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RADIO WORLD

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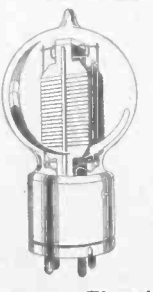
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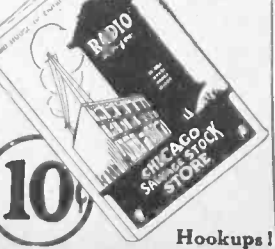
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RADIO WORLD

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March 29, 1924

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Construction of a Battery Charger Part I.

By *Walt. S. Thompson, Jr., E. E.*

ALMOST everybody has had an evening's entertainment spoiled by a storage battery "going dead." Unless the battery is charged frequently, this is bound to happen and usually it does so just when the battery is needed most. This annoyance can be avoided by using a battery charger so that the battery can be kept in condition at all times by charging it every few days.

For those who are fortunate enough to have a source of direct current available, a battery charger is not

Tungar tube; F—socket for Tungar tube; G—double pole, double throw switch; H—front panel 8" x 8 1/4" x 1/4"; I—baseboard 8" x 8" x 1/2"; J—backboard 8" x 8 1/4" x 1/2"; brass braces; K—two brass strips 9" x 1/2" x 1/16"; L—two brass strips 10" x 12" x 1/16"; M—four mounting bolts 3" x 1/4" dia.; N—economy fuses with mounting clips; 1 ten ampere size; O—five ampere size. Binding posts, wood screws, connecting wire, lamp cord, small brass bolts, empire cloth, etc.

Of the materials mentioned, probably the most difficult to obtain is the silicon steel for the transformer core. As this steel is the material used in the manufacture of large commercial transformers, it can sometimes be purchased at electrical supply houses or from some transformer manufacturer. Often electric light companies have steel stampings, taken from burnt-out transformers, which they will sell at a reasonable price. In any case a little shopping will usually be necessary before the proper material can be found.

After the silicon steel has been obtained it should be cut into sheets, the dimensions of which are given in the list of materials. Each stamping should have

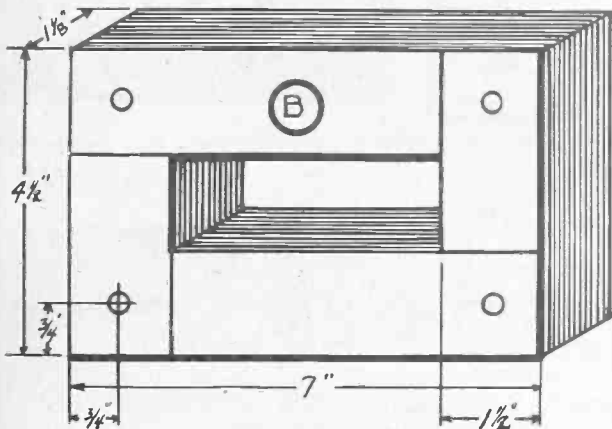


Fig. 1. Illustration showing a completely built up core. All dimensions given here are in accordance with the laminations called for in the bill of materials. Therefore if any change is made in the bill of materials see that a change is likewise made in the drilling and cutting dimensions.

necessary, but as the house lighting current is almost universally taken from 110-volt alternating current supply mains, some sort of charger must be purchased or made before such a source can be used. It is the writer's purpose to describe in this article the construction of such a battery charger. This charger makes use of a Tungar vacuum tube as a rectifier and can be made at slight expense, considerably below the market cost of a similar piece of apparatus, and will give just as efficient service.

In the following list of materials necessary, each piece of apparatus has been given a designating letter, corresponding to the letters given in the figures: A—ammeter; B—transformer core, 150 pieces of silicon steel 7" x 1 1/2" x .015", 150 pieces of silicon steel 4 1/2" x 1 1/2" x .015"; C—primary coil, 440 turns of No. 20 DCC wire; D—secondary coil, 60 turns No. 18 DCC wire, 8 turns No. 12 DCC wire; E—two ampere

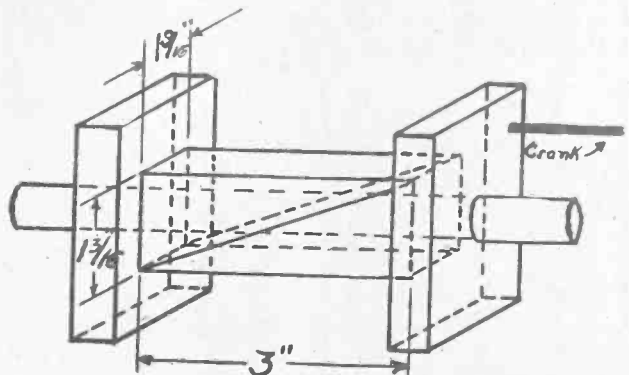


Fig. 2. Diagram shows dimensions for the winding jig on which both primary and secondary coils of the transformer are wound. Each coil is wound separately

a 5/16" hole drilled in the end as indicated by Fig. 1. In order to drill these holes with the least amount of work, a bundle of these stampings should be clamped together and drilled, repeating the process until all of them have been finished.

In making the coils, a winding form such as shown by Fig. 2 will be found convenient. The split-block
(Concluded on next page)

(Concluded from preceding page)

between the two end pieces should be made a little larger than the core of the transformer as is indicated. When winding, the form should be supported by the centre rod and turned by the crank shown. This crank is a wire nail driven in one corner of one of the end pieces. By placing a few turns of wire across the form before winding the completed coil can be held together, when finished, by twisting the ends of the wires together. The coil can be removed from the form by removing the centre rod and then removing

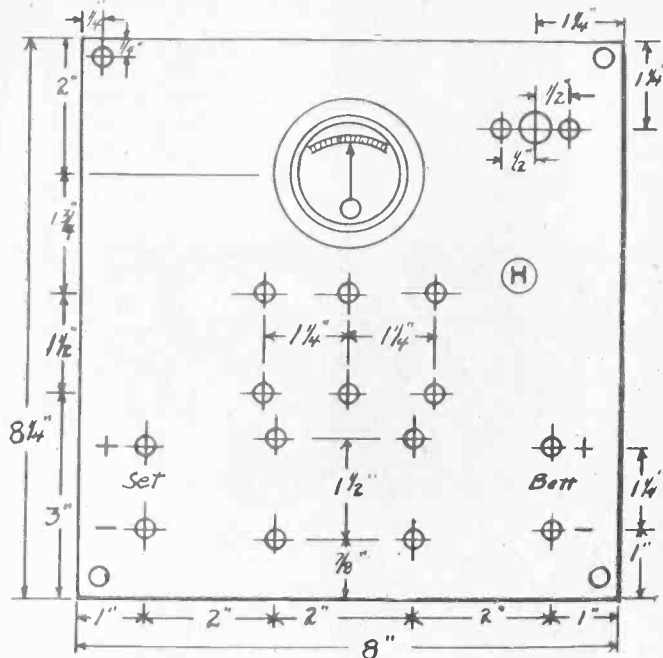


Fig. 3. Panel layout for front of battery charger giving dimensions and showing location of holes to be drilled. The size of the binding posts to be used will govern the size of the holes where no measurement is given.

the two split halves of the form. Each layer of the winding should be separated from the others with a layer of empire cloth and the entire coil should be neatly taped after being removed from the form. The tape should be threaded through the centre of the coil and around the outside, lapping each turn over the preceding one until the coil is covered.

The primary winding C (assuming a 110-volt A.C. source of current) consists of 440 turns of No. 20 DCC wire. The secondary D, for a six-volt battery, is divided into two parts, one, for filament lighting, consisting of eight turns of No. 12 DCC wire, and the other winding consists of sixty turns of No. 18 DCC wire. Both parts of the secondary should be wound in the same direction and should be connected in series bringing a tap off at that connection, as well as at

both ends. The end terminals of both windings and the tap from the secondary should be brought through the tape covering.

After the coils have been wound and the steel stampings drilled, the transformer should be assembled by building up the core inside the winding. The method of building up the core is shown by Fig. 1, the primary being on one leg and the secondary on the other. This operation can be simplified by using the four 3" bolts to keep the stampings in place as they are added one by one. After the core has been built up, the stampings should be firmly clamped together with the four bolts. The more firmly the core is clamped the less it will hum.

The front panel H, shown in Fig. No. 3, should be of radion, bakelite or other good insulating material.

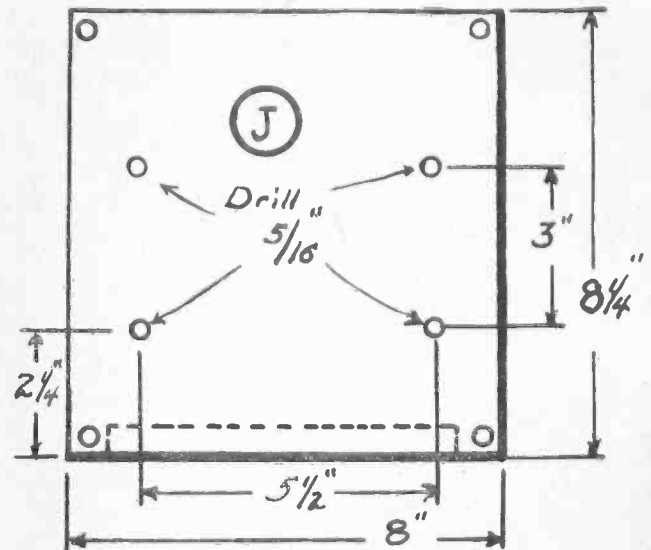


Fig. 4. Back panel J which is same size as front panel. This can be made of hard wood although radion or hard rubber may be used. The corner holes correspond to those drilled on front panel.

The dimensions given should be adhered to, except those for the double-pole double-throw switch. The location of the six holes for this switch will depend upon its size and should be laid out accordingly. No sizes have been specified for the holes as they will depend upon the size of the binding posts, etc.

The back panel J may be of hard wood and should be drilled as indicated by Fig. No. 4.

The ammeter shown mounted on the front panel in Fig. 3 should indicate both charge and discharge, such as those on automobile dashboards.

The second installment of this article, giving further details of construction, will appear in the next issue of RADIO WORLD.

Reducing Power Line Interference

ONE of the most annoying species of interference is the distracting and nerve racking low frequency radiation from electric light lines and street arc lamps. It is unfortunate that these noises cannot be entirely eliminated, but quite a bit has been done towards doing away with a good percentage of the nuisance. Where a number of tubes are used in a set, a loop may be employed, and a metal screen placed between it and the direction of the source of trouble. The screen must be grounded. This method

works fairly well in some cases, but the results may not prove very satisfactory.

Another and more workable method employs a one henry ironcore choke coil, which is connected in series with a .5 mfd. fixed condenser. These are placed across the antenna and ground terminals, thereby forming a low frequency by-pass. With some types of sets, this system is highly effective, and the interference can be cut down fifty per cent or more, depending upon conditions.

A Receiver of Tremendous Power

By Edward J. Wiggins

Chief Engineer, Electrical Research Laboratories

A NEW receiving circuit, with coast-to-coast range on the loud speaker and only two adjustments, has just been perfected by the Electrical Research Laboratories and is given to those who "roll their own." It is not a manufactured set. This

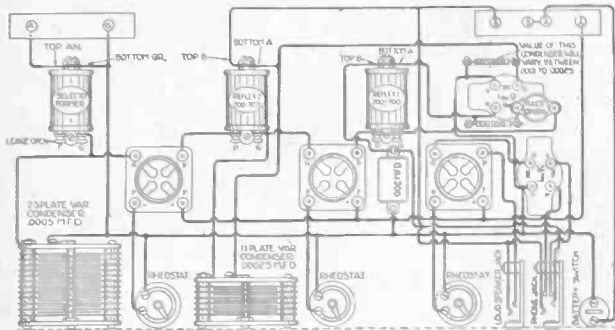


Fig. 1. Schematic diagram showing wiring and layout of apparatus used in the new three tube duo-reflex. Notice that there is no variocoupler used, thus eliminating taps and switches.

circuit can be accurately logged on its two adjustments and its selectivity is as good as that of any circuit yet devised, with the possible exception of the super-heterodyne.

The new circuit is a development and refinement of the three-tube duo-reflex and the secret of its unusual selectivity and volume is the selectoformer, which takes the place of the variocoupler, switches, taps, etc., that have always complicated tuning to a great degree, depending on the ability of the person operating the set.

The selectoformer requires no adjustment and has for its main object the coupling of the antenna to the receiver without broadening the signals. The antenna circuit is never tuned to resonance with any particular incoming signal, and the coupling of the antenna to the receiver is only sufficient to excite the receiver at the wave length to which it is tuned, without adding the resistance of the antenna circuit to the

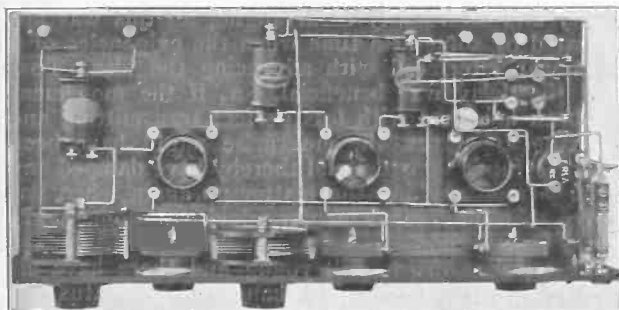


Fig. 2. Illustration showing layout of parts on baseboard. Note separation of R. F. transformers.

secondary circuit, which always causes a broadening and reduction of signals.

With the usual variocoupler it is possible to reduce the inductive coupling between the primary and the secondary to a fairly low value, but capacitive coupling still exists, which allows as full a coupling as if the total inductive coupling were maximum. The inductive and capacitive coupling between the primary and

secondary circuits is always fixed at a very low value by the selectoformer. With other couplers, reducing the coupling also reduces the volume of signals. This new device, due to its peculiar design, reduces the apparent resistance of the secondary circuit and, therefore, increases the volume.

In addition to this tuning device, the new circuit contains one stage of straight tuned radio-frequency and one stage of reflexed radio and audio-frequency and one stage of straight audio-frequency amplification. A crystal detector of the fixed type takes the place of a detector tube.

In building this set great care must be used in the

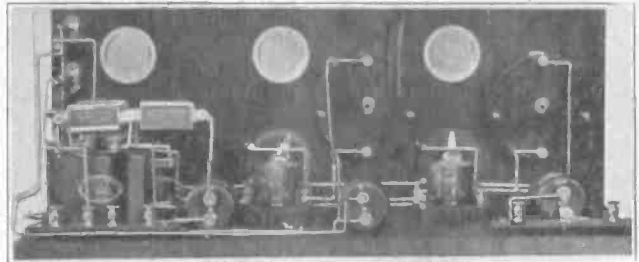


Fig. 3. Illustration showing back of panel and position of condensers and rheostats.

selection of parts, and it is best to use parts designed so that they synchronize to get the full value of the circuit.

Tests show that the UV201A and the C301A tubes are the best for use in this circuit. The UV199 and C299 tubes, which require 30 ohm rheostats may be used, with lowered volume as a final result. The WD11 and WD12 tubes are not recommended at all, as they cannot work in this circuit.

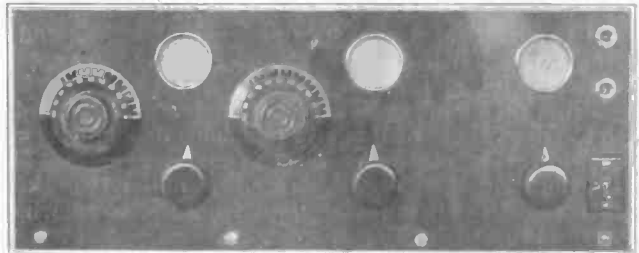


Fig. 4. Front panel layout of the three tube reflex set. Note simplicity of arrangement.

Here are the parts used in building of this set: One selectoformer; two bakelite dials; three rheostats; one 23 plate variable condenser (.0005 mfd.); one 11 plate variable condenser (.00025 mfd.); one single circuit jack; one double circuit jack; three sockets; one reflex transformer No. 1; one reflex transformer No. 2; one 6 to 1 audio transformer; one 3½ to 1 audio transformer; one crystal rectifier; three fixed condensers of .001, .002 and .00025 mfd. respectively; one panel 18 x 7 x 3/16; six binding posts; 25 feet tinned copper bus wire.

Tuning is done by adjusting the two variable condensers. The 23-plate tunes the selectoformer and input circuit while the 11-plate tunes the radio-frequency amplifier. These two adjustments should be about the same on the dial positions.

How Old Is Broadcasting?

By John B. Taylor

IT is often said that there is nothing new under the sun. The broadcasting art may be presented as either old or new, depending on the analysis and comparisons that are set up. Men have long employed supplementary devices to aid and extend their ability to see and hear.

The term "broadcasting" will, for most of us, call to mind such things as microphones, batteries, vacuum tubes, condensers and telephone receivers—all associated with an antenna or an aerial coil.

That our familiarity with a certain arrangement of these devices or mechanisms may not cause us to lose sight of fundamental features of the broadcasting enterprise, a brief perspective view is desirable.

In an ordinary speech or musical performance the starting point is the conscious mind of the speaker or performer, and the final point to be reached is the comprehending brain of the listener. Exactly the same initial and objective points hold for all broadcasting.

For the common communication as well as for the broadcast communication, control of energy and transformation of energy is involved. In the simpler case a nerve impulse (perhaps electrical in its nature) controls the muscles of lungs, larynx, lips, tongue and the like, so that an interrupted or vibrating air-stream gives speech or tone. A wave motion in the air spreads to nearby individuals. The pressure of these air waves on the diaphragm of the ear continues along the tiny bones which connect the external diaphragm with a smaller inner diaphragm, which in turn imparts a corresponding pressure or motion to the fluid of the internal ear. At this point (in an imperfectly understood manner) the pressure or motion affects the nerve lines, which terminate in the fluid, and convey to the brain what is sensed as sound or music.

All of the same links are used in radio broadcasting, while in addition the chain is greatly lengthened in the middle by adding a transformation from mechanical to electrical energy at the sending station, and a transformation back from electrical to mechanical at the receiving station.

From the diaphragm of the microphone in the studio to the diaphragm of the head telephone or loud speaker the forces involved are electric and magnetic. The air vibrations given out by receivers or loud speakers correspond to the air vibrations from the voice which were absorbed by the microphone.

The art of communicating between individuals is so old that nothing is known of the beginning. We can be quite certain that there was an early appreciation of the commercial, political or military advantage from informing, exhorting or directing large numbers of persons simultaneously. The Greek poet, Homer, in his account of the Siege of Troy, tells how one, "Stentor" by name spoke with a voice as powerful as the combined voices of fifty ordinary men.

It is related that Alexander the Great devised or made use of speaking trumpets of enormous size by which he could give orders to his generals at distances assumed to be the equivalent of about twelve of our

present miles. The ancients also gave much attention to the general design of their open-air theatres with the view of making it possible for the large audiences to enjoy and appreciate the dramatic and musical performances.

Throughout the centuries, working along in parallel with the development of communication by sounds, there has been communication by visible radiation. Under favorable atmospheric conditions, visible signals have a greater working distance than sound signals. An additional advantage of the visible signals is the straight line propagation of light which makes it possible to make the light signals a private or secret matter—whereas, with most sound signals, the information is sent in all directions.

Anywhere within a mile or two of some of the present broadcasting stations, a human body absorbs the radiated energy in greater amount than the quantity of energy which eye or ear must absorb to produce a visual or aural sensation—but, as we have no organs especially adapted to translate this radio broadcast energy into nerve forces and mental impressions, we require detectors and energy transformers as part of receiving sets to reach the brain in an understandable way.

We may speculate on the possibility of a more direct means of sensing the radiated energy. The eye and the ear are more complex than the simplest radio receiving set, so that we may, without going entirely beyond the realms of possibility, suggest that there may come forward some individual who, in the neighborhood of a broadcasting station, can, without detectors or telephone receivers, sense the fact that the station is transmitting.

Our present broadcasting activities are a valuable addition to the many means of communication discovered and developed in the course of centuries. Many notable individuals and much organization work has contributed to the technical success and popularity of the present day procedure. Wireless telephony had been successfully demonstrated and used to a limited extent some years before we acquired the habit of looking at the clock, consulting the published program and tuning to receive a particular station. The possibility and desirability of arranging all this was appreciated by some at a time when the exigencies of a great war interfered with advancing the idea. Possibly the delay was beneficial, for, if the movement had been launched with less perfect transmitting and receiving apparatus, the enterprise might have been unsuccessful at the start and thereby have damped any enthusiasm for taking the matter up again when improved tubes and supplementary devices become available.

The wireless art is still young and there have already been several sweeping changes in apparatus and working methods. What strikes me as the one outstanding fact in the whole achievement is that we have succeeded in "putting a bit in the mouth of space," which can carry our speech a million times faster and perhaps a million times farther than before.

Anniversary Number Next Week!

A Good DX Receiver at Low Cost

By C. White, Consulting Engineer

THESE is a general tendency in the radio field to develop radio receivers into extremely complex circuits. Many eight- and nine-tube receivers are not only expensive to maintain in perfect working condition, but secure results just a little bit better than regulation three and four-tube receivers. I maintain that simplicity should be the keynote of radio receiver construction. A complex system is not only critical in adjustment, but it is often inefficient due to the fact that there are many losses. Startling results have often been obtained on receivers that are, in reality, very simple.

In a recent test at which I was present, a certain receiver was "fixed up" in such a manner that it would be impossible to tell exactly how many tubes or what style of circuit was inside. After that demonstration many of those present were surprised upon inspecting the set to discover that only three tubes had been used. Aside from the space occupied by the tubes themselves, the interior of the cabinet looked empty. The great secret of the wonderful results was

ly through fibre gears to have these two united to form one single operating control. A method for doing this is illustrated in Fig. 2.

The gear trains are mounted on the front of the panel and method of initial adjustment is to tune the two condensers with idler gear removed. After the tuning has been accomplished the idler can then be inserted. A dial should be mounted on the shaft of the idler, as all tuning after the initial setting will be done by means of the idler gear shaft. Any person who is mechanically inclined can calculate and cut these gears out of hard rubber or some other workable insulating material. It will often be found convenient to equip one of the tuning condensers with a separate two-plate vernier for critical tuning, to allow for the slight play in the gear mechanism.

