entire interior of set.

Cabinet—genuine Walnut, beautifully finished.

Rheostats—(3) one each for radio frequency tubes, detector tube and audio tubes.

Transformers—three of Thordarson make or equal, one stage of audio plus power amplification.

Coils—spider web, low-loss, of Audiola manufacture.

Condensers—dust-proof, low-loss, of Audiola manufacture.

Sockets—low-loss, of Audiola manufacture.

Wiring—first made mechanically self-sustaining and then soldered.

Circuit—standard tuned radio frequency type, with addition of power amplification.

"Sealed Five"

Five tube tuned radio frequency set.

Panel—eighteen by seven inches, Walnut finish.

Sub-Panel—Walnut finish covering practically entire interior of set.

Cabinet—beautiful Walnut finish.

Rheostats—(2) one for detector tube, and one for radio and audio tubes.

Transformers—two of three-to-one ratio of All American make or equal.

Coils—spider web, low-loss, of our own manufacture.

Condensers—dust-proof, low-loss, of our own manufacture.

Sockets—low-loss, of our own manufacture.

Wiring—first made mechanically self-sustaining and then soldered.

Circuit—standard tuned radio frequency type, revamped to eliminate oscillation or howls and to give more "pep" than the usual five tube set.

(Turn to page 56)

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Our unique home-study course in practical radio engineering makes you an expert quickly. You devote spare-time hours to intensive study of world's greatest science. We show you how to wire as you learn, to get into the big-pay field on the ground floor. Full equipment furnished free, including Superdoo Twin radio set. Our training is superior for you learn to make money from the start. **LEARN HOW TO GET THIS COURSE FREE**

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Laboratory Product

CRESCENT LAMITE RESISTANCES

Insure Distortionless Amplification and a clarity of tone not obtainable through any other resistances. All capacities 12,000 Ohms and up. List price \$1.50. Special sizes to order. Write for full information.

Crescent Radio Supply Co., 5 Liberty St., Jamaica, L. I.

(Continued from page 53)

ever, the task of locating the exact source is often a long and tedious one. The public utilities of the Twin Cities have already individually devoted much time and money to this problem in spite of the fact that many times after extensive search, they find that the interfering device is neither owned nor controlled by them. The Northwest Radio Trade Association contemplates the establishment of trouble shooting service to assist in the work already so ably initiated by the public utilities. It is only by such whole-hearted co-operation as I have outlined that we can arrive at the ultimate solution of our problems in inductive radio interference.

"Neglecting radio interference, there are three factors which determine whether or not reception from a given radio broadcasting station can be made satisfactory at a given location. These factors are: The intensity of the received signal, the intensity of static, or atmospherics, and the intensity of inductive interference. In discussing these factors, the terms 'signal level,' 'static level' and 'interference level' may be applied to the average conditions existing at a given location during a given period of time. With modern efficient amplifying receiving equipment, it is not the actual levels of these three factors which are important, but their relative values. A signal from a broadcasting station can easily be amplified to satisfactory intensity, providing the ratio of the signal level to the static and interference levels is sufficiently high. If this ratio is not sufficiently high, satisfactory reception cannot be obtained.

"During the summer months, the static level is usually much higher than the inductive interference level, and consequently it is static which limits the reception of distant stations. Man has not yet found a satisfactory method of controlling the static level. During the winter months, the static level drops almost to zero and consequently it is the interference level which limits reception. It is therefore but natural that we should hear more about inductive interference in the winter than in the summer time.

"The time is not far distant when we must determine just how much right to protection from inductive interference the user of an ultra sensitive receiving set is entitled to. If, in any community, we succeed in lowering the interference level to a given point the users of sensitive receivers immediately increase the amount of amplification in use until the same interference level exists in his mind, as before, and the same problem arises again.

"My experience in the radio communication field has led me to the conclusion that there is no other field, where the need of co-operative effort directed towards the solution of common problems is greater. It is only by bearing constantly in mind the necessity for co-operation with our fellow men, that we can arrive at satisfactory solutions of all of the problems which today confront the radio industry and those associated with it."



Distortion



Perfection

Where is the difference in radio transformers?

THE audio frequency transformers in your radio perform a most important duty. They aid in increasing the volume of sound . . . in building it up to the desired strength. BUT—

When sound is increased, the tendency is toward distortion. That's where the difference comes in transformers. Inefficient transformers will give distorted reception, just as a defective mirror will show a distorted image.

Whether you are building a set, or buying one, be sure about the transformers. No radio, remember, can be better than its transformers. A safe guide to follow is the Jefferson trade mark. You can depend on quality in performance when the name "Jefferson" is on the product.

Jefferson Transformers are made by transformer specialists—the world's largest manufacturers of small transformers. There is a very definite reason why leading radio engineers specify "Jefferson." You'll find it in the clear, sweet, life-like amplification which Jefferson Transformers give. Sold by the better dealers, used by leading set manufacturers.

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World

The New Model L-3 Ultradyne

By The Experimenter
(Continued from page 54)



I HAVE had before me a cabinet of pleasing appearance. It looks well from all sides but it is the front that holds the eye. Besides being a thing of beauty, it is different. It might or might not be taken for a radio set; at least it does not resemble the sets one is used to seeing. I took it for a cabinet type loud speaker until I was told that it was a full fledged radio set with a built-in loud speaker and everything.

This was the new Model L-3 Ultradyne and R. E. Lacault is the man who developed it. I thought back to the time he first introduced the original Ultradyne Receiver to the radio public, who accepted it with confidence and who now remain to praise it. And I have thought since that whatever fame Mr. Lacault has gained in the past will be small compared to that he will gather in the future.

I couldn't help but form a contrast at the time for it came to me that the new Ultradyne no more resembles the old type than the original Edison Talking Machine resembles the present day Victrola. This contrast entered my mind first, I believe, because the mechanical appearance of the usual type of radio set has been entirely removed from the new Ultradyne. It is more like a nice piece of furniture than an electrical instrument and from its beauty of type and broad adaptability to design, I would say that one could put it where one pleased without the slightest worry of its clashing in any way with the scheme of a room.

General Refinements

The front view photograph of the new Ultradyne shown herewith reveals more than words possibly could, still there is much that cannot be seen well and quite a bit that cannot be seen at all, so a description is required if I am to do the set justice.

First of all, let me say that the set is as near to being automatic in operation as is possible to make one under present limited circumstances. I believe this to be true under the consideration that there are three stages of radio frequency amplification to contend with. And doesn't it look automatic if we judge by the absence of knobs and dials? There is a small knob, placed at the lower right of the cabinet front, but it has nothing to do with tuning. Rather, it controls

the volume. When turned full to the left it cuts off the current to the filaments of the vacuum tubes and this is all that is necessary to do to "turn things off." A small jack at the lower left on the cabinet front balances up with the volume control and is there should you care to use head-phones.

This set, being knobless, is also dialless, though there is a large but unobtrusive scale bordering the circular grill, in the center. This scale is the determining factor for all stations one wishes to receive. There are no wavelength, frequency or station markings on this scale whatsoever. Who would desire to mark a fine piece of furniture or a phonograph with numbers or letters, done free-hand, excepting for the moment that there was some reason for doing so, when the manufacturer could have provided other and simpler means in the first place? In other words, why make it necessary for the owner to detract from the beauty of a radio set made to be beautiful when a simple chart can be provided to do the trick just as well and just as rapidly? That is the system worked out for the new Ultradyne. There are two levers, which are out of sight, but whose ends terminate in convenient grasping handles.

Their path is along the large scale. They are the station selectors and it's as simple as falling off a log to handle them. There is no "cramping" of stations within a few degrees on the scale, nor any of the usual critical adjustments found necessary in the common type of receiver. All you have to do is to grasp the lever ends and move them down slowly until you have the station you want.

Another feature of the new set is the position of the loud speaker. It's right in front of your nose so to speak, or to be more specific, directly behind the circular grill. This grilling, by the way, is given a statuary bronze finish and is backed by a screening of dull gold. The whole blends well with the cabinet which is made of five ply mahogany veneer with a two tone line cutting.

Technical Specifications

The new Ultradyne employs six tubes of the storage battery type, three of them, as mentioned before, functioning

(Turn to next page)



Adjustable to any position
Wiring always taut
GUARANTEED FOR A LIFETIME

The Aalco—the lowest resistance loop made—assures maximum selectivity and range, and perfect dial matching made possible by variable inductance. Constructed of the highest grade materials in a new and masterly design. Length, 24 in.—Normal III 30 in.—Wavelength range 150-600 meters. LABORATORY TEST RESULTS UPON REQUEST.

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as radio frequency amplifiers, the fourth as the detector and the last two as the audio frequency amplifiers. Two of the radio frequency stages are tuned, while the third stage is fixed. In connection with the radio frequency amplifier unit Mr. Lacault has killed two birds with one stone. The "stone" amounts to two resistances included in two of the grid or input circuits of the radio frequency tubes. They prevent these circuits from oscillating or "spilling over" at resonance points and at the same time actually increase the selectivity of the entire radio frequency amplifier.

Then, there is the matter of the condensers employed in the new Ultradyne that have made the improved tuning system possible. They are the now well known Ultra-Lowloss variable condensers with a "straight line wavelength curve." With such a type condenser, the wavelength is distributed evenly over the entire scale reading; that is to say, one hundred meters or so are not crammed in a relatively small space on the scale. Thus, cramping of stations within a small degree reading is eliminated.

In the new Ultradyne the loud speaker unit is electrically matched with the audio frequency amplifier so that the impedance of both is the same. This does wonders yet there is nothing so complicated about the system; it comes to me, in fact, that there is nothing complicated about any of the little schemes Mr. Lacault works out. He seems to have the faculty of solving an abstruse problem in a very simple way. The volume is as much as any normal soul would ask for. The set will not entertain the people on the next block, perhaps, but then it is not built to be a public address system.

I think I have mentioned that the new Ultradyne is self contained. The "B" batteries fit in the cabinet to the side of the instrument framework and connect to binding posts on the side of the sub-base which carries the vacuum tube sockets and automatic filament controls. Four posts are mounted to the rear of this base for the "A" battery, aerial and ground connections which are run to them through holes in the rear of the cabinet.

A Resistance Coupled Amplifier

The Allen-Bradley Company of Milwaukee has developed a Resistance Coupled Amplifier that amplifies all tones proportionately and does not distort. The Bradley-Amplifier, as it is called, is compactly designed and so small in size that it may be conveniently installed in place of transformer-coupled amplifiers in factory built sets. All wiring, resistors, and condensers are contained in a highly polished Bakelite base. Only the tube sockets and terminals extend above the base.

The resistors used in the Bradley-Amplifier are Bradley-units (moulded resistors). Since Bradley units are impervious to moisture and atmospheric changes, and are not affected by age or service, the Bradley-Amplifier retains its marvelous tone quality even after many years of service. All joints inside the Bradley-Amplifier are soldered to assure perfect contact. The tube sockets are designed to hold the new UX tubes as well as tubes of the UV 201-A type. Only the UV-199 tubes require an adaptor Tube contacts are silver plated, and so designed that positive contact is assured.

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The only Tuned Radio Frequency Kit of which the secondary unit is of exact and equal inductance value.

NOW you can build a set and have all three tuning dials tune exactly the same—or, you can build a one control set using a gang condenser and know that it's going to work right. AERO Coils are matched!

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Makes an exceptionally efficient wave trap for crystal set - \$4.00



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Tremendously increases the efficiency of the oscillator circuit in any Super Heterodyne receiver \$5.50

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A five tube, improved tuned radio frequency receiver, known as the RADIO AGE MODEL RECEIVER, to be described in the December RADIO AGE, will be given away at the Fourth Annual Radio Show in Chicago during November. See details on page 20, this issue.

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WITH THE MANUFACTURERS



Fans—Here's the Amsco

The Amsco Compensating Condenser is a three electrode Condenser and is so designed that it will not detune the radio-frequency transformers while adjusting to eliminate the feedback or regeneration.

The Amsco Compensating Condenser is mainly constructed for the purpose of balancing the grid charge on the Amplifying Tubes. It stops all local oscillations without detuning the amplifier. It is shielded against hand capacity disturbances. It makes it easy for the operator to find the correct capacity because of the circuits always being tuned. It is the third electrode in the Amsco Compensating Condenser that makes this a clean-cut and straightforward adjustment.

The compensating condenser for the last stage in particular may be varied so that the receiver can be used efficiently for C. W. reception, or it may be only slightly unbalanced so as to give sharper tuning characteristics to each stage in the set.

The ideal set using tuned radio-frequency transformer amplification must have a variable compensating condenser in order to eliminate the regeneration due to tube capacity.

The "V. T.-1" or "J" tubes have nearly three times the capacity between the grid and plate than the Radiotron tubes have so that a greater variation is necessary.

Radio Battery Cable Made by Belden

The Belden Manufacturing Company, 2300 South Western Avenue, Chicago, Illinois, has recently placed a battery cable on the market that is very similar to the well known and universally used Belden Radio Battery Cord. It is supplied in 100 foot lengths on spools, or 200-foot lengths in coils, and can thus be cut to any special length that the occasion requires.

The cable consists of 2 No. 16 B. & S. stranded and 3 No. 20 B. & S. stranded copper conductors, each rubber covered and insulated with individually colored cotton braid, coded in accordance with the standard of the A. M. E. S. The entire unit is then encased in a heavy, black, glazed cotton braid cover.

The cable is used when it is desirable or necessary to isolate the batteries from the set, by placing them in the basement or in a similarly remote location. The difficulty usually encountered in tracing a maze of tangled, unsightly wires from battery to set is thus eliminated. The colored tracers simplify the checking of connections and insure absolute accuracy in the hook-up. Blown-out tubes, crossed wires, short circuits and wrong connections are entirely disposed of by the use of this cable.

