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RADIO NEWS

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March
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Edited by H. GERNSBACK

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C-300
GAS CONTENT
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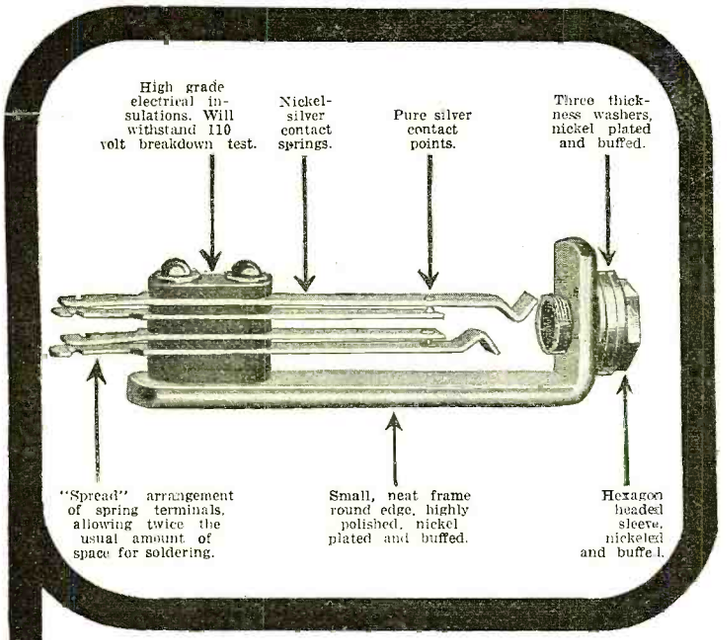

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INTERCHANGEABLE WITH OTHER STANDARD MAKES

Cuts are actual size

No. 132. Plug only, $1.00

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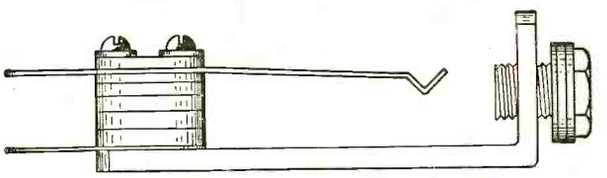

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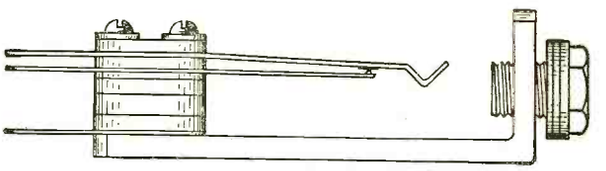

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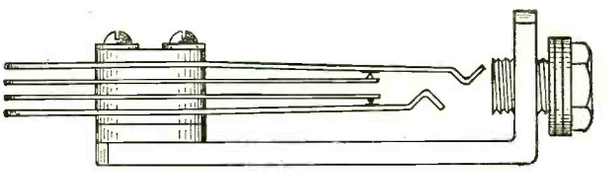

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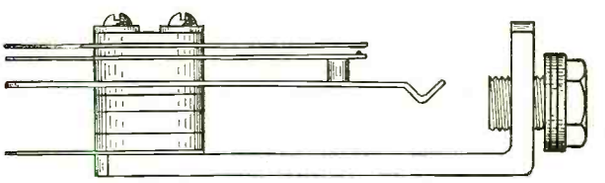

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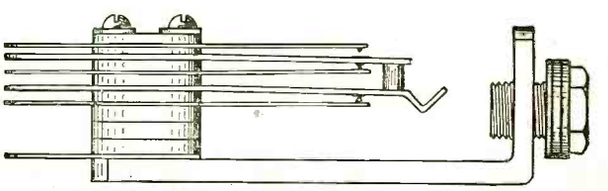

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HERBERT H. FROST

154 W. Lake Street
Chicago, Ill.

RADIO NEWS

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VOL. 3 FOR MARCH No. 9

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Confucius has said = "Only two classes of men never change- the wisest of the wise and the dullest of the dull." The owner of a Grebe Receiver will never change it = he is the wisest of the wise

Doctor Mu

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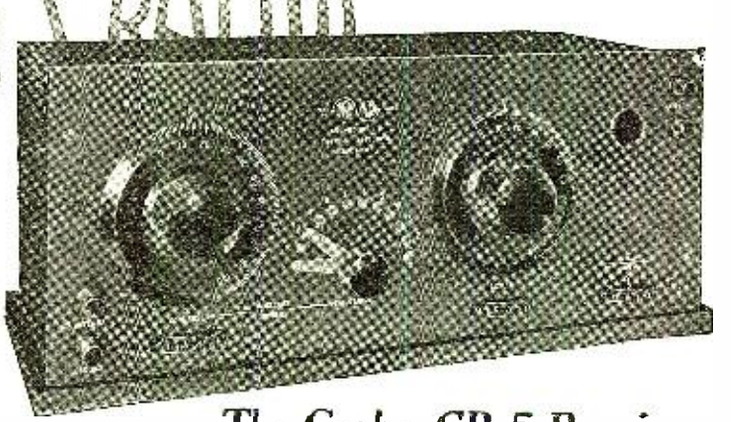

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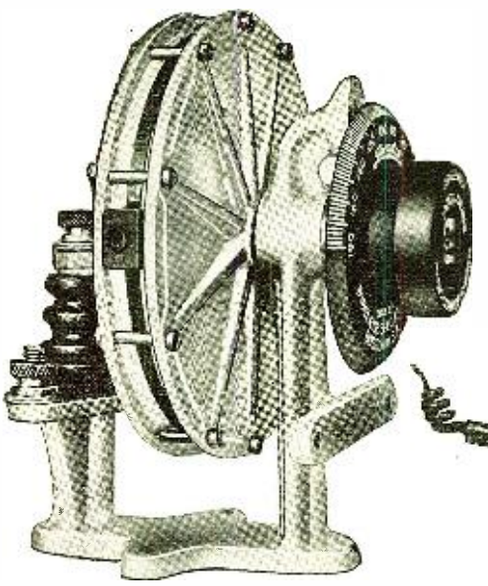

Faradon UC-1803

For use as blocking or coupling condenser in CW radio telegraph and telephone circuits. Lowest loss of any condenser on the market and is the only compact and satisfactory unit of its kind available for CW work today. Positively necessary to prevent "swinging" of CW telegraph signals. Has a capacity of .000025 MFD, and is rated at 10,000 volts.

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Faradon UC-1831

Variable Type

Essential for tuning of CW transmitters. Designed as a series antenna condenser and will stand five amperes of CW and its maximum capacity setting. Will vary your radiated wave length by 50 to 100 meters. Minimum .0001 MFD, maximum .0012 MFD. Rated at 4000 volts.

Price, $9.00

Faradon UC-1014

For use as a key condenser, grid leak condenser, or radio frequency bypass condenser in circuits utilizing Radiotrons UV-202 or UV-203. It is fitted with mounting tabs on back. Has a capacity of .002 MFD. and is rated at 3000 volts. Will carry two amperes at a 200 meter maximum setting.

Price, $2.50

OTHER FARADONS

Model UC-1015

Series antenna condenser and intermediate CW circuit condenser utilizing Radiotrons UV-202 and UV-203. Three capacities possible with each unit; .0005, .0004, .0003, at 7500 volts effective.

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Model UC-1806

Suitable as a grid condenser in higher power Radiotron transmission. Also for insertion across plate transformer in sets where high potential surges follow key transmission. Has a capacity of .002 MFD, and is rated at 6000 volts.

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NOTE: These two models are similar in appearance to UC-1014

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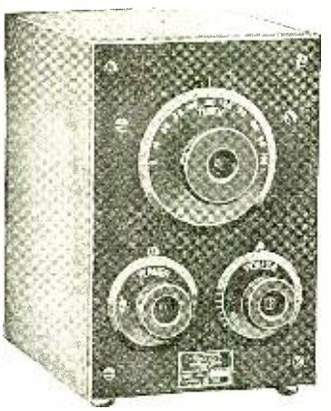
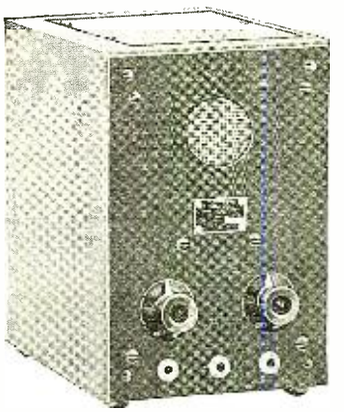


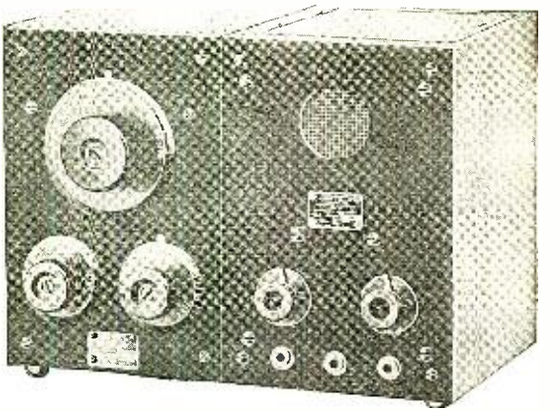
Type R A Short-Wave Regenerative Tuner

Most novices begin with crystal detection and later use vacuum tubes. With this unit they can change from crystals to tubes. Only one adjustment is required to tune in the desired signal. The device responds to any wave length between 180 and 700 meters simply by turning a knob. An adjustable tickler coil permits the use of regenerative amplification with a vacuum tube detector unit (Type DA). This tuner can also be used with Type DB Crystal Detector. Hence the novice can begin with crystal detection and later use tubes and amplifiers with this unit. A fine tuning adjustment is provided by a single-plate condenser for tuning in "CW" stations, or for receiving broadcasted music, news, etc. Price $65.



Type D A Tube Detector and Two-Stage Amplifier

This unit enables the novice to pass from crystal to tube detection easily and naturally. It gives him a vacuum tube detector and two stages of audio frequency amplification. Filaments are controlled by two rheostats, one of which regulates the current to the detector tube and the other the current to the two amplifying tubes. Signals may be received either without amplification, with one stage, or with two stages of amplification merely by inserting a telephone plug in the proper jack. The unit should be used with Radiotrons UV-200 as a detector and UV-201 as amplifiers, although UV-201 may be used throughout. Price (less Radiotron tubes and telephone plug) $68.



Type R C Short-Wave Regenerative Receiver

This receiver combines in one cabinet Type RA Short-Wave Regenerative Tuner and Type DA Detector and Two-Stage Amplifier, described elsewhere on this page. Hence it meets the requirements of the amateur or broadcasting enthusiast who wants a modern, compact, portable, efficient receiver which will enable him to hear distant stations. This is an ideal instrument for use with the loud-speaking Vocarola. Messages may be received with the detector alone or with one or two stage amplification. Used with a load-coil (Type CB) signals can be received on wave lengths up to 1,600 or 2,800 meters, depending on the antenna. Price (less Radiotron tubes) $125. Type CB Load-Coil can be supplied for $5.

There's News and Music in the Air

Some of the sets like the Aeriola Jr. and the Aeriola Sr. are so simple that even one who has no knowledge of electricity whatever can set them up and "listen in" to the messages and music sent by broadcasting stations or by enthusiastic radio amateurs. Other, more sensitive sets, described and illustrated on this page, can be operated after a few hours' experience. By connecting a Vocarola loud-speaker with the more efficient sets shown *the whole family* can "listen in."

Radio telephone broadcasting now takes its place in the home as a permanent *means of family entertainment and the entertainment costs practically nothing after the apparatus has been installed.*

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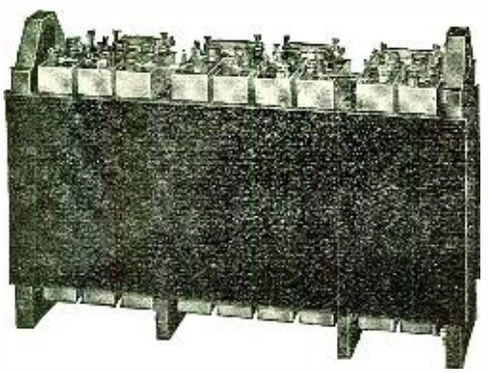
ANNOUNCEMENT

The New EDISON Radio Battery for Tube Circuits



Typical assembly of the new Edison Radio Battery—nine twin cells—22½ volts, 2½ ampere hours, complete, ready for service

Permanent, Dependable, Noiseless

The Army and Navy use thousands of Edison Batteries of higher voltage and small ampere hour capacity designed by Mr. Edison especially for the plate circuit.

Dependability, noiselessness and long life, among the many exclusive advantages proved so conclusively by Edison Storage Batteries in actual service, lead Mr. Edison to design a special radio cell, for vacuum tube work in plate circuits, suitable for operators and experimenters who demand the best radio equipment obtainable.

The Edison Radio Cell is built of steel—steel grids, steel poles and a steel container. The active materials, nickel hydrate and iron oxide, are held securely in perforated steel tubes and pockets. The electrolyte is an alkaline solution that preserves steel.

PRICES

The new Edison Radio Battery can be obtained for any desired voltage.

Twin cell units, each	$ 2.50
9 twin cells (22½ volts)	22.50
Tray	1.50
22½ volt battery, complete	$24.00
45 volt battery, complete	$48.00

Prices on trays for other assemblies quoted on request

All prices, f.o.b. Orange, N. J.

Advantages of the Edison Radio Battery

It is stronger and has a longer life than any other make of storage or dry cell.

It is clean and gives off no noxious fumes.

It requires little attention.

Obviously, from its principle and construction, there can be no sulphation, sedimentation, corrosion of terminals or separator troubles.

There is nothing about it to "buckle" or crack.

It can be completely discharged without injury.

It can be put on charge at any time regardless of how little or how much of previous charge has been used.

It can be taken off charge at any time and used, whether fully charged or not.

Because it can be left standing idle in any condition of charge, or discharge, you can charge it at your convenience.

If charged when polarity is accidentally reversed; or if accidentally short-circuited, it is not injured.

THE EDISON RADIO CELL OPERATES SILENTLY. There is no "frying" or other noises to interrupt when receiving.

At the rate generally used, the voltage curve is flat.

The terminals are exposed and convenient for "tapping in" to secure any desired voltage within the range of the battery.

PERMANENCY, DEPENDABLENESS, NOISELESSNESS, LONG LIFE and LOW OPERATING COST enables the Edison Radio Cell to be classed as an investment and not a continual source of expense. To those who demand the best radio equipment, the Edison Radio Cell gives satisfaction.

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Thomas A. Edison
A PRODUCT OF THE EDISON LABORATORIES

Edison Storage Battery Company

Department B

ORANGE, NEW JERSEY

RADIO NEWS

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

Vol. 3 MARCH, 1922 No. 9

Boom Times in Radio

THE situation in radio for which every ardent well-wisher of the art has been longing, seems to have arrived at last.

Due to the activities of the various broadcasting stations throughout the country—there are now almost 80 such stations—the public, as we all know, has become an enthusiastic supporter of our great art.

But even the boldest prophet in radio, and the most ardent well wisher certainly never foresaw any such condition as has existed for the past few months and exists right now. The only parallel to the radio business at the present time is the recent rush to the Texas oil fields, or the boom times of the motion picture industry some years ago.

When the entire country is in the throes of depression, and with nearly every other industry, that one can name, running part time or else is at an entire standstill, the radio business is the young giant, that will soon rival such great industries as the automobile business—and this is not an idle prophecy.

The entire radio industry was caught unprepared when the rush started last December. No one had foreseen such a thing, or thought such a condition could be possible. People stormed stores in their effort to buy radio apparatus, and anything from a ten dollar outfit to a two hundred dollar one, found, and is finding, sales, just as rapidly as the material can be delivered.

During a single week, the writer has had on his desk correspondence, circulars, special letters and telegrams which show that over five million dollars of new capital went into the radio business for the period of a single week. Every manufacturer is working at capacity day and night, trying to keep pace with the demand, and the more he turns out, the more he falls back. It makes no difference what he makes—whether it is a knob, a dial, a detector or one of the expensive outfits—all find ready sale and overtax the capacity of every maker.

The public seemingly does not care what it buys or what the price is, and, as in any boom, it may be imagined that prices on radio goods are by no means low. In other words, the manufacturers and dealers are exacting top price.

This condition is a natural one, when people are storming the stores and are lining up behind the showcases six deep, and very often breaking the showcases in the bargain.

All these are bare facts, but we are far from saying that such a condition is a healthy one. A situation of this kind is the worst that can be imagined, for many reasons. In the first place, it makes for loose manufacturing methods. Some of the manufacturers who have not been in the game very long do not care what sort of material they turn out. Inspection is apt to be lax, and many a layman who starts in the radio field to-day is disappointed, for the reason that he cannot get results. Such a man will give the entire radio business a black eye, and we would impress upon all manufacturers to rather curtail their sales and turn out workable instruments that will stand up, than make sales that will be a detriment to them later on.

The other dangerous condition that has sprung up lately is the ill-famed stock selling scheme. A manufacturer will get up a sample of a home radio outfit that looks like a Victrola, and run a full page advertisement of it in the daily papers. He has not a single outfit to sell, nor has he a plant in which to make them. Due to the boom conditions he will get many orders for future delivery, and he will show these orders to his victims as a proof that his venture is a tremendously profitable one. He will get out circulars and begin selling sock, as has been done in the past, to the detriment of the entire radio art.

When radio was young, several large concerns, as will be remembered, sold stock indiscriminately to the tune of many millions of dollars, out of which the public was defrauded. Due to this, the public for many years was wary of anything with the word "wireless" attached to it; as a result the entire radio business suffered proportionately. It is to be hoped that such business methods will be exposed as quickly as they spring up, as the radio business cannot now afford such dishonest methods.

The question which the writer is most often asked today is, how long will the boom last? When will the storm of prosperity blow over, leaving everyone prostrate with huge stocks on his hands?

It is our opinion that the present conditions will last for at least another year and that the radio business will be a very healthy one for several years to come. There will probably be the usual summer slack—although much less pronounced—and then a great rush for the fall and winter. The one thing regarding which we would caution dealers and jobbers is to be careful and not over-buy. Indications are that within the next six months there will be enough apparatus to go around. Tremendous efforts are being made by manufacturers to meet the situation, and with all the new capital being poured into the business, we estimate that within six months at the most the supply will exceed the demand. In other words, everyone, unless he buys carefully, will be overstocked, and the usual hardships will follow.

This not only holds true for the dealer who will find himself loaded with material on his shelves that he cannot move rapidly, but for the small manufacturer as well, who will have all his money tied up in merchandise for which the sale is not as brisk.

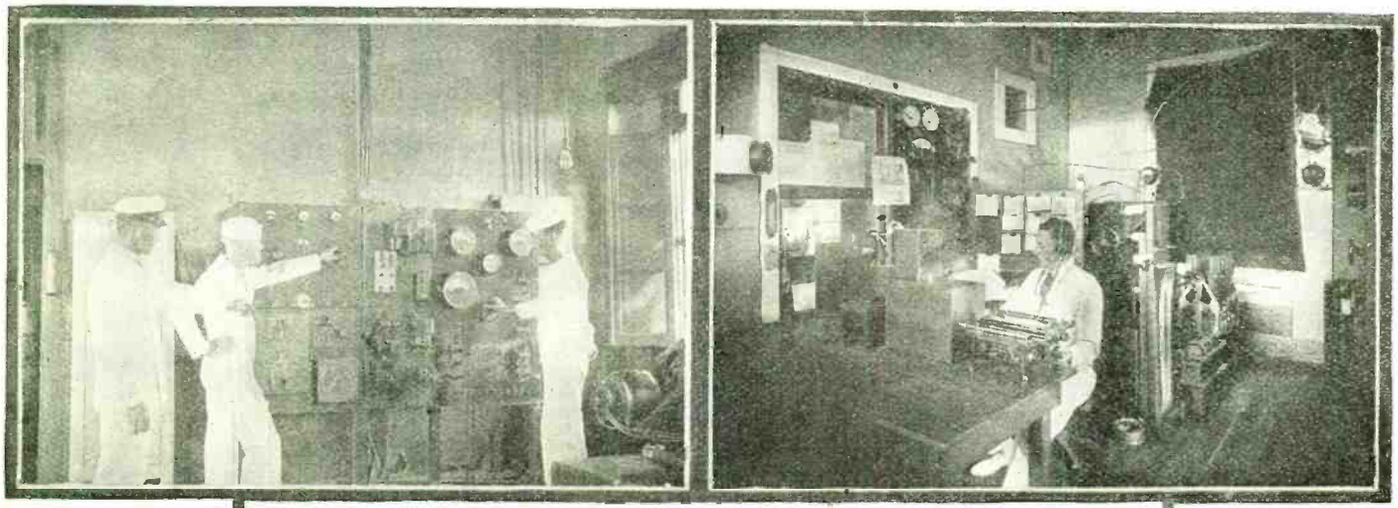
We will then witness the next cycle: price cutting, when real competition will begin in earnest. This condition, however, is at least six months distant, and perhaps a little further. It is due to come, however, at any time, for some of the supplies.

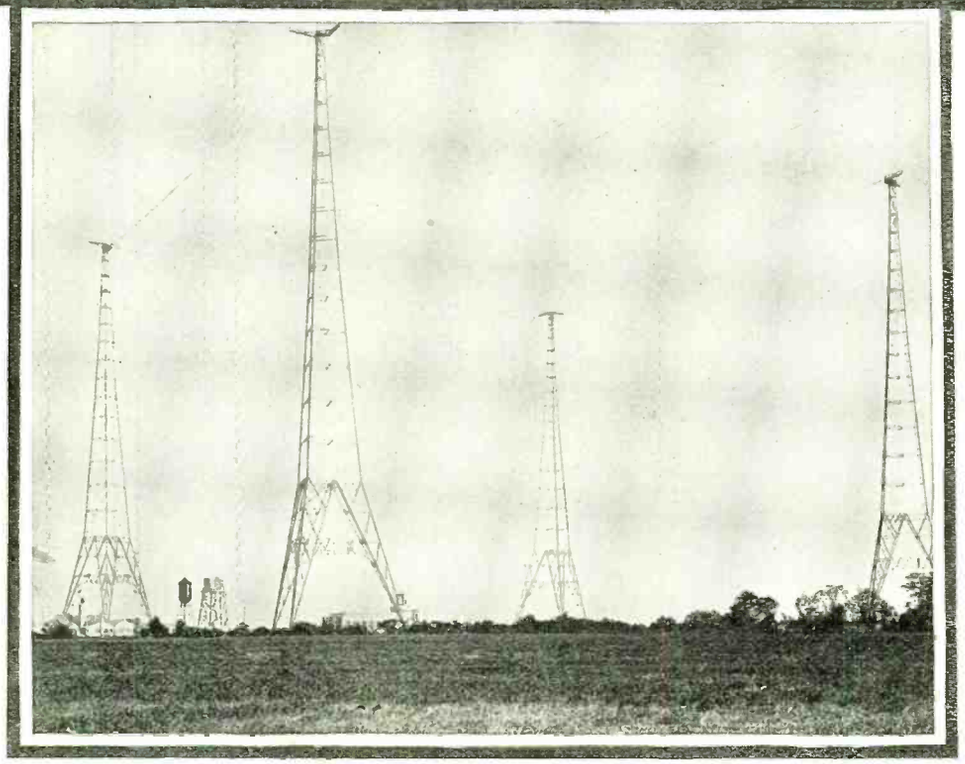
But as mentioned before, the radio business in general should be brisk for some time to come, and those who can read the future best, will no doubt reap the harvest.

H. GERNSBACK.

The Navy Radio School at Great Lakes

By S. R. WINTERS





Above Are Shown the Power Control, and the Operating Room of a U. S. Navy Station Where "Gobs" Are Trained to Become Operators Aboard the Ships of Uncle Sam's Fleet. Below is a General View of One of the Large Stations of the Atlantic Coast Operated by the Navy.

SUPPOSE a philanthropist tendered you the opportunity of learning a trade or profession while traveling and reimbursed you with a reasonable salary for taking advantage of the offer—and without penalizing your future. I daresay there would be no hesitancy in accepting the privilege. Analogous to this supposition is the recruiting invitation of the United States Navy Department whose acceptance affords avenues of travel and study, payment of a monthly stipend, board, lodging, and medical services. Such are America's floating colleges wherein a fighting craft may be transformed into a schoolroom.

No, this article is not an attempt to boost enlistment figures in the Navy. The poster representing Uncle Sam, with his stern and unerring finger, addressing the multitudes from the street corner, "Your Country Needs You," was striking enough to induce an adequate force of young men to visit one of the 52 navy recruiting stations distributed throughout the United States. Nor, is this even a feeble effort to describe the variety of trades and professions which can be learned at sea. Without continuing the introductory paragraphs, I may claim for this exposition an attempt to narrate the details of Uncle Sam's system of operating schools for the inculcation of lessons in wireless communication. Reference is made especially to the radio training school at Great Lakes, Illinois, where during the week ending July 9, 1921, 715 students were enrolled for a complete course in wireless telephony and telegraphy.

The training station at Great Lakes, however, bears to radio instruction a relation similar to that of the college in academic education. It is here that the student completes a well-balanced course, and if not awarded a diploma, receives the stamp of approval which is a token subscribing to his qualifications for entry either into naval or civilian service as a wireless operator. The radio preparatory schools of the United States Navy Department are four in number, and are located at Newport, Rhode Island; Hampton Roads, Virginia; San Francisco, California, and Great Lakes, Illinois. The last station maintains a preliminary school as well as the graduate school for radio instruction. The training in the first principles of the transmission of messages by electric waves through space embraces a period of eight weeks, after which the students are transferred to Great Lakes for a continuation of this form of instruction for thirty-two weeks.

Knowledge of the Continental Code is the objective toward which the student labors during the first week of enrollment in the preliminary school. The information relative to the system of dots and dashes is augmented and enlivened by lectures on the opportunities beckoning the trained operator in the service of the Navy Department once he has mastered the art. The rudiments of wireless transmission are broached by the simplest ways of instruction, involving explanation of magnetism in its crude form, such as lectures on the lodestone, horseshoe magnet, bar magnet, poles of a magnet and the earth's magnetism. Instructors who saw service at sea during the recent world conflict are usually assigned in the dissemination of this rudimentary knowledge. Having mastered the Continental code during the second week, pairs of telephones are allotted to the "gobs" and knowledge by experience begins. The signals heard simulate actual sounds of a radio transmitter, they being dispatched by a trained operator. Lectures supplement the regular class room exercises, the subjects of the lecturers being electrons, the electron theory, the electroscope and other electrical gears. Meanwhile, the potential wireless "bug" may be told how he may achieve any aspirations of becoming a petty officer, informed as to the methods of pay and accounts, and even how to transfer his pay-check to folks back home.

Instruction by analogy is the favorite method. The commonplace things of the street, office or home are translated into terms by way of explaining the phenomena of electrical transmission. The pendulum

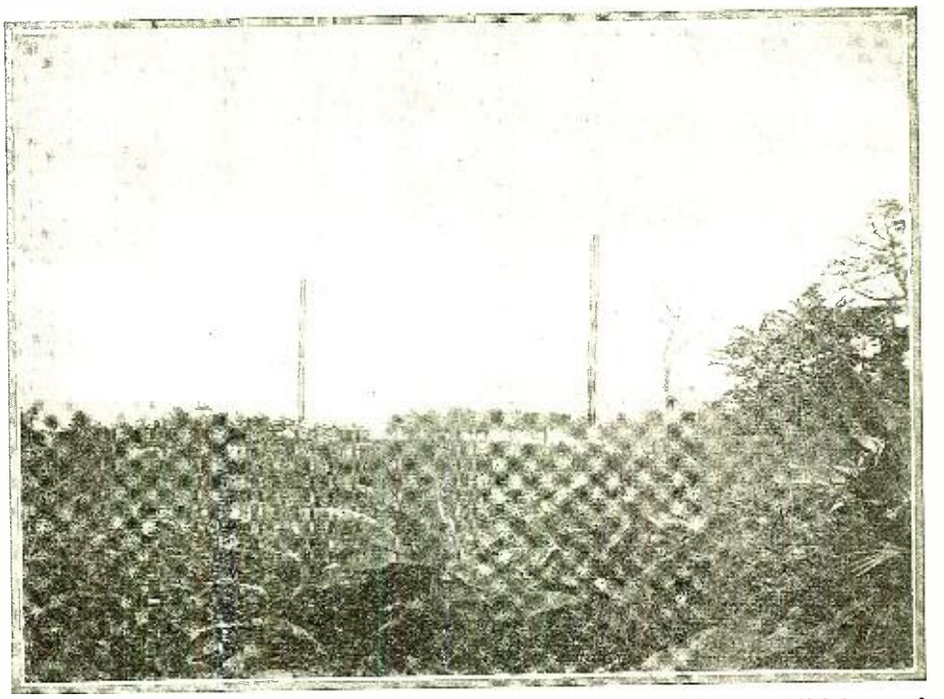
of a clock, when swinging freely and then permitted to halt gradually, is likened to the motion of the oscillary discharge of an electrostatic accumulator in a closed circuit. These fundamentals are firmly fixed in the mind of the pupil before real problems of electric transmission are attacked. The subjects of electric current, electromotive force, the simple coil, storage cells in series and parallel, are introduced to the student the third week following his enrollment. A review of the history and customs of the Navy—ranging from information of a first-class battle cruiser to a submarine—may be edged in as instruction foreign to radio transmission and yet valuable to bluejackets who apply their wireless knowledge at sea. The fourth week of instruction finds the aspiring operator receiving signals at the rate of from eight to twelve words a minute. Meantime the instruction on theoretical wireless currents has progressed through the varying stages of condensers, inductance, and transformers of different types.

In the parlance of the street, you can well imagine the "gob" inquiring, "Where do we go from here?" Forthwith, whether he is from Missouri or not, his vision is directed toward the largest training station of its kind in the world—at Great Lakes, Ill. Here the world is reproduced in miniature, athletics, entertainments, welfare quarters, and chaplains of every religious denomination, are supported. The sterner things of life—for instance, the pursuit of a diploma in recognition of having completed a well-balanced course in wireless communication—are deprived of some of their monotony by frequent opportunities for amusements. The day is not to be prolonged with sports, however, for thirty-two weeks are crowded with lessons offered by a radio curriculum. Seven days are allotted to each subject, with the final examinations consuming as many days. The outline of the course in its logical order follows:

Magnetism and electromagnetism, static and current electricity, generators, motors, primary and secondary batteries, internal combustion engines, practical laboratory, alternating current and A. C. machinery, measuring instruments and measurements, radio power circuits, practical laboratory, oscillatory circuits, damped wave transmitting sets, undamped wave transmitters, radio regulations, vacuum tubes, receiving apparatus, practical receiving, high frequency measurements, practical laboratory, portable telephony, radio compass, auxiliary station equipment, main station equipment, main station operation, final examinations. A course in radio telephone may be substituted for a corresponding week in the main course, the outline of instruction being: General electricity, tube theory, circuits, operation, troubles, review and examination.

A student graduates from the Great Lake training station as either a third or second class electrician (radio) and is transferred to a shore station or to a navy vessel for duty. Service may involve globe-trotting errands, as Uncle Sam's ships literally ply the seven seas of the world. Other than the numerous stations dotting the Atlantic and Pacific Oceans, the Navy Department owns and operates stations in Alaska, Isthmian Canal Zone, Cuba, the Virgin Islands, Porto Rico, Hawaiian Islands, the Philippines and China. Graduation from the training school at Great Lakes qualifies one to venture into commercial projects involving a knowledge of electrical wiring, electrical repairing, power station engineering, storage battery plant, automobile lighting, ignition and starting; gas engine operation, telegraphy, radio telephony, wire telephony, and radio inspection.

Or, the Navy Department being in a position to retain a constantly increasing number of its own graduates for service at sea, students can pursue the course with assurance of jobs, as the World War considerably accentuated the use of radio telephony and telegraphy as a useful vehicle of the Navy Department.



One of the Navy Stations on the Southern Coast of the Atlantic, Erected in a Beautiful Corner of the Gulf.

A Well Planned Station in Which All the Controls Are Within Reach of the Operator. In Front of Him Are the Quenched Gap and the Wave Changer Switch, While Behind is the Power Control Panel. Note the Receiver on the Table.

Radiophone in Banks

By Bert A. Teeters

Advertising value of radio telephony has been recognized by the City National Bank, of Dayton, Ohio, which plans to erect a station in Dayton within the next few weeks, according to an announcement made by President Harry Darst. It is believed this will be the first bank-owned radio station in the country.

Mr. Darst declares that regular programs will be given, of a financial nature, of course. It is planned to broadcast financial advice, give quotations on local bond and stock issues, send out warnings of activities of bogus promoters, in brief, to be of every aid in a financial way to the recipients of the messages.

Talks will be given on any special subject by officers of the bank upon request of a group of receiving stations, Mr. Darst said. Outcome of the experiment is being watched with interest by financial men in Ohio who see in the plan the first step in making Americans a more economical and thrifty race.

A Sea-Plane High Power Bulb Transmitter*

By JESSE MARSTEN

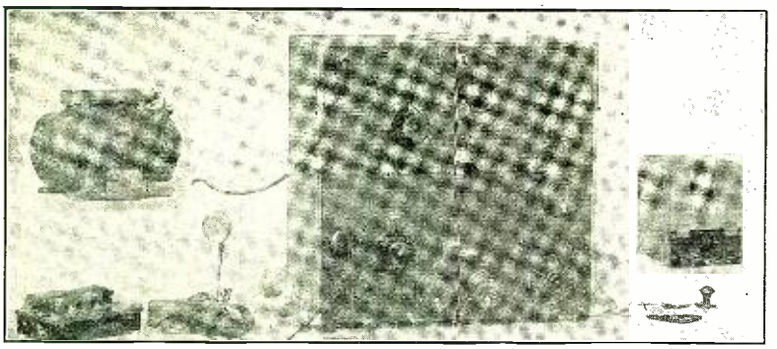


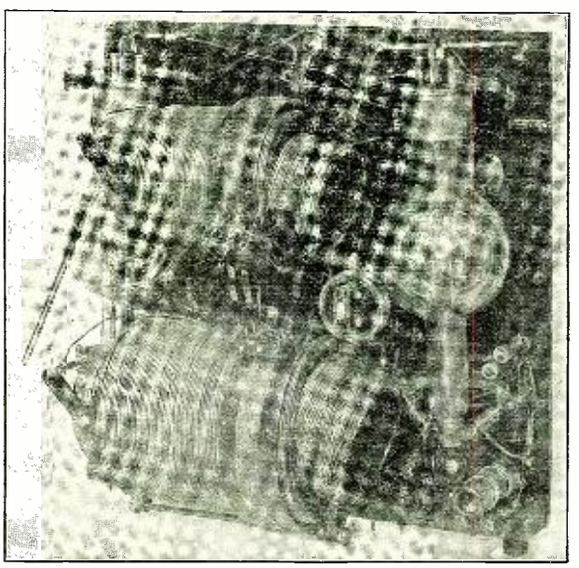
Fig. 3. View of the complete outfit for sea plane. This V.T. transmitter using two 250-watt tubes may be used for telephony or telegraphy.

IN the September, 1921, issue of the RADIO NEWS the writer described a Flying Boat Bulb Transmitter built by a Radio manufacturing company. What might be called the twin to this set was built by an Eastern company, and as a comparison of these two sets will be very instructive in showing differences in circuits and design, it is the object of this article to describe the latter outfit. This set is the type CG 1130 transmitter and is illustrated in the accompanying photographs.

The points of similarity will first be considered. The conditions which this type CG set was to meet are identical with those of the other set. It was to be used on the same type of flying boat having two antennae, an emergency antenna on which 600 meters was to be transmitted, the other the regular antenna on which 1,600 meters was to be transmitted. Three types of transmission were here also to be used: (1) C.W., (2) Buzzer modulated telegraphy, and (3) Telephone.

The set employs two Pliotrons, one for oscillating, the other for modulating, the plate voltage on each being 1,500 volts. The plate voltage is secured from a motor generator, seen in Fig. 3, driven by a 24-volt storage battery, which at the same time supplies filament power.

The circuit design of this set differs considerably from the previously described outfit. A schematic wiring diagram of this circuit is shown in Fig. 1, where it will be seen that the plate and grid are inductively coupled to each other and to the antenna. This provides a much more flexible arrangement than conductive coupling, since it permits of varying the coupling to meet variable conditions. For example, variations in antenna capacity can be compensated for by varying the plate-antenna coupling, which is not possible with conductive coupling where the taps are fixed. In series with the grid coil will be seen a condenser shunted by both a switch and key. The key is used for telegraphy, the switch being open. For telephony the switch is closed, thus securing uninterrupted oscillations.



Back View of the Transmitter Panel. Note the Two Sets of Inductances Used for Different Wave-Lengths.

High efficiency is secured in this set by employing two separate coil systems, one for each wave-length. This avoids short circuiting ends, and absorption of energy by hanging on ends. These two coil systems are seen in the rear view photograph, Fig. 4. The upper coil system is the 600-meter, the lower is the 1,600-meter system. The inductive coupling of plate, antenna, and grid is continuously variable as seen from the photographs, and in operation this coupling is varied until the ammeter registers a maximum at the required wave-length. The proper wave-length is indicated by a small wavemeter lamp seen in the front view photograph, Fig. 3, marked "WAVE INDICATOR," which lights up most brilliantly when the antenna wave-length coincides with the wavemeter setting.

A high degree of modulation is obtained in this set by using a so-called "modulation amplifier." In order to secure complete modulation the speech or buzzer voltage applied to the modulator grid must have a certain minimum value. This value will not be obtained unless the output voltage of the microphone transformer is amplified; and for this purpose a modulation amplifier is employed in a circuit as shown in Fig. 2. The modulation amplifier is supplied with voltage through an audio frequency choke coil and limiting resistance seen in the illustration. The speech or buzzer voltage is stepped up by the microphone transformer and this voltage is applied to the grid of the amplifier. The amplified voltage repeated in the plate circuit of the modulation amplifier is then applied to the grid of the large Pliotron modulator tube, as marked in Figs. 1 and 2. This entire modulation amplifier is contained in a small, compact cabinet unit shown at the right of Fig. 3.

Fig. 3, the front view of the set, shows clearly the various controls and parts. The high voltage plate motor generator unit is seen at the left on top of which is mounted the generator protective condenser whose capacity is about 0.2 microfarads. The microphone is seen right next to the set; this microphone is specially designed to exclude engine and vibration noises. To the right of the main cabinet will be seen the transmitting key and the modulation amplifier cabinet.

On the right side of the main panel are mounted the meters and controls for the Pliotron filaments. An ammeter is included in each filament circuit, enabling simultaneous reading of filament currents in both oscillator and modulator. On the right, at the bottom is mounted the rheostat controlling the filament currents. To the left of the filament rheostat will be seen the plate circuit ammeter and antenna ammeter. The plate ammeter reads the sum of both oscillator and modulator currents. In the center of the panel and above the plate and antenna ammeters will be seen the telephone type of wave-change switch. When thrown to the bottom, the set radiates on 600 meters; on top it radiates on 1,600 meters. Above this wave-change switch is the antenna send-

(Continued on page 858)

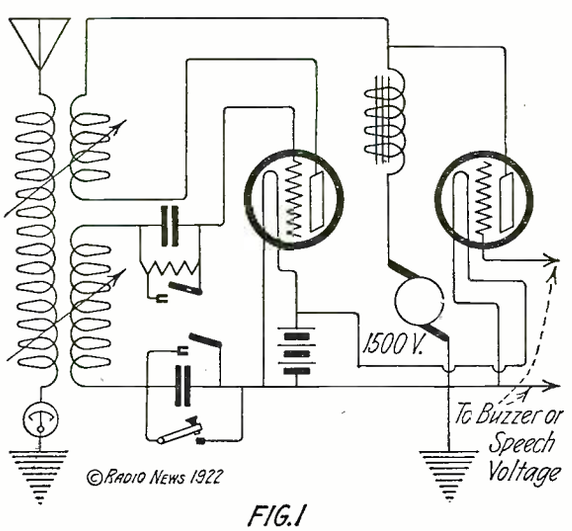


FIG. 1

The Transmitting Circuit of the Set Includes Separater, Grid, Plate and Antenna Inductances.

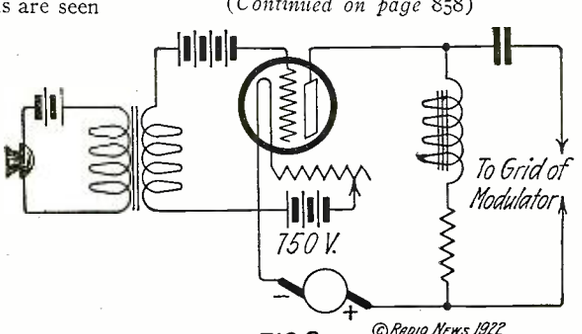
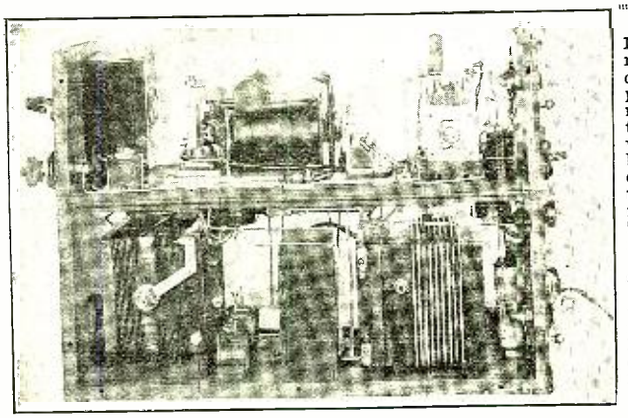


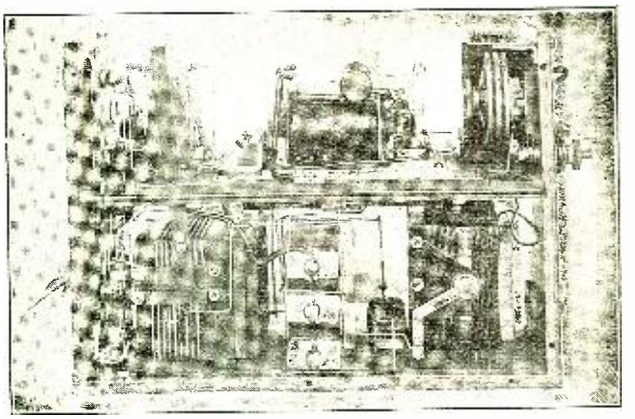
FIG. 2

In the Modulating Circuit for Telephony a Speech Amplifier is Used.

A German Trench Radio Set

By CHARLES R. LEUTZ*

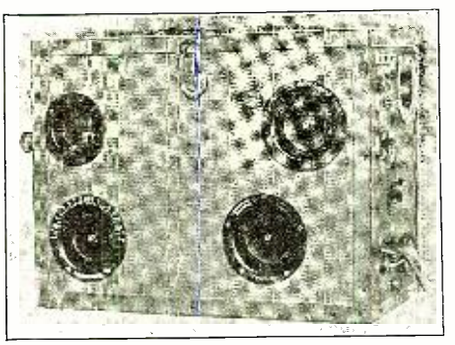




In the left and right side views of this compact portable set may be seen all the organs which have been carefully designed so as to take a minimum of space. This set is fitted with a quenched gap and a special double action vibrator furnishing A. C. Below is a view of the set in its box.

THIS unusual piece of radio equipment has so many unique and original features that it will be of interest to even the novice. The complete equipment, as shown in the following photographs, weighs approximately 15 pounds and can be readily carried on the back of a soldier. The only additional equipment required is a storage battery and the antenna material. The standard antenna was only 25' long and 4' high, so the entire equipment could be carried by one man, if necessary. The purpose of the station is to carry on communications between the trenches and other military groups behind the lines, in both directions.

To reduce the physical dimensions and weight to the smallest possible size and lightness, some of the individual parts are used for both transmitting and receiving. First considering the transmitter, this consisted of a special two-way buzzer that handled 50 watts at 12 volts from a storage



battery. The potential taken from the secondary of the buzzer was approximately 7,000 volts alternating current and practically in the form of a pure sine wave. The mica condenser across the secondary was in two sections, the resultant capacity being correct for resonant conditions and one section only used as part of the oscillatory circuit to give a wave-length of 190 meters with the inductance used. The inductance was a copper wire of square cross section, heavily silver plated. A switch was provided to increase the inductance used to change the wave-length to 210 meters. The quenched gap consisted of three heavily silver plated, copper discs, separated with thin mica gaskets, the sparking being in air.

The antenna circuit was tuned with a variometer wound with heavy Litzendraht and resonance indicated by a small lamp. The reason a meter was not used was primarily so that resonance could be indicated at night and also because meters are fragile. All the component parts are contained in a weather-proof box and the control handles external. Referring to Fig. 1 which shows the full view, the window at the upper left hand corner is in front of the resonance indicating lamp. In the right hand upper corner is the control switch which has four positions: 1. Send (Senden); 2. Receive

(*Continued on page* 854)

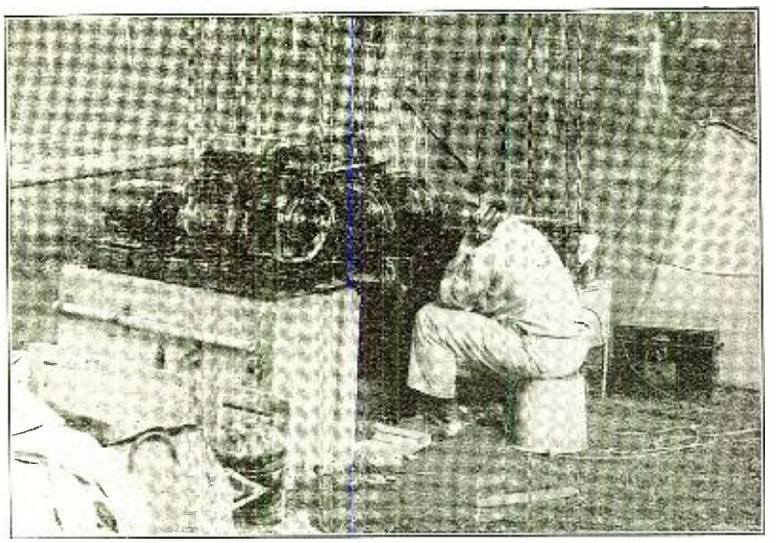
**Formerly Engineer, Marconi Wireless Telegraph Co.*

Portable Sets Prove Most Useful During Army Manoeuvres

By S. R. WINTERS

EFFECTIVE radio communication in the event of future wars was one of the objectives sought in the recent fall manoeuvres of 5,000 marines in their march from Quantico to Wilderness Run, Virginia, when conditions of actual warfare were simulated. A portable wireless outfit and the equipment of aeroplanes with radio apparatus were arrangements which put this form of communication to severe tests in the field, in the air, and at conventional radio stations.

The manoeuvres at Wilderness Run with reference to artillery observations developed this interesting recommendation as offered by the Commanding Officer: "For this duty an officer should be used who is familiar with riding in a plane (not necessarily a flyer), who is qualified to send and receive radio, and who is capable of spotting and deciding on questions involving the artillery. So far, I know of no officer with these qualifications. It is recommended that some of the officers attached to the artillery be given training along these lines. During the manoeuvres enlisted men who were radio operators did this work, but they knew nothing of spotting or of artillery." Thus the Commanding Officer of the Marine Flying Field at Wilderness Run opens up an opportunity for qualified radio operators to enlarge their field of usefulness, both in patriotic and self-help ways.



This Type of Field Set Was Used by the Marines During the Manoeuvres in Virginia

The criticisms and recommendations of the fall manoeuvres of the Marine Corps, with reference to communication, specify that the airdrome shall constantly remain at the rear of the operating expeditionary forces. This practice obtained during the recent mock warfare at Wilderness Run. It was found that communication was not good under different conditions, and, consequently, in actual activities a direct line should be run from the headquarters of the expeditionary forces to the airdrome. Manoeuvres at night in which aircraft participated during the activities over ground with troops, set a precedent in mock warfare in America. The aircraft, operating in conjunction with the troops on the ground, answered all calls issued both day and night. The absence of any casualty indicates the efficiency of the

(*Continued on page* 856)

Radio Transmitters Amateurs Have Overlooked

By EDWARD T. BICAK*

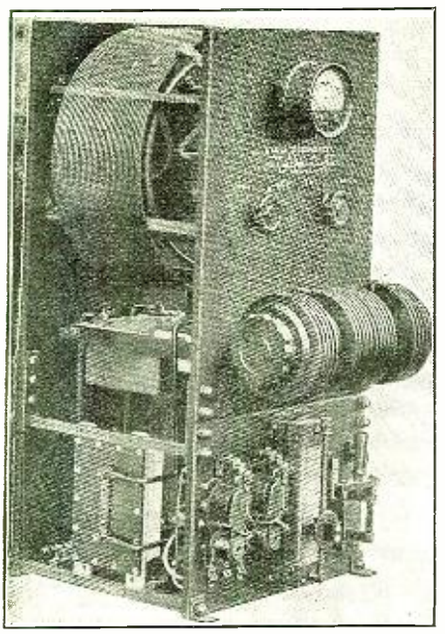


Fig. 4. This Cutting and Washington Transmitter is Equipped With a Special Spark Gap Which May be Seen on the Front Panel.

IN the mind of the average radio amateur there exist but two types of radio transmitting systems, one of which he solemnly chooses and becomes reconciled to for life. His experimenting is confined to his chosen system and any attempt to divert his thoughts from the single track on which they ride, is regarded with suspicion. This does not necessarily mean that the American radio amateur is not progressive. Indeed, he is; but at best his progress is limited.

One of the two transmitting systems chosen by the amateur is that originally patented by Marconi and employing two coupled circuits with either rotary or quenched spark gap. The other system is a Colpitts or Heising arrangement of circuits for continuous wave transmission.

Chaffee, Simpson, Thompson, Stone, Shoemaker, Cutting and Washington have evidently preached to deafened ears and their work has been entirely disregarded by the multitudinous radio experimenters and amateur radio operators. Does it not seem strange to the reader that of several transmitting systems which have proven satisfactory in commercial service, only two have been adopted by the American radio amateur? It is doubtful whether as many as a half dozen amateur stations in these vast United States employ a type of transmitter other than one of the two general types mentioned in the second paragraph. Whatever the various reasons for this condition may be, it is certain that the final analysis would condemn the lack of sufficient publicity given certain transmitting systems in the mediums through which the radio amateur obtains his information.

No misinterpretation, please! It is not the object of this article to attack the systems of radio communication which the amateur has so wilfully chosen. On the contrary, it is desired to consider some of the disadvantages as well as the advantages of the other systems which will be described, and the amateur will then be left to decide whether he has selected the proper system or whether he should change to a different type of transmitting circuit. If the following will arouse the amateur radio operator to think of possible improvements he can make to his transmitter and stir him to carry out some intelligent experiments, it will have accomplished its purpose.

Head of the Department of Radio Engineering, Extension Division, United Y. M. C. A. Schools.

THE SIMPSON TRANSMITTER

To begin with, consider the *Simpson transmitter*. At the mention of this name some amateurs will obviously say, "That's true, it never occurred to me to try out the Simpson circuit on 200 meters." To the great majority, however, the name will be new. It will be new, regrettably, to some very prominent amateur operators. The writer had this brought to his attention on three different occasions recently in interviews with a prominent Yonkers (N. Y.) amateur, a well-known Pennsylvania radio man, and an advanced radio amateur of Texas. Each of these three men went away very anxious to try out this particular one of the several circuits which has proven satisfactory for commercial radio communication and yet which happens to be one of those that have been overlooked by amateur operators.

Permit, here, a preliminary word of caution. The secret of proper operation of the Simpson transmitter lies in the spark gap. This, however, is true of all spark transmitters. Only with a well designed quenched gap can the Simpson transmitter be made to function properly. With this in mind, refer to Fig. 1. Does this not appear a very simple method of exciting oscillations in the antenna system? But wait! Simplicity is not the only feature. There are no conditions of high frequency resonance to be fulfilled in the Simpson circuit. This latter feature makes it entirely different from transmitters in which two oscillatory circuits must be adjusted to resonance for maximum radiation. In the Simpson transmitter only one oscillatory circuit exists and hence it can be very easily adjusted to radiate a wave of given length. The oscillatory circuit referred to consists of the overhead wires, inductance coil, condenser, ammeter and ground. All that is required is to select the proper capacitance of the high voltage condenser or to adjust the inductance of the circuit at the contact L. A change in either capacitance or inductance alters the wave-length. The circuit which includes the spark gap is not oscillatory and consequently is not adjusted to obtain the usual conditions of resonance; nor is the coupling of the gap and radiating circuits critical. The only requirement to be met which affects the former circuit is to keep the spark gap connected across points on the circuit that are at nodal potential. This can quite easily be found by experiment.

The operation of the Simpson transmitter

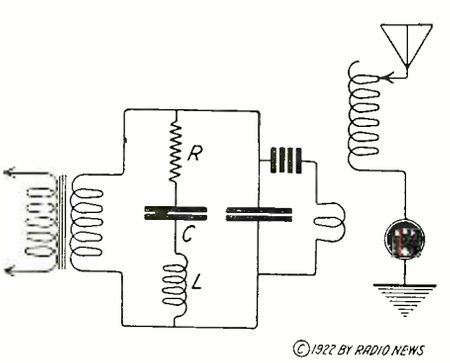


Fig. 3. The Cutting and Washington Circuit Using Impact Excitation.

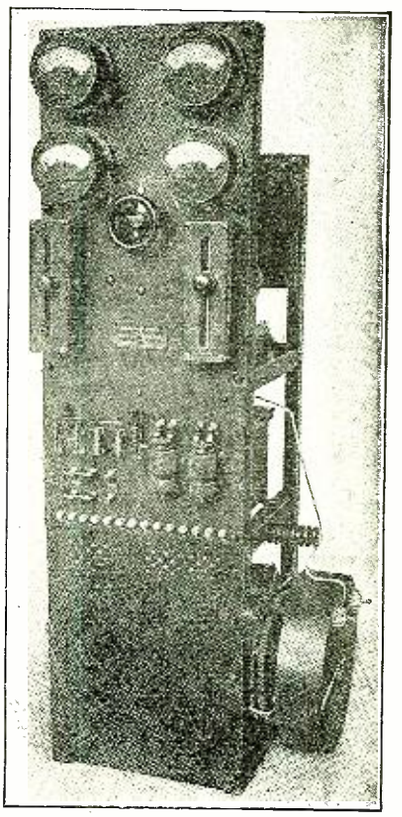


Fig. 6. A Commercial Type of Shoemaker Transmitting Set. The Rotary Gap is Enclosed in the Case on the Right.

is not difficult to understand. The overhead wires of the antenna system and the ground are considered as the conducting surfaces of a huge condenser which may be called the *antenna-ground condenser*. In series with this condenser is the inductance coil and main high voltage condenser. During the interval that the telegraph key is depressed the alternating current from the secondary of the high voltage transformer charges this main condenser in the usual manner. Since, however, the main condenser is in series with the antenna-ground condenser, the latter also becomes charged. Then at the instant the difference of potential across the condensers becomes a maximum, the spark gap acts as a trigger and releases the energy which was stored in the antenna system in a static form, thereby converting it into its oscillatory form. The number of sections in the spark gap should be so selected that the discharge through it is not oscillatory in character. That is, only one-half of a complete oscillation should take place in the gap circuit, after which the radiating circuit should be left free to oscillate at its natural frequency.

The incorporation of the Simpson circuit in a modern panel transmitter is shown in Fig. 2. Several antenna loading inductances, shown above the panel, are employed to obtain the commercial wave-lengths. The quenched gap is shown mounted at the top of the panel, with the wave changing switch directly below it. The automatic starter, meters, rheostats and switches are mounted on the lower half of the panel.

The advantages of this type of transmitter are more numerous than the disadvantages. It is a perfect model of simplicity; has no critical adjustments; can be used on short wave-lengths with the long antenna usually

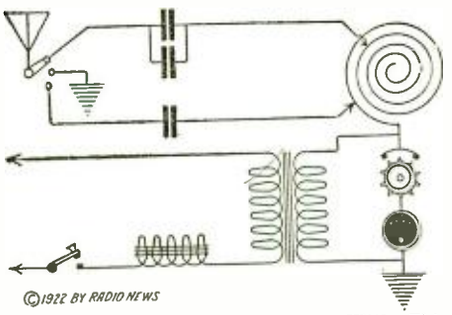


Fig. 5. The Shoemaker Circuit; With This Transmitter Using a Synchronous Rotary Gap a Very Sharp Wave is Radiated.

employed for reception, owing to the fact that the main condenser in series with the antenna systems shortens the wave-length; and it eliminates the necessity of resonance adjustments. There is this disadvantage, however, which may cause the amateur some trouble. Unless the quenched gap is of efficient design and is so adjusted that only one discharge will take place in one direction per alternation of the condenser charging current, the transmitter will not function as explained and the efficiency of the set will be detrimentally lowered.

THE CUTTING AND WASHINGTON TRANSMITTER

How many amateurs have experimented with or adopted the Cutting and Washington transmitting circuit at their stations? If Government records give any indication, the answer to this question will be disappointing. Yet it would seem that a reasonable group out of the large army of amateur operators would find something attractive about this type of transmitter and would have experimented sufficiently to perfect the circuit for amateur short wave transmission. The Cutting and Washington transmitter operates well on 300, 450 and 600 meters in commercial practice; why not on 200 meters?

This transmitter differs from ordinary quenched spark transmitters in two respects. Of these the first is the multi-spark system, wherein the high voltage condenser is charged and discharged several times during each alternation of the supply current. This permits the use of extremely low voltage in connection with very short spark gaps. At the same time it is possible to obtain large output by sparking many times as often as the common quenched or single spark system. Any necessity for low frequency resonance in the supply circuit is also obviated, thus making the adjustments very few and in no way critical.

The second differentiation is in the use of the impact-excitation system. By employing a primary circuit having high damping characteristics in connection with a spark gap designed to have perfect quenching properties, only one-half of a complete oscillation is allowed to take place in the primary circuit. Just as the multi-spark feature eliminates the necessity for audio frequency resonance, so the impact-excitation feature makes radio frequency resonance unnecessary, further reducing in number and simplifying the adjustments required. It should be noted, however, that although no resonance relation exists between the primary and secondary circuits, empirical data indicates that it is advantageous to preserve approximately the ratio of 1.3 to 1 between the wave-lengths of the primary and secondary circuits. Considerable departure from this ratio may be made, nevertheless, without appreciable reduction in efficiency.

As will be observed in Fig. 3, the arrangement appears very much like the ordinary quenched spark transmitter with the excepted addition of the branch circuit RCL. There is this important difference, however, The main condenser is of large capacitance and in connection with the single turn of inductance forms a primary circuit of high damping. The extra inductance, capacitance and resistance (RCL) across the main condenser form a so-called *concentration circuit,* the function of which is to concentrate the spark discharges into regular groups when the supply current is passing through peak values. In other words, the concentration circuit does not permit the discharges to occur irregularly at all times during the alternation. The concentration circuit can have a period between 1,200 and 1,500 cycles and is necessary in order to produce a pure and musical note that may be easily copied at the receiving station.

The operation of the Cutting and Washington system may be explained as follows: During the first 60 degrees of an alternation the concentration circuit acts almost as a short circuit across the transformer, and the condenser C accumulates a charge. In the interval between 60 and 120 degrees this circuit discharges into the primary condenser in conjunction with the supply current. From 120 to 180 degrees the concentration circuit again acts as a partial short circuit on the line. Each time the potential difference across the primary condenser becomes sufficient to break down the resistance of the quenched gap, it discharges through the gap in a single swing or half cycle which sets the antenna into oscillation. After the initial excitation of the antenna in any one period that the transmitting key is depressed, successive charging and discharging of the condenser is aided by the small e.m.f. induced in the primary circuit while the antenna circuit is oscillating. That is, the induced e.m.f. adds just sufficient increment to "trigger" the gap off in proper phase relation to maintain smoothly the antenna oscillations.

Fig. 4 shows a one-half K.W. transmitter of the type under discussion. The primary condenser in this transmitter has the value of 0.16 microfarads while the primary inductance, a single turn of heavy copper tubing, is about 1.2 microhenries. Either direct or alternating current at 500 volts or more may be employed to charge the primary condenser. If direct current is employed, an iron core inductance should be inserted in the supply line.

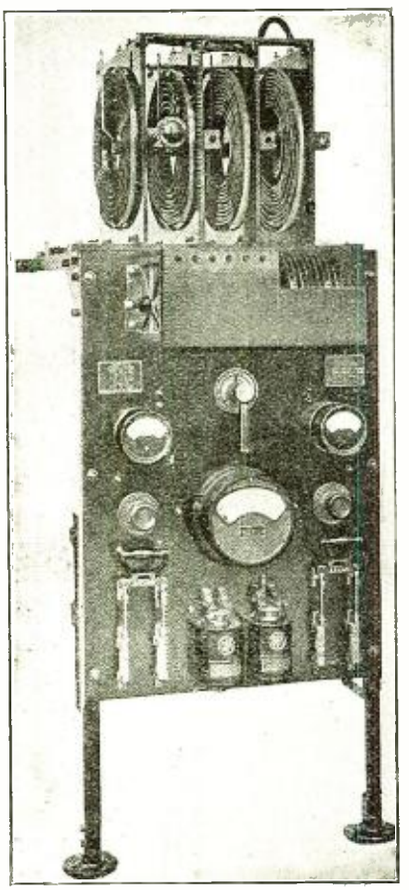


Fig. 2. In This Compact Panel Type Transmitter the Simpson Circuit is Used. By Means of the Pancake Inductances the Set May be Tuned on All Commercial Wave-Lengths.

