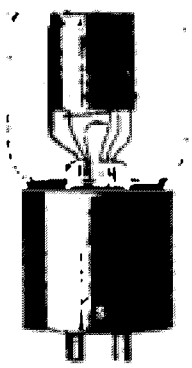
RADIO





Use A-P Tubes for Efficiency

A-P Radio in the Home—

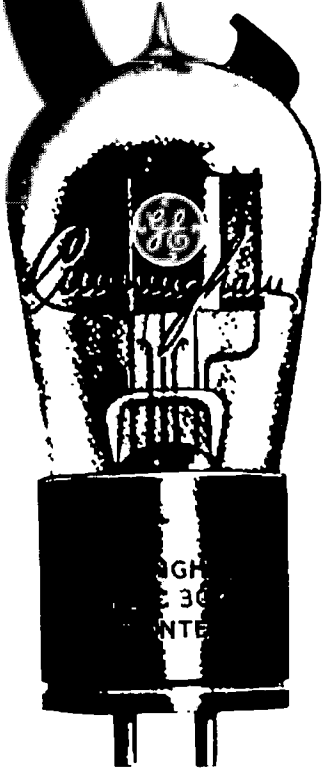
The [illegible] Radio is covering this coast. The photograph above shows a [illegible] in the San Francisco Bay Region receiving a Radio [illegible] concert received with the finest standard equipment [illegible] from the Radio Magazine. A-P Tubes are used throughout for efficient receiving and [illegible] the Magnavox Power Amplifier shown. Over the Radiophone, the daughter of the hostess is [illegible] the soloist at the [illegible] and [illegible] is [illegible] the [illegible] by [illegible] to [illegible].

ATLANTIC-PACIFIC RADIO SUPPLIES CO.
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Henry M. Shaw, President

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For Home Receiving Sets



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Detector

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For further particulars see or write your nearest dealer or write us direct.

Dealers should take advantage of the enlivened interest taken by the fathers and mothers of the amateurs throughout the country who today look upon radio concerts, etc., as a very interesting and highly instructive form of entertainment. Dealers will make no mistake in stocking Cunningham Tubes and Remler Apparatus.

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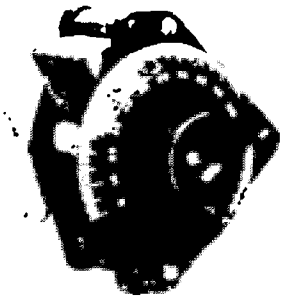
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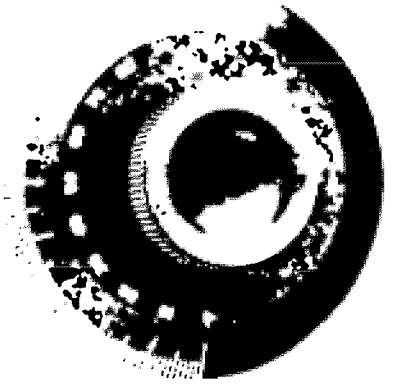
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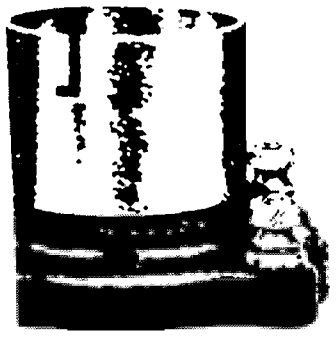


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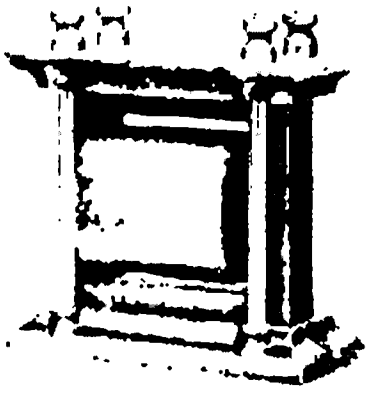
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RADIO

Established 1917 as Pacific Radio News

Volume IV *for* JANUARY, 1922 *Number 1*

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RADIO is Published Monthly by the Pacific Radio Publishing Co., Inc., Pacific Building, San Francisco, Calif.

ARTHUR H. HALLORAN, *Editor.*
LAWRENCE MOTT, *Associate Editor.*
GERALD M. BEST, *Technical Adviser.*
H. W. DICKOW, *Advertising Manager.*
Branch Offices: 147 Sixth Ave., New York City; 1307 Hartford Bldg., Chicago; 18 Boylston St., Boston; 1003 North Coronado St., Los Angeles.

Advertising Forms Close on the First of the Month Preceding Date of Issue

Issued Monthly, 20c a copy. Subscription price $2.00 per year in the U. S., $2.50 per year elsewhere. Instructions for change of address should be sent to the publisher two weeks before the date they are to go into effect. Both old and new addresses must always be given.

Entered as second-class matter at the Post Office at San Francisco, Calif., under the Act of March 3, 1879.

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Forecast of Contributions for February Issue

Announcement of the winner of the $25.00 prize contest for the best description of an all-wave regenerative receiver will be made in the next issue. The judges of the contest are Leonard F. Fuller, consulting engineer, Colin B. Kennedy Co., B. F. McNamee, chief engineer, Atlantic-Pacific Radio Supplies Co., and D. B. McGown, assistant radio inspector, sixth district. This contest has called forth a number of excellent ideas to be incorporated in receiving sets. These will be published in forthcoming issues, the first manuscript submitted being published this month.

Next month Ensign Jennings B. Dow will follow up the first installment of his "C. W. Manual" series with descriptive comment on Modulating Systems, Alternating Current C. W. Circuits, and The Power Amplifier.

A dozen questions for answer by Gerald M. Best, technical adviser, were received too late for publication in this issue. They will appear next month, together with answers to any other questions that may be received prior to the first of January.

The new "Pacific Plan" for radio traffic regulation, as determined by the convention at San Francisco, Dec. 29-30th, will be given first publication in February RADIO. By this plan it is hoped that much of the present chaos of the air may be eliminated.

Edward M. Sargent will detail some successful experiments with ground antennæ as a result of his recent experiences in Mexico. This, as well as an article on "The Click Method of Determining Resonance," by G. W. Cattell, will be of especial interest to the technically inclined.

For the practical constructors, A. H. Babcock, electrical engineer, Southern Pacific Railroad, has written simple directions for winding transformers. D. B. McGown will continue his articles on how to make equipment for laboratory measurements, and several other good men will tell how to "roll your own."

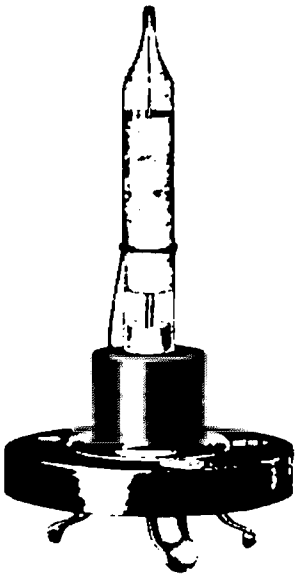
Fiction features will include a soul-stirring story of "The Small Person," by Lawrence Mott, who in addition to being 6XAD in private life, is one of the more successful American writers of short stories and scenarios, as is well shown by the story of "Martin Robbins" in this issue. Our old friend Volney G. Mathison, of Samuel Jones fame, will come back with "The Kick-back," a tale with a real kick, and Clyde C. Young, better known as "Squawk McGuff," has some weird words of wireless rejuvenation and escapes from cannibals.