Describing Eagle Radio Co.'s Latest Neutrodyne

The Eagle Radio Company's new neutrodyne receiver is twenty-two inches long, eight and three-quarters inches high. The black Bakelite panel is finished with gold trimmings and lettering. The battery switch and phone jack are also of gold. The set is designed to operate, with five 201 A or 301 A tubes, or with four 201 A or 301 A tubes and one power tube.

Other striking points of improvement in the new Eagle model F, are, first: radio frequency coils.

These coils are a radical departure from the conventional type. The wire on both primary and secondary is space wound on very thin cylinders of cellulose acetate. The high frequency resistance and distributed capacity is lower by actual measurement than on any other type of commercially adaptable coils. This means a greater ability to receive stations on the lower wave lengths than we have hitherto been able to accomplish in any neutrodyne receiver.

Second is volume control. Instead of a switch which changes from first stage to second stage, the Eagle model F resistance is across the secondary to the second audio frequency transformer. This permits a gradual regulation of volume instead of the two jumps which is obtained with a switch. This resistance also acts as a protection to the quality.

In the model F the rheostats are changed so that one controls the radio frequency tubes and the other the audio frequency tubes. The detector has been placed on an automatic filament control. With this change the sensitivity and clarity can be adjusted to the best point much more easily than previous rheostat systems.

The dials, which are of Bakelite, have been changed to the concealed type and geared down to a 5 to 1 ratio making fine tuning very easy.

The company has an exceptionally fine line of consoles in either mahogany or walnut finish with battery compartments, and built-in loud speaker horns.

J. L. Polk Designs a Binding Post

Somewhat on the order of a spring binding post is the latest product turned out by J. L. Polk, 443 South Madison Ave., La Grange, Ill. The binding post which was submitted has been tested and approved by the RADIO AGE Institute.

THE LEADER OF THEM ALL!

**The New Radio Age Receiver—
in December**

Saturn Co. Puts Out Extension Cord Connector

Radio, having passed the experimental stage, progressive firms like the Saturn Mfg. & Sales Co., of 48 Beekman Street, N. Y. City, are concentrating on equipment to eliminate the unsightliness of connections and are producing parts that are good to look at as well as useful.

One of the latest products of this firm is The Saturn Extension Cord Connector with which owners of receivers may move their ear phones or loud speakers to different parts of the house or rooms. In case of illness, the chap who must stay in bed for a time, need not be deprived of the pleasure to be derived from the air programs; also, the family at dinner can bring the metropolitan orchestra music right up to the table. There are numberless ways in which this latest addition to radio will be a help and advantage to the fan.

The Saturn Connector is of hard rubber, neatly constructed, with the positive and negative cords in different colors, easily differentiated, and terminals that fit snugly into place. With this connector, and as many extra feet of cord as are desired, a very neat looking extension can be made.

Connewey Now Located in Magnatron Bldg.

The Connewey Electric Laboratories have taken possession of their mammoth new fireproof and sanitary plant at 406-408 Jefferson Street, Hoboken, New Jersey. The structure will be known as the Magnatron Building. The building has been entirely reconstructed to fit every detail in the manufacture of Magnatron Tubes and will vastly increase production.

The New Magnatron Plant has been almost entirely refitted. New machinery was installed in every department and the latest appliances necessary for the manufacture of their product were purchased. Everything was done to make the structure one of the most modern of its kind. Clean, wholesome working conditions and plenty of room to do efficient work has been provided for the employes.

To the Connewey Electric Laboratories goes the honor of being the first to develop a vacuum tube especially for B Battery eliminators. This new tube, known as the "REX," has proved more than successful in a series of exhausting tests conducted at the new factory and in outside laboratories.

The "REX" is manufactured with a standard bakelite base, so that it will fit all present standard sockets. The bulb itself is round in shape and of such size as to quickly dissipate the heat generated during operation. The base carries the usual four prongs, although only three of them are used in the circuit.

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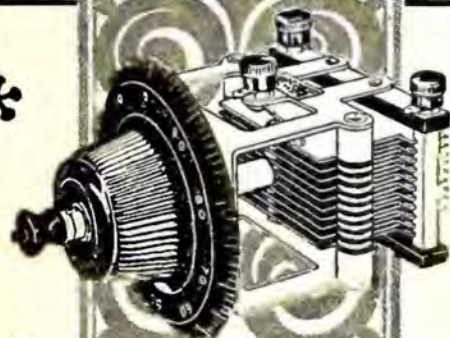
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A RECEIVER cannot bring in a station unless it is tuned into resonance with that station. There are many stations which you have not been able to receive because the condensers in your set did not have a sufficiently wide range of minute capacity variations to enable you to tune enough separate and distinct resonance points. No matter how finely you try to tune with your present condensers you skip these signals—because their tuning range is limited.

Install Barrett & Paden Micrometer Type Condensers and bring in the weak distant stations with loud speaker volume! The micrometer action of the Barrett & Paden when applied to its broad capacity range, enables you to find the exact resonance points of many stations which with other condensers are so close to interfering stations that separation is impossible.

You will be amazed at the tremendous immediate difference these condensers will make in the performance of your set. They not only will give you more stations, by reason of their micrometer action, but because of their lower loss will appreciably increase the strength with which signals are reproduced.

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Master Radio Engineers will show you how to qualify quickly and easily at home for Radio's fine jobs. We guarantee to train you successfully. Every day N. R. I.-trained men are taking good places in the Radio field. Thousands of openings now awaiting the trained man. FREE EMPLOYMENT SERVICE. Many other big features. Get the facts—CLIP COUPON.

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Send coupon below for FREE BOOK—"Rich Rewards in Radio." Read for yourself. No previous experience needed. Common schooling enough. WRITE NOW.

You get all these sets

Receiving sets, from simplest kind to thousand mile receiver, included to help you learn. AN UNEQUALLED OFFER. Other special features for limited time only, so ACT QUICK!

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

MAIL COUPON

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

Without obligating me in any way, please send me your free book, "Rich Rewards in Radio," also complete information on your practical, home-study Radio course.

Name _____

Address _____

Town _____ State _____

Tuned and Untuned R. F. Linked

For the first time in radio history, tuned and untuned radio frequency have been successfully linked. It has been done by William H. Priess and the engineers assisting him.

When the experiments leading to this result were begun, they were with the thought of commercial application in mind. Pure research at no time entered the minds of the experimenters. How successfully the result worked out was shown in the demonstration of the receiving set at the Radio World's Fair in New York last week.

Radio scientists have long desired to combine tuned with untuned radio frequency, but the difficulties that had to be faced narrowed the experimentation almost to a minimum. Priess has done it and as a result achieves an amplification that is simply enormous.

As is generally known, the distance reception property of any set is dependent upon the voltage amplification that it delivers at radio frequency prior to the detector tube. The average five tube set rarely delivers in excess of 400. By combining tuned and untuned radio frequency, the Priess method reaches an amplification value of 3000 before the detector tube. Its effect on distance-getting is obvious.

The Priess method employs five stages of radio amplification, one of which is tuned. The output of the fifth tube is fed into a detector. The power output of the detector is amplified through two successive stages of audio frequency amplification. The volume yield equals that of a phonograph playing with a loud needle.

Bosch Magneto Co. Devises a Hydrometer

A new hydrometer of unusually excellent and compact construction has just been placed on the market by the Robert Bosch Magneto Company of New York, manufacturers of Bosch magnetos and other electric automotive equipment.

In addition to long life which is insured by the high quality of the rubber parts and the uniform strength of the glass used, the manufacturers claim several unique features of mechanical superiority. Among these is a "non-drip" construction which traps any liquid remaining in the barrel after use, and prevents acid being dripped on clothes or rugs. Other features are extremely plain markings which make readings easy to take, a lively bulb which responds to the slightest pressure; and glass tips which hold the float in easy sliding position so that it cannot stick in the barrel.

Although on the market but a short time, this new product is being purchased widely, both by car owners and radio enthusiasts.

Radio Advertisers' Data Issued by Rosenberg

The 1925-1926 Radio Advertisers' Data Book, a volume of rates and other information for national advertisers, has just been issued by its publishers, Arthur Rosenberg Co. Inc., New York.

Several features which were not in the 1924 issue have been included in the current edition. The contents include advertising rates, circulation and other data regarding Radio Consumer and Trade publications, as well as of all the periodicals of the allied trades, including Automotive, Electrical, Hardware, Music, Talking Machine and Sporting Goods.

60-page Reference Book

Free

POLK'S REFERENCE BOOK FOR DIRECT MAIL ADVERTISERS

Mailing List Catalog No. 55

POLK'S REFERENCE BOOK FOR DIRECT MAIL ADVERTISERS

Shows how to increase your business by the use of Direct Mail Advertising, 60 pages full of vital business facts and figures. Who, where and how many prospects you have. Over 8,000 lines of business covered.

Write for your FREE copy.

R. L. POLK & CO., Detroit, Mich.
899 POLK DIRECTORY BUILDING
Branches in principal cities of U. S.

BIG MONEY!

\$3,000 to \$10,000 a year

Want to make big, easy money? Learn how to install, operate, repair, construct and sell Radios. Write now for facts about the amazing opportunities for Radio experts, and our special offer of a FREE 1000-mile receiving set, and how you can quickly train at home by mail.

Be a Radio Expert

No previous experience necessary. Anyone with ordinary education can now learn Radio quickly under our simplified home-study plan. We need men right now to represent our Association. Be the Radio expert in your neighborhood. Get your share of the big profits. Hundreds about you want Radios and advice how to operate. You can earn enough money right from the start to pay for course. Nothing difficult about it. Low cost and easy terms.

FREE

1,000-MILE Receiving Set

Don't miss this big special offer to supply FREE all parts necessary to construct a high-grade 1000-mile receiving set. You can sell this set alone for practically the entire cost of the course. Send for the facts now. Find out all about this big-pay field. Address

Radio Association of America
4513 Ravenswood Ave., Dept. 210 Chicago, Ill.

Premier* 5 TUBE Ensemble

TUNE MAIL

Before you decide on a radio of any kind at any price, see the new Premier 5 Tube Ensemble. A complete Ensemble of genuine Premier parts (not a kit) already attached to panels of genuine black walnut grained Bakelite. Selectivity! Distance! Superb reception! Does anything any set at three or four times its price can do. It is today's unmatched radio value. See your dealer at once. Find out why a hundred thousand Ensembles will be sold in the next few months. See your dealer. Ask him. There is a genuine surprise waiting you.

\$35

Premier Electric Co., Dept. M-21, 3813 Ravenswood Ave. CHICAGO ILLINOIS

* Tested and Approved by RADIO AGE *

**To-day
-in every
good set!**



**Tone Clarity
Beyond Expectation**

Just pull the switch and note the clarity and richness of tone any Amperite-equipped set gives you. Amperite is the automatic rheostat which does away with hand rheostats and filament meters. No guessing. No uncertainty as to correct tube current. Tubes last longer. Makes any novice a master operator. Insist upon Amperite when you buy or build. Price \$1.10.

Write for free hook-ups

RADIALL COMPANY
Dept. B. A. 11, 50 Franklin St., N.Y. City

AMPERITE
REG. U.S. PAT. OFF.

The "SELF-ADJUSTING" Rheostat

**A Super Without the
I. F. Stages!**

(Continued from page 10)

readjust dials (C1-C2) for maximum results and then re-adjust (K1) for the required volume and to clear up any distortion or mush that may be present.

The radio frequency transformer (RFT), also known as the "filter coil," is adjustable by sliding the primary coil back and forth on a brass rod in relation to the secondary coil. In effect, this adjustment is similar to the adjustment of a vario-coupler, for it controls the degree of coupling between the primary and secondary circuits and hence determines the selectivity. With the primary close to the secondary, the tuning will be broader and the set will be less selective than when the coils are farther apart, therefore the adjustment affords a means of varying the selectivity in accordance with local interference, and after the adjustment is made after an installation, the coil is locked in place and no further adjustment is necessary until the set is moved or changes are made in the antenna construction.

With strong signals which cause overloading of the last audio tube, and therefore produce howling, adjusting the resistance knob (r) will stop the howl. If a carbon disc type of resistance is used, screwing down the knob will reduce the resistance and the overloading. Unscrewing the knob increases the resistance and also the volume on weak stations. This adjustment is not critical, and needs no adjustment over a wide range of volumes, but when a strong local is tuned in, it may be necessary to unload the tube. The grid condenser for a 201A tube it normally 0.00025 mf. capacity, while the leak value will range from 1.0 to 2.0 megohms. Experiment will show the proper leak value to use, but in any case it is not critical.

The usual length of antenna, from 60 to 75 feet long, is used with this superheterodyne. Longer aeriels are not recommended.

"Roxy" on Way Back to His Admirers

S. L. Rothafel, famous "Roxy" of radio, will soon return from a European trip and early next season make his entrance as a director of his own Theatre in New York City.

Mr. Rothafel is not only a great announcer of radio concerts—gifted with the power of injecting his personality over the ether—but there is no more enthusiastic listener on the radio than "Roxy." He takes great pride in the wonderful log of stations that he has received on several receiving sets.

When he went to Europe on the "Leviathan" he took with him a Freed-Eisemann 5-tube radio frequency portable receiver and used this on his travels on the continent.

On the trip home he will "listen in" to the "Gang" from the Capital on the same receiver.

**Rhamstine★
TUBE BOOSTER**



**Rhamstine★
Tube Booster**

Only \$6

Your radio enjoyment depends largely on the tubes. They must function properly. They can be made "just like new"—Rhamstine★ Tube Booster gives them new pep, freshness—a true, full, round tone which carries the message as "clear as a bell."