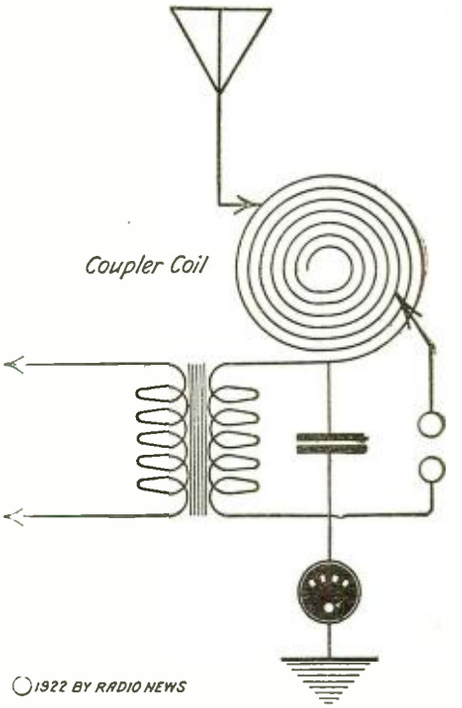


Fig. 1. The Simpson Transmitting Circuit is One of the Simplest, Having No Critical Adjustment.

The advantages of this type of transmitter are the very few adjustments required. The primary inductance, the primary capacitance, and the coupling of the oscillation transformer may be fixed. Changes from one wave-length to another in the amateur range can accordingly be made by simply varying the secondary inductance. Any change of 75 meters or more, however, requires a variation of the primary condenser capacitance to restore the proper ratio between primary and secondary wave-lengths. The chief disadvantage of this transmitting circuit is that if the primary condenser is charged from a 500-volt line or transformer secondary—and the applied e.m.f. should not exceed 500 volts by any great amount—extremely small separations are required at the spark gap. Consequently, since no suitable spark gap of this type is now on the amateur apparatus market, it will mean that the experimenter must construct one.

THE SHOEMAKER TRANSMITTER

A third type of transmitter that has failed to find a place in amateur radio stations is the *Shoemaker "B-1" transmitter.* Beyond a doubt this is the most simple transmitting circuit that has ever complied with the Fourth United States Regulation regarding the use of a sharp wave. It has been in commercial use for more than two years and from such reports as the writer has been able to obtain, has evidently given satisfactory service

It will be remembered that when a plain or straight gap is connected in series with the antenna and ground, it causes oscillations set up in the antenna circuit to have excessive damping and a broad wave is consequently radiated. Notwithstanding, experiment has shown that under suitable conditions when the plain gap is replaced with a synchronous rotary gap and proper adjustment made, the radiated wave will be sharp—sharp in the sense that the logarithmic decrement will be 0.2 or less. At a first consideration it may appear that the circuit constants must be carefully chosen so as to have values of capacitance and in-

(*Continued on page* 850)

Notes on High Power Quenched Spark Sets

By CHARLES R. LEUTZ*

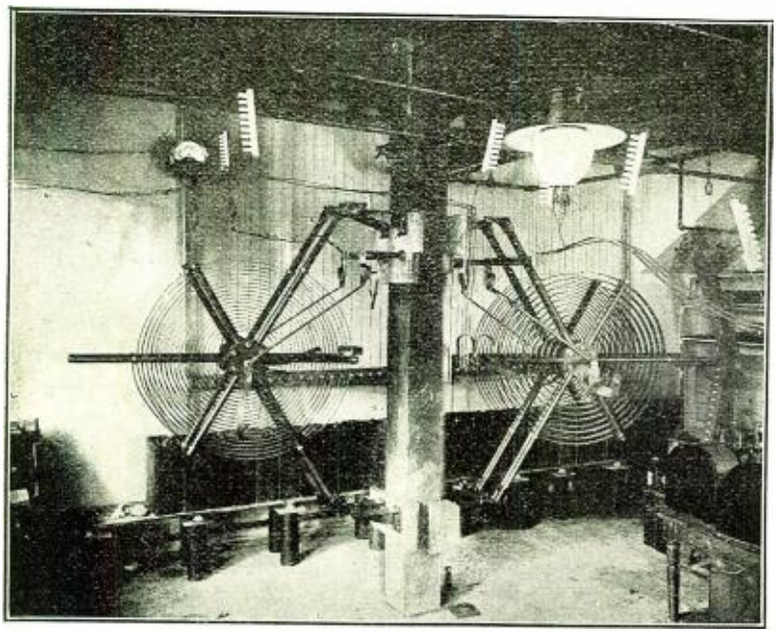


Fig. 2. This quenched spark set, on which the tests described in this article were made, is now located in Havana, and is operated by the Cuban government.

VERY little practical data has been released on high power quenched spark transmitters, and this paper will deal principally with the important and interesting features of their correct design.

Aside from efficiency, the most desirable feature of a spark transmitter is stability of note, and maximum stability is only obtained when resonance is obtained in all circuits concerned from the generator to the antenna circuit. That is, the generator must be in resonance with the transformer primary and external reactance. (Refer to Fig. 1, which shows a complete 20-K.W. transmitter.) The primary and secondary of the transformer relations must be correct, then the transformer and the first radio frequency circuit consisting of the main condenser, gap and primary of the oscillation transformer. Then of course there must be resonance between the primary and secondary high frequency circuits. In the circuit shown in Fig. 1, the note can be broken from a clear 500 cycle note to a rough "rumbling noise" by varying the supply voltage to the transformer, changing primary condenser or inductance, or the antenna circuit wave-length. The percentage of stability of note is obtained by determining over what limits the transformer supply voltage can be varied without the note breaking.

To demonstrate just how the various values are related to each other, consider the generator, transformer and primary condenser and refer to Fig. 4. This shows graphically the transformer primary supply voltage and current variations with primary condenser variations from .040 MF to .080 MF. It will be noted from the graph that the voltage and current are not in phase.

The following formulae give mathematically all the relations of the component parts of a quenched spark transmitter to each other and are based on actual laboratory measurements, at working frequency:

- X_1T Total effective primary reactance, ohms.
- X_2T Total secondary reactance, ohms.
- XC Working secondary capacity reactance.
- XM Alternator reactance, which equals synchronous impedance less armature reactance which is small.
- XX_1 Primary external reactance.
- XL Leakage reactance of transformer on primary side with secondary short circuited.
- R Ratio of Transformer turns.
- XP Primary reactance, open secondary at working volts.
- XX_2 Secondary external reactance.
- XCR Secondary capacity reactance at working frequency.
- Eo Alternator open circuit voltage at working excitation.
- I_1 Primary current at working condition.
- I_2 Secondary current at working condition.
- P Power in watts, primary side at working condition.

The following relations then hold true:

$$I_1 = \frac{0.825\ \pi\ P}{Eo}$$

$$P = 0.385\ Eo\ I_1$$

$$Eo = \frac{2.59\ P}{I_1}$$

$$XIT = \frac{3\ \pi\ P}{4\ I_1^2}$$

$$R = \sqrt{\frac{XCR}{X_1T}}\ \sqrt{\frac{XP + X_1T}{XP}}$$

$$XC = \frac{4XCR}{3} \qquad XC = \frac{10^6}{2\pi f\ MFD}$$

$$X_1T = XM + XL$$

$$X_2T = XX_2 + (XX_1 + XL)\ R^2$$

$$XM = \frac{2\pi f\ CR^2\ XP\text{-}1}{XP}$$

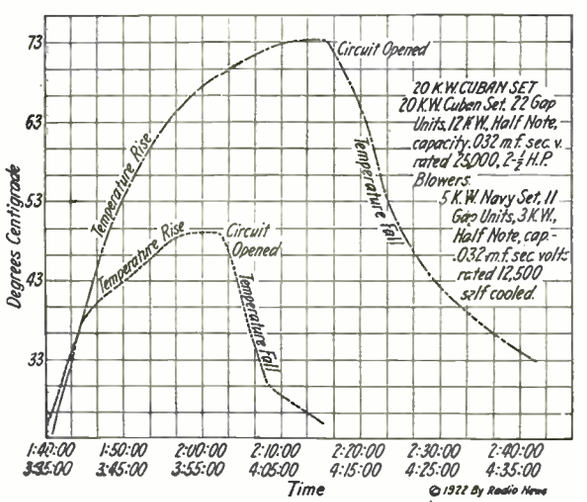
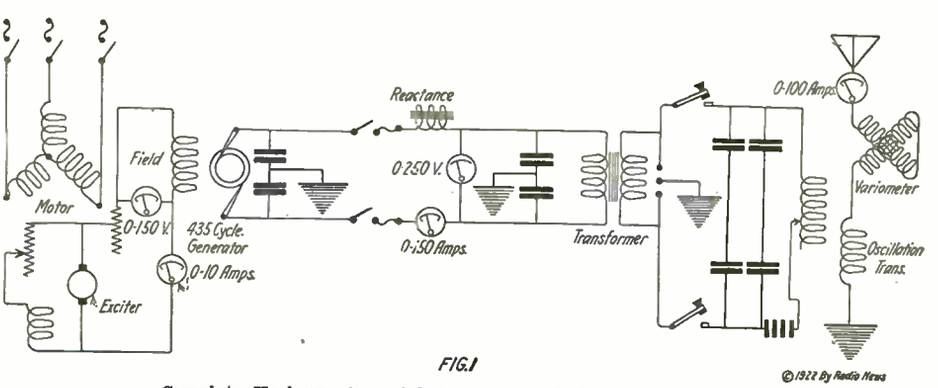


Fig. 3. This Diagram Shows How the Decrease in Sparking Distance Results in Reducing the Transformer Secondary Voltage.

The apparatus that these tests were taken on is now located at Havana and operated by the Cuban Government. Fig. 2 shows the main inductances of which there are four. One of 1½" strip copper for the primary, one of 1" copper for the secondary and the last two of 1" copper forming the variometer. The variometer may be connected to either add inductance or oppose each other and in this way gives a wide inductance ratio. The 20-K.W. alternator rotor is of the wound armature type, the field being separately excited from a 110-volt direct current generator, the latter machine also supplying current to the clapper contactor switches, magnetic keys, motor air blowers for cooling the quenched gaps, etc.

The current in the transformer primary leg approximates nearly 100 amperes at full load and presents a problem to break same for sending telegraph. To overcome this, the secondary side of the transformer is broken before it reaches the primary condenser bank. This current is approximately one ampere but at 25,000 volts and gives a decided "arc." The break at this high voltage is made with special magnetic keys, having horn contacts and the break being right in a strong blast of air



Complete Hook-up of a High Power Quenched Spark Transmitter.

*Formerly Designing Engineer, Marconi Wireless Tel. Co.

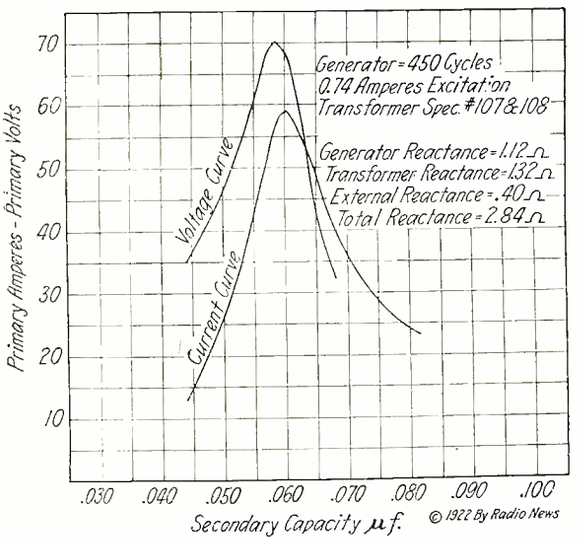


Fig. 4. This Graph Shows the Transformer Primary Voltage and Current Variation With Primary Condenser Variations From .040 M.F. to .080 M.F. Note That the Voltage and Current Are Not in Phase.

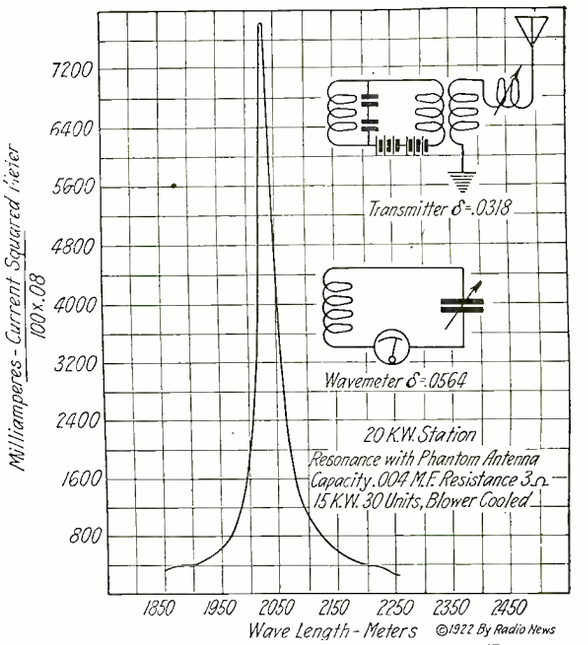


Fig. 6. Resonance Curve Between the Two Radio Frequency Circuits at 2,000 Meter Wave-Length.

from a motor driven blower. When sending, the "arc" is blown upwards 3" to 5", but extinguished sufficiently fast to enable transmission at 25 to 30 words a minute. The primary total capacity is .032 MF. and by varying the primary inductance from one to 18½ turns, the wave-length range is 1,000 to 5,800 meters and may be loaded above that or reduced below 1,000 meters by reducing the capacity.

The quenched gap consists of 30 units assembled in two banks of 15 gaps each. These gaps were mounted on concrete pedestals and the blower pipes run under the cement floor.

A substantial drop in radiated energy is experienced when a quenched spark set has been run continuously for some time. This is due to the fact that the gap units are assembled by a bolt under considerable tension. When the gap heats, the insulating gaskets soften allowing compression and in addition the sparking surfaces raise slightly. The decrease in sparking distance results in reducing the transformer secondary voltage, consequently power input and reduced antenna current. This is shown very clearly by the graph in Fig. 3, which shows the reductions in one hour of continuous operation with the key locked. This particular test is at 10 K.W. with only 15 gaps. The temperature of the gap units is measured with an alcohol thermometer. Mercury thermometers are not reliable in an electric or magnetic field.

Other interesting considerations in the gap itself are the facts that gap resistance increases with decreased current through the gap, and furthermore, although the gap resistance increases with increased sparking distance per gap, there is a limit to this increase, and after that the gap resistance decreases again. This is also true of the size of the individual sparking surfaces in square inches. The losses in the gap increase very rapidly with increased current through the gap. Fig. 5 shows the temperature of the gap over a length of time both during operation with the current passing through the gap and after the current shut off. The steepness of the cooling curve is of course an indication of efficient heat radiation and rapid cooling. It will be noted that the maximum temperature of the larger transmitter is attained in about one hour and that is with the key locked. Transmitting dots and dashes, the maximum temperature is not reached until about three hours when sending at a rate of 25 words per minute.

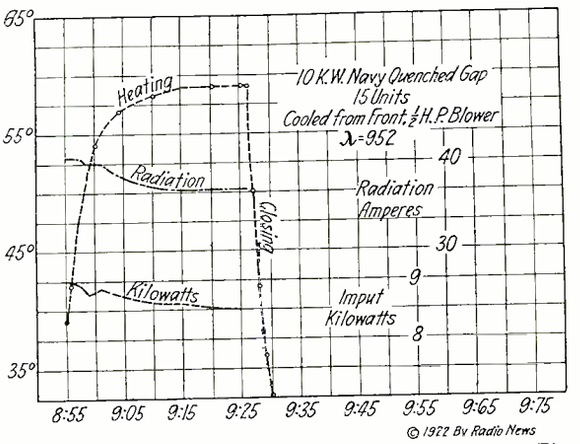


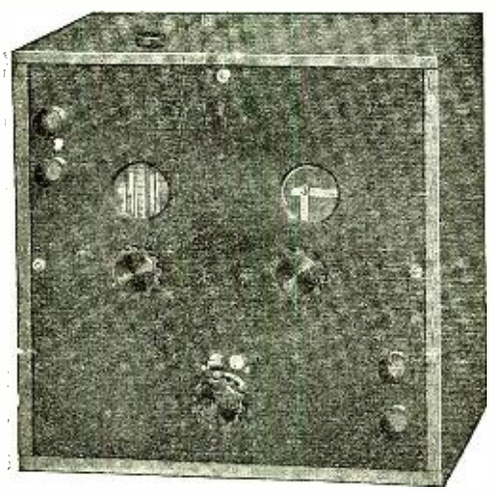
Fig. 5. Temperature of the Gap Over a Length of Time Both During Operation With the Current Passing Through the Gap and After the Current is Shut Off.

Fig. 66 shows a resonance curve between the two radio frequency circuits at 2,000 meters. The transmitter decrement is only .0318, indicating that the greater part of the maximum antenna current is being transmitted effectively on a very small band of wave-lengths. With a three-ohm antenna at 2,000 meters it is possible to secure an antenna current of 70 amperes, indicating an antenna input of 14,700 watts with a transformer input of 20,000 watts or an overall efficiency of slightly more than 70 per cent.; efficiency higher than this is possible under favorable conditions.

The watts loss in the transformer core is

(*Continued on page* 895)

The Hall Air Jet Relay for Recording Radio Signals



With This Sensitive Relay Messages May be Recorded on a Tape Recorder, or a Bell, Horn or Other Device Operated Automatically.

NOT since the advent of the audion has a more spectacular or useful radio invention been offered the experimenter than the Hall Air Jet Relay and Recorder. In the past, many improvements in the radio field have been withheld, that would have proven of great value and interest to Citizen Radio. It is, therefore, that radioists of the world will more appreciate the recording relay, knowing that its release in the experimental and commercial fields is practically simultaneous.

The recent tremendous influx of new enthusiasts in the radio field has shown the necessity of a machine, which will automatically record or give perfect amplification of radio telegraph signals. The business man, the farmer, the banker, the jeweler, and the thousands of others who own, or are contemplating the ownership of a radio set, will one and all welcome this device. Many are unable to quickly decipher the code signals as they are received by ear. Using the relay and recorder, government market reports, news broadcasts, weather reports, and other messages, may be automatically recorded on tape and the code deciphered at leisure.

The jeweler who desires to ring time signals on a large gong, may do so by connecting his gong circuit directly to the relay. With a suitable arrangement he can automatically set his master clock directly from the incoming radio time signal.

The relay operates directly in series or parallel with the head receivers of the radio

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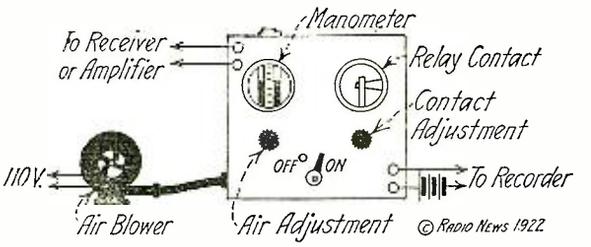

Connections of the Air Jet Relay in a Receiving Circuit.

$350 Detector Amplifier Prize Contest

IF Radio is to be the great thing we all expect it to be some day, it will be necessary for the public to become more and more interested in its wonders. The public at large is still somewhat skeptical and while thousands of laymen are becoming converted to Radio each and every day, we are still far from our goal. As long as there is not a Radio outfit in EVERY house in the United States, we have not fulfilled our mission. Now, it is a fact that not everyone cares to invest a great deal in Radio, but wishes at first to become convinced. Not everyone can visit a friend and hear the wonders of the Radio broadcast and if he does, nine times out of ten, he finds that the outfit which his friend has, costs anywhere from $75 to $200 and as a beginner, he does not care to invest so much money.

So he goes and buys a cheap crystal set, costing anywhere from $5 up. He takes it home, and makes it work after a fashion, but he is not satisfied. His friends are likely to sniff at such an outfit because a head set is necessary for the music cannot be heard in the whole room with a crystal outfit.

What is desired and needed most today to convert the public at large to the Radio art is a simple outfit that will give music loudly. At the present time, we appreciate, this cannot be done. Frankly we have ourselves not often seen a crystal outfit that brought the music in loud, and many experts will probably deride us by claiming that we are stepping backwards instead of forwards in attempting to make a crystal talk loud. We are not at all deterred by that, for we firmly believe that in the multitude of amateurs, there are a few who will be able to turn the trick.

We know that it can be done. Some years ago, there were sold outfits that worked on a microphonic principle that stepped up the small energy, from the vibrating telephone diaphragm. These loud talkers were none too good and not a huge success; still thousands of them were sold.

Our aim is to pay the prizes as shown here for the best detector amplifier that will bring in the music loud, so that it can be heard in a fair-sized room. Here are the conditions: With an ordinary detector set, it should be possible to hear music as broadcasted from one of our broadcasting stations so that the sound can be heard by everyone in a fair sized room. When we speak of a detector, we mean *one that is not a vacuum tube*. Any other detector may be used. It may be a Galena, a Perikon, or Silicon type. It may be a magnetic or an electrolytic one. It makes no difference. Or it may be an entirely new kind of detector, of which we know nothing today. The only exclusion is the vacuum tube detector as that term is understood today.

1st Prize		$150.	in	Gold
2nd	"	75.	"	"
3rd	"	50.	"	"
4th	"	35.	"	"
5th	"	25.	"	"
6th	"	15.	"	"
		350.		

In order to win a prize such an amplifier must bring in the music audibly within a radius of 50 miles from the station, on a 4-wire aerial, not longer than 35 feet. If a loop can be used, so much the better. The amplifier may be of the microphonic type, or any other type that can be constructed by the average experimenter. It should not be a contrivance that is very difficult to adjust and which does not "stay put."

The amplified music may be received on any contrivance that brings in the volume of the sound loudly such as a horn, bowl, etc. If more than one detector is necessary there will be no objection to that.

In connection with this contest, it would seem to be physically impossible to award a prize unless the Editors have fully satisfied themselves that the device works. For that reason one of the requirements is that a model must be submitted with every entry. This model is to remain the property of the builder. It will also be understood that the patent rights if any, will revert to the builder, and such rights will not go over to the publisher in this contest. The only rights that the publisher reserves are the right to publish the article or articles on such amplifiers, and also the right for all manuscripts submitted which may be published at his option in future issues. Such manuscripts to be paid for at regular space rates. In all events a complete sketch must be furnished by the contestant.

No manuscripts entered in this contest can be returned. We reserve ourselves the right to publish all worthy ideas, which did not win a prize by paying regular space rates. Use only one side of the paper for writing and keep sketches on a separate sheet. No penciled matter can be considered. More than one idea may be entered by contestants. The contest is open to everyone, radio clubs included, except manufacturers of wireless apparatus. All prizes will be paid upon publication.

Should two contestants submit the same idea, the same prize will be paid to both.

This contest closes on May 15th at twelve o'clock, noon, at New York, by which time all entries must be received.

Address all manuscripts and models to Editor, *Radio Amplifier,* care of this publication.

A Transmitting Tube Is A Good Amplifier

By HERBERT E. METCALF*

WITH the entrance of the general public into the radio game, as enthusiasts over the reception of radio music and speech from radio broadcasting stations, there has come a demand for reproduction of these concerts and programs so that they may be heard with practically the same volume as an ordinary phonograph. The public has also demanded that the music and speech be heard with a minimum of distortion. The average amateur has become deluged with requests from neighbors, friends, and his own intimate family, to hear these programs, and the loud-speaker has come into general use for their reproduction. However, no loud-speaking device, either electromagnetic or electrodynamic can reproduce or give off more energy that it receives, consequently these amateurs have been casting about for methods of obtaining additional amplification. Some have increased the number of stages and find that the desired results are far from satisfactory, because using the ordinary type of receiving or amplifying tubes the actual limit of output is soon reached, and usually is reached in three stages. Multistage amplifiers using over three tubes certainly make for reproduction of weaker signals, but still do not give out the wished for increased output.

The real way to obtain a power or increased output is to use tubes which are designed to carry heavy loads. These tubes are available in the power tubes used for transmitting today, and all of the standard types now on the market make excellent amplifiers when used with their rated plate voltages. If the amateur will substitute these power tubes for others in his amplifiers and then apply a higher plate voltage than he has been accustomed to use, he will find his output enormously increased. In this way, by the use of only two or three stages, a power output may be obtained. It used to be thought that transmitting tubes when used as amplifiers were not sensitive to weak impulses and that it was necessary to start off a power amplifier with one or two stages of ordinary amplification. Many hundreds of experiments carried out by a western company have proved this statement unfounded, and that a power amplifier using 5-watt tubes with 350 volts on the plates may be attached to even a crystal receiver through the medium of a proper input coil, and very excellent results obtained. This means that all stages of the amplifiers may be power tubes, each with the same voltage, thus simplifying the hook-up. Amplifiers are now available on the market which are designed especially for power tubes. Only one thing must be watched for in using power tubes for amplifiers, and that is that one must make sure that the amplifying transformers in the amplifier will stand the voltage used, so that there will not be burn-outs occurring in them. In the power amplifiers now available, special transfer coils are incorporated so that no danger is

(Continued on page 903)

*Engineer, The Magnavox Company.

Tubes and Transformers in Cascade

By JOHN F. BRONT

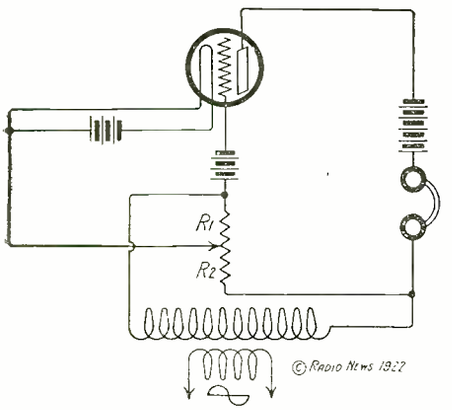

FIG. 2

The Dynamic Test of a Tube May be Made as Shown Here.

IN choosing tubes for use with the experimental set, it seems that the average experimenter is inclined to purchase those which in a way may not be quite the best for the maximum desired result in the particular apparatus employed. It appears that many certain tubes, upon the recommendation of other users, and employed by them in their own sets, regardless of the similarity or the reverse, are in many cases totally different from the circuits employed by the user who may laud the virtues of a particular tube, of a given manufacture.

It is quite apparent that the same tube employed in one circuit carrying certain constants and with probable radical departures from the standard type, may function quite differently in another circuit, of other constants and other eccentricities.

Different tubes carry with them certain characteristics, which vary to a considerable extent from the peculiarities of other tubes and they may or may not be the best available for the most efficient results in a given circuit.

It is obviously manifest that tubes of one type will not function in exactly the same manner as those of other characteristics. Even in the same type the various tubes vary slightly, and especially in those adapted to amplification, the peculiarities are amplified in almost the same proportion as the signal undergoing amplification.

The present market affords some excellent types of apparatus in the form of low power telephone and telegraph transmitters and various forms of amplifiers and detectors in whole units ready for use. The manufacturers of these units have applied scientific investigation in the choosing, wiring and testing of the component parts of these units and in most cases they have applied the results of long tests in formulating the best available apparatus of the particular type manufactured.

The average experimenter with but little or no investigation, employs a certain type of tube, generally upon the recommendation of an acquaintance who has had very good and sometimes astonishing results with it, and then when that tube is applied to the other set of apparatus, finds that comparative results are not all apparent in his particular apparatus.

It must be remembered that certain constants in individual circuits and certain characteristics of tubes greatly affect the efficient operation of the apparatus in which that tube is employed, and departures from the straight and narrow path laid out by electrical laws cannot be violated without exacting penalties.

The object of this paper is to present in a popular way, a few bits of data upon and relating to tubes which may be of utility to the earnest experimenter in the construction and operation of late type apparatus.

It must be considered that first of all the shape, dimensions, interdistances and the relative positions of the inner elements of every tube have a direct bearing upon the efficient application of tubes in different apparatus for different but allied purposes The vacuum, the gas content if any, the composition of the elements, the care in manufacture, etc., all bear directly upon the operation of the apparatus in which the tube is employed, and although the experimenter is not generally in a position to dictate the exact manner of manufacture of tubes for

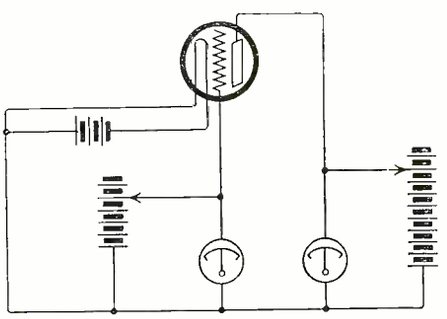

FIG. 1 © Radio News 1922

This Hook-up is Used to Determine the Characteristic Curve of a Tube.

his special use, nevertheless he may apply in an intelligent manner the characteristics of the tubes which are brought to him through the markets from the shop of the manufacturer.

In the following paragraphs a few references will be made to certain tests and to some useful applications of principles, which may aid the experimenter in a material way toward the proper selection and operation of the entailed apparatus.

TESTING THE AMPLIFICATION FACTOR

The AF may be expressed as the ratio of the grid potential to that of the plate at zero plate current. The AF varies directly with the plate-filament and the grid-filament distances. The closer the grid to the filament, the lower the potential required to effect a given change in plate current. For large amplification it is apparent that a close meshed grid placed in proximity to the filament, with regard to the plate-filament inter-distance, will cause a very large fluctuation in the plate-filament electron stream

For tests of tubes for the amplification factor, and plotting of the static characteristic curve, the accompanying Fig. 1 may demonstrate the process.

With the ordinary circuit as represented, a grid battery is inserted with a voltmeter in shunt. The plate circuit carries its accompanying "B" battery with a similar meter. When the grid battery is adjusted to a point where the plate current is at zero, the ratio of the grid EMF to that of the plate will give the approximate amplification factor. In this test, the resistance and the voltage drops across the leads is not taken into strict account and is reserved for finer and more intricate work in which the experimenter may not feel inclined to indulge, being unnecessary for his particular needs.

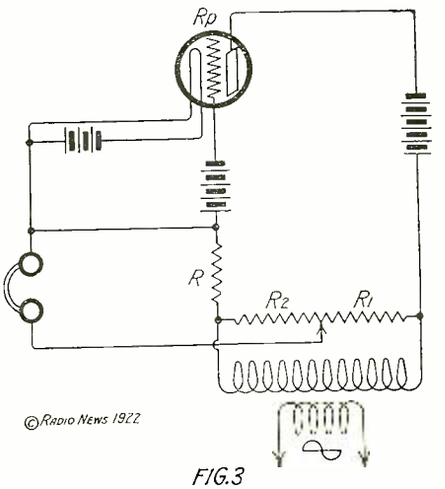

FIG. 3

The Internal Resistance of a Tube May be Found by This Method.

In this static test for the amplification factor, the value of the factor will vary over a certain range for different values of plate and grid potential, but an average will give the mean result.

The static test demonstrates the amplification factor in an easily reached manner, but in the actual operation of the tube under the influence of an induced EMF from the antenna system, it will be found obvious that the result will vary from the factor gained by the test with the grid under the influence of a steady EMF, from a battery.

The dynamic test of the tube brings about a condition where the operating characteristics will compare favorably with the demonstrations evident when actuated by the absorption of waves in the aerial system.

Referring to Fig. 2, the dynamic test is based upon the theory that the alternating current flowing in the outer plate circuit would be the same if it were connected to an alternator which possessed the same internal resistance, and an EMF of the product of the amplification factor and the grid voltage.

In Fig. 2, a source of AC is applied to the plate and the grid circuits through a secondary shunted by a large variable resistance, with a sliding contact connected direct to the filament. The slider may be moved across the resistance until there oc-

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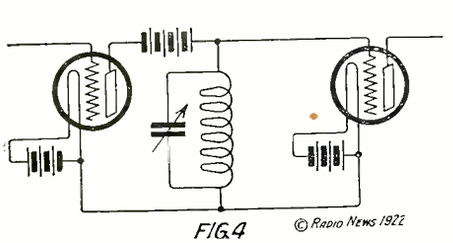


FIG. 4 © Radio News 1922

For Radio Frequency Amplification the Tubes May be Coupled by Means of Tuned Circuits.

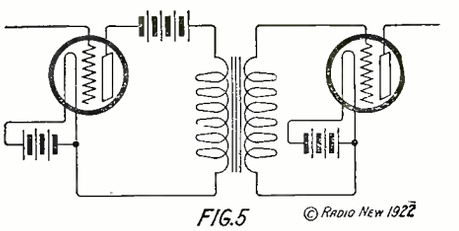


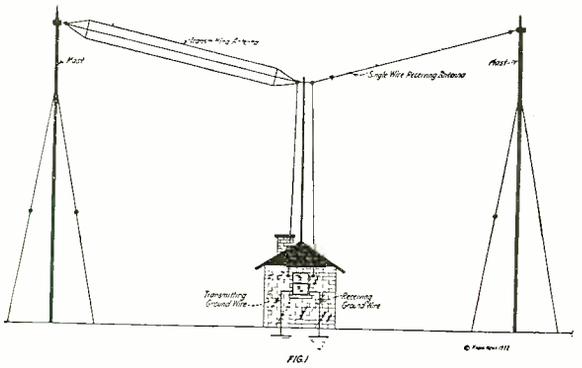
FIG. 5 © Radio New 1922

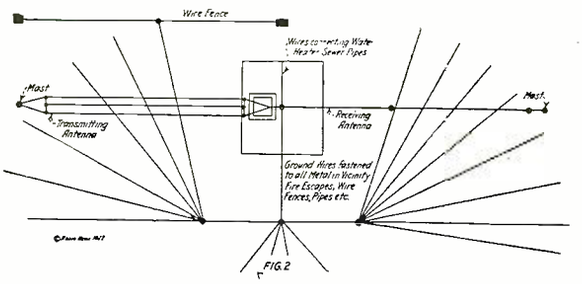
Audio Frequency Amplification is Obtained by Means of Iron Core Transformers.

A Radio System for Simultaneous Sending and Receiving

Applicable to Vacuum Tube Transmitters

By LOUIS GERARD PACENT, I. R. E.





This Sketch Shows the Ideal Arrangement of an Amateur Station, Using Two Aerials and as Good a Ground as Possible Consisting of Buried Wires and All the Metallic Surfaces in the Neighborhood of the Station.

HOW often have you wished that the old antenna switch could be discarded and a message or telephone conversation sent the same time one was being received? This is being done by some of the high power stations and some Naval Radio Telegraph and Telephone Stations. Let us look into the methods employed at these stations with a view toward utilizing them for amateur use, if possible.

SOME OF THE LONG DISTANCE AND NAVAL STATIONS

The method, in general, is to employ different wave-lengths for transmitting and receiving and to locate the receiver far enough from the transmitter so that excessive interference does not take place. In many cases the receiving stations are 20 miles from the transmitting stations which they control over a telegraph wire. Such an arrangement is shown in the diagram of Fig. A. This method obviously is not suitable for the amateur and will be dismissed from consideration.

NAVY RADIO TELEPHONE (DUPLEX)

Some time ago there appeared an article in one of the radio magazines describing a Duplex Radio Telephone System used by our Navy. The system is schematically shown in Fig. B.

It operates on the principle that the antenna inductance, resistance and capacity are duplicated very accurately by the variable resistance R, inductance L and capacity C and that when the transmitter is connected to the center of the carefully shielded coil A, equal current flows to the antenna and to the artificial antenna. If the secondary coil is properly located under these conditions no signal will be heard in the receiver from the local transmitter but a distant signal impressed on the antenna will pass through the coil A in one direction and it will be detected and amplified by the receiver. This system requires very careful adjustment and completely shielded transmitters and receivers. One-half of the transmitter output is wasted in the resistance of the artificial antenna. This system, because of these reasons is not adapted to the needs of the radio amateur.

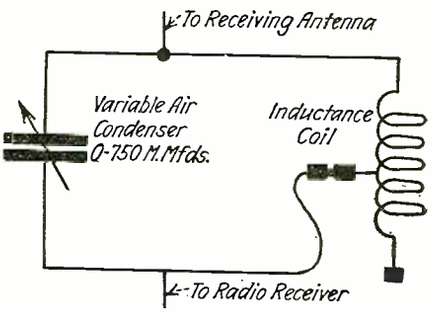
WHAT IS THE IDEAL SYSTEM

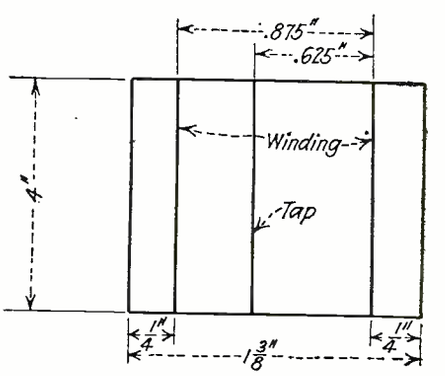
The ideal system is that which allows both the transmitting and receiving apparatus to be installed in the same room which does not require a multitude of critical adjustments and does not require expensive shielding arrangements.

The system to be described meets the needs of the amateur and can be very easily put into operation at most amateur stations because so little apparatus, which is not already in the station, is required.

Primarily the system is applicable to stations using audion transmitters and it will not work satisfactorily with the spark type of transmitters. It is necessary to transmit on the wave-length and receive on another which differs roughly at least 10% from the transmitter wave-length. Two antennae are required; one for transmitting and one for receiving. The frequency trap is connected in the receiving antenna circuit and performs the important function of preventing the signals from the local transmitter from being impressed on the receiver in the manner which will be explained later in this article.

In adapting your station for simultaneous reception and transmission of telephone and telegraph messages a few improvements may be made at the same time. Some of these are suggested in the following paragraphs.





COIL

Inductance coil wound with #18 double cotton covered magnet wire, 4" dia., Turns 17 tap at 12 turns.
Inductance total = .0046 M.H.
At tap = .0024 M.H.

FIG. 5

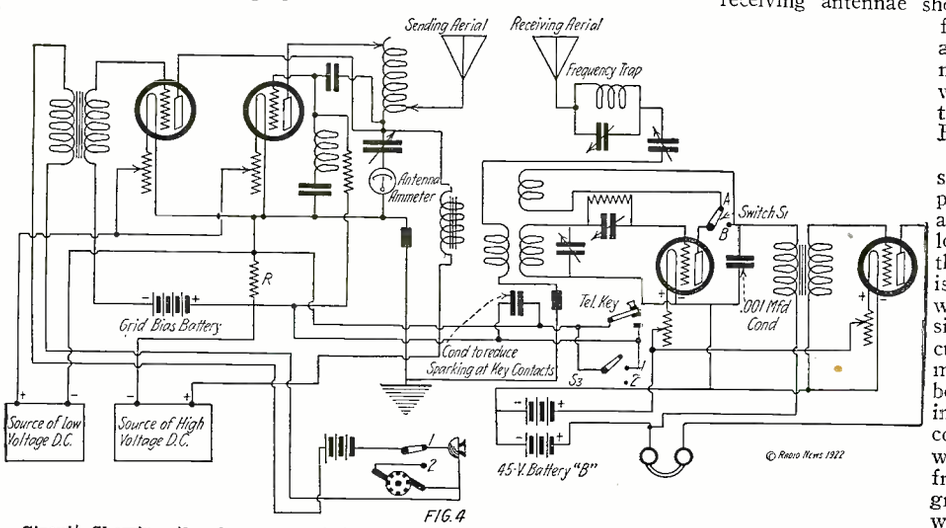
Details of the Frequency Trap Inserted in the Receiving Aerial.

WHAT ANTENNAE SHOULD BE USED

This system requires the ordinary transmitting antenna, a small single wire receiving antenna and two ground leads to the ground system. (Figures 1 and 2.)

The transmitting antenna should not be so large that it must be operated at less than its natural wave-length. Better results can be obtained by operating an antenna near but at a longer wave than its natural wave-length. The transmitting and receiving antennae should be separated as far as convenient. An almost ideal arrangement and one which will be met in practice is illustrated in Figures 1 and 2.

In continuous wave sets it is very important to keep the antenna resistance as low as possible. While the water pipe is satisfactory for receiver work much lower resistance antenna circuits and therefore more efficient ones can be made by spreading out a network of copper wire (Fig. 2) which can be insulated from or buried in the ground. All of the wire fences, water pipes, etc., should be connected to these



Circuit Showing the Arrangement for Duplex Operations. Two Aerials Are Used With a Frequency Trap in Series in the Receiving Aerial.

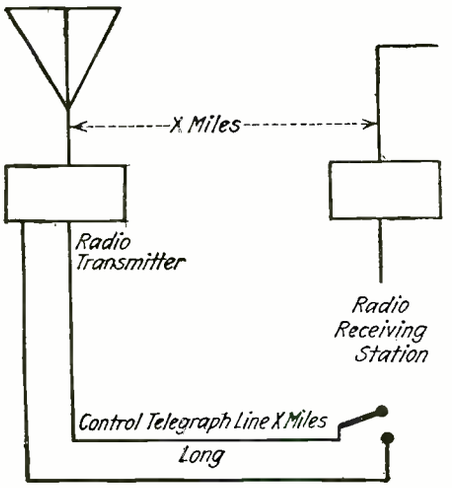


FIG. A

Method of Simultaneous Sending and Receiving Employed by Some of the High Power and Naval Stations.

wires. The transmitter and receiver should be connected to this system by separate insulated ground wires of large area and low resistance (Fig. 2).

IS THE ARRANGEMENT OF APPARATUS SHOWN IN FIG. 3 SATISFACTORY? HOW SHOULD THE THE SET BE WIRED?

The ideal arrangement of apparatus is shown by Fig. 3. The transmitter and all its wiring is separated from the receiver. All the transmitting wiring should preferably be in conduit which should be grounded as should the motor generator and other metal work.

The telegraph key, telegraph telephone switch 5_3, the telephone interrupted telegraph switch 5_2 and the telephone transmitter should be located near the receiver. Fig. 4 is a diagram which shows this in a general way. The wires between these pieces of apparatus and the transmitter should be put in grounded conduit.

SHOULD THE RECEIVER BE SHIELDED?

For the most satisfactory operating the receiver should be shielded by mounting it in a brass or copper box, care being taken not to allow the high frequency coils to come closer than 1" to the copper. It may be possible by careful arrangement of apparatus to eliminate the shielding, but this is not recommended.

TYPICAL SYSTEM DIAGRAM

A typical system diagram showing a station arranged to transmit and receive telephone continuous wave (C.W.) telegraph and interrupted continuous wave telegraph (I.C.W.) is shown in Fig. 4.

The circuit is arranged to show the arrangements for a distribution of apparatus in accordance with Fig. 3.

A description of what is necessary to be done in order to telegraph by the two means and telephone is given as a means of explaining the circuit.

FOR C.W. TELEGRAPH

The switch S_2 is placed on the off position so the modulator cannot receive an input of any kind, switch S_3 is placed on position 2 so that by pressing the telegraph key the negative voltage across resistance R is removed from the grids of the audions and high frequency power is delivered to the antenna.

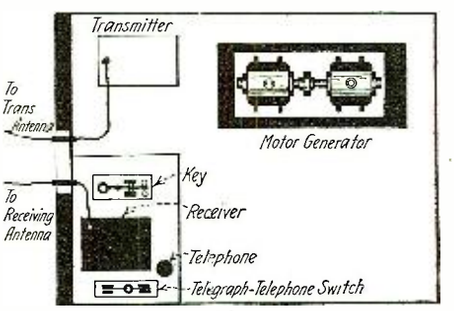


FIG. 3 © Radio News 1922

A Good Arrangement of the Apparatus in the Radio Room.

In order to receive C.W. signals the receiver must produce local oscillations. This is possible when switch S_1 is on position A which connects the tickler coil in circuit.

FOR I.C.W. TELEGRAPH

With the negative grid potential method of control of the oscillator modulator described above, it is only necessary to make and break the modulation transformer primary circuit by the motor driven commutator to produce I.C.W. signals. This can be accomplished by placing switch S_3 on contact 2, switch S_2 on contact 2 and starting the motor driven commutator.

Signals are only radiated when the oscillator and modulator are operative, which is when the key is closed.

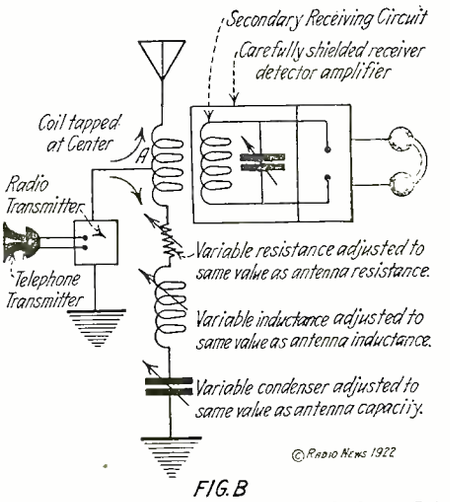


FIG. B

Circuit Used in a Navy Radio Telephone Set for Duplex Operation.

FOR TELEPHONE

The switch S_3 connects the telephone transmitter to the transmitter modulator circuit when it is on contact 1 and the transmitter is energized when switch S_2 is on contact 1.

For straight detection the switch S_1 of the receiver is placed on position B.

THE FREQUENCY TRAP, ITS FUNCTION

The frequency trap is a circuit which when tuned to the transmitter wave-length offers a very high impedance to currents of the transmitter wave-length and allows very little to reach the receiver, but offers less

(Continued on page 854)

A Method of Recording Wireless Signals by Means of a Morse Inker

By CAPTAIN H. de A. DONISTHORPE

THE following description embodies a very simple and effective way of recording wireless signals and will appeal to all wireless enthusiasts who are unable to read the Morse signals by ear.

The method makes use of the well-known system called the Wheatstone Bridge; the connections of this arrangement are illustrated in Fig. 1. If the resistances A and C are adjusted so that no deflection is given on the galvanometer then the product of the resistances A and B is equal to the product of the resistances C and D.

The application of this principle for the purposes of operating a relay on wireless signals is accomplished in the following manner:

Referring to Fig. 2. Thermionic triodes are inserted in the two opposite limbs of the bridge A and B, the high-tension battery in this instance takes the place of the bridge battery. The grids of these two triodes are

(Continued on page 852)

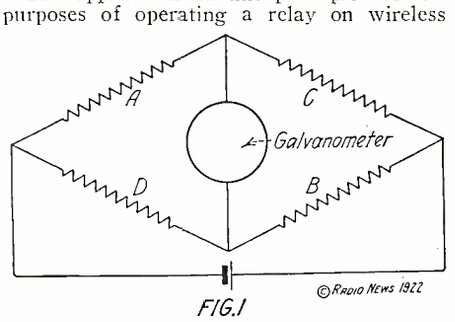


FIG. 1 © Radio News 1922

On the left is the diagram of connections of a Wheatstone bridge showing the method used in the hook-up Fig. 2 in which two of the resistances A and B are constituted by vacuum tubes, the relay being connected in place of the galvanometer.

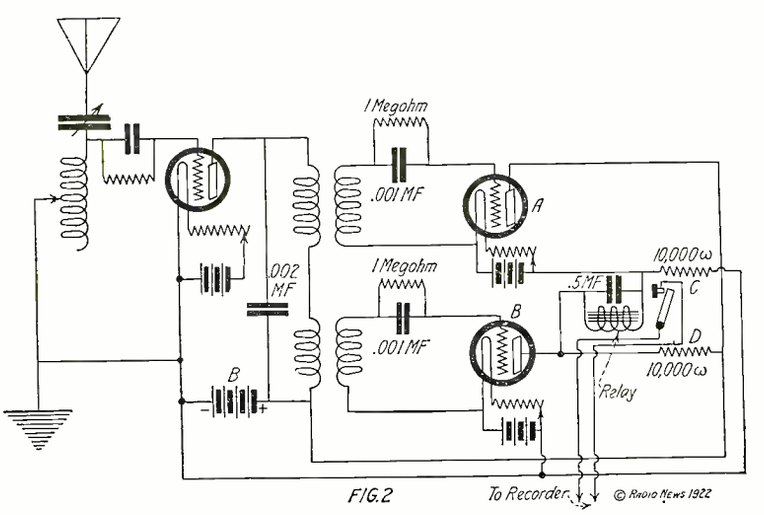


FIG. 2

What Anyone Can Hear

Complete List of Broadcasting Stations in U. S.

By ARMSTRONG PERRY

SUPPOSE the American Telephone and Telegraph Co. and its local subsidiary companies had tried to build up a business as the radio interests are trying to build up theirs. Suppose that, instead of issuing directories telling whom you can talk to with a telephone, they should offer you an installation backed up by only two arguments: First, that you can talk; second, that you can hear. Would you fall for such a proposition?

Maybe you would. Phonographs were sold in the early days even though there was little in the way of records to play on them. People are still buying toy motion picture machines with only 20' of film. They are still born at the rate of one every minute, or more. But the manufacturer or dealer who wants to sell radio, keep it sold and build up a business, must recognize the fact that at the present stage of the industry the middle eighty per cent of the population is his field, not the submerged tenth who fall for a thing just because it is new, nor the intellectual ten per cent who are capable of learning radio. The "radio amateur" represents only the big game, like the elephant or moose that can be stalked and brought into camp occasionally. Some people make money hunting elephants. Also some can sell Rolls-Royces, but Henry Ford is the only man today who is rated higher than John D. Rockefeller, and both of them built their successes on the common people. The common people are ripe for radio if they are told what they can hear.

I have answered during the past year several hundreds of letters from men and boys who wanted to use radio. I am beginning to get letters now from women, and women spend more than eighty per cent of the household funds. Practically every letter shows that the common people are hopelessly confused by the advertising, the catalogs, and even by the radio magazines. What they want to know is: "What can I hear with a radio outfit and how can I hear it?"

Careful inquiry failed to reveal any list of the things that common folks—those who want to use radio without studying the theory, learning the code or building apparatus—could hear. We have our call books, but they are all Greek to the novice. Even those of us who have used them for years cannot get out of them what the common people want to know, because it is not there. These books do not tell about the concerts, the lectures, the bedtime stories, the church services that are in the air. Those are the things that the army of new radio customers wants to know about.

Thinking that the collection of a list of broadcasts of interest to the public would be of service in the promotion of radio as a household utility, I wrote to all the manufacturers and dealers whose names and addresses I could secure. To my utter astonishment the replies showed that not one out of three knew himself what could be heard with the apparatus he made and sold. Even the fact that the list was to have a circulation of at least half a million, among persons who would be influenced by thousands to buy radio receivers, failed to stimulate many of them to the point of digging up such local information as they could secure in five minutes' conversation with any enthusiastic amateur.

Many of them gave me the information that they were very busy. I was interested in that, but it was no news to me. From radio departments in department stores to the high class shops specializing in radio, I had heard of the fact that the manufacturers had fallen down—that deliveries, just at the beginning of a radio era that should make millionaires, were 30 days and more behind. No manufacturer, so for as I could learn, had had confidence enough in himself and his business to use the dull months last summer to really get ready for the holiday trade.

But a few came across with lists of voice broadcasts. Altogether, the list is impressive, though I doubt if it contains twenty-five per cent of the reliable broadcasts that people would buy receivers to hear.

In Washington I have been getting White and Boyer's concerts once or twice a week Once a week I heard a lecture from the United States Public Health Service, with music before and after. From the Church of the Covenant I have heard not only the morning and evening services but also afternoon addresses by eminent men and women. To get all these things, I have used a mineral detector set that cost less than $30 to buy and install. I could have managed it successfully without any technical knowledge. Other folks in the house learned to use it in a few minutes. But the people of Washington do not know that such a boon is within their reach. They have read about it, but they do not *know* it. I have talked with scores of them and they have marvelled at the simple facts that I have given them.

The man who sold me the set would have sold me a regenerative receiver if he had had his way. He would have had me all tangled up in complicated connections, doubtful about the expediency of bringing into the house a storage battery full of sulphuric acid solution that eats whatever it touches if it is spilled, prudently considering problems of upkeep that do not arise in using the simple set I bought.

These Washington broadcasts could be maintained just as well in the summer time, when atmospheric conditions cause the DXer to pack up his troubles, leave them in the closet and go off for a vacation. More people stay at home than can afford to go away. If they can bring in a concert from five miles away, they should worry because the range of the broadcast is cut down from 300 miles to 50, by the summer static.

My list of broadcasts probably contains errors. Much of the information is from listeners, and not all of it has been checked up by the broadcasting stations. But such as it is, I got it up with my own money and with the kind co-operation of a few manufacturers and dealers, and I offer it to radio men for what it is worth. Somebody, I hope, will be inspired to maintain a complete list and keep it accurate and up-to-date. Such a list could be printed in a booklet, with a manufacturer's or dealer's advertising, and given away to prospects and customers, or sold for enough to cover the cost of printing.

THE present article by Mr. Perry is one of the most important because it gives a complete list of all the present broadcasting stations throughout the country. Things are moving so rapidly in Radio of late that it becomes almost impossible to keep up with the trend.

It is of course no news to anyone that at present Radio companies, be they manufacturers, dealers, or jobbers, are springing up by the dozen over night; but it will come as a surprise to even the wise ones that there are now over seventy broadcasting radio telephone stations throughout the country, and new ones are being added almost every week. It seems that the Radio interests have awakened to the fact that a broadcasting station on top of their roof will pay for itself within 48 hours.

And we are only at the very beginning of things. Thus, for instance, the American Telephone and Telegraph Company is now erecting in New York City the most powerful broadcasting radio telephone station in the country. And for what purpose do you think they are doing it? To rent out the station!

In other words, within a month from the date this is written, the advertising manager of a big New York department store may reach for his desk telephone, and talk over the new broadcasting station to several hundred thousand people, giving them the latest prices and sales talk from gold fish to pianos. He need not leave his desk, as his telephone through "Central" will be connected to the broadcasting station. Thence his voice will be connected with the Radio transmitter to be hurled out into space. The American Telephone and Telegraph Company will hire out their station to anyone who wishes to rent it for any length of time, day or night. This may seem nothing but a stunt to us, but it is the coming thing. It merely goes to show what a tremendous grip the Radio telephone has upon the popular imagination to-day.—EDITOR.

MOST IMPORTANT BROADCAST OF ALL FOR YOU

The Amateur Broadcast transmitted from the United States Navy Station NAH, New York City, daily about 9.30 P. M., on 1832 meters is undoubtedly the most important broadcast for the American citizen to receive.

The message usually is short, about 25 words. It is sent at slow speed, 10 words per minute, and with great distinctness.

The message is always of interest and often of value, but the importance of the broadcast does not depend upon that alone. It is the means by which the citizen may keep in direct touch with our Government and make sure of receiving instant advice concerning an impending disaster, such for instance as the approach of a hostile air fleet, or the menace of an epidemic against which immediate precautions might prevail.

Every American community is neglecting one of its greatest opportunities if it fails to receive this broadcast daily, and

(*Continued on page* 874)

Note on Oscillations of a Two-Element Valve

By JESSE MARSTEN

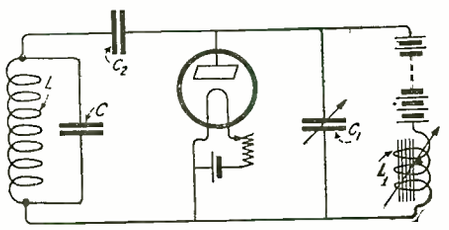


Fig. 1

High Frequency Oscillations May be Produced by a Two-Element Valve, Using This Circuit.

ALTHOUGH it may not be a very widely known fact, it is true that a two-electrode vacuum tube can be made to oscillate under certain conditions. However, the principle underlying its operation as oscillator is entirely different from that of the three-electrode vacuum tube, and by no means is it to be compared with the latter. During the summer of 1918, some simple experiments along this line showed this, and furthermore mathematical analysis also proves the difference in principle underlying the operation of two- and three-electrode tubes as oscillators.

A two-electrode tube, consisting of a spiral tungsten filament, and a circular nickel disc as plate, is connected in a circuit as shown in Fig. 1. A plate battery supplies the necessary voltage to the plate through an iron core choke coil of several henrys inductance. The reactance may be varied by turns. The condenser C_1 is the usual radio frequency by-pass condenser, and while it may be omitted, best results will be obtained with it in circuit. For audio frequency oscillations it is strictly necessary. It is a variable air condenser, maximum capacity about 0.006 mf.

On the left of the valve in Fig. 1 is connected the radio frequency circuit proper. The inductance L is a cylindrical single layer coil about 12" long and 4" in diameter wound with 400 to 500 turns of wire. C is a variable air condenser of the order of 0.0005 to 0.001 mf. The condenser C_2 is a blocking condenser inserted to prevent short circuiting the plate battery to filament through the inductance L.

The valve may be set oscillating in one of two ways. By burning the filament at normal brilliancy and increasing the plate potential until just beyond the point where the blue glow occurs, it will be found that oscillations are produced. Or by keeping the plate potential fixed (in our case at about 100 to 120 volts) and increasing the filament current until just beyond the point where the blue glow occurs, it will again be found that oscillations are produced.

It appears that the oscillations are produced at a definite point on the valve characteristic. Also that it is essential that gas exist in the tube. Tubes which would not show a blue glow would not oscillate. On the other hand, if the blue glow was very pronounced the oscillations were extremely unstable. Of course, even at best, the oscillations were not what would be called steady. Transmitting was effected by shunting a portion of the inductance L with a key, and beats were received on an oscillating receiver.

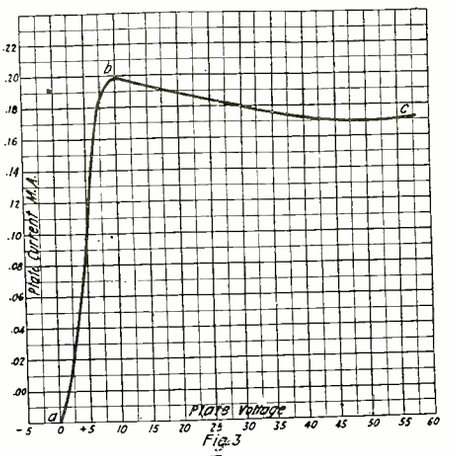


Fig. 3

Actual Curve of a "Soft" Tube Having Only a Filament and a Plate.

Audio frequency oscillations were also produced in this way, the circuit oscillating at audio frequency being L_1 C_1. The oscillations could be heard in a pair of telephone receivers connected in series with L_1. The frequency or pitch of the oscillations were varied by varying either the value of L_1 or C_1.

Both types of oscillations could not take place at the same time. The existence of radio frequency oscillations seemed to preclude the simultaneous generation of audio oscillations and vice versa.

As stated, no tube which had a good vacuum would oscillate—it was essential that

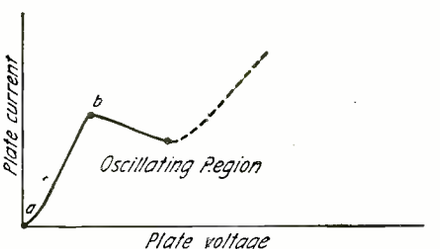


Fig. 2

Characteristic Curve of an Oscillating Two-Electrode Tube. Note the "Falling Part" of the Curve Corresponding to the Point Where the Tube Will Oscillate.

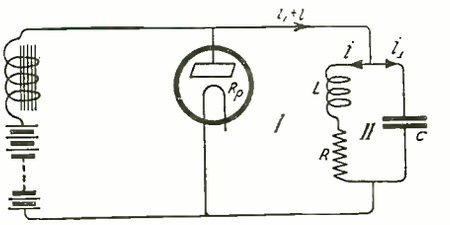


Fig. 4

In This Diagram Are Only Shown the Essential Elements of the Circuit for Analysis.

a blue glow be produced. This might be compared, in effect, with the formation of an arc, and thus the principle underlying this operation is that of the "falling characteristic." Consequently the tube would have to have a falling characteristic over a certain range, and the characteristic of the tube would be of the nature shown in Fig. 2. About a year before, in 1917, a characteristic curve taken of a tubular audion showed exactly this kind of a curve, and is here reproduced in Fig. 3. Beyond the maximum current b, there is a drop in plate current with increase in plate potential. Oscillations would take place, of course, in the region between b and c.

From a to b on the curve, the tube behaves as a well evacuated tube, namely the plate current increases as the plate voltage. Beyond point b and up to a point c, the plate current decreases somewhat with increase in the plate voltage. The cause for this drop in the plate current from b to c is probably that ionization of the residual gas begins to take place, with consequent partial neutralization of the space charge current, and hence a decrease in plate current. Beyond c increase in voltage would probably produce large increases in plate current as shown by the dotted portion of the curve in Fig. 2. This increase is due to ionization by collision of electrons and gas ions and between gas ions themselves.

