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the tube from the outside and a small loop should be left outside the building to permit the rain and water to drop off both the lead-in and the insulating bushing.

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The proper grounding of the ground wire sometimes puzzles an amateur. The ground clamp is a strip of metal made to fasten around the pipe. It is held in place by a clamping device. It is important that the pipe be scraped very clean. After being sure that the pipe is cleaned the ground clamp may be attached. The small photograph above shows how to connect the ground to the ground clamp.

(Both photos C. Kadel & Herbert News Service.)

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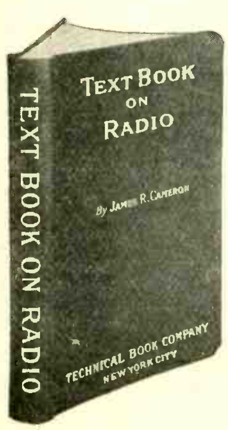


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VOLUME TWO OF

# RADIO WORLD



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# Superheterodyne Receiver as Applied to the Armstrong Superregenerative Circuit

## *By Charles R. Leutz*

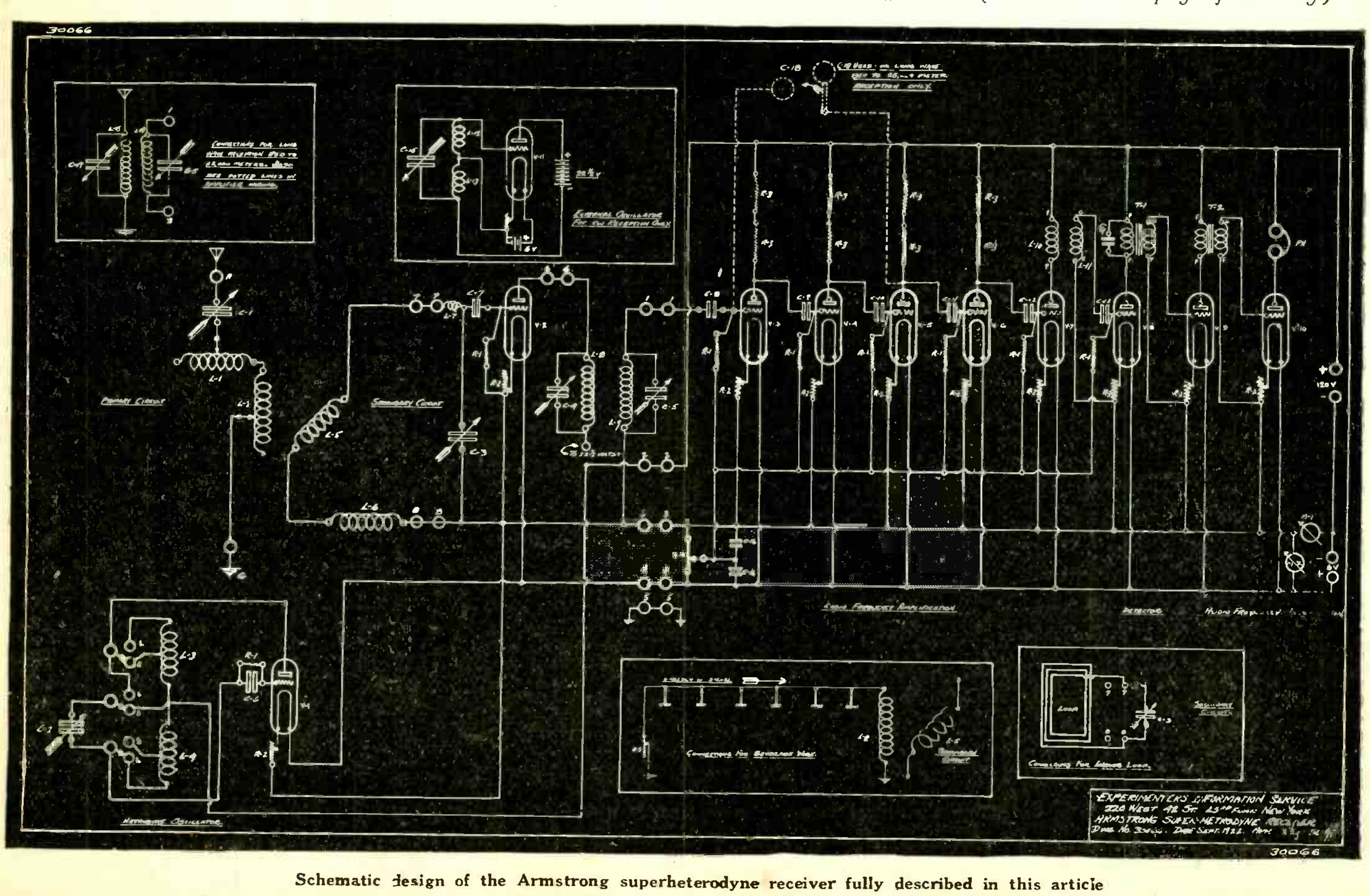
DURING the past five years, considerable expert engineering has been directed toward finding an efficient and satisfactory method of amplifying radio-frequency energy at short wave-lengths. A glance at the characteristic curves of the present available detector tubes will show a very weak signal cannot be rectified efficiently or completely. In view of this, additional audio-frequency amplification would not be of assistance. All detector, or rectifier, characteristic curves indicate that the resultant audio-frequency current is approximately proportional to the square of the impressed radio-frequency voltage. Therefore, the efficiency of the detector decreases rapidly with decrease of signal until a stage is reached at which the detector almost ceases to function. Many types of amplifiers have been devised to magnify radio-frequency energy before applying it to the detector; and many have worked very well on long wave-lengths—resistance, inductance, or capacity couplings. However, to use the same method of coupling for extremely high frequencies corresponding to wave-lengths of 50 to 200 meters, most results have been complete failures. There is a good reason for this. The low-capacity reactance existing between the structural elements of the amplifying tubes acts as the equivalent of a dead short circuit around the coupling medium and prevents a difference—a potential being transferred to the exterior plate-circuit.

This short circuit can be eliminated by tuning with a parallel inductance, but this leads to difficulties in the form of complicated adjustments and local oscillations.

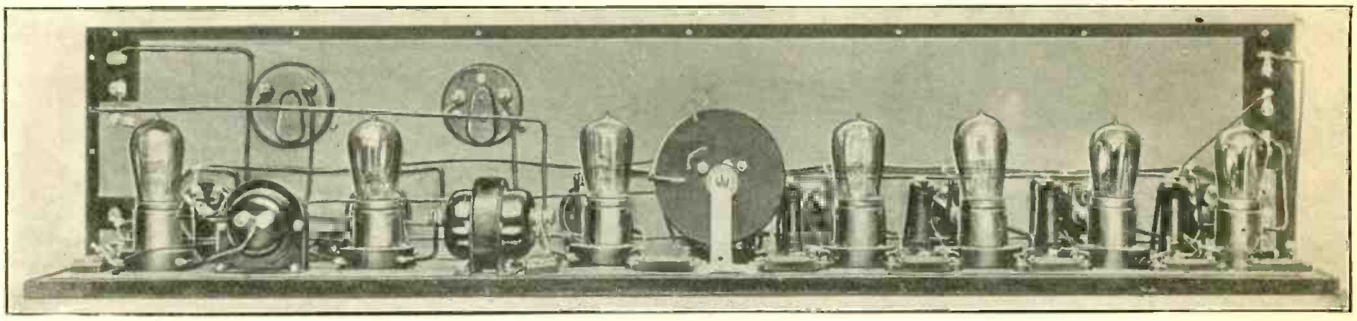
The French and English have constructed special tubes with a view to reducing the internal capacity. by special design. In addition, they have designed special transformers; but the efficient results in each case have been confined to a narrow band of wave lengths; for example, 300 to 700 meters.

Any attempt to increase the effective working wave-length band, particularly toward lower waves, has resulted in failure. It is obvious that if the receiver is to have a com-

(*Continued on page following*)



**Schematic design of the Armstrong superheterodyne receiver fully described in this article**



Thos. Coke Night, Photographer.

**Illustration showing the rear view of the panel with the instruments mounted. Seven tubes are used for this particular hook-up. The arrangement should be given close attention, as this is the best method for wiring such a set.**

(*Continued from page* 3)

mercial value a range of wave lengths from, say, 100 to 850 meters must be available with a minimum amount of adjustments and with uniform efficiency over the entire wave-length range.

In December, 1919, Major Edwin H. Armstrong gave publicity to an indirect method of obtaining short-wave amplification, called the super-heterodyne. The idea is to reduce the incoming frequency which may be, say, 1,500,000 cycles (200 meters) to some suitable superaudible frequency which can be amplified sufficiently, then passing this current through a radio-frequency amplifier and finally rectifying and carrying on one or two stages of audio-frequency amplification if desired. Transformation of the incoming signal-frequency to the amplifier frequency is usually accomplished by a heterodyne oscillator and rectifier.

This action may be understood readily by referring to the wiring diagram. The primary circuit, C-1, L-1, L-2, is tuned in resonance to the incoming signal-frequency—say, 1,500,000 cycles. The secondary circuit, L-5, L-6, L-7 and C-3, is tuned in resonance to the primary circuit, the coupling between these two circuits being adjusted between L-2 and L-5. V-2 is a rectifier or usual detector tube, and V-2 with the associated parts is an external heterodyne-oscillator. V-3 to V-8 is a resistance-coupled radio-frequency amplifier designed to operate efficiency at a frequency of 100,000 cycles, corresponding to 3,000 meters, the last stage of this amplifier (V-8) also acting as a detector rectifier. The amplifier on the imput side is coupled to the first detector by the tuned circuits C-4, L-8 and C-5, L-9, and on the output side to the detectors and audio-frequency amplifier tubes. L-7 is in inductive relation to L-4.

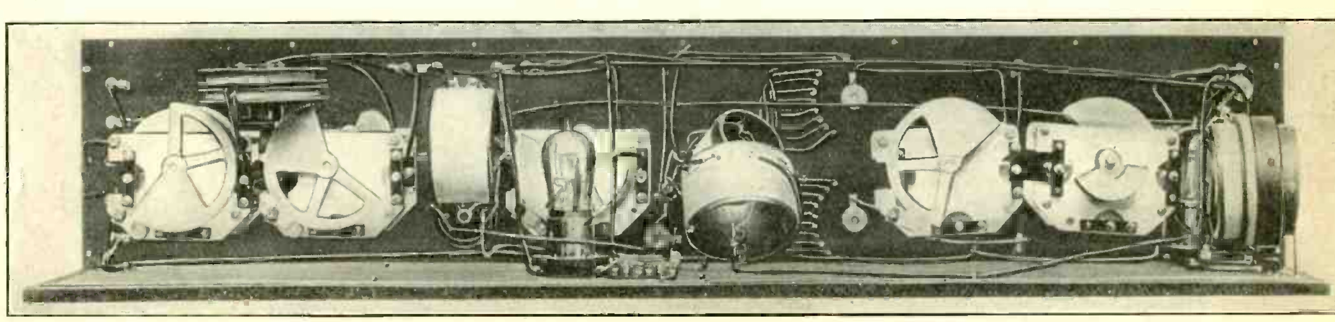
Now, assume that the heterodyne oscillator is tuned to 1,400,000 cycles or 1,600,000 cycles, either position will produce a beat frequency of 100,000 cycles. The combined currents of 1,500,000 cycles and 1,400,000 cycles (or 1,600,000) are then rectified by the detector V-2 to produce in circuit (C-4 L-8) a direct current with a superimposed 100,000-cycle component. This 100,000-cycle component is then amplified by V-3, V-4, V-5, V-6 and rectified by V-8 and the resultant audio-frequency note amplified by the audio amplifying tubes V-9 and V-10. In the case of continuous-wave reception, the best method of obtaining the audible note in the phones is to employ a second heterodyne adjustable to 1,000 cycles either side of the amplifier frequency of 90,000 to 101,000 cycles, and loosely couple this to the amplifier circuit. It is also possible to receive continuous-wave signals but producing oscillations in the amplifier of a slightly higher or lower frequency than the amplifier-tuned transfer wave-lengths. Oscillations and, also, regenerative amplification can be controlled by the special condenser, C-18. This special condenser must obviously have a very small minimum capacity or it would be difficult to stop the amplifier from oscillating.

Reception of spark and telephone signals can be carried on with equal efficiency and without any distortion, which is odd inasmuch as heterodyning a spark or telephone signal with an ordinary regenerative receiver will result in loss of note or tone. The efficiency of rectification of the incoming signal, when heterodyning depends on the phase relation with the local current. The efficiency of the rectification is a maximum when the two currents are 180 degrees out of phase, or in phase; a minimum when 90 degrees out of phase.

In ordinary heterodyning, the initial phase difference will be different for each wave train from spark transmitters, as the initial phase difference depends on the sparking at the transmitter. The frequency of the two currents are practically the same, and the length of the wave train is small compared with the time required to form a complete beat at audible frequencies. Different wave trains are, therefore, rectified with different degrees of efficiency and the plate current becomes irregular.

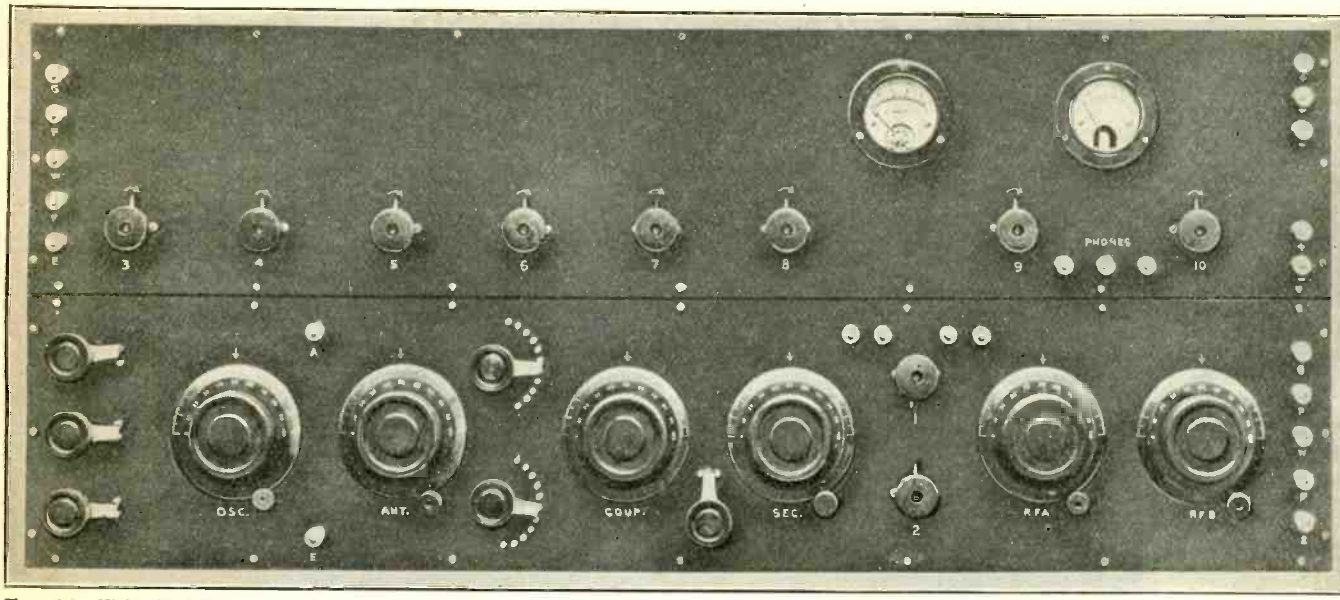
The beat frequency is high in the superheterodyne—several beats per wave train being established. The phase angle between the two currents changes through a number of cycles and the initial phase difference need no longer be considered.