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Detector and Self Amplifier

(Fully protected by patents in the principal countries throughout the world)



This Tube, the Sensation of the Chicago Radio Show, is new in principle and operation. Hence it offers these notable advantages:

No B Batteries
No Tickler
No Grid Leaks
No Filament Adjustment
High Selectivity
Extreme Sensitiveness
(Equal to one stage of amplification)

Much Longer Life
Uniformity of Tubes
(All equally good)

It represents the result of over four years' exhaustive research, the study of nearly 2000 tubes, with complete records of the characteristics of each one. It has had thorough tests in our own research laboratories, and months of continuous operating use.

Only after gaining this full knowledge of its characteristics, its remarkable possibilities, and its practical usefulness, are we ready to offer it to radio workers as a forward step in a great field.

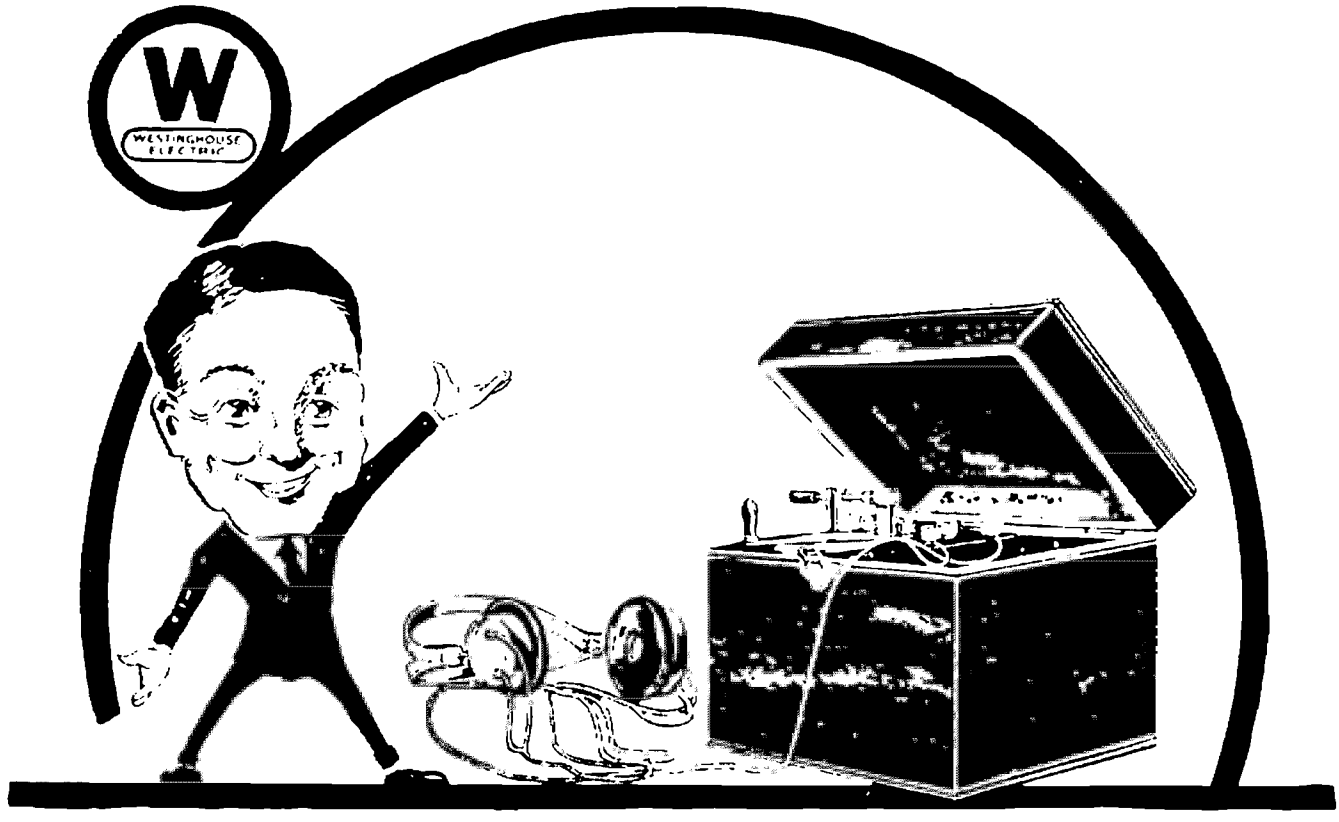
Made up in the complete CONNECTICUT Detector Set at $35.00; Detector Unit alone, $12.00; Tubes (for replacement), $3.50.

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The Type AD Receiving Antenna Outfit includes 150 feet of No. 14 Copper Weld Wire, one Splicer, two Micarta Receiving Antenna Insulators, two Screw Eyes, three Porcelain Knobs with holding screws, one Porcelain Wall Tube, 50 feet of insulated Ground Wire, one Ground Clamp and one Receiving Antenna Protective Device.

The Receiving Antenna Protective Device is a complete safety gap and fused protector, so constructed that it assures protection from lightning or from power lines.

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January, 1922 **RADIO** Vol. 4 No. 1

341389

Radiotorial Comment

ENTHUSIASTIC assurance has been given that large and representative delegations will be present from thirty Western radio clubs at the convention in San Francisco Dec. 29th and 30th, to draft a "Pacific Plan" for regulating radio traffic and to organize the C. W. Club of America. The convention will be held in San Francisco Gymnastic Building, at 2460 Sutter St., with Major J. F. Dillon as chairman. A banquet will be held on the evening of the 29th and a radio ball on the evening of the 30th. A radio show will be held in conjunction with the meeting. Each club will be entitled to six votes through its accredited delegates. Visitors will be welcome. Our readers are urged to be there and to pass the word on to their radio friends.

A REMARKABLE instance of the benefits of co-operation is afforded by the action of the radiophone broadcasting operators of Northern California in agreeing to a schedule which allows each in turn to work on 360 meters, as now required by the Department of Commerce. The tentative schedule, which is published elsewhere in these columns, will probably be revised after a few weeks' trial, especially as several new stations will soon be on the air. The sentiment is rapidly crystallizing that the ultimate solution of the problem will be the establishment of one great station to be sustained by the Pacific Radio Trade Association. Thus it will be possible to command the best musical talent and news features to serve the thousands of people now enjoying the novelty of radio concerts.

WITH any art that is advancing as rapidly as is radio, regulatory laws may be expected to lag behind radio progress. But when the angle of time lag becomes years instead of months, 'tis seemly that corrective action be substituted for long-suffering endurance. Great expectations were held out for accomplishment at the Paris conference. But, as may be noted in the summary thereof elsewhere in these columns, these hopes have been dashed to the ground. Now the only recourse for immediate relief rests with Congress.

That Commissioner Carson is alive to the situation may be readily gathered from his letter to the associate editor of RADIO which appears on the C. W. Club of America page. Most welcome is the news that due consideration is being given to allocating a band from 200 to 280 meters for continuous wave stations and that amateur spark transmitters be graduated from 150 to 200 meters as the operators become more proficient.