That a two-electrode tube with a high vacuum will not oscillate, and that the oscillations of a two-electrode tube are based on the arc principle, can be readily shown by a mathematical analysis. This has been done before, and a simple and concise analysis by Van der Bijl in his recent book "Thermionic Vacuum Tube and Its Applications," Chapter 8, will be here reproduced.

Fig. 4 represents the essential elements of the circuit for analysis and we are concerned solely with the alternating current circuits I and II. R is the valve resistance, L C and R the values of the oscillating circuit constants, i and i_1 are the A.C. currents in the two branches of the oscillating circuit.

Setting up now the Kirchoff equations for

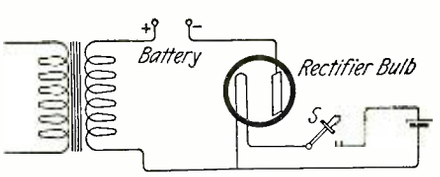
(*Continued on page* 849)

Increasing the Output of a Rectifier

By MAX LEVY

WHILE experimenting with battery charging, using a two-ampere Rectigon bulb, I hit upon the following scheme to overload my tube without injury: A 60-volt step-down transformer was procured, and a flashlight battery to start the filament of the tube; these were hooked up as shown in the diagram.

In order to start the battery charging, the step-down transformer was connected to the 110V.-line current and the battery terminals to the plate marked "battery."



By Using This Hook-up, the Author Was Able to Increase the Current Rectified by a Kenotron.

Care was taken that the polarity of battery terminals was the same as that of the charger terminals. The switches were then thrown, thereby lighting the rectifier bulb, after which the switch was pulled out again leaving the bulb lit, due to the plate bombardment.

In this way, five amperes may be pulled out of a two-ampere bulb, without injury.

I have employed this method at my station, 9DGZ, for about six months and the bulb is still in good condition.

The Development of the Transmitter

By JOHN S. ARMSTRONG

ONE of the earliest attempts to perfect a commercial transmitter to supplant the then used, and but recently invented magneto-electric transmitter of Dr. Alexander Graham Bell, was a battery instrument devised by Elisha Gray, which formed a part of one of his earliest telephones, the construction of which, as shown by drawing No. 1, was very simple, the instrument consisting of a vibrating diaphragm of laminated iron having attached to its center a needle point of platinum immersed in a fluid of low conductivity, such as acidulated water contained in a receptacle. the other terminal of the transmitter being formed by a similar needle, projecting into the liquid from below. Vibrations of the diaphragm caused the needle to vary the length, and therefore the resistance of the path from one point to the other through the liquid. The variations in resistance thus brought about by the vibrations of the diaphragm cause corresponding variations in current from the battery connected in the circuit, which variations are then capable of acting in the receiver

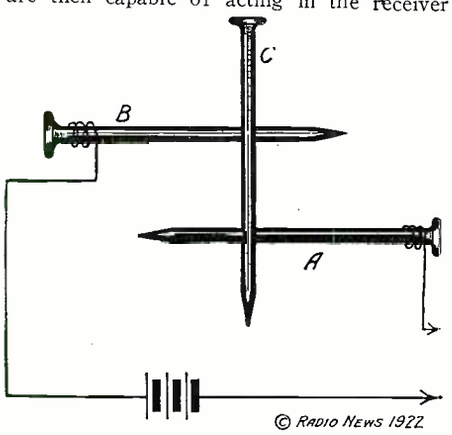


FIG. 4

This Form of Microphone Was Used by Prof. David E. Hughes in His Experiments in 1878. It Consists of Three Nails Disposed of as Shown.

connected with the wires by causing changes in strength of the magnetic field in which the coil of the receiver lies. These currents vary in uni-directional pulsation, strength, and frequency in unison with the movement of the diaphragm of the transmitter and cause the permanent magnets of the receiver to be strengthened and weakened and cause it to exert a varying pull on the diaphragm which vibrates in unison with the changes in current, and therefore more or less faithfully reproduced the sound causing the diaphragm to vibrate.

The results obtained from the water transmitter were slightly better than those obtained with the magneto-electric transmitter, but it had the disadvantage of the presence of liquid and could not be used with much success as a commercial transmitter.

It was, however, the first transmitter ever constructed with the idea of causing the vibrations of the diaphragm to vary the strength of the current by changing the resistance of the circuit in which it was flowing.

The results of this attempt led to further experiments to vary the resistance of the circuit in which the transmitter was placed by having the vibrations of the diaphragm produce a pressure between two electrodes thus varying the total resistance of the circuit.

A transmitter of this principle, incorporating the use of carbon electrodes in place of the platinum electrodes in water, was invented and patents applied for in 1877, and granted in 1894, to Emile Berliner, the principle of which is shown in drawing No. 2 in which is the diaphragm of ordinary tinned iron, resting against a ball electrode of carbon, carried on a thumb screw. This thumb screw is mounted in a bracket in such a manner as to afford a means of adjustment of the pressure between the diaphragm and the ball electrode. Variations in pressure between the diaphragm and the ball cause corresponding variations in resistance, and thus produce similar fluctuations in the current strength In Mr. Berliner's first transmitter, the diaphragm was about 4" in diameter, of thin tinned iron, mounted very roughly over an opening in a wooden box; the back contact consisted of an ordinary wood screw. There has been much discussion as to whether or not this instrument ever transmitted speech, but it is certain that it was not a transmitter suitable for practical use.

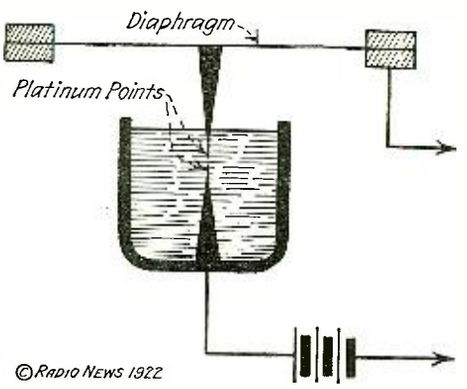


FIG. 1

This Microphone Consisting of Two Platinum Points Immersed in Slightly Acidulated Water Was Devised a Long Time Ago by Elisha Gray.

In the same year, 1877, Mr. Edison brought out the condenser transmitter, using the theory of electrostatic induction instead of electromagnetic induction. Drawing No. 3 shows the general method adopted. This transmitter, as shown, was composed of very thin metal plates "P," separated by paraffin paper, having a mica diaphragm "D" with a cork button "B" between it and the condenser. When the diaphragm is set in vibration, the plates are pressed together more or less; thus, the distance between them varies, and this changes their electrostatic capacity. While the principle of this transmitter was sound, it required a very great electromotive force and consequently a large number of cells to operate it successfully therefore it was not very practical, due to the fact that it could be used only on a short metallic line and under only the most favorable circumstances. Now, while this transmitter did not meet with much success in commercial telephony, it has, I have become convinced, great merits for its use in radiophone circuits. This is also the opinion of J. Stanley Brown, Radio Engineer.

Up to the time of Mr. Edison's electrostatic, and later, his carbon transmitter, the best condition for producing changes in resistance between two electrodes by varying the pressure, had not been realized. Prof. David E. Hughs, in 1878, by a long and interesting series of experiments, proved that the resistance of two conductors in loose contact with each other was far more susceptible to changes in pressure than if

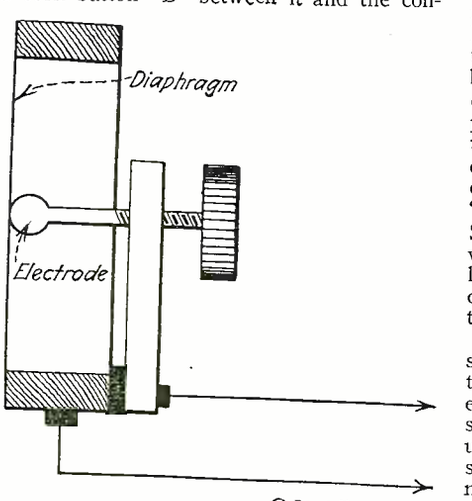


FIG. 2

An Early Type of Carbon Ball Microphone Patented in 1877 by E. Berliner; the Pressure Between the Electrode and the Diaphragm is Adjustable.

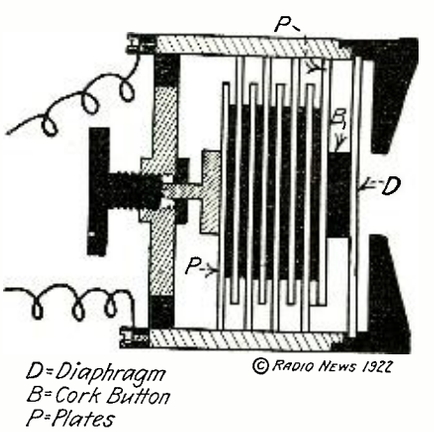


FIG. 3

This Condenser Transmitter Was Designed by Mr. Edison and Functions on the Principle of Electrostatic Induction.

firmly clamped together. He found that these laws held for any conducting material whatsoever, and in one of his experiments succeeded in producing a microphone from three nails arranged as shown in Fig. 4. In this, the nails A-B form the terminals of the circuit, which includes a battery "B" and a receiving telephone, the circuit between the two nails being completed by the nail "C" laid loosely across the other two. Any vibration in the air caused vibration of the nails, and this caused variations in the resistance where "C" came in contact with "A" and "B." So, it can thus be seen what crude but forward steps led to the production of the finely machined microphone that stands on your office desk, or hangs beside your transmitting cabinet.

The condenser tranmitter, to my mind, should be of considerable use in radiophone transmitting circuits, as therein it is not so essential that current density be varied to so great an extent as it is that the voltage upon the grids of the modulating tubes be subject to great changes through very little mechanical vibration as a cause. It will be possible to do away with a lot of undesirable crackling sounds such as occur when there are carbon grains in the conducting path of the modulating source, it will elim-

(*Continued on page* 852)

How to Sell Ten Million Radio Outfits

By STANLEY B. JONES*

"ENTERTAIN people? Easy! You've got to do one of four things: amuse 'em, or feed 'em, or shock 'em, or tell 'em something they didn't know before!" That sage bit of advice I once came across, I think, in one of Mr. Scott Fitzgerald's inimitable "flapper" stories. I remembered it because of the force of the basic truth underlying its rather flippant mode of expression. And whenever you are really entertained you will doubtless recall afterwards that you were either fed, or shocked, or amused, or instructed.

What is there in radio that is claiming the interest and time of so many people? I am writing as a man who has never reacted to its very real marvels beyond the "Isn't that wonderful!" stage. It *is* wonderful, almost too wonderful for its own immediate good, I believe. Common people continue to regard it as a mysterious and complicated servant of nations, a tremendous force, greater even than the forces of nature, which a few geniuses have bound to their wills. It is much too vast and incomprehensible for John Smith and Bill Brown. When they sink back in the worn chair after a day's grapple with invoices or accounts or stubborn buyers, light the bitten-up briar, and take up the paper, it is going to take a lot more persuasion than the radio manufacturers are showing at present to dig them out of it and kindle the spark of radio interest in their eyes.

As yet, John Smith has never thought of radio as having any relation whatsoever, to himself, such as his trusty phonograph and well-worn camera can claim. He knows, in a vague sort of a way that Bill Brown's boy has a jigger rigged up on his roof which has been said to "Pick up Washington" and snatch stray fragments of news out of the night air, but who wants to sit up half the night to be doing that when he can get it all in the first edition of the morrow's paper? Radio, huh!

And what does the word "radio" convey to the average man? Research among my friends, and talks with men who sell radio apparatus, leave in my mind this composite picture as a reflection of the mind of John Smith in regard to the workings of this great force.

A few rectangular boxes, sprouting wires, and adorned with knobs and dials of black rubber, two or three little standards with small rods of metal set up on them, a group of batteries (ah, there's something familiar, at last!), a headpiece, such as telegraph operators in the movies wear, and a rather flimsy contraption of wires stretched between poles which doesn't do much to help the looks of the housetops. He is also aware that there is a strong and resonant buzzing, a mysterious and intricate "code" which one must learn, and he fears that there is a strong likelihood of being burned (to say nothing of his house) by the hissing purple and yellow sparks which he has seen zig-zagging between the small rods. Also, the group of hobbyists who take up this strange business appear to be obliged to spend most of their nights hunched over their boxes and batteries. As for him, give him a paper or a good book, and eight hours of sleep!

Well, why should he sit up, leaving the family circle and his journal, to fiddle with dinguses? Why? As you manufacturers know, there are a great many reasons why he should, and it's up to you to tell him, and show him, in such a way as to open up the vast possibilities of radio to him, in a language which he understands. It can be done. It was just about as difficult to sell John Smith a camera or a phonograph when they first began to reveal their possibilities for entertainment and instruction. It just needs the right kind of an approach, and —but we'll take that up later.

In the course of my investigation, I asked a large number of radio amateurs how they happened to take it up. I must admit, in this connection, that I was astonished at the range in ages and occupations of its devotees. The youngest was a boy of nine, the oldest a retired physician of seventy-two! Surely radio offers a hobby which is even less subject to the dictates of age than golf itself, whose wild-eyed followers have won a place all their own as the world's champion boosters.

In one store I spent an entire morning, seeing for myself just what sort of people

(*Continued on page* 838)

The above is a reproduction of a page advertisement for December, 1922. This is advance information, of which we hope our manufacturers will make good use. It covers Mr. Stanley Jones' idea of what a real radio advertisement should look like—an ad that can be understood by the merest tyro, unless he is blind. We admit our first attempt is a rather crude beginning, but there is hope that our manufacturers will take the hint in due time, and get up REAL artistic copy.

*Of the J. Walter Thompson Co.

Important New Radio Legislation

By H. GERNSBACK

WE publish, herewith the correspondence which the Editor had with the Department of Commerce recently. Newspapers in the latter part of January made the announcement that Radio amateurs would be restricted from sending out radio messages. This was confirmed by orders received from the United States Radio Inspector, who sent out notices that amateurs were no longer to broadcast weather reports, market reports, music, etc., and later the word came from Washington that the present administration had in mind more or less drastic restrictions, which would affect all radio transmitting stations.

Secretary Hoover ordered a special commission composed of the various radio interests, and which was held on February 27th. This was a preliminary move to report to the President what recommendations were in order.

Due to the fact that this publication goes to press at the end of February, it was not possible to include in this issue the results of the meeting held on February 27th. The amateurs at large may rest assured, however, and this is the Editor's opinion,—that nothing rash will be done in Washington to curb the entire activities of the Radio fraternity. We cannot conceive of such a thing at this time of writing, when the President himself has installed a radio outfit in the White House, he himself having become an exalted radio bug, so to speak.

The whole discussion seems to have been brought about by the large radio interests who have suddenly become alive to the fact that in the radio telephone, they have found a new industry that will soon rival the automobile. These large interests naturally wish to have the ether to themselves as much as it is possible to the exclusion of everyone else, and we understand from a reliable source that they have brought pressure to bear upon the administration to eliminate everything that would tend to interfere with their activities.

It has been proved, for instance, that the cost of our largest and most powerful broadcasting stations is ridiculously trifling when compared with the amount of business such a station is able to create. Since broadcasting started a few months ago, even the very largest of our manufacturers have been unable to cope with the demand for radio apparatus which they make. It is naturally to the interest of our big corporations to look out for themselves and see to it that there shall not be any hitch in the broadcasting, because the minute that happens, the demand for radio apparatus will fall off.

To be sure, we need some sort of regulation. We will all be better off if the amateur with his "squeak box" does not "butt in" when a concert is being broadcasted. If you were sitting in the Metropolitan Opera house while one of the stars was singing, and suddenly someone stood up and insisted upon playing a harmonica you know what would happen. He would not live two minutes.

The conditions in radio are analogous. If we amateurs who are allotted our 200 meters were to stick to this, we would do no harm. But the trouble is, we do not. It often happens that the amateur insists, in the goodness of his heart, upon doing his own broadcasting, thinking that he thereby amuses his friends. To be sure, he might do that if his wave length were 200 meters, but quite innocently his wave length is often nearer 250, and it is then the mischief starts.

The regulation that we do need is adjustment of the broadcasting stations' wave length, not adjustment of the amateur wave length. Also, every amateur should be made responsible as to his station and he should be warned,—and if warning does not help, he should be penalized to the extent of confiscation of his station,—if he does not keep within the 200 meters. *The writer advocates and is quite strong about it, that amateurs should be allowed to do as they please within their 200 meter wave length.*

The recent tests across the Atlantic on a wave length of 200 meters proves that the scientific amateur can take care of himself. As for special legislation for the broadcasting stations, we do not need it at the present time. The writer thinks that the Radio Act of 1912 covers all the requirements and no new law is needed. The Department of Commerce has the power to allow the large broadcasting stations to use a wave length where interference with the amateurs is no longer to be feared, or even be seriously reckoned with.

Why the broadcasting stations, as at present, should send at 360 meters is a profound mystery. Probably it was only intended as an experiment. The change that should be made is to let the broadcasting stations operate it, say 850 to 900 meters. This has a two-fold advantage. In the first place, it will not make for confusion; in the second place, they will be heard further because it has been shown time and again that under ordinary conditions, the longer wave carries better than the shorter wave, particularly when the receiving instruments are not very sensitive. Let the amateurs broadcast as much as they please on 200 meters. It will not harm anyone, but on the contrary, it will be the means of advancing the art.

While we are on the subject and talking about regulation, to prove our contention that the large broadcasting stations should be regulated in some way, we may make mention of the following incident. At the present time, Newark (WJZ), and Pittsburgh (KDKA), are both sending at 360 meters. That this is downright foolishness is best proven by the fact that if someone has a sensitive receiving outfit, he can at almost any time pick up his receiver, and *the two stations being on exactly the same wave length, will come in together on top of each other, making it impossible to tune out one or the other.* Of course, there are not a great many thousand receiving stations that can thus receive the two stations simultaneously, but their number is increasing every day. Is it then not up to the broadcasting stations to be under such regulations that such an occurrence will not happen in the future?

There should be sufficient difference in wave length between the stations which send out concerts daily, that they will not interfere with each other. There should be a minimum of 25 meters or better 50 meters of wave length difference between such stations. Thus, for instance, if Newark were sending at 850, Pittsburgh should be sending at 900, Chicago at 1,000 meters, etc. As the art becomes more and more advanced, such large differences in wavelength will, of course, not be necessary. Perhaps in two or three years from now, a difference of one or two meters in the wave length of various stations will be found sufficient. At the present time, between 25 and 50 meters will do nicely.

The readers will be kept informed of any moves that may come up at Washington and should great danger threaten, all amateurs will be advised by letter within twenty-four hours as has been the custom of the Editor for many years. Appended, herewith, is the correspondence which the writer had with the Department of Commerce:

Jan. 20, 1922.

Department of Commerce,
Washington, D. C.
Hon. Mr. C. H. Huston, Ass't Sec. of Commerce,
Dear Sir:

The writer just received a letter from the New York Custom House Inspector, asking that we give publicity to the following:

Instructions have been received from the Honorable C. H. Huston, Assistant Secretary of Commerce, to insert in all General and Restricted Amateur Radio Station Licenses the following:

"This station is not licensed to broadcast weather reports, market reports, music, concerts, speeches, news or similar information or entertainment."

Please give this matter publicity in the next two or three issues of your magazine.

As the largest radio organ in the United States, with a circulation of over 70,000 copies, will you not be good enough to give us your reasons for this step? The writer is very much afraid that the large body of radio amateurs will feel very strongly about this rule, as they will naturally argue that there is no specific law prohibiting the broadcasting of music, concerts, speeches, news, etc. The writer has before him a newspaper clipping from a Chicago, paper where the Chicago amateurs seem to be very much incensed at the restrictions placed upon them, as they argue that the Department of Commerce is giving the Westinghouse people a monopoly that will ultimately work against the good of the radio art.

Since the writer became identified with radio, nearly twenty years ago, he has always through his publications, endeavored to instill in the amateur the fact that he must keep within the law, and in many instances, the writer has been successful due to his various writings, in making the amateur see this point.

The writer is very much afraid that this drastic order will bring the entire radio fraternity up in arms unless, of course, the writer misunderstands the new ruling.

It is the writer's desire to cooperate to the fullest extent with the Department of Commerce at all times, and we wish to do everything in our power to have any rule observed that has been found necessary to adopt. In this case, will you not be good enough to give us the full facts as to why it was necessary to make this rule, and advise whether the ruling means that no amateur hereafter is allowed to send out music concerts, speeches, or similar information, or entertainments on wave-length differing from that used by the present broadcasting stations?

Personally the writer sees no harm if the

(Continued on page 898)

An Efficient Remote Control System

By ALFRED CLARK and H. D. MABRY

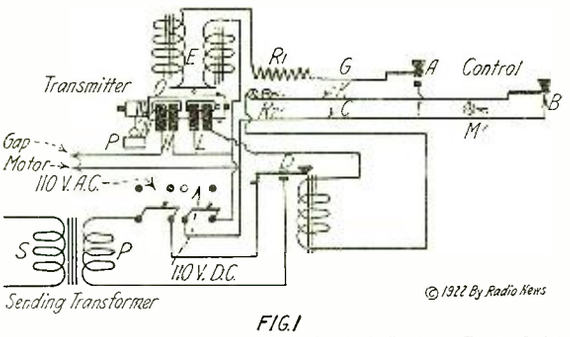


FIG. 1

Circuit Diagram of the Remote Control System Devised by the Authors.

A SUITABLE remote control and break-in system was desired for the operation of the writers' station. After considerable experimenting and designing we have perfected a control system at a moderate cost and which has given the utmost satisfaction during the four months it has been in operation. Noting the dirth of remote control articles in the various radio magazines and believing that a great many amateurs appreciate the advantages of such a system, we submit our method of control to them through RADIO NEWS.

Our transmitter is located in an uptown office building, near the main power wires, making it convenient and inexpensive to install special wiring, thus doing away with troublesome light blinking, at a much less cost that the installation of a special transformer. This location also affords better facilities for a transmitting aerial. The receiving stations are located eight blocks from the transmitter, in the residential section

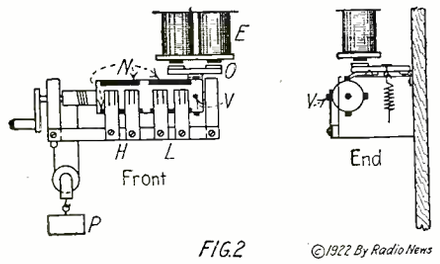


FIG. 2

Details of the Revolving Drum Upon Which Are Fixed the Blades Making and Breaking the Circuit.

where we are not bothered with induction from nearby power lines, or from street noises due to traffic. The control system has the added advantages of doing away entirely with the crash of the transmitter which is often troublesome to neighbors and parents in the late hours of the night. In fact we have all the advantages of two transmitting stations for the cost of one, due to each operator having control keys in his own home, with an inter-phone system between. The break-in system is also very desirable during heavy QRM or QRN. We have found the two receiving stations a great asset in handling traffic and doing DX work, due to the fact that both operators can copy at the same time on separate receiving sets, and often one operator will get what the other misses, due to QRN or QRM. With the abolishment of blinking lights, crashing noises, complaining neighbors and the accomplishment of absolute co-operation in receiving, we believe that the perfect citizen radio situation is realized. With this control a transmitter can be installed in almost any location, thus getting away from the troubles every amateur has to meet, all at a very minimum cost. A small piano box or small shack set out on the ground or installed on top of buildings, will do just as well for the location as an elaborate house, and the operator may transmit and receive with the greatest comfort and ease.

The control performs the following functions:

1. It starts and stops the rotary gap at will.
2. It can shut off the entire set and control by disconnecting transformer and control line power wires.
3. It grounds the aerial at will of operator.
4. It operates the relay transmitting key.

The control is operated by three wires, C, K and G, in Fig. 1. Making a short dot on key A, Fig. 1, operates magnets E, raising armature O, and allowing the rotor on escapement switch to make one quarter turn. This connects switch H, Fig. 1, starting the gap motor, and switch L, connecting the key B, at control station, to magnets on the relay key. This position of the rotor is indicated at the control station by light M, Fig. 1, burning. This indicates whether or not the gap motor is running, and is necessary to show when the control is in transmitting position. Also in this position, Key D, Fig. 1 may be operated by key B, Fig. 1, thus operating the sending transformer. When transmission is finished, another short dot on key A, turns the rotor to its off position, shutting off the gap motor and disconnecting the relay key. In this position, light M, Fig. 1 is off. Holding down key A, Fig. 1, allows the rotor to revolve, until the weight P, Fig. 2, touches trip S, Fig. 3 releasing arm B, Fig. 3, which pulls out the line switches thus disconnecting A.C. and D.C. current from the entire system, and also grounds the aerial. This arrangement provides absolute safety to the remotely controlled station, by cutting off every source of current to the transmitter, and also grounding the aerial.

The escapement switch, Fig. 2, is the salient feature of the control, and was constructed as follows: All references to parts will be in Fig. 2. The actuating magnets, E, are Ford magneto rechargers. These, we understand, are no longer on the market, but amateurs should be able to get a set of them very cheap at any garage. For the benefit of those unable to purchase the rechargers, we give the following dimensions: Each magnet is wound full with No. 22 enamel wire, is 3" long, 2" in diameter, with a ¾" square core. The armature O may be of wood or fibre and has two iron washers fastened to its upper side, spaced to correspond with the magnet ends of E. On the under side of this armature is fastened a steel strip to engage with the pins in the rotor. The armature is hinged at the back to allow the magnets to actuate it, and an adjustable coil spring is fastened on the under side, to assure a quick action of the armature. The rotor for this switch was made of hard wood, and when turned down should be about 1½" in diameter and 7" long. One end of this is turned down to about ¾" in diameter to provide winding space for the weight cord. A 3/16" shaft passes through the rotor and should be properly centered to provide a smooth and uniform action in operation. Four wood screws are now screwed into the other end of the rotor, at equal intervals around its circumference. The heads of these should then be cut off in such manner as to let the ends protrude about 3/16" above the rotor's surface, and placed in a position to engage with the steel strip on armature O, allowing rotor to make ¼ revolution when key A, Fig. 1 is pressed for a very short interval. Next copper strips, N, are inlaid in the rotor, two on each side to engage with brushes H and L on every half turn. These strips should be smooth and conform to the rotor's surface so its action will be uniform. The brushes H and L should be of light brass or phosphor bronze, with sufficient tension to insure good

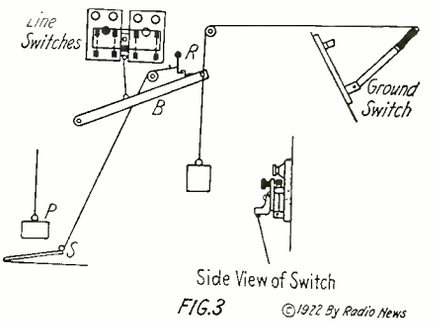


FIG. 3

By Means of This Lever Arrangement the Main and Ground Switch May be Operated From a Remote Point.

contact with the strips N, and yet not cause too much friction on the rotor. These brushes should be cut in a short distance to insure good and even contact. Weight P will depend on the friction it will have to overcome in the rotor, and this can best be determined by experiment, after the switch is built. In our case, a two-pound weight is used. The length of cord on the rotor determines the number of times the control may be operated before the entire set is shut off. In our case string long enough to permit turning off and on 110 times was used and it has proved sufficient for all ordinary operation.

Fig. 3, illustrates the method of closing down the station and grounding the aerial. This feature was incorporated in the control to provide absolute safety of operation. This trip S is placed so that as the rotor unwinds and the weight P descends it will finally set off S, thereby releasing arm B, throwing out the line switches and also operating the ground switch. This is a very simple arrangement, being run with cords and weights, and has given the utmost satisfaction. The weight on arm B should be sufficient to provide positive action of the switches.

(*Continued on page* 846)

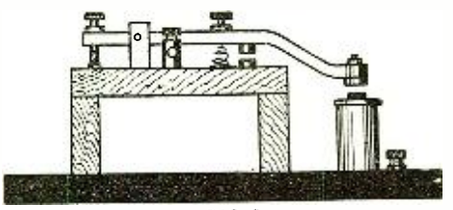


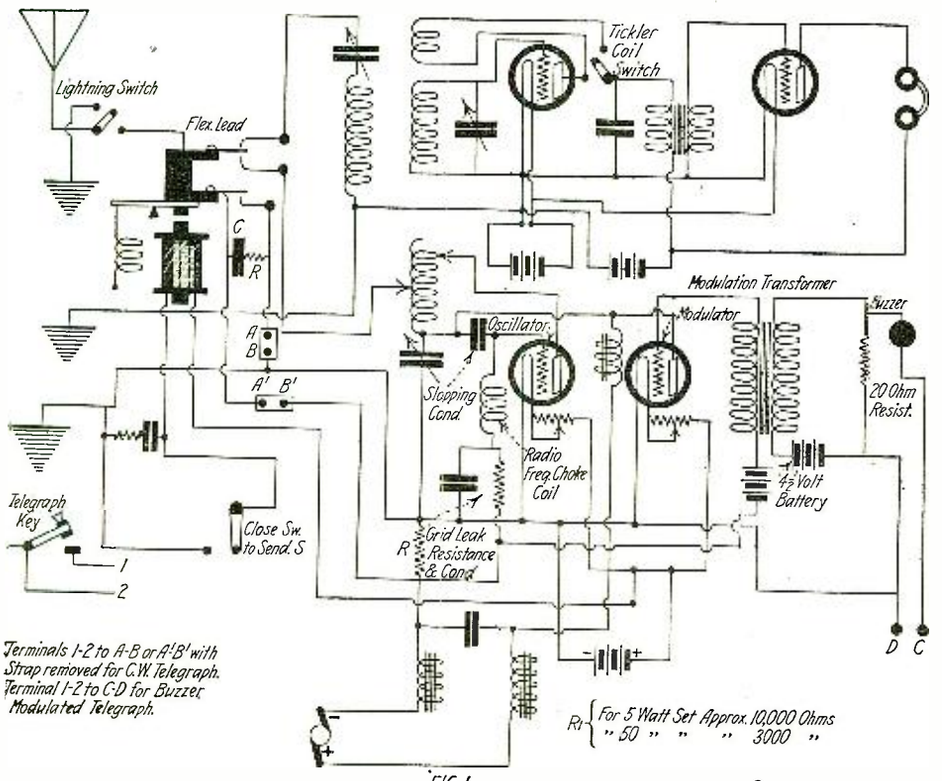
FIG. 4

Detail View of the Relay Key.

The Relay Antenna Transfer Switch

Its Application to Vacuum Tube Radio Telegraph and Telephone Sets

By LOUIS GERARD PACENT, I. R. E.



Complete Hook-up of a Combination Modulated Buzzer Transmitter and Receiver Equipped With a Relay Switch.

IN most of the radio telegraph stations of yesterday and a large number of amateur and experimental stations of today, the somewhat crude hand-operated switch was used to change from the transmit to the receive positions. This, of course, while not very convenient, is not so disadvantageous for telegraphy as for telephony.

Think how unnatural, if not difficult, it would be, if each time we spoke it was necessary to throw a switch, and throw it again in order to hear.

In the ordinary radio telegraph circuit, if one station is transmitting and local interference makes it impossible for the receiving station to copy the message, the receiving station cannot break in and tell the transmitter to stand by until the interference (QRM) is over. How useful it would be if the receiving operator *could* break in on the transmitter in just the same way the receiving operator breaks in on the transmitting operator of an ordinary wire telegraph circuit.

The purpose of this little article is to describe an antenna relay switch which makes just this possible for Continuous Wave (CW) and Modulated Continuous Wave (ICW) transmitters.

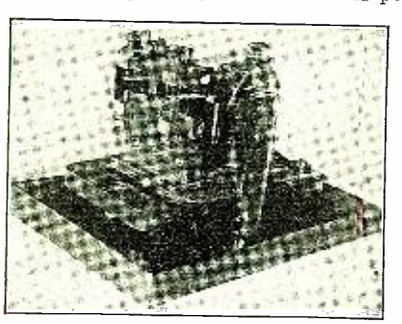
FOR TELEGRAPHY

1. An arrangement which makes it possible to change from transmit to receive by the operation of a small switch near the telegraph key.

2. Use of the relay switch in such a way that break in operation can be accomplished.

FOR TELEPHONY

3. Connection of the relay switch with a push button located on the transmitter hand set so that by pressing the button it is possible to talk, and by releasing it, it is possible to listen.



Here is the Relay Switch Made From a Telegraph Sounder

TELEGRAPHY

How can the Remote Control Antenna Switch be used?

The remote control antenna transfer switch can be used with either a continuous wave (CW) or a modulated or interrupted continuous wave (ICW) set as illustrated in Fig. 1. This relay switch is controlled by the small switch S which can be located, for convenience, near the transmitting key. When switch S is closed, the antenna is connected to the transmitter and the resistance R is connected in the negative lead of the plate circuit generator by the relay switch.

How does the Resistance R stop the Oscillation of the Transmitter?

This resistance, when in circuit, due to the current flowing through it, applies a large negative potential to the grid of the oscillator through the grid resistance and the grid leak of the modulator through the modulation transformer. (Figs. 1, 2 and 3.) This voltage is of sufficient magnitude to reduce the plate current sufficiently to stop oscillations and reduce the power taken by the modulator to a very low figure. Upon short circuiting the resistance, the high negative potential is instantly removed and the circuit oscillates and is ready for modulation.

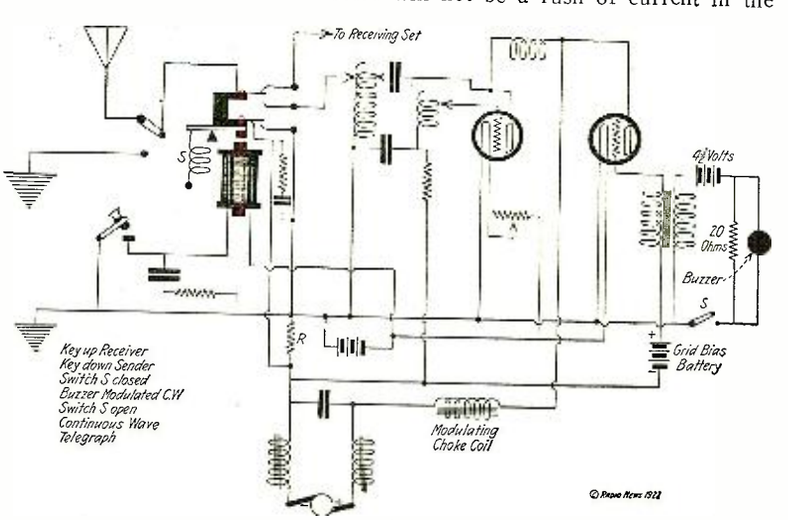
A New Way to Control the Oscillator of a CW Set.

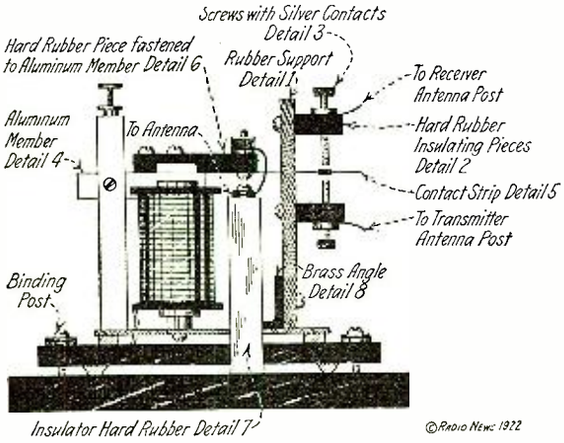
For Continuous Wave (CW) Telegraphy, instead of connecting the key in series with the grid leak resistance or in series with the plate circuit, as it is usually done, it can be connected to short circuit and insert the resistance R in the negative lead of the generator as already described. This can be accomplished in Fig. 1 by removing the strap AB or A'B' and connecting the key contacts 1 and 2 to A' and B' or and A and B. This inserts the key in series with the lower contacts of the relay switch. Upon closing the key, with the switch S closed, the resistance R is short circuited and the large negative potential is removed and oscillations are produced.

ICW Buzzer Modulation. Key Connections.

For interrupted continuous wave (ICW) telegraphy strap A B and A' B' and connect the key contacts 1 and 2 to d and d of the modulator circuit. (Fig. 1.) The buzzer and key are connected around the resistance (20 ohms) as shown, so that there will not be a rush of current in the

Another circuit including a relay switch. In this case it is operated by the key itself and forms a breaking in system.





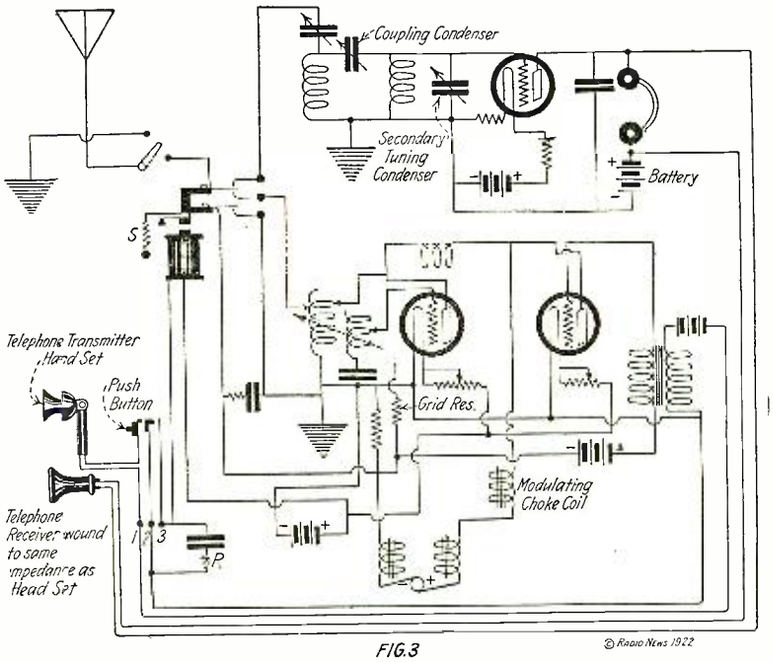


FIG. 3

On the Right is the Hook-up of a Radiophone Station With Remote Control, Operated by a Push Button Mounted in the Handle of the Microphone. Above is a View of the Relay Switch With the Parts Indicated to be Built According to the Drawing at the Bottom of the Page.

modulation transformer circuit each time the key is closed and opened. This arrangement has been found to work very satisfactorily and by its use, many *troubles* with tubes, *generally* present in buzzer modulater sets will be absent.

Condenser C and Series Resistance R Prevent Sparking and Sticking Contacts.

The condenser C which can be ½ or 1 mfd. paper condenser and the resistance R (15-30 ohms) connected across the switch S and the relay contacts, will eliminate the sparking at these contacts. The resistance limits the flow of current and prevents sticking contacts.

The storage battery or generator which furnishes the filament circuit energy can be used to supply the current and voltage necessary to operate the relay switch. (Figs. 1, 2 and 3.)

The circuit of the receiver is of the ordinary coupled circuit type using an audion detector and one stage of amplification.

How Should the Transmitter be Connected to Protect the Operator From Burns and Shocks?

The transmitter employs the oscillating and modulating circuit similar to that employed by the Western Electric Co., Inc., in their Army and Navy Telephone Sets put out during the war. In this circuit, the filament circuits, the buzzer and the key are at ground potential and it is impossible for the experimenter to get a burn or shock by touching these parts. (Figs. 1, 2 and 3.)

The Break in System.

We have just seen how the obsolete hand operated antenna switch can be replaced by a switch operated one. The same antenna switch can be operated by the telegraph key itself. (Fig. 2.) With this arrangement, the set is ready for reception at all times when the key is up and for transmission when the key is down. With this arrangement it is possible for the transmitting station to hear the receiving station if he breaks in.

For CW telegraph, the switch S in the modulation transformer should be open; for ICW, the switch should be closed. The oscillator circuit of Fig. 2 is of the simple grid feed back type and was used to some extent by the British during the war.

The complete circuit diagram of the radio telephone is shown in Fig. 3. The circuit plainly shows the details of the connections of the push button which is mounted on the transmitter hand set or other convenient place. The receiving circuit is, for the sake of variety, one using capacitive coupling and the transmitter is one of the ordinary types.

The push button can be conveniently mounted in the hand set similar to those used in the Submarine Chaser. Radio Telephone Sets used by the U. S. Navy. The push button has three springs which close two contacts; one to supply the microphone with battery, the other to operate the antenna relay switch. With this arrangement, conversations can be carried on very satisfactorily by remembering the following: "Press the button to talk—release it to listen."

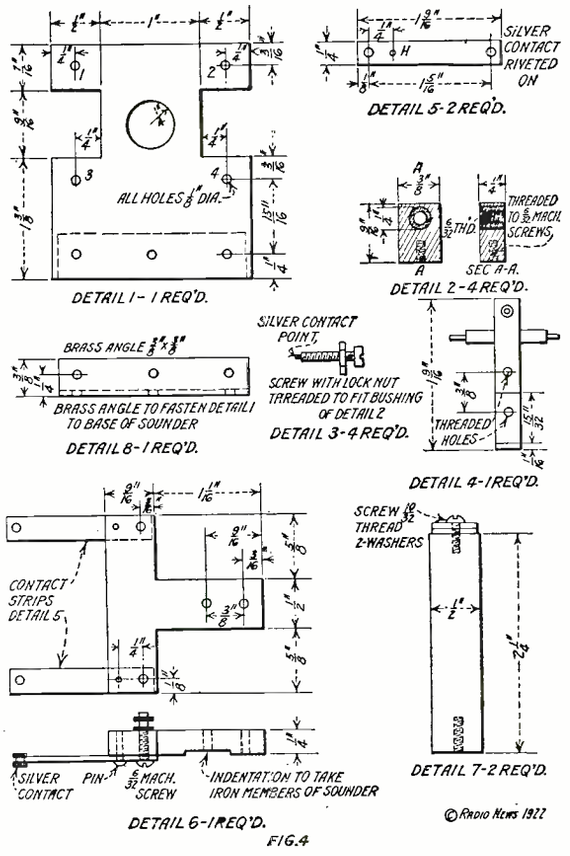


FIG. 4

Constructional Details of the Automatic Relay Control Switch.

DETAILS OF THE RELAY SWITCH

The foregoing description of the use of the antenna relay naturally brings up the question: "How can one be built?" The next few paragraphs are devoted to a description in fair detail, of just such a relay switch, made from the materials easily obtained by the amateur.

Fig. 6 is a photograph of a switch which will operate satisfactorily on a 50- or 100-watt CW, ICW or Telephone Set. The 20-ohm sounder, the magnetic circuit of which has been retained, is modified considerably as shown.

The sounding member has been removed, the aluminum moving element has been shortened (Fig. 4, detail 4). The contacts (silver) are on phosphor bronze contact strips (Fig. 4, detail 5) and have been fastened to the insulating detail 6 Fig. 4 which in turn is fastened to the aluminum detail 4. The rubber insulator detail 1 is fastened to the brass base of the sounder by the brass angle, detail 8. To this insulator are fastened the four hard rubber pieces detail 2, Fig. 4, which carry the threaded brass bushings. The contact, 6.3 2 machine screws, fitted with silver contacts (Fig. 4, detail 3) fit the brass bushings in detail 2 and are provided for adjusting the relay switch. The lock nut serves the double purpose of locking the screw in position and fastening the wire from the set to the contact.

WHY RUBBER IS USED FOR INSULATION

Rubber is a better insulator at the very high frequencies than such materials as the ordinary micarta condensite, etc., available to the amateur. For this reason it should be used wherever it is necessary to insulate high voltage high frequency leads.

The sounder, with its modifications should be mounted on a sub-base, preferably of hard wood, in order to provide a satisfactory binding post for the movable contact strips. The insulated binding post is illustrated in Fig. 4, detail 7. Fig. 5 is an assembly drawing of the relay switch and shows, among other things, the flexible leads between the binding posts and the contact strips.

In operating a set with this switch, it will be found that as close spacing as possible, consistent with safety,

(*Continued on page* 899)

Soon!

By H. GERNSBACK

PERHAPS you did not know it, but radio has at last invaded Fifth Avenue. By this we necessarily do not mean Fifth Avenue, New York, but every "Fifth Avenue" throughout the country. There is now hardly a department store that does not boost its radio section, from one end of the country to the other. They are even selling the outfits now in hardware stores, drug stores, clothing stores, and many other stores, candy stores excepted. At least, up to the hour of going to press, none of our scouts have reported any candy stores that were pushing radio telephone sets. But we have hopes.

By right, the head line of this article is wrong. If we had had time to correct it, we would have gladly done so, but our time being taken up so much of late we bring the correction notice herewith. The correct title should be, "The Girl and the Wireless," or perhaps, "When Radio Invades the Kitchen," or, "Houswifish Radio." All of this is not a joke, as the adjoining illustration clearly shows, where the housewife receives the latest gossip by radio while she washes dishes at the sink.

Here is where radio comes into the home. Getting the gossip by radiophone will be the thing in the future.

After having been invaded with the Spanish Influenza, this epidemic has successfully given way to the insidious bite of the Radio Bug which has at last attacked the female contingent and it seems sure now that the hard boiled fair sex has gone all daffy about it. Just think what it means to mamma to stay right at the stove and listen to the latest gossip, instead of walking through the back yard and doing it over the fence. The wireless has the bulge on the fence for the simple reason that the lady of the house at the fence can only hear one, or at the most, two gossips at one time. By radio she can get any amount of selections of gossip in any tune, and in any degree of scandal that she desires. And if she does not like one particular kind of divorce case, she may tune in to another without much ado, and at her free will and volition. Neither is she forced to listen to the entire string of gossip for she can tune out the particular "tame" gossip not desired.

But joking aside, has it ever occurred to you, Mr. Manufacturer, that you are missing one of the best bets by not catering to the female faction? At the present time you are making outfits only for the male members of the household. Now, as any well-educated dog knows, the male member of the family is the one that is permanently "broke," while the female of the species, being stronger and more magnetic, attracts all the cash. Now then, we say, why not cater to this class of trade?

The present mannish looking outfits are all right for father and son, but not for the lady of the house or the fair daughter who wishes something that the newspaper reporter would call "snappy" or, *le dernier cri*, or "long, low, and rakish." In other words our present radio outfits have no style. They may fit the garret or the garage, but not the boudoir. Now here is your chance, Manufacturers, to make a big clean-up by selling boudoir radio outfits. *Allons!*

Our cover shows just a few tame ideas. For instance, the radio toilet outfit contains besides the regenerative set also a mirror, powder puff container, comb, scissors, nail file, and other necessary burglar's tools. On the front of the cabinet, merely by pushing a button, a panel will drop down and this brings into view the hidden perfume safe, containing anywhere from four to six bottles of *Mary Garden Extract, Quelques Fleurs, Eau de Cologne, Muguet de Houbigant,* etc. The perfume waves, mixing with the radio waves give better "reception." Every condenser instead of having the brutal looking black composition knob should have a velvet knob, pin cushion-like in which pins may be stuck thereby killing two ideas with one stroke. The idea is to have the ladies get stuck on the condenser.

As for other electrical apparatus such as telephone cords, we would suggest a pink, or other color, to match the general color scheme of the boudoir. The head band should be covered with silk of the same color. The telephone caps should be finished off in velour in a color to match the *tout ensemble*.

As for the vacuum tubes, they are distinctly cold now and they should be made in gaily colored glass. Heliotrope or a dark shade of coral would be acceptable to most ladies, we believe, as the tubes would then cast a much richer glow. The electrons, we are sure, would go wild about it, too. They should be made in all colors—the tubes, not the electrons—to match prevailing color schemes of the room. Every article of manufacture, be it a condenser, B-battery, vario-coupler, etc., should also have provisions made so that colored ribbons can be inserted into the right places. This is all important. It is very *récherché*.

The cases or boxes for complete receiving apparatus should be furnished in various wood finishes so that the furniture of the room can be matched as well. For instance French greys, or ivory colored ones should be particularly acceptable at the present time. Boxes can be covered with silk or brocade as well.

Black panels on outfits for female consumption should be entirely taboo. The manufacturers of composition or bakelite materials should resort to distinctly colored panels resembling the furniture of the rest of the room as much as possible. This would give that last touch of *finesse* so much needed.

It is understood that apparatus of this kind will come very high. The better the decoration, the higher the prices that they will bring. We understand that a large eastern firm engaged in the manufacture of such apparatus, already has given out orders for several thousand radiophone cases all decorated with reproductions of old masters. The painting is to be done in olive oil, due to the greater insulation.

As for grid leaks, these should be taboo. Unless, of course, a waterproof container is furnished with it to catch the leaking waves.

Some of the latest outfits now contain marcel wave implements as well; they combine easily with the radio waves. "Ticklers" should be avoided assidiously in all outfits. There's a reason.

Two step amplifiers are not *chic*, any longer. Fox trot amplifiers are much more up-to-date.

If only some genius can now incorporate jazz into a regenerative hook-up set, to keep the tubes from oscillating too strongly, radio will be in its millenium.

As a brand new article for feminine consumption, we might suggest a loud talker, *as is*. By this we do not mean the lady herself—we mean the radio loud-talker.

At the present time, this is merely an ugly, black or nickel-plated horn that mars the landscape. Would it not be better to pick out a good-looking tenor of the Metropolitan Opera and reproduce him about a foot high, in some sort of material that has acoustic qualities?

His inside, of course, would be hollow—as well as his head. With his mouth wide open as is his wont—he would be enabled to give forth the radio music artistically, and no doubt acoustically, to a high degree.

Manufacturers could have an entire line of such loud talkers, such as Gigli, De Luca, Martinelli, etc., so that the future shopper could pick out the tenor she likes best.

Storage Batteries for the Plate Circuit

By CHAS. K. FULGHUM

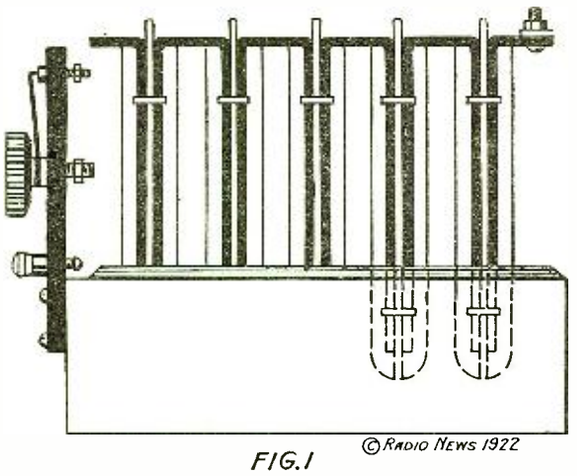


FIG. 1

Details of Mounting of the Storage "B" Battery.

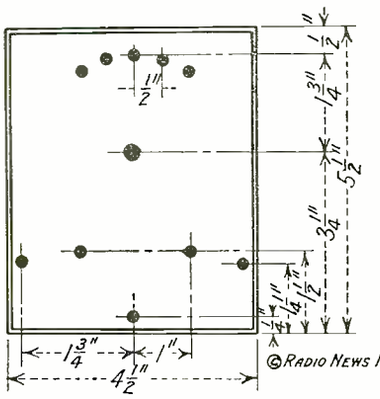


FIG. 2

FIG. 3

Fig. 2 is the Layout of the Front Panel for Switch Mounting, While Fig. 3 Shows the Shape of the Plates Which Should be Made so as to Have the Largest Possible Surface.

MANY amateurs would find it possible to install a low powered C.W. or telephone set if the cost of a high voltage generator were obviated. True enough "B" batteries can be used, but their cost would soon be so great that it would be policy to have purchased a generator in the first place. Also if one is using a power amplifier the cost of "B" batteries is usually very great.

This article covers the design and construction of a high voltage storage cell that is comparatively inexpensive and that can conveniently replace the "B" batteries now used in receiving sets or as a source of high voltage in a low powered telephone or C.W. set. The unit is so constructed that it can be charged from a regular 12-volt rectifier.

Fig. 1, shows 22-volt unit that is variable over half its full range of voltage in steps of two volts. It is convenient to use with the new Radiotron detector tubes. The construction of this unit will first be described.

A block of quarter sawed oak was used as the base. It measures 9" by 4½" by 3". It should be finished off smooth and 10 holes slightly over an inch in diameter are bored in it. These holes should be about 2" in depth and should be ½" apart each way, and an inch from each side of the block. When bored, the edges should be finished smooth with a piece of fine sandpaper These holes hold the test tubes that are used as containers for the electrolyte. The design of these unit cells will be considered later.

At one end of the base, a panel of bakelite is placed. The template for this panel is given in Fig. 2. All holes are 3/16" except the one that contains the switch bishing. The switch lay-out can be varied if desired.

The construction of the cell units will now be considered. As containers, 1" by 6" test tubes were used. They can be purchased for about five cents apiece. The separators were strips of window glass 6½" long and slightly under an inch in width. They can be cut from an old window pane or picked up at any store where glass is sold. For the electrodes, strips of lead were used. Sheet lead can be purchased in a number of thicknesses at most plumbing shops. In this case it was found best to use a thickness of about 1/10". If plain electrodes, as shown in Fig. 1, are used, they are cut in strips ⅞" wide and 11" long. They are bent in a hair-pin shape and held to the separators by rubber bands. As the surface presented to the electrolyte determines the amperage of the cell, it is desirable to increase that surface as much as possible. This can be done by corrugating the strip as shown in Fig. 3. These corrugations can be made by passing the strip of lead between two fine toothed gears.

The outside electrodes at the ends of the battery are made by cutting the strips in half. The ends that protrude over the cell should be left quite long. At the end furthest from the panel these electrodes are fitted

(*Continued on page* 864)

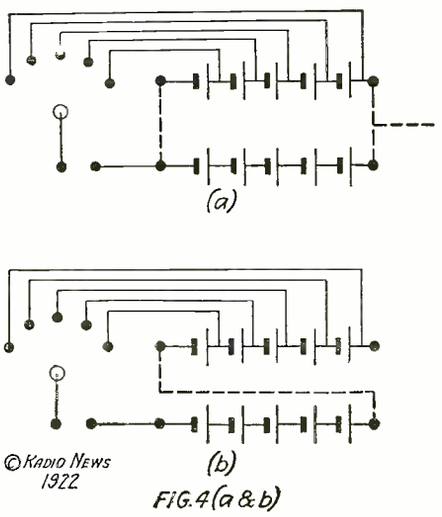


FIG. 4 (a & b)

Hook-up of the Switch Controlling the Voltage to the Cells.

The Newspaper of Tomorrow

By J. FARRELL

SEATED comfortably in the club car of the Twenty-first Century Flyer—fast airplane service between London and New York—the president of the Ultra National Bank removes a small rubber disk from his vest pocket and places it over his ear. A moment hence, he will receive by radiophone the financial news of the world. Simultaneously, millions of other people all over the globe will receive the message. At designated hours, news of a general character will also be received.

The broadcasting of news by radiophone had long displaced the daily newspaper, and. . . .

Don't scoff! The day may be nearer than you suspect. In Hungary, a wire "telephone newspaper" has been successfully conducted for more than 25 years. For nearly a year, financial news direct from the Amsterdam Bourse has been broadcasted by radiophone to 200 banks and brokerage firms in Holland. And within a few months the German Government has installed near Berlin a wireless telephone station for the broadcasting of general news on a regular daily schedule throughout the entire country.

The "Telephone-Hirmondo," Budapest's telephone newspaper, has been operated continuously since 1894. The "newspaper" has 6,000 subscribers whose telephones are connected with the central office of the publication by means of 42 party-telephone lines, and a regular schedule of news, instruction and music is provided from 9 a. m. to 10 p. m. daily. The subscribers are unable to call central, and "listen in" simply by holding the receiver to their ears. Fiction stories are read to the subscribers every afternoon. Lectures and speeches are also delivered. During the war, daily instruction in French was given; the subscribers are now learning English. In the evening, the subscribers attend the opera "by telephone." This is accomplished by means of microphones on the stage of the Budapest Opera House. Plans for receiving the opera from Berlin are now being made. The "newspaper" has had a huge success and similar "publications" are soon to be started in France and Italy.

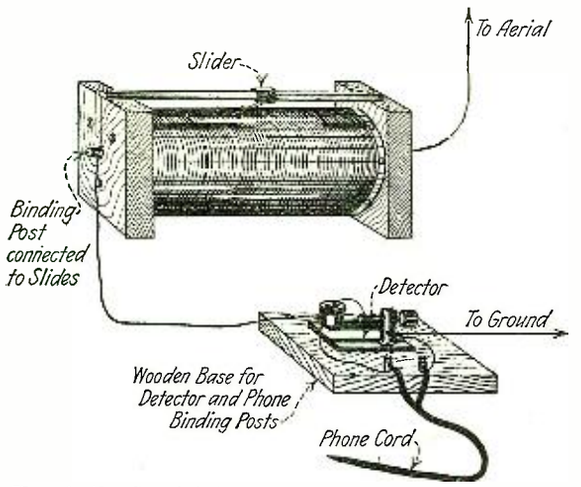
The radiophone broadcasting service of the Amsterdam Bourse has been of great value to financial interests in Holland in keeping them in immediate touch with market conditions. The sending equipment is located in a small room on the floor above the Bourse and consists of a motor generator affording a current of 400 volts, and stepped up to 4,000 volts for the plates. The panel is equipped with two rectifying tubes, three 1-kilowatt oscillators, a 1-kilowatt modulator and two 1-kilowatt amplifiers. This gives an output of about 1½ kilowatt in the antenna. The operating force comprises an electrician at the apparatus and a stentor on the floor of the Bourse, who repeats the quotations into a

(*Continued on page* 866)

How to Make a Radiophone Receiving Station

A Simple Description of What Is Necessary, How to Make It, How to Install It and How to Operate It, Written For the Folks Who Know Little About Wireless or Other Forms of Electricity

By ARTHUR H. LYNCH



Here is the Completed Tunng Coil Connected to the Detector and Telephones Forming a Complete Receiving Set.

ALL the country is up in arms and legions besiege the electrical supply stores, the hardware stores and even the drug stores, in an effort to quench their thirst for apparatus and information about apparatus which may be used to pick up the music and speech from the radio broadcasting stations. The demand for this apparatus and information is so great that the largest electrical manufacturing organizations in the country, in fact in the world, are devoting a great portion of their effort to the production of apparatus, suitable for supplying this demand. Everybody is all "het up" about this wonderful and vastly interesting accomplishment of radio science and they have every reason to be, for it is certain to play a very important part in the lives of most civilized nations. The surface of radio's possibilities has been but scratched.

With the inception of this tremendous demand for apparatus, coming almost over night, it is quite natural that many people shall go into radio without having any knowledge of what they are doing and they are likely to experience some disappointments. In some cases it is safe to say that they are likely to be imposed upon by unscrupulous dealers who would take advantage of the uninitiated to the extent of unloading upon them a lot of practically useless material.

Some of the large companies are constantly working to minimize the possibility of such imposition by carefully selecting their dealers and selling their equipment with complete instructions for its installation and operation. The importance of the responsibility of the dealer cannot be over-estimated, for there are some who consider themselves well within their rights when they exaggerate a little in describing the results which may be obtained from any form of receiving equipment when such elaboration seems to be the controlling factor in clinching a sale.

These remarks are merely included for the purpose of aiding those who contemplate the purchase of receiving instruments, either complete or the parts for assembling. It is recommended that the prospective purchaser carry on his dealings with some reliable radio or electrical dealer. Where purchases are made in the radio departments of other stores, it is a pretty safe thing to limit one's purchases to apparatus manufactured by companies recognized as being reliable.

WE have had so much demand recently from Radio beginners all over the country, that we have decided to run a new monthly department under the above heading.

A number of articles will be published in RADIO NEWS every month on Simplified Radio, and we hope that it will be the means of instructing those who are now thinking of becoming interested in Radio.—Editor.

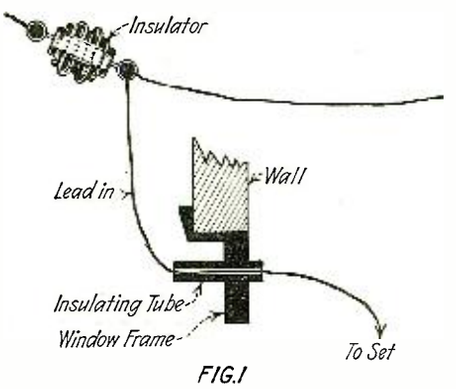


FIG.1

The Aerial or Lead-In Should Not Touch Anything and Should be Kept Apart From Buildings, Trees, Etc. This Sketch Shows How the Aerial May be Taken Into the House Through an Insulating Tube.

SOME OF THE COMMON ERRORS

It is quite a common thing to find those novices who have visited some station where radio concerts have been received by experimenters with up-to-the-minute equipment, and who desire to have such a station themselves. In many instances they read smatterings about radio in some of the papers and gather the idea that all they need to fill their homes with music and other entertainment from the air are a few little gadgets which may be procured at the corner fancy store for little or nothing.