Works on any alternating current 110-120 volts, 50-133 cycles—201-A or 199 Type Tubes. Send no money—check the coupon below—pay on delivery.

"B" Rectifier (Eliminates "B" Battery)



Price Only \$25

Rhamstine★ "B" Rectifier—a quality product furnishing a dependable source of "B" power. Eliminates "B" Battery troubles such as chemical action, dead cells, recharging, and gives a continuous and uniform current, reproducing perfectly the original sound. The cost is nominal compared to service.

Send no money—just check the coupon

MAIL THE COUPON TODAY

J. THOS. RHAMSTINE★ (11)
504 E. Woodbridge,
Detroit, Mich.

Please send me your Tube Booster at \$6.

— your "B" Rectifier at \$25, by express C. O. D., subject to inspection. If not entirely satisfied with the "B" Rectifier I will return it to you in five days and receive a refund of full purchase price.

Name.....

Address.....

J. THOS. RHAMSTINE★

Radio and Electrical Products

504 E. Woodbridge

Detroit, Mich.

**NEW BIG POWERFUL
MIRACO ultra 5 TUBE RADIO**



Factory prices save you 1-2. Users everywhere report Miraco Ultra 5 gets programs coast to coast; Canada to Gulf, loud and clear on speaker; outperforms \$100 to \$250 sets. Many hear Europe, marvelous value—let testimony of users convince you. Smaller sets \$13.75 up. Write AGENTS MIDWEST RADIO CORPORATION 523-D E. 8th St., Cincinnati, Ohio

now only \$30 retail
MIRACO RADIO GETS EM COAST TO COAST

WRITTEN 2-YEAR GUARANTEE

Battery Prices SMASHED!

To Consumers Only
Here is a real battery quality, guaranteed to you at prices that will astound the entire battery-buying public. Order Direct From Factory. Put the Dealer's Profit in your own pocket. You actually save much more than half, and so that you can be convinced of true quality and performance, we give a **Written 2-Year Guarantee**. Here is your protection! No need to take a chance. Our battery is right—and the price is lowest ever made. Convince yourself. Read the prices!

| Auto Batteries | | Radio Batteries | |
|---------------------------|--------------------------|---------------------------|--------------------------|
| 6 Volt, 11 Plate, \$9.50 | 6 Volt, 100 Amp, \$9.50 | 6 Volt, 13 Plate, \$11.50 | 6 Volt, 120 Amp, \$11.50 |
| 12 Volt, 7 Plate, \$13.00 | 6 Volt, 140 Amp, \$13.00 | | |

Buy Direct—Send No Money
We ask no deposit. Simply send name and address and style wanted. Battery will be shipped same day we receive your order Express C.O.D., subject to your examination on arrival. Our guarantee accompanies each battery. We allow 5% discount for cash in full with order. You cannot lose! Send your order today—NOW!

ARROW BATTERY CO. Dept. 11, 1215 So. Wabash Ave., Chicago

BATTERY LEAD TAGS
PAT. PEND.



SAFE & QUICK 15 PRICE CENTS
ASK YOUR DEALER

* MFD. BY PAUL CLAMZO
233 LAFAYETTE ST. NEW YORK

THE BEST RADIO APPARATUS obtainable is being given away with new subscriptions to RADIO AGE. The Magazine with Blueprints. Full announcement in this issue. Get your share of these valuable parts by a little spare time work.

Read Radio Age

* Tested and Approved by RADIO AGE *

Now you can UNDERSTAND RADIO!

514 PAGES



100,000 SOLD

Compiled by HARRY F. HART E.E.

Formerly with the Western Electric Co. and U. S. Army Instructor of Radio. Technically edited by F.H. Doane.

More than 100,000 radio fans rely on this I. C. S. Radio Handbook to take the mystery out of radio. Why experiment in the dark when you can quickly learn the things that insure success? Hundreds of illustrations and diagrams explain everything so you can get the most out of whatever receiver you build or buy.

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

A practical book. Written by experienced radio engineers, in plain language. Something useful on every one of its 514 pages. A book that will save you many times its small cost.

Just mail the coupon with a dollar bill and your name and address, and this 514-page I. C. S. Radio Handbook will be sent to you by return mail. Note the other good books listed below at low prices.

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Box 8781-E, Scranton, Penna.

I enclose \$..... for which send me, post-paid, the Handbooks marked X, at \$1 each. It is understood that if I am not entirely satisfied I may return them within five days and you will refund my money.

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Name.....

Address.....

Enclose \$1.50 instead of \$1 for each book if you want the leatheroid binding. All of the above books can be had in this binding except the Traffic Handbook and the Building Trades Handbook.

Real Radio Apparatus for Subscriptions to Radio Age! Something New in Prizes for Readers! See Announcement in this Issue

The Magnetic Theory of Transmission

(Continued from page 50)

quiet day than on a windy day when the air is in violent motion. Why would not the same be true of radio transmission? The magnetic field of the earth is constantly changing during daylight and is comparatively calm at night.

Recent experiments have shown that short wave, or high frequency transmission, gives much better results than long wave or low frequency transmission for daylight work. It is possibly that the high frequency waves are so rapid that they are not affected so much by the natural daylight oscillations in the earth's magnetic field.

The magnetic field of the earth has been found to be strongest and most uniform during the months from October to March, during which time the earth is two million miles or more nearer the sun than in June. During these months our radio reception is at its best. What is the nature of the reception during these months in the Southern Hemisphere? An answer to this question would be interesting.

A comparison of radio transmission conditions with conditions of the magnetic field of the earth during its daily and annual changes gives us very strange coincidences if radio does not depend on the magnetic field of the earth as the means of its transmission.

The observations of the earth's magnetic field, upon which the above statements are based, were made about sixty years ago, the results of which were published, in part at least, in 1870 by George B. Airy, Professor of Astronomy at Cambridge University.

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 October, 1925.

State of Illinois, County of Cook }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Frederick A. Smith, who, having been duly sworn according to law, deposes and says that he is the President of the 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 411, 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., F. A. Smith, President, 500 N. Dearborn St., Chicago, Ill.; Editor, Frederick A. Smith, 500 N. Dearborn St., Chicago, Ill.; Managing Editor, Frederick A. Smith, 500 N. Dearborn St., Chicago, Ill.; Business Managers, M. B. Smith, 500 N. Dearborn St., Chicago, Ill.

2. That the owners are: RADIO AGE, Inc., 500 N. Dearborn St., Chicago, Ill.; Frederick A. Smith, 500 N. Dearborn St., Chicago, Ill.; M. B. Smith, 500 N. Dearborn St., Chicago, Ill.; J. H. Lohbeck, 6429 Cates 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 other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

FREDERICK A. SMITH.

Sworn to and subscribed before me this 20th day of September, 1925. [Seal.] HARRIET DILLON.

(My commission expires June 7, 1927.)



A Real Long Range Crosley Receiving Set, \$9.75

Do not assume from its very interesting price that this very unusual Crosley set is a toy. Its impressive performance alone entitles it to serious consideration. Heretofore, the \$10 radio was designed only for local reception. Now the Crosley Pup extends the entertainment radius to 1500 miles under ordinary conditions. Place it beside some costly multiple-tube set and operate the dials. Both tune through local stations sharply. Both get the same programs with equal ease and clarity. Both let you tap the infinite enjoyment coming through the air. There is only one difference—the Pup operates with head phones instead of a loud speaker.

Almost overnight the Pup has become the most popular Crosley set ever offered. It is being bought for youngsters whose curious fingers cannot resist the lure of dials and switches; for the cook, the maid, the old folks back home, and for shut-ins. Traveling men are selecting it because of its easy portability, and radio enthusiasts to have an inexpensive check on their larger sets. Hear it once—and you will own one too!

Crosley manufacturers receiving sets which are licensed under Armstrong U. S. patent No. 1,113,149 and priced from \$9.75 to \$60.00 without accessories. Add 10% to all prices west of the Rocky Mountains. See your Crosley dealer or write Department 63 for catalogue of complete Crosley line.

CROSLEY RADIO

BETTER COSTS LESS

THE CROSLEY RADIO CORPORATION

Cincinnati, Ohio.

Owning and operating WLW, first remote control Super power Broadcasting station.

An Announcement of Importance to Every American Radio Fan! Turn to page 20 of this issue of RADIO AGE

KARAS HARMONIK

AUDIO FREQUENCY

AMPLIFYING TRANSFORMER



For over 30 years
makers of
PRECISION
Electrical Apparatus.

The Triumph of a Masterpiece!

—A Marvel of Transformers that Brought Real Musical Quality to Radio Reception

JUST one year ago the Karas Harmonik Audio Frequency Transformer took the radio world by storm.

Nothing like it had ever been known before. For the first time, scientific study had been devoted to perfecting an audio transformer for the reception of broadcast music. The problem of amplifying high, low and medium frequencies to equal degree was finally solved. Bass notes were poured from the speaker in full strength and rich tone quality. The vital harmonics in rich overtones, formerly lost, were brought out in their full beauty by this marvel of audio transformers.

Music critics, who had always condemned radio music as false and distorted, approved the results of Karas Harmonik amplification with great enthusiasm. Prominent radio engineers subjected Karas Harmoniks to exhaustive laboratory tests—and pronounced it a technical masterpiece. Technical editors who promoted the season's most successful hook-ups specified Karas Harmoniks in their circuits. The triumph of the Karas Harmonik was complete!

But, for all of this, the enjoyment of Karas Harmonik amplification was too greatly confined to one class of radio enthusiasts. Home set builders bought Karas Harmoniks by the tens of thousands. They were free to pick and choose. They were most exacting in their demands for the newest and best developments.

It was the owners of factory-built sets who missed the

delightful pleasure of real, true radio music in their homes. Set manufacturers were prevented by price from adopting Karas Harmoniks for their sets. So the ready-made set-buyer, unless he undertook to switch transformers, had to do without Karas Harmoniks.

Today there are in use, hundreds of thousands of sets—good sets—which could be vastly improved in musical quality by the simple operation of replacing the old transformers with Karas Harmoniks. Perhaps you own one of these sets. It may be all you desire from the standpoint of selectivity, of range, and other tuning qualities. But, if it is not equipped

with Karas Harmonik Audio Frequency Transformers, you are NOT getting nearly the musical quality you can just as well enjoy. Are you going to be content with anything short of the best?

You can install Karas Harmoniks yourself. It's a short, easy job. Or, any radio repair man can do it for you. Make up your mind to do it now—at once. Get a pair of Karas Harmoniks TODAY!

In large cities, most good dealers carry Karas Harmoniks—and in many small towns. If your dealer is out of them, order direct from us. Send no money. Just use the coupon below!

Karas Electric Co.,
4065 N. Rockwell St.,
Chicago, Ill.

The Distinctive Qualities that Elevate Karas Harmonik Transformers to the Highest Pinnacle of Success in the Radio World.

1. Many thousands of turns of wire
2. Low ratio of turns
3. Extra large quantity of special formula iron in core
4. Controlled air gap
5. No core saturation
6. Minimum of Reluctance
7. Least Hysteresis and Eddy Current Loss
8. Low Distributed Capacity
9. Scientifically circular shielding preventing intercoupling of electrostatic and electromagnetic fields
10. Very High Primary Impedance
11. Extremely High Inductance
12. High and even Amplification of all Audio Frequencies.

Karas Electric Co.,
4065 N. Rockwell St., Chicago, Ill.

Please send me _____ pairs of Karas Harmonik Audio Frequency Transformers. I will pay the postman \$7 apiece, plus postage, on delivery. It is understood that I am privileged to return the transformers any time within 30 days if they do not prove entirely satisfactory to me, and my money will be refunded at once.

Name _____

Address _____

If you send cash with order, we'll send transformers postpaid.

Build the Set That Holds 4 World's Records



The receiver that brought in stations 6,000 to 8,000 miles distant with loud speaker volume night after night.

Holds World's Records For

- (1) Longest distance ever received on a loop aerial—8,375 miles
- (2) Most consistent reception of stations 6,000 to 8,000 miles distant—117 programs in three months.
- (3) Brought in 6 different stations in 2 1/2 hours—all over 6,000 miles

Full sized blue prints with complete instructions showing how to make exact duplicate of this marvelous receiver.

PRICE \$5

Story of development and proofs of records sent on receipt of stamped and addressed envelope.

Scott Radio Laboratories
35 S. Dearborn St., Chicago
Dealers and Jobbers Write

\$110,000 Super-Station Planned for St. Louis

The primary plans of organization were completed recently for the establishment in St. Louis of one of the largest and most elaborate radio broadcasting stations in the United States. The project, which is being undertaken by nine representative business organizations of St. Louis, including the *Globe-Democrat*, involves the erection of a \$110,000 super-station, which is expected to be ready for operation shortly before Christmas. It will be announced as St. Louis' Christmas gift to the nation. Contracts for the apparatus have been placed with the Western Electric Company.

It is proposed that this mammoth stations, operated at a cost of approximately \$135,000 a year, will typify the "voice of St. Louis," identifying the city with superpower and super-programs of exceptional merit. Application will be made for a charter for a corporation, membership in which will be held by the following original organizers: St. Louis *Globe-Democrat*, The Merchants' Exchange of St. Louis, The Brown Shoe Company, Skouras Brothers Enterprises, C. F. Blanke Tea and Coffee Company, Colin B. Kennedy Corporation, Wagner Electric Corporation, St. Louis Radio Trade Association and George Kilgen & Son, Inc.

To Include Sixteen Firms

The plan calls for a total membership of sixteen firms and several other concerns, besides the present members, are considering the plan with a view to joining the organization.