FROM out of the editor's mail comes a subscriber's letter too long for publication, but too pertinent to pass by without comment. The writer is a radio concert enthusiast, one of thousands to whom radio is bringing new pleasures. His ideas are constructive as to the popularization of radiophone concerts, but restrictive of radio telegraphy.

He urges that no 200 meter spark set work during the concert hours, which in California are now practically from noon till nine at night. He is vexed at having a beautiful orchestral or vocal selection spoiled by, to him, an unintelligible series of disturbing dots and dashes. But he forgets that some boy thereby is enjoying himself at home and learning things that will always be of value to him. He suggests that this evil be corrected by C. W. transmitting, but forgets that this may be beyond the boy's limited pocket-book.

Eventually the spark set will be as obsolete as the Marconi coherer. In fact it is probable that it will be prohibited by law, just as are automobiles without a muffler banned from hospital zones. Its one merit is its broad and attention-compelling interference in sending out distress signals from a ship. And many an old-timer will note its passing with regretful sentiments.

But we will have the spark set with us for some time to come and it is only through the voluntary consideration and courtesy of the amateur operator that others may be undisturbed in their enjoyment of radio music. Many operators now lay off between eight and nine in the evening or when special events are being broadcasted, and it would be well for all to do so. For, remember, boys, we are on the air, not as a right, but as a privilege—a privilege which should not be abused.

EDOUARD Belin's method of radio transmission of photographs has successfully sent a picture of President Harding from Annapolis to Paris in twenty minutes' time. A gelatine print of the picture in relief was pasted on a motor-driven cylinder at the sending end and received on sensitized paper on a revolving cylinder on which a beam of light was directed from a mirror galvanometer at the receiving end. The two cylinders were kept in synchronism by means of radio controlled chronometers. A microphone point traveling over the relief print, much as a phonograph reproducer travels over a record, causes a variation in outgoing radio impulses which produce a corresponding variation in the mirror galvanometer and thus reproduces the picture at the receiving end.

The same method is employed to reproduce hand-writing by using a special ink giving sufficient relief to affect the sending needle. The first trans-Atlantic messages sent by this new method were between Premier Briand and General Pershing.

The day is not far distant when, with the perfection of secrecy in sending and receiving, much of the world's business and pleasure will be conducted by radio. Wireless movies in every home is not an impossible dream. The sky's the limit in the development of radio's application.

Fighting Forest Fires with Radio

By Clyde C. Young



Airplane Patrol in the High Sierras, Showing Mt. Elwell on the Left, Mt. Lassen on the Upper Right, and Signal on the Lower Right. Photos by Courtesy U. S. Forest Service.

WIRELESS telegraphy has taken an important part in the newly organized airplane fire patrol system in the timbered area of the Pacific Coast, which comprises several states. The amateur with his little set once more stands out as an essential spoke in the wheels of progress.

Paul G. Redington, District United States Forester, told the Twelfth Annual Convention of the Pacific Logging Congress something about wireless, and the part the amateur has played in the government's campaign against fires, which was not only of interest to those present but to the world as well.

"Boys and young men interested in wireless telegraphy," said Mr. Redington, "are being utilized by the United States Forest Service to man radio stations in national forests as a part of the government's campaign against fires." "Radio communication is supplanting the less effective telephone communication in the forests," he added.

The airplane patrol in California for the season 1921 covered practically the entire forested area of the state, with the exception of the Coast redwood region. It included the Coast range from the Oregon line to Lake County, the Sierra Nevadas from the Oregon line to Kern County, and the Angeles and Santa Barbara National Forests in the south. It was a cooperative project, undertaken by the United States Air Service, the United States Forest Service, the State Forester, and local communities. Briefly, the part taken by each was as follows:

1. The Air Service furnished and maintained the planes and furnished the personnel for the patrols, including the observers, also the radio on the planes and at the bases, and the radio equipment for the fifteen forest stations, located at the various Forest Service headquarters throughout the state.

2. The Forest Service furnished a liaison officer at each base to handle fire reports and attend to all other business except such as was strictly Air Service; furnished the maps; prepared emergency landing fields, and furnished the operators for the radio receiving stations located in the forests.

3. The State Forester contributed in a financial way toward the subsistence of the Air Service personnel.

A very important part of the air patrol program is efficiency in communication. As soon as the airplanes land at the bases or sub-bases, they report all fires discovered enroute, and these reports are telephoned or telegraphed to the proper forest officers. The periods of flight, however, are often two hours or more in length, and the bases are out in the valley, necessitating the transmission of reports by telegraph or long distance telephone. This often consumes another hour, so that if it were depended alone upon the reporting of fires after the planes landed, there would be a delay of two to four hours in getting the reports to the men who would actually fight the fires.

It is necessary, therefore, to have a direct and continuous means of communication from the planes equipped with wireless transmitting sets, which are operated by the observers. There are ground wireless stations at all the bases and sub-bases, and in addition radio receiving stations are maintained at all the forest headquarters throughout the state. The latter are manned by operators employed by the Forest Service, who are usually well-qualified amateurs, including school boys and others who wish to go out into the forest during their summer vacations and who are particularly enthusiastic and ambitious on radio work.

The observer on the plane reports regularly to the ground stations at intervals of fifteen or twenty minutes. If he discovers any fires, he reports them; if not, he merely gives his location and anything else that he may have observed of interest. As he passes over one forest and out of range of the radio station there, he picks up the radio station on the next forest and is thereby in continuous touch with the ground forces.

The Forest Supervisor is enabled to trace on a map in his office the exact location of the plane, as it flies over his office, by the radio reports he is receiving at these regular intervals. If any fires are burning, he knows it immediately; if not, he has the assurance that everything is safe.

That the readers may know further what the Forest Service thinks of our amateurs, we quote directly the following from a report by that organization:

FIRES REPORTED BY PLANES
Forest Air Patrol, Season 1921

Patrols	Reported from planes	Elapsed time from discovery of fire to delivery of report to Forest organization							
	By radio	Verbally on landing	10 min. & less	11-20 min.	21-30 min.	31-40 min.	41-50 min.	51-60 min.	Over 1 hr.
Corning, Calif.	171	51	161	14	3	3	3	4	34
Mather Field, Calif.	228	42	205	14	2	5	3	8	33
Visalia, Calif.	35	15	18	3	1	2	1	3	22
March Field, Calif. (approx.)	44	3	33	10	1	0	1	0	2
Oregon and Wash.	482	171	339	69	31	31	29	31	123
Totals	960	282	756	110	38	41	37	46	214

Continued on page 28

Radio Central, For World-Wide Wireless

WITH a message from President Harding, the Radio Corporation of America on November 5th formerly inaugurated world-wide radio telegraph service from the first unit of Radio Central, its new station on Long Island, 70 miles northeast of New York City. This high-power, multiplex transmitting station is operated in conjunction with a multiplex receiving station at Riverhead, L. I., 16 miles east. Both outgoing and incoming messages are directly controlled by operators at the company's central office in New York City.

This first unit of an eventual eight consists of twelve 410-foot towers, spaced 1250 feet apart, together with a power house accommodating two 200 k. w. high frequency transmitting alternators with auxilaries and equipment. The towers are arranged radially, with six towers on each radius, like the spokes of a huge wheel, covering an area of 10 acres, with the final installation of 72 towers. The ultimate power installation will consist of ten 200 k. w. high frequency alternators. Power for operation is supplied through a 23,000 volt transmission line from the Long Island Light Company's plant at Northport.