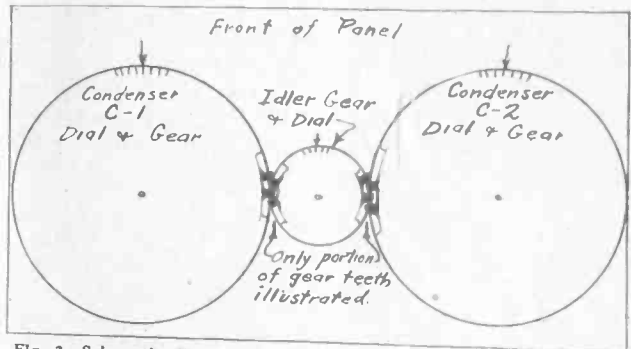


Fig. 2. Schematic diagram showing how both condensers are adjusted by means of one control. A fiber gear is used on the central shaft, with corresponding gears on condensers.

inch radion or formica tubing three inches long. The coil F is first wound on the tube and has 55 turns. On top of this is wound coil E with ten turns with taps for switchpoints at every two turns. The unit G-H is exactly similar except that the coil G is untapped and an extra coil I is wound on. This coil I has ten turns with taps at every second turn. This coil is arranged with a set of switchpoints and a switch arm.

In Fig. 1 is shown a very sensitive two-control radio-frequency receiver. Only two tubes are shown, the radio-frequency amplifier, and the detector. This receiver is very effective when operated with a one-stage power amplifier for audio-frequency

amplification. In an actual test wonderful results were obtained with a Magnavox one-stage power amplifier known as the AR-1 model. A vital point of difference in this receiver is the counter-balancing resistance R and the by-pass condenser C-3. A potentiometer is used to insure non-oscillation no matter how the construction is altered.

For the radio-frequency amplifying tube, I recommend Myers tubes, as they have unique construction that makes them very effective radio-frequency amplifying tubes. Daven Precision resistance units are recommended for the grid leak and the resistance R.

The constants for the construction of this receiver are as follows: The unit E-F is wound on three-

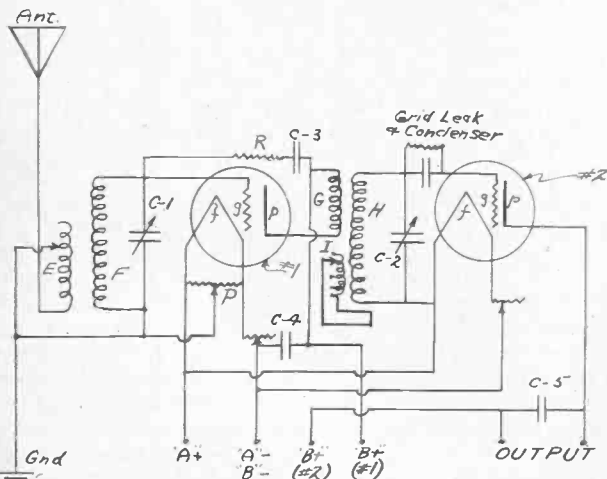


Fig. 1. Circuit diagram of the very sensitive two control radio-frequency receiver. Only the radio-frequency amplifier and detector are shown.

the extreme simplicity and the low loss apparatus in the make-up.

Tuned radio-frequency when properly constructed represents one of the most efficient types of receivers for DX work. When such a receiver is coupled up with a one-stage power amplifier most remarkable quality is obtained. In normal working there are only two controls to the receivers described and it can be arranged mechanical-

cy amplification. In an actual test wonderful results were obtained with a Magnavox one-stage power amplifier known as the AR-1 model. A vital point of difference in this receiver is the counter-balancing resistance R and the by-pass condenser C-3. A potentiometer is used to insure non-oscillation no matter how the construction is altered.

For the radio-frequency amplifying

The Mystery of a Grid Leak

By C. White, Consulting Engineer

THE action of a grid leak in the detector circuit has always been regarded as a sort of incalculable mystery. Many well-known technical writers on radio subjects have completely overlooked its action or rather an explanation thereof. Maybe it is because they consider its action too simple or too obvious to explain, or perhaps they regard it as too complex and uncertain. But nevertheless, it is a most important action and is certainly worthy of some explanation. It is well to bear in mind that the successful operation of your receiver lies in the few square inches of space occupied by the grid-leak and the grid condenser. The wrong grid leak will not only set up disturbances, but will cause all sorts of distortion. A lot of "home-made" static results from the use of a poor or inefficient grid-leak resistor.

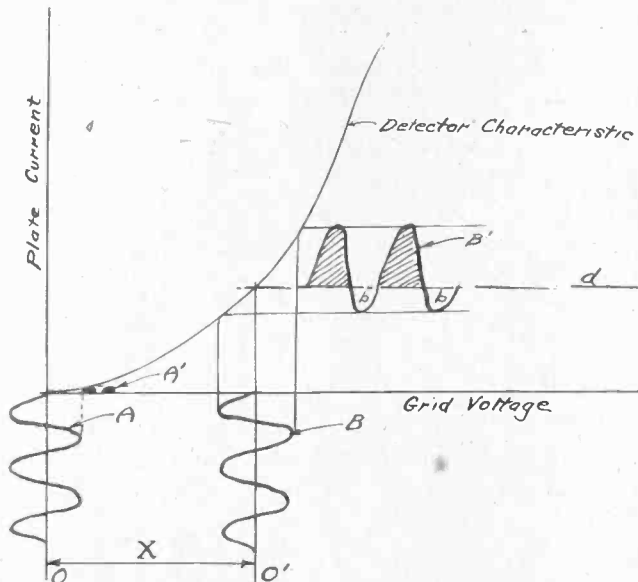


Fig. 1. Characteristic curve of detector tube showing increase of grid potential when grid condenser and leak is inserted in the circuit.

Every vacuum tube obeys certain definite laws which we call "characteristics of the tube." For example, we can rest assured that if we have a certain filament current, a certain plate voltage and a certain grid voltage, a definite known value of plate current will flow. Now if we vary this grid voltage and allow the filament current and plate voltage to remain constant, another known plate current which is different from the first value will now flow in the plate circuit. Now, if we rapidly vary the grid voltage, taking care to see that the filament current and the plate voltage remain the same, a variation in plate current will result and this variation will have the same frequency as the frequency of grid voltage variation.

On Fig. 1 is shown a typical characteristic curve of a detector tube for a given filament current and plate voltage. From this curve we can easily determine what variation of plate current will result from a certain variation of grid potential or voltage. Now let us analyze what would happen if we attempted to use a detector tube in an ordinary circuit without a grid condenser and grid leak resistance. This would mean in other words that the grid of the tube would

be very near to zero voltage until a signal was impressed upon it. If the alternating signal A be impressed upon the grid we would get a rectified, but small variation of plate current in the phones as noted by the small size of A. But let us place a grid condenser and grid leak in the circuit. The grid condenser would collect charges until it reached a point where they leak off around the condenser through the leak at the same time they accumulate on the grid. This would mean that the grid would be held at a certain definite voltage owing to the retention of charges on the condenser, regardless of the fact whether a signal were impressed on the grid or not. It would mean in other words that the zero grid, or rather, free grid, potential would be shifted from its former position at O to O1. Now, if the signal B be impressed on the grid of the tube a variation B1 will appear in the plate current which flows through the phones. Although the signals A and B are of the same magnitude it will be noted that the grid leak and condenser made a big difference in the response obtainable. In reality the grid leak and condenser shifted A to the right through a distance of X volts until it became B.

Unfortunately, it will be noted that although the response (that is the magnitude of the plate variations) was very much improved, still the signal is not completely rectified as shown by the presence of the small loop marked b-b. In reality these loops are so small as compared with their larger half B1, that they produce little or no effect at all in the phones. But, if you do not choose a grid leak and condenser that shifts the signal through the correct distance X, these loops or "back-tones," marked b, might drop far below the neutral axis c-d and the result will be a serious and noticeable distortion. A good detector tube will have a characteristic curve so shaped that the left hand throw of the wave B, will produce an extremely small loop b below the line c-d, and, the right hand throw will produce an extremely large loop B1. But, no matter what type of tube is used it is of the utmost importance to see that the signal is correctly displaced through the voltage X in order that as nearly ideal rectification as possible may result.

Grid leaks must not only be correctly and carefully selected, but must also have certain qualities that will insure their continual performance. A grid leak that changes resistance from day to day due to the absorption of moisture certainly is not desirable. Neither would a leak that changed its resistance when mechanically jarred be correct. In my opinion the ideal leak would be one that would adjust itself with the swing or alternations of the signal.

Suppose, for instance, we could make a leak that would so automatically and instantaneously adjust itself, that when the signal B took a left hand alternation the voltage X would become zero, thus bringing O over to O1 but, the instant B would start its right swing it would again shift O back to its original position. What would this mean? What would it avail us? It would mean that the negative loops b-b, which only diminish signal response and produce distortion in the phones would be immediately and completely eliminated, and that B1 alone would remain unchanged. As yet, no such leak has been produced, but, if ever such a thing were perfected, wonderfully true tone and quiet reception would be the result.

How the C Battery Works

Negative Bias Makes Plate Battery of Two Stage Set Last Twice as Long

By Brainard Foote

THE use of a C or grid bias battery has long been advocated for clear amplification. As a matter of fact, its most important function is that of B battery life-saver. As far as improved clarity goes, this function of the C battery is noticeable mostly in audio-frequency amplifiers using dry cell tubes. The UV201A or C301A tubes receive enough negative bias directly from the negative side of the filament to insure faithful tube amplification. *It must not be supposed that the C battery will overcome distortion caused by poor audio-frequency transformers.*

How does the C battery manage to cut down the drain on the B battery and thus lengthen its period of service? The answer is shown graphically in Fig. 1. The grid of the vacuum tube resembles the old familiar wooden window shutter which has a row of small vanes for regulating the passage of air. The rod to which all of the vanes are connected controls the size of the openings and thus allows more or less air to pass through the shutter.

In just the same manner the grid of the tube exercises control over the electron stream which flows from the filament to the plate. Since the electrons must pass between the wires of the grid, the electrical charge on those wires will either permit them to pass unchecked, or will, by repulsion, reduce the electronic flow. The electrons are negative because the filament from which they come is negative and also because electrons are negative charges of electricity by nature. They are attracted to the plate by virtue of the positive

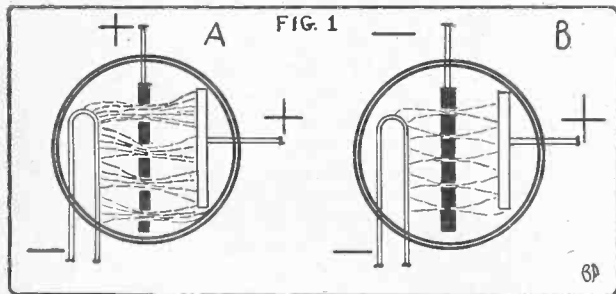


Fig. 1. A negative charge on the grid of an amplifier tube throttles down the electron flow and in that way saves the "B" battery, by only allowing sufficient current to pass.

charge placed thereon by the plus end of the B battery. The electrical law of attraction and repulsion is familiar to most of us. We know that the negative pole of one magnet attracts the positive pole of another magnet: (unlike poles attract). Also the negative pole of one magnet repels or pushes against another negative pole: (like poles repel). When the grid is charged positively, electrons are attracted to it as well as to the plate. Because the grid's charge never is very strongly negative (only a volt or two), the number of electrons drawn to the grid is not very large. The important fact to note is that the positive charge on the grid DOES NOT oppose the passages of the electrons as they shoot through the grid in their mad dash to the positive plate.

But, if we change from tube A of Fig. 1 to tube B,

where the grid is charged negatively things are much different. As like charges repel each other, the negative or minus charge on the grid opposes the passage of the electrons. The stronger this negative charge becomes, the fewer electrons "get by" and reach the plate. Fewer electrons mean less current drawn from the B battery. Of course if we carry the negative charging of the grid too far, the plate current will be so much reduced that the phones or loud speaker will scarcely operate. Hence we merely place enough negative charge on the grid to reduce the plate current to a value where good amplification is maintained.

The actual figures will be of interest. Fig. 2 gives the common connections for a tube amplifier—IN representing the secondary of an audio or of a radio transformer, and OUT being the primary of another

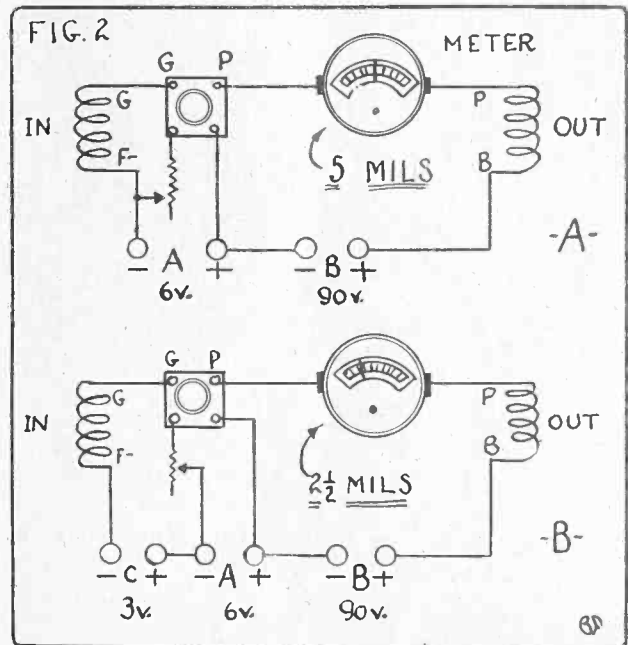


Fig. 2. What the milliammeter tells. Although without a "C" battery, the "B" battery must deliver 5 milliamperes, with the 3 volt "C" battery, the "B" battery is called upon for only one-half that amount.

similar transformer. Part A illustrates the circuit without a C battery. With a UV201A or C201A tube, the plate current at 90 volts of B battery is about 5 milliamperes, or five-thousandths of an ampere. But the insertion of a C battery of 3 volts in the grid return lead works a magic change. The plate current now is practically cut in two, and the meter reads only 2½ milliamperes.

Suppose we have a 3-tube set. One of them is a detector and C batteries can only be applied to the amplifiers, or two of the tubes. Without the C battery, the total plate current would be about 10 milliamperes, but with it, the plate current drops to about 5 milliamperes. If the B batteries we buy last two months without the C battery, they will last four months with
(Concluded on next page)

Volume—Its Use and Abuse

By Solon Crane

IF you have ever walked along the streets of downtown New York through what is now the radio center of the town, you undoubtedly have heard many loud speakers operate and wondered whether or not the merchants who were using this method of attracting attention thought that it was really valuable advertising. Just how the usual collection of groans, squeaks and distorted music and speech can be of any advertising value is far beyond the ken of the writer.

Then, too, you very often come across a rabid radio bug whose constant cry is "volume, volume and still more volume." It seems that some people never will be satisfied with the correct amount of volume from their receiving sets and will always be striving for more noise. The writer uses the word "noise" purposely because that is just what the average result is. The apartment house dweller who operates a loud speaker with three stages of audio-frequency amplification, the tubes turned up to full brilliancy and 150 volts on the plates of the amplifier tubes, ought to be drawn, quartered and thrown to the mercy of the other inhabitants of the same house. He has no business to operate his set in this manner and what pleasure can be gotten out of it is problematical. When a set is operated in this manner, the music or speech is far from good quality and is always distorted to a more or less extent, usually more. The set tends to howl and whistle and the average loud speaker could not stand the amount of power thus forced into it. The diaphragm starts to rattle and then there is "an awful mess."

It should be understood by every one that the vacuum tubes used in amplifiers are only made to operate on a certain voltage and that to force them beyond this point only causes them to distort the output. If you increase the filament current past normal or if you increase the plate voltage above a certain point, the

tubes cannot possibly operate correctly. The result is noise, nothing more nor less. Your tubes should always be operated at the best point for clarity and quality, rather than for quantity of volume. By doing so you obtain the most pleasure from your set and you do not disturb others. Some people seem to think that if they can get enough volume out of their set to cause the windows to rattle and the building to vibrate that they are having a good time, but do they think of anybody else?

The writer knows one radio bug in particular who has the disease of "volumitis," and this fine chap lives right near him. Even in the winter nights with the doors and windows closed it is very often possible to hear his set squeaking and screeching away. The other night while the writer was peacefully reading, he heard a noise which sounded actually as if someone was either in mortal pain or being murdered. However, upon investigation it was found that it was only a soprano singer from station WEA, who had hit a high note. The result was that the loud speaker diaphragm could not stand the load and it gave off a terrific screech. This combined with the tin horn used on the loud speaker gave rise to an awe-inspiring and fearful racket. The writer has often tried to find out just why this particular party likes to use a three-stage audio-frequency amplifier followed by a push-pull power amplifier, but has been unable to do so. The result is terrible.

All that one has to do in order to observe the etiquette of the game and prevent this annoying trouble is to learn to operate the set properly and manipulate his tube voltages so that they are not overloaded and so that the loud speaker and the rest of the set works at its greatest efficiency. Of course, sometimes poorly designed transformers give rise to distortion, but when such is the case there is not usually sufficient volume to annoy others.

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it! Instead of paying out perhaps \$20 a year for B batteries, we therefore spend only \$10. And the beauty of the whole scheme is that scarcely any current is drawn from the C battery. Natural deprecia-

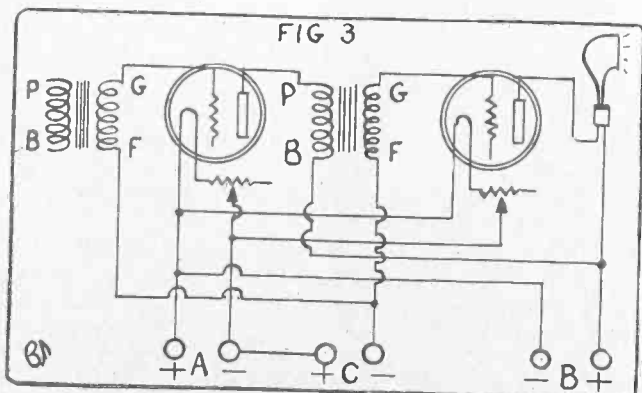


Fig. 3. The essential connections of a two stage audio frequency amplifier, with the "C" battery shown inserted in the "grid return" leads from both tubes.

tion alone wears it out. A 3-volt C battery is the correct size for most amplifying currents. More C

battery will, it is true, still further reduce the plate current, but this practice will result in diminished signal strength.

The elementary connections of a two stage audio amplifier are indicated in Fig. 3. The position of the C battery is shown. Its positive terminal is connected to the negative A battery and its negative side to the grid return leads of both amplifier tubes.

With dry cell tubes, where the A battery voltage is so low that no great negative bias is placed on the grid, the C battery is of more value than before. Poor amplification results when dry cell tubes are used without grid bias because of the fact that the grid is not always maintained at a negative potential. The amplifier tube operates because of the voltage fluctuations impressed upon its grid by the secondary of the transformer, whether this be of audio or radio-frequency. If the grid bias is slight, it is possible that sufficient voltage changes will occur to charge the grid positively now and then. A loud note will do this in the case of an audio-frequency amplifier. The variations of the plate current do not then follow uniformly the smaller changes going on in the grid circuit, and as a result, a particularly rasping note will be heard. By using enough grid bias to prevent the grid from ever becoming positively charged we avoid this distortion.

How Radio Relay Linked Six Stations

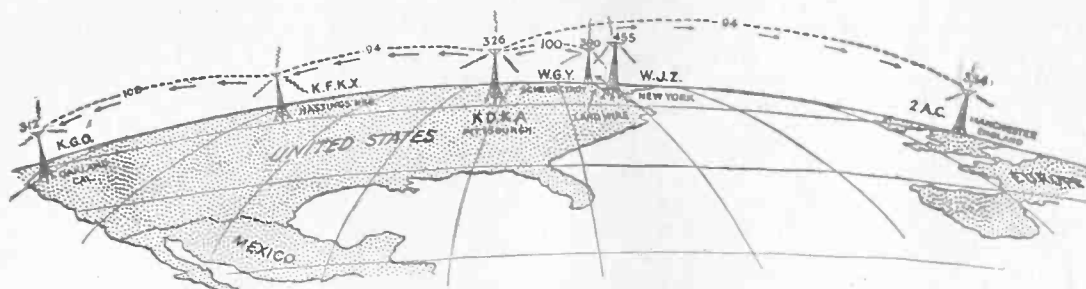
Simultaneous Broadcasting of Single Program by Stations Separated Seven Thousand Miles

THE latest and greatest achievement of modern radio science was successfully demonstrated recently by an experiment of heretofore unheard-of proportions when five powerful broadcasting stations in the United States and one in England, linked only by radio, simultaneously broadcast the speeches and music at the Annual Alumni Dinner of Massachusetts Institute of Technology given by the Technology Club of New York in the main ballroom of the Waldorf-Astoria Hotel in New York City.

Station WJZ of the Radio Corporation of America

The accompanying illustration shows pictorially just what paths the radio waves followed in their leaps from station to station. The speed with which the radio waves travel is so terrific that 2AC was broadcasting the same sounds as KGO at practically the same instant, there being an inappreciable time loss in the jump from the Waldorf to Manchester or to Oakland.

Because of the difficulties in perfecting relay transmission at one link of the chain, no advance notification of the experiment was given the listener-in, although



Sketch showing how it was possible to broadcast the same program simultaneously from six stations located throughout the United States and England without the use of any interlinking cable or telegraph lines, with the one exception of the line between WJZ and WGY. This simultaneous re-broadcasting opened the eyes of the scientific world to the wonderful possibilities of short wave relay broadcasting.

in New York City had its microphones installed upon the speakers' table and musicians' rostrum in the main ballroom of the Waldorf-Astoria, and carried the program from there to its control room at Broadcast Central by direct wire. Station WJZ broadcast the program on its usual wave length of 455 meters, while a tap-off wire from the amplifier panel in the control room carried the speeches and music to station WGY of the General Electric Company in Schenectady. From that wire the program was sent out from WGY by two different transmitters, one on the customary wave length of 360 meters and by the other, a specially designed short wave transmitter, on a wave length of 100 meters. This 100-meter signal, inaudible to the ordinary listener-in, was received on a special receiving set at station KDKA, Pittsburgh, Pa.

From that receiving set the program was again transferred to two separate transmitters, one broadcasting on KDKA's usual wave of 326 meters for listener-in reception, the other sending on a 98-meter wave length. This 98-meter wave linked KDKA with stations KFKX in Hastings, Nebraska and 2AC in Manchester, England. Station KFKX also re-transmitted the speeches on a 108-meter wave to station KGO in Oakland, California, which latter station re-broadcast the received signals for local reception on the west coast.

telephonic, telegraph and radiogram communication was arranged between the Waldorf-Astoria and the various stations which were to re-broadcast the program in order that early reports as to the success of the transmission could be secured. Consequently listeners-in from England to California were amazed to hear the announcement that "This program is being broadcast by station WJZ, New York City, WGY in Schenectady, KDKA in Pittsburgh, KFKX, Hastings, Nebraska, and KGO, Oakland, California." Almost immediately upon the conclusion of Mr. Ralph Howes' opening address, telegrams of congratulation commenced pouring in to the Waldorf-Astoria Hotel and continued to arrive from increasing distances until the conclusion of the program at 12:15 Eastern Standard time. At 11:22 P. M. Eastern Standard time, the first report of reception by station 2AC in England was telephoned from the radiogram office. At 12:15 A. M., Eastern Standard time a telegram from Mr. Sadenwater, engineer-in-charge of station KGO in California, stated that the signals had been received and rebroadcast. These latter messages definitely placed the stamp of success upon the experiment, for two stations over seven thousand miles apart had inconceivably received and been able to rebroadcast the same program without the use of any material connection.