To a certain extent this is true, but in most instances these folks have a wet blanket thrown over their enthusiasm when they find that there are certain limits—even to radio. Just because there are great radio stations, scattered throughout the country, broadcasting all sorts of news and entertainment does not mean that a cheap receiving outfit will enable its user to listen to all of them. Some folks feel a great deal of chagrin when they are informed that they cannot install a receiving set in New York and listen to the grand opera transmitted by a broadcasting station in Boston or Chicago. It can be done, but not with a receiving outfit which may be had for ten

(Continued on page 836)

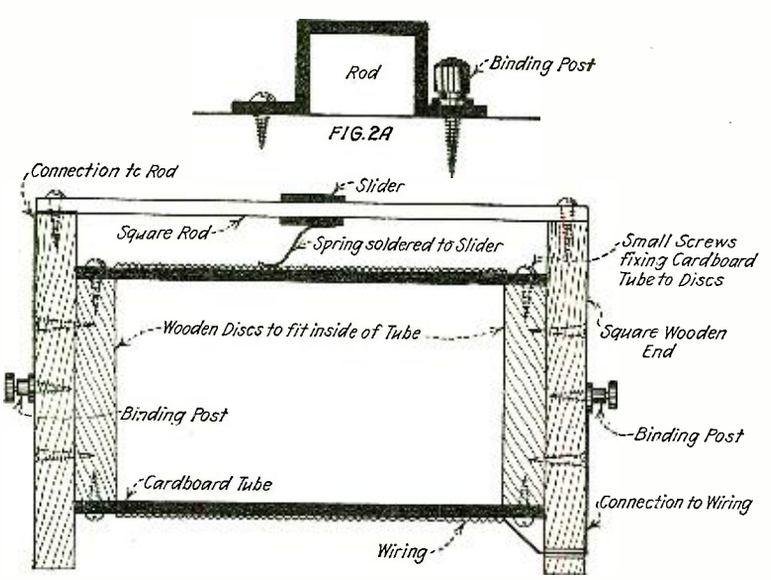


FIG.2

Constructional Details of the Coil. Fig. 2A Shows How the Slider Rod May be Fixed if it is Not Possible to Drill a Hole Through.

Real Sport Playing Games by Wireless

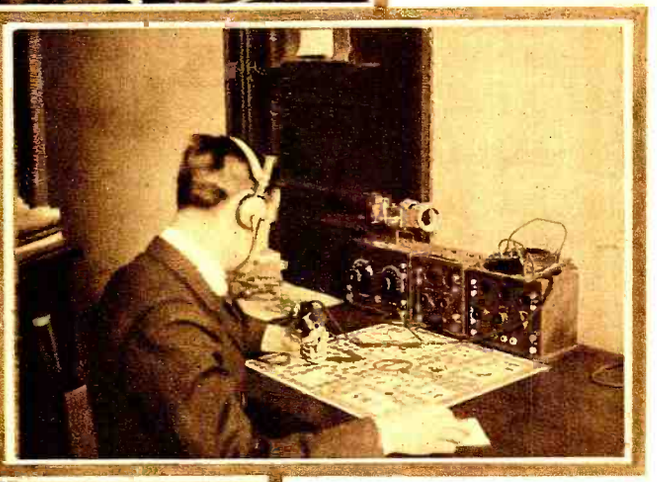
Contests Through the Air Newest Sport of the Twentieth Century

By THERON BEBEAU

RADIO is entering into our social life in more ways than one. Playing games by radio is the latest innovation of this fascinating art. This is now a fad of thousands of amateurs in and around New York City, and the idea is fast spreading throughout the country. While listening in on the radiophone receiver it is not uncommon to hear a conversation something like this:

"Your move next. I just moved from 10 to 15."

"All right, 8XB, I move from 24 to 20."



Many Games May be Played by Radio, and This Sort of Amusement Provides a Lot of Fun for the Owner of a Station. Cards, Chess or Checker Players May Have Their Partners Far Away in Other Towns. This Method Also Removes All the Inconveniences of Returning Home Too Late!

"My game, I've got you cornered. I move to 19."

Checkers is one of the popular radio games and a great deal of amusement can be had playing it through the ether. This is not only novel but highly practical, since both chess and checker experts have played professional games with the Atlantic Ocean separating them. The captains of many vessels have amused themselves playing checkers through space with many hundred miles separating them from their opponents.

Checkers can be played by radio through the use of either a radiophone transmitter and receiver or a spark transmitter, using the regular code. With a 50-watt vacuum tube radiophone transmitter, games can be played with from 10 to 15 miles separating the two stations.

Very little preparation is needed in the case of checkers. The spaces on the board are simply numbered, starting from the lower left hand corner and running from left to right until the top is reached. This can be easily done by cutting the numbers from an old calendar and pasting these on the squares of the board. Two boards must be prepared in this way, each with the same system of numbering, and one of these is used in each of the contending stations.

Two complete sets of checkers are also needed, and, when the game is started, all the checkers are set up on the two boards, as is customary. The players simply report their moves to each other. Each player has to make his opponent's moves as well as his own. In this way the status of the game is known at all times to each player.

If player A makes a move he immediately reports it to B. For instance he may say:

"14 to 18."

This means that he has moved his checker from the space 14 to space 18 on the board. His opponent then arranges his board to correspond with this move. When the king row is reached, the successful player may say:

"25 to 30," or "5 to 4" (as the case may be), king."

When a checker is jumped, the player doing the jumping may report to his opponent in this way:

"22 to 31. Jumped checker 27."

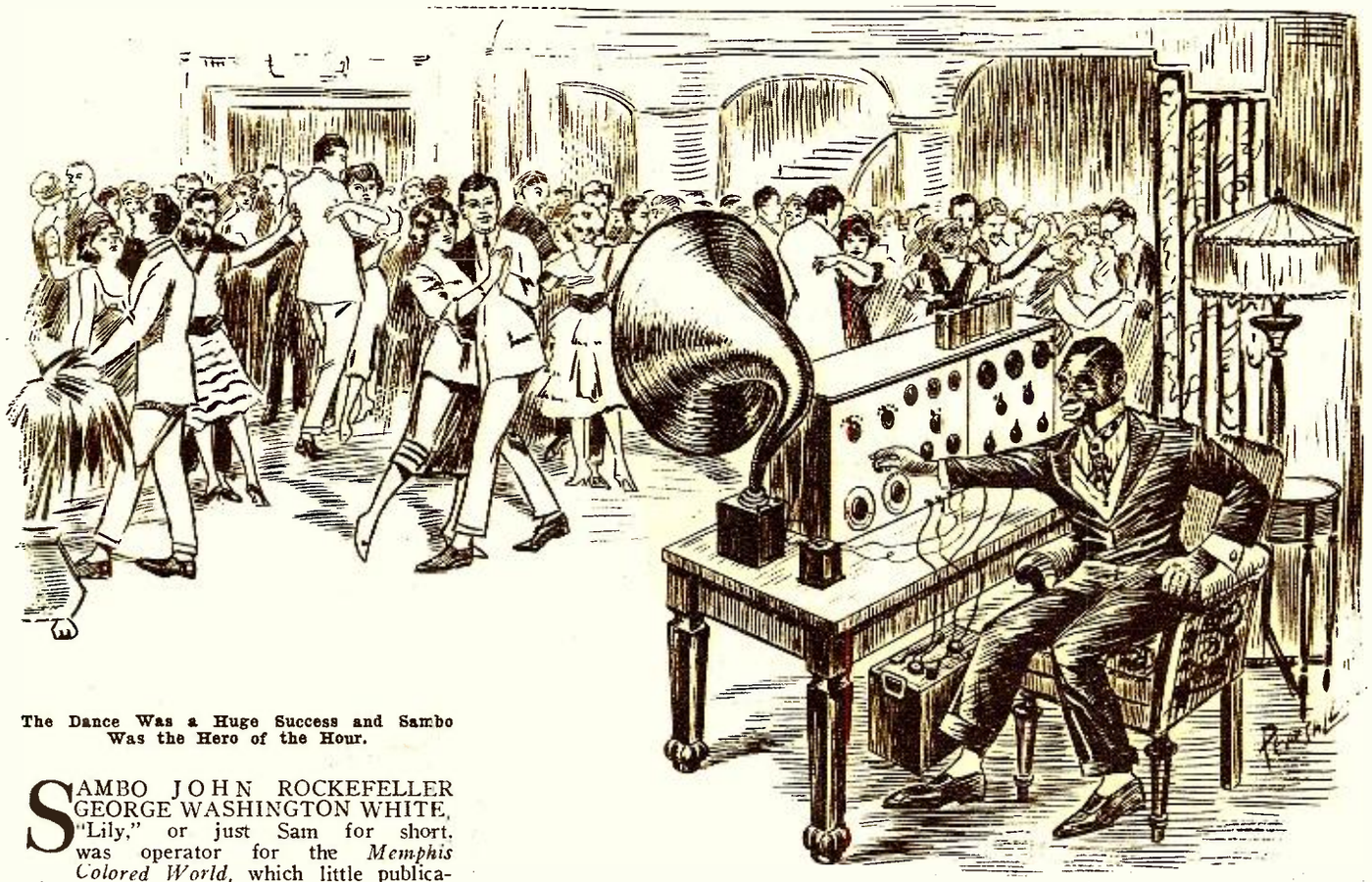
A game of checkers can be carried out by radio in a surprisingly short time. In fact, if radio telephony is used, a game can be played within the space of a half hour if the plays are made rapidly. With spark systems, where the code is necessary, more time will be required, since this method is not as rapid. However, if only the numbers are used and a certain way of reporting moves is standardized, rapid progress can be made.

At first thought, the reader may think that it is impractical to play checkers by radio. A little sober reflection will show

(*Continued on page 897*)

There's Nothing Too Good for the Man with Brains

By ARMAND C. ROSS



The Dance Was a Huge Success and Sambo Was the Hero of the Hour.

SAMBO JOHN ROCKEFELLER GEORGE WASHINGTON WHITE, "Lily," or just Sam for short, was operator for the *Memphis Colored World,* which little publication respected Sam for his knowledge of the occult science of Radio. He was also secretly respected by officers of the white publications, because his successful efforts at getting news and reports far ahead of the wire method used by the other newspapers had built up the little *World* to the extent that white folks were buying the colored paper in preference to the *Journal* and the other white sheets. Sam, too, was largely respected by Sam.

But Mandy, otherwise known as Mrs. John Rockefeller George Washington White, respected not Sam, nor Radio, nor his constant babbling about things Radio. Warfare was the result.

Now we all know that flatirons may be bounced off our cerebella, dishes may sing through the air in our direction, hot, and otherwise effective words may flow, but once the bug has firmly established itself, it buzzes on indomitably, often, though, it must be admitted, in secret.

"Sambo John R. G. W. White, ef you all don' stop pinesterizin' me wif dat talk 'bout puttin' up a old antenizum in mah back yahd, Ise sho gonna bust yo' haid."

"Sez you. Reckons dat air back yahd is as much mine as yohn. Who put up dem poultry fence and dem chicken housen? Didn't I labor there mos' two houahs one week helpin' dig dat well?"

"Yes, an' who done did de washin's fo' to buy de pump an' de hens? 'Sides, we bin a eatin' sand outen dat well evah since, caise you caved in ail whut yo' dug out!"

Up to this time no missiles had been threateningly touched, and Sam, in his indignation, grew bold.

"Mandy, I heahby states firmly and absotootelooey dat I stahts dat antenny dis afternoon, yes or no from youall. Outen my way, niggah."

"Young fellah, lissen heah!" and Mandy's corpulent form dammed the exit. "W'en dat antenily goes up, yoh goes *down!*"

Arms akimbo, her black eyes snapping fire, Mandy was not one to oppose, except from a distance. Mostly distance, and the little coon backed off toward the rear door.

"W—w'at you mean, Mandy?"

"I means simply dis heah," explained Mandy viciously. "Dat onless yo' earns de money wif dat idiut ray-dee-oh what I earns wif my washin' yo' don' nev-ah git to cluttah up de place wheah I hangs mah close wif no tool contraption, no-way, no-howsumever, nev-ah! An' whuts moh, if I heahs one moh wurd 'bout it, dis heah rollin' pin's gonna splintah on yoh antennica so hahd, dat w'en de amboolence comes, it'll take de bump, an' yoall'l haf ter walk. Does yo' git me?"

"I gits yoh, Mandy, I sho does."

Sam moped out of the room, but just as he reached the door he called, "But by gollineezer, I'se gonna have dat ant——!"

He dodged the water bucket, and went muttering down the street toward the office of the *World.*

"Cain't understan' w'y Mandy hates mah puffession so muchly," he mumbled, sighing and shaking his head. "Lor' but dat woman sho can articumulate. She soun's foh all de worl' like a couble o' loud speechers hitched onter de end of a leventeen stage amplifiah, tellin' whut a fohteen hunderd kilomuwat station nex' do is sayin'. An' Lor' lumme, but I'd radder be sittin' under de aerial at Radio Central wif a pair of sebenteen million ohm fones on mah eahs. I knows she's jest bluffin', but summerrudder I cain't seem to convince me of dat w'en she's a standin' dere wif de refrigerator in one han' an' de cook-stove in t'uther. Doggone! DOGGON!! Whut de——"

His gloomy musings were broken off suddenly by rough contact with a pedestrian. He dodged, but straightened up when he saw that the object of his collision was Editor Wheeler of the *Journal.*

"Mornin' suh. 'Scuse me, but I'se a troubled an' sorrowful coon, an' it's gone to mah eyes er sumpin, I guess. 'Scuse me."

"What's the matter, Sam? You do look a little pale. One of the children sick? No death among them, I hope. One dead, that would leave fifteen, wouldn't it?" said Wheeler seriously, but inwardly smiling at Sam's doleful visage.

"No, suh, Mist' Wheelah. Aint no sickness or def. Mah kids is too husky for dat. And Mandy—Lor' luvus, she won't never kick de bucket, 'ceptin' at me!"

"Well," said Mr. Wheeler. "Can't be anything so very serious, then. Come on, you haven't anything to do until noon. Walk up to the office with me and tell me about it."

Sam agreed, and told Wheeler, as they walked along, of the strenuous objection to his beloved Radio, and of the heated arguments he and Mandy had over the aerial in the back yard.

"So yoh see, suh, 'tain't no use, 'tall," the darky was saying. I cain't try out my new instrooments, noway. Dey won' let me down to the *Worl'* and I cain't 't home, an' I cain't now'ere. Doggone!" and Sam again lapsed into sad silence.

They walked on a little way. Sam grumbling to himself at his fate. Mr. Wheeler was thinking of an article published in his paper recently, pertaining to a dance given with music via Radio. A sudden idea struck him.

"Sam!" spoke Wheeler sharply.

Sam was startled. "Y-y-yes, suh. Whut yoh want "

"Sam, how much do you earn with the *World?*" the editor asked.

"Why, de wireless school said I'd get a

(*Continued on page* 901)

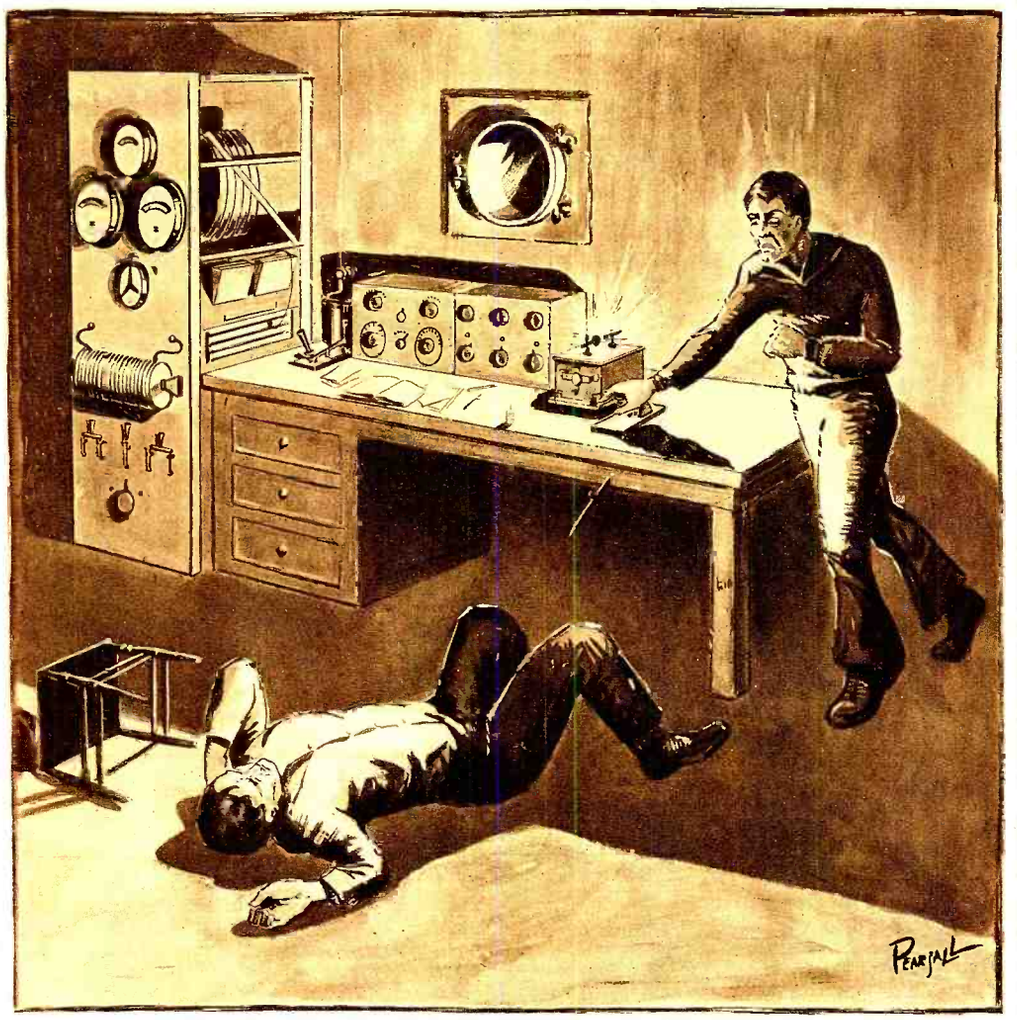
The Ordeal

By ERALD A. SCHIVO

THE monotonous quietness of the radio cabin seemed to prophesy some impending evil. William Kluge, the wireless operator, removed the head-receivers and set them upon the table before him. He was ostensibly restless. Although the cabin was comfortably heated, the young man wiped the perspiration from his forehead. Try as he would, the weather reports transmitted from the coastal radio station were inaudible; the intermittent blasts of static caused the incoming signals to be muffled hopelessly. Kluge could not concentrate; a question insistently invaded his mind; it must be answered: why had he, an ex-convict, been chosen operator of the freighter, S. S. *Midway*, when other men skilled as radio operators were eluded discriminately?

Kluge was troubled. This was his first assignment as a wireless man, but his worry in that capacity was very little. His only difficulty had been with the incessant static which pervaded the ether. He could get the weather reports later, from another ship operator more successful than he. It was something vague, yet of the utmost importance, that bothered him: the clandestine scrutiny of the captain, the sneer of the vessel's owner who was on board and the obnoxious character of the crew.

The long dull roar of the fog-horn interrupted the thoughts of his agitated mind. Indubitably a mist had sprung up. Kluge hated its obscurity. He imagined the vessel as a blind woman feeling her way through perilous traffic.



The Italian Stumbled Over Him; The Man's Hand Fell Upon the Transmitting Key, and the Shrill Tone of the Spark Coil Frightened the Ignorant Seaman.

When the noise subsided he was cognizant of the fact that someone was knocking upon his door. It might be the commander who had come to ask for the weather reports. Kluge was nonplussed that his superior should call so soon, but the elements were to blame for his failure, the wireless set was not efficient enough to counterbalance the deafening electrical disturbances. He hoped the captain would understand his excuse and wait patiently until communication could be established with another vessel.

"Come in," he called.

The captain thrust open the door. Kluge was surprised to see Johnston, the owner, follow the commander into the cabin. Both men seated themselves without invitation. They surveyed Kluge with sagacious eyes; then the owner chuckled.

This disturbed the young man. He wondered at the presence of the two men. What could they want? Why did the owner seem so pleased with himself?

"You wish the reports, sir," said Kluge, for want of something better to say. "I'm sorry, sir, but the interference, static interference, was so great that I was unable to get the signals. I'll have them as soon as I can get into communication with another ship."

The rumble of the fog-horn pierced the silence which followed, and the owner again chuckled.

"Never mind the reports," said the captain bruskly. "Get them in the morning. Mr. Johnston and I wish to have a little talk with you."

"Yes, sir," replied Kluge. Did the men only wish a pleasant chat with him? He thought it improbable, considering the circumstances. The actions and manner of the men belied any forthcoming pleasantness.

"You do the talking, Captain," ordered the owner. "I'll help you if necessary."

The captain muttered something unintelligible and reached into a pocket for cigars.

"Have one," he offered Kluge, "a man can listen better when he's smoking."

Kluge accepted, and soon all three men had lighted cigars. The captain bent forward in his chair and eyed the young operator sternly.

"Kluge," the man's voice came from the side of his mouth and sounded accusing, *"you are an ex-convict."*

The young man was so surprised that some smoke entered his lungs, causing him to cough spasmodically. The owner, leering conspicuously, waited for Kluge to deny the accusation. The commander, with cigar held firmly between two sets of strong teeth, had keen expectations of a tearful denial.

"Why—why, Captain," cried Kluge, "you couldn't fail to know that. Detectives were always on my trail." He lowered his voice dejectedly. "Yes, Captain, I no sooner had a position within my grasp than one of them would inform my employer about my serving time for a felony. You must have known, Mr. Johnston, I saw you talking with Muller, a police detective, just after I was assigned to this ship."

Johnston grinned and motioned the captain to continue speaking.

"We knew all right, Kluge," laughed the commander. "Certainly, Kluge, old boy, what do you think we hired you for?"

The young man stared with consternation at the two men. His greatest fears were to be realized. The iniquity of his superior officer and the owner was now ascertained. These men thought him a criminal. He decided to change their opinion immediately.

"Gentlemen, I am innocent of the charge I served five years for." Kluge said the words with such straightforwardness that the captain could not say a word, but not so the owner. Johnston glared at the operator with unfeigned amazement, he then broke into a loud laugh which lasted almost half a minute.

"Oh my!" he guffawed. "He can certainly pull it off fine, Captain. He said it so nice like, that any old woman would believe him."

Johnston suddenly subsided, remembering no doubt, that time, precious time, was being wasted.

"Come, Captain," he ordered, "get down to business."

This was not the first time that men had refused to believe Kluge. He was not surprised at the attitude of the owner. He waited for the captain to continue with the business.

"I'll give you the facts in as few words

(*Continued on page 903*)

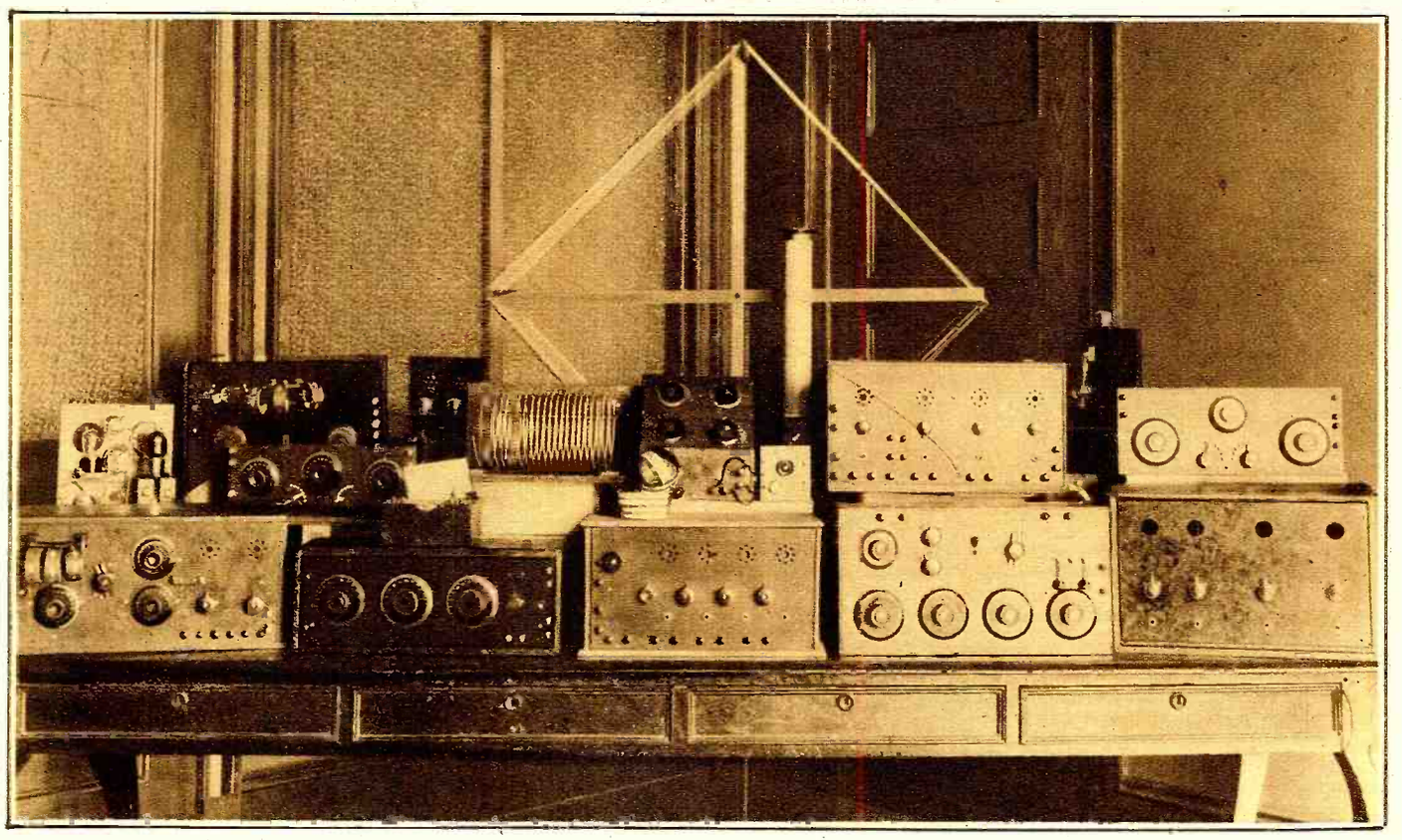
THIS Department is open to all readers. It matters not whether subscribers or not. All photos are judged for best arrangement and efficiency of the apparatus, neatness of connections and general appearance. In order to increase the interest in this department, we make it a rule not to publish photographs 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 published will be paid for at the rate of $2.00.

The Plainfield Radio Association Contest

Awards of Cups for Best Home Made Radio Apparatus



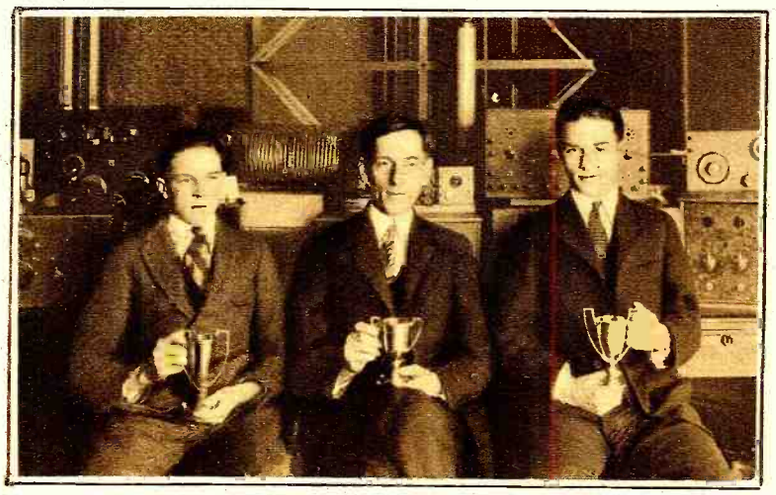
THE Plainfield Radio Association recently held a Radio exhibit in which were displayed home made apparatus of every kind, as may be seen in the photograph illustrating the display. Three cups were awarded for workmanship, efficiency and novelty. A type of variometer to replace the tickler coil in a DeForest mounting, was part of the equipment given unusual treatment; this, Mr. Taylor explained, will convert any DeForest set into a very efficient short-wave regenerative receiver.

The special club detector and amplifier panel built for the club by Mr. Taylor and D. J. Scott was another center of attraction because of the elaborate and expert workmanship on it. The set is built in a solid mahogany case and every wooden and metal part is accurately fitted and polished. It was regarded as an example of perfect workmanship that could not be duplicated in the most expensive ready-made sets. Almost every part was actually constructed by either Mr. Taylor or Mr. Scott. The parts were purchased by the club, the necessary amount being raised by popular subscription.

In connection with this detector and amplifier panel was shown a Paragon RA-10 tuner, which was given to the club by Mr. Scott.

Another exhibit by Mr. Scott, who is one of the first radiophone fans in this section, was a carefully

(Continued on page 864)



Above May be Seen the Varibus Apparatus Entered in the Contest by Members of the Association. Below are the Prize Winners: Messrs. Gibson Buttfield, J. P. W. Taylor and George Booth, Who Received the Cups Awarded for Efficiency, Novelty and Workmanship.

H. Robinson's Station 2QR

at Keyport, N. J.

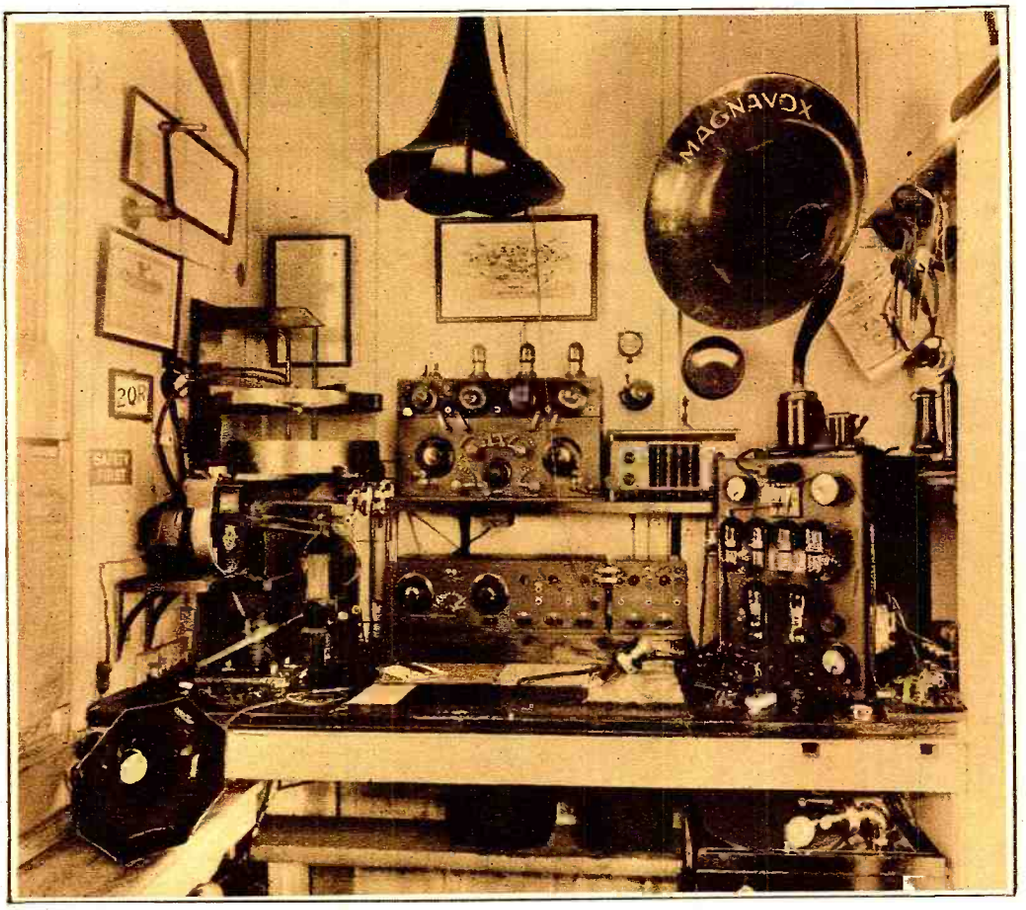
This Month's Prize Winner

ENCLOSED photograph shows the new equipment now used at station 2QR at Keyport, N. J. On the left is the 1-k.w. spark transmitter which is now rarely used since the radiophone and C.W. set has been installed. It is of the DeForest type using rectified A.C. on the plates; it is used especially for telephony and to broadcast music.

In the center, on the table, is a Grebe CR-9 receiver including detector and two-step amplifier to which has been added a separate two-step amplifier. This set gives wonderful results and most of the time it is found that three-step amplification is sufficient to produce very strong signals through the Magnavox, which is on the top of the Radiophone cabinet, or the other loud talkers which may be seen fixed to the ceiling and on the extreme left in front of the spark set.

On the shelf is a home-made regenerative receiver and amplifier, which has also given excellent results, and a storage "B" battery of the Edison type, which may be switched on either set.

A special relay arrangement has been installed near the Radiophone set so as to change all the connections from transmission to reception by means of a single switch; this permits instantaneous change when talking with another station and makes the change, from send to receive, an easy matter. This relay bearing the contacts of the automatic switch, may be seen on the extreme right.



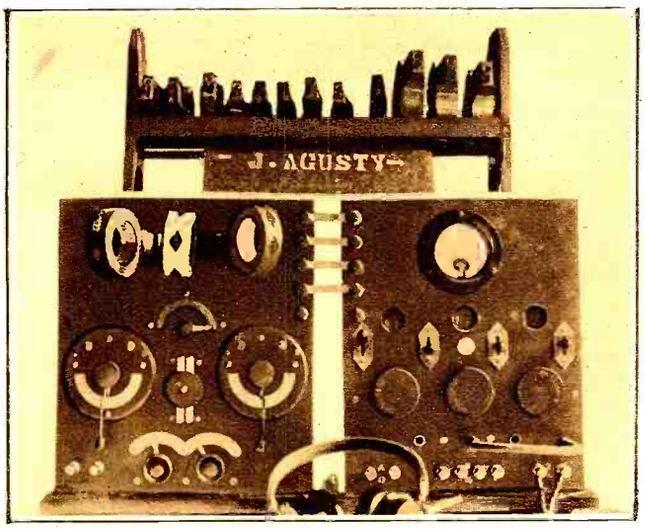
Here is the New Equipment of Station 2QR, Including New Receivers and Amplifiers Neatly Installed in the Radio Room Especially Built Under the Aerial.

Radio in Porto Rico

J. Agusty's Station

THE following is a description of my home-made receiving station, the first of this style in Porto Rico and the fourth built by me.

My antenna has a wave-length of 125 meters and consists of No. 15 solid copper wire, L type. Masts are of bamboo 35 ft. high and have been used a long time with good results.



A Good Example of Amateur Workmanship. This Receiver and Amplifier Were Made Entirely by a Porto Rican Amateur.

Referring to Fig. 1, the rack in the top of receiver is of the DeForest type, built in a few minutes at a cost of about 10 cents.

All honeycomb coils are home-made, including mounting plugs.

The coupling control for primary and tickler, as shown in the left panel, below series-shunt switch is original, having special advantages over others in use. Knobs are common typewriter knobs. With this arrangement fine coupling is done without capacity effects from the hand.

The right-hand panel is a detector and two-stage amplifier using Marconi V.T.'s Nos. I and II respectively. These bulbs are still working perfectly after two years of continuous use. Only .6 amp. are used for each one.

The four binding posts in the base center are for B battery, making a perfect combination for different voltages. Contrary to the common way, I am using for all work 45 volts in the detector plate and 22½ in the amplifiers.

Jacks and plug were found in an old telephone testing set.

Panel is ¼" Bakelite XX. Rheostats are Parkin.

Three anticapacity switches below meter to the right are entirely home-made. They are used to light filament with or without ammeter readings. Center is neutral. The one on the left is to change circuit from audion to ultra-audion.

I am using Baldwin phones now.

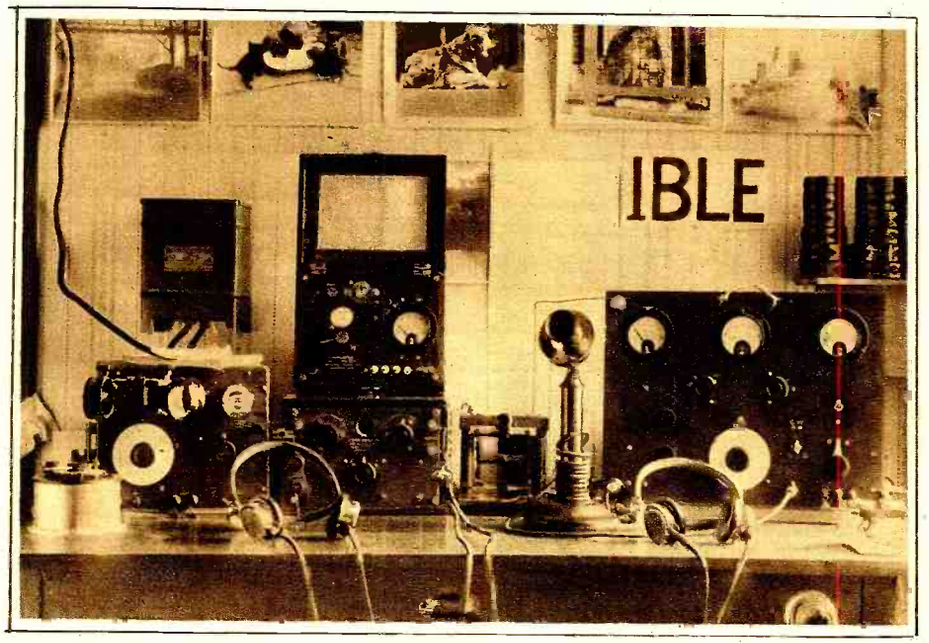
Both panels are hinged to base of cabinets and can be opened for inspection in one second. Grounded shields are used inside of cabinets.

B batteries are taken from flashlight batteries. I have used three blocks since last July and they are as good as new. All connections are soldered and wire is spaghetti covered on back of panels.

Reception is accomplished at any time, day or night, without trouble with the exception of the common QRM from NAU

(*Continued on page* 895)

Station IBLE in Boston, Mass.



A Typical Modern Amateur Station Equipped With a Radiophone and C.W. Transmitter Only.

The accompanying photograph is of the apparatus used at 1-BLE, owned by Alfred Brust, 1289 Massachusetts Avenue, Arlington Heights, Mass., and operated by Harold McNamara.

The C.W. set uses four 5-watt tubes, two as oscillators and two as modulators; Colpitts-Heising system. Power, A.C. rectified by electrolytic rectifiers.

Antenna is of inverted L type, two wires 90 feet long and 5 feet apart at a height of 50 feet. Counterpoise, six wires, 5 feet apart directly under antenna. Radiation 1½ amps. Can be used for phone C.W. or I.C.W.

Receiving set is regenerative, 3 honeycomb coils and 2-step General Radio Amplifier; can easily copy all districts except sixth and seventh, and Canadian and long wave arcs.

On the receiver may be seen the wave meter which has proved most valuable at all times.

NOTE.—This call (1-B.L.E.) was formerly Norwich University, Vermont, and has been re-issued. Any cards as to distance will be appreciated.

HAROLD MCNAMARA,
ALFRED BRUST.

A Luxembourg Amateur Station

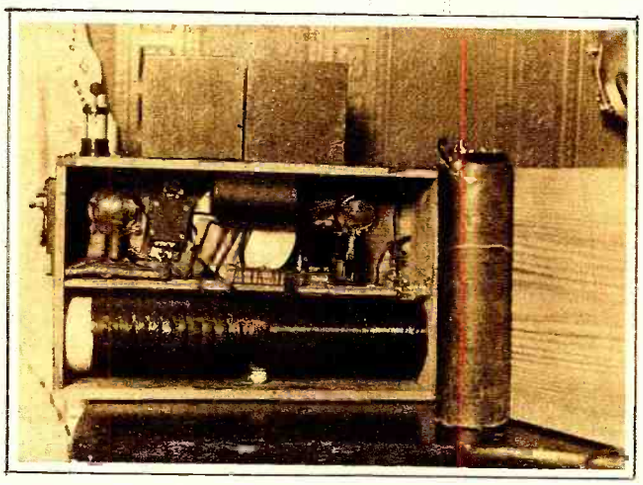
My new station, recently built, is mounted on my desk, and has a wave-length of from 800 to 25,000 meters. I can receive all the big stations of Europe, ships at sea, and even Annapolis, Tuckerton and Marion in the United States, which come in loud enough to be heard all over the room with two tubes. The most interesting radiophone communications I receive are from Paris, Koenigs-wurterhausen and Amsterdam, which come in quite clearly. When listening to these concerts, I usually use a two-step audio frequency amplifier with my receiving set which has two stages of radio frequency.

My radiophone set, which I built myself, is the only one in Luxembourg, and I have improved its range from 35 miles last year to 50 miles this year.

My transmitting tube has burned out and I am unable to secure another because amateurs here are forbidden to transmit messages, therefore, I am compelled to send with four receiving tubes.

Those who gave me the first information and data for the construction of a station were the American soldiers who had a camp in this city in 1919. A section of the Signal Corps being in the neighborhood, I became acquainted with some of the men, and they so kindly helped me out that after a short while I was able to understand a great deal about Radio. With various German apparatus, which were captured and brought back by the men of the Signal Corps, I built my first station which worked remarkably well. Later, I built new instruments which, added to the former ones, completed my receiving set so that I now have one of the best amateur stations in Luxembourg.

Having interested a few friends in Radio, I started the Radio Club of Luxembourg, where, at each meeting, I give information to the newcomers on how to make apparatus with the little obtainable material in this city. Today, several amateurs have good stations which are entirely home-made, except, of course, the phones, tubes and batteries, which were bought in France or England. Several of us have small C.W. sending sets, which are also used for telephony.



In Spite of the Little Facilities He Has, Mr. J. Wolff, an European Amateur, Built All His Equipment Himself. Above is an Inside View of His Receiver, While Below May be Seen His Radio Room. Note the Large Loop Aerial.

My present telephone set is equipped with German sending tubes and a dynamo furnishing 12 and 500 volts for the filament in the plates of the tubes.

I expect to do much work with the French amateurs when some of them have their stations erected, as just recently they were permitted to install sending stations using a power of 100 watts in the antenna on a wave-length of 200 meters.

Who's Who in Radio

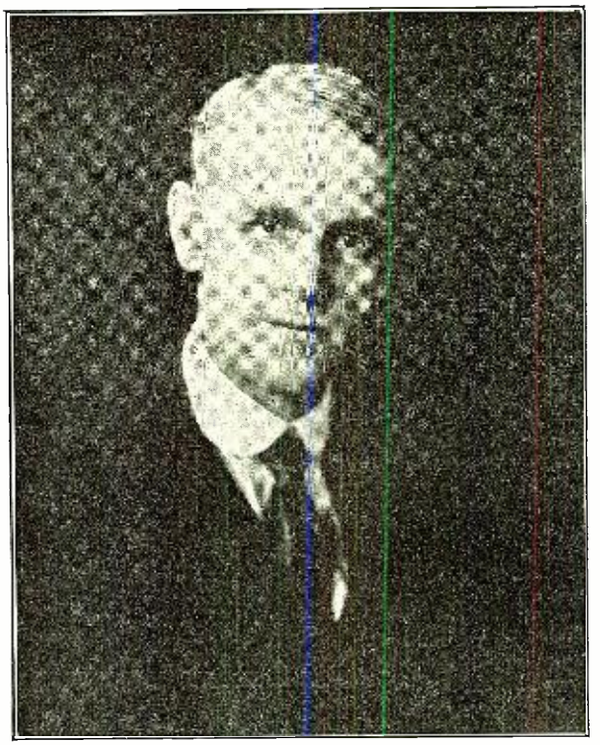
No. 14 ROY A. WEAGANT

ROY A. WEAGANT was born at Morrisburg, Ontario, Canada, in 1881. He received his education at the Stanstead College, Stanstead, Quebec, and McGill University, Montreal, Canada. He took a course in electrical engineering, from which he graduated in 1905, and studied physics under Sir Ernest Brotherford, becoming interested in wireless through watching his experiments in Hertzian waves.

Mr. Weagant took up commercial wireless work in 1908, and in 1912 entered the service of the Marconi Wireless Telegraph Company of America, where he soon rose to the position of chief engineer, and when the Radio Corporation of America absorbed the Marconi company, he was retained as consulting engineer.

The Lieutenant Colonel Liebermann Memorial Prize, consisting of the interest for 1919 on $10,000, and awarded for the best work of the year in progressive discovery tending toward the advancement of Radio, has been awarded to Mr. Weagant for his discovery for the elimination of static interference. This prize was founded one year ago by a friend of Lieutenant Colonel Liebermann, who was killed in action in the late World War.

Mr. Weagant is a Fellow of the Institute of Radio Engineers and a former member of its Board of Directors and Standardization Committee.



Mr. Roy A. Weagant Consulting Engineer; Inventor of the Static Eliminating Circuit.

The static eliminator, invented by Mr. Weagant, is a combination of balanced circuits and wave traps which choke the static disturbances induced in the antenna, leaving only the signals to be received free to pass through the circuits. This is based on the phenomenon of resonance and inductive reaction which this prominent engineer studied in detail. This is the result of lengthy experiments carried out in the most unfavorable places for Radio work; Mr. Weagant tried his circuits in various parts of the country during the different seasons when the statics were strongest and troubled the reception of the signals in the various Coast stations.

He is actually engaged in research work in vacuum tube circuits for elimination of interference and statics, to be used in the Transatlantic receiving stations of the Radio Corporation of America. This indefatigable worker, not satisfied with the results obtained with the instruments he designed, constantly revises the details in order to improve it and attain perfection, that is, absolutely eliminate signals and electrical disturbances from the telephone circuit of a receiver, so that only the signals desired to be heard are audible, which thus become readable even if they are very weak.

At the present time, the Weagant's static eliminating circuit is used in several of he high power and Government stations engaged in long distance communication for the reception at high speed of Press and Commercial messages.

Splitting the Game

By HOWARD S. PYLE

LOOK back five years, just before we entered into the world struggle. Where was the radio game then? We amateurs were using the old tubular audiotrons (a wonderful detector) together with a slide loose coupler and a couple of variables. That was the average amateur receiver. The only regenerative then available was the one that has never been beat—the Paragon. Who had a thought of three coil tuners, four prong bulbs, grid leaks, amateur radiophones, oh, an infinite number of radio instruments, which we now number among the common? The war speeded up radio development, remarkably, but still we have not discarded altogether the stuff we used a few years back. Rather than replace obsolete parts with the newer developments, haven't we just added the new stuff, and consequently added to the mass of information which we must gather, to be up to date in radio? Imagine a new fan enering the game. Compare him to those who entered some five or six years back. Then the evolution of a radio operator consisted of breaking in at the crystal and tuning coil stage, with a spark coil transmitter, and progressing to the loose coupler and audiotron with a non-synchronous rotary transmitter; just a few intermediate steps involved.

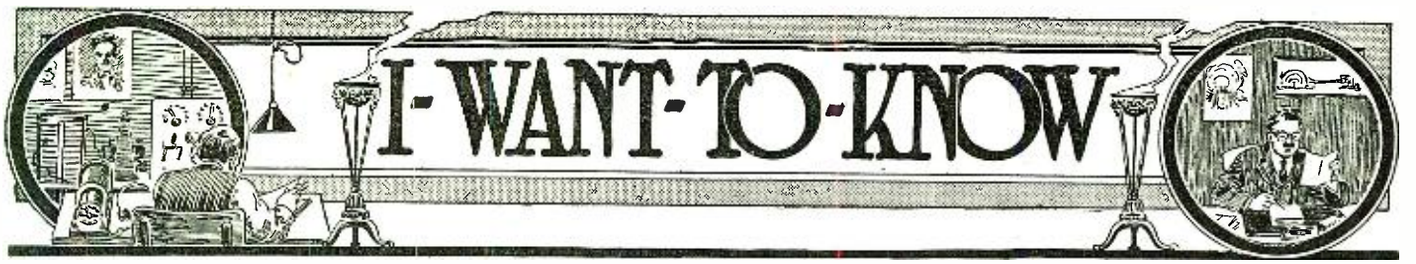
But now! Either our new "bug" must start as before, with the crystal and tuning coil, and slowly and painfully climb to the present stage of radio development, doubtless to find it several steps ahead by the time he reaches the present stage, or he must enter with his head crammed full of vacuum tube data, etc., all of which is but a hazy mass, to be straightened out by long experience.

That is why I head this paper, "Splitting the Game." Not so many years ago, a telegraph operator could, and often did, string his own lines, do his own installing and operating, besides many varied duties. But soon came the modern repeaters, duplex, quadruplex work, and the multiplex machines. The switchboards of a modern telegraph office are a meaningless maze to the average operator of today. Consequently, the commercial telegraph companies have "split the game" and now hire operators, and plant men. Operators are required to be familiar with a typewriter, and pretty well versed in Morse code. Possibly they are conversant with a simple plug board, such as used in branch offices. But the men that handle the circuits, and test and maintenance ends, are developed from operators to that specialized purpose. Note that by far the great majority of wire chiefs are of the old-timers; they have grown with the game. They still can handle a key, but they do not work a regular operating trick. Many of them would be lost on a fast Phillips' press wire today. But they do know the electrical end of their game. They must.

Now the comparison: We have many fast commercial radio circuits, working Transoceanic and Transcontinental today. They require speedy Continental operators, and men who are familiar with typewriters at the working speed of such circuits. They must devote their time to keeping up the gait they are required to hit. They cannot spend part time familiarizing themselves with all the accessory apparatus which they control with their keys. The same for the arc tenders, and repair and installation men. Take the radio electricians employed by the Government in various Navy yards, as installers, etc. Very few know even the letter characters comprising the Continental code. If they were to devote part of their time to becoming proficient operators, they must needs fall behind in the progress of the electrical end of the radio profession. It is time for a split in our game. We cannot keep up a 30 to 35 word a minute pace, handle Philips' code, "bugs" typewriters and at the same time be up to the minute in all the latest developments of the radio art. They come too fast. Our heads are in a constant whirl. In the writer's opinion, to maintain efficiency in the radio field, there must be radio electricians and radio operators. Not to say there isn't some distinction now, but it is not officially recognized.

Take the new license examinations. They require a considerable knowledge of the modern radio apparatus, and have raised the code speed also. Of course that puts radio operators on a higher plane; they are recognized as being more of specialists than in the old days, but take an examination for an extra first-grade license. You must be a highly specialized radio electrician, and familiar with arc, spark and tube sets. In addition, you must be a competent radio telegrapher at 30 words a minute, and a Morse man at 25 words; a jack of all trades in that particular line. It is all right, perhaps; we appear to be getting by, but it

(*Continued on page* 860)

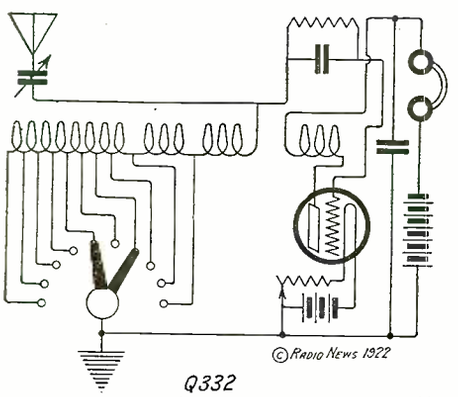


SINGLE CIRCUIT REGENERATIVE SET.

(332) Charles W. Flichman, Jr., of Baltimore, Md., asks:

Q. 1. Please publish a hook-up of a single circuit tuner to receive wave-lengths up to about 1,000 meters, with data for the construction of inductances.

A. 1. The hook-up for this set appears on this page. The winding of the inductance in the aerial should consist of about 160 turns with taps every 15th turn. The variable condenser should have a capacity of .001 m.f. and the phone condenser, of .0005 m.f. The tickler coil in series in the plate circuit should rotate one-half a turn



Q332

This Single Circuit Regenerative Receiver May Easily be Made by the Average Amateur.

inside, and at one end of the main inductance, and should consist of a wooden rotor wound with 60 turns of No. 28 wire.

Q. 2. Are .001 m.f. variable condensers suitable to be used across the primary and secondary coils of a honeycomb receiver?

A. 2. Yes, this capacity is quite suitable.

INDUCTION TROUBLE

(333) E. E. Straffon, of New Baltimore, Mich., wants to know:

Q. 1. Is there any way of getting rid of the noise from a converter used by the Telephone Company, which is heard in all the radio sets in this town?

A. 1. To eliminate the induction effects caused by the converter you mention, we suggest that you try the hook-ups published on this page, which may help you to cut out the noise you hear.

Q. 2. I am using a Remler two-step amplifier and a Clapp-Eastham regenerative set, how can I cut out the squealing I sometimes hear in this set?

A. 2. It is difficult to locate the trouble in your detector circuit, without actually seeing your set, but we believe the squealing is caused by a loose connection, incorrect value of grid leak or condenser, or by a bad cell in your "B" battery. You should also verify the connections in your amplifier and make sure that all the connections are tight.

Q. 3. What is the wave-length of an aerial 45 ft. long, 70 ft. high, composed of three wires 3 ft. apart inverted L type?

A. 3. The wave-length of such an aerial is about 150 meters.

NO RESULTS.

(334) J. Shannon, of Bridgeport, Nebr., would like to know:

Q. 1. I have a single wire aerial 350 ft. long erected 18 in. below the phone wire on insulators 15 ft. above the ground. I have been unable to receive anything on this aerial; does the phone line interfere?

A. 1. It is difficult to answer this question, as you do not give any details regarding your receiving set. If you use a good receiver with a vacuum tube detector, you should receive signals with this aerial, unless you use too much inductance in the primary and cannot tune down on short wave-lengths. You should try a variable condenser in series with the primary of your tuner and also to attach a shorter wire in another direction to see if any signals are received on a different antenna. If you fail to hear anything, most probably the trouble lies in your set.

Q. 2. Is a No. 12 galvanized soft iron wire 100 ft. long running underground and soldered to a well-casing, a good ground?

A. 2. Yes, this should constitute a good ground.

Q. 3. Could I use the voltage from a 32-volt lighting battery for the plate voltage of radiotron tubes, taking only the proper voltage for the detector?

A. 3. Yes, this is quite feasible and should work well.

ELECTROLYTIC RECTIFIER.

(335) Louis E. Metcalf, of Greenfield, Ill., writes as follows:

Q. 1. Can an electrolytic rectifier, as described on page 201 of the September issue, be used successfully on a three-stage amplifier, without giving too much hum in the phones?

A. 1. It would be difficult to use such a rectifier to supply the plate voltage to a three-stage amplifier, without hearing any noise in the phones. However, if a detector and one-step only were used, we think it would be possible to use such a rectifier, provided the proper smoothing circuit composed of capacities and choke coils is used.

Q. 2. Can such a rectifier be used to charge a storage battery?

A. 2. An electrolytic rectifier can be used for charging storage batteries, but it should be of a different size than the one you mention. The cells should be very much larger, so should be the plates in order to carry safely four or five amperes.

Q. 3. For phone reception, should a condenser be shunted across the grid variometer and secondary of an Armstrong regenerative circuit?

A. 3. It is not necessary to shunt the secondary and grid variometer of such a set, if the receiver can tune the wave length which it is desired to receive. In case the wave-length is beyond the range of the set, a small variable condenser may be connected so as to increase the tuning range of the apparatus.

RECEIVING AERIAL.

(336) Edward Wilker, of Saugerties, N. Y., asks the following:

Q. 1. What is the most efficient type of aerial for receiving, the surrounding objects not being over 35 ft. high?

A. 1. A good aerial could consist of four wires 80 ft. to 100 ft. long, spaced 3 ft to 4 ft. apart, erected as high as possible. The lead in could be taken either from one end or from the center, making it an L or a T aerial.

Q. 2. Would I be able to receive concerts from 100 miles with a loose coupler, mineral detector, variable condenser and a 3,000-ohme head set.

A. 2. Under good conditions, you may be able to hear some concerts, although we are afraid you are too far away to get good results with a mineral detector, in receiving radiophone transmissions.

A RECEIVING SET.

(337) A. Norman Goebel asks:

Q. 1. By whom is the crystal receiving set, described by A. Henry in the January issue, made?

A. 1. This set is manufactured by F. A. D. Andrea Co., 1882 Jerome Ave., New York City, N. Y.

GRID LEAK.

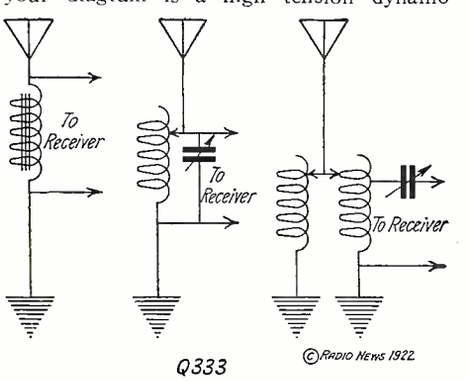
(338) Melvin Bergland, of Joyce, Iowa, asks:

Q.1. Where can I obtain a 10,000-ohm grid leak to be used in a radiophone transmitter?

A. 1. You will find, in the advertisements in this magazine some grid leaks of any resistance for the purpose you mention. We suggest that you look over the advertisements.

Q. 2. Please tell me what the apparatus represented in the sketch I enclose is.

A. 2. The instrument represented by your diagram is a high tension dynamo



Q333

If You Are Troubled by Induction From Power Lines, Try These Circuits.

furnishing the plate voltage to the transmitting tubes.

RAC$_3$ TUBE

(340) Garrett S. Parsons, of Romney, W. Va., would like to know:

Q. 1. What is the best hook-up for one Myers tube made by the Radion Audion Co.?

A. 1. This type of tube may be used in any standard circuit. We suggest that you look over the back copies of this magazine, in which you will find very efficient circuits.

RADIO DIGEST

USE RADIOPHONE TO SEND WEATHER FORECASTS AND WARNINGS.

Beginning with January 16, the air mail radio station in the Post Office Department at Washington has been broadcasting weather forecasts and warnings of the Weather Bureau, United States Department of Agriculture, by radio telephone instead of by radio telegraph. These reports are sent out for the District of Columbia, Virginia, Maryland, West Virginia, Eastern Pennsylvania, Western Pennsylvania, and Ohio. In sending out this information, a wave-length of 1,160 meters is used and all receiving instruments as far west as Ohio, if properly keyed, may be used to receive the reports which will be sent out at 10 a. m. and at 9.50 p. m. Experience has shown that the radio telephone gives better and more rapid service than the radio telegraph.

MARKET NEWS NOW SENT TO EASTERN STATES BY RADIO FROM WASHINGTON.

A radio market news service designed to keep agricultural interests within a 600-mile radius of Washington informed daily on national market conditions respecting live stock, fruits, and vegetables, grain and dairy products, was recently established at Washington by the United States Department of Agriculture. This service covers nearly all States east of the Mississippi River. The messages have been heard in Texas. The Washington wireless station of the Post Office Department is used to dispatch the reports.

A report showing the prices that retailers pay wholesalers for fruits and vegetables in the Washington market is also broadcasted by radiophone, 1,160 meters, over a radius of 100 miles or more, at 10.30 a. m. daily.

A report giving the day's receipts of cattle, calves, hogs, and sheep at the ten principal live-stock markets throughout the country, and a brief message on the opening of the Chicago and St. Louis hog markets are broadcasted at 12.30 p. m. A complete report of conditions and prices in the Chicago and St. Louis live-stock is sent at 2.30 p. m. Prices of fruits and vegetables in the ten principal consuming markets are dispatched at 3.30 p. m. A report of conditions and prices on butter, cheese, eggs, and dressed poultry at New York and Chicago is broadcasted at 5 p. m. At 5.30 p. m., a press dispatch on the Chicago grain market is sent. A complete report on the Chicago grain market, giving closing future and cash grain prices, is dispatched at 7.30 p. m. And at 8 p. m. a complete report of quotations on fruits and vegetables in the leading consuming markets is sent. In broadcasting all radio telegraph reports, except the 7.30 p. m. and 8 p. m. messages, 1,980 meters, tube C.W., is used. The 7.30 p. m. and 8 p. m. messages are sent on 2,500 meters, arc C. W.

The department's broadcast service virtually completes the chain necessary to enable all agricultural interests in the United States, wherever located, to obtain daily information of conditions and prices in the national agricultural markets. The service entails no additional expense to the Government inasmuch as existing market reporting agencies and wireless broadcasting facilities are used.

The Department of Agriculture already maintains at important shipping points and consuming centers a number of market reporters to report daily conditions and prices on agricultural products, and the wireless station of the Post Office Department is part of the air mail service. The reporters of the Department of Agriculture operate from branch offices of the department which are connected with each other and with the Washington office by a system of leased telegraph wires, and the daily market news is flashed over these wires to the various branch offices for immediate release to the public.

The leased-wire service does not cover territory in the Southern States, and it is thought that the new wireless broadcasting service will meet a long-felt need of southern growers for national market news.

AN OPPORTUNITY FOR EXPERIENCED RADIO AMATEURS.

The National Guard of New York State which, offers to its members several advantages, such as the use of the gymnasium, bowling alleys, billiard rooms, library, running track, comfortable club rooms, etc., needs the services of about 20 Radio operators to fill the technical grades for the Radio section of the Headquarters Company of the Regiment, which is located at the 71st Armory, situated at Park Avenue at 34th Street, New York City. The duty required of each member is that he present himself one night a week for drill, and once in a while two nights a week for regimental parade and drill. Each man receives, in addition to that for the regular weekly drill, pay amounting anywhere between $1 and $2.50 per drill.