The Board of Trustees of the organization is composed of E. Lansing Ray, president of the *Globe-Democrat*, chairman; W. A. Layman, president of the Wagner Electric Company, and C. F. Blanke, president of the C. F. Blanke Tea and Coffee Company.

The entire enterprise has been inspired by the civic interest among the organizers, who expect the project to prove an important factor in fostering the development of the city and community.

W. Palmer Clarkson, president of the Chamber of Commerce, has been present at several of the meetings, which have been held during recent weeks to perfect the organization, and has manifested enthusiasm over the possibilities which the plan offers for advertising the city.

"Capital of 49th State"

The programs, which will take rank with the outstanding radio-casting programs of the world, will be designated as coming from "St. Louis, the Capital of the 49th State," and while the call letters have not yet been assigned, it is probable that their arrangement will suggest "The 49th State."

Business offices have already been established at 737 Frisco Building, under the management of Thomas P. Convey, general manager of the St. Louis Radio Trades Association. A committee, composed of Colin B. Kennedy, Melville B. Hall, treasurer Brown & Hall Supply Company, and W. A. Layman, president Wagner Electric Company, will select a site for the broadcasting towers and building, which will be located about sixteen miles from the heart of the city. This committee is also negotiating for temporary quarters for the central studio, where the programs will be produced, pending completion of the new Ambassador Building. Permanent studios will eventually be located on the top floor

(Continued on page 65)

Pat.
April
21, 1925

Other
U.S. and
Foreign
Patents
Pending

Geared
80 to 1

Ideal

THE ACCURATUNE
Is ideal for coarse or extremely fine tuning, segregating even those stations now so closely grouped on the lower wave lengths; it brings them in with absolute precision. Volume and clarity are matters of course to the Accuratune. Quickly substituted without alteration of your set.

MYDAR RADIO CO.
17 CAMPBELL ST., NEWARK, N. J.

ACCURATUNE

REGISTERED GEARED 80:1 U.S. PAT. OFF.

Yours-free!

RADIO

WRS 96-PAGE RADIO GUIDE BOOK
Profusely illustrated, "checkful" of data for the radio fans.
Trouble Shooting Chart.
Complete New List of Broadcasting Stations
Log Chart
—and details of newest apparatus and hundreds of

Exceptional Radio Values on our

MONEY BACK GUARANTEE

From bus bar to the finest multi-tube set, we carry one quality—THE FINEST! EVERY article represents 100 cents worth of value for every dollar you invest! EVERYTHING purchased from WRS is guaranteed! Your Money is still YOUR Money until you are thoroughly satisfied in every way.

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| Cockaday Super | EVERY STANDARD RECEIVER | Neutrodyne Superdine |
| Cockaday D. X. | | Presley Super Radio |
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| Roberts' Knock-Out | | |

FREE A postal brings you our latest radio guide book. costs you nothing. Write for it TODAY!

WHOLESALE RADIO SERVICE CO.
6 Church St. Cat. R. A. 10, New York City

Exceptional Radio Values on our

MONEY BACK GUARANTEE

From bus bar to the finest multi-tube set, we carry one quality—THE FINEST! EVERY article represents 100 cents worth of value for every dollar you invest! EVERYTHING purchased from WRS is guaranteed! Your Money is still YOUR Money until you are thoroughly satisfied in every way.

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| Cockaday Super | EVERY STANDARD RECEIVER | Neutrodyne Superdine |
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FREE A postal brings you our latest radio guide book. costs you nothing. Write for it TODAY!

WHOLESALE RADIO SERVICE CO.
6 Church St. Cat. R. A. 10, New York City

* *The Famous Truly Portable*
TELMACO P-1 Receiver
Four Tubes Do the Work of Seven

The peer of portables in size, weight, ease of tuning, selectivity, distance, volume, workmanship and price. Aerial, loud speaker and batteries self contained. Complete with tubes and batteries. **\$125.00**
\$141.50. Receiver only

P-1 Kit Saves You Money!

Our offer of the Telmaco P-1 Receiver in kit form has met with enthusiastic reception. This contains all parts, as built by us, including case, drilled and engraved panel, and illustrated instructions. **\$80.00**
Complete kit
Ask your dealer or write us. Descriptive folder free.

Radio Division:
Telephone Maintenance Co.
20 So. Wells St. Dept. C Chicago, Ill.

TELMACO

Quality Radio Exclusively Established 1918

NO QUESTIONS ASKED!

You won't have a thing left to ask about when you build the RADIO AGE Model Receiver to be described in the December issue. Every part, down to the last binding post, will be specified by its trade name. **ORDER YOUR COPY NOW!**

ULTRA-VERNIER TUNING CONTROL

A VERNIER DIAL ON WHICH YOU CAN PENCIL RECORD THE STATIONS. GEARED 20 TO 1 SILVER FINISH 32.50—GOLD FINISH 53.50

PHENIX RADIO CORP., 115 E. East 25 St., N. Y. C.

of that building, adjoining the miniature rehearsal theater of the Skouras Bros' enterprises.

Engineers on Way

Engineers are now on the way to St. Louis, having been sent by the Western Electric Company to survey the ground here and supply the technical information necessary for immediate installation.

The reason for the location of the broadcasting towers at a point removed from the city, according to members of the organization, is that programs transmitted from such a station will offer a minimum of interference with the less powerful broadcasting from other St. Louis stations.

"The radio receiving public is becoming more and more discriminating," said W. A. Butler, manager of radio apparatus sales of the Western Electric Company, in discussing the project. "Radio enthusiasts want better programs and better broadcasting. For this reason, our company, in recommending the apparatus and the location for this super-station, has urged the selection of an outlying site, which will enable listeners to tune out selectively, without, however, monopolizing the air.

Effective Throughout Nation

"St. Louis, in its geographical location, is exceptionally well adapted to the establishment of a super-station like the one planned. This station, with its 5000-watt capacity, will be ten times as powerful as any within 'The 49th State.' It will have a dominant range throughout 'The 49th State,' and, according to the experience of similar stations, an effective range throughout the entire nation."

While the plans for the programs have not yet been announced in detail, members of the organization pointed recently to the possibilities offered by the grouping of a newspaper, a producing company, an organ manufacturer, radio trade organizations, commercial and manufacturing firms and the Merchants' Exchange. They indicated that the programs will be widely varied, ranging from news announcements and entertainment features of unusual nature to market quotations which will enable farmers and stock raiser to ship and sell their products most advantageously.

Value to Exchange

The Merchants' Exchange, it was disclosed, was inspired to join in this project in order to protect business within the St. Louis trade territory against the overtures from markets in other cities, where grain exchanges have, for some time, been broadcasting market quotations from their own stations.

"The importance of the radio, as it concerns the farmer, has been increasingly apparent," said Woodson K. Woods, president of the Merchants' Exchange, recently. "With this new super-station we hope to draw stock men and grain growers closer to the St. Louis market, through our ability to broadcast the latest market quotations.

"Broadcasting St. Louis grain market quotations will put the St. Louis market in better position to grow grain than it has occupied for many years."

New X-L Binding Post

Loose connections are done away with in the new "Push Post," put out by the X-L Radio Laboratories of 2424 Lincoln Avenue N, Chicago, makers of the well known X-L Variodensers. All that is necessary is to push the post down, insert the wire, let go!



The Season's Sensation

THE KODEL MICROPHONE LOUD SPEAKER is an exact replica of the transmitting microphone used in broadcasting.

The efficient Kodel reproducing unit, with an ingenious new snail-shell horn, mounted inside the microphone case, produces a remarkably clear, full-toned volume. Non-vibrating tone chamber eliminates distortion.

The \$15 model incorporates the new Kodel, Jr. unit; with the large Kodel unit, \$20

Radio dealers everywhere have them

THE KODEL RADIO CORP
506 E. Pearl St., Cincinnati, O.

\$15⁰⁰

Design Patented

The **KODEL**
MICROPHONE
* **LOUD SPEAKER**

Increase Distance, Volume, Clarity

"Colytt" adjustable grid leak improves receiving. Gives proper value of leak in grid circuit, and holds it. Simple, compact, easy to install, only one hole in panel. Tunes any tube perfectly.

Try the "Colytt" on Money-back guarantee. \$1.00 complete, with full directions. 3301

R. A. COLYTT LABORATORIES
* 565 Washington Blvd., Chicago



A regular \$25 loud speaker for \$16. Loud, clear, mellow tone. Bell 13 3/4 in. diameter, horn 22 in. high, equipped with Lakeside Adjustable Unit. Agents wanted, write for particulars.

Lakeside Supply Co.
73 W. Van Buren St., Chicago

Radio Dealers HEADQUARTERS

Dealers—if you want the best products, the fastest shipments and the most liberal discounts, write on your letterhead for our catalog L1003.

WAKEM & McLAUGHLIN
225 E. ILLINOIS ST. — CHICAGO

Broadcasters Elect Officers

The Annual Convention of the National Association of Broadcasters was held at the Commodore Hotel, New York City, on September 16th and 17th, 1925. New officers were elected as follows:

Officers

President, WOC, Frank W. Elliot, Davenport, Iowa.
 Vice-President, WHO, Wm. H. Heinz, Des Moines, Iowa.
 Vice-President, WLW, Powel Crosley, Jr., Cincinnati, O.
 Secretary, KFI, A. F. Kales, Los Angeles, Cal.
 Treasurer, WNAC, John Shepard, III, Boston, Mass.
 Executive Chairman, Paul B. Klugh, New York City.

Directors

Regional Chairmen

For New England, WTIC, W. G. Cowles, Hartford, Conn.
 For Atlantic—WAHG, Alfred H. Grebe, New York City.
 For Great Lakes, WJR, E. H. Jewett, Pontiac, Mich.
 For Atlantic, WHO, George Kuhns, Des Moines, Iowa.
 For Pacific—KFI, Earle C. Anthony, Los Angeles, Cal.
 KFAB—Charles Stuart, Lincoln, Neb.
 KFLX—Arthur B. Church, Independence, Mo.
 KFWA—Robert Nevins, Ogden, Utah.
 KLX—J. R. Knowland, Oakland, Cal.
 KPO—R. B. Hale, San Francisco, Cal.
 WCCO—Prof. C. M. Jansky, Jr., Minneapolis-St. Paul, Minn.
 WEA—W. E. Harkness, New York City.
 WFBG—Walter S. Greevy, Altoona, Pa.
 WGHP—George Harrison Phelps, Detroit, Mich.
 WGN—George Morris, Chicago, Ill.
 WGR—W. E. Kidney, Buffalo, N. Y.
 WHT—H. H. Bligh, Chicago, Ill.
 WIP—Richard Gimbel, Philadelphia, Pa.
 WJAZ—E. F. McDonald, Jr., Chicago, Ill.
 WLS—Edgar Bill, Chicago, Ill.
 WTAM—S. E. Baldwin, Cleveland, Ohio.

The Membership Committee reported favorably upon a large number of applications, principal among which was Station WEA, The American Tel. & Tel. Co. of New York City. All were unanimously elected to membership.

Among the important matters discussed was the troublesome copyright matter. Ever since broadcasting was started there has been a conflict between the publishers of music and broadcasting stations over the public performance of music. At first broadcasters took the position that the copyright law did not contemplate, and therefore did not cover broadcasting of music, for the reason that such broadcasting is in the nature of a public service, and is without any means of having direct pecuniary return from the listeners. For various reasons the position of broadcasters is now changed to one desiring to see that the writers of songs themselves, as well as their assignees, shall be paid a fair sum. Many plans have been discussed, finally resolving in adopting at this convention, the doctrine of extending the present paragraph of the copyright law relating to mechanical reproduction to cover broadcasting. Unanimous adoption of the following resolution expresses the basis upon which broadcasting stations propose to deal with this subject:—

"WHEREAS, there are here assembled at the Annual Convention of the National Association of Broadcasters a considerable number of representative broadcasting stations,

IT IS RESOLVED that the following plan be presented to all broadcasting stations for their approval or disapproval, and in the event of their approval,

THEN BE IT FURTHER RESOLVED that the following plan go into effect; that the principle involved in the reproduction of music by mechanical means now embodied in the present copyright law be extended to the reproduction of music by radio."

Another matter of importance was the ques-

(Turn to page 69)



Power-Plus Coil

Power-Plus Straight Line Frequency Condenser

Power-Plus Lock-Lug



A. F. Henninger, well known among radio enthusiasts the world over, presents his three new inventions:

POWER-PLUS Coil

The remarkable system of winding minimizes the picking up of interference and absolutely localizes the electromagnetic field in a new manner, giving tremendous increase in power and hairline selectivity without critical operation. Used for tuners and radio frequency transformers. Extremely compact, only 3 inches high with brackets.

POWER-PLUS Condenser

Straight Line Frequency. The Rotor and Stator plates of the new Power-Plus condenser are designed to give straight frequency line and perfect contact. Pigtail design eliminates contact resistance and automatic wear compensator prevents frequency change. Numerous features of design render effectiveness never before approached with straight line or any other type of condenser.

POWER-PLUS Lock-Lug

The Power-Plus Lock-Lug fits all standard machine screws. Its contact portion is corrugated, providing a permanent tension which prevents the loosening of the screw terminal. The lug is trough shaped, allowing a heavy layer of solder to cover the wire on all sides instead of merely two sides as when the old type lug is used.

FREE DESCRIPTIVE literature will be sent to you absolutely FREE—and you are under no obligation. We will also enclose without charge the Henninger Folder with seven of the latest hook-ups that are giving ultra selectivity and tremendous power. Send for YOUR free copy today—now! Please mention your dealer's name and address.

A. F. Henninger Corp.

4509 Ravenswood Ave.

Chicago, Ill.

A RECEIVER YOU CAN RELY ON!

