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RADIO NEWS

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September

1921

Over 100 Illustrations

Edited by H. GERNSBACK

"THE 100% WIRELESS MAGAZINE"

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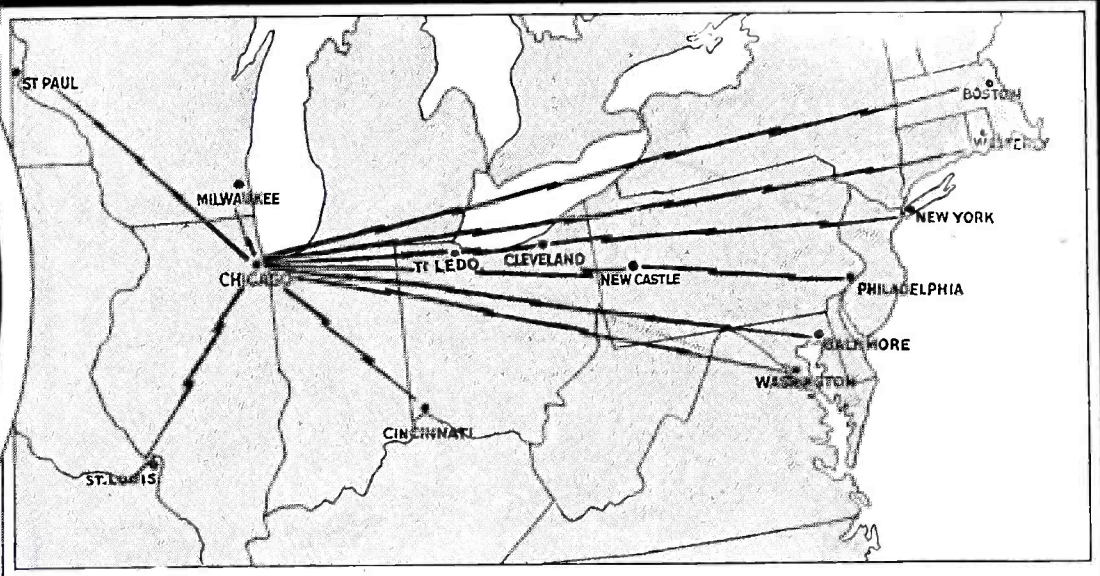

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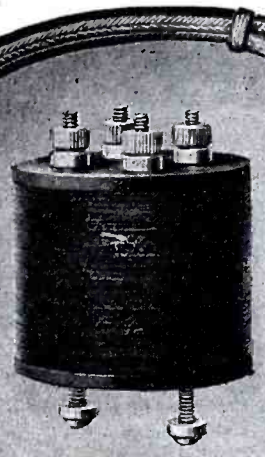

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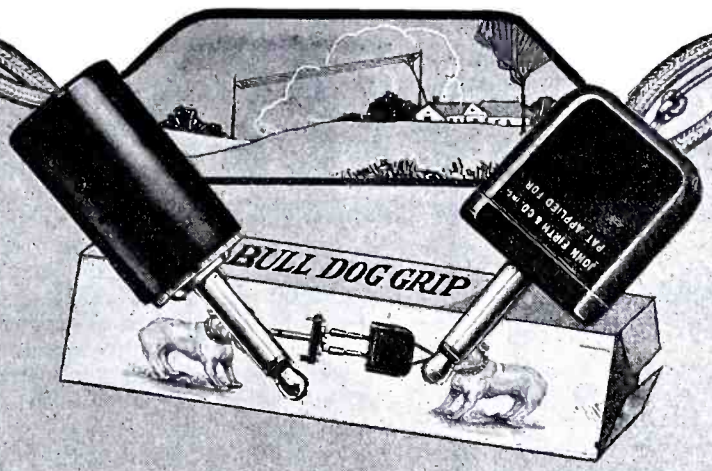

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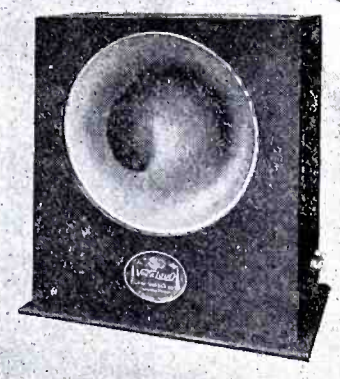

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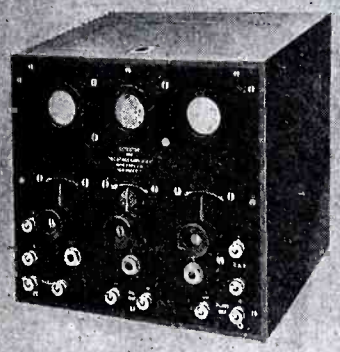
Station Type



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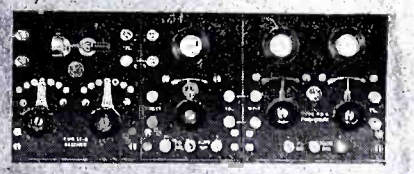

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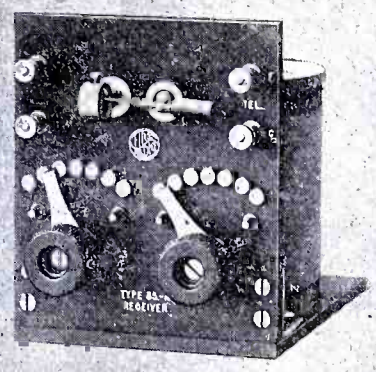

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FIRCO VACUUM
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THERE might be a full page ad devcted to every instrument on this page. But the actual apparatus is far more convincing than anything we could say. So we simply refer you to your dealer. He has our elaborate loose-leaf catalogue, and will gladly obtain any instrument you ask for. In fairness to yourself, insist on examining Firco instruments before you buy.

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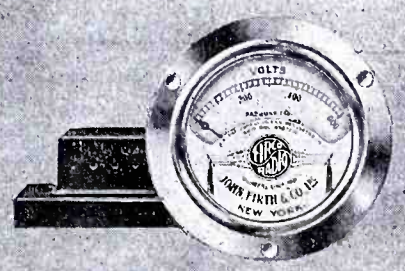

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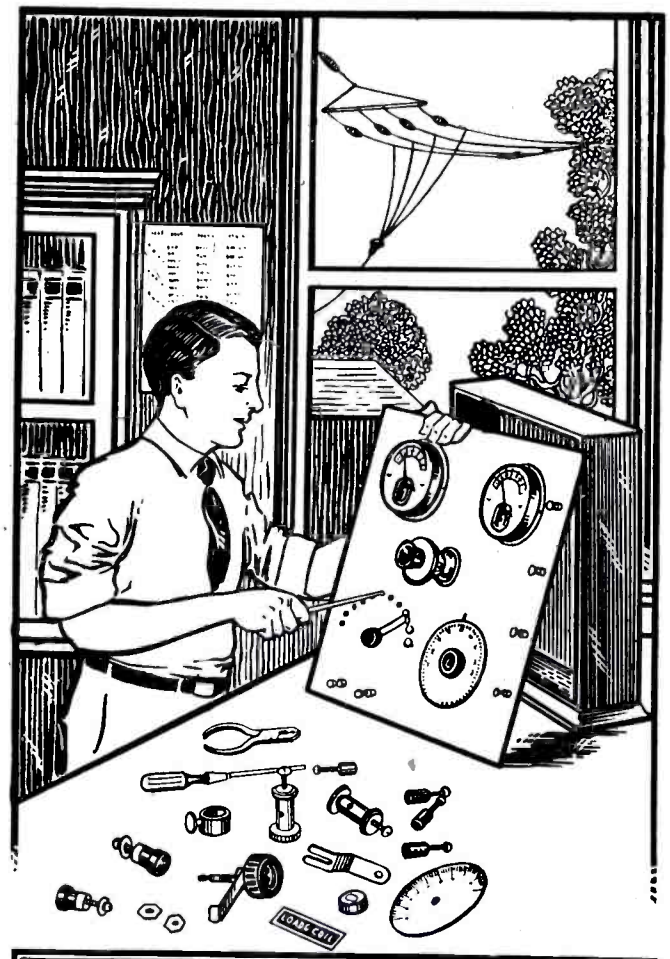
THESE NEW FIRCO INSTRUMENTS are typical of the quality of apparatus which we have been supplying to the departments of the Government for many years — yet the prices are unusually low.

And remember, only a few of the instruments are illustrated here. *JOHN FIRTH*



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The radio fraternity today understands perfectly that the word "Rasco" is synonymous for service—marvelous service at that. We are showing a few *unsolicited* testimonials on this page, selected at random from hundreds that have reached us, and we only wish that we had sufficient space to print all of the enthusiastic letters. This company is unique in that it sells practically no complete apparatus or instruments—only parts, raw material, etc., are sold. If you are interested in any of the goods listed below, it is vitally necessary that you have our catalog in which you will find all these goods.

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A COLOSSAL EVENT

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CONTAINS 50 VACUUM TUBE HOOK-UPS

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This list is only a partial one. You must positively see this wonderful book to appreciate it.

It is made to fit the pocket—has heavy covers to withstand the wear and tear which it is sure to have at your hands because it will be your constant companion.

And Oh yes! Before we forget it. If you are in need of the following, remember "Rasco has it." These are only a few things contained in this catalog. **Lugs, Nuts, Dials, Knobs, Washers, Crystals, Litz Wire, Selenium, Cord Tips, Cap Nuts, Tin Foils, Name Plates, Spring Posts, Switch Parts, Metal Ribbon, Carbon Balls, Binding Posts, Switch Points, Switch Levers, Carbon Grains, Metal Pointers, Contact Points, Low Melting Metal, Carbon Diaphragms, Screws, Copper Strip, "Spaghetti," Name Plates, Sliders, Mica, Switches, Resistance Wire, Variocoupler Rotors, Test Clips, Condenser Plates, Condensers, Antenna Connectors, Threaded Brass Rod, Ground Clamps, Etc., Etc.**

The catalog contains 185 illustrations. On account of its great cost, this catalog cannot be distributed free of charge. It will only be mailed upon receipt of **15c** *in stamps or coin.*

Remember that this business was originated with the sole purpose to cater to the amateur who has small orders. ALL OF OUR ORDERS ARE SMALL and that is why your small order will never be side-tracked by us. trial order will make you a life customer. You can order from the above illustrations. "We can only stick you once." Try us with a 50c order.

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650 651 202

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No. 304, 1/4" dia.; 1/4" thick; stem 6-32...each, $0.03 1/2; dozen, $0.40
No. 305, 1/4" dia.; 1/4" thick; stem 4-36...each, $0.03 1/2; dozen, $0.40
No. 306, 1/4" dia.; 1/4" thick; stem 4-36...each, $0.03 1/2, dozen, $0.40
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Just a Sample Page from our Catalog. Order from this page if you wish. ***All goods sent prepaid.***

RADIO NEWS

H. GERNSBACK—Editor
ROBERT E. LACAULT—Associate Editor

Vol. 3 SEPTEMBER, 1921 No. 3

NEW USES FOR RADIO

THE more we know about Radio in general the more applications we find for it. Radio is getting to be such a tremendous proposition that it fairly staggers the imagination when we try to think out what the future has in store for this youngest art of Electrical Science. That Radio should be used only for radio purposes seems a trite thought. Actually it is not. To how many persons would it occur to use a radio outfit for purposes other than Radio? But it seems that we are coming to just that, preposterous as the idea seems at first.

In the October issue of *Science and Invention* are described two applications for radio outfits that really have nothing to do with Radio primarily. The Westinghouse Electric Company now mounts a sensitive wireless receiving outfit on an auto truck using a loop aerial as antenna. And what do you suppose they do with it? They run the truck parallel to a high tension line to discover the leakage of the insulators! Wherever there is bad leakage, the crackling sound in the receivers of the radio outfit will reveal the energy going to waste. An insulator may look alright from the outside, but it might be porous and thus waste a lot of the company's power. The radio receiver will detect the bad insulator immediately. Then we have power companies in the West which are now opening and closing switches in distant sub-power plants by Radio. Instead of keeping an operator at each one of their substations to throw the switches in and out, this is now accomplished without the touch of human hands.

These ideas make one think of other purposes for which Radio might be used. At once the thought comes to mind of trailing an automobile by Radio. This is not as extravagant an idea as it seems at first. Every amateur knows that if his set is sensitive he will be able to hear in his phones the little Ford Car standing below his window, provided it is running; in other words, the electrical waves given out by the ignition system are of sufficient strength to be recorded via radio.

It therefore should not be an impossibility to design a radio apparatus sensitive enough to hear an automobile as far as a mile away, once the set was attuned properly. Immediately, the police pursuing craft suggests itself. Often an automobile has gotten away far enough that it may use any one of two or three roads, thereby baffling the police, with the offending car making its getaway. If the pursuing car had a properly tuned radio outfit it should be simple to follow it, providing of course, the ignition system of the pursuing car is so screened that it does not affect its own radio set. This, however, could be accomplished and does not present an insurmountable technical difficulty.

Every amateur is familiar with the hum of the generators at the Power House. Perhaps this annoying feature can be used industrially to good advantage by constructing a special radio receiver to listen to the hum of various electrical machinery in order to find out if it is working correctly, as far as the electrical part is concerned. Sparking, uneven running, etc., would thus be readily detected.

Then we have the Fessenden Ore Detector, which uses radio to locate hidden and buried ores. The system was described some years ago in the *Electrical Experimenter*. It is a subject of a patent. It seems that the same system could be used for locating underground bodies of water, perhaps oil as well. It all depends upon the design of the outfit.

These are just a few ideas showing what has been accomplished and what has been proposed. There is no doubt in our minds that in years to come the non-radio uses for radio outfits will be tremendous. We should be glad to hear from our readers of some new suggestions for radio.

H. GERNSBACK.

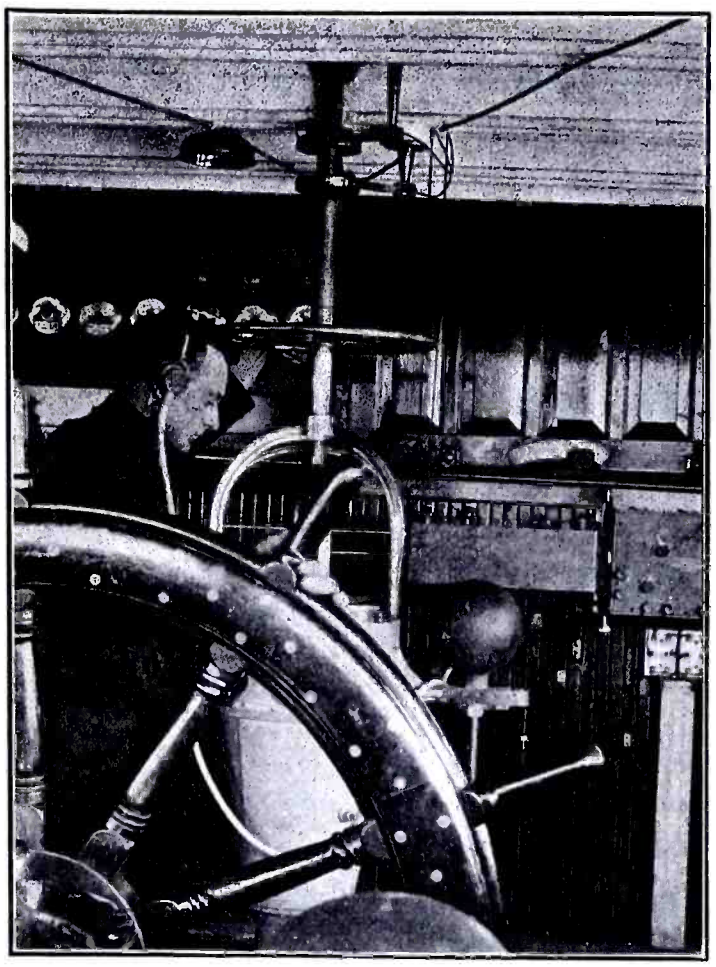
IMPORTANT TO NEWSSTAND READERS:

In order to eliminate all waste and unsold copies, it has become necessary to supply newsdealers only with a sufficient amount of copies for which they have actual orders. Please note that your newsdealer will be glad to reserve a copy for you every month. This costs you nothing and you will be assured of your copies. Hand your newsdealer a slip of paper on which write your name and address with a request to reserve a monthly copy of RADIO NEWS for you. This will be the only way to assure you of your copy hereafter.

THE PUBLISHERS.

Radio Guides Ships

By S. R. WINTERS



Piloting the Ship by Radio. Note the Receiver and Amplifier on the Right.

The Pilot House of the "Tulip", on Which May Be Seen the Loop Aerial of the Compass Set.

THE lighthouse—a lofty structure reflecting a powerful light from its top as a guide to navigators, originating with the 550-feet tower erected by the Pharaohs 300 B. C.—may be displaced, or its service greatly augmented by the utilization of electric waves, common to radio communication, as fog signaling agencies. A device for determining the direction of the source from which the electric waves are transmitted has been perfected by F. A. Kolster of the Radio Communication Section of the United States Bureau of Standards, and the seemingly visionary and revolutionary theory of yesterday becomes the triumphant scientific achievement of today.

The preliminary experimentation with wireless as a vehicle in facilitating sea-going expeditions was begun in 1916 when the Navesink light station at Atlantic Highlands, New Jersey, was equipped with a one-half kilowatt transmitting equipment designed to automatically reflect a signal at frequent intervals. A radio compass was installed on board the lighthouse tender *Tulip*, with which a series of bearings were taken during the brief period of the experiments, which were halted summarily by the world conflict overseas. With the cessation of war, tests were renewed, and three lighthouses in the Chesapeake Bay equipped with wireless transmitting apparatus and a radio compass made a fixture on the lighthouse tender *Arbutus*.

The rigid requirements of the experimental stage were successfully met, and recently the so-called radio beacons became permanent equipment on the Ambrose and Fire Island lightships marking the entrance into New York and at the Sea Girt lighthouse on the Jersey coast below Asbury Park. The apparatus is maintained and operated by the keeper of the lightstation, thus obviating the employment of additional forces. The signaling range of these stations is 30 miles, at a wavelength of 1,000 meters. In the absence of any sounding or sighting from the shore, a 45-mile voyage was completed on wireless bearings taken from the Fire Island light-vessel by the captain of the *Tulip*, who was a novice in the operation of the newly-devised apparatus. A 30-mile run, course 257°, from the Jones' Inlet buoys to Ambrose was negotiated by F. A. Kolster, the inventor of the radio fog signaling and radio compass system, without any information other than that furnished by the use of the radio compass.

Wireless as an agency in illuminating the voyage of the mariner is diametrical to the sound and visual signaling devices now in vogue. Instead of the captain of the vessel communicating with the lighthouse in determining the whereabouts of the ship, the navigator takes his own bearings. The inability of illumination from a lighthouse to penetrate fog, when guidance to a vessel is most imperative, is said to be overcome by the new method of directing the navigator to safety. With the possible exception of the most powerful light in the world, which emanates from a lighthouse on the Heligoland Island, Germany, with an electric installation of 40,000,000 candlepower, a common criticism of lighthouses is their failure to function or clearly penetrate fog. The transmission of electric waves is not beset with this limitation and they are capable of spanning greater distances than either light or sound.

The device, as developed by the National Bureau of Standards, for determining the direction of the source from which the electric waves are transmitted, comprises a coil of wire wound on a frame about four feet square, preferably mounted over the vessel's pilot house and so installed as to be rotatable from within the latter quarters. As the coil is rotated about its vertical axis, the characteristic signals of the radio beacons are received in all positions with gradually varying degrees of intensity, until the coil becomes exactly normal or at right angles to the direction in which the radio beacon lies, at which time no signal is audible. The critical position of unyielding silence indicates the direction of the radio beacon, and its bearings with respect to magnetic north is read directly from a magnetic compass which forms part of the equipment. The bearing of two or more radio beacons within range may be taken, thus determining at once the position of the ship. Not infrequently, however, it is only essential to set a direct course towards the radio beacon. as in approaching a lightship, for example, the ship's course is held on the radio bearing.

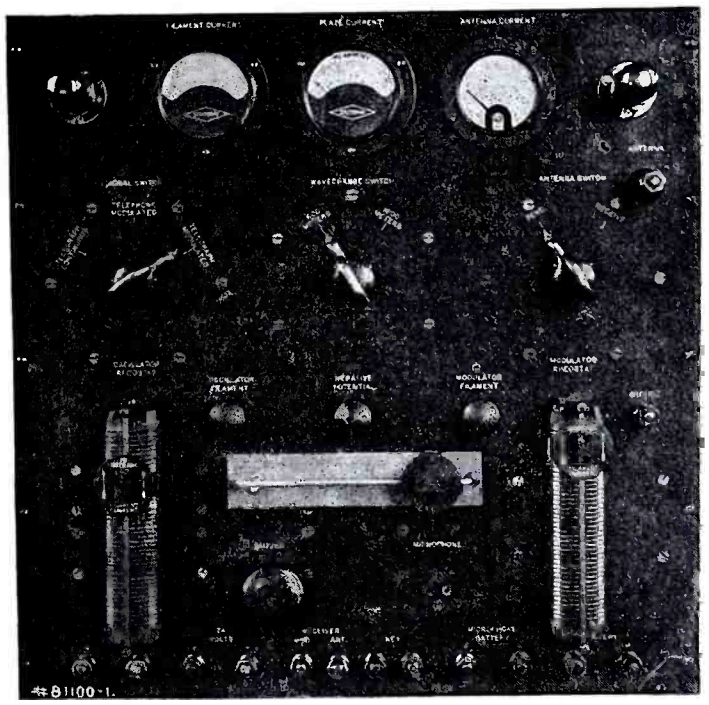
A lighthouse or lightship equipped with a simple, automatically operated radio transmitting apparatus simultaneously becomes a radio beacon which is iden-

(*Continued on page* 218)

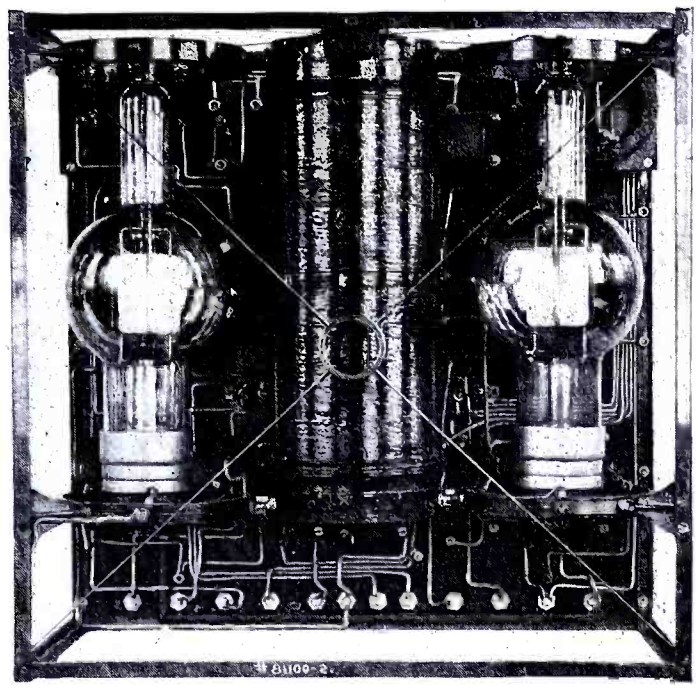
The Navesink Light House at Atlantic Highlands, N. J., Equipped With a 500 Watt Set Operating Automatically at Frequent Intervals.

Flying Boat Radio Transmitter

By JESSE MARSTEN



Front View of the 250 Watt Telephone and C.W. Set Used Aboard the Modern Flying Boat.



Inside View of the Set Showing the Two Tubes and the Inductance. Note the Simplicity of This Outfit.

THE particular design of any radio set—apart from output and efficiency, which should always be as large as conditions permit—depends largely upon where it is to be used. Thus the war gave rise to an immense variety of designs, for the conditions under which these sets were to operate were extremely diverse. For example, apparatus had to be built for battleships, submarines, dirigibles, sea-planes, trenches, etc. It is obvious that each of these stations was controlled by conditions peculiar to itself and therefore required a uniquely designed set.

In this article there will be described a telegraph and telephone transmitter, designed for use on the large Flying Boats of the type of the H-16 Naval Seaplane. This set was developed, designed and built by the Marconi Wireless Telegraph Co. of America co-operating with the Bureau of Steam Engineering of the Navy Department. It is obvious that aside from meeting the necessary electrical and range conditions, which applies to any type of transmitter, the chief considerations here were those of stability of operation, space and weight, the last two necessarily being a minimum.

The set was designed to meet the following conditions. The telegraphic range of the set was to be 100 miles over sea. There were to be two wave-lengths and two antennae, a main operating wave-length of 1,600 meters, and an emergency wave-length of 600 meters. The 1,600 meter antenna was to have a capacity of 0.0004 microfarads, and a resistance of eight ohms at that wave-length; the 600 meter antenna was to have a capacity of 0.00026 microfarads and a resistance of 20 ohms at that wave-length. Intelligence was to be transmitted in three ways: (1) Continuous Wave Telegraphy. (2) Tone Telegraphy. (3) Telephony.

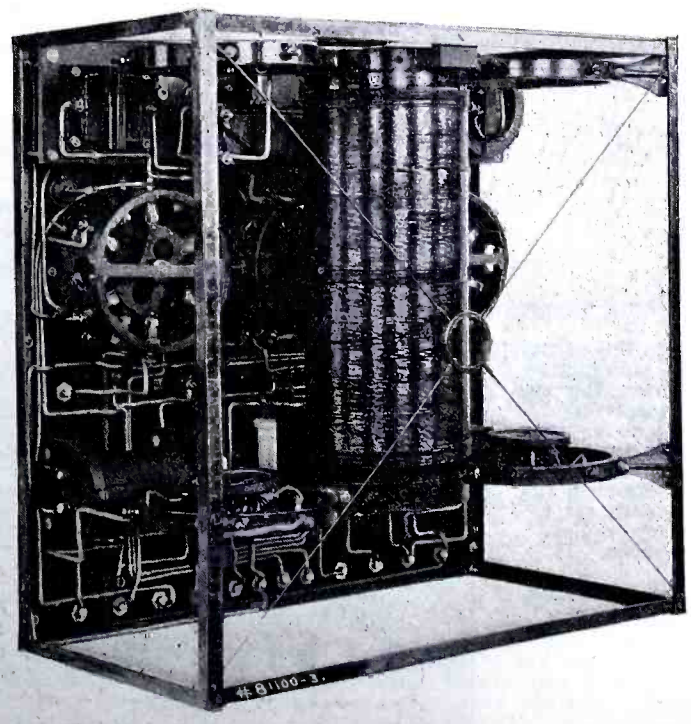
Vacuum tubes are employed for the generation of radio frequency oscillations and for their modulation. Tone transmission is accomplished by means of a buzzer modulating the continuous wave.

The circuits employed in the set are shown in Figs. 1 and 2, Fig. 1 being the fundamental wiring diagram, and Fig. 2 showing the actual circuits employed. Valve No. 1 is the oscillating tube, valve No. 2 the modulating tube, both being the high power General Electric Type P pliotrons. The D. C. voltage for the plates of these tubes is obtained from a 1,500 volt dynamotor, having two windings, one a 24 volt winding and the other a 1,500 volt winding. The 24 volt winding is supplied with current by a 24 volt Willard storage battery. The dynamotor is a two ball-bearing machine, having stream line dust caps over the ends, total weight of the machine being not more than 30 pounds. The filaments of the pliotrons, which take from 3.4 to 4.0 amperes, are supplied with current from the 24 volt Willard storage battery which has a capacity of 50 ampere-hours.

It will be seen from Fig. 1 that the oscillating circuit employed is the shunt feed or constant current system. The radio frequency oscillating circuit proper, L1 L2 RC1C2, is a balanced circuit consisting of two parts, (1) L1RC1 and (2) L2C2. Each of these circuits is tuned to the oscillating wave-length, that is, the circuits are balanced against each other. This is accomplished by winding the inductances L1 and L2 on the same form and making them of equal inductance values. Condenser C2 is made to equal the capacity of the antenna. An accurate balance is, of course, almost impossible to secure, due to variations of the antenna capacity, but a close enough balance is obtained for practical purposes.

The coupling between the plate and grid coils is fixed mechanically. The necessary coupling variation required for the different wave-lengths is accomplished automatically when the wave-length is changed by altering the number of turns in the plate coil, and by changing to the new loading inductance required. As seen in Fig. 2, when the emergency 600 meter wave is employed the hanging-on ends of the two coils are short circuited by the wave-change switch.

It will be evident that the total oscillating current flows through the antenna coil and the grid balance coil, thus increasing the total losses. The advantage of this balanced circuit is that no critical adjustment of the plate grid coupling is required and a maximum of stability in operation is secured.



In This View the Tubes Are Removed to Show the Special Rotary Switches and the Modulation Transformer.

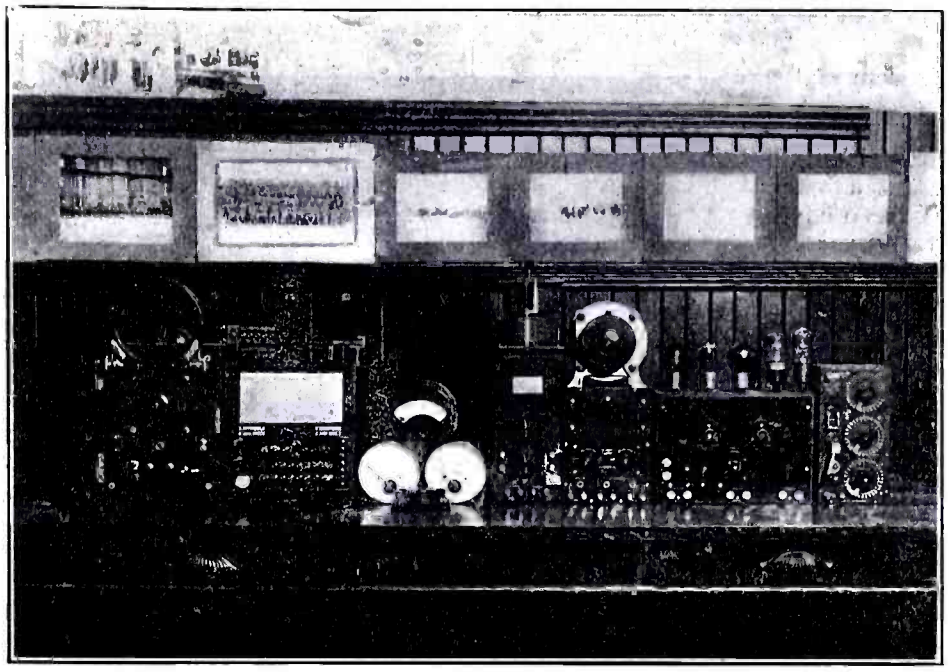
When C. W. telegraphy is employed, the modulator tube is not used. The telegraph key is connected across a high capacity condenser in the grid circuit, C. When the key is not depressed, this condenser prevents the grid charge from leaking, thus reducing the plate current and stopping oscillations. When the key is closed the grid filament circuit through the grid leak is also closed and the grid charge leaks off, thus permitting oscillations. For telephony, it is obvious that the key would have to be short-circuited, which is accomplished by the change-over signalling switch seen on the Front View of the transmitter.

The modulation system employed is the Heising or Constant Plate Current System, where the modulator tube is connected as an audio frequency shunt across the oscillator tube. The power of the modulator tube is exactly the same as that of the oscillator. The grid of the modulator is supplied with the necessary value of negative potential by means of a battery and potentiometer arrangement shown in Fig. 2. Inasmuch as the interference due to the aeroplane engine noises was very great, it was necessary to use a spe-

(*Continued on page 234*)

The Work of the 101st Signal Battalion

By GRANT LAYNG*



Here are various apparatus completing the equipment of the very efficient station installed in the Park Avenue armory.

IN line with the reorganization and development of the National Guard; Company A, of the 101st Signal Battalion, N. Y. N. G., formerly the First Signal Battalion, has devoted considerable attention during the past season to the development of its radio organization and to the training of the radio personnel.

A full realization of the importance of Radio Service in the army of the future, has resulted in every effort being made to increase the efficiency of this branch of the service.

To carry out the work, Company A has established in the tower at the 71st Regiment Armory, 34th Street and Park Avenue, a radio station complete in every detail. Radio apparatus and equipment has been received from the Signal Corps, U. S. A., and in addition considerable special equipment has been furnished by the organization or built by its members.

The transmitting aerial is a flat top one, having 5-7 S. P. B. wires, 1½ feet apart. It is 60 feet long, and L type with a 100 feet lead in from the high end.

The counterpoise consists of six wires 75′ long spread out in the shape of a fan 90 feet beneath the flat top.

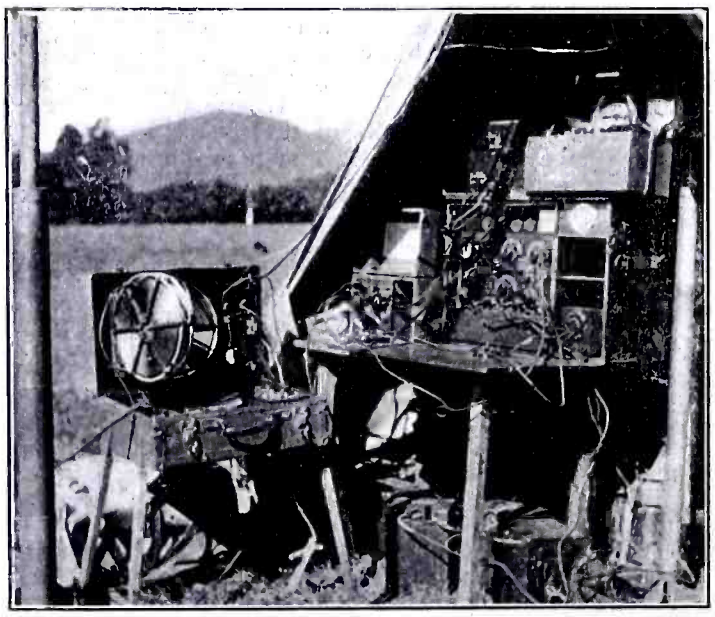
The receiving is all done on a single wire extending diagonally down from the top of the tower about 200′ in length and at an angle of 30′ from the transmitting aerial.

The short wave regenerative set at the left of Fig. 2 consists of a variable condenser with a three way switch in the primary circuit, a vario-coupler, two variometers, a detector and two stage amplifier.

The long wave honeycomb set was designed with a view to the greatest flexibility. The set is divided into three panels with individual boxes. The first consists of the honeycomb mounting and primary condenser with three way switch. The second panel is the secondary circuit complete with three variable condensers and the detector, the last consists of a two stage amplifier. All condensers are DeForest and the primary and secondary condensers have a vernier plate.

V. T. 1 Tubes and Baldwin phones are used.

Special attention is called to the distributing jack shown between the sets. This consists of two single throw triple throw anticapacity switches with a common handle projecting through the top of the panel. This throws the antenna to either of the two sets and also lights the filament. Extra contacts are provided for a third set so that it is possible with a short throw to connect the antenna and a battery on any one of three sets. The phones are connected by means of a plug and cord which is inserted in the set being used. All jacks on the block are short circuiting and the upper jack also controls the six volt battery on the load speaker. This gives great flexibility and is a very essential feature of a station in which it is necessary to constantly try out different types of receivers.



Inside View of the Field Station Installed at Peekskill, N. Y., by the 101st Signal Battalion.

TRANSMISSION

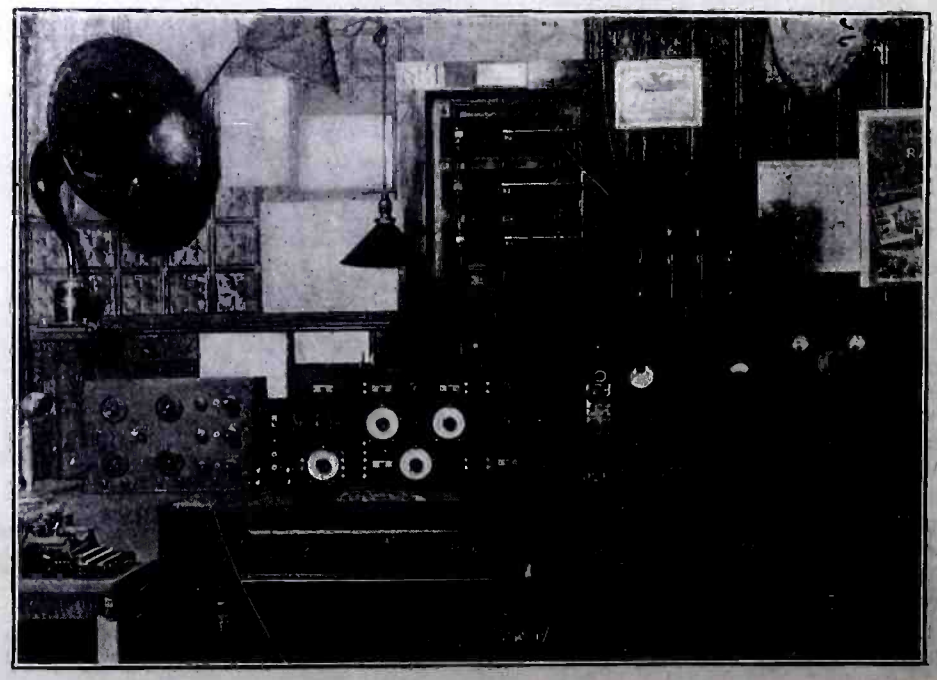
The spark transmitter is a ¼ K.W., model 1915 Pack Set disassembled and installed in rear of the panel. It consists of an open core transformer, Dubilier condenser, quenched spark gap and pancake oscillation transformer, radiation of 3 amp. on 475 meters. The set as normally furnished used a hand generator turned by two cranks revolving at a speed of 50 R.P.M. Through suitable gearing this gives the generator a speed of 5,000 R.P.M.

In order to use this equipment as issued, the gear case was removed and gear disconnected from the generator. As the unit has an exciter mounted on the generator shaft the connections were changed so that the exciter operated as a D.C. motor and the fields of the alternator were excited direct from the D.C. supply mains. Although the generator would now run up to no load speed the flywheel was not sufficiently large to carry full load when the key was pressed. It was then necessary to obtain a 1/6 H.P. 5,000 R.P.M. motor and with this connected to generator shaft the unit delivered full capacity. Both the exciter motor and the external motor are connected in parallel and start through the control resistance seen on the lower part of the panel.

The telephone set uses four V.T. 2 with a plate voltage of 350 volts obtained from a 110/350 volt Westinghouse Dynamotor. Simplicity is the keynote of this set which has no unnecessary controls on the face of the panel. The unit was first tuned with a variable inductance and variable condensers. When the correct condenser capacity was found, fixed condensers were substituted of the same capacity making a set practically impossible to get out of adjustment.

A radiation of .7 amp. is obtained using two tubes as oscillators or two as modulators. It has been reported QSA on phone as far as Asbury Park.

A recent drill was conducted by means of this phone set. The riding academy in



In this photograph may be seen the two receivers, each of them equipped with a two-stage amplifier, the spark set and the radiophone.

*Master Sergeant, 101st Signal Battalion.

which the mounted drills are held is about two miles from the armory and on this building a low portable antenna was erected —using the short wave set shown and three steps of audio amplification. Captain Gorman at the armory gave commands which were successfully executed by the entire company on horseback.

The experimental equipment used by the members of the radio detail consists of a wavemeter, a wheatstone bridge, a three stage shielded audio frequency amplifier, a two stage amp, and a six stage (4 radio and two audio) amplifier, besides various types of tubes, high voltage D.C. meters, milliammeters, etc.

The portable units are the newest army issue and consist of an SCR 54A crystal set, SCR 121A two stage amplifier, an SCR 79A complete transmitting and receiving unit and a station wavemeter. This main set used two W.E. 2 tubes for transmission and three V.T. 1 for reception. The power is obtained from storage batteries, one four volt 90 amp. hr. unit shown on top of case. Three batteries are used, giving 12 volts which light the tube filaments and run the dynamotor. Normal radiation is about .8 amp. on straight C.W., no method of interruption being provided. Besides this equipment there are four ¼ K.W. pack sets with hand generators for mule back transportation.

These portable units are used during the period of camp and a typical installation erected at Peekskill, N. Y., is shown using the above apparatus.

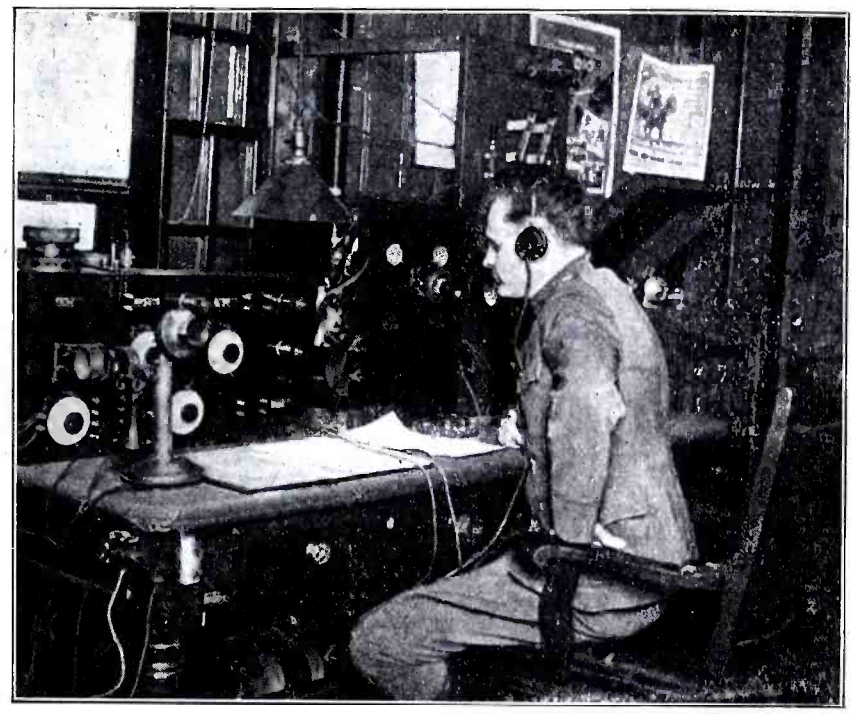
With reference to operation the station is open every night between 8 and 10 o'clock, two operators being on duty. Traffic is handled with amateurs and call letters used are SC1. In the coming fall, a shorter aerial will be erected for two hundred meter operation, at which time 2BGS will be used.

Amateur traffic will be very gladly accepted as the station is a member of the American Radio Relay League.

Radio stations are also established and are operated by members of the organization. 2BGT Radio Station number 1 is owned by Corp. Hunt, who is chief operator. There are two stations yet to be assigned as only members with the most modern equipment can be considered.

The radio room is open to visitors every Monday and Thursday night and all those interested are cordially invited to inspect the station.

In view of the present enlarging of the National Guard, there are a few openings for those men interested in radio work. Instruction is given in both the mounted and dismounted drill, together with work in visual signalling, and telegraph operating. All men receive Federal pay for the weekly drills and for two weeks of field service each summer.



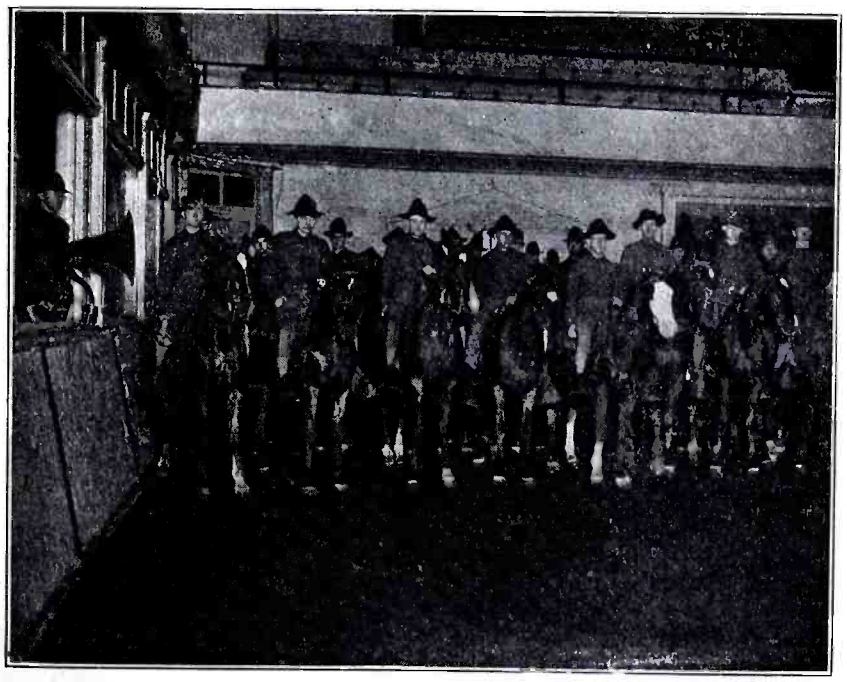
Here is Captain Gorman Conducting the Drill of the Company by Radio. A New Stunt Which Has Proved Very Successful.

Courses are provided in radio operation, by progressive classes, that is, a man enlisting in the organization first enters the class in visual signalling and thoroughly learns the code. From this class graduates go to Buzzer practice and after attaining a speed of twenty words per minute, advance to radio instruction. Lectures on the basic principles of wireless, consist of the first half of the instruction period, and actual operation, care and maintenance the second half. All men, before being allowed to operate the station are required to obtain operators' licenses from the Radio Inspectors' Office, and the organization at present has 15 licensed operators.

The equipment of the organization includes horses, motorcycles and trucks, as mobile operation is an essential feature of Signal Corps maneuvers.

The armory is equipped with a complete machine shop having a machine lathe, wood turning lathe, grinding stone, buffer, etc. A battery charging unit keeps the issue batteries in condition, and is also used by members with their own sets who wish to have their batteries

(*Continued on page 218*)



The Company Here Shown Drilled Without the Captain Being Present, Orders Were Received Through the Magnavox, Which May be Seen on the Left, Captain Gorman Sending Them via Radiophone From the Armory Two Miles From There.

Amateur Record an Historical Fact

Here is some good publicity for amateur radio. The record established by some radio amateurs is made known to the thousands of motorists passing there. Thanks to a tire company. Why not duplicate this in some other town?

A large tire manufacturing concern has recently placed in several towns some big posters on which is given touristic information about the town and a fact about its history.

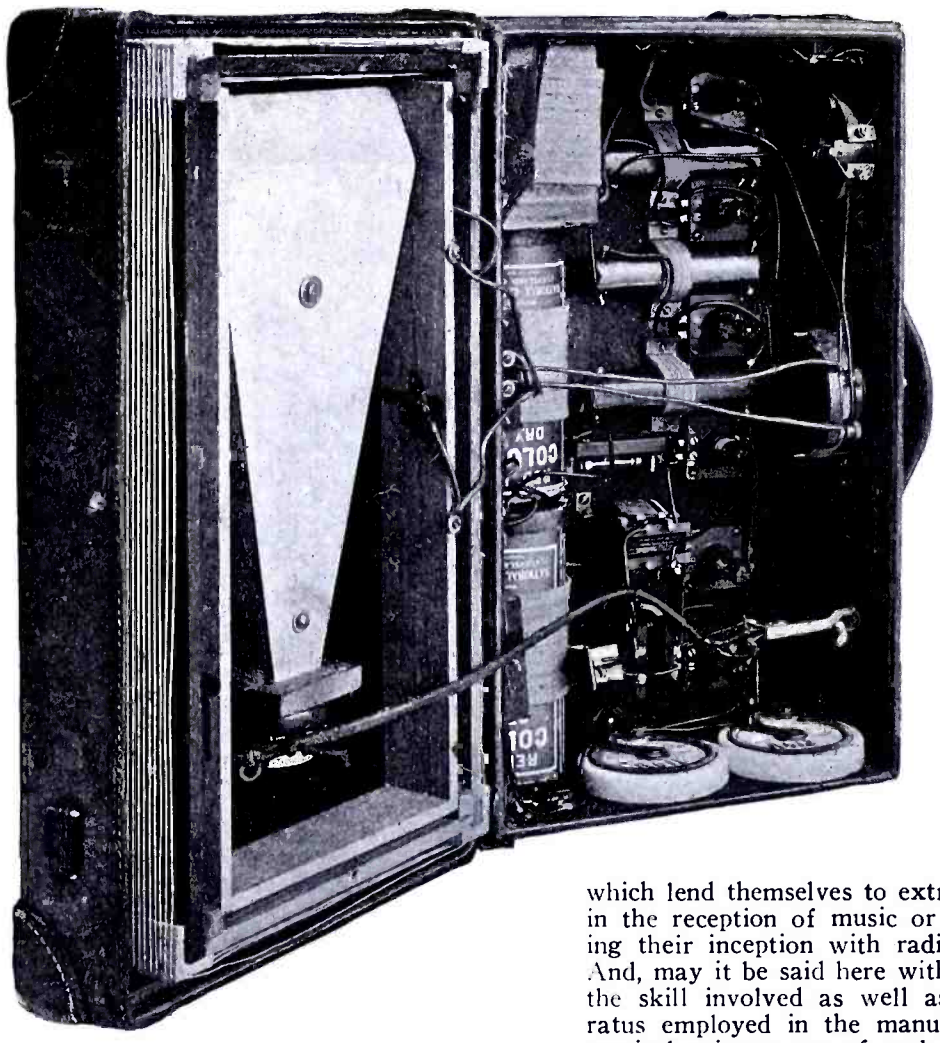
The accompanying photograph shows one of these posters erected near Keyport, N. J., and relating as an historical fact the transmission of music by Radiophone to Scotland by two well-known amateurs, Messrs. H. and H. Robinson.

This fact is in itself good publicity for amateur Radio, for it shows to thousands of people the possibilities of Radiotelephony and the efficiency of amateurs' stations. Moreover, this may awake the interest of many who are not aware of the actual progress made and the practicability of Radio.

Another consequence and perhaps the most important is that, when passing this sign, many a bug will grasp the opportunity and use it as a convincing argument to show Dad what can be accomplished, with for instance two 50 watt tubes and a few other parts; and perhaps Dad, convinced at last, will let loose a check, thanks to which a new Radiophone will be born.

A Grip Radiotalker

By S. R. WINTERS



This photograph shows the inside of the entirely self-contained radio receiver equipped with a loud talker and five stages of amplification. Note the horn fixed in the center of the loop aerial.

SUPPOSE you are lounging in a hotel lobby when apparently a "knight of the grip" enters upon the scene, carrying a small-size suitcase. Abruptly, clearly-defined strains of music begin issuing from the leather-made container. Completely amazed, the group of aroused spectators are likely to ascribe the unexpected musical sounds to deceptive ears or to the mystifying powers of an unheralded stranger. The supposition is not far-fetched. Literally, a common suitcase has been transformed into a music-box through the ingenious efforts of P. D. Lowell of the Radio Communication Section, United States Bureau of Standards. Moreover, this self-containing musical unit is capable of harnessing a phonograph concert by the medium of wireless transmission from a point six or eight miles away.

"Portafone" is the descriptive term which implies its compactness and ability to corral sound vibrations from out of space. Barely weighing 30 pounds, the device from all exterior appearances is a suitcase. Scrutinizing observation alone reveals its modified aspects once the container is closed, an opening of 3 by 5 inches in size having been plugged in one side to facilitate the emission of sounds. Not markedly discernible to the casual observer is a button-like fixture under the leather handle of the suitcase for adjusting the tuning condenser, and to the left of the handle are a stabilizer for adjusting the veritable traveling music-box to maximum sensitivity and a single-action electrical switch for introducing and suspending the filament current. These are visible objects when the container is closed, but are not conspicuous enough to identify the cleverly concealed mission which they serve in the conversion of an ordinary suitcase into a complete musical unit.