Communication Conference Postponed

THE Inter-American Electrical Communication Conference, set for March 27 in Mexico City, was postponed until May 27, at a recent meeting of the Pan-American Union in Washington. This action, it is reported, was agreeable to the twenty-one countries interested, for several reasons. Unsettled conditions in Mexico and the fact that some of the member countries have not yet completed their agenda are understood to be among the reasons for postponement.

One of the most important subjects to be discussed at the conference is the use of radio in the western hemisphere and the relations between these two continents and the Old World. An All-American agreement is hoped for, and this would in turn be presented at the world conference at Paris, when that general session is assembled.

A full report of the activities and agreements reached by this conference when it meets will appear in RADIO WORLD at some future date, as soon as the information is available.

Wet Wash and Superheterodynes

By Jay Lewis Cermack

Experience Editor, RADIO WORLD, Dear Sir.—I enclose herewith a true account of my experience with two radio crooks. The hotel referred to in the narrative is in the neighborhood where several crooks were apprehended, and who confessed to several mysterious robberies in the vicinity.—Yours very truly, Jay L. Cermack.

A FEW weeks ago, while teasing a particularly stubborn three-tube Kaufman circuit to "do its stuff" with the "At-a-lanta Jurn-all," the telephone put an end to my endeavors.

The lady who was so anxious to call me at something after eleven at night was a highly valued client of mine, albeit a trifle troublesome whenever her outfit developed a tiny squeal.

"Would Mr. Cermack be so kind as to come over right away, I have so many friends here listening in, and just a moment ago the radio emitted a series of terrific squawks, and then Chicago wouldn't come in any more. Do you think it's an S O S, etc., etc."

Of course I went, but not until passing a rigid cross-examination conducted by—my wife.

The lady who telephoned resided in a small family hotel in West 57th Street, just a step from my home. Atop this building there were numerous aerials, many of which I had put up myself.

A trip to the roof and a look for her aerial disclosed the fact there wasn't any. Just a fragment of a lead-in remained. The radio "K.K.K." had evidently done its work quite thoroughly.

I had a roll of annunciator wire in my repair kit and proceeded to put up a temporary aerial with the aid of my flashlight. Having finished this, I started downstairs to fish in the lead-in, when, in the hallway, I met a young Englishman whom I had sold a superheterodyne to some time previous.

He invited me to his rooms, after I had again brought in WDAP for the fussy lady and her friends. I smoked one of his excellent Havanas, and discussed thieves in general and radio thieves in particular, to the strains of a radio orchestra.

I had known for many weeks that the hotel and the houses adjoining it had been subject to the depredations of petty-larceny thieves. Neighbors had missed their washing from the roof, aerials had been stolen—not to disconcert single-circuit set owners, but for the sake of the copper wire; and a very fine and expensive "super" had disappeared from the rooms of its owner only two nights previously.

Cope, the Englishman, was telling me of radio conditions in England, in which I was very much interested, when suddenly he sat up rigidly in his armchair, his eyes almost popping from his head, and his tense fingers breaking his cigar into fine smoking tobacco.

I looked toward the radio set, which had suddenly stopped its music. *It was slowly sliding in a silent, ghostly manner from the table to the open window!*

Slowly it crept further and further out—the thin ground wire snapped—the loud speaker jangled to the floor as its plug came out of the jack, and then, while we watched in mingled fear and amazement, the set slipped under the drawn shade and hung suspended outside the window.

Very quickly Cope recovered his senses and turning to his trunk extracted a formidable-looking revolver, and with me at his heels, ran to the roof. Cope was for disturbing the entire neighborhood with a series of

well-directed shots, but I convinced him that if he scared the thieves his very expensive outfit would be smashed in the court below.

We carefully opened the roof door and there in the pale moonlight we discerned two young men slowly pulling the radio set up to the roof by means of its lead-in, with an ease that spoke of long practice in the art.

We waited, impatiently, of course, for the set to be firmly placed upon the roof before starting operations. One of the men gathered up the "super" and hugged it to his breast as though he was fondling a long-lost child. The two then silently crept to a large water tank nearby. One climbed to the top of it, and the other culprit handed him Cope's set. This was hidden in the vast recess of the empty tank.

Cope intended making a quick and efficient capture with the aid of his automatic, but such was not to be the case. As soon as he produced the gun, one of the men knocked it from his hand with a black-jack. The other I had quickly and silently sent to worship Morpheus with a lucky punch.

Cope was on his knees groaning with pain. More interested in him than in the second thief, I permitted him to get away, and tried to bring my friend back to consciousness.

After a policeman had taken our one captive away, Cope and I investigated the tank. We found in its dark interior miles of copper aerial wire, sheets, pillow cases, and covered up by dozens of dainty pink ladies' unmentionables, a glorious Neutrodyne, all gold and mahogany, the "super" which was stolen a night or two previous, two or three loud-speakers, a multitude of headphones, and other radio material.

At court the next day, we received the information that the other crook had been apprehended and had confessed to similar crimes in other nearby districts.

New Broadcasters

Supplemental List of Class A Broadcasting Stations

Call	Station	Frequency Kcys.	Wave Length Meters	Power Watts
KFOJ	Moberly High School Radio Club, Moberly, Missouri....	1220	246	5
KFOL	Leslie M. Schafbush, Marengo, Iowa	1280	234	10
KFON	Echophone Radio Shop, Long Beach, California.....	1280	234	100
KFOP	Willson Construction Co., Dallas, Texas.....	1120	268	100
KFOQ	Ora William Chancellor, Galveston, Texas.....	1250	240	50
KFOR	David City Tire & Electric Co., David City, Nebraska...	1330	226	10
KFOT	College Hill Radio Club, Wichita, Kansas.....	1300	231	50
KFOV	Davis Electrical Corporation, Sioux City, Iowa.....	1280	234	10
KFOX	Board of Education, Technical High School, Omaha, Neb...	1210	248	100
KFBP	Edwin J. Brown, Seattle, Washington.....	1340	224	15
WCBF	Paul J. Miller, Pittsburgh, Pennsylvania.....	1270	236	50
WCBG	Howard S. Williams, Pascagoula, Mississippi (Portable)	1270	236	10
WCBI	Nicoll, Duncan & Rush, Bemis, Tennessee.....	1330	226	100

Ten Rules for "Making Your Own"

By *Onehoo Noes*

1. BUY the very best parts. It is better to spend five or ten dollars more than you had planned—and be surprised, than to buy cheap parts—and be disgusted.

2. Do not try to improve on the circuit—unless you understand just what you are doing. Changes never work.

3. Solder every connection. Use resin core solder and a fairly hot iron. Never use soldering paste, as it contains acid in some form—which is poison to a radio set.

4. Don't make a nice set and then put up a poor antenna. Make the job neat and thorough throughout.

5. Wherever there is the least possibility of two leads touching, use insulating spaghetti. A three cent length of spaghetti is cheaper than a \$5 tube.

6. It is cheaper to use good batteries and test them frequently than to wonder why the signals are failing. A voltmeter is cheap, and you don't have to throw it away when you get through using it.

7. A good worker is fast because he knows his work, but if you try to hook a three-tube set up in an hour and a half, you are wrong.

8. Good tools were never responsible for poor work. A man who uses good tools and turns out poor work is foolish. Likewise a man who uses poor tools and turns out good work is a genius. Good apparatus resembles good tools, and will make a good set.

9. A little solder in the right place is better than a pound of solder in the wrong place.

10. Do it right the first time and there will not have to be any second. No set made needs "ripping up" if it is made right the very first time.

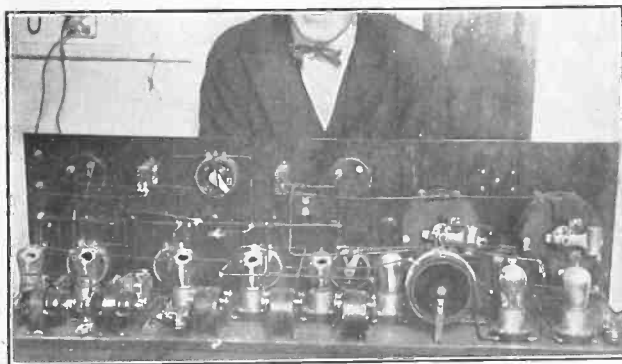
American Songs from England



(C. International Newsreel)

In the recent trans-atlantic tests, music broadcast from England by eight high-powered radio stations was heard by a number of fans on this side of the pond. It was the first time in radio history that an American copyrighted work was broadcast via radio from England. On the evening of March 13 the dance orchestra at the Savoy Hotel, London, England, played "I Love You," feature number of "Little Jessie James," the writer of which song, Harry Archer, is shown in the above picture. Mr. Archer must feel pretty good about this bit of work, according to his expression.

Efficient Low-Wave Set



(C. Foto Topics)

Here is a short wave super-heterodyne set that is unusually good for amateur work. Illustration shows rear view of Navy type A-6 Super using two original Telefunken Variable condensers. Notice the balancing weights fastened to ends of the shafts. Only a few changes were made from the original wiring, making the set remarkably adapted to receiving short waves in the vicinity of 200 meters. The arrangement of the transformers on the baseboard as shown permits very short plate and grid leads. Notice the grid condenser and leak attached right to the detector tube socket,

The Radio Primer

INDOOR ANTENNA ERECTION—It is often the misfortune of a radio receiving set owner to be so located, in a large apartment house or congested neighborhood, that he cannot erect an aerial out-of-doors without disfiguring the premises or interfering with neighboring antennae. Thus, the owner of the set is placed in a pretty difficult position—that of having a radio set and not being able to get the full benefit of it. However, there are more ways of getting around the problem than by stepping on everybody's feet.

A very good antenna can be put in houses of the slanting roof type, of which the top floor, or garret over the ceiling runs from one end of the house to the other with little or no obstruction. Bare or insulated wire may be used with equal results. Start on the side opposite to that from which you want to take the lead in. Fasten an end of the wire to a staple driven into the rafter or support, about half way between floor and top of roof. Run the wire in a straight line, taking care

that there are no kinks in it, to the other end of the house and there fasten it in the same manner. Insulators are not absolutely necessary but may be used. Next run the wire to a point one quarter of the way across to the other side and fasten it up higher than where the first wire ends. In doing this just run the wire upward diagonally. Now bring it back in a straight line to the starting point and you have the antenna half up. Care should be taken that the wires are placed equidistant from each other. The starting point will be the free end of the antenna.

Continue the wire exactly as before on the other side of the house, and take the lead-in from the finishing point. The lead-in can be run to the set through the usual opening in the ceiling, or a small hole in the ceiling of the room, directly over the set. With this type of antenna no lightning arrester or switch is necessary. Excellent results can be obtained using an antenna as described, in a very congested district. It was found that volume and distance were just as good and that less static was picked up than when using an outdoor aerial.

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Editor

Roland Burke Hennessy

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IMPORTANT NOTICE

While every possible care is taken to state correctly
 matters of fact and opinion in technical and general writ-
 ings covering the radio field, and every line printed is
 gone over with a scrupulous regard for the facts, the
 publisher disclaims any responsibility for statements re-
 garding questions of patents, priority of claims, the proper
 working out of technical problems, or other matters that
 may be printed in good faith and on information furnished
 by those supposed to be trustworthy. This statement is
 made in good faith and to save time and controversy in
 matters over which the publisher cannot possibly have
 control.

MARCH 29, 1924

Show as Well as Feel Your Appreciation

HOW often have you sat at your receiving set and been charmed by the voice of some entertainer! Frequently you have said to yourself: "I shall drop a line of appreciation to this wonderful artist." Then the busy affairs of everyday life intervene and you do not carry out your generous plan.

This is not right. You are, in a sense, a guest of the broadcasting station and of their fine artists, and as a guest you should, when so moved, write to the entertainers and tell them how you enjoyed their offerings. In no other way are you able to indicate to them how much happiness they have afforded you.

In the words that have been said many times before, "Obey that impulse." Be as generous with your written applause as the artists have been in giving you many precious moments of keen enjoyment.

Follow your inclination before it gets cold.

Substitution!

F OOLISH and short-sighted are radio dealers—fortunately few in number—who resort to substitution. It is all well enough for a salesman to try and sell the goods his firm has in stock when something not on the counters is called for, but this change should be made by gentle persuasion and not through any downright substitution. A very necessary thing, of course, is for a clever salesman to be something more than clever and not to persuade a customer to take some of his goods to be used in conjunction with other goods with which they do not fit. In other words, honesty is just as much the best policy in 1924 as it has ever been.

of one evening? Everything is in the favor of broadcasting new songs when you figure out the thing carefully.

Mr. Berlin and his brother publishers are barking up the wrong tree. Instead of withdrawing the broadcasting privilege, they should go out and on bended knees beg the broadcast managers to use their material. This fact is going to be demonstrated many times during 1924 by those independent music publishers who possess enough commonsense to know from which direction come the pleasant breezes of profit and popularity.

New York's Municipal Plan

AFTER a lot of fuss, New York has at last made arrangements to have a municipal broadcasting station installed. Commissioner Whalen, head of the Department of Plants and Structures, has been putting up a strong fight for a municipal broadcasting service, and has at last convinced the powers that be that it is a pretty good idea to bow to public opinion.

Now that New York has made its appropriation and actually is to have a broadcasting station of its own, there is no doubt that other municipalities will go and do likewise. There seems to be little doubt that before long every city of the first class on the North American Continent will have a broadcasting station of its own.

Service Important Factor in Growth of Radio

R ECENT demands in the development of radio show conclusively that greater attention to service in connection with the making and operation of sets is necessary.

Service is as important to radio as service and service stations have been in the development of the automobile industry, and in time it will have as important an effect on the radio industry.

The extent of research and service work now done by leading manufacturers of radio apparatus is not generally realized. Progressive radio manufacturers who have established their business on a permanent basis, realize that to keep abreast with developments in radio, and to make a product which will give service and satisfaction, they must maintain efficient engineering and research departments.

The Complaint of Irving Berlin

I N the first place, Irving Berlin is somebody in the song and publishing world. Therefore, when he declared recently that he would not permit the broadcasting of his song numbers, the incident was not lacking in interest. Mr. Berlin is the gentleman who some years ago made a very interesting jazz interpretation of Mendelssohn's "Spring Song." Since then he has done many nobler things in the realm of music. He now steps forth with the announcement that he cannot "see" radio.

Mr. Berlin is a shrewd business man, notwithstanding his artistic accomplishments—and yet how does he account for the fact that the song publishing business, in which he is engaged in an important way, was on the downward grade, so far as public support is concerned, before radio took hold of the public fancy? Music publishers have been grumbling and marking time for the past four years, whereas radio has really come into its own only since 1922.

Let Mr. Berlin take this thought into consideration: song numbers that were recently broadcast showed immediate activity at the sale counters of music stores. Some of these numbers were not of great popular appeal, and yet the mere fact that the broadcasting started the buyers of sheet music in the direction of the music shop is significant. If "song plugging," as it is known in the music trade, helped to popularize songs through the medium of singers in vaudeville and elsewhere, who reached only a few thousands, what should be said of the tremendous impetus given to numbers that are broadcast to millions of listeners—in the course

How to Build a Neutrodyne

Part III

The Neutralizing Adjustments

AFTER the set is wired, there is still one integral part of the circuit to be attended to. This is the neutralizing circuit, and takes in the two neutrodon and their adjustment. It will be noticed that on the outside of the neutroformer there is located a small loop of wire. This is the neutralizing tap. Take note of the fact that this tap is used only on the second and third neutroformers, and not on the first or antenna tuning neutroformer.

Bring a lead from this tap, on the second neutroformer, to one of the posts of the first neutrodon. From the other side of the neutrodon, bring the lead to the grid post of the first tube, and repeat the process on the second tube and third neutroformer, just as is shown on the circuit diagram, appearing in RADIO WORLD for March 5, 1924. The location of these two neutrodon is plainly shown in the illustration appearing on page 5 of RADIO WORLD for March 22, 1924. They are located between the first and second neutroformer, and the second and third neutroformer.

After this is done, and all the other leads are connected and checked, the next point is the complete neutralization of the tube capacity that causes the regeneration. This sounds like a very difficult proposition, but if the method outlined herewith is followed, it will not be very hard.

Connect the batteries to the proper binding posts, making sure of their polarity, and insert the tubes in the sockets. Connect the antenna and ground posts to the set, and turn up the tube rheostats. Place the phone plug in the first audio-frequency stage jack, and tune the set until a loud signal is located. Always move the three dials in step with one another. If the set is working properly, the signals will be heard with the same effect as though excessive regeneration were being used. Get the signal in loudest, remove the first radio frequency tube, and cover one of its filament prongs with a small piece of paper and replace it in the socket. The tube will not light, and in all probability the signals will not be heard. Re-tune the dials until the signals are again heard. When they are loudest, take a pencil and, with the rubber end, vary the capacity of the first neutrodon by sliding the metal tube back and forth until the signal fades nearly out. It is very rare that complete neutralization can be obtained, so some slight signal will leak through. However, when the signal is at its very weakest, place a piece of spaghetti under the sliding tube to hold it in place so that it cannot move. Remove the tube from the socket and replace it again after taking the paper off of the filament prong. This completes the neutralization of the first stage.

The neutralization of the second stage is identical, with the exception, of course, that the second tube is "stopped" by the paper, the first tube being lit to normal brilliancy. After both stages have been adjusted, the set should be tuned with both tubes at normal brilliancy to make a final test for the "neutralization." If at any point on the dials a squeal is heard when a station is being tuned in, and that squeal is not due to an outside regenerative receiver causing a "beat" note, the stage that is controlled by the dial which will cause the squeal is not completely neutralized and the process should be repeated. However, if care is

taken in the first adjustments, this should not be necessary.

Tuning a neutrodyne, when it is working right, is simple, and once a station is "logged" properly, it will always be found at that point, regardless of anything except a change in the constants of the antenna circuit, or a change in the wave length or frequency of the transmitting station.

The method to use in tuning the set is simplicity itself. The three dials are tuned, in step with one another, a degree at a time, until the stations are heard, and then a slight retuning on the second and third dials may be necessary in order to get the proper tuning. This, of course, will be understood when the wiring in the circuit is taken into consideration. Do not rush the tuning, but patiently stay with the receiver for three or four weeks, logging stations. Some stations that are almost identical in frequency (wave length) will be found just half of a degree different on the dial settings, but when once found they are there, and can be picked up if they are on the air, weather conditions permitting.

Don't get discouraged if you do not log sixty or seventy stations the first night that you operate the set. By taking your time and doing it right, it is perfectly possible to get stations 3,000 miles away with ease, and get them quite consistently.

Once the tubes are neutralized it is best to let them alone, and not take any chances by changing them around in their sockets. While it is not necessary to re-neutralize the set if the tubes are changed in the radio frequency sockets, it is advisable not to do so to preserve the original adjustment. With care the tubes should have a life of at least three thousand hours of constant service.

(This is the final installment of a three part article telling how to build and operate the popular five tube Neutrodyne. The first two installments appeared in RADIO WORLD for March 15 and 22.)

Radio!

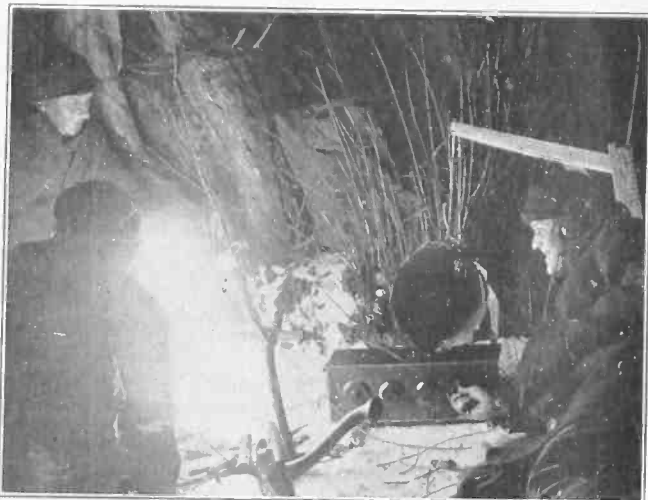
THE clear and vibrant ether winging,
This sister of the light
In subtle spaces soars,
And over Earth goes singing
Electric tones of might,
Released from unknown stores.

Of realms remote is this, her gift,
Though human is the choice
That holds the trembling sound,
Bestowed so strong and swift
By the radiance of her voice,
From out the welkin 'round.

Beyond the clouds and pale-lit moon,
Across the Planet Mars
Towards infinity she flies,
And the gleaming eyes of mind may soon
Discern her in the stars,
That point the distant skies.

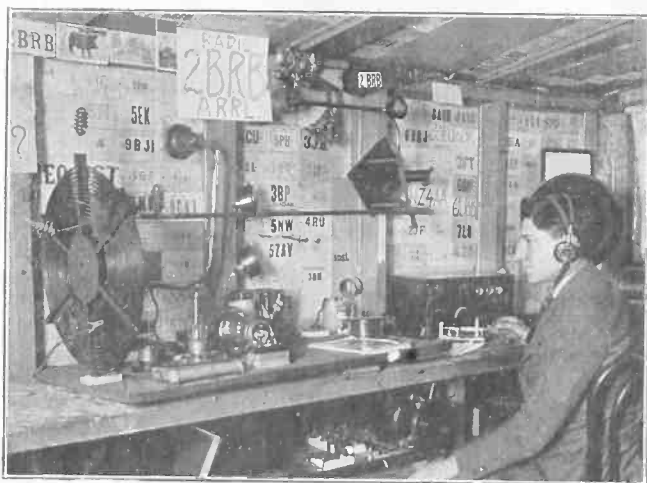
Harvey D. Cheney.

Radio World's Cameramen C



(C. Foto Topics)

For the outdoor enthusiast, these are the nights to gather around the campfire and tell of exciting experiences of yesteryear—unless you happen to have your radio set along, when you tune in to the stations, and get the latest from Broadway or "The Loop." In the illustration, these three old campfire pals are listening-in with the aid of a birch-bark loud speaker, while the fire crackles merrily.



(C. Foto Topics)

E. M. Gaser's station 2BRB, located in Brooklyn, N. Y., showing the transmitter and receiver. Note the fact that a 250 watt "bottle" is used. It is shown lying down alongside of the 50 watt. The imposing array of cards makes the other fans jealous, and serves as a sort of futuristic wall paper.



(C. Kadel and Herbert)

Doug and Mary, two moving picture stars who are endeared to the hearts of countless millions, recently gave the radio fans a thrill by broadcasting a little personal talk from WJZ. This was Doug and Mary's first appearance before a microphone in the east.