On the top of the Regiment tower is installed one of the finest Radio stations in the City, which is used every drill night for instructional purposes and consequently experienced handling is required of the members, who are taught by instructors both theory and practice of Radio to enable them to qualify for operators. All those who are interested should address, for further details, Commanding Officer, Headquarters Company, 71st Infantry, New York National Guard, Park Avenue and 34th Street, New York City.

Radio Articles Appearing in the March Issue of Science and Invention

The Radiotrola — The Wireless Phonograph. With full details and hook-up of apparatus employed, for V. T. detector and four-step amplifier. By H. Gernsback and R. E. Lacault.

Talking Over a Trolley Wire. Combined radio and wire system.

Shall I Take Up Engineering? Including electrical and radio engineering. Described from the viewpoint of the prospective student as well as the parent. By H. Winfield Secor.

Radiophoning to and from "L" Trains.

Radio For the Beginner—No. 1 of a series. How to buy and install a receiver. By Armstrong Perry.

Amateur vs. Commercial Radio Stations. Describing with graphic chart the wonderful work done by the small amateur set compared to the huge commercial stations in transmitting across the Atlantic Ocean.

WESTINGHOUSE ELECTRIC ESTABLISHES RADIO BROADCASTING NEWSPAPER.

Radio Broadcasting News, a weekly newspaper, has been established to mark the first anniversary of KDKA, the radio telephone broadcasting station of the Westinghouse Electric & Manufacturing Co., at East Pittsburgh, Pa.

The newspaper is believed to be the first of its kind in the United States and the only one devoted solely to the publication of news concerning the activities at one broadcasting station.

About one year ago, the Westinghouse Electric & Manufacturing Co. broadcasted its first program from KDKA, which was the first station in the world to give nightly broadcasting programs. Interest in the programs became so great that, in the latter months of 1921, there came to the company an insistent demand on the part of "Listeners in" that they be informed "in advance" of the programs to be broadcasted from KDKA.

With this demand—good naturedly given, yet insistent—*Radio Broadcasting News* was born. Today, with only a few issues off the press, it is a fixture. It has come to stay because public opinion has demanded it. The birth of this newspaper marks one of the many great forward steps in the marvelous history of the advancement of radio broadcasting.

Radio developments are the chief items published in *Radio Broadcasting News*, which derived its first circulation list from those friends of radio broadcasting, who, after "listening in" on the KDKA programs, wrote to the Westinghouse Company expressing appreciation of the broadcasting service.

The publication gives in word and picture news concerning various broadcasting programs and pictures of artists who entertained radio enthusiasts. A feature of each issue is the program to be broadcasted nightly during the week following the date of issue of the newspaper.

It is estimated that more than 60,000,000 persons are within the range of the four Westinghouse broadcasting stations, the calls, wave lengths and locations of which are as follows: KDKA, 360 meters, East Pittsburgh.; KYW, 360 meters, Chicago, Ill.; WJZ, 360 meters, Newark, N. J.; and WBZ, 360 meters, Springfield, Mass.

The program broadcasted nightly by the Westinghouse broadcasting stations include concerts, church services, results of various games of sport, market reports, stories for children and news bulletins.

Copies of *Radio Broadcasting News* will be sent to all persons desiring to receive the newspaper who send their names and addresses to the Editor, *Radio Broadcasting News*, Department of Publicity, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

SEATTLE RADIOPHONE IMPROVED.

By Howard S. Pyle.

The radiophone which has been operated on a nightly broadcast schedule by the Seattle *Post-Intelligencer*, a morning daily, has been recently improved by the addition of two 100-foot masts, on the roof of their building. These masts will replace the much shorter ones formerly used,

(*Continued on page* 860)

Correspondence from Readers

RE. CHOKE COIL AMPLIFIERS.

Editor RADIO NEWSS

Referring to your December number—Mr. Jessup's article on the choke coil amplifier, his assertions concerning its superiority hold little weight, due not only to the fact that he gives no details concerning the transformer coupled amplifier with which comparisons were made, but also to the general principles which underlie vacuum tube amplifiers.

Amplifiers may be divided into two general classes, voltage amplifiers and power amplifiers. It may be shown mathematically that for maximum power amplification the impedance of the output circuit of a tube should be equal to the plate resistance. It may also be shown that, when the output impedance is largely inductive reactance and is about four times as great as the plate resistance, the *voltage* amplification is about 90 per cent. of the maximum obtainable with a given tube. The thermionic tube is a potentially operated device, so we must impress as great an alternating E.M.F. on the grid as possible without working the tube off the straight portion of its characteristic curve, causing harmonics and distortion. This potential may be obtained by operating the preceding tube or tubes as voltage amplifiers, or by the use of an input transformer of sufficiently high ratio. Low ratio transformers do not work the tubes to highest efficiency, because they do not take advantage of the entire length of the characteristic. This straight portion is, of course, longer at high plate potentials.

It should now be clear that if a "choke coil" amplifier is designed as a voltage amplifier, the equipment is put to a purpose that could be accomplished as well by a high ratio transformer. On the other hand, if the chokes have an impedance equal to the plate resistances of their respective tubes, the result is practically a power amplifier with 1 : 1 transformers and all the benefits of transformer voltage amplification are lost.

I employ a 25 : 1 transformer in the first stage of my power amplifier and a slightly lower ratio in the second, 200 volts being used on the plates. Fluctuations in the phone circuit as great as 10 milliamperes are obtained on some signals with this combination. I can say from my own experience with choke coil coupled amplifiers that tube for tube the results are not comparable to a correctly designed transformer coupled amplifier, and that beyond two steps of the latter, amplification should be radio frequency.

KENDALL CLOUGH.

Chicago, Ill.

C.W. ON GALENA WITHOUT TICKLER!

Editor RADIO NEWS:

Having just received back numbers of your magazine for nine months that I had missed, have started to read up to date.

Upon reading Mr. Boucheron's article on page 548 of the April, 1920, issue, I am particularly impressed with what he says in regard to few amateurs paying attention to effective reception of 200-meter wavelengths, and I will give some examples of what is possible along these lines.

As to getting arc stations on an ordinary galena hook-up, this has been very courteously explained to me by Mr. Elmer E. Bucher, who says that when two or three are working at the same time this is possible, owing to the fact that one heterodynes the other, thus making the signals readable on a crystal detector.

None of the instances I have quoted in my article are based on any guesswork, nor have I jumped at conclusions. I have worked at telegraphy for many years under all sorts of conditions, and I never note any radio station as having been heard by me, until I have heard him "sine" several times, so that I know who he is, beyond the shadow of a doubt.

I have no transmitting outfit, and consequently have devoted my attention exclusively to improvement of receiving conditions, the following being some of the results.

With an ordinary galena hook-up I bring in the following amateurs whenever they are working:

5EA (Baton Rouge, La.), 5EF (McAlester, Okla.), 5HK and 5HL (Oklahoma City), 5ZL (Little Rock, Ark.), 5ZS (Shreveport, La.), 5YH (Camp Pike, Ark.), also many other intermediate Fifth District stations, and have several times heard the (to me) unknown ones, 5JA, 5JG, 5JS, 5JI, 5JD and 5IF.

In the ninth I get 9AEG (Eldorado, Kas.), very QSA, 9BW, 9EL, 9HI, 9LR, 9ND, 9OE, and 9SZ (all Kansas stations); 9AFX (Stromsburg, Neb.); 9HN, 9EQ, 9JQ, and 9KV (all St. Louis calls), 9ZQ (Oelwin, Iowa) and 9JN (Ames, Iowa). 9JN comes in very plain and clear; also the following unknown "9s": 9BEM, 9DE, 9YI, and 9ZB. Have also heard 9VA (Chicago) when the QRM lets up long enough.

In the sixth I hear 6IG (Douglas, Ariz.) every night, and when not too much "CQ"-ing, etc., frequently hear 6CO (San Jose, Calif.) and 6CG (Berkeley, Calif.).

I also hear the phone at Catalina Island quite often (790 miles air line distance).

So much for short-waves, bearing in mind that all this is on galena.

Coming higher, I can copy ships all over the Gulf waters, also all along the Pacific coast, from San Francisco to 1,800 miles south of there.

I quite often, for practice, copy XDA's "Prensa" on my noisy typewriter without any difficulty, as he comes in strong, and by the way, if you want to be operators, sit in and copy him through some night, and you will know you are sure enough ops. if you copy him without slipping up, as he uses the Spanish n, the Spanish a, the Spanish ch and the German o.

WNU and US both come to me fine, and I get "time" from NAA every night and generally take his Navy Press, when these Mexican stations with waves as broad as a barn door will stay out.

NAT, NPL, NPX and NPG (on medium waves) all come in well. I can copy KET any evening after sundown, and along about 9:00 P. M., if they are working "dux," can bring in both KET and KIE together (by proper adjustment of second condenser), hear them sending to each other, and hear when they break each other. This breaking, however, does not occur very often, for the boys on that circuit are some artists, and the way they shoot those ten-letter code "Japs" into each other, when they get warmed up, is a caution.

So much for spark stations, and now I come to a phenomenon: I am frequently able to copy WSO, WII, NSS, and occasionally NPL, NPG, NAO, NAT and NBA, all of them C.W. stations, on GALENA, and even once, when WSO and WII were both running idle for a few minutes, plainly heard POZ calling and signing. I know this sounds "fishy," but it is a fact, and I had no tikker, or any sort of auxiliary whatever, and I also get their true tone. What use have I for a V.T.?

I have two aerials, one of three wires, 5 ft. apart, 100 ft. long, 60 ft. above ground, and one single wire 500 ft. long. These can be used either separately or both together as one, by throwing one switch at the instrument table. Ground is 300 feet of electric light No. 10 "outside" copper wire, buried about a foot in marshy ground.

Receiving instruments: small DeForest vario-coupler for 200 meters, Navy Type loose coupler for 300 to 4,000; large bank wound loose coupler for 1,000 to 15,000 M., and DeForest three-coil mounting for any wave-length.

I made an eight pole, four throw rotary switch, with which I can instantly cut any one of the four receiving sets into the receiving circuit.

Location 300 miles west of San Antonio, 225 miles east of El Paso, Texas. Let's hear some other *galena* records.

GEO. C. HASELTINE,
Fort Stockton, Texas.

DID YOU HEAR HIM?

Editor RADIO NEWS:

Alva Smith, operator at Radio 9DMA, Caledonia, Minnesota, wishes to hear from all those who have heard his spark signals. He is using a ½-K.W. and is getting four amperes, but has received no reports from over 18 miles. All reporting will be sent radio literature free. Pse QSL.

ALVA SMITH.

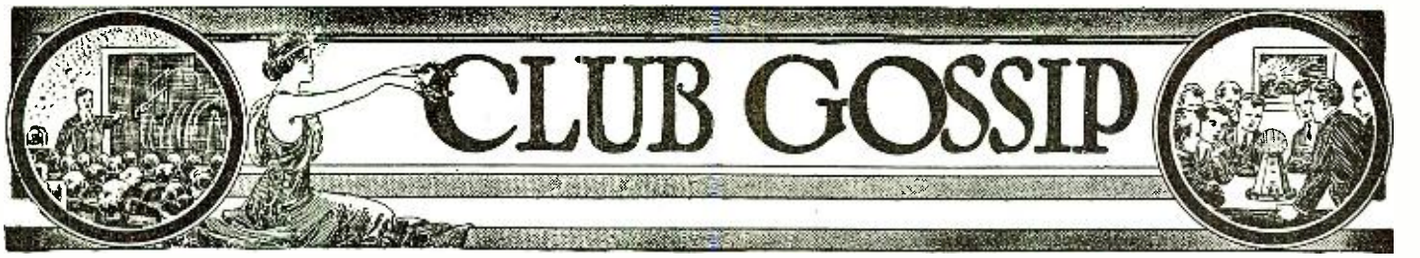
SOME RECEPTION

Editor RADIO NEWS:

Thinking the following may be of some interest to the amateurs, I have decided to write to you.

I receive the radiophone at Long Beach, Calif., the one that connects the mainland with the Catalina Islands; I can duplicate this reception any good night. It came in very clear the other night. I tuned the station in at 10:29 P. M. Eastern time, Pacific time being four hours earlier. I have been receiving this station almost every night. I use a Grebe CR-3 and a type RORF detector and two-step. I hear the station on the detector very loud.

WESLEY ROBINSON, JR.
St. Mary's, Georgia.



WIRELESS CLUB OF ST. PETERSBURG, FLA.

The first meting of the Wireless Club of St. Petersburg, Fla., was held on January 20. Twenty-two charter members were present and the following members were elected to office: E. Richard Hall, president; E. B. Maclung, vice-president; Wilbur Worly, secretary and treasurer. The leading business men of the city are well represented in the membership of the club which has increased to 32 members since the meeting and they are all enthusiastic boosters. The city may install a large broadcasting station as a result of this.

At the present time all outside traffic is being handled by Mr. Hall, 4JY, who is also the city manager for the A. R. R. L. It is due to his untiring efforts that the city is taking up the proposition of installing a large broadcasting station.

The club is going to give prizes of power tubes and C.W. articles to the most progressive men in these lines, phone, I.C.W. and C.W. We hope to make this a "sparkless" city. We have the Naval station NGL here, but instead of being a hinderance it is the greatest aid we could have and the station is manned by as fine a group of men as will ever be found in any naval station.

Any member of this club who is found to be operating his transmitter on a wave-length of over 200 meters, is to be fined $5 for each offense; all men must agree to this before they can become members. It will be enforced.

Address all correspondence to the secretary, Mr. Wilbur Worly, Wireless Club of St. Petersburg, P. O. Box 1188, St. Petersburg, Fla.

PHILADELPHIA AMATEUR RADIO ASSOCIATION

The Philadelphia Amateur Radio Association held its last meeting on January 16, 1922, in the Widner Memorial Library, 1200 North Broad St. Mr. E. B. Meyers, of Jersey City, N. J., read a paper on "Vacuum Development From 1884 to 1922". This paper was very interesting and attracted a large attendance. Mr. Meyers also exhibited a six-step amplifier made of the Meyer vacuum tubes and choke coils. This was followed by a talk by Mr. Charles A. Service, presenting the interests of the Third District Convention at Washington, D. C., on February 17 and 18, 1922. A plan was presented, to the effect that members could bring any apparatus that they wished to dispose of and the club would offer it for sale during the meeting. The attendance was so large that some had to stand, as the seating capacity of the hall was not large enough to accommodate all.

TOLEDO RADIO CLUB

Radio amateurs of Toledo have formed a radio organization, the name of which is the Toledo Radio Club.

At a meeting held in November, the following officers were elected for the year: President, A. J. Gogel; vice-president, Clark J. Taylor; secretary, E. E. Pearson; treasurer, Earl Ensign.

Four meetings have been held with an average attendance of 30 or 35 fellows. Meetings are held the first and third Wednesdays of every month at the Toledo Commerce Club rooms in the Nicholas Building. Special program committees are appointed and a certain program is arranged for every meeting.

The club has held a prize contest in which the person who made the cheapest and most efficient crystal receiver received a tube and panel donated by the Kuebler Radio Co. of this city. The second prize was a set of Murdock 56 phones donated by the W. B. Duck Co. Considerable interest is being shown by local amateurs, and it is hoped that the club will grow into a real live organization. Anyone desiring to communicate with the club can do so through the secretary, E. E. Pearson, 515 St. Louis St., Toledo, O.

NORWOOD RADIO ASSOCIATION, NORWOOD, OHIO

On November 8, 1921, the first meeting of the Norwood Radio Association was held at the home of Mr. Alfred Tucker. The following officers were elected:

President, Alfred Tucker, 8BNR; vice-president, Carl Brinkman; secretary, Martin Ross; treasurer, Curtis Clements. Mr. Ross has resigned his office and Mr. Arnold H. Westhaus is now taking his place.

The club now has a clubhouse at Linden and Kenilworth Sts., South Norwood, and intends to have a transmitting and receiving set in the near future, as well as a battery charger and several other instruments that will be of benefit to every member as well as to the club.

The Norwood Radio Association started with 11 members and now has 20, and we intend to have every amateur in Norwood and vicinity join soon.

On the first and third Tuesdays of the month we have code classes and on the second and fourth Tuesdays we have business meetings.

We have a trade bulletin and a question box. Two of our most experienced members, Mr. Alfred Tucker, 8BNR, and Mr. Clarence Wright, 8AHX, endeavor to answer all questions that the rest of the "hams" have to ask.

"Hams", "O. W.'s" and "O. M.'s" living in Norwood and surrounding suburbs join us at our next meeting.

Other clubs or organizations please do not forget to write. Address Arnold H. Westhaus, 1942 Elm Ave., Norwood, Ohio.

1FM

Owing to a recent change of the call 1FM which is listed under the name of John Marshall, 9 Sherman St., Portland, Me., to the Portland Y. M. C. A., Portland, Me., it is requested that all amateurs please change their call books accordingly.

The Y. M. C. A. also has a class of radio amateurs which meets every Monday night. The radio room is fitted up with code tables on which many things can be performed, such as listening in with operator on watch and using tables separate for code practice or they can all be connected together. These tables are controlled by a switchboard about 14x10, which has 11 switches on it. A class in theory is also conducted.

Recently a 1 K.W. spark transmitter was installed and is giving excellent results. All amateurs hearing this station are requested to write to the operator and instructor, H. C. Sever, care Y. M. C. A., Portland, Me., giving full particulars as to tone, wave, whether Q.S.A. and Q.S.S. or what

A regenerative and two-step are now used and later a three-step will be installed.

C.W. will soon be put in and will be used with spark set. A motor generator supplying A.C. is used, owing to D.C. being in the building. Will Q.S.L. all cards and letters.

LANSDOWNE, PA., RADIO ASSOCIATION

Our association was organized on Jan. 29, 1921. On that date our membership was composed of seven charter members.

At present we have increased to the number to 20 members. Mr. J. C. Holtby, 3BIF, has been president since organizing.

Our clubrooms are located at 18 North Wycombe Ave., Lansdowne, Pa.

We meet every Tuesday night, at 8:00 P. M., in said clubrooms. Visitors are cordially welcomed and correspondence is invited by the secretary.

At one of our meetings we brought up the discussion that we have club stationery, which is now in use.

We have four licensed members, 3BIF, 3AVL, 3ANH and 3BAL, of which three have phone sets. We have two important committees.

Our library consists of "Science and Invention", RADIO NEWS and "Q. S. T." and a variety of radio books.

The club set consists of ¼ K.W. spark and an efficient receiving set also a C.W. set is under construction.

Address communications to above mentioned address.

CORRESONDENT WANTED

Would any member of some club be willing to correspond with me in Esperanto on radio?

K. Lundquist, Pohjois, Makasiini katu G rapp: C. H. 14, Helsinki, Finland.

ROSELLE PARK RADIO CLUB

At the meeting of the Roselle Park Radio Club, held January 12 in the new clubrooms in the Tuthill Building on Chestnut St., the election of new officers for 1922 resulted as follows:

President, Robert H Horning, 2KK; vice-president, Gus Bosler; secretary, Charles A. Reberger; treasurer, H. T. Ryder; traffic manager, Howard Luttgens, 2BCC; assistant traffic manager, Marvin C. Lane, 2BTM; radio inspector, Paul Larsen, and assistant radio inspector, Cunard Hagberg, 2BCP.

MON-YOUGH RADIO ASSOCIATION

Late last August a few radio enthusiasts of this vicinity had a meeting and organized the Mon-Yough Radio Association. An election of officers ensued with the following results:

President, James G. Parson, McKeesport; vice-president, John S. Hunter, Duquesne; secretary-treasurer, J. C. Dunn, East McKeesport, and assistant secretary-treasurer, Emil Klob, McKeesport.

Four permanent committees were elected to promote the association. These were the Technical Committee, the Membership Committee, Publicity Committee and the Constitution and By-Laws Committee. These committees went to work immediately and the membership began to slowly climb. Meetings are held every two weeks on Thursday evenings. The place of meeting is at 427 Olive Street, McKeesport, Pa.

At a recent meeting the president and secretary-treasurer were re-elected

A few of the organizers of this club were the organizers of the old Western Pennsylvania Radio Society which merged with a radio club from McKees Rocks, Pa. This society then adopted the name Radio Engineering Society of Pittsburgh. Later this society was incorporated and is now very active in the radio circles in the district.

A short time ago the Mon-Yough Radio Association made application to A. R. R. L. and became affiliated. It is striving to become active in the radio circles. The Technical Committee has been putting on technical talks for the members. These are enjoyed very much, as the majority of the members have little knowledge of the new science.

The association will welcome any correspondence with other clubs throughout the country. Address the Publicity Chairman, 427 Olive St., McKeesport, Pa.

RADIO CLUB OF THE CITY OF ITHACA

The first meeting of the Radio Club of the City of Ithaca was held January 19, at the home of Mr. Wm. Bostwick. Officers of the club were elected as follows: Prof. William Ballard, of Cornell University, honorary president; Mr. Wm. E. Bostwick, 8ACM, acting president; Mr. David Sinclair Perry, 8OO, vice-president; Mr. Fred Burnham, 8NI, traffic manager of this locality; Mr. Dexter S. Kimball, Jr., 8BEV, secretary-treasurer. A radio adviser is to be chosen at the next meeting. It is the duty of the adviser to inspect transmitting stations at the request of the operators and tune them properly.

The purpose of the club, to quote from its constitution, is "to advance the local amateurs along radio lines and to cope with the interference." The meetings are to be held the first and third Wednesdays of every month at the homes of the members. As to membership, any person owning or intending to own a radio set is eligible to membership; however, the members are classified as senior members (licensed), and junior members (unlicensed) and the club will attempt to get as many transmitters licensed as possible.

The following traffic schedule was decided upon for this locality: 7.00 A.M. to 12 M. air is free for transmission and testing; 12 M. to 2.00 P.M. long distance relay work. 2.00 P.M. to 7.00 P.M. air free for transmission and testing; 7.00 P.M. to 9.50 P.M., local transmission, testing and DX work forbidden; 9.50 to 10.10 P.M., no transmission; 10.10 P.M. to 7.00 A.M. long distance relay work.

Inasmuch as the club was but recently organized, no lectures or tables have been arranged on radio subjects, but the matter is to be done up in good style so that members of the club will increase their knowledge as rapidly as possible.

The club is very desirous of communicating with other clubs and will greatly appreciate a line telling what other organizations are doing. All communications may be addressed to Secretary D. S. Kimball, Jr., 5 Central Ave., Ithaca, N. Y. Let's hear from you!

MORNINGSIDE RADIO CLUB, SIOUX CITY, IOWA

A radio club for the benefit of the residents of Morningside, Sioux City, Iowa, was formed last September by several amateurs of the city.

The membership of the club now totals 15, and considerable interest has been shown by the members, several of whom are prominent amateurs of the city and have made some real records in transmission and reception. The club was formed for the purpose of popularizing radio. Demonstrations have been given on several occasions and proved a real success, having won over several of the citizens to the realm of radio.

As yet, no transmitting set has been installed, but the club is contemplating the installation of a 10-watt radiophone, C.W. and I.C.W. transmitter. The location of the clubroom is ideal, being on the top floor of the East Junior High School, which makes the aerial about 65 feet high with a length of about 150 feet. This aerial is now used for the

(*Continued on page* 900)

How to Make a Radiophone Receiving Station

(Continued from page 824)

or twelve dollars, as some of these people seem to believe.

Every now and again there appear descriptions of some youth who uses his bed spring or a fire-escape or even the frame of an umbrella for receiving radio messages. That is quite possible, but it does not mean that all you have to do to listen to stations in Europe is to open an umbrella, stick a pin in a piece of coal and hear all that is going on. Bed springs and small coils of wire have been used to pick up messages from abroad, but they have been used in conjunction with receiving apparatus of a highly developed nature, quite different from that commonly used for the reception of the broadcasting entertainments, so let us be reasonable.

THE ERECTION OF THE AERIAL

The aerial, or antenna of a receiving station plays a very important part in the results we are likely to obtain with a given type of receiving set. For this reason, it is well for those who contemplate taking advantage of radio receiving, to give the matter more than passing consideration. Unless you are willing to take your problems to a very responsible dealer and are willing to spend eventually a hundred dollars or more, it is well to forget all about the bed springs and the fire-escapes and the umbrella frames.

The distance over which a receiving set will function satisfactorily with a given receiver may be considered to increase as the effective height of the antenna increases. By "effective height" is meant the distance above any surrounding objects—not the height above the sea level. If an antenna is suspended between two 30-foot poles in the open country it is much more effective than an antenna of the same dimensions raised 10 or 12 feet above the roof of a 15- or 20-story apartment house. However, an antenna of the same dimensions, hung between two such appartment houses, with comparatively low buildings between, may be counted upon to perform better than either of the former two types.

It is obvious, from consideration of these facts that the most suitable antenna is one which is as high as conveniently possible and is isolated from everything else. Ordinarily, where it is desired to receive from the broadcasting stations, with the receiving sets of the less expensive variety, the antenna may be confined in form to a single wire, 100 to 150 feet long and 25 or 30 feet above the ground. Where this form of antenna is contemplated, it should be thoroughly insulated. There are many forms of antenna insulators on the market, most of which may be relied upon to give satisfaction. With a single wire, the end furthest away from the receiving instruments should be attached to an insulator and the other side of the insulator attached by a wire or rope to the pole or building which is to support the antenna. Where a building is used for this purpose, the position of the insulator should be at least 10 feet from the nearest point of the building. If a tree is used to support the antenna, the insulator should be placed at a point at least 10 feet outside the branches of the tree. The same thing is true of the part of the antenna which is to be carried into the house and is generally called the "lead-in" wire.

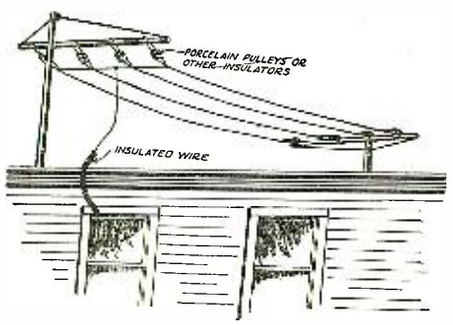
In bringing the lead-in wire into the room where the instruments are to be mounted, some form of lead-in insulator should be used. This is especially true if the lead-in wire is not heavily insulated. A very convenient and satisfactory form of lead-in insulator is found in a porcelain tube. The tube may either be passed through a hole drilled in the wall or the window frame and the lead-in wire is passed through the tube.

It is sometimes more convenient to use two shorter wires instead of a single long one. In this event two wires, 50 or 60 feet long and 3 to 4 feet apart will suffice. Almost any arrangement of the wires will give satisfaction, but the essential point to consider is that they must be as completely separated from neighboring objects as possible. Several convenient arrangements are pointed out in the accompanying illustrations.

A SIMPLE RECEIVING SET

Eventually, various methods for receiving over short and long distances shall be described and explained, but for the present, let us limit our considerations to a very simple receiving set. It is to be remembered, in connection with this receiving arrangement, that the parts which go to make it may be employed in conjunction with some of the more advanced and more satisfactory arrangements to be described at a later date.

The first consideration and the most difficult in making this set is what is commonly called a "single slide tuning coil." Definite measurements are given in the accompanying illustration, but they do not have to be followed very closely. For instance, where cardboard is mentioned, dry wood or some other non-metallic substance may be employed; instead of having the diameter of the tube two and one-half inches, it may be either two, three or even three and a half. The same logic applies to the number of turns and the size of the end pieces, though the given length of wire should be employed.



If Only a Short Aerial May be Erected, it May Consist of Four Wires as Shown Here.

To make the tuning coil, the following material is necessary: some form of round, non-metallic cylinder (either solid or hollow) of approximately the dimensions shown in the illustration (an empty cardboard container will suffice); two end-pieces (wood, hard rubber, bakelite or some other insulating material), of approximately the size indicated or a size which will be suitable when used with the cylinder decided upon; a piece of square brass rod, long enough to extend to the outside edges of the end-pieces (quarter inch square rod is most suitable, but other sizes may be used in a pinch); an inch of square tubing which will just slide over the square brass rod; a piece of sheet brass or phorphor bronze about a quarter of an inch wide and an inch and a half long; two binding posts or battery connectors (almost any kind will suffice), and about 200 feet of insulated wire. The wire may be enamelled single or double cotton or silk covered and may range in size from No. 18 to 24 B & S gauge; No. 22 B & S is preferable.

With this material it is but necessary to proceed according to the directions indicated in the illustration. It is sometimes more convenient to purchase a slider from an electrical supply house, especially where a soldering iron or a blow torch is not to be had. The cylinder should be coated with shellac before the wire is wound upon it and dried and one end of the wire is fastened to the binding post "A" on one end piece, while the other end of the wire is fastened directly to the cylinder or the other end piece and NOT to a binding post. It is generally found more convenient to wind the coil before attaching the end pieces.

After the coil has been wound and the end pieces have been attached, the slider rod should be measured drilled and put in place. Where it is not possible to drill the brass rod, the arrangement shown in the illustration may be used. Two strips of comparatively thin metal are used to clamp the slider rod to the end pieces by wood screws passing through both ends of the metal strips.

When the position the slider rod is to occupy has been decided upon and before it has been put in place permanently a sharp knife should be run along both sides of it in order to mark the winding; the cotton or silk covering between these markings should be removed from the top surface of the wire by fine sand paper or a fine file. Emery paper or emery cloth should not be used for this purpose. The reason for removing this portion of the insulation is to make some place where the slider will come in contact with the winding of the coil, in order to provide a ready means or including any desired number of turns.

The object of the tuning coil is to provide a simple means for bringing in desired signals at their greatest intensity and eliminating undesired signals. Every radio transmitting station operates on what is known as a "wave-length" and this term is to be explained later: the object of the tuning coil is to alter the wave-length of the receiving station in order that it may be of the same character as that of the transmitting station; this operation is called tuning. The method we are now considering is the simplest form of tuning known and it is not entirely satisfactory. Improvements, using the same tuning coil are to be described from time to time, as we progress.

In conjunction with the tuning coil, it is necessary to employ what is known as a detector. A very simple and inexpensive form of detector is made by placing a piece of galena or silicon in some form of holder and having a fine wire arranged so as to touch its surface. The construction of detectors is to be considered in the next installment of this series, but the type illustrated will suffice until then. Crystal detectors are not expensive and, where the prospective radioist is not in a position to secure the tools necessary for making one, it is recommended that he purchase one from some reputable store. Good ones are to be had from 50 cents upwards.

In order to hear radio signals, either speech, music or code, it is necessary for the radioist to provide himself with at least

(Continued on page 898)

MURDOCK

radio necessities

MURDOCK REAL RADIO RECEIVERS have delivered complete satisfaction, on a "money-back" basis for 14 years. Those years of experience have so simplified and perfected our production that there are today no receivers quite so good at so low a price.

The latest Murdock achievement, the No. 56 Receiver, is a highly sensitive instrument which retains all the rugged strength of previous types. Important features are, the improved comfortable headband, the "Murdock-Moulded" ear pieces shaped to exclude outside noise, and the moulding of all parts into one durable unit.

All models of Murdock receivers are sold with free trial offer and money back guarantee. Use them in direct comparison to any other phones for 14 days. Make any test you wish. Then at the end of the two weeks, if the Murdock Phones are not entirely satisfactory, return them and your money will be refunded!

Many of the complete "ready-to-operate" wireless sets now on the market include Murdock Phones as standard equipment. If the set you buy does not, be sure you get a set of Murdock receivers to complete your station. We strongly urge you to go to your dealer and convince yourself of the quality of Murdock receivers, by actual examination, before you buy. Prices $4.50 to $6.

Murdock Phones are the standard bearer for a complete line of "Made-by-Murdock" radio parts and instruments. This includes the famous Murdock condensers, couplers and variometers, and the new Murdock Rheostat at $1.00.

Buy Murdock Radio Apparatus
From Your Dealer

WM. J. MURDOCK CO.

How to Sell Ten Million Radio Outfits

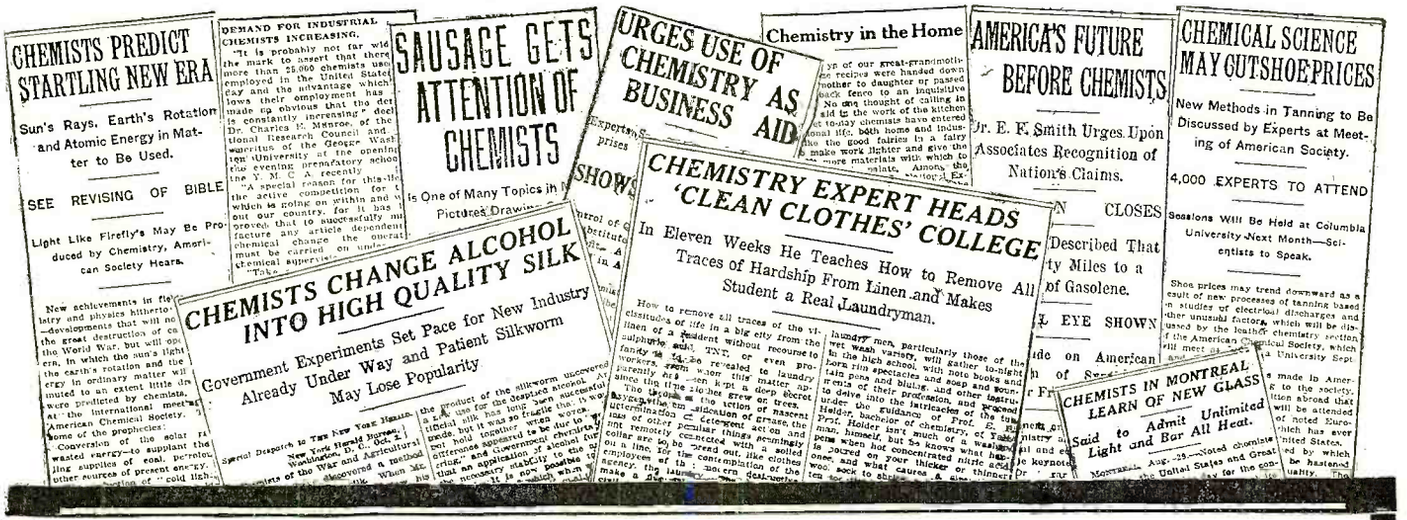
(Continued from page 817)

these "radio bugs" were, and why. The first man I approached, oddly enough, proved to be an advertising man, who had taken it up because of the promise its future held, and who had become so absorbed in it that he had, he confessed, "dipped into it on its own account until he had almost forgotten what his regular business was." He was trying to perfect some sort of ar. arrangement which would revolutionize commercial radio, and was up to his elbows in drawings which looked to me like a snarl of fishline, with sinkers dropped in here and there. My next victim was a youngster of twelve, whose eyes burned with the unquenchable fire of the zealot as he eyed the pieces of apparatus on the counter. His fingers, rough and chapped, fairly twitched to get hold of them, and once he got the ear of the obliging clerk he fairly exploded with questions until that worthy threw up his hands with a smile and told the boy to come back after five o'clock and he'd talk it over. For he was a bug, too.

Next came a well-dressed mining engineer, who was a slave to the lure of the radiophone, and who confided to me that he had left his partners engaged in a conference to "hear this new amplifier for himself." A prominent actor told me that he "had got Pittsburgh last night with an antenna strung up under his bed in his home in New Rochelle." It is safe to say that it had given him as much of a pleasurable kick as a big hand on his first night, too. Two middle-aged men, and their wives, approached the counter next, and for twenty minutes the men talked animatedly of audions and grid-leaks and step-ups, illustrating with pencil sketches on the wrappings of their packages until the wives adjourned their indignation meeting and bore them off. "And you talk," said one, "of the job you have to lead US past a millinery window!" There was no comeback.

Three young men entered, two of them brokers' clerks and the third a bond salesman. They were interested because of the jump the radiophone market quotations would give them over competitors, they said. They all operated their own receiving sets. A prosperous looking lawyer sauntered up to the counter, adjusted gold-rimmed spectacles and was about to look over a highly polished mahogany box with a great horn labeled "magnavox" rearing up over it. I asked him how and why he had become interested.

"Well," he said, with a smile, "you know every man is better off if he has a hobby, —something totally unrelated to the work which gives him his bread and butter. I started fooling with a little receiving set about four years ago, and today I'd hate to tell you what I've spent adding to it. There's always something new to this game—it's becoming as new and as timely as tomorrow morning's newspaper. More so, in fact, as I catch most of the news given out by the big broad-casting stations before the papers go to press, even. It's more than a novelty, however, it's going to be one of the greatest forces for education and entertainment that our day has even seen. Listen.—here's what I have heard during the last five evenings, in my own room, from seven to eleven p. m. (1) A concert by Sousa's Band, (2) Speech by Senator Lodge, in Washington, (3) Special news of the market and stock exchange, every night, (4) The opera 'Faust,' in Chicago, (5) News and Government weather forecast, (6) Short story



Chemists Are Badly Needed To-day In Every Branch of Industry

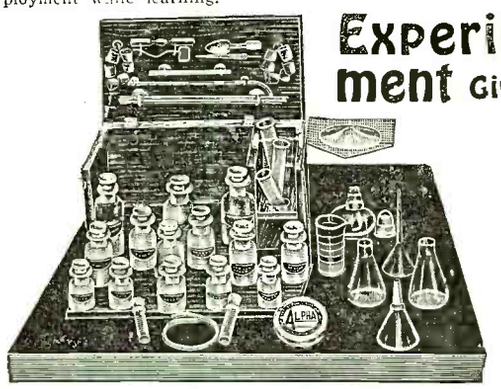
All industry to-day is three-fourths chemical. Every day brings new announcements of new ways in which chemistry is employed in business and industry. The sudden and almost unbelievable expansion of the chemical field in the United States has increased the need for trained men in our country. Industrial plants of all kinds pay tempting salaries to get good men—salaries of $10,000 to $12,000 a year are not unusual for those who have proven their abilities. If you want a profession that offers unlimited possibilities—if you are looking for more money—if you like fascinating work—take up chemistry. No other vocation offers such splendid opportunities for real money and rapid advancement. Chemistry is now recognized as the coming great science and the demand for trained men is increasing every month.

Learn Chemistry At Home

We will teach you Chemistry right in your own home, and in your spare time, in a practical and intensely interesting way. Our home study course written by Dr. T. O'Conor Sloane is practical, logical and remarkably simple. Endorsed by leading scientific and educational authorities. The entire course is illustrated by so many experiments that are performed right from the start that anyone, no matter how little education he may have, can learn and thoroughly master every lesson. Dr. Sloane teaches you in your own home with the same individual and painstaking care with which he has already taught thousands in the class room. And Dr. Sloane personally examines and corrects all examination papers, pointing out your mistakes and correcting them for you. His personal training will be of inestimable value to you in your future career. If you really want to learn Chemistry and will honestly apply yourself to our lessons, our course will give you just as thorough and just as complete an education in general chemistry as you would have received had you been able to attend College.

Easy Monthly Payments

You can pay in small monthly amounts as you go along. The price of our course is very low and includes everything, even the chemistry outfit—there are no extras to buy with our course. Our plan places a chemical education within the reach of everyone. No matter what your income is, you can meet our low terms, and you do not have to give up your present employment while learning.



Experimental Equipment Given Free To Every Student

We give to every student, absolutely free of charge, this chemical equipment including everything you need for the entire course with the exception of a few pieces of apparatus which we teach you how to make. You couldn't buy so complete an outfit anywhere for one cent less than $20.00. There are forty-two pieces of laboratory apparatus and supplies and eighteen different chemicals and reagents all enclosed in a fitted heavy wooden box with hinged front and cover. This hand-finished box serves not only as a case for the outfit but as a laboratory accessory for performing countless experiments.

Special 30 Day Offer

Besides furnishing the student with his Experimental Equipment as described above, we are making an additional special offer for a short while only. You owe it to yourself to find out about it. Write today for full information and free book "Opportunities for Chemists." Send the coupon right now while it is fresh in your mind. Or just write your name and address on a postal and mail it to us. But whatever you do, act today before this offer is withdrawn.

Chemical Institute of New York, Inc.

Home Extension Division **140-R LIBERTY STREET, NEW YORK CITY**

Dr. T. O'Conor Sloane Will Teach You.

Dr. Sloane, Educational Director of the Chemical Institute of New York, is one of this country's foremost authorities on chemistry. He was formerly Treasurer of the American Chemical Society and is a practical chemist with many well-known achievements to his credit. Not only has Dr. Sloane taught chemistry for years, but he was for a long while engaged in commercial chemistry work.

Many people would pay big money to have Dr. Sloane teach them chemistry. You can secure his services and personal training without one cent of extra expense by enrolling with the Chemical Institute of New York.

CHEMICAL INSTITUTE OF NEW YORK
Home Extension Division,
140—R Liberty St., New York City.

Please send me at once without any obligation on my part, your free Book "Opportunities for Chemists," and full particulars about the Experimental Equipment given free to every student. Also please tell me about your plan of payment and your special 30 day offer.

NAME .....

ADDRESS .....

CITY .....

STATE .....

R. N., March, '22.

reading by Edna Ferber, (7) Concert by a leading Broadway light opera star, (8) An informing talk on insurance by the president of a large company in Pittsbugh, (9) Crop forecasts, and (10) a cracking good sermon by a nationally known preacher. Time pretty well spent, eh? Like hiring all of these people to come and speak and sing in your own home. Maybe you could afford it, but I know I couldn't!"

As he ran on, I began to generate a little heat myself to the idea. If a moderate priced wireless telephone could put up into close daily touch with the great world of thought and action in this fashion, why shouldn't nine men out of ten be interested in it? I asked him. "That's easy," he replied. "The progress of radio telephony has been so extraordinary during even the past few weeks that the news of it hasn't gotten around yet. Men not actually in touch with its development are, almost without exception, ignorant of its practical workings as applied to them. They think of radio in terms of dots and dashes, requiring translation, instead of the actual words and sounds as heard over the ordinary telephone." He went on to explain how you "listened in," with your receiver at your ear, to whatever sounds were sent out by the transmitter to which your receiver was attuned. The addition of an amplifiier, such as a phonograph horn, would reproduce audibly and magnify the spoken message, song, music, or other sound, so that a whole roomful of people could hear it, from a hundred or a thousand miles away, or even a greater distance. By this time I wanted to hear some of this for myself. It sounded good. He directed me to a large store where they had a good receiving set hooked up.

"But don't you start unless you've made up your mind," was his parting shot. "It gets into your blood, and, believe me, it's so all-fired interesting that a perfectly normal loving father is apt to find his children's shoe money irresistibly swept into tubes and condensers!"

I "listened in" and it proved a revelation. Once the head-phones were adjusted I might have been completely off of this whirling sphere, for all of the mental connection I had with it. It was as though you were sitting up on top of the globe, in a world made up solely of sound. First a few clicks, then a steady humming, like a distant hive of enormous bees, then, with startling and sudden distinctness, a man's voice saying, "Baltimore, Maryland," in my ear. I jumped, and the operator threw back his head and laughed. "He won't hurt you," he assured me, "he's a long way off." We revolved one of the black rubber knobs on the face of the box, and the strains of Schubert's "Song of Love," exquisitely played by some fairy violinist in this invisible world, flowed in to us as sweetly and distinctly as ever I heard it in an auditorium with the virtuoso standing before the footlights. This was followed by an outline of the minute's news (almost before it happened!, and a couple of fox-trots by some etheral jazz band. The operator plucked my sleeve, and removed my 'head-piece. 'We staged a wireless dance upstate last summer," he laughed, "with the orchestra down here in the city. Went over great, too. The only trouble was that the players couldn't hear our applause, and after one encore had been played a negro voice would announce, 'Dat'll be all fo' dis one, folks!'"

It was late that night before I reached home, but I had learned a lot. It had all the fascination of listening in on the mysterious conversation of two men in the train seat just ahead of you, with infinitely more profit—and no chance of getting your nose punched. It gave me that warm feeling, so gratifying to every small human soul, of "hearing something first," and be-

Get This All-Rubber Willard Radio Battery

All the features of the automobile starting and lighting battery applicable to radio work have been retained.

This battery which has been developed especially to meet the requirements of radio work, is made in a range of sizes to fill all needs.

You can't have the quiet operation of your set you are entitled to unless your battery is proof against leaks both from cell to cell and from cells to ground.

The Willard All-Rubber Radio Battery is made so that there is no possible opportunity for leakage. The case is a single solid piece of rubber formed under heavy pressure. It is tested with wireless transformers at 24,000 volts, and every case has to withstand that voltage before leaving the factory.

The Threaded Rubber Insulation between the plates is the same as that in the Willard Threaded Rubber Battery, now in such wide use on motor cars, and for which the builders of 191 makes of cars and trucks pay an additional price.

Ask the nearest Willard Battery Station for details, or write us direct.

Willard Storage Battery Company, Cleveland, Ohio

Made in Canada by the
Willard Storage Battery Company of Canada, Limited, Toronto, Ontario

Willard THREADED RUBBER BATTERY

ing able to yawn comfortably in my friend's face when he rushed up next morning with the paper, and to say, "Oh, yes, I got that last night, while it was going on, or just afterward." And it lent a pleasant satisfaction as "being in on" a great and most remarkable invention, still in its childhood, but destined to rival the telephone at a not far distant date.

So much for its appeal to the constantly increasing number of radio enthusiasts—they have arrived. What we are concerned with is the placing of it before the John Smiths and the Bill Browns in such a personal and interesting manner that they'll begin, one by one, to think, "Now, that's something that I'd like to get in on. That's too good to pass up. Wonder how much it is, anyway." While the gospel is being faithfully and earnestly preached by the present converts, the story of radio's attractions cannot depend, obviously, on this good but slow method of advertising for the immediate and universal boom which it deserves. The present advertising is practically confined to technical radio publications and dry as dust to John Smith and Bill Brown. They don't understand it; the cuts are of apparatus and the text bare outlines sketching its selling points. They might, and undoubtedly do, sell the man who knows all about such dinguses, but they leave John and Bill as cold as a pawnbroker's eye. I venture to state that they even appall the layman and exaggerate his fears as to the complexity of radio. I know they affect me that way, and I have just seen how relatively simple it is to operate a set, too. They talk a different language, and to too restricted a field.

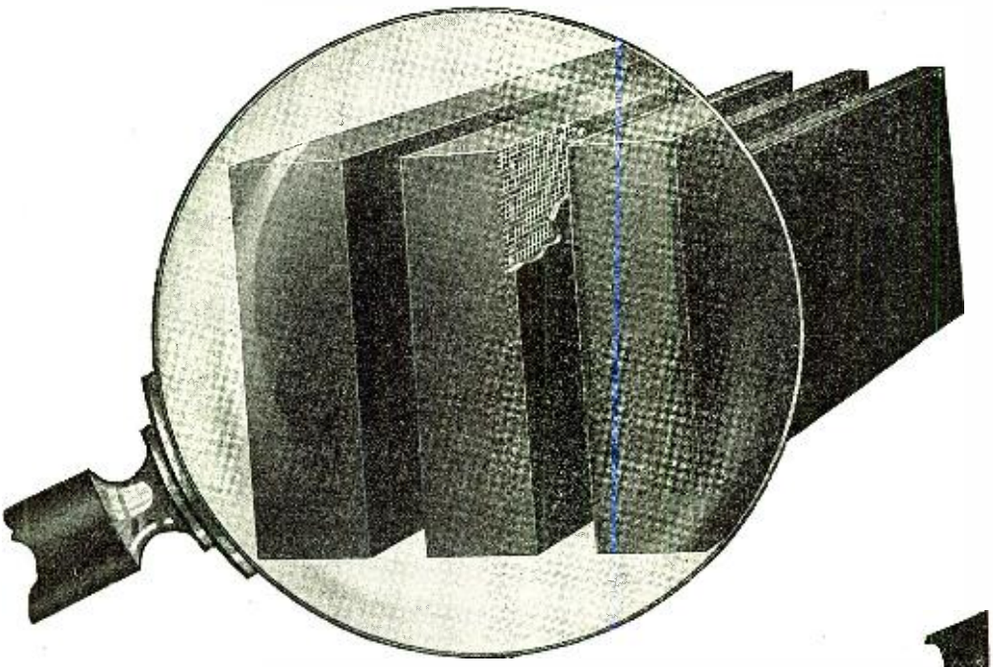
Radio demonstrations are doing much to familiarize it with men to whom it has always been one of the black arts. Recently a bankers' convention was held in New York City. Leaders in every field of business spoke on topics of immediate and vital interest. But the first thing which two of the bankers mentioned to me next day was the roar of the breakers on the Pacific Coast and the playing of a band in San Diego, Cal., made clearly and marvellously audible in the banquet hall by the genius of the wireless telephone. That was good advertising.

The well-known broad-casting of President Harding's Armistice Day Speech was another instance of actual "show-how" publicity of the most effective sort. It gave more people an idea of the possibilities of radio, as a factor in their everyday affairs, than they could sqeeze out of the advertising columns of the radio magazines in the pats twelve months.

Conventions and gatherings of representatives are excellent soil for the planting of publicity seeds which will grow and yield rich returns under the warmth and ever widening favor of good will there engendered. State fairs might be used, featuring an address by a high government official, music by the famous Marine Band, or a short concert by a well-known opera star.

Every opportunity for demonstrating should be seized by the manufacturer and dealer. The latter should be offered every encouragement to keep a receiving set in a prominent part of his store, on the job all the time. Once you get a man's hand on the tuner, once he begins to hear the first faint buzz swell suddenly into a burst of music from out of the apparently empty ether, and he is yours! Give him every chance. Most of us are willing to be sold if you can show us something that will make us healthy, wealthy, happy or wise.

Is not general advertising the one force which can educate the layman and make him see that radio will fill a definite need in his life? But it must be a right-about-face from most of the radio advertising which has appeared to date. It would be



panels

Three distinct and exclusive types

CHOOSE the panel best suited to your needs and made to your own individual specifications. Any size or shape you desire—any quantities, one to a thousand—engraved or plain—polished or dull mat surface—plain blank or fully machined and ready for mounting. Diamond F Radio Panel Service gives you the choice of three distinct types of panels, each a leader in its field.

CONDENSITE CELORON

Grade 10 is the highest type radio insulation made. Extremely high in surface and volume resistivity, high in dielectric strength and low in dielectric losses. It is handsome in appearance, extremely water resistant, machines easily, and will give long lasting satisfactory service.

CELORON FIBRE-VENEER

(patent applied for) is made of a hard fibre core veneered on both sides with Condensite Celoron Grade 10. It meets the demand for quality plus low cost. We recommend it for use in receiving sets and other apparatus where very high voltages at radio frequencies are not involved It has the same fine surface as grade 10 and similar machining and engraving qualities.

CELORON SHIELDED PLATES

(patent applied for) are made with a concealed copper wire mesh imbedded directly under the back surface of the plate. This wire shield, when properly grounded, very effectively neutralizes all detuning effect and "howl" caused by body capacities. Made in both Grade 10 and Celoron Fibre Veneer.

Send for our Radio Panel Guide

Write today for our special "Radio Panel Guide," giving complete details regarding all Celoron Radio Panels. This guide quotes prices and enables you to determine just how much any type of Celoron panel will cost in either standard or special size—plain or fully machined, and engraved to your own specifications. Don't fail to get your copy of this important Guide by return mail. Write us immediately. Dealers: Our Radio Panel Service enables you to sell panels completely machined and finished to the buyer's specifications. Write for our Special Dealers Proposition.

DIAMOND STATE FIBRE COMPANY

BRIDGEPORT (near Philadelphia) PENNA.

Branch Factory and Warehouse, Chicago

Offices in Principal Cities

In Canada: Diamond State Fibre Co. of Canada, Ltd., Toronto

simple, both in phraseology and illustration, and would show him, not what the inside of the apparatus looks like, but what it will do for HIM. In this connection, I feel sure that if the manufacturer could cover up more of the knobs and dials and posts, and work along the line of simplifying the present ominous exterior, it would go far to break down sales resistance. Knowing nothing of the technical end of the business, this may be impractical, but it would most certainly be of far-reaching effect in the favorable approach of John Smith.

How shall we reach him? Obviously, we cannot leave the entire burden on the radio magazines. He must come across our story in the magazines and newspapers which are a definite part of his daily life. Radio could show John Smith that it could do something for him. It could induce the mood to "Well, let's just look at her, anyway," when you or your dealer made that possible.

What form would it take? Would it not be well to inquire into the methods which shrewd advertisers of phonographs have employed to sell more than 4,000,000 in the last three years?

Does he show his machinery, cross-sections of his cabinet, and hope to halt the skipping progress of the man who thumbs through the advertising pages by a fetching cut of his scratch-proof sound-box? Not on your life. He shows 'em pictures of favorite opera stars in their magnificent costumes, singing. He brings black-face Al Jolson, Ted Lewis and his jazz band, John McCormack, John Philip Sousa, and the vaudeville head-liners right into life before you on the page, and sells you, not phonographs, but music. And we will be able to do that, and go them one better, for we can bring them their music in their homes without the expense which the purchase of records entails. And news, red-hot!

Would we not be able to offer every variety of musical entertainment, with the co-operation of the manufacturers, and schedule definite programs in advance? Much has already been done along this line. Could incidents of real human interest which radio has brought out—not spectacular "stunt" advertising—fail to interest John Smtih? Actual daily happenings emphasizing the simplicity and the thrill of it, the comparatively small expense and the "whole family" appeal which this marvelous little box can make a reality for him?

There is apparently no limit to the future of radio.

And by future I do not mean years and years from now, but the immediate future. With such tremendous strides as it has made in the past year alone, may we not look with something more than reasonable assurance for some of the following developments?

A wireless telephony service in railroad stations, large and small, to help pass the tedious waits between trains. Could not the amplifier, which is even now used to announce arrivals and departures of trains, be utilized with radio to produce music, news and entertainment for the waiting throngs in the station "Radio Room"?

On shipboard, with the radio sufficiently amplified, could not the passengers' connection with the outside world be made more real and alive than by means of the occasional bulletins now issued?

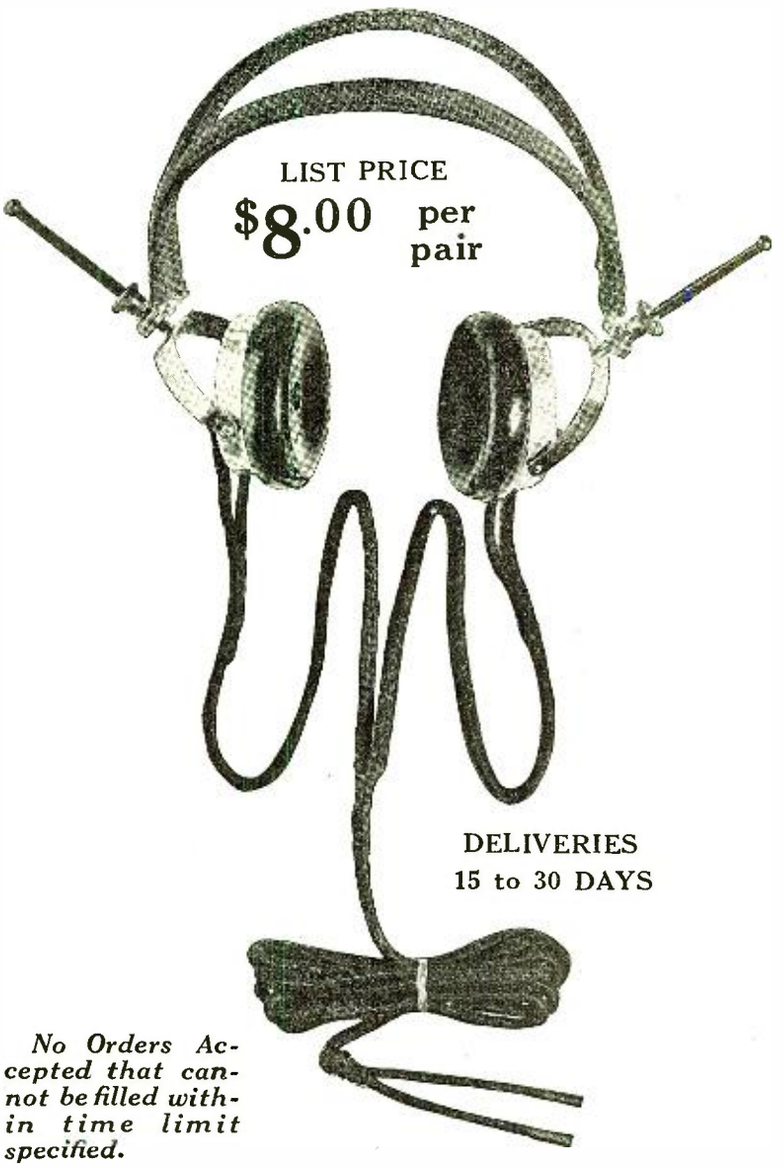
How about adapting the radiophone to make profitable use of the hundreds of hours we annually waste on subway and "L" platforms?

Today's pace in living exacts a higher toll on the energy and nerve force of the individual than ever before—we MUST keep abreast of the times, or a little ahead, and every mechanical help which works

DREYFUSS PHONES

CONCERT TYPE

NOW READY FOR DELIVERY



No Orders Accepted that cannot be filled within time limit specified.

Distributors—Dealers

Be sure to visit

BOOTHS 26 & 27

at the Radio Convention (March 7 to 11) at Pennsylvania Hotel and see the

DREYFUSS PHONES ON DISPLAY

These are 2000 ohms, have aluminum backs and rubber caps, and are considered the ***best phones for Radio telephony work.***

Designed by Telephony Engineers of over 18 years experience.

$8.00 per pair, list price

Distributors will find it to their advantage to see us early for open territories.

P. M. DREYFUSS CO., INC.

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for conservation of our resources is not only welcome, but necessary.

Chicago is equipping its policemen with receiving apparatus, the aerials woven into the coat fabric, the "box" so small and so simple that it can be carried in the pocket and operated with one hand. Does this not suggest possibilities for similar practical use by other municipal bodies than the Police Department?

In our State Capitols, as in Washington, matters of the utmost concern to every citizen are being proposed and debated. Officials, from the President and State Governors down, are making speeches which we ought to hear. Is this not Opportunity?

Hundreds of thousands of business people commute to and from their work in our large cities every working day. The motion of the train and the often unsatisfactory lighting go far to produce the eye-strain which our habit of "read-while-you-ride" has rendered national. If the radio telephone were installed in these cars, and the day's news given out briefly, crisply and distinctly, would not such an innovation pay a manufacturer, as well as contribute mightily to our national health?

In these days of congestion and overcrowding of our public schools, with as great a dearth of teachers as of seating-space, is there not a golden opportunity for the broadcast instruction and dissemination of knowledge by radiophone? We think there is, if there be men of sufficient vision to see it, and the courage to make the most of it.

All of these particular projects may not be feasible, just as there are, doubtless, dozens of others which are useful and workable. But the fact remains that radio has already demonstrated its right to a front seat in the theatre of our life, and it proves this right almost by the hour, with its continual revelation of new powers for good. Its merit is established—all that remains is to popularize it as it deserves. The greatest force in the world is need for this; intelligent, far-sighted advertising.

An Efficient Remote Control System

(*Continued from page 819*)

This safety feature may be used in various ways. For example, if the relay key should stick, which it never has in our case, holding down Key A, Fig. 1, will shut off the entire set, thus preventing a trip from the receiving station to the transmitter. Also if any of the control line wires should become shorted through accident, the magnet E would operate, allowing the weight P to descend and again shut off the entire set.

Fig. 4 illustrates the magnetic relay key used. A regular Boston hand key was used in constructing this, and an armature was mounted directly below the knob. The magnets were made by cutting a common telephone induction coil in two parts, removing the windings and rewinding them full with No. 24 enamel wire. The core is ½" in diameter and both magnets are 2" long, and 1¼" in diameter when completed. This key has given excellent results, handling easily 30 words a minute, and has never given any trouble from sticking due to use of a strong spring tension.