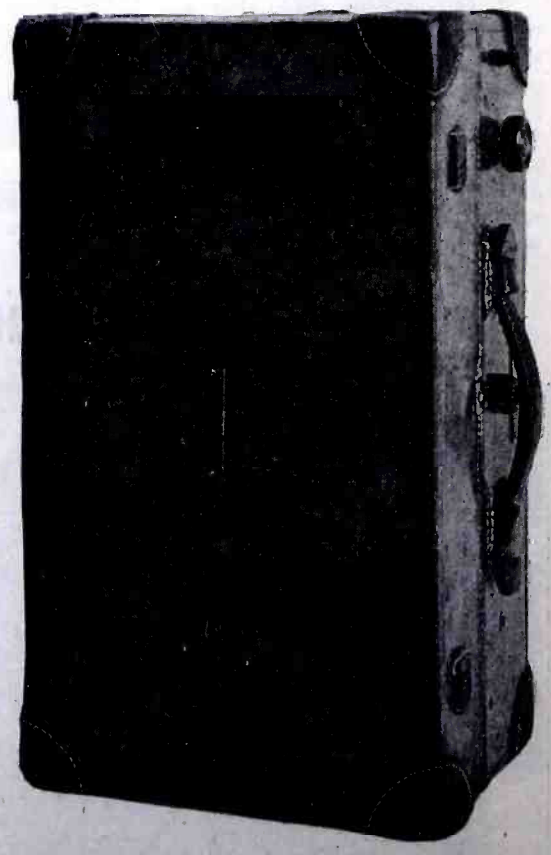
Take a peep on the inside of the container. Here are to be found the intricacies which lend themselves to extreme sensitivity in the reception of music or messages having their inception with radio transmission. And, may it be said here with emphasis that the skill involved as well as special apparatus employed in the manufacture of this musical suitcase are of such a nature as to preclude its duplication by amateur wireless operators at the present time. The success of the experimental unit is attributable to the use of a special design of small electron tube which renders it possible to employ two Columbia dry-cell batteries in supplying filament current. Six stages of amplification are in operation—three of radio, two of audio, and a detector. By the use of tuned radio frequency transformers extreme sensitivity is obtained—not an inconsiderable factor in the functioning of the apparatus.

The amplifier consists of the following elements: Six electron tubes of special design with sockets, two filament rheostats for controlling filament temperatures, a stabilizer for adjusting the device to maximum sensitivity, a tuning condenser for adjustment to the wave-length of radio telephone transmitter, two and one-half volt dry-cell batteries for supplying filament current—these being connected in parallel, two 20-volt "B" batteries for supplying plate voltage, three tuned radio frequency transformers, grid leak and condenser, and two audio frequency transformers. The apparatus is absolutely self-containing, functioning in the absence of an antenna. A receiving coil, 8 x 16 inches in dimension, is encased in the suitcase cover. This coil is of No. 26 copper wire, with 21 turns. The latter, as well as the horn and telephone receiver, are snugly arranged in the cover of the leather container. The complete "portafone" weighs approximately 30 pounds, and is 7 inches thick and 18 inches long. When receiving from a one and one-half K.W. radio telephone transmitter the device has a range of about eight miles.

The equipment was originally conceived as serviceable for field use in conducting experiments with respect to directional coil transmission, whereby exploration errands in the region of a transmitter coil could be negotiated with beneficient results. The "grip radiotalker" was but a natural consequence. As such, it is adjusted to have maximum sensitivity at a wave-length of 350 meters, thus conforming to the present wave-length employed by the naval aircraft radio laboratory at Anacostia, on the outskirts of Washington. Concerts and technical news bulletins are distributed from this station every Friday night, beginning at 9 o'clock. The "portafone" is able to "pick up" the music emanating from Anacostia when located anywhere in the city limits of Washington. Merely by turning a button that connects with the electrical switch on the inside of the suitcase, and an adjustment of the stabilizer until the signal attains the greatest loudness, music issues from the 30-pound budget with unrestricted freedom. The cost of operation is represented by the amount of battery-power consumed, ordinarily two dry cells, costing thirty cents each, will last two or three evenings. A non-spilling type of small storage cell could replace the present dry cells, thereby greatly reducing the cost of operation.

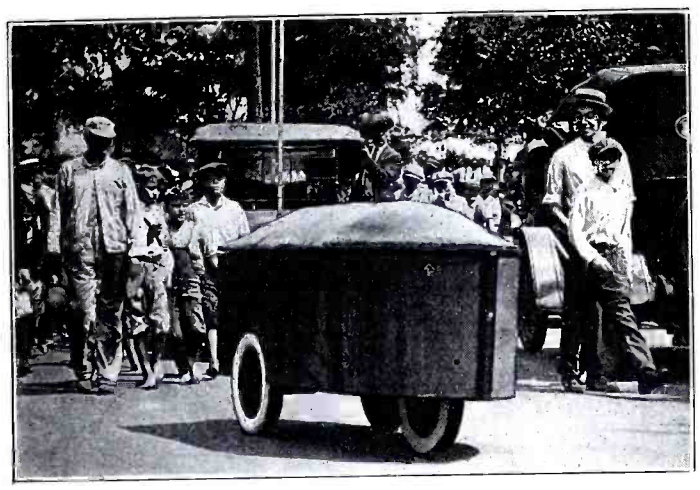
The "grip radiotalker," a description applied by the writer, is a radical improvement over a previous design of "portafone," recently built by the Bureau of Standards. The forerunner of the instrument described in this article was contained in a box, with a horn projecting from the outfit. Its cumbersomeness compared with the more recent invention is obviously apparent. Messages as well as music are faithfully recorded and audibly reported by this virile suitcase. Its conversational powers—parrot-like, of course—are quite varied. The inventors have conducted a variety of "stunts." A groceryman was given an order by the instrument, the leather-bound container being placed on the counter while specific instructions were being issued. Even the pro-

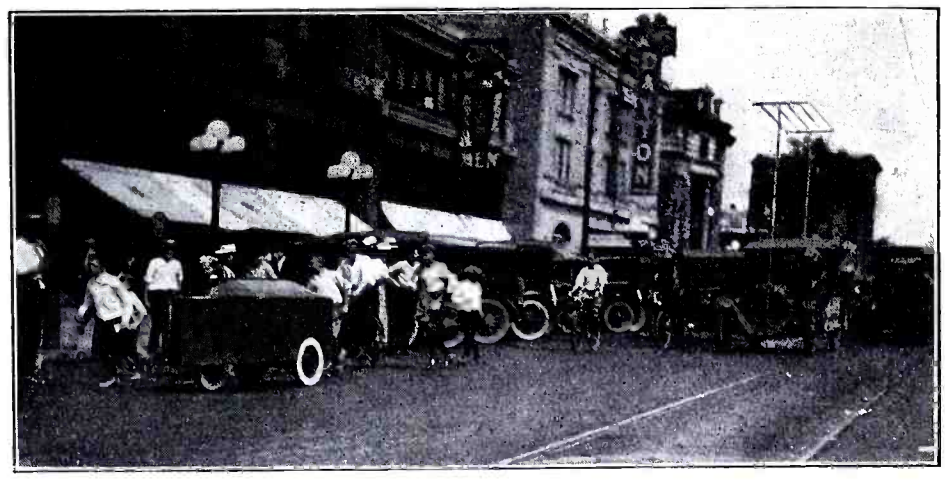
(*Continued on page 223*)



When Closed This Receiving Set Looks Like an Ordinary Suitcase. The Necessary Controls May Be Operated From the Outside and on This View May Be Seen the Condenser and Rheostat Knobs, and the Opening Cut Through Which the Music or Speech Comes Out.

A Novel Radio Controlled Automobile





These Two Photographs Show the New Automobile Developed by Capt. R. E. Vaughan in the Streets of Dayton, Ohio. On the Left May be Seen the Radio Controlled Machine, Which Has No Outside Aerial, Curiously Watched by the Crowd. On the Right May be Seen the Automobile in Which is the Sending Set.

THIS new car, which is cigar-shaped, about 8′ long by 3′ high and 2½′ wide, is mounted on three wheels equipped with pneumatic tires. It is propelled electrically by a motor supplied by storage batteries and may run at a speed varying from four to ten miles an hour.

This car, which was developed and perfected by Capt. R. E. Vaughan, Chief of the Radio Branch of the Engineering Division of the Air Service at McCook Field, Dayton, Ohio, was begun in January, 1921, and has been in practical operation for about three months. The first public demonstration was given on August 5, in the streets of Dayton, when the car was run through the entire length of the various streets in the business district during the hours when the traffic was heaviest.

The car, entirely controlled by Radio, can be made to start, stop, reverse, steer to right and left, blow a horn, ring a bell, fire a pistol and perform other functions; all the controls being obtained by pressing buttons on an automatic transmitter, which sends the proper combinations of dots and dashes operating each control. At the present time the range of operation depends entirely upon the range of visibility, for it is possible to control the car up to a distance of 50 miles.

During some experiments, the car was controlled from an airplane and, thanks to the quick operation of the selector, the car may be driven along very narrow roadways at full speed, or through heavy traffic in crowded business streets. The selector, which decides the various combinations of dots and dashes, is so quick in operation that several controls can be operated in a space of one-quarter of a second, and any one of the 12 controls can be made operative in less than one second. As may be seen in the photographs, there is no outside aerial; the aerial used consists of two pieces of wire cloth fixed in the cover and under the car and acts as a condenser antenna.

Captain R. E. Vaughan, Who Designed and Built the New Radio Controlled Car.

APPLICATIONS

The new system of control developed by Capt. Vaughan can be applied to anything mechanical that moves in the air, on the ground, on the water or under the water. As a war weapon, it could be used to direct tanks loaded with TNT, which could be driven to any desired point and exploded. This would be especially valuable in destroying enemy machine gun nests without losing hundreds of lives in making an assault, as the tank could be directed from an airplane, from which it is easy to locate the enemy's positions. Of course, torpedoes controlled by Radio could also be used to destroy the enemy ships in the same way.

At last, as suggested by a humorous paper, such Radio controlled automobiles could be used these days to carry some liquors along guarded roads without endangering the liberty of the owners!

Reporting Yacht Races by Radio

Reporting by radio becomes popular. This photograph shows the reporters of the Montreal Standard reporting the international yacht races on Lake St. Louis.

Photo Underwood & Underwood.

Another practical application of the Radiophone is shown in the accompanying photograph which represents the reporters of the sporting section of the Montreal *Standard* sending the results of the yacht races to the office of the paper, where they were immediately set in type and printed.

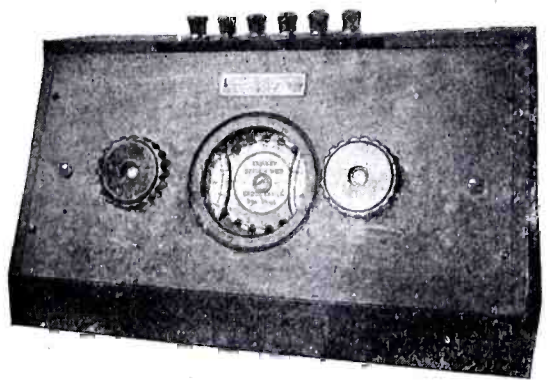
By this method considerable time was saved and several incidents of the race could be reported, as the boat carrying the reporter was close to the yachts. This enabled the Montreal *Standard* to beat the World and give its readers the detailed results of the international yacht races for the Royal St. Lawrence Club trophy well in advance of the other papers.

The American challengers which won the race had the characteristic names of "Bootlegger" and "Freebooter."

This demonstrates the practicability of the Radiophone for reporting, and several newspapers have already considered the matter seriously, but in the near future one will be able to see the reporters with the camera in one hand and the radio set in the other in direct communication with their office while on the sporting fields.

New Radio Apparatus

A NEW REGENERATIVE RECEIVER

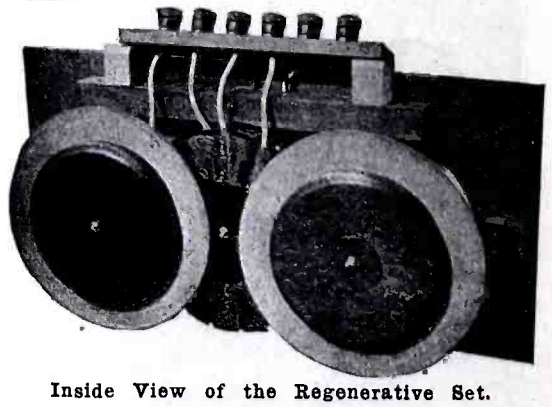


This New Short-Wave Set Uses an Entirely New Process of Tuning, Which is Very Sharp.

The two accompanying photographs show an absolutely new type of short-wave receiver, which is now on the market, and which operates on a new principle. This receiver, equipped with spider web inductances, is tuned with variable condensers only, and has a new system of regeneration and oscillation control which is the new feature of this unique set. The range is 180-1,000 meters.

Thanks to this new device, the coupling is fixed, and yet a very sharp tuning is obtained by means of a special vernier system allowing an ultra fine adjustment; as in other receivers, three coils are used, but the hook-up is somewhat different. Owing to the patent situation more cannot be said of this instrument at the present time, but we hope to be able soon to give more details about it.

Besides the new reaction control, the receiver embodies some other new features such as inside dials and desk type front panel, giving to this apparatus an unusual and neat, as well as attractive appearance.



Inside View of the Regenerative Set.

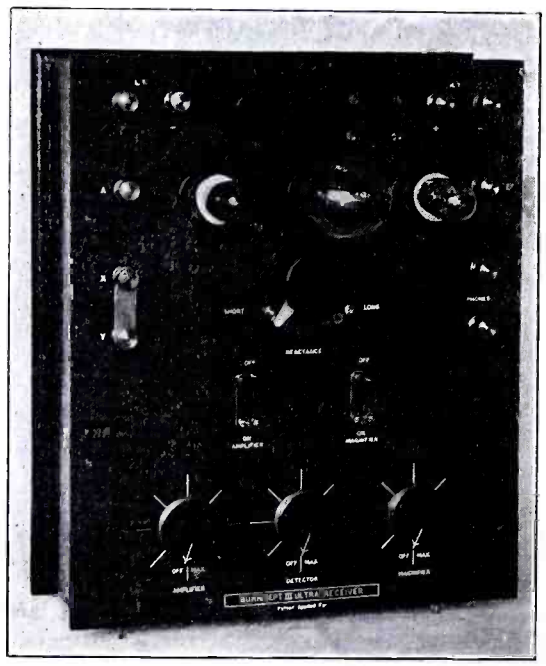
Further information regarding this set appears elsewhere in these columns.

Photos by courtesy of E. Turney Co.

A RADIO AND AUDIO FREQUENCY AMPLIFIER

This new three-valve amplifier receiver is the outcome of a lengthy series of experiments and the results obtained are claimed to be superior to any combination of three to five valves.

The apparatus consists of a polished cabinet 13″ by 11″ by 4″. Three valves are used, each being controlled by a separate filament rheostat. The first tube amplifies at radio frequency, the second is the detector, and the third amplifies the rectified signals at audio frequency. This arrangement, therefore, allows the amplification of all signals before rectification, and is certainly the very best method of magnifying weak signals, as, when signals are very weak, there is practically no current to rectify so that they cannot build up by audio frequency amplifications only. The illustration shows that the panel contains an arrangement of multiple switches which control the operations of the three valves either individually or in coöperation. ALL THE VALVES DO NOT HAVE TO BE ALIGHT ALL THE TIME. By means of these switches the user can bring into operation just those valves necessary to give the correct amount of amplification for any signal, spark, CW or telephony. This also economizes plate and filament current. With all switches set at OFF, the center valve only is alight and operates on the best possible single-valve circuit as a detector amplifier. By moving the left hand switch to the left the respective valve is added to the circuit giving high frequency amplification, of course, in front of the detecting valve. By moving the right hand switch to the right, the respective valve comes into operation and acts as an audio frequency amplifier of the rectified signal. When all switches are in the ON position, so that all three valves are in operation the amplifier is exceedingly powerful, having an amplification constant of between 200 and 300.



This Amplifier Embodies New Features. It Has One Stage of Tuned Radio Frequency Amplification, Detector, and One Stage of Audio Frequency. The First Stage and Detector or Detector and One Stage May Be Used at Will.

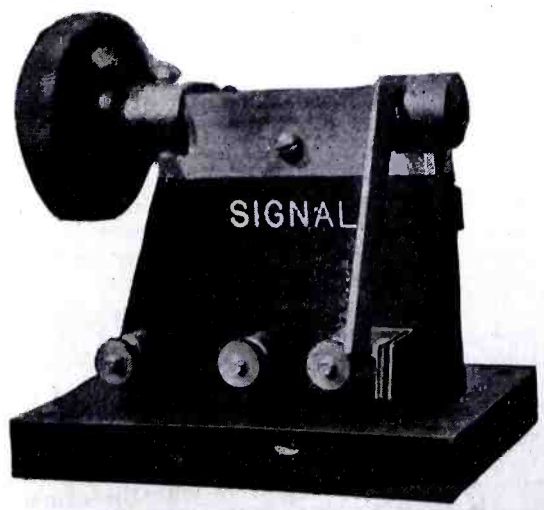
Photo by courtesy of Burndept. Co.

A well-known disadvantage of the usual radio frequency amplifier of the inter-valve transformer type is that, owing to the self-capacity of the transformers and their having a natural wave-length of their own, good amplification is obtained over a somewhat limited range so that special transformers have to be used to get best results over certain combinations of wave-lengths; *e. g.*, a transformer giving best results at 1,000 meters would be poor over 5,000 meters or more, and a transformer amplifying at 17,000 meters would be very inefficient at 8,000 meters and no good at all at 1,000 meters and under. Also this type of transformer will not amplify at wave-lengths less than 500-600 meters. Resistance capacity amplification at HF is only suitable over 1,000 meters and has disadvantages in requiring high plate current, etc.

In this instrument all these difficulties have been completely overcome; no radio frequency transformers are used, but the design allows for steady and regular amplification (RF) on ALL wave-lengths from 150 meters to 24,000 meters. This feature, which is unique, is guaranteed, so that RF amplification on this apparatus becomes as easily handled as AF amplification which is in more general use amongst amateurs. The semi-circular series of studs in connection

(*Continued on page 228*)

AN IMPROVED CHANGE-OVER SWITCH



Right Side View of the New Change-Over Switch Showing the Blade Connecting the Aerial to the Receiver.

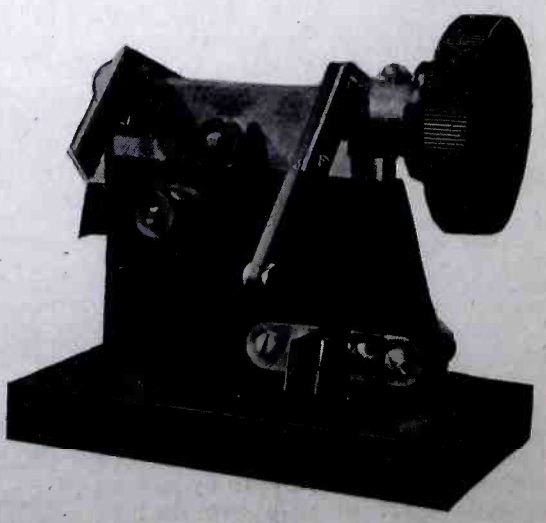
This switch comprises all good features incorporated in high priced amateur change-over switches, but in addition possesses all the qualifications of the modern commercial antenna switch.

It is operated by a large knob through a simple twist of the wrist. All contact members are mounted on opposite sides of a vertical formica support that allows no accumulation of dust or dirt to lower the resistance of insulating members.

The location of the contact members on both sides of the vertical support makes the switch very compact and neat in appearance and, in fact, it is much smaller than any other switch could be constructed, having anywhere near as high an insulation factor.

Another feature that is only found in commercial aerial switches of the most expensive construction, is an arrangement whereby the aerial is drained of any accumulated charge before the switch reaches the receiver position. Any operator who is

(*Continued on page 228*)

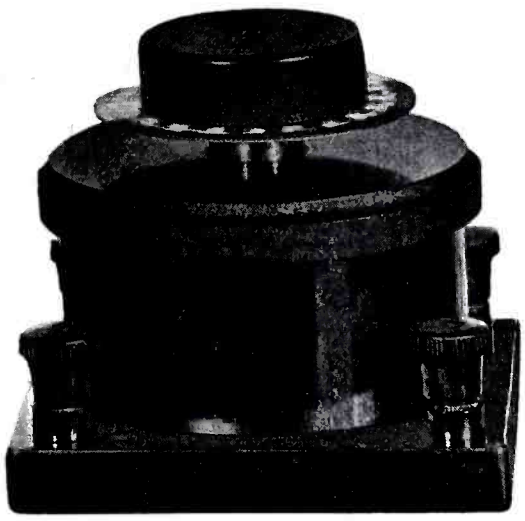


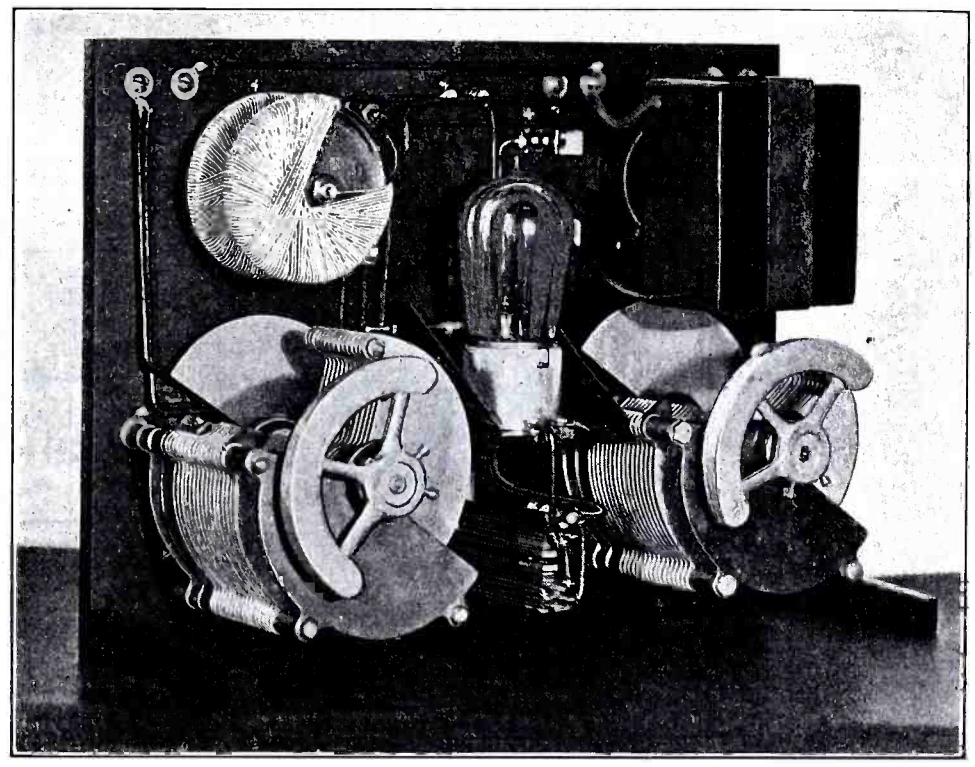
Left Side View of the Switch. Note the Well Designed Contact for the Motor Circuit.

Photo by courtesy of "Signal" Co.

Radial Inductance Eliminating Q. R. M.

By EHLERT





On the right may be seen the receiver built by the Navy, using radial inductances. The coupler is in the upper left hand corner. On the left is the coupler alone as it appears when mounted in its case.

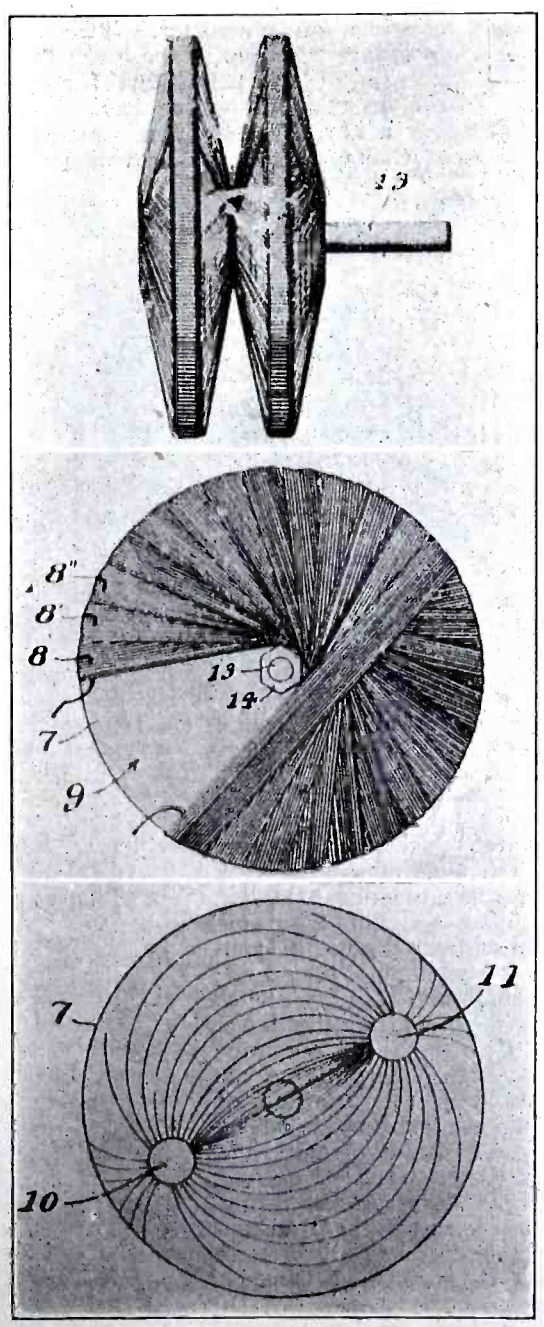
IT has become a known fact that with the incrasing number of amateur radio stations, from year to year, without mentioning the naval or commercial stations, QRM seems to be the most important factor that the amateur or commercial operator has to contend with. QRM or interference needs no introduction in radio, as this is our greatest enemy. Can it be stated now to all amateurs and commercial operators that this QRM has at last been conquered?

Yes, it has been conquered, thanks to the work of some long experienced men who have spent most of their time in the laboratories of the government. For the past two years this deadly QRM was fought and finally conquered. All the amateurs of the East know the terrific QRM that exists at all times around New York, where many stations are continuously working, mostly jamming, thereby squeezing in to get their traffic through.

Let us take into consideration New York, the most congested harbor in the world, that is, as far as radio is concerned. Eight commercial stations cover a vicinity within 100 miles and here QRM is drastic, no argument at all, as when one listens in, all he can hear is jamming, possibly QRM QTA. Above all, in Bedloes Island, sits a radio station known to the amateurs as WYCB, or WUM to the commercial operator; there, after two years, Mr. Bogdanoff, due to his experiments, finally discovered these so-called coils, radial inductances, and with proper finishing touches, came to a practical QRM eliminator. This was accomplished by him in order to get away from induction from nearby high powered stations.

Mr. Ehlert, lately from the U. S. Naval station at New York, and Mr. Schaefer, of the Ship Owners' Radio Service Co., were consulted as to this new invention and after several weeks of experiments, he designed a receiver which can cut or tune out QRM more than any known receiver on the market at the present time. Most of the experiments were conducted at Fort Wood by Lieutenant Paddock, signal officer U. S. Army, in the following manner.

A quarter K.W. set was sending on three hundred meters wave-length using a large antenna, while below was another antenna connected to the receiver which was placed in another room. Thanks to the radial inductance, the receiving operator could cut out entirely the induction from the sending set and receive a transmission effectuated on four hundred meters wave-length by moving the two coils apart of only two degrees. This wonderful result may be obtained on any wave-length and a station interfering with the reception of faint signals may be tuned entirely out by a very small variation of coupling.



These Sketches Show the Method of Mounting of the Coils and the Special Process of Winding as Well as the Resulting Field Inside the Coil.

As may be seen in Fig. 3, the coils are wound around a disc in sections overlapping each other, this produces a very concentrated field of the form shown in the diagram. As may be seen two coils are mount ed on the same axle, one of them rotati in front of the other, so that the coupl may be varied.

These coils possess for a given w length the least distributed capacity of coil known, which in turn gives it the est high frequency resistance; a ve portant factor in short-wave recepti

The wire used is preferably some ed or litz wire, insulated and of th gauge. The winding has no taps, t being effectuated, as for the honey of coils, entirely by variable One of the photographs shows t a set built especially for experi the Navy, the radial inducta seen above the condenser on t photograph gives a good idea the coils compared to the oth receiver; with this receiv lengths up to 700 meters

The new inductances wh on the market will be bu a separate tuner shown the experimenter to use apparatus or in conjun struments he already is compact and fitted the value of coupling

In ending this des that undoubtedly th tance is the solutio so important at th

Correction

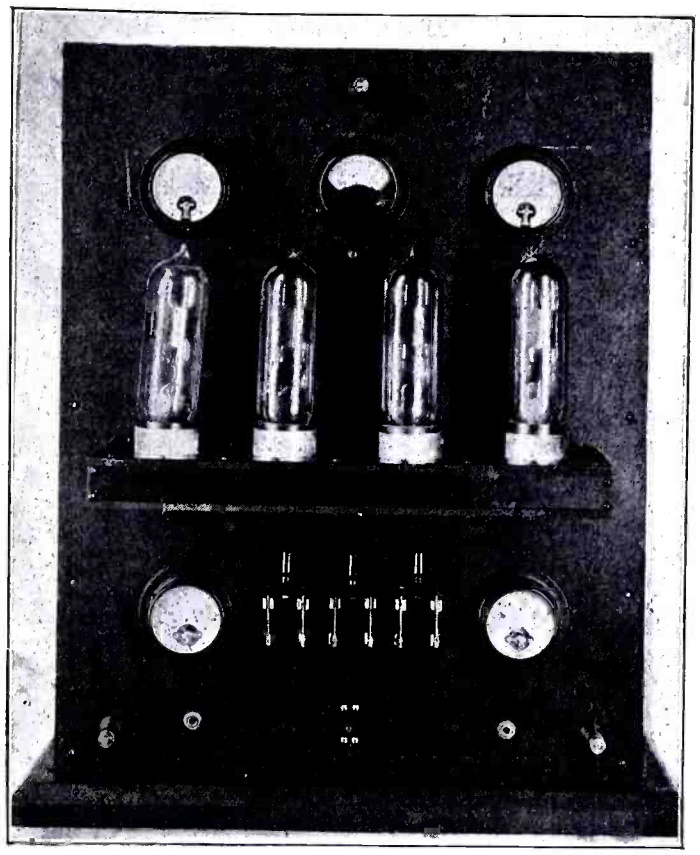
In one of NEWS, the Dia in an advertis difference of meters wave conducted b be 1.2. Th as 1.8. T us to ma

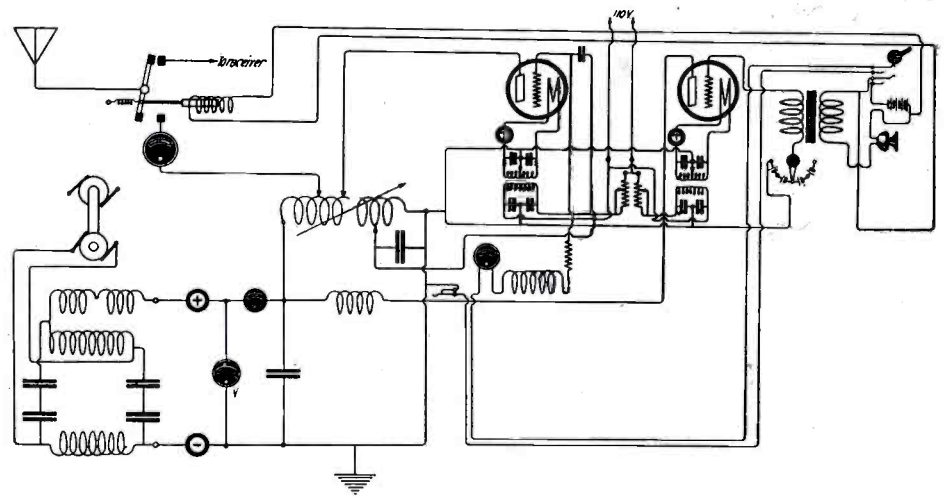
ne recent issues of RADIO mond State Fibre Company, ement, stated that the phase Condensite Celoron at 3,067 length was found by a test y the Bureau of Standards, to is figure should have been given he advertiser has written asking e this correction.

The 3-AWI Radiophone

at Philadelphia, Pa.

By L. PARKE*





On the Left is a Photograph of the Well-Designed Radiophone Used at 3-AWI, While Above is the Complete Hook-up of the Set.

IN response to hundreds of letters coming from amateurs within a radius of 500 miles of Philadelphia, we will endeavor here to present some of the feaures of the radio telephone equipment at this station which has caused so much comment.

The owner, Thomas F. J. Howlett, is one of the pioneer amateurs in the third district and one of the first to successfully give concerts over the radiophone. Desiring to increase the range and flexibility of his equipment, the set illustrated and described below was designed for him by L. B. Traugott to meet his requirements and built in the shops of the Philadelphia School of Wireless Telegraphy.

In designing and building this phone, a specific effort was made to follow the latest engineering practice and to incorporate wherever possible the design, data and latest features which have been proven superior by several years of experimenting and observation of the leading authorities by the designer.

The main part of the equipment, namely, the power tubes, are of the new type UV-203. Four of these tubes are used, two in parallel as oscillators and two as modulators. The tubes are arranged on the front of the panel and the leads brought through the panel to the oscillating circuits in the rear. The transmitting unit is arranged on a hard rubber panel 20" x 25". All necessary controls being placed on the front of the panel within easy reach of the operator, and at the same time any circuits that could possibly carry high voltage current or any of the oscillatory current, are carefully arranged so that accidental contact by the operator is obviated. Three double-pole, single-throw switches are provided on the front of the panel, one controlling the main supply current to the filament transformers, one being provided for the oscillator tube filaments and one for the modulator tube filaments.

A meter is provided in the filament circuits of both the modulator tubes and oscillator tubes to show normal operating filament currents. The upper portion of the panel holds three meters, grid current meter, radiation meter and a space current meter. Two jacks are provided at the lower portion of the panel, one for the insertion of a plug having in circuit either a key for continuous-wave signaling or a chopper wheel for providing chopper modulated C.W. and the other for the insertion of either the microphone, a victrola tone arm, or a buzzer set, for buzzer modulated C.W., thus giving a flexibility of operation without the use of complicated switching.

The Upper Photograph Shows the Back of the Filament Control Panel. The Lower One is an Inside View of the Set.

A small anti-capacity switch is provided also at the lower portion of the panel operating a relay which throws the antenna from the transmitting inductance to the receiving inductance and at the same time, in the latter position, opening the grid leak circuit and throwing the lead off the transmitting tubes, thus allowing a "break in" operation while in use.

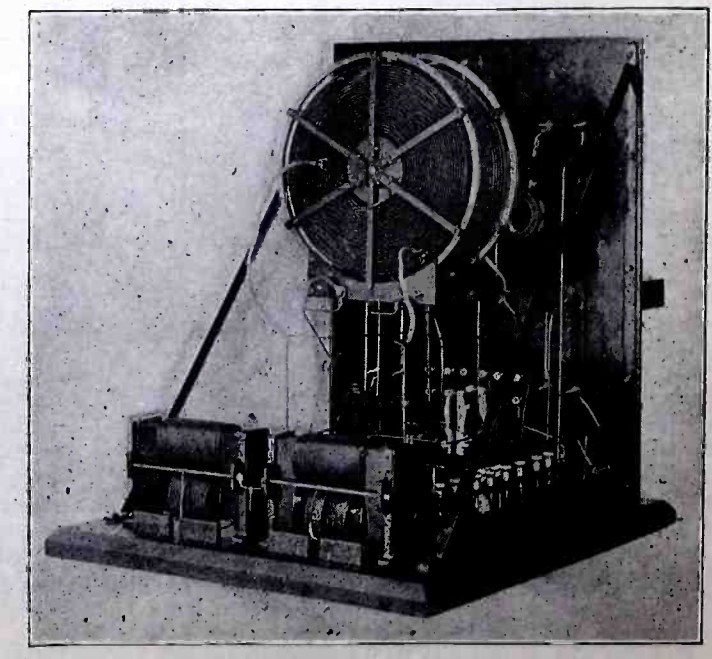
Three high tension terminal posts are provided on the panel front for antenna, ground and receiving inductance, respectively, which completes the control equipment on the transmitter panel.

A separate control panel is provided for the control of the oscillator filaments and modulator filaments. This unit is shown to the left of the transmitter panel in the accompanying photograph and consists essentially of variable resistances in series with the primary of the two filament heating transformers.

The filter system, together with the constant current choke coil, is also built as a separate unit in panel form. The front of the panel carries a double-pole, single-throw switch which, when open, completely isolates the entire equipment from the high voltage circuits. Above this switch is an especially designed circuit breaker in the negative lead of the high voltage circuit, which is adjusted to throw slightly above the normal space current of the tubes under normal operating conditions. Fuses are also provided in the filament circuits of the tubes to further safeguard them against accidental overloads.

The transmitting inductances, filament lighting transformers and their protective condensers, variable voltage supply for modulator grid potential, modulation transformer and the breaking relay are all mounted behind the transmitter panel in such a way that the transmitter panel is

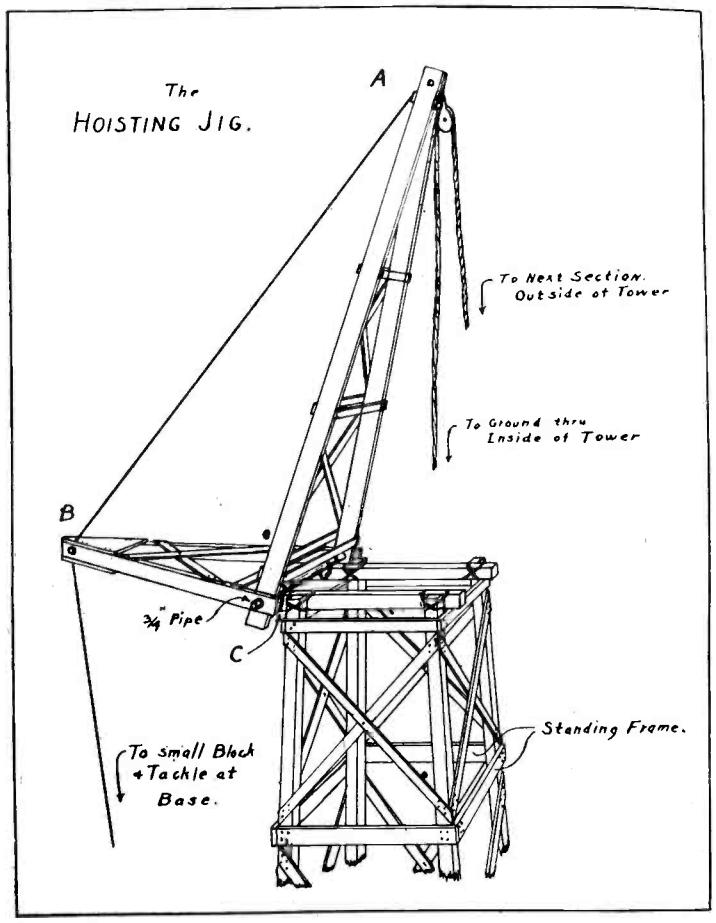
(Continued on page 266)



*In collaboration with L. P. Traugott.

Latticed Radio Towers for the Amateur's Station

By ALLAN K. THOMPSON



This Sketch Shows How the Sections are Hoisted Up to be Assembled.

A RELATIVELY high wireless pole must be of heavier construction and more rigid than one of average height. Built-up towers of latticed construction fulfill these requirements and are inherently more stable. They cost very little more than a correspondingly rugged pole of the straight type, while their greater serviceability and neater appearance make them more desirable.

The design discussed below was built and erected by the writer for 6ZN in San Fernando, California; owned by Mr. H. B. Denis and Mr. C. A. Taylor. It has been in service for several months and has withstood very severe wind strains.

The design chosen for this tower was 50" square at the base, 10" square at the top and 100' in height. Detailed dimension of this tower will not be given, but the method of construction and erection involved will be outlined, as this type presents some new features in both these operations.

Wireless poles should be guyed at shorter intervals, progressing toward the top, and the sections should be of corresponding lengths, i. e., joints should occur at the point where the guys are attached. The lowest or base section should, of course, be the longest and the others may be shorter by 2' successively, up the tower.

The exact size of the square section at each end of all sections should be next determined. This is readily given by the formula:

$$S_n = \frac{l\,(S_b - S_t)}{h} + S_t$$

Where S_n in inches = Width at any point.

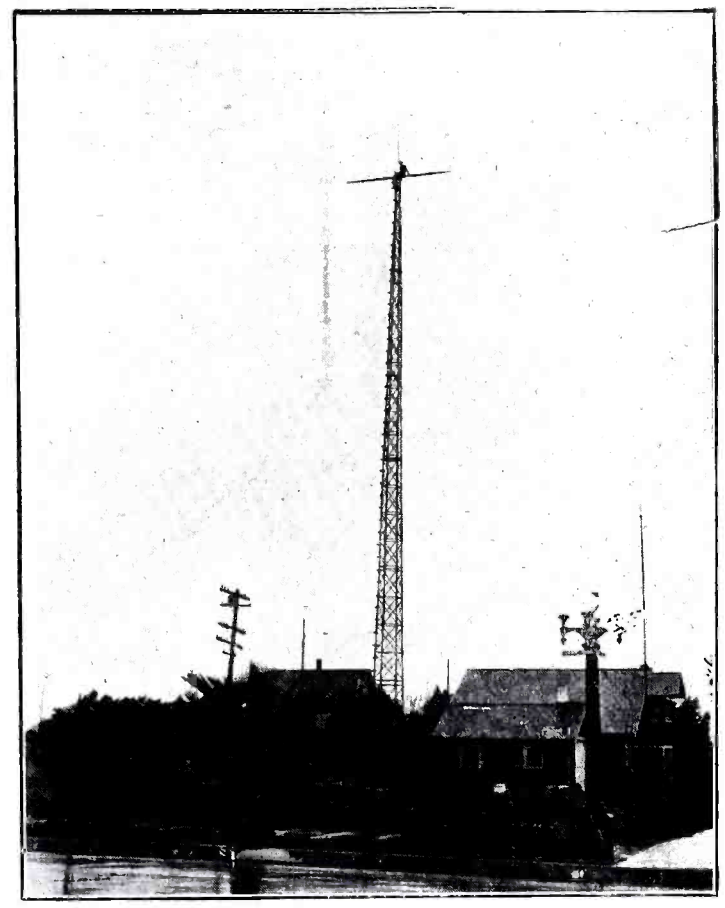
S_b in inches = Width at Base.

S_t in inches = Width at Top.

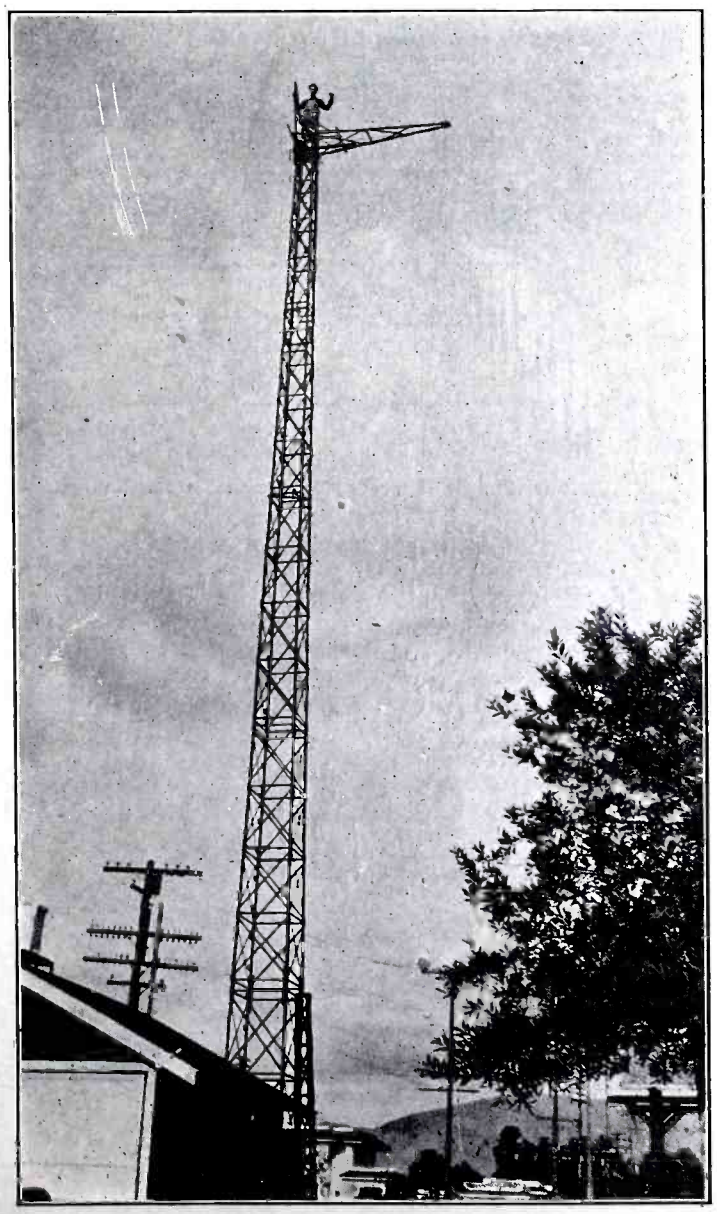
l in feet = Distance *Down from Top.*

h in feet = Height of Tower.

Both ends of every section should be framed with 1 x 3 sticks, 5 inches back from the ends in order to give support while handling and, as will be seen later, to support the hoisting jig. A similar frame of 1 x 3 sticks should be placed on the upper ends of every section but the lowest one, at the point where the horizontal lath members would normally be placed (see sketch), to serve as "standing room."



Here is the Tower Completed. Note the Builder at the Top Fixing the Spreader.



In This Photograph May Be Seen the Various Sections of the Tower, and the Hoisting Jig Being Fixed for the Erection of the Last Section.

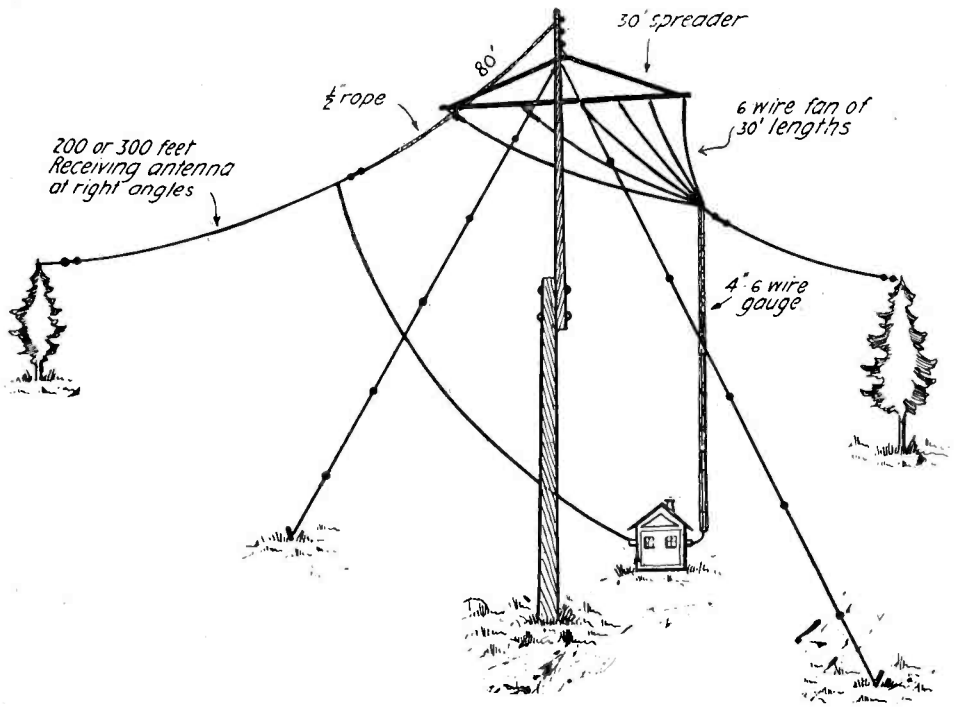
The cross members should be placed so that the diagonals intersect at an angle of, or slightly less than 45°. The vertical side members are 2 x 2 in section and should be as straight and clear as possible. Two opposite sides of a given section may be made up alone and these two then combined with similar latticing to form the completed section. The latticing is made from 8' lath. These are slightly heavier than the ordinary lath, being ⅜ x 1¼ in section. A box nail 1⅜" in length was used and not less than three were driven at each end. Two nails were driven through the intersection of the diagonal members and clenched. The four struts of any one section should be exactly the same length and their ends flat and square. Time will be saved by painting or staining the pieces before assembling, but they should be allowed to become thoroughly dry before assembling. The legs may be set in concrete and extend 2' into the ground or they may be allowed to rest on a smooth concrete base. If the former method is used, the concrete should not be placed until the section has been placed in a truly vertical position.

The joints are made by nailing and wiring 2' pieces of 1 x 2 along the inside of the struts. The two lowest sections may be joined in this manner and erected as one piece (about 30' or 40'. The guys should be attached and may be used to pull up from the opposite side. Heavy pike poles and several strong assistants can easily raise thirty or forty feet, high enough that the pull on the opposite guy will swing it into position. Steps should be firmly nailed to each section about 2' apart.

(*Continued on page 236*)

Break in Systems

By D. W. RICHARDSON of 3 DH and 3 XM

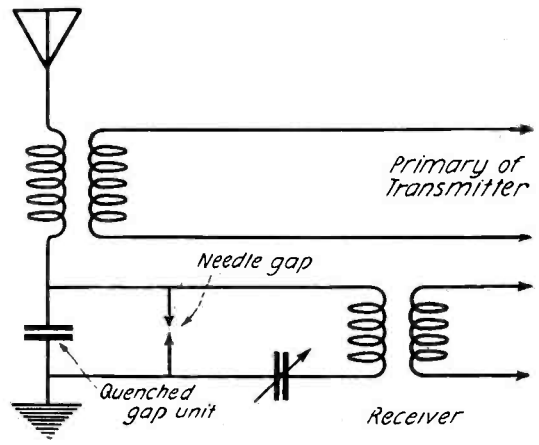


Using a sending aerial of the type shown and a single wire for receiving allows duplex work and higher efficiency of the sending set.

THE relatively few stations in actual duplex operation at present shows an ignorance of some very simple feats of engineering. The duplex system, besides being simpler than throwing a lot of switches while changing from sending to receiving, facilitates operation and saves endless interference by allowing the operator to be always alert to what is going on. When an operator is finishing a message which he is transmitting to a long distance station, he knows whether there is local interference or not, and does not give his "k" until the air is clear for the answer he is expecting, or if the receiving operator is troubled with interference, a simple "min" lets the sending operator know enough to wait. When the local interference is over, a simple "k" tells the sending operator to continue. In sending a message it saves endless repeating. If the receiving operator misses a word, he merely breaks-in, repeats the word before, and the sending operator takes it up and continues. If there is a string of messages to be sent, just an "r" from the receiving operator indicates that the message is O.K. and that he is ready for the next.

A break-in system is especially useful when the receiving station is having some trouble with a difficult message through static, for the sending station can keep repeating and repeating until the receiving operator has it all O.K. One never hears a station with a break-in call while some station is calling him.

Two systems will be described, each with its advantages and both so simple that any one can install a system in a few hours of work.



Another Simple System for Duplex Operation.

The first system involves a separate receiving antenna and should be used with bulb transmitters, especially when it is desired to be able to work two-way conversations, which can be done, provided there is a difference of approximately fifty meters between the outgoing wave and the received wave. In this case, the sending set is always connected to the transmitting aerial and the receiving set is always connected to the receiving aerial, which should be at right angles and as far removed as possible from the transmitting antenna. (See diagram "A.") At least seventy feet of rope should be put in if the receiving antenna is hung on one of the transmitting poles, to let it hang as far away as possible. It should be several hundred feet long and of stranded wire or brass ribbon. A single wire is best, because it absorbs a minimum of static. It can be run to a tree or a pole several hundred feet away.

System "B," which does away with this extra antenna, is superior in that it is simpler. It is inferior in the fact that it can only be used with spark sets or bulb sets where a high voltage is used. (See diagram "B.") The leads to the receiving set can only be taken off near the ground (about 20 feet being the limit) where the potential to the ground is low, or in a counterpoise system, at the nodal point. A quenched gap unit does very well for the slight break in the circuit, or two brass or copper plates, 4 inches by 4 inches, separated by a thin piece of mica, with a hole 2 inches by 2 inches cut in it. These plates should be clamped together, in order that the resistance of this break in the circuit may be a minimum.

In both of these systems, a small needle gap is used across the aerial and ground leads on the receiving circuit, to keep what energy is absorbed from sparking in the cabinet. The grid leak on the detector should have a value between 10,000 and one-half megohm, in order that the bulb will not be polarized.

If a station is poorly wired, there may be various noises due to induction while the rotary motor is running. These can be avoided by grounding the frame of the motor and enclosing the leads in conduit or pipe and grounding the pipe, or else by controlling the set with relays and a six volt system. The latter, however, is unnecessarily expensive and should only be used when the sending set is a considerable distance away. As a rule, in the average station employing an induction or synchronous motor, there is no noise while the rotary is running.