The adjustments for 1 C-W and telephony are a combination of the previous mentioned adjustments for spark and C-W reception. Bear in mind that the amplifier circuits should be damped slightly to prevent distortion due to maximum resonance.



Thos. Coke Night, Photographer.

**Photograph to illustrate how the apparatus works in conjunction with the set in the photograph at the top of this page.**




Thos. Coke Night, Photographer.

**Photograph of the front of the panel showing its appearance after the set is finished. This is the Armstrong superheterodyne receiver used for short-wave reception.**

The present equipment being used is shown schematically in the wiring diagram, and actually in Figures 1, 2, and 3. The radio-frequency amplifier circuit is designed for 3,000 meters. Special attention has been paid to the effective design of the receiver circuits. L-2 and L-5 consist of a 180-degrees coupler and give a 180-degrees scale movement to a 90-degrees coil relation. The condenser, C-3, has shaped plates to give a straight-line wave-length variation. The maximum capacity of this condenser is very low and the values of inductance are large in order to develop the largest possible potential on the detector grid. In view of the fact that a loud signal is produced with only a fraction of a volt on the detector grid, the ratio of L and C is important. To keep the high-frequency resistance low, the coils are designed to have very low values of distribution capacity and the condensers are of special design, having only one-tenth the resistance of the ordinary condensers. The inductance, L-5, is used in parallel to C-3 to give the first wave-length the range 150 to 450 meters; and L-6 is connected in series to L-5 and both in parallel to C-3 for the second range—310 to 850 meters.

As the mechanical distance between L-8 and L-9 is increased, the tuning becomes sharper and a very high degree of selectivity can be obtained. The output resistors, R-3, can be replaced by iron-core chokes of proper value. The resistors can also be replaced by inductances and capacities, each tuned to 3,000 meters and give an additional advantage of having the amplifier reject all frequencies but the frequency to which it is tuned. The last stage of radio-frequency amplification is coupled by the tuned transformer, L-10, L-11. A potentiometer is provided for the common grid-leaks on the radio-amplifier tubes providing a means to adjust the characteristic curves to a point when maximum amplification is obtained without chance of the amplifier oscillating. The complete equipment is built in two units each entirely shielded with 10-ounce copper. The phone cords are also shielded with Belden braid. The shields are connected to the negative side of the filament battery.

To use a loop the links are taken out at posts 8 and 7, and loop inserted there using C-3 to tune. For long-wave reception, a large inductance is connected in place of L-9 for the secondary and that coupled to the antenna. The resistance-coupled amplifier will function down to 850 meters. The long-wave reception would not be possible if a tuned radio-frequency amplifier was employed. The first rectifier, V-2, and heterodyne V-1 are not used, of course, for long-wave reception.

Material increases in signal audibility can be made by inserting a variometer in the detector plate lead, at post 6, 6, tuning the plate for regenerative amplification. In place of tuning the plate, it is also possible to provide inductive coupling between the plate and grid of the detector, V-2, in the usual manner.

The results obtained with this unit have been very satisfactory. The antenna used was 125 feet long and 50 feet high, located in New York City. On 600 meters, spark signals from NGE (Miami), NAU (San Juan), NAR (Key West), NAW (Cuba), NAP (Pensacola), NAO (New Orleans), VCE (Cape Race), and ships in the canal zone were received with sufficient audibility to be heard 50 feet from the telephones. On 360 meters radiophone signals from KYW (Chicago), WOC (Davenport), WWJ (Detroit), WHB (Kansas City), WSB (Atlanta), WHA (Wisconsin) were received with the same signal audibility. On 200 meters, a continuous stream of 8th, 9th, 4th and 5th district amateurs were near. All these results were obtained in the late summer with the usual heavy static conditions.

This data, photographs, and schematic drawing of this design were supplied through the courtesy of the Experimenters Information Service, 220 West 42nd Street, New York City. This firm has available for distribution complete sets of blue-prints covering the entire construction of this equipment.

# Radio to Play Important Role in New Aircraft Carrier, "Langley"

*By Carl H. Butman*

WASHINGTON, D. C.—There is a strange Naval craft cruising about Chesapeake Bay. She looks something like a marine dance-hall, as her upper deck is broad, flat, and unobstructed. She does not carry the usual masts and funnels. No aerials are visible, yet this curious ship answers to the radio call NNC, designated in Naval radio or signal language as "Nan Nan Cast." Being mastless, one wonders about her aerials, but there are both permanent and adjustable aerials and radio masts which can be raised or lowered at will. She is also equipped with new and novel radio apparatus. She carries a number of flyers and many kinds of flying craft.

The vessel is the newly commissioned aircraft carrier, "Langley," built out of the hull of the old collier "Jupiter," the first Naval vessel to be equipped with electric drive. She is now making her "shakedown" or trial cruise in Chesapeake Bay under command of Captain S. A. R. Doyle, U. S. N.

The "Langley," named for the late Samuel P. Langley, the American scientist who was the first practical student of aeronautics and mechanical flight, is a veritable floating landing-field and mother ship for both aeroplanes and seaplanes; but, at the same time, she is a sea-going radio laboratory for the study and development of radio communication between aircraft and ships.

Her great flying deck, which stretches for 520 feet from stem to stern and is 65 feet wide, prevents the erection of permanent masts for radio or other purposes; for her "top sides" must be clear for the launching and landing of her aircraft. Special telescopic masts have been installed amidships, approximately 250 feet apart, fore and aft, which can be elevated when desired, or housed below decks when the planes are being projected into the air by the catapults or alighting from the air on the spacious upper deck. The masts, 50 feet in height and used primarily for the radio aerials, are controlled by hand-operated gears which raise and lower them somewhat as periscopes are operated. When lowered, the aerials are unhooked and stored below or laid alongside the palisades which guard the edges of the flying deck. The masts are elevated simultaneously after the antenna wires are hooked on. This aerial is the principal one used for long-distance communication. Auxiliary antenna are carried aft along both port and starboard sides. These antenna are hung outboard on davits which can be swung in, like ordinary boat-davits, and housed close to the vessel's side when not in use. Primarily these antenna are used to work nearby land stations and aircraft when aloft, as they do not interfere with the operation of the landing deck. At sea, with no aircraft aloft the vessel uses its mast antenna; but when planes are taking off and landing the auxiliary side antenna are used, although the masts could be raised for transmitting a message and then lowered.

Located below decks is the usual radio room found on all men-of-war with its equipment for transmitting and receiving, generators and batteries. The day of a radio house on the "top side" of military ships has passed. To-day the operator on watch sits below instead of "on top of the world" as on merchantmen and liners.

When operating with the radio compass on the Langley, however, the radioman comes up on the top deck and brings his house with him. In this very important work, an original idea has been carried out by the Naval constructors; for ascertaining the position of aircraft, ships or shore stations, the radio-compass house, built on the lines of an elevator, is run up to the top side where it projects above the deck like a pilot house. Its operator, the radioman, can raise and lower it at will, and from its location—aft on the starboard side—he can take bearings without interrupting the operation of planes as they land or depart. The roof of his house, when he is "up," forms part of the deck of the flying platform when he is "down."

Below in the radio room the ship has a regulation Naval 2-kilowatt spark-set for ordinary traffic work; but there is also a 300-watt tube transmitter, consisting of six 50-kilowatt tubes. This set is adaptable for use either as a radiotelephone or as a telegraph apparatus with I C W (interrupted continuous wave) or C W (continuous wave). For communication with the aircraft in the vicinity of the mother ship, either on the sea or in the air, the 300-kilowatt set is used. This is to insure direct and instantaneous communication.

Another feature of this unique vessel is the plane elevators, which raise and lower planes from the storage hold below, and the top of the elevators forming part of the ship's deck when they are "down" like the radio-house roof. Fore and aft are the catapults for launching the planes, as well as the arresting gear for stopping them when they land. Most of the usual "top side" equipment of an ordinary ship is below the flying deck: for example, the pilot house, which is well forward, port and starboard jib-cranes for lifting seaplanes from the water, the four 5-inch rifles, and deck houses. Her two funnels project from her sides toward the stern, where they may be turned upward, aft, or downward to keep the smoke from the upper deck.

Great results are expected from the "Langley," the first aircraft carrier of the Navy, and many advanced experiments in radio communication with aircraft are planned. The lessons learned in radio and practical aeronautical operation at sea will be incorporated in the new aircraft carriers which the Navy will build out of two battle-cruisers scrapped by the Armament Conference.

## Adding a Tube-Amplifier to a Crystal-Detector Set

MANY amateurs wonder if it is possible to use a one-step amplifier with a crystal set. When one is a crystal receiver and the other a tube amplifier, it would appear to the fan that it is impossible to use them together. However, experienced raidomen have proved that it can be done. According to the accompanying diagram, if the amateur purchases the necessary equipment and hooks up the material according to the circuit he will discover that satisfactory results will be obtained. The amateur must not get overexcited and think that this is a regenerative set. It is *not!* Nevertheless, with this in view, reliable signals should be secured. One drawback will be the proper upkeep of a good point on the crystal; and if this is obtained with the proper voltages on filament and plate, signals should be heard easily. The operation has already been explained; the various wave lengths are obtained by varying the frequency of the circuits. The alternating current obtained from the distant transmitting station is impressed on the detector of the receiving set.

# Constructing a Radio-Frequency Regenerator

## *By C. White, Associate A. I. E. E.*

RADIO-FREQUENCY regeneration is, perhaps, a very misleading and unknown thing to many; but, in reality, it is nothing more than accomplishing a double purpose with a single operation. We are just beginning to grasp the full realization of what may be done by means of regeneration and radio-frequency amplification. The recent invention of Major Armstrong reveals that it is possible to accomplish critical or superregeneration by means of special circuits which, literally speaking, keep the tube from misbehaving. Therefore, we can say that our development in the radio field consists in not only discovering new things but in perfecting our old apparatus so that certain previous troubles are cured. Such is the case of applying radio-frequency and regeneration to the same circuit.

The circuit illustrated in Figure 1 is quite different from the ordinary radio-frequency amplification hook-up. The first very apparent dissimilarity is the use of a tuned plate-circuit that is regenerative; the second is the employment of a crystal detector instead of the ordinary bulb type of detector. The reason for the first change is that we can obtain a slight regenerative effect with a tuned plate type of radio-frequency amplifier; but it must be remembered that good results are obtainable only when the mutual coupling is kept extremely low. If, however, it is attempted to operate the set with a critical coupling between the tickler and the secondary there will develop a serious distortion of the sound waves which will very materially hamper the true reception of music, although the volume will be greater than when the coupling is maintained at a low value. From the electrical standpoint, we are not actually regenerating our signals, but we are so altering the constants of the tuning circuit that the effective resistance, or impedance, of that circuit to the incoming wave will be extremely low, thereby improving reception from a long distance.

The virtue that the crystal detector is practically noiseless in operation explains fully the only basic reason for its use in the construction of this outfit. The one disadvantage of the crystal has been the trouble one experiences in trying to find the sensitive spot, but with one stage of radio frequency it is quite easy to get a good adjustment. However, since we are going to employ one stage of audio-frequency amplification, the total volume emitted by the detector will be sufficient under all normal conditions. While the bulb detector is by far the more efficient in operation, still the quality of the sound received through a crystal detector is much more natural. A bulb detector can, however, be substituted for the crystal; but the amateur must remember that serious howling may develop, due to extremely critical reaction owing to the fact that the detector tube reacts on the grid of the radio-frequency amplifying tube through the mutual inductance between the secondary and the regenerative tickler element. To avoid all possible trouble of this nature, I would suggest that the amateur stick to the crystal detector in using the particular type of the hook-up explained in this article.