(C. Kadel and Herbert)

Radio receiving sets aboard speeding railroad trains is now commonplace, but what appears to be an unchallenged record was recently established when Miss Ethel Inman and L. S. Lindstrom tuned in PWX while their train was speeding out of Los Angeles.



(C. Foto Topics)

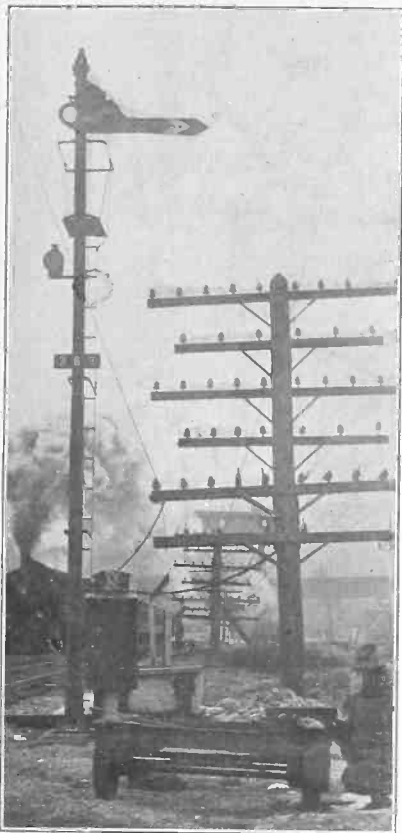
Hiking nowadays has more attraction than before. Misses Laura and Mary, of New York, took turns carrying their set along when they climbed to the top of Mount Washington, favored lugging the outfit, but when they reached the top and found a radio station.

If appearances mean anything, some favorite announcements

ck News Pictures Everywhere



Captions
by
N. N.
Bernstein



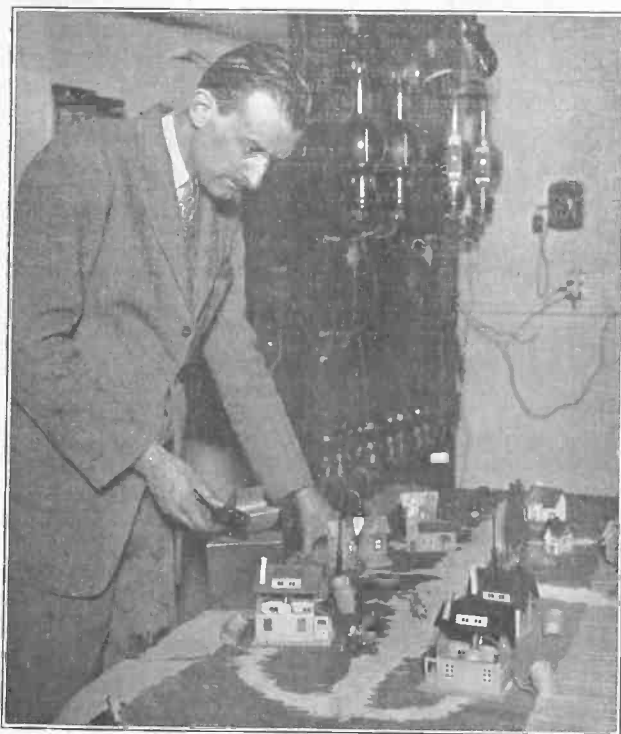
(C. Foto Topics)
Railroad engineers have established radio communication between a train and the dispatcher's office by means of radio.



(C. Kadel and Herbert)
Miss Helen Dickinson evidently did not want to handle a drill, or injure her hands by making a hole in the wall or window. Maybe the cruel landlord objected, or mother would not permit her to pass the lead-in under the window. Anyway, she got around all this by having nature serve her purpose. Radio waves will pass through any substance, and the arrangement pictured is simply two heavy lead or copper foil plates, one pasted on each side of the window pane, and the antenna wire soldered to the outside.



potter, Elizabeth Bason and Mabel Potter of Tuxedo Park, top of a mountain in the Adirondacks. None of them especially it going—oh boy—the jazz made them forget all their fatigue. was just sprung the "nub" of a pretty good story.



(C. Foto Topics)
The lights in the diminutive village are entirely controlled by radio. Mr. John M. High, Jr., who built this town, can, by simply turning the dial of the variable condenser on his transmitter, light up or put out any of the lamps in the toy houses.

Here Are Good Broadcast Programs

Station WRC, Washington, D. C.

469 Meters (640 Keys.) E. S. T. Mar. 27.—5:15 P. M.—Instruction in International Code. 6 P. M.—Children's hour by Matthews Dawson, author and illustrator. 7:45 P. M.—The Question Box by arrangement with the Pathfinder Publishing Company. 8 P. M.—Piano recital to be announced. 8:15 P. M.—"America's Playgrounds" by Senator Lawrence C. Phipps of Colorado. 8:30 P. M.—Song recital by Nina Pizoz, soprano. 10:00 P. M.—Concert of Hawaiian music.

Mar. 28.—3:00 P. M.—Fashion developments of the moment prepared by "Women's Wear." 3:10 P. M.—Song recital by Arthur McCormick, baritone. 3:25 P. M.—Current Topics, by the Editor of "The Review of Reviews." 3:35 P. M.—Piano recital by Ethel Grant. 3:50 P. M.—The Magazine of Wall Street.

Mar. 29.—8:00 P. M.—A talk on the United States Coast Guard by Oliver Maxon. 8:15 P. M.—Concert by The Brown Trio. 8:30 P. M.—"The Battle of the Dialects," by Ed Callow, Tom Brabany and Arthur B. Pierce. 8:45 P. M.—Concert by the United States Marine Band.

Station WSB, Atlanta, Ga.

429 Meters (720 Keys.) C. S. T. Mar. 27.—4:30 P. M.—Howard Theatre overture and prologue. 5:00 P. M.—News, music, etc. 5:30 P. M.—Miss Bonnie Barnhardt's songs and Burgess bedtime story. 8:00 P. M.—Gertrude L. Johnson Quartet in "Songs of Yesterday." 10:45 P. M.—LaGrange College Girls' Glee Club, of LaGrange, Ga.

Mar. 28.—4:00 P. M.—Howard Theatre overture and prologue. 5:00 P. M.—Vick Myers' Melody orchestra. 5:30 P. M.—Miss Bonnie Barnhardt's songs and bedtime story. 8:00 P. M.—Gospel melodies by Charlie Tillman, Georgia singing evangelist, and his company.

Mar. 29.—4:00 P. M.—Howard Theatre overture and prologue. 5:00 P. M.—News, etc. 5:30 P. M.—Miss Bonnie Barnhardt, songs and bedtime story. 8:00 P. M.—Emory University Glee Club and Jazz Orchestra (tentative). 10:45 P. M.—Skylark by Journal Hired Help, featuring Miss Bonnie Barnhardt, of the amethyst-purple eyes; Ernest Rogers, reporter-songster-guitarist; Ancient Ed and Silent Will Calloway, Spanish War instrumentalists and other parties on the payroll. 2:00 A. M.—Lambdin Kay's birthday party.

Station WGY, Schenectady, N. Y.

380 Meters (790 Keys.) E. S. T. Mar. 27.—11:55 A. M.—Time signals. 12:40 P. M.—Produce market report. 2:00 P. M.—Music and household talk, "How to Buy China" (courtesy "Modern Priscilla"). 6:00 P. M.—Produce and stock market quotations; news bulletins. 6:30 P. M.—Dinner music, Romano's Orchestra, New Kenmore Hotel, Albany, N. Y. 7:45 P. M.—Musical program furnished through courtesy of Jean Lyman Cooper School, Troy, N. Y. A few moments with new books.

Mar. 28.—12:30 P. M.—Stock market report. 2:00 P. M.—Music and talk, "Colors and Fabrics for Spring," Robert L. Smith. 6:00 P. M.—Produce and stock market quotations; news bulletins. 6:30 P. M.—Children's program. 7:35 P. M.—Health talk, N. Y. State Department of Health. 7:45 P. M.—"The Merchant of Venice," presented by WGY Players.

Mar. 29.—11:55 A. M.—U. S. Naval Observatory time signals. 12:30 P. M.—Stock market report. 12:40 P. M.—Produce market report. 9:30 P. M.—Dance music by Romano's Orchestra, New Kenmore Hotel, Albany, N. Y.

Station KGO, Oakland, Calif.

312 Meters (960 Keys.) P. T. Mar. 27.—1:30 P. M.—New York Stock Exchange and U. S. Weather Bureau reports. 6:45 P. M.—Final reading, stock exchange and weather reports, and news items. 8:00 P. M.—Hotel Claremont Jazz Orchestra and Mildred Erickson, coloratura soprano.

Mar. 28.—1:30 P. M.—New York Stock Exchange and U. S. Weather Bureau reports. 3:00 P. M.—Short musical program. Paper by William T. Innes on "The First Principles in Aquarium Management." 6:45 P. M.—Final reading, stock exchange and weather reports, and news items.

Mar. 29.—12:30 P. M.—New York Stock Exchange and U. S. Weather Bureau reports. 8:00 P. M.—Feature numbers by Mu Phi Epsilon Sorority, from College of Pacific, San Jose, California. 10:00 P. M.—1:00 A. M.—Dance music from the orchestra in the St. Francis Hotel Ball Room, San Francisco, Henry Halstead, leader.

Station KGW, Portland, Ore.

492 Meters (610 Keys.) P. T. Mar. 27.—11:15 A. M.—Window shopping. 12:30 P. M.—Concert. 3:30 P. M.—Woman's story program. Installment of "The Midlander," by Booth Tarkington. 8:00 P. M.—Accordion solos by Johnny Sylvester. 8:15 P. M.—Studio program of dance music by George Olsen's Metropolitan Orchestra. 10:00 P. M.—Dance music by George Olsen's Metropolitan Orchestra of the Hotel Portland.

Mar. 28.—11:15 A. M.—Market basket. 12:30 P. M.—Concert. 3:30 P. M.—Lecture provided by Extension Service, Oregon Agricultural College. 7:30 P. M.—Weather forecast and market reports. 8:00 P. M.—Lecture provided by Extension Division. 10:30 P. M.—Hoot Owls.

Station KFI, Los Angeles, Calif.

469 Meters (640 Keys.) P. T. Mar. 26.—4:45 P. M.—Evening Herald news bulletins. 6:45 P. M.—Nick Harris detective stories and concert. 8:00 P. M.—Evening Herald concert. 10:00 P. M.—Hollywoodland Community Orchestra. 11:00 P. M.—Ambassador-Lyman's Coconut Grove Orchestra.

Mar. 27.—4:45 P. M.—Evening Herald news bulletins. 6:45 P. M.—Y. M. C. A. concert, sales lecture and bedtime story. 8:00 P. M.—Ambassador Hotel concert. 9:00 P. M.—Examiner concert.

Mar. 28.—4:45 P. M.—Evening Herald news bulletins. 6:45 P. M.—Vocal and instrumental concert. 8:00 P. M.—Evening Herald concert. 11:00 P. M.—Ambassador-Lyman's Coconut Grove Orchestra.

Mar. 29.—4:45 P. M.—Evening Herald news bulletins. 6:45 P. M.—Agnes Woodward arranging vocal, whistling and instrumental program. 8:00 P. M.—Leonard Van Berg, Jimmy Kessel and Barney Weber. 10:00 P. M.—Vocal and instrumental concert. 11:00 P. M.—Ambassador-Lyman's Coconut Grove Orchestra.

Station CKAC, Montreal, Canada

425 Meters (710 Keys.) E. S. T. Mar. 26.—1:45 P. M.—Mt. Royal Hotel Concert Orchestra. 4:00 P. M.—Weather, news, stocks. 4:30 P. M.—Mt. Royal Hotel Dance Orchestra.

Mar. 27.—4:00 P. M.—Weather, news, stocks, music. 8:00 P. M.—Special program by Canadian National Railway artists and talks by officials.

Mar. 28.—1:45 P. M.—Mt. Royal Hotel Concert Orchestra. 4:00 P. M.—Weather, news, stocks. 4:30 P. M.—Mt. Royal Hotel Dance Orchestra.

Mar. 29.—7:00 P. M.—Kiddies' stories in French and English. 7:30 P. M.—Rex Battle and his Mt. Royal Hotel Orchestra. 8:30 P. M.—Variety entertainment from La Presse studio. 10:30 P. M.—Jos. C. Smith and his Mt. Royal Hotel Orchestra.

Mar. 31.—1:45 P. M.—Mt. Royal Hotel Concert Orchestra. 4:00 P. M.—Weather, news, stocks. 4:30 P. M.—Mt. Royal Hotel Dance Orchestra.

Station WBAP, Fort Worth, Tex.

476 Meters (630 Keys.) C. S. T. Mar. 30.—11:00 A. M.—Complete services of the First Methodist Church. 4:00 P. M.—Organ concert by Miss Margaret Agnew White. 11:00 P. M.—Popular concert by Fred Cahoon's WBAP Southern Serenaders Orchestra.

Mar. 31.—7:30 P. M.—Old-time fiddle music by Captain Dunning of Tahoka, Texas. 9:30 P. M.—Concert by the 50-piece band of Moslah Temple Shrine.

Apr. 1.—7:30 P. M.—Concert by the Municipal Band of Alvarado, Texas. 9:30 P. M.—Concert of Hawaiian steel guitar music by Fred Paul and Nanette Wagner.

Apr. 2.—7:30 P. M.—Concert by talent from Venus, Texas. 9:30 P. M.—Concert by George Freeman's Sooner Serenaders, the Texas Hotel Orchestra.

Apr. 3.—7:30 P. M.—Concert by James Wood, tenor; Mrs. Herman Knox, pianist, and other artists. 9:03 P. M.—Concert by the 50-piece Fort Worth Police Band.

Station WFAA, Dallas, Tex.

476 Meters (630 Keys.) C. S. T. Mar. 31.—12:30 P. M.—Address, Prof. J. D. Boon, department of astronomy, Southern Methodist University. 8:30 P. M.—The MacDowell Sisters in Hawaiian music, or George Ashley Brewster, in male quartet recital.

Apr. 1.—12:30 P. M.—Address, DeWitt McMurray, in a medley of humor, pathos and wisdom. 8:30 P. M.—Musical recital presenting the Mozart Choral Club. 11:00 P. M.—Musical and dramatic entertainment by players from The Jefferson Theatre.

Apr. 2.—12:30 P. M.—Musical program presenting the Red Head Girl of The Dallas Journal.

Station WQI, Medford Hillside, Mass.

360 Meters (830 Keys.) E. S. T. Mar. 27.—5:30 P. M.—Closing stock market reports. 6:30 P. M.—Meeting of the Amrad Big Brother Club. 7:00 P. M.—Evening program. 7:30 P. M.—Concert arranged by Elizabeth Bernard, soprano.

Mar. 28.—12:00 Noon—(1) Selection on the Ampico in the Chickering; (2) Amrad Round Table; (3) Selections on the Brunswick. 12:40 P. M.—New England weather forecast furnished by the U. S. Weather Bureau. 12:45 P. M.—Closing report on farmers' produce market report. 3:00 P. M.—Amrad Women's Club program: 1. Talk by Miss Dorothy H. Goodwin; 2. Afternoon musicale by the Brunswick playing Brunswick records, arranged through the courtesy of Kraft, Bates Spencer Co., of Boston. 5:30 P. M.—Closing stock market reports furnished by Elmer H. Bright & Company, members of the New York and Boston stock exchanges. Live stock markets report. 6:15 P. M.—Code practice, Lesson No. 258. 6:30 P. M.—Meeting of the Amrad Big Brother Club. 7:00 P. M.—Boston police reports, Boston police headquarters. 7:30 P. M.—Evening program.

Mar. 29.—6:30 P. M.—Meeting of the Amrad Big Brother Club. 6:45 P. M.—Code practice, Lesson No. 259. 7:05 P. M.—New England weather forecast. 8:00 P. M.—Ninth of a series of talks on New England Business Industry by Arthur R. Curnick of the New England Business Magazine.

Station WEAF, New York City

492 Meters (610 Keys.) E. S. T. March 27.—11:00 A. M.—Musical program to be announced. 11:25 A. M.—Talk on Table Silver by Alvin Silver Company. 11:50 A. M.—Consolidated market and weather reports by the U. S. and N. Y. State Departments of Agriculture and American Agriculturist. 4:00 P. M.—Gertrude Krantz, soprano; Tanglewood Serenaders; Edith Thayer, soprano. 7:00 P. M.—Midweek services under the auspices of the New York Federation of Churches. United Cigar Stores Daily Sport Talk by Thornton Fisher. Hambone Quartette; Talk by the Bank of America. Concert from Hunter College under the auspices of the Adolph Lewisohn Free Public Course in Chamber Music. Joint concert by Ella Good, contralto; Dr. Robert McConnell, baritone; Gladys Durham, soprano; Frank Munn, tenor, with accompaniments by Elsie T. Cowen.

March 28.—11:00 A. M.—Lecture by Professor Charles Zueblin under the auspices of the League for Political Education, direct from Town Hall, New York City. 11:50 A. M.—Consolidated market and weather reports by the U. S. and N. Y. State Departments of Agriculture and American Agriculturist. 4:00 P. M.—Original Radio Synchronizers Orchestra. Children's Hour with stories and songs. Mrs. Thornton Fisher, contralto. 7:00 P. M.—Dance program by Wittstein's Orchestra. United Cigar Stores Daily Sport Talk by Thornton Fisher. "The Happiness Boys," Billy Jones and Ernest Hare. Music by the World Mutual Instrumental Trio, and talk by Major A. A. Stewart, of the World Mutual Automobile Casualty Insurance Company. B. Fischer and Company's "Astor Coffee" Dance Orchestra. 10:00 P. M.—Music by the 24th Artillery Band.

March 29.—4:00 P. M.—Meta Christensen, contralto, accompanied by Elmer Zoller. Dance music by the Carolinians Orchestra. 7:15 P. M.—Health talk under the auspices of the New York Tuberculosis Association; Claremont Male Quartette; Adele Marcus, pianist; John Alden Spooner, tenor, accompanied by Ruth Spooner; Elizabeth Spencer, dramatic soprano, accompanied by Mabelanna Corby. 9:10 P. M.—Speeches at the Fourth Annual Banquet of the Associated Motion Picture Advertisers, Inc., direct from the Hotel Astor, New York City. Mr. S. L. Rothapel of the Capitol Theatre, will act as Toastmaster, and speakers will be Douglas Fairbanks, Mary Pickford, Will Hays, D. W. Griffith and Rupert Hughes.

Station KYW, Chicago, Ill.

536 Meters (560 Keys.) C. S. T. March 28.—6:30 P. M.—News, financial and final market furnished by the Union Trust Co., Chicago Journal of Commerce, and U. S. Dept. of Agriculture. 6:00 P. M.—Spanish lessons by Prof. A. A. Braashi. 6:50 P. M.—Children's bedtime story. 7:00 P. M.—Dinner concert furnished by the Congress Hotel Co. 7:00 P. M.—Joska DeBarbary's orchestra playing in the Louis XVI room. 7:10 to 7:20 P. M.—Clyde Doerr's orchestra playing in the Pompeian room. 10:00 P. M. to 2:00 A. M.—Midnight Revue: This is a Chicago Evening American-Westinghouse feature and is broadcast from the KYW studio in the Hearst building.

March 29.—6:30 P. M.—News, financial and final markets furnished by the Union Trust Co., Chicago Journal of Commerce, and U. S. Dept. of Agriculture. 7:00 P. M.—Dinner concert broadcast from the Congress Hotel. 7:00 P. M.—Joska DeBarbary's orchestra playing in the Louis XVI room. 7:20 P. M.—Clyde Doerr's orchestra playing in the Pompeian room. 7:30 P. M.—Joska DeBarbary's orchestra playing in the Louis XVI room. 8:00 to 8:58 P. M.—Musical program: Grace Zimmerman Wallace, soprano; Paul E. Woods, tenor; Maurice Kowsky, pianist; Georgia Karlson, contralto; Louis Kottler, violinist.

March 30.—2:30 P. M.—Studio chapel service furnished by the Chicago Church Federation. 7:00 P. M.—Chicago Sunday Evening Club service broadcast from Orchestra Hall, Chicago. Special musical program under the direction of Edgar Nelson.

Station WOC, Davenport, Ia.

484 Meters (620 Keys.) March 27.—10:00 A. M.—Opening Market quotations, garden and household hints. 12:00 M.—Chimes concert. 3:30 P. M.—Educational program—Musical numbers to be announced. Lecture by Karl G. Stephan, P.S.C., Dept. of Gynecology. Subject: "Physiology of the Stomach." 6:50 P. M.—Sport news and weather forecast. 9:00 P. M.—Orchestra program (1 hour)—P. S. C. Orchestra. Gerald M. Barrow, director.

March 28.—10:00 A. M.—Opening market quotations. Garden and Household Hints. 12:00 M.—Chimes concert. 2:00 P. M.—Closing Stocks and Market. 8:00 P. M.—Musical program (1 hour)—Erwin Swindell, musical director. Program given by the Jones String Quartette, of Oregon, Ill. Pauline Jones, first violin; Duane Jones, second violin; Donald Jones, viola; Cyrus F. Jones, cello. String Quartette.

March 29.—12:00 Noon—Chimes concert. 12:30 P. M.—Closing Stocks and Market. 3:30 P. M.—Educational program. 9:00 P. M.—Orchestra program (1 hour). P. S. C. Orchestra. Gerald M. Barrow, director. Featuring—"You'll Miss the One That Misses You," "Drift On, My Little Boat," "She's My Gal," "The Shadow in My Dream," "Maggie, Darlin'," "You Better Leave My Man Alone."

Station KDKA, East Pittsburgh, Pa.

326 Meters (920 Kcys.). E. S. T. Mar. 28.—9:45 A. M.—Union Live Stock Market reports from the studio of the National Stockman and Farmer. 11:55 A. M.—Arlington time signals. 12:00 M.—Weather forecast. United States Bureau of Market Reports from the studio of the National Stockman and Farmer. 12:20 P. M.—Lenten services of the Trinity Church, Pittsburgh, Pa., conducted by Rev. Floyd W. Tompkins, D. D., of the Holy Trinity Church, Philadelphia, Pa. 6:15 P. M.—Organ Recital by Lucile Hale. 7:15 P. M.—“From Abraham to Solomon,” the Sunday School lesson for March 30, presented by Dr. R. L. Lanning. 7:30 P. M.—Feature. 7:40 P. M.—National Stockman and Farmer market reports. 8:00 P. M.—Radio Boy Scout meeting. 8:30 P. M.—Concert, by the quartet of the St. Andrews Lutheran Church, Pittsburgh.