There should be no trouble with these systems. The two antenna system has been in operation at 3DH for nearly a year, and the single antenna system is working perfectly at 2GR at present.

Description of 9 UQ Transmitter

By J. C. KOSITZKY

Due to numerous inquiries regarding my unusual transmitting tone, I give the following details for those interested.

The transformer, whose secondary is in series with the rotary gap motor (must be a series motor) is any small transformer, of variable voltage up to 60 volts, and may range from 50 to 100 watts output. Its secondary voltage may well be from 10 to 60 volts, and in six 10-volt steps.

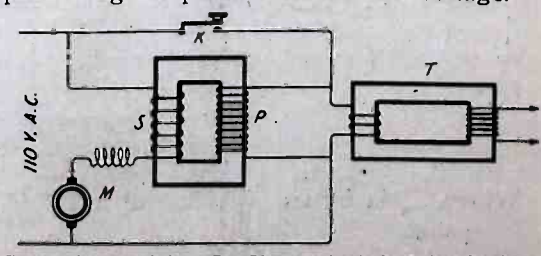
The principle is simple. When the key is up, the secondary of the above transformer acts as impedance.

This makes the rotary move more slowly than it would if directly across the 110-volt line.

But on depressing the key, the secondary becomes a source of potential in series with the line voltage, which gives the rotary motor line voltage plus transformer output voltage. The speed rapidly picks up on depressing the key. This "pick up" may be made to just equal the slowing down ordinarily caused by the transmitting transformer load; or the tone may be made to raise on the key depression. This tone is distinctive.

This works best on the light revolving arm type of rotary, as the change in voltage produces a more immediate change in speed than in other types of rotaries. Most rotary gap motors (series) will stand up to 140 or 150 volts, provided they are on the light revolving arm type of rotary.

If on depressing the key the speed falls off, then your transformer output is "bucking" or is 180 degrees out of phase with the line voltage. A reversal of primary connections of this transformer puts its output voltage in phase with the line voltage.



Connections of the Sending Set at G.V.A., Giving an Unusual Tone.

I. C. W. for the Amateur

By GARRETT W. LEWIS

FOR the past few months the amateur has found that each copy of Radio periodicals has contained one or more articles on the subject of bulb transmission; he has become convinced that C.W. has many of the advantages that he desires in spark, but the cost has prevented the average amateur from installing one. The object of this article is to describe the construction of C.W. and I.C.W. set that will work circles around the average spark set, and will cost much less. The actual cost of the set described was $28, including the bulb. Using either a V.T. 2 or a U.V. 202, the radiation is about one ampere for straight C.W. and seven-tenths for I.C.W. Communication was established with 6AR from the author's station (7OZ) in Portland, Ore. Signals were reported QSA. The aerial at that time was 35' long and only 25' high.

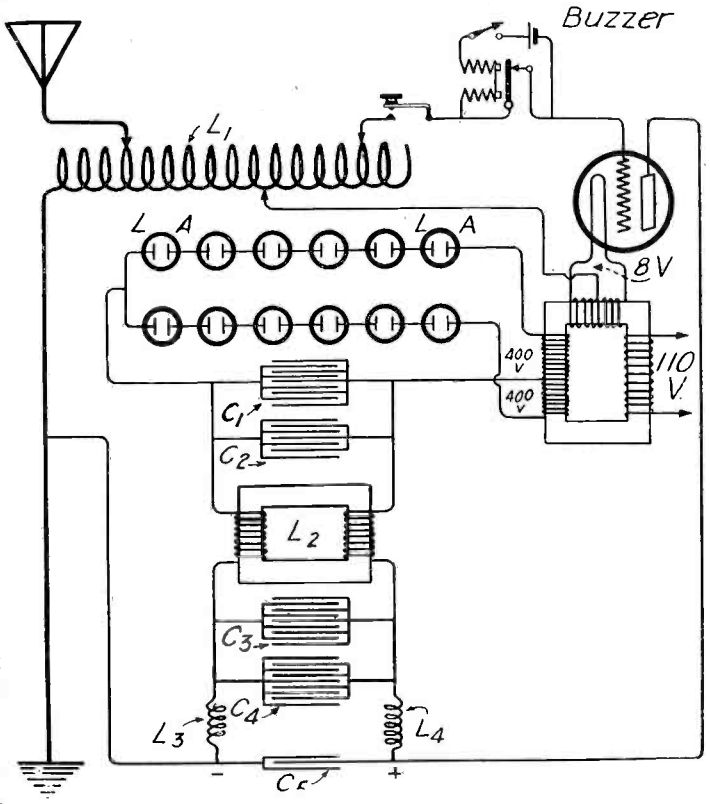
The set proper is mounted on a piece of white pine with a fiber panel in front to hold the switches. The transformer and rectifier are under the table and are operated by the aerial switch. There are five parts to the set and they will be described in order.

THE HIGH VOLTAGE TRANSFORMER

The transformer is built on a core 1" square with inside dimensions 2½" x 3½". Such a core will cost about $1.50. The coils are wound on the long legs of the transformer, using linen tape for insulating. The primary consists of 440 turns of No. 18 D.C.C. Over this is wound the filament heating coil, consisting of 32 turns of No. 12 tapped in the center. On the other leg the high voltage secondary is wound, in two pies, each of 1,600 turns of No. 28 S.S.C. The pies are connected in series with a center tap brought out. One pound of No. 18, one-fourth pound of No. 12 and two pounds of No. 28 are needed.

THE RECTIFIER

This is the cause of much trouble to the amateur, because he does not allow enough jars to cut the voltage across each cell to a value that will rectify. For this voltage, the author used six cells on each side of the cycle. The cells are in one-quart jars and consist of a pure lead and a pure aluminum electrode in a saturated solution of 20 Mule Team borax. The electrodes are 1" wide and 8" long, are immersed as much as possible in the solution and are separated 2". Six cells place a voltage of 65 volts across each cell, quite under the amount that such a cell will rectify. One set of electrodes will last about a year and give good service. At first the rectifier will not function and is liable to overheat the filter condensers, so it is best to break it in. This may be done by placing a load across the output; a set of four 25-watt lamps in series will do very nicely.



C.W. Transmitter Supplied with A.C. Electrolytically Rectified.

THE FILTER SYSTEM

The filter system consists of a choke coil and about eight microfarads of condenser. Four of the 2 MF. phone condensers will be the best that the average amateur can afford. They will stand up under the voltage required, as they are rated at 500 V. The choke coil is wound on a core about the same size as the tansformer; it consists of one pound of No. 24 enamelled wire on each leg. The leads from the rectifier are run so that the coils are in series. The condensers are connected across each end of the choke. With this filter the author has had no trouble with A.C. hum at a distance of 10 miles.

THE INDUCTANCE

The inductance for this set is wound on a fiber tube 3½" in diameter. It consists of 80 turns of No. 18 D.C.C. wire, not shellacked. Fifteen taps were taken off at each two turns, the rest tapped at every fifth turn. A little loop was made and taps taken off with flexible cord. The tube was fastened to the base directly in back of the switches that control the tuning.

THE INDICATORS

The amateur does not need a plate voltmeter, the rectifier will furnish the correct voltage. Neither is a plate milliammeter needed as the proper amount will be drawn. The experimenter will do well to watch

(*Continued on page 254*)

More Efficiency for the Rotary

By R. U. SEARES

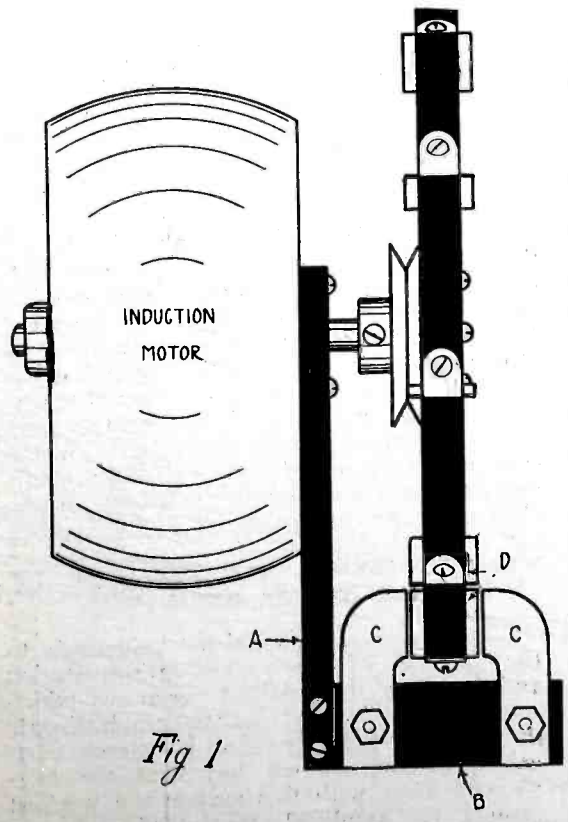


Fig 1

This Type of Electrode Shortens the Circuit and Has a Quenching Effect.

THE rotary spark gap herein described has the following advantages over the general type. The circuit through the wheel, from one stationary electrode to the other, is very short, permitting the use of more capacity. The flat electrodes used give a quicker break, thus improving the quenching qualities. Finally, to qualify with the essentials of good amateur apparatus, the construction is both simple and rugged.

A small induction motor which runs at 1,200 r.p.m., will give the best results if nine electrodes are used on the disk. On 60 cycles, the above combination produces a low musical note with good carrying properties.

The disk is 6" in diameter, ⅜" thick, and may be of bakelite or black fiber. At equal distances, nine holes should be drilled into the edge of the disk and tapped 8/32. Next, ¼" from each hole, slots are cut radially into the disk to a depth of ½". These slots are made 1/16" wide by using several blades together in a hacksaw. It is of importance that the slots be not cut until the holes in the edge are tapped, otherwise the disk might crack (particularly if bakelite is used) during the process of tapping. The disk is best connected to the motor by drilling three holes and bolting it to a pulley which fits the shaft.

The disk electrodes, D, are cut from 1/16" sheet copper and dressed up carefully with a file. Fig. 2 shows the dimensions plainly. After these electrodes are formed, each is placed in a vise and the lug with a hole in

(*Continued on page 252*)

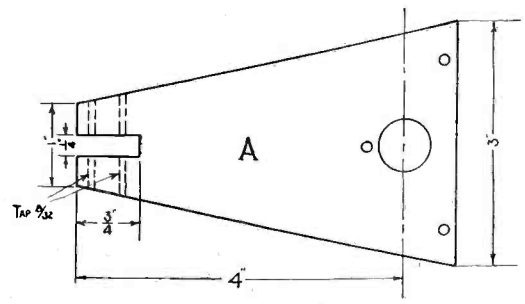
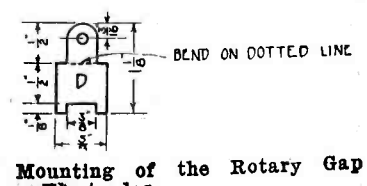


Fig 2



Detail of the Mounting of the Rotary Gap Electrodes.

Government to Broadcast News by Radiophone

A WIRELESS telephone, daily bulletin news service for the benefit of the country generally, and particularly the agricultural regions, is to be considered by the newly appointed National Radio Service Commission, which met and organized recently at Washington in the office of Postmaster General Hays. The commission was appointed by the Post Office Department, acting with the Department of Agriculture, and is composed of R. B. Howell (Chairman), of Nebraska; Courtland Smith (Secretary), of New York; William A. Wheeler, Bureau of Markets, Department of Agriculture, and James C. Edgerton, radio expert of the Post Office Department.

Market reports and other Government information have been sent daily by wireless telegraph from Washington to agriculture communities since April, but they are now considering the practicability of putting this service and bulletins of general news through by means of the wireless telephone, so that the farmer, or other business man, more or less isolated, who could not profit by the dot-and-dash message, may be able to listen to the spoken message.

More Good News for the Amateur

The Government has just announced that it will broadcast Radio Telephone News at stated hours during the day. This will supplement the Market News Service reported in these columns some time ago.

This new step by the Government will probably do more than anything else to popularize Radio and it will be the cause of loud-speaking Radio Telephone Receivers being installed in many places to entertain the public.

If our Radio Manufacturers can read between the lines. they will see that this will be a tremendous opportunity for them to put standard outfits on the market to enable laymen to receive Radio Telephone news to their heart's content.

—*Editor.*

The Commission's work of investigation will be divided with Mr. Howell in charge of ways and means; Mr. Wheeler in charge of news copy and service, and Mr. Edgerton in charge of apparatus, stations and operations.

The plan proposed is to utilize the major radio stations of the air mail service, each about 400 miles apart, and stretched across the United States, as stations from which to disseminate this news by wireless telephone. Each station will serve approximately 125,000 square miles of territory. Wireless telephone stations may be established and maintained in homes and places of business at approximately the small outlay of $35 for the receiving set. There are no wires to bother with. A very simple antenna may be made from a single strand of wire stretched from the top of a house to another nearby building, says a bulletin issued by the Commission.

Amplifiers may be used so that large audiences, if desirable, can hear what is spoken. Several banks, farm houses, and county agents have signified a desire to install re-

(*Continued on page 226*)

The Termojonic Valve

We present to the radio fraternity herewith one of the great documents of the age. It is taken bodily from no less a paper than the Sunday "New York Herald" of June 12th. We have taken pains to copy the article verbatim, but the italics are ours. It seems that the correspondent of the "New York Herald" interviewed Senator Marconi at Fiume on May 28th, sending the dispatch to the "Herald." He was invited on Marconi's yacht "Elektra," and our readers will agree with us that he has seen many marvelous things. Just to mention a few: There were "termojonic valves," "sensitive revelations of the electric waves," "electric light bulbs which have been made a vacuum," "electrons attracted to a cold band," "size of the electro-magnetic waves varied by the human voice," "messages received on special 'semi'(?)vertical antennae," etc., etc.

We guarantee every reader an interesting ten minutes in the careful perusal of this article, which we might have dubbed "Unconscious Humor" or "The Vacuum Inside the Correspondent's Head." With all due respect to Senator Marconi, we must say that he has probably never in his wildest dreams uttered such an amount of crass nonsense as the special correspondent of the "New York Herald" attributes to him. It is a pity that our great dailies should assign non-technical men to important interviews.

THE "mystery cabin" on board the *Elektra* is quite small. Perhaps 12 feet by 12 feet by 8 feet. In spite of the weight of material there appears to be plenty of room. With the assistants we were at one time twelve people inside. But arrangement is the great thing. All the apparatus is fixed on screens and narrow shelves around the wall and made fast. For the unwary notices are appended: "The apparatus on this screen must not be touched unless current is off." In almost the center is a generator in a box 3 feet cube. The apparatus used for the experiments that morning was what is called "a piano cabinet telephone set," working from a one-half kilowatt generator. It works with the continuous wave system and *is also fitted with a Morse code apparatus* and a buzzer for wireless telegraph purposes. The telephone apparatus is the same as might be found in any office for speaking purposes. From this apparatus on board the yacht it is not possible to speak and hear at the same time except from two separate apparatus. But Senator Marconi said a new apparatus is now under construction which is easier to manipulate than this experimental one.

"PIANO" SET RECEIVES MESSAGES FROM UNITED STATES TO NAPLES

The "piano" set can receive wireless telegraph messages from the United States of America to Naples, and its telephone radius is always good for 200 miles, and on occasions has received and spoken up to 400, for instance, from Biscay to Poldhu. This set is the ideal set for all ordinary merchant vessels and costs from 500 to 600 pounds.

In the corner next to it are two ships' spark transmitters, working from the one-half kilowatt generator and capable of 200 miles radius. This system has been superseded by the valve (continuous wave) transmitter, but is carried on the *Elektra* in case of an SOS being received and for experimental purposes.

The beauty of the room, however, is the large valve transmitter working from the 3 kilowatt generator. Her distance is 1,500 miles. It is through her that the *Elektra* carries out the greater experiments, her talks with Poldhu, Chelmsford, Paris. Through her she needs no newspaper on board. By radiotelegraph or radiotelephone she receives when she wants all the news of the day. In a few short minutes, by merely altering the wave-length, we were picking up Paris with a lengthy 12 o'clock wire; a turn of the button to a longer wave and it was Nauen wirelessing a long message to New York. Two minutes later, Lyons. It was interesting to learn that Nauen transmits at a faster rate than any other station.

What, however, interested the uninitiated among us was the fact that the work appeared to be connected with a number of small glass tubes, which lit up as the current was turned on. These are the *termojonic valves*, the first of which was invented by Prof. Fleming of University College, London, consulting engineer of the Marconi Company, in 1904. The *termojonic valve* insured to radiotelegraphy and radiotelephony *new and extremely sensitive revelations of the electric waves*, new and efficient productions of oscillation. This valve has the ordinary appearance of an electric lamp. When it is used as a transmitter it replaces the complicated sparking apparatus and the big high frequency alternators. Its efficiency, its invisible working and its silence, with the fact that it produces most marvelous results over thousands of miles, as, for instance, between England and Australia, proves that it is one of the most marvellous applications of physics yet known. Said Senator Marconi:

"To understand the working of the valve and the results it has given in radiotelegraphy and radiotelephony it is necessary to speak of the electronic theory. Electrons are contained in all conducting bodies at their ordinary temperature, but by rendering incandescent a thin metallic wire placed in space the electrons jump away from the metal in the same way as when water is heated—the molecules of the liquid break away and form vapor. If a metal filament is placed in a glass tube, *such as an electric light bulb, which has been made a vacuum*, and is surrounded by a metalband kept cold, it is noticed that when the filament is made incandescent a certain number of electrons break away from the incandescent filament *and are attracted to the cold band.*

"In such a case by switching into the space between the filament and the cold band an electric power this space becomes a conductor—that is, allows an electric current to pass, but only in one direction.

"If a metallic net is then placed between the filament and the cold band the electronic current is stopped, *because a large number of electrons which are jumping off from the incandescent filament become absorbed by the metal, which becomes a potential negative.* By neutralizing this potential negative with a small electric power the electrons are again free; therefore with the smallest variations of power on the metallic net there are very great variations on the electronic currents *produced by the valves.*

WEAKEST SOUNDS ARE AMPLIFIED BY MEANS OF THE METAL NET

"By attaching the metal net inductively to the antennæ of the radiotelegraph station and receiving the smallest variations which are produced by the radiotelegraph signals they in their turn produce very strong variations of the current heard at the telephone. Thus with this system the weakest sounds are amplified, reinforced and rendered perceptible. Varying the potentiality

(*Continued on page 223*)

Effect of Counterpoise on Antenna Resistance

By Maurice Buchbinder

The resistance of an antenna is normally a function of three factors, only one of which is useful. These factors are dielectric losses, ohmic losses and radiation resistance. It is the object of antenna system design to make the first two factors as small as possible, in comparison with the other. In the course of this article, it will be shown how, by the use of a counterpoise, it is possible to greatly reduce the deleterious components of resistance, keeping the useful component substantially constant.

We first give a brief theoretical discussion of the above mentioned factors. By dielectric losses is meant the energy dissipation on account of the fact that the dielectric e. g., the space between the antenna and the effective ground, is in part poorly conducting earth and poor dielectric. The losses from this source increase linearly with wave length. That is, if Rd be called the dielectric loss then $Rd = a\lambda$.

By ohmic losses is meant the energy dissipated in the conducting wires and earth by currents. Excluding the skin effect for short wave lengths $Ro = b$.

Finally the radiation resistance is

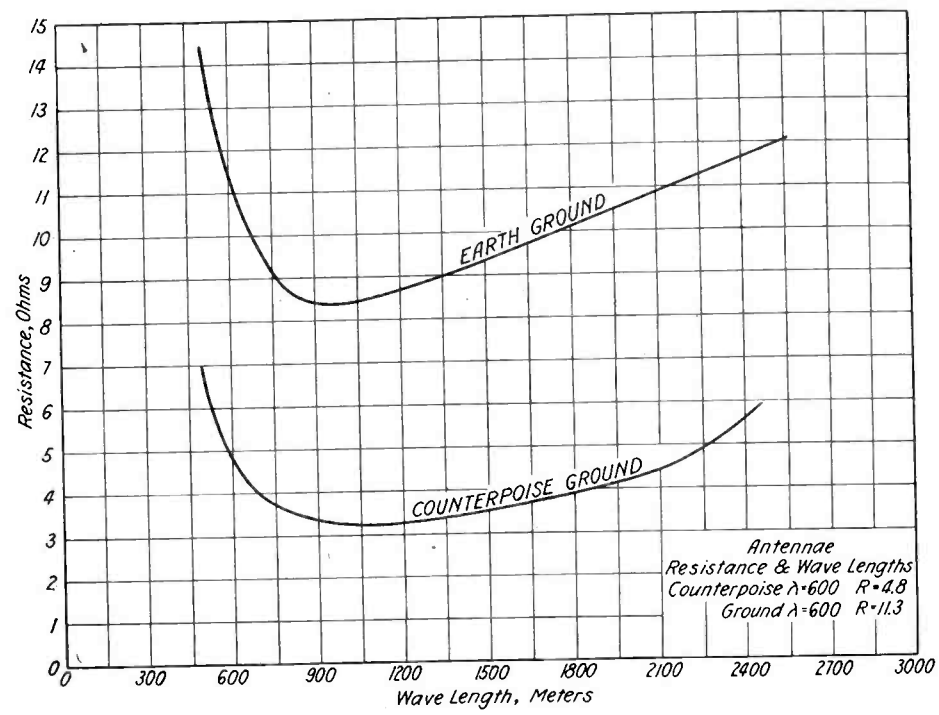
$$B_r = \frac{1600\ h^2}{x^2}$$

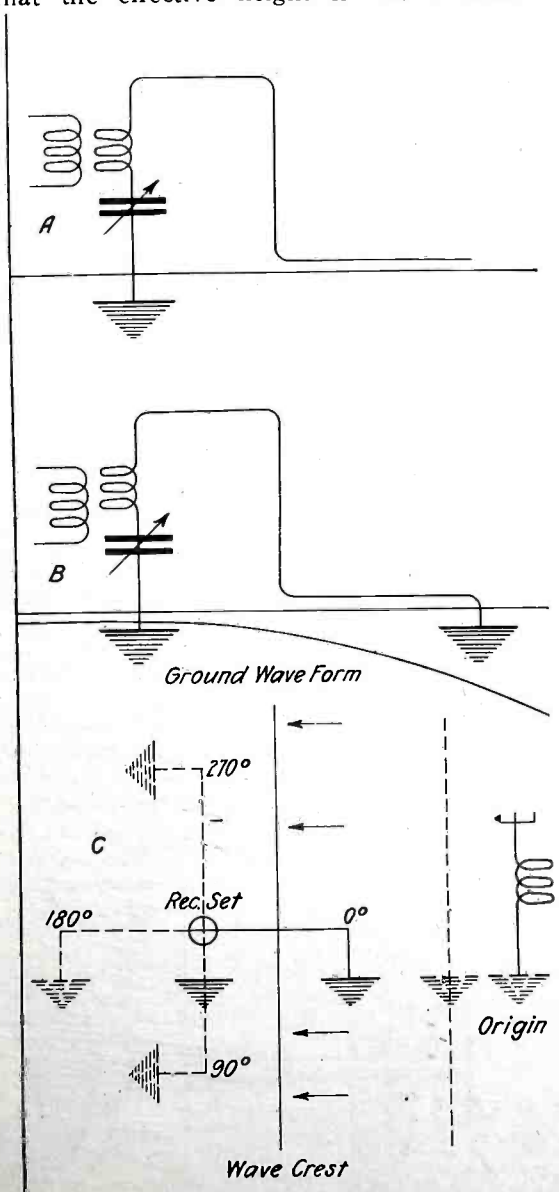
in consistent units where h is the effective height of the system. It should be noted that the effective height is not constant but varies markedly near the fundamental of the antenna due to change in the current distribution.

Now the effective height of a system will be substantially the same if it is a ground system or a counterpoise system, provided the counterpoise is not lifted too high off the ground and is adequate in size. It follows that any advantage in a counterpoise

(*Continued on page 261*)

This chart shows the advantage of the counterpoise over the ordinary ground.





At 90° and 270° crests reach both grounds at the same time producing minimum potential difference.
At 0° and 180° crests reach one ground before the other producing maximum potential difference.

Etherless Wireless

By O. H. KNAPP

Mr. Gernsback's editorial, "Fool Ideas," urging the amateur to pursue the untrodden path, is to blame for my reporting the following experiments:

Several months ago, while making a study of the usual method of reception, loop reception, directional reception, and underground antenna, I decided that long-distance reception depended upon energy received, not by high-frequency electromagnetic and electrostatic induction (the ether wave), but by earth conduction.

My home is in the country, nearly due west of Sayville and North Annapolis, so that I have unusual opportunities for experimenting with directional work in the open. To further investigate this idea of conduction, I devised and carried out several experiments which were interesting, as the results were exactly as predicted.

In this work a long-wave, single-tube receiving set of the usual type was used. One terminal of the open circuit was grounded through a small iron stake, and the other (antenna) terminal was connected to 250′ insulated wire laid on the ground in an east-and-west direction (A). This, of course, constituted a very low antenna, and I could read Sayville, but he came in rather weak. The free end of the wire was now grounded through another iron stake, whereupon the signals from Sayville were increased many times, coming in stronger than on my 90′ elevated antenna.

The 250′ wire no longer acted as an elevated capacity, but as a mere conductor between two points of different potential on the earth's surface. Any potential wave advancing along the earth's surface will produce this difference at the two grounds, unless the crest of the advancing wave reaches both grounds at the same time, a condition possible only when the origin of the wave lies in a line at right angles to a line joining the two grounds. The fact that Annapolis could not be heard when the grounds were in the east-and-west position seems to substantiate this view. The grounds were then changed to a north-and-south line and Annapolis came in so loud that I could read him 10′ from the phones. With the grounds in this position Sayville came in very weak.

The distance between grounds was reduced with a corresponding reduction in signal strength, but I could hear Annapolis when the grounds were less than 2′ apart. By describing a 10′ circle with one of the grounds the other ground, acting as center, a station which could be heard strongest at 0°, could not be heard at 90°, came in as loud at 180° as at 0°, and again became silent at 270° (Fig. C). The above experiments were carried out on damp ground. A series condenser was used in the open circuit. When this condenser was cut in parallel it did not function, and very close compiling between open and closed circuits became therefore necessary.

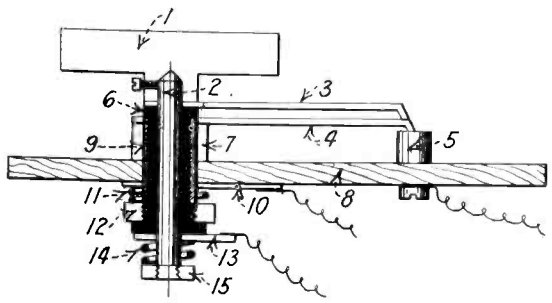
It may seem that my hook-up is merely a loop with ground return, but this is not true, since a single loop of like dimensions can in no way equal the results of the double ground. I would rather believe that the loop, particularly at long distances, depends upon these ground waves which are equivalent to charges moving vertically and therefore capable of inducing potentials in the vertical elements of the loop.

With the grounds 250′ apart in an east-and-west direction, I have read YN without the least trouble when I was unable to get him with my regular elevated antenna.

Earth conduction will, I believe, explain many things in radio, and I would certainly like to hear what some other experimenters have to say on this subject.

Awards of $100 Radio Accessory Prize Contest

1-Knob
2-Brass Rod
3-Switch Lever
4 " "
5 " Points
6-Insulation
7-Washer
8-Panel
9-Brass Tube
10-Soldering Lug
11-Spring
12-Nut
13-Soldering Lug
14-Spring
15 Nut



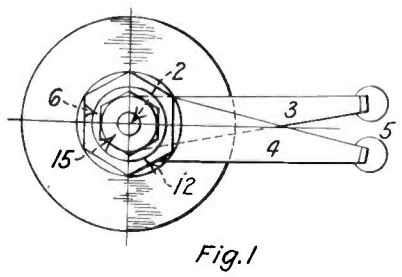


Fig. 1

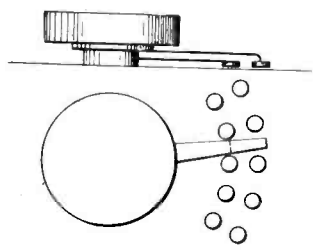


Fig. 2

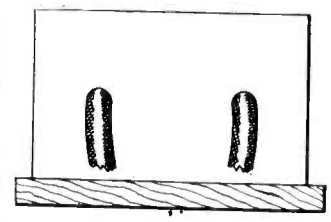
With this type of switch two circuits may be tuned at the same time or it may be used as a D.P.D.T. of a new design.

Designed by Bernard Lintzman.

WE present on this page several of the accessories which were awarded prizes in our RADIO ACCESSORY CONTEST. Altogether 2,249 ideas were submitted and the ones shown on this page, and in subsequent issue of this magazine, are only a very small percentage of the ideas submitted. Frankly, we were somewhat disappointeed in the quality of the suggestions received because very little that is really new and startling was submitted.

Many contestants did not understand the rules, some of them submitting, for instance, constructions of an amplifier, or complete radio sets, which was of course not what we wanted. Most of the other ideas were old, very old, re-invented while the rest were not suitable nor practicable. Entries were received from practically every country of the Globe and although quite a good deal of originality was displayed, there really was not a single idea that could be termed startling or brilliant. The contest itself may be termed a huge success if the quantity of replies is considered. It seems to show that there is a great and real need for improvements in the small, and oftentimes unseen, accessories of present Radio Outfits.

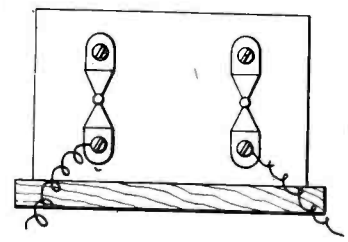
—*Editor.*



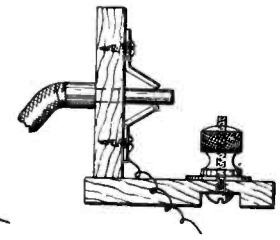
Front View

Shape of Metal Strip before being bent

Fig. 1



Rear View



Side View

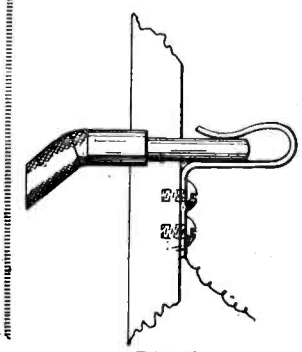


Fig. 2

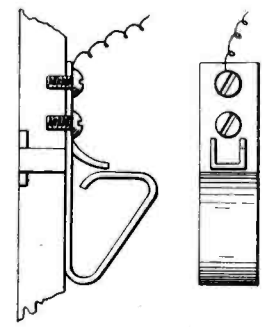


Fig. 3

With These Devices the Telephone Cord Tips Are Used as Plugs.

Designed by Richard Carsten.

Prize Winners

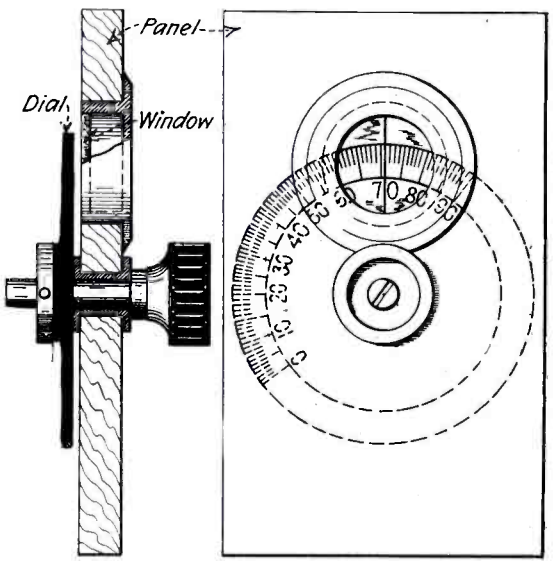
First prize, $50.00.
Mr. Bernard Lintzman,
1823—19th St., Omaha, Neb.

Second prize, $20.00.
Mr. Keith la Bar,
3207 E. 27th St., Kansas City, Mo.

Third prize, $15.00.
Mr. Richard Carsten,
1400 E. 76th St., Chicago, Ill.

Fourth prize, $10.00.
Mr. Malcolm Gager,
1430 College St., Scranton, Pa.

Fifth prize, $5.00.
Mr. Philippé A. Judd,
1814 Gallia St., Portsmouth, O.



With This Little Window Only the Useful Portion of the Scale of the Dial is Shown as it is Mounted Behind the Panel.

Designed by Philippé A. Judd.

Honorable Mention

Mr. Frank Dieringer,
441 W. McMicken Ave., Cincinnati, O.

Mr. Philippé A. Judd,
1814 Gallia St., Portsmouth, O.

Mr. Rudolph R. Young,
Gray, Pa.

Mr. Richard Baker,
2716 Baldwin St., Los Angeles, Cal.

Editor's Suggestion:
By making one blade shorter and sliding on another set of points as in Fig. 2 the switch may be used as a D.P. multi-throw switch to tune 2 circuits at the same time.

First Prize
A D. P. D. T. SWITCH
By Bernard Lintzman

In the new type of switch I designed, the knob is an ordinary composition knob with a set screw. The shaft is composed of two electrically independent parts. one a brass rod and the other a brass tube separated by an insulating flanged tube. These parts are fitted tightly together.

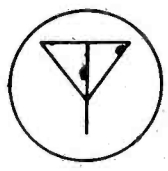
There are two blades, the upper one is freed onto the brass rod and is longer than the other. It is separated from the other blade by the insulating flange. The lower blade is fastened on the brass tube. There is a brass washer to keep the blades away from the panel. Contact is made by two coil springs, one on the brass tube and one on the rod; the one on the tube also serves to give the proper tension to the levers.

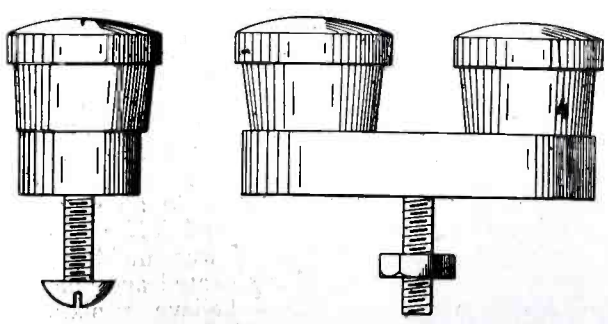
The switch can be made to any size and fit panels one inch thick. The diagram is self-explanatory.

SECOND PRIZE.
Engraved and Double Binding Posts.
By Keith La Bar.

Idea number one, an engraved binding post. These binding posts, which can be engraved with the symbol or letter designating the different parts of the apparatus, can

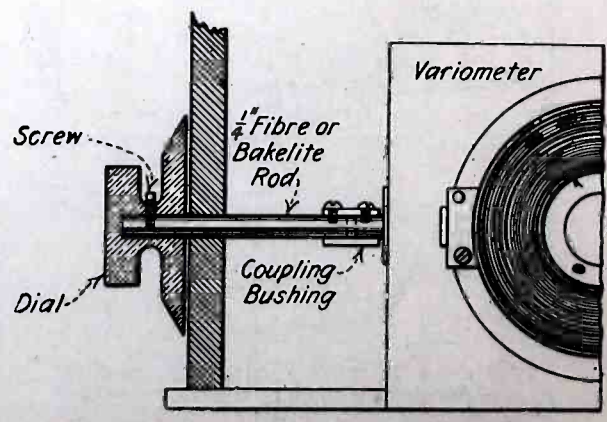
(*Continued on page 267*)





These Binding Posts Are Engraved With a Letter or Symbol Avoiding Any Wrong Connections or Engraving of the Panel.

Designed by Keith la Bar.



A Clever System of Coupling for Variometers Avoiding the Capacity Effect of the Operator's Hand.

Designed by Malcolm Gager.

Measuring the Characteristics of Vacuum Tubes

By LELAND J. LEASE

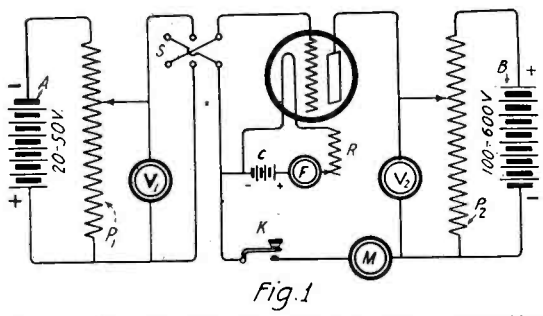


Fig. 1

Using This Circuit, the Various Characteristics of a V.T. May be Found.

IN the current literature on vacuum tubes we often find quite a discussion about their characteristics, but seldom do we find much about the actual measurement of these qualities, so that the average amateur may understand what they are and have a workable way of finding them. It is the purpose of this paper to explain to the amateur something of what these things mean and to give him a working method of measuring them with the apparatus he may have on hand.

Our work will concern: (1) the curves showing the effect of the grid and plate potentials and the filament current on the plate current (2) the amplification factor; (3) the internal plate impedance.

In the vacuum tube the heated filament throws off electrons. These have a negative charge. Now, if a positively charged body is placed in the field about the filament, these electrons will be attracted to it. Hence, we have the "plate" in the tube made positive by the "plate battery." When the negative side of this battery is connected to the filament, a current will flow from the filament to the plate, through the plate battery and phones to the filament again, but not in the reverse order. The greater the positive potential on the plate, the greater the number of electrons attracted, and hence the greater the plate current, up to saturation limit. This effect of plate potential is one factor that we propose to measure.

Suppose that now we put a grid in the field between the filament and the plate. If we put a slightly negative potential upon this grid, it will repel these electrons somewhat, causing fewer to go to the plate, hence there will be less plate current. If the gride is made sufficiently negative the plate current can be stopped entirely. Therefore it is easy to see that if we had a pulsating potential upon the grid, the plate current will pulsate in synchronism with it. This is another factor that we shall measure.

If we increase the temperature of the filament, more electrons will be emitted, hence the plate current will increase. This is the third factor that we propose to measure.

For the tube that you wish to test, find

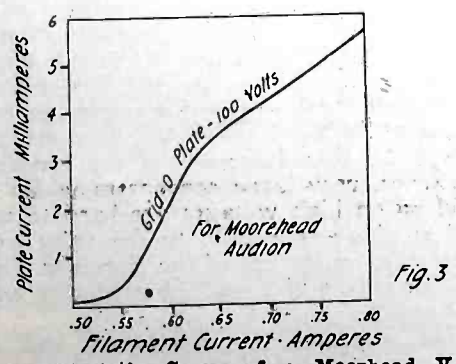


Fig. 3

Characteristic Curve of a Moorhead V.T.

out the maximum filament current and plate potential as given by the manufacturers as a guide and safety limit in your work, and do not exceed them much in your work. In the table below are given these limits for a number of the common tubes:

Tube	Fil-Amp.	Plate-Volts
Audiotron	.85 at 6 V	60
A-P Detector (Electron Relay)	.60 at 4 V	30
A-P Amplifier	.70 at 5 V	100
A-P- Transmitter	.80 at 6 V	500
Radiotron UV 200.....	1.1 at 5 V	30
Radiotron UV 201.....	1.1 at 5 V	100
Western Electric VT1.	1.1 at 4 V	40
Western Electric VT2.	1.36 at 7 V	400
General Electric VT18..	6.5 at 10 V	800
French Tube	.7 at 4 V	400
General Electric UV202	2.35 at 7.5V	350

Let us study these changes separately. Set up your apparatus according to Fig. 1.

A is a battery or motor generator of from 20 to 50 volts as a source of grid potential. P_1 and P_2 are "slide wire" potentiometers of about 2,000 to 3,000 ohms for the regulation of the grid and plate potentials, respectively. B is a battery or motor generator of about 100 to 600 volts

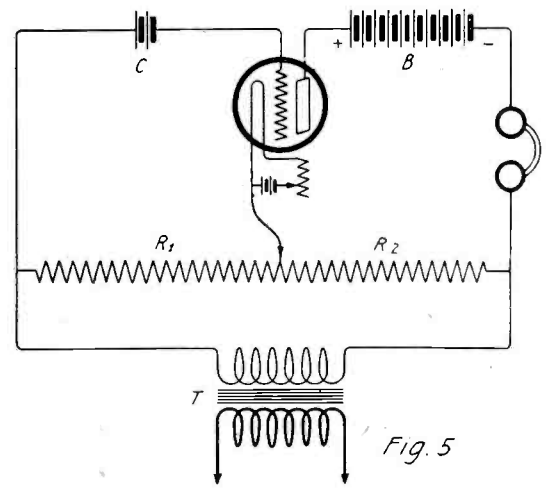


Fig. 5

This Hook-up of a V.T. is Used to Determine the Voltage Amplification Factor of the Tube.

for plate potential. V is d. c. voltmeter of a range of about 0 to 50 volts for measuring the grid potential. V_2 is d. c. voltmeter of about 0 to 600 volts for measuring the plate potential. M is a d. c. milliammeter of about 0 to 50 milliamperes. F is a d. c. ammeter of about 0 to 5 amperes to measure the filament current, and should preferably be read by steps of .05 amperes. K is any S.P.S.T. knife switch. R is the filament rheostat of about 0 to 10 ohms. C is the filament battery of six to eight volts. S is a reversing switch for the grid. It may be said here that reliable voltmeters and ammeters are necessary, if accurate work is to be expected.

The layout should be made neatly and systematically on the table with short, clean wiring and with the meters arranged for easy reading. This set-up will do for all the "curve measurements."

Suppose we wish to find the variation of the plate current with plate potential. The ammeter in the filament circuit is set by means of R to read the current recommended by the manufacturers for the particular tube you are using. The slider on P is set so as to make zero grid potential and S is closed and left alone. P_2 is now regulated so that the voltage on V_2 is changed by regular steps of from 5 to 50 volts, according to the tube used. The key K is closed after each change

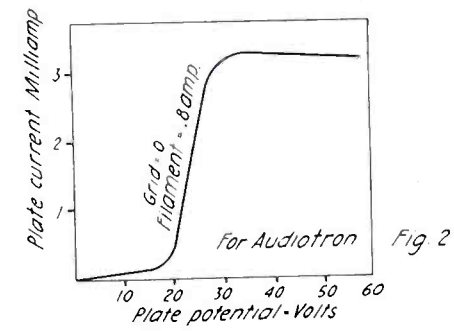


Fig. 2

Characteristic Curve of an Audiotron Tube.

for a long enough time to read the plate current in M. K is not kept closed, because of the danger of heating the plate too much and also to get rid of the effect of ionization in gas filled tubes. Plotting the plate potentials as absciassae and the plate current as ordinates will give us the curve of plate current vs. plate potential.

For an Audiotron this curve will be something like Fig. 2.

Next, we may leave the plate potential constant as recommended for the best operation of the tube and vary the filament current by steps of .05 amperes from maximum downward, reading the plate current as before. This gives us the curve of plate current vs. filament current, as in Fig. 3, which is for a Moorehead Audion A "hard" tube.

To get the effect of the grid potential, proceed as follows: Set the filament at the recommended operating value. Now set the grid at 0 and plot the plate current for the various plate potentials as in our first test. Next set the grid at -2 volts and repeat. Now reverse the grid to $+2$ volts by means of the switch S and repeat. This is continued for a range of 10 to 40 volts on the grid, depending somewhat upon the tube you are using. Plotting these results will give the set of curves similar to Fig. 4, which is for a Moorehead Audion A.

AMPLIFICATION FACTOR

The voltage amplification factor is the ratio of the plate and grid variation which will produce an identical variation of the plate current. If K be this factor V_p the plate potential, V_g the grid potential, then

$$V_p \text{ change} = K V_g \text{ change},$$

and

$$K = \frac{V_p \text{ change}}{V_g \text{ change}}$$

This would mean that it would take a change in the plate potential K times as large to cause the same variation in the plate current as a given grid potential.

(*Continued on page 265*)

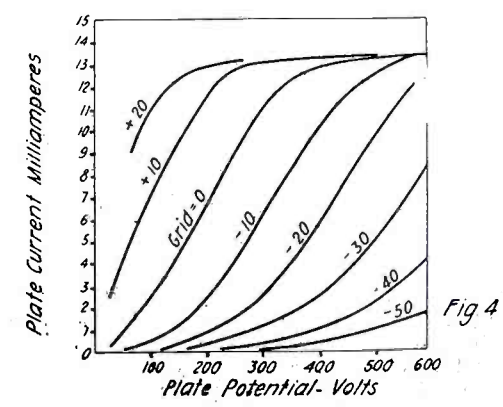


Fig 4

This Curve Shows the Voltage Amplification Factor of a Moodhead Tube.

Rectifying A. C. for Vacuum Tubes

By L. R. FELDER

IT is well known that for Radio telephone work the plate voltage applied to vacuum tubes must be constant voltage. It is desirable and preferable, if possible, that D. C. also be used for telegraphy, although it has been pointed out by several people that for telegraphy A. C. voltage may advantageously be employed. However, in telephony, straight D. C. is necessary for best results. With receiving tubes this D. C. is obtained by the use of batteries. In the case of transmitters this is not practicable as the voltage and power required are much higher than those for receiving tubes and the batteries which are used cannot supply these.

Direct current generators developing the required voltage and power are therefore used. Whether this is the most feasible and practicable solution from the amateur's point of view depends upon several considerations such as: (1) The apparatus the amateur has available; (2) the expense involved in rigging up a D. C. generator outfit as compared with other methods of obtaining D. C.; (3) the source and kind of power available in his house.

If the amateur has a D. C. generator of the necessary voltage and power, with a ready means of driving it, then he is very well off indeed and has nothing to worry about. But for the amateurs who have not

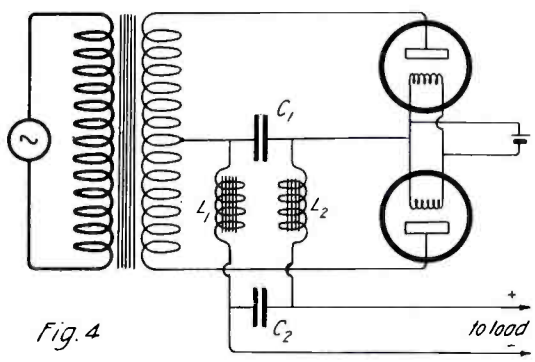


Fig. 4

In This Diagram are Shown the Choke Coils and Condensers Used to Smooth Out the Slight Variations of Voltage of the Rectified Current.

this apparatus—and they are legion—the problem must be carefully considered. The cost of a D. C. generator outfit is very high, and it can safely be said that it is much higher than an outfit for rectifying A. C. The kind of power available in most districts is A. C. and where this is available and the amateur has no D. C. generator the best solution to the problem of obtaining D. C. is to rectify the A. C. which is at hand. This solution will be found satisfactory both from an electrical and economical point of view. If the power supply is D. C. this cannot be done, of course.

The use of rectified alternating currents offers some advantages which are not had when a D. C. generator is used. For example:

1. The plate voltage can be made as high as the tube will stand, and thus greater output is secured, or it can be made as low as you please and thus transmit at low powers. That is, the use of a transformer means flexibility and permits of plate voltage variation over a wide range. D. C. generators usually operate at fixed voltages or within a very narrow range.

2. The use of A. C. on the filament is available. This permits of an equalization of plate current in both legs of the filament, thus preventing excess current in one filament leg and decrease of the life of the tube. This is not secured with D. C. operation.

Up to the present time rectification of

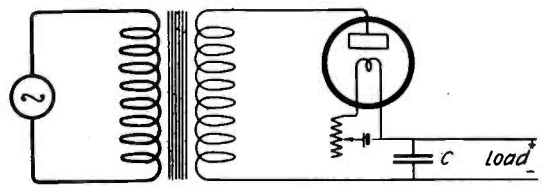


Fig. 1

When Only One Rectifier Tube is Used, Only One Half of the Cycles is Rectified Producing a Pulsating D.C.

A. C. for amateurs presented some difficulties due to inexpensive rectifiers not being available for amateur purposes. However, this is no longer the case.

A complete understanding of the physical actions taking place in the rectifier tubes and their associated circuits, together with a knowledge of the principles involved in choosing rectifier circuit, will be of great assistance to the experimenter and will enable him with very little trouble to design his own circuits.

Fig. 1 shows the simplest form of tube rectifying circuit employing but one tube. Fig. 2 shows the two-tube rectifier. The one-tube rectifier of course rectifies but one-half of the wave, whereas the two-tube circuit rectifies both halves. Although the latter circuit requires a second tube, this increased expense is warranted by the increased efficiency and satisfaction thus obtained. The following discussion will, therefore, consider the two-tube rectifier.

Consider the circuit in Fig. 2, and assume that the alternating voltage between the terminals of the transformer secondary is represented by Fig. 2a. During the upper half of the wave, point A of the transformeer is positive and current therefore flows through rectifier valve 1 into condenser C at terminal *a*. Thus terminal *a* of the condenser C is positive and a D. C. flows from C. During the lower half of the wave the positive potential is now at terminal B of the transformer and current therefore flows now through rectifier valve 2 into condenser C at terminal *a*. Thus terminal *a* of condenser C is again positive and the D. C. is supplied again by the condenser. In this way a continuous supply of D. C. is available at the condenser C.

No matter what the direction of the A. C. voltage, it is evident from the above that the valves permit current to flow into the capacity C in only one direction and thus enables a continuous current to be delivered. As long as the transformer voltage is higher than the condenser voltage, there will be an excess of voltage on the plates of the rectifiers and current will flow through the valves into the condenser. But even if the

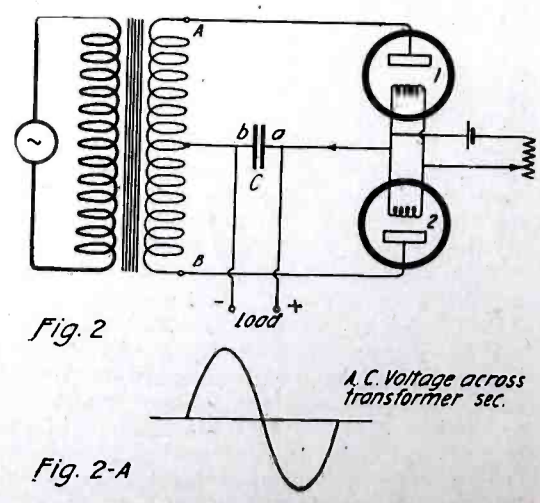


Fig. 2

Fig. 2-A

This is the Standard Hook-up for Rectifying A.C., Through Kenotron Tubes, for C.W. or Radiophone Work.

condenser voltage should become higher than the transformer voltage (which it never does, by the way) there would not be a reversal of the flow of current, as the valves conduct in but one direction, thus assuring direct current.

The capacity C behaves in the fashion of a storage tank which stores electrical energy during the period in which the transformer supplies it, and then delivers this energy in the form of direct current throughout the whole period of operation. Thus the larger the condenser the less would be the drop in the terminal voltage of the condenser as it delivers this energy, and consequently the smaller would be the fluctuation in the rectified D. C. voltage which is what is desired. This will be more evident from the explanation of Fig. 3. The sinusoidal full-line curve represents the terminal voltage of the transformer secondary. The dashed curve represents the voltage across the condenser terminals, which, it is seen, is direct voltage. At point 1 the condenser is fully charged to the maximum voltage of the transformer. That is, current flows from transformer through recti-

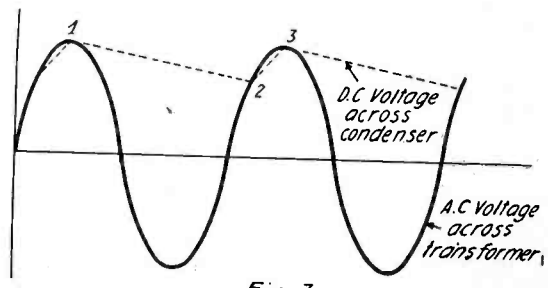


Fig. 3

The Sinusoidal Line Represents the Terminal Voltage of the Transformer Secondary. The Dashed Curve Represents the Voltage Across the Condenser.

fier valves into the condenser until the condenser is fully charged to maximum. This condenser voltage, therefore, bucks the transformer voltage and since they are equal, there is no longer any current flow. The condenser furthermore does not receive any more current for the maximum portion of the cycle up to point 2. However, it is delivering a direct current to its load and consequently its terminal voltage is steadily falling as seen from the slope of the dashed line. The larger this condenser C, the more electrical energy it can store and therefore the smaller will be the drop in condenser voltage. When the condenser voltage reaches the value at point 2, the transformer voltage has also reached that value and thereafter for the remainder of the cycle the transformer voltage is higher than the condenser voltage. Thus there will again be a flow of current into the condenser, charging it once more until its voltage reaches the maximum represented by point 3. Then the same actions take place for the rest of the cycle as before.