The alternators are Alexanderson 20,000 cycle machines, operated for the present at 18,200 cycles. Future operation will probably be in parallel for charging two or more sections of antenna wings. Such operation is entirely practicable and will be employed where great distances are to be covered. Even as it is, President Harding's message was received at Auckland, New Zealand, a distance of over 10,000 miles, and in practically every important country in the world.

A sending speed of 100 words per minute is possible with each transmitting unit, giving a combined sending capacity of 200 words per minute for the two completed units. No operators are located at either the transmitting or receiving stations, as remote control of land wires from the New York office cares for actual transmission, and the received radio signals are likewise automatically transferred to wire lines and received at New York.

A 150-foot cross-arm on the top of each tower supports the antenna wires. Each antenna consists of 16 silicon bronze cables three-eights of an inch in diameter, stretched horizontally from tower to tower. Fifty miles of this cable were used for the first two antennæ systems. The ground system for both antennæ consists of 450 miles of copper wire buried in the ground of the entire system in starfish and gridiron fashion.

A multiple tuned antenna is employed to reduce wasteful resistance of the long, low, flat topped aerials and to permit the length of such aerials to be increased indefinitely for the use of greater powers. The radiation of flat topped antennæ are not impaired by multiple tuning, as a series of tests have shown that with an equal number of amperes in either type, the same signal audibility is obtained at a receiving station, but there is an enormous saving of power in the case of the multiple tuned antenna.

Another interesting factor concerned with Radio Central is the use of the magnetic amplifier. As is well known, tele-

Continued on page 43



Radio Central Power House and Cooling Pond in the Center. High Frequency Alternators on Upper Left. Receiver Section on Lower Left. Operating Room on Upper Right, and Main Switchboards on Lower Right.

The Vacuum Tube Transmitting Circuit

The First in a Series of Articles on the Construction and Operation of Continuous Wave Apparatus which, when finished will Constitute and later be reprinted as "A C. W. Manual."

By Jennings B. Dow
Ensign U. S. Navy

THE reader is assumed to be familiar with the principles involved in the operation of the three-electrode valve, the triode, or to have access to the literature available on this subject. Consequently, to avoid duplication and to save space, we will begin by considering the vacuum tube circuit. With slight variation, but consistent with the words of Van Der Bijl,[1] the conditions that are necessary to make the tube act as an oscillation generator may be stated briefly as follows:

1. The tube must be capable of amplifying, that is, it must have an unilateral impedance which is occasioned by potential variations on the grid producing a greater effect on the current in the plate circuit (output circuit) than the effect produced on the current in the grid circuit by potential variations on the plate.

2. Part of the energy in the output circuit must be returned to the input circuit by suitable coupling of these circuits electro-statically or magnetically, and in order to insure a re-amplification of this energy, the output and input must be in phase.

3. An oscillating circuit must be attached to the tube, having inductance, capacity and resistance of such values as to make the tube oscillate at the desired frequency. These values should be such that a maximum efficiency is obtained with maximum output.

Fig. 1 shows a typical vacuum tube transmitting circuit—a Hartley circuit.

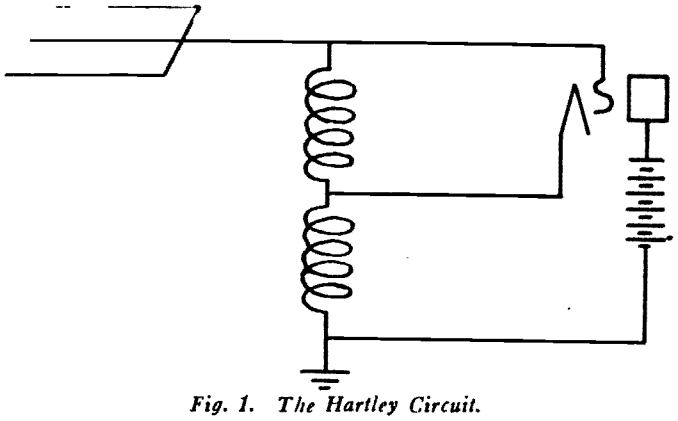


Fig. 1. The Hartley Circuit.

Fig. 2 shows this same circuit reduced to a simpler form for purposes of explanation. The antenna of Fig. 1 is represented by the dotted portion of Fig. 2.

The grid and filament of the tube in this circuit are connected to the branched circuit containing inductance and capacity, constituting the oscillatory circuit, in such a manner as to include a portion of the inductance of that circuit represented by the symbol L_g. In a similar way the inductance represented by L_p is included between the filament and plate.

Suppose first that the circuit is not oscillating. Because of the potential impressed upon the conducting path between filament and plate, a steady current will flow from plate to filament inside the tube and from filament through inductance L_p outside the tube. The magnitude of this current will vary with the voltage of the grid. It can become zero when the flow of electrons between filament and plate is made negligible by a highly negative potential on the grid, but it cannot reverse. A current can also flow from grid to filament inside the tube, the current returning from filament to grid through the inductance L_g in the external circuit. This latter current is appreciable only when the grid is positive with respect to the filament. Like the plate to filament current mentioned above, this current is also unidirectional and its magnitude is dependent upon the potential on the grid.

When the tube is oscillating, these currents will, of course, not be steady, but pulsating. The pulsating currents

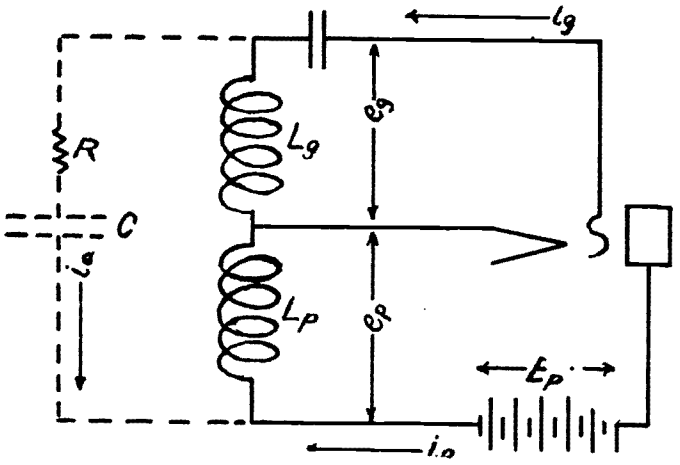


Fig. 2. Simplified Diagram of Hartley Circuit.

generated by the tube enter the circuit from the filament and leave it through the plate and grid connections. They are pulsating and not alternating on account of the unidirectional conductivity between filament and plate and filament and grid. The circuit CL_gL_p is resonant to these pulsating currents and an oscillatory current is generated and circulates around this branched circuit, flowing through the capacity C and the inductances L_p and L_g. This current, which will be called the output current, can be many times greater in amplitude than either of the pulsating currents.

The pulsations in the steady current which flows during the stable condition from filament to plate are, as stated heretofore, caused by periodic variations in the potential of the grid with respect to the filament and these variations in grid potential are induced in the grid coil L_g by the output current. There is a similar potential induced by the output current across the plate coil L_p.