March 29.—9:45 A. M.—Union Live Stock Market reports from the studio of the National Stockman and Farmer. 11:55 A. M.—Arlington time signals. 12:00 M.—Weather forecast. United States Bureau of Market Reports from the studio of the National Stockman and Farmer. 12:20 P. M.—Lenten services of the Trinity Church, Pittsburgh, Pa., conducted by Rev. A. W. S. Garden, Emanuel Church, Pittsburgh, Pa. 1:30 P. M.—Concert by Daugherty's Orchestra, from McCreery's dinner room, Pittsburgh, Pa. 6:15 P. M.—Dinner concert by the Westinghouse Band, T. J. Vastine, conductor. 7:15 P. M.—Feature. 7:30 P. M.—Story by Dr. David Lang, pastor of the Shady Avenue Presbyterian Church. 7:45 P. M.—Last Minute Helps to teachers of Bible classes, by Carman Cover Johnson, Professor of History, Westinghouse High School. 8:00 P. M.—Address by Charlie Moran. 8:15 P. M.—Feature. 8:30 P. M.—Concert by the Westinghouse Band, T. J. Vastine, conductor; Alice Christine King, soprano and Louise Dicus, violin.

Station KHJ, Los Angeles, Calif.

395 Meters (760 Kcys.) P. T. Mar. 27.—12:30 P. M.—News items, weather report, music. 2:30 P. M.—Matinee musicale, arranged by N. W. Devereux. 6:45 P. M.—Children's program, presenting Dickie Brandon, screen juvenile. Bedtime story by “Uncle John.” 8 P. M.—Program through courtesy of A. F. Barton.

Mar. 28.—12:30 P. M.—News items, weather report, music. Address by Capt. W. F. Cannon. 2:30 P. M.—Matinee musicale. 6:45 P. M.—Children's program presenting Richard Headrick, screen juvenile. Bedtime story by “Uncle John.” 7 P. M.—Organ recital from the First Methodist Episcopal Church. 8 P. M.—Program presenting Spring Club Band of Pasadena, Carl Grischbach, violinist.

Mar. 29.—2:30 P. M.—Matinee musicale arranged by N. W. Devereux. 6:45 P. M.—Children's program. Bedtime story by “Uncle John.” 8 P. M.—Program through the courtesy of the Barnes Music Company, arranged by E. M. Bonnell, “Uncle Remus.” Hudson-Essex Male Quartet, Carl Crockett, Lute Crockett, Lute Eldridge and C. E. Barton.

Station WJY, New York City

405 Meters (740 Kcys.) E. S. T. Mar. 27.—7:30 P. M.—Clementine Rigo, soprano. 7:50 P. M.—Lincoln Trio, negro spirituals. 8:15 P. M.—Debate, New York University vs. University of Richmond. 10:30 P. M.—Roger Wolfe's Hotel Knickerbocker Grill Orchestra.

Mar. 28.—8:30 P. M.—“We of the New York Assembly,” by the Honorable Julius Berg. 10 P. M.—“The Democracy of Wall Street and the New York Stock Exchange,” by Jason Westfield. 10:10 P. M.—Dora Damon Pardee. 10:30 P. M.—Max B. Brick, lyric tenor. 10:45 P. M.—“Old Popular Songs,” by Fitzpatrick Brothers.

Station WNAC, Boston, Mass.

278 Meters (1,080 Kcys.). E. S. T. March 28.—12:15 P. M.—King's Chapel service. 1:00 P. M.—Shepard Colonial Orchestra. 4:00 P. M.—Shepard Colonial Orchestra. Incidental music—Broadcast from Loew's State Theatre. 6:00 P. M.—Children's Half-hour. 6:30 P. M.—WNAC Dinner dance—Broadcast from Hotel Westminster. 8:00 P. M.—Program arranged by the Weltman Conservatory of Music.

March 29.—1:00 P. M.—Shepard Colonial Orchestra. 4:00 P. M.—Tea dance—Broadcast from Copley Plaza Hotel. 6:30 P. M.—WNAC Dinner dance—Broadcast from Hotel Westminster. 8:00 P. M.—Concert program. 9:00 P. M.—Dance music—State Ballroom Orchestra—Broadcast from State Ballroom. 10:00 P. M.—Copley Plaza Orchestra—Broadcast from Copley Plaza Hotel.

Station WHAZ, Troy, New York

380 Meters (790 Kcys.). E. S. T. March 31.—9:00 P. M.—Concert by blind musicians, singers and entertainers. Garden talk by John Jeannin, Jr., extension lecturer. 9:45 P. M.—Conservation Week program under auspices of the State of New York Conservation Commission. Commissioner MacDonald and others. 10:15 P. M.—Popular dance music by the Campus Serenaders, Rensselaer Polytechnic Institute students' orchestra. Miss Pluma G. MacIntosh, leader.

April 7.—9:00 P. M.—Juvenile program of instrumental music and readings by children under twelve years of age. 10:00 P. M.—Popular dance music by Domino Novelty Orchestra. 10:30 P. M.—Program of old time songs and music, Radio Mail Quare and assisting artists, under the direction of Will H. Wade. 11:30 P. M.—Continuation of program of dance music by Domino Novelty Orchestra.

Station WHN, New York City

360 Meters (830 Kcys.). E. S. T. March 28.—11:00 A. M.—Harry Hock Entertainers, singing. 11:25 A. M.—Rose Garavante and Harry Donnelly, piano. 12:30 P. M.—Fred Whitehouse Song Review. 12:50 P. M.—Don Roberts of the Monte Carlo Restaurant. 1:00 A. M.—Harry Richman of the Wigwam Club singing his own songs. 1:15 A. M.—Lee Morse of “Artists and Models” at the Winter Garden. 1:30 A. M.—McGushion Sisters, late of “Adrienne,” in songs. 1:45 A. M.—Anna Balthy, prima donna of Earl Lindsays’ “Jingle Feet,” at the Strand Roof. 1:50 A. M.—Sam Lannin and His Roseland Ballroom Orchestra. 1:55 A. M.—Frances Upton and Blanche O'Brien of “Little Jessie James,” at the Little Theatre.

Station KSD, St. Louis, Mo.

546 Meters (550 Kcys.). C. S. T. March 27.—3:00 P. M.—Broadcasting the complete opera, “Martha,” by Von Flotow. 8:00 P. M.—Program to be announced.

March 29.—11:00 A. M.—Special music broadcast direct from the down town radio show. 4:05 P. M.—Special music broadcast direct from the down town radio show. 8:30 P. M.—Missouri Theatre Orchestra concert and specialties broadcast direct from the theatre.

Station WOR, Newark, N. J.

405 Meters (740 Kcys.). E. S. T. March 27.—2:30 P. M.—E. Paul Southe and Estelle Tobin, Vaudeville Sparks in Harmony, in Songs as You Like to Hear Them Sung. 2:55 P. M.—Brooke Johns, banjoist-singer, Victor Recording Artist, now appearing with the Ziegfeld Follies, in a short skit. 3:40 P. M.—E. Paul Southe and Estelle Tobin, Vaudeville Sparks in Harmony. 6:15 P. M.—Albert E. Sonn, Technical Editor of the Radio Department of the Newark Sunday Call, in his weekly talk on “Radio for the Layman.”

March 28.—2:30 P. M.—Program by the Cinderella Georgia Melodians. 3:00 P. M.—Princess Matchabelli (Maria Carmi), the Madonna in “The Miracle.” 6:15 P. M.—Songs for the children, by Agnes Leonard. 6:30 P. M.—“Man in the Moon Stories for the Children.” 7:00 P. M.—Concert by the Royal Trio.

March 29.—2:30 P. M.—Recital by Joseph Lord, tenor. 3:00 P. M.—Baritone solos by Vanston Lee. 3:15 P. M.—“An Afternoon with Young Genius,” under direction of “Uncle Robert” and Countess de Bruche, introducing several well-known young prodigies. 6:15 P. M.—“Music While You Dine.” 7:15 P. M.—Fred J. Bendel, sports writer. 8:00 P. M.—Gene Ingraham's Bell Record Orchestra. 9:15 P. M.—Concert by the Madrigal Male Quartet of Brooklyn.

Station WLW, Cincinnati, Ohio

309 Meters (970 Kcys.). C. S. T. March 27.—10:30 A. M.—Weather forecast and business reports. 1:30 P. M.—Business reports. 3:00 P. M.—Market reports. 4:00 P. M.—Piano solos by Adelaide Apfel. Times-Star News. 10:00 P. M.—“The Holy City,” by A. R. Gaul. Directed by Geo. Kampe. Soloists: Mrs. Fred Hollmeyer, mezzo soprano; Mrs. Norma Brinkmeyer, alto; Mrs. Geo. Graf, soprano; Mrs. Geo. Mehling, alto; Mr. Chas Klusemeyer, baritone; Mr. Geo. Hempfling, bass. 11:00 P. M.—Popular dance program by Doherty's Melody Boys E. A. Pendergast, piano; Ridge Bludin, trumpet; Leo Bludin, saxophone; Bake Holthaus, drums; Harry Kennedy, trombone; J. L. Doherty, banjo, and manager.

Station WBZ, Springfield, Mass.

337 Meters (890 Kcys.). E. S. T. Mar. 28.—11:55 A. M.—Arlington time signals; weather reports; Boston and Springfield market reports. 6:00 P. M.—Dinner concert by the WBZ Orchestra. 7:00 P. M.—“Ked of the Forest Patrol,” a dramatized story prepared by the Youth's Companion. 11:00 P. M.—Program of Chamber music by the WBZ Orchestra; and Arthur S. Cann, tenor.

March 29.—11:55 A. M.—Arlington time signals; weather reports; Boston market report. 7:00 P. M.—Dinner concert by the Hotel Kimball Trio, transmitted from the Hotel Kimball dining room; Jan Geerts, violinist and director; Angela Godard Longergan, cellist; Paul Lawrence, pianist. 7:30 P. M.—Bedtime story for the kiddies. 7:40 P. M.—Concert by Mrs. Milton J. Aronson, pianist; Walter Marsh, baritone.

Station WIP, Philadelphia, Pa.

509 Meters (590 Kcys.). E. S. T. March 28.—1:00 P. M.—Luncheon music by the Tea Room Orchestra. 1:30 & 6:00 P. M.—Official weather forecast. 3:00 P. M.—Recital by artist students from the Frank Oglesby Vocal Studios. 6:05 P. M.—The Jordan-Lewis Dance Orchestra, Mr. Bob Lewis director. 6:45 P. M.—U. S. Dept. of Agriculture Livestock and Produce Market reports. 7:00 P. M.—Uncle Wip's Bedtime Stories and Roll Call for the Children.

March 29.—1:00 P. M.—Recital by Karl Bonawitz on the Germantown Theatre organ. 1:30 and 6:30 P. M.—Official weather forecast. 3:00 P. M.—The Scranston Sirens. 6:05 P. M.—Harold Leonard's Red Jackets from Club Madrid. 7:00 P. M.—Uncle Wip's Bedtime Stories and Roll Call for the Children. 8:15 P. M.—The Russian Choir from the Church of the Holy Virgin, S. Nemetz, director. 9:00 P. M.—Excerpts from “Stradella,” by Flotow, by the Philadelphia Operatic Society.

March 30.—11:00 A. M.—Morning service from Holy Trinity Church. 4:00 P. M.—Broadcast of a program under the auspices of the International Bible Students' Association of Brooklyn, N. Y.

Station WHAS, Louisville, Ky.

400 Meters (750 Kcys.). C. S. T. March 28.—4:00 P. M.—Selections by the Walnut Theatre orchestra. Police bulletins. Weather forecast for Kentucky, Indiana and Tennessee. Crimson Ramblers, of the Transylvania University of Lexington, Ky. Selections by the Strand Theatre orchestra. Late important news bulletins. 4:50 P. M.—Local livestock, produce and grain market reports. 7:30 P. M.—Full concert under the auspices of Miss Helen I. Mitchell.

March 29.—4:00 P. M.—Selections by the Strand Theatre orchestra. Police bulletins. Weather forecast for Kentucky, Indiana and Tennessee. Selections by the Walnut Theatre orchestra. Late important news bulletins. 4:50 P. M.—Local livestock, produce and grain market reports. 7:30 P. M.—Concert by the Zur Schmiede Harmony Diggers.

Station WJZ, New York City

455 Meters (660 Kcys.) E. S. T. Mar. 27.—12 M.—Lenten service direct from Trinity Church. 1 P. M.—Pennsylvania Luncheon Music, from Pennsylvania Hotel. 4:45 P. M.—“That Street Called Broadway,” Rosalie Armisted Higgins. 7 P. M.—“Uncle Dave Corey's Jack Rabbit Stories.” 7:30 P. M.—Time questionnaire by time. 8 P. M.—“Problems of Crime,” by Dr. Henry P. Fairchild, N. Y. U. 9:30 P. M.—Duet by Leonia Adams, soprano; Kathryn Laehr, contralto. 10:30 P. M.—Dance program by Theodore's Hotel Majestic Orchestra.

Mar. 29.—12:10 P. M.—Friday Noon Hour of Music, direct from Brick Presbyterian Church. 5:15 P. M.—“Systematic Psychology” by Dean James E. Louish of New York University. 7 P. M.—Bedtime stories by Thornton Burgess. 7:20 P. M.—Radio boxing lesson by Carl R. Temple. 7:45 P. M.—Looseleaf Current Topics. 8:15 P. M.—“Booth Tarkington,” courtesy of Doubleday Page Co. 9:30 P. M.—Program direct from Emerson Recording Laboratories. 10:30 P. M.—Dance program by Paul Specht and his Hotel Alamac Orchestra.

Mar. 30.—2:30 P. M.—Special Saturday discussion of the National Democratic Club. 3:30 P. M.—Famous Fain Dance Orchestra. 4 P. M.—Tea concert by the Hotel Belmont Stringed Ensemble. 5 P. M.—Warner Hawkins, pianist. 7:45 P. M.—K. M. Wellinger, “Mistakes of Employees.” 10:30 P. M.—Frederick Velez's Spanish Orchestra.

Station KPO, San Francisco, Cal.

423 Meters (710 Kcys.). P. T. March 28.—12:00 M.—Time signals from the Naval Observatory. Reading of the Scriptures. 1:00 P. M.—Rudy Seiger's Fairmont Hotel Orchestra. 2:30 P. M.—Ray Tellier's Orchestra. 4:30 P. M.—Rudy Seiger's Fairmont Hotel Orchestra, Broadcast by wire telephony.

March 29.—12:00 M.—Time signals from the Naval Observatory. Reading of the Scriptures. 1:00 P. M.—Rudy Seiger's Fairmont Hotel Orchestra. 2:30 P. M.—Virginia Miller, pianist; California Collegians Jazz Orchestra. 3:30 P. M.—Max Bradford's Versatile Band. 8:00 to midnight—Art Weidner's Fairmont Hotel Dance Orchestra.

Station WOO, Philadelphia, Pa.

509 Meters (590 Kcys.). E. S. T. March 27.—11:00 A. M.—Grand organ. 11:30 A. M.—United States weather forecast. 12:00 M.—Luncheon music by the Tea Room Orchestra. 4:45 P. M.—Grand organ and trumpets.

March 28.—11:00 A. M.—Grand organ. 11:30 A. M.—United States weather forecast. 11:55 A. M.—United States Naval Observatory time signal. 12:00 M.—Luncheon music by the Tea Room Orchestra. 4:45 P. M.—Grand organ and trumpets. 5:00 P. M.—Sports results and police reports. 7:30 P. M.—Dinner music from the Hotel Adelphia Concert Orchestra. A. Candelori, director. 8:30 P. M.—Special musical program from Fox Boggs studio. 9:15 P. M.—Address: Samuel R. Boggs, National President of the Association of Gideons. 9:30 P. M.—Grand organ recital: Mary E. Vogt. 9:55 P. M.—United States Naval Observatory time signal. 10:52 P. M.—United States weather forecast. 10:03 P. M.—Dance music from the Kentucky Kernal. 10:02 P. M.—United States weather forecast.

Station KDKA, East Pittsburgh, Pa.

326 Meters (920 Kcys.) E. S. T. Mar. 27.—12:20 P. M.—Lenten services of the Trinity Church, Pittsburgh, Pa. 6:15 P. M.—Dinner concert by the KDKA Little Symphony Orchestra, conducted by Victor Saudek. 8:30 P. M.—Concert of Spanish music arranged especially for reception in Mexico and other Spanish speaking countries, by the KDKA Little Symphony Orchestra, and assisting artists. Greetings by Vice-Consul of Spain, J. L. Corriola.

Mar. 28.—12:20 P. M.—Lenten services of the Trinity Church, Pittsburgh, Pa. 6:15 P. M.—Organ recital by Lucile Hale. 7:15 P. M.—“From Abraham to Solomon,” presented by Dr. R. L. Lanning. 8 P. M.—Radio Boy Scout meeting. 8:30 P. M.—Concert by the quartet of the St. Andrews Lutheran Church, Pittsburgh, and an instrumental trio consisting of Mrs. Howard Noble, violin; Christine Adams, cello; Mrs. Lucille Gregg Fulton, piano. Members of quartet—Ada Corey Aufhammer, soprano; Eleanor Olive Edstrom, contralto; Robert Reed, tenor; Fred Wallis, baritone; Lucile Gregg Fulton, director and accompanist; Margaret Gregg, piano.

Mar. 29.—8:15 P. M.—Dinner concert by the Westinghouse Band, T. J. Vastine, conductor. 7:30 P. M.—Story by Dr. David Lang. 7:45 P. M.—Last Minute Helps to teachers of Bible classes by Carman Cover Johnson, Professor of History by the Westinghouse Band, T. J. Vastine.

The Radio University

A Question and Answer Department conducted by the Technical Staff of RADIO WORLD for the information and instruction of its subscribers. A "trouble shooter" is always ready here to help new radio fans.

INQUIRIES CANNOT BE ANSWERED OVER THE TELEPHONE.

Please communicate with the Radio University Department by mail, and your inquiry will be answered at as early a date as possible.

I have an R-C receiver which has given me good service, and on which I wish to place the C. White radiation killer. Can this be done on this type of receiver?—R. O. Ward, Winter Park, Fla.

You may incorporate this device on the set you mention. You will note the following, however, which has caused several of our readers to wonder whether the device works. You will be able to hunt for and get the stations by the squeal method and you will probably notice that the squeals are more intense, but rest assured that your set is not creating them or radiating them. The owners of other radiating sets in the neighborhood should be persuaded to incorporate such a device in their sets, and a non-radiating club started. These clubs are starting all over the United States, and are proving of great help in curing this evil.

I would like to have a correct diagram of the circuit used in the Federal 110 receiver. What are the best tubes to use in the circuit?—Earl Morgan, Hamburg, Iowa.

The correct circuit diagram and an explanation of the inductances used appeared in RADIO WORLD for January 19, on page 20, written by Jonas Leet. This is the only circuit diagram available and it is complete.

I intend to purchase a receiver, after having looked over and inspected a lot of the manufactured sets. The set I want must be moderate in cost, be extremely selective (I live but a mile from KDKA), must be able to get stations at a distance at any time that they are on, and lastly must be simple enough to be operated by anyone. Most of the sets on the market cost \$100 and over, which is considerably more than I care to spend. What manufactured receiver do you think is best, as I have seen none that satisfy my needs as yet.—James Mercione, Pittsburgh, Pa.

With the limitations given by you, it is pretty hard to give any particular set outside of one of the simpler regeneratives. All the good sets cost more than \$100, which is a cheap price for any receiver unless it is a thoroughly impractical set thrown together out of cheap materials. We cannot use this column to recommend competitive apparatus sold on the market.

I enclose a circuit diagram of a set which has not been performing correctly, if one can judge from some of the DX reports seen in your paper. It is the Gordon Circuit, using one tube, and no amplification. Is it possible to get distance (over 100 miles) out of this set? I am using homemade coils, and a WT201 tube. Will the addition of an extra tube help this circuit any?—Franklin Sellers, Philadelphia, Pa.

Your trouble lies in your tube. Use a standard three electrode tube and stop fooling around with these imitations. You cannot expect anything better from a tube that is not as good as a crystal detector. With this circuit and a dry cell tube you will do real DX work.

Please publish a hookup combining the Sodian S-13 tube and the one control reflex set described by B. C. Caldwell in RADIO WORLD for February 23. Can the UV199 tube be used in this set? What is the wave length of this set using the 75-turn honeycomb coil? Will the addition of a straight stage of audio-frequency on this set permit loud speaker work up to 1,000 miles? What is the loud speaker range of the superdyne on a loop antenna?—Harold Ellsworth, 2319 10th St., Troy, N. Y.

This tube is not an amplifier, so cannot be used in the circuit mentioned. The UV199 can be used with fair success as the reflex tube. The wave length range using a 75-turn coil, with the condensers specified, is around 350-600 meters maximum. It is problematical, you might and you might not, depending upon the conditions surrounding the reception. This receiver has received signals from stations 800-1,000 miles distant, using just 20 feet of light cable strung around the moulding, using UV201A and 216A tubes. It will probably do the same on one side of a loop, using a regulation ground.

I have just purchased a neodyne receiver, and get all the local stations because the installation man gave me their chartings. However, I understand that this is a good loud speaking distance

receiver, yet Troy is the first and only station outside of New York City that I have received. Is there any place that gives instructions as to the tuning of these receivers?—Harry M. Conzidine, Brooklyn, N. Y.

With this receiver it takes a little experience to tune it. However, there is generally a chart or book that comes with each set, showing the chartings for definite wave lengths. You will note that all three dialings are generally within a point or two of each other. The manner of finding stations is to revolve all dials a point at a time, from zero through to 100, marking down the dial settings every time a new station is heard. Sometimes two stations will be found within one-half point of each other, so careful manipulation is necessary. The more distant station the sharper and more critical the tuning.

I have a Radiola Aeriola Senior receiving set, with two stages of audio-frequency amplification, using the WD11 tubes. Is there any reason for hearing signals in the second stage, with the second stage tube turned off? I can do this any time I want, if the signals in the detector are loud enough for the purpose.—J. V. Henderson, New York City.

This trouble you are experiencing is due to the manner in which the amplifier is hooked up, namely, both filament returns are placed together, and one lead going to a common negative filament lead. This is not harmful, and your set is not operating any differently from a hundred others of the same make.

What does it cost to get an amateur license? How do I get it? Where do I get it? Do I have to have a license to buy radio parts and assemble and sell the completed sets?—C. Lusk, Jonesville, Mich.

Amateur licenses are free. It is only necessary to appear before the Radio Supervisor in your district, take a test to show that you are capable of operating a transmitter, and can receive and send at least ten words per minute, and are conversant with the laws governing the matter. Write to the Radio Supervisor, Federal Building, Chicago, Ill., for further details. If the circuits used are licensed or patented you must have permission to manufacture them.

Kindly give me the correct size of wire to use for an inside antenna, around the moulding of three rooms? How long should it be? Will it be possible to use a steam pipe for a ground?—Carl Swainer, Shenandoah, Pa.