From the diagram and explanation it is evident that the condenser receives energy during a fraction of the alternating current cycle and delivers it the maximum portion of the cycle. The larger the condenser the more horizontal will be the condenser curve 123, that is. the less will be the fluctuation in the D. C. voltage across the condenser. However, very large condensers which will hold up on high voltages are hard to make and so there is a limit to the value of C. However, by the use of the circuit in Fig. 4, smaller values of C may be used with excellent results.

The effect of the inductances and con-

(*Continued on page 240*)

"A" and "B" Batteries on 110 Volts A. C.

By JERROLD SWANK

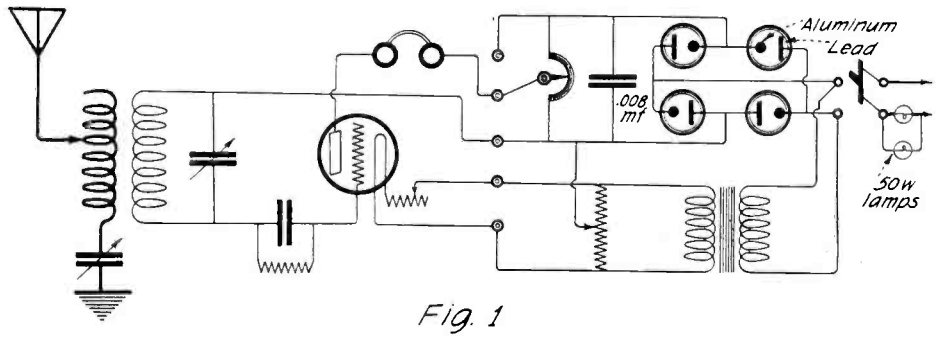


Fig. 1

On the left Fig. 1 shows the connection of the rectifier used in conjunction with a standard receiving circuit. While on the right the sketches are of the control panel and one rectifier unit.

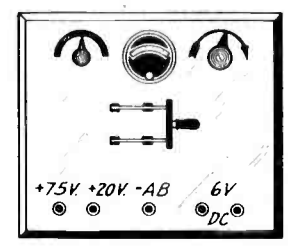


Fig. 3

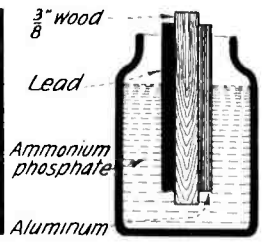


Fig. 2

AT last you can cut the high cost of operating V.T's. This combination H.V. and L.V. cabinet supplies both plate and filament current. It is very easy to make and should prove worth while. The six-volt filament current is supplied by a small step-down transformer, see page 447 of the January RADIO NEWS.

The "B" battery is supplied by an electrolytic rectifier from 110 volts A. C. Not much explanation is necessary here, as the drawings explain it very well. The rectifier consists of four pint Mason jars, each containing a sheet of lead and a sheet of aluminum separated by a 3/8" piece of hard wood. They are immersed in a saturated solution of ammonium phosphate. The connection is shown in the wiring diagram. This arrangement rectifies both valves of the cycle and with the .008 M.F. condenser, gives a steady D. C. of about 75 or 80 volts, which is regulated by the potentiometer. This could be used for the plate of a short distance radiofone using the entire 75 or 80 volts. The voltmeter, while not absolutely necessary, is advisable to adjust the plate voltage for receiving, and should read up to at least 80 volts D. C. The stepdown transformer should, of course, have a secondary voltage of six volts. Fig. 3 shows how this may be used for a detector and two-step amplifier, using 22½ volts on the plate of the detector and 75 to 80 volts on the plate of the amplifier tubes.

The operation is as follows: The cabinet is connected to the receiving set as shown and the 110 volt switch is thrown in. The *regular* rheostat is then used to adjust the filament temperature, after which the extra rheostat is adjusted until the A. C. hum is eliminated. The "B" battery potential is adjusted by the potentiometer on the rectifier cabinet. The extra rheostat must be of about 25 ohms. This device eliminates the necessity for both "A" and "B" batteries, is much cheaper both in first cost and operating expense, and furnishes a plate potential up to about 80 volts, which should be valuable in a combination radiofone and receiving set, or in either one singly. The writer will be glad to answer any inquiries in regard to the construction or operation of this outfit.

Throw That "B" Battery Away

By CHARLES L. WHITNEY

THE following will describe a system I have worked out for doing away with a special "B" battery in operating an audion, or V.T.

No high voltages are used, and the danger of burning out the phones or the primary of the amplifying transformer is reduced to a minimum, besides providing a more compact arrangement for portable apparatus using an audion.

All that is necessary is a six-volt battery to run the filament.

The first hook-up is shown in Fig. 1. In this case a variation from zero to six volts is provided in the plate circuit by using the potentiometer connected across the "A" battery.

Fig. 2 shows another arrangement which provides a fixed voltage for the plate, this being whatever voltage the "A" battery happens to be. No variation is allowed in this circuit.

In Fig. 3 the voltage for the plate is taken from the drop across the filament terminals and is variable by means of a potentiometer, while in Fig. 4, the voltage is taken in the same manner, except that there is no variation.

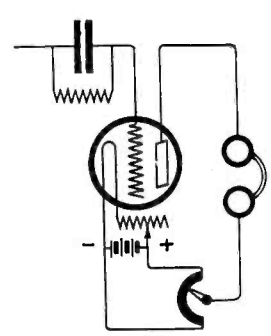


Fig. 1

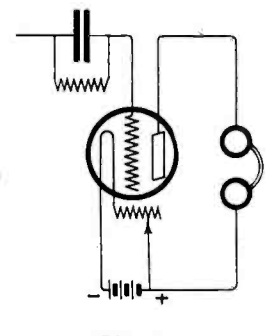


Fig. 2

By Using the Drop of Voltage of the A Battery a V.T. May Function Without Other Source of Plate Voltage.

In experiments, which were carried out for a period of over a year, oscillations were maintained on 600 meters in a circuit shown in Fig. 5, with as low as three volts on the plate, while with another circuit, Fig. 6, on 12,600 meters oscillations were maintained with a voltage as low as 2 to 2.5.

The signal strength on both wave-lengths was slightly reduced when using this reduced voltage, but when using the full six volts, Fig. 2, no reduction in signal strength was experienced, comparing with the usual arrangement where 20 to 60 volts is provided for the plate. POZ, LY, YN, MUU, IDO and the rest of the high-wave fellows came in just the same strength, while spark and CW on short waves was the same. Even down as low as 200 meters amateurs were heard up to approximately 1,800 miles, but no regular tests were held on this wave.

The aerial used was 100' long, four wires 2½' between wires, with an effective height of approximately 50'.

In using this arrangement some tubes were found to work better than others just the same as when using 20 to 60 volt plate arrangement, and even a transmitting tube which was built for 350 to 1,000 volts plate, was used with excellent results.

Now these circuits could be used with a 110-volt D.C. supply (or other high voltage) using an audion which was built for such voltage.

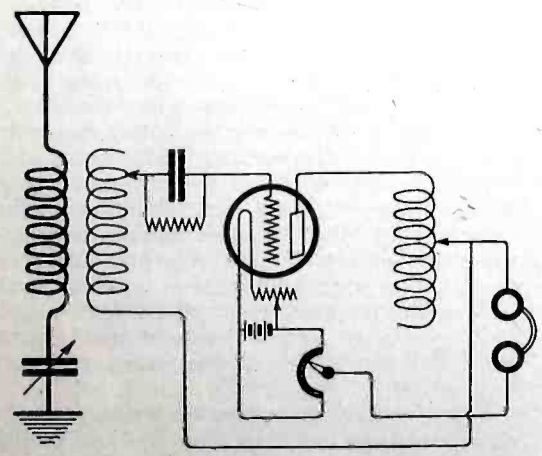


Fig. 5

A Regenerative Circuit in Which No B Battery Is Used.

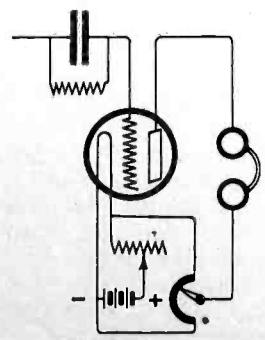


Fig. 3

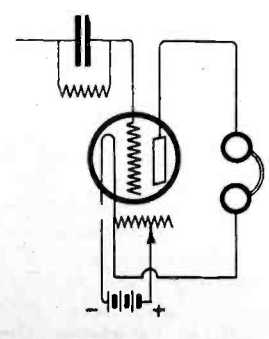


Fig. 4

Two Other Methods of Using the Drops of Voltage of the A Battery.

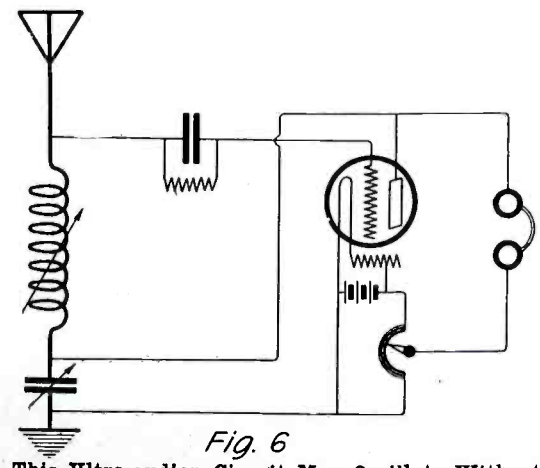


Fig. 6

This Ultra-audion Circuit May Oscillate Without High Plate Voltage.

Radio Digest

RADIO MEDICAL SERVICE.

Through a typographical error, the call letters of the Seamen's Church Institute of New York station were given as KDKE in the July issue of RADIO NEWS.

The correct call is KDKF and in case medical advice is needed by a ship it will be furnished free upon calling this station which is erected on the Institute building, 25 South Street, New York City.

FREE INSTRUCTION IN WIRELESS IS OFFERED.

Announcement is made by the officials of the National Radio Corporation, Inc., Atlanta, Ga., that they are offering a free course in Wireless Telegraphy and operating to those who desire to enter their service or that of the U. S. Merchant Marine. The course may be taken at one of their schools or by correspondence. The salaries range from $85 per month upward.

The corporation is forming a chain of commercial stations and schools throughout the United States in addition to their manufacturing all kinds of commercial and amateur Radio equipment. This is the first company of its kind to spring up in any Southern State. Every effort is being made to unite amateur and commercial stations according a statement of Mr. A. E. Autrey, president of the company, who for several years trained Radio Operators in Atlanta for service in the Merchant Marine and was for some time connected with the Government there.

Although this offer is limited, considerable time and attention will be given to all applicants.

WIRELESS TELEPHONY EXPERIMENTS IN FRANCE.

Some experiments with wireless telephonic apparatus have recently been made between Sainte-Assise (near Melun) and Beauvais. Transmission and reception were effected by means of valve sets manufactured by the Société Française Radioélectrique using a transmitting energy of not more than five watts. The distance between the two stations is 74 miles.—(*Abstracted from the Radio Review.*)

RADIO TELEPHONES TO BE PUT ON GERMAN EXPRESS TRAINS.

Wireless telephone instruments will be installed on a number of important German express trains, and receiving instruments will be placed in hotels and embassies, according to an announcement made recently.

Experiments conducted in a moving freight car have shown that the wireless system works well, the men engaged in the testing of the instruments being able to hold conversations with friends in Berlin. The tests were made under the observation of engineers, military attachés and the diplomatic representatives of the United States and Sweden.

It is said that in three weeks it will be possible for travelers on express trains to reserve hotel accommodations by Radio.

Radio Articles Appearing in the September Issue of Science and Invention

Radio Reports Dempsey-Carpentier Prize Fight With Special Feature Illustrations and Story. By Arthur H. Lynch.

British Use Radiophone in Airplane Service.

Resonance Wave Coil Antennae. By Major J. O. Mauborgne and Capt. Guy Hill, S. C., U. S. Army. Part two of specially written article, complete with diagrams and photos—the first authentic article on the use of a concentrated inductance as an antenna for both transmitting and receiving.

A Radiophone Set That Works. By Robert E. Lacault. A clever radiophone and C. W. Set which can be built easily by any radio amateur.

The Transformation of Professor Schmitz. By Geo. R. Wells. A gripping radio-electric tale.

Oracle—Question and Answer Column.

A NEW DIRECTION FINDER.

It is now well known that an ordinary direction finder of the single or crossed-coil type may give very erratic results at night and more especially at sunrise and sunset, the direction of the transmitting station appearing to wander about, the deviation in some cases reaching 90° from the true bearing. In the paper published in the February issue of the *Radio Review* Mr. T. L. Eckersley showed that one of the main causes of this aberration was the presence of a wave with a horizontal electric field coming down at an angle on to the receiver after reflection from the upper atmosphere. Such effects would, therefore, be expected when receiving from an inverted "L" aerial, broadside on to the receiving station, since the horizontal portion would radiate waves polarized in the direction to produce these disturbing effects. The system described by Messrs. Wright and Smith, of the Marconi Co., consists of the well-known combination of the Bellini-Tosi aerial and an open aerial, adjusted to give a heart-shaped diagram with a single zero. The plain aerial effect which was regarded as an evil by the users of the frame direction finder is here made to serve a useful purpose. The diagrams which accompany the paper show how the polar curve would be distorted by the night effect on certain assumptions. These diagrams indicate, however, that a receiver of this type may give very inaccurate results, since, although the position of the minimum remains unchanged, the shape of the curve on either side of it may be very different. If the signals are so strong that the minimum is sharply defined there should be no difficulty; this agrees with the results given in the paper, the signals from Lyons and Clifden being relatively strong. With weak signals, however, where one would find a wider silence range the correct zero could not be determined so accurately. The fact that experimental results agree with those predicted from these diagrams serves as a further confirmation of Eckersley's theory of the cause of the night effects.—(*Abstracted from the Radio Review.*)

LONG DISTANCE WIRELESS TRANSMISSION.

A discussion on this subject took place at a meeting of the Wireless Section of the Institute of Electrical Engineers on May 25. The discussion was opened by Mr. C. F. Elwell, who reviewed the theoretical and experimental work on the subject and maintained that there was no reliable data for the determination of the power required for distances and wave-lengths beyond those covered by the experiments of Austin. He thought that amateurs could assist in collecting data. Admiral Sir Henry Jackson regarded the measurements as too difficult for amateurs, but emphasized the necessity for such measurements being made. Messrs. Round, Eckersley and Lunnon described the work being done by the Marconi Company at Chelmsford, using a carefully calibrated aerial 16 meters high and determining by a substitution method the E.M.F. induced in it by some of the large American transmitting stations. Although varying considerably, the average E.M.F. was 1.8 times that given by the Austin-Cohen formula. The measured E.M.F. agreed fairly well with the field strength of 0.37 microvolts per cm. which we assumed as the basis for the tables of necessary transmitting power.

Captain Lee described somewhat similar measurements made by the Radio Communication Company using a four-foot frame with 120 turns: preliminary tests have given

(*Continued on page 259*)

STATIONS SENDING MARKET AND WEATHER REPORTS.

Name of Station	Call Letters	Wave-Lengths Call	Wave-Lengths Work	Broadcasting Hours
Washington, D. C....	WWX	3800	3650	7:30 and 8:00 P. M.
Hazelhurst, N. Y.....	WWU	3800	3400	
Bellefonte, Pa.	WWQ	3800	3450	
Cincinnati, O.	KDQC	3800	3600	9:00 and 11:00 A. M., 12:00 noon, 7:30 and 8:00 P. M.
St. Louis, Mo.....	KDEL	3800	3750	9:15, 11:30 A. M., 12:30, 3:30, 8:15 and 8:45 P. M.
Omaha, Nebr.	KDEF	2900	4167	9:00, 11:00 A. M., 12:00 noon, 2:00, 3:00, 5:30, 8:00 and 8:30 P. M.
North Platte, Nebr...	KDHM	2900	3400	9:30 A. M., 12:00 noon, 6:00 and 9:00 P. M.
Rock Springs, Wyo..	KEHN	2900	3200	9:00 A. M., 12:00 noon, 6:30, 8:00 and 8:30 P. M.
Cheyenne, Wyo.	KDEG	2900	3800	
Salt Lake City, Utah..	KDEH	2200	3600	
Elko, Nevada	KDEJ	2200	3400	8:30 A. M., 12:00 noon, 4:00 P. M.
Reno, Nevada	KDEK	2200	2800	9:00 A. M. and 1:00 P. M.

Stations are also now being installed at Bryan, O., and Iowa City, Iowa.

The above stations are all 2-KW Federal arc transmitters and are not only used for furnishing communications to the Air Mail Service, but they are also utilized in broadcasting agricultural market reports, and weather reports. Broadcasts are now being transmitted from the stations as shown above at the hours listed.

It is proposed to install radio telephone transmitters in all stations of the Air Mail Radio Service. The chief function of these telephone transmitters will be to maintain direct communication with the Air Mail planes in flight, but in addition the broadcasting now being handled by the present continuous wave transmitters will be transmitted by radio telephone.

Future plans, of course, depend on a number of factors so that no definite statement can be made at present.

Who's Who in Radio

DR. NIKOLA TESLA

No. 8

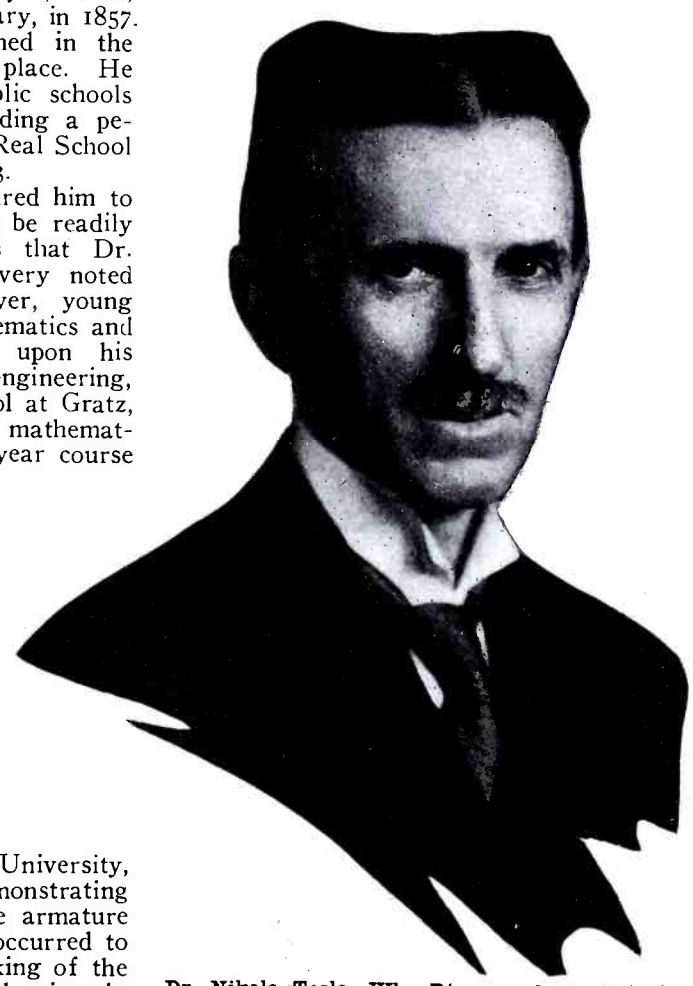
PERHAPS the ever-broadening field of invention has never known a genius more successful in developing far-reaching and original inventions than Dr. Nikola Tesla, whose name is known in every corner of the globe for his scientific achievements.

Dr. Tesla was born in Smiljan, Lika, border country of Austria-Hungary, in 1857. His early education was obtained in the elementary school of his native place. He continued his studies in the public schools in Gospic, Lika, and after spending a period of four years in the Lower Real School in Croatia, he graduated in 1873.

His parents had originally desired him to study for the clergy, which can be readily understood when one considers that Dr. Tesla's father was himself a very noted clergyman and orator. However, young Tesla had his mind set on mathematics and physics, and after prevailing upon his parents for permission to study engineering, he entered the Polytechnic School at Gratz, where for four years he studied mathematics, after which followed a two-year course in philosophic studies at the University of Prague, Bohemia. His practical career started in 1881 in Budapest, Hungary, where he made his first electrical invention, a telephone repeater, and conceived the idea of the rotating magnetic field, which later made him world famous. It may not be amiss to devote a few moments here to the manner in which this savant approached the idea of the rotating field and inductance motor.

One day, while attending the University, one of the Professors was demonstrating an experiment with the Gramme armature type of dynamo, when the idea occurred to the young physicist that the sparking of the commutator, which he alone had minutely observed, could be eliminated. The professor immediately denied that this was possible, but with a steady mind and self-conviction, young Tesla determined to work out his ideas, with the result that the modern induction motor was developed, which operates solely from alternating current and requires no commutator of any kind, thus overcoming the nuisance of sparking, inherent in former type direct current machines.

Realizing the value of his invention, he left for France in an effort to interest someone in his device, but his efforts proved fruitless. At the time, he was employed by a prominent European engineering concern, but hearing of the rapid growth of the electrical industry in America, he promptly decided to come to this country, which he did in 1884, and since then has been a naturalized citizen of the United States. To this country he brought with him the various models of the first induction motors, which were eventually shown to George Westinghouse, the great American inventor, and it was in the Westinghouse shops that the induction motor was perfected by Nikola Tesla. Numerous patents were taken out on this phenomenal prime-mover, all of which are under Dr. Tesla's name, and he was, therefore, the first person, beyond the shadow of a doubt, to introduce the rotating field principle, in perfecting the induction motor, which is today universally used.



Dr. Nikola Tesla, Who Discovered the Principle of Rotating Fields and Has Invented Numerous Radio Instruments.

Large sums of money were expended by Dr. Tesla to protect his patents on this prime-mover, and he was at the time not permitted to express himself in print or give the history of his invention; thus, many erroneous impressions were entertained regarding his inventions. He was far ahead of Ferraris, Schallenberger and many other early, able investigators.

Later, another type of machine was brought out by him in connection with his work in electric power transmission. This one had a field energized by currents of different phase relation (i. e., while one current was at zero amplitude, the other would be at maximum, etc.), producing a rotating field in which conductors were employed, and in this way the high frequency current was obtained. This type of machine was subsequently developed by Goldschmidt and is now known under that name, although Tesla described this principle in a patent dated 1889.

His next work, which attracted universal attention, was the production of high-frequency currents at high potentials. One of the first high tension apparatus built by Dr. Tesla consists of a step-up transformer, and a specially built kick-coil, which boosted the secondary transformer voltage to an enormous value. The terminals of this coil are connected to the large spark gap, which, when the apparatus was excited, was filled with a spark two feet long. With this device, Dr. Tesla was able to obtain a potential of one million volts, which is quite extraordinary with such a small apparatus.

In 1900 Dr. Tesla obtained his two fundamental patents on the transmission of true wireless energy covering both methods and apparatus and involving the use of four tuned circuits. He also obtained a number of other patents at the same time, describing many other improvements. Among these may be mentioned his application of refrigeration and the oscillatory systems with which he obtained remarkable results in his well-equipped laboratory in New York City.

In 1901 and 1902 several patents were granted to him describing a number of improvements, among which two have assumed great importance in the Radio art: one of these is known under the name of "tone wheel" and the other the "tikker." Others are making claim to these inventions, but Tesla was far ahead of any of

(*Continued on page* 258)

Should the Government Examinations Be More Severe?

By CHARLES A. REBERGER*

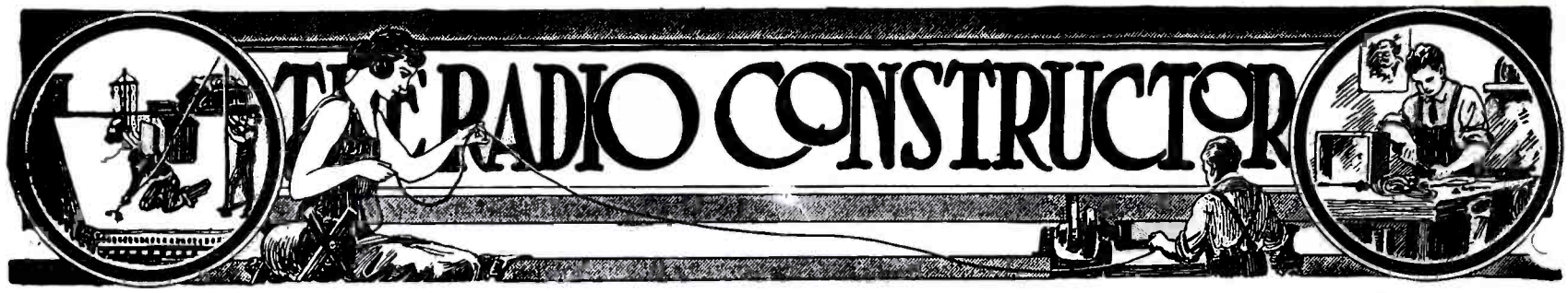
HAVE you been fortunate enough to sail the briny deep as a commercial radio operator and had the misfortune of being subjected to an attack of "*mal de mer?*" Let us presume you have. I am now assured and you will openly confess that, many a time as you sat in the cosy little radio shack, listening to the numerous ships working, you have more than once been compelled to slam the phones down on the table and murmur to yourself, disgustedly, "Gosh! What an awful 'ham' that is on," or perhaps, "How did that guy ever get away with a license?" or then again, some similar exclamation suitable for describing the "awful" operators on various vessels you happened to hear.

Shameful words to utter about our fellow "bugs," but true; this is the case with a number of the sea-going operators of today and most of the boys will themselves admit, there would be no cause for such words being voiced had the Government exams. been more severe, thus insuring the type of radio men they would be. Had they been forced to pass a special test in the art of transmitting and the proper method of forwarding the various kinds of traffic to the coast stations, then, as they sallied forth to take up the duties of ship's wireless men, they could rest assured that the qualities of an efficient commercial operator were fulfilled to almost the highest degree. But this is not the only thing which makes a good operator, as will be revealed in paragraphs following.

Deep in our hearts we know that the questions which were asked in the examinations of previous years, were only sufficient to allow us to just barely "get away with it" on board ship. Today the examinations are a little harder, but the questions asked by the inspector are questions which will be of very little benefit to us when a break-down occurs while at sea. When we first boarded our designated ships, little did we know about the forwarding of an "O. L." or the charging of such. Neither did we know (nor does the new operator of today) whether or not there is a charge for obtaining bearings from American or foreign radio compass stations and if so, the way of entering these charges on the abstract sheet. The making out of these abstract sheets was more than a puzzle and the charging of radiograms a mys-

(*Continued on page* 254)

**Chief operator S.S. Atlantic Sun.*



Practical V. T. Detector and Two-Stage Amplifier

By Frederick J. Rumford, A. M. I. E. E.

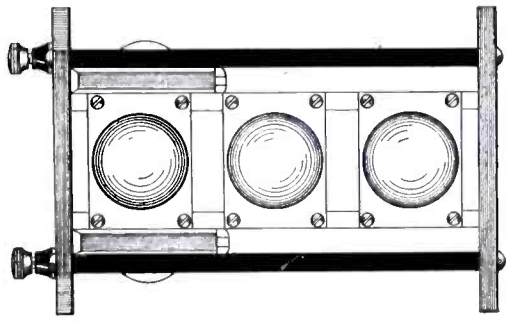


Fig. 3

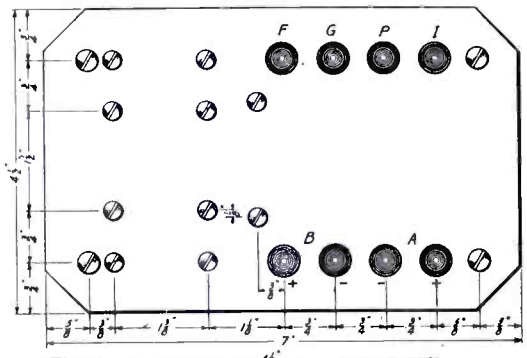


Fig. 4

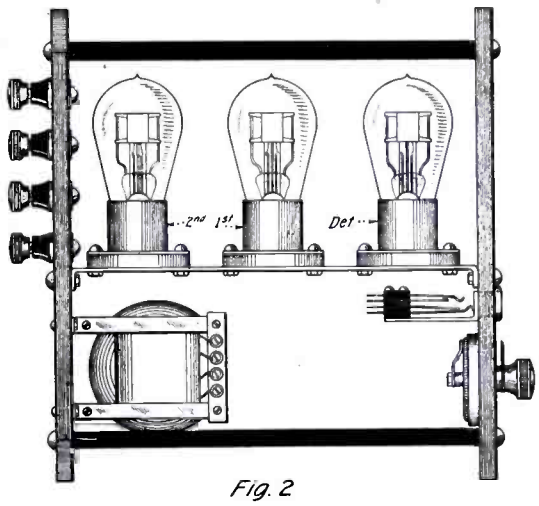


Fig. 2

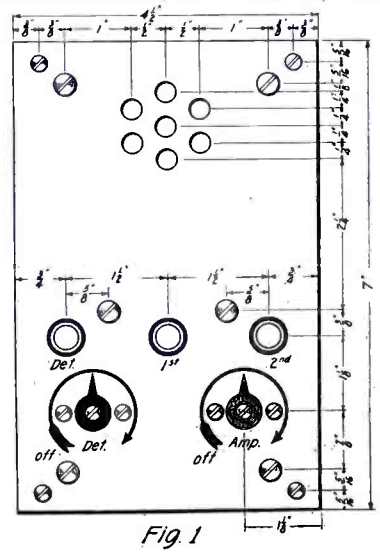


Fig. 1

In This Drawing Dimensions Are Given for the Construction of the Amplifier Which, as May be Seen, is of New Design

THE accompanying drawings show to good advantage my own private detector and two-stage amplifier, which have been in use for over a year; from this set I have obtained the very best results. I designed it for the purpose of combining efficiency, simplicity and compactness. It requires but very little work to build, and its actual cost is less than $50. This price includes the tubes, and as every amateur knows, in the average detector two-stage amplifier sets, the tubes are an extra expense.

This outfit is so compact that I have often carried it from city to city in my travels. Those who build this set can mount it in a cabinet, if they so desire. It can be easily duplicated and requires but a few tools in the making, such as a screw driver, drill, etc. This outfit is similar to the one the Westinghouse Co. is at the present time offering to the public, but the outfit described below was designed by me personally a year or so ago, and this outfit has been made up also by several prominent radio men, and tried and tested for its true worth and proved to be successful in every way. It is composed of all standard parts which can be readily purchased in any radio supply store, but, no doubt, most amateurs have the necessary parts laying around their labs. It will take only very little time to assemble this outfit when ready. Below is the list of necessary items, with their respective costs:

2	Formica panels, 7" x 4½" x ¼". @ $1.50	$3.00
2	Rheostats for back mounting @ $2.00	4.00
2	Clapp-Eastham Amplifying Transformers @ $4.00	8.00
1	V. T. Detector tube @ $7.00	7.00
2	V. T. Amplifier tubes @ $7.00	14.00
3	Murdock V. T. sockets @ $1.00	3.00
3	Telephone jacks @ $.85	2.55
3	Grid leaks and condensers 0.0005 mfd., 1 megohm @ $.50	1.50
1	Telephone plug @ $.75	.75
25"	of round ¼" brass stock or rod	.30
15"	of flat brass stock ¼" wide ⅛" thick	.25
5'	Bare copper wire B. & S. No. 8	.30
	Screws and bolts	.50
8	Large size binding posts @ $.20	1.60
	Actual cost	$46.75

With the accompanying data are four drawings as follows:

Fig. 1 shows the front panel with the different apparatus mounted along with the correct dimensions.

Fig. 2, side view and also the interior, showing the positions of the tube, transformers, rheostats and jacks.

Fig. 3 represents the interior looking down from the top.

Fig. 4 represents the rear panel, showing the different dimensions for the placing of the binding posts and positions of the different attaching screws.

Fig. 5 shows the general hook-up with proper connections.

We will now pass on to the actual making of this set. The two 7" x 4½" x ¼" formica panels are given a dull grain finish with No. 0 sandpaper, and then rubbed with oil. After this is done, the usual marking off and drilling of holes is done as shown in Figs. 1 and 4. The rheostats and jacks are mounted on the front panel as shown, and the binding posts are next mounted on the rear panel, which panel will be cut out at the corners, see Fig. 4. This gives the panel a distinctive appearance and also provides for air in case the outfit is mounted within a cabinet.

The round ¼" brass rod is now cut into four 6" lengths, being drilled and tapped at each end to take ⅛" machine screws. If the outfit is not mounted in a cabinet, it would be advisable to have these rods nickel plated. For that matter, it would be a good idea to have all the metal parts that are exposed to view nickel plated, as this will set the outfit off to its best advantage.

The eight binding posts, of which four are on each side of the rear panel, are indicated by the engraving upon this panel as follows: On the right side: A is for the "A" battery, which in this particular instance is a 6 volt 60 amp. hour Eveready storage battery; B, for the "B" battery, which happens to consist of 20 No. 703 Eveready flashlight batteries wired in series multiple. The reason for this is that with three tubes functioning, the "B" battery will not stand up very long, and it also weakens the amplifying power of the outfit. There is a jumper wire which runs from the "B" battery negative to the "A" battery negative.

Now the posts on the left-hand side are as follows: No. 1 is for the tickler connection, P, plate, G, grid, and F, filament. As will be seen, there are but very few binding posts, not at all like the old amplifier sets, which had a large number of posts, and were very complicated and awkward to operate. All the tubes are of the same filament voltage and the plates are of the same "B" battery voltage.

We will pass to the making of the strips for the socket shelf. This is cut, drilled and tapped as per Figs. 2 and 3. The sockets are then placed upon the strips and held in place by means of screws and nuts; the

(*Continued on page 232*)

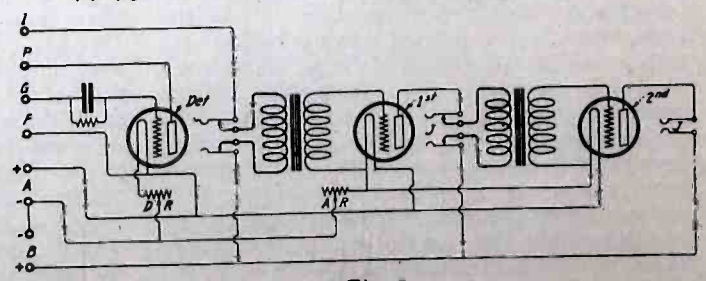
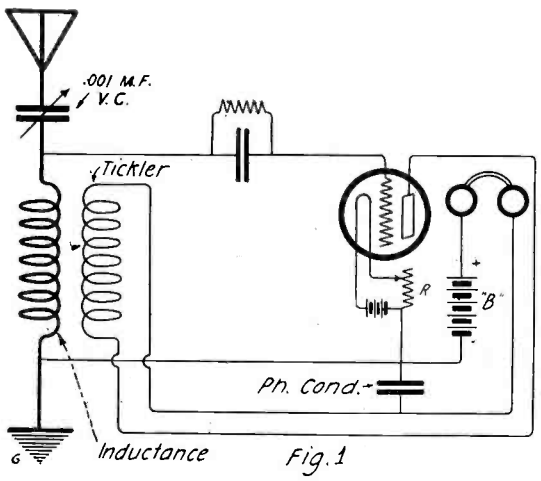


Fig. 5

Wiring Diagram of the Apparatus Described in this Article.

A Single Control Universal Range Receiver

By MORRIS LEVEY



General Hook-up of the Set.

THIS panel set consists of two separate sets, arranged so that either one can be used by throwing a four-pole double throw anti-capacity switch to right or left. The complete set is mounted on a panel measuring only 5" in width by 12" long, which makes it small and compact. The wave-length range of the short-wave part is from 170 to 800 meters with a .001 MFD variable in series with the antenna; and from 500 to 1,700 meters with the same condenser in shunt to the coil. The long-wave part has a range of from 1,800 to 14,000 meters with condenser in series, and from 4,000 to 25,000 with condenser in shunt The position of the condenser is controlled by a series parallel switch. The two photographs show a back and front view of the set.

A single coil tuning circuit is used, making use of direct coupling for primary and secondary circuits, while a tickler coil is used to produce oscillations for beat reception of undamped waves or for regenerative amplification. The excellence of this type of circuit is attested to by the fact that the Westinghouse Electric Co. recently put out a short-wave regenerative set using a circuit of this type; this circuit is also used in the new Grebe CR-5 and Universal receiving sets. While a circuit of this type is not as selective as a loosely coupled one, the ease and rapidity with which signals can be tuned in more than compensate for this defect, although the signal strength is about the same. With the exception of the coil taps, the variable condenser is the only variable element for wave-length control, it being only necessary to swing condenser from zero to maximum to receive anything within wave-length of tap used. Fig. 1 shows diagram used.

The following parts will be necessary, the total cost of which does not exceed $11:

One formica panel 5" x 12"; three indicating dials 3" in diameter; three large knobs; two switches with knobs about 1" in diameter, and two small switches with knobs about ½" in diameter; 24 switch-points; one 4-pole double throw anti-capacity switch; one .001 MFD variable condenser; one series-parallel switch for condenser; cardboard tubing 4" and 3½" in diameter; six 6/32 thread brass machine screws, and six 10/24 thread brass machine screws with nuts; one Radisco 1,200 and one Radisco 550 coil.

The panel should be drilled as shown in Fig. 2. After all holes are drilled, the panel should be rubbed with a fine emery cloth and oil to give it a grained finish.

The variable condenser should be mounted in the center of the panel. It is advisable to mount the condenser first, as this is always troublesome to line up correctly. No holes are shown in Fig. 2 for mounting the stationary plates of the condenser, as these holes will depend on the type of condenser used. I used a Murdock 43-plate condenser. Solder a flexible lead to rotating shaft to insure positive contact. Do not use a condenser having a greater diameter than 3½", or there will not be sufficient clearance for the other parts.

To construct the long wave part of the set, tap the 1,200 Radisco coil at six equal points and bring the taps out to the six switch-points in the lower right-hand corner of the panel. The coil can be fastened to the panel by a brass bracket passed through the hollow part of the coil. Use 6/32 flat headed brass screws for fastening bracket, also countersink the holes for the screws. Mount the coil one inch from the right-hand center hole, which is for mounting the large tickler.

To mount the 550 Radisco coil tickler so that its rotation can be controlled by a knob and dial on the front of the panel, it will

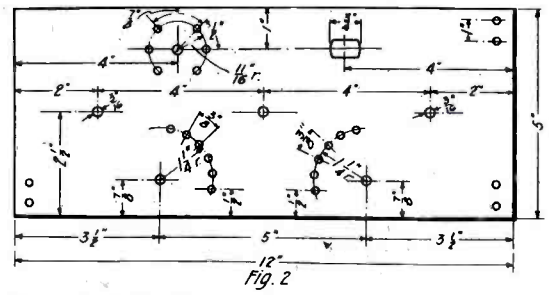


Fig. 2

Layout of the Panel With Necessary Dimensions for Drilling the Holes.

be necessary to construct a brass bracket having an offset appearance. It can be made as follows: Get a piece of fairly stiff brass ⅜" wide by 6" long. One inch from one end bend the piece at right angles. Clamp the 1" end in a vise and twist the long end until it is at right angles edgewise to the piece in the vise. The piece of brass will now resemble a tri-square. Where the long end is bent over the 1" end, bend the long end again at right angles as though a right angled bracket was being made. Drill a 3/16" hole in the center of the 1" end. Cut a wooden plug to fit the hollow part of the 550 coil. Drill two holes in the long end, 1½" and 2¾" from the bend. Fasten this bracket to the wooden plug. It will probably be necessary to move the tickler coil around the bracket until a position is found where the coil can be rotated without brushing the large 1,200 coil. Through the 3/16" hole pass a 1" length of 10/24 brass screw

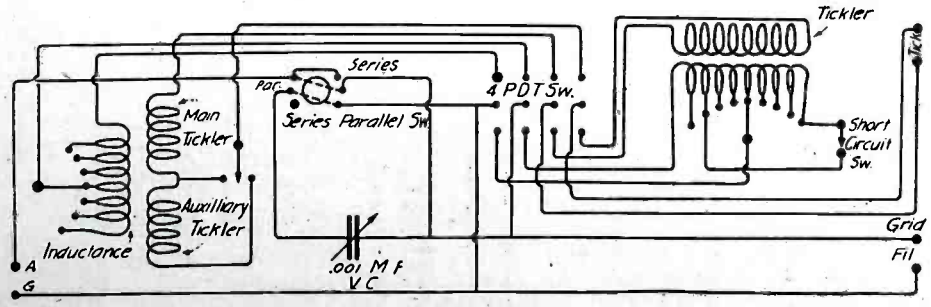
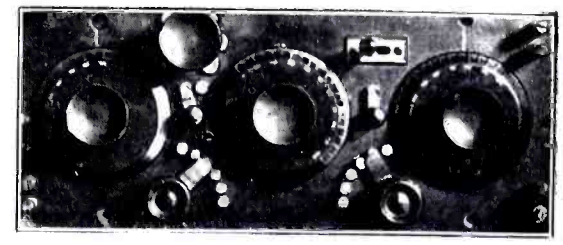
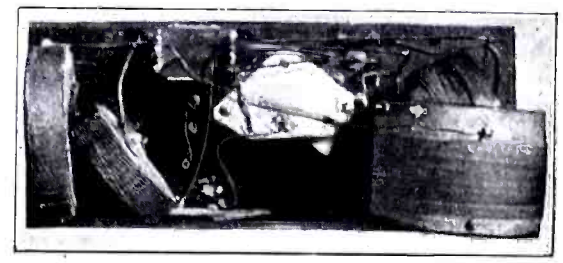


Fig. 3

Complete Wiring Diagram of the Combination Short and Long Wave Set.





Front and Inside View of the Short and Long Wave Regenerative Set.

and tighten with a nut. Pass the rest of the screw through the hole in the panel and tighten with a nut. Then clamp dial to nut with a large knob having a brass bushing threaded for 10/24 thread.

In order to receive waves from 1,800 to 3,000 meters satisfactorily, it will be necessary to short circuit all unused turns of the 1,200 coil from the 2nd to the 6th tap. This is done by the small one-point switch (between condenser and long-wave tickler). This switch lifts short when it is open, or closes short when switch is closed. This short does away with dead end losses to extent that allows NAA and similar stations to come in with greater intensity than on a Navy standard medium range receiver.

The short-wave portion of the set, which is on the left side of the panel, consists of a short-wave vario-coupler, with the exception that the rotating coil is used as a tickler, while stationary coil is used for conductively coupled primary and secondary. These coils may have the following dimensions: Wind 54 turns of No. 24 S. C. C. wire on a tube 4" in diameter by 3" long. Start winding 1" from top and take taps at every nine turns. Bring taps to switch-points on lower left side of panel. Give the coil a coat of shellac.

The tickler consists of 36 turns of No. 26 S. C. C. wire on 3½" tube about 1¼" wide. Leave a ¼" space in center. Two brass screws 10/24 thread, 1½" long are used for bearings. These shafts are passed through holes in the stationary tube about ½" from top. Solder the ends of coil to the heads of the screws. A flexible lead is soldered to each screw as it comes through the hole in the stationary coil. By using a 10/24 nut on the shaft on the back of the panel and soldering it, and by tightening the nut on the shaft on the face of the panel, the shaft will hold rigid with no end play.

In regards to the tickler, the constructor should consider this; if a larger winding than that given is constructed, it will be difficult to prevent the circuit from oscillating even with tickler at right angles on the smaller wave-lengths from 180 to 800 meters. But on the other hand, a larger tickler will produce oscillations on the longer waves from 600 to 1,700, whereas the small tickler will not do this even with a

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Construction of Choke Coil, Two-step Amplifier and Honeycomb Coil Receiver

By P. JESSUP, 2 A. U. G.

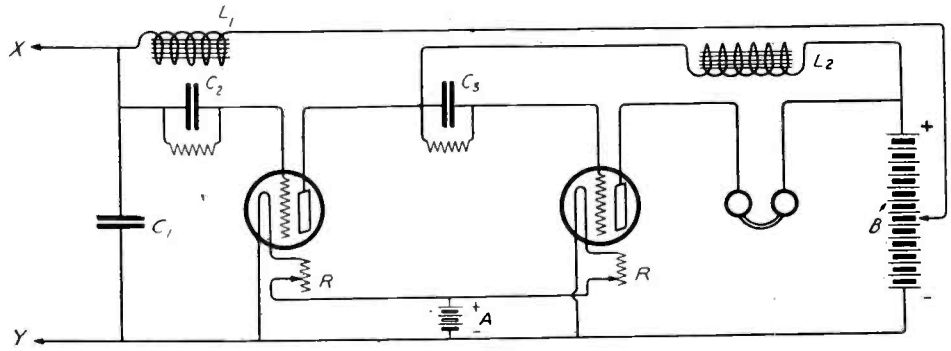

Fig. 2

On the left Fig. 2 shows the hook-up of a two-stage choke coil coupled amplifier, while on the right Fig. 3 shows the layout of the panel of the receiver.

SINCE my article on choke coils was published in April RADIO NEWS, I have received a number of letters asking for data on construction of a choke coil two-step.

AUDIO FREQUENCY CHOKE COIL TWO STEP

The articles necessary to build this amplifier are as follows:

Two Ford spark coils (Ford or otherwise).

Two rheostats (Paragon).

Two grid condensers (.0015 mfd. and .015 mfd.).

One stopping condenser (.0005 mfd.).

Two bulb sockets (Murdock).

Two amplifying bulbs (Moorehead).

Six binding posts.

A wood base 7" x 12".

Two homemade grid leaks.

Not counting the bulbs, the total cost is about $10, which is very reasonable. Old Ford coils may be obtained for $1.50. If the secondary is O. K., that is all that matters, since the primary is not used. If an inch spark coil is substituted for the second Ford coil, the signals will be a little louder.

In arranging these instruments, it is important that the grid circuit be as short as possible on the two bulbs. The success or failure of your set will be determined by the length of wire in the grid circuits. In building this amplifier, I took great care to get the leads as short as possible. Fig. 1 is a birdseye view of the amplifier. Notice the arrangement of the sockets and grid condensers. C2 is the grid condenser on the first amplifying tube. "S" is socket on the first amp-bulb. The lead from grid to grid condenser is about ½" long. C3 is the grid condenser on the second tube and S1 is the socket of the second tube. C1 is placed right between the two sockets and the two connections are each about ½" long.

L1 is the choke coil between the detector and first amplifying bulb. This is a Ford coil and takes up very little room. The secondary is the choke and the primary is not used. The connection from X on the choke to the grid condenser is also short. Short grid circuit leads give loud signals. The point X is connected to the tickler or variometer in the plate circuit of the detector.

L2 is the choke between the first and second steps. R and R are the two rheostats. If desired, a panel may be fastened to the base and the rheostats mounted on it. In the birdseye view (Fig. 1), I have shown the most important wiring. The length of the filament leads does not matter much.

C1 is a phone condenser used as a pass for the radio frequency currents. It is connected between the choke and negative filament. One very important thing is the matter of leads running close together. Capacity and inductance between leads cuts down on the signal. All leads should be as direct as possible and separated as much as possible. It may be necessary to move the chokes a little farther away from the bulbs

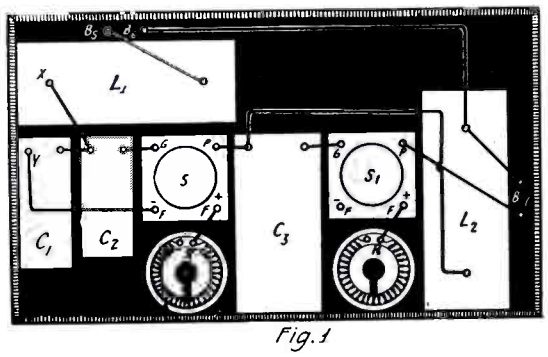

Fig. 1

General Arrangement of the Parts Inside the Cabinet.

because of squeals. There are no squeals if the leads are kept separated and the chokes are kept a couple of inches away from the bulbs. I purposely placed the chokes at right angles to each other to avoid squeals.

Fig. 2 shows the hook-up of this amplifier. The parts are lettered the same as in the diagram. The capacities that I gave for the condensers are only approximate. I find that ordinary phone condensers work O.K. as grid and stopping condensers. Different tubes may require different capacities though. In the hook-up, X goes to the tickler or plate variometer of the detector tube.

I use variable "B" batteries, and all connections are variable. Hence in the diagram (Fig. 1), B5 is the binding post which is connected to the "B" battery at the proper voltage for the detector tube and B6 is connected on "B" battery at proper voltage for amplifying tubes. B7 indicates the phone binding posts. My grid leaks are made of pencils and are about ¼" by 2". The easiest place to put them is across the grid condenser, but signals will be a little better if the grid leaks are placed between grid and negative filament.

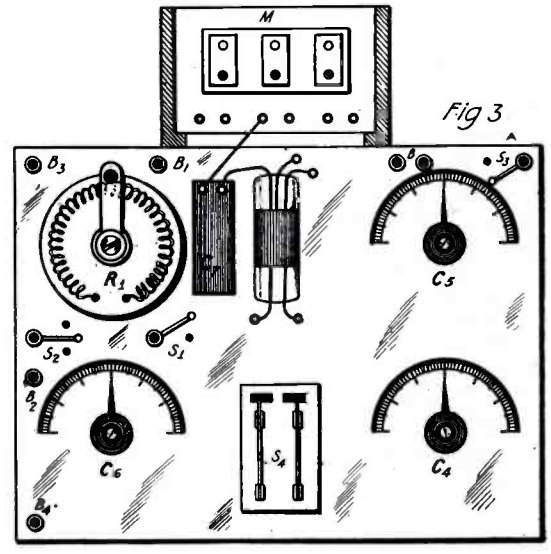

Fig 3

A two-step of this kind gives much better amplification than amplifying transformers and is much cheaper.

HONEYCOMB PANEL

I never believed in the panel type sets very much because I could get shorter leads and better efficiency with my set spread out over the table. Recently, however, I put my honeycomb mounting, condensers, bulb, etc., on a panel and got very good results. In designing this panel, efficiency came first. Appearance and looks came second. I arranged the apparatus so as to have the shortest possible leads, especially on the grid condenser. This is very important with a detector bulb. A few inches of wire too much, in the grid circuit, will cut down on your signals to a great extent. It may not look quite as good as some panels, but it certainly works fine. A great many amateurs prefer regenerative sets to honeycomb sets on 200 meters. It might be of interest to know that the Ridgewood Radio Club (membership 70) recently held a debate, "Honeycombs versus Regenerative Sets on 200 Meters." I happened to be on the "Honeycomb" team. The "Honeycombs" won the debate.

Fig. 3 is a diagram, drawn to scale, of my panel. The panel is 12" by 9". The honeycomb mounting is fasteneed above the panel; this was necessary in order to save space and shorten leads.

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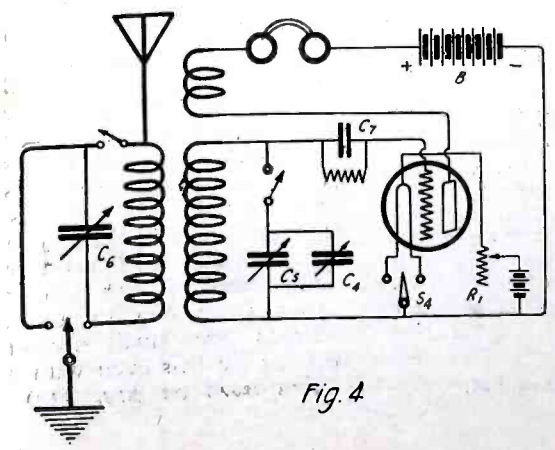


Fig. 4

Fig. 4 is the hook-up for a honeycomb receiving set with an audiotron detector. Fig. 5 is the same circuit with two stages of choke coil amplifications.