The technical staff of RADIO AGE has spent months in planning the "Radio Age Model Receiver" to be described in detail in the December issue.

This set, of the improved tuned Radio Frequency type, does not claim to do more than actual tests revealed; but those tests showed it far surpassed many receivers of its type that have come under the scrutiny of the RADIO AGE INSTITUTE Laboratory for many months. Order your DECEMBER RADIO AGE!

A NEW HI-MU TUBE The HI-CONSTRON Tube (Price \$3.00)



Model C. T. 101A

A CLEARTRON PRODUCT For Resistance Coupled Amplifiers

The Hi-Constron is a Hi-Mu tube with an amplification constant of 20 that has been especially designed for Resistance Coupled Amplifiers. The Hi-Constron was the first Hi-Mu tube offered for sale to the general public and is the result of years of research work. Others may imitate the Hi-Constron as to its appearance but none surpass its quality.

We also manufacture

- CT 201A
- CT 199 Small Base
- CT 199 Standard Base
- CT 400 Rectron for B Battery Eliminators

List Price of all types, \$2.50

CLEARTRON VACUUM TUBE COMPANY

28 West 44th St., New York, N. Y.

Factories—West New York, N. J. and Birmingham, England



CLEARTRON

GUARANTEED RADIO TUBES

Table listing radio stations and their locations across the United States, including call letters, frequencies, and station names.

Broadcasters Elect

(Continued from page 67)

tion of Censorship. There have been rumors of bills to be introduced in Congress which will require a broadcasting station to label, through announcement, whether a program is an advertisement or not. Discussion on the subject covered much data on the present state of broadcasting for profit. The final result was the adoption of the following resolution:

"The question having come up in some quarters as to whether a program paid for by others than the owner of a broadcasting station should be labelled 'Advertising' or not.

BE IT RESOLVED that inasmuch as it is necessary that the name of user of the station be connected, by suitable announcement with the program in order to derive good will, and furthermore, inasmuch as any such announcement or program if improperly presented will create ill will, there seems no necessity for any specific regulation in regard to form of announcement in connection with such paid, or any other program."

Discussion of Censorship developed the following resolution, which was unanimously adopted.

"WHEREAS it is universally agreed that the success of Radio Broadcasting is founded upon the maintenance of public goodwill and that no broadcasting station can operate successfully without an appreciative audience, and

WHEREAS the public is quick to express its approval or disapproval of broadcast programs.

BE IT RESOLVED that it is the sense of this meeting that any agency of program censorship other than public opinion, is not necessary and would be detrimental to the advancement of the art."

No agreement could be reached upon the matter of Super Power and therefore no resolution was adopted. The trend of opinion, however, among the stronger stations was definitely toward increased power, the only limitation being, in their opinion, that any increase of power be based upon non-interference with other stations.

A number of plans were submitted which have as their purpose the untangling of the wave allotment problem. This matter was referred to a committee at the next meeting.

All of the resolutions adopted were constantly mentioned as recommendations only to the Secretary of Commerce, to aid him, if possible, in the many problems with which he is confronted. It was the opinion of members, frequently expressed, that any new legislation which had for its purpose the giving of full power to the Secretary of Commerce to regulate and control radio in all of its phases would be satisfactory, if radio could always be assured of a Secretary of Commerce as competent and as sympathetic toward radio as Secretary Hoover. Fear was expressed, however, that some Secretary in the future might not be competent to handle the problems of radio, and it was therefore the opinion of those present that any legislation intended to regulate and control radio should be solely in the interests of the public, and that the authority to so regulate and control should therefore not be put in the hands of one man.

Upon vote it was decided that the country be divided into five divisions, New England, Atlantic, Great Lakes, Central and Pacific, with Regional Chairmen to be charged with the duty of calling meetings for their regions when matters were up for decision which could not be delayed until the time of meetings of the whole Association.



Superior Results Guaranteed

\$9.75

Now-Plate Voltage for any Set — and You can afford it!

First Cost Economy now makes it possible for EVERYONE to obtain efficient "B" current supply right from their electric light socket. Now one of the biggest improvements in modern-day radio reception is placed within the reach of all. Think of it! A perfect, always efficient source of plate voltage for any set for \$9.75! It marks a revolutionary step forward and will be welcomed by millions of radio enthusiasts.

Ferbend "B" Eliminator

The price of this remarkable new unit is spectacular in more than one way. Besides saving you from \$15 to \$50 it is amazingly low considering the quality and superiority. You may ask "how could it be possible to build such a unit for the ridiculously low price of \$9.75?" True mechanical genius and resourcefulness alone are responsible. But the logical way to answer this question is to equip your set at once with this marvelous unit and be convinced.

ASK YOUR DEALER—OR SEND DIRECT

FERBEND Wave Trap
 This company also manufactures the famous Ferbend WAVE TRAP—the instrument which has been widely imitated but never equaled. It is the only original and genuine.

Until nation-wide distribution is completed it is possible that your dealer hasn't stocked the MAXMIN "B" Battery Eliminator as yet. So you will not have to wait, we will make prepaid shipment direct to you upon receipt of \$9.75, or C. O. D., plus postage. Remember, superior results are guaranteed or your money back. Be one of the first to own and use the Ferbend MAXMIN "B" Battery Eliminator.

Use the COUPON NOW!

Ferbend Electric Company
 431 West Superior Street
 Chicago, Ill.

Ferbend Maxmin "B" Eliminator

FERBEND ELECTRIC CO.
 431 West Superior St., Chicago

- Send Postpaid. I am enclosing \$9.75.
- Send C. O. D., Plus few cents postage.
- Send Literature.

Name.....

Address.....

City.....

State.....

THE BIGGEST RADIO AGE OF THE YEAR

will be the next, the December issue! More news—more blueprints—more hookups—and more features!

And of course the predominating feature will be the good receiver, the "Radio Age Model Receiver" that has been in the process of development for many months. The same receiver that will be displayed at the Chicago Radio Show in November! Clearly illustrated with blueprints by John B. Rathbun. The biggest 25 cents worth ever offered! In

DECEMBER RADIO AGE—OUT NOVEMBER 15

| | | | |
|------|--------------------------------------------------|------------------------------------|-----|
| WREO | Reo Motor Car Co. | Lansing, Mich. | 286 |
| WRHF | Washington Radio Hospital Fund. | Washington, D. C. | 256 |
| WRHM | Rosedale Hospital, Inc. | Minneapolis, Minn. | 252 |
| WRNY | Experimenter Publishing Co. | New York, N. Y. | 258 |
| WRK | Doron Bros. | Hamilton, Ohio | 360 |
| WRL | Union College. | Schenectady, N. Y. | 270 |
| WRM | University of Illinois | Urbana, Ill. | 273 |
| WRMU | A. H. Crepe & Co., Inc., Motor Yacht "MU-1" | New York, N. Y. | 236 |
| WRST | Radiotel Mfg. Co., Inc. | Bay Shore, New York | 216 |
| WRW | Tarrytown Radio (ex. Laba.) | Tarrytown, N. Y. | 273 |
| WSAC | Clemson Agricultural College | Clemson College, S. C. | 336 |
| WSAI | United States Playing Card Co. | Cincinnati, Ohio | 325 |
| WSAJ | Grove City College | Grove City, Pa. | 258 |
| WSAN | Allentown Call Publishing Co. | Allentown, Pa. | 229 |
| WSAP | Seventh Day Adventist Church | New York, N. Y. | 263 |
| WSAR | Dauby & Welch Electrical Co. | Fall River, Mass. | 254 |
| WSAU | Camp Marienfeld | Cheebam, New Hampshire | 229 |
| WSAV | C. W. Vick Radio Construction Co. | Houston, Texas | 360 |
| WSAY | Irving Austin (Port Chester Chamber of Commerce) | Port Chester, N. Y. | 233 |
| WSAZ | Chas. Electric Shop | Pomerooy, Ohio | 258 |
| WSB | Atlanta Journal | Atlanta, Ga. | 428 |
| WSBC | World Batley Co. | 1219 B. Washab Ave., Chicago, Ill. | 210 |
| WSBF | Stix-Bee-Fuller D. G. Co. | Atlanta, Ga. | 275 |
| WSKC | World's Star Knitting Co. | Bay City, Mich. | 261 |
| WSM | Nashville Life Ins. Co. | Nashville, Tenn. | 319 |
| WSMB | Sanger Amusement Co., and Mason Blanche Co. | New Orleans, La. | 319 |
| WSMH | Shattuck Music House | Owosso, Mich. | 240 |
| WSMK | S. M. K. Radio Corp. | Dayton, Ohio | 275 |

| | | | |
|------|---------------------------------------------|------------------------|-----|
| WSOE | School of Engineering | Milwaukee, Wis. | 246 |
| WSRF | Hardem Sales and Service | Broadlands, Ill. | 233 |
| WSTA | Camp Marienfeld | Cheebam, N. H. | 229 |
| WSUI | State University of Iowa | Iowa City, Iowa | 498 |
| WTAB | Fall River Daily Herald Publishing Co. | Fall River, Mass. | 248 |
| WTAC | Penn Traffic Co. | Johnstown, Pa. | 366 |
| WTAD | Robt. E. Compton | Carthage, Ill. | 234 |
| WTAL | Toledo Radio & Electric Co. | Toledo, Ohio | 252 |
| WTAM | Willard Storage Battery Co. | Cleveland, Ohio | 392 |
| WTAP | Cambridge Radio & Electric Co. | Cambridge, Ill. | 246 |
| WTAQ | S. H. Van Cordon & Son | Oaseo, Wis. | 221 |
| WTAR | Reliance Electric Co. | Norfolk, Va. | 283 |
| WTAT | Edison Electric Illuminating Co. (portable) | Boston, Mass. | 244 |
| WTAW | Agricultural & Mechanical College of Texas | College Station, Texas | 286 |
| WTAX | Williams Hardware Co. | Streator, Ill. | 231 |
| WTAY | Thomas J. McGuire | Lambertville, N. J. | 283 |
| WTB | Kansas State Agricultural College | Manhattan, Kans. | 273 |
| WTBC | Flint Senior High School | Flint, Mich. | 216 |
| WTBS | Travelers Insurance Co. | Hartford, Conn. | 323 |
| WTCT | H. G. Saal Co. | Chicago, Ill. | 268 |
| WTX | Wright & Wright (Inc.) | Philadelphia, Pa. | 364 |
| WWAD | The Alamo Bull Room | Joliet, Ill. | 241 |
| WWAE | Radio Engineering Corp. | Richmond Hill, N. Y. | 211 |
| WWGL | Radio Engineering Corp. | Richmond Hill, N. Y. | 211 |
| WWGS | Ford Motor Co. | Dearborn, Mich. | 277 |
| WWI | Detroit News (Evening News Assn.) | Detroit, Mich. | 352 |
| WWJ | LoYola University | New Orleans, La. | 264 |
| WWL | | | |

Canadian Stations

| | | | |
|------|-------------------------------------------|----------------------|-----|
| CFAC | Calgary Herald | Calgary, Alta. | 434 |
| CFCA | Toronto Star Pub. & Print. Co. | Toronto, Ont. | 357 |
| CFCF | Marcoux Wireless Tele. Co., (Ltd.) Canada | Montreal, Que. | 411 |
| CFCH | Abitibi Power & Paper Co., (Ltd.) | Iroquois Falls, Ont. | 500 |
| CFCK | Radio Supply Co. | Edmonton, Alta. | 517 |
| CFCN | W. W. Grant (Ltd.) | Calgary, Alta. | 434 |
| CFCR | Laurentide Air Service | Sudbury, Ont. | 410 |
| CFCT | Victoria City Terminal | Victoria, B. C. | 329 |
| CFCU | The Jack Elliott (Ltd.) | Hamilton, Ont. | 341 |
| CFHC | Henry Birks & Sons | Calgary, Alta. | 434 |
| CFKC | Thorold Radio Supply | Thorold, Ont. | 248 |
| CFQC | The Electric Shop (Ltd.) | Saskatoon, Sask. | 329 |
| CFRC | Queens University | Kingston, Ont. | 450 |
| CFXC | Westminster Trust Co. | Westminster, B. C. | 291 |
| CFYC | Commercial Radio (Ltd.) | Vancouver, B. C. | 411 |
| CHBC | The Calgary Albertan | Calgary, Alta. | 434 |
| CHCM | Riley & McCormack (Ltd.) | Calgary, Alta. | 434 |
| CHCS | The Hamilton Spectator | Hamilton, Ont. | 341 |
| CHIC | Northern Electric Co. | Toronto, Ont. | 357 |
| CHNC | Toronto Radio Research Society | Toronto, Ont. | 357 |
| CHUC | International Bible Ass'n | Saskatoon, Sask. | 329 |
| CHXC | R. Booth, Jr. | Ottawa, Ont. | 414 |
| CHYC | Northern Electric Co. | Montreal, Que. | 411 |

| | | | |
|------|--------------------------------|------------------|-----|
| CJCA | Edmonton Journal | Edmonton, Alta. | 511 |
| CJCL | A. Couture | Montreal, Que. | 275 |
| CJCC | London Free Press | London, Ont. | 321 |
| CKAK | La Presse | Montreal, Que. | 411 |
| CKCD | Vancouver Daily Province | Vancouver, B. C. | 397 |
| CKCK | Leader Pub. Co. | Regina, Sask. | 471 |
| CKCO | Ottawa Radio Association | Ottawa, Ont. | 434 |
| CKCQ | P. Burns & Co., (Ltd.) | Calgary, Alta. | 434 |
| CKFC | First Congregational Church | Vancouver, B. C. | 411 |
| CKLC | Wilkinson Electric Co., (Ltd.) | Calgary, Alta. | 434 |
| CKNC | Canadian National Carbon Co. | Toronto, Ont. | 357 |
| CKOC | Wentworth Radio Supply Co. | Hamilton, Ont. | 341 |
| CKY | Manitoba Tel. System | Winnipeg, Man. | 384 |
| CNRA | Canadian National Railways | Moncton, N. B. | 312 |
| CNRC | Canadian National Railways | Calgary, Canada | 434 |
| CNRE | Canadian National Railways | Edmonton, Alta. | 511 |
| CNRF | Canadian National Railways | Montreal, P. Q. | 411 |
| CNRO | Canadian National Railways | Ottawa, Ont. | 434 |
| CNRR | Canadian National Railways | Regina, Sask. | 471 |
| CNRS | Canadian National Railways | Saskatoon, Sask. | 325 |
| CNRT | Canadian National Railways | Toronto, Ont. | 357 |
| CNRV | Canadian National Railways | Vancouver, B. C. | 411 |
| CNRW | Canadian National Railways | Winnipeg, Man. | 384 |



Vigilance

Constant vigilance is the price of uniformity and constant vigilance is maintained over Magnatrons. That is why Magnatrons are uniform, and uniformly good.