It is true of this circuit and typical of any circuit for generating oscillations, that during the portion of the cycle of the output current when the grid is positive with respect to the filament as a result of the potential difference across the coil L_g, the voltage drop between the plate and filament connections (across the inductance L_p) is such as to oppose the potential of the plate battery and hence to reduce the potential between filament and plate inside the tube. During the other part of the cycle when the grid is negative with respect to the filament the potential acting between plate and filament is increased above that of the stable potential of the plate battery. During the portion of the cycle when the grid is positive with respect to the filament, current flows within the tube between the grid and filament and this current increases as the grid becomes more positive. The direction of the current flow is in the direction of the potential, that is, from grid to filament inside the tube and from filament to grid outside. Further, as the grid becomes positive with respect to the filament, there is a resultant increase in the current flow between the plate and

(1.) Thermionic Vacuum Tube, VAN DER BIJL (P267)

(2.) Bureau of Standards publication No. 355, L. M. HULL, Dec. 1, 1919.

filament of the tube, even though the plate potential on the tube is being reduced. This increase is limited, when the stable oscillating condition has been reached, by the saturation effect, which may occur at lower values of plate current than that corresponding to the total filament emission owing to the loss of electrons to the grid.

As has been stated, the plate current wave is distorted at the other extreme of the cycle—that is, when the grid is negative—by rectification effects; moreover, the grid current is always pulsating, and is zero for a considerable part of a cycle, while the grid is negative. Consequently, the waves of current supplied to the circuit between filament and plate, and filament and grid (Fig. 3) are each composed of a direct or average constituent, a fundamental constituent corresponding in frequency to that of the output current, and a number of higher frequency or harmonic constituents.

The useful oscillating output current depends neither upon the direct or average values of the plate and grid currents nor upon the multiple frequency constituents; it is determined solely by the fundamental constituents of these currents, to which the same consideration as regards direction and phase relations apply as have been roughly stated with regard to the distorted current waves.

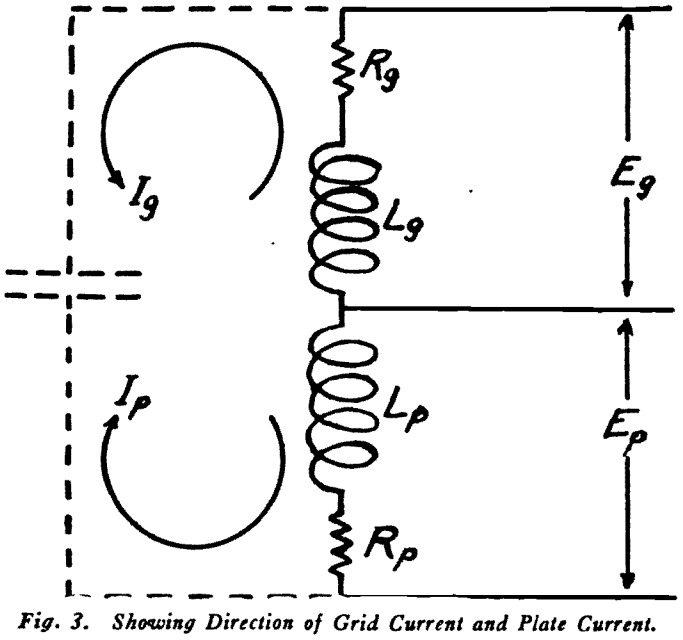


Fig. 3. Showing Direction of Grid Current and Plate Current.

Thus, speaking only in terms of useful current constituents, a sinusoidal alternating current flows in the grid circuit in phase with the alternating e. m. f. across the inductance L_s, and therefore represents a withdrawal of power from the output circuit, which power is expended within the tube. On the other hand, a sinusoidal, alternating constituent of plate current flows in opposition to the e. m. f. across the inductance L_p; this means that power is being supplied to the output circuit from the plate circuit of the tube. As will appear later, the impedance of the output circuit to all frequencies that are harmonic multiples of the fundamental is very great. Hence there are no appreciable multiple frequency constituents of the current circulating in the output circuit and the alternating e. m. f.'s across the inductances L_p and L_s are in all cases practically sinusoidal. Consequently the useful power supplied by the tube can be determined in terms of the alternating e. m. f. across L_p and the fundamental constituent of the plate current. If we would neglect the grid current, this would be the power available for dissipation in the resistances. As the output current increases, the amplitudes of the alternating e. m. f.'s across the plate and grid inductances increase proportionately. The alternating grid current increases more and more rapidly as the amplitude of the plate e. m. f. becomes larger. On this account, the power loss to the grid increases. The power supplied by the plate increases with increasing plate potential, but as the grid potential increases the effective saturation current is reached when the grid is positive and the plate current becomes zero for an appreciable part of the cycle when the grid is negative. Consequently, a continued increase in the amplitude of the output current results chiefly in an increase in the harmonic constituents of plate current without greatly increasing the fundamental. Obviously, then, a condition of stability ensues when the power supplied by the fundamental of plate current minus the power dissipated by the fundamental of grid current is just equal to the power dissipated by the output current in R_s, R_p and R_c.

C-W Circuits to Date

There are as many as five vacuum tube circuits that may be considered of primary importance. Only two of these, however, are found in common use in modern transmitting circuits, namely, the Hartley circuit and Heising's modified Colpitts circuit. Meissner's circuit, while used to some extent in its basic form, resolves itself into a modified Hartley or Colpitts circuit in practice. Its approach to either of these depends upon the constants of the circuit.

Both the Hartley circuit and Heising's modified Colpitts circuit possess certain advantages and disadvantages, all of which are not common, and the experimenter, in selecting one will do well to consider each. For example, the Colpitts circuit, while highly efficient, does not well adapt itself to flexibility insofar as rapid change of wavelength is concerned. This disadvantage was largely overcome by Heising's alteration. The Hartley circuit, probably the most efficient, retains

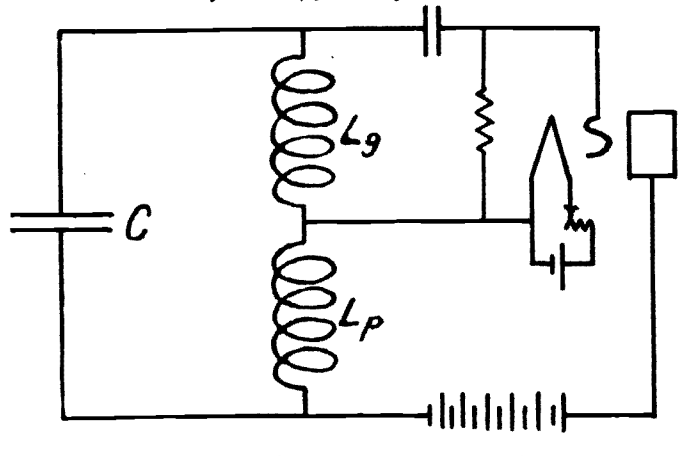


Fig. 4. Hartley Circuit as Used in the Laboratory.

its efficiency only through the narrow band of wave lengths for which a given installation is designed; this, because the variable feature is vested in inductance rather than in capacity. Large amounts of inductance are obviously necessary for operation at the longer wave lengths, and when using only a small portion of this inductance for the shorter wave lengths, there is added resistance in the circuit resulting from the so-called "dead end effect" and from corona losses which are very apparent in any open end inductance adjacent to circuits where high frequency currents of any magnitude are flowing.