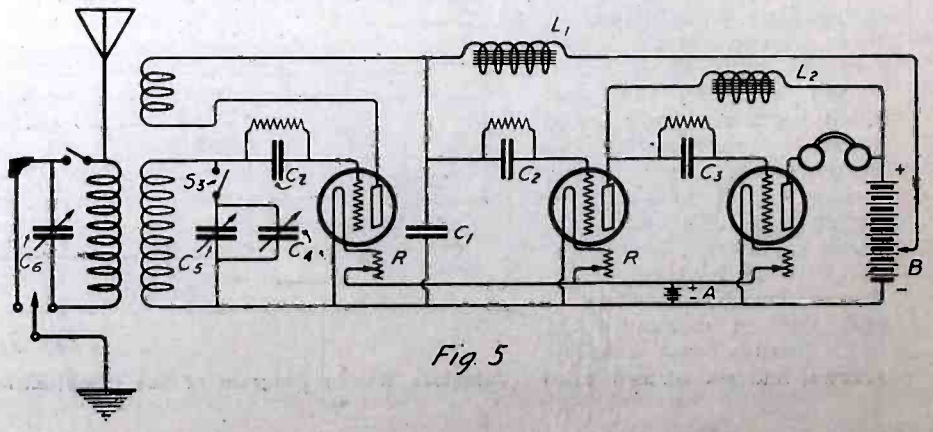
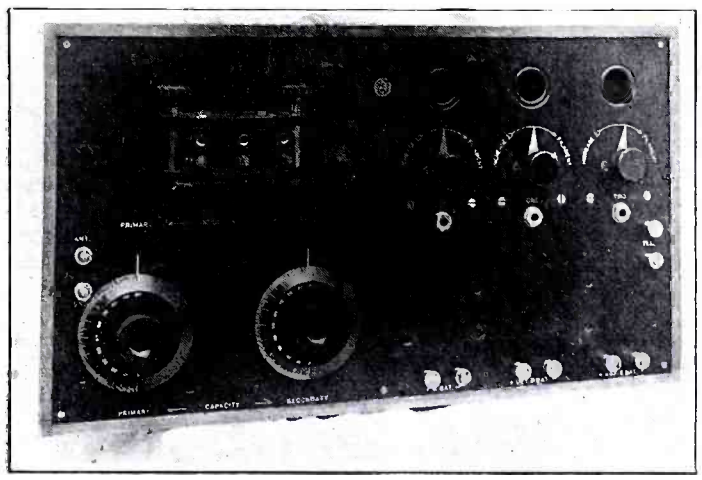


Fig. 5

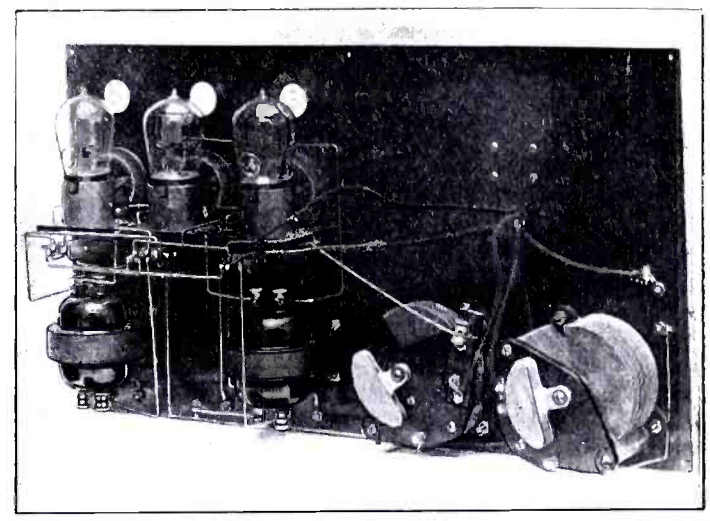
An Example in Radio Economy

A Radio Receiver with Detector and Two-Stage Amplifier for $75.00

By K. H. STARK



Front View of a Receiver and Two-Stage Amplifier, Which May Be Constructed by the Amateur at a Cheap Price.

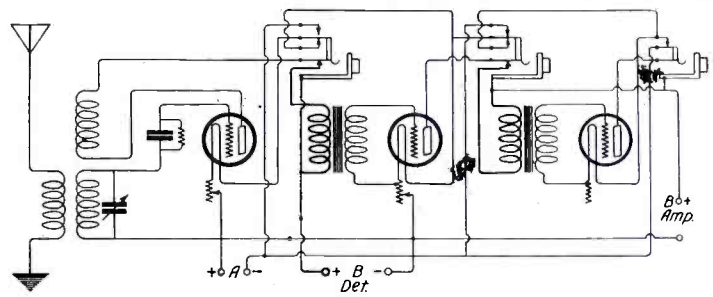


Inside View of the Receiver. Note the Simplicity of This Set.

THE desires of the radio amateur of today as regards his receiving equipment are many and varied. The first problem is to have a receiver capable of receiving efficiently over a wave-length range from 180 to 25,000 meters. Aside from the actual tuning devices a vacuum tube detector and at least two stages of audio-frequency amplification will allow the use of a loud speaker that all may listen "via radio."

If the actual design and appearance of all this equipment is the only consideration and if the cost is secondary, then it becomes simply a matter of purchasing on the open market the necessary receivers, detectors, amplifiers and other equipment. The investment, however, of from $150.00 to $500.00 is entirely out of the question for the majority of us. There is a possibility of going to the other extreme, that is, to design and construct all of this equipment at home. This method, while being the most economical one, does not always produce finished instruments that look as well as you expected. The big fact though to bear in mind is that this home-made equipment usually operates as well or better than the most expensive that can be bought.

I want to describe an intermediate plan of obtaining instruments that function efficiently, that have the appearances of the best and that are economical in cost. The keynote of this plan is to utilize in so far as possible the various radio parts which are now on the market by combining them into the sets of your desires. As an illustration, the accompanying photographs show a radio receiver with a detector and two stage amplifier built on a single panel for an amateur of limited means. He was willing to sacrifice the ultra-efficiency on the shorter wave-lengths that he might receive the long-wave stations without additional apparatus



Complete Hook-up Showing the Connections to the Automatic Filament Control Jacks.

For the receiver proper the inductances were honeycomb coils. The lower signal strength on 200 meters to be compensated for by the amplification.

This amateur went to reliable manufacturers and told them of his problem. Their answer was the one he followed. They suggested that the receiving panel be laid out completely, all holes drilled and the lettering engraved. This combined with a salvaged cabinet which the amateur already had would provide the desired appearance of the finished set. Also by this method the parts on the panel could be added to as it was financially possible. A receiver and detector could be used from the very start at an initial cost of about $40.00.

The completed instrument operates very satisfactorily. It is up to date in every respect. The new shielded intervalve transformers are used as is also the automatic filament control

(*Continued on page* 264)

Vernier Condensers

By F. S. WILLIAMS

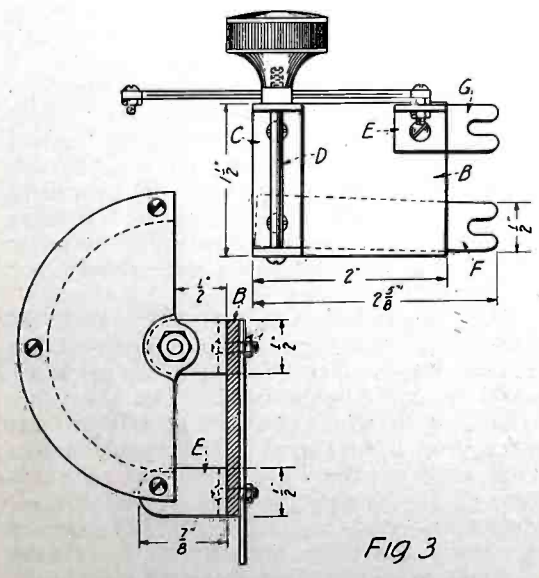
IN C.W. and especially in telephone reception, the circuits must usually be very sharply tuned. A vernier adjustment is desirable and frequently indispensable. A simple expedient for this purpose is shown in Fig. 1. A strip is cut from ⅛" bakelite, formica or other insulating material having the necessary strength and rigidity. The knob of the condenser is loosened and the end of the strip A slipped beneath. In most cases the strip must be filed thinner at this point in order to fit between the knob and the pointer of the condenser.

Another method is to drill a hole in the side of the knob and force a brass rod therein, as in Fig. 2. A small knob may be attached to the end of the rod, but this is not essential if the rod makes no electrical contact with the bushing in the knob of the condenser.

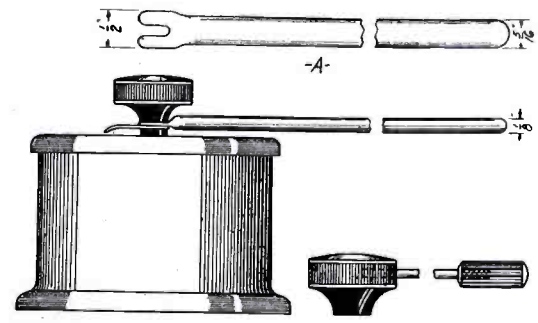
The above devices have the additional value of obviating capacity effects of the operator's hand.

Fig. 3 shows a small vernier condenser which may be attached to the binding posts of the variable condenser. The plates, two stationary and one rotary, may be cheaply obtained from a firm listing standard condenser plates. The base B is of bakelite or formica 2" by 1½" by ⅛" thick. All the brass strips used are 1/16" thick and ½" wide. The piece C has each end turned up to a height of ¾" and is made from a 3" strip. It is fastened to the base B by two 8/32 machine screws. The 8/32 screw D used as a shaft should be about 2" long. A larger shaft would be preferable; the plates are designed for a ¼" shaft. The rotary plate is held between two nuts. The bearing holes in the piece C should not be large enough to allow any appreciable play. The bracket E supports the stationary plates and should be slotted at the bottom so that the stationary plates can be adjusted laterally

(*Continued on page* 264)



This Type of Vernier May Be Used With Any Type of Variable Condenser.



With These Handles, Fine Adjustment of Variable Condensers May be Made Easily.

Radiomania

By CHARLES S. WOLFE

AFTER all, why not? De Quincy did his "Confessions of an Opium Eater" with just as little justification and got away with it, and it is possible that this revelation of my own dark past may strike a responsive chord in the breast of some other wight who, in his time, has suffered from Radiomania.

Why not? And yet, why? Unless I have some kind of a hazy idea that it may serve as a guide to the newly bitten ham. Not that it will prove to be such an admirable guide to the methods of procedure in such cases, but as a "How Not To Do It" article all I ask is a clear field and no favor.

The thing dates back to that momentous evening when my ears were for the first time irritated by the clamp of Holtzer Cabots. The only thing about the outfit that was mine, barring the good intentions, were the ears. The set (I owe it to the chap to call it that) belonged to a new found friend of mine. If I am ever called on to testify before a jury of my peers as to the most envious moment of my life, I will be able to say without hesitation that it was that instant when I first heard the bell-like whistle of N.A.A.—on another man's set.

True, he was only heard after two hours of patient coercion of an innocent lump of galena with a piece of brass wire. But at the first shrill piping I knew that I was a gone gosling. My very pocketbook trembled, and you can take it from me, it had cause to.

For the next two weeks the only minutes that I can recall as being spent with my nose outside of a catalog were those intervals when I was dreamily reflecting. Reflection is the only cheap part of the radio game that I have ever been able to discover.

Having resolved to acquire a station, my first manoeuvers were purely diplomatic ones, calculated to feel out the famlly policy in the matter. I remarked in an offhand way to my father that the papers were full of wonderful yarns about this wireless telegraph business, and that I had heard that there were a couple of chaps in our town fooling with it. I made this little feeler with the air of utmost innocence, but long acquaintance with yours truly (Father was the first man I ever boarded with) had rendered father able to read between, around, above, and through the lines, and he failed to rise to the bait. He merely replied—and I must admit that his air of innocence made mine look like an open confession of guilt—that in his estimation the person who first jabbed holes in a perfectly good tin roof should pass the remainder of his life in the electric chair.

It is only fair to this stern and adamant parent that he should go down in history as the same man who, some two or three weeks later, cursed fluently and expressively as he aided me to point a pair of twenty foot spruces skyward.

To resume. My first experiment in the new art was classic. It deserves to trickle down to posterity along with Benny and his kite.

The very first piece of apparatus that I purchased (I have the purchasee's word for it that it was apparatus) was a receiving condenser. It had been constructed by this eminent radio engineer himself, and, having been unable by any means to make it function, he passed it on to me—for a consideration. No doubt his justification was that I had more time to fool with it than he had.

It would certainly give me much pleasure to hold that poor old dust-covered relic up before my grandchildren and say, "Here, my dears, is the very first piece of wireless apparatus that your renowned grandpa ever owned." That simple pleasure is denied me. The condenser is no more. It has been no more since three days after I took it unto my bosom. I fear that at that period my bosom was no fit place for a struggling receiving condenser. My second purchase was a one-inch spark coil.

I bought that coil because the catalog said that it would give a good, hot spark, and I had a deep-rooted idea that a good, hot spark was more to be coveted than great riches. If that unfortunate condenser's ghost could be hailed back from the Great Beyond to bear witness, I am positive that it would cheerfully swear that all the claims made by the manufacturer about that good, hot spark were Gospel truth. It ought to know.

Father Had Occasion to Come Into My Room One Night and the Next Day We Discussed the Erection of an Outside Aerial!

Well, when the cunning little white flames had ceased playing through the in'ards of the receiving condenser I had about reached the conclusion that the guy who put out the bunk about connecting a condenser across the secondary terminals of a spark coil was a malicious liar.

Somewhat daunted by the suddenness of the fate that overtook my tinfoil beauty, I abandoned *pro tem* my attempts to shatter the ether, and turned from the emitting of etheric nuisances to the waylaying of a few. I stalked them with caution, being on totally unfamiliar ground. The catalogue on which I pinned my faith spoke glowingly of the possibilities of the indoor aerial—glowingly, but, I fear, somewhat hazily. The details were, for the most part, left to the imagination. My imagination is quite capable of some startling acrobatics if given anything like a loose rein, but in this case it was hampered somewhat by the dirth of materials at hand.

We began operations by stringing hence and thence across my bedroom a regular mystic maze of annunciator wire. For several days navigation within that room called for considerable skill. For even assuming that you escaped decapitation when you entered the door it availed you little—you were almost sure to be unchinned before you reached the gas fixture. And once in bed, it behooved the novice to do all his sleeping within six inches of the pillows. Any sudden changes in elevation were well nigh bound to prove fatal. It was by sleeping in this room for a whole week with that contraption that I won my family reputation for valor, a reputation which endures even unto the present day.

It must be recorded that I never heard anything on this forerunner of the loop. I have often thought since, though, that I would quite likely have gotten the arc light on the street corner had I had a detector of some sort to hook into circuit. It was later that I learned that the 'phones are not most efficiently placed when they are connected to the primary of a loose coupler.

Father had occasion to come into my room one night, and the next day we discussed the erection of my big outdoor aerial. Peace at any price was the keynote of his attitude throughout the council.

The very first evening that I completed the installation of my first real receiving station, I got signals. Old Sayville had not yet fallen from grace, and nightly his "press" was tearing great gaps in the atmosphere. I had listened to this larklet for about two minutes when I realized that I held the cup of Tantalus in my hand. I could hear that bird without the least bit of trouble, but he might well have been sending in the purest Martian. I couldn't understand a darned thing he said.

When this cataclysm was realized by the household, father assumed the air of a martyr. He was wont to roam out into the night and gaze wistfully up at those neat twenty-footers. His yearning stare fairly shouted, "You'll keep the home fires burning for a couple of hours, but what in hell will I do with all that wire?"

Nettled, I went to the mat with the Continental code, and the day came when those flying combinations whispered perfectly understandable English in my ear.

On the evening that I first captured the scores as hurled forth by Arlington, father took back all the unkind thoughts he had ever thunk. He used to sit majestically enthroned on the front stoop in the early evening while all the neighborhood holders of those little red tickets flocked humbly around him and computed their losses for the day.

Pride goeth before a fall. The crash of Babylon produced no greater upheaval in the community than did the collapse of my aerial in our neighborhood. The sheer efficiency with which that thing fell has always been a source of wonderment to me. That such a little thing could do so much damage in so short a time surpasseth all understanding. Of course, the bill reached its really startling proportions by reason

(*Continued on page* 228)

Power by Radio

By KENNETH WARNER

THIS is a pirate story. I warn my readers in advance, so they may take full advantage of the thrills and mystery in the plot. It is not a tale of the Spanish Main days, where blood so often stained the ocean red, and the cries for mercy of those who "walked the plank" were unheard; but it is a tale where a corporation takes the place of the many-oared galley and brains and a check book take the place of the guns and a cutlass. And the cries for mercy of the victims still go unheard.

To be even a modern pirate story, the setting should be placed in a long, low room, dimly lighted, while outside of the tightly closed blinds, the storm raged and the waves on the lake pounded the shore with never ending ferocity. However, much as we might like to be so romantic, we must stick to the facts, which were somewhat different. The room (for there must be a room in which to conspire) was large and finely furnished, as befitted a modern pirate den. The lake was still there, but it was too peaceable to be even mentioned in such a story as this. In the center of the room stood a large, solid table, and around it sat twelve large solid chairs. For what could hold the modern pirate but an extremely large and heavy chair? Eleven of these chairs were occupied at the time, while "Captain Kidd" himself stood before the twelfth one. We must take a little better look at this important character before we note the eloquent harangue with which he is favoring the first, second, third, et cetera, mates of his crew.

Osborne Lewis was a leader. From his wide, straight forehead to his prominent chin he bore that look by which everyone recognizes a leader of men. And he was a leader, from the days when he pulled the cat's tail, through the days in school and college, where he led in both popularity and grades, until he graduated, the leader of his class in electrical engineering. And from the attitude of the listening men, he still led.

It would be an interesting character study to watch the faces of the men as they listened to Lewis speaking. Amazement, incredibility, doubt, acquiescence, and finally enthusiasm were the facial expressions of the listeners as the plan proposed by the speaker was brought out. Finally Lewis ceased speaking and awaited comment. For some time no one spoke. The audacity of the project staggered even the boldest.

"But the proof—," began one.

"Is easy," finished Lewis. "Are you in favor of adopting the proposition?"

"Aye." Eleven men spoke. The twelfth was Lewis.

* * *

If you will look through your electrical magazines for the latter part of the year 1920, you may see the following advertisement, which was printed in large type in several of the more important publications:

ATTENTION AMATEURS

We would like to communicate with several amateurs living at a distance greater than five hundred miles from the State of Minnesota. For some time we have been perfecting a device to send power by wireless, and at last we have succeeded far beyond our hopes. We now wish to place several receiving sets in the hands of reliable operators for a final test. We take this method of testing in order to bring our invention before the public. Amateurs living in manufacturing cities preferred. Those interested will please write to Box 84, News Bldg., Minneapolis, Minn.

At this time a chum of mine, Robert Greer, "Bob" for short, and myself, had what we thought was a rather complete station. A I K.W. Transmitter, a rotary with all the "fixin's" and a three step with Magnavox tacked on the end to drown out the neighbor's cat on lively nights, constituted a fair set, in our estimation. Accordingly, when Bob hailed me one evening with a yelp of joy and fell on my neck like a long-lost brother, and informed me that at last we were going to receive our just reward, I sat up and took notice. Between shouts and noises that could not be classified, he said we now could divert our attention from the latest outrage in the form of a "squeak-box" and could be Somebody. Somebody, with a capital S. When I got him quieted down enough to get a word in edgewise, I said to him: "Either shut up or say something." This took the peak off of his enthusiasm and he shoved a magazine in front of me and pointed out the above advertisement. I took the paper and read the notice.

"I can't see that this is any reason for your gaiety," I said. "Where do we come in?"

"If we can be one of the stations used to test that contraption, and if it works we'll—," Bob started.

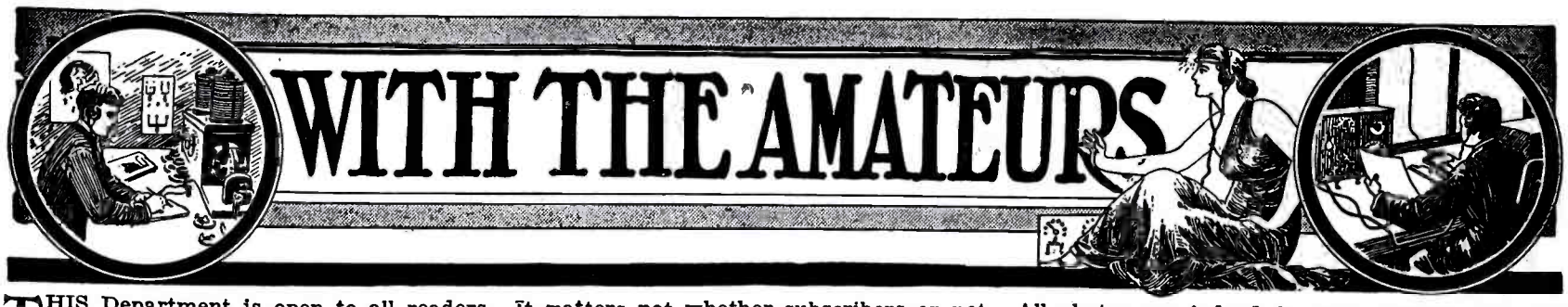
"Yes, if," I shot back.

But the long and short of it was that we answered the "ad" and told of the advantages of our set and somewhat more than mentioned that we lived in a manufacturing center. We had talked it over and we didn't see how we could lose, and so we went in head first. Fortunately or unfortunately, as remains to be seen, we received due notice from the concern that our station would probably be one of those chosen. We filled out several yards of records and mailed them back. We had waited almost two weeks and had begun to think that the company had lost our address, when one day the express wagon stopped at our door and the driver inquired for me. I went out to see what he had for us and Bob came right along. It was a good thing he did, for I could never have carried the box the expressman gave me alone. And stamped in big letters on the box was, "Wireless Power Company, Inc." I "signed here," and we carried the thing into the shop. Although we had no instruction yet, we removed the outside box and then after taking several basketfulls of paper off we reached the treasure. It was a typical treasure box, all right; long, black and very heavy. On the top of the box were set in two meters; an ammeter and a voltmeter. Two large binding posts and two knife switches were the only visible objects. We wanted to see "what made it go," but the company must have known the inquisitiveness of the average amateur, for there was no crack visible beneath the enamel, and we didn't know where to begin. And taking an ax to it was a rather risky business, for who knew what they might derive their power from, dynamite, cordite, or some other "ite" with considerable elevating power. Consequently we left the apparatus strictly alone until we should receive directions for its operation.

The Voltmeter Wavered and Jumped to Twenty Volts! The Ammeter Followed Suit and Read About Five Amperes. Bob Jumped Up, Shouting, "It Works, it Works!"

That afternoon we received a letter from the company stating that a series of tests was to be run for three days, commencing three days from that date. The first was to be run at 10:00 P. M., the second at 2:00 A. M. and the third at 10:00 A. M. The letter did not give the diagram of connections and so we were left in the dark as to the method of receiving. The voltmeter (so the letter told us) was connected across the incoming power line and the ammeter connected in series with a resistance coil used as a load. There were several of these resistances in the box and a selective device enabled anyone of them to be used. Thus both voltage used during the test and the actual power used could be readily seen or computed. A chart was given to us, showing just what the ammeter and the voltmeter should read at any given time, corresponding to the changes made in the sending apparatus. The aerial was to be connected to one post and the ground to another. A blank was given to us to note the readings at various times, and we were to specifically state any variation from the above "time table." We read this over several times, to be sure what was wanted, and then fixed up our shop ready for the test. We

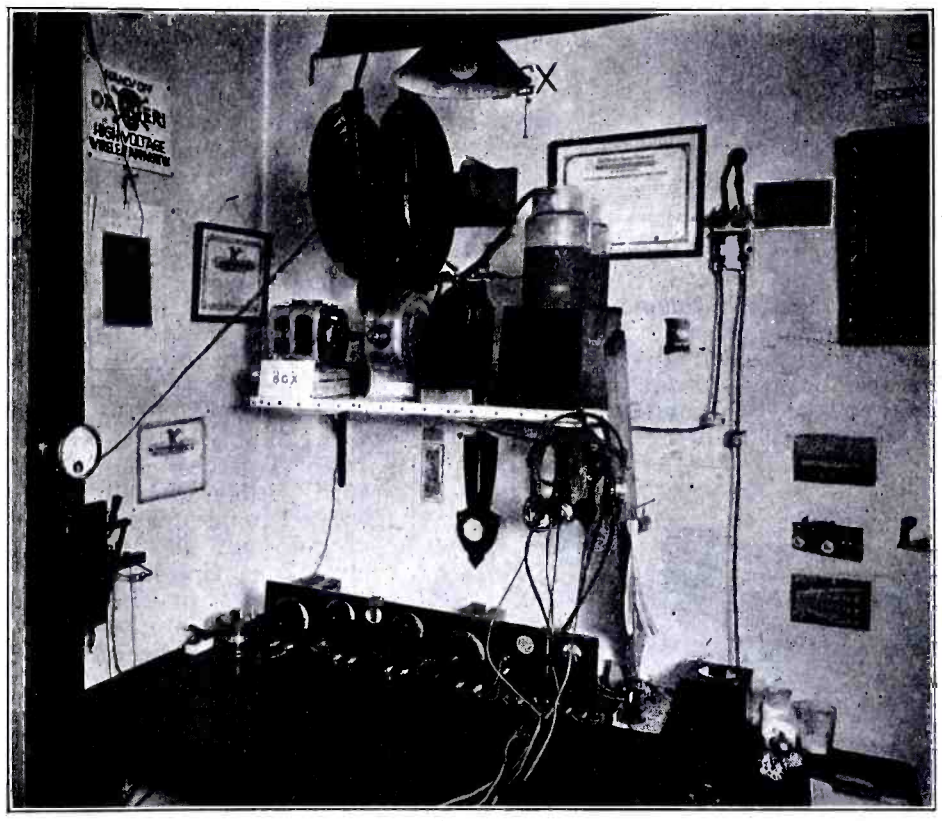
(*Continued on page* 244)



THIS Department is open to all readers. It matters not whether subscribers or not. All photos are judged for best arrangement and efficiency of the apparatus, neatness of connections and general appearance. In order to increase the interest in this department, we make it a rule not to publish photographs of stations unaccompanied by a picture of the owner.

We prefer dark photos to light ones. The prize winning pictures must be on prints not smaller than 5 x 7". We cannot reproduce pictures smaller than 3½ x 3½". All pictures must bear name and address written in ink on the back. A letter of not less than 100 words giving full description of the station, aerial equipment, etc., must accompany the pictures.

PRIZES: One first monthly prize of $5.00. All other pictures publisht will be paid for at the rate of $2.00.



E. W. Thatcher's Station

8GX, Oberlin, Ohio

This Month's Prize Winner

Here is a good relay station neatly arranged and equipped with a wavemeter.

The antenna used is a four-wire inverted "L" type of stranded copper wire, spaced three feet apart and sloping from 60' high at one end to 50' high at the other. For a ground connection, a radial system of buried wires spreads out under the antenna in the shape of a crowfoot. These wires are attached to six-foot rods at the far end and are connected to the water system of the house.

The receiving equipment consists of a homemade Paragon-type short wave regenerative and two-step amplifier. There is also a long wave honeycomb coil set, which is not shown in the picture. The amplification is controlled by plug and jack system and a small contact is placed upon the antenna switch for the purpose of shutting off the "B" battery while transmitting. Western Electric phones are used.

The transmitting set is mounted on a shelf above the operating table, and consists of the following apparatus: A ½ K.W. half mounted Acme transformer with a Benwood enclosed gap, jars and O. T.

Signals from 8GX have been heard up to 2,000 miles, 6KA reporting them QSA during March. Communication was regularly carried on with stations up to 1,000 miles distant, and a great deal of relay work has been put through during the last season.

Robert A. Gerhard's Station, 8RL

Lehighton, Pa.

This station is entirely home made and does, indeed, look fine. We extend our compliments to Mr. Gerhard for his workmanship.

The receiving set is mounted on a 12" x ¼" x 18" formica panel, hand engraved. A set of honeycomb coils was made to cover all wave-lengths. The two variable condensers are 48 plate balanced type with vernier, the plates being made of 20 gauge aluminum, and the end pieces of bakelite.

A zinc plate, which is grounded, covers the inside of the panel. This overcomes the capacity effect when the hands are brought near for tuning. For this reason the coils were placed inside the cabinet, the top of which is hinged to permit the coils being readily changed, the knobs above the condensers controlling the tickler and secondary coupling.

The transmitter consists of a ½ K.W. transformer, rotary spark gap, oscillation transformer, and hot wire meter. The spark gap is mounted on the back of the panel and enclosed, a small window permitting observation of the spark.

The entire sending set, except motor and key, is home made.

The aerial consists of six wires 80' long.

F. H. Avers' Station 9DBD

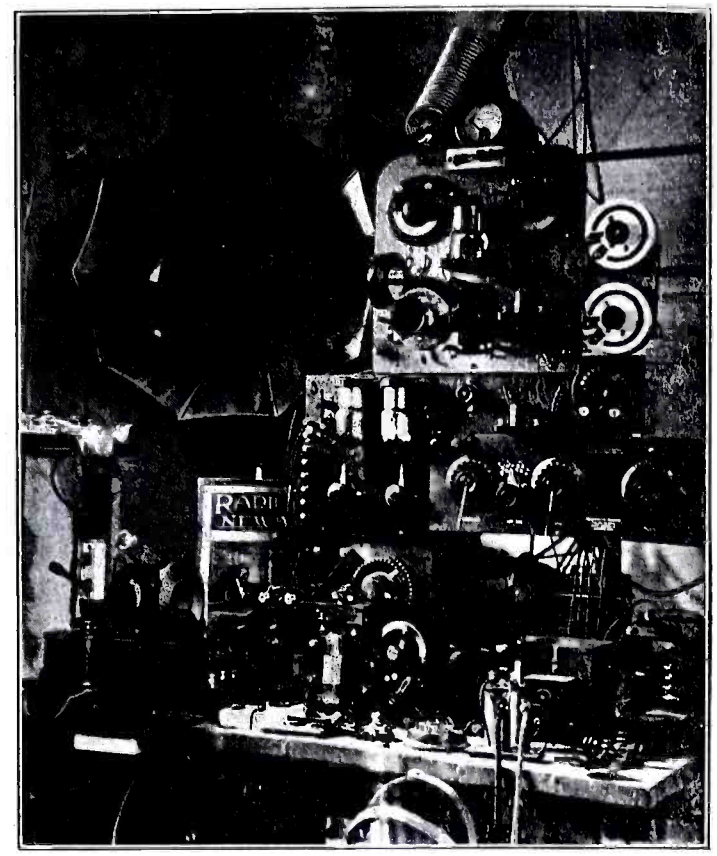
Portage, Wis.

The receiving outfit consists of an audiotron detector and three-step V. T. amplifier. In addition to these is a two-step microphone amplifier. Three tuners are used.

The regenerative receiver from 175 to 600 meters, Navy type coupler from 600 to 4,000 meters and honeycomb coils from 4,000 to 25,000 meters. The second step microphone consists of a Skinderviken transmitter button fastened to the diaphram of the receiver of the first microphone circuit.

Leads from this button can be plugged into four different circuits, viz: a Magnavox loud speaker shown in the picture a Magnavox loud speaker in the theatre auditorium (this station is located in a motion picture theatre), a tape recorder and into the regular wire telephone. When plugged into the wire telephone this button is merely a transmitter in series with it and is a very satisfactory way of sending voice music and signals over the phone, such as music and speech from Madison, Wis., and Pittsburgh, Pa., and also time signals from Great Lakes and San Diego, Cal., to the jewelry stores for correcting their clocks, when the button is used with a tape recorder the vibrations of the incoming signals on the receiver diaphram causes the change of resistance in the button, causing it to operate the polarized relay, which in turn operates the recorder. Have several times reproduced music from Madison and Pittsburgh through the Magnavox in the theatre.

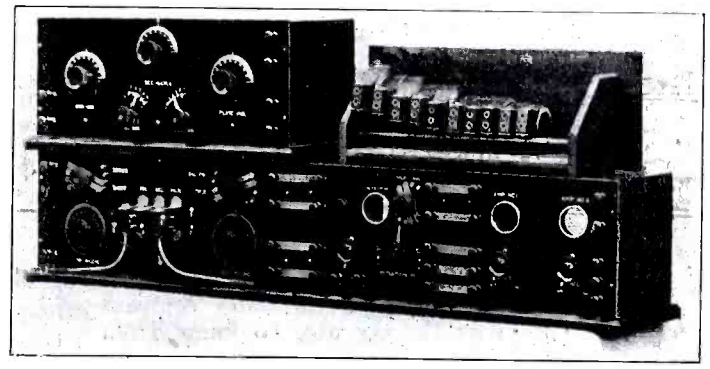
The transmitting set consists of a ¾ K.W. transformer, Amrad quench gap, Murdock oscillation transformer and condenser. In addition to this there is a small transmitting radiophone using two bulbs, one oscillator and one modulator with a small motor-generator to supply the necessary plate current. A double throw switch changes it from the voice transmitter to a tone arm.



Owing to Lack of Space Frank Had to Pile Up His Instruments, Skyscraper Style. However He Has a Good Equipment and a Radiophone.

B. A. Noe's Station

The enclosed photograph is of my complete receiving set, which includes amateur spark, C. W., radiophone, and commercial spark stations, as well as arc stations. This set was designed and built by me and covers all wave lengths of any form. In the coil set use is made of the balanced primary circuit for spark stations, and the well known tickler circuit for arc stations. The regenerative cabinet can be placed in the circuit by simply replacing the coils in the coil set with plugs to which wires are attached and extended to the binding posts on the regenerative set. This is a desirable feature because it prevents having to take the coil set out and placing the regenerative set in its position, shown in the photographs, and also allows the use of the primary condenser in the regenerative primary circuit. A resistance of about 8,000 ohms is used across the "B" battery in the detector circuit, which allows very fine adjustment of the plate voltage. All "B" battery is contained in the detector cabinet and is extended into the amplifier cabinet by means of bus bars, which connect up the detector and amplifier cabinets. The same arrangement applies to the "A" battery which enters the detector cabinet.



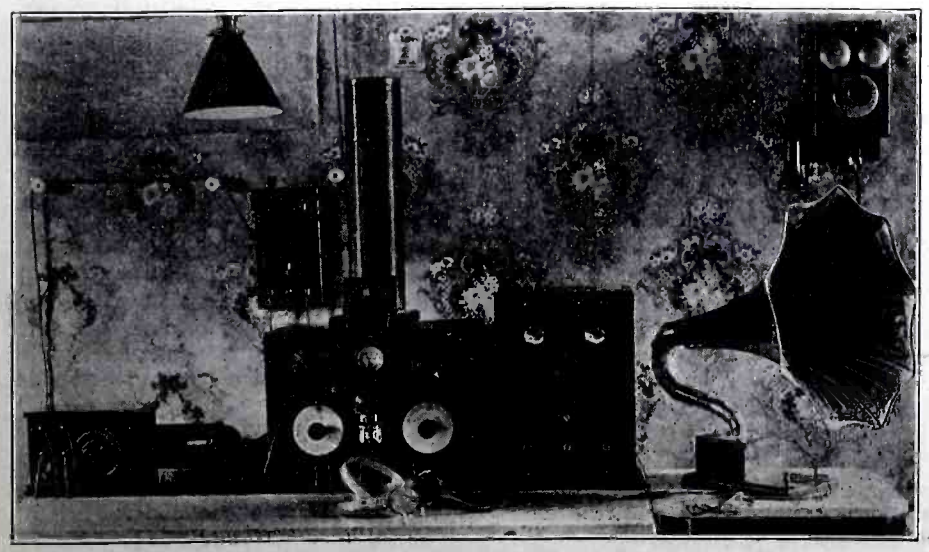
This Combined Long and Short Wave Receiver With Two-Stage Amplifier is Home Made, and May Be Called a "Peach", and its Owner Deserves a Compliment for This Nice Work.

As proof of the efficiency of the set I will merely state that practically all the high-powered arc stations have been heard and also the radiophone of Catalina Island.

Ray L. Lenhart's Station

This is a photo of my receiving station. My aerial is of the inverted L type and is made up of three 7-strand copper wires 130 feet long and spaced two feet apart. It is 48 feet high at one end and 40 feet high at the other. My ground is composed of water pipe and a sheet of zinc four feet square, buried five feet underground.

The tuner of my receiver is a "Radio Apparatus Co," Navy type loose coupler with a wave-length range of 200-4,000 meters. All other instruments except the phones were built by myself.



Another home-made set of good design. Let's see more like this.

The detector panel is of Bakelite, size 11¼" x 16" x 3/16", on which is mounted potentiometer, filament ammeter, rheostat, phone jack, "A" and "B" battery switches and an inverted tube receptacle. Two .001 mfd. variable condensers are also mounted on the panel. The one on the left is connected in shunt across the secondary binding posts, while the one on the right is a ground series condenser. The 40 volt "B" battery and grid condenser are mounted behind the panel, which is set in a quartered oak cabinet.

The two stage amplifier on the right is fitted with Paragon rheostats, Acme transformers and two home-made "B" batteries of 30 volts each. The panel is of grained Bakelite on the base behind which are mounted the two "B" batteries. This panel is also set into a quartered oak cabinet.

The loud speaker on the extreme right consists of an amplifying receiver connected to a horn.

Junior Radio Course

The Radio Compass

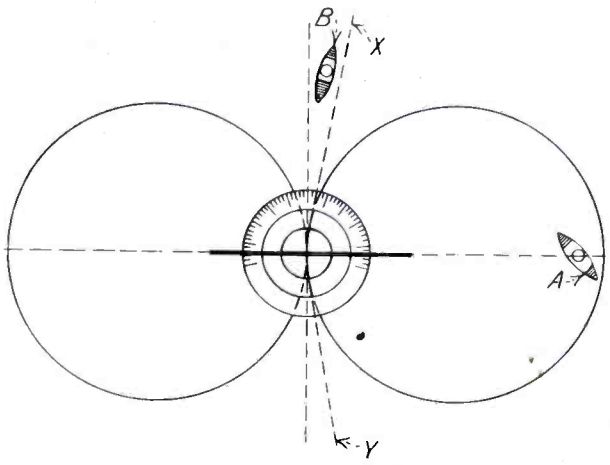


Fig. 2

The Two Circles on Each Side of the Loop Aerial Represent the Effective Area of the Radio Compass Station.

IN this lesson, we shall describe the radio compass and the loop aerial which is used in direction finding. The radio compass, which at the present time is extensively used along the coasts, has become an important factor in navigation, and a last improvement consists in the use aboard the ships themselves of the compass, which enables them when in a fog, or at night, to ascertain their true position.

The loop aerial, well known by all radio amateurs, is theoretically of the shape shown by Fig. 1. This aerial has the property of receiving stations which are in its plane. In practice, the loops are often given the shape of B, Fig. 1, and in case of very large loops they are made in triangular form for practicability of construction and operation, as C, Fig. 1.

These loops are generally wound with several turns and are, in fact, coils of big dimension; the number of turns used depends upon the range of wave-lengths to be received by the station. The loop is mounted on a shaft so that it may be revolved in any direction, and on the saft is fixed a dial divided into 360 degrees, for the purpose of ascertaining which direction the signals received are coming from.

Fig. 3 illustrates the operation of the loop aerial. When the ship A sends, the loop L1 receives the signals with maximum audibility, for it is in the same plane with the ship, while the loop L2 does not respond at all to the signals, since it is at right angles to the sending station, thus having no induction from it through its turns. In Fig. 2 may be seen the effective field of action of the loop. On both sides signals may be heard when coming from one of these two circular areas.

If, for instance, the loop of the radio compass station is in the position shown in Fig. 2, a ship in the position A, will be received with maximum intensity, while the ship at B will not be received at all.

It will be understood, therefore, that it is possible to determine the exact position of a station by turning the loop so that the signals come in with maximum strength, but in practice another method is used to obtain accurate results which are not possible when the "maximum" method is used. If, for instance, the loop is turned slowly the signals are first heard very faintly, then increase in volume till the plane of the loop is in the direction of the sending station. They then decrease when the loop is turned further.

However, it is difficult to ascertain the exact direction of a station by trying to find the position for which the signals are maximum. The method used in practice is called the "minimum" method, and consists in finding the two directions on each side of the sending station where the signals become inaudible, then the number of degrees between these two directions is divided by two and the middle position is the true direction of the sending station. Fig. 2 illustrates this method. If the ship A is sending, the loop is turned in both directions X and Y, where the signals from station A cease to be audible in the receiver. Then, the middle position between X and Y is the true position of station A.

Of course, this type of radio compass does not allow the operator to know from which side of the loop the signals are coming. The effective field, from which signals may be received, is equal on both sides of the loop. This is of little importance when the compass station is erected on the shore and used in conjunction with other stations to determine the position of ships

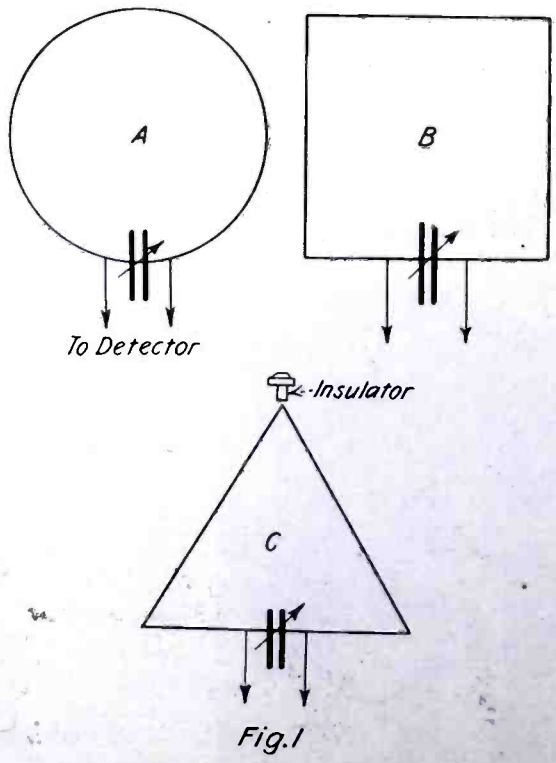


Fig. 1

Various Types of Loop Aerials Used in Direction Finding Work.

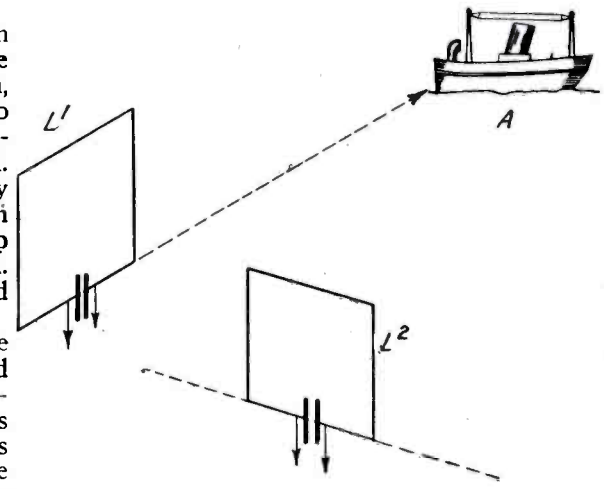


Fig. 3

The Station L1 Receives the Signals From the Ship A With Maximum Intensity, While Station L2 Does Not Hear Them at All.

at sea, for the signals are always coming from the same side as that of the sea; but if the station is intended for use on land to find the position of aeroplanes or movable field stations, it beomes more difficult to ascertain the exact direction from which the signals are coming.

The radio engineers tried to find a device giving a unilateral response, and several schemes have been designed which give the desired results, and of which we shall speak later.

The method of determining the exact position of a ship is clearly illustrated in Fig. 6. If the ship A asks by radio its position to the compass stations, it is told to send a long dash, while the compass stations turn their loops slowly and ascertain the direction from which the signals come, as already explained. Then, each of them, connected either by wire or radio to the land station B, sends to it the number of degrees they found the signals coming from, and by drawing on a map some lines from the stations in the direction given, shows the position of the ship at the intersection of these lines. This position is then sent by station B to the ship, which knows its exact location.

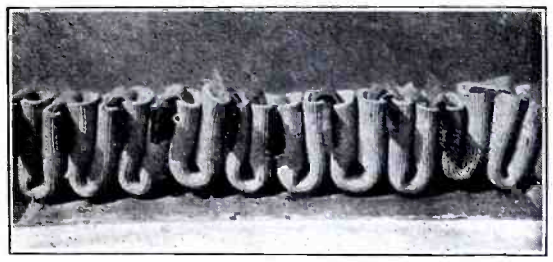
THE UNILATERAL COMPASS

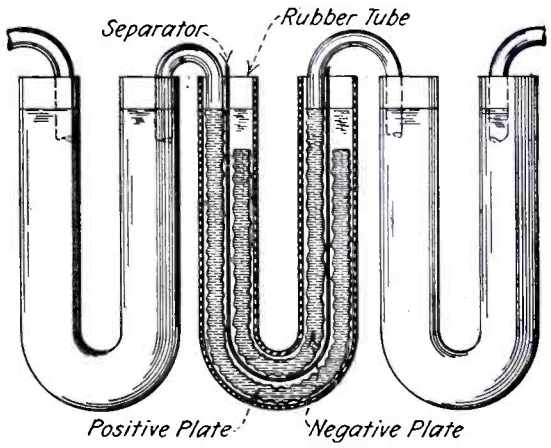
The unilateral compass may be made in several different ways. One of the types that gives good results is shown in Fig. 4, and consists of a coil wound around one side of the loop and shielding it. The shape of the active field of the loop is of the form shown in Fig. 5; as may be seen, the effective area is greater on the free side of the loop, and is of the shape A, while it is very much smaller on the shielded side of the loop and is approximately as B.

It becomes possible by the use of such a shielded loop to ascertain the exact direction from which signals are sent, if the station sending them is out of the field B

(*Continued on page 262*)

Junior Constructor





Here is a Clever Idea to Build a Storage "B" Battery Cheap.

A SIMPLE NON-ARCING KEY.

The idea is not original with me, but the application may be. Most every amateur has an old relay lying around the shop. The resistance, although 150-250 is preferred, is not essentially specific. In the event there isn't one around, any high resistance electro-magnet of sufficient ampere turns will easily lend itself to the office of a homemade relay. The construction of the relay is well known enough to enable its being left out here. At any rate, hook it up as in the accompanying diagram, and watch the sparks leave the key.

The explanation is simple: The current flows through the relay coils as long as the key is down. The key contacts as well as the relay contacts, carry the current to the transformer. Now, when the key breaks the circuit, the relay armature is still held down by reason of its own contacts, which will stay closed until the 110 volts, A. C. come to the zero-point of the phase, at which time they will open of their own accord, and since the phase is at zero, there will be no current, and consequently no arc at any of the points. Should the key open at zero itself, the relay will also open, then—sparkless again.

The amount of adjusting the relay spring and armature so as to release at the proper time, is almost negligible. The relay that the writer used with a one K.W. was a Mesco 150 ohm, and gave very good results, with a small tinfoil and paper condenser across the contacts.

Contributed by S. P. McCABE.

A SIMPLE HIGH POTENTIAL STORAGE BATTERY.

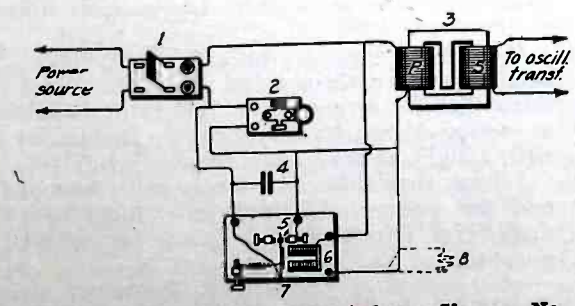
There are many uses to which a high potential battery can be put, especially in radio and allied electrical work, and although there are many types of high voltage cells on the market, there are few that can be made more easily than the one shown here.

In addition to being easy to construct, the battery to be described is not breakable, which is a very important item, and the cost of construction is very low.

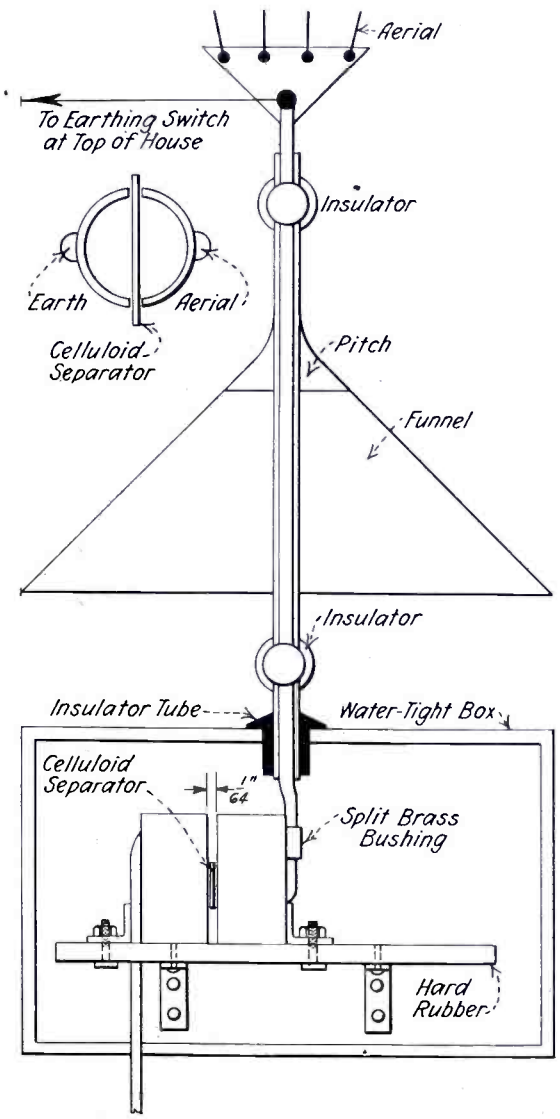
The containers are made from short pieces of rubber tubing about 4" in length by ½" in diameter. This material can be bought for five cents a foot or less, and by bending each piece in the centre, a U-shaped container, open at each end, will be the result.

The plates for a battery such as we are considering can be made from small pieces of thin sheet lead about 8" long by ½" wide. The surface of each plate can be greatly increased by stamping it with a corrugated check protector.

Separators can be readily made from celluloid strips, which can be perforated on the check protector mentioned above.



With an Old Relay Connected as Shown, No Spark Occurs at the Break of the Circuit.



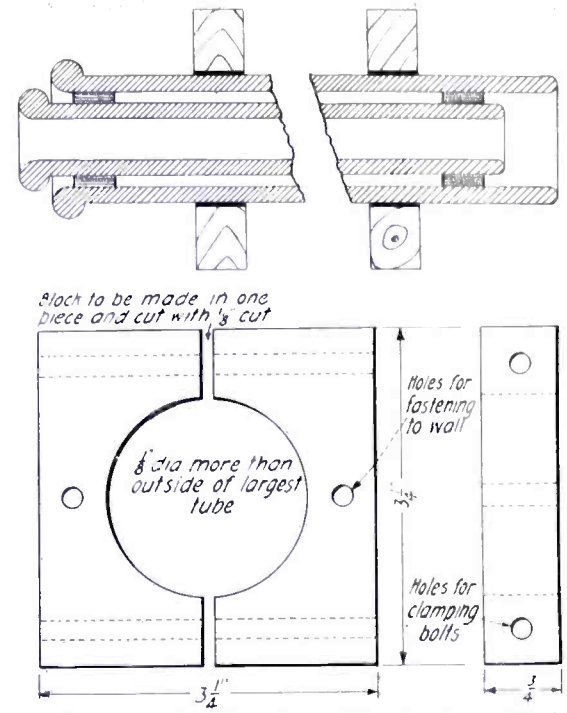
With This Device the Aerial May Discharge Itself During a Thunderstorm, if the Ground Switch is Not Closed.

Old pieces of film with emulsion washed off can be used, if desired.

In assembling, each lead plate overlaps another by 4", the rubber tubing being forced on over the lapping portions, and bent to the U-shape mentioned above. A separator is placed between the lead plates where they lap.

The usual acid solution is used to complete the battery, and the forming of the plates done by charging and recharging at about 2.6 to 2.9 volts per cell, too high a rate being avoided, as this causes boiling over and spoils the whole battery.

Contributed by R. V. CLARK.



A Simple and Efficient Lead-in Insulator That May Be Made Cheap.

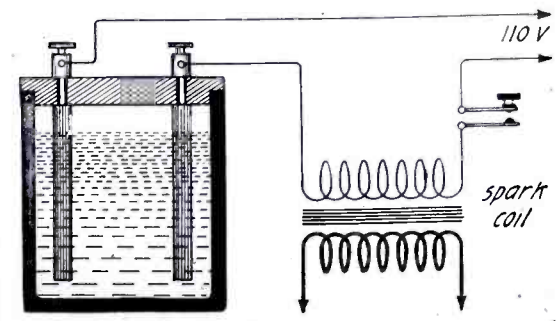
A RECEIVING AERIAL WITH A LIGHTNING GAP.