The Magnatron DC-201A, DC-199, and DC-199 (large base) now list for only \$2.50 each.

Connewey Electric Laboratories
Magnatron Bldg. Hoboken, N. J.

West coast supplied from complete stocks carried by PACIFIC RADIO LAES.,
256 So. Los Angeles St., Los Angeles, Calif.



R. M. A. Names Official Radio Shows

Official announcement has just been made by Herbert H. Frost, President of the Radio Manufacturers' Association, that the Show Committee of the association has designated the official shows of the manufacturers for 1926. These will be the Third Annual Radio World's Fair in New York and the Fifth Annual Chicago Radio Show in the latter city.

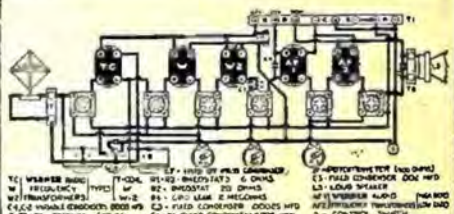
These two shows will be under the direction of U. J. Herrmann and G. Clayton Irwin, Jr.

The Radio World's Fair next year will be held in the new Madison Square Garden, and the tentative date approved for the opening is September 13.

The Chicago show next year will be moved forward about five weeks, October 11 having been designated for its opening. It will be held in the Coliseum.

NEW SELECTIVE CIRCUIT

This special offer includes genuine FULL SIZE blue print with illustrations and full instructions, together with large size print of circuit diagram, all for only 50¢ Stamps or Coin



An ideal circuit for selective "DISTANCE GETTER" with fine tone, requires no outside wire. Operates on a loop

Werner Radio and Audio Frequency-Transformers are used in the above circuit which consists of 1 stage of tuned radio frequency amplification for selectivity and "P-p" followed by two powerful untuned stages—a vacuum tube detector and two stages of quality audio frequency amplification.

Send for free descriptive literature
Werner Radio Mfg. Co., 204-206 Ninth St., Brooklyn, N.Y.

MAGNATRONS

Fourth Conference Called

THE Fourth National Radio Conference in the interest of public service had been called by Secretary of Commerce Hoover to meet in Washington on November 9th. Representatives of all radio interests are invited to participate, and should consider this notice an invitation to be present.

For the first time the members of the Press are called in to represent the public especially in matters affecting broadcasting. Special letters to some 400 magazines and newspapers having radio departments are going out asking that each publication send a delegate to represent the public at the national sessions, which will carry on for about a week. This method of selecting delegates, it is believed, will guarantee to the fans the best possible representation.

The conference, Secretary Hoover points out is called for the general discussion and consideration of matters affecting radio communication in the United States. The delegates called in will represent the following groups: broadcasters, press associations, radio magazines and newspapers, radio set manufacturers, organized broadcast listeners, amateur organizations, commercial land and marine interests, radio trade associations, Governmental departments, engineers, electric light and farm organizations interested in radio.

The heads of the above organizations and groups should communicate with Secretary Hoover before October 26, advising him who their representatives will be. No persons will be recognized as a delegate whose name is not filed with the Commerce Department before the above date.

The major problems scheduled for discussion include: interests of the listening public in broadcasting; saturation in broadcasting channels and necessity for limitation of stations on basis of public service; requirement of construction permits prior to building of broadcasting stations; wavelengths or frequencies for the several radio communication groups; use of high power in broadcasting; location of stations outside congested centers to prevent interference; allocation of channels with regard to time and geographical distribution; use of broadcasting for publicity; amateur activities; and rebroadcasting.

Bakelite Used in Loud Speaker Horns

The first loud speakers for radio were patterned after the morning-glory type of horn used in the early phonographs. Radio fans quickly began to realize that the resultant sounds were not all that they should be, and the loud speaker came in for its share of the blame.

Tin, thin sheet iron and other metals that have a definite rate of vibration, have a metallic or harsh sound when used in the construction of amplifying horns. It has been found that inert materials, such as paper, wood pulp and mineral compositions, and other substances that are neutral as far as vibration is concerned are best for loud speaker horns. The best materials from an acoustical standpoint, however, are usually very fragile.

Bakelite, a substance formed by a composition of phenol and formaldehyde under heat and pressure, has been found ideal for loud speaker horns,

A REAL RADIO SET

for \$27.27 * ❄

Built Around

THE HEATH CONDENSER

Designed by Citizen's Radio Call Book Laboratory

NOW you can build a super-efficient radio set at an extremely low cost. The well known performance of the Heath Condenser caused the Citizen's Radio Call Book Laboratory to design a radio set featuring this remarkable Condenser. There are two points of vital interest about the HEATH CONDENSER—

1. Permanent Flat Plates—stamped under huge presses to absolute flatness and tempered to prevent warping.
2. A micrometer geared vernier that reduces ordinary adjustments to hair breadth distinction.

To each purchaser of a Heath .0025 Variable Condenser we are giving a complete set of plans, and instructions on how to build this high quality, low cost radio set. See your dealer and get yours today, or if your dealer cannot supply you, order direct, giving your dealer's name.

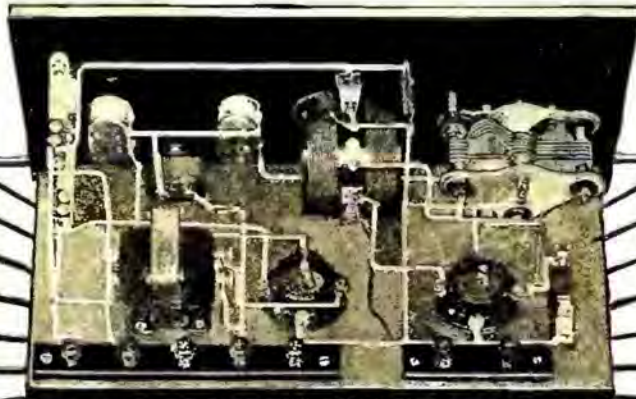
Heath Radio and Electric Mfg. Co.

206-210 First St.

Newark, N. J.

Manufacturers of

HEATH CONDENSERS HEATH SOCKETS HEATH DIALS
HEATH RESISTANCE COUPLED AMPLIFIERS



Hear What YOU Like

* SEND NO MONEY

Stations are glad to put on numbers at your request. We print special postal "Thank You" cards that get ATTENTION. Thank your favorite. Get more pleasure from your radio. All the RAGE. Good trade-cards. Quality printing. Satisfaction guaranteed. You'll be delighted.



FREE LOG

For your stations with first order. Places for call, city, wave length, 4 dial settings, remarks, etc. Other

valuable information. Beautiful rippled cover. **YOUR OWN Name and Address Printed FREE** on each card. Be individual. Post Card back. 100 only \$1.45; 200 \$1.95; 500-\$2.45 plus a few cents postage. Don't send one cent. Pay postman after cards arrive. If you prefer to pay with order, we pre-pay postage. Money RETURNED if not DELIGHTED. You to be judge. Order today—NOW. Postal will do. **RADIO PRINTERS, Dept. 9025, MARENGO, ILL.**

RADIO AGENTS WANTED
5 Tube Demonstrator FREE!

Earn \$25 to \$100 a week, part or full time. Everyone a prospect. Complete line standard sets and accessories. \$5 to \$90. Write today for illustrated catalog and exclusive selling plan for live dealers and community agents. **20TH CENTURY RADIO CO., 1021 Coca Cola Bldg., Kansas City, Mo.**



MASTERTONE RADIO TUBES \$2.00
ALL TYPES GUARANTEED
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* Tested and Approved by RADIO AGE *

They're Nearly All Gone! Get Your "Annual" Now!

It's Worth It:

THE RADIO AGE ANNUAL for 1925 is worth every cent of the dollar you pay for it. The leading engineers and set-builders of America have acclaimed it the most complete, authoritative and clear hookup book ever printed. Anyone can understand its many pages of constructional articles, diagrams, and 32-page blueprint section—a feature that has never before been duplicated—in any hookup book or radio manual! 120 pages of gilt-edged features! A treasure for your radio library for years to come!

THE edition of RADIO AGE ANNUALS that was first introduced to the radio public last Spring is almost exhausted! Month after month, orders have come in from enthusiastic fans, until at this writing only a few hundred of these valuable books remain unsold!

Now that the radio season is in full sway, you cannot afford to be without this authoritative guide and first-aid for all radio troubles! If you have not yet built your set, here is the book that will tell you which one to make—and how!

Or, if you already have made or purchased your set for this season, you will need the priceless pages of the RADIO AGE ANNUAL for constant reference, to solve the many problems that arise in connection with the operation of the average receiver.

The ANNUAL contains not only scores of tested hookups, and a 32-page blueprint section of every type of hookup, from crystal to super-het, but has several articles dealing with construction and operation of loud speakers, battery chargers, aerials, wave traps, amplifiers, etc. The original BLUEPRINT SECTION is worth many times the price of the book!

ORDER NOW! Don't wait until every copy is gone! No more will be printed. One dollar a copy, and your fund of radio knowledge is complete.

**\$1.00 a
Copy**

**RADIO AGE ANNUAL
FOR 1925**

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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,

feedback 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 a proud owner of 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.....

11-25

Mar-Co Vernier Dial Is Unique

All radio apparatus requires a sensitive indicating device for the careful calibration of a particular setting of the instruments. Such an indicator must be carefully designed in order to include in its operation all the good points that are required.

In building the Mar-co Vernier Dial, the greatest care has been taken to include desirable features. In the first place, the hair line indicator in combination with the double scale graduated in half points gives a sight reading comparable to the indicators on the highest types of engineering instruments. The fact that the hair line is close to and extends across it destroys the error due to parallax which is the most common defect in radio dials using an indicator engraved on the panel at some distance from the dial scale. The fact that the indicator is built into the Mar-co Dial also eliminates the necessity for providing a separate indicator.

The Mar-co Vernier Dial has no backlash, and is non-microphonic. It does not use worm or spur gearing which is rough in action and extremely hard to assemble without play or shake, nor does it use rubber or cork friction washers which quickly wear out and cause trouble. In this dial a special split metal pinion is provided as a part of a friction bevel gear train which will last indefinitely. The resultant operation is noiseless, extremely smooth and extraordinarily sensitive.

The Mar-co Vernier Dial is housed in a black bakelite base carefully designed to harmonize with any panel arrangement. Mounting requires the drilling of but one hole to provide for the panel stud. A special template is provided with the instrument for this purpose.

A new and original feature of the Mar-co Vernier Dial is the means provided for the registration of call letters. Two apertures are provided in the face of the dial housing, through which pencil notations may be made on a specially prepared surface to correspond with dial settings, providing a most convenient means of reference.

Globe Loud Speaker

The Globe Phone Mfg. Company, Reading, Mass., for nearly 20 years makers of supersensitive acoustical devices, including earphones for the deaf, the Vactophone, a vacuum tube device for the hard of hearing, auditorium phones, and earth stethoscopes, now announce the development of a new Globe Loud Speaker.

Built on an entirely new principle the Globe Loud Speaker has a Silicon steel diaphragm, extra large drop-forged magnet with carefully balanced coils mounted on a sound bridge with a special tone pocket beneath. This gives a surprising smoothness of tone and faithfully reproduces music or the spoken word in full, deep, mellow tones throughout the entire acoustical range.

A vibrationless horn is used and it is claimed that all unpleasant overtones are eliminated and that the speaker is excellent for distant reception.

Careful, accurate and expert factory adjustment assures maximum volume regardless of the type of receiving set used.



Mfd. under Lowenstein Patents, March 5, 1918.

Equi Space Gives Ideal Tuning at all Wave Lengths

Spreads low wavelength stations without crowding those from 50° to 100°. Lightweight and compact in style.

HERE is a new condenser that surpasses all present-day types. The conventional straight line frequency condenser spreads stations on the dial but it also brings stations between 50 and 100 too close together. On the higher wavelengths are many high-powered stations that are extremely difficult to separate.

The Erla *Equi Space makes allowance for this. It gives maximum spreads between stations over the entire range of the dial. Specially designed plates make this possible.

Now all stations, low frequency as well as high frequency, are spaced on the dial to insure the best results. Tuning is made far sharper. Sensitivity is greatly increased, reducing losses to an unprecedented minimum. Plates of special spring brass are scientifically spaced and give maximum conductivity. Scientific tests show a resistance far lower even than costly laboratory types.