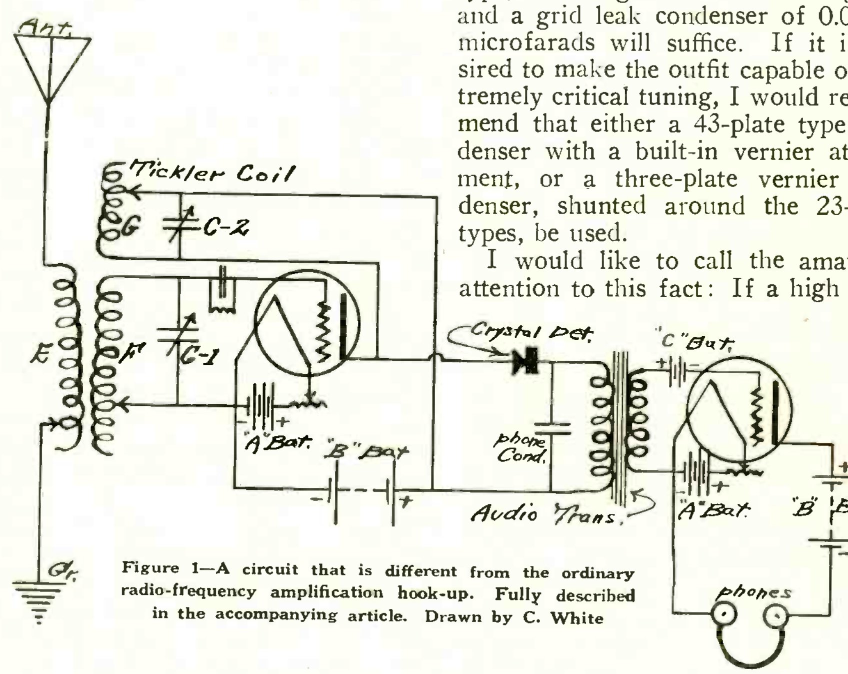



Figure 1—A circuit that is different from the ordinary radio-frequency amplification hook-up. Fully described in the accompanying article. Drawn by C. White

Relative to the actual construction of this outfit, I would advise that the unit E, F, G be made up of three pancake type of inductances mounted in a manner similar to the mounting of three honeycomb coils. Spider-web inductances can be made up easily by cutting out a form about five inches in diameter and dividing it so as to have seven, nine, or eleven spokes. Using a circle, two inches in diameter as a hub of the wheel, the novice should cut out the spokes. Using this form he should wind on about fifty turns. Some may find it more convenient and expedient to put on more turns and tap the same every ten turns; but this added refinement, though not absolutely necessary, allows a more flexible control and greatly augments sharp tuning. All three coils should be constructed similarly and mounted so that the mutual coupling can be varied. The middle coil, or secondary, should be stationary; and the tickler and the primary should swing in and out from it. If it is so desired, the amateur can purchase coils similar to the ones just described, already mounted, for a reasonable sum, from any radio supply store. The condensers C-1 and C-2 are variable condensers of the 23-plate type, while a grid leak of one megohm and a grid leak condenser of 0.00025 microfarads will suffice. If it is desired to make the outfit capable of extremely critical tuning, I would recommend that either a 43-plate type condenser with a built-in vernier attachment, or a three-plate vernier condenser, shunted around the 23-plate types, be used.

I would like to call the amateur's attention to this fact: If a high value of B-battery voltage be used with the audio-frequency amplifier tube and a small C battery having a variable voltage from two to ten be employed in the grid circuit of the tube as shown in the diagram, he will find that the net resultant amplification will be many times greater than if he had used the customary 45 volts with a U-V 201 type of bulb. Therefore, I heartily recommend that the novice get the maximum use out of his bulbs for amplifying purposes by having a potential of at least ninety volts applied to the plate circuit. In addition to the scientific qualities of this receiver, the price is much lower than any other type of long-distance receiver. This is true because there are no expensive variometers and variocouplers to be purchased. It is possible to make up this outfit for $15 if the amateur does not wish to use a panel type of mounting.

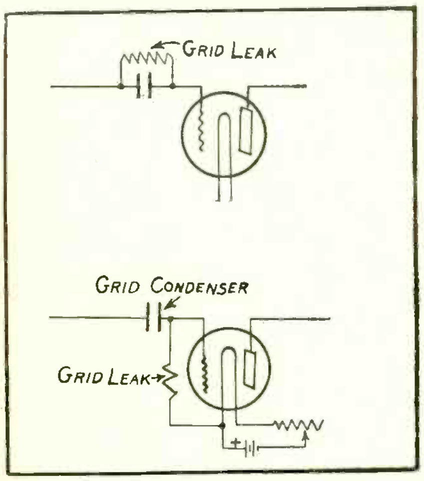
# The Radio Primer

## *Weekly A B C of Radio for the Beginner, in which Elementary Facts and Principles Are Fully and Tersely Explained*

## *By Lynn Brooks*

*What is the grid leak?*

WHEN waves enter the tuner from the aerial, the grid is affected with an alternation of positive and negative waves. The flow of electrons from the filament is helped when the grid is positive, but is hindered, or prevented, when the grid is negative. For our purposes, it can be considered that, when the grid is positive, the little charges of electricity exchange places with the negative charges flying from the filament in the form of electrons. But when the grid is harboring only negative electricity, it is held a prisoner. There is no place for these charges to go.




Upper diagram—Vacuum tube with grid leak shunted around the grid condenser. Lower diagram—Grid leak shunted around the filament and grid.

The little ups and downs of the radio waves, however, come in thick and fast, and the grid endeavors to take care of them. It has no trouble in getting rid of the positive halves because they flow over to the filament; but the negative halves remain where they are. Soon these negative charges are crowding the grid. As soon as the wave train ceases—and before the next wave train appears—the grid gets rid of these negative charges by making them leak through the most convenient hole. The grid leak is for this purpose. It takes care of the negative charges on the grid. Unless this is done, the action of the tube as a detector would be unsatisfactory if not impossible.

* * *

*Can a grid leak be placed anywhere in the circuit, or is there a special place for this to go?*

The grid leak has its own place in the circuit and must go there to function properly. If placed elsewhere in the circuit, it would not function and would render the whole set inoperative.

* * *

*What effect will the grid have on the action of the tube?*

Current is normally flowing from the positive pole of the B battery to the plate across the filament and from this point through the telephone receivers. If it were not for the grid, this current would not produce any sound whatsoever in the telephone receivers. But the grid is keeping time changing from positive to negative and keeping pace with the alternations of the incoming signals.

* * *

*What happens to this flow when the grid is negative?*

We must remember that the electrons are also negative. The electrons coming from the filament are repelled for the instant. When this happens the current flowing through the telephone receivers from the B Battery is interrupted. Since the flow of electrons depends, in turn, on the current. It is easy to see how this current is interrupted by the changing charges on the grid. When the grid is made positive, the electrons are attached and the space current between the plate and the filament becomes a good conductor.

* * *

*Does it make any difference if a C battery is used on any type tube used in the circuit of the grid element of the tube?*

The C battery has played some important parts; but is not needed in the present type regenerative circuit. It has been used successfully in Major Armstrong's superregenerative circuit.

* * *

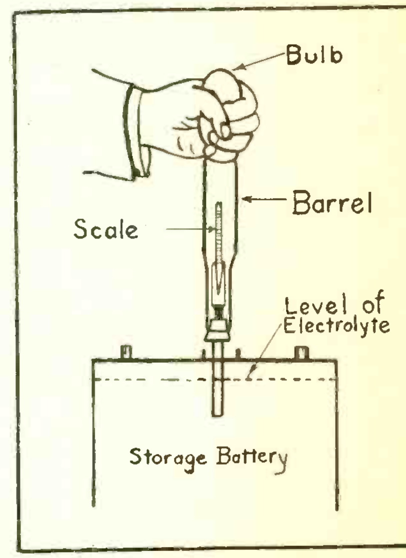
*What voltage generally is employed on the filament of the vacuum tubes in general use?*

The voltage used for lighting the filament of the vacuum used to-day is secured by a storage battery. Sometimes the dry cell is used, but it will be found that this method of lighting filament tubes is an expensive proposition. Stick to the storage battery until something better is invented.

* * *

*What instruments are needed for the care of storage batteries?*

Storage batteries need great care. If neglected they will go to ruin. A D-C voltmeter or hydrometer are two instruments that will enable the radioman to keep in touch with the condition of his storage battery. The accompanying illustration shows how the hydrometer is used. These hydrometers may be purchased in most any radio or electrical or automobile shop.




The condition of a storage battery is determined by the specific gravity of the acid solution. An instrument, called the "hydrometer," is used, as shown in this diagram, to test density of specific gravity.

* * *

*How does the tube function?*

The vacuum tube of to-day has three elements. The grid is connected to what is known as the "input" circuit of the tube. The radio currents pour in through this circuit from the antennae. Since these currents are alternating, the little grid between the plate and the filament will be positive one moment and negative the next. In this respect, it will be kept busy changing its charge thousands of times every second.

* * *

*Is it necessary to use storage batteries for filament lighting of vacuum tubes when working with a transmitter employing tubes?*

When using vacuum tubes for the transmission of radiotelegraphy and radio telephony, it is not essential to have the filaments heated by battery current as it is when using tubes for receiving, as the use of low commercial-frequencies at the transmitting station does not effect the reception of signals at the receiving station. Filament-heating transformers have been developed for filament heating.

# Why the Open Antenna Is Best for the Radio Listener

By C. D. Wagoner

THE radio art suffers, as does all new arts, from "too many ways of doing the same thing," and in no feature does this appear more than in the type of antenna used. The "radio pages" of the newspapers, the semi-technical press, even the higher-grade publications, teem with suggestions as to using the electric-light wires, the telephone leads, barbed-wire fences, wires strung around picture molding and the like, for picking up broadcast signals. It is no wonder that the newcomer in this fascinating field is bewildered to the point of not knowing what to choose from this chaotic array.

Let us consider for a moment the reason for all this. The unfortunate fact appears that, practically, every conductor known may be used to receive signals, because the signal sent out from any transmitter sets up currents in every piece of metal it encounters, such as the metal structure of buildings and bridges, the rails of railroad tracks, and, of course, every electric light, telegraph, and telephone wire that exists above ground or even below ground. Thus it is that our problem is not in finding a conductor to pick up signals for us, but rather in choosing a good one.

Now the fundamental laws governing the best form of receiving antenna were worked out long ago, particularly in popular form by Dr. Austin of the United States Navy. They are simple, indeed. Here they are, expressed in nontechnical language:

**1. The higher the receiving antenna, the stronger the signal.**

**2. The "height" of an antenna is the distance above ground of its "middle point."**

**3. For any particular wave-length, there is a best over-all length for the antenna.**

In addition, a few other simple rules may be added, such as:

**4. The antenna should be as far away as possible from other wires, particularly grounded ones.**

**5. If it is necessary to cross other wires, run as nearly as possible at right angles to these, and as far as you can above them.**

With all these rules in mind, and with other considerations which have been proven by practice, let us consider the best form of antenna for the radio novice to install in order to receive broadcast.

First of all, use a *single wire* antenna. This, at least, is just as good as a four-wire antenna, or cage antenna, and in many cases will prove a little better. The *material* of the wire does not matter much. It may be bare or insulated, it makes absolutely no difference which. Copper, phosphor bronze, or brass, may be used; even galvanized iron can be used without much loss. Of course, it is advisable to use a good strong wire, such as phosphor bronze, so it will not break under strain. It is further recommended that this wire be used whenever possible. Every retail radio store carries this stranded aerial wire, so it is always easy to get.

In regard to the "height" part of the antenna. The *ideal* antenna would be one erected straight up and down, such as a wire suspended from a very tall flagpole. This is because the "middle point" of this wire is higher above ground than would be the case if the wire were inclined, or bent in an L shape. But, unfortunately, few of us have masts 200 feet high, and so some compromise must be sought. The answer is this:

**A. Run your wire from your radio room straight up into the air, AS HIGH AS YOU CAN; and then,**

**B. Run the rest of the antenna approximately horizontally, to a point as high as you can find.**

You will then have as good an antenna as you could wish, so far as the question of *height* is concerned.

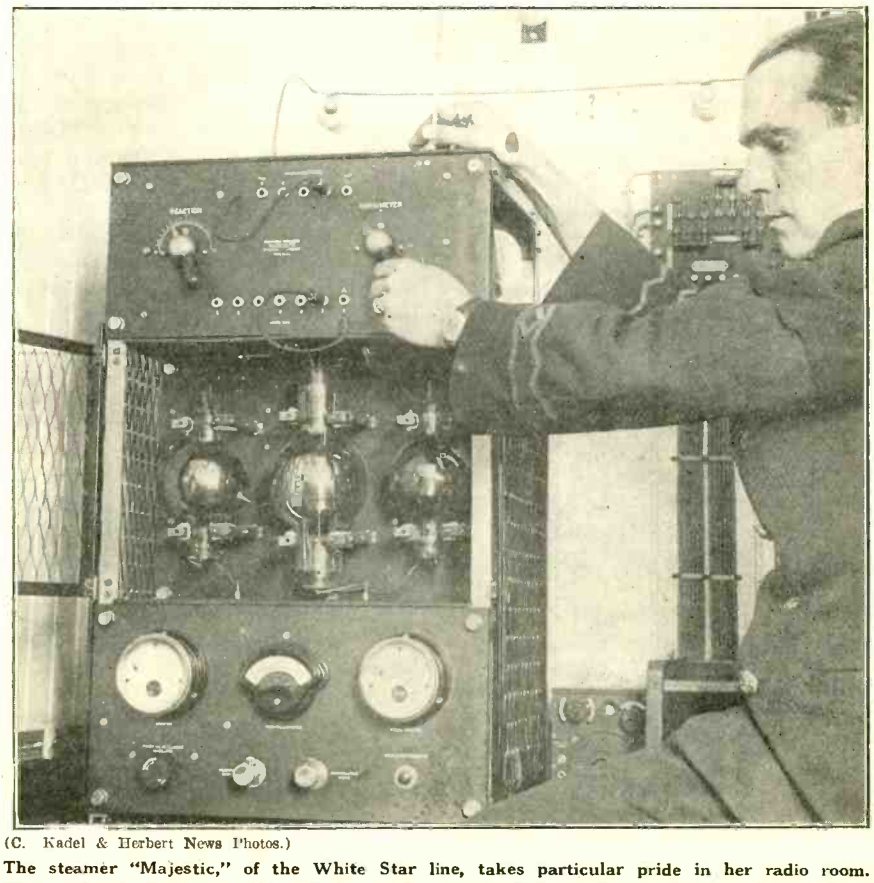
This antenna is called, for obvious reasons, the "inverted L" type.

If you run the upper part of the L horizontally, then the height of the middle of your wire is the height of the wire above ground. But if the far end of this wire happens to be higher than the near end, you have raised the middle point, and your antenna will receive signals slightly better. On the other hand, if you have to run the antenna "slanting downwards," you have lowered the middle point and the antenna will not receive so well. So try to have both ends of the "horizontal" part of the antenna as high as possible. If you find it possible to make one end higher than the other, by all means do so.

If the far end of the antenna happens to be a tree—as in many cases is the case—remember that during heavy winds the tree will sway greatly. This is likely to break your wire. One way

*(Continued on following page.)*

## Radio Room of "Majestic" the World's Largest Transatlantic Liner



(C. Kadel & Herbert News Photos.)