Now that the time for lightning and atmospherics is upon us, I should like to suggest a way for safeguarding an amateur station against this danger. As lightning makes me rather nervous, I wanted to devise a way which would prevent any electrical discharge from getting even as far as the lightning switch outside of the house, and recalling having seen a lightning gap on an old telephone system, I set about constructing one large enough for the purpose.

This gap, as can be readily seen from the sketch, is made by a piece of heavy split brass tubing, such as a bearing of an automobile engine, or like parts; some amateurs will probably find this bearing already in two sections. These sections are mounted on a piece of hard rubber and separated about a sixty-fourth of an inch. This is done by placing a very small strip of celluloid between the two halves. To the one on the right is fastened a length of No. 4 copper wire. The other one is fastened to the earth wire, which is made of a piece of No. 4 galvanized iron wire, which in turn is joined to a 10' length of iron pipe driven into the ground. The wires are joined to the pieces of brass by means of pretty strong rivets. The whole is placed in a water-tight box, and the lead-in and earth pass out through porcelain insulators. The copper wire, which by the way should be of the insulated kind, is held by two strong cleat insulators to the top of a pole about 7' long, driven in the ground.

To avoid any water running down the aerial, and then over the box, and thus

(*Continued on page 259*)



With Such a Resistance You Can Use the 110 Volts on Your Spark Coil.

Correspondence from Readers

ABOUT "OPS."

Editor RADIO NEWS:

In reading the May issue of RADIO NEWS I noted with much satisfaction that Mr. R. N. Oakley, 5YB, commended the work done by "Limie" operators on ships and on shore.

Although 5YB was with the Grand Fleet during the war, the same service was given by the English "Ops" after the war. I served 19 months in Scotch and English waters with the Mine Laying and Mine Sweeping Squadrons and at all times I have failed to see as many and as big "Hams" as we had with us aboard, myself included.

The English do not go to a Government school for 10 to 20 weeks to be then sent to the Fleet as full fledged "Ops." I have been told by different English "Ops" that their school period was at least 10 months even during the war, and when sent to the Fleet they were not permitted to handle the key for a good while. I will say here that the QRM in the English Channel is about as bad in peace times as it is around Long Island. How about it, 5YB, were those "B" stations busy?

And now for some enlightenment. Who can give me some information regarding an antenna that is wound in a loop form, but is used as an ordinary antenna with regular ground? Also, has anyone any new hook-up for a crystal detector?

I may add that while the knowledge of Radio is increasing very rapidly as to C.W. transmission and reception, amplification and so on, also is the cost, and if it goes much further where will the amateur come in, who has but a few odd dimes each week to spend for the construction of his "Set"? It would seem as if it were getting farther away from the fellow who would like to learn the Radio game. Every time I look at a regenerative set (without batteries $75), I think of the time when the Radio "bug's" set was comprised of a one-wire antenna, a 75-ohm phone and a piece of carbon with a steel needle as a detector. "Ye Gods" how this Lil Ole World moves.

WALTER L. SMITH.
397½ So. High St., Columbus, O.

QUENCHED GAPS AND RADIO COMPASS.

Editor RADIO NEWS:

Here is another of the many, many unpleasant things that can be found in the otherwise O. K. Radio. Why is it that certain apparently ignorant Navy men will take it upon themselves to accuse other Radio men, Naval or amateur, of being liars, etc.

The first flagrant case of this came to my notice thru the columns of "Q. S. T.," just after the amateurs in the third district had started to complain about bad QRM from NAM and NAH. Someone, presumably a Navy expert (???) who did not have the courage to sign his name in full, just "D. B.," came out with the preposterous statement that it "is ridiculous for anyone to claim that a modern quenched gap transmitter can possibly emit a broad wave" and wanted to know "how many amateurs ever gave any thought to the fact that this apparent broadness of wave might be due to a broadly tuning receiver? Not many, I'll warrant," when the chief complainants were amateurs using the Paragon type of short-wave sets, the sharpest, or at any rate, nearly the sharpest tuned receiving circuit known, and they were over 200 miles away from NAM anyway. I, personally, have heard NAM on my short-wave Paragon, which will not tune any higher than 300 meters, yet my station (Canadian 3DS) is about 1,000 miles away (on one bulb). It certainly is most surprising to think that a Navy man, belonging to one of the best, if not the best, Navies, from a radio point of view, anyway, would not know anything about the standard Navy quenched gap transmitter. Anyone who knows anything at all about the quenched gap knows that if the voltage per gap unit is not adjusted very accurately, the gap will not quench and will be as bad as a straight gap, which has not held international repute for producing a sharp wave. Also the quenched gap will permit a 20 per cent. coupling instead of 10 per cent., as with a rotary, and most people seem to think that this means that you can use about ⅛" coupling safely with a quenched gap without broadening your wave. However, when a quenched gap set is operated properly, as in WCG, a *commercial* station, it makes a very sharp wave. So much for Case No. 1.

Case No. 2 started with me when I read Paul Mansfield's letter in RADIO NEWS for May, 1921. Why is everyone taking a wallop at that fluke made in Phil Vernon's interesting disclosure of the U. S. direction finding system? Mansfield thinks Vernon needs a kick, but my private opinion, for all to read, is that Mansfield should be the kicked, not the kicker. How do we know that the linotype operator didn't make that fluke of "full power" for "low power"? Broad coupling need not necessarily mean tight coupling. I do not think that such terms should be used in describing the coupling, as they are apt to be misleading. Vernon probably meant "coils wide apart" by "broad," because Mansfield is not the only person who knows that a broad wave cannot give as accurate a bearing as a sharp one, and surely one's own common sense would tell him that the rule of "minimum power necessary for sure communication" would apply even in this work. Now, to come to the point. Why don't they send Mansfield back to the radio school? Here he comes out with the following: "but if they are any kind of operators and have a *sharp tune and high decrement* we are able, etc." Well, I'll be dogwallowed if that sort of wave isn't a new one on me. First time I have ever heard of a sharp, broad wave. Perhaps Mansfield will kindly tell us what vessels use this type of wave. I would like very much to listen to one. This must be the kind of wave that one gets with rubber insulation between the plates of the 10-k.w. quenched gap, or else with a silver antenna.

By the way, I have noticed a little "nuisance" in RADIO NEWS. You editors seem to take exceeding care not to publish station calls along with descriptions of stations, especially commercials, etc. Also the only amateurs that get their calls published in the "With the Amateurs" department are those who have a big call card showing in the photograph. I think you should make it a rule not to accept photographs of amateur stations for publication in this department unless accompanied by the station call letters. Through some oversight, none of the calls of the various stations were shown in the article "Government and Amateurs Join" on page 768 of the May, 1921, number. If some one wants to get the QST about market prices, who will he stand by for? The author only has the names of the cities down, and each city has probably half a dozen high power amateur stations that might or might not be the transmitters of the reports. I would like to see what other amateurs think about the calls.

H. S. GOWAN, 3DS.
120 King Street, West, Kitchener, Ont., Canada.

(Thanks for the hint, 3DS—constructive criticism is what we want. You'll see plenty of calls soon—didn't know you wanted 'em so badly. We're here to please, first, last and always.—Editor.)

IN publishing the three letters in the adjoining column we bring to a happy close our recent controversy.

We much regret the fact that we find it impossible to publish all the hundreds of flattering letters as well as the brick-bats received during the last few weeks—and they are still coming in lively. We will say, however, that at least 75 per cent. of the letters so far received are on our side. We are publishing three letters, each one of which is written by a member of the A. R. R. L. We feel that these letters,—better than anything else—from the great League illustrates the true feelings of the majority of the American Radio Relay League. This closes the incident, as far as we are concerned and, we hope, to the satisfaction of all readers.

—Editor.

HERE HE IS.

Editor RADIO NEWS:

Thanks very much for printing that knock of mine in the July RADIO NEWS. Might I say that I appreciate fun as well as the rest of you, but I wish you would use that space for more articles giving valuable information and hook-ups. As for "Calls Heard" one magazine is enough to print them. I wish all your numbers were as good as the August issue.

Sincerely yours,
ANDREW POTTER,
8BIP.

"MOUNTAINS OUT OF MOLE-HILLS."

Editor RADIO NEWS:

I have read with interest the letters in the past two issues of RADIO NEWS regarding the story written by Mr. Burgess in the May issue.

I wonder if Mr. Burgess realized what he was doing at the time he wrote that story? It seems that he has injured a number of super-sensitive dispositions when he mentioned the "Awful Racket Raisers' League." I do not think it takes a broad mind to see that the story was a humorous one and that there was no malicious allusion to the A. R. R. L. *I am a member of that organization* and I did not feel that the organization was injured in any way, neither did I feel compelled to sit down and write scathing remarks concerning the editors of RADIO NEWS, as did Mr. Mann, or accuse them of being unfair, as did Mr. Talianoff.

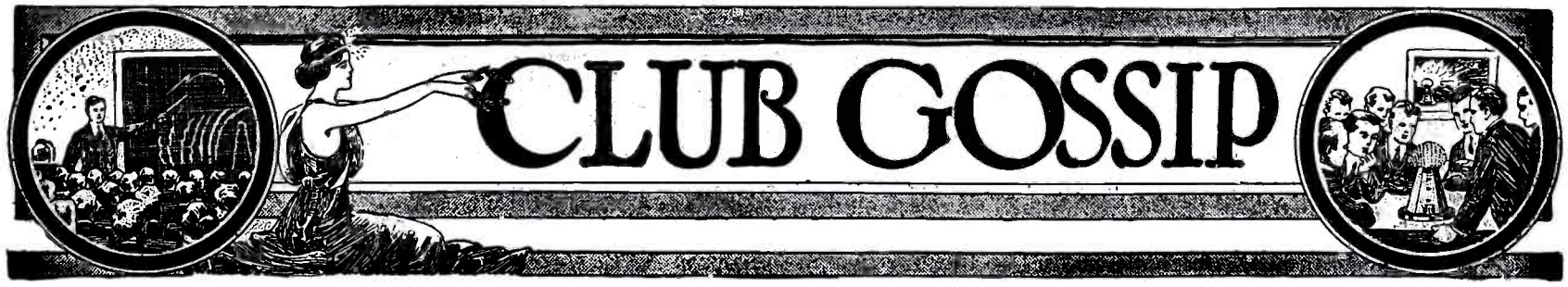
I am surprised that the A. R. R. L. has such hyper-sensitive men in its ranks. I do not think that such a spirit tends to promote the welfare of amateur radio and I am more than surprised that the matter was mentioned by the editors of "QST" in an editorial. It is making "mountains out of mole-hills" and a mighty feeble mole-hill at that.

It is cheap notoriety to write such "brick-bats" and dare them to be published and I think that the writers must feel rather small at seeing themselves before the public in such a light as they have shown themselves.

I hope that this controversy will die out and the energy expended in writing such distasteful letters will be used for better purposes.

JOHN B. DOWDEN,
Glen Cove, N. Y. Radio Station 2-BFF.

(Continued on page 226)



NEW NATIONAL ALPHA DELTA ALPHA RADIO FRATERNITY ORGANIZED

Alpha Chapter, Alpha Delta Alpha Radio Fraternity of Coe College, Cedar Rapids, Iowa, announces the affiliation with the installation of Beta Chapter at the State University of Iowa, Iowa City, Iowa.

Alpha Delta Alpha Radio Fraternity was founded at Coe College, Cedar Rapids, Iowa, in September, 1920, by 18 commercial radio engineering students. After being granted a charter by the College, Alpha Chapter was legally installed the following month. There is a present membership of 25 men. From the very first the organization has been marked by a spirit of enthusiasm and co-operation, which has had very marked results.

The nationalizing and establishment of chapters in the universities and colleges of the United States mark the forming of a new type of fraternity which should prove very popular. At the present time a number of petitions from some of the leading universities of the Middle West have been received by the fraternity, and very likely other chapters will be installed in the near future.

Alpha Chapter, Alpha Delta Alpha Radio Fraternity, recently sponsored an Iowa State Radio Convention which was held at Coe College, Cedar Rapids, Iowa, May 28, 1921. Reports from all concerned indicate that the convention was a great success. The main achievement was the establishment of the Iowa Radio Relay League, an organization solely for the amateurs of the State, which will be affiliated with the American Radio Relay League.

THE ROCHESTER (N. Y.) RADIO CLUB

The regular meeting of the Rochester Radio Club was held on May 27 at Mechanics' Institute. Reports of committees were received. The Banquet Committee reported that arrangements had been made to hold the event Thursday evening, June 16, at Powers Hotel. Professor Ballard, of Cornell University, spoke on "Some Phases of C.W. Transmission." He is considered one of the leading experts on radio in the country. A delegation was present from the Radio Association of Western New York, of Buffalo, two of whom spoke.

The Engineering Committee reported that cards were being mailed to those who were reported for violating Federal and club traffic laws and that conditions were being improved rapidly.

BATAVIA RADIO CLUB

The boys of Batavia, N. Y., have organized the Batavia Radio Club and have elected the following officers: President, John Valentine; vice-president, John Johnson; and secretary, Ackley Wicks. Richard Ogden and John Johnson have been appointed to make arrangements for weekly talks on radio subjects.

SYRACUSE AMATEUR RADIO ASSOCIATION

Fifty-one amateur wireless operators attended the first annual banquet of the Syracuse Amateur Radio Association recently. They were present from Utica, Skaneateles, Cazenovia and other Central New York places.

Among the speakers were E. L. Colby, head of the Colby Telegraph School at Auburn; W. G. Jackson, professor in North High School; Daniel Woodworth, of Syracuse, and Willard Taylor, of Syracuse. They outlined recent developments in telegraphic science.

SOUTHAMPTON RADIO CLUB

The Southampton, N. Y., Radio Club was reorganized recently and meetings are now held the first and third Wednesdays of each month. At the re-election of officers the following were elected: President, Leo Turner; secretary-treasurer, Clarence Deim; traffic manager, Robert Freeman, 2AO. The purpose of the club is to interest amateurs in the vicinity of Southampton in amateur relay work. The more advanced members are experimenting with C.W., while the others are getting good receiving sets installed. We invite correspondence with any other radio organization. Address all communications to Clarence Deim, Water Mill, New York.

THE COLLEGEVILLE RADIO CLUB

At a recent meeting of the Collegeville Radio Club, held in the station of G. G. Clamer, 8A1A, the election of officers was held. The results were as follows: President, A. C. Baden; secretary-treasurer, F. M. Mergenthaler. Amateur radio activity in this section has been on the increase all through the summer as is shown by the increasing membership in our club. Meetings are held every Tuesday at which business is first transacted and then talks and discussions are held. Correspondence from other clubs would be appreciated and should be addressed to the secretary, Collegeville, Pa.

FORDHAM RADIO CLUB

The Fordham Radio Club has heretofore been functioning as an institution dealing with radio work in general, while those in the club, who specialized in continuous wave work organized a C.W. chapter, and were chartered by the club. The interest in C.W., however, has grown to such proportions and the membership has increased so rapidly that it became necessary to change our system. Now we are organized as a C.W. club with a "spark" chapter for those members who are not yet C.W. members.

As a C.W. club we have adopted a standard transmitter that all C.W. operators use. At a recent meeting a paper was read in which the details of construction and theory of operation were fully described. We have found the adoption of a standard set to be of material aid in getting the spark men into C.W. operation, and in solving the problems always encountered in C.W. work.

We are at present formulating plans for the erection of clubrooms where a C.W. set will be installed. At that time we expect to take an active part in relay work.

At the present time local traffic is being handled smoothly by a number of the phone operators throughout the district, while the greater part of the D.X. traffic is handled on several nightly schedules by ZXK.

We expect very shortly to begin the publication of a club periodical, containing a permanent record of the proceedings of the club, and enough technical and humorous matter to make it interesting to the radio fraternity at large.

Pending the completion of permanent quarters, meetings are being held at the home of Mr. L. M. Cockaday, ZXK, 2674 Bailey Avenue, Bronx, every Monday evening at 8 P. M. Men desiring to join should attend a meeting at that address to make formal application. Communications should be addressed to the secretary, Mr. William Weller, 2156 Webster Avenue, Bronx, New York City.

IRVINGTON, N. J., RADIO CLUB

After a very busy season of lectures, radio talks, banquets and conventions, the radio club is having its clubhouse remodeled and redecorated, and while this work is progressing we have departed slightly from the regular routine of business and are laying plans for another busy season next fall, when we hope to have a 100 watt C.W. set, and telephone in operation. This set is being figured on at present but will be in the course of construction very soon. We will still retain our one-half K.W. set for emergency.

At the past Presidential election we had the official return station of Irvington, and had the set installed in a local news office. During the returns approximately two hundred phone calls were answered.

During the big fight between Dempsey and Carpentier we operated a battery of loud speakers placed in the Krueger Auditorium at Newark, N. J. This auditorium holds about two thousand five hundred people and was packed long before the fight started.

We also had a set at the Elks' Club in Irvington and received the returns there with loud speakers. The results were greatly appreciatd by all present at both stations and after which the operators were deluged with questions pertaining to the mysteries of wireless.

The club holds its meetings every Thursday evening at 8.30 o'clock and visitors are heartily welcome at any of the meetings at the club house, 55 Linden Avenue.

RADIO SCCIETY OF CHRISTCHURCH, N. Z.

On Feb. 15th the radio society of Christchurch was formed, about twenty wireless enthusiasts meeting together at the home of Mr. R. J. Orbell. The following officers were elected: President, Mr. R. J. Orbell; vice-presidents: Messrs. L. Steel and H. Ragg; secretary and treasurer, Mr. L. F. Ball. The society now has over thirty members. Rooms have been secured in the center of this city and keys to buzzers, lectures, etc., are in full swing. We are not so fortunate as American amateurs, we have no permits yet, but we are informed that receiving permits will be granted shortly. The club is preparing for this by getting a receiving set together. This will be of the two-step amplifier type, using honeycomb coil tuning, etc. Several of our members possess fine receiving and transmitting sets. Transmitting, of course, is not done at all, but a good many receiving stations are working. We are too keen to keep away from radio until permits are issued. European and American stations are easily received all the time, especially POZ, LCM, LY, YN, 1DO, NPM, NPN, NSS, KIE (spark and C.W.). All these can be heard on one bulb and can be heard with phones several yards away, using a four-stage amplifier (resistance coupled). This is rather good, considering that we are about twice as far from Europe as from the United States.

We would be very pleased to hear from anyone who cares to write. Correspondence from other clubs is especially invited. All communications should be addressed to the secretary, Mr. L. F. Ball, 114 Southampton Street, Christchurch, New Zealand.

RADIO IN ARGENTINE

I am an enthusiastic reader of your paper and would like to get into touch with some fellow "hams" out there.

I have a receiving set made up of a loose-coupler and a French army type tube. I get all the stations around here besides three or four radiophones.

I've also got a ¼ K.W. transformer and Murdock condensers and hope to soon have the set working.

It is very difficult to get anything out here unless one is a millionaire. Dealers charge exorbitant prices. One has to pay as much as three times the ordinary catalog prices. It would be fine if some firm started a shop here through an agent. I'm sure the amount of amateurs would increase surprisingly.

At present there are about 150 "hams" in the Argentine.

I would be very glad if you will publish this so as to get in touch with some of the boys out there. J. Horace Sotham, Guanacache 3965, Coghlan, F. C. C. A., Buenos Aires, Argentine Republic.

GREEN POINT RADIO CLUB

Several amateurs of the Green Point section of Brooklyn, N. Y., starting a radio club, notice is given here for those interested. All amateurs in this section are invited to correspond with Mr. George W. Pope, 1038 Lorimer St., Brooklyn, for detailed information.

THE SUNDAY LEADER RADIO CLUB

The Sunday Leader Radio Club was formed last January for the purpose of encouraging and helping the amateurs throughout the Maritime Provinces and Newfoundland.

For several months radio articles were published in the *Sunday Leader*, a Halifax, Nova Scotia, weekly paper, but on account of the difficulty of securing articles through the summer months it was decided to stop printing them.

It is hoped that the Maritime amateurs will send the secretary descriptions of their sets, constructional details of their homemade apparatus, hints and hook-ups, etc., as it will not be possible to have a radio column in the *Sunday Leader* unless they do so.

The S. L. R. C. will be glad to welcome as a member any Maritime amateur who sends in full particulars of his wireless set results obtained, call letters, etc.

Address all correspondence to the secretary, C. H. Starr, Windsor, Nova Scotia, Canada.

THE RADIO CLUB OF ELECTRIC LIGHTING INDUSTRIES

This club was formed to bring together the radio amateurs and those interested in wireless. The club has a membership of 140. The officers are the following: J. L. Prince, president; H. R. Searing, vice-president; H. F. Rotchford, secretary-treasurer.

The directors are the following: R. H. Nicherson, A. M. Mitchell, George Gropp, Gustave Shroff, George Ward and C. L. Law.

Also the following committees were appointed: Membership committee, code committee, operation and construction committee and library committee.

The code committee has secured an omnigraph and has started a practice class. The constructon committee has started working on a 20-watt C.W. and phone set. Dues are $1 per year. This club was formed by the radio amateurs of the New York Edison Co.

Any person interested in wireless, who is working for an electric lighting company, and who wishes to join this club, should write to the secretary-treasurer for an application blank. Address H. F. Rotchford, Radio Club, care New York Edison Co., 15th St. and Irving Place.

THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can only publish such matter of sufficient interest to all.

1 This Department cannot answer more than three questions for each correspondent.

2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.

3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.

4. Our Editors will be glad to answer any letter, at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge. You will do the Editor a personal favor if you make your letter as brief as possible.

FRENCH TUBES.

(246) Roland F. Lough, of Plainfield, N. J., wants to know:

Q. 1. Where can French tubes be purchased?

A. 1. These tubes may be obtained at the Electro Importing Co., 233 Fulton St., New York City; from W. R. H. Tingey, 92 Hatton Garden, London, E. C. 1, England, or from Burnham & Co., 19 Hand Court, High Holborn, London, England.

Q. 2. Is the Universal audion suitable for a portable set?

A. 2. Yes, this type of tube may be used in a small set.

Q. 3. Please give hook-up using one variocoupler, two variometers, one .001 mf. condenser and audion socket, a grid leak and condenser, a rheostat and batteries.

A. 3. This hook-up appeared as Fig. 2, page 443, of the January, 1921, issue of Radio News.

DATA FOR SHORT-WAVE SET.

(247) G. R. Rimla, of New Zealand, requests information:

Q. 1. Please give me sizes, etc., of variometers for plate and grid circuits and for variocouplers, for short waves?

A. 1. This data appeared on page 526, February, 1921, Radio News.

Q. 2. Would it be better to use a variometer for tuning the primary circuit than to use a loading coil with a unit and tens switch?

A. 2. The same results may be obtained with a variometer or tapped primary.

Q. 3. For long waves, is it better to use a tickler circuit, or a Weagants circuit with tuned plate and grid circuits?

A. 3. A tickler circuit is somewhat simpler and is just as efficient.

WINDINGS FOR REGENERATIVE CIRCUIT.

(248) W. O. Kondolf, of Rochester, N. Y., would like to know:

Q. 1. What windings should be used in the regenerative circuit, Fig. 2, page 704, April, 1921, Radio News, for the variometers and coupler for 150 to 600 meters?

A. 1. Reply to this may be found on page 526, of the February, 1921, issue.

Q. 2. Is this the best regenerative circuit for short waves, or is the true Armstrong circuit better?

A. 2. This is the Armstrong circuit, but the coupling between the variometers should be adjusted for the best results.

Q. 3. Is the circuit in Fig. 4, on that page, better than the ordinary tickler circuit for long waves?

A. 3. This is the tickler circuit, but with the plate inductance shunted by a variable condenser. Back copies of Radio News may be obtained from the Experimenter Publishing Co., at the regular price.

CAUSE OF HOWLING.

(249) Alymor Quinney, of Komoka, Ont., Canada, would like to have the following questions answered:

Q. 1. What is the trouble with a vacuum tube when a hissing sound is audible?

Q. 2. My detector hisses sometimes. I am using an electron relay tube. What causes this?

A. 1 and 2. The hissing sound in a vacuum tube is generally caused by the charge of the grid leaking inside of the tube. It may be caused by incorrect value of grid condenser or grid leak, or by wrong adjustment of the filament and plate voltage. The electron relay is rather difficult to adjust and 35 volts should be used on the plate for the best operation.

Q. 3. Why is it my detector will not oscillate evenly over the entire wave-length which is about 200 to 600 meters?

A. 3. This may be caused by incorrect value of plate and grid inductance, or incorrectly designed circuit, or else the last suggestion given to Q. 1 is the cause.

VARIOMETERS VS. HONEYCOMB COILS.

(250) Harold Lunk, of Pittsburgh, Pa., wants information:

Q. 1. Which is the better for short-wave reception, a short-wave regenerative set or honeycomb coils?

A. 1. A short-wave regenerative set is better.

Q. 2. Please give a hook-up for honeycomb coils, tickler circuit, the necessary condensers, audion detector and three-stage amplifier?

A. 2. The hook-up for the receiver was given on page 786, of the May, 1921, issue of Radio News, and the hook-up for the amplifier appeared on page 512 of the February, 1921, issue.

H. T. PLATE SUPPLY.

(251) Alva Flippin, of Ranier, Oregon, asks:

Q. 1. Would it pay me to step up A.C. for the plate of a C.W. set, or get a motor generator? I use only a five-watt tube.

A. 1. To obtain H.T.D.C. with a transformer supplied with A.C., you should use two rectifier tubes with a filter circuit, while a motor generator will supply you directly with D.C. Considering the price, we believe you may obtain a small D.C. machine cheaper than a transformer and tubes. Consult the classified ads in the radio magazines.

C.W. POWER TRANSFORMERS.

(252) Emil Horlin, of Brooklyn, N. Y., asks some questions:

Q. 1. Using stepped-up and rectified A.C. with the hook-up of Dannal's radiophone set of page 689 of June, 1920, Radio News, would the choke coils be of the same size as described?

A. 1. The choke coil of the set you mention should be O. K. for the filter circuit.

Q. 2. What range should the milliammeter of the same set read?

A. 2. About 200 milliamperes.

Q. 3. What design of C.W. transformer should be used with this set?

A. 3. A suitable C.W. transformer may be built as follows: Iron core 6 x 4¼ inches outside dimension and 1¼ inches on a cross section. Primary should consist of 407 turns of No. 20 D.C.C. The secondary should be made in two sections of 1,230 turns of No. 30 S.C.C. *each*. The 24V. winding for filaments of rectifier tubes of 88 turns of No. 14 D.C.C. wire, and the six-volt winding for power tubes, 22 turns of No. 14 D.C.C. wire, with a center tap at the 11th turn.

CUNNINGHAM TUBE vs. RADIOTRON.

(253) Edwin V. Worden, Jr., of White Plains, N. Y., sends the following:

Q. 1. Would you please tell me whether there is any difference between the Cunningham V.T. and the Radiotron V.T.?

A. 1. No, they are of the same make.

ELECTROLYTIC RECTIFIER.

(254) Dale Stoddard, of Ames, Iowa, asks for the following information:

Q. 1. How can I make an electrolytic rectifier and step-up transformer to change 110 volts A.C. to 250 volts D.C. for radiophone work?

A. 1. A transformer supplied with 110 volts, 60 cycles and delivering 250 volts, may be built as follows: Core 6 x 4¼ inches outside dimensions, 1¼ inches on a cross section. The primary consists of 407 turns of No. 20 D.C.C. The secondary wound in two sections of 924 turns of No. 30 S.C.C. wire *each*. The rectifier may be made of six, one-quart jars, with aluminum and lead plates 2 inches apart. Three cells should be connected on *each* side of the secondary.

Q. 2. Please publish a hook-up for a radiophone using two bulbs, an audiotron and a Cunningham transmitter, with data for its construction.

A. 2. You will find on page 690 of the June, 1920, issue of Radio News, a hook-up and necessary data for the construction of a two-tube radiophone, but you cannot use your audiotron for transmitting, as this tube is not made for that purpose and would probably glow blue. For the best results, use, if possible, two transmitting tubes of the same make.

AMPLIFYING TRANSFORMER.

(255) Lawrence Peterson, of Worcester, Mass., writes as follows:

Q. 1. Regarding the construction of amplifying transformer in the February, 1921, issue of Radio News, page 533, where can I purchase, and what would the price be, of 20,000 feet of the wire used in constructing the amplifier?

A. 1. Some fine wire may be obtained from any well supplied radio shop. However, if wire of the size mentioned is not obtainable, enamelled wire No. 38 or No. 40 may be used instead.

We suggest that you write to the Manhattan Electric Supply Co., 17 Park Place, New York City, or the Electro-Importing Co., 233 Fulton Street, New York City.

INSULATED WIRE FOR AERIAL.

(256) J. B. Urie, of St. Thomas, Ont., Canada, asks:

Q. 1. Can insulated wire be used in an aerial

A. 1. Yes, insulated wire may be used for an aerial, if no other wire is available.

Q. 2. Is the circuit enclosed a suitable one?

A. 2. Yes, but we would advise a greater capacity for the stopping condenser, for instance 2 Mf.

REGENERATIVE SET.

(257) G. A. McBeth, of Bucyrus, Ohio, requests answers to the following questions:

Q. 1. Can a regenerative hook-up be used in connection with one of the old type loose couplers?

A. 1. Yes, see page 443 of the January, 1921, issue of Radio News, Fig. 2.

Q. 2. Please give data for making variometers for use on a regenerative set; the tubes I have are 4¼ inch and 3½ inch outside measurement, and the wire is No. 28 D.S.C.

A. 2. Forty turns should be wound on the rotor and 40 on the stator.

Q. 3. In the hook-up for a regenerative receiver, page 527, February, 1921, Radio News, there is no grid leak. Is this unnecessary, or is the tube not an audiotron?

A. 3. A grid leak should shunt the grid condenser.

THREE-STAGE AMPLIFIER.

(258) Irvin Stephens, of St. Charles, Mo., asks us to please answer the following questions:

Q. 1. Please give a diagram of a detector and a three-step audio-frequency amplifier using same "A" and "B" batteries for all tubes.

A. 1. This circuit is given on page 512 of the February, 1921, issue of Radio News; if you wish to use a higher voltage on the amplifier tubes, the leads from the three last jacks should be connected together and to the positive of the extra "B" battery, the negative of which is connected to the positive of the first one.

Q. 2. When using Acme transformers, is there danger of a howling noise at the third stage?

A. 2. To prevent howling, if there is any, the filament current should be adjusted carefully. A good precaution consists in connecting the iron core of the transformers to the positive of the "B" battery.

Q. 3. Why is it that, with my new honeycomb coil set, I can cover all waves from 200 to 1,700, but never hear any radiophones, several of which are operating in St. Louis on from 200 to 500 meters?

A. 3. If you do not hear radiophone transmissions it is probably because you are out of their range, or because you do not properly tune your set. Tuning for C.W. or radiophone is very sharp and should be made slowly. Another probable reason is that your aerial has too long a wave-length and you cannot tune on short waves.

Radio Guides Ship

(*Continued from page 184*)

tified by its characteristic signal and the location of which is definitely indicated on the mariner's charts. It is essential that the ship be equipped with a radio compass, the coil being mounted over the pilot house. The receiving set and magnetic compass are located within the pilot house, thus facilitating the convenient manipulation of the device by the navigating officer. The shaft upon which the radio compass coil is supported extends into the pilot house, where it is directly connected through a bearing to the binnacle which carries the magnetic compass. Thus the wireless determination of the beacon station is read directly on the magnetic compass and the complete performance necessary in taking a bearing is merely that of rotating the wireless compass coil by means of a wheel to the critical angle of silence and then noting the position directly upon the magnetic compass cord.

The radio compass on shipboard entails calibration, as is true in the case of the magnetic compass. The metallic mass of the vessel is responsible for a deviation of the electric waves approaching the ship from its normal course of travel. The degree of deviation is dependent upon the relative position of the vessel. The result of calibration involves the application of a correction to the actual radio compass reading, either added or subtracted and varying in amount from zero to a maximum depending upon the fore and aft position of the ship with respect to the direction of approach of the electric wave. A horizontal axis represents the position of the radio compass coil with respect to the ship's center line, and a vertical axis shows the positive or negative amount of the correction to be applied for every position of the coil. A scale marked in accordance with this calibration curve is attached to the binnacle in such a fashion as to enable the observer to read the amount of correction to be added or subtracted directly and simultaneously with the radio compass bearing.

Other than obtaining bearings on known stations or near shore, an even superior virtue claimed for the new wireless signaling and compass system, is that of lessening the menace of fog—the bugaboo of sea-voyaging expeditions. Ships at sea, perhaps in distress or submerged in fog, can be located, and their course determined. In the interest of safety, every vessel at sea in fog could transmit radio fog signals effectively over a distance of 10 miles at frequent intervals. Such a practice would enable a companion ship, within range and when equipped with a radio compass, to ascertain the direction of the vessel thus signaling and thereby proceed with safety and without delay. Finally, in a large perspective, it is claimed that a universal adoption of the system as recently evolved would establish more effective safeguards around life and property on the commerce-traveled oceans.

The Work of the 101st Signal Battalion

(*Continued from page 187*)

charged.

A library with all the latest books on radio, active subscriptions to all radio magazines, keep the members in touch with the radio world. A gymnasium and a pool room are also part of the organization, and frequent dances and entertainments keep up the social end.

A Grip Radiotalker

(*Continued from page* 188)

prietor of the "one-arm" lunch-room, it would seem, would respond to the novelty of this message-bearer and the patron of the café would not be compelled to serve himself. Imagine the consternation of being approached on the street and having a suitcase negotiate a conversation—not an impossible feat for this amplifying apparatus in its ability to repeat a wireless message being transmitted by a neighboring radio station.

Another redeeming feature of this equipment is its capacity to locate the wireless transmitting station, the coil in the cover of the leather container having directional powers. Similarly, indicative of its variable uses, a plug is so arranged on the suitcase that a telephone receiver may be connected in place of the amplification horn. Thereby, when held in front of a Bell telephone land-line transmitter, music or a conversation may be relayed to a friend at some distant point. Experiments have included a realization of this innovation. When related to the amplifying equipment, the infinitesimal amount of energy "picked up" by this small loop is so increased in volume that music or conversation may be heard distinctly in any portion of an ordinary room. Without attempting to appraise its ultimate value as a contribution to the multiple agencies of wireless communication, this strangely-formed equipment is assuredly arresting in its appeal to the popular imagination. Ultimately this device may supplement the talking machine, since one radio telephone transmitting station may supply music to a whole city.

The Termojonic Valve

(*Continued from page* 196)

of the metal net of the valve as a result of the reaction *of the Marconi antennæ, oscillations are produced and the transmission of electro-magnetic waves. By means of a microphone the human voice further varies the size of the waves and the result is wireless telephony.* It is evident that to vary the size of the waves by the modulation of the voice it is necessary to operate with waves of a constant size, such as the continuous wave produced by the *termojonic valve.*

"We have already spoken with and heard a few words from the United States, and I hope soon it will be quite complete. But," concluded the Senator, "it is reserved for wireless telephony to first speak across the Atlantic. Cables will never be able to do it, because of their electric capacity, which distorts the voice."

Later the Senator explained to me his wireless compass. By means of messages *received on special semi-vertical antennæ then automatically marked on a compass,* the position of the ship is fixed, also the shore station and that of any other neighboring ship. This is marked by diagonals on the chart, and course is steered accordingly. Last year, on three occasions, the *Elektra* was saved from disaster thanks to this compass. To show how good a ship she is, the log records that in 12,000 knots traversed last year only on three days was it necessary to have "fiddles" on the table.

This winter Senator Marconi hopes to take the *Elektra* to India, where he has been invited by Lord Reading, the new Viceroy.

RADISCO BETTER "B" BATTERIES

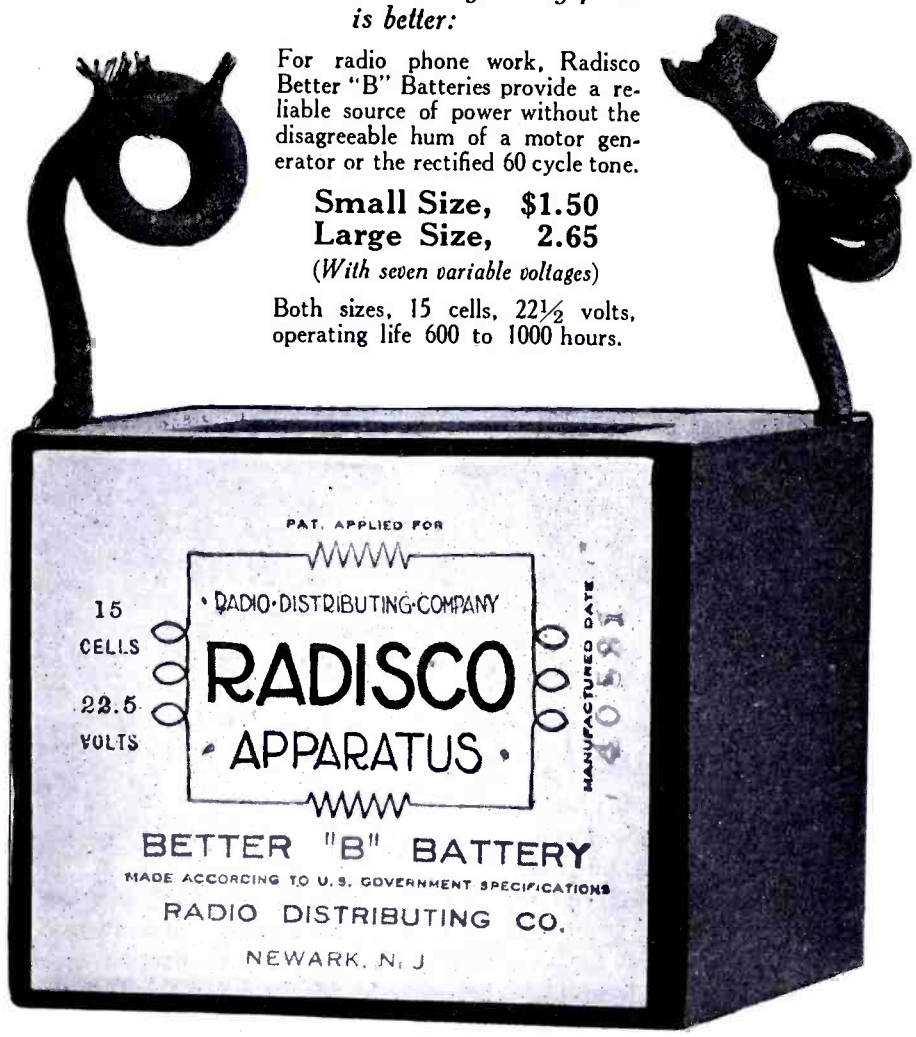
No battery at the price is as good:

No battery at any price is better:

For radio phone work, Radisco Better "B" Batteries provide a reliable source of power without the disagreeable hum of a motor generator or the rectified 60 cycle tone.

Small Size, $1.50
Large Size, 2.65
(With seven variable voltages)

Both sizes, 15 cells, 22½ volts, operating life 600 to 1000 hours.



RA

"Your As

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a month later.

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here. The battery never w
buy, and today still continu
long life for your money.
the market a short time, an
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possible price, consistent with

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Rose Radio Supply
604 Gravier St.

OMAHA, NEBRASKA.
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NEW BRUNSWICK, N. J.
Geo. N DeLaplaine
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8th and Magnolia Sts.

PHILADELPHIA, PENN.
Philadelphia School of Wireless Telegraphy
1533 Pine St.

PITTSBURGH, PENN.
Radio Electric Co.
3807 Fifth Ave.

PLAINFIELD, N. J.
Paul R. Collier,
154 E. Front St.

PORTLAND, ME.
Atlantic Radio Co.
15 Temple St.

PROVIDENCE, R. I.
Rhode Island Electrical Equipment Co.
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SCRANTON, PENN.
Shotton Radio Mfg. Co.
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Northwest Radio Service
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NEW RADISCO VARIO-COUPLER

"Accurate to the .002 part of an inch"

Entirely standardized and made with machine precision, so that micrometer measurements show less than .002 in. (a fraction of a hair's breadth) variation in all important dimensions. Moulded base, Formica tube, all metal parts brass.

Hundreds in use, every one noted for "Satisfactory Performance". Build your own regenerative set, but be sure to use Radisco Couplers and Variometers.

Price of Coupler, $7.50

This Mark RADIO DISTRIBUTING COMPANY · RADISCO · APPARATUS · *Your Guarantee*

Government to Broadcast News by Radiophone

(*Continued from page* 196)

ceiving wireless telephones. From these stations, information may be relayed over coöperative farm land wire telephones.

The plan is to have a certain class of information sent out at a certain hour in order that those wishing it may be advised of the hour to expect it.

The British Government has just appointed a similar commission, composed of Winston Spencer Churchill, Secretary of the Colonies, as Chairman, with one representative each from Canada, Australia, New Zealand, South Africa, and India, which is to consider practical means available for the development of imperial communications by land, sea, air, radio telegraphy, and radio telephony.

Mr. Howell leaves in September to visit London, Paris, Budapest, and Berlin, at his own expense, to study the question, which has been of great interest to him as a civil engineer, in its possible use throughout the Western farming communities.

Correspondence from Readers

(*Continued from page* 214)

LET'S DROP IT.

Editor RADIO NEWS:

Having received so much criticism of G. Ridleak's article from prejudiced sources, I think you will welcome something written from a neutral standpoint.

First of all, in fairness to you, I must say that I have seen similar plays upon words in "QST," in articles contributed, to those which are causing the discussion. Since I believed the publishers of "QST" to be above any other motive, I took it as a little fun at your expense, and I do not see why that which you published cannot be interpreted in the same way.

The fact that you have published those insulting letters and the fact that you publish an "ad" for the A. R. R. L. Convention, proves to me your sincerity.

Some of the letters you have printed savor too much of the "grand-stand play" to be given any serious consideration.

This is a childish discussion at best, and bodes no good for amateur radio—let's drop it.

ALFRED J. POTÉ,
1BBF.

Boston 50, Mass.

HE UNDERSTOOD IT RIGHT.

Editor RADIO NEWS:

I have read with a great deal of amusement, the letters concerning the article by G. Ridleak in a recent issue of RADIO NEWS, and wish to state that in my opinion the whole thing was carried a trifle too far, meaning the comments by 8BIP, and 2PF, as well as Mr. Mann.

The American Radio Relay League is certainly not the organization that I think it to be, if a little thing like the fun which this article poked at it could hurt it. I consider this recognition of it in the same light that Henry Ford does his "Lizzie," namely, every knock is a boost, and anything that our contemporary publications of radio might say in derision about the League would be just one more sincere recognition of the great work it is doing and the big organization it is.

I might say here that the "Awful Racket Raisers' League" should be the official name of the ship operators who open up their 2 K.Ws. on high power and jam everything on 200 meters for 1,000 miles. They are

the bunch of air hogs who deserve the shorted condenser, and I sincerely hope that the next one who tries it in our neck of the woods, blows his Dubilier.

FRANCIS L. PULLEN,
5ZAB.

Houma, La.

Radiomania

(*Continued from page* 208)

of the fact that the outfit arrived all at once, so to speak, in Jones' greenhouse. The roof of that institution did not deter it in the least.

We bartered more or less successfully with Jones. He was a coarse man, and seemed to value a few scrawny tomato plants above the onward march of science. Eventually we led the erring spruces once more roofward, where they remained until I hocked the whole outfit.

I developed a mania for freak apparatus, and some of the creations which have graced my table would make any radio engineer froth at the mouth. To the beginner I can only say, don't do it. I realize that you will just the same. We all do.

About this time some one called my attention to DeForest's notorious experiments *in vacuo*. He began, it seemed, with nothing, and evolved seven dollars and fifty cents worth of electric light and about eighteen dollars worth of contributory and accessory apparata. I could ill afford it, Heaven knows, but needs must when the Bug drives, and eventually my 'phones were outraged nightly by the high plate voltage. The advent of this necessary evil, with its inevitable storage cell, marked the downfall of an heretofore irreproachable carpet. It was, in the eyes of my mother, a carpet of the first magnitude, but sulphuric acid is no respecter of carpets. Be it remarked, *en passant,* that I did not escape scathless.

So it went, one step followed by two

A Radio and Audio Frequency Amplifier

(*Continued from page* 190)

with a switch just under the valves sets the high frequency amplifier to the various wave-lengths required, the left hand stud controlling the shortest waves and the right hand switch the longest waves.

The panel is arranged so that magnetic reaction may be used if desired, in which case the brass link is removed from terminals X—Y and the tickler coil connected in its place. Contrary to the usual type of high frequency amplifiers, and due to the employment of a new circuit, reaction is absolutely steady and under perfect control; the size of reaction coil used with the usual type of single-wave circuit will be found quite suitable when high frequency amplification is switched on.

An Improved Change Over Switch

(*Continued from page* 190)

familiar with a disagreeable kick in the telephone receiver, when changing quickly from send to receive, will appreciate this feature of the new switch.

The closing of the switch in the sending position also closes the power circuit which starts the rotary gap motor and places power at the disposal of the key.

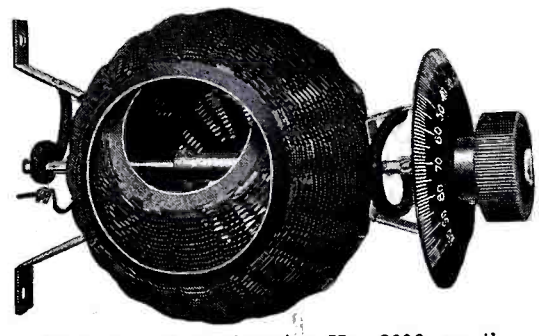
On throwing the switch to receiving position, the power is first cut off, then the aerial is drained and finally the receiving circuit is closed.

AMRAD

The Recognized Symbol of Superior Performance

A Real Variometer

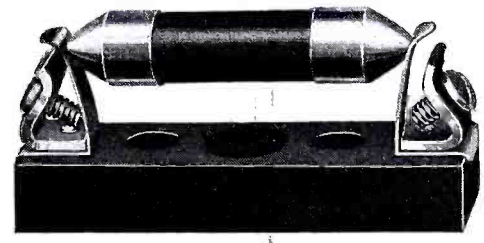
This new Amrad development offers the exacting operator the very apex in efficiency and durability. No other variometer gives such strong signals. No other variometer provides any greater wavelength range than the Amrad. See it! Try it! Use it! The secret of its wonderful performance lies in the absolutely new method of winding, the close clearness made possible by accurate workmanship and the elimination of friction contacts which cause circuit noises. Couplers of the same design also available. Ask your dealer for descriptive Bulletin O.



New Amrad Variometer No. 2606, as illustrated $6.75
New Amrad Coupler, No. 2613..... 6.90
With Knob and Dial, 65c extra

A New-Fixed Condenser

A long-felt need is met at last. These new cartridge-type Fixed Condensers can be used in a standard grid leak mounting or between our special clips (10c pair extra), designed for fastening under a pair of binding posts. Four capacities; each the same price. Use .0001 mfd. for a Grid Condenser. Use .0005 mfd. or .001 mfd. across input binding posts of VT Detector to increase wavelength of regenerative sets. Use .002 mfd. for a telephone shunt or by-pass condenser. Different capacities can be clipped in or out in a second.



Fixed Condenser in Grid Leak Mounting.

A Novel Grid Leak

As simple as it is perfect. Rugged and permanent; not easily broken. Fits a standard grid leak mounting. Six resistance values; each the same price. For Radiotron U.V. 200, ½ megohm. For A-P Detector Tube, one and two megohms. For tubular Audiotron, three megohms. For old Electron Relay, four and five megohms. Grid Leaks and Fixed Condensers described in Bulletin N.

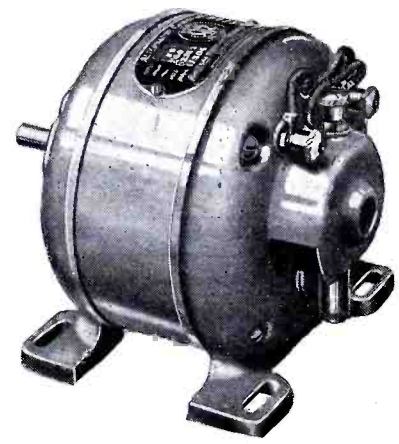
Amrad Grid Leak No. 2332, $.35

Aerial Wire

The aerial problem solved. Pure copper wire, seven strands No. 24, in 125-ft. coils, per coil 60c. Our supply is limited; order at once from nearest dealer.

A New Synchronous Motor

Our Motor Division, which manufactures fractional horse-power motors for industrial purposes, under the trade name "TWIN-R", has made this valuable contribution to the Amrad line. This reliable and moderate-priced synchronous motor is being welcomed by those operators desiring a pure high spark frequency note. We can supply 1/12 H.P.—1800 R.P.M.—110 V.—60 cycle—synchronous motors (¼ H.P. frame size). Its rugged construction, long bearings and tool steel shaft, ½" diameter, permit the use of the largest discs. Immediate deliveries. Send for Bulletin T.



Synchronous Motor $25.00
¼ H.P. Frame

However, for greatest distance and lowest decrement the Amrad QUENCHED GAP is recommended.

All products trade-marked AMRAD and all products trade-marked TWIN-R—the big brother of AMRAD, are guaranteed to give satisfaction. Send 10c for complete catalogue.

AMERICAN RADIO AND RESEARCH CORPORATION

203 College Avenue, Medford Hillside, Mass.

15 Park Row, New York **608 So. Dearborn St., Chicago**

TWIN-R

RELIABILITY **RUGGEDNESS**

steps, that by endless lamps, until in desperation I was about to turn once more to silicon and endeavor to start all over again, when, as suddenly as the disease had seized me, it quitted me. One night I was an ardent fan, the next morning I awoke with a positive distaste for all things radio. After vainly striving to arouse some enthusiasm, I swore off with a finality that left no doubt as to the sincerity of my intentions. I haggled for days with the Faithful, disposing of every last piece of my once cherished outfit and turned to pastimes new. I was done. D-O-N-E spells "through." I was out. It was over.

I have been back just four times since that irrevocable quit, and I haven't the slightest doubt that unless I am called into unexpected consultation with Peter I shall have that many more excursions. Don't try to throw the thing. It can't be done.

A Single Control Universal Range Receiver

(*Continued from page 205*)

high plate voltage (45 volts is best for all around work) over this range of wavelengths. So a compromise was effected. A small 20-turn tickler was fastened permanently in the bottom of the stationary coil, and through a small two-point switch was either placed in series with rotary tickler or cut of circuit altogether. This auxiliary tickler is used only when the variable condenser is in shunt to tuning coil for waves from 600 to 1,700.

The series parallel switch for the condenser should not have blades longer than 1¼", to leave enough clearance for dials. Only three switch-points should be used for each side of the switch.

The four-pole double throw switch may be of the DeForest or any other make. It should be mounted in position shown by slot in Fig. 2.

A complete diagram is shown in Fig. 3.

In regards to results obtained, I have had this set with me aboard ship for a few trips during winter months and laying in Gulf ports I have heard amateurs from every district except the seventh. I have heard every medium and long undamped wave station worth while; such as NPL, NPO, NPM, KIE, KET, IDO, LCM, POZ, MUU, UA, FL, OUI, BYC, MFT, and numerous American and Canadian C. W. stations on one bulb only. In comparison with a Navy standard set on waves between 250 and 7,800 meters, this small set gave stronger signals, although it was not as selective.

Its compactness, ease of control and operation, universal wave-length range combined with its low cost make this set a desirable addition to any amateur's outfit.

Note:—The range of wave-lengths given above is for an antenna having a wavelength of 320 meters. If this set is to be used on an antenna of less than 200 meters, I would advise the constructor to increase the size of the winding of short-wave coil. Make it of 72 turns tapped every 12 turns, instead of 54 turns tapped every nine.

CURRENT GOSSIP.