Special Erla Features

- Minimum capacity only 10 m. m. f.
- Ratio of maximum to minimum capacity 35 to 1.
- Total resistance of only 3 ohms at 1000 cycles.
- Four riveted cross members supporting stator plates provide rigidity unapproached.
- Single-hole mounting makes it easy and quick to attach.
- Light weight plates of special spring brass appreciably reduce bulk and weight, and tremendously reduce tendency toward misalignment from rough usage.

Equi Space is small and compact, requiring little space. Very light but having extreme rigidity because of four riveted cross members.

Go to any radio store and see this amazing condenser today. It will make a striking difference in any set.

Send your name and address today and we will mail free, news of the latest radio discoveries and inventions.

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CHICAGO, U. S. A.

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| Name | |
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"THE BEST RADIO MAGAZINE PRINTED"

—is the verdict of thousands of broadcast enthusiasts who have voluntarily written to RADIO AGE of their appreciation. Every month come additional praises for the newsy, interesting material to be found in our pages.

Are you a regular subscriber? \$2.50 a year, postpaid anywhere. Subscribe NOW if you want to be sure of getting the big December issue, with its eight page section devoted entirely to the

"RADIO AGE MODEL RECEIVER."

ORIOLE!

The Most Amazing Performer
You've Ever "Tuned In"



Oriole—Model 7—5 Tubes

Oriole radio receivers step right out and make astounding records on distant stations—they give exceptional volume—unequaled for clarity and sweetness of tone—the most selective, sharpest tuning set you ever played with—you'll be "sold" on the ORIOLE the minute you turn its dials.

Model 7—5 Tubes. Model 8—4 Tubes.
Write for illustrated folder.
Dealers: There is some exclusive territory open—ask for details.

W-K Electric Co.

KENOSHA, WISCONSIN

New Mu-Rad Receiver Has One Dial Control

THE factory of the Mu-Rad Radio Corporation is ideally located, so it is small wonder its engineers have been able to turn out a receiver that is a help to the industry.

The new Mu-Rad is a one dial tuning control and there are no other tuning adjustments of any kind. The circuit and control system were completed last January, and all through the Spring and Summer have been subjected to the most careful tests under various conditions.

There are two stages of tuned radio frequency amplification, detector, and two stages of audio frequency amplification with a new type of fieldless R. F. transformer coil and a new method of tuning through one manual control. There are no verniers or tuning compensation devices. The tuning is extremely sharp on all wavelengths and the receiver can be used on any antenna in any location. A very slight turn of the knob shuts out powerful local stations and brings in the distant stations with good volume.

The cabinet is two toned mahogany of finest furniture construction and finish. It is 33 1-2 inches long, 12 1-2 high, and 14 wide. It contains compartments for A, B and C batteries and may be operated on an inside or outside antenna. The single control simplifies the tuning so that the most unmechanical person can bring in stations.

YOU CAN GET

Greater reflex or crystal set reception if you use the

**BROWNLIE
VERNIER DETECTOR**

\$2.00 At your dealer or Direct.
ROLAND BROWNLIE & CO.
21 Sanders St. Medford Mass.



End your Radio Troubles for 30c in Stamps

We have laid aside a limited number of back issues of RADIO AGE for your use. Below are listed hookups to be found in these volumes. 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 Trap—Eliminators
- Filters
- A Junior Super-Heterodyne.
- Push-Pull A Amplifier.
- Rosenbloom 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.
- Refining 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 Radio and Audio to Baby Heterodyne.
- Radio Age Data Sheets.

July, 1924

- A Portable Tuned Impedance Reflex.
- Operating Detector Tube by Grid Bias.
- A Three-Tube Wizard Circuit.
- Data Sheets.

August, 1924

- Break into Radio Without a Diagram.
- The Engleb 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 Radio and Two Audio for Clear Tone.
- A Simple Regenerative Set.
- The Ultradyn 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 Refused 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 Sup-Het.
- A 5-Tube R. F. Receiver.
- How to Wind Low Loss Coils.
- A Short Wave Receiver.
- Blueprints of a Two-Tube Ultra Audio 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.

May, 1925

- A "Quiet" Regenerator.
- A Power Supply Receiver.
- How to Make a Tube-Tester.
- A Unique Super-Het and an Improved Remarts.
- A Six Tube Portable Receiver Illustrated with Blueprints

June, 1925

- Reducing Static Disturbances
- A Seven-Tube Super-Heterodyne.
- The Double Grid Tube in Ordinary Sets.
- Browning-Drake Receiver.
- Overcoming Oscillations in the Roberts Receiver.
- An Ideal Set in Practical Form.
- Soldering Secrets.

July, 1925

- Learning Tube Characteristics.
- How Much Coupling?
- The Six-Tube Super-Autodyne.
- A Simplified Portable Super-Het.
- Blueprints of Conventional Radio.
- Symbols and Crystal Detector Circuit.

August, 1925—50c per copy

- How to Attain Smooth Tuning.
- Alternating Current Tubes.
- Deciding on a Portable Super—
- And a big 60-page blueprint section, in which is contained blueprints of all the basic circuits from which all radio bookups have been developed since the birth of Radio.

September, 1925

- Thirty-one ways to prevent self-oscillations.
- Tuning efficiency with two controls
- Ideal Audio Amplifier Circuits.
- Blueprint section.

October, 1925

- Auto-Transformer Coupling
- Some Facts about Quality
- An Improved Slide-Wire Bridge
- Blueprints of Circuits Using Single and Dual Controls.

RADIO AGE, INC.,

500 N. DEARBORN ST., CHICAGO

* Tested and Approved by RADIO AGE *

A Guide to Readers who Want Radio Books

IN THE belief that our readers will be interested in knowing where to obtain booklets on various radio subjects, from manufacturers, engineers, and other sources, RADIO AGE is beginning this month the publication of a directory for such literature.

The title of the booklet, the person or company from whom it can be obtained, and the latter's address, are given for your convenience. This service will be continued from month to month in RADIO AGE, and readers desiring to know where to get literature not listed herewith may obtain this information by addressing our Technical Department.

The directory for this month follows:

Aero Booklet. Aero Products, 217 N. Desplaines St., Chicago, Illinois.

Henninger Folder. A. F. Henninger, 4509 Ravenswood Ave., Chicago, Illinois.

Log Book & Catalog. Economy Radio Sales, 288 6th Ave., Dept. C, New York, New York

Literature. Ferbend Electric, 431 W. Superior St., Chicago, Illinois.

Descriptive Folder. Hammerlund-Roberts 1182-D Broadway, New York, N. Y.

Booklet 31. Bakelite, Corporation, 247 Park Ave., New York, N. Y.

Catalog. Daven Radio Corporation, 158 Summit St., Newark, N. J.

Descriptive Folder. Telephone Maintenance, 20 S. Wells St., Dept. C, Chicago Illinois.

Descriptive Folder. Silver-Marshall, Inc., Dept. C, 114 S. Wabash Ave., Chicago, Illinois.

Rich Rewards in Radio. Nat'l Radio Institute, Washington, D. C., Dept. 53NB.

Better Tuning (10c). Bremer-Tully, Dept. 53NB, 532 S. Canal St., Chicago, Illinois.

Millions Untouched. American Radio Engrs., Hearst Square, Dept. 15, Chicago, Illinois.

Catalog. Standard Radio Company, 1424 Walnut St., Kansas City, Mo.

Descriptive Folder. Allen-Bradley, 289 Greenfield Ave., Milwaukee, Wisconsin.

Catalog. Pacent Electric, 91 Seventh Ave., New York.

Catalog. Crosley Radio, Cincinnati, Ohio, Dept. 63.

15-B Radio Catalog. Jewell Electrical, 1650 Walnut St., Chicago, Illinois.

Catalog. Randolph Radio Corporation., 159 N. Union Ave., Chicago, Ill., Dept 94.

Free Hook-Up. Radiall Company, 50 Franklin St., Dept. R. A., New York, N. Y. 11-50.

Catalog. W. C. Braunn, 34-50 S. Clinton St., Chicago, Illinois.

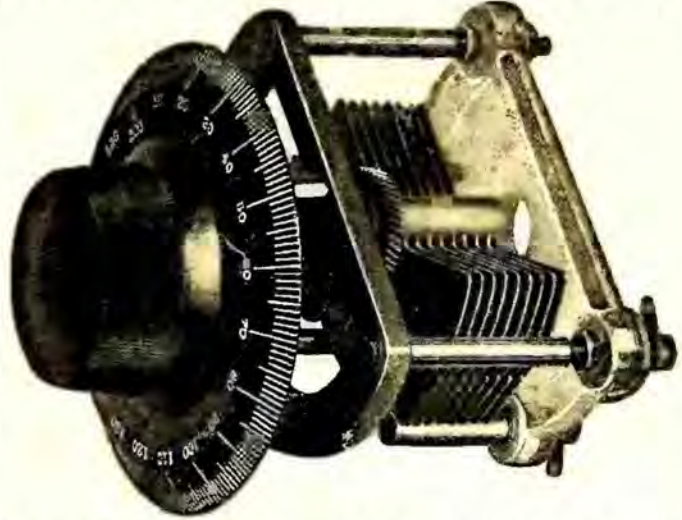
Catalog. Barawik Company, 103-126 S. Canal St., Chicago, Ill.

Ozarka Instructions No. 200 Ozarka, Inc., 122A Austin Ave., Chicago, Illinois.

Ozarka Plan No. 100, Ozarka, Inc. 122A Austin Ave., Chicago Illinois.

Catalog. Montgomery Ward & Co., Chicago, Ill., Dept. 18-R

Quam Condensers With The Pyrex End Plate are world beaters



This is an actual statement of Fact! Pyrex is the best insulating material known. It is used by the U. S. Navy, Bureau of Standards and the majority of the broadcasting stations of the world. The Pyrex end plate is one of the features that makes the Quam the lowest loss and highest quality condenser built—showing even less resistance than the laboratory standard. As a matter of actual fact the Quam is used as a laboratory standard in many experimental and testing laboratories, not only in America, but in all parts of the world.

Furnished in straight line frequency and straight line wavelength design. Prices .00025, \$6.00; .00035, \$6.50; .0005, \$7.00 (with a 4-inch Bakelite 360° Dial, add \$1.00)

QUAM Audio Transformers \$5.00

QUAM RADIO CORPORATION

1925 S. Western Ave.

Chicago, U. S. A.

WHO GETS THE RADIO AGE MODEL RECEIVER?

It will be on display at the November RADIO SHOW in Chicago, and will be GIVEN AWAY to some radio fan at the conclusion of the exposition. Who will get this remarkable set—the receiver that is attracting the attention of the entire country?

Further details in the December RADIO AGE. Out November 15.

Set Builders Save Space With DUPLEX CONDENSERS

Specially designed shaped-out stators make these straight-line frequency condensers as small as ordinary condensers. Write for literature.

*
DUPLEX CONDENSER & RADIO CORP.
42 Flatbush Ave. Extension, Brooklyn, N. Y.

Investigate Before Investing

Every advertiser—whether national or local—owes it to the best interests he represents to fully investigate every publication's claim for circulation, etc., before he invests in "white space" advertising.

It is the advertiser's right to demand *facts*, not *theory*. Superficial information is not the kind on which to build a successful advertising campaign, and unless each copy is *delivered* and *read*, the advertiser is paying for waste circulation and his advertising dollars are not producing proper results.

By our membership in the *Audit Bureau of Circulations* we safeguard the advertiser's money, for *we want it known* that we make no claims of any nature that are not fully substantiated with A. B. C. verified reports.

Get our last report. Know what you are buying. Then invest.

RADIO AGE

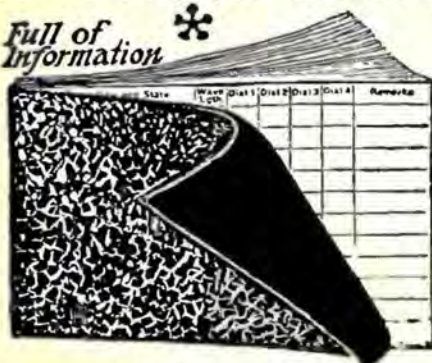
500 N. Dearborn St., Chicago

NEW LOG

64-PAGE LOG

Loose Leaf for Revisions

Full of Information



Send NO Money

Log YOUR radio. This new perpetual log with loose leaves can be kept up-to-date. Revised sheets can be secured as changes occur. Holds 500 stations. Shows calls (alphabetically), cities, wave lengths, 4 dial settings, remarks, etc. Station list by wave lengths. Stations alphabetically by states and cities. Valuable tuning suggestions. Station owners. Trouble aids. Check full of other valuable information. So convenient. Get clearer programs. Illuminate your troubles. Worth many times small cost. Only \$1.00. Order Now.

Radio Map FREE

Don't send a cent. Pay postman after log and map arrive. If you pay with order we pay postage. Money refunded if not delighted. You will enjoy this log. Order today—NOW. Postal will do.

RADIO PRINTERS, Dept. 2028, MARENGO, ILL.



SOLD under a positive guarantee—you take no chances when you buy EMPIRE-TRONS. No finer tube made! Retail in U. S. A. at \$2.50. If your dealer cannot supply, write us.

EMPIRE SPEAKERS

Beautiful in design; scientifically constructed; acoustically correct. Made in all popular models and finishes. Retail at \$13.50 up. We supply Fibre Horns to manufacturers of Loud Speakers at special prices. Inquiries solicited.

EMPIRE LOUD SPEAKER UNITS

Equal to any Unit on the market. Retail \$6.50.

Write for Illustrated Folder "A"

EMPIRE dealers are the leaders in every field.

Distributors Wanted—Write for prices.

AMER. INTERNATIONAL TRADING CO.

24-26 Stone St., New York

Cable address "Stanmarks"



If you want to be sure of getting your December RADIO AGE, with its big "Radio Age Receiver" Feature, Order from your news-dealer or subscribe NOW!