**The steamer "Majestic," of the White Star line, takes particular pride in her radio room. The equipment is of the best, and the room has one of the choice positions on the big boat. The photograph shows the second-in-charge radio operator, L. H. Tamplin, at the C-W panel used for long-distance sending.**

# Broadcasting Stations of United States and Canada

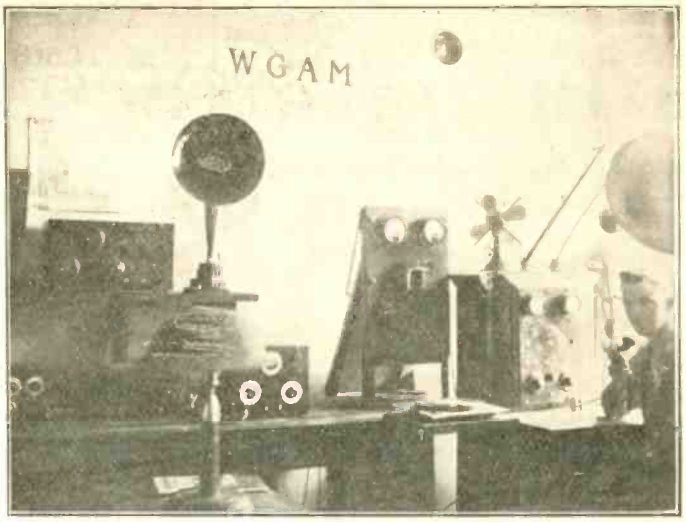
*Complete to Date of Going to Press*

UNITED STATES

KDKA—Westinghouse Co., East Pittsburgh, Pa.
KDPM—Westinghouse Electric & Mfg. Co., Cleveland, Ohio.
KDZT—Seattle Radio Association, Seattle, Wash.
KFAN—The Electric Shop, Moscow, Idaho.
KFAP—Standard Publishing Co., Butte, Mont.
KFAQ—City of San Jose, San Jose, Calif.
KFAR—Studio Lighting Service Co. (O, K. Olesen), Hollywood, Calif., 1645 Hudson Avenue.
KFAS—Reno Motor Supply Co., Reno, Nev.
KFAT—S. T. Donohue, Eugene, Oreg, 681 Willamette Street.
KFAU—Boise High School, independent school district of Boise City, Boise, Idaho.
KFAV—Cooke & Chapman, Venice, Calif.
KFAW—The Radio Den, Santa Ana, Calif.
KFBA—Ramey & Bryant Radio Co., Lewiston, Idaho.
KFBB—F. A. Buttrey & Co., Havre, Mont.
KFBC—W. K. Azbill, San Diego, Calif., 5038 Cliff Place.
KFBD—Clarence V. Welch, Hanford, Calif., 315 North Douty Street.
KFBE—Reuben H. Horn, San Luis Obispo, Calif.
KFBF—Butte School of Telegraph (F. H. Smith), Butte, Mont.
KFBG—First Presbyterian Church, Tacoma, Wash.
WAAD—Ohio Mechanics Institute, Cincinnati, Ohio.
WAJT—Kelly-Vawter Jewelry Co., Marshall, Mo.
WAJU—Yankton College, Yankton, S. D.
WBAP—The Star-Telegram, Wortham-Carter Pub. Co., Ft. Worth, Texas.
WBAZ—Times-Despatch Pub. Co., Richmond, Va.
WCAB—Newburgh News Print & Pub. Co., Newburgh, N. Y.
WCAC—John Fink, Jewelry Co., Fort Smith, Ark.
WCAD—St. Lawrence University, Canton, N. Y. (Only weather.)
WCAE—Kaufman & Baer Co., Pittsburgh, W. Pa.
WCAG—Daily States Pub. Co., New Orleans, La.
WCAV—J. C. Dice Electric Co., Little Rock, Ark.
WCAW—Quincy Herald and Quincy Electric & Supply Co., Quincy, Ill.
WCAX—University of Vermont, Burlington, Vt.
WCAY—Kesselmen O'Dricall Co., Milwaukee, Wisc.
WCAZ—Robert E. Compton & Co., Quincy Whig Journal, Quincy, Ill.
WHAG—University of Cincinnati, Cincinnati, Ohio.
WHAH—John T. Griffin, Joplin, Mo., 112 West Sixth Street.
WHAI—Radio Equipment & Mfg. Co., Davenport, Iowa.
WHAJ—Bluefield Daily Telegraph and E. K. Kitts, Bluefield, W. Va.
WHAK—Roberts Hardware Co., Clarksburg, W. Va.
WHAL—Phillips Jeffrey & Derby, Lansing, Mich.
WHAM—University of Rochester, Rochester, N. Y.
WHAN—Southwestern Radio Co., Wichita, Kans.
WHAO—Frederic A. Hill, Savannah, Ga.
WHAP—Dewey L. Otta, Decatur, Ill., 659 West Eldorado Street.
WHAQ—Semmes Motor Co., Washington, D. C.
WHAR—Paramount Radio & Electric Co., Atlantic City, N. J.
WHAS—Courier-Journal and Louisville Times, Louisville, Ky.
WHAT—Yale Democrat-Yale Telephone Co., Yale, Okla.
WHAU—Corinth Radio Supply Co., Corinth, Miss.
WHAV—Wilmington Electrical Specialty Co., Wilmington, Del.
WHAW—Pierce Electrical Co., Tampa, Fla.
WHAX—Holyoke Street Ry. Co., Holyoke, Mass.
WHAY—Huntington Press, Huntington, Ind.
WHAZ—Rensselaer Polytechnic Institute, Troy, N. Y.
WIAA—Waupaca Civic and Commerce Association, Waupaca, Wis.
WIAB—Joslyn Automobile Co., Rockford, Ill.
WIAC—Galveston Tribune, Galveston, Tex.
WIAD—Ocean City Yacht Club, Ocean City, N. J.
WIAE—Mrs. Robert E. Zimmerman, Vinton, Iowa.
WIAF—Gustav A. De Cortin, New Orleans, La., 139 North Alexander Street.
WIAG—Matthews Electrical Supply Co., Birmingham, Ala.
WIAH—Continental Radio & Mfg. Co., Newton, Iowa.
WIAI—Heer Stores Co., Springfield, Mo.
WIAJ—Fox River Valley Radio Supply Co., Neenah, Wis.
WIAK—Journal-Stockman Co., Omaha, Nebr.
WIAL—Standard Service Co., Norwood, Ohio.
WIAN—Chronicle & News Publishing Co., Allentown, Pa.
WIAO—School of Engineering of Milwaukee and Wisconsin News, Milwaukee, Wis.
WIAP—Radio Development Corp., Springfield, Mass.
WIAQ—Chronicle Publishing Co., Marion, Ind.
WIAR—J. A. Rudy & Sons, Paducah, Ky.
WIAS—Burlington Hawkeye & Home Electric Co., Burlington, Iowa.
WIAT—Leon T. Noel, Tarkio, Mo.
WIAU—American Trust and Savings Bank, Le Mars, Iowa.
WIAV—New York Radio Laboratories, Binghampton, N. Y.
WIAW—Saginaw Radio & Electric Co., Saginaw, Mich.
WIAX—Capitol Radio Co. (Paul C. Rohwer), Lincoln, Nebr.
WIAY—Woodward & Lothrop, Washington, D. C.
WJAB—American Radio Co., Lincoln, Nebr.
WJAC—Redell Co., Joplin, Mo.
WJAD—Jackson's Radio Engineering Laboratories, Waco, Tex.
WJAE—Texas Radio Syndicate, San Antonio, Tex.
WJAF—Munsey Press, Munsey, Ind.
WJAG—Norfolk Daily News (Huse Publishing Co.), Norfolk, Nebr.
WJAH—Central Park Amusement Co., Rockford, Ill.
WJAJ—Y. M. C. A., Dayton, Ohio.
WJAK—White Radio Laboratory, Stockdale, Ohio.
WJAL—Victor Radio Corp., Portland, Me.
WJAM—D. M. Perham, Cedar Rapids, Iowa.
WJAN—Peoria Star & Peoria Radio Sales Co., Peorio, Ill.
WJAP—Kelly-Duluth Co., Duluth, Minn.
WJAQ—Capper Publications, Topeka, Kansas.
WJAR—The Outlet Co., Providence, R. I.
WJAS—Pittsburgh Radio Supply House, Pittsburgh.
WJAX—D. M. Perham, Cedar Rapids, Iowa.
WJAZ—Chicago Radio Laboratory, Chicago.
WDAA—Ward-Belmont School, Nashville, Tenn.
WDAB—M. C. Summer & Son, Portsmouth, Ohio.
WDAC—Illniois Watch Co., Springfield, Ill. (Weather only.)
WDAD—William Louis Harrison, Central Kansas Radio Supply, Linsborn, Kansas.
WDAE—Tampa Daily Times, Tampa, Fla.
WDAF—Kansas City Star, Kansas City, Mo.
WDAG—J. Laurence Martin, Amarillo, Texas.
WDAI—Hughes Electrical Corp., Syracuse, N. Y.
WDAJ—Atlanta & West Point R. R. Co., College Park, Ga.
WDAK—Mine & Smelter Supply Co., El Paso, Texas.
WDAL—"Florida Times Union," Jacksonville, Florida.
WDAM—Western Electric Co., New York, N. Y.
WDAN—Glenwood Radio Corp., Shreveport, La.
WDAO—Automotive Electric Co., Dallas, Texas.
WDAP—Midwest Radio Central Inc., Chicago.
WDAQ—Hartman Riker Elec. Co., Brownsville, Pa.
WDAR—Lit Bros., Philadelphia.
WDAS—Samuel A. Waite, Worcester, Mass.
WDAT—Delta Electric Co., Worcester, Mass.
WDAU—Slocum & Kilbourne, New Bedford, Mass.
WDAV—"Muskogee Daily Phoenix," Muskogee, Okla.
WDAW—Georgia Railway and Power Co., Atlanta, Ga.
WDAX—First National Bank, Centreville, Iowa.
WDAY—Kenneth M. Hancé, Fargo, N. D.
WEAA—Fallain & Lathrop, Flint, Mich.
WEAB—Standard Radio Equipment Co., Fort Dodge, Iowa.
WEAC—Baines Electric Service Co., Terre Haute, Ind.
WEAD—Northwest Kansas Radio Supply Co., Atwood, Kansas.
WEAF—Western Electric Co., N. Y.
WEAG—Nichols - Heneline - Bassett, Edgewood, R. I.
WEAH—Wichita Board of Trade and Landus Radio Co., Wichita, Kansas.
WEAI—Cornell University, Ithaca, N. Y.
WEAK—Julius B. Abercrombie, St. Joseph, Mo.
WEAM—North Plainfield, N. J.
WEAN—Shepard Co., Providence, R. I.
WMAB—Radio Supply Co., Oklahoma City, Okla.
WMAC—F. Edward Page, Fernwood, Cazonovia, N. Y.
WMAF—Round Hills Radio Corp., Dartmouth, Mass.
WMAJ—Drovers Telegram Co., Kansas City, Mo.
WNAC—Shepard Stores, Boston, Mass.
WOAI—Southern Equipment Co., San Antonio, Tex.
KDZA—"Arizona Daily Star," Tuscon, Arizona.
KDZB—Frank E. Siefert, Bakersville, Cal.
KDZD—W. R. Mitchell, Los Angeles, Cal.
KDZE—The Rhodes Co., Seattle, Washington.
KDZF—Automobile Club of Southern California, Los Angeles.
KDZG—Cyrus-Peirce Co., San Francisco, Cal.
KDZH—"Fresno Evening Herald," Fresno, Cal.
KDZI—Electric Supply Co., Wenatchee, Wash.
KDZJ—Excelsior Radio Co., Eugene, Oregon.
KDZL—Rocky Mountain Radio Corp., Ogden, Utah.
KDZM—E. A. Hollingworth, Centralia, Wash.
KDZK—Nevada Machine & Electric Co., Reno, Nev.
KDZQ—William D. Pyle, Denver, Colo.
KDZP—Newbery Elec. Corp., Los Angeles, Calif.
KDZR—Bellingham Publishing Co., Bellingham, Wash.
KDZT—Seattle Radio Association, Seattle, Wash.
KDZV—Cope & Cornwell Co., Salt Lake City, Utah.
WKAA—Republican Times and H. F. Paar, Cedar Rapids, Ia.
WKAC—Star Publishing Co., Lincoln, Nebr.
WKAF—W. S. Radio Supply Co., Wichita Falls, Tex.
WKAD—Charles Looff, East Providence, R. I.
WKAG—Edwin T. Bruce, M. D., Louisville, Ky.
WKAH—Planet Radio Co., West Palm Beach, Fla.
WKAJ—Fargo Plumbing & Heating Co., Fargo, N. D.
WKAK—Okfuskee County News, Okemah, Okla.
WKAL—Gray & Gray, Orange, Tex.
WKAM—Adam Breede, "Daily Tribune," Hastings, Neb.
WKAN—Alabama Radio Mfg. Co., Montgomery, Ala.
WKAP—Flint, Dutee Wilcox, Cranston, R. I.
WKAQ—Radio Corporation of Porto Rico, San Juan, P. R.
WKAR—Michigan Agriculture College, East Lansing, Mich.
WKAS—L. E. Lines Music Co., Springfield, Mo.
WKAT—Frankfort Morning Times, Frankfort, Ind.
WKAV—Laconia Radio Club, Laconia, N. H.
WKAW—Turner Cycle Co., Beloit, Wis.
WKAX—Wm. A. MacFarlane, Bridgeport, Conn.
WKAY—Benau College, Janesville, Ga.
WKAZ—Landaus Music and Jewelry Co., Wilkes-Barre, Pa.
KDYC—Herald Publishing Co., Klamath Falls, Ore.
KDYS—The Tribune, Inc., Great Falls, Mont.