Both the escapement switch magnets and the relay key magnets are operated on 110 volts direct current. R^1, Fig. 1 allows about five amperes to flow through the magnets E, giving them an abundance of power and a snappy action. R^2, Fig. 1 is two 100 watt lamps connected in parallel. Where direct current is

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No. 2 Switch, same as above except all brass finish	.55
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CP-1 Contact Points with machine screw, per doz.	.20
CP-4 Contact Points with nut (brass), per doz.	.35
CP-5 Contact Points with nut (nickel plated), per doz.	.40
SS-18 Switch Stops, each	.05
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Large size (with 7 taps)	2.65

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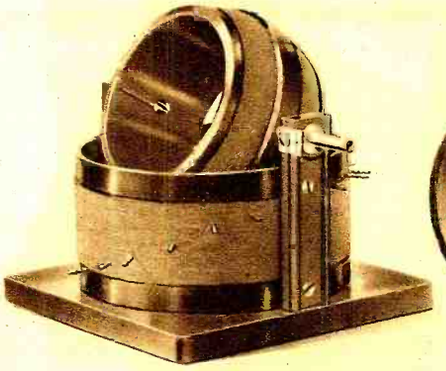
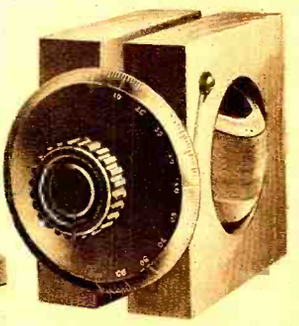
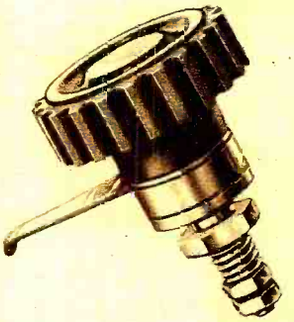


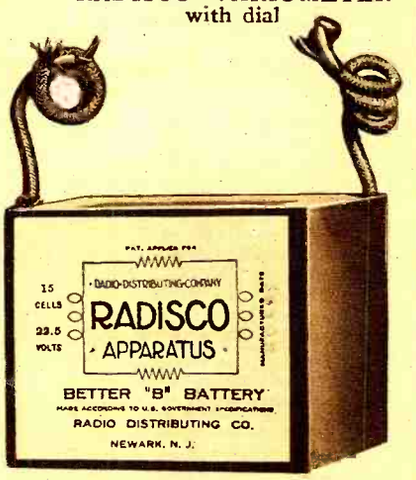
RADISCO COUPLER
without dial



RADISCO VARIOMETER
with dial



No. 3 SWITCH
LEVER



RADISCO BETTER "B"
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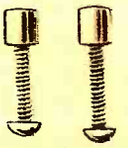
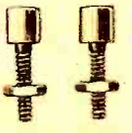


CONTACT
POINTS No. 1

BINDING
POST No. 2

BINDING
POST No. 3

CONTACT
POINTS No. 4



CONTACT
POINTS No. 5

SWITCH
STOPS

RADISCO

"Your Assurance of Satisfactory Performance"

not available to the amateur for operation of the control, we believe that alternating current, rectified through electrolytic jars will give the same excellent results and be just as efficient.

It will perhaps occur to the mind of the reader that a positive escapement arrangement on the main switch would be better that the escapement arrangement we have provided. This occurred to our minds, but was discarded because of the larger factor of safety obtainable with the escapement finally decided on, in that an accident happening to the line will automatically shut the set off under the present arrangement. Key B at the control station may be the ordinary telegraph key or a bug, as there is no arching at this point while operating the transmitter. Key A, which handles a heavier current should be built with carbon contacts, and should have a larger gap adjustment than Key B. Light M should be 10 watts or even less if available, and is merely used as an indicator to show position of the rotor on escapement switch. The wire used in running the control line was 14 gauge galvanized iron, and this was fastened to poles and trees by small porcelain insulators, making a very economical installation. The entire control apparatus was mounted on a panel, which was placed in the transmitting station, and greatly helped the appearance of this apparatus.

The control described in this article has actually been built, and during the four months it has been in operation, has given the greatest satisfaction. We will be glad to answer any letters concerning the construction of this set, and will help any amateurs desiring to construct such a control.

Note on Oscillations of a two element valve

(*Continued from page* 815)

the sum of the e.m.f.'s in circuits I and II, we have

Circuit I—

$$\Sigma\epsilon = o = R_p\,(i + i_1) + L\frac{di}{dt} + Ri \qquad (1)$$

Circuit II—

$$\Sigma\epsilon = o = Ri + L\frac{dt}{di}\frac{di}{dt} - \frac{C}{1}\int i_1\,dt \qquad (2)$$

Solving for i_1 in equation (1) and substituting its value in equation (2) we get

$$\frac{d^2i}{dt^2} + \left(\frac{R}{L} + \frac{1}{CR_p}\right)\frac{di}{dt} + \frac{i}{LC}\left(1 + \frac{R}{R_p}\right) = o$$

The condition for oscillations is that the coefficient of $\frac{di}{dt}$ be equal to zero. Setting $\frac{R}{L} + \frac{1}{CR_p}$ equal to zero and solving for R_p we get

$$R_p = -\frac{L}{CR}$$

That is, the resistance of the two element valve must be negative in order that oscillations be generated. In other words, the characteristic must be a falling one, and since no well evacuated tube gives a falling characteristic, it will not oscillate. A tube with gas does give a falling characteristic over a certain range of voltages and it will oscillate in this range of the curve.

Radio Transmitters Amateurs Have Overlooked

(*Continued from page 807*)

ductance which when substituted in the common decrement formula would yield a legal decrement. This apparently is not so, however. No technical explanation of the phenomenon has been advanced by the engineers of the Independent Wireless Telegraph Company or by others. To study the actual oscillations that take place in the radiating circuit of this type of transmitter requires the use of an oscillograph which is a rather delicate instrument not always available.

A diagram of the Shoemaker "B-1" transmitting circuit is shown in Fig. 5. As will be seen, the circuit is extremely simple and the connection of the apparatus requires no explanation. The wave-length can be readily changed by altering the value of inductance at the single coil in the circuit. With the large antennae used in commercial practice it is necessary to insert a short-wave condenser in the radiating circuit when it is desired to transmit a 300-meter wave-length.

Offhand, it may be that the relation of the stationary electrodes to the periphery of the revolving disc of the gap acts as an effective capacitance immediately after each spark discharge. This capacitance then takes the place of a small condenser in series with the antenna and ground and permits the circuit to oscillate freely until the next spark discharge occurs. This view, however, is attended with some difficulties though it is partly strengthened by the fact that the system operates best when the distance between the stationary and moving electrodes is great. This is in contradistinction to the adjustment necessary in other types of transmitters employing synchronous rotary gaps and tends to indicate that the spark must be of extremely short duration. That is, the quenching must be rapid enough to permit the system to oscillate freely and with as little conversion of the energy into heat and light as possible. There is another and more technical explanation of the possible operation of this transmitter, in which the potential and current distribution of the antenna systems are taken into account. It is not to be discussed at this time because of space limitation, but may form the subject of some future article.

Fig. 6 shows the commercial construction of the Shoemaker "B-1" transmitter. All low voltage accessories are mounted on the front of the panel, whereas the high frequency apparatus is mounted at the back of the panel. At the lower right hand side the rotary gap and synchronizing control are plainly visible. The rotor of the gap may be mounted directly on the shaft of the motor-generator, as shown, or it may be driven by a small synchronous motor.

Although other types of transmitters exist which have served the commercial interestes well and which should rightfully be included under the heading given this article, enough has been said to drive home the fact that there is a field for experimentation which the radio amateur has entirely ignored. Many will now look forward to the publication of empirical data that may be gathered by progressive amateurs working along this line of thought, and it is hoped it will not be long forthcoming. A 200-METER IMPACT-EXCITATION TRANSMITTER—*who will be the first to develop it?* Or, SIMPLICITY PLUS IN TRANSMITTERS *by* ....? Sign on the dotted line.

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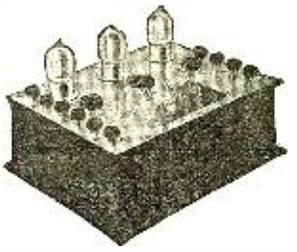
MAGNAVOX NEW POWER AMPLIFIER



The New MAGNAVOX Power Amplifier is designed for use with transmitter tubes and high plate voltages to furnish amplifying power for the Radio MAGNAVOX where great sound intensity and large volume are required. It also minimizes the possibility of distortion. Solid mahogany case, sits either flat or on edge. Simply throw the switches to operate. Two-stage and three-stage types. Ask your dealer for prices and particulars.

There is NO substitute for the Radio MAGNAVOX

The Development of the Transmitter

(*Continued from page* 816)

mate trouble from "packing" and permit the use of a much higher modulation voltage than would otherwise be necessary. It is even possible that the modulation transformer might be done away with. The writer has experimented with the condenser-microphone and has found that it has vastly more superior modulation qualities than any existing form of microphone. There is no carbon or other weighty button to hamper the free movement of the diaphragm and the same may be so designed as to be practically of no natural period within the most used ranges of audibility. It may be designed to handle almost any voltage or may be operated from a few standard plate batteries in series. The progressive amateur is urged to make full use of the wonderful possibilities of this device and it is my belief that his efforts will be amply rewarded.

As to the construction, it may follow, more or less, along these lines: Use a rear conducting surface made of a solid brass plate over which a very thin disc of mica is fastened, the thickness depending on the voltage it is intended to use. Separated from this by a felt damping ring is a thin brass diaphragm. Arrangements may be made so that the distance between the two conducting surfaces may be varied mechanically in order that different capacity values may be tried. With this much of a base whereon to stand, the experimenter is in a fair way to try the results in various modulation circuits. Bearing in mind that the source of modulation causes more trouble than any one thing about a radiophone circuit, the experimenter might well use a little of his time for the study of the various applications of the devices used. He will find that telephone engineers are very well versed on this subject and most of them have data at hand that cannot be obtained elsewhere.

A Method of Recording Wireless Signals by Means of a Morse Inker

(*Continued from page* 813)

connected across the secondaries of transformers carrying the wireless signals, rectified by the single-valve circuit shown. A condenser of .002 mfd. is in "shunt" with the primaries of their transformers in order to permit the oscillations passing freely, which otherwise would tend to be "choked" if passed directly through the windings.

Now the fluctuations in the potentials of the grids of the triodes A and B cause an increase in the currents flowing in the anodes circuits, which is equivalent to a decrease in the effective resistance of these triodes. The balance of the bridge is, therefore, upset and a current flows through and operates the relay, which takes the place of the bridge galvanometer. In the other two limbs of the bridge resistances are inserted of values equivalent to those of the triodes. The inker is, naturally, connected in series with a battery and the contacts of the relay.

The valves shown in Fig. 2 for condensers and resistances will serve as a guide in connecting-up such a system, but obviously they can only be approximate and must be amended to suit the types of triodes used and the transformer windings.

The special feature of this circuit is that a current will only pass through the relay circuit when signals are being received. so that there is no permanent current through

the relay, as would be the case if connected directly in the anode circuits. In this manner it consequently follows that the relay can be set to a most sensitive adjustment and so made to operate on reasonably weak signals.—*Abstracted from The Model Engineer and Electrician.*

A Radio System for Simultaneous Sending and Receiving

(*Continued from page* 813)

impedance to currents of all other wave-lengths.

In order to receive a signal the antenna circuit is tuned to the wave-length of that signal by the primary condenser. The secondary circuit is adjusted in the usual way.

DETAILS OF THE TRAP CIRCUIT

The trap circuit is extremely simple and consists of a variable air condenser and a small inductance. Fig. 5 gives the details of the condenser and coil.

It is hoped that the amateur can make use of this system to improve the ever increasing efficiency of amateur radio. With this arrangement it is possible for one to send a message from station A to station B at the same time a message is being sent by operator No. 2 at station B to operator No. 2 at station A. For radio telephony it eliminates the necessity of pushing a button or throwing a switch to talk and allows two to converse by radio in just the same manner as they would by telephone.

A German Trench Radio Set

(*Continued from page* 805)

(Empfangen); 3. Receive with Load Inductance (Empfangen mit Zwischenkreis); 4. Prufen (Test). The last position is to adjust the crystal detector using the buzzer. but not emitting energy from the antenna. The lower left-hand control is the Variometer Tuning device (Abstimmung). The right-hand lower control is the Receiver Coupling (Kopplung) for receiving with and without Loading Inductance (mit Zwischenkreis, Ohne Zwischenkreis). At the right-hand end can be seen the sending key, jacks for the storage battery leads and jacks for the telephones and the detector adjusting control.

Now considering the receiver, the transmitting variometer is also used to tune the primary of the receiver circuit. The transmitting inductance is also used as the primary of the receiving coupler. The secondary of the receiver is rotated within the transmitting inductance. The receiver secondary is aperiodic and used in connection with a sensitive crystal detector. The stopping condenser is of unusual construction, consisting of two fine enameled copper wires wound side by side on a spool, the enamel covering of the copper being the dielectric. This receiver is capable of efficient reception on 190 and 210 meters and for receiving from a different headquarter on a different wave-length, a load coil is connected in series with the antenna circuit.

Referring to Fig. 2, the control switch is shown. This unit is of the cam type, having silver contacts and positive action. All the necessary connections are automatically made for the four positions.

In back of this switch can be seen the jack for the detector and in, directly back of that, the switch for changing the transmitting wave-length. The special buzzer is in the center and the construction of the spark gap is also clearly shown. A piece of mica is supported over the spark gap to prevent rain from short circuiting it, in the

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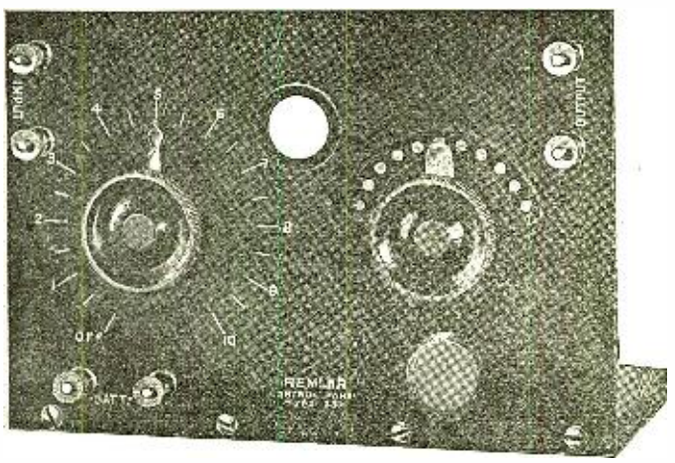

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event that the cover has to be opened to change wave-lengths.

In Fig. 3 the same items are shown on the top shelf, and in the right-hand corner will be seen the special wire wound stopping condenser previously described. On the lower shelf from left to right, the variometer, external reactance, mica condenser, inductance and key resistance are shown in order. The buzzer armature also has a high resistance winding and current runs through this armature when the control switch is in the sending position, through the key resistance. This keeps the contacts moving regularly and when the key is pressed, allowing the main current to flow, the possibility of the contacts sticking, is small. The same items are shown in the rear view, Fig. 4.

For actual operation, it was only necessary to erect the antenna between two sticks and connect to the set. The ground was in form of a counterpoise, an insulated wire 25' long, run under the antenna. Then the battery and phones are plugged in and everything is ready. The operator then simply changes to either receive or send position with the control switch, in both cases tuning with the variometer.

The instrument shown was manufactured by a company in Berlin. Some actual tests were made with one of these instruments in Washington in the summer of 1918. Two complete stations were used, the second one being an exact duplicate of the German instrument as manufactured by the Marconi company. Mr. Paul F. Godley was at one instrument and Mr. John Miller and the writer at the other instrument. No difficulty was experienced in maintaining constant two-way communications over a distance of 8.3 miles of thickly wooded and hilly country. The antenna in each case was 25' long and approximately 20' high. The counterpoise was an insulated wire 25' long laid under the antenna. It was found by experiment that by pointing the two antennae toward each other and having the counterpoise pointing away from the antenna 180 degrees, the antenna current was reduced, but the signal audibility increased in each case. This was due to the fact that the energy was concentrated and propagated in the desired direction, rather than equally distributed over an entire circle. The antenna current averaged .8 of an ampere with an input of approximately 50 watts. Incidentally, while making the receiving tests in addition to hearing each other, both receivers also picked up a radiophone from the Bureau of Standards laboratory, ships at sea and the Arlington station, demonstrating that the receiver was truly aperiodic.

A similar equipment is also manufactured having an input of 200 watts. In this case the buzzer steps the 12 volts up to 250 volts and the current is then stepped up through a power transformer to 10,000 volts. The construction is very similar, only heavier, and instead of a storage battery supply the power is provided by a generator mounted on a bicycle and driven by foot power.

Portable Sets prove most useful during Army Manoeuvres

(*Continued from page* 805)

performance.

Communication was established and maintained between the marching Marines and the radio station at Quantico, Virginia, by use of the portable wireless equipment described in the photograph reproduced with this article. Radio apparatus installed in aeroplanes functioned without a hitch and no difficulty was experienced in maintaining communication with stations on the ground. The execution of Infantry experiments

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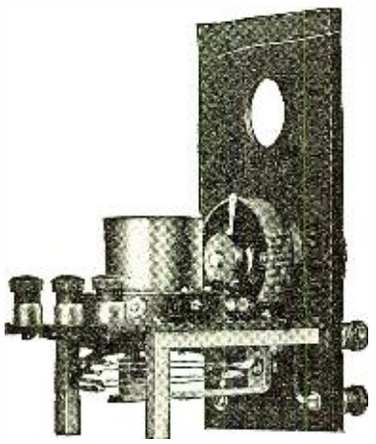

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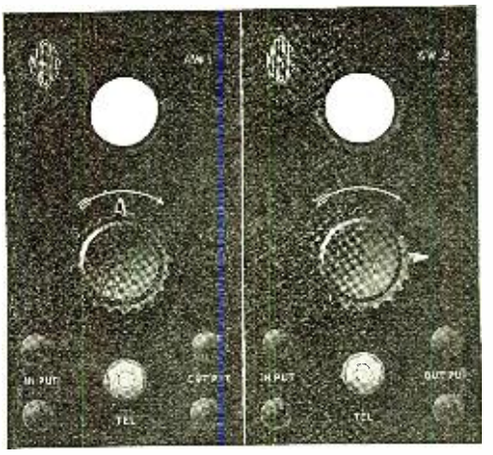
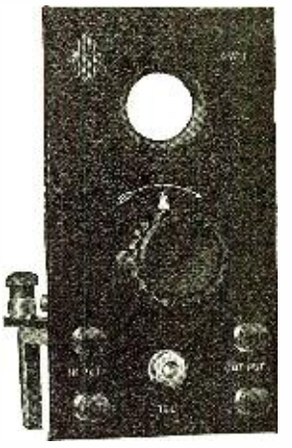
These new Detector panels are in keeping with our standard of "Quality Always." They incorporate the latest developments in instruments of their kind and have that distinctive touch characteristic of Marshall-Gerken products. These units match perfectly with our amplifiers and together they make a wonderful combination.

Type A.W. 1-0 In individual cartons, each $11.50. Equipped with Standard Federal Jack.



Detector-Amplifier Combination



Detector—Front View Amplifier

The Amplifier units, made to match with the new detector panels are identical in their design and construction with the addition of an amplifying transformer that has been built to our own specification. The use of one of these amplifying units produces very noticeable increase in volume. Two of these units are sufficient to use with any loud speakers.

Amplifier—In individual cartons, each $15.50. Equipped with Standard Federal Jack.

To these units can be added additional single stages of amplification until the desired volume is obtained. To add these additional stages of amplification, it is only necessary to connect the "in put" binding post of the added unit to the "out put" binding post of the last unit employed. This combination of detector and amplifiers can be placed in a cabinet to match the receiver.

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Manufacturers and Jobbers

Toledo, Ohio

called for a manoeuvre in which the Third and Fourth Brigade captured and established an advance base on Wilderness Beach. This organization supported the landing and aided in the seizure of the general line, known as Wilderness Tavern—Payne—Hailey—Tanner. An artillery air-going machine, equipped with radio apparatus, assisted the artillery forces in fire control. An observation airplane, also carrying wireless equipment, negotiated a search of all lines of approach accessible to the make-believe enemy, their observations being reported to the command post, the Fourth Brigade. A contact aircraft unit, flying over the lines of mock warfare, informed the expeditionary force headquarters of the progress of the attack. The warfare fronts, whenever changes took place, were sketched in forms of maps and dropped from the air at headquarters.

The study of Infantry problems in human conflict, when radio telephony and radio telegraphy are put into service, was approached from another angle in the Wilderness Run manoeuvres. The First Battalion, Fifth Regiment, made an assault on Payne's Ridge, conducting an assimilated bombing raid on the enemy ammunition dump at Dempsey, and also assisted in the advance. A command aeroplane flying over the line of moving infantry reported the progress of the attack to the battalion headquarters. An observation flying machine hovered over the make-believe enemy lines and dropped bombs on their fronts to show the hostile positions. An artillery airplane assisted in the control of artillery fire by the use of radio equipment in spotting. The decks of a battleship and an airplane carrier had been marked on the ground and were employed during the manoeuvres as a mount for the anti-aircraft guns and landing field, respectively.

A Sea-plane High Power Bulb Transmitter

(Continued from page 804)

receive switch. A little to the left of these switches are the antenna inductance controls, the 600-meter control at the top, and the 1,600-meter one at the bottom of the set. To the right, on the other side of the wave-change and antenna switches will be found another pair of controls, small knobs sliding in curved slots. These controls vary the plate-grid coupling of the set. Finally at the left of the panel near the top will be found the antenna lead-in. Near the bottom will be seen the Century buzzer used for tone transmission. Below this at the extreme left are the microphone plug and jack, and right next to them the three point signal switch, for connecting either for straight C.W., buzzer modulated telegraphy or speech.

The rear view shows very clearly the tubes and tube mountings with springs for absorbing heavy shocks and vibration. The two separate coil systems for the two waves are clear, and also the mechanism for altering the coupling between the coils. The contacts of the antenna switch are seen at the top center, and the three-point signal switch is seen at the bottom, directly under the right hand tube.

The approximate ranges of the set using the different methods of transmission are as follows: On 1,600 meters, 150 miles for C.W., 130 for buzzer modulation and 120 for speech. On 600 meters, 250 miles for C.W., 200 for buzzer modulation and about 150 for speech.

**Photos by courtesy of General Electric Co.*

The Stromberg-Carlson

No. 2-A Radio Head Set

No. 2-A Radio Head Set, Complete, $7.50

These Stromberg-Carlson Radio Head Sets reproduce broadcasted, long distance, vocal or musical sounds with unequalled distinctness. Fine tonal qualities and extreme sensitiveness, are features of this high-grade piece of apparatus.

For the past eight years its makers have been recognized leaders in manufacturing professional Radio Head Sets. Back of that is twenty-eight years' service in building voice transmission apparatus for telephone companies. Stromberg-Carlson Telephone Receivers and Radio Head Sets are known in every part of the world where telephones and radio stations are installed.

This wide experience has enabled us to produce a new perfected Radio Head Set, a high-grade apparatus at a moderate figure—combining the important requirements of sensitiveness with convenience and comfort for the wearer.

The No. 2-A Radio Head Set comprises four distinct units; two receivers, head band and 5 foot cord.

The Receivers

Receivers are equipped with a one-piece bipolar permanent magnet, of high grade magnet steel; provided with phenol fiber spool heads, slotted soft iron pole pieces, corrosion proof diaphragm, enameled copper wire coils. All parts are encased in a receiver shell of cast non-magnetic insulating material, that is unaffected by either moisture or temperature changes. Each coil is wound to 500 ohms. The coils are connected in series. This gives a combined resistance of 2000 ohms for the 4 coils of a No. 2-A Radio Head Set.

The Head Band

A head band is furnished of the spring wire type, covered with heavy brown webbing, correctly shaped, light in weight and comfortable to the operator. Knurled thumb screws are provided on both ends to permit locking the adjustment after it is once fitted to the head. Exposed metal parts are nickel finished. Another feature of merit, in regard to the design of this head band is a provision for separating the receivers which permits two observers listening in on a circuit simultaneously with but one Stromberg-Carlson No. 2-A Head Set. This accomplishment is simple because the Head Band is provided with spring stirrups which engage the receivers, in such a manner, that either receiver may be disengaged from the head band by simply spreading the stirrups.

The Cords

Each No. 2-A Radio Head Set is equipped with a 5-ft. brown silk, moisture proofed, receiver cord which is forked in two branches, one branch for each receiver. This forked construction permits two persons to use the head set simultaneously when desired—a feature of great convenience.

Stromberg-Carlson Telephone Mfg. Co.
Rochester, N. Y.

Send me your free bulletin 1029-R describing your No. 2-A Radio Head Set.

Name.....

Address.....

Stromberg-Carlson Telephone Mfg. Co.
ROCHESTER, N. Y.

Radio Digest

(Continued from page 833)

and make it possible to overcome the shielding effects from nearby high buildings. A counterpoise ground system will be used, this type having proven very effective with the other antenna arrangement.

Excellent work has been done by this radiophone, its voice and music having been heard as far as fifteen hundred miles at sea, and eight hundred miles being a nightly occurrence. This is remarkable when it is considered that but five watts are used.

Together with the erection of the new antenna system, a much higher powered outfit is planned, and apparatus is now on the way from the east to complete the installation. When completed, two 50-watt tubes will be used, and it is expected that the range will include from Sitka, Alaska, on the north, to Mexican coast on the south, and from Honolulu to well inland eastward. The wave will probably be between 350 and 400 meters, and the hours of operation the same as at present, nine to nine thirty P. M. daily.

THE CHICAGO POLICE MOST EFFICIENT.

By Charles E. Wiley.

The Chicago Police Department under the direction of Chief Charles Fitzmorris is rapidly becoming the most efficient police force in the United States. Chicago was the first to perfect, on a large scale, a system of wireless communication from the headquarters to the police on his beat.

By the means of the latest police wireless radio, it is possible for the patrolman or mounted officer to catch from the air the radio messages of his superior officer. This appliance is working wonders in the apprehension of auto bandits.

By means of a small receiving instrument which buzzes when calling the officer, by placing the receiver to his ear he is able to receive orders. He cannot talk back, as there is no means afforded in answering.

The police department has a portable sending station or squad wagon, which can be rapidly moved for sending orders to squads of police covering strikes, riots, etc.

DAYTON POLICE TO USE RADIO.

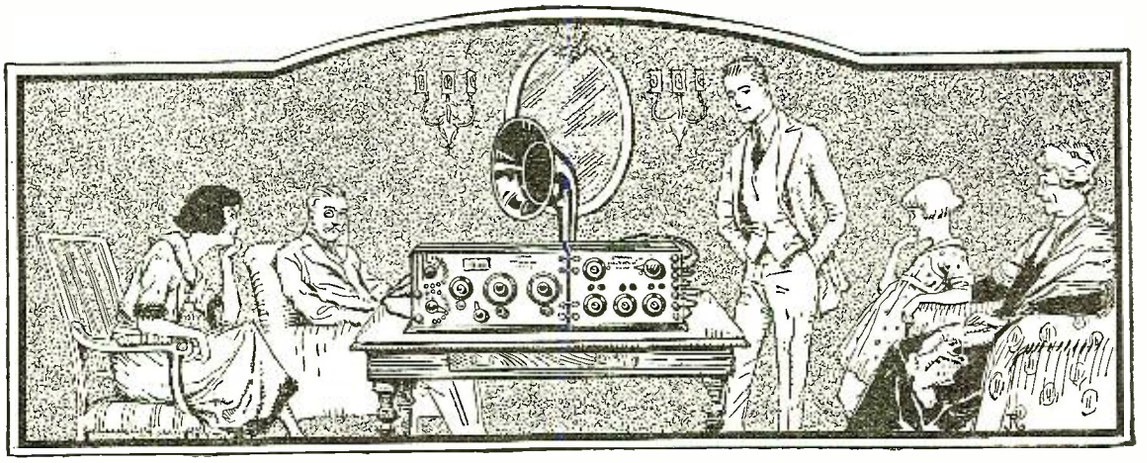
By Bert A. Teeters.

Following a demonstration conducted by radio officials at McCook field on December 31, 1921, authorities of Dayton, Ohio, are contemplating the installation of municipal wireless equipment as an aid to the police department in combatting crime. Under the tentative plans, a "central station" would be established at police headquarters, and four of the five police automobiles would be equipped with both sending and receiving apparatus.

During the demonstration, Chief of Police J. N. Allaback rode about the city in an automobile equipped with receiving sets, and at all times was able to hear and understand distinctly, matter transmitted by radiophone from McCook Field, several miles away.

"I was able to hear every word spoken," said the chief in commenting on the demonstration, "and the messages were as distinct as any I have ever received over a telephone.

"I see great possibilities in the use of radio in the police department. We could relay messages to our machines in any part of the city, giving them vital information which might result in the prevention of a serious crime, or the capture of dangerous



Complete Sets to Receive the WIRELESS TELEPHONE CONCERTS

In response to the tremendous new interest in wireless, created by the sweep of broadcasting stations all over the country, many styles of complete ready-to-operate outfits have been developed. Continental has carefully selected certain of these sets, of a wide price range, which combine efficient service with simplicity of operation.

The "Marvel" set at $15 complete is truly "The Marvel of Radio." Within 25 or 50 miles of a powerful broadcasting station, you can hear concerts clearly on a Marvel set. It requires no knowledge of radio whatever, and is so simple to install that you cannot go wrong.

Another low priced, but entirely satisfactory set is the Westinghouse Aeriola Jr., at $25. This is an easily adjusted crystal detector set purposely designed to receive the broadcasting. It is so simple to operate and the instructions are so clear that it is practically fool proof. The Westinghouse reputation is back of this efficient instrument which will be found unexcelled for distances of 40 to 50 miles from a broadcasting station. The price of $25 includes head phones. The only extras you will need are included in our Antenna equipment Number 1 at $2 complete. Thus, for $27 you can get an outfit complete in every detail. You can put it up in an afternoon and listen to concerts that same evening.

To receive longer distances, it is, of course, necessary to have vacuum tube equipment. Most vacuum tube sets are complicated and require considerable technical knowledge. This objection is overcome in the Westinghouse Aeriola Sr. This set employs the Armstrong regenerative circuit, and includes a vacuum tube detector in one handsome, portable cabinet. This outfit, which is far more sensitive and has considerably longer range than the Aeriola Jr., comes to you complete for $75.

For those who want a longer range, sensitive and highly efficient set including a loud speaker, we recommend the following outfit: a Grebe CR-9 receiver, which includes vacuum tube detector and two-stage amplifier equipment, one Radiotron detector tube, two Radiotron amplifier tubes, one pair of Baldwin type "C" phones, one Radio Magnavox, 3 "B" Batteries, and one storage Battery. This set has a range of 750 to 1,000 miles. Under normal conditions you can hear voices and music by wireless telephone clearly 25 to 50 feet from the loud speaker. It is unusually simple to install and operate. Simply connect your Antenna and ground connections, insert tubes, hook on batteries, and you are ready to listen. The price of this outfit as listed above is $246.

For those who want the limit of perfection, there is the Paragon R.A. Ten, for which we are sole wholesale distributors. Many prominent experimenters who have tested Paragon R.A. Ten, unanimously report that it is "unexcelled for telephone reception." This receiver employs the Armstrong Regenerative Circuit and is 24 per cent more sensitive and selective than its famous predecessor—Paragon R.A.-6. And the new low price of $69.50 makes Paragon R.A. Ten a remarkable value.

For a complete set built around the Paragon R.A. Ten receiver we recommend the following additional equipment: one $65 Paragon DA-2 amplifier cabinet, 3 vacuum tubes, 3 "B" batteries, one storage battery, one pair of Baldwin Type "C" phones, a radio Magnavox and our number 3 Antenna Equipment. This entire equipment, which gives you a set fully equal in results and appearance to a high class commercial receiving station, is priced at $258.50 complete.

In addition to the sets described above, we also recommend complete sets built around the deForest "Everyman" set at $25, the Clapp Eastham type H-R receiver at $35, and the Acmefone at $80. Descriptive literature on request.

If you can visit the Continental Store in New York, by all means do so. Come and listen to the different sets in actual operation. Let our salesmen, who are experienced Radio operators, help you select a set which meets with your particular requirements.

If you live farther away, our mail order department is prepared to serve you efficiently. Any of the complete sets described above will be shipped to any part of the United States by express, immediately.

If you do not wish to order at once, let us send you our new folder "Music From the Clouds" which illustrates and describes in detail five complete ready-to-operate outfits. It is absolutely free. Drop a post card for your copy today.

CONTINENTAL RADIO AND ELECTRIC CORPORATION

Dept. C-3 **6 Warren Street** **New York City**

"New York's Leading Wireless House"

criminals. The radio sets would be especially valuable when the machines were out in the country searching for criminals for it would permit the interchange of information and make captures more certain."

The chief indicated his belief that use of radio in police work would be of greatest benefit when applied to rural patrol work. He pointed out that with a central station in the cities, rural patrols could operate in the country in automobiles, and be instantly available in case of any trouble.

"The rural districts of the state could be blocked off in districts," said the police head, "and these districts could be patrolled by officers in automobiles, the same as our city streets are patrolled by policemen on beats.

"In case of any crime in any city, when the criminals fled into the country, the patrols could be notified by wireless so they could lay in wait and capture the men.

"Such a system would greatly decrease the chances automobile bandits now have of making a getaway."

WOULD USE RADIOPHONES.

E. F. Albee, head of the Keith vaudeville interests, has a plan to equip all the theatres on the Keith circuit, as well as his residence, with wireless telephones. He is having a big electrical company furnish him with estimates on the cost and efficiency of such a system. It is his idea to keep in close touch with the managers of all the houses and, possibly, get a line on new acts, how they are received, etc., by the use of the radiophone. It is believed the Government would fix a Keith wave length, which would avoid interruptions. If the plan is carried out it will be the first extensive commercial application of the radiophone.

AWARD OF PRIZE FOR COVER IDEA.

Owing to an oversight, we neglected to give credit for the clever suggestion pictured on the cover of the January issue of RADIO NEWS, entitled "The Street-Organ of the Future." This was sent us by J. M. Wellman, 473 Greene Avenue, Brooklyn, N. Y., who received the $10 award which we offered last year for cover suggestion.

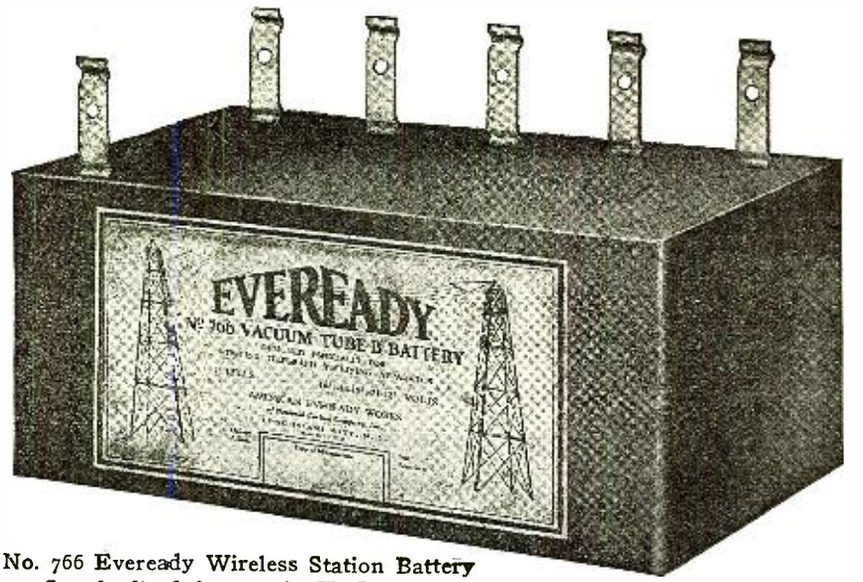
Splitting the Game

(*Continued from page* 831)

would seem to the writer, that particularly in the case of the coastal station operators, where the responsibility of the lives of all those aboard a ship is not in their hands (I refer to the circuit jobs—not coastal Marine stations) that they be licensed and employed as operators; not necessarily familiar with such a variety of radio apparatus. There are men provided at all shore stations of any size, to care for the electrical end; all that operators are required to do, is to pound out the signals, and get the incoming stuff down on a good, presentable copy.

At sea, it is necessarily different. An operator must be able to repair his own breakdowns, and operate his installation intelligently. But it would seem as if a division of classes could be made. For instance, we could license high speed operators for shore station circuit jobs, under one class. If necessary, create a license to radio electricians, to cover the apparatus end. Then have a grade of license that would include such knowledge of radio apparatus as was necessary for a man to handle apparatus aboard a vessel at its highest efficiency, together with a fair telegraphing speed. The Marine man would not need to be so highly specialized a code man. Neither, on the other hand, would the shore operator have to be an electrician. Or perhaps, the vacancies in shore stations could be filled

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



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

5 SIGNAL FACTS about the Eveready Wireless B Battery

—it lasts longer

Because uniformly high grade materials and refinement of manufacturing processes insure proper working of elements

—its insulation is perfect

Because each cell is coated with special insulating material, and then further insulated from other cells by means of specially treated waterproof cardboard separators

—its operation is noiseless

Because of adequate depolarization and steady voltage, perfect connections, and prevention of corrosive punctures and leaks

—it maintains high voltage

Because ingredients are of proper proportion, and because short circuiting is prevented

—it gives five positive leads without extra cost

Giving critical voltage adjustment for all types of vacuum tubes

This 100% Eveready B Battery, linked to your receiving set, will give you more in service—more in satisfaction—than any battery you have hitherto known. See your radio equipment dealer—or write us.

NATIONAL CARBON COMPANY, Inc.
Long Island City, N. Y. Atlanta Cleveland
Chicago Kansas City San Francisco

EVEREADY
FLASHLIGHTS AND BATTERIES

Note:—Every wireless operator has use for an Eveready Flashlight

N1654

from the marine posts, by requiring shore operators to have had a certain amount of sea-going experience. They would then have a fundamental knowledge of radio electricity at least, and when they attained a certain code speed in their Marine experience, they would be eligible to assignment ashore.

There is room for improvement yet, and it will soon be a necessity to make some such distinction as I have outlined, I believe. Meanwhile, can we not have a few opinions on this from readers, among the old-timers?

The Plainfield Radio Association Contest

(*Continued from page* 828)

finished new transmitting set. It will be put into operation as soon as Mr. Scott can obtain four 50-watt tubes to be used as oscillators and modulators. Mr. Scott's station is 2BZH.

At present, he is not transmitting, as his 70-foot lattice tower was blown down in the wind storm a short time ago. He intends erecting a seventy-five foot steel telescopic mast.

Another of Mr. Taylor's exhibits is an entirely home-made regenerative receiver following Paragon lines but differing from it in several respects.

Another exhibit was a combination long and short wave regenerative receiving set with home-made honey-comb coils built by George Booth. The engraving of the panel was considered by experienced amateurs as worthy of special note.

Others showing equipment were:

N. G. Haas, 3 VU, portable receiving set.

Henry Mrynairski, 2 AQY detector and one-step amplifier.

Gibson Buttfield, NH, detector and three-step amplifier and a special helix. The detector attracted attention because of the shortness of the leads in the amplifying circuits.

C. R. Vincent, Jr., long and short wave regenerative receiver, also detector and two-step amplifier.

Harold Blackford, 2 QB home-made regenerative set and detector.

George M. Booth, long and shorts wave regenerative set of which every part, including honeycomb, was entirely made by himself.

Corwin Scott, regenerative honeycomb set.

George L. Babcock, two-step amplifier, notable for the neat workmanship.

E. E. Iremonger, 2 BWM, special C. W. set.

Walton Bostwick, detector and three-stage amplifier of exceptionally compact design. Also a regenerative receiver.

Storage Battery for the Plate Circuit

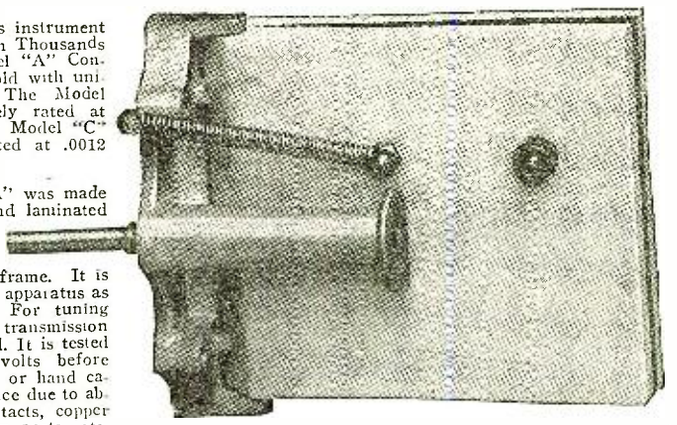
(*Continued from page* 823)

with binding posts. Also in the strips down one side of the battery there are small holes bored in the connecting strip between the cells. These are fitted with brass bolts for connecting with the switch contacts on the panel. When the cells have been completed and set in the holes and the electrodes put

The New CROSLEY Variable Condenser

"Better — Costs Less"

MODEL "C"



The principle of this instrument needs no introduction Thousands of the Crosley Model "A" Condensers have been sold with uniform satisfaction The Model "A" is conservatively rated at .0005 Mf. The new Model "C" is conservatively rated at .0012 Mf.

While the Model "A" was made with wood frame and laminated wood plates the new Model "C" has ground porcelain plates with die cast frame. It is as efficient a piece of apparatus as you could desire. For tuning C.W. and for power transmission it cannot be equalled. It is tested on one thousand volts before shipment. No body or hand capacity. Low resistance due to absence of spring contacts, copper plates, brass binding posts, etc. We call it the "sensation" of radio—"Better—Costs Less".

Every CROSLEY VARIABLE CONDENSER is GUARANTEED to give absolute satisfaction or money refunded.

The CROSLEY VARIABLE CONDENSER is now made in three styles:

Model "A" with wood frame and laminated wood plates.

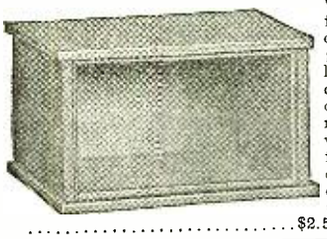
Model "B" with wood plates and die cast frame.
(Both models have the same capacity—.0005.)

Model "C" as illustrated—capacity .001—porcelain plates, die cast frame, etc.

Prices as follows:

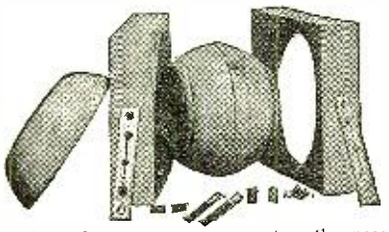
	Without knob and dial	With knob and dial	With knob and dial mounted in cabinet
Model "A"	$1.25	$1.75	$2.50
Model "B"	1.75	2.25	3.00
Model "C"	2.25	2.75	3.50

Crosley Cabinets



We build a full line of cabinets in gum, mahogany or quartered oak and furnish them with genuine formica panels. Prices on cabinets range from .....$2.50 to $10.50

Crosley Variometer Parts



Consists of two stators, one rotor, the necessary hardware as shown in illustration. Shaft for knob and dial is 3/16" diameter. The wood parts are furnished either in poplar or mahogany. Price of Variometer parts, using poplar wood, $1.50. If wood parts are made of mahogany $1.75

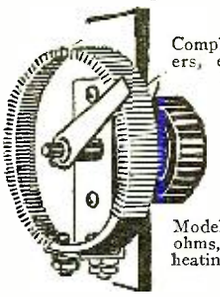
Crosley Vario-Couplers

Consists of formica tube, rotor and brass hardware. Price, complete as shown in illustration not wound or assembled, $1.50. Stator only 40c

Crosley Detector Units

Furnished completely wired and mounted as shown in illustration or in knocked down form. Price completely assembled $7.50. Price of all parts including formica or other panel of high grade dielectric composition, not drilled $6.00

Crosley Rheostats



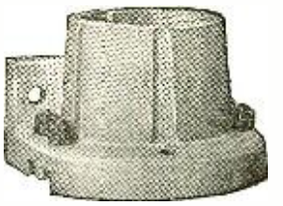
Complete with knob, pointers, etc., as shown in illustration.

Model "A"—overall diameter 1⅝". Resistance 7 ohms, one ampere without heating. Price 60c

Model "B"—Resistance 4 ohms, 3 amperes without heating. Price $1.25

CROSLEY V-T Socket -- 60c.

"Better -- Costs Less"



The biggest selling socket on the market. Practically unbreakable. For either base or panel mounting. Made of one piece porcelain. no metal shell, hence no ground hum. Better—and costs only 60c

Harko Radio Receiver

The most compact and complete efficient crystal receiving outfit on the market Will tune from 200 to 600 meters bringing in spark, voice and music with amateur antenna. A wonderful little instrument. Price complete with battery, etc., $9.00. One thousand ohm single head set, 125 feet antenna wire regulators, etc., $6.00 extra. Complete outfit $15.00

Harko Senior Radio Receiver

Complete tuner and audion detector assembled on a formica or other high grade diclectric panel, mounted complete in mahogany finish cabinet. Range, 150 to 600 meters, non-regenative hook-up. Price without battery, tube or phones $16.00

Crosley Two Step Amplifier

Complete with amplifying transformers, sockets, rheostats, switch, binding posts, etc., mounted on formica panel in mahogany finished cabinet. Price complete as shown in illustration $25.00

Every article guaranteed to give absolute satisfaction or money refunded. If your dealer can't supply you, send us his name and order direct.

Dealers and Distributors. Every item shown above should be in your stock. Write for proposition.

CROSLEY MFG. CO. Radio Dept. R-7 CINCINNATI, O.

in place, the battery is wired according to the diagram in Fig. 4a. In this way the cell is ready for charging. When discharged, the connections are as in Fig. 4b. The electrolyte is made by adding CP sulphuric acid to distilled water until a reading of 1.1 is obtained on a hydrometer in the solution. The electrolyte should stand to within half an inch of the top of each cell. In charging the battery, care should be taken to keep the current low so as to prevent the cell from heating. When fully charged, a reading of 1275 Sp.G. should be obtained.

The cells will require a number of chargings and dischargings before the plates are fully formed. The battery, of course, is used as usual to discharge. With ordinary care, the battery will operate the detector for 500 hours. The cell should be charged periodically even if its voltage is not clear down. Care should be taken to keep the electrolyte up in the cells. As the water evaporates, pure distilled water should be added. It is well to keep the battery covered to protect it from the dust.

Similar construction is used for batteries of higher voltage. It is practical to construct batteries of 200 volts in this way. Such a battery of 100 individual cells using the corrugated electrodes described will operate a telephone set using two bulbs, one oscillator and one modulator, for 500 to 1,000 hours before the battery will need recharging. As before mentioned, the battery should be recharged every so often, especially when it has been standing idle for some time.

The Newspaper of Tomorrow

(*Continued from page 823*)

microphone connected with the radiophone equipment above.

For receiving the messages, Galena crystal detectors are used within a radius of 12 miles; tube detectors within a radius of 12 to 30 miles, and tube detectors with one or more amplifiers beyond 30 miles. The sending apparatus was installed by the Marconi Company at an annual rental of about $1,700. The receiving sets are also furnished by the Marconi company at an annual charge to the subscribers of about $66 per station. In addition, the Bourse charges each subscriber about $34 per annum. By placing the receiving instruments in prominent positions in banks and brokerage houses the entire personnel of these organizations receive the market news without having to leave their desks. Clients are also invited to the companies' offices to hear the market reports.

The "radiophone newspaper" published by the German Post Office near Berlin follows much the same general plan of the "Telephone Hirmondo" at Budapest. The news bulletins are furnished by a news agency, and there is a regular daily schedule of news dissemination. There are approximately 1,000 receiving stations. Different kinds of news is radiated with different wave lengths, each receiving set being permanently adjusted to receive the particular kind of news contracted for. The Government controls the entire wireless situation in Germany and only licensed operators are permitted to install receiving or sending sets.

German experiments with a 10-kilowatt set for radiophone broadcasting have indicated that the efficiency of radiophone service depends much upon the stentor's quality of voice, enunciation, and training; that men and women are about equally effective as stentors; that more satisfactory results are secured at long distances than close in; and that receiving sets equipped with de-

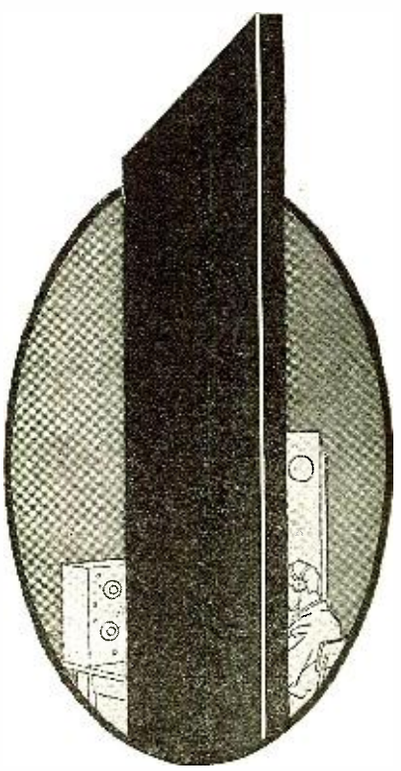
The Most Popular Radio Insulation

Week by week the amount of Formica used for radio insulation by amateur and commercial operators increases. It is the most popular material of its kind.

This great demand for Formica is due to its high dielectric strength, and the low power and hysteresis losses with high frequency currents where it is employed.

It is due also to the handsome, good looking panels that Formica makes and to the fact that it machines easily. It is unaffected by weather conditions, oil, water, acids, alkalies. It retains its good looks and high efficiency indefinitely.

Formica is approved by the United States Navy and the Signal Corps!



Dealers: We co-operate to increase your Formica sales. You can buy Formica in 36" x 42" sheets and cut it yourself or we will cut it into any series of standard sizes that you want at a small extra cost. Write for our dealer helps. Let us send you electrotypes for your local newspaper advertising.

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FORMICA

Made from Anhydrous Redmanol Resins

SHEETS TUBES RODS

tectors alone are unsatisfactory beyond 150 miles. A vessel en route to South America heard the station at a distance of 2,100 miles. Experiments at the Nauen Station with a high frequency alternator and 130 kilowatts in the antenna also demonstrated that speech and music could be rendered clearly audible throughout Europe from Madrid to Bucharest without the use of amplifiers.

The latest model of receiving set used in the German broadcasting service consists of an upright panel above a small desk to which the receiving apparatus is attached. The instrument is tuned so as to leave but one adjustment for the operator and is then locked. At the top of the panel there is an additional apparatus controlling a relay bell which can be rung from the sending stations by a series of dots and dashes. This is for sending news extras. An electro-static apparatus that registers telegraph code letters on a tape at the rate of 2,000 a minute, and which can be used for receiving and record telegraph messages sent either by wireless or radiophone has also been perfected.

About a year ago the British Government experimented with the broadcasting of news from a station in the vicinity of London, a 12-kilowatt vacuum tube sending set being used. The general results were satisfactory except for the interference of shipping signals. It is now proposed to establish a radiophone broadcasting station at Nairobe in British East Africa to be supported by English farmers and ranchmen in that region. A 10-kilowatt set will be installed, as considerable energy is required because of the absorptive power of the jungle regions.

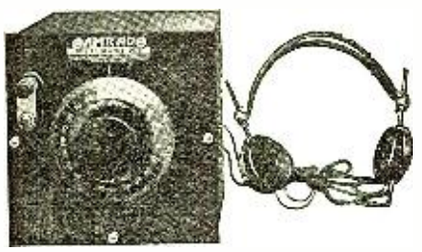
Although amateur wireless telegraphy and telephony in Europe is not conducted on nearly so extensive a scale as in the United States, due largely to Government restrictions, there has been considerable experimentation in types of receiving sets. One of these sets consists of a pyramidal panel surmounted by a revolving loop five feet square and equipped with two detector tubes, a five-step high frequency amplifier and a three-step low frequency amplifier. The price of this apparatus complete, including tubes, accumulator and B battery is $391. Additional tubes are furnished at $1.60 each. Another set consists of a crystal detector with two amplifying tubes, equipped with a loop about six inches square, dry batteries being used for both filaments and plates.

Vacuum tubes or radio valves are manufactured everywhere in Europe and a 500-watt oscillator which sells in the United States for $175 can be purchased in England for about $36. A London concern manufactures fused quartz oscillators about one-half the size of ordinary glass tubes of about the same power. The life of the filaments of the tubes offered by this concern is about 800 hours, but the filaments can be renewed at about 25 per cent of first cost. The Marconi Company manufactures oscillators up to 10 kilowatts and expects shortly to produce them as large as 16 kilowatts.

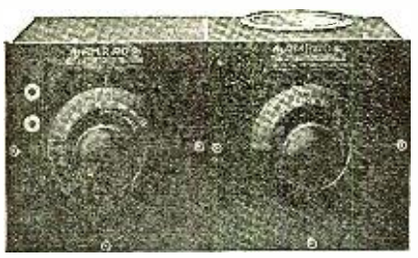
How soon a national radiophone "newspaper" will be attempted in the United States is problematical, although many experiments of a local character along this line are being successfully conducted. When it does come to pass, the dream of every editor in the United States will be realized, a national newspaper received and read everywhere throughout the country the same day it is issued. No longer will the farmer or other urban dweller receive his news twenty-four hours, and sometimes days, late. He will be as quickly informed as his city brother. For the radiophone will simultaneously carry the news of the world to millions of people wherever they are located.

AMRAD

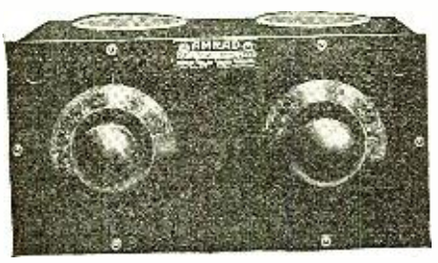
The Recognized Symbol of Superior Performance



AMRAD CRYSTAL RECEIVING SET $27 00
A Beginner's Set De Luxe—One You Never Need Discard. Anyone Can Operate. Price includes Phones and 125 ft. aerial wire. Range 15-25 miles.



AMRAD COMBINATION B-I
Range for Radio telephone, 50 miles
Range for radio telegraph, 500 miles
Amrad Crystal Receiver, 2575.....$21.50
VT Detector only, 2771 ..... 12.50
AMRAD Load Coil only, 2962 ..... 3.85
(The above is one of 15 Combinations)



AMRAD VT 2 Stage Amplifier, 2776.....$38.00
Can be added to either of above Sets to triple range and audibility.

Do YOU Know What's NEW?

SUPPOSE some friend asked you to compare the merits of the several receiving sets designed for the beginner. Would YOU KNOW about the automatic wave-change switch, the plug-in crystal detector, the rear panel connections, the all formica insulation, the basketball variometer, the load coil terminals, the solid mahogany cabinet—all features found only in the new de luxe Amrad Crystal Receiver. You should SEE and EXAMINE this instrument. If your dealer does not stock, write for Bulletin M.

Do you know the Amrad Crystal Receiver, with detector removed, is a highly selective single circuit tuner when combined with an Amrad VT Detector also NEW? This combination, with Amrad Load Coil, will bring in Arlington, 500 miles away. And where can you find a modern VT control panel in a mahogany case for only $12.50? New Bulletin F describes it.

Do you know a VT 2-stage Amplifier can be used on a CRYSTAL with quite as good results as on a VT detector? This is being done. Amrad Crystal Receiver and VT 2-stage Amplifier in combination can be used with a loud speaker for local radiophone. Here is a set which your friend, just shaking hands with Radio, can operate. No critical adjustments. Tell him about it. Also described in Bulletin F.

Do you know all about the improved Amrad Unit System? Does your friend? Does he know he can buy the Amrad Crystal Receiver and expand his equipment without losing a cent—as he progresses in his knowledge of radio?

Do you know there are at least fifteen NEW Amrad instruments actually ON SALE this month? Seven Individual Receiving Units, a new Wavemeter, Send-Receive Switch, Electrolytic 38 mfd. Condenser, and Safety Devices for the antenna are among the more important. Better send five two-cent stamps for the latest Amrad Catalog. It will pay you to keep posted.

No. 2573
Vario-Coupler
$17.50

No. 2572
Variometer
$12.00

No. 2834
Send-Receive Switch
$11.00

No. 2766
VT 1-Stage Amplifier
$19.50

No. 2777
Variable Condenser
$10.00

AMERICAN RADIO AND RESEARCH CORPORATION

New York District Office
21 Park Row

General Office, Factory and Laboratory
203 College Avenue, Medford Hillside, Mass.

Chicago District Office
600 So. Dearborn St.

Tubes and Transformers in Cascade

(*Continued from page* 811)

curs either a minimum ot sound or silence in the receivers. At this point, the two phases of the AC are equal and opposite, differing by 180 degrees. The ratio of the resistance in the grid side to that in the plate side, will give the nearly approximate amplification factor of the given tube. This test presents the factor in a more accurate manner because it more nearly represents the action of the tube under actual operating conditions. Variations of the grid voltage will yield slightly different results, but an average will give the amplification factor close enough for the practical work of the average experimenter.

For the computation of the internal resistance of the tube, refer to Fig. 3, where the dynamic value of the internal plate resistance is measured by the utilization of the apparatus represented.

In the plate circuit is inserted the ordinary plate battery at a fixed value of EMF. The secondary of the transformer receives current from an A.C. source connected in series with the primary. In shunt to the secondary is connected the large variable resistance R1-R2 to which is connected the slider, with a lead to the phones and thence to the filament. The resistance R is of known value, as well as that of R1-R2. This is the ordinary bridge method, and when the slider is placed at a certain point where the sound in the phones is at a minimum, or silence occurs, the insertion of the resistance values in the following rule will yield the approximate internal resistance of the tube:

R-p equals R1 divided by R2 and multiplied by R.

In connection with the plate resistance measurement, a word regarding the application of transformers in amplifying: Let us repeat a former statement, which is that the same current would flow in the plate circuit if the latter were connected to an alternator of the EMF of the product of the amplification factor and the grid voltage and possessing the same internal resistance as the tube (plate to filament).

It remains that the maximum of power will exist in the plate circuit when the resistance of the latter is equal to that of the internal plate to filament resistance. If we consider that the impedance and the resistance of the plate circuit is all resistance there are several ways in which to suit the particular tube to the individual plate circuit, or of fitting the particular plate circuit to a particular tube, over a certain range As the internal resistance of the plate-filament depends upon the tension of the plate battery, the temperature of the filament, and the voltage of the grid, there are offered at least three ways in which a tube may be used to greatest advantage in a certain circuit, or a certain circuit's constants may be altered to fit the particular tube.

The voltage of the "B" Battery may be changed, thereby changing the internal resistance of the tube, or the grid EMF may be changed, or the external plate circuit resistance may be altered to suit the particular and desired result in the functioning apparatus.

It is evident that in the selection of a tube for use with a particular transformer in order to get the maximum of results, the internal resistance of the tube should be

found by actual test. In the presence of manufactured read-to-use apparatus, such as a particular transformer of a certain type this test of the tube must be made if the best functioning of the apparatus is desired because to resort to the change in the construction of dimensions of the transformer might incur tedious and extraneous labor, which the experimenter might shun as uncalled for and wasteful, in all probability depreciating the value of the transformer under the value of the purchase price. On the other hand, if the characteristics of the tube are considered, in order to harmonize with the constants of the transformer, the change of the tube constants by the ways suggested heretofore might bring the working capacity of the tube to a stage where the results desired would be conspicuous by their absence, whereas another tube of other manufacture might exactly suit the requirements. As the tube itself could not be altered in interior construction, with a great lot of labor, it remains that the proper tube be selected in the first place to be utilized with the available transformer.

Measurement of the ohmic resistance of the primary of the transformer may be made with the ordinary bridge method. When the internal resistance of the tube is comparable with the external plate circuit resistance, through the transformer primary the leads, etc., the secondary of the transformer must be regarded with care. Although the average experimenter may not care to carry the test to such an extreme as calculating the infinitely exact maximum possible voltage delivered by the secondary of the transformer to the grid of the next tube, nevertheless the secondary must be designed for this maximum delivery of maximum potential to the grid of the succeeding tube in the cascade.

By calculation of the constants of the secondary of the transformer, it can be approximated as to the potential delivered to the grid of the next tube, if the constants of the other plate-transformer primary circuit has been found by test.

In this connection, it may be well to remind the reader of the load current of the transformer, which, although of not large actual value in these transformers, nevertheless has considerable effect upon the operation of the amplifier. As the primary induces a current in the secondary, 180 time-degrees behind the inducing current, there is a reaction upon the primary current due to the re-induced electromotive force in the primary of the transformer and this resultant current opposes the primary current (original), thus representing the load upon the primary circuit, which is a part of the plate circuit of the other tube. This load effects the maximum power delivery of the plate circuit, and it may be of such value as to considerably deviate the power in the plate circuit from the value which represents the imposition of maximum tension upon the plates of the succeeding grid condenser. This fact occurs in certain types of transformers which are utilized in amplification circuits of this type.

The actual tests of the transformers may be calculated by the measurement in watts of the input and the output, and if the result of the output is divided by that of the input and that result multiplied by 100, the last result will be in per cent. efficiency.

In the selection of a proper tube for use with the choke coil coupling, it must be kept in mind that one of the advantages of this type is the possible reduction of the external plate resistance to a medium low value (ohmic) and the resultant possible employment of a lower tension "B" battery. The power loss is, therefore, small. By the application of a condenser in shunt to the choke, the reaction of the circuit may be made maximum, and the resultant voltage

amplification be made maximum.

In this connection, it may be kept in mind that the characteristic of vacuum tubes indicates that the latter will function best when the amplitude of the charge on the grid is at a maximum, operating at a better stage than when the impressed grid voltage is at a lower voltage, due to the fact that the voltage amplification from the preceding tube is smaller than possible or ordinary on account of the improper selection of constants in the external plate circuit of that tube. If the constants of this latter circuit are not calculated by actual test, or by the knowledge of the manufacturer's tests, the resultant efficiency and the desired results will not approach the maximum possible in the particular cascade.