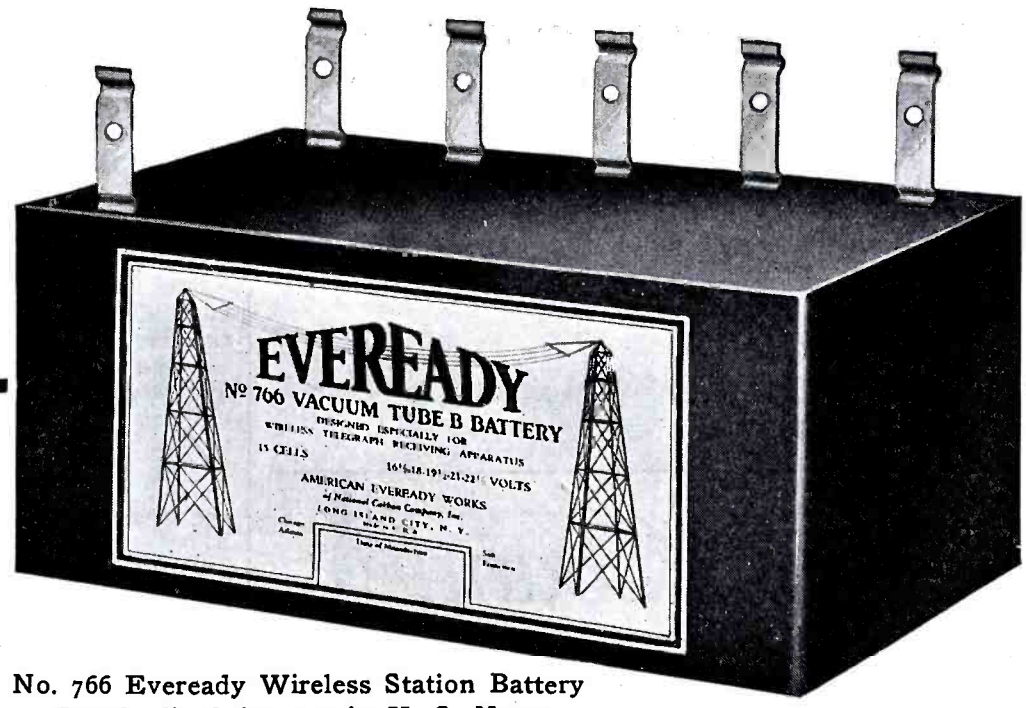
Open Circuit—To a Storage Battery—What are you GASSING about?

Storage Battery—I'm going to be DISCHARGED, and I don't see how I can keep up with my CURRENT requirements.

Open Circuit—You ought to be working in my LINE; I've got some GOOD CONNECTIONS in the electric light industry, and you know there is always a good FIELD for commercial power generation.

Storage Battery—Oh, I don't know if you are so well off, you can't make both ends meet now without going SHORT.

By Wm. H. Parmelee.



No. 766 Eveready Wireless Station Battery
Standardized for use in U. S. Navy

What gives the Eveready Wireless B Battery its extra long life?

THE high quality of materials used—the refinement of process—thorough research and experiment—the suppression of corrosion—the perfect insulation of cell from cell.

Hitch an Eveready to your receiving set, and enjoy the marked increase in effectiveness. Go to your radio equipment dealer—or write us.

No. 763 Eveready Airplane Wireless Battery. Standardized for use in U. S. Signal Corps Aviation Section

AMERICAN EVEREADY WORKS
of National Carbon Company, Inc.
226 Thompson Ave., Long Island City, New York
Chicago Atlanta San Francisco

EVEREADY
FLASHLIGHTS AND BATTERIES

Every wireless operator has use for an Eveready Flashlight

A-24-TE

Practical V. T. Detector and Two-Stage Amplifier

(*Continued from page 204*)

size is left to the individual's own judgment.

The sockets are to be spaced equally apart, leaving a little margin of space at each end. The assembly in turn is mounted between the two panels as in Figs. 2 and 3 and held there by means of screws, which are passed through the panel and secured on the back by nuts. The brass rods may now be screwed between the panels. The two Clapp-Eastham amplifying transformers can now be fastened to the back of the rear panel by means of screws and nuts, which are properly spaced, as shown in Fig. 4. As mentioned above the holes above the jacks will give the necessary ventilation and also serve as windows so the brightness of the tubes filament may be observed.

Now that the outfit is assembled, the next step is the wiring, which is done with No. 8 B. & S. bare copper wire, and it is advisable to run the wire as straight and direct as possible, as No. 8 B. & S. wire is very stiff. It would be advisable to straighten the wire out, making it firm and rigid.

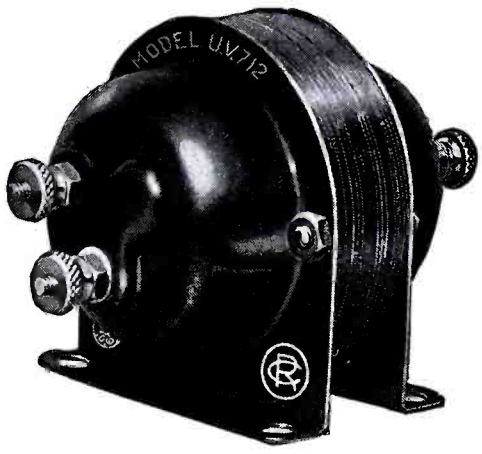
The ingenious arrangement of the different parts makes most of the leads comparatively short and direct. The wiring is extremely simple. The positive terminals of the filaments are connected together on the sockets by one wire running straight across; one wire runs from the negative terminal to the front panel and across the width, having the two rheostats connected from it onto one side of each. The other side goes to each individual tube socket, having one side of the amplifying transformer secondary connected to it. The three jacks are connected on one side to the plates of each individual tube, and on the other side, to one wire which runs direct to the positive binding post of the "B" battery; the two center strips of the jacks are connected to the two individual amplifying transformer primaries. The other side of the amplifying transformer secondaries are connected on one side of the grid leak and grid condenser which connect directly to the tube grids of each individual tube. The end jack connects on one side direct to the plate of the last amplifying tube, and the other side connects direct to the positive side of the "B" battery.

I have omitted showing the position of the grid leaks and grid condensers which are combined, but in the outfit described I have secured them to the inside of the rear panel; the builder may use his own judgment regarding this.

The grid leaks of this outfit are 1 megohm resistance and the grid condensers are of 0.0005 mfd. capacity. They were purchased from the General Apparatus Co.; the jacks and plug were purchased from the Federal Telephone & Telegraph Co., and the sockets from the Murdock Co. The rest of the necessary supplies were obtained from the nearest radio supply house. In this particular instance I used the Magnavox Radio Telemegaphone with one set of binding posts connected to the extra telephone plug, and the other set connected to a 6 volt 40 ampere hour storage battery, which had a rheostat connected in series, making various adjustments and continuous service possible. When the amateur wishes to use this loud speaker, he plugs into either jack he desires and, presto, the signals will be heard all over the room. With this arrangement the necessity of having the receivers clamped on the head all the time will be eliminated and will make it also possible to entertain any number of friends, when radio music is being transmitted. No doubt you have noticed by this time that very little adjustment is required in operating this out-

(*Continued on page 236*)

"ATLANTIC RADIO" SEPTEMBER BULLETIN



U. V. 712

Intervalve Transformer
"Radio Corporation"
$7.00

ANNOUNCEMENT

WE TAKE pleasure in announcing a change of location,—Our Boston store is now located at 727 Boylston street, in the heart of the Back Bay business section. Quickly and directly reached by train or trolley. Additional floor space and an increased sales force *enable* us to give every customer immediate attention. This applies to mail orders as well as over-the-counter purchases. We cordially invite you to inspect our new store.

P. R. 536

"A" Battery Potentiometer (200 ohms)
"Radio Corporation"
$2.00

WESTINGHOUSE RADIO EQUIPMENT

Westinghouse Radio Equipment embodies the latest ideas in receiving equipment, providing a most efficient set for telegraph and telephone reception over the amateur and normal ship wave-length ranges.

Type R. A. Short Wave tuner, Style 307189, responds to a wave-length of 180 to 700 meters and is especially selective. Type D. A. detector-amplifier, Style 307190, combines a vacuum tube detector with a two-stage amplifier. Both units are mounted on Micarta panels attached to a polished mahogany cabinet. Simple in design—easy to operate —single-tuning circuit. Highly efficient.

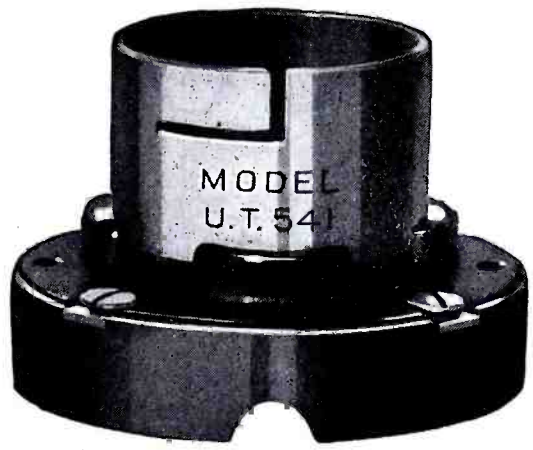
Type R. A. Tuner.....$65.00
Type D. A. Detector Amplifier.. 65.00
Type R. C. (Combination of above mounted in single cabinet)....125.00

TWO SPECIALS

ACME Type F-1 500 watt radio transformers. Exceptional efficiency, as high as 90%. Original price $25.00. Special clearance price, $19.50. Only two left, order at once.

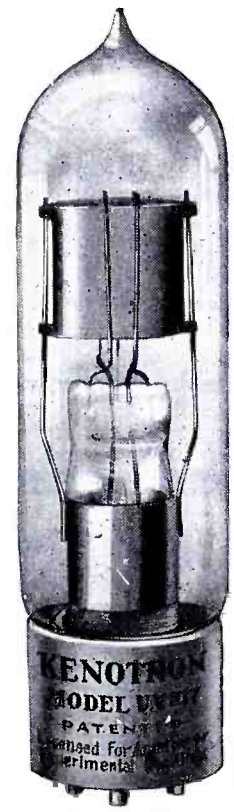
Roller-Smith T-A-W Hot Wire Meters, Ranges, 0-1, 0-2.5, 0-5 amperes.

Special price, $5.00. Just a few left.

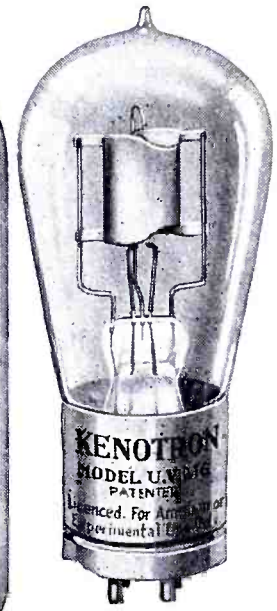


U. T. 541

Tube Socket for Radiotron U. V. 203
$2.50



U. V. 216



U V. 217

USE KENOTRON Rectification for C. W. Transmission

U. V. 216, 20 watt, for use with Radiotron U. V. 202, **$7.50**

U. V. 217, 150 watt, for use with Radiotron U. V. 203, **$26.50**

ATLANTIC RADIO COMPANY, Inc.

727 Boylston Street
Boston 9, Mass.

REQUEST "BULLETIN 14"

Branch: **15 Temple St.**
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Please include sufficient postage with all mail orders

Flying Boat Radio Transmitter

(*Continued from page* 185)

cially designed microphone which would not be sensitive to these noises, but which would be sensitive to the speech. This microphone, made by the Western Electric Co., in turn required a specially designed transformer of very high ratio, about 200 to 1.

By simply switching a buzzer in the place of the microphone, the continuous oscillations will be modulated by the audible high tone buzzer note and in this way tone transmission is secured.

The design of the set was made in such a way that the actual operation of the set is extremely simple. No adjustments are required of the operator other than those of filament current regulation and grid battery potential regulation. Operation then is simply a matter of speaking into the transmitter, or keying. This will be evident from a consideration of the set as seen from the accompanying photographs. Figs. 3, 4, 5 and 6 show respectively the front, rear, right side, and left side views of the complete set.

As seen from these illustrations, the construction of the set has been designed with a view to reducing the weight to a minimum. Practically all the apparatus is mounted on the main panel, and a few parts are mounted on a small sub-panel, which is

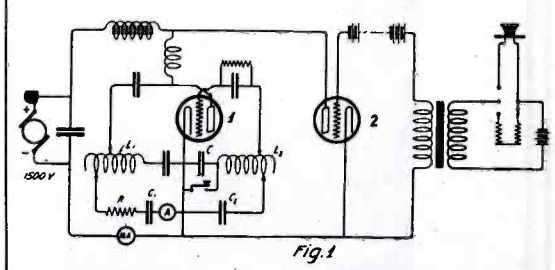


Fig. 1

Complete Hook-up of the Transmitting Set.

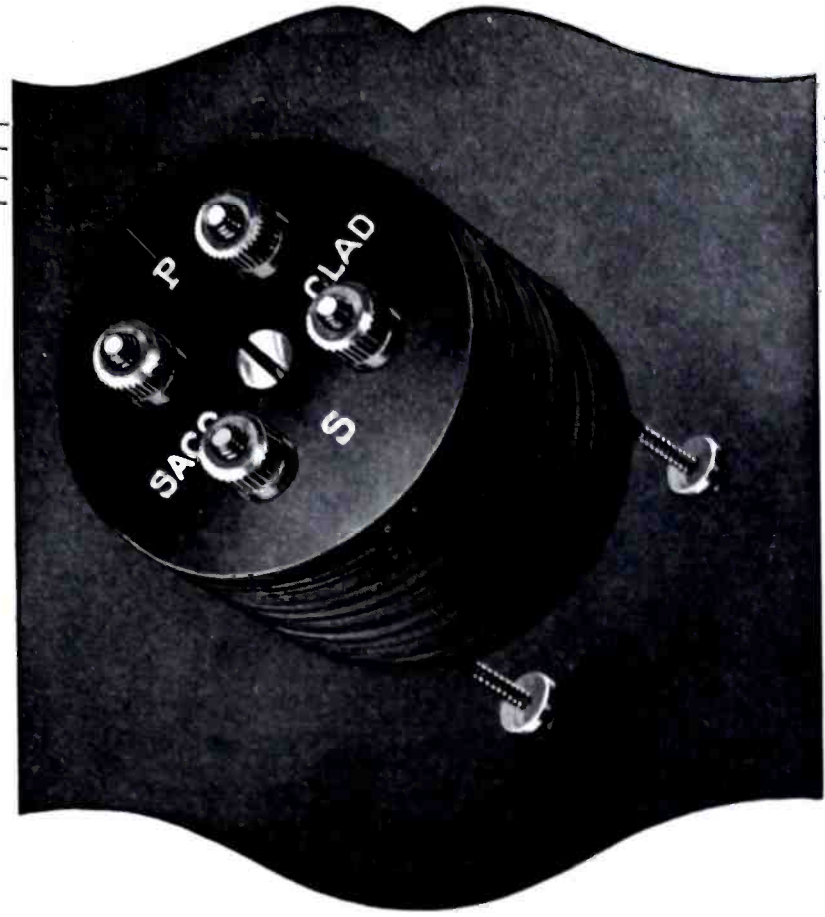
tied to the main panel at the top rear, seen best in Fig. 6.

The main panel is made of a 19-inch square of dilecto and is supported by an angle brass skeleton framework which is strengthened at the top and rear by steel wire turnbuckles which meet at the center in an insulating ring. When not in use, the set is protected by an artificial leather cover fastened to the brass frame with glove buttons.

The rear view of the set, Fig. 4, shows the complete set with valves in place, and gives a good idea of the symmetrical design. The two inductances are clearly seen wound on one tube, slightly spaced at the center. Tied to the coil and brass framework of the set are shown four dilecto rings, two at the top and two at the bottom. In each of these rings are connected three springs. The top ones are connected to a spring cap which fits over the plate terminal of the pliotrons, the bottom ones are connected to a special form of jack-block designed to take the filament and grid terminals of the pliotrons. The pliotrons are, therefore, supported by six springs each and the constructions and connections are such as to prevent sudden shocks being transmitted to the valves.

At each side of the top of the main panel, Fig. 3, front view, is a small Pilot lamp which illuminates not only the meters, but the whole transmitter. The lamp brackets have small switches which enable the lights to be turned on or off as required. The storage batteries supply the power. Only three essential meters are included in the set. The antenna ammeter is a 0 to 2.5 ampere hot wire meter and is always in circuit. The plate current ammeter is a 0 to 300 milliampere instrument and is con-

(*Continued on page* 239)



Photograph shows an ABC SACO-CLAD amplifying transformer, slightly less than actual size.

Use ABC SACO-CLAD TRANSFORMER

No magnetic leakage-no howling

A SOLID WALL OF METAL, 1/8 OF AN INCH thick, completely encloses the SACO-CLAD. *Magnetic leakage is impossible.*

The primary and secondary coils are wound around a laminated silicon steel core. Every part is securely fitted *under pressure*, and the whole held together in one solid unit. Ordinary rough usage that would ruin most transformers has no effect on the SACO-CLAD.

SACO-CLAD'S step-up ratio is 4 to 1,—instead of the usual 3 to 1 or less. You can get a higher voltage in your grids, by using SACO-CLADS than with any other transformer.

SACO-CLAD transformers are designed to provide the correct ratio of impedance for present-day VTs. Six steps of SACO-CLAD amplification have been used *without any howling whatever!* And with 800 SACO-CLADS already in use, there has never been a single burnout!

ABC SACO-CLAD transformers are built entirely in the *ABC* factory, *including the windings*. *ABC* engineers had to design a special winding machine to use No. 40 enamelled wire, in place of the usual No. 44. And, while there never has been a single burnout, the WIRELESS EQUIPMENT CO., INC., accepts full responsibility for all *ABC* SACO-CLAD transformers. Build your amplifiers with *ABC* SACO-CLADS,—and satisfaction is assured by the unequalled *ABC* guarantee, "Your Money's Worth or Your Money Back!"

$5.00

ASK your radio dealer for *ABC* SACO-CLADS. If he should happen to be without them, send his name and address, and 10 cents for the new *ABC* 2-color catalogue, *"Professional Radio Equipment at Amateur Prices."* Request Catalog CR9. If there is no dealer in your vicinity, we will gladly fill your order by mail.

$5.00

Wireless Equipment Co. Inc.

Newark, New Jersey

Standardized Radio ABC SACO-CLAD TRANSFORMER

Just mail this coupon and one dime today to the Wireless Equipment Co., Inc., Newark, New Jersey, for your copy of the new ABC catalog, CR9.

Name .....

Address .....

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

Practical V.T. Detector and Two Stage Amplifier

(*Continued from page 232*)

fit. After you have adjusted the detector and the amplifier rheostats, it is then ready to use at any time. I have used Baldwin phones for a headset.

By shunting a variable condenser across the posts marked No. 1 and F, you will obtain a regenerative effect, or shunting at the tickler coil which may be a honeycomb coil across No. 1 and P and a honeycomb coil across G and F will act as a secondary having the usual primary will make it possible to tune any wave-length 100 to 20,000 meters with the usual variable condensers to make sharp tuning possible. It will be noted that all the apparatus is fastened to either the front or the rear panels and almost all the connections are made direct from the binding posts on the rear panel, making it possible to remove the different apparatus from time to time, whenever it is necessary to inspect them, or for the replacing of a new V. T. or for renewing old parts.

If traveling any distance, the outfit can be easily knocked down and the different parts stowed away in the corners of a bag or trunk. The complete diagram of the proper connections is shown in Fig. 5, with the proper symbols; or the letters and numbers are the same as on the panels themselves. To get the proper wiring for the backs of the panels it would be advisable to reflect the drawing in a mirror, or to place it on top of a plain piece of paper, right side up, and under this paper have a sheet of carbon paper, carbon side up. This last will give the best results as the tracing of the original drawing will make the proper impression upon the under side of the plain sheet of paper. This idea would apply to any or all diagrams.

I have covered all the necessary details pertaining to this particular outfit, but will say a few words more to the effect that its advantages are neatness, fine finish, compactness, workmanship-like construction, moderate price and efficiency. To really understand and appreciate its worth, it would be advisable to compare it with some of those sold in stores. The beginner can make this outfit without the least danger of making a "bull" of it, as all the parts are of well-known makes and widely advertised in all the radio publications, and it only requires patience and time to assemble.

I feel sure this outfit can be built without the least difficulty, as all the drawings are self-explanatory. In the event of difficulties arising, address a letter to me in care of the Editor of RADIO NEWS, enclosing a self-addressed envelope; this will be forwarded promptly and I will reply to same.

Latticed Radio Towers for the Amateur's Station

(*Continued from page 193*)

The succeeding sections were raised by means of the jig shown in the sketch. The jig should be as light as possible as it has to be managed by one or two persons in a rather small place. The side members may be 1 x 3 and are latticed much like the tower. The long leg must be two-thirds the length of the longest section to be raised. This is important as the section must be lifted from a point above its center of gravity, and must be raised to the level of the beneath section. The shorter leg may be

(*Continued on page 240*)

Flying Boat Radio Transmitter

(*Continued from page 234*)

nected so that it reads the total plate current supplied to both valves. In order to read the plate current of any one valve, it is necessary to extinguish the filament of the other valve. The filament ammeter is a 0 to 10 ampere meter and is also connected so that it reads the total filament current taken by both filaments. To read the filament current taken by one valve it is again necessary to extinguish the filament of the other valve. This is accomplished by means of the two filament pull switches seen on the front of the panel in Fig. 3. These pull switches are marked "Oscillator Filament" and "Modulator Filament," and when they are pulled out, the filaments are lit, when pushed in, the filaments are extinguished. On the side of these pull switches are seen two rheostats vertically mounted, one being for the oscillator and the other for the modulator valve. The slider knob on these rheostats are marked with directions for moving the slider for increased or decreased current. Between the two filament pull switches is seen another pull switch marked "Negative Potential," directly above a horizontally mounted rheostat. This rheostat is a potentiometer across the modulator grid battery and the pull switch throws this battery on or off. By adjusting the potentiometer, the proper value of grid potential is obtained. Beneath this grid battery potentiometer is seen the buzzer used for tone-transmission and the microphone jack into which the plug carrying the microphone is placed. At the extreme right side of the front panel directly under the pilot lamp is the antenna terminal set in a moulded insulator, and the ground terminal. At the bottom of the panel are the various binding posts each clearly marked to take its proper lead wire.

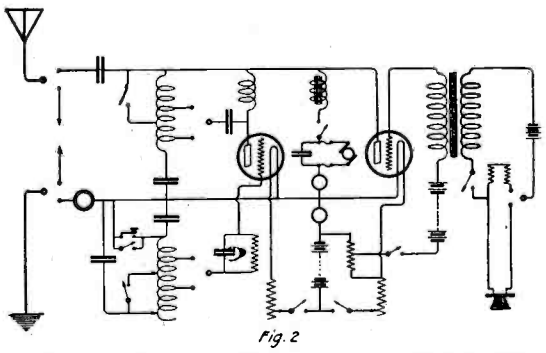


Fig. 2

Actual Diagram of Connections of the Set.

Just below the meters will be seen the three main switches. The right hand switch is the antenna send-receive switch, the center switch is the wave change switch designed for two wave-lengths, the left hand switch is the so-called signal switch which gives any desired kind of transmission, C. W. telegraph, tone telegraph or telephone. When the signal switch is connected to telegraph continuous, the plate circuit of the modulator valve is disconnected from the set; when it is connected to telegraph modulated, the buzzer and modulator are connected in circuit; and when connected to telephone modulated, the buzzeer is disconnected and the microphone connected in its place.

Figs. 5 and 6 show clearly the construction of these three main switches, which are mechanically identical. The body is seen to be dilecto barrel perforated to provide for air insulation. The barrel is provideed with the necessary number of switch jaws, the stationary part of the switching mechanism. The rotating or moving element of the

(*Continued on page 242*)

Latticed Radio Towers for the Amateur's Station

(*Continued from page 236*)

two-thirds the length of the long one. The inner ends of both are bored to fit a ¾" pipe and are spread to a distance greater than the top of the section in place. A bolt through A supports a heavy pulley through which a ½" rope passes from inside the tower to the new section outside. A heavy wire (No. 10 or 2 of No. 12) is securely attached at A and is held at B in such a way as to prevent the members B-C from hinging. From B this wire extends down to a small block attached to the legs at the base.

A hinged support is constructed at C by wiring notched pieces of 2 x 2 to the pipe inside the side members. These in turn are firmly wired to the struts. The pipe itself, however, may be securely wired to the two struts on that side and rest on the 1 x 3 frame mentioned above. The jig may be laid in a folded position across the top of the tower, while the hinge is being attached.

The next section with guy wires attached is set up beside the base under A. The rope from A is attached with a yoke to two struts of this section at a point just above the center of gravity or middle. A light rope or wire should be attached at the same point on the opposite side to guide the section up and to prevent it from "going-on-over" when the jig is pulled back, as will be seen later.

The jig is then hinged back to the position shown in the sketch, the point A being just over the edge of the tower, and the small block tied securely.

One man should be at the jig where he can assist in lifting the section and be ready to fasten the joints quickly. Another will be needed to pull from the ground and manage the small block, and a third to steady on the guide rope. The section is pulled steadily up to its proper level and the supporting rope tied at the base. The small block is then slowly taken up until the section hangs directly over the tower, and retied. The guide rope is pulled up fairly tight at this time in ordere to prevent the weight of the jig from pulling the section clear over. A slight lowering of the hoisting rope will allow the new section to rest in position. The guys should be attached and the section plumbed, after which the joints should be made.

The jig may now be supported from the new section and the hinge unfastened, after which it is raised to the top of this section, set up as above and the next section placed in a similar manner.

If a cross arm is desired, it may be two latticed 1 x 3 fastened together at each end and bowed out in the center and having a guy from one end down 35′ or 40′ on the pole or it may be simply a 2 x 3 rigged with suitable bracing. The aerial rope should pass from the end of the cross arm through a pulley inside and down through the center of the tower.

Rectifying A. C. for Vacuum Tubes

(*Continued from page 200*)

denser C2 is to reduce still more the fluctuations in the D. C. voltage across C1. This is due to the fact that the combination of inductance and second condenser offer low impedances to the higher harmonics in the voltage wave *123*, thus absorbing them and flattening out the D. C. wave so that it is nearly horizontal. Thus their effect is really equivalent to increasing the value of

the first capacity. The use of the inductance and second condenser enables the use of low capacity condensers at C1 and C2. Across the terminals of C2 there will then be a D. C. voltage which is practically without a ripple.

There are certain values of C1 and C2 which are best for any given purposes and these values can be calculated by a method described by Hull in the *General Electric Review* of February, 1916. The derivation of the formulae used will not be given, but the formulae will be given and used in a practical example.

Let L be the total inductance which equals L1 and L2 together.

Let C be the value of C1 C2, the total capacity which is fixed.

Let w be equal to 2 f, where f is the frequency of the A. C. (60).

Let dV be the permissible fluctuation in condenser voltage which will not effect the operation of the set.

Let i equal load current.

Then these equations will give the relations between the various factors.

$$dV = \frac{8\pi i}{Lw^3\left[C+\frac{1}{Lw^2}\right]^2} \quad \ldots\ldots(1)$$

$$C_1 = \frac{1}{2}\left(C+\frac{1}{Lw^2}\right) \quad \ldots\ldots(2)$$

$$C_2 = \frac{1}{2}\left(C-\frac{1}{Lw^2}\right) \quad \ldots\ldots(3)$$

These equations give the minimum fluctuation in voltage for a given total value of C equal to C1 and C2 together.

Take the following practical example: Suppose it is desired to use 750 volts on the plate of a 50-watt tube and it is necessary to use rectified A. C. Let us say that the tube can be operated reasonably well even if the voltage fluctuates to the extent of 5 per cent., that is, the voltage may vary between 750 and 713.5 volts, then dV is equal to 37.5. The problem then is to obtain values for L, C1 and C2 which will give a fluctuation equal to this but not more. The plate current of the 50-watt tube at 750 volts will be about 100 milliamperes.

It is necessary to assume a value for the inductance, and from the experience of others if L1 and L2 are each chosen around 100 henrys, the value will be right. The secondary of old spark coils will do for each of these, thus getting a total inductance of 200 henrys. By substituting these values for L, current, and dV in equation (1) and solving for C we will see that C equals about 2 microfarads. Substituting now in equations (2) and (3) we find that C1 equals one microfarad and C2 likewise equals one microfarad, approximately. Small paraffined paper condensers, similar to the Western Electric telephone condensers, can be built to this capacity which will easily withstand this voltage.

By combining the inductances and capacities together on a small panel, a compact rectifying unit can be built. The cost of this entire rectifying unit with the valves will easily be less than a D. C. motor-generator outfit and will give just as good service.

Flying Boat Radio Transmitter

(*Continued from page 239*)

switch consists of two dilecto arms centrally located in the barrel, each arm carrying a copper blade at both ends, the arms being spaced on a shaft that terminates in the control handle seen on the front view. Each of these copper blades short-circuits two of the adjacent jaws, thus making the necessary electrical connections. The jaws

are made of phosphor bronze, thus insuring good contact between jaw and blade. Although not all of these switches carry the high frequency current, they have all been designed to withstand the maximum high frequency potential to which any one will be subjected. Wherever possible air insulation has been provided by perforations.

At the top of any of the rear views of the set will be seen the sub-panel with its various parts. On the rear side of the sub-panel at the left is seen the antenna series condenser, capacity about 0.1 microfarads. At the center of the sub-panel is seen the long iron cored audio frequency choke coil and at the right top, Fig. 5, is seen the circular, square section radio frequency choke coil. In Fig. 4, at the left, near the bottom is seen the microphone transformer, and to the right of this, directly behind the loading coil, is seen a condenser, which is the balancing condenser in the grid circuit, capacity 0.0004 microfarads. Looking now at Fig. 5, we see at the right near the bottom a dilecto block on which is a small box. This box contains the grid leak and condenser, and behind this is the high tension 1,500-volt generator condenser, capacity 0.5 microfarads.

The wiring on the back of the set is clearly visible, the leads all being No. 12 B. & S., and covered with empire tubing. On any of the rear views there will be seen at the bottom, running horizontally, a lead encased in thick dilecto tubing. This lead is the plus 1,500 volt lead which must be heavily insulated, since it runs near some low tension leads. Wherever there is a lead which carries a very high potential, it is encased in this dilecto tubing to insure safe insulation.

It will thus be seen that all constants are fixed and that apart from the switches there are no movable elements. All necessary circuit changes are taken care of by the three main switches, and thus the operation of the set is a very simple matter.

**Photos by courtesy of General Electric Co.*

Power by Radio

(Continued from Page 209)

decided to use our regular aerial for the test and rig up a temporary affair to use with our set for that night. We invited several amateur friends to come and view the proceedings. The day before we had everything set for the tests and were waiting rather impatiently.

A dozen times that day I went out to look at the weather. As yet we had had no snow, although we had had some cold weather. In the afternoon a storm blew up and about five o'clock it began to snow. We cussed the weather in general and the snow in particular, for the static was very bad and we were afraid it would spoil the tests.

Our shack was back of our house and so I invited Bob to stay for supper, which he gladly did, and which also shows how excited we were, considering that Bob only lives about two blocks away. About an hour after supper several "bugs" dropped in, most of whom were openly scornful. Of course, as we were one of the few stations chosen, we were very optimistic. Personally, I couldn't see the wisdom of any company in trusting a perfectly good Weston ammeter and voltmeter in the gentle(?) care of a full blooded ham, unless they had something to show for it. At any rate, we did not worry about it. As the time grew nearer, we grew more and more impatient. Finally, as Bob held up his hand for silence, we saw him turn around and heard him say, "NAA has just started her time signals." We scarcely breathed those five minutes. Finally Bob

snapped the stem of his watch and said, "TEN O'CLOCK."

All eyes were turned on the meters. Where, oh where, had the power gone? We continued to watch, but there was not a movement of the pointers. Bob looked at me and grinned rather sheepishly, and I returned the favor. One fellow started to laugh, but the look Bob gave him soon shut him up. No one spoke. Silently the fellows turned to go. I felt too disappointed to show my disapproval.

Suddenly Bob let out a yell, "Wait a minute. Are they going by our time or by Central time?"

"Righto," I shouted. "We're not licked yet. We've got another hour to wait."

The bunch came back and sat down, and this time when they started to laugh we laughed with them. We amused ourselves through the hour with a wireless concert, something a trifle unusual just then. However, the sender must have run out of records, for he stopped sending after about fifteen minutes.

It had stopped snowing about nine o'clock and had cleared off considerably. There was very little static just before eleven o'clock (our time) and so we expected good results. As eleven drew nearer even the most pessimistic of our audience grew more hopeful for the success of the tests. Just before the time for the experiment I went over the connections to be sure that they were all in place, and closed the switches as we were directed, while Bob listened in on our auxiliary aerial for any disturbances of the ether. Bob hung his watch on the wall, where all could see it, and as the second hand traveled around the circle for the last time, every eye followed it. Thirty, forty, fifty, fifty-five, fifty-eight, fifty-nine, ELEVEN! As the little hand crossed the sixty mark we all stared at the meters. Suddenly a muffled whir was heard somewhere in the box and the voltmeter wavered and jumped to twenty volts! The ammeter followed suit and read about five amperes. Referring to our "time table" we saw that this was the correct reading. Bob jumped up and slapped the fellow nearest him on the back and nearly knocked him over, shouting "It works, it works," over and over. We saw with our own eyes over one hundred watts being transmitted by wireless! The dream of the inventors had come true! As this power was to continue for five minutes, I stepped over to the receiving set to listen for interference. At the lower wave lengths I could pick up a good many amateurs and some ships, both lake and ocean. As I went on through the scale I could hear NAR, then NAA, and then WSL transmitting at about 6,000 meters. I heard no more stations, although I turned up to 15,000 meters. And through this whole range I could detect no sound besides the signals and a little static. There was absolutely no interference! The five minutes quickly passed and the meters changed, again in accordance with the stated voltage and current. These tests ranged in time from one minute to ten minutes, and the power from five watts to a little over three hundred. Throughout the trial, which lasted twenty-five minutes, not one variation was noted. The apparatus was a perfect success!

We closed the shop for the night soon afterwards and went for a walk "to cool off," as Bob expressed it. I sent a telegram to the company telling of our success and congratulating them on their invention, and then piled in bed and dreamed of the test all over again.

The following day a certain Mr. Thomas, owner and general superintendent of one of the large manufacturing companies, called on me. I was at a loss to know the nature of his call, as I only knew him

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as one of the "big men" of the town. He introduced himself and gave me a letter he had received that morning. I was astonished to see that it was from the wireless power company, and I hurriedly read it through. Briefly, it told of the tests they were making, and the part we were playing, and invited him to "go see" for himself. It also gave the location of one of their big power plants under construction in Minnesota, and the output in kilowatt hours ready for distribution at that time. They quoted him a price on power at about half of that of the local company. If he would be interested in their offer he should call on me and arrange to see the final tests. As befitted a modern business man, he decided to investigate any proposition that would save him something like $10,000 a month in his power costs. Accordingly he asked if he might attend the second set of trials the following morning at 2:00 o'clock. Of course I told him I would be glad to see him there and to bring any friends he might wish. Later in the day Mr. Carroll, another owner of a large manufacturing plant, called me on the phone and read to me a letter received that morning from the same concern and similar to that received by Mr. Thomas. I told him he would be welcome at our station and I told him of the previous night's test. He promised he would be there *"en masse."*

These two men and a few friends arrived about midnight and during the remaining three hours we explained to them some of the mysteries of the wireless and entertained them with a little long distance work. The night was fine for transmitting and we worked about seven hundred miles. As the time approached we ceased sending and waited until Bob's watch (again set by NAA) read three o'clock. Less than thirty seconds after three we again heard the slight whir and the meters jumped as before. The operations were similar to those of the previous night, and so I will not repeat. The third day two more manufacturers joined the watchers. The morning was one of the worst for sending or receiving that I have ever tried to work in. A heavy, driving snow seemed to force the signals down to the ground and the static was terrible. But the power came through absolutely perfect, with no trace of waver in the pointers of the meters. The results were simply wonderful.

The next day we got ready to pack the outfit up and send it back, when we got a telegram thanking us for our assistance and telling us to keep the apparatus for the time being as more tests might be made in the future. We lovingly wrapped the outfit up and stuck it away in a big cupboard, and connected our set to our permanent aerial.

Things went on as usual for a month or so, until one day Bob came rushing home with the news that Mr. Thomas had accepted the contract offered by the wireless company and was now installing a receiving plant. We immediately hied ourselves to the scene of operations for a personal view. A large aerial had been erected between two smoke stacks and a switchboard installed. At this point the engineers of the wireless company made the installation of the receiving apparatus behind closed doors. From what we could pick up here and there, we made out that the concern was willing to take a chance on the discovery of the operating principle, rather than trust the patent office with their secret. Consequently we could only surmise what was in the crates and boxes that were carried inside of the fence. However, we stuck around, and finally the day came when the power was actually to be turned on. Mr. Thomas had extended

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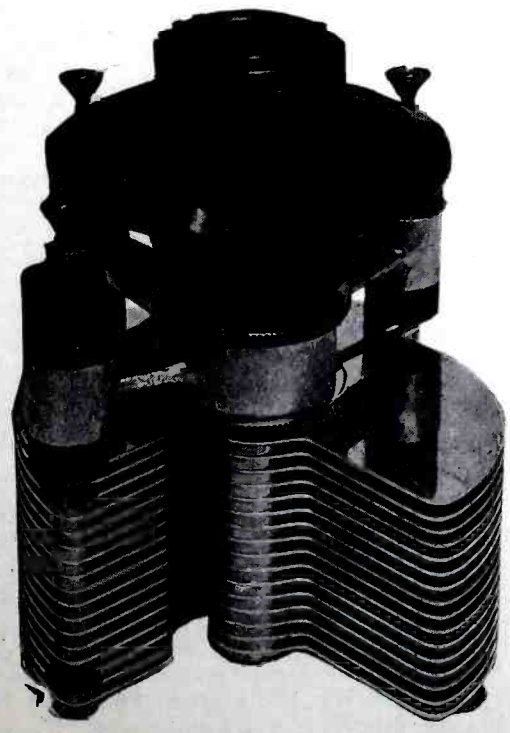

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This condenser used in conjunction with our inductance units will enable you to build a set that you will be proud to own.

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us a special invitation to be present, and while we were waiting for the time to turn on the "juice," he told us some of the details of the affair. The company saved so much money on the fact that they had no transmission lines to install, that they could sell power at about half of the ordinary price. The cost of installation was very high, about $100,000, but as they saved so much one way, his plant could soon make up that amount and save money in the future. One-half was to be paid before the work was started and the other half on completion. We went out to see Mr. Thomas pull the big switch. The whole office force was lined up around the switchboard and in back of them stood the workers, waiting for the "power from above." The engineers said everything was O. K. and Mr. Thomas stepped over to the switch. There was absolute silence as he pulled down the switch. There was a flare of green, and then we could hear the whine of the motors as they increased speed. For an instant no one spoke. Then as by common accord a shout was raised loud enough to be heard a mile. And we didn't restrain ourselves, either. When it was all over we went out to see the final result. The aerial came down into a large brick building and the power wires came out of this, high up on the side. The only door looked like the door of a safe and I think it was stronger. We hung around a while and then went home to discuss it all over again.

Engineers came from all over the country to see the plant in operation, and many went home resolving to have such a plant. We learned in roundabout ways that a good many plants were being built all over the country similar to this one.

And then the crash came. We were at home when someone told us that the power at the plant had failed. We hurried down there and saw Mr. Thomas and the rest of the directors nearly frantic. On inquiry we found that the power went off at midnight and they had telegraphed the company for a man to fix it. The telegraph boy found the office vacant and no forwarding address. Inquiries were started at different plants where construction work was going on, but to their surprise, no one was working. And the last straw had just been reached when the engineers had forced their way into the receiving station. Instead of the intricate receiving apparatus they expected to find, they found only a transformer and a buried power line. And they had just traced the power line to a neighboring power house. We gathered in this information and looked at each other blankly. Urged by a common impulse, we turned and started for the house. We arrived out of breath and as we turned the corner I picked up the axe. Bob nodded his mute approval. We made short work of the black box, and in a moment the whole sham was laid bare. An old clock, long since run down, a series of contacts, a few flash light cells, several resistance coils and two meters, wound out of all accordance with the scales, completed the junk. The posts for the aerial and ground and the switches were dead. We turned and once more put the box back in the cupboard; not lovingly, however.

Eleven chairs around the big table were again occupied. As before, Lewis stood beside the twelfth one.

"The acting treasurer, Mr. Carson, will now make his report," he boomed. Mr. Carson rose slowly, as befitted a man of his weight and importance, and after carefully adjusting his glasses, read the following report:

One complete installation...	$100,000.00
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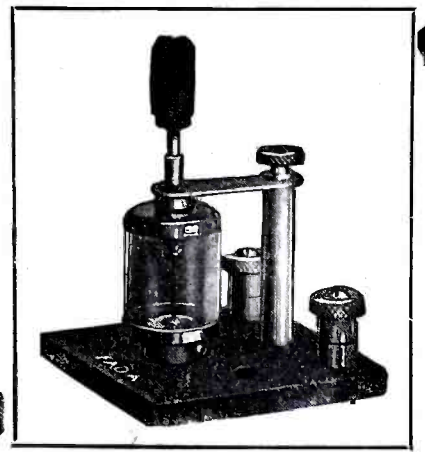

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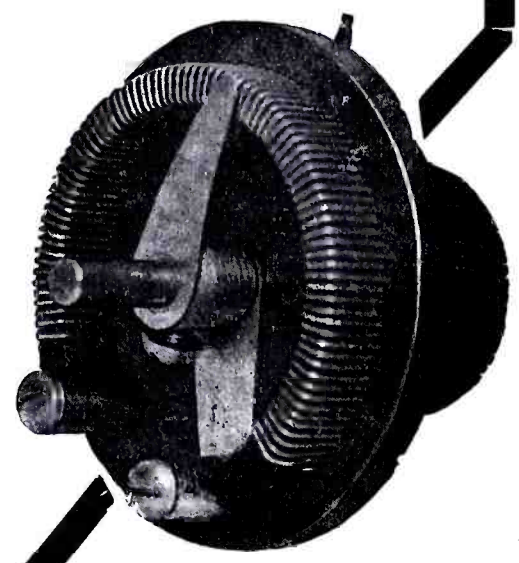

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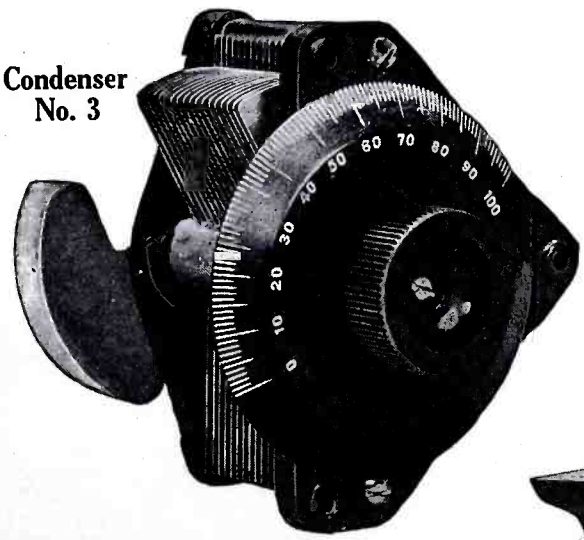

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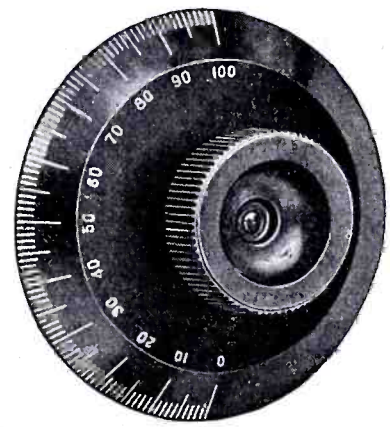

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Mr. Carson sat down in silence.

"Hmm. Twelve millions," mused Lewis. "Not so bad. Next?"

More Efficiency for the Rotary

(*Continued from page* 195)

it is bent over until it makes a right angle. Each electrode is fastened in its slot by means of an 8/32 bolt ½" long.

The stationary electrodes, C, are shaped as shown in Fig. 1 from $\frac{1}{16}$" sheet copper. They are both bolted to a piece of ¼" fiber, ¾" wide, which in turn is held in a slot in the supporting arm, A, attached to the frame of the motor. This supporting arm is of ¼" fiber and of the form shown in Fig. 2. Holes are drilled for bolts to hold the piece, B. The holes above the slot are large enough to pass the bolts freely, while those below are tapped to receive them. Further dimensions for this piece, A, will have to be adapted to the particular motor used. It is to be noted that the piece, A, besides acting as a supporting arm, also serves as an insulator to prevent the possibility of discharge between the stationary electrode, C, and the motor frame.

I. C. W. for the Amateur

(*Continued from page* 195)

the plates and not allow them to become red hot, as the life will be considerably shortened. An aerial ammeter is very useful, but the author used an ordinary flashlight globe shunted with a short piece of No. 22 copper wire as an indicator, until he was able to get an ammeter.

A Mesco No. 55 was used, and by removing the shunt across the sparking points and connecting them in series with the grid, a tone was produced similar to a chopper, with the modulation as good.

OPERATION

The grid should be broken with the key, as this gives the tubes less wear and provides more easily read signals than the compensated C.W. The change to straight C.W. is made simply by allowing the buzzer to stop, for when using the I.C.W. the buzzer is running at all times. When tuning the set, the receiving set may be used as a wavemeter using I.C.W. to tune with, the decrement of the I.C.W. will be very small and that of the C.W. will be nil so that all that is necessary is to tune to maximum radiation.

If an aerial of about 180 meters natural period is used, the best results will be obtained as the antenna current increases, as the radiated wave nears the fundamental. A switch must be provided to apply the plate current after the filament has been applied, so that destructive arcing will not start.

The tubes have only to supply enough energy to make up the radiation and the decrement loss, so it will benefit the experimenter to cut down the wire resistance in his aerial. The use of a counterpoise will eliminate the ground resistance. With a properly designed aerial, one ampere is about the best to be obtained from one five-watt tube.

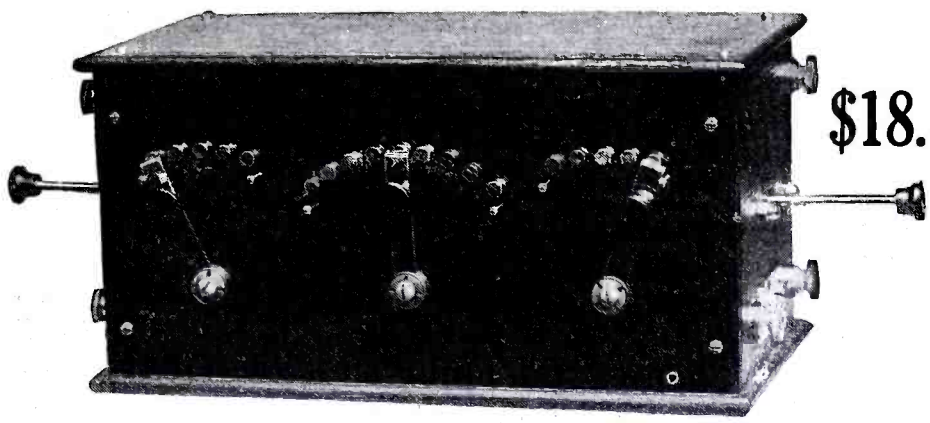
Often some little misconnection will prevent the working of the set, but if the amateur will follow all the directions, he will have little or no trouble, and, providing he keeps the wave below 200 meters, he will never have anything to fear from the Radio Inspector.

Should the Government Examinations Be More Severe?

(*Continued from page* 203)

tery. The majority of the new operators, due to the lack of knowledge, leave abstract sheets, special traffic reports, etc., not filled out, and upon their arrival in port the man at the office gets the job. Little did we realize that the knowledge of just such things as mentioned above was what we would need most when acting as a ship's wireless man. The majority of us did not bother about studying such, for we knew that questions dealing with such subjects would not be asked in the examinations.

Many a time, while at sea, I have heard messages and "tr's" being transmitted to the land station in an entirely wrong manner and together with the operators falling all over the key, a most disgusting mess resulted. It is not surprising to hear ships working, using a very broad wave, which causes no little amount of QRM, and their sparks so rough and scratchy as to make it difficult to distinguish the characters in the sending. In such cases we can easily see that the man aboard knows little or nothing about the tuning of a wireless set or the procedure to be taken to insure having a fine, clear, commanding spark. Such a spark is more easily read through heavy in-



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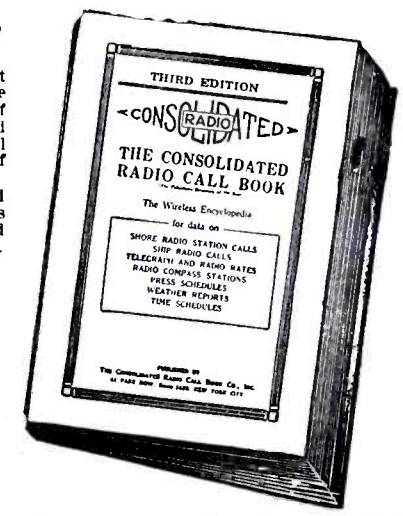

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Kendall Co., W. D. Worcester, Mass.
Killoch Co., David, New York City
Klaus Radio Co., Eureka, Ill.
Kluge, Arno A., Los Angeles, Cal.
Krause & Co., A. F., Detroit, Mich.
Kusel Co., D. & F., Watertown, Wis.
Lehigh Radio Co., Bethlehem, Pa.
Liberty Radio Sup. Co., Chicago, Ill.
Linze Elec'l. Sup. Co., St. Louis, Mo.
Luther, H. E., Centerville, Ia.
McCarthy Bros. & Ford, Buffalo, N. Y.
Manhattan Elec. Sup. Co., N. Y. & Chic.
Marshall-Gerken Co., Toledo, O.
Meter Elec'l. Const. Co., Oshkosh, Wis.
Meyberg Co., Leo J., San Francisco, Cal.
Mohawk Elecl. Sup. Co., Syracuse, N. Y.
Nat'l Radio Institute, Washington, D. C.
New Era Shop Milwaukee, Wis.
Newman-Stern Co., Cleveland, O.
Nichols Radio Sup. Co. Bwlg Green, Ky.
Nola Radio Co., New Orleans, La.
Noll & Co., E. P., Philadelphia, Pa.
Northwest Radio Serv. Co., Seattle, Wash.
N. S. W. Bookstall Co., Sydney, Australia
Pacent Electric Co., New York City
Parks, Henry Francis, Butte, Mont.
Paramount Radio Sup. Co., Atlantic City
Pearlman's Book Shop, Washington, D. C.
Penn Radio Apparatus Co., Reading, Pa.
Penn. Marconi Wireless Schl. Phila.
Phila. Schl of Wireless Tele. Phila., Pa.
Piedmont Electric Co., Asheville, N. C.
Pioneer Electric Co., St. Paul, Minn.
Pitts Co., F. D., Boston, Mass.
Pitts. Radio Sup. Co., Pittsburgh, Pa.
Post Office News Co., Chicago, Ill.
Precision Equipment Co., Cincinnati, O.
Radio Distributing Co., Newark, N. J.
Radio Electric Co., Pittsburgh, Pa.
Radio Equipment Co., Boston, Mass.
Radio Equipt. & Mfg. Co., Minneapolis
Radioelectric Shop, Cleveland, O.
Ray-Di-Co., Chicago, Ill.
Reuter Electric Co., Cincinnati, O.
R. I. Elec. Equipt. Co., Providence, R. I.
Riverside Laboratory, Milwaukee, Wis.
Rose Radio Supply, New Orleans, La.
Roy News Co., Fre'k J., Toronto, Can.
Sayre-Level Radio Co., Phila., Pa.
Schmidt & Co., R., Rochester, N. Y.
Sears, Roebuck & Co., Chicago, Ill.
Service Radio School, Washington, D. C.
Shotton Radio Mfg. Co., Scranton, Pa.
Smith Bros., Sarnia, Ont., Canada
Smith Novotoy Elec. Inc., Charlotte, N. C.
So. California Elec. Co., Los Angeles, Cal.
Southern Elec'l. Sup. Co., San Diego, Cal.
Southwest Radio Sup. Co., Dallas, Tex.
Sprott-Shaw Schl. Vancouver, B. C.
Sterling Electric Co., Minneapolis, Minn.
Stubbs Electric Co., Portland, Ore.
T. & H. Radio Co., Anthony, Kans.
Tuska Co., C. S., Hartford, Conn.
United Elec. tores Co., Braddock, Pa.
Warner Bros., Oakland, Cal.
Whitall Electric Co., Westerly, R. I.
White Co., The, Columbus, Ga.
White & Boyer Co., Washington, D. C.
Williamson Elec. Co., Seattle, Wash.
Wilmington Elec. Spec. Co., Wilmington
Winner Radio Co., Aurora, Colo.
Wireless Mfg. Co., Canton, O.
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terference. It is these things which reveal to us the ship's operator's knowledge of commercial operating.