Fig. 4 shows the common Hartley laboratory circuit as used to generate sustained oscillations for calibration work, heterodyning incoming signals, producing high potentials for testing insulation, etc. If the resistance of the circuit CL_sL_p is sufficiently low, a simple circuit of this kind may be made to generate oscillations from a few per second to upwards of 3,000,000 per second. If. in place of the concentrated capacity C, an antenna having distributed capacity and appreciable resistance is substituted, the band of frequencies at which the circuit will oscillate will be restricted to a comparatively narrow range. In this circuit, both inductances L_p and L_s necessarily coupled to obtain the required grid input, are a part of the oscillatory circuit and must be wound with low resistance wire, tubing, or tape in order to keep the resistance of the circuit as low as possible. In practice, in

transmitting circuits, L_s is exterior to the oscillating circuit and may be wound with almost any kind of conductor. In so far as the supply of power to this circuit is concerned, it is of the series power circuit type—the plate battery or generator is in series with the plate and is unshunted by capacity. Here the plate circuit is not a part of the oscillatory circuit and the current which flows in this circuit is pulsating rather than oscillating as previously explained.

In Fig. 4, a small capacity and large resistance are used to obtain the required negative potential on the grid. With this arrangement the grid obtains a positive potential only during the small fraction of the cycle when the grid leak current is building up to rob the grid of its positive charge. Notwithstanding the fact that the grid attains a positive charge during a small fraction of each cycle, which results in a grid to filament current inside the tube, the capacity-grid-leak resistance method of obtaining the required negative potential is more efficient than the method of inserting a grid battery in the circuit. In using the latter method the plate potential must be increased to a much greater value before oscillations will start, than when the former method is used. The value of the current in the oscillating circuit is greatly dependent upon the value of the grid leak resistance, which will vary with the type of the tube used, but will usually lie within the limits of 5,000 to 12,000 ohms.

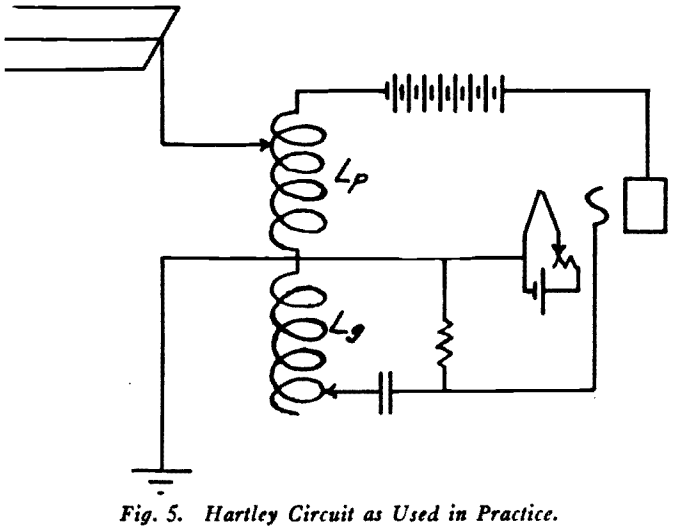


Fig. 5. Hartley Circuit as Used in Practice.

Fig. 5 shows the Hartley circuit as used in practice. Here the inductance, L_s, is not a part of the oscillating circuit, but is merely coupled to the oscillating circuit to obtain the required input for the regeneration of oscillations. The variable feature of the inductance L_s may be obtained either by a fixed coil inductively related to L_p, with a variable contact, or by a coil having a fixed amount of wire in circuit at all times, but so mounted as to provide a means of changing the degree of coupling with L_p, or by a combination of both of these methods as found in some of the more refined sets. In this circuit, the filament and grid are more or less strongly tied to earth which results in the plate only being "hot." This is a feature which is very desirable in a power circuit where high voltages are used. The period of oscillation of this circuit is dependent upon the value of antenna capacity and inductance, and the inductance L_p. At very high frequencies, however, intra-electrode capacities and other capacities and inductances in the circuit may influence the period of oscillation, and in all circuits these values, together with the resistances, determine the upper limit of oscillation. In the design of the transmitters to operate at short wave lengths (wave lengths under 250 meters) the Hartley circuit is recommended. As a matter of information the General Electric Company has been able to obtain waves six meters long with such a circuit. At this wave length, which corresponds to a frequency of 50,000,000 cycles per second, the inductances resolve themselves into nothing more than the straight connecting wires.

Fig. 6 shows a Colpitts laboratory circuit. In the case of the Hartley circuit, the coupling between input (grid) circuit and output (radio frequency) circuit was obtained inductively. In the Colpitts circuit, the coupling between input and output is capacitive and is varied by changing the value of the capacity C_1. In changing this capacity as required in adjusting the circuit for most efficient operation, the period of oscillation of the circuit $LC_1C_2C_3$ is changed and it is necessary to change the capacity C_2 an amount necessary to obtain the desired period of oscillation. This double adjustment is somewhat of a disadvantage in practice. In this circuit, the plate potential is applied across the capacity C_1, and in order not to affect the oscillating circuit

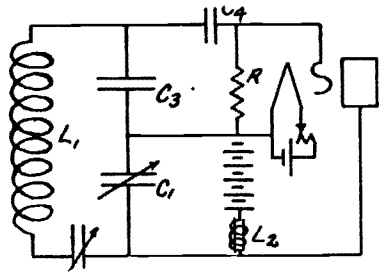


Fig. 6. Colpitts Laboratory Circuit.

$LC_1C_2C_3$ a radio frequency choke L_2 must be inserted in the plate supply lead as shown. The matter of obtaining the proper value of this choke inductance will be considered in detail later. The capacity grid-leak resistance method of obtaining the required negative potential on the grid is used here, also.

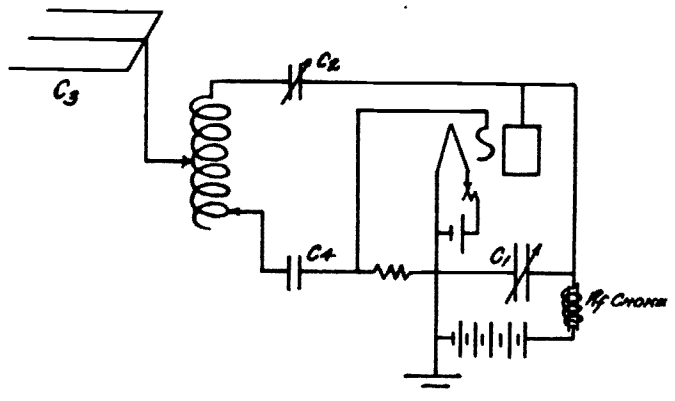


Fig. 7. Colpitts Circuit as Used for Transmission.

Fig. 7 shows the Colpitts circuit as applied to a power transmitting circuit possessed of an antenna which is represented by the capacity C_3.

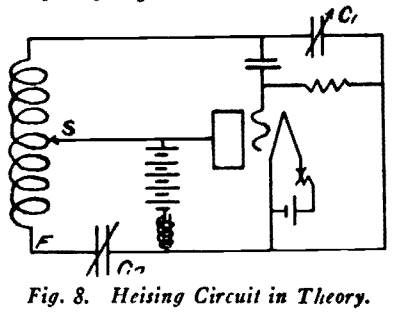


Fig. 8. Heising Circuit in Theory.