The actual measurement of the total impedance of an alternating current circuit may be calculated in much the same manner as that of a D.C. circuit, and with the proper instruments, the impedance of the external plate circuit may be calculated from the following formula or rule, where I is the current in decimal fractions of an ampere, the voltage V, and the total impedance Q, that is, Q equals E divided by I.

In regard to the calculation of the safe current carrying capacity, the following may well be utilized for comparison, by the experimenter:

A filament .005" in diameter will safely emit .03 ampere per centimeter of length The filament heating current represents 3.1 watts per centimeter of length. A filament .01" in diameter may safely emit .10 ampere per c.m. of length, while the filament current represents 7.2 watts per c.m. in length.

In summary it is made readily obvious that if the average experimenter carefully selects the tube of the desired (or as near as can possibly be obtained) characteristics and with the same forethought, chooses the constants for the circuits of the cascade amplifier, the result will be most successful and most gratifying.

What Anyone Can Hear

(*Continued from page* 814)

thus keep the line of communication open. One boy, or young man, or girl in any community, with an efficient radio receiver, could maintain this contact with Washington. In time of danger a continuous watch could be maintained—an easy matter if the system is once established locally. The Boy Scouts of America are especially encouraged to serve as operators and messengers in this system.

In times of danger, speed is necessary. Wire service is fast, but radio is instantaneous. One Government official in Washington could give a word of warning to every American community at the same moment if every community were listening.

Sometimes, to provide a means of secrecy, these messages are transmitted in Navy Amateur Code. Key to the codes used will be sent free on request by the Seascout Radio Commodore, 200 Fifth Avenue, New York City.

BROADCASTS FROM GOVERNMENT STATIONS

(International Morse Code)

Weather reports are transmitted by Naval Radio Stations as follows:

Atlantic Coast.

Washington, call letters NAA, 2650 meters. 10 P. M. (Eastern Standard Time). Time signals start at 9.55 and stop at 10 P. M.

Key West, Florida, call letters NAR,

SOMETHING NEW IN RADIO

MAKE YOUR OWN

Pattern No. 2 Just Out

50c. Per Set Prepaid

Send for Pattern No. 1 Complete Short Wave Regenerative Set and for Pattern No. 2

Both Together: $1.00 Prepaid

The second set of patterns that we are offering now to the amateurs and radio experimenters, was designed so as to match the short-wave regenerative set which may be built with patterns No. 1 designed especially for its construction. The panel of each unit is of the same height, and the disposition of the binding posts makes it possible to use the detector control cabinet alone, or with any number of amplifier units, with only one "A" and one "B" battery, if so desired. The arrangement of the binding posts was made with a view to avoiding any long wiring from the batteries to the filaments of the tube used in each unit, and each of these control cabinets, being fitted with a jack, the telephones may be plugged in for the detector alone or any number of stages of amplification connected to it.

The detector and amplifier units, which may be built from this set of patterns, may be used with any type of regenerative receiver, or long wave set, using honeycomb coils or any other form of inductance for tuning. Only those who built the short wave regenerative set of this series of patterns, can appreciate the simplicity and ease of construction of these new instruments.

If, to the short wave set, which may be built with the set of patterns No. 1, are added a detector and two amplifying units, the receiving outfit thus composed will give wonderful results and will enable the owner to operate a loud talker for the entertainment of his friends with radiophone transmissions, which may now be received every day. The appearance of the complete receiving outfit, which may be built with these sets of patterns, is as attractive as that of any standard make of apparatus, and its functioning is as good and we may say, in several cases, better.

Patterns are printed on heavy blueprint paper exactly the size of the panels to be used.

The position of the holes and other markations are exact, so that all you have to do is to paste the pattern on top of your bakelite panel by means of ordinary library paste, and when dry drill right through the pattern wherever the marks are located.

This does away with all fussing and calculating as we have done all the laying out in our own shop, and you need not worry that the final instrument does not come out right.

BEFORE SELLING YOU THIS PATTERN WE HAVE GONE TO THE TROUBLE OF ACTUALLY BUILDING THE OUTFIT AND WE KNOW THAT IT IS ABSOLUTELY RIGHT IN ALL PARTICULARS.

The original may be inspected at any time. Only standard parts are used in making the outfit.

Complete and very explicit directions go with the pattern which is furnished in a heavy envelope 9 x 12".

Complete pattern for detector and amplifier units consisting of two full size blue-prints and four pages 9x12 instruction pamphlet in heavy envelope, per set prepaid,

50c

Either Direct from us or for sale by the following responsible Dealers:

Alamo Sales Corp. Indianapolis, Ind.
Am. Electro Tech. App. Co., N. Y. City
American Hdw. Stores, Bridgeport, Conn.
Andrea & Sons, Julius, Milwaukee, Wis.
Andrae & Sons, Julius Mason City, Ia.
Anthracite Radio Shop Scranton, Pa.
Atlantic Radio Co. Boston, Mass.
Bamberger & Co., L. Newark, N. J.
Banister & Pollard Co., Newark, N. J.
Benwood Specialty Co. St. Louis, Mo.
Bluebird Electric Shop Newark, N. J.
Brode Electric Co. Los Angeles, Cal.
Brown, J. Edw. Glenbrook, Conn.
Bullock's York, Neb.
Bunnell & Co., J. H. New York City
Burham & Co., Deptford, S. E. S. England
California Elec. Co., San Francisco, Cal.
Carter Electric Co. Atlanta, Ga.
Catton, Neill & Co. Honolulu, T. H.
Central Radio Co., Independence, Mo.
Central Radio Co., Kansas City, Mo.
Chase, Geo. H. Newport, R. I.
Chicago Radio Ap. Co. Chicago, Ill.
Cleveland Co., L. W. Portland, Me.
Cloud & Son Macy, Ind.
Con. Radio & Elec. Corp. N. Y. City
Cutting & Washington New York City
Daily Battery & Equipment Co., Pittsburg, Pa.
Delancey-Felch & Co. Pawtucket, R. I.
Detroit Electric Co. Detroit, Mich.
Dewey Spts. Goods Co. Milwaukee, Wis.
Doubleday-Hill Elec. Co. Pittsburgh, Pa.
Dreyfuss Sales Co. New York City
Duck & Co., Wm. B. Toledo, O.
Dunn, J. J. Pasadena, Cal.
Electric Motor & Eng. Co. Canton, O.
Electro Importing Co. N. Y. City
Elito Electric Shop El Paso, Tex.
Erie Book Store Erie, Pa.
Fergus Elec. Co. Zanesville, O.
Findley Electric Co. Minneapolis, Minn.
Fleron & Son, M. M. Trenton, N. J.
Fuller Co., Seth W Boston, Mass.
Galveston Wless Sup. Co., Galveston, Tex.
Gurd & Co., Wm. London, Canada
Hall Electric Co., Wm. Dayton, O.
Hatfield Electric Co. Indianapolis, Ind.
Heustis, A. E. Fitchburg, Mass.
Hickson Electric Co. Rochester N. Y.
Hiro Wireless Sup. Co. Marion, Ill.
Holt Electric Util. Co., Jacksonville, Fla.
Hughes Elec'l. Corp. Syracuse, N. Y.
Jenkins, Lester I. New Bedford, Mass.
Karlowa Radio Corp. Rock Island, Ill.
Katzenbach & Co., F. S., Trenton, N. J.
Kendall Co., W. D. Worcester, Mass.
Keubler Radio Co. Toledo, O.
Killoch Co., David New York City
King Radio Co. Pittsburgh, Pa.
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 Incandescent Sup. Co., Pittsburgh, Pa.
Liberty Radio Sup. Co. Chicago, Ill.
Linze Elec'l Sup. Co. St. Louis, Mo.
Ludwig Hommel & Co. Pittsburg, Pa.
Luther, H. E. Centerville, Ia.
McCarthy Bros. & Ford, Buffalo, N. Y.
McMillan Bros. Pittsburg, Pa.
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.
National Radio Corp. Atlanta, Ga.
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New England Motor Sales Co., Greenwich, Conn.
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Newman-Stern Co. Cleveland, O.
Nichols Radio Sup. Co., Blg. Green, Ky.
Nola Radio Co. New Orleans, La.
Noll & Co., E. P. Philadelphia, Pa.
Northern Radio & El. Co., Seattle, Wash.
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Pitts. Radio & App. Co., Pittsburgh, Pa.
Port Arthur Rad. Lab., Port Arthur, Tex.
Post Office News Co. Chicago, Ill.
Precision Equipment Co. Cincinnati, O.
Radio Development Co., Springfield, Mass.
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.
Reynolds Radio Denver, Colo.
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.
Sands Electric Co. Wheeling, W. Va.
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 Radio Lab. 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. Stores Co. Braddock, Pa.
United Electric Stores E. Pittsburg, Pa.
U. S. Radio Co. Pittsburg, Pa.
Warner Bros. Oakland, Cal.
Western Radio Co. Kansas City, Mo.
West'n Radio Elec. Co., Los Angeles, Cal.
Wheeler Green Electric Co., Rochester, N. Y.
Whitall Electric Co. Westerly, R. I.
White Co., The Columbus, Ga.
White & Boyer Co. Washington, D. C.
White & Bro., Frank Canton, Ill.
Williamson Elec. Co. Seattle, Wash.
Wilmington Elec. Spec. Co., Wilmington
Wilson Co., Harold K., Grundy Center, Iowa.
Winner Radio Co. Aurora, Colo.
Wireless Mfg. Co. Canton, O.
Wireless Press New York City
Wolfe Electric Co. Omaha, Neb.
Y. M. C. A. Los Angeles, Cal.
Zamoiski Co., Jas. M., Baltimore, Md.
Zibart Bros. Nashville, Tenn.

Consolidated Radio Call Book Co., Inc., 98 Park Place, New York City

1500 meters. Same time.

Great Lakes.

Great Lakes, call letters NAJ, 1512 meters. 10 P. M. (Central Standard Time). Time signals 9.55 to 10 P. M.

Pacific Coast.

San Francisco, call letters NPH, 952 meters. Noon and 10 P. M. Preceded by time signals on 2400 and 4800 meters from 9.55 to 10 P. M.

North Head, call letters NPE, 952 meters. Same schedule.

San Diego, call letters NPL, 952 meters. Same schedule.

Local weather reports are broadcasted by Tatoosh, North Head, San Francisco and San Diego at 8 A. M. and 4 P. M. on 600 meters and at noon and 10 P. M. on 952 meters. Also by Puget Sound, Marshfield and Point Arguella at noon and 10 P. M. on 600 meters. Total weather report from Farallone Islands is forwarded to San Francisco for Marine Exchange at 8 A. M., noon, and 5 P. M.

There are Navy radio stations in or near most of the coast cities of the United States and its islands. Many of these transmit press. Details are not given in the pamphlet on Commercial and Government Radio Stations of the United States, but they are usually known to local amateurs.

An example of the broadcast schedules of Navy stations is given in the following official statement:

"All Broadcast Schedules of the Third Naval District are transmitted by the U. S. Naval Radio Station, Navy Yard, New York, on 1832 meter wavelength as follows: Ten thirty A. M. and five P. M. Weather and Hydrographic information; Nine P. M. and three A. M. press; Nine thirty P. M. Amateur Radio Broadcast."

RADIO MARKET NEWS SERVICE

The Bureau of Markets and Crop Estimates of the United States Department of Agriculture, in coöperation with the Air Mail Radio Service of the Post Office Department, broadcasts market news by radio daily except Sundays and holidays, in accordance with the following schedule: Between June 15 and September 15 no radio reports will be broadcasted on Saturdays after 1 P. M. Notice of any changes in this schedule will be broadcasted in connection with the radio reports for one or more days prior to the date such changes become effective.

Washington, D. C. Call letters WWX. Weather 10 A. M. Grain and live stock, 7.30 to 8 P. M. Fruit and vegetables, 8 to 8.30 P. M. Eastern time. 1800 meters.

Cincinnati, Ohio. Call letters KDQC. Live stock receipts 9 to 9.15 A. M. Chicago live stock 11 to 11.30 A. M. St. Louis live stock 12 to 12.30 P. M. Chicago live stock 7.30 to 7.45 P. M. St. Louis live stock 8 to 8.15 P. M. Central time. 4000 meters.

Omaha, Neb. Call letters KDEF. Live stock receipts 9 to 9.15 A. M. Chicago live stock 11 to 11.30 A. M. Omaha live stock 12 to 12.30 P. M. Kansas City live stock 1 to 1.30 P. M. Grain 2 to 2.15 P. M. Chicago live stock 4.30 to 4.45 P. M. Kansas City live stock 7 to 7.15 P. M. Omaha live stock 7.30 to 7.45 P. M. Central time. 2500 meters.

North Platte, Neb. Call letters KDHM. Live stock receipts 9 to 9.15 A. M. Chicago live stock 12 to 12.30 P. M. Chicago live stock 5 to 5.15 P. M. Kansas City live stock 8 to 8.15 P. M. Omaha live stock 8.30 to 8.45 P. M. Mountain time. 3000 meters.

"RASCO HAS IT!"

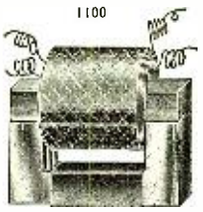
THE Radio Specialty Co.—*"Rasco"* for short—is probably the most unique supply house in the United States, if not in the world to-day. This company makes a specialty of small orders, no order being too small to get immediate and prompt attention for the simple reason that most of our orders are small.

The reputation of this house was built upon service. Ask any of your acquaintances what they think of *Rasco* goods, *Rasco* service, *Rasco* promptness! Thousands of unsolicited testimonials on file to prove that we serve the public best!

Be sure to get our great catalogue, containing several hundred different parts, which is illustrated below.

ORDER DIRECT FROM THIS PAGE. ALL GOODS SENT PREPAID IN 24 HOURS

1100



"RASCO" AUDIO FREQUENCY TRANSFORMER

We have compared many of the present transformers on the market but have finally decided upon a type that is the most efficient one we have seen so far. The best amplifying transformer is that in which the impedance of its primary is equal to or exceeds the impedance of the plate-to-filament circuit of the tube in which it is connected.

We guarantee this transformer to equal any one on the market.

No. 1100 "Rasco" Audio Frequency Transformer **(not assembled) each prepaid**.....$2.65

ANTENNA CONNECTOR

999

This antenna connector is made entirely of aluminum, is light and will not rust. The only connector of its kind. The 4 antenna wires go to the upper holes; the lower hole takes the lead-in. Don't solder your aerial, don't have loose connections. Dimensions 2" high, 1¾" wide, ⅝" thick.

No. 999, Connector, each..$0.35

PANEL KNOBS

6241

838

No. 6241 is well made and has a good corrugation. Its dia. is 1", height is ½", hole 5/32". The shank is ¼" high.

No. 6241, Knob, each.....$0.08

MARCONI KNOB

Has a central hole of 5/32" and seat to hold the screw, dia. is 1¼", height ¾".

No. 838, Marconi Knob, each.....$0.15

RASCO POSTS

202 201

030 029

These are our very own patterns, from our own designs and look mighty handsome on any instrument. The top knobs are of composition, the bottom parts brass nickel plated polish.

650 651

No. 202 is nickel plated at bottom part.

"Rasco" Binding Post, 8/32 thread, each, $0.10· doz., $1.00.

No. 202, Post, each, ...$0.08

Nos. 650 and 651 made entirely in composition with a hexagonal brass nut in center.

No. 650 has 8/32 machine screw.

No. 651 has bottom wood screw.

No. 650, Post, each.....$0.08

No. 651, Post, each.....$0.08

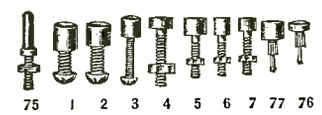
Dozen, each style.....$0.90

BRASS NICKEL POSTS

No. 029, Binding Post, each.....$0.05

No. 030, Binding Post, each.....$0.04

RASCO SWITCH POINTS



75 1 2 3 4 5 6 7 77 76

Nickel plated and polished. The following have been found the most popular.

No. 1 ¼"x¼", 6/32 thread, ea., $0.03; doz., 35c

No. 2, 3/16" high, ¼" dia., 6/32 thread, ea., $0.03; doz., 35c.

No. 3, 3/16" x 3/16", 4-36 thread, ea., $0.03; doz., 35c.

No. 4, ¼" dia.; ⅛" thick; stem 6/32, ea., $0.03½; doz., 40c.

No. 5, ¼" dia., 3/16" thick; stem 4-36, ea., $0.03½; doz., 40c

No. 6, 3/16" dia.; 3/16" thick; stem 4-36, ea., $0.03½; doz., 40c.

No. 7, 3/16" dia.; ⅛" thick; stem 4-36, ea., $0.03½; doz., 40c.

No. 75, Switch Stop, ⅞" long, 4-36 thread, complete with nut, ea., $0.05; doz., 50c.

No. 76, New style Switch Point, to be pressed into bakelite panels with forced fit. Wire is soldered to pin end. Head ¼"; dia., 1/16" thick, ea., $0.03½; doz., 40c.

No. 77, same as above, but head is ¼" dia. x 3/16" thick, ea., $0.03½, doz., 40c.

THE RASCO BABY DETECTOR

1898

In presenting this little Detector, we feel sure that it fills a place never taken before by any small detector. It does a variety of things and does them all well and better than many $5.00 detectors. The base is solid, black composition. Mounted on same is a nickel holder and binding post which holds a flutted hard rubber knob with its sliding rod member.

The outstanding part of the Detector, is the patented nickel detector cup and binding post. The knurled cap unscrews and you place the Galena Crystal in the cup, then replace the knurled cap and the galena crystal is held secure. The circular hole in the cap exposes enough of the crystal for ordinary purposes.

No. 1898, Rasco Baby Galena Detector. Price, prepaid.....$0.50

No. 1899, Rasco Baby Detector with Galena and Radiocite Crystals. Price, prepaid.....$0.75

PANEL SWITCH LEVER

200

New style switch lever with lock fork. It is impossible for this lever not to make positive contact at all times. The blade radius is 1¼". Blade is nickel plated and polished. Fork is phosphor bronze. The lock fork holds the screw (in which it rotates), securely. A loose contact is impossible.

No. 200, Switch Lever, complete as illustrated..$0.30

LITZ WIRE

323

This wire is recognized as the only thing for winding coils for Radio instruments. Particularly recommended with our **No. 343** Variocoupler Rotor, for vario-couplers, banked windings, etc.

No. 323. Litz Wire, 20 No. 38 strands, enameled double silk wire, per foot, $0.02; per 100 feet, $1.15

No. 890, Litz Wire, 10 strands No. 38 wire, per foot, $0.01; per 100 feet, $0.75.

No. 891, Litz Wire, 16 cables of three strands No. 38 wire, per foot, $0.03; per 100 feet, $2.25.

NOTE: This page contains only a few of our 300 specialties.

PANEL KNOB

815

This is a very distinctive knob and can be used on dials, panels, switches, condensers, etc. It is exceptional and well made. Dia. 1 1/16"; height 11/16"; comes with 8/32" bushing.

No. 815, Knob, each.....$0.18

VARIOCOUPLER ROTOR

343

This rotor is used by all up-to-date amateurs. Is accurately turned of hard wood and is used as a secondary coil. It takes any finish, either shellac or stain and can be drilled readily for any size hole. Large hole 2" dia. Width of spool is 2". Total dia. 3⅜".

No. 343 Variocoupler Rotor, each $0.75

"RASCO" NAME PLATES

827

839

Our name plates are of brass with a black background. Letters are polished nickel. Order by name and number.

	Each		Each
807 "Phones"	$0.05	810 "Ground	$0.05
809 "Aerial"	$0.05	812 "Primary"	$0.05
811 "Secondary"	$0.05	814 "Detector"	$0.05
813 "Audion"	$0.05	866 "On"	$0.05
865 "Off"	$0.05	840 "Increase Current" (Left)	$0.10
839 "Increase Current (Right)	$0.10	834 "Series"	$0.05
813 "Vacuum Tube"	$0.05	830 "Receive"	$0.05
831 "Transmit	$0.05	820 "2rd Step"	$0.05
821 "3rd Step"	$0.05	827 "Tickler"	$0.05
819 "1st Step"	$0.05	825 "Plate Variometer"	$0.05
826 "Grid Variometer"	0.05	835 "B Battery"	$0.05
823 "Secondary"	$0.05	817 "Output"	$0.05
836 "A Battery"	$0.05	824 "Primary Condenser"	$0.05
818 "Input"	$0.05	828 "Parallel"	$0.05
829 "Telephone"	$0.05	837 "+ —"	$0.05
833 "Detector Tube"	$0.05	841 "(Blank)" (takes pen or pencil writing)	$0.05
822 "Coupling"	$0.05		
808 "Load'g Coil	$0.05		

Price of all of our name plates in dozen lots, 50c, with the exception of the two "Increase Current"

BAKELITE PANELS

350-55

We list below six panels, the sizes of which have been selected after carefully checking up many dimensions of the most popular radio apparatus on the market.

Note particularly that our prices are anywhere from 25 to 50% lower than those quoted by most other concerns. The reason is that we buy these panels in very large quantities, **and we do not cut sheets to order.** Remember always that when sheets are cut to order they cost you at least 50% more than our prices, because **you must pay for the cutting and the necessary waste.**

Note also that we ship these panels prepaid. This alone amounts to a considerable saving.

No. 350	6"	x 12"	x 3/16"	thick,	each	$1.90
No. 351	6"	x 18"	x 3/16"	"	"	2.85
No. 352	9"	x 12"	x 3/16"	"	"	3.00
No 353	12"	x 18"	x 3/16"	"	"	5.65
No. 354	6½"	x 19½"	x 3/16"	"	"	3.50
No. 355	6"	x 7½"	x 3/16"	"	"	1.20

"RASCO" LUBRICATED PANEL SWITCH

1921

A radio switch that has two nuts at the end is a monstrosity, for the reason that it will never stay put. Our patent spring fork holds the switch handle always under uniform tension, at the same time it insures the best contact possible. **New wiping contact**, which covers every point of the switch point. Another new improvement is the lock fork, which can assume three different positions to accommodate the switch to various thicknesses of panels.

No. 1921 "Rasco" Switch, as illustrated, each $0.50.

KNOBS

199

4451

These knobs are favorites with all experimenters The size of both is: dia. 1⅛", height ⅝". No. 4451 comes with 8/32 and 10/32 bushing.

No. 4451, Knob, each...$0.06

No. 199 (screw length ⅝") Knob, each $0.10

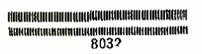
NAVY KEY KNOB

748

This navy key knob is now used on all standard wireless keys. It gives the right swinging mation and rests the fingers. It is a favorite with all advanced amateurs. Once used always used. The screw is 8/32 and will fit all keys.

No. 748, Key Knob, each.....$0.28

THREADED BRASS ROD



8032

We carry two styles, 6/32 and 8/32 thread. **Only 6" lengths sold. No others.**

No. 8032, Threaded Brass Rod 8/32 thread, per 6" length $0.08

No. 6032, Threaded Brass Rod, 6/32 thread, per 6" length $0.06

THE "RASCO" CATALOG

CONTAINS 50 VACUUM TUBE HOOK-UPS

Complete hook-ups of all important vacuum tube circuits are given in clear diagrams with complete explanation. Just to name a few. —The V.T. as a detector and one-step amplifier; regenerative circuit; De Forest ultraudion; V.T. to receive undamped and spark signals; Armstrong circuits; one step radio frequency amplifier and detector; three stage audio-frequency amplifier; short wave regenerative circuits; V.T. radio telephone; 4-stage radio frequency amplifiers; radio and audio frequency amplifier, inductively coupled amplifier; Armstrong superautodyne; radio frequency amplifier and crystal detector; etc., etc. The catalog contains 200 illustrations. On account of its great cost, it cannot be distributed free of charge. Mailed only upon receipt of

The catalog contains 200 illustrations. On account of its great cost, it cannot be distributed free of charge. Mailed only upon receipt of

15c in stamps or coin.

Radio Specialty Co.

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 sidetracked by us. A trial order will make you a life customer. Order from the above illustrations. "We can only stick you once." Try us with a 50c order. **ALL GOODS PREPAID.**

DEALERS

Get Our Special Proposition

96-98 PARK PLACE, NEW YORK CITY

Factories Brooklyn, N Y.—Elkridge, Md.

Rock Springs, Wyo. Call letters KDHN. Live stock receipts 9 to 9.15 A. M. Chicago live stock 12 to 12.30 P. M. Chicago live stock 4.30 to 4.45 P. M. Kansas City live stock 8 to 8.15 P. M. Omaha live stock 8.30 to 8.45 P. M. Mountain time. 3000 meters.

Elko, Nevada. Call letters KDEJ. Live stock receipts 8.30 to 8.45 P. M. Chicago live stock 12 to 12.30 P. M. Chicago live stock 4 to 4.15 P. M. Pacific time. 3000 meters.

Reno, Nevada. Transmits on 3000 meters at 10 A. M.

Weather reports for mailplane pilots are broadcasted whenever conditions require it. Pilots listen at all times while in the air.

The above market reports, whether sent in Morse code or by radio telephone, are given by using abbreviations that would not be understood unless the receiver had before him the blanks provided by the Bureau of Markets. A supply of these should be obtained from the Bureau. With them even a novice can receive the reports. The reports are repeated by a number of local radio stations, especially those connected with State Universities and Colleges. Details can be obtained locally.

CONCERTS, STORIES, LECTURES, NEWS, SERMONS

Akron, Ohio. Monday, Wednesday and Friday, 6.30 to 7 P. M. Eastern Standard Time, 190 or 200 meters, Radioart Store station. Call letters 8UX. Radiofone, latest phonograph records. Normal range 30 miles. Exceptional range, 200 miles.

Friday evenings. Cleveland Radio Association. Concerts.

Daily except Sunday, 8 to 9 P. M., Eastern Standard Time, 375 meters. Westinghouse station, Pittsburgh. Call letters KDKA. Press and music.

Sunday, 7 to 8 P. M. Same station. Church service.

Atlanta, Georgia. Daily 7 P. M., Eastern Standard Time. 5500 meters. Mexico City, Mexico, station. Call letters XDA. Spanish press.

Daily 8 to 8.15 P. M. 4000 meters. Cincinnati station. Call letters KDQC. Press.

Daily except Sunday, 7 to 8 P. M. 375 meters. Westinghouse station, Pittsburgh. Call letters KDKA. Press and music.

Sunday, 7 to 8 P. M. Same station. Church service.

Daily except Sunday, 7 to 8 P. M., 375 meters. Westinghouse station, Newark, N. J. Call letters WJZ. Press and music.

Schedule unknown. 200 to 250 meters. Government station, Anacostia, D. C. Call letters NSF. Radio telephone.

No regular schedules. 200 meters. Amateur stations 4ZF, 4BT, 4CO, 4VA. Music.

Sunday, Tuesday, Thursday, and possibly Saturday, 7.30 to 8 P. M. 200 meters (may change to 275, 325 or 375 meters). Carter Electric Company. Call letters 4CD. Music and press. This station was installing radio telephone on date of report.

No schedule. Amateur station Rome, Georgia. Call letters 4BQ. Radio telephone. Range said to be 500 miles.

Berlin, N. H., Y. M. C. A., is installing radio telephone transmitter for broadcasting program of interest to the public.

Buffalo, New York. Daily except Sunday, 8 to 9 P. M., Eastern Standard Time. 375 meters. Westinghouse Station, Pittsburgh. Call letters KDKA. Press and music.

Sunday, 7 to 8 P. M. Same station. Church service.

Daily except Sunday, 7 to 8 P. M., 375 meters. Westinghouse stations.

Newark, N. J. Call letters WJZ. Press and music.

Monday and Thursday, 8 to 9.30 P. M., 450 meters. Canadian Independent Telephone Company, Toronto, Canada. Radio telephone, wonderfully clear voice modulation.

Boston, Mass. Daily except Sunday, 8 to 9 P. M., 375 meters. Westinghouse station, Pittsburgh. Call letters KDKA. Press and music.

Sunday, 7 to 8 P. M. Same station. Church service.

No schedule. H. A. Beale's station, Parkersburg, Pa. Call letters 3ZO. Radio telephone.

Daily except Sunday, 7 to 8 P. M., 375 meters. Westinghouse station, Newark, N. J. Call letters WJZ. Press. Music.

No schedule. T. F. J. Howlett's station, Philadelphia, Pa. Call letters 3AWI. Radio telephone.

No schedule. (200 and 250 meters.) Government station Anacostia, D. C. Call letters NSF. Radio telephone.

No schedule reported. Variable wave lengths. Union College, Schnectady, New York. Call letters 2XQ. Music. Church service.

Daily, 8 P. M., 350 meters. American Radio and Research Corporation station, Medford Hillside, Mass. Call letters WGI. Boston city police reports, first in International Morse Code, ten words per minute, then by radio telephone.

Wednesday, 8.15 P. M. Same station. Concert.

Tuesday and Thursday, 8.15 P. M. Same station. Burgess Bed Time Stories.

Monday, 8.15 P. M. Same station. Publicity and information of general interest.

Saturday, 8.15 P. M. Football, baseball and other athletic events and general news.

Special broadcasts. Same station. U. S. Public Health Service Lectures. Detailed reports of World Series. Concerts by high class artists. Sermons on Sundays. Address by prominent speakers. Business reports. Heard in Indiana, North Carolina, Canada, Texas, and on board ships in the Atlantic.

No schedule. Raymond F. Farnham's station, Pawtucket, R. I. Call letters IOJ. Radio telephone.

No schedule. Thomas Giblin's station, Pawtucket, R. I. Call letters IXAD. Radio telephone.

Cambridge, Mass. Daily except Sunday, 8 to 9 P. M., 375 meters. Westinghouse station, Pittsburgh, Pa. Call letters KDKA. Press and music.

Sunday, 7 to 8 P. M. Same station. Church service.

No schedule. 1600 meters. Station of National Amateur Wireless Association. New York City. Reports of athletic championship events such as the Dempsey-Carpentier fight, and the baseball World Series. Concerts by famous musicians. Daily papers announce details needed by persons who wish to hear the broadcasts from this station.

Daily except Sunday, 7 to 8 P. M., 375 meters. Westinghouse station, Newark, N. J. Call letters WJZ. Press and music.

Daily, 7 P. M. H. B. Richmond reports: "One station using but a single wire aerial, detector and 2-step amplifying unit, has been able to copy the time signals from Honolulu, Hawaii, and Nauen, Germany. . . . These stations are sending the time signals 12 hours apart, yet they are received in Boston simul-

taneously. Nauen is sending signals at midnight. . . . The time signals from Honolulu are being sent out at 12 o'clock noon of the previous day. Because of the difference in time both come in at Boston at 7:00 o'clock P. M. It is quite effective to sit at one's apparatus and by simply turning the condenser knob shift from Germany to Honolulu, realizing as we do that these places are 12 hours apart; in other words, on opposite sides of the globe.

No schedule. Local radiophone concerts.

Chicago, Illinois. 8 P. M. Westinghouse station, Chicago. Call letters KYW. Music. Grand opera every night.

Navy station. Call letters NUR. Weather forecast, market reports. Press.

Army station at Fort Sheridan (not complete for public transmission on date of report).

Police and Fire Departments reported to be experimenting with radio telephone.

Amateur stations 9XG and 9LY. Music.

Cincinnati, Ohio. Daily except Sunday. 7 to 8 P. M. Central Standard Time. 375 meters. Westinghouse station, Pittsburgh, Pa. Call letters KDKA. Press and music

Sunday, 6 to 7 P. M. Same station. Church service.

Schedule not given. Government station, Anacostia, D. C. Call letters NSF. Radio telephone.

Monday, Wednesday and Saturday, 8 P. M. Central Standard Time. 375 meters. Station of Precision Equipment Co. Call letters 8XB. Music, vaudeville, baseball scores and other information of value. Heard in Iowa, Michigan, Illinois, Minnesota, Canada, Pennsylvania, Virginia, Florida and Tennessee.

Cleveland, Ohio. Sunday, 7.30 or 8 P. M. Eastern Standard Time. Station of Cox Manufacturing Company, Cleveland. Call letters 8ACS. 200 meters. Music and voice. Can be heard with mineral detector receivers in Cleveland and suburbs. With amplifiers it is heard clearly at distances up to 50 or 60 miles and has repeatedly been heard at distances of several hundred miles.

Thursday evenings. Concerts under auspices of Cleveland Radio Association. Different members give these concerts. They are heard throughout Greater Cleveland and sometimes at greater distances.

Daily except Sunday, 8 to 9 P. M. 375 meters. Westinghouse station, Pittsburgh, Pa. Call letters KDKA. Press and music.

Sunday, 7 to 8 P. M. Same station. Church service.

Reception of broadcasts from the above station is subject to local interference.

Almost any evening. Various radio telephones.

Occasionally in the evening. Westinghouse stations at Newark, N. J., and Chicago. Music and press.

Columbus, Ohio. Monday, Wednesday and Friday, 7.30 P. M. Central Standard Time. 200 meters. Station of Electrical Specialty Company. Call letters 8BYV. Music, football scores, baseball scores and other news.

Daily except Sunday, 7 to 8 P. M., Central Standard Time. 375 meters. Westinghouse Station, Pittsburgh, Pa. Call letters KDKA. Music and press. Market reports.

Sunday, 6 to 7 P. M., Central Standard Time. Same station. Church service.

Daily except Sunday, 6 to 7 P. M.,

Central Standard Time. Westinghouse station, Newark, N. J. Call letters WJZ. Market reports, music, press.

No schedule. Doron Brothers Electrical Company, Hamilton, Ohio, station. 200 meters or over. Radio telephone.

McCook Field, United States Army, Dayton, O. Call letters WA-1. Radio telephone.

United States Army station, Fairfield, Ohio. Call letters WL-2. Radio telephone.

No schedule reported. 275 meters. Station of Ohio State University, Columbus. Time signals, market reports and other useful information. Call letters 8YO.

Daily except Sunday, 12.35 P. M., Central Standard Time. 800 meters. University of Wisconsin station. Call letters 9XM. Weather forecast for Wisconsin. In International Morse Code. 18 words per minute. Repeated at 7 words per minute. Then repeated by voice from radio telephone three times.

Daily except Sunday. Same station and wave-length. 12.15 P. M. Report of Wisconsin Department of Markets. Same code, 10 words per minute. Special abbreviations are used. Persons interested should secure from the University Forms MI-20 and MI-22. Reports are repeated by voice from radio telephone, using same special abbreviations, beginning 12.50 P. M.

Friday, 7.30 P. M. Same station and wave-length. Edison phonograph music. At 8.15 P. M., wave-length is changed to 375 meters for the benefit of those whose receivers will not receive the longer wave. Concerts given in the University Armory by distinguished artists such as Vecsey, Lhevinne and Casals are transmitted by radio telephone in place of the phonograph concerts whenever the consent of the artists is obtained.

Monday, 9 to 11.30 P. M., Central Standard Time. 375 meters. Same station. Campus news exchange with other universities. International Morse Code, 20 words per minute.

Tuesday, Thursday and Friday, 10 to 12 P. M. (beginning one hour earlier on Friday). Same station. 330 meters. Exchange of messages with amateurs. Wave-length raised to 375 on Friday. Speed adapted to the operator who calls.

Monday, Wednesday and Saturday, 8 P. M., Central Standard Time. 375 meters. Station of Precision Equipment Company, Cincinnati. Call letters 8XB. Music, vaudeville, baseball scores and other information.

No schedule given. Station of University of Iowa, Iowa City. Call letters 9YA. Market reports by radio telephone.

No schedule given. Station of DeForest Radio Telephone and Telegraph Company, Ossining, N. Y.

Dallas, Texas. Rumored that the Westinghouse Company will establish a broadcasting station similar to that at Newark, N. J.

Davenport, Iowa. Tri-City Radio Electric Supply Company reports: "Physically impossible to list all the calls heard. We get all the stations sending market reports. Hear Los Angeles music. Get NAH (U. S. Navy station, New York), like a "ton of bricks."

Denver, Colorado. Daily, 10 P. M. Y. M. C. A. station. Time signals, weather report and news.

Thursday, 8 to 9.30 P. M. Fitzsimons Hospital station. Concert.

Daily, 8.30 A. M. Station of Reynolds Radio Company, Inc. Weather forecast (voice only). Radius 250 miles. Call letters 9ZAF.

Daily, 9 P. M. Same station. Weather forecast (voice only). Radius 1,000 miles.

Sunday, 8 to 10 P. M. Same station. Concert. Radius 1,000 miles. This music is used for dances in Wyoming, Nebraska and Kansas.

Galveston, Texas. Galveston Wireless Supply Company reports: "Hear press and music from Houston, 65 miles away. Do not know schedules. We expect to install 30-mile radiophone and later a transmitter for relay and press work on regular schedule.

Hartford, Connecticut. Tuesdays, Thursdays, Saturdays, 8 P. M., Eastern Standard Time. 425 meters. Station of The C. D. Tuska Company. Call letters WQB. Concerts. These have been heard over a range of approximately 900 miles.

Johnstown, Pennsylvania. Hack's Electrical Store broadcasts program of interest to the public.

Kansas City, Missouri. 11.30 A. M. 375 meters. Station of Western Radio Company. Call letters 9XAB. Kansas City Live Stock Market reports and weather forecast. Voice only.

2 P. M. Same station. Kansas City and Chicago Live Stock Market report, grain market and weather report.

7.30 P. M. Same station. Repeats market and weather reports, followed by concert at 8.

8.30 to 9 P. M. Same station. Concert. Phonograph, and vocal and instrumental music.

Radio telephone is used exclusively in the above broadcasts and the voice at the telephone is heard over a range of 1,000 miles.

Lincoln, Nebraska. Noon and 7.30 P. M. University of Nebraska station. Call letters 9YY. Phonograph concerts. Range several hundred miles.

Los Angeles, Cal. Hamburger's Department Store broadcasts program of interest to the public. Range 1,000 miles.

Louisville, Ky. Monday, Wednesday, Friday, 10 P. M. 200 meters. Station of Darrell Ashton Downard. Call letters 9ARU. Police news in code.

Madison, Wisconsin. Daily except Sunday, 12.35 P. M., Central Standard Time. 800 meters. University of Wisconsin station. Call letters 9XM. Weather forecast for Wisconsin. In International Morse Code, 18 words per minute. Repeated at 7 words per minute. Then repeated by voice from radio telephone three times.

Daily except Sunday, 12.15 P. M. Same station and wave-length. Report of Wisconsin Department of Markets. Same code, 10 words per minute. Special abbreviations are used. Persons interested should secure from the University Forms MI-20 and MI-22. Reports are repeated by voice from radio telephone, using same abbreviations, beginning 12.50 P. M.

Friday, 7.30 P. M. Same station and wave-length. Edison phonograph music. At 8.15 P. M., wave-length is changed to 375 meters for the benefit of those whose receivers will not receive the longer waves. Concerts given in the University Armory by distinguished artists such as Vecsey, Lhevinne and Casals are transmitted by radio telephone in place of the phonograph concerts whenever the consent of the artists is obtained.

Monday, 9 to 11.30 P. M. 375 meters. Same station. Campus news exchange with other Universities. International Morse Code, 20 words per minute.

Tuesday, Thursday, 10 to 12 P. M. Same station. 330 meters Exchange of

messages with amateurs.

Friday, 9 to 12 P. M. Same station. 375 meters. Messages and tests. Speed adapted to amateurs.

Medford Hillside, Mass., Daily, 8 P. M. 350 meters. Station of American Radio and Research Corporation. Call letters WGI. Boston city police reports, first in International Morse Code, ten words per minute, then by radio telephone.

Wednesday, 8.15 P. M. Same station. Concert.

Tuesday and Thursday, 8.15 P. M. Same station. Burgess Bed Time Stories.

Monday, 8.15 P. M. Same station. Publicity and information of general interest.

Friday, 8 P. M. Amateur Night. Code instruction; new licenses announced.

Saturday, 8. 15 P. M. Football, baseball, other sporting events and general news.

Special broadcasts. Same station. United States Public Health Service Lectures. Detailed reports of World Series. Concerts by high class artists. Sermons on Sundays. Addressed by prominent speakers. Business reports. Voices from this station are heard in Indiana, North Carolina, Canada, Texas, and on board ships in the Atlantic.

Menominee, Michigan. Reported by Signal Electric Manufacturing Company that they hear all broadcasts sent out with sufficient power to carry up to 800 or 1,000 miles.

Montreal, Canada. Tuesday, 8 to 9.30 P. M. 1,200 meters. Station of the Marconi Telegraph Company of Canada, Limited. Radiophone concerts, news bulletins, notices of wireless society meetings and other information. Range about 200 miles. Heard at Charlottetown, Prince Edward Island.

Newark, New Jersey. Radio telephone broadcasts and all sorts of traffic too numerous to mention. Wireless Equipment Company reports hearing amateur Radio telephones in New York, Perth Amboy and Rutherford. Also Westinghouse station WJZ, Army radio telephones at Fort Wood, N. Y., and the De Forest Radio Telephone and Telegraph Company's broadcasts.

The Westinghouse Company's radio telephone broadcasting station in Newark is one of the most powerful in the country and, like this company's stations in Springfield, Mass., Pittsburgh, and Chicago, provides varied entertainment for all who listen in during the day and evening. With proper receiving apparatus Westinghouse Broadcasts may be heard over practically the entire Eastern United States and the addition of multistage amplifiers and loud speakers will make the music, sermons and other things audible throughout the largest auditorium.

New York City. A list of all that can be heard with a radio receiver anywhere within three hundred miles of Greater New York would fill a book. At any hour of the day or night, with any type of apparatus, adjusted to receive waves of any length, the listener will hear something of interest. Scores of ships may be heard exchanging messages with shore stations or with each other in the International Morse Code. Many of them have radio telephones also and conversations may be heard in many different languages. Government stations send out weather forecasts, hydrographic information and time signals. Amateurs signal in Morse code, converse over radio telephones or amuse the world by playing jazz. At times there is so much going on that it is difficult to tune out all but

the station that the hearer wishes to receive, though the selectivity of modern tuning apparatus is marvelous. By merely listening in and writing down the adjustment of the receiving apparatus at the time when it brings in each station, anyone may quickly develop a list of broadcasts and then add to it each day as new and interesting stations are discovered.

One man reports: "I can hear nearly every high power station in the world."

Paris, Texas. Daily, 7 P. M. 375 meters. Station of James L. Autry, Junior, Houston, Texas. Call letters 5ZX. Weather forecast and local news. International Morse Code.

Daily, 7 P. M. 375 meters. Dallas, Texas, station. Call letters 5ZC. Weather forecast, highway report (CAMAA), police bulletin and local news. Code.

No schedule given. 375 meters. State University, Austin, Texas. Results of athletic contests, local news and other information. Call letters 5ZU. Code.

Daily, 7.30 P. M. 450 meters. Dallas, Texas, station. Call letters WRR. Police and Fire Departments. Weather forecast, police bulletins, local news and other information. Radio telephone.

Daily, 8.30 to 9 p. m. Same station. Concerts.

Daily, 6 P. M., until 11 or 12 P. M. 375 meters. Denver, Colorado, station. Addresses, music and local news.

At intervals. California stations. College stations in New York, Michigan, Wisconsin, Nebraska, Ohio, Illinois, Iowa, Dakotas, Indiana, Missouri, Georgia, Texas, New Mexico, Kansas, Mississippi, Louisiana, Alabama, Virginia, Kentucky.

All the above were reported by A. L. Overstreet.

Pittsburgh, Pa., Daily, 8 P. M. 360 meters. Westinghouse Station. Varied program. Doubleday-Hill Electric Co. 450 meters. Range 700 miles. Schedule to be announced.

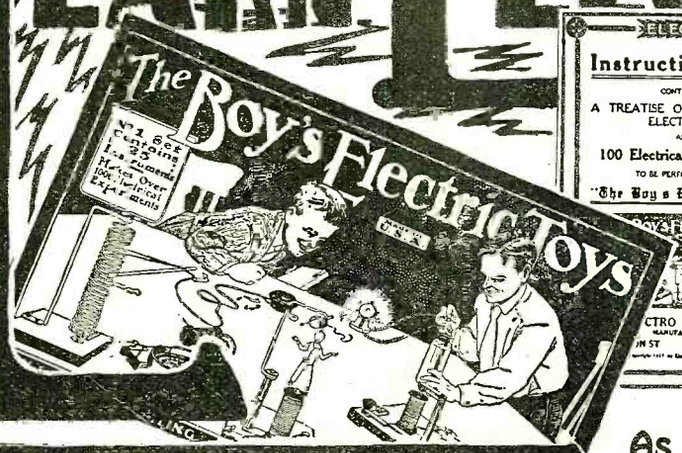
San Francisco, Cal. Leo J. Meyberg Company reports the following concert schedule:

Sunday, 10 to 11 A. M., Fairmont Hotel station.

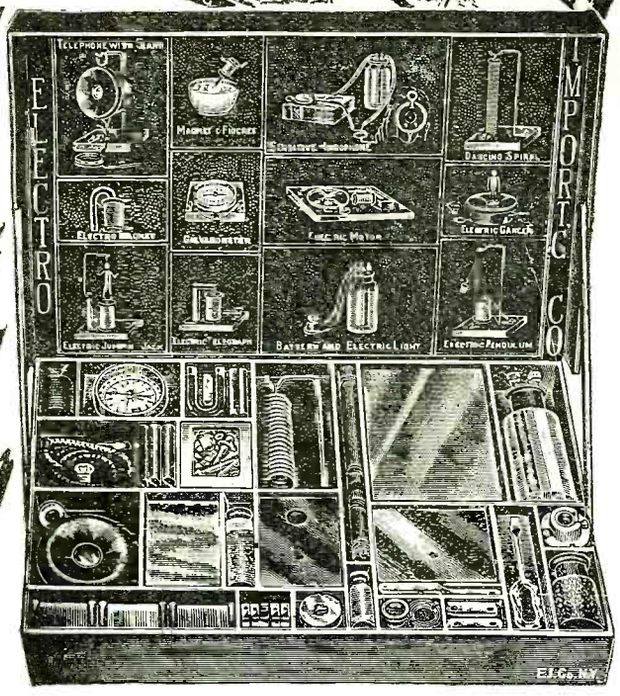
Monday, 7 to 9 P. M., Presidio station.

Monday, 7. 30 to 8.30 P. M., Los Altos station.

LEARN ELECTRICITY



The BOY'S ELECTRIC TOYS



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Complete

Teaches you all the principles of electricity by the "Learn by Doing" Method. Entertaining, Instructive, More Fascinating than any game. The most complete electrical experimenters' outfit that has ever been put on the market.

Valuable Electrical Instruction Book With Each Outfit

With each outfit we furnish free a very comprehensive book of electrical instruction. All the fundamentals of this fascinating science are clearly explained so even a layman can understand every word. Profusely illustrated. The instructions for building the apparatus are given in such a simple and easily grasped manner that anyone can make them without the least trouble. Over a hundred experiments that can be performed with the outfit are listed in the instruction book, nearly all of them illustrated with superb drawings.

Teaches You How To Build Electrical Apparatus

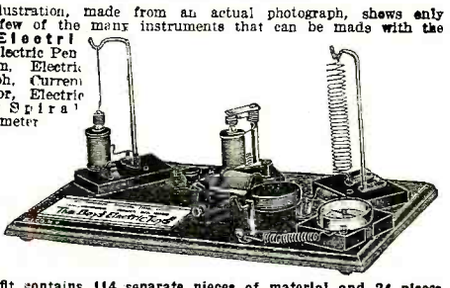
THE BOY'S ELECTRIC TOYS contains enough material to make and complete over twenty-five different electrical apparatus without any other tools, except a screwdriver furnished with the outfit. The box contains the following complete instruments and apparatus which are already assembled:

Student's chromic plunge battery, compass-galvanometer, solenoid, telephone receiver, electric lamp. Enough various parts, wire, etc. are furnished to make the following apparatus:

Electromagnet, electric cannon, magnetic pictures, dancing spiral, electric hammer, galvanometer, voltmeter, hook for telephone receiver, condenser, sensitive microphone, short distance wireless telephone, test storage battery, shocking coil, complete telegraph set, electric riveting machine, electric buzzer, dancing fishes, singing telephone, mysterious dancing man, electric jumping jack, magnetic geometric figures, rheostat, erratic pendulum, electric butterfly, thermo electric motor, visual telegraph, etc., etc.

A Sample of What You Can Do With This Outfit

This illustration, made from an actual photograph, shows only a very few of the many instruments that can be made with the **Boy's Electric Toys:** Electric Pendulum, Electric Telegraph, Current Generator, Electric Dancing Spiral, Galvanometer.



The outfit contains 114 separate pieces of material and 24 pieces of finished articles ready to use at once.

Among the finished material are included: Chromic salts, lamp socket, mercury, core wire, iron fillings, three spools of wire, carbons, machine screws, flexible cord, wood bases, glass plate, paraffine paper, binding posts, screw-driver etc. etc.

Shipment guaranteed within 24 hours.

SEND NO MONEY

We have so much confidence in this set that we desire to ship it to you C. O. D. with the privilege of inspection. It does not cost you one cent to take a good look at the outfit, and see if it comes up to your expectations. If it does, pay the postman $7.50, plus shipping charges. If it does not, you need not accept it, and we will pay the return charges as well.

THE ELECTRO IMPORTING CO.
231 Fulton St., N. Y. City

ELECTRO IMPORTING CO.
231 Fulton St., N. Y.

As per your advertisement, ship to me at once, C.O.D., the Boy's Electric Toys with privilege of inspection. It is understood that if I do not like the outfit I can refuse it.

Name .....

Address .....

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

(RN 3-22)

Monday, 8.30 to 9 P. M., Fairmont Hotel station.

Tuesday, 7.30 to 8.15 P. M., Hotel Oakland station.

Tuesday, 8.15 to 9 P. M., Radio Shop station, Sunnyvale.

Wednesday, 7.30 to 8.15 P. M., Harrold Laboratories, San Jose.

Thursday, 7.30 to 8.30 P. M., Fairmont Hotel station.

Thursday, 8.30 to 9 P. M., Los Altos station.

Friday, 7.30 to 8.15 P. M., Radio Shop station, Sunnyvale.

Friday, 8.15 to 9 P. M., Hotel Oakland station.

Saturday, 8.15 to 9 P. M., Fairmont Hotel station.

Every afternoon except Sunday, 3.30 to 4.30 P. M., Rockridge station of Atlantic-Pacific Radio Supplies Company. 360 meters. Call letters KZY. Concert.

Every night except Sunday, 6.45 to 7 P. M. Same station. General news, sports, foreign news.

Sunday, 11 A. M. to 12.15 P. M., sermon and sacred music. Same station.**

3 to 4 P. M., Same station. Concert.

4 to 5 P. M., Same station. Concert**

**This station will carry the Sunday morning schedule of Trinity Center and the Sunday afternoon schedule of Colin B. Kennedy until these two stations are ready to carry their schedules shown for that day.

Wednesday, 7.30 to 8.15 P. M. Same station. Concert.

Saturday, 8.15 to 9 P. M. Same station. Concert.

Also the following, daily except Sunday:

7.10 to 7.20 P. M., Hotel Oakland station. General news.

7.20 to 7.30 P. M., Fairmont Hotel station. Market, bond, and weather reports.

4.30 to 5.30, Fairmont Hotel station.

Until the California Theatre can make the necessary changes to operate on 360 meters, the Presidio will broadcast concerts on their schedule, Wednesday evenings, 8.15 to 9, and the Fairmont Hotel will run the full hour and a half from 7.30 to 9 P. M. on Saturdays.

The Fairmont Hotel, Los Altos, Hotel Oakland, and the Presidio are heard consistently up to 1,500 miles. Reports have been received from Alaska, British Columbia, Washington, Oregon, Nevada, Utah, Arizona, Montana, North Dakota, and practically all of the Northwestern states. Stations within a radius of two and three hundred miles are consistently receiving concerts from the above mentioned stations loudly enough to be heard all over the house

Rumored that Westinghouse Company will establish broadcasting station similar to that at Newark N. J.

St. Paul, Minnesota. It is reported that through cooperation with city officials, a Boy Scout Municipal Radio station is being established. The station will be able to send by radio telegraph over a radius of 1,000 miles and by radio telephone as high as 500 miles. It will distribute crop and weather reports and cooperate with the State Department of Forestry by reporting forest fires. Intertroop communication will be maintained between Scouts in all parts of the State. Concerts, lectures and addresses given at the Municipal Auditorium will be broadcasted. The station is reported to be in charge of 16 Scouts under the leadership of a Scoutmaster who was formerly a radio inspector.

Schenectady, N. Y. Union College broadcasts programs of interest to public.

Seattle, Wash. Post-Intelligencer broadcasts programs of interest to public, including United States Public Health Service Lectures.

Toronto, Canada. Tuesday, 8 to 9.30 P. M. 1,200 meters. Station of the Marconi Telegraph Company of Canada, Limited Radiophone concerts, news bulletins, notices of wireless society meetings and other information. Range about 200 miles.

Washington, D. C. Tuesdays, 7.30 to 9.30 P. M. Station of White & Boyer. Concerts, with short lectures on radio and information of interest to radio amateurs. Planning to broadcast. Keith's vaudeville.

Tuesday, 4.15 P. M. Naval Air Service Station. Call letters NOF. 1,100 meters Music United States Public Health Service Lectures.

Wednesday, 9 P. M Same station. 365 meters. Music. Talks on radio.

Friday, 8.30 P. M. Same station. Music. Music, 9 P. M., United States Public Health Service Lecture

Sunday, 10.30 A.M. Church of the Covenant. (Transmission by Radio Construction Company. Call letters WDM. 365 meters.) Church service.

Sunday, 3 P. M. Same church and transmitting station. Addresses by famous men and women on topics of public interest.

Sunday, 7.30 P. M. Same church and transmitting station. Church service.

Some of the most important Government stations are located in the vicinity of Washington. The Arlington station of the Navy, call letters NAA, transmits time signals and news on 2,650 meters daily at noon and 10 P. M. This station and the still more powerful one at Annapolis, which transmits similar information on the same schedule, can be heard throughout the United States and in fact throughout a large part of the world. The station at the Bureau of Standards conducts tests in which it has the coöperation of many amateur stations. Then there are Army stations and stations connected with the Army and Navy flying fields. Radio telephones may be heard frequently. Loomis Radio School is planning to broadcast, daily, music played in a local theatre.

Westerly, Rhode Island. Nightly. Whitall Electric Company station. Music and speech.

The Westinghouse stations at Pittsburgh, Newark, N. J., and Springfield, Massachusetts, are heard here. They transmit on 375 meters concerts, readings, sermons, and news. Schedules are given in reports from a number of preceding cities.

American Radio and Research Corporation station, Medford Hillside, Massachusetts. See schedule under "Medford Hillside, Mass."

Radio telephones on board vessels sailing along the coast are frequently heard here.

Anywhere in the United States. With an up-to-date long-wave receiver, it is possible to get the news broadcasted by high powered stations in the British Isles, Germany, France, Italy, Russia, Mexico, West Indies, South America, Hawaii With the increase in power of transmitting stations world-wide reception has become possible. Radio Central the new commercial station of the Radio Corporation of America, located at Rocky Point, Long Island, New York, has been heard in New Zealand, 10,000 miles away

Radio in Porto Rico

(Continued from page 829)

and NZR.

I am using regeneration for all waves, damped and undamped.

Time signals are heard every day at 1 P. M. and at 2 P. M. and 10.55 P. M. from NSS, NAA, NBA and NAR. This is a great benefit for me as I am a watch-maker. All high power stations are copied easily, and on favorable conditions, LCM and POZ are also copied. XDA speeds up every night from 9.00 P. M. sending press in Spanish. We are one hour faster than 75 meridian.

I have been working and experimenting alone in Porto Rico since 1914. At last, there are some amateurs here and I expect to have a Club in the near future. It is my wish to have some good work with the amateurs, specially those in the 4th District.

I was the second amateur licensed in Porto Rico. The first was Mr. E. Camuñas, my assistant, who was taught by me.

I am building a spark set and a Radiophone set, using 3-5 watt bulbs.

As I have been interested in the construction of apparatus, I have not speeded up much in the code, so I can copy only about 15 words a minute.

My experience in construction work is that an intelligent amateur may construct any kind of radio apparatus as efficient as any built by firms, saving two-thirds in initial cost.

I hope to get amateurs with my nearly completed short wave set, in a few months.

Notes on High Power Quenched Spark Sets

(Continued from page 809)

sometimes considerable, and can be reduced by proper insulation of the laminations. The best insulation of laminations is shellac as indicated by the following results obtained on a 5-K.W. Navy transformer at 500 cycles:

Insulation.	Volts.	Watts Loss
1. Irons shellacked	150	251
2. Irons paper insulated loose	150.2	273
3. Irons paper insulated tightened	147	295
4. Irons simply rusty loose	150	298
5. Irons simply rusty tightened	150.1	332

The core is held together with wood braces and iron bolts. These iron bolts reach a considerable temperature due to hysteresis loss. Substituting brass bolts the temperature attained is only one-half and mostly due to heat conduction from the core temperature.

In a similar manner the losses in an external reactance wound with one heavy wire due to eddy currents is much greater than in a reactance wound with a cable of a number of small wires each insulated from each other. Furthermore, the cable is easier to wind mechanically than the heavy wire.

The reactance in ohms of an external reactance can be found closely by. Ohms = K × Turns^2 × solid section in square inches (core), K being a constant for the shape of the core.

The maximum inductance per square inch is found as volts times 45,000 divided by section in square inches times the turns. There is a limit to heating due to maximum induction in the center of the coil and should not be much greater than 20,000 C.G.S. lines per square inch for 500 cycles.

In a 20-K.W. spark transmitter the volt-

ages in the antenna circuit are high with a high antenna capacity which in this case was .004 MF. Even in the primary radio frequency circuit an arc can be drawn out 3' or 4' around the gap units. The transformer secondary is protected by two-air core radio frequency choke coils. To be effective these chokes should have a fundamental wave-length approximately that of the transmitting wave-length and with a minimum of distributed capacity. The transformer secondary is also protected by a ball gap, a third ball in the center and connected to ground. Transformers of this size are usually oil cooled which in addition adds to the safety factor of the insulation.

Tuning of the various circuits is first accomplished on low power, even as low as 5 K.W. on a 20-K.W. transmitter, and after all circuits are adjusted the power may be increased 25 to 50 per cent. above 20 K.W., without any danger of overload, the equipment being designed to stand that additional load for short periods of 30 minutes.

The Hall Air Jet Relay for Recording Radio Signals

(*Continued from page 809*)

set. Amplifiers are not a necessity, providing a clear, readable signal of only average strength is audible in the head receivers. The relay is, to a great extent tone selective, and signals of equal intensity, which cannot be readily differentiated by the ear, may be individually recorded, providing a reasonable difference in tone frequency exists between them

The foregoing paragraph would indicate the relay to be an extremely sensitive device, and so it is. In marked contrast to this inherent quality to detect the weak incoming currents of the radio signal, is its extreme ruggedness and ability to withstand abuse. After once having adjusted the air pressure feed, which is supplied by a miniature blower, to the incoming signal, further adjustment is unnecessary.

A remarkable and unusual test of this instrument came about unexpectedly. During a recent demonstration a relay, which was operating, accidentally was thrown from its support and dropped over three feet on to a hardwood floor with sufficient impact to loosen the seams of the enclosing wood cabinet of hard dovetail oak. The instrument upon being replaced on the table, continued to operate perfectly, without the necessity of a single adjustment or repairing of any part. This same instrument, without any replacements other than a new cabinet, has given over five hundred hours' service, and shows no signs of usage.

In the matter of replacements, the only parts would be the rubber diaphragm and the silver contacts, which would possibly require renewal every three thousand working hours. The up-keep cost would hardly average one dollar per year.

The relay is a sound, operated device, with no electrical or magnetic amplifying circuits. A small air jet inflates the rubber diaphragm, on which the movable spring contact rests. Adjacent to the jet, is a standard telephone receiver, which is connected to the radio receiving set. An incoming signal, audible in the receiver, is conveyed to the air jet, causing it to flare, which allows the diaphragm to deflate, bringing the spring contact in touch with a stationary contact. This closes a local circuit of about six volts to which a tape recorder, bell, buzzer, or land line sounder may be connected. Upon cessation of the incoming signal, the air jet immediately returns the diaphragm to its normal condition thus opening the local circuit. This process is repeated in response to each incoming dot

or dash. It is very evident that this perfectly and speedily reproduces the original signal. It has been found that 12-volt currents are readily handled directly by this rugged set of contacts. For higher currents a four-ohm relay is first actuated and used as an intermediate circuit. One Western university nightly flashes government time signals from its administration building dome by means of a 1,000-watt lamp searchlight. This makes it perfectly evident that distant mechanical devices may be started and controlled by radio signals.

Real Sport Playing Games by Wireless

(*Continued from page* 825)

the fallacy of such an objection. The contestants cannot cheat when playing a radio game any more than they can cheat when engaged in the usual game. If one player makes a move without reporting it, his attempt to cheat will appear on the other player's board sooner or later and one experience of this kind is sufficient to prove that it is best to play honestly.

Chess can be played in much the same way. The boards can be numbered, or if the players are expert enough, it is not necessary to use a numbered board. For beginners, however, it will facilitate the playing if numbers are employed. The game of chess is carried on in much the same way as checkers. Cheating is just as inadvisable.