I firmly believe that the American operator, like our British friends, should be compelled to read blinker signals at a certain rate of speed before being given a license which entitles him to take charge of a ship's station. How often, while passing some unknown vessel in the dead of night, or while lying at anchor in some small harbor, are we asked by the captain to indulge in some sort of a conversation? From experience I am aware that very few fellows holding commercial grade licenses can read these signals. Why not have blinkering come under the duties of the sea-going operator? It would greatly help to make the radio man's presence aboard ship more valued and better friendship between master, mates and operator would surely result. Strange, that a few of our commercial men believe an operator is entitled to demand extra pay for blinkering. Should we be heartless enough to accept our monthly salaries for sending in two or three messages during the entire trip? We should do everything possible to make the radio operator's position aboard ship more respected. Remember, a radio man is considered an officer aboard all ships and it is up to him to uphold his rank.

We all know it is required of us to keep a "log" while at sea, but what sort of a log do half the operators keep, especially the fellows on the freighters? I believe masters should sign these logs daily so as to confirm its truthfulness. It is easy enough for us to put anything down in the log which would never cause any comment from the master, but he could easily tell if we really stood the watches which are entered in the log sheets. Some "ambitious" operators are not men enough to stand the watches they are supposed to. They copy press, weather and obstruction reports whenever they have ambition enough to put the phones on their heads. Operators themselves have informed me, shamelessly, of certain little incidents which occurred while at sea. While returning from "across," due to the clinging effect of liquor, they stood but one or two watches, sleeping half the rest of the time. Can we blame masters and mates for having a bad opinion of wireless operators? We can easily imagine what the relieving operator will have to contend with. These fellows who are disgracing the wireless game will soon be thrown out of the profession as they are not worthy of being in our ranks.

If we were forced to pass a severe examination, instead of a foolish one, we could be sure that masters would have no complaints regarding an operator's knowledge of wireless telegraphy. The operator would know how to do this and that without going down to the engineers for assistance. Engineers and captains do not want to listen to our troubles; if we hold a commercial grade license we are expected to know how to repair breakdowns.

Imagine an operator filling an air condenser with sea water to act as the dielectric, or imagine an operator putting a whole set of storage batteries on the "bum" by charging them in the wrong direction. I recall an incident which occurred during a recent voyage to Europe. Following the termination of Arlington weather broadcast, a fellow on one of the Hog Island boats immediately called NAA and asked him to repeat the last part of the forecast. He called on 600 meters and after receiving no acknowledgment called again. Can we blame a number of English operators for giving this fellow the grand ha! ha!? What a disgrace to the American operator! Never, during my wireless career, have I heard a British operator disgrace himself by asking the foolish questions which a good number of our "just out" American

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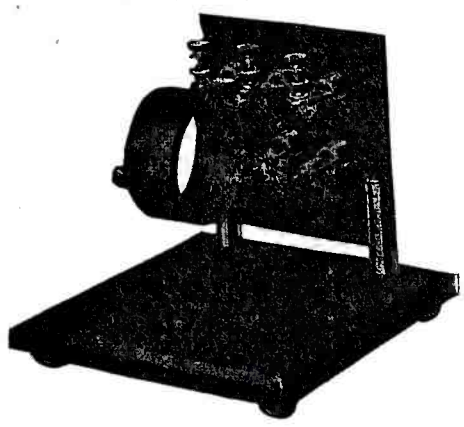

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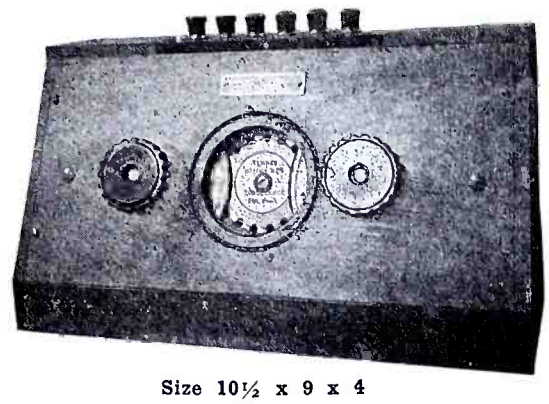

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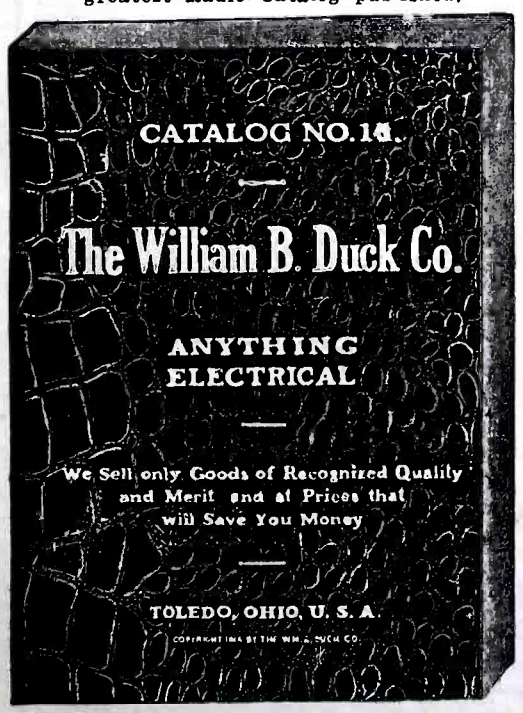

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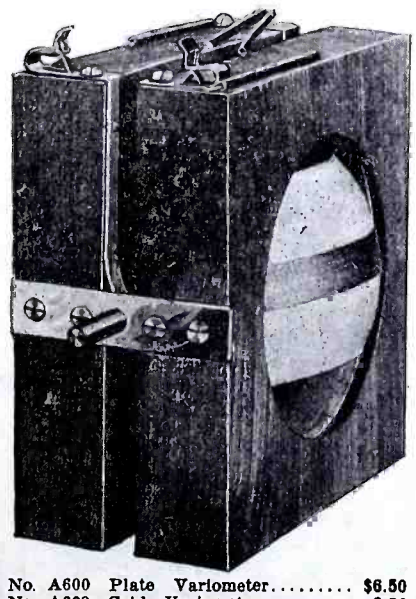

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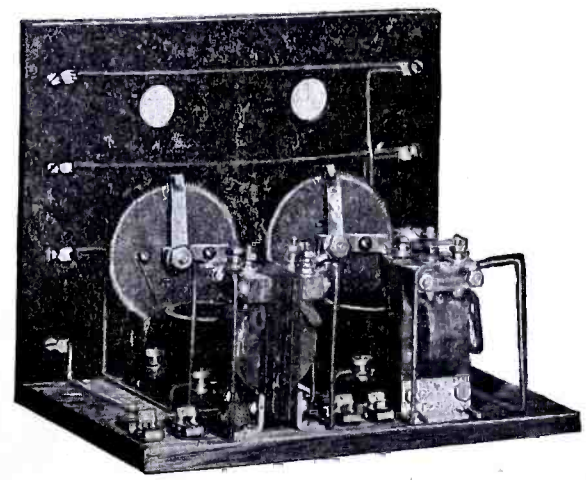

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fellows do. The whole thing is, the British boys were compelled to pass a real examination.

What a difference between the American and English operators. Only the boys who sailed the seven seas can confirm the truthfulness of this statement. First, we can readily hear they all know how to use the key, being good senders. They can also correctly forward their traffic, regardless of the prefix. This operator is compelled to read the Morse lamp signals at a certain rate of speed and is very good when it comes to using other devices designed for daylight signalling. According to data obtained while in various cities of the British Empire, I really believe that only 50 per cent. of the American boys could pass an examination identical to the English, the other 50 per cent. getting a percentage of about 50. If we expect our fellows to be real good operators, they must be asked questions which will some day be of benefit. Never have I found a time, when any of the questions which were asked in the examination were of any use during the hundreds of little break-downs which occurred during the period I served as a commercial operator.

Why not give the applicant a practical test in the manipulation and the various circuits employed in the different makes of radio apparatus? If this were done, any operator, upon going aboard ship, would be sure to know the fundamental principles of the radio outfit aboard, whether it happened to be a "Navy Standard" or a "Marconi P8" set. Very severe questions should be asked regarding the various types of receiving sets. I know of operators who attempted to alter the circuits of receivers they knew nothing about, so as to employ a bulb instead of the plain crystal detector. After trying a number of ways to make the new hook-ups work, they failed and then decided to put the connections back in their old place. This they also failed to do correctly, and the result was a company repair man was necessary to overhaul the entire receiver, when the ship arrived in port. Some steamship companies have issued orders forbidding operators to alter any connections in either the transmitter or receiver; dismissal would result should these orders be ignored.

It seems as though a number of the operators know very little about the emergency power-storage batteries. I have visited ships in foreign ports and found these "bats" entirely run down. The operators aboard admitted they had no idea how the charging panel worked and so could not place them on charge. Suppose in the case of a collision, or running ashore we discovered that the batteries were too run down to operate the transmitter, what would be the result? What is the use of having emergency power if it is going to be useless in the time of need?

The sea-going operator who has himself found such conditions aboard many an American ship, is the only one who can realize the truthfulness of this article, which has been especially prepared for the amateur wireless "bug" who, in the future, contemplates going to sea and I hope it will prove a benefit. Why not make the American operator the best on the high seas? Stop to consider the proposition of making the Government exams. more severe. Wouldn't you rather have a hard time passing the test and be sure of being a good operator, than to get through easily only to discover when out at sea, that you were really only a "ham?" Think it over, boys.

* *Chief operator, S. S. Atlantic Sun.*

Who's Who in Radio
(*Continued from page 203*)

them.

A patent was granted to Dr. Tesla in 1914 on an improvement of far-reaching

importance in wireless work. The application was filed in 1902. It described a new form of transmitter with which, according to Tesla's statement, an unlimited quantity of energy can be transmitted from a small and compact plant. This transmitter possesses the wonderful feature whereby static, the one nuisance of the Radio art, and any other interference, can be completely eliminated.

This master magician of modern electrical science has spent a fabulous amount of time and money in perfecting his inventions, and we await with great expectancy the next great stride in scientific development which will mark another epochal invention of Dr. Nikola Tesla.

Radio Digest

(*Continued from page 202*)

a field strength of 0.2 microvolts per cm. for the signals from Annapolis. Several speakers mentioned that the signals from the American stations are weaker during the night than during the day, although for stations in other directions the reverse is true. —(*Abstracted from the Radio Review.*)

Junior Constructor

(*Continued from Page 213*)

causing leakage, I placed a ten cent funnel over the wire, point upwards, and filled in the top of the funnel with pitch. At the extreme top of the copper wire there is fastened a C. E. 3339 "electro" connector, from which one wire goes up to the top of the house to the lightning switch and the other three to the aerial, which is 40′ above the ground.

Contrary to the popular belief that the lead-in wire must not be brought to a lower level than the instruments, this system works O. K. in every way. Of course, it must be understood that this method cannot be used for a transmitting set.

Contributed by E. H. WALTHER.

SALT WATER RESISTANCE

Some of you "hams" who have small spark transmitters and employ batteries for power had better get on to this:

Secure a large "mayonnaise" jar, or a larger jar if you have more than a ½" coil to run.

Out of ¼" bakelite cut a disc, leaving a ½" border around, so as to make it ½" in all around the jar (top). Cut out another piece large enough to fit snugly into the top of the jar. Then with some thick glue, glue the smaller disc in the center of the larger one and let them dry. It is best to clamp them until they dry.

Then one inch from the center, on opposite sides, cut slots one inch long and thick enough to allow a strip of tin to pass through freely. Secure two heavy brass binding posts. Next cut (with a hack saw) a slot ¼" into the base of the binding posts, respectively.

Then cut out of galvanized tin two strips of same 1" wide and 3¼" long. Fit these into the slots in the binding posts and solder them on. Put the strips through the slots in the cover and put the cover on. Then prepare a solution consisting of one-half teaspoon of common salt (table) mixed in three-quarters of a jar of water. Put the cover with the strips fixed on and it will look as in preceding drawing. Then hook up as in diagram.

Contributed by BERNARD STAHL.

AMATEUR RADIO LEAD-IN INSULATOR.

The insulator described hereafter was made about one year ago, from two porce-

lain tubes discarded by a local electric company as useless, having their ends cut to a special length, for which there was no further use.

The assembly drawing shows how the tubes are arranged inside each other. On the outside of the inner tube, at points about ½" from each end, a layer of rubber tape is arranged, to a thickness which will just push tightly inside the larger tube. After the rubber tape is in place, the smaller tube should be pushed inside the larger one, and care taken that it is tight enough to avoid pulling out easily. In winding on the tape it is better to have a little too much than not enough, as the tighter the rubber is, the better, and if it is loose the inner tube will fall out. In placing the inner tube in its final position, the heads or capped ends of the two tubes should be kept at the same end, and after being assembled, a space of about ¼" left between the heads of the tubes to give the regular "Petticoat" effect and to increase the surface over which leakage might take place in wet weather.

Another way to fasten the inner tube is to pack the plain ends and run hot wax or insulating compound in, making a solid insulator. If hot wax or insulating compound is run in the porcelain, it must be heated nearly to the boiling point, or it will crack when the wax is poured inside the larger tube. In packing the plain end to pour wax a layer of friction tape can be used, as this is a fair insulator, but rubber tape is much better.

In placing the tube, the way first described, the inner tube should have wax or some good insulating grease wiped over the part falling between the two pieces of tape, to prevent moisture accumulation on the unglazed porcelain surface. The inside of the large tube should be treated in the same manner.

There are various ways of fastening this insulator in the wall, some being plastered in place, making other support or fastening unnecessary, while others do not care to do this. In the assembly drawing a fastener used on the original is shown. A wooden block, of soft wood, and of the size shown in the drawing, was bored out to a diameter of ⅛" larger than the diameter of the outer tube. The block is then drilled for the two machine screw holes, using a ¼" wood bit for boring. The exact size and spacing of these holes is not shown in the drawing, as this can be varied to suit the ideas of the constructor. After boring the holes to clamp the block together, it is split, running with the grain of the wood, with a ⅛" saw cut. After smoothing it off, the block is ready to use. The object of boring the large hole ⅛" larger than the tube is to allow a layer of rubber tape to be placed between the tube and the wood, making a watertight joint, and protecting the tube from breakage when fastening the clamp to the wall.

Two blocks, as described, are required to make the insulator fast.

After completing the blocks, the insulator is ready to install. A hole must be cut through the wall or partition large enough to allow the porcelain tube to pass easily and without undue pressure from any point. If one end of the tube is to be exposed to the weather, use the plain end, as the outer tube extends over the inner one, provided tubes of the same length are used. This will eliminate a great deal of leakage due to water on the porcelain. The inner end of the tube should be elevated an inch or so over the outer end to prevent water from following the wires inside. In placing the tube at an uneven level, to keep the water out, the blocks to clamp it in place will have to have the surface next to the wall cut down

at one end, so it can draw tight against the wall without cracking the tube.

After the hole is cut, the tube can be placed in the wall, giving about the same end space on each side, and then wrap the layer of rubber tape around the outside of the tube, from the surface of the wall to a point about ¾" out, so that when the block is put around the tube, and drawn against the wall, the tape will fall under the block, and from packing as already described. After placing the block around the tube, the clamping bolts should be put through the two holes and, after washers are placed under both the head and the nut, should be drawn up to a light tension. The block should then be fastened to the wall, and the screws or other fastenings left loose. The other end of the tube should then be fastened in the same manner, and after getting the block attached to the wall, with the screws loose, the first set of clamping bolts should be drawn up to the desired tension, and the block fastened down tightly. The same is then done with the opposite end. This completes the installation except for painting the wooden blocks, to keep them from swelling with moisture.

In selecting tubes for this insulator it is desirable to have the tubes about 6" or 7" longer than the thickness of the wall, and to have as much space as possible between the walls of the two tubes, or in other words, use as small inside tube as the conductor will permit, and as large an outside tube as is available. Judgment must be used in connection with this statement, since the sizes of tubes ordinarily run from about ½" to about 2" inside diameter. Tubes in which the head of the smaller will slide into the larger should not be used. If it would be possible, due to having an extremely large tube, a third tube could be placed over the outside of the first, and fastened in the same manner, giving a still higher dielectric strength.

The insulator described above was used on a 1-k.w. amateur set for nearly a year, and several times as emergency insulator on board a ship, and has never broken down or shown brush discharge of any amount. The total cost of the original, including a roll of rubber tape, was 94c. which is as cheap as it is possible to make a good insulator. Purchasing the same tubes in a store brings the cost to $1.25.

In case a brush discharge shows on the outer end during damp weather, it can be remedied by wiping off with a rag and some petroleum jelly, and then wiped clean.

Contributed by PAUL G. WATSON.

Effect of Counterpoise on Antenna Resistance

(*Continued from Page* 197)

must result from its reduction of the dielectric and ohmic losses. The reason for this reduction is quite clear as the counterpoise acts as an electrostatic shield for the earth beneath it, preventing the formation of high electric intensities or of conduction currents.

Little information is on hand regarding the resistance of typical amateur antennae. This is due to many reasons, particularly because accurate resistance measurements are so difficult to make. Of all the standard methods given the only one capable of good results is the one involving a C.W. oscillator as driver, and a standard resistance and condenser as phantom circuit. Even this method is full of sources of large errors to the inexperienced, errors of unwitting capacity, coupling and stray currents principally. In a subsequent article

An Example in Radio Economy

(*Continued from page 207*)

system for the vacuum tubes. The photographs show clearly the constructional details. The actual dimensions will of course vary if other parts are used than those shown. The size of the panel in this case was 18" x 10" x ⅛". Thicker material would have been preferable for the panel, but at the same time considerably more expensive.

The wiring diagram in Fig. 1 shows the typical three coil tickler regenerative receiver circuit as well as the automatic filament control jack system. The filament control in particular is a very good feature and a most economical one for the tubes as well as the storage battery.

Here is a list of the materials used and their cost. The engraving as well as the assembly, machine work and wiring was done by the manufacturer. The assembly and wiring cost may be saved by those who prefer to do this work themselves.

Bakelite Panel 18" x 10" x ⅛"	$3.60
One Honeycomb Coil Mounting (Three coil)	9.00
One 0.0006 Chelsea Condenser with Dial	4.25
One 0.001 Chelsea Condenser with Dial	4.75
Three FADA Panel Mounting Sockets	5.25
Three Automatic Telephone Jacks	4.20
Three FADA Panel Mounting Rheostats	3.75
Two UV-712 Intervalve Transformers	14.00
Ten FADA Binding Posts	1.60
One Grid Condenser and Leak	.85
One Phone Condenser	1.50
Engraving Complete	7.25
Assembly and Wiring	5.00
	$65.00

If we may add to the cost of $65.00 an assortment of coils it is seen that for approximately $75.00 we have a finished receiving equipment that is mighty fine in appearance, that is desirable to use and what is most important has been obtained for a very economical cost. In fact, to purchase a good detector and two stage amplifier alone would cost this much money and the receiver would be an additional expense of considerably more.

This is only one instance of the way satisfactory equipment can be had at a reasonable figure. Spark transmitting equipment, radio telephone sets, amplifiers, in fact, any instrument can be designed and built economically with the aid of a reliable manufacturer whose interest reaches beyond the cash drawer. This co-operation of the manufacturer means a great deal to all of us. It will help to reduce the high cost of radio, it will give you better equipment which means better results and it's going to mean the success of citizen radio the quicker.

To those whose work is serious, to he who has the success of amateur and citizen radio at heart, this problem of obtaining satisfactory equipment at an economical cost and everybody pleased is a mighty big problem. The receiver illustrated above is only a suggestion of what may be done to help along the good work.

Vernier Condensers

(*Continued from page 207*)

in relation to the rotary plate. The stationary plates are held together by 6/32 screws and nuts. The spacers generally used are .08" thick. It would be easier and perhaps better to use spacers as thick as ⅛", for the capacity would still be suf-

ficient. The lug F is held by one of the screws by which C is fastened to the base. It can be turned radially so as to fit the binding posts of the large condenser. Lug G is similarly held by the screw holding bracket E.

Careful adjustment will be necessary to prevent the plates from striking together, especially if the narrower spacers are used. In any case, however, the vernier condenser will be found well worth the trouble of construction.

Measuring the Characteristics of Vacuum Tubes

(Continued from page 199)

A large value of K makes the tube desirable as an amplifier.

To measure it directly, set up the apparatus as in Fig. 5. R_1R_2 is a non-inductive resistance so that the center contact may be varied to get the ratios of R_2 to R_1. The slide wire in a Leeds and Northrup student's potentiometer works very well. This must have something on the order of 100 ohms, or it will be difficult to get a point of minimum sound in the telephones. The transformer T may be a bell transformer, a "current" buzzer, or a small alternator. The filament and plate batteries are set at their regular operating points of the tube. The grid

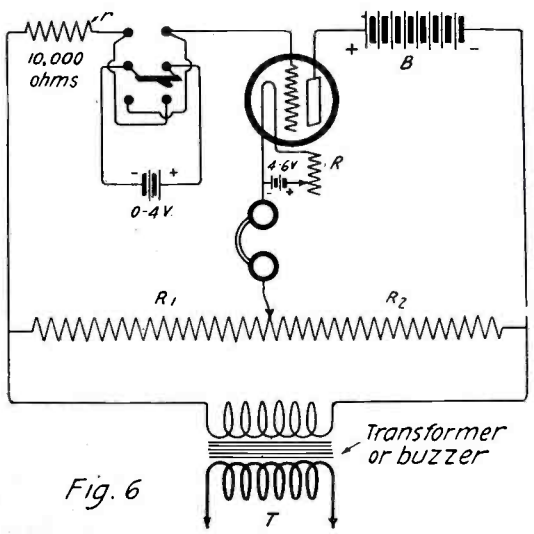

Fig. 6

This Circuit is Used to Determine the Plate Impedance of a V.T.

battery C may be set at about —2 volts for one trial and at "zero" for another.

When the slider is adjusted to a minimum sound in the telephones,

$$K = \frac{R_2}{R_1}$$

The transformer may be replaced by a battery and key and the telephones by a d. c. galvanometer. When no current flows through the galvanometer, on closing the key, we have the same relation as given above.

THE INTERNAL PLATE IMPEDANCE

The internal plate impedance is the A.C. resistance between the plate and filament inside the tube. Set up the apparatus as in Fig. 6. R_1 and R_2 are the same resistances used in the test just given. R is a non-inductive known resistance of about 10,000 ohms. The filament and grid batteries are set at their best operating values as before, and the grid potential set at —2 and "zero" and trials taken. When the slider is adjusted to minimum sound in the phones the internal plate impedance R is

$$R = \frac{R_1}{R_2} r$$

For the grid potential at "zero" the grid battery must be removed so that the grid is connected directly to the resistancer.

The transformer T may be either of the ones used in the test of amplification factor or may be a battery and key. In the latter case the telephones are replaced by galvanometer.

These tests have all been used by the writer in his work on vacuum tubes and with a little care they can be used by any average amateur without a technical training. Those wishing to carry their tests further are referred particularly to Lauer and Brown's "Principles of Radio Engineering," R. Stanley's "Wireless Telegraphy," Vol. 2, and Van der Bijl's "The Thermionic Valve."

The writer will be pleased to receive queries or comment on these tests. Address him at East Liberty, Ohio.

The 3 A.W.I. Radiophone

(*Continued from page 192*)

a complete operating unit in itself.

The circuit used is ostensibly a modification of the one used by the British Air-Craft Service during the War with such great success and was incorporated in this apparatus because of its ease of application to the design desired. The constant current or "power modulation" system is used.

No variable condensers or other delicate controls are used and only two adjustments are necessary for various wave-lengths over the range, i. e., adjustment of the inductances in the antenna circuit and the coupling of the grid inductance to the plate inductance.

The high voltage necessary for the plate potential is supplied by a motor generator set at a point remote from the operating room and controlled by a separate set of switches convenient to the operator. This equipment consists of a 1½ h.p., self starting, repulsion motor belted to two 750-volt D.C. generators connected in series and having their fields separately excited by a separate motor generator. The high tension leads from the generator to the operating room are lead overhead on high tension insulators.

An 0-1,500 voltmeter is connected across the line immediately before these leads are brought to the filter panel and its controlling switch. This, in conjunction with the meters described above, assures the operator that proper power supply and correct operating conditions prevail at all times.

Part of the success achieved by this equipment is undoubtedly due to the excellent antenna equipment provided for at 3-AWI. A 50′ self-supporting steel tower surmounted by a 30′ wooden pole erected on the roof of a four-story house at 2303 North Broad St., Philadelphia, totaling a height of 130′ supports one end of a ten-wire 80′ span, the other end of which is connected to a 30′ pole at the opposite end of the roof, this making an antenna of ideal proportions and of wonderful effectiveness.

At normal filament currents and plate potential of 1,200 volts, when used with the above described antenna, the radiation varies between thee and one-half and four amperes at the wave-length of 200 meters and an effective output resistance of approximately 10 ohms, however, the output seems to be fairly constant over the entire range of wave-lengths, i. e., 200 to 550 meters The modulation is reported as being perfect in most cases, although the percentage of modulation does not seem to be as large as it should be, appearing to be in the neighborhood of 50 per cent.

The successful operation of the set by Mr. Howlett is attested to by hundreds of

letters and phone calls received from amateurs and enthusiasts from the surrounding states, requesting that he continue to give his concerts and nightly talks for their entertainment and instruction. Music has been supplied by this radiophone on numerous occasions for dances and public audiences.

Awards of $100 Radio Accessory Prize Contest

(*Continued from page* 198)

be used with any hook-up in either transmitting or receiving apparatus. In the event of the panel being wired over the tops can be moved around to fit. These would help a great deal those of us who make our own apparatus.

Idea number two, a double binding post. These can be used in any place where ordinarily two binding posts would be used and connected together. These would be especially valuable on an audion panel. The accompanying sketch illustrates the ideas.

Editor's suggestion: Instead of engraving the binding post itself the letters and symbols could be engraved on celluloid caps to fit ordinary binding posts.

THIRD PRIZE.
A New Phone Connecting Jack.
By R. Carsten.

The new Phone-Connecting Jack I designed uses the phone cord tips as plugs. As will be seen from the drawing, it consists of four strips of metal, exactly alike, bent at about a 45° angle, and slightly curved to accommodate the phone cord tips These are placed, two on each end of a strip of wood (or at same distance on back of a panel), so that the tips press against each other lightly. A hole is drilled so that the phone-cord tip goes straight through and is clamped by the two pieces, as shown in the diagram.

Editor's suggestion: This type of jack could be simplified and made of one piece as in Figs. 2 and 3.

FOURTH PRIZE.
Anti-Capacity Coupling Shaft.
By Malcolm Gager.

My entry in the accessory prize contest is an anti-capacity coupling shaft for variometers, condensers, etc., and is particularly useful in short wave regenerative sets to avoid the effect of the operator's hand when tuning. Using this shaft the instruments may be set far from the panel, and accurate adjustment obtained when receiving C.W. or phone.

It consists of an insulating rod ¼" in diameter which is set in the dial instead of the shaft of the condenser or variometer, which is itself fixed in the coupling bushing.

The diagram shows clearly how it is mounted and this device is a real improvement which may be used with any type of instruments actually on the market.

FIFTH PRIZE
Inside Mounted Dials.
By Philippe A. Judd.

My idea which is illustrated in the accompanying sketch is to mount the dials inside the cabinets; and have a small window with a hair line drawn in the center, fixed in the panel through which the scale may be seen. This small window could also be used in the amplifiers as observation hole for the filament brightness.

A HARD ONE.

"Yes, 9DUH is a queer bird."

"He sure is. He reminds me of an audion tube."

"How's that?"

"Because he is a cunning ham (Cunningham)."

By Milan Boex.

OPPORTUNITY AD-LETS

Follow these advertisements every month. Reliable advertisers from all over the country offer you their most attractive specials in these columns.

Classified advertising rate six cents a word for each insertion. Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Objectionable or misleading advertisements not accepted. Advertisements for the November issue must reach us not later than October 10.

THE CIRCULATION OF RADIO NEWS IS OVER 42,000

EXPERIMENTER PUBLISHING CO. INC., 233 and 236 Fulton Street, New York, N. Y.

Agents Wanted.

Big Money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 133, East Orange, N. J.

Men, Women, Children! Sell hosiery. Big profits. Get samples, instructions. Arthur Moose, Tappan, N. Y.

Fast Selling Goods. Every description. Source of supply. Samples 25c. Harvey Teeple, Decatur, Indiana.

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Automobile Owners, Garagemen, Mechanics, Repairmen, send for free copy of our current issue. It contains helpful, instructive information on overhauling, ignition troubles, wiring, carburetors, storage batteries, etc. Over 120 pages, illustrated. Send for free copy today. Automobile Digest, 528 Butler Bldg., Cincinnati.

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Auto Motors Supplies—Buick, Michigan, Stoddard-Dayton, E. M. F., Cadillac, Overland, Continental and Buda Motors. All types, $50 each and up. New Dixie magnetos, $20; Splitdorf high tension magnetos, $10; Kellog pumps $3.50; Auto-Lite generators, new, $10; air gauges, 65c; Remy ignition coils, new, $3; electric and gas headlamps, coils, distributor heads, air compressors, etc. Write for catalog. Motor Sales Dept., 16 West End, Pittsburgh, Pa.

Motorcycles—Bicycles.

Don't Buy a bicycle motor attachment until you get our catalog and prices. Shaw Mfg. Co., Dept. 1609 Galesburg, Kans.

Used Parts for all motorcycles. Schuck Cycle Co., 1922 Westlake, Seattle, Wash.

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Special Garage Motors—Manufactured by the General Electric Co.; 1 H.P., $78.50; 2 H.P., $110; 3 H.P., $128.50; 5 H.P., $166.50. All sizes both single and polyphase motors for immediate delivery. Special charging generators, all voltages. Write for catalog. Motor Sales, Dept. 16, West End, Pittsburgh, Pa.

Blueprints

Blueprints.—Electrical connecting diagrams. Samples 20c. Catalog Free. Charles Chittenden, N 3024 Matthews, Kansas City, Missouri.

Books.

We Buy and Sell back issues of Radio Amateur News and Electrical Experimenter. Boston Magazine Exchange, 109 Mountfort St., Boston, Mass.

Concordia Magazine, Quarterly, 9 Water, York, Penna., prints essays, stories, current events, poetry, formulas and plans. Send $1 for three-year subscription. Sample copy 10c.

Build Your Bungalow from "The Bungalow Man's Plans. Handsome book containing complete Ink Sketches, floor plans and shrubbery planting of 32 modern homes and bungalows. Postpaid for $2. "The Bungalow Man." (Walter G. Treuttner), 4728 Lisbon Ave., Milwaukee, Wis.

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Substantial Manufacturing Corporation wants capable men to establish branch and manage salesmen; $300 upward necessary. Will allow expenses to Baltimore as explained. Address secretary, 603 N. Eutaw St., Baltimore, Md.

Chemistry

Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our full page ad on page 180 of this issue. Chemical Institute of New York, 150 Nassau Street, New York City.

Correspondence Courses.

Dollars Saved—Used correspondence courses of all kinds sold, rented and exchanged. List free. (Courses bought.) Lee Mountain, Pisgah, Alabama.

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Tobacco or Snuff Habit Cured or no pay; $1 if cured. Remedy sent on trial. Superba Co., SB, Baltimore, Md.

Pyorrhea (Rigg's disease—bleeding or swollen gums)—hundreds have been helped by "Pyorrdent" the successful home pyorrhea treatment. Purifying, healing, preventative. **Full month's treatment,** consisting of a very beneficial massage paste and an antiseptic tooth-cleansing paste to be used in place of your ordinary dentrifice, together with full directions for treatment. $1 postpaid. Or write for free booklet "R." Pyorrdent Mfg. Co., 439 Seventh St., Brooklyn, N. Y.

Exchange.

For Sale Quick: 9AEA.—1 KW Thordarson transformer, Dubilier condenser, Amrad gap, glass plate condenser, oscillation transformer, key, motor, battery charger. Particulars on request. Edwin Moore, 309 Sherman St., Joliet, Illinois.

Bargain—Detector and amplifier cabinet with bulbs, $24.00. Daryl McClung, 1221 9th Ave., Huntington, W. Va.

For Sale—Cyclopedia of Applied Electricity, 7 vols., $10; Cyclopedia of Automobile Engineering, 5 vols., $12; Cyclopedia of Drawing, 4 vols., $8. All perfect. G. E. Co. Thompson ammeter, 0-10 Amps., 110 V., $5; brass steam engine, 7/8" bore, 1¼" stroke, with governor, $7; Duck's No. 16X water motor generator, $10; K. & D. No. 9 generator, 6v. 6 amp., $5. Sell or exchange for phonograph or outdoor goods, Colt .45, etc. F. H. Ransford, Dalton, Mass.

Trade—$85 tenor banjo and base, nearly new, $60 cash or will trade. Bertram Rogers, 44-A James St., Newark, N. J.

For Sale—1 "N.A.A." Receiving transformer, $7; 1 fixed condenser, 75c; 1 Jove detector, $1.75; 1 bell and push button, 75c. Warren E. Wilson, Medford, Oklahoma.

For Sale—1 K.W. Thordarson Type "R" transformer, $28; Young & McCombs rotary, $12; Vibroplex (bug) telegraph key and secondary key for use on wireless, $15; General Radio hot wire meter, 0-10 amps., $5; Murdock oscillation trans., $3; C-R-CO. oscill. trans., $8; Murdock 2000 ohm headset, $3; NAA loose coupler, $4.50; Murdock 43 plate variable condenser, $2.50; DeForest type P-402 audion panel and cabinet, $9. Kenneth Wright, Corydon, Iowa.

For Sale—Hardwood rotors, 55c, prepaid. Benj. Ainsworth, 561 Grand Street, Brooklyn, N. Y.

Stop—National Radio course, complete, $50. C. H. Crawford, Box 47, Hastings, Nebr.

Sell or Trade—.45 cal. automatic, belt, magazine carrier, holster, extra magazine, cost $55, sell $40; brand new Jap 8X binoculars and case, cost $65, sell $45; 1 KW Tesla coil, $10; Murdock fones, $2.50. Want Grebe CR-3 Baldwin fones, Magnavox. S. L. DuBuclet, 3722 Concord Place, Chicago, Ill.

Memorize Continental Code in one hour. Qualify quickly for amateur license. See our ad on page 260 this issue. C. K. Dodge.

Sell or Trade a 100-9500 meter, damped or undamped wave, audion receiving cabinet, complete with bulb, batteries and phones. Want detector and two-step and regenerator. Edgar Knepper, Maitland, Missouri. 9DUQ.

For Sale—Variometer regenerative receiver, $15. One step amplifier including B battery, $18. Ralph Leffler, Tiffin, Ohio.

For Sale—Complete spark and C. W. receptor including 125 ft. 3 wire aerial, ground switch, tuner, detector and two stage amplifier, tickler, Baldwin E phones, loud speaker horn, new B batteries and three new A. P. tubes. Entire outfit encased in oak cabinets, $100. F.O.B. Hamburg. Worth $185. Selling out to raise money to go to school. R. L. Lenhart, 21 N. Fourth St., Hamburg, Pa.

Benwood for Omnigraph or $15. Nisbet Mayre, Lafayette Drive, Atlanta, Ga.

Cash—Faragon .004 mfd. Cond., $25; Marconi 2 qt. Leyden jar, $3; 1 pt. jar, $1.50; Connecticut variable, $5; Radio Tron, $4.50; 2 rolls omnigraph tape, $.25 each. All these are new. Following are slightly used: Murdock O.T., $4; Ford spark coil, $1.50; antenna switch, $1.75; Western Union 4 line 2 instrument plug board, $3.50. Fred. A. Blethen, Houlton, Maine.

For Sale—Grebe CR Five with tube, Sixty-five Dollars. Duck Navy tuner, thirtyfive hundred meters, Ten Dollars; Federal amplifying transformer, Five Dollars; loading coil, fifteen thousand meters, Five Dollars; Murdock forty-three plate variable condensers, Two-Fifty. Earl Barritt, Care Western Union Telegraph Co., Bowling Green, Ohio.

15,000 Meter Loading Inductance, new, $4.50; 3,500 meter coupler, $3.50; Westinghouse type radiophone receiving set complete, $20. S. M. Boddington, Elmhurst, Pa.

Sell—$30 omnigraph, perfect condition, 15 dials, first $20 money order takes it. Harry Baldwin, Union City, Pa.

For Sale—Receiving set with audion detector. Also Ford spark coils. Write for particulars. Dan Brock, Waynesburg, Pa.

Honeycomb Coil Set with audiotron, batteries, etc. Alan Chapman, Decatur, Illinois.

$185 Moving Picture Outfit—Want wireless telephone. Box 82, Canton, Ohio.

For Sale—Good regenerative set for music, $10; 1 transmitting button (new), $3; 1 ¾" spark coil, $4. $15 takes all. Noel C. Bronson, 41 Plum St., Greenville, Pa.

Murdock Navy Type Loose Coupler. New style. Almost new, $12; Lyle Anderson, 3685 17th St., San Francisco, California.

For Sale—Motiograph motion picture machine, model 1A. Good condition, used 3 months, cost $312, sell $75. F.O.B. Plainview, Wayman Davenport, Plainview, Texas

Sale—Cheap, 6 volts battery and radio parts. Diehl, 379 East 162nd St.

Complete Receiving Outfit—3,500 meter crystal set. Brandes phones, Navy type transformer, 53 plate condenser, $23; Aerial wire, ground set, insulators, $5. Lyman Drake, Wilmette, Ill.

(Exchange continued)

Sell—2 Clapp-Eastham variometers, without dial, $4.25 each. Navy coupler, $7.75. L. Didsbury, 111 Jane St., Bridgeport, Conn.

For Sale,—1" coil, $5; gap, $.50; key, $1; Murdock transmitting condenser, $2; Tron detector panel with potentiometer, $7; two new audiotron bulbs, $4 each; 6 Marconi-Victor records, $5. Clarence Deim, Watermill, N. Y.

For Sale or Trade—18 V., 20 A D. C. Generator and H-Davidson single cylinder belt drive, magneto engine. Will trade separate—What have you for $45. Walter deWaal, 3502 Jones, Omaha, Neb.

Bargain—Electro "Tuckerton" receiving outfit. Never used, for $23.50. Everette Dye, Plainview, Texas.

For Sale—Complete wireless receiving outfit, $23. Write for particulars. Paul R. Eshelman, Esterly, Pa.

Sale—Thordarson ¼ K.W., $10; Murdock rotary, $12; O. T., $3.50; ¼" coil, $2.50; 1", $4. Howard Frazier, 5714 Hazel Ave., Philadelphia.

For Sale—Receiving set consists of 3500 meter coupler two variable condenser, patentiometers, detector, price $15. Audion detector, $15 extra. Ransford French, Blue Ash, Ohio.

For Sale—DeForest type P-300 Ultra-Audion detector and one step amplifier. Nearly new. Price $35. Fred A. Grizner, 282 Steinway Ave., Astoria, L. I.

For Sale—RLC5 Mignon cabinet receiving set, can be used with either audion or crystal detector, tunes to 9000 meters; cost $45, will sell $25; General Radio mounted amplifying transformer, $5; also, one step amplifier mounted on Bakelite panel, $9; Model 5 Oliver typewriter in good condition, $20. Ralph Goodspeed, Wilton, Maine.

Sell—½ K.W. Acme type F-1, fully mounted, $20; Saw tooth rotor, $3.50; loop aerial, $3. Alfred Gienow, River Edge, N. J.

Sell—Telefunken ship set, receiving. Wavelength 200-2500 meters, $25. Address Alfred Gienow, River Edge, N. J.

Bargain—Ranger Motorbike. Nearly new, $35. Roscoe Hanna, 310 Hoy, Wilkinsburg, Pa.

Bargain—Gilbert $65 transmitting and receiving set, $35, Practically new. E. W. Hoffman, 3221 Chestnut St., Milwaukee, Wis.

For Sale—Triple coil honeycomb DeForest cabinet type. Six D. L. coils, amplifying transformers and other stuff very cheap. Jos. Halperin, 1723 Melville St., Van Nest, Bronx.

Look! 3" spark coil, $12; heavy, flanged gap, $2. Trade coil for a good 5-watt power tube. Write. Frank J. Homsher, North Glenside, Pa.

DeForest type panel for eighteen panels, $5.00; Acme amplifying transformer unmounted, $2.50; 0-50 Jewell Voltmeter 5" diameter, $5.00. Leitch, Park Drive, West Orange, N. J.

At Sacrifice—Short wave regenerative set, $35; detector and 2 stage amplifier, $40; ¾ K.W. Acme transformer, $20; 2-100 AH-6 V. storage batteries, $14. 50V storage battery with charger, $10; 3 K.W. oscillation transformer, $10. All guaranteed and shipped prepaid. R. H. Marshall, Jr., 425 Lincoln Ave., Bellevue, Pa.

New York Wireless Institute Omnigraph, $26. John Maurer, Spring Valley, Illinois.

For Sale—350 volts Ray-Di-Co motor-generator, $33, new W. E. VT 2, $9; socket, $1. Mack's Phone Shop, 483 Main St., Ansonia, Conn.

Variometer Regenerative Set in mahogany cabinet, $25; two large loose couplers, $12 each. Ralph W. Miller, 136 Hudson St., Reading, Pa.

Sell—New Mignon RLC5 Receiving Cabinet, $25 cash; range 200 to 9000 meters. John Morris, 933 Midland Ave., Syracuse, N. Y.

Sell—Phone set complete unwired, $100. Write F. Mann, 327 4th Ave., New York City.

Grebe CR—3A Regenerative Receiver, brand new, $35; DeForest .001 Vernier condenser, $10. Emanuel Nyman, 525 W. 160th St., New York City.

Trade 1916 Harley and side car A-1 condition with lot of extra. What have you in wireless about $275 value. Harold W. Noble, Hop River, Conn.

Sell—Colby short wave regenerative tuner and Remler control panel bulb and B-battery. Brand new. Also condensers loose coupler fones, switches, copper aerial wire, loading coils, insulators—all for thirty dollars. E. C. Norton, Hinsdale, New York.

Clapp-Eastham Regenerative, $25. Place, 350 Sprague, Fall River, Mass.

Long Wave set ready to put in cabinet and connect. A-Bat., aerial and ground, $38. Send stamp for information and list of other bargains. Carle C. Perkins, Box 55, Sangerville, Me.

Long Wave Cabinet Set, $22; two receiving transformers, $8. Phones, switches, condensers. Arlington time set, $9. James Rich, Hobart, New York.

Multi-Wave Receiving Set, 200-20,000 meters; complete with one-step amplifier and bulbs. All in nice cabinet. Send stamp for photo and description. A real bargain. Radio, Box 1504, Providence, R. I.

For Sale—Complete receiving set, only $25. Write for particulars. Earl Soesbe, Greene, Iowa.

First Money Order for $35 takes Radio Type Magnavox. Used once only. C. R. Stevens, 6 Winter St., Framingham Ctr., Mass.

For Sale—Complete one variocoupler and 2 variometers, Murdock, never used, $16. A. Staud, 601 Morgan Ave., Brooklyn, N. Y.

(Exchange continued)

Bargain—Singerland's course, mandolin and case, $15. Will trade for radio. Ralph Spielman, Hagersville, Pa.

Bargains—Triple geared honeycomb receiver with audion in mahogany cabinet, $35; two new 41 plate variables with Corwin dials, each $4; Remler rheostat, 75c; Bakelite socket, $1; crystaloi, $2; Century buzzer, $1. E. Siemsen, Alden, Minn.

For Sale—Sending station 8QG. ½ K.W. Acme transformer, 11,000 volts, cost $25; Franklin 1 K.W. gap and motor, cost $33; oscillation transformer (Penna Wireless Co.), cost $10; glass plate oil condenser, capacity equal six sections of Murdock, cost $20; Boston key, cost $7; 1 K.W. change-over switch, cost $7. Everything for $75, all goods new and guaranteed. Selling reason—telephone trouble. Harold Smith, Charleroi, Pa.

Wanted—Good regenerative set. Reasonable. Not home made. Raymond Schlegel, 1118 N. Negley Ave., Pittsburgh, Pa.

For Sale—DeForest fifteen panel long wave set with a few coils, $125. In good condition. Write for pictures and details. Edward Thurber, 3466 Lincoln Ave., Detroit, Mich.

Sell—First MO for $12 gets Arlington coupler, Crystaloi detector, buzzer, fixed and variable condensers. Fred Trube, 3110-R, Galveston, Tex.

Opportunity!—Short wave detector and tuner—green weathered oak cabinets; grained bakelite panels, $21. Details on request. Radiotron, $4; Murdock 23 variable, $2.50; Murdock phones, $3. Fenn Vogt, Acheson Ave., Washington, Penna.

Sell—D-L coils, 25% off. L. Vexler, 70 Lyons Ave., Newark, N. J.

"Lookee."—New $23 5 x 3 printing press outfit complete, $16. Wanted ½ Kilowatt transformer. Lloyd Vickery, 304 West Lincoln, Blackwell, Oklahoma.

For Sale—15 dial omnigraph complete with receiver, buzzer, and key, $25. Also a rotary spark gap, $10. Don Wiese, 400 University Ave., Hastings, Nebraska.

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For A or B Batteries—Edison 150 ampere hour cells, $6.50 each. W. J. Travers, 815 Humboldt Parkway, Buffalo, N. Y.

Unit Receiving Inductances assure satisfactory, efficient and unparalleled long distance reception of all forms of radio transmission. For long wave work our Bi-Lattice coils (Duo-lateral) need no introduction. For short wave reception a set of single layer coils compares favorably with the best regeneratives; and the cost is but a fraction of the regular regenerative receiver. Send 3c for bulletin. Our prices and service will surprise you. P. J. Stockwell, Box 157-C Reading, Massachusetts.

(Wireless continued)

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(Continued on page 270)

(Continued from page 269)

(Wireless continued)

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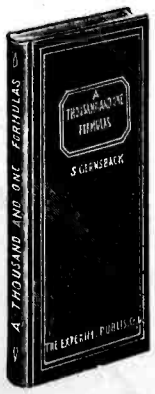

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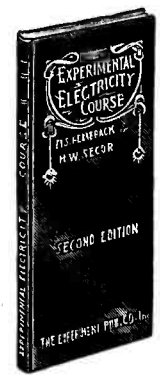

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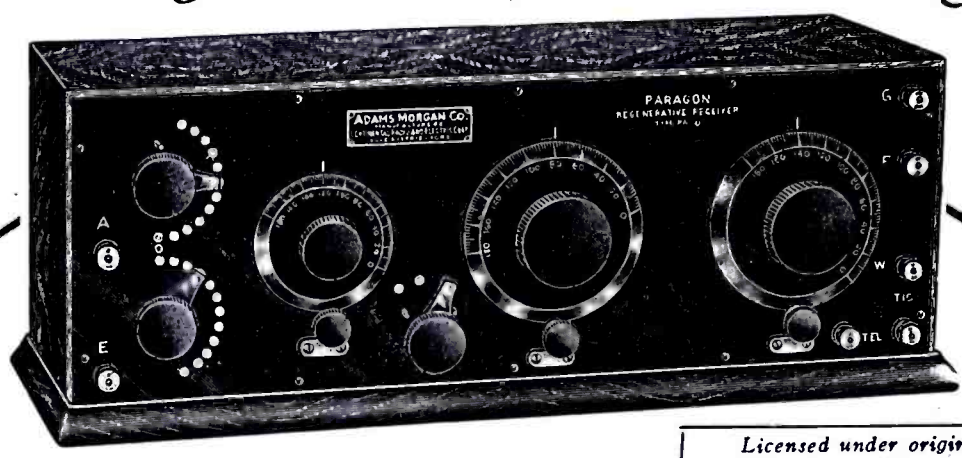

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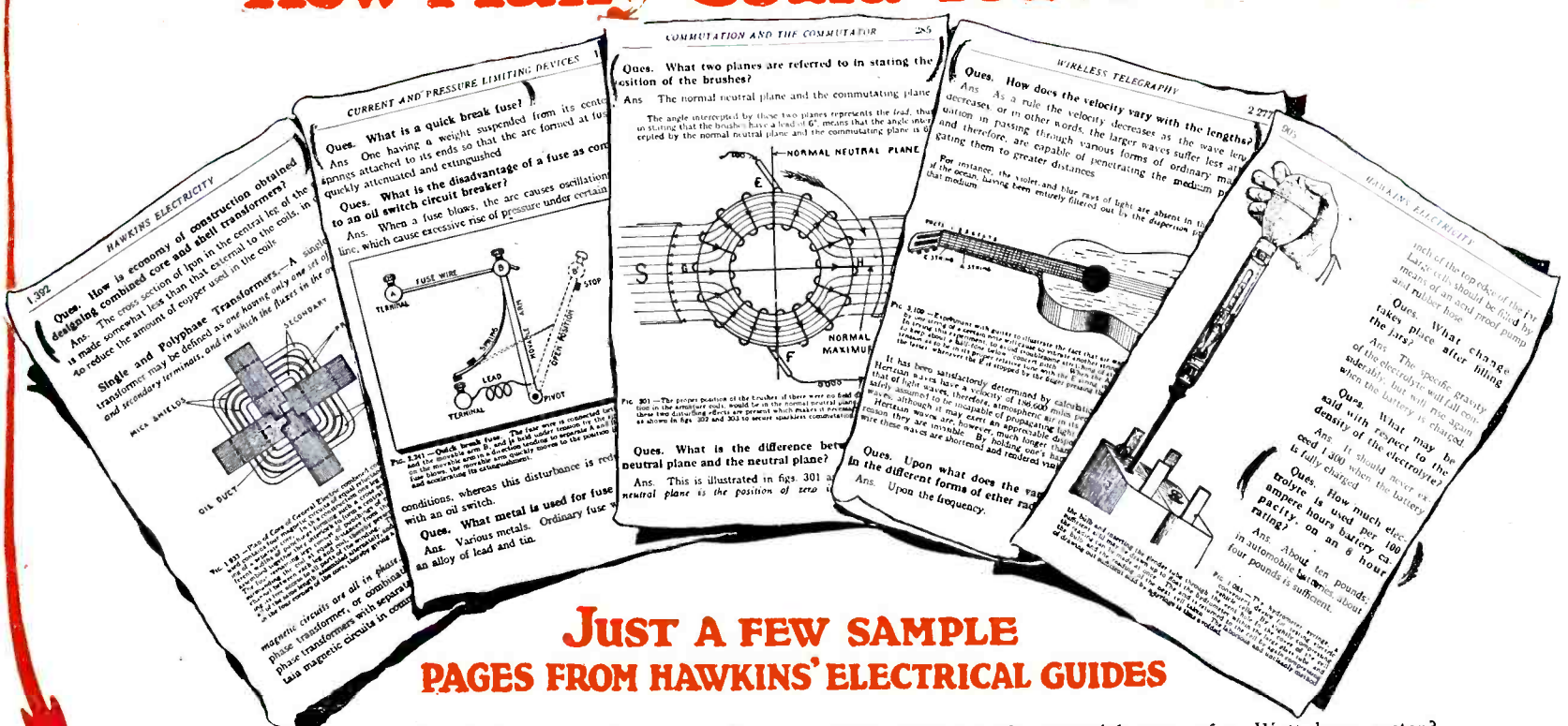

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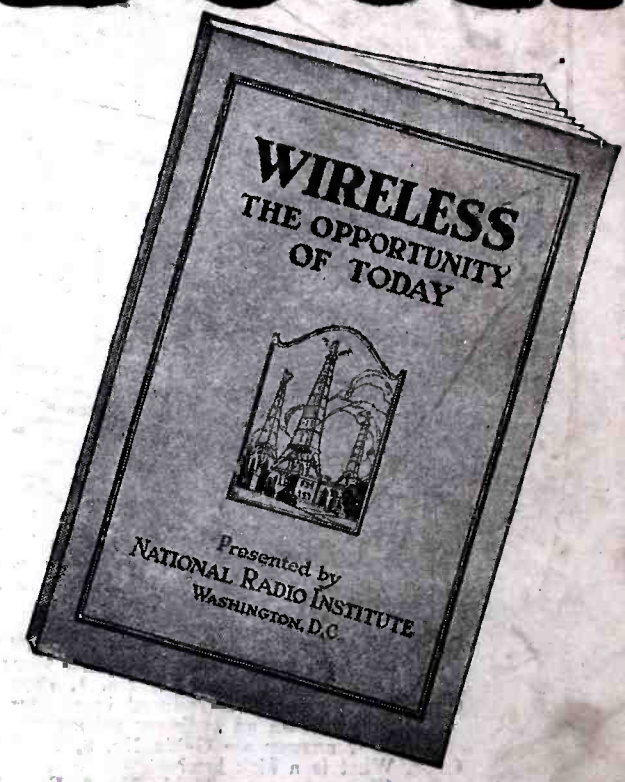

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