Credit is due Heising for the circuit represented in Fig. 8. This is one having a number of very desirable features. The coupling between input and output is varied by changing the position of the contact S. If contact S is moved along the inductance to the point F and a variable capacity is inserted in the circuit between the plate and F, the circuit shown in Fig. 6 will result. By means of Heising's variable contact S, then, it has been possible to eliminate the variable capacity C_2 of Fig. 6 and at the same time provide a method of chang-

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A Medium and Short Wave Regenerative Receiver

By F. L. Wisner

The First Entry in the $25.00 Prize Contest which Closed December 15th. This Set Has a Range of 175 to 2400 Meters

IN ORDER to have a simple and efficient receiver for medium wave lengths, including time signals, weather reports, etc., and yet maintain maximum efficiency on short wave lengths, the following receiver was designed. In the short wave position the receiver has a range of from 175 meters to 500 meters. It is a plain variometer regenerative receiver and, as may be seen in Fig. 2, there are no extra coils or condensers connected to lower its efficiency.

brackets, on either side of the stators. Care must be taken when connecting these two coils in circuit to see that their polarity is correct. Fine regenerative results have been obtained and the receiver will oscillate over its entire range. These secondary loading coils each have 34 turns of No. 22 double cotton-covered copper wire and are of the five-layer bank-wound type on a formica tube 3 3-4 inches in diameter and 1 inch long.

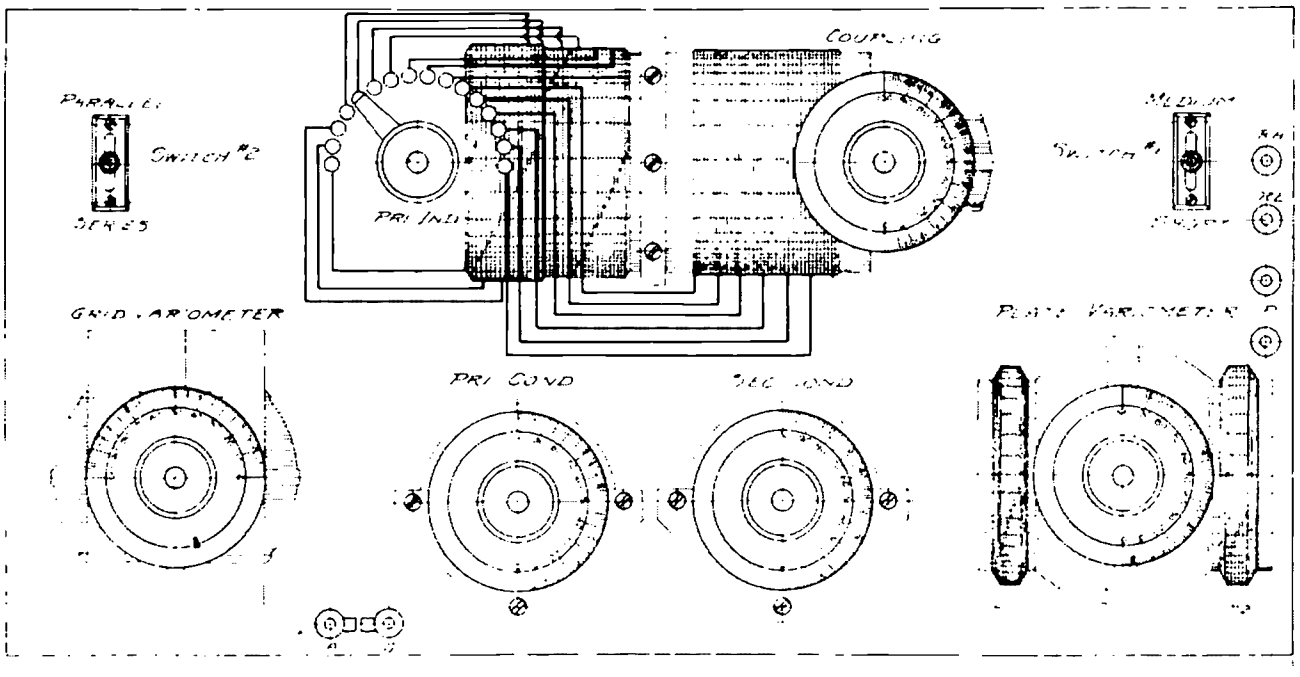


Fig. 2. Phantom View of Regenerative Receiver.

On the medium wave position of switch No. 1 in Figs. 1 and 2, two secondary loading inductances are connected in the circuit as well as a secondary variable condenser of 0.0011 microfarads capacity, which brings the wave length range up to from 450 meters to 2400 meters. This switch also connects the bank wound primary loading inductance in the circuit, giving the antennae circuit the same range as the secondary. In this position the plate variometer becomes a variable tickler because of its close inductive relation to the two secondary loading coils which are mounted with brass

A variable condenser of 0.0011 microfarads capacity is connected either in parallel for long waves or in series for short waves by switch No. 2 in Figs. 1 and 2. There is sufficient inductance in the loading coil and primary of the vario-coupler to use the condenser in series up to 1200 meters wave length.

The primary loading inductance is wound in a two-layer bank winding for 42 turns and then three-bank winding for 53 turns, using No. 20 double cotton-covered copper wire on a formica tube 3 3-4 inches in diameter and 4 inches long.

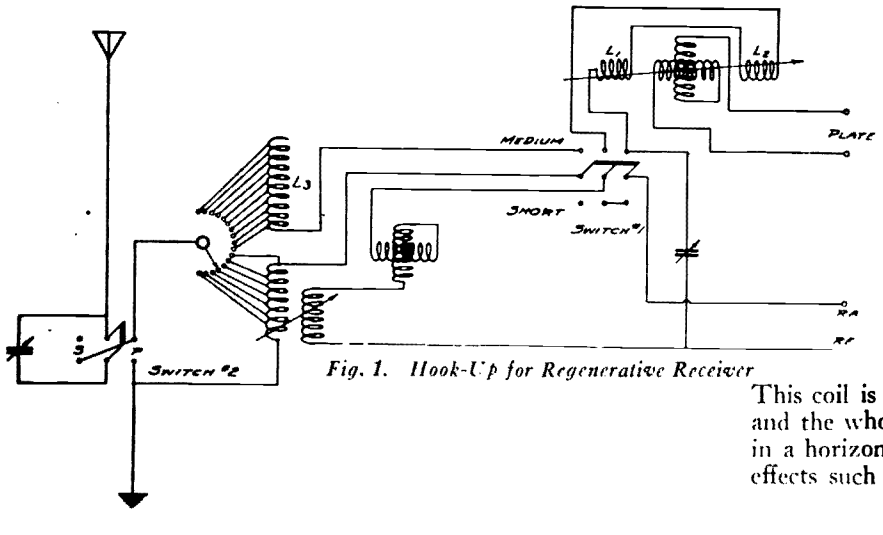


Fig. 1. Hook-Up for Regenerative Receiver

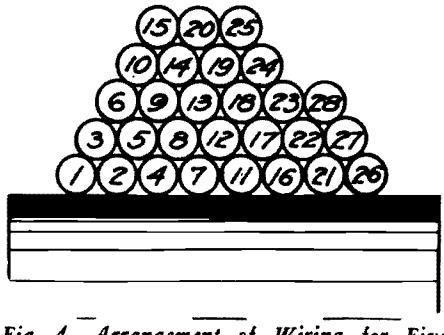


Fig. 4. Arrangement of Wiring for Five Bank Winding

This coil is mounted on the bottom of the vario-coupler base and the whole unit is mounted on the panel with the tubing in a horizontal position, as this conserves space with no bad effects such as coupling to either variometer. The primary