Single cotton covered wire about No. 14 or 16 gauge will be correct for the antenna mentioned. About 100 feet of wire will do. Yes.

Where can blue prints of the superdyne receiver be obtained? Can DV2 tubes be used in this circuit? What make of rheostat do you think will give best results? What make of transformer do you suggest?—S. W. Moss, 1028 Sanford St., Muskegon Heights, Mich.

Blue-prints are not available for this circuit. Yes, the tubes you mention may be used with this circuit. Any good make will do. We cannot specify competitive apparatus through these columns. Use the best you can buy.

Can I use UV199 tubes in the reflex circuit that appeared in RADIO WORLD for March 1? How is the set hooked to the antenna?—T. L. Finch, Lookepa, Okla.

You may use these tubes in the circuit mentioned. It is not meant for operation on an outside antenna. Use the loop as otherwise the tuning will be too broad. We cannot answer your other questions as they refer to apparatus sold on the competitive market.

I intend to build a radio set incorporating one stage of tuned radio-frequency using the Crasley apparatus and idea. I have been told that such a set is capable of re-radiating, but at the same time understand that a set that incorporates one stage of radio-frequency cannot re-radiate. Is this true?—Carl Weber, Fleetwood, Pa.

Any radio-frequency receiver, unless it incorporates some means of neutralization, either by reverse feedback, anti-capacity neutralization, or by some other means of stopping the oscillation in the tube circuits, will re-radiate. This is what makes the normal tuned radio-frequency receiver so hard to handle, as it is very critical.

I have constructed the regenerative circuit outlined underneath and find that while it gives me good results on detector, that when I try to get any thing except the real loud signals through on the first stage that I cannot do it. What is my trouble?—M. E. Searles (no address).

Your diagram shows that you have connected one side of the primary to the plate, but does not show any connection for the other side to the B battery. The side of the transformer marked B should go to the side of the jack that makes contact with the open spring connecting to the B plus side of the circuit. Then your grid return is placed on the plus side of the filament instead of the minus. Change these two items and see if it does not function properly.

Can I use a UV200 for detector and three UV201A tubes for the audio, radio amplifiers in the superdyne? I am also bothered by induction from the arc light outside my house. When the light goes out, everything is fine, but when it is lit I cannot get anything but a terrible roar, no matter how I tune. Different antennae have been tried, but with no success.—P. D. Bailey, 380 Wood Ave., Bridgeport, Conn.

You may use the tubes you mention with good success. As to the induction trouble you notice, you seem to be in a pretty bad fix. A partial solution of your trouble is to place a 1 Henry choke and .5 mfd. coil condenser between the antenna and ground posts of your receiver. Also use a counterpoise instead of a ground. Inform the lighting company of your trouble, as there is probably a faulty transformer near your house.

I have a K— receiver and amplifier but am unable to get any DX out of it. Several of my friends have the same trouble, and I desire to put two stages of radio frequency in front of it. Can you furnish such a circuit?—L. H. Brumster, St. Louis, Mo.

The set mentioned uses tuned plate regeneration, and is good for both selectivity and distance. It is not desirable to put radio frequency in front of a regenerative set as the control of such a set is rather critical and will cause no end of trouble by howling. Learn how to tune the set mentioned and you will find out that it is good for distance work.

How much plate voltage will a C12 dry cell tube stand in the circuit of LeRoy Westerns, published in RADIO WORLD for January 5, 1924.—Daniel C. Kennedy, Christopher, Ill.

Twenty-two and one-half volts will be sufficient for the purpose. When a tube is used as a detector, that is all that is necessary. Some tubes even operate better on less, but this is a matter of personal experiment, as all tubes are not exactly the same.

I have constructed a two step tuned radio-frequency receiver as described in the RADIO WORLD for Dec. 8 and find it works very well. Also added an amplifier which still improves it. Would a set with three steps of radio-frequency "reach out" still further?—F. W. Hall, 333 Lander Ave., Toronto, Ontario.

Yes. You can add another step of radio frequency amplification using the same values as are used in the other two steps. You will find that three steps will be a bit more selective, and that distant stations will be heard better.

I am using a one bulb detector set to which I have added a one step audio amplifier. Can the White radiation killer described in the RADIO WORLD for Dec. 8 be used with this outfit?—Fred C. Loney, 4835 Woodward Ave., Detroit, Michigan.

The White radiation killer can be used with your set. In addition to preventing your set from radiating, it will make your set more sensitive and selective.

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Name.....
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Problems of Broadcasting Quality Discussed by Experts

IN a demonstration and technical paper delivered before the Midwinter Convention of the American Institute of Electrical Engineers by W. H. Martin and H. Fletcher, engineers of the American Telephone and Telegraph Company and Western Electric Company respectively, a thorough discussion of quality in broadcast reproduction of music took place. Many points of great interest to radio listeners were brought out.

Both music and speech consist of combinations of sound waves of many differing frequencies. The notes of music range all the way from the lowest tones of the organ and the kettle drum, which are in the neighborhood of sixteen vibrations per second, up to the high overtones of the violin and the piccolo which may exceed even 10,000 vibrations per second. The sounds of speech do not cover quite as wide a range of frequencies as those occurring in music. In general, most of the energy of speech is carried by the vowel sounds and at frequencies below 1,000 vibrations per second, but the fine modulations of the vowels which produces the stop consonants involve frequencies mostly above 1,000 vibrations or cycles. The production of the fricative consonants also involves higher frequencies and it was found that such sounds as "S" and "F" and "TH" have their sound spectra in the frequency range between 4,000 and 10,000 cycles.

Such a broad band of frequencies need not be transmitted in order to make speech intelligible. For example, a transmitting system, be it either wire or radio, which carries a frequency range from 500 to 2,000 cycles reproduces speech which can be easily understood. Although these limited frequencies give intelligibility, they do not give a natural reproduction. For this reason a wider frequency range is used in broadcasting. A frequency range

from 100 to 3,000 cycles gives a satisfactory degree of naturalness in broadcasting speech. Appreciable improvement is obtained by the extension of the upper end of the range to 4,000 cycles, and preferably it should be placed much higher.

In broadcasting music, the broad sweep of its frequencies from about 16 cycles to 10,000 cycles makes its proper handling extremely difficult, particularly when the large energy of some of the low notes such as used in the pipe organ are taken into account. However, it has been found that by transmitting a frequency range from 50 to 5,000 cycles good reproduction of most kinds of music can be given.

Another problem which offers many difficulties is the wide variation in volume which must be handled in the case of certain musical instruments. This, according to the authors of the paper in question, constitutes one of the phases of the technique of broadcasting which requires constant attention. For speech, the variation in average power is of the order of 1,000 to 1. In music, and especially such as is given by a symphony orchestra, the energy variation between the softest and the loudest passages may be as great as 100,000 to 1. In the present state of the electrical art, it is not practicable to handle such an enormous range of volume in broadcasting. This limitation arises, not so much from the capacity of the broadcasting apparatus as from the existence of extraneous noise. The softest musical passages when broadcast, must be made sufficiently loud to override static and other electrical interference in the ether, receiving set noise and any incidental noise. When the softest passages are made loud enough to overcome such extraneous interference, it would be extremely expensive to provide the equipment for making the loudest passages 100,000 times as loud.

Conflict in Broadcasting

RADIO enthusiasts in the zone between Montreal and Toronto, have for a long time been puzzled by the difficulties attending the reception of broadcasting from these cities and with a commendable thirst for knowledge want to know why Toronto is apparently isolated from the East.

All sorts of reasons have been given as explanations of the phenomenon—the existence of an atmospheric resistance belt—the static interference caused by the hydro electric power leads, etc.—but these causes are seemingly not convincing to the radio inquirer, if the volume of correspondence received on the subject by the E. B. Myers Co., Ltd., manufacturers of the Myers Tube, is a criterion.

To settle the question definitely and conclusively the Myers Company sent out an expert from Montreal to make tests and obtain data at numerous points between Montreal and Toronto, who reports as follows:

"As far as Montreal is concerned, Toronto is not isolated because of any atmospheric or static conditions, despite the failure of a very large percentage of amateur operators to receive the Queen City's broadcasting. The trouble seems to be caused by simultaneous broadcasting by Montreal and Toronto stations and if the programme times were altered so as not to conflict, Toronto could be heard readily enough.

"Again it is not the lack of penetrating power of the Toronto or Montreal stations, nor the ethereal conditions that prevent their concerts being enjoyed by radio audiences in the majority of the intervening towns."

New Committee Formed by I. R. E.

AT the last meeting of the Institute of Radio Engineers a new committee called the "Standardization Committee" was formed, whose work it will be to bring up to date the book of definitions of radio engineering which was published by the Institute in 1922. The following prominent engineers are members of this committee:

E. H. Armstrong, L. A. Hazeltine, A. N. Goldsmith, J. V. L. Hogan, J. N. Dellinger, C. A. Hoxic, A. E. Reoch, L. W. Chubb, H. W. Nichols, F. M. Kroger, R. F. Gowan, L. E. Whittemore, Bowden Washington and Capt. Guy Hill. Donald McNichol is chairman of this committee.

In view of the many forward steps which have been taken in the radio art in the past few years, the work of this committee will be of high value to all experimenters.

Ask That Question and Get the Answer

THE weekly broadcast event which has found greater favor among listeners-in than any other event, single or weekly, is the "Time Questionnaire" which has been broadcast for the past two weeks from WJZ and WJY. The asking of questions of varied interest, with the allowance of thirty seconds for the listener to form his own answer before he hears the correct answer over the radio, has tickled the vanity of the intellectual and awakened the interest and pride of the less quick-witted.

MAGNAVOX Radio Products



A1—\$27.50

MAGNAVOX Audio-frequency Power Amplifiers

THESE instruments offer the most ideal method for amplification of audio-frequency waves before they are reproduced into sound.

Wherever ordinary audio-frequency is replaced with Magnavox Power audio-frequency, stations previously out of range can be reproduced in excellent volume.

The new one-stage Magnavox Power Amplifier A1, illustrated above, is just what is needed in many cases to bring in the distant stations.

Magnavox Reproducers

- R2 with 18-inch curvex horn \$50.00
- R3 with 14-inch curvex horn \$35.00
- M1 with 14-in. curvex horn. Requires no battery for the field. \$35.00

Magnavox Combination Sets

- A1-R consisting of electro-dynamic Reproducer with 14-inch curvex horn and 1 stage of amplification \$59.00
- A2-R consisting of electro-dynamic Reproducer with 14-inch curvex horn and 2 stages of amplification \$85.00

Magnavox Power Amplifiers

- A1—new 1-stage Power Amplifier \$27.50
- AC-2-C—2-stage Power Amplifier \$55.00
- AC-3-C—3-stage Power Amplifier \$75.00

Magnavox products can be had at Registered Magnavox Dealers everywhere. Write for new 32-page catalogue.

The Magnavox Company
Oakland, California

New York Office: 370 Seventh Avenue

Canadian Distributors

Perkins Electric, Limited, Montreal

BUSINESS NEWS OF THE INDUSTRY

The Vacuum Tube Situation

THE problem of securing good tubes is daily becoming a matter of deep concern, alike to dealer and consumer. The vacuum tube situation, today is not quite as serious as it was last winter, yet there is a decided lack of tubes in certain quarters. Last winter it was believed that the radio industry would suffer for lack of this vital element of the receiver, but the advent of spring apparently caused a slackening in the sale of apparatus. This gave the tube manufacturers time to catch up with back orders.

The popularity of radio throughout last summer and the readiness of the public to accept radio as an out-door, as well as an indoor sport, undoubtedly, helped use up what little reserve in tubes was accumulated in the early spring.

An explanation of the shortage, however, does not in the least supply the missing article.

Serious as it may seem, the situation is not without its remedy. The following interesting episode was overheard recently at one of those gatherings of enthusiasts that are to be found in any radio supply house. A prominent business man happened in on several of his acquaintances who were discussing this problem.

"Why so disappointed?" he asked of

the one who just had the floor. "Well, you would be, too, if you had just built a five tube neurodyne and couldn't get tubes for it," replied the disappointed one.

"Me, too," chimed in a third, "I just got a couple of UV201A amplifier tubes and one UV200 for a detector and had to take two dry cell tubes or go without any. It's a fine combination."

"Hum," mused the business man, "nothing extraordinary about that. Why just last night I burned out one of my tubes and was at a loss what to do. All of a sudden, I recalled that camp outfit of mine with the dry cell tubes in it. The dry cells were long since dead so the set could not be used, but then I remembered that my receiver was equipped with special rheostats to fit any tube. So I put in a WD12 just to see what would happen, and you would be surprised how well the scheme worked, with my six-volt storage battery too."

"Well, why can't I do the same thing," asked the first one. "Why, certainly," replied the cheerful business man, "all you need is a receiver with rheostats like mine."

Which goes to show that though the tubes may be "out" a fan is never down—while he retains his resourcefulness, which goes with being a fan.

Radio and Electrical Business Opportunities

Rates: 40c a line; minimum 3 lines

BE A REPAIR WIZARD—Millions of receiving sets and nobody to repair them. Greatest opening in radio field today. Revised edition "Radio Trouble Shooter" just off press. Details methods of professional trouble shooters. Price, fifty cents. First edition was quickly exhausted. Radio Information Service, Box 278-A, Galveston, Tex.

INDUSTRIAL ENGINEERING

Assisting in practical perfection of mechanical ideas; suggestions offered to promote interest of investors in inventions of merit; confidential investigations of contemplated investments; reports submitted; prompt attention to correspondence. T. P. McLaughlin, Fisk Bldg., New York City.

ELECTRICAL STORE, ESTABLISHED 5 years; large contracting trade equipment, lighting fixtures, brass goods, electrical supplies, appliances; sell reasonable terms; becoming radio manufacturer. Modern Gas & Electric Co., 556 Newark Av., Jersey City, N. J.

Coming Events

INTERNATIONAL RADIO & ELECTRIC SHOW, Baltimore, Md., March, 1924.

RADIO SHOW, N. Y. Edison Co., Irving Place and 15th St., New York, March 22 to March 29, 9 A. M. to 10 P. M. No admission charge.

RADIO will be featured at the electrical exhibition to be held at Melbourne, Australia, in September, 1924.

FIRST NATIONAL RADIO CONFERENCE, under the auspices of the American Radio Association, Waldorf-Astoria, April 16, 17, 1924.

Federal Develops New Radio-Frequency Tuners

ONE of the newest contributions to the radio art recently brought out by the Federal Research Division is a tuner of the variocoupler type, so designed that a wide coupling between its primary and secondary coils can be obtained.

A blank tuning chart is shipped with each Federal set. The ease with which

In All Ranges from .005-10 Megohms

THE Daven Radio Co. of Newark, N. J., is putting on the market a complete line of grid leak resistances, ranging all the way from 5,000 to 10,000,000 ohms (.005 to 10. megohms) in twenty-nine different sizes. Daven precision resistance units are tested and guaranteed to be accurate within very narrow limits, each one being calibrated by a megohmmeter. These units fill a long-felt want on the part of experimenters, who, when they want to use a leak resistance of .048 Megohms, know that they can obtain a unit of unusual accuracy.

This concern also manufactures a very neat and sturdy resistor and condenser mounting furnished with lugs for soldering. The Bakelite base has two pairs of spring clips for holding a resistor and the standard type of mica condenser. This clip arrangement eliminates the bother of cutting and resoldering connections to the condenser, and permits quick changes. The resistor units are slipped into the pair of notched springs directly over the condenser, thus making a compact and efficient piece of apparatus. The units are all hand made and enclosed in glass tubing.

New Radio and Electric Firms

Alley-Fettig Radio Stores, Port Chester, N. Y., \$8,000; G. Band, W. C. Alley, J. J. Fettig. (Attorneys, Tierney, Schrenkeisen & Kettner, New Rochelle.)

Sunny Line Electric Sales Corp., Jamestown, N. Y., \$25,000 to \$200,000.

Herzog Radio Corp., New York, manufacture equipment; \$1,000,000. (Registrar & Transfer Co.)

Mansfield Radio Corp., Brooklyn, N. Y., \$5,000; directors, G. R. White, S. C. Binder, E. Afsensky.

BROADCAST TUNING CHART

for use with the

Federal TYPE 59 RECEIVER

STATION CALL LETTERS	LOCATION	STATION WAVELENGTH	PRIMARY INDUCTION		SECONDARY WAVELENGTH
			LEFT	RIGHT	
WGR	BUFFALO	319	12	4	1.5
WTAS	ELGIN ILL.	275	12	3	3 1/2
WSAI	CINCINNATI O.	305	12	3	10
WDAP	CHICAGO	360	10	4	23 1/2
W H B	KANSAS CITY MO.	411	16	3	30 1/2
WOC	DANFORTH ID.	484	19	7	50
WCDD	ZION ILL.	345	18	2	20
WOS	JEFFERSON CITY MO.	441	19	6	43
WFAA	DALLAS TEX.	476	24	6	55
W LAG	INDIANAPOLIS INDI.	417	19	2	30
W J Z	NEW YORK	445	26	6	50
WDAF	KANSAS CITY MO.	411	26	4	36

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it can be filled in is illustrated in the accompanying diagram.

The original of this chart was submitted by Gilbert Hyatt, of Buffalo, as testimonial of its reference value in locating stations. Mr. Hyatt says that frequently a long program, such as opera, symphony concert or prize fight is picked up. His chart such as illustrated immediately tells what station is transmitting. No need to wait until the transmission is finished.

RADIO RECORD

A permanently bound record, 5 1/2" x 14", 600 lines of all stations you have received, and how you received them. Self-indexed, and easy to find. All broadcasting stations listed and indexed with space for new stations.

Radio Record \$1.00 Postpaid
Applause Cards 60 for \$1.00

THE BEADLE PRINTING CO.

MITCHELL, SOUTH DAKOTA
Dealers: Write for attractive offer.

PORTER'S COPPER CONNECTOR

Overcomes poor connections which are 90% of radio troubles. The Porter Connector consists of a flat strip of copper 5/16" wide, perforated every 1/4 inch with 3/16" holes, enabling perfect wiring without soldering.

A diagram of a marvelous Reflex Circuit and enough PORTER'S Copper Connections for your set included you prepaid on receipt of 25c.

PORTER MANUFACTURING CO.
8737 Grand River Ave. Detroit, Mich.

\$15 Set Gets 2,000 Miles

The Essex Radio Special, the receiving set with a conscience gets you more distant stations clearer and sweeter than sets costing ten times its price.

Complete Set Includes

Vario-Coupler, Special Winding, 23 Plate Essex Condenser, 17 Plate Essex Condenser, Lenthrota Cabinet, Standard Essex Socket, Rheostat, 6 ohms, will work any tube, 4 Binding Posts, Hard Rubber, 7x10 Hard Rubber Panel, 3-3/4" Dials, 4 Pieces Bus Wire, 1 Length Spagetti.

\$15 SET COMPLETE WITH CABINET WITHOUT TUBE OR BATTERIES

\$20 SET COMPLETE WITH CABINET TUBE AND BATTERIES

Essex Radio Service

617 West 125th St.

New York

DX Nite Owls Still Sending in Their DX Records

DX Nite Owls, Attention!

THE DX season is now upon us. All faithful DXers are requested to prepare themselves for the night vigil. Send your records to the DX Editor of RADIO WORLD.

Write only on one side of the paper and write clearly.

Give full particulars of your location, your set, your aerials and other items of interest.

Pretty Fair DX

From Hugo Reinhold, Denver, Colo.

I have been reading Radio World for some time and am especially interested in the DX column. I herewith send you a few of my records listed from December 3 to 13 inclusive, using just a detector (Cunningham G301A) and CR5 hook-up. Antenna is 85 feet long, single wire, and 45 feet high and located at 2261 Hudson street, Denver, Colo. The list of stations heard are as follows: CKCK, Regina, Canada; CFAC, Calgary, Canada; KHJ, Los Angeles; KJS, Los Angeles; KPO, San Francisco; KGW, Portland, Ore.; CFCN, Calgary, Canada; WDAP, Chicago, Ill.; KDKA, Pittsburgh, Pa.; WHB, Kansas City, Mo.; KFKX, Hastings, Nebr.; WBAH, Minneapolis, Minn.; WJAZ, Chicago, Ill.; WHAH, Joplin, Mo.; KFFQ, Colorado Springs, Colo.; WLAG, Minneapolis, Minn.; WFAA, Dallas, Texas; WCAL, Northfield, Minn.; WDAF, Kansas City, Mo.; WOC, Davenport, Iowa; WOS, Jefferson, Mo.; WQAW, Omaha, Nebr.; WAAW, Omaha, Nebr.; WMAQ, Chicago, Ill.; WMC, Memphis, Tennessee; WBAP, Ft. Worth, Texas.

In fact, about four days of this time did not listen in at all, so really there are only five complete days.

Good DX for a Crystal

From J. Hood, 1397 Manistique Avenue, Detroit, Michigan.

I wish to thank you for printing the DX list which I sent you a few numbers back and I hope you will think this worthy of printing also. It is only the broadcasting stations and not the stations sending code.

I have a crystal set, using a forty-three plate condenser, and a vario coupler. It is home made. The antenna is fifty feet long, in three parts. This is my DX list: WWJ, WCX, KOP, WWI, WTAM, WJAX, WBCD, KDKA, WLW, WSAL, WJAZ, WDAP, WGY, WOR, WHAZ, WHAS, WHB, WOC, WOS, KFKX. Have also heard KDKA with only the electric lamp for an antenna.

On Loud Speaker

From G. Franz, 268 Clarkson St., Denver, Colo.

Here is another record for the DX'ers to look at for only 5 1/2 hours' time. Most every station was received on the Magnavox with the exception of a few. Using a five tube Neutrodyne receiver built by myself, with Freid Eisemann parts. Here is the list of stations I received from 6 P. M. to 11:30 P. M., Saturday, Jan. 19, 1924:

KDKA, Pittsburgh, 1,350 miles; KYW, Chicago, 925 miles; WOAW, Omaha, 500 miles; WOC, Davenport, 775 miles; WBAP, Fort Worth, 650 miles; KWH, Los Angeles, 825 miles; WLAG, Minneapolis, 735 miles; WAAW, Omaha, 500 miles; WDM, Topeka, 500 miles; WDAP, Chicago, 925 miles; WSAL, Cincinnati, 1,250 miles; KSD, St. Louis, 800 miles; WPAT, Sioux Falls, So. Dakota, 550 miles; WMC, Memphis, 875 miles; WFAA, Dallas, 650 miles; KFL, Los Angeles, 825 miles; WTAM, Cleveland, 1,250 miles; WGY, Schenectady, 1,700 miles; KZN, Salt Lake, 350 miles; WOC, Kansas City, 550 miles; KGO, Oakland, 950 miles; WJAZ, Chicago, 925 miles; KPO, San Francisco, 925 miles; KHJ, Los Angeles, 825 miles; KFKB, Milford, Kansas, 400 miles; WDAF, Kansas City, 550 miles; WCAL, Northfield, Minn., 700 miles.