Operate Your Radio With One Switch

"Whenever you make radio so easy to operate that I can turn it 'on' and 'off' like an electric light, with no batteries to recharge or replace, you can send me the finest set you turn out," wrote a Congressman recently to a manufacturer.

This has been the challenge to radio of thousands of persons who have held off buying sets by reason of real and imaginary difficulties in their operation.

The Congressman referred to above has received his set. It was equipped with a new power unit that plugs right into a lamp or wall socket and transforms ordinary electric light current into the smooth, hum-free current necessary for radio.

One switch on this new power unit controls everything—"A" power, "B" power, even the radio set itself. Snap it "ON" and you get a strong, uniform flow of both "A" and "B" power. Snap it "OFF" and your power is shut off and your radio is silent.

This new radio power unit was developed by the Philadelphia Storage Battery Company and is named "Philco Socket Power."

Philco Socket Power is supplied in three general types: Socket Power B, to replace "B" batteries on any radio set; Socket Power "A" to supply filament current at six volts for all sets having standard storage-battery or five-volt tubes; and Socket Power "AB," which is a combination filament-current and plate-current supply for Radiola Super-Heterodyne and other receiving sets employing so-called dry-battery or three-volt tubes.

New Receiver Developed by McMurdo Silver

RADIO fans will be interested in a new receiver which is to be put on the market.

The set in question has successfully passed thorough tests and has been found efficient in construction and performance. These tests, together with the comment the set caused at the Radio Shows in New York, Chicago and Indianapolis, make it a logical contender for popularity this season. Construction details have not been announced as yet by the designer, McMurdo Silver, Assoc. I. R. E., who has already made a number of contributions to Radio.

The set is a six tube outfit that anyone can build in a few hours. Three stages of resistance coupled audio amplification result in a high quality of reproduction. The circuit is very sensitive and selective. It is a marvel of simplicity, and handles with equal efficiency all wavelengths above 50 meters. The set, which for the time being is called the Silver Six, operates with either one, two or three controls as desired, on either a loop or an antenna.

It's principle and construction are startlingly new.

* Tested and Approved by RADIO AGE *



Patented Nov. 18, 1924

Windsor Loudspeaker Console

For EVERY Radio Set

A stunning piece of furniture that restores order in the room where you have your Radio! No more cluttered table-tops, nor litter of equipment under-foot.

No unsightly horn in evidence, either! This console has its own loudspeaker, in-built. It's out of sight, but with very apparent tonal superiorities. For it has the highest-developed type of unit. With horn built of special non-vibrating, extra-hard, ceramic material. Produces clear non-vibrant tone.



Non-Vibrant Ceramic Horn

The clearest tone producer on the market. Made of special composition which defeats vibration.

There's ample room for everything; space for largest A and B wet batteries—or battery eliminator—required for any home set; and for a big charging outfit, too.

Finished in mahogany, or walnut color. Dainty design of parqueterie on two front panels. Top, 38 in. x 18 in. Substantially built; the product of a 40-year-old furniture maker.

The price, forty dollars, is for the complete console and includes the loudspeaker horn and unit. Thousands of dealers are showing this artistic addition to home radio equipment.

Rear View—Set Hooked Up



Price, \$40
West of Rocky Mts., \$42.50

Windsor Furniture Co.

1428 Carroll Ave.
Chicago, Ill.

Radio Parts *FREE!*

What parts do you need to complete your set, or what new parts do you want to try out? Below is a list of premiums we are offering which are easy to get. Look through the list, pick out what you want and send in the new subscriptions with a request for parts. Every item has been tested and approved by the RADIO AGE INSTITUTE, so you can be sure of the best parts made. More complete description will be sent upon request.

New premiums will be added to this list each month, so if you do not find here just the item you want, send in your new subscriptions and you will be given credit for them. Your premiums will be sent as soon as you decide what you want. Get in on this now! It is the best way to get guaranteed parts FREE. Subscription, \$2.50 per year.

Send checks or money orders with your letters when you send in new subscriptions. Let's go.

For ONE new subscription the following parts are offered as your premiums:

1. AMSCO Bakelite Dials, 100 graduations, 2,3 or 4 inches.
2. AMSCO Tube Sockets, panel or table mounting.
3. EVER READY C Battery.
4. BURGESS C Battery.
5. RED SEAL Dry Cell Battery.
6. BREMER TULLY type U L Socket. Eliminates use of adapters.

For TWO new subscriptions the following parts are offered as your premiums:

1. AMSCO Rheostats, Arrow Knob or Bakelite Dial. 2, 6, 8, 10, 12, 15, 20, 30, or 50 Ohm.
2. AMSCO Potentiometers, Arrow Knob or Bakelite Dial. 250 or 400 Ohm.
3. AMSCO Grid-Leak and Condenser. Fixed condenser, .00025 mfd. capacity and Grid-Leak, 2 Megohms.
4. Genuine non-inductive CRESCENT LAVITE Resistances. 12,000, 48,000, 50,000, or 100,000 ohms.
5. DAVEN LEAKANDENSER. Combination grid leak and grid condenser. 2, 3, 4, 5, or 7 megohms.
6. DAVEN RESISTO Couplers. Two pair of clips, one for holding the plate resistor and one for holding the grid leak.
7. STEINITE Interference Eliminator. Enables you to tune out locals and get distant stations.
8. Small BURGESS "B" Battery.
9. Small EVER READY "B" Battery.

For THREE new subscriptions the following parts to choose from:

1. CRESCENT Bakelite Panels. $\frac{3}{8}$ " thick. Size 7"x10" or 7"x12".
2. BREMER TULLY Variable High Resistances. Maximum resistances of 2,000, 50,000, 100,000 or 200,000 ohms.
3. BREMER TULLY Volume Control or Modulator. Used in audio circuits for noiseless adjustment of volume and improvement of tone qualities.
4. BREMER TULLY Non-Inductive Potentiometer. A variable high resistance with three terminals. Slider connects to center terminal and varies at either outer terminal to maximum resistance. 400 or 2,000 Ohm maximum resistance.

For FOUR new subscriptions the following premiums to choose from:

1. KLADAG EUPHONIC, Bakelite base, no tip, thoriated filament tube. 201A or 199 type.
2. CRESCENT Bakelite Panels. $\frac{3}{8}$ " thick. 7"x14" or 7"x16" or 7"x18".
3. VAN HORNE 3VA "Double Service" or Compromise Tube. Operates at 3 volts from either dry cells or batteries.
4. BREMER TULLY Tuning Control. 12 to 1 ratio. Provides positive control with a smooth easy action. With disc for marking station call letters.

For FIVE new subscriptions you can pick your premiums from the following:

1. ENSIGN Variable Condenser. Either .00025 or .0005 capacity.
2. MUSSELMAN Selective Antenna. 75 foot length coil.
3. Model 5VA, 3VA or 3VB MUSSELMAN Certified

Electron Tubes. 5VA and 3VA fit 201-A sockets 3VB fits 199 sockets.

4. AMSCO Allocating Condenser. Straight Line Frequency. 13 plates or 17 plates, .0003 or .00035 mfd. Single unit.
5. CRESCENT Bakelite Panel. $\frac{3}{8}$ " thick. 7"x21".

For SIX new subscriptions you have the following to choose from:

1. The AERO COIL Wave Trap Unit. Makes a very efficient wave trap or crystal set.
2. CRESCENT Bakelite Panels. $\frac{3}{8}$ " thick. 7"x24" or 7"x26".
3. SILVER-MARSHALL S.L.W. type, .00025, 11 plate, or .00035, 17 plate, condensers. Silver plated. Three inches square.
4. BREMER TULLY Three Circuit Tuner. A tuner of unquestioned merit for use in one to four tube sets. Two types, for 200 to 566 meters reception and for 50 to 150 meters reception.
5. BREMER TULLY "Torostyle" Transformers. Three types: Antenna Coupler, for Intermediate R. F. Stages, and for four tube sets.

For EIGHT new subscriptions we offer the following premiums:

1. AERO COIL Oscillator for Super Heterodynes, as advertised in RADIO AGE.
2. CREST Convertible Condenser. 23 plate. Convertible to all capacities. S.L.F.
3. Model 5VC MUSSELMAN Certified Electron Tube. Fits 201-A sockets.
4. SILVER MARSHALL type 105 Low Loss Coupler. For three circuit, tuned R.F., or other circuits requiring a highly efficient inductance unit. Wave length range, with stator shunted by .0005 mfd. condenser, 200 to 550 meters.
5. SILVER MARSHALL S.L.F. type, .0005 mfd., 35 plate, or .00035, 25 plate, or .00025, 17 plate condensers. Silver plated. Three inches square.
6. Seven by eighteen inch cabinet with hinged cover. (SILVER MARSHALL).
7. BREMER TULLY "Euphonic" Audio Transformers. Type 210, ratio 2.2 to 1 and Type 410, 4.7 to 1.
8. BREMER TULLY S.L.F. condensers. 13 or 17 plate, .00025 or .00035 mfd.

For TEN new subscriptions you can pick your prize from this list:

1. The AERO COIL Three Circuit Tuner. Advertised in RADIO AGE.
2. AMSCO ALLOCATING Condensers. S.L.F. 17 or 23 plates, .00035 or .0005 mfd. Double Unit.
3. KLADAG Knock Down, Mahogany Loop Antenna. Bank Wound, Centre Tapped.
4. STEINITE long distance crystal set. In beautiful hand-rubbed, walnut finish case.
5. STEINITE one tube regenerative set. 1500 mile range. Mahogany cabinet.
6. SILVER MARSHALL "Two Ten" Transformer. A long wave inter-stage transformer, peaking at 60 kilocycles. Combination iron core type and air core type. Turn ratio, 1 to 2.3.
7. SILVER MARSHALL "Two Eleven" Transformer. Peaks at 60 kilocycles in conjunction with the tuning condenser supplied. Air core type. May be used at input or output end of the amplifier, turn ratio 1 to 10. Complete with 60RC tuning condenser.



Howling and distortion in radio sets is frequently caused by running transformer leads too close together.

The case and brackets on B-T Euphonic Transformers are so designed that the transformer may be mounted in any position,—base-board, sub panel, or side,—with terminals always in position for most convenient and efficient wiring.

This is exclusively a feature of the B-T Euphonic Transformer.

“Pleasing to the Ear”

More and more is popular judgment of radio directed toward quality. Fidelity to speech or music as given in the studio is the requirement of today.

Convinced that better audio transformers were necessary to secure the full benefit of B-T circuits and apparatus, B-T engineers tackled the transformer problem. The result of their long effort is the B-T Euphonic, a superior transformer. As its name implies, it is “Pleasing to the Ear.” We believe it the best audio transformer available today.

Ratio 2.2 to 1

Price \$5.00

Ratio 4.7 to 1

Price \$5.75



B-T Straight Line Frequency Condenser

All the solid dependability of the famous B-T “Lifetime” Condenser,—the same electrical efficiency, the same superior bearing construction,—now available in straight line frequency plate design. For those who prefer this type.

Send for circulars.



Two Condensers, but One Dial Control

The famous B-T Type L Condenser now available in tandem. A typically sensible “trimming” device enables accurate balance between units.

Literature on request.

Tuning is Easier

Distance and tone are often only a matter of accurate adjustment. B-T Tuning Controls permit hairline adjustment easily and quickly.

Improve the appearance of your set as well.

Circulars on request.



The Latest Thing in Radio

The latest best circuits, the newest apparatus are always in “Better Tuning.” Helpful hints to set owners make it worth ten times the price. Send 10 cents for your copy.



B-T Torostyle Transformer

Built properly the toroid inductance is a big improvement. Poorly designed, a toroid makes oscillation control difficult and tuning broad.

B-T Torostyle Transformers are the result of inductance experience that began before broadcasting.

The Torostyle is built right.

Send for complete information.



B-T
“TOROSTYLE” FOR
EASY WIRING

Used in New Circuits

New circuits require potentiometers and variable high resistances. Tone is often improved by using a modulator. B-T Resistances are stepless, non inductive, smooth in operation and are unaffected by continued service.

Literature on request.

The B-T Universal Socket

A socket that takes the Navy Base Tubes all the New UX tubes without an adaptor. Poor contact an impossibility. Less capacity due to small area and wide separation of contact springs.

Send for circulars.



BREMER-TULLY MFG. Co.

532 S. Canal Street, Chicago, Illinois

Zenith was created for the home

ALL one needs to get the finest radio results from Super-Zenith is good musical taste and a feeling for exquisite tonal values.

So far as *technical ability* is concerned, the Super-Zenith is so easily controlled that a child can bring in just as many stations—just as quickly—*each with the same clear quality of tone*—as a radio engineer.

Only a demonstration can make completely evident the remarkably selective character of the Super-Zenith—its clear, sweet tone—its thorough dependability.

Such a demonstration is yours for the asking—in your own home, if you so desire. Simply telephone your nearest dealer.

Again Commander Donald B. MacMillan chooses Zenith for his Arctic Expedition. When human lives may depend upon the reliability of radio performance, only one reason can explain his choice: Zenith has proved to be the best obtainable at any price.



Super-Zeniths are priced at from \$240 to \$2,000. Each instrument is sold under a quality guarantee. Above is shown the De Luxe Spanish model.

| | |
|-----------------------|-------|
| Super-Zenith VII . . | \$240 |
| Super-Zenith VIII . . | 260 |
| Super-Zenith IX . . . | 355 |

Also Zenith regenerative sets (non-radiating) licensed under Armstrong U. S. Patent No. 1,113,149

| | |
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| Zenith 4R | \$100 |
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Zenith Radio Corporation, Straus Building, Chicago, Ill.



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