*(Continued from preceding page)*

KDYW—Smith-Hughes & Co., Phoenix, Ariz.
KDYX—Star Bulletin Publishing Co., Honolulu, T. H.
KDYY—Rocky Mt. Radio Corp., Denver, Colo.
WBAC—Republican Publishing Co., Hamilton, Ohio.
WBAQ—Myron L. Harmon, Y. M. C. A., South Bend, Indiana.
WBAV—The Erner & Hopkins Co., Columbus, Ohio.
WBAW—Marietta College, Marietta, Ohio.
WBAX—John H. Stenger, Wilkes-Barre, Pa.
WBAY—American Telephone & Telegraph Co., New York.
WGAM—Orangeburg, S. C.
WGAX—Radio Electric Co., Washington, D. C.
WHAW—Pierce Electric Co., Tampa, Fla.
WLAB—George F. Grossman, Carrollton, Mo.
WLAC—North Carolina State College, Raleigh, N. C.
WLAD—Arvanette Radio Supply Co., Hastings, Neb.
WLAF—Johnson Radio Co., Lincoln, Neb.
WLAG—Cutting and Washington Radio Corp., Minneapolis.
WLAH—Samuel Woodworth, Syracuse, N. Y.
WLAJ—Waco Electrical Supply Co., Waco, Tex.
WLAK—Vermont Farm Machine Co., Bellows Falls, Vt.
WLAL—Tulsa Radio Co., Tulsa, Okla.
WLAM—Morrow Radio Co., Springfield, Ohio.
WLAN—Putnam Hardware Co., Houlton, Mo.
WLAO—Anthracite Radio Shop, Scranton, Pa.
WLAP—W. V. Jordon, Louisville, Ky.
WLAQ—A. E. Shilling, Kalamazoo, Mich.
WLAR—Mickel Music Co., Marshalltown, Iowa.
WLAS—Hutchinson Radio Co., Hutchinson, Kan.
WLAT—Charles G. Bosch Co., Burlington, Iowa.
WLAX—Putnam Electric Co., Greencastle, Ind.
WMAH—General Supply Co., Lincoln, Nebraska.
WMAM—Beaumont Radio Equipment Co., Beaumont, Texas.
WNAL—R. J. Rockwell, Omaha, Nebraska.
WAL—McCook Army Station, Dayton.
WBA—Marshall-Gerken Co., Toledo, Ohio.
WBZ—Westinghouse Co., Springfield, Mass.
WCL—Philadelphia
WCJ—A. C. Gilbert Co., New Haven, Conn.
WCX—Detroit Free Press, Detroit, Mich.
WDM—Church of the Convent, Washington, D. C.
WDT—Ship Owners Radio Co., New York City.
WDY—Radio Corp. of Amer., Roselle Park, N. J.
WDW—Radio Construction Co., Washington, D. C.
WGH—Light and Water Power Co., Montgomery, Ala.
WGI—Amer. Radio & Research Corp., Medford Hillside, Mass.
WGL—Thomas J. Howlett, Philadelphia.
WGM—Georgia Railway & Power Co., Atlanta, Ga. (Atlanta Constitution.)
WGY—General Elec. Co., Schenectady, N. Y.
WHA—University of Wisconsin, Madison, Wis.
WHK—Warren R. Cox, Cleveland.
WHN—Brooklyn, N. Y.
WHQ—Rochester Times, Rochester, N. Y.
WHU—William B. Duck Co., Toledo, Ohio.
WHW—Stuart W. Seeley, East Lansing, Mich.
WFO—Riker Kumler Co., Dayton
WJH—White and Boyer, Washington, D. C.
WJK—Service Radio Equipment Co., Toledo, Ohio.
WJX—De Forest Radio Co., New York City.
WJZ—Westinghouse Co., Newark, N. J.
WKB—Sweeney School Co., Kansas City, Mo.
WLB—University of Minn., Minneapolis, Minn.
WLK—Hamilton Mfg. Co., Indianapolis.
WLQ—United States Army, Fairfield, Ohio.
WLW—Crosley Manufacturing Co., Cincinnati.
WMH—Precision Elec. Co., Cincinnati.
WNO—Wireless Tel. Co. of Hudson County, N. J.
WOC—Karlowa Radio Co., Rock Island, Ill.
WOH—Hatfield Electric Co., Indianapolis.
WOK—Pine Bluff Co., Pine Bluff, Ark.
WOO—Western Radio Co., Kansas City, Mo.
WOR—L. Bamberger & Co., Newark, N. J.
WOS—Mo. State Marketing Bureau, Jefferson City, Mo.
WOU—Metropolitan Utilities, Omaha, Neb.
WOZ—Palludium Printing Co., Richmond, Ind.
WOB—C. D. Tuska & Co., Hartford, Conn.
WPB—Hamilton Elec. Co., Pittsburgh.
WRK—Doron Bros. Elec. Co., Hamilton, Ohio.



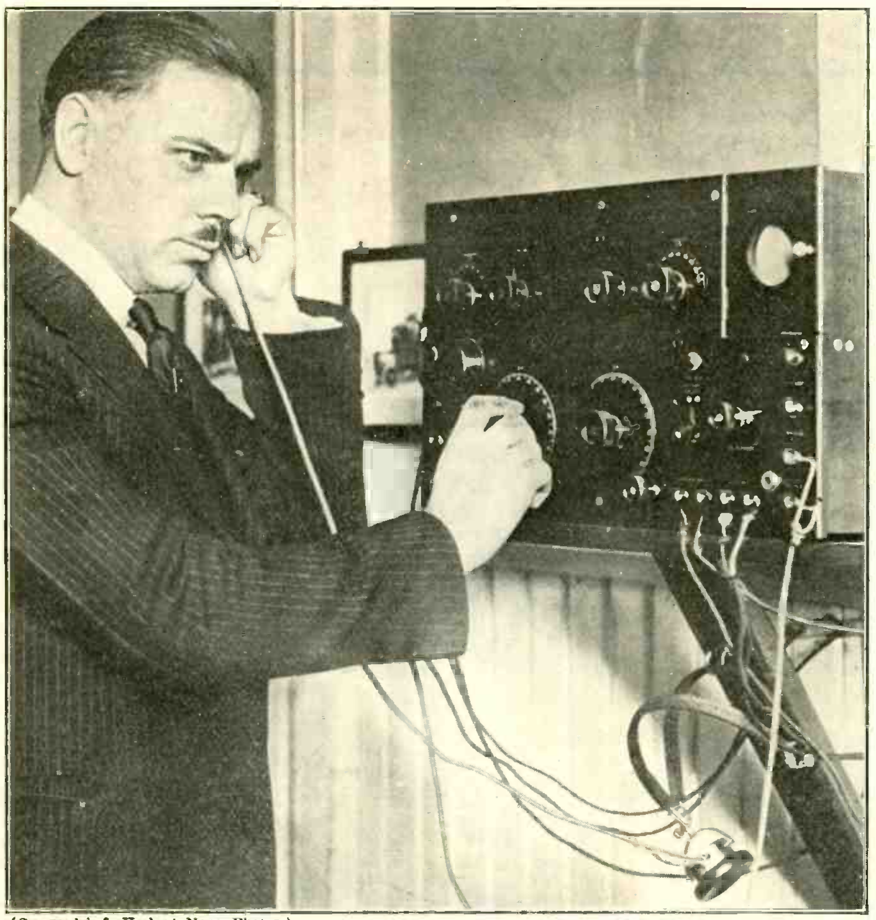

**The busy broadcasting station WGAM, Orangeburg, South Carolina, one of the best-equipped broadcasters in the South**

WRL—Union College, Schenectady, N. Y.
WRR—Dallas Texas, Dallas, Texas.
WRW—Tarrytown Radio Research Co., Tarrytown, N. Y.
WSZ—Marshall-Gerken Co., Toledo, Ohio.
WVP—United States Army, New York City.
WWJ—Detroit News Co., Detroit, Mich.
WAAC—Tulane University, New Orleans, La.
WBAD—Sterling Elec. Co., Minneapolis, Minn.
WBAE—Bradley Institute, Peoria, Ill.
WBAH—Dayton Co., Minneapolis, Minn.
WBAM—B. Rennysen, New Orleans, La.
1 XAD—Thomas Giffen, Pawtucket, R. I.
2 IA—Jersey Review, Jersey City, N. J.
2 XJ—American Tel. & Tel. Co., Deal Beach, N. J.
4 CD—Carter Electric Co., Atlanta, Ga.
5 ZU—State University, Austin, Texas.
8 UX—Radioart Store, Akron, Ohio.
8 YO—Ohio State University, Columbus.
8 BYV—Columbus Spec. Co., Columbus.
9 YY—State University, Lincoln, Neb.
10 J—Robert F. Farnum, Pawtucket, R. I.
KDN—Meyberg Co., San Francisco.
KFC—Northern Radio & Elec. Co., Seattle, Wash.
KFU—Precision Shop, Gridley, Cal.
KGB—Edwin L. Lorden, San Francisco.
KGC—Hamilton Mfg. Co., Hollywood, Cal.
KGF—Pomona Fixture Co., Pomona, Cal.
KHO—Louis Wasmer, Seattle, Wash.
KIZ—Reynolds Radio Co., Denver, Colo.
KJJ—Radio Shop, Sunnyvale, Cal.
KJO—C. O. Gould, Stockton, Cal.
KJR—Vincent I. Kraft, Seattle, Wash.
KJS—Bible Institute, Los Angeles, Cal.
KLB—J. J. Dunn & Co., Pasadena, Cal.
KLP—Colin B. Kennedy, Los Altos, Cal.
KLS—Warner Bros., Oakland, Cal.
KLX—Tribune Pub. Co., Oakland, Cal.
KNI—T. W. Smith, Eureka, California.
KNX—Electric Lighting Supply Co., Los Angeles.
KOG—Western Radio Co., Los Angeles.
KOJ—University of Nevada, Reno, Nev.
KOV—Doubleday Hill Electric Co., Pittsburgh.
KQI—University of California, Berkeley, Cal.
KQL—Arno A. Kluge, Los Angeles.
KQW—Charles D. Herrold, San Jose, Cal.
KTW—First Presbyterian Church, Seattle, Wash.
KUO—Examiner Printing Co., San Francisco.
KVQ—J. C. Hobrecht, Sacramento, Cal.
KWG—Portable Wireless Co., Stockton, Cal.
KYF—Thearle Music Co., San Diego, Cal.
KYI—Bakersfield Californian, Bakersfield, Cal.
KYJ—Leo Meyberg Co., Los Angeles.
KYY—Radio Shop, San Francisco.
KYW—Westinghouse Co., Chicago.
KZC—Public Market and Dep't Stores, Seattle.
KZM—Preston D. Allen, Oakland, Cal.
KZN—Desert News, Salt Lake City, Utah.
KZV—Wenatchee Battery & Motor Co., Wenatchee, Wash.
KZY—A-P Radio Supplies Co., Oakland, Cal.
KFAY—W. J. Virgin Milling Co., Central Point, Oregon.
KFBH—Thomas Musical Co., Marshfield, Oregon.
KFBJ—Boise Radio Supply Co., Boise, Idaho.
KFBK—Kimball-Upson Co., Sacramento, Calif.
KFBL—Leese Bros., Everett, Wash.
KFBM—Cook & Foster, Astoria, Oregon.
KFBN—Borch Radio Corp., Oakland, Cal.
KFBQ—Savage Electro Co., Prescott, Ariz.
KFCB—Nielsen Radio Supply Co., Phoenix, Ariz.
KFCC—Auto Supply Co., Wallace, Idaho.
KFCD—Salem Electric Co., Salem, Oregon.
KFDB—John D. McKee, Lombard & Kearney, San Francisco, Cal.
KPAV—Cooke & Chapman, Venice, California.

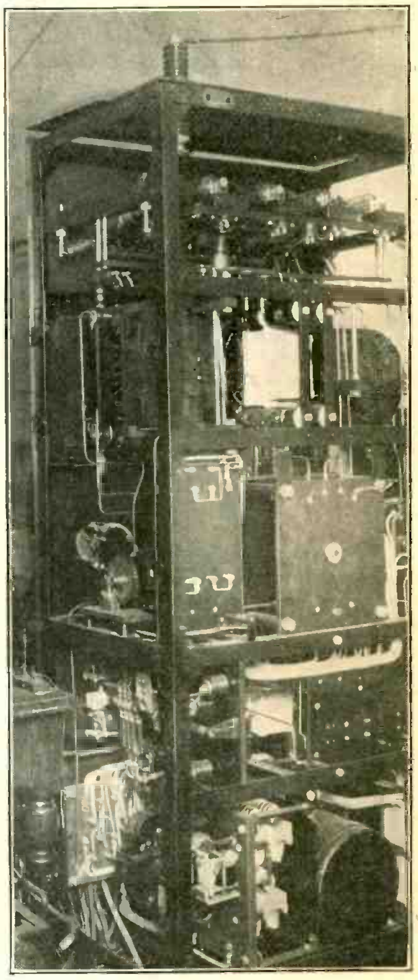
CANADA

CJCU—Manitoba Free Press, Winnipeg, Man.
CHCA—Radio Corporation of Vancouver, Ltd., Vancouver, B. C.
CFAC—Radio Corporation of Calgary, Ltd., Calgary, Alta.
CKCK—G. Melrose Bell, Regina, Sask.
CHCF—G. Melrose Bell, Winnipeg, Man.
CJCE—Vancouver Sun, Vancouver, B. C.
CKCD—Vancouver Daily Province, Vancouver.
CKCE—Canadian Indepe. Tel. Co., Toronto, Ont.
CFCF—Marconi Wireless-Telegraph Co., Montreal.
CFCA—Star Publishing & Printing Co., Toronto.
CHCB—Marconi Wireless-Telegraph Co., Toronto.
CFCB—Marconi Wireless-Telegraph Co., Vancouver, B. C.
CJNC—Tribune Newspaper Co., Winnipeg, Man.
CJCD—T. Eaton Co., Ltd., Toronto, Ont.
CKZC—Dalton Radio Eng. Co., Winnipeg, Man.
CHYO—Northern Electric Co., Montreal, Que.
CFCE—Marconi Wireless-Telegraph Co., Halifax.
CHCB—Marconi Wireless-Telegraph Co., Toronto.
CJBC—Dupuis Freres, Montreal, Que.
CHVC—Metropolitan Motors, Toronto, Ont.
CJCA—Edmonton Journal, Edmonton, Alta.
CJCI—McLean, Holt & Co., Ltd., St. John, N. B.
CHIC—J. R. Booth, Jr., Ottawa, Ont.
CHCC—Western Radio Co., Calgary, Alta.
CFYC—V. W. Odlum, Vancouver, B. C.
CKAC—La Presse Pub. Co., Montreal, Que.
CHBC—Albertan Pub. Co., Calgary, Alta.
CFPC—International Radio Development Co., Fort Frances, Ont.
CJGC—London Free Press Printing Co., London, Ont.
CKOC—Wentworth Radio Supply Co., Hamilton, Ont.
CJCN—Simons, Agnew Co., Toronoto, Ont.
CJCB—J. G. Bennett, Nelson, B. C.
CJCS—Eastern Telephone & Telegraph Co., Halifax, N. S.
CKQC—Radio Supply Co., London, Ont.
CHCS—London Radio Shoppe, London, Ont.
CJSC—The Evening Telegram, Toronto, Ont.
CKCS—The Bell Telephone Co., Montreal, Que.
CFTC—The Bell Telephone Co., Toronto, Ont.
CJCF—The News Record, Ltd., Kitchener, Ont.
CKCR—Jones Electric Co., St. John, N. B.
CFCH—Abitibi Power & Paper Co, Iroquois Falls.
CFCN—W. W. Grant Radio, Ltd., Calgary, Alta.
CHCX—B. L. Silver, Montreal, P. Q.
CFCI—Motor Products Corp., Walkerville, Ont.
CKKC—Radio Equipment & Supply Co., Toronto.
CKUC—Can. National Railways, Toronto, Ont.
CHFC—John Millen & Sons, Ltd., Toronto, Ont.