Also four Denver stations, KFLE, KLX, KPAF, KFEL. Altogether 27 distant and four Denver stations, making a total of 31 in one night. I have now a total of over 90 stations received.

Enclosed is a picture of both my receivers and Magnavox. I am only using the neutrodyne at present.

Good Work

From W. Bermingham, Wright Ave., Bayside, L. I.

I have been reading the Radio World for quite a time and have noticed some good DX records. My set is a single circuit set and I have received the following stations:

WOO, WOC, WIF, WEL, WKJ, WCX, WGR, WHB, WGY, WSB, WLW, WOS, WSY, WBZ, WDAF, KDKA, WCAE, WCAP, WJAZ, WDAP, WSAL, WOAW, PWX, HKW, WTAM, WEAS, WJAX, WTAS, KYW, KHJ, KGO, WBCD, WNAC, WCAN, CFCA, WBAK, WLAG, WMC, KSD, WMAQ, WDAK, KOP, WFAA, WDAP, WGM, 4DH, 9BCY, 2XAR, NRE.

New York City Radio Plant Ready Soon

AFTER much controversy and unwinding of red tape (and the end is not yet), the date has been set for the erection of a one kilowatt municipally owned and operated radio broadcasting station.

Hon. Grover A. Whalen, Commissioner of Plant and Structures of New York City, received a letter recently from the Westinghouse Electric and Manufacturing Co., in which that concern agreed to sell the City of New York a 1,000-watt broadcasting plant, but stated that it would take about a month to deliver the set. Westinghouse engineers figure that it will take another month to renovate, modernize and install the outfit. The set is now in Rio de Janeiro, where it was sent for the Brazilian Centennial Exposition in 1922. Mr. Whalen states that the plant will be complete and ready to operate by May 15, and may be used to broadcast the doings of the Democratic National Convention.

"I don't know whether the convention officials have made plans for broadcasting the proceedings, but I intend to find out at once," said Commissioner Whalen. "If they have not made an exclusive contract I will try to arrange to have it done by the municipal radio. If we can do it, we will be very pleased to broadcast the convention."

"The city in any event will see to it that the people who do not own radio receiving sets, and who are not fortunate enough to be admitted to Madison Square Garden during the convention, will be able to hear the proceedings in public places over the radio. Mayor Hylan has suggested that large amplifying apparatus be installed in six or seven of the principal parks," he said. "We will have amplifiers in the Mall at Central Park where there are seats for ten thousand; in Madison Square Park, Bronx Park and elsewhere."

The station will be installed in two rooms on the top floor of the Municipal Building, and the studio will be in an adjoining room. Engineers of the American Telegraph and Telephone Co. claim that broadcasting from the Municipal Building will not be efficient due to the large amount of metal in the framework of the building and the close proximity of the steel constructed Brooklyn Bridge. On the other hand, experts of the Westinghouse Co. declare that they can install the plant so as to overcome this difficulty. As yet, no application has been made to the Radio Inspector for the Second District, Arthur Batcheller, for a Federal license, and it is not known, therefore, what wave length is to be assigned for the new station.

Quite a Variety

From G. Lynn, 59 High St., Springfield, Mass.

I am a regular reader of the "Radio World" and find it very helpful and interesting. I am sending you a record taken from my log book of the broadcasting stations I have heard. I have used two different hookups in making this record and I have only used a WDI tube. This first hookup used was a double circuit regenerative employing one bulb. The second hookup, which I am using at present, is a regenerative loop receiver. I also use a one hundred foot outside aerial. Following is my list:

WGI on loud speaker, KDKA, WGY, WHK, WJAX, WCAD, WLW, WDAK, WDAP, WJAZ, KYW, WTAS, WOS, WHAS, WCB, WBAK, WSAL, WTAM, WDAK, KFKX, WQAA, WPAD, WDAF, CFCB, KFDZ, WLAG, WBAK, WDAF, WCE, WLB, WBAH, KFH, WAD, WAAF, WAAW, WAAW, WQAW, WBAK, WBAW, WBL, WBS, WBU, WCAE, WCAL, WCAS, WCM, WCX, WDAJ, DAY, WDBC, WDM, WEA, WEAK, WEAY, WEB, WEW, WFAF, WFAM, WFAN, WFAT, WFA, WVF, WGF, WGG, WHAB, WHAZ, WHB, WJAS, WJZ, WLAP, WMAQ, WMAT, WMA, WMC, WQAL, WQAX, WOC, WOI, WOR, WAC, WRR, WSB, WSY, WWI, WWJ, WFAF, WEW, KFDP, KFBC.

Real Distance

From W. C. Davis, 6 Cliff St., Trenton, N. J.

I don't think a DX list should include locals or "Big Boys" within a 1,000 mile range, so I am leaving out over 100 stations and listing below my real "pride and joys."

KDYM, KHJ, KPO, KFI, KLZ, PWX, GKW, WKAQ, WQAL, WDAE, CFCX, WBAP, WKY, WFAA, KFKX.

On January 4 I logged 35 stations and on Jan. 7 came back with 38. The combined lists showed 49 different stations in 21 states for a total of 20,152 miles. The circuit is a home made Jones Symphony, using detector and one audio with 199 tubes.

On December 27 Porto Rico, Cuba and Canada were heard. The set is table "mounted" and has no soldered connections. Questions will be cheerfully answered.

On Reinartz Circuit

From R. Johnson, 2630 N. Racine Ave., Chicago, Ill.

Here is my list of stations received on a three tube Reinartz in three months. I seldom use three tubes, except for loud speaker. I have a three wire, 50 ft. long aerial. Here are the stations:

KYW, WPAD, WMAQ, WDAP, WAAF, WIAO, WBAK, KDKA, WDAK, WSE, WOC, WGY, WAAV, WJAZ, WHAS, WLB, WJX, WDAF, WAAV, WGM, WEAF, WLAG, WOO, KSD, WFAA, WBS, WGT, WCAW, WHAZ, WJZ, WTAS, WSY, WGR, WCAW, WHAZ, WJZ, WCAJ, WOS, WAAW, WRAK, WAF, WSAC, WDAJ, WCAE, WWD, WHAC, WOAW, WQAG, WFAL, WHB, WHAD, WEAQ, WBAK, WSAH, WMC, WCB, WRK, WSAL, WCX, WPAH, WCK, WBAV, WDAK, WEAS, NAA, WRC, WFI, WCAP, WJAX, WEAN, KFKB, WBZ, WFAB, WDT, KFI, WOR, WTAM, WOO, WIP, KHJ, WJAD, WJAB, KOP, WNAC, WHN, WJAX, KFKX, WHK, KPO, KLX, KLZ, WRM, WSAX, WRL, WBAK, WJY, WAAE, WMAK, WCAL, WIAD, KFFQ, WPAK, WNAD, WPAB, KFPF.

Canadian stations: CFCN, CJCA, CKCK, CKE, CFCE, CFAC and CFCA.

As Radio World Goes to Press

The Radio Corporation of America makes financial statement showing gross income of \$26,394,789 for 1923, as against \$14,830,856 for 1922, and a net income increased from \$2,974,579 in 1922 to \$4,737,774 in 1923.

United States District Attorney A. E. Bernstein filed suit in Federal Court at Cleveland, Ohio, against the General Electric Co., alleging conspiracy in restraint of trade and violation of the Sherman Anti-Trust law. The charge is based on the alleged manner in which G. E. manufactures and distributes its output of electric bulbs.

At a meeting of the American Federation of Musicians in Chicago it was voted that its members should charge for all radio engagements. Also that hotels broadcasting radio concerts shall pay extra wages to the members of their orchestra.

Reports from Washington state that over ten thousand people jammed their way into Convention Hall, Washington, D. C., on the opening night of the First Annual Radio Show. Between four and five thousand people were turned away as the exhibition hall could not accommodate the crowds.

Important Notice

NO attention will be paid to communications that do not carry the full name and address of the correspondent.—EDITOR.

BUY DIRECT AT WHOLESALE PRICES

Ours and Manufacturers' Guarantee
AUDIO TRANSFORMERS

Federal No. 65	\$5.25
Jefferson, 3-1 and 6-1 Ratio	2.85
Acme	3.95
All-American, All Ratio	3.95
Modern Push-Pull, per set	9.50
Amerfran	5.75

Money back if not satisfied.
Postage paid on all orders over \$5.00.

WHOLESALE RADIO SERVICE
9 Church St. (Tel. Cort. 2638) New York City

RADIO

SEND FOR OUR COMPLETE
MONEY SAVING CATALOG
TIMES SQ. AUTO SUPPLY CO. INC.
MAIL ORDER DEPT.
1745 BROADWAY AT 58th STREET
NEW YORK, N. Y.



with any set. Contains up-to-date list of 1,100 Broadcasting Stations, Time of Principal Cities and instructions How to Record Stations. 24 Pages, Valuable Information. No set complete without one. 50c per Copy, Postpaid. For your convenience send a one dollar bill for two copies, otherwise send Money Order for one or more. No checks nor stamps.

We also furnish Kasper's "APPLAUSE CARDS," printed on stamped Postal Cards—25 mailed anywhere upon receipt of 50c.

KASPER BROTHERS COMPANY

317 Lorain Street Bank Building

Cleveland, Ohio, U. S. A.

FOR THE SET BUILDER—

For the "Ready-Made Set" Fan

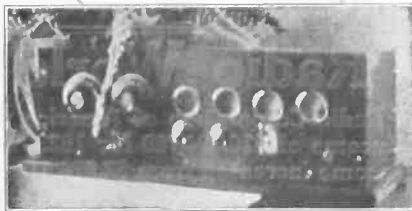
Do you wish to make a set which will really work, which is guaranteed to satisfy, and which is made of the best standard parts?

Our set outfits include drilled panel, base-board, instruments of Eria, Acme, Cotoco, Dnbilier, Signal, Amrad, and other high grade manufacture, bus-wire, lugs, and blue-prints—everything for the complete construction of the set.

If desired we assemble the set, ready for wiring, at no extra charge.

None of the sets listed below radiate and cause interference. They are the most efficient sets and the most satisfactory.

- Reflex. One tube. This set is equal to three tube sets. It incorporates one stage of radio-frequency amplification, detector, and one stage of audio-frequency amplification. More selective than a regenerative set. Loud speaker range 50 to 100 miles. Range on phones up to 3,000 miles... \$15.00
- Reflex. Two tube. 500 to 1,000 mile loud speaker range..... 23.00
- Reflex. Three tube. Up to 3,000 mile loud speaker range..... 33.00
- Neutrodyne. Five tube. Build your own and save \$105.00..... 45.00
- Ultradyne. Five tube. Similar to the Neutrodyne, but due to the extremely efficient transformers no



THE BILTMORE REFLEX 4 TUBE

- neutralizing condensers are required..... \$45.00
- Superdyne. Four tubes. The wonderful set just described in RADIO WORLD (December 15-29, 1923). Results equal those obtained on an eight tube Super-Heterodyne. 38.00
 - THE BILTMORE REFLEX. Four tubes. Loud speaker range up to 3,000 miles with no outdoor antenna, nor even a loop. The most sensitive set made. Complete parts, without cabinet..... 45.00
- Completely assembled and wired, ready for use, as shown in illustration: Mahogany panel, and genuine hand-rubbed solid mahogany cabinet..... 100.00

Biltmore Radio Company
Boston 30, Mass., Dept. W.

Taking the "Bogie Man" Out of the Bedtime Stories

FROM the land where wild game is still plentiful has come a request to WGY, the Schenectady, N. Y., radio broadcasting station, that child-eating bears be deleted from bed-time stories. In a country where bears are a frequent sight such stories, it is explained, put fear in the hearts of children.

The letter came from F. J. Lee, a resident of Lee Valley, seven miles from

Massey Station of New Ontario, Canada. Mr. Lee is the first settler of the place which is named after him. He is well over seventy years old and has lived at Lee Valley for thirty years.

"I want to file a protest," writes Mr. Lee, "against the bed-time stories for the children about bears eating up little boys or wanting to. Remember that stuff goes to this new country where there are bears. There are few children going to school who haven't seen a bear. Boys eight or ten years old only laugh at such stuff here, but the little tots are made afraid."

Mr. Lee explains that he has a five-tube neutrodyne set and always gets WGY best. "We have church services at our house every Sunday evening. Sometimes there is a houseful of friends."

**Save
1/2 Price
of
New Tubes**

Burned out or broken tubes repaired and guaranteed equal to new.

Harvard Radio Laboratories
200 Old Colony Ave.
South Boston, Mass.

Lattice Coil Specialties



Variometers
Varlocouplers
R.F. Transformers
Micro-Mike
Condensers
Plain Coils
Tapped Coils

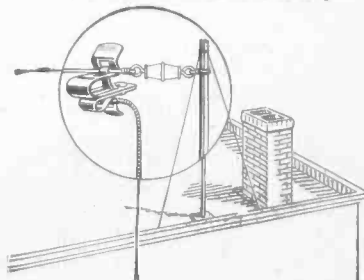
ESTRU LATTICE COIL PRODUCTS have been designed so as to produce as nearly as possible IDEAL INDUCTANCE in various forms. It was not the intention in designing, to produce Miniature Apparatus, the small size being the result of careful electrical design with no UNNECESSARY Mechanical parts which would detract from the electrical efficiency.

YOU will appreciate these facts as set forth in our COMPLETE DESCRIPTIVE LITERATURE, which will be sent on request and in reading our GUARANTEE which goes with all ESTRU PRODUCTS.



2905 WEST MADISON STREET

FAHNESTOCK'S RADIO PRODUCTS



The Antenna Connector

Snap larger connector over Antenna Wire, insert Lead-in Wire into smaller clip and a perfect connection is the result.



Improved Ground Clamp

Equipped with Fahnestock Patent Wire Connectors. Easily Attached.

No Soldering—For Radio Use Only
Our name stamped on all products, none genuine without it.

At Your Dealers
FAHNESTOCK ELEC. CO.
LONG ISLAND CITY, NEW YORK

Nath. Baldwin Phones with

SHELTONE LOUD SPEAKER
 COMPLETE \$10.00
 Postpaid. Use your headset for 3 purposes—Exceptional combination value—Every pair of phones tested—Guaranteed to give results.
WALTER SCOTT
 1157 B. Broad St.
 Newark, N. J.



New Orchestra Finds Favor With Fans

BERCHMAN'S Symphonique Dance Orchestra, which is substituting for "Roxie and His Gang" Sunday evenings at WEAJ is rapidly coming into the favor of radio fans. The manner in which the organization render their selections sounds a new note in dance music. Several classical numbers played in waltz time found instant favor, and so great has become their popularity that several recording companies have sent flattering offers to Henri Berchman, creator of the Symphonique Dance Orchestra, for his services.

Like a Voice from China

AMONG the many listeners in on the Far East program given by Oriental students at the Rensselaer Polytechnic Institute from station WHAZ at Troy, N. Y., a fortnight ago was Cherman Shen, a Chinese student at Ohio State University, who writes:
 "I listened with great pleasure to your program which came in clear and loud on my one-tube set. I want to express my deep appreciation of your efforts in bringing your listeners-in to get acquainted with far away China, my beloved country. C. K. Shen's flute solos were well rendered. His talk on Chinese family life and C. Y. Lin's recitations were also very well delivered."

RADIO REX

"THE WIRELESS DOG"



A WONDERFUL NOVELTY

Put **RADIO REX** in his kennel, call him, clap your hands, or turn on your loud speaker and out pops "REX" to listen. He is a DX hound. This marvelous toy amazes, interests, amuses your family and friends.

Sent prepaid for \$2.00

NO C. O. D.

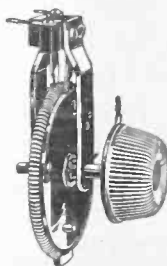
DEALERS—Write for trade terms. Sells on sight.

AY-WON TOY NOVELTY CORP.

434 Broadway NEW YORK CITY

KELLOGG USE-IS THE TEST

Build Your Radio Set With Kellogg Guaranteed Parts



THE Kellogg rheostat assures sharp, positive tuning. It is of a most practical design. There is only one moving part, the resistance element which is securely mounted on a Bakelite rotor. The wide staggered contact springs grasp the resistance element firmly, eliminating scraping, open circuits, and assuring certain, even control of the current. The Bakelite knob attaches securely to the shaft without threads, nuts or set screws—an exclusive Kellogg feature. Easy to mount and unusually smooth operation.

Specify Kellogg radio equipment and know you are getting the best. If your dealer does not handle Kellogg communicate direct with us.



Kellogg Switchboard & Supply Company
 1066 W. Adams · CHICAGO

USE-IS THE TEST KELLOGG

\$25 for \$10

The Famous BEL-CANTO Acoustical Amplifier



DIRECT FROM MANUFACTURER TO YOU

YOU cannot buy the Bel-Canto through any dealer, only direct from us. We save you these three profits—Distributor, Jobber and Dealer,

Sent prepaid to any part of U. S. and Possessions

PRICE \$10

Guarantee

Money back any time within ten days if dissatisfied. We further guarantee to the publication carrying this advertisement that each and every speaker sold will be exactly as advertised in this issue.

7 POINTS OF BEL-CANTO SUPERIORITY

1. Our own Elber horn. Crystalline finish.
2. Our own adjustable loud speaking unit, giving a wide range of tone quality and volume without distortion.
3. The base of cast iron, weighing four pounds, eliminating top heaviness.
4. All other metal parts are of heavy cast aluminum, highly polished.
5. Complete instrument stands a 24 inches high, 10-inch bell.
6. Guaranteed for one year from date of purchase against mechanical defects of any kind.
7. No auxiliary batteries required. Just plug in on second stage.

Delivered C. O. D. free to your Door

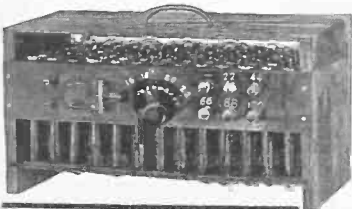


BEL - CANTO MFG. CO.
 BENSEL-BONIS CO., INC.
 GENERAL OFFICE & FACTORY:
 417-419-421 E. 34th St. Dept. RW N. Y. C.
 Tel. Vanderbilt 8959

Get a Real "B" Battery!

Roberts Rechargeable "B" Battery LASTS A LIFETIME—MADE OF EDISON ELEMENTS SATISFACTION GUARANTEED

No Change of Wiring Necessary Only Three (3) Main Terminals to Connect Powerful—Durable—Rechargeable



↑ Drip Pan ↑

A swing of the switch lever gives instant voltage.
 Type A—100 volt, with variable detector, from 16-22 volts \$20.50
 Type B—100 volt, with variable voltage, from 16-22 volts on detector, and variable voltage from 44 to 100 volts for amplifier \$28.50
 Type C—140 volt, with variable detector, from 16-22 volts \$26.50
 Type D—140 volt, with variable voltage, from 16-22 volts on detector, and variable voltage, from 44-140 volts for amplifier \$30.00

BATTERY SATISFACTION AT LAST! Hundreds of enthusiastic owners of Roberts "B" Batteries tell us: "Positively the best battery on the market—I have tried them all." "All my battery troubles are over!"

Examine Our Battery Before Buying Any Other Manufactured by **W. ROBERTS TOY STORE "B" BATTERY COMPANY**

1120 MYRTLE AVENUE, Near Broadway BROOKLYN, N. Y.
 Tel.: Bushwick 6753 Open till 9 P. M. Daily



You'll be neighbor to Havana

WITH the new Shamrock Kit you can build a set that pulls in stations 3000 miles away. These revolutionary kits contain two of our new balancing condensers—and three Shamrock air core transformers mounted and properly balanced on U. S. Tool condensers, made expressly for Shamrock.

Kit, list \$20

Inspect this kit at your dealer's today. If he hasn't it in stock, send us the coupon below.

SHAMROCK MANUFACTURING CO.
Dept. 4, Market Street, Newark, N. J.

SHAMROCK

FOR SELECTIVE TUNING

SHAMROCK MFG. CO.,
Dept. 4, Market St., Newark, N. J.

Gentlemen: Send me detailed information on the Shamrock Kit.

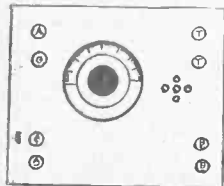
Name
Address
Dealer's Name

SHAMROCK for Selective Tuning



"TATTLE-TALE"

ONE TUBE DX RECEIVER



ONLY
\$6.50

1000 MILE RANGE
GUARANTEED

"Brings America to Your Ears"

Efficient in Operation.
Substantial in Construction.
Beautiful in Appearance.
Easy to Operate—Only ONE CONTROL.
Low in Price—Easy to Install.

"Every Home Should Have a Tattle-Tale"

Just fill in the coupon below and we'll send your TATTLE-TALE by RETURN MAIL.

SEND NO MONEY!

CONRAD RADIO COMPANY,
70 Boylston Street, Jamaica Plain, Mass.

Gentlemen:
Please send me one of your TATTLE-TALE RECEIVERS, for which I will pay the postman \$6.50 upon arrival. I understand that if I am not satisfied, my money will be refunded.

Name
Address

Fitzpatrick Brothers Back to WJY

THE Fitzpatrick Brothers, two famous old-timers whom WJY listeners heard a few weeks ago will be before the same microphone on Friday, March 28, in answer to a flood of requests for the old-time popular songs which the Fitzpatrick Brothers wrote and sang during the 19th century. That pep and jazz do not depend upon age, is shown by the popularity of their last radio performance, for both of them are over seventy years of age, and yet their rendition of the song-hits of yesterday and today brought forth an unusual number of letters from the listeners-in.

SUBSCRIBE NOW AND TAKE THE WORRY OFF YOUR MIND. RADIO WORLD, 1483 Broadway, New York City.



Radio World
The Radio News.
The Sun-Globe.
The Telegram-Mall.
The Tribune.
The World.

In fact all radio writers are unanimous in their praise of the

HIRSCH \$2.50 VACUUM CRYSTAL TUBE

WHAT IT IS
A fixed crystal mounted inside an ordinary small bulb. The vacuum tube then is simply an unusual method of mounting a fixed crystal.

WHAT IT DOES
Makes it impossible to tamper with adjustment. The rod electrodes provide a spring mounting to protect it from shocks. The vacuum prevents any contamination of the crystal surface.

For Reflex Sets—Nothing Better

Manufacturer's Agents
ELLESS RADIO EXCHANGE, INC.
49 Vesey St., N. Y. Cortlandt 0405-6788

Big Money and Fast Sales

EVERY OWNER Buys Gold Initials for His Auto—You charge \$1.50, make \$1.44. 10 Orders Daily Easy.

Samples and information Free!

WORLD MONOGRAM COMPANY
Dept. 92 NEWARK, N. J.