A trip through a sporting goods store or toy shop will bring to light many games that can be played over the wireless. Take, "Bringing Up Father" for instance, which is the latest. In this game, little spinners are used to determine the various moves that are to be made. In fact, this principle is used in numerous games. If each station has one of the game boards and one of the spinners, as many as four people can enjoy the game at one time. The little spinner is manipulated and the arrow stops at a certain number. The player then makes this move and reports the move to the distant player who accounts for the move on his own board, moving the button forward to the proper position. He then spins for himself and in turn reports this to the opposing players.

Every game in which the moves are determined by a spinner or by throwing dice can be played by radio. Most of the popular games depend upon this method, and for that reason there are few games that cannot be "radioed."

Many card games have been very successfully played by wireless. Some wireless fans have gone to the trouble of inventing new games that lend themselves to this sort of playing. One enterprising fan has brought out a game that he calls Radiolites. To play it, a single pack of cards is divided between two stations, each station receiving 26 cards. The cards are laid face downward. A starts the game by turning one of his cards over. Let us say that it is the ace of hearts. A at once reports this to B, who then turns over his top card and attempts to match A's. If B turns over, say, the ace of diamonds, he is credited with ten counts. If he turns over the ten of spades he gets nothing. However, if he happens to turn over the eight of hearts, he gains five, since he would then be *matching the suit* of the first card turned over by A. First A turns over a card and then B, and the plays are made alternately until the halves of the deck are exhausted. The cards are then picked up, shuffled and the game continued until one player has two hundred counts to his credit. To sum up this game: One player simply tries to match the card turned over by his opponent either

in number or suit. If he matches the card, he gets ten points, and if he matches the suit he gets five points. It is, of course, necessary to carry the game through on an honor basis.

The popular game of rummy can be played very nicely by four players, two at each station. To do this it is necessary to overstep the rules of the conventional game to a slight extent. However, the new game is just as fascinating and requires the same amount of wit and just as much enjoyment can be had from it. Two separate packs of cards are used, one at each station. Each of the four players is independent. Everyone plays for himself. The progress of the game is reported at various times.

Let us assume that we have four players, A, B, C and D. If A succeeds in laying down three or four cards, a report is immediately made to the other station. If A's good luck continues and he succeeds in laying down all his cards he wins the game and each of the other players must have the number of counts in his hand chalked up against them. The game can be carried on in this way, or if the players wish, one station can play against the other. The game is carried on in exactly the same way, only the counts, instead of being marked against the individual players, are marked against the station.

How to Make a Radiophone Receiving Station

(*Continued from page 836*)

one telephone receiver, though a pair is the more satisfactory arrangement. A very good pair may be obtained for four or five dollars and as the distance over which a set will receive is governed to a great extent by the type of receivers employed, it is recommended that good receivers made specially for radio be purchased.

After these requisites have been secured, we come to the installation of the apparatus, which is a very simple matter. The lead-in wire is connected to the binding post of the tuning coil which is attached to the end of the wire wound around the cylinder. The binding post which is connected to the slider rod is then connected to one side of the detector and the other side of the detector is connected to a wire which runs to the ground connection. The receiver cords are connected to each side of the detector, as shown in the illustration.

In making the ground connection from the detector, it is merely necessary to run a wire to a water or gas pipe, located somewhere near the receiving instruments. The pipe should be thoroughly scraped and the ground wire wrapped tightly around it and soldered if possible.

Important New Radio Legislation

(*Continued from page 818*)

amateur broadcasts speech or music on a wave-length say below 200 meters, for the reason that the present commercial broadcasting stations use a wave-length of 360 meters. Inasmuch as the tuning has to be quite sharp anyway to receive the present radio concerts, etc., it would seem that the lower wave-length would certainly not interfere with that of the commercial stations

Will you be kind enough to inform the writer fully, so we can publish an intelligible article in connection with this matter, and greatly oblige,

Yours respectfully,
(Signed) H. GERNSBACK,
Editor RADIO NEWS.

Department of Commerce,
Office of the Secretary.
Washington, Jan. 31, 1922.

Mr. H. Gernsback,
Editor, RADIO NEWS,
233 Fulton St., New York.

Sir:

I have receiver your letter of the 20th instant, requesting information concerning the new regulation prohibiting the use of amateur radio stations for broadcasting.

The new regulation is not intended to permanently prohibit amateur radio stations performing a broadcasting service, but to prevent the indiscriminate use of any amateur station for service of this kind.

Broadcasting is a new service which had developed rapidly within the last three months, and which can be made of great public benefit in many ways if properly regulated. It is realized that certain regulations must be enforced or the value of the service will be destroyed.

The first regulatory steps have been taken in connection with the larger stations, limiting them to certain wave lengths and classes of licenses. It is not possible to assign to each station a special wave-length for broadcasting, therefore the wave-length of 360 meters was selected for broadcasting entertainment and the wave-length of 485 meters for Government reports, such as market and crop estimates and weather forecasts.

It is desired to arrange some satisfactory plan for the amateurs. At present, the following plans are under consideration: First, authorizing amateurs desiring to broadcast, if such broadcast is of public benefit, to use the wave length of 200 meters at certain specified times, so as not to seriously interfere with the existing amateur radio telegraph service; Second, to allow amateurs to broadcast only on 175 or 225 meters, leaving the 200 meters wave-length open to regular amateur communication service.

If it is decided to authorize broadcasting on 175 meters this authority can be included in their present regular amateur station licenses. If 225 meters is authorized special amateur station licenses will be necessary.

It is not the intention of the Department to impose upon the amateurs any unreasonable regulation. It will be helpful to the Department if the amateurs will cooperate in arranging a plan which will be productive of the greatest good to the largest number.

Broadcasting should be considered a service desired by the public and not operated solely for the amusement or benefit of the individual having the broadcasting station.

Respectfully,
(Signed) C. H. HUSTON,
Assistant Secretary of Commerce.

The Relay Antenna Transfer Switch

(*Continued from page 820*)

should be maintained between the transmitter and receiver antenna contacts. Very small spacings can be employed with CW sets due to the much lower voltages encountered for the same output than that obtained with the obsolete spark sets.

It is hoped that this relay, because of the ease with which changing from transmitting to receiving can be effected, will stimulate the use of the up-to-date CW and ICW equipment and help to eliminate the obsolete spark sets and the QRM caused by them.

Government Needs Assistant Radio Engineers

The United States Civil Service Commission announces an open competitive examination for the position of assistant radio engineer. A vacancy in the office of the Chief of Air Service, Washington, D. C., at $2,400 a year; a vacancy at Camp Alfred Vail, N. J., Signal Service at Large, at $2,000 to $3,000 a year; and vacancies in positions requiring similar qualifications, at these or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer or promotion.

Applicants should at once apply for detailed information, and for Form 2118, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C.; the Secretary of the United States Civil Service Board, Customhouse, Boston, Mass., New York, N. Y., New Orleans, La., Honolulu, Hawaii; Post Office, Philadelphia, Pa., Atlanta, Ga., Cincinnati, Ohio, Chicago, Ill., St. Paul, Minn., Seattle, Wash., San Francisco, Calif., Denver, Colo.; Old Customhouse, St. Louis, Mo.; Administration Building, Balboa Heights, Canal Zone; or to the Chairman of the Porto Rican Civil Service Commission, San Juan, P. R.

Receipt of applications to close on March 21, 1922.

Something to Try

BY FRANK BUKACEK.

While experimenting at the radio station of Coe College some time ago, I discovered that phone and C.W. stations will come in more consistently and louder on the single coil, tickler circuit such as the Grebe CR-9, CR-5 and the Westinghouse set, by disconnecting the ground and connecting the ends of a loop antenna to the antenna and ground posts, leaving the regular antenna connected on.

This connection seemingly works one way only, that is to say, one end of the loop connects to the antenna post only and the other end to the ground post only, for best results.

I was listening to KDKA's bedtime story when I discovered the above, and almost fractured my ear drums as a result of the increased intensity of the carrier wave.

The dimensions of the loop appear to be the limiting factors as regards wave-length. Phone stations and C.W. stations come in better than spark stations. The strangest part of it is that no directional effect is noticeable.

I discovered in my own station one evening that the above mentioned circuit requires no external ground. 9XI surprised me by coming in louder without a ground than with one. I have heard KDKA quite normally on a Grebe CR-9 using no ground, way out here in Iowa.

Club Gossip

(*Continued from page 835*)

reception of the long-wave stations. We also have a smaller aerial for the reception of amateurs. The smaller aerial will be used for transmission also.

The club has been very fortunate in securing the services of Mr. J. Jacob, manager of the Radio Exchange, as president. The Radio Exchange is backing the club and is donating the use of any equipment the club requests. The other officers of the club are: Mr. Herman Asmus, vice-president; Mr. Owen Marsh, secretary and treasurer, and Mr. Milton Reiser, sargeant at arms.

We would like very much to hear from other radio clubs in this territory Address all communications to the secretary, Mr. Owen Marsh, 3915 Peters Ave., Sioux City, Iowa.

There's Nothing too Good for the Man with Brains

(*Continued from page 826*)

hunderd an' fifty," said Sam wonderingly. "But I'se gettin' fifteen, now. Specks to get sixteen stahtin' right aftah Crismus."

"Sam, do you ever hear music on that Radio outfit down there?" asked Wheeler.

"Yass, suh. I gits snatches of it in de evenin's sometimes. Times is when it's real clear, but that low down radio trash they got ain't no good 'tall. Now ef I jest had my new set on dat little ol' aerial, why—yoh could heah de musics all ovah de town," boasted the little coon. "But Mandy, she winds the bed roun' my neck ebery time I peeps 'bout it"

Wheeler cut in with, "Are you sure that your set will work anywhere near that well, Sambo?"

"Abso-tootelooey," Sam declared. "C'ose, 'twould need a few little finishin' touches yet, whut I cain't afford, lessen Mandy does moh washin' an' less heavin' de sideboard at me whenevah I says any——"

"Listen, Sam. Where is your set now?"

"Hid up in de bahn. Mandy'd smash——"

"Sammy, how would you like to quit your job with the *World* and work for me for fifty dollars a week?"

Astonished, Sam opened his mouth, shut it again with a snap, bit his protruding tongue, and swore.

"Doggone! Whenevah I does dat I knows dat my cup is gonna runneth ovah. How many of dem dare iahn men did yoh say?"

"Fifty, Sam," said Wheeler laughing. "How about it?"

"Man, yoh is mah bacon. Who does you all want murdered? Which will be mah capacity at dis heah beauteous sum per each Saturday nite?"

"You will be chief Radio reporter on the *Memphis Journal*. But in addition, I have a little scheme which should net us each over twice what I have just offered you. I have already had a fine set installed in the *Journal's* offices, so you won't have to work on any low down trash any more. Come on in, Sam, and let me tell you about the rest of it."

The editor and his colored employee of five minutes entered the office of the former. A half-hour later, Sambo emerged, a huge grin splitting his face wide open. His step was light and springy as he swung along homeward. He stepped into the door of his house, grinned amiably at Mandy, and sat him down to his battered old desk.

"Mandy, yoh can put de sideboard in de attic. Yoh sho ain't gwine t' need it t' throw at me no moh. Caise I done nevah gonna say no moh 'bout dat antenny. Don' want de darn thing no moh," he said as he pulled a yellowed sheet of stationery out of a skibbet-hole.

Mandy was amazed.

"Is yoh sick, Sambo?" she queried.

Sam shook his head mysteriously. "No, but I might be dreamin'," he said.

Mandy, a little awed by the distance her husband's chest stuck out, and by his unafraid, and otherwise unusual manner, retreated to the kitchen door where she stood leaning on her broom, surveying the back of Sam's curly pate. Noting this from the corner of his eye, Sam immediately assumed a more important and business-like manner, and with many "Ah-hum's" and scratchings amid his wool, composed his letter of resignation from the staff of the *World*.

When finished, he arose, cast a sidelong glance at Mandy, and moved toward the door. When outside, he peeped in at her, and said. "They ain't nothin' too good for de man wif brains, Mandy. Specks maybe yoall kin have dat air chicken-fedder hat 'long 'bout nex' week. I'se gonna be gone foh a time. Don' take in no moh washin's dan yoh has to."

And he went whistling away down the street.

Mandy was dumbfounded and a little scared.

"Dat main sho have done gone plumb bughouse ovah dat fool ray-dee-oh. 'Taint no use, I'se got to brain him an' put him outen his misery," she mumbled to herself.

As he had promised, Sam did not show up for several days, and his spouse was distracted. She made the rounds of the neighbors, telling them all about the "idiut ray-dee-oh" and its dreadful effect upon the human mind, loudly bewailing the fact that she had not let the antenna go up long ago, and that she would never more see her poor little "Lily."

A few days later, the towns of Woodsville, Hampton, Seedville, Cedar Creek, and several others, all of which were little isolated villages around Memphis, were buzzing with excitement. On the roof of the town-hall of each little place had been erected a strange-looking contraption of wires strung from upright poles. And propaganda had been spread that each week there would be given in each town, a hoedown for colored folks exclusively, with the finest, most up-to-date music by Radio. A large advertisement also appeared to that effect in the *Journal* from Memphis, giving the schedule of dances—Monday in Woodsville, Tuesday in Hampton, and so on.

Monday night of the first dance came, and the hall doors were mobbed long before opening time. When the doors opened, there sat Sambo John Rockefeller, etc., White, chest puffed out to the bursting point, before his instruments, tightening up a binding post here, adjusting a cordenser there, but all the time seeming to watch the eager crowd with the whites of his eyes.

The dance was a huge success, and Sambo was the hero of the hour.

Each succeeding dance was the same, and Sambo's eyes bulged dangerously as, at the end of the week, Editor Wheeler handed him the *Journal's* check for fifty dollars, and his personal check for a hundred and thirty dollars!

Without a word, Sambo clenched the checks in his fist, and started on a run for home, but as he passed the bank, he stopped short and considered.

"No suh!" he grinned. "Dis yere money ain' safe within Mandy's heavin' range. Dis goes right in heah, ceptin' a little."

That evening, Sam sat at the head of his multiple seated table, and grinned incessantly.

"Reckon," he said, glancing at Mandy. "Reckon, dat ef yo'se gwine to de hoedown at Woodsville Monday nite, yoh better have dat chicken fedder hat. How much is him?"

"Foh dollahs," replied Mandy breathlessly.

"Hmmmmm. Well, heah's yoh grocery money an' heah's three dollahs moh. Put a dollah of yoh chicken money wif it, and git de hat," Sam spoke generously.

"Sambo, mah little Lily, I's usually a awful shy an' gentle little lady, but w'en yoh is like dat——"

She came around the table.

"W'en yoh is like dat, I jest gotta kiss yoall," and she spread her lips over Sam's physiognomy.

When Sam got his breath, he said, "They ain't nothin' too good foh de man's whuts got brains. Reckon, maybe I'll make up dat dollar to yoall 'bout nex' week."

A Transmitting Tube Is A Good Amplifier

(*Continued from page 824*)

caused from that source as these coils will stand well over 500 volts continuously without danger.

The transmitting tube is also much freer from distortion than lower voltage tubes, and when used at or slightly below their rated voltages will give a minimum of distortion so long desired for the perfect reproduction of the wireless music and speech. Try transmitting tubes if you need greater volume for your loud-speaker, and you will be surprised at the excellent speech as well as the increased volume.

The Ordeal

(*Continued from page 827*)

as possible," said the captain, for the first time removing his cigar from his mouth. "Details are unnecessary. Everything has already been arranged for except your part. We are now in the midst of a thick fog. All you have to do is this: send out an SOS, give out the position of the ship and also that we are ablaze and are about to abandon her. Isn't that easy? For this slight service, very slight compared to what you did before, you shall receive one thousand dollars. How does that sound to you?"

Kluge puffed vigorously on his cigar, he seemed to be deliberating what the captain had offered him. So they expected him to send out false distress calls. What advantage would be gained by the owner if this were done? He determined to find the answer by seeming undecided.

"Well?" said the captain.

"I'll have to know the reason for the SOS," blurted Kluge obstinately. "I have to know what I'm going into."

Johnston grinned and nodded to the commander.

"Very simple," the uniformed man began, "all we intend to do is this: after the ship is supposed to be abandoned we'll lower a boat. Part of the crew and Mr. Johnston will be in it. They'll tell the rescuers about the supposed destruction of this vessel by fire. We'll then change the name to the S. S. *Tirso* and no one will be able to tell the S. S. *Midway* from a hundred other ships like her. We shall then sail under the Spanish flag. Papers and everything else have been arranged for. The cargo we have is very valuable as is the ship. Leave it to Mr. Johnston to collect the insurance in full. As I said, there are details with which you will have nothing to do, and it will be unnecessary for you to know about them."

"I see," murmured Kluge, "but when no trace is found, what then?"

"Some disaster has overtaken us," smiled the captain. "This is your chance to get away from the police. The rest of the crew we'll let off at some foreign port with enough money to keep them in booze for a long time. They don't know what's up anyway. No need to fear them, they're all crooks wanted for something or other."

"Your scheme is very clear to me now!" cried Kluge. His eyes flashed with indignation. "Thought I was a crook, did you? Well, you thought wrongly. I'll have nothing to do with your nefarious crime."

No sound disturbed the absolute stillness. Both men were momentarily dumfounded. The captain's first thought was that their diligent plans could not be carried to a successful finish. He then saw his dignity falling. Even a word to the proper authorities would ruin him. Once before he had been called before the shipping board, and only

by painstaking pleas of his innocence did they dismiss the charge. Only lack of sufficient evidence saved him.

The owner did not appear worried: he scrutinized Kluge as a detective views a criminal. Satisfied with his circumspection, he smiled. The smile turned to a sneer, and the man winked at the perplexed captain.

"You certainly know how to get it, Kluge, my boy," guffawed the owner. "It doesn't fool me, though. Ha-ha-ha, I don't see how the jury could doubt your sincerity on the stand. They must have been twelve deaf men. No, Mr. William Kluge, you can't fool a man with my experience."

Kluge did not understand the man's declamatory outpouring. He had expected both men to curse him in anger. The captain no longer seemed worried, the man leered conspicuously, and the owner puffed away like a man of wisdom.

"I don't know what you mean, Mr. Johnston," said Kluge. "Please explain yourself more fully."

"Still trying to hold off, eh, young man?" Johnston chewed on his cigar in preparation for further speech, and with a menacing grimace cried: "See here, Kluge, I'm willing to give you a good price and a chance to disappear. I intend to make a large profit on this deal and I don't mind playing fair. How will fifteen hundred dollars strike you? That's the best I can do and not a cent more."

"You have the wrong impression," spoke up Kluge serenely. "What I said a few moments ago, I mean. I will do nothing against the law."

This last statement enraged the two men. The captain frowned and bit hard on his cigar. Johnston seemed about to strike the operator, instead he twisted his mouth into an ugly hypocritical semi-grin.

"Damn it!" swore the owner, decided upon a course of action. "I'll 'tend to this man, Captain. No crook can put anything over on me."

"Yes, but the SOS must be sent out immediately," muttered the captain. "The fog will not last forever, you know, and we need it to hide our movements. I have everything ready. The men will throw over the half-burned pieces of the lifeboat and other small parts of the ship when I give the word. We can launch the other boat soon afterward."

Johnston remained thoughtful for a moment. He glanced at Kluge, who seemed quite heedless of what the captain said.

"You absolutely refuse to help us?" asked the owner tentatively.

Kluge had no intention of aiding the owner in any way. The man had made a mistake. Kluge had served a term in the penitentiary, true, but many men innocent of crime had been convicted because of circumstantial evidence. Johnston's offer was tempting: it presented Kluge with a chance to evade the police, but the young man did not wish crime to pend his struggle for existence.

"I refuse to help you in any way," said Kluge firmly.

Johnston raged internally. To have his plan go unperfected after his labor and a large bill of expenditures was too much for the owner.

"See this!" he cried, drawing a revolver from his hip pocket. "You send what we tell you or I'll send you to hell!"

The revolver served to make Kluge falter momentarily. His face became pale and his hands twiched nervously.

"Send the SOS!" ordered Johnston, "or in three seconds you'll be a dead one, and I'll send the signals myself."

The man's last statement about sending the SOS himself brought back Kluge's ebbing courage. It was ludicrous to think of any person trying to send intelligible signals unless a perfect knowledge of apparatus and code was available.

"You'll never be able to send anything yourself," Mr. Johnston," said Kluge. "It takes a practised hand to do that."

The man was quite aware of the fact and had no intention of discussing it. He knew nothing whatsoever about the wireless apparatus, nevertheless he did not intend to let his long contemplated scheme be suppressed on the night it should be perfected, because of the whim of an operator.

"Kluge, I'll give you half a minute!" threatened Johnston, aiming the weapon with steady hand. "Captain, if you wish to see a man die, stay in this room."

If Kluge had any doubts concerning the man's sincerity he had only to look upon the captain for corroboration. His superior officer, the stub of his cigar clasped firmly between his teeth, looked the very picture of a man expecting death to come upon a fellow being: perspiration oozed from the captain's forehead, his face was ghastly pale and he leaned away from Johnston, fearing to hear the roar of the revolver at any moment.

The seconds passed. For a few moments vague thoughts flashed through Kluge's mind. There came before him vivid pictures of his past life: his mother's kiss as she sent him to school, the good woman lying upon her death-bed, his trial for grand larceny and his term in prison. "Always obey the law, my boy," his mother had said during her last moments, "and you will be rewarded."

He had determined to strictly comply with her advice, and when he had been most happy in a position of honor, he was convicted of a crime he did not commit. Why not take the fifteen hundred dollars Johnston offered him and escape the death which now faced him? The police would think him dead, he would no longer suffer their continued vigilance.

Why not? Again he saw the picture of his mother upon her death-bed. Like a bolt of lightning an idea flashed through his mind. Johnston had started to count off the few remaining seconds.

"Twenty-four, twenty-five," the man was nearing the allotted time, and as he spoke his pressure on the trigger became harder.

"Hold it, for God's sake!" cried Kluge. "I'll send anything you want!"

Johnston lowered the revolver. The captain sighed with relief and wiped the perspiration from his face.

"Make it fast, then!" demanded Johnston.

"Does your offer still hold good?" asked Kluge, playing for time.

"It does," said the owner sharply, but his voice held a menacing threat which bode ill for the wireless operator. "Make it snappy!"

"Just send the SOS," ordered the captain, remembering that he had said nothing for some time. "When some ship answers tell him the whole ship is ablaze and you just got the apparatus into working. Here's the position you're to give him."

The captain thrust a paper forward: Kluge glanced at it and observed that the latitude and longitude was correct.

"Why the correct position?" he asked, somewhat puzzled.

"We're to lower a boat in this vicinity," the captain informed him, "also there will be plenty of evidence of the ship's destruction around here. We'll be many miles away before the rescuers find Mr. Johnston and part of the crew, and by that time we will be S. S. *Tirso*, flying under the Spanish flag."

"Never mind the explanations," muttered the owner, "we have wasted enough time already. Start her up."

He motioned to Kluge. The operator intended to play a bold game. He placed the telephones upon his head and tuned his receiver for incoming signals. He then listened intently. Luck was with him: he heard the loud dots and dashes of a ship station. The vessel could not be many miles away.

"Hear anyone?" questioned Johnston.

"Yes, a ship far away," lied Kluge, "must be at least ten hours from us."

"Just about right," exulted Johnston, "but to make sure no one is nearer send out a general call on very low power. Sign with the Spanish call letters."

Kluge did as directed, except that he signed the call of the S. S. *Midway*. The signals could be picked up on an ordinary ship receiver about thirty miles.

"Any answer?"

"None," lied Kluge, for the second time. The vessel had answered his call. This was sufficient evidence that it was in the vicinity.

"Send out the SOS now!" ordered Johnston, "and use full power."

The young operator, already decided upon a course of action, thrust in the transmitting switch and called the vessel he believed to be within thirty miles of him; he had no intention of sending false distress signals.

His call was answered immediately.

"Now send what we told you," ordered Johnston, when informed that a distant ship, the S. S. *Wilde*, had answered his call.

Without deliberation Kluge sent the following message:

"Ordered to send false distress calls. Plot to obtain insurance. Name of vessel to be changed to 'Tirso.' False story of ship's destruction by fire to be told by owner and part of crew. Vessel supposed to be abandoned immediately; only one lifeboat to put off." (Here Kluge transmitted the latitude and longitude from the written sheet given him by the captain.) *"Can say no more, life is in danger. Operator Kluge."*

"Good," said Johnston, after the young man had finished. "You'll be paid at the first safe port." Then turning to the captain: "Come, carry out the plans in full."

The two men left the cabin.

A few moments passed, and the single light which illuminated the cabin suddenly went out. The owner was taking no chances with Kluge. The current for his transmitter had been cut off.

The young man felt that the vessel was being stopped. The fog-horn was silent, and a commotion could be heard on deck. No doubt false wreckage of the ship was being thrown overboard and the lifeboat with the owner and part of the crew as occupants was about to be launched.

A half hour passed in this manner. Kluge dared not leave the shelter of the cabin. There was no telling what might happen to him if he went on deck.

He remembered that he could still use his receiving set, and he tuned for incoming signals. The S. S. *Wilde* was calling him. Its operator signed the proper call letters and then sent the following message:

"Coming full speed ahead, making fifteen knots per hour. Captain under suspicion for like case. Commander."

Kluge gave thanks to God that his message had been received and considered important enough to cause a passenger liner to swerve from its regular course. He did not know that two United States Inspectors had been in the wireless cabin when the message was received and that they were quite instrumental in determining that the S. S. *Wilde* should investigate.

If he could only communicate with the speeding passenger liner. He must have a light: a spark coil could then be connected and used for transmitting.

A candle was near at hand. He lighted it, and as the flame flickered he realized that the steamer was again moving. No doubt the captain was in a hurry to get out of the vicinity.

The commander had excellent reason for calling for full speed. The fog now showed every sign of lifting. Although as far as he was concerned his vessel was now the S. S. *Tirso*, the captain was taking no chances on being near the scene of the rescue of the owner. The new name had not

yet been painted on the ship's side.

Ten minutes passed and Kluge was ready to again communicate with the rescue ship. It was necessary that the direction of the S. S. *Midway* should be known by the other ship. Kluge determined not to risk the use of his pocket compass. He would casually walk into the pilot house and observe the compass there.

A soft step sounded without. Someone was approaching the radio cabin. Kluge extinguished the dim flame and waited. He had neglected to lock his door; it was suddenly thrust open, and in the dim passageway he recognized an Italian seaman.

"What do you want in he——"

Kluge had no time to finish his question. The intruder sprang forward, a long murderous weapon within his hand. The young operator dodged the first flash of the keen steel.

So this was the price he had to pay for casting suspicion upon himself. Johnston had hired a man to murder him. Kluge's life depended upon his ability to grasp the vicious weapon, and he determined to fight until the last ounce of strength had left him.

Again the Italian sprang forward. The man's stroke was powerful enough to send the blade through a thin wooden wall. Kluge dodged again, but this time he was not quick enough. The knife pierced his shoulder, and the operator fell back hitting his head on the transmitting panel. He dropped to the floor unconscious.

The Italian stumbled over him; the man's hand fell upon the transmitting key, and the shrill tone of the spark coil frightened the ignorant seaman. The spark lighted the room momentarily, and noticing the operator lying prone upon the floor, a sudden fear came to the murderer.

His only thought was to get away from the cabin, which he did in haste. Coming on deck he heard the captain swearing.

The ship was disabled; the propeller was useless and the vessel must wait for help. . . .

When Kluge gained consciousness he was cognizant that he was amid new surroundings. He heard the voices of two men near him; he had a dim recollection of conversing with one of them before.

"Only a slight wound," a physician was no doubt speaking, "it was the knock on the head that put him out."

"A brave lad," the second man said, "I'm sorry now I refused him a position some time ago. I readily thanked the detective for telling me he was a crook to be avoided."

"Was he an ex-convict?" asked the first speaker, surprised.

"Yes, but I believe he is innocent of the crime for which he was convicted. He told me so at the time. I have a fine position for that man after he becomes well. . . ."

The passenger liner S. S. *Wilde* continued with all possible speed toward the nearest port with the S. S. *Mildway* in tow. Johnston and his associate, the captain, would soon be in prison, together with one Italian assassin.

The Buzz

Father—And what is this little block with the two wires connected?

Son—Oh, that's the "B" battery.

Father—So that's where you obtain the "honeycombs" you are always talking about.

By RUPERT F. STARLING.

Poor Capacity

Kate—"That new preacher must be a poor one."

Duplicate—"Why?"

Kate—"Why, the first couple he married got a divorce."

Duplicate—"Humph! must be a loose coupler."

By ROBERT LISK.

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(Wireless continued)

Build Your Own Synchronous Gap and save money. Synchronous motors at very low prices. Stahl Rectifier Company, 1405 W. Jackson Blvd., Chicago, Ill.

Kehler Magnavox Premiums.—The Radio Ma navox as is well known is the only loud speaker which will reproduce radio telephone speech and wireless music in any volume, without distortion and without injury to the apparatus. Type R-3 radio magnavox, with 14-inch horn, $45; input 5-watts, premium 1 A.P. or radiotron U.V. 201 V.T. amplifier, $6.50 each, or 2 large size Ace 45-volt block batteries, $10. Type R-2 magnavox with large horn, $100. Input 20 watts, premiums 2 A.P. or radiotron U V. 201 amplifiers, $6.50 each or 3 large size Ace 45-volt block batteries, $15. For extreme and distortionless amplification of radio telephone speech and music the magnavox power amplifiers should be used. Magnavox two-stage power amplifier, Type A.C.-2, Model C, $80, premiums 2 A.P. Type C power tubes at $7.50 each or 1 Everready 100 volt block battery, $15. 3-stage power amplifier Type A.C.-3 Model C, $110. Premium 3 A.P. Type C power tubes, at $7.50 each. Backed by our usual guarantee. Shipments F. O. B. either Oakland, California, New York City, or Abilene. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Boys! Don't Overlook This. The "Rasco" Baby Detector. Greatest detector ever brought out with molded base. Fully adjustable. See former advertisements in this publication, or our catalogue. Detector with Galena Crystal, complete 50c, the same detector with Radiocite Crystal 75c prepaid. Send for yours to-day. Radio Specialty Company, 96-98 Park Place, New York City.

Order Murdock, Clapp Eastham, DeForest, Acme, Firco, Radio Corp, Amrad and Westinghouse apparatus from Rochelleau's Store, Baltic, Conn.

Used Radio Apparatus of standard makes purchased, send us your apparatus prepaid, we will make you an offer if you accept, our check will follow; if you reject, we will return same to you prepaid. Send list highest prices paid. The Radio Shop of Newark, 41 S. Orange Ave., Newark, N. J.

Stop! Lock! and Act! V.T.'s and accessories!—With each of the listed tubes Radiotron U.V. 200, $5 and A. P. detectors, $5; radiotron U.V. 201, $6.50 and A. P. amplifiers, $6.50. We will supply free of charge your choice of either of these five premiums—latest Fada rheostat, $1, No. 810 Remler smooth running rheostat, $1; Paragon V.T. socket, $1; Murdock V.T. socket improved contact type, $1, or Crosley porcelain panel or base mounting V.T. socket, $0.60. Either of the Federal single, closed or double circuit jacks listed respectively at $0.70, $0.85 and $1 will be given as premiums with each Federal 226W amplifying transformer, $7 or R. C. of A. U. V. 712, $7, and the U. V. 1714 radio frequency amplifying transformer. Fada 5 ampere Nichrome power rheostats, $1.35 or R. C. of A. U. R. 542 porcelain V. T. socket supplied free of charge with each $8 U. V. 202 5-watt power tube, for C. W. or radiophone transmission. We absolutely guarantee the foregoing apparatus. Only new and high grade equipment carried in stock. Unsatisfactory goods subject to return within five days. Twelve hour service. Postage and insurance prepaid by us, thereby saving time and money. Remember us. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Perasco Tested 150-2600 meter regenerative receiver, $40. Perasco detector control, $15. Both $52. Unwired Perasco 150-475 meter regenerator with detector control in same cabinet, $40. Grid and phone condensers, 25c each. All standard parts at standard prices. Perry Radio Supply Co., 604 N. Grove Avenue, Oak Park, Illinois.

Quality, Service, Low Price, are predominent features of our Jupiter Radio Receiving Outfit. Consists of 1000 meter tuning coil, 1000 ohm phones, fixed condenser, detector, wire, insulators, ground clamp, and instructions, only $12.75. Just the outfit for the beginners or students. Rush order as sets at this price are limited. Maynard Ralston, Wireless, Electrical Dealer, North Baltimore, Ohio.

Baldwin Phones.—Why are Baldwin Phones so sensitive? Briefly because—(1) the small armature is pivoted and designed to act as a fulcrum when connected to the diaphragm by a small link. There is no tension or springing of metal as in ordinary receivers. (2) Four pole pieces of a single solenoid act upon both sides of a lightly balanced armature. (3) The force is concentrated at the exact center of a mica-diaphragm. (identically the same as used in all high grade phonograph reproducers). Original Type C $12; Improved Type E, $13; Lighter Type F, $14; Anti-Static Type G, $15. Single loud speaker unit Type C without cord, $6. This is the same unit as used in the Vocaloud and are excellent for making your own loudspeaker. With each pair of phones purchased we will extend or give as premiums a one year's subscription to the RADIO NEWS or one of the latest Federal Universal Plugs, $1.75. These well-known head sets are absolutely guaranteed and subject to return within five days if not satisfactory. Postpaid, insured, and twelve hour service. The Kehler Radio Laboratories? Dept. R, Abilene, Kansas.

Radio Circuits On Blueprints are Convenient. Our VT circuits, each on a separate blue print, enable you to try out a large range of proven hook-ups. Set of twelve, receiving or phone and combination transmitting, 50c. Complete set of 24 for $1. The Plan Bureau, 1929 McCausland Avenue, St. Louis, Mo.

Wanted.—A few Western Electric VT-1's, VT-2's and receivers for use in our laboratory. Must be in good operating condition. State quantity and lowest price. Reading Radio Shop, Box 6, Reading, Massachusetts.

Audion Detector and Amplifier, V.T., 50 cents. Honeycomb coil mountings, 25 cents. Back mounted rheostats, 40 cents. Composition for molding your own knobs, panels, etc. 35c pound. Send stamp for particulars. Palmers Electrical Equipment Co., Duluth, Minn.

Kehler V.T. Special $. $. $.—A complete set of 3 Federal automatic filament control jacks amounting to $4.20 will be given as a premium with order for 3 tubes to consist of 1 A.P. detector, $5; and 2 A.P. amplifiers at $6.50 each. Only new and high grade equipment carried in stock. Unsatisfactory goods subject to return within five days. Don't forget the twelve hour service with the postage and insurance prepaid by us. The Kehler Radio Laboratories, Dept. R, Abilene, Kans.

(Wireless continued)

Grebe! Grebe!! Grebe!!! Notice the attractive premiums we offer for a limited time on the latest Grebe regenerative sets and vacuum tube controls. Bakelite variometers, shielded units, and vernier controls. Type C.R.-3, $65; Premium 1 pair Type C Baldwin phones, $12. Type C.R.-8, $80 or Type C.R.-5, $80; Premium 1 pair Type C Baldwin phones. Type C.R.-9, $130, premium choice of Radiotron or A.P. detector combined with 2 Radiotron or A.P. Amplifiers, a complete set of tubes. Type RORD detector and 2 stage amplifier, $75, premiums choice of either 2 A.P. or radiotron V.T. Amplifiers. Type ROK 2-stage amplifier, $55, premium choice of radiotron or A.P. V.T. Amplifier. Absolutely new stock and guaranteed to be up to the usual well-known Grebe standard; without question the finest regenerative sets on the market representing the last word in Radio Engineering. The Kehler Radio Laboratories, Dept. R., Abilene, Kansas.

Variable Condensers.—Assembled, with Bakelite top, bottom, knob, pointer and scales; 23 plate, $2.95; 43, $3.95. Knock down, $1 less. Also separate parts sold. Plate samples, 10c. Postage prepaid. Gravenstede, 84 Hancock Ave., Jersey City, N. J.

Memorize Continental Code in one hour. Qualify quickly for amateur license. See our ad on page 894 this issue. C. K. Dodge.

Radio Bargains—50c each postpaid. Phone plugs; 3 contact jacks, work either open or closed circuit; receiving station lighting arresters, carbon gap with high voltage fuse, on porcelain base, $1 value; Bakelite 3" diameter tubing, per foot; Ward Leonard resistance tubes, up to 2000 ohms; non-inductive alloy wire resistance units on wooden spools, any resistance up to 2000 ohms; six feet No. 5 ground wire flexible 61 strand R. C.; postage not paid on wire. D. C. C. Enam. No. 14 copper wire, 40c pound. Miscellaneous bargains—change-over switches, for panel mounting with knob, six pole, D. T., $2 each; same, 2 P. D. T., $1; same, single pole D. T., 80c; Wheatstone Bridge resistance boxes, with plugs, 6 circuits, $4.50, F. O. B., Chicago. Twelve hour service on all above. American Radio Supply, 2140e So. Harding Ave., Chicago, Ill.

Ten Per Cent. off on Radiotrons. Burgess large B batteries, $2.50. New Radio Magnavoxes, $39; new Clapp-Eastham HR sets, $31. Write for list. Radio Supply Company, Weedman, Ill.

This is Real Service.—Panels cut to order, smooth sawed edges. We cut them exactly to size and ship the same day your order is received. ¼" thick, $0.01½c per square inch; 5/16" thick, .02c; ⅜" thick, .03c; 7/16" thick, .03½c; ½" thick, .04c, why pay more? These radio panels are made of the highest grade black fibre. This material possesses high dielectric strength, is inexpensive, unbreakable and easy to work. Our special offer, radio panels 6 x 6 x ¼", 50c; 6 x 12 x ¼", $1. We also carry a complete stock of fibre rod and tubes, the real thing for electrical insulation,, special prices quoted upon application. We pay postage. Radio Instrument & Panel Co., Box 75, Cicero, Illinois.

Get Acquainted $. $. $.—Aside from our special premium offers on this page we have an excellent proposition for you which will save you many dollars on your purchases of well-known radio apparatus. We will be pleased to hear from you and if you desire a representative set of bulletins enclose 10c which may be deducted from your first order. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Quality, Satisfaction, Service First. The Kehler Radio Laboratories.

"Arkay" Radio Horns, black, $4.50; nickeled, $5.25. Order today for immediate shipment Jennison, 83 Russell Street, Waltham, Mass.

Short Wave Regenerative Sets. Two variometers, variocoupler, Formica panel, large dials. Fully assembled. While they last, $25. Detector control panels, $4.50. P. C. Hanger, 4130 Holmes St., Kansas City, Mo.

Quality, Satisfaction, Service First. The Kehler Radio Laboratories.

Free.—Rheostat, dial; socket, or honeycomb coil with every short wave set at $22. Write for description. Haas, 2011 Atlantic Ave., Atlantic City, N. J.

It comes in like a ton of bricks through the king "Amp-Li-Tone." See page 885.

It isn't a Loud Talker if it isn't a King "Amp-Li-Tone." See page 885.

Twelve Hour Service. The Kehler Radio Laboratories.

Think of it.—2 stage amplifier, $19.59; Det. 2 stage, $24.50; 1 stage, $12; Det. 1 stage, $16. Description request. Regenerative, $25. ABCO Radio Co., 350 Linden Ave., N. Y.

Beginners.—Don't buy unwisely. Send 25c for Blueprint of Wireless Receiving Set. Diagram—telling you just what to buy—also "Dixie" Automatic Lock 3/16" Sliders, 25c coin or stamps. R. H. Dixon, 185 Milford Ave., Newark, N. J.

Special.—5% discount on all standard apparatus. Postpaid. ABCO Radio, 350 Linden Ave., Brooklyn, New York.

Twelve Hour Service. The Kehler Radio Laboratories.

Complete Sets.—(Audion) phones, bulb, battery, tuner, etc., $29. ABCO Radio, 350 Linden Ave., Brooklyn, New York.

V.T. Receiving Panel, just out, price $8. Write for circular. Cheney Radio Co., Cheney, Kansas.

Amateurs.—Grebe or any standard apparatus, 10% off order from any standard catalog. Cash or C. O. D. B. M. Walker, Roseville, Ohio.

Amateurs Attention.—$6 for variometers and variocouplers. Regenerative sets, unwired, $35. Parts of all kinds for sale cheap. Why go downtown when we are 4 blocks from Grand Central Station. Estimates cheerfully given. 2B.U.A. M. H. Electric Co., 214 East 38th St., Phone Vanderbilt 2038.

Try a Coil Aerial to cut out interference receive on an indoor coil aerial and use its directive receiving properties to eliminate interference Knowing the maximum capacity of the variable condenser you will use across the coil terminals, the curves and tables we have compiled enables you to construct a coil of proper number of turns for any wavelength. Charts covering 0 to 3600 meters, 50c; 3600 to 24000 meters, 50c. No stamps accepted. C. A. Davis Co., 2371 Champlain N.W., Washington, D. C.

(Wireless continued)

.00 ft. No 16 Aerial Phorforus Bronze Wire, mailed, $1.50. Experimental wire. Ralph Brandt, Trenton, N. J.

Short Wave Regenerative Set. All necessary parts for assembling short wave set, $30. Includes 6 x 18 formica panel, Remler variometers and tube. All new stock. Circular containing other bargains on request. B. & B. Radio Co., 507 Bigelow, Peoria, Ill.

One-Half K.W. Transmitter, using Acme Transformer, Dubilier condenser and Super-Benwood gap, $50 F.O.B. James M. Hollowell, Jr., Chestnut Hill, Mass.

Orders Shipped Day of Receipt. New price list just out. B. & B. Radio Co., 507 Bigelow, Peoria, Ill.

Clapp-Eastham ½ K.W. Hytone Set, $70, F.O.B. James M Hallowell, Jr., Chestnut Hill, Mass.

Amateurs! Biggest Thing Today! Chokes for radio frequency amplifiers! With simple hookup, only $1.25 postpaid! Act now! Max Shapiro, 630 Howard Avenue, Brooklyn, New York.

Wireless Apparatus Bought and Sold. We buy used apparatus. Amateurs call and see us. Wireless Development Co. of New Jersey, 634 Gordon St., Hoboken, N. J.

Unwired Regenerative Set, $15. F. O. B. James M. Hallowell, Jr., Chestnut Hill, Mass.

Variable Condensers and Parts.—Assembled for Panel mounting 43 plate, $3; 23 plate, $2.40. Rugged construction unassembled 43 plate, $2.25; 23 plate, $1.90. Plates stationary .03; rotary, .025. Washers stationary, 20c doz; rotary, 30c doz. Shafts complete, 43 plate, 40c; 23 plate, 35c. Bearing top and bottom, 35c. Brandford Radio & Manufacturing Co., Brandford, Conn.

Honey-Comb Set. Triple coil-mounting, series shunt switch, grid leak, and primary, secondary and grid condensers mounted on bakelite panel, with oak cabinet. James M. Hallowell, Jr., Chestnut Hill, Mass.

Telegraphy—(Morse and Wireless) and Railway Accounting taught thoroughly. Big salaries. Great opportunities. Oldest, largest school. All expenses low—can earn large part. Catalog free. Dodge's Institute, M St., Valparaiso, Indiana.

Radio Receiving Apparatus, Chemistry Laboratory, 180 amp. storage batteries, air rifle. R. Wahlmann, 3257A California, St. Louis, Mo.

Sell New "Acme", $45.. 1 K.W. transformer, $30; "Mignon" RLC5, $20. Want Grebe CR5 or CR8. Weaver., 1802 Spring Garden, Philadelphia.

For That New Set. Extra fine brass mesh. Ideal for audion panel windows. Commercial appearance. Keeps out dust. Squares 2" x 2", 20c 3 for 50c. Jas. Millen, Fife St., Forest Hills, N. Y.

Log Sheets.—To your own specifications, $1.50 per 100; $2.25 per 200. Write for sample sheet. Port Arthur Radio Laboratory. Port Arthur. Tex.

Radio Dealers. Send us your name and address. We can interest you King Radio Mfg. Co., Century Bldg., Pittsburgh. Pa:

C.W. Supersensitive reception with unusual hookup. Better than detector and one step ordinary amplifier. Send 50c, no stamps, for circuit and directions: Montgomery, 900 Seventh St.. Port Arthur, Texas.

Stop.—Here are some real bargains, DeForest 15 panel type receiving set, worth $140 for $65; Paragon RA Ten short wave receiver, worth $85 for $55; Three Grebe CR3 receivers worth $65 for $45 each: Complete Universal wave receiving set, the best money can buy. has a short wave regenerator, two step amplifier and honeycomb coil mounting, with all accessories except honeycomb coils. Worth over $250 for $175. These are only a few of our bargains. See page 893 if you want to save money, join The Radio Exchange, 804 Helen St.. Sioux City, Ia.

Radio Telephone Set.—2700 meters 1000 ohms receiver complete ready to set up. Guaranteed. Parcel Post paid. Allen & Hartman, 508 W. 122 nd St., New York City.

Navy Material.—Fessendin ½ KW 500 cycle trunk receiver and transmitter, $100. Telefunken set, various parts, gasoline power units, motor generators. Henry Kienzle, 501 East 84th Street, New York.

Lot of International Radio Co. variable condensers for panel mounting, with dial and knob at prices less than wholesale .0005 Mfd., $3.50; .001 Mfd., $3.75; .002 Mfd., $4.25. Weight 4 lbs. Variometers and variocouplers for short wave sets, the $6 kind, complete with dial and knob $3.75 each. Weight 2 lbs. Variometer or variocoupler rotors 50c each Stators, 75c each. V.T. sockets with bakelite base, 75c. Binding posts, $1 doz. Add postage. Money back if not satisfied. H. V. Butterworth, 331 Quincy Street, Brooklyn, N. Y.

Buy Direct From Manufacturers, mahogany cabinet containing short wave tuner with detector. $30 with one stage amplification, $45; two stage, $60; three stages (Use loop), $80. No jacks. Rear connections. Rogers Radio Company, 5133 Woodworth St., Pittsburgh. Pa.

Double Your CW and Radiofone Range! You can easily do it without adding another piece of apparatus or greatly changing your set. The new "Master Circuit" is the secret. Tested by many prominent ARRL stations it more than doubled range of each station. One five watt set puts twenty watts into antenna; easily sends 2000 miles; fones 1000! Think of it! It's absolutely the best circuit out. Ideal for 200 meters. Guaranteed to double or increase your range regardless of what it is now. Send $2 for complete confidential photoprints of this wonder circuit. Get it working for you—be the first in your town—surprise your friends by your phenominal results. Order today—immediately! Master Engineering Company, Omaha.

(*Continued from page 909*)

Exchange.

Amateur Agents wanted in every city and town to sell radio apparatus. A few stocking agencies still open. Delfelco, 12 Meeting Street, Pawtucket, R. I.

M.O. takes 2000 M loose coupler and crystal detector, $4; 16 bracket banjo-mandolin, $10. All good. Oakley Gordon, Rays Crossing, Indiana.

Memorize Continental Code in one hour. Qualify quickly for amateur license. See our ad on page 894, this issue. C. K. Dodge.

Compare it and you will buy the King "Amp-Li-Tone." See page 885.

The Price is Right and is based on quantity production, it's up to you "Sparks". Send in that "Twelve." Quick delivery. King "Amp-Li-Tone." See page 885.

Short Wave Variometer Receiver, $15, Audion cabinet, $3. Will sacrifice entire equipment including standard made and experimental apparatus. Geo. Fiem, 2304 N. 15th St., Phila., Pa.

Rare C.W. Sacrifice—First money order $90 gets four tested A-1 Western Electric 50 watt tubes used about two hours. Sell separately, $25. No trades considered. J. M. Cone, Box 53, Rockdale, Texas.

Bargain.—Ranger motorbike. Nearly new, $35. Write Roscoe Hanna, 310 Hay, Wilkinsburg, Pa.

Here's Your Opportunity.—Must sell, 2 standard 50 watt sockets, $2 each; .0015 mfds. Vernier Deforest condenser, $12; .001 mfds. Vernier DeForest condenser, $10; .005 mfds. DeForest condenser, $5; all condensers are new in original wrappings assembled ready for panel; new panel DeForest adjustable 3 coil mounting, $8. W-E Anticapacity switch, $1.50; 3 W.E. plugs and jacks for $3.50. All letters answered. J. M. Cone, Box 53, Rockdale, Texas.

Sell!—Paragon regenerative receiver, $30. 2 Acme amplifying transformers, $4.50 each; 2500 meter Navy coupler, $15. 3 Murdock sockets, 80c each; 1 pair Murdock 3,000 ohm fones, $4; 3 Paragon rheostats, $1.50 each; 3 jacks, $1.75; 1 plug, 50c. All letters answered. Norman Gimmy, 13503 Emily St., East Cleveland, Ohio.

Bargain.—$95 takes triple coil tuner and audion control (both mounted on shielded bakelite and in cabinets), Baldwin fones, Firco plug, coils, B battery, and tube. All instruments new and in excellent condition. Value $125. Write John Keene, Mont Clare, Pa.

Short Wave and Detector, $35. Complete Crystal, $18. Bargains. Joseph Quilter, 10 St. John Ave., Binghamton, N. Y.

Portable Crystal Receiving Set, complete with phone and aerial equipment, $15. Prepaid. Anthony Mogush, 859 Grant St., Braddock, Pa.

Variable Grid Leak, 35c; grid condensers, 40c; audion panels, $7; binding posts, 10c. Hudson Radio Supply, 262 Palisade Ave., Jersey City.

Call Changed, my call has been changed from 8 A.C. to 8 B.T.O. C.W. on 230 meters. A. L. Kent, 87 Chenango St., Binghamton, N. Y.

Bargain.—Murdock 43 plate condenser, $3; Ducks 3500 loose coupler, $5.50. D. C. Kurtz, Mechanicsburg, Pa.

Marconi Receiver and audion control, $15. Fred Keutmann, 434 East 89th St., N. Y. C.

For Sale.—National Radio Institute Correspondence course. Perfect condition, $40. Clifford Bry, Oregon, Ill.

For Sale.—25 dial omnigraph, $20. Alfred Cook, 148 Walnut St., Holyoke, Mass.

For Sale.—20,000 meter navy type coupler, $12; one inch "Bull Dog" spark coil, $2.50. 8-BIIT, 711 Wheeler Ave., Scranton, Pa.

For Sale.—Clapp-Eastham ¼ K.W. rotary spark-gap, condensers for same, key and antenna switch, $25. W. C. Southard, 15 Park Ave., Baldwin, L. I.

Cleveland Light-Weight Motorcycle for Radio receiving apparatus. Richard White, 909 Daniels St., Cedar Rapids, Iowa.

Trade.—Six bound volumes I. C. S. Steam and Electrical Engineering course complete with questions and answers. 1 G.E. split phase, 1/10 H.P. induction motor, reversible, 1800 R.P.M. Want audion receiver. Send your proposition. L. A. Young, 15 Liberty St., Pontiac, Mich.

For Sale.—2 Navy receivers type S.E. 95a, 1000-10,000 meters, $150 each. N. Abrams, 510 Claremont Parkway, Bronx, N. Y. C.

Sell.—Clapp-Eastham regenerative, $25. Half K.W. Thordarson Transformer, never used, $20. Osman Starner, Effingham, Ill.

Exchange.—American Technical Society's "Telephony and Telegraphy." Cost $19.80 for wireless receiving set. Norman Stearns, 857 Fulton St., Brooklyn, N. Y.

Sacrifice.—Slightly used radio apparatus in perfect condition. Write for list. Wm. Smallenberger, 15 William St., Meadville, Pa.

For Trade.—One nearly new Remington automatic shot gun, best condition, for paragon 10 or Grebe receiver or small radio phone. What have you. J. D. Rathman, Egan, S. D.

Bargain.—Regenerative set. Detector and two step with tubes A and B batteries. Seymour, 417 E 80th St., New York City.

Bargain.—Grebe 2 step, $25. Also Grebe coupler. C. Schrader, Rockland Ave., Yonkers, N. Y.

Bargain.—Complete 600 meter receiving set. Ray Pfankuck, Menominee, Mich.

For Sale.—DeForest R5 200 cabinet style double honeycomb receiver with detector panel combined, cost $45. Will sell for $32 or exchange for detector and 2 step. Richard Prowell, Tuscaloosa, Ala.

For Sale.—1 Federal receiving transformer, $15. 1 Omnigraph with 4 dials, $10. Both in perfect condition. Jas. Potts, Rawlins, Wyo.

For Sale.—Complete DeForest, Type 0.20 watt radiophone. Excellent condition, cost $290, sell for $190. Guaranteed satisfaction. Have worked 300 miles, with poor antenna. Send dime for photo and details. Immediately. All letters answered. D. F. MacKenzie, 3801 Ingomar, Washington, D. C.

For Sale.—Meteor loose coupler, crystal detector, new variometer set, ⅛ K.W. transformer and condenser, all for $40. T. S. Nichols, 500 South 5th St., Moberly, Mo.

For Sale.—Crystal detector receiving set. Cost $40. Will sell for $23. Address Garrett S. Parsons, Romney, W. Va.

(Exchange continued)

Wireless Course in National Radio Institute, Omnigraph, key, buzzer, phones, text books, cost $75. Sacrifice $25. Frank Philippi, 80 Thompson, New Bedford, Mass.

Sell.—Back issues Electrical and Mechanical Magazines. Write for description. Violin correspondence course with instrument, $10; gas bicycle lamp, $2.50. Donald Zook, Denver, Indiana.

Quitting the Game.—Detector and two step, $35. Long and short wave regenerative receiver 150-1000 meters, $50. Doolittle loud speaker, $15. Brandes navy type phones, $10. All in cabinets. E. Carter, 156 E. 85th St., N. Y. C.

Are you a Member of the Radio Exchange?

Sell.—22 caliber H.R. target revolver, $6.75; B. flat Brass cornet, $7; No. 6 erector, $7. John Baenteli, Sterling, Neb.

Stop, Look, Act.—Pathfinder motorbike, including tires and other accessories. All in excellent condition, $28 or trade for two step amplifier and loud talker. Specify make of instruments. Herbert Lee, Egan, So. Dak.

Wanted—Omnigraph. Continental code 5 dial style. Dewey Reifsteck, Calumet, Iowa.

Selling Out.—"Duck's" variometer set mounted on panel, $20; detector, 1 step on bakelite panel with jacks, plugs, etc. $18; 13 plate condenser, $1; E. Relay detector tube (never used), $4. Everything guaranteed. Rodney Roach, 41 Janvrin Ave., Bronxville, N. Y.

Rotary.—Super-Benwood, $15. Never used. Thordarson ¼ K.W., $10. William Ranft, 4102 Kate Ave., Baltimore, Md.

Special Radio Storage Batteries. Edison, Lead all sizes. Radio Battery Service Station, 44 Bryant St., Malden, 1. K.M.

For Sale.—200-600 meter regenerative set and bulb detector with binding posts for all connections, $20. Arlington receiving transformer, $10. Harold H. Lawler, Rushville, Illinois.

For Sale.—Radio apparatus Navy coupler, $16. Wm. Mathemeier, Webster, S. D.

For Sale.—1 K.W. spark set nearly new, write for particulars. Uriah Morris, 128 South Prince, Princeton, Indiana.

Stop.—Amrad type detector and one stage amplifier, respectively, $10, $15. DeForest oak coil mounting, $8. Thirteen coils 150-20,000 meters, $15. Willard 60-80 ampere 6 volt battery, $15. Complete 1" Mesco field sending set, $12. All excellent condition. Gross, Post Road, White Plains, New York.

Sell, Trade.—Phones, loose couplers, etc. List mailed. Send yours. Want bulb. Hugh Lassie, Gardner's Lane, Ansonia, Conn.

Dirt Cheap.—Selling out my wireless. Send for list. Henry Lehmberg, 3832 N. Percy St., Philadelphia.

For Sale.—1 K.W. Thordarson transformer. Type RS, $20; C. & W. rotary gap, $10. Both excellent condition. R. W. Fullerton, Beaver Dam, Wisc.

For Sale.—¾ K.W. transmitting set. Used 2 months, good as new. Complete except condenser. $40. Defoe Ginnings, Macomb, Illinois.

Exchange.—Radio Apparatus Co. undamped set, Type 93. Sell $52. Russell Huckstep, Lebanon, Indiana.

Wanted.—Omnigraph A-1 condition with head phones. Continental dials only must be cheap. R. H. Jones, Box 448, Petersburg, Virginia.

600-20,000 meter receiver including radiotron, $35. Box 205, Williamsport, Pa.

Mellophone, $10; motorcycle, $25; field glasses, $6; Mandolin, $3.50. Box 221, Waukomis, Oklahoma.

For Sale.—Station 9 DFX includes acme 1 K.W., 2 step amplifier. Roy Conibear, Amboy, Ill.

Bargain.—R41 receiver. Good as new, $20. Benj. Click, Tangier, Ind.

Selling Out.—¾ K.W. Thordarson transformer, $15; Enclosed rotary gap with glass front and Emerson motor, $13; plate glass condenser in can with oil (14 plates) $10; heavy O.T., $3; pair chirad variometer (new). $8; Brandes phones, $4.50. Coupler, bulbs, dials, aerial sockets, jacks, condensers and rheostats. Write N. A. Evans, 1133 Hodiamont Ave., St. Louis, Mo.

For Sale.—Choke coils for Radiophones, $1.75 each; two m.f. condensers, $1.50. T. Sabini, 415 East 148th St., N. Y. C.

For Sale.—14 honeycomb coils $25; 2 Murdock .001 variables $3.50 each; DeForest ULC-400 $3; National Radio Natrometer less phone $25; one-inch spark coil, $4; one repaired tube with socket, $3; Jove detector, $1; DeForest CV-500 condenser, $4. Or all of above for $60. J. P. Burton, Box 385, Ashland, Virginia.

Tricks, Puzzles and Games.

Lightning Cartoonists Book, secrets, tricks, $1. Christman, 2925 Euclid, Kansas City, Mo.

"Alladin Bulletins" Free. Novelties, new magic. Thomas, Dept. 16, Box 86, French Lick, Indiana.

Wanted to Buy

Mail Old Gold, unused postage, war and thrift stamps. Liberty Bonds, silver, platinum, diamonds, jewelry, watches, false teeth, magneto points, etc., new or broken. Cash immediately. Held ten days, returned if unsatisfactory. Ohio Smelting Co., 207 Lennox Bldg., Cleveland, Ohio.

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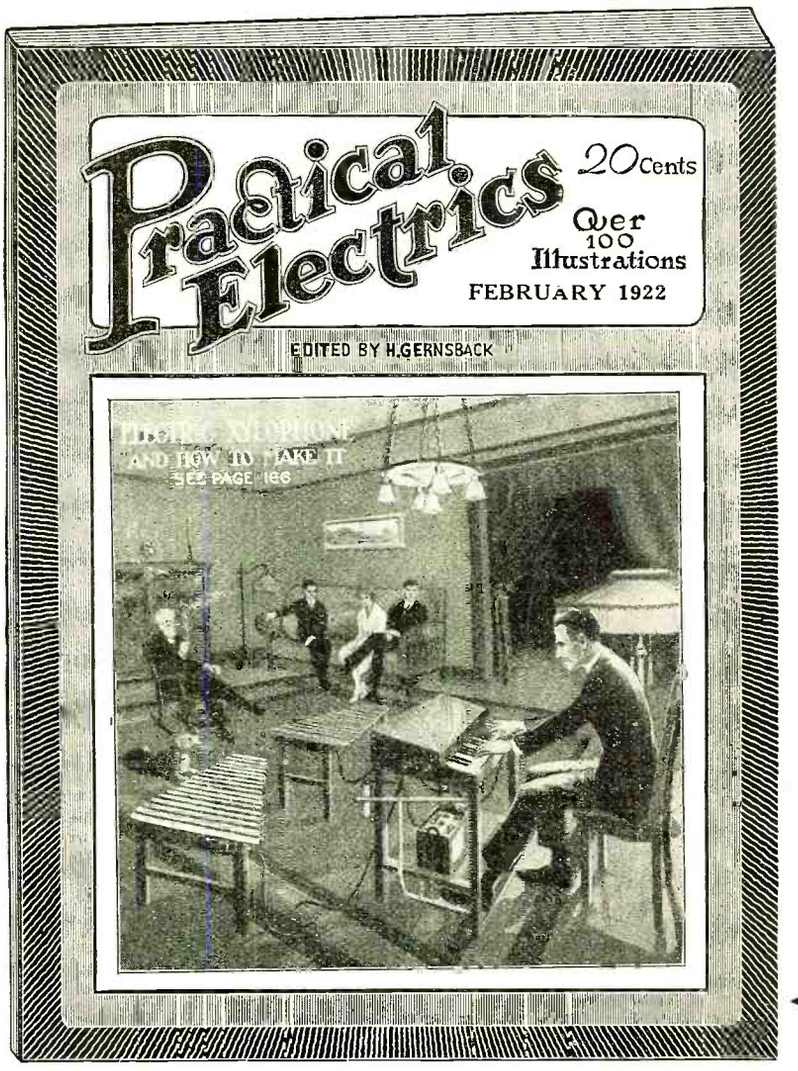

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