# The Week's Important Radio Even



(C. Kadel & Herbert News Photos.)
Here is a man with a new job! He is a radio critic. His duty is to check up and keep tabs on all the broadcasting from WJZ, Newark, N. J.



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(C. Kadel & I

(C. Underwood & Underwood, N. Y.)
Paul Coates, Chicago radio amateur, and Miss Beulah Milburn, also a fan. Mr. Coates recently caused some ripple in radio circles with a superregenerative circuit built by himself. With a three-foot loop, he tuned in Newark, Schenectady, Atlanta and Kansas City.


(C. Kadel & Herbert News Photos.)
Radio amateurs have waited long for a dev
lighting of the filaments of their tubes.
lights have a supply of alternating curren
been to adapt this current to the lighting
kept charged, and most every radioman ask
for such work." The accompanying photog
at Columbia University, with a set in wh
makes use of the house current for light
check up the voltage. The coils which pl
are indicated by 2. The receiving set is s
vacuum tubes used as amplifiers. 6 are
home. These bulbs are used here to aid th
force for filament use. Toy transformers
the voltage down to that recommended fo
60-cycle hum was heard in the phones. Wi
e

# ts Picked up by Busy Photographers

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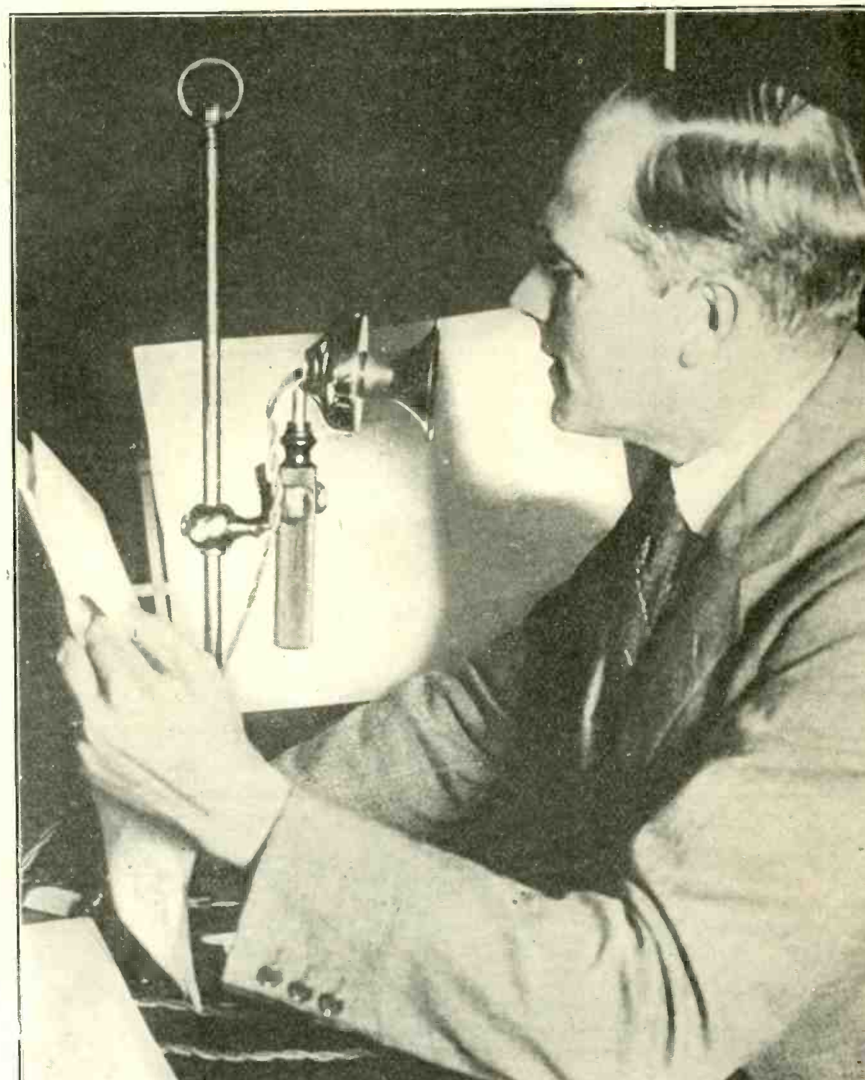
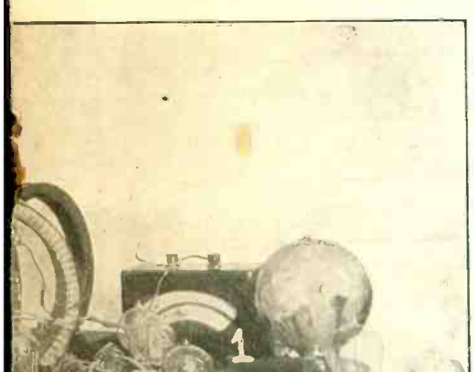
Herbert News Photos.)



(International News-reel Photo)

The radio operator at Marconi House, London, broadcasting information that he is receiving from airplane pilots during a flight around the British Isles. The flight was one of the most sensational ever "staged" in Europe, a score of "boats" contesting. Each was equipped with radio and kept in touch with the transmitting apparatus in the photograph.




ice that would remove the trouble attending the
Since most houses that are wired for electric
t of 60-cycles frequency, the main problem has
of vacuum tubes. The storage battery must be
s this question: "Can I utilize the house current
raph shows Mr. J. C. Aceves, electrical engineer
ich he has eliminated the storage battery. He
ing his tubes. 1 is an A-C voltmeter used to
ay the important part in this particular circuit
hown at 3. 4 are the detector tubes, and 5 the
ordinary electric bulbs in general use in the
e circuit in reducing the voltage to the required
have been employed for this purpose; to step
tubes, but the method failed because a strong
th Mr. Aceve's method this hum was eliminated
ntirely.

(C. Kadel & Herbert News Photos.)

Realizing the entertaining value of the radiophone, officers of the Hebrew Orphan Asylum, New York, installed an outfit for the benefit of the eleven hundred orphans there. With this regenerative set and two stages of amplification, results are highly satisfactory.

## Broadcasters Will Pay Royalties for Copyrighted Music

MORE than one million dollars per year additional revenue is expected to enrich the coffers of the American Society of Composers, Authors and Publishers, says "The Clipper," New York, when final arrangements are completed between the society and various radio broadcasting-stations that perform copyrighted music for profit, take out performing rights licenses and pay an equitable fee for such rights.

The most definite step taken by the society to license the radio stations was on Wednesday, September 20, when a conference was held at the A. S. C. & P.'s rooms, between various radio representatives and organizations interested in copyright and the rights of such copyright owners. All of the representatives of the leading radio interests acknowledged the rights of copyright owners to collect a fee when their works were performed for profit, and the suggestion by E. C. Mills, chairman of the executive board of the Music Publishers' Protective Association, who presided at the conference, that $5 per day be a minimum fee for each station, graduating up to a larger fee, was favorably received by those representing the important radio corporations. At this rate, the tremendous amount that will be paid the society by the radio stations will easily reach the million-dollar mark.

Many interesting questions were brought up at the conference, the stenographic report of which covers more than 100 pages and copies of which will be available to those interested as soon as they can be printed and bound. Most of the questions that arose were made by the radio men for points of information, and practically all of them were answered by E. C. Mills, who was later warmly congratulated.

Those present at the conference were: American Society of Composers, Authors and Publishers—Nathan Burkan, general counsel, and J. C. Rosenthal, general manager. Author's League of America—Mr. Williams, president, and Eric Schuler, vice-president. Music Industries Chamber of Commerce—Alfred L. Smith, general manager. Music Publishers' Association of the United States—George Fischer, president, and Alfred L. Smith, secretary. Department of Commerce, United States of America—Arthur Batcheller, Radio Inspector of Second District. American Telephone and Telegraph Co.—A. H. Griswold, S. L. Ross and C. H. Fuller. Radio Corporation of America—J. C. White, and Ira J. Adams, counsel. General Electric Company—H. E. Dunham, counsel, and M. P. Rice, in charge of WSY station. Westinghouse Electric & Manufacturing Company—William E. Easton, vice-president; Calvert Townley, assistant to the president, and C. B. Popenoe, of WJZ broadcasting station. G. Shirmer, Inc.—O. G. Sonnecke, National Radio Chamber of Commerce—Mr. Lewis, secretary. Music Publishers' Protective Association—E. C. Mills, chairman of the executive board, presiding at the conference.

## Radioisms

A RADIO Beginner is a man who spends $90 on parts to build a $19 set.

A Radio Fan is a man who believes that God made the air for broadcasting.

An Amateur is a man who is convinced that the devil invented broadcasting merely to fill the atmosphere with noise to smother the sweet sounds of the dah-de-dah.

The Dah-de-dah is a peculiar bird who is never satisfied with QRK, but is ever looking with longing eyes on DX. He abhors QRN, but manages to stand it, yet QRM, particularly from broadcasting stations, brings tears of anger to his eyes.—"The Globe," New York.

# California Leads in Broadcasting Stations

## Service Continues in All but One State

*By Washington R. Service*

BROADCASTING still continues in all but one State in the United States, notwithstanding pessimistic reports from some quarters that this service, which is likened to a fad, is falling off and likely to collapse. On September 21, there were 510 active broadcasting stations, according to a survey by the Radio Section of its limited commercial stations, operating on 360 meters.

The list of broadcasting stations published on pages 12 and 13 of this issue of RADIO WORLD is a complete record record of licensed stations in the United States and Canada, alphabetically arranged. It has been brought up to date—every station officially reported from Washington received up to the time of going to press is included. All new stations are published in RADIO WORLD from week to week, as soon as received from Washington.

California still leads with 66 stations sending entertainment, news, and information; Ohio is second with 34; and New York third, having 28 stations. Wyoming brings up the rear, without a single station. Every other State of the Union has one or more transmitting stations carrying entertainment in some form.

#### Class B Applications

Several applications from larger broadcasting stations for the class-B license, permitting the use of the 400-meter wave, have been received by the Department of Commerce, but to date only two have been authorized to transmit on this wave. They are the "St. Louis Post Dispatch" and the Westinghouse Station, Chicago. The officials in charge of the licensing of radio stations do not anticipate that more than a dozen applications for the class-B license will be received, as only the most powerful stations carrying high-class entertainment regularly may hope to qualify.

#### Four New Licenses

During the past week, four licenses were issued for regular 360 meter broadcasting stations, as follows:

WLAX—Greencastle Community Broadcasting Station (Putnam Electric Company), Greencastle, Indiana.

WLAS—Hutchinson Grain Radio Co., Hutchinson, Kansas.

WPAN—Levy Bros., Dry Goods Co., Houston, Texas.

WMAG—The Tucker Electric Co., Liberal, Kansas.

The list by States is as follows:

**Number of Broadcasting Stations by States on September 21, 1922**

| | |
|---|---|
| California | 66 |
| Ohio | 34 |
| New York | 28 |
| Pennsylvania | 27 |
| Texas | 25 |
| Washington | 23 |
| Missouri | 22 |
| Illinois | 20 |
| Iowa | 20 |
| Nebraska | 17 |
| Oregon | 15 |
| Kansas | 15 |
| Minnesota | 12 |
| Indiana | 12 |
| Massachussetts | 12 |
| Michigan | 11 |
| New Jersey | 11 |
| Louisiana | 10 |
| Wisconsin | 10 |
| Florida | 9 |
| District of Columbia | 8 |
| Oklahoma | 8 |
| Georgia | 7 |
| Arkansas | 6 |
| Colorado | 6 |
| Arizona | 5 |
| Connecticut | 5 |
| Idaho | 5 |
| Rhode Island | 5 |
| West Virginia | 5 |
| Alabama | 4 |
| Maine | 4 |
| Utah | 4 |
| Kentucky | 4 |
| Montana | 4 |
| Maryland | 3 |
| North Carolina | 3 |
| South Dakota | 3 |
| Tennessee | 3 |
| Nevada | 2 |
| New Mexico | 2 |
| North Dakota | 2 |
| Porto Rico | 2 |
| South Carolina | 2 |
| Hawaii | 2 |
| Vermont | 2 |
| Virginia | 2 |
| Delaware | 1 |
| Mississippi | 1 |
| New Hampshire | 1 |
| Wyoming | 0 |
| Total | 510 |



**Volume 1 of RADIO WORLD Now Complete**

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**RADIO WORLD CO., 1493 Broadway, New York City**

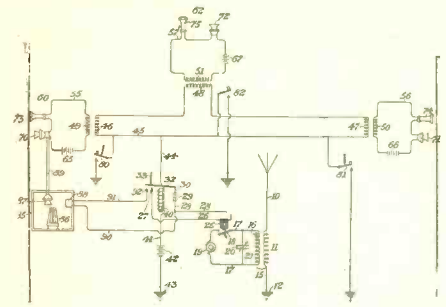
# Radio Patents

## John Hays Hammond, Jr's., New System for Transmitting Radio Waves

**No. 1,425,523. Patented August 15, 1922. Patentee, John Hays Hammond, Jr., Gloucester, Massachusetts.**

JOHN HAYS HAMMOND, JR., one of the most prolific inventors in the radio field, has added another patent to his long list. It is an improved system for transmitting electroradiant energy; particularly where a control station, and one or more auxiliary control stations, is operated. In this new system means is provided for informing the operator at any one of the auxiliary stations as to the responsiveness of the central station.

A particular embodiment of this invention comprises an antenna or open aerial circuit, which includes an inductance and which is grounded through the



**Diagrammatic representation of a transmission system constructed in accordance with Mr. Hammond's invention.**

inductance. The inductance forms the seondary of a transformer which includes a primary inductance which is in a circuit controlled by a normally open switch and arranged to be energized by a high-frequency electric alternator. A variable condenser is connected in a well-known manner to form with the primary inductance, a closed oscillatory circuit, which is preferably tuned to the natural frequency of oscillation of the open aerial circuit.