Reg. U. S. Patent Office

THE IDEAL AUDIO FOR NEUTRODYNES



Every Neutrodyne Receiver requires audio transformers which are especially built for this circuit. Build right by selecting SUPERTRANS first! Greatest volume. Least distortion.

Works equally well with all types of modern tubes.

Price \$6.00

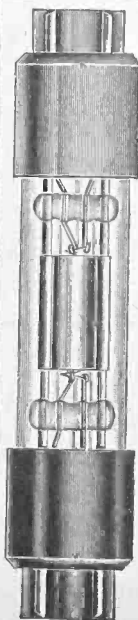
At your dealers or by mail postpaid on receipt of purchase price. Write for our free literature.

Ford Mica Co., Inc.
14 Christopher St., New York

MONTREAL—CALIFORNIA

(More than 2500 miles)

ON ONE MYERS TUBE



(Actual Size)

Remarkable radio reception is an everyday result with MYERS TUBES. Mr. W. E. Gerrard, 73 Pine Avenue, St. Lambert, Montreal, Canada, with a set designed and constructed by himself, and using only one MYERS TUBE, hears KDZB, Bakersfield, California.

Get distance with clarity. Myers are the only tubes correctly designed for radio without bunched leads. Two types—for dry or storage battery. Insist on MYERS at your dealer's—otherwise send purchase price and be supplied post paid. Write for free circuit diagrams.

\$5 EACH Complete with clips ready to mount on your set; no sockets or extra equipment required.

F. B. Myers Co. Ltd.
Radio Vacuum Tubes

240 CRAIG ST. W.
MONTREAL CANADA

GUARANTEED Dry B Batteries

Shipment prepaid at the following prices direct to consumer:

	large	medium	small
22½ volt variable.....	\$1.55	\$1.25	\$0.80
45 volt variable.....	2.85	2.55	

Guaranteed money back if you're not satisfied.

Sidbanel Radio—Premium Dept.
25 W. Mt. Eden Avenue New York City

**LITZ WIRE
IN STOCK**

I. R. NELSON CO.

Bond Street Newark, N. J.

WAAM

Write for Bulletin N-2

GLOBE COILS

For the famous SUPERDYNE CIRCUIT, \$6.25. Complete set knockdown. Best parts only. Everything to the last screw. Drilled front and back panels of Bakelite.

4 TUBE SET—Nothing Else to Buy—

\$35.00

Shipped anywhere, one-third the amount with order. Balance C. O. D.

Globe Radio Equipment Co.

217 West 125th Street NEW YORK

RADIO WORLD, the only radio paper that keeps right up to the minute on all radio news—it's NEWS when you see it in RADIO WORLD.

WOC Locates Father of United States Sailor

DAVID CLYDE CLARK, a chief quartermaster on one of Uncle Sam's ships, the U. S. S. Hannibal, is a happy sailor man these days and is anxiously waiting for the furlough which will permit him to join his father, whom he hasn't seen or heard from since he was a babe; or at least, hasn't heard from until a few days ago.

On January 30th Clark, whose ship is now in Cuban waters, wrote to The Palmer School of Chiropractic, at Davenport, Iowa, asking Radiophone Station WOC to broadcast a call in a final effort to locate his father, Rufus Clark. The letter was received and the report broadcast February 7th. A week later two reports from listeners were forwarded to the son, who followed the instructions given by the listeners and located his father immediately at Fort Gage, Ill. A happy reunion is being planned as soon as the son gets back to the States.

This is an example of the far-reaching service made possible by the radiophone with the proper co-operation of the listening public.

New Distance Record

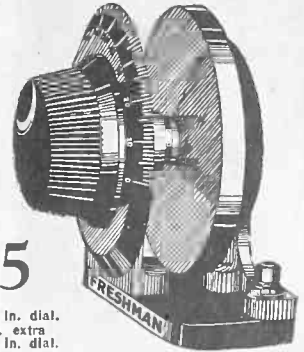
The news of the reception of Broadcasting Station WKAQ at San Juan, Porto Rico, by a radio fan in Glasgow, Scotland, has just been received by the International Telephone and Telegraph Corporation.

J. Gordon Ritchie, of 314 Renfrew Street, Glasgow, has written that on the night of January 15th, at 1:12 A. M., Greenwich mean time, he heard the orchestra playing the overture "Zampa" followed by the announcer giving the call letters of the Station.

This establishes a new long-distance record for WKAQ which is a 500 watt station sending on a wave length of 360 meters every Tuesday and Friday night.

"FRESHMAN SELECTIVE"

Variable Condenser



\$5

with 3 in. dial.
50c. extra
with 4 in. dial.

- brings in distant stations through the most powerful of local stations.
- increases the selectivity of your set fully 50%.
- permits unusual volume.

Quiet in Operation — Attractively Compact
Cannot Short Circuit.
Withstands 8,000 Volts.

All moulded parts and dial of finest Bakelite.

.0003 MF (Equiv. to 17 pt.)
.0005 MF (Equiv. to 23 pt.)
.001 MF (Equiv. to 43 pt.) **\$5 Each**

At your dealer's, otherwise send purchase price and you will be supplied without further charge. Ask your dealer or write for free diagrams of Neutrodyne, Tri-Flex or Heterodyne Circuits.

Chas. Freshman Co. Inc.
Radio Condenser Products
106 Seventh Ave. New York

Back numbers of Radio World supplied at regular price of 15c. a copy. Any 7 copies for \$1.00. Radio World, 1493 Broadway, New York.

1500 MILES and MORE on ONE TUBE

Thousands of Fans Are Doing Better—A Guaranteed DX Getter

**"SHEPCO"
"ALL PURPOSE"
NON RADIATING
RECEIVING SET**

TRADE MARKED—PATENTS GRANTED AND PENDING

A complete one tube set mounted on genuine Bakelite panel in finely finished genuine mahogany cabinet. Equivalent to one step of audio frequency for volume. Equal to much more expensive many-tubed sets for distance and selectivity.

ALL PARTS GENUINE

Contains only best units,—guaranteed genuine "SHEPCO" "All Wave" Jr. DX Coupler and genuine U. S. Tool Condenser.

INTERCHANGEABLE CIRCUITS

May be used as complete single, double or triple circuit, single tube reflex, part of plate variometer set, plate and grid variometer set and as tuner in many other circuits. Hook-ups can be changed quickly, without tools.

NO OTHER SET LIKE IT

Good as a course in Radio

Price, Without Accessories:

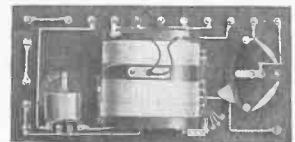
\$21

Absolute Money-Back Guarantee.

At your dealers or sent prepaid on receipt of order and remittance,

SHEPARD-POTTER CO., Inc.
PLATTSBURGH, N. Y.

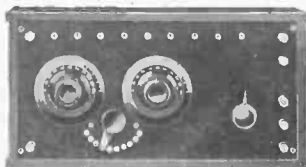
REAR OF PANEL



Set of six efficient hook-ups with every set or sent on receipt of 10 cents in stamps to cover cost of mailing.

Two stage Audio Amplifying Unit for use with "SHEPCO" "All Purpose" or any other set.

\$21



FRONT VIEW

**"SHEPCO"
"All Wave" Jr.
Non Radiating
DX Coupler**

Patents Granted and Pending

Combination flat and bank wound. Eliminates use of variometers, vario-couplers and loading coils. Guaranteed to bring in distant stations loud and clear on one tube.

Guaranteed wave length 150 to 1,000 Meters in single circuit

150 to 700 Meters in triple circuit

At all dealers or sent prepaid on receipt of price. **\$6** With 8 Hook-Ups

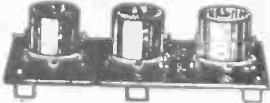
USE

EVEREADY Radio Batteries

-they last longer

THE VICTORY

A Socket Built on Merit
Electrically and Mechanically Perfect



Genuine Phosphor Bronze Contacts
Used for Panel Mounting

List Price Triple, \$2.75; Single, \$1.00.

Insist that your dealer supply you with the genuine
VICTORY SOCKET. Triple, \$2.75; single, \$1.00.
Expert Drillers and Cutters of Genuine Formica
Panels and Tubing.

Estimates Cheerfully Given.

UNITED RADIO MFG. CO.

191 Greenwich Street

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SOME SUNBEAM SAVINGS

12 Years
in the
Same
Spot.



From
Wholesaler
Direct
to You.

SUNBEAM

A SUNBEAM SPECIAL

Westinghouse Vecorola Loud Speaker. List

Price, \$20.00; Our Price, \$12.50

Hercules 8 ohm Rheostat, .45

Conkady Cells, 1.85

Electrodot Soldering Iron, 2.95

FREE WITH EVERY ORDER, OUR HANDY

RADIO RECORD BOOK

SUNBEAM ELECTRIC CO.

71 Third Avenue

New York City

VACUUM TUBES REPAIRED

WD-11, WD-12,
UV-201A, UV-199 \$2.50
and others for

Quick service. All tubes repaired by us
guaranteed to work as good as new.

Send your dead tubes. All you pay is \$2.50
plus postage to postman.

THOMAS BROWN CO.

511-519 ORANGE ST.

NEWARK, N. J.

Seventy-five thousand radio "fan" read-
ers look for RADIO WORLD every Wednes-
day. It is dated Saturday. Its advertising
forms close Thursday, nine days in advance
of date of issue.

Washington Show Stages Radio Golf Contest

RADIO GOLF, the novel and fascinat-
ing game of radio fans, was intro-
duced by the Radio Golf Association at
Washington's First Annual Radio Show
at Convention Hall, Washington, D. C.

Demonstrations of the new game were
given during the show by girls, garbed
in the fashionable raiment of the links
to give the proper atmosphere.

The object of the game, which all radio
enthusiasts with an "itch for distance"
appreciate, was to establish a "DX" re-
cord for both the total number of stations
picked up and the aggregate mileage. The
game, played "according to Hoyle," cov-
ered a period of seven days. At the end
of the week, the number of stations heard
and their distances in statute mileage
were totaled. The radio golfer covering
the greatest distance and receiving the
largest number of stations was adjudged
the winner.

During the show the game was illus-
trated with a large map of the United
States, giving the call letters and location
of the 561 broadcasting stations with their
air line distance from Washington. With
headphones clamped on their ears, two
of the radio golf girls listened in and
played the new game. The forty-eight
States in the Union were the links, the
mountains the bunkers, the rivers the
hazards and the broadcasting stations the
holes. A referee in front of the big map
recorded on a radio golfmeter the scores.

The radio golfmeter is a new instrument
which records the mileage of all broad-
casting stations, their call letters and the
wave bands on which they transmit. The
golfmeters were distributed to visitors at
the show with a revised list of the broad-
casting stations and a map showing the
geographical location of the stations.

Organization of radio golf clubs all over
the country is proposed by the golf
association in anticipation of a national
radio golf tournament.

Used in 41 States, 7 Provinces,
2 Foreign Countries Within 4
Months After First Issued

"WHERE I GO BY RADIO"

IDEAL
RADIO
RECORD
BOOK

Unique System. Every Line Complete
Record When, Where, How and What
You "Tuned In"; also Accurate List
Radio Stations. Other useful features.
Popular Edition, space 300 Records,
2 for \$1.00.

Halfday Ed., space 700 Records, only
\$1.00.

Get at any Newsstand, Bookstore or
Dealers, or send \$1.00 direct Now to

Radio Dept. W., Progress Press

Progress Building

Union, South Carolina, U. S. A.

PATENTS
FREE INVESTOR RE-
CORDING BLANK
Form Vanderbilt 1211

FREE MANUFACTURERS
PATENT FORM
BOOK 520 FIFTH AVE
NEW YORK

SOMETHING NEW

Green Radio Applause Cards
Bound in Book Form

With stubs on which records of Radio Artist are kept
after card is detached and sent. A Log Book and Card
combined, all for 1c. 25 CARDS 25c.

Sent by mail postpaid. No stamps. Address
PLATTSBURGH RADIO SUPPLY CO.

PLATTSBURGH, N. Y.

DEALERS: Write for sample and terms.

BRISTOL AUDIOPHONE

MORE THAN A LOUD SPEAKER

Bristol Audiophone, Sr., 15-in. Horn, \$32.50

Bristol Audiophone, Jr., 14-in. Horn, \$22.50

Bristol Single Stage Power Amplifier, \$25.00

Write for Bulletin 3006-W

The Bristol Company

Waterbury, Conn.

CORTLANDT RADIO CO.

Down Town

Up Town

80 Cortlandt St. 149 W. 23rd St.

NEW YORK CITY

Do You Want the Best for Least Cost ? ? ? ? ?

Buy a

5 TUBE SET NEUTRODYNE for \$44.75

Includes a beautiful engraved panel.

Cabinets \$3.75 Extra

"It's the Guaranteed Set!"

As Good as Any Set Valued to \$150.00

Complete parts for the above

set with drilled and beauti-

fully engraved panel, \$28.75

All Other Merchandise at Lowest Prices.

MAIL ORDERS PROMPTLY FILLED

Instruments of Excellence

Ballantine Tuned Radio Frequency
Transformers \$9.00
and units 15.00

Parts for Acmedyne in Stock

BALLANTINE Tuned Radio Fre-
quency Transformer \$9.00

LANGBEIN & KAUFMAN
Variometers and Variocouplers 1.00

AMPERITES 1.10

MYERS HI-MU Vacuum Tubes 4.55

Service That Is Certain

RADIO & MECHANICAL TRADING CORP.

23 Warren St. New York City

When you see it in RADIO WORLD you know
it's news—not a month old.

Out Next Week!

RADIO WORLD

Anniversary Issue April 5th

(Entering Its Third Year)

We want every one of our 75,000 readers to get
at least one friend to become a RADIO WORLD
reader, too.

This Anniversary issue, written by the greatest
radio experts, will tell, illustrate and fully de-

RADIO WORLD TELLS IT FIRST

The best—most reliable—fabricators of radio
goods make their announcements in RADIO

scribe many new and marvelous improvements.

RADIO WORLD tells how to improve your set;

how to get greater distance; ways to eliminate

interference, in fact, all that is new and best.

WORLD. It is the most productive radio adver-
tising medium at the lowest cost.

RADIO WORLD, 1493 Broadway, New York


YOU DON'T NEED TUBES To Hear Programs from Stations 400 to 1000 Miles Away
 I can show you how to get them on YOUR CRYSTAL SET. Changes often cost Less Than One Dollar. Send self-addressed envelope for picture of my set.
LEON LAMBERT
 562 So. Volusia Wichita, Kansas


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 Booklet "More Light on Patents" Sent Free
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 Specializing in Radio
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— VARIO TRANSFORMER —
 Variocouplers and Variometers
 For Every Standard Circuit
LANGBEIN & KAUFMAN
 654 Grand Ave. New Haven, Conn.

For best reception you need

The Goodman
 The nation's short wave tuner on the market. Great for present broadcasts, local and D.L. Used in all parts of the world. Certificates of merit from testing laboratories. Pamphlet on request.
L. W. GOODMAN, Mfr., Drexel Hill, Pa.

WE REPAIR RADIO TUBES

 WD-11 ... \$3.00 DV-2 ... \$3.00
 WD-12 ... 3.00 DV-6A ... 3.00
 UV-200 ... 2.75 UV-199 ... 3.00
 UV-201 ... 3.00 C-299 ... 3.00
 C-300 ... 2.75 UV-201A ... 3.00
 C-301 ... 3.00 C-301A ... 3.00
 DV-6 ... 3.00 Marconi ... 3.00
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 6 v. Plain Detector ... 2.75
 6 v. Plain Amplifier ... 3.00
 Mail orders solicited and promptly attended to.
 Dealers and agents write for special discounts.
H. & H. RADIO CO.
 P. O. Box 22-B
 Clinton-Hill Station Newark, N. J.

STOP "B" BATTERY EXPENSE
 SUPER RECHARGEABLE "B" BATTERY AT PRACTICALLY THE SAME PRICE AS DRY CELLS

\$3.95
 100 Volts or more in Special Trays
 12 Cells—24 Volts—Capacity, 2000 M.A. Hours
NEGLEY-HIMMER, Jr.
 Laboratories
 316 CANAL STREET, NEW YORK CITY
 Mail Orders Promptly Filled
 Dealers Apply for Terms

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RADIO MAILING LISTS
 Use Our Card Catalog Directory In Use Now With Over 200 Radio Manufacturers and Jobbers
 Your ENVELOPES ADDRESSED
At \$2.50 per 1,000
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Prize Offered for Best Solution of Broadcasting Problem

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"This proposed cash offer has been made possible through the courtesy of an anonymous donor and may be taken as the first constructive step for the solution of the problem which has left the radio world in a highly puzzled state of mind," said Mr. Caddell, among other things. "Many individual suggestions have already been made as to who shall pay for broadcasting. Needless to say, before any solution will be found to the problem there will need to be a careful study made of the part played by the industry and those semi-public agencies which are now bearing the burden of cost, as well as an investigation of the benefits to be derived from the radio public in general. Some people feel that the expense is one that should be borne entirely by the industry, and yet at the same time a large part of the radio public feel that they are getting something for nothing which anyone will concede is wrong from an economic as well as an equitable point of view.

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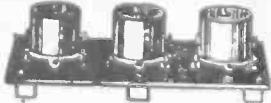
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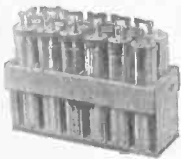


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FIVE hundred dollars in gold is the cash prize to be awarded by the American Radio Association to the persons sending in the best answers to the question, "Who is to pay for broadcasting?" according to an announcement made by Alfred M. Caddell, secretary of the American Radio Association, with headquarters at 50 Union Square, New York City.

"This proposed cash offer has been made possible through the courtesy of an anonymous donor and may be taken as the first constructive step for the solution of the problem which has left the radio world in a highly puzzled state of mind," said Mr. Caddell, among other things. "Many individual suggestions have already been made as to who shall pay for broadcasting. Needless to say, before any solution will be found to the problem there will need to be a careful study made of the part played by the industry and those semi-public agencies which are now bearing the burden of cost, as well as an investigation of the benefits to be derived from the radio public in general. Some people feel that the expense is one that should be borne entirely by the industry, and yet at the same time a large part of the radio public feel that they are getting something for nothing which anyone will concede is wrong from an economic as well as an equitable point of view.

The terms of the contest require that all answers shall have been placed in the mail addressed to the American Radio Association on or before July 20, 1924. The contest is open to any resident of the United States without regard to sex or affiliation with the radio industry. Contestants are requested not to exceed fifteen hundred words in their statement of any one plan, which should be typewritten and double spaced. In addition to the plan itself a brief summary should also be included. In the possible event of the same plan being received from two different sources, the board of judges will be requested to award a prize to each.

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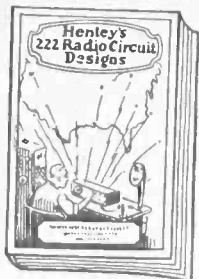
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The station records show that next to
the last piece was a violin solo, which
was followed by a march by the orches-
tra and taps was played when WJAN
signed off at 10:35½ C. S. T.

The letter written by Mr. Jose Velasco
is reprinted, verbatim.

Santa Ana, El Salvador, C. A.
February 22nd, 1924.

Radio Station WJAN,
Peoria Star Co.,
Peoria, Ill.

Dear Sirs:

Your fine broadcasting station has
been heard by me here very loud, clear
and steady quite a few times and as it is
a long way what your signals have trav-
eled before they have got in here I
thought you may find interesting this
report.

Just to show you that I am writing
facts here is this: "Radio log record, Feb.
21st, 1924, 10:24 p. m., Central standard
time, WJAN coming in fine, very loud,
perfectly clear and steady, at this time
transmitting a violin solo with piano ac-
companiment; 10:30 p. m. (C. S. T.) a
band, maybe orchestra, playing a march
10:35 p. m. (C. S. T.) signing off, an-
nouncer playing a cornet as he was sign-
ing off."

Your station has been heard here using
but two tubes and heard very loud too,
clear and steady. Now, gentlemen, let
me congratulate you very heartily and
truly deeply for the extra fine perfor-
mance of your fine station and the good
concerts you always give to the listening
public. Will I trouble you too much if I
ask you to please have the kindness to
acknowledge me reception of these lines?
Thanking you very much for this favor
and wishing you a greater success with
your fine WJAN, I beg to remain as

Yours very faithfully,
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Speaker Model UZ-1320, \$25; 2 UV712 audio Trans-
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This unusual reception achievement was recorded during the epochal experimental broadcast relay conducted in connection with the dinner of the alumni of the Massachusetts Institute of Technology at the Waldorf-Astoria, New York.

The General Electric Company stations WGY and KGO were the first and last links, respectively, in the transcontinental relay. WGY was connected to the amplifying apparatus of WJZ, the Radio Corporation station, which in turn was directly connected to the microphones in the banquet hall. Signals were conveyed via wire to Schenectady at which place WGY broadcast on 380 meters for radio listeners tuned in to the station wavelength and 105 meters to energize the next relay station, KDKA at East Pittsburgh. The Westinghouse station also broadcast on two wavelengths, that is, 326 meters and 94 meters, the low wave transmission for KFKX at Hastings, Nebraska, as well as 2AC in London, England. Hastings rebroadcast on 108 meters.

From 9 p. m. to 9:20, Pacific coast time KGO at Oakland picked up and rebroadcast the proceedings of the banquet in New York. KGO by using a super-sensitive receiver picked up the signals from KDKA at East Pittsburgh. Mr. Williams only a half mile away from the antenna of WGY was listening in along the relay line, picking up station after station. Getting on 312 meters he found KGO as the Pacific coast station was rebroadcasting the address of Gerard Swope, president of the General Electric Company.

Shortly after the address Mr. Williams tuned back and heard WJZ sign off for all the stations on the relay. Then he picked up WGY as the Schenectady station sang out "good night" and then KGO came in with its "good night," completing his round the States trip for the evening.

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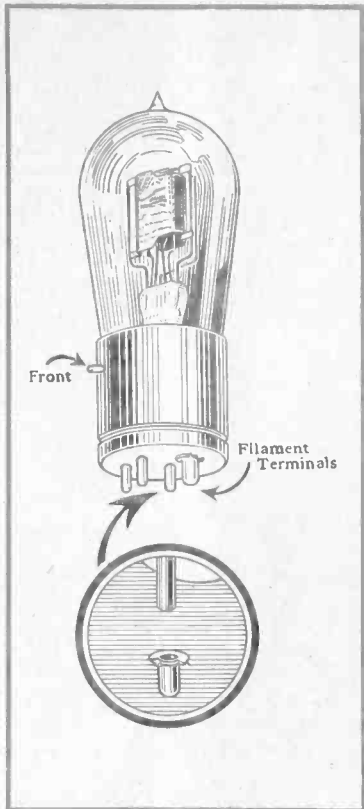
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