The normally open switch is arranged to be controlled by an electromagnet, one end of the winding of which is connected by a conductor to a fixed terminal. The other end of the winding of the magnet is connected by a conductor to one pole of a battery the other pole of which is connected by conductor to a switch which is arranged to swing into and out of engagement with the fixed terminal, and which is normally held open by a spring.

For controlling the normally open switch either from a central station or from anyone of a plurality of auxiliary stations, an electromagnet is suitably arranged.

* * *

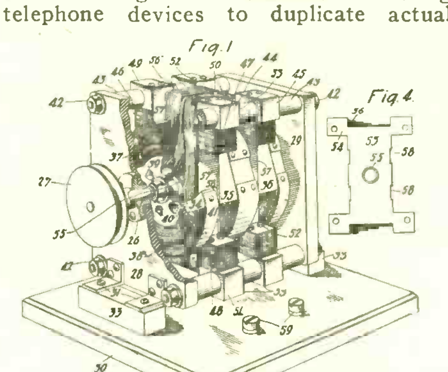
## For Testing Transmitters or Receivers

**No. 1,426,807. Patented, August 22, 1922. Patantees: Harold D. Arnold and John P. Minton, East Orange, New Jersey.**

THIS invention relates to a method of and system for testing the comparative efficiency of telephone transmitters or receivers, and for testing the component parts thereof, such as their diaphragms and also the granular carbon employed in the transmitter.

The invention makes use of a source of sound; for example, a telephone receiver, which acoustically operates the apparatus under test, that is, the transmitter, or receiver, or component parts thereof. A source of energy is connected to the receiver and the alternating-current energy produced thereby in the apparatus under test is measured and compared with the results obtained when other apparatus is tested under like conditions. In this way it may be determined if the element tested—transmitter, receiver, diaphragm, or granular carbon, measures up to the chosen standard of efficiency.

It is well known that telephone currents produced by speaking into a transmitter are very complex and may be considered as made up of currents of various frequencies, extending over the acoustic range. It is desirable in testing telephone devices to duplicate actual



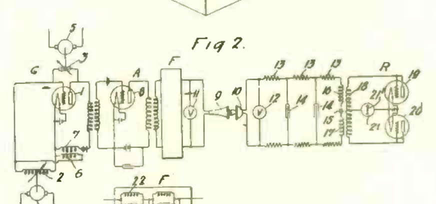




**Figure 1 shows a perspective view with parts broken away, of the variable inductance; figure 2 shows, diagrammatically, a testing system that may be used; figure 3 indicates diagrammatically a wave filter; and figure 4 is a plan view of a coil supporting plate forming a part of the inductance shown in figure 1.**

working conditions as nearly as possible, while obviating the necessity of actually employing currents produced by the voice. To this end the invention provides a special form of generator for energizing the receiver which actuates the element under test. This generator supplies current which continuously and cyclically varies in frequency over the important part of the voice frequency range, thereby testing the apparatus at all those frequencies which are most important in speech.

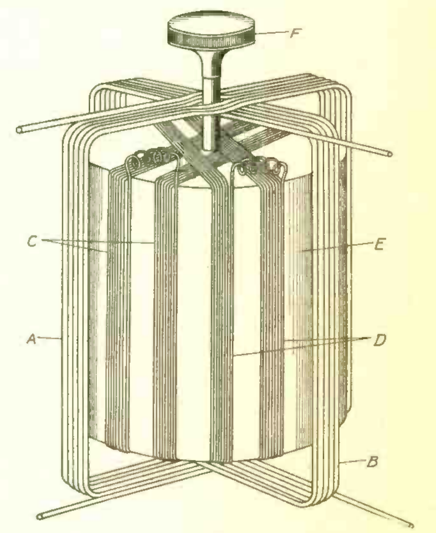
* * *

## To Aid Direction Finding

**No. 1,425,137. Patented, August 27, 1922. Patentee: George Maurice Wright, Lyngrove, Chesterfield, England.**

IN the "aperiodic aerial" system of direction finding, using two fixed aerials and a radiogoniometer, it is necessary to make the coupling between the tuned search-coil circuit and the aerial circuits as tight as possible. This condition is desirable firstly in order to minimize the loss in signal strength due to the method of tuning; and, secondly, to increase the ratio of signal strength to stray effects which tend to distort the ideal polar diagram of the system.

A radiogoniometer usually consists of windings disposed on two co-axial cylinders, the inner cylinder carrying the search coil winding and being capable of rotation. In order to make the coupling between field and search-coil windings as large as possible, it is necessary to make the cylinder carrying the search coil of as large a diameter as possible in order to bring the windings close together. The magnetic field inside the outer winding is, however, not uniform but is more intense in the neighborhood of the conductors themselves. Consequently, as the search coil is rotated, the




**A radiogoniometer comprising two stationary coils in planes at substantially right angles, and a rotatable search-coil comprising two windings in planes at an acute angle with each other.**

law of coupling between it and each field winding does not follow the sine law required theoretically and errors are produced.

In the positions of symmetry, i. e. when the plane of the search coil either coincides with that of either aerial coil or lies midway between the two, no error will exist. Consequently the error curve takes the form of a cyclic variation making four complete cycles per revolution of the search coil and if one aerial coil is parallel to the 0-180 degree line of the scale pointer system, then the points of zero error will be 0, 45, 90, 135, etc., and the points of maximum error about 22½, 67½, etc.

According to my invention I construct a radiogoniometer having a double search coil with its two windings in planes making an angle of substantially 45 degrees.

The coils may be connected in series. In this case the total E. M. F. induced in the winding by the currents in the two aerials is given by the algebraic sum of the E. M. F.'s in the individual coils. And though the difference of each E. M. F. from the ideal case may be quite considerable, yet since the differences are of opposite sign they cancel out and the radiogoniometer will read correctly in all positions of the search coil.

# Eight Radio Stations for Alaska

## Also, Five New Radio Beacons for Lighthouses Attest Government's Liberality

EIGHT new radio stations have been opened in Alaska and five new radio beacon-stations have been added to lighthouses.

The opening of the Alaska stations means the introduction of radio broadcasting in Uncle Sam's northern territory on a large scale. The geography and limited population of the territory make the general use of radio receiving sets somewhat difficult of achievement, but government officials suggest that the stations may be used in connection with community radio-sets installed in town halls or mining camp central buildings for the enjoyment of inhabitants in these various localities. The stations have been opened at Alitak, Akutan, Libbyville, Funter, Naknek, Chisik Island, Snag Point and Koggiung.

The installation of radio beacon stations in lighthouses is another step forward in installing radiophones in isolated spots. The new installations are primarily for code signals, but can be adapted to radiophone receiving-sets. The new installations are being made at Boston, Nantucket, Cape Charles, Columbia River, and Puget Sound.

If financial appropriations permit similar equipment will be installed at Delaware Bay Lighthouse, Los Angeles, and Blunts Reef. These are in addition to the two new radio beacons at Diamond Shoal. Cape Hatteras, and the San Francisco Light Vessel. Three radio beacons have been in operation in New York harbor for over a year: Ambrose, Fire Island and Sea Girt.

# Army Air Service Broadcasts

TWO stations of the United States Army Air Service have made decided hits with the radio fans by broadcasting on a small scale—"entering the newest field of indoor sports," they term this public service.

The 91st Observation Squadron, stationed at Eugene, Oregon, on Forest Fire Patrol duty, is using the radio station at its flying field during spare time to entertain neighbors within a good radius and has met with marked success. There is no other station of any size in that locality broadcasting, so they are putting on a program chiefly of phonograph music and short talks on forest fire fighting and prevention, with occasional entertainment of other kinds. It is their intention to build a regular broadcasting room in order that they can carry music by a local orchestra. Great enthusiasm is said to be shown by local fans who listen in at home or attend the loud-speaker concerts held in the city park on special nights.

Brooks Field, at San Antonio, Texas, also has an "amateur" broadcasting station where the officers and men of the aerial squadrons put on a varied musical program. his created considerable interest in the surrounding territory, according to letters received by Lieutenant McGregor, of the Field Communication Department. The post jazz band, augmented by piano, saxaphone and cornet solos, furnishes the latest music nightly. The slogan, "Own your own radiophone," has come to be very common thereabouts.

**Subscribe for RADIO WORLD. $6.00 a year, $3.00 six months, $1.50 three months.**

## Naval Transmitting Sets for Sale

THREE hundred and ninety-six radio transmitting-sets are being offered for sale by the United States Navy Central Sales Office by sealed bids. These radio transmitting-sets are of short-range type, C W-396, with vacuum tubes manufactured by the Western Electric Company for use on submarine-chasers during the World War.

This apparatus is said to be reliable for radiotelephone communication within a distance of ten miles, but numerous instances have been noted where the sets have been used for distances up to 300 miles at sea. In the hands of competent operators, under favorable weather conditions, they should have a reliable land range of 50 miles.

Purchasers of sets have the right to operate them for any purpose, except where a charge is made, under the Department of Commerce Regulations.

## A Unique Radio Experience

EDITOR, Radio World: Recently there occurred in the little town of Fairdale, North Dakota, an incident which may be of interest to your readers; and one, which, so far as I know, is unique.

One day, when turning the tuning knob of a small set (tube detector with two-stage amplifier) the operator was surprised to hear telephone conversation over a telephone wire that ran about ten feet below the aerial. Thoroughly surprised, he tore off his head piece and went to his own telephone where he called up the party he had heard and found that the words he heard had just been spoken.

He had the tuning "somewhere in the shortest wave-lengths," when he heard the voices, but has been unable to duplicate the feat. Has anyone else had a similar experience?—Albert Lundberg, Fairdale, North Dakota.

## Current Articles on Radio Listed

RADIO enthusiasts who are anxious to keep in touch with current literature on radio developments and news will be able to do so by consulting the list of radio references prepared by the Bureau of Standards and issued monthly in the "Radio Service Bulletin" of the Department of Commerce, Washington, D. C. The list is divided into the following topics: Radio Communication, Principles, Measurement and Standardization, Apparatus and Equipment, Communication Systems, Applications, Stations and Management, Manufacturing, and kindred subjects.

## Fire-Prevention Data by Radio

DURING Fire Prevention Week, October 2-9, officials of the National Board of Fire Underwriters have requested broadcasting stations to cooperate in a campaign to stop fires and to generally educate the public in fire prevention. Several broadcasters have already offered their aid. Data concerning fire fighting and fire prevention is being sent to the radio stations, for distribution, by radio.

## Park Receiving Stations

WIAY, WOODWARD & LATHROP'S a popular broadcasting station of Washington, D. C., has expanded its service to the public by installing loud speakers in several of the Capital's parks. Hundreds of people assemble on Saturday nights to listen to concerts. Entertainment by radio is thus furnished to many people who do not have receiving sets, and has the advantage of keeping them out in the air while the radio service is on.

## Foreign Inquiries for Radio Apparatus

INQUIRIES are being received at the offices of American Commercial Attache McQueen, Santiago, Chile, regarding the development of radio telephony in the United States. It seems probable that, before long, serious consideration will be given to the exploitation in Chile of this new development. Legislation is now contemplated there based on the laws of the United States, and although it does not provide specifically for broadcasting stations by private enterprises it is possible that this service will be available through the leasing of government-owned stations during times of peace.

If American manufacturers interested in the Chilean market will send catalogues and other descriptive literature to the office of the commercial attache at Santiago, the Department of Commerce states, this literature will be placed at the disposal of all persons inquiring for this type of apparatus.

Trade opportunities, during the past week, include inquiries from Czecho-Slovakia as to radio transmission stations. From the Philippine Islands comes a call for information on radio apparatus in general.

American radio exports during July totaled 225,475 pounds of apparatus, valued at $385,861, which shows that some American exporters are taking advantage of trade opportunities.

## Radio Thief Caught by Set in Motor-Car

ONE night last month, the home of Daniel F. Murphy, Cleveland, Ohio, was burglarized and a large part of the equipment of his radio station stolen. Among the loot was a high-powered sending set.

Several days later radio operators in Cleveland heard a new station with powerful apparatus sending out messages. The new station had no call number, was not licensed, and could not be located.

Believing it was operated by the thief who robbed him, Murphy, an electrician, set out to find it. He installed a receiving set on an automobile and night after night toured the city, tuning the set to the pitch of the unknown operator. When the messages grew faint, he changed the direction of the car.

Finally repeated circling of a particular block failed to show any point where the messages could be heard more plainly than at another.

Eric Kutz, 18 years old, lived in this block. He had become the pride of the neighborhood with his new wireless set. Persons came to his home every day to see the set. As fellow radio fans, Mr. Murphy and his friends also visited the house. There they recognized the stolen apparatus.

## Radio Courtesy

WOR overstayed their time last Monday evening, thanking WJZ for the latter's courtesy in permitting them to encroach on five or ten minutes of the RCA's schedule. The thanks were sent over the air by WOR's fair announcer with an almost ironic politeness that called to mind the way Carpentier and Dempsey shook hands before the battle.—2 PI, in "The Globe."

## Another Epitaph

Sad the tale of mild Ben Meyer,
Who tried to fix a call-bell wire;
Tapped high voltage to his sorrow;
They're grounding Ben, at ten tomorrow.
—"Science and Invention."

Fifty-two issues for $6.00. Sub. Department, Radio World, 1493 Broadway, N. Y. C.

## Points to Remember When Buying Parts

SO many thousands of small manufacturing firms sprang into being last winter when the radio excitement was at its height that all of us—fan, amateur and professional—are reaping the sad rewards, says "The Globe," New York. But because of their inexperience the greatest loss falls on the radio fans, particularly those who are just becoming interested in the subject. To this latter class the following points will be of assistance in selecting sets and parts:

Trade only at reputable stores.

Buy only reputable goods, preferably those having the name of the maker on them.

Insist on having every part tested before leaving the store. In the case of tubes this means more than merely attaching the proper prongs to a six-volt battery to see that the filament is intact. It means that the tubes should be tried out in a set that is actually in operation.

Arrange with the seller that any parts found unsatisfactory may be exchanged or the amount paid refunded. All stores with a solid backing will readily agree to this.

Don't shop with a dollar in your hand. Watch the quality of the goods. Cheap goods give cheap results, first, last, always. Pay a little more and get the tubes, phones, tuning units and other accessories that have made a name for themselves.

It is dangerous to pay too little for complete sets. Cheap transformers are useless. Poor design is fatal. Disorderly arrangement of parts is sure to prove disappointing. If you buy a complete set, buy one with a confidence that tells you that you will never have to open the cabinet unless you so desire.

Buy a set that you can eventually expand into your ideal outfit, whatever that may be.

And lastly—when you shop—take some one along who knows the game from aerial to variometer. If you do that you can have no regrets.

## Ether Wave's Journey to Mars

EDITOR, RADIO WORLD: I wish to call your attention to a slight discrepancy in an article entitled "Radio Travels to Mars," in the September 16th issue of RADIO WORLD. To quote from the article: "Every ether wave that leaves the earth touches Mars a *few months later*." Radio waves travel at the rate of 186,000 miles per *second*. As there are 2,592,000 seconds in one month (30 days), if it took even that long for a wave to reach Mars, that planet would be placed at the tremendous distance of 482,112,000,000 miles from the earth. As a matter of fact Mars is, approximately, 44,000,000 miles away, and would be reached by a radio wave in a trifle over four minutes. A wave reaches the moon, which is 240,000 miles away, in about 1¼ seconds. The wave reaches Neptune, the most distant of all the planets, in less than four hours.

I noticed in the same issue of RADIO WORLD an article based upon the work of our own school on this station; and as we all like publicity, I was very much interested.—Henry Hall, Squadron III, Naval Air Station, Pensacola, Florida.

# Radio Activity Booms Copper and Brass Business

LARGE demands are reported by manufacturers of copper wire, sheet, tube, and bar stock for copper in one form or another for use in radio apparatus. This statement, and the following, is taken from a bulletin issued by the Copper and Brass Research Association.

There is not a single instrument of a radio sending or receiving set but what requires copper, brass, or bronze in its construction. The high electrical conductivity of copper makes it absolutely essential for all switches and parts using wire to convey the delicate electrical impulses received from the air. Brass, because of the ease with which it can be machined, is largely used for binding posts, plugs, audion bulb bases, and the like. Where unusual strength is a requirement, phosphor or silicon bronze finds wide application.

Sheet copper and brass are used in construction of the adjustable condensers that assist in increasing the strength of the electrical impulses. From one to three condensers of ten to thirty plates each are necessary to the average amateur receiving station. The plates are semi-circular in shape, with a diameter of four to five inches and .025 inch thick.

Perhaps copper's greatest usefulness in radio telephony, however, is in antennae or aerials for intercepting the electrical impulses transmitted from one station to another. And probably in no other commercial application is copper called upon to stand up under such severe conditions as are found in antennae service. It must resist the corrosive action due to varying climatic conditions, and must have sufficient strength to withstand the strains due to wind pressure and its own weight when suspended in long spans.

Most radio engineers have come to agree that for short span aerials the most satisfactory material is No. 14 or No. 16 bare copper wire. Experiments conducted by the U. S. Bureau of Standards have led to the same conclusion. Furthermore, the slight difference in first cost is more than offset by copper's uniform, lasting service.

For large antenna, phosphor bronze stranded wire has given most satisfactory service, the best size being seven strands of No. 20 or 22, providing a larger copper service for catching the electrical waves in the ether. Another advantage of this kind of aerial lies in the fact that, due to its stranded construction, this form of aerial absorbs considerable stress before the metal itself begins to stretch.

# Important Change in Second District Radio Schedule

A NEW schedule for broadcasters in the Second Radio District, New York, is now in effect. The new programme has been arranged to eliminate interference so far as is possible:

The management of WJZ had the privilege of broadcasting on 360 meters, sharing the time with the less powerful stations, or going in with the Class B, the most powerful stations in the Second District, and operating on 400 meters.

The Class A stations agreed to stand by on special occasions should WJZ, the Radio Corporation-Westinghouse station at Newark, N. J., want to broadcast concerts, such as the Stadium Concerts given by the Philharmonic Orchestra; play by play results of the World's Series, and the Saturday afternoon football, also, to permit WJZ to broadcast every evening.

Class A stations are: WWZ, John Wanamaker, New York; WBS, D. W. May, Newark, N. J.; WHN, Ridgewood Times, Ridgewood, L. I.; WRW, Koenig Bros., Tarrytown, N. Y.; WBAN, Wireless Telephone Company, Paterson, N. J.; WAAT, Jersey Review, Jersey City, N. J.; WAAM, I. R. Nelson Company, Newark; and WFAF, Shotton Electric Company, Poughkeepsie, N. Y.

WJZ will continue to operate on the 360 meter wave length. As usual, the bedtime stories will be broadcast every evening from 7 to 7:30 P. M. by WJZ. This station will then stand by for an hour on Monday, Thursday and Friday and Saturday evenings and for an hour and a half on Tuesday and Wednesday evenings for the other members of Class A stations.

Class B stations of the Second District, New York, are supposed to keep up a continuous daytime and evening programme on 400 meters.

At present the programmes for Class B stations are not complete. Class B members are: WOR, Bamberger & Co., Newark, N. J.; WGY, General Electric Company, Schenectady, N. Y.; WHAZ, Rensselaer Polytechnic School; WBAY, American Telephone and Telegraph Company, New York.

The proposed arrangement will provide continuous entertainment on two separate and distinct wave lengths from 8 A. M. until 11 P. M.; and 400 meters, sometimes, until midnight.

# Radio Operator Lost! Will Radio Find Him?

J. RAY ATKINS, a radio operator, last heard from a year and a half ago on board the steamer "Bellemina," on the New York-Argentine run, is sought by his mother, Mrs. J. R. Atkins, Box 253, Midlothian, Texas. In the hope that some of his brother operators may know where the missing young man is, or that he may be located by means of radio itself through broadcasting, the Department of commerce is asking that his story be carried in both the press and in the ether.

Junius Ray Atkins served as a sergeant, first class, in Company A, 111th Field Signal Battalion of the 36th Division, during the World War. He returned to this country on June 4, 1919, and was discharged at Camp Mills. On July 14, 1919, he secured a first-grade radio operator's license, which expired in August, 1921, but was not renewed. Later, he was a ship wireless operator. He is twenty-three years old and a native of Midlothian, Texas, where his father is principal of the high school.

**Subscribe for Radio World, $6.00 a year, $3.00 six months, $1.50 three months.**

## Pictures and Facts About Armstrong Amplifier

Radio World has published a number of pictures, diagrams and descriptive articles regarding the New Armstrong Super-Regenerative Amplifier. The numbers containing this material are dated June 24, July 8, July 15, August 5 and September 16. They will be sent postpaid on receipt of 15 cents each, the five copies complete for 75 cents. Or you can subscribe, $6.00 year; $3.00, six months, and have your subscription start with the number dated June 24. RADIO WORLD CO., 1493 Broadway, New York.

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## New Office Building to Be Wired for Radio

FOR the first time in the history of Pacific-coast office-building construction, a 15-story skyscraper in San Francisco, erected by a navigation company, will be wired throughout for radiophone installation, says "Popular Mechanics." Tenants wishing to put in a receiving set will only have to "plug in" to a wall socket, as for a desk lamp, to be connected with the antenna on the roof and receive broadcasting programs from stations in San Francisco and vicinity. Not only will the new building be completely wired as a convenience to tenants who are radiophone enthusiasts, but the company intends to install a powerful sending and receiving set, with which it is expected it will be possible to give orders to the captains of the company's nine freight and passenger ships, which maintain a weekly service between San Francisco and the Hawaiian Islands.

## British Radio Situation

BRITISH manufacturers appear determined to keep the products of Yankee manufacturers out of their country, says "The Mail," New York. No one will suffer thereby except the English public. They will be denied reasonably priced apparatus that will perform more efficiently than the products of their own manufacturers. We have been manufacturing amateur apparatus for many years and the experience we have gained not only makes it possible to produce reliable apparatus at reasonable prices, but puts our production at a point where it will take foreign competitors many years to reach. England, however, is going to do much better than we have done on one thing. Their broadcasting will be done systematically from the very start. Who wouldn't start systematically after having had the opportunity of witnessing the terrible mess we have made of broadcasting? However, we can overlook our blunders, since they were characteristically Yankee.

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# RADIO WORLD'S QUICK-ACTION CLASSIFIED ADS

**This department is intended for everybody who wants quick action on short announcements covering the buying, selling, exchanging or general merchandising in the radio field. Readers of RADIO WORLD will find that it pays to read these columns every week. Advertisers will get a ten-day service here—that is, copy received for this department will appear in RADIO WORLD on the news-stands ten days after copy reaches us.**

**The rate for this RADIO WORLD QUICK-ACTION CLASSIFIED AD. DEPT. is 5c. per word (minimum of 10 words, including address), 10% discount for 4 consecutive insertions, 15% for 13 consecutive insertions (3 months). Changes will be made in standing classified advs., if copy is received at this office ten days before publication. RADIO WORLD CO., 1493 Broadway, N. Y. C. (Phone, Bryant 4796.)**



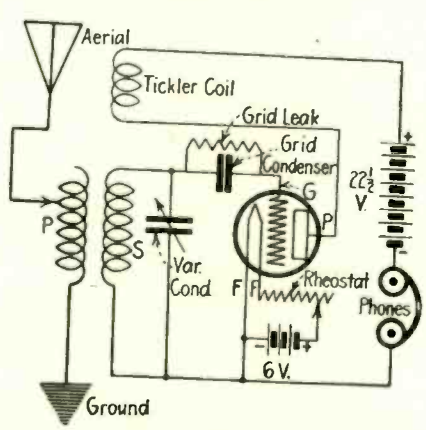
# Answers to Readers

*RECENTLY we installed a radio set about 20 feet from the power lines of a nearby railway. We have a 4-wire inverted L aerial. Each one of these wires is 50 feet long. We also tried an inside aerial, about 100 feet long, but are unable to stop the machine-gun effect coming from the power wires. Is any way by which this interference may be eliminated?—John Hoffman, Phoenix, Arizona.*

The best way to achieve your object is to place the aerial at right angles to the power lines of the railroad. If this means that you are compelled to place the aerial so that it becomes anti-directional with the broadcasting stations, then we suggest that you make a T-type aerial of your present system. A single-wire aerial would be far better than your 4-wire aerial.

* * *

*I have a regenerative coil using a tickler. I do not experience any results. Please publish a hook-up of the connections.—James Wildflower, Toledo, Ohio.*




**Hook-up requested by James Wildflower, Toledo, Ohio.**

A diagram is herewith shown of the proper connections for a regenerative set employing the tickler coil.

* * *

*I have a short-wave regenerative set, including 2 variometers and 1 vario-coupler, using a radiotron U V 200 and U V 201 as an amplifier. I don't seem to hear any signals and believe something is wrong. Could you offer me any such suggestions to remedy my trouble?—Arthur Olsen, Brooklyn.*

Assuming that all your corrections are correct, it would seem that the trouble lies in wrong polarity. Reverse your plate-B battery and see if any change develops. All you need to do is join the positive pole of the B battery to the plate of the tube. The negative terminal, of course, is joined back to the storage battery. If you do not get any results, simply reverse the negative of the B battery on the negative of the storage. Your trouble lies there.

* * *

*Regarding the Armstrong superregenerative amplifier, are the honeycomb coils right for the millihenry choke coils and in what position should they be. Can duo-lateral coil, No. 400, be used for the coil L-4. What is the constant for the phone fixed condenser?—Morris Siegel, Mahopac, N. Y.*

You may use the 400 turn duo-lateral coils for the 10 millihenries high-frequency choke. The coil you mention may be used. The capacity of this condenser should be .0025 mfd.

* * *

*Should I use a soft tube or hard tube in the detector step of a two-stage amplifier? Where are stations WLAW and WEAM? — Michael Brody, Springfield, Mass.*

Use a soft tube for the detector and hard tubes for the amplifiers. WEAM is located in North Plainfield, N. J. WLAW is the new police broadcasting station, New York City.

* * *

*My aerial is a single wire, 85 feet long, having 35-feet lead-in. Is a single wire, 150 feel long, better than a two-wire, 75-foot aerial. With my present aerial, signals seem to come in loud from one direction. Why is this?—Arthur Swenson, Brooklyn, N. Y.*

Would suggest that you erect the one-wire aerial, 150 feet long, in preference to the two-wire. The reason your signals come in loud from one direction proves that you have a directional antenna. This is accomplished by the end the lead-on is taken from. If you change your lead-in wire to the other end, then signals from that direction will come in loud.

## Trying to "Raise" Us

AT WGI last night the radio program began with a Sleepytime Story. Next was "Banking," by Frederick W. Sleeper, and then came "Making Use of Last Year's Clothing," by Miss Harriet E. Ainsworth. If the radio fans listening in on WGI had a wakeful night after that, let them consult physicians, suggests the critical and observing F. P. A., in "The World," New York.

* * *

A Southern contemporary says it would like to hear broadcast the news of the execution of the "inventor of white socks." Perhaps he would be more satisfied if he saw the event.

* * *

The Houston "Post" has invented this joke:

"Why was it that George Washington never told a lie, Pa?"

Because he was never asked if he picked up a 1450-meter wave.

* * *

"If you would care to speak," the latter goes on, "or broadcast some of your material through the air—" Enough. Here is some humorous material:

I read this poem into the air
And it was broadcast everywhere;
It didn't have much sense or wit,
But the Westinghouse people wouldn't pay
for it.

* * *

A Sunday-supplement scribe on "The World," New York, brought his editor the following:

"Oh, mother, listen to the radio!" cried a small boy in the B. R. T. subway train. He had heard the voice from the electric announcer at the end of the car.

* * *

"The radio religious service will never be popular," the Washington "News" observes, "because the women can't see each others' hats."

* * *

And now, I suppose, aviators and submarine commanders and radio fans will bawl each other out in the new realms. What will happen when the day comes that we all carry an instrument in our pockets by which we can read everybody's thoughts?

"So that's what you're thinking, is it?" a stranger may say to you—and punch you in the eye.—Bruno Lessing.

* * *

## Farewell, Static!

GOOD-BY, static,
We speed you on your way.
So long, static;
We would not have you stay.
The summer's gone, the autumn's here;
No more your noises, many, queer,
Will break in on our evening cheer—
So on your way; move fast, old dear.
Good-by, static;
You sure have had your fun.
So long, static;
Your dirty work you've done.
You've spluttered, hissed, and filled our set
With wild, unearthly sounds, and yet
We'll miss you. Are we glad? Just let
Us say we are—you bet, YOU BET!

—H.







Latest broadcasting map, 15c. That is, a complete broadcasting map appeared in RADIO WORLD, No. 8, dated May 20. Mailed on receipt of 15c. Radio World Company, 1493 Broadway, New York City.



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| .0025 | .50 |
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| .01 | 1.50 |

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