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Tuning for Long Waves

A Discussion of the Theory and Practice of Using Multi-Layer Coils

By B. F. McNamee

TUNING apparatus for long waves presents some difficulties not met with in the short wave apparatus. The loose coupler, when made of sufficient size to tune to the long waves, is a very bulky and awkward object. Many attempts, more or less successful, have been made to use coils of several layers of wire to replace the single layer coils of the ordinary loose coupler. In the radio trade the term "loose coupler" has been pretty much confined to two telescoping single layer coils, such as shown in Fig. 4 of the author's article on "The Handling of Tuning Apparatus" in December RADIO. But the term really means a combination of two coils of any kind to act as a radio frequency transformer.

Let us take a single layer coil of 1000 turns wound on a tube 4 inches in diameter. Another coil of about the same diameter, but much shorter, has also 1000 turns of wire, wound in 10 layers of 100 turns each. While the inductances of the two coils may be somewhere near equal, the 10 layer coil will not tune to as short a wavelength as the single layer one. This is due to its *distributed capacity*, or we might term it the turn-to-turn or layer-to-layer capacity.

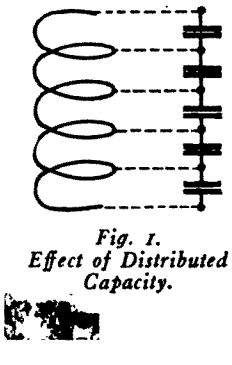


Fig. 1. Effect of Distributed Capacity.

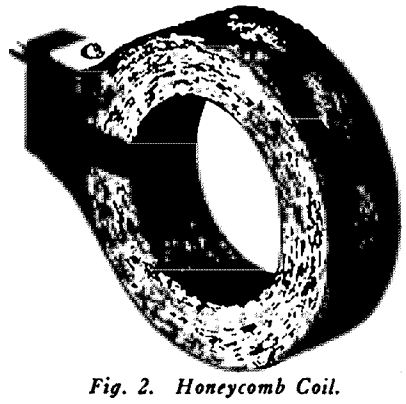


Fig. 2. Honeycomb Coil.

Two adjacent turns of wire, with the insulation between them, constitute a small condenser. The voltage drop due to the inductance of a single turn is appreciable at high frequency, and serves to charge this small condenser. This much is true of both types of coil, and may be called the turn-to-turn capacity. But in the 10 layer coil we have also a number of condensers consisting of the layers of wire and the insulation between them. In this case the capacity is therefore much greater than in the single layer coil, and since the wavelength to which the coil will tune depends on the capacity of the circuit as well as the inductance, the 10 layer coil with its larger fixed capacity will not cover as great a range of wavelengths with a given variable condenser as the single layer coil.

Fig. 1 shows the effect of distributed capacity by the imaginary condensers connected between adjacent turns. In circuits where variometers are used for tuning without any shunting condenser, the capacity of the circuit (which is necessary for tuning) is the distributed capacity of the variometer coils, in addition to some small capacity between leads, etc.

The common practice of "tapping," i. e., using only a part of large coils in order to tune to shorter wavelengths, often results in great losses in signal strength, due to what is known as the "dead end" effect. The term "dead end" refers to the unused portion of the coil, which in virtue of its distributed capacity, is more or less tuned to the signal. It therefore absorbs more or less of the incoming energy. For some wavelengths the inductance and capacity in the dead end is tuned perfectly to the signal, and the coil will give very poor results at such wavelengths. One method much used in the past to overcome this effect is a dead end switch, which disconnected the unused turns from the part in use. But the presence of the unused turns, even if disconnected, makes possible their absorbing energy by induction.

Multi-layer coils of the "honeycomb" type have proved a success in overcoming these difficulties in some degree. The distributed capacity is low because the wires touch only at crossing points, and are kept apart by the thickness of one wire at all other points. The largest coil required for wavelengths now in use has 1500 turns, and is only 1 inch wide and about 4½ inches outside diameter. A plug and socket arrangement makes them easily removable.

Since no "taps" are provided for using only a part of the turns, the whole coil is always in use, and dead end effects are completely done away with. When a wave is too short for a given coil, it is replaced by a smaller one.

Coils termed "duolateral" are a modification of the "honeycomb," and are wound with the wires a little further apart, giving a slight decrease in distributed capacity.

In tuning with honeycomb coils it is necessary to observe the same cautions regarding coupling as stated in the December issue about the loose coupler; i. e., every time the coils are moved it is necessary to retune with the variable condensers to keep in resonance with a given signal.

It is generally possible to tune in a station on two or more coils of different sizes. Let us say that some particular signal comes in when the secondary coil is a 35 turn honeycomb and the secondary condenser is set at 130 degrees. If we now substitute the 50 turn coil, we will no doubt tune in the same signal at a lower condenser setting. This is because tuning to any particular wavelength does not mean selecting just one certain amount of inductance and one certain amount of capacity, but selecting one certain value for the product of the inductance and capacity. So we should be able to select any value of inductance whatever, and then choose a sufficiently large or small capacity to make the product come out right.

We are limited in this, however, by two things. First, we have always the distributed capacity of the coil as the minimum capacity. Second, the tuning will be too broad if too little inductance is used, and difficulty in coupling is experienced due to fewness of turns in coils. So it is generally best to use as large a coil as possible on any given wavelength.

TABLE OF CONSTANTS FOR DEFOREST DUO-LATERAL COILS

By EDWARD M. SARGENT

Coil	No. of Turns	Outside Diameter	Inductance at highest wavelength (Milhenries)	Wavelength when shunted with condenser having capacity of .0001 mf	.001 mf	.0015 mf	D. C. Resistance Ohms
DL-25	19	2.22"	.020	100	270	338	.37
DL-35	40	2.30"	.092	225	580	698	.72
DL-50	49	2.32"	.144	287	710	887	.70
DL-75	74	2.37"	.322	405	1090	1310	1.31
DL-100	102	2.47"	.567	560	1450	1740	1.77
DL-150	135	2.56"	.875	693	1765	2160	2.31
DL-200	172	2.59"	1.61	945	2360	2930	3.97
DL-250	250	2.87"	3.51	1390	3580	4330	5.73
DL-300	329	3.03"	5.10	1680	4200	5300	7.44
DL-400	420	3.15"	10.2	2300	6000	7360	10.04
DL-500	519	3.47"	15.4	2925	7370	9200	13.70
DL-600	760	3.34"	32.0	4440	11120	13130	37.20
DL-750	990	3.56"	56.2	5500	14200	17300	51.20
DL-1000	1200	3.87"	99.5	7400	18850	23000	67.00
DL-1250	1410	4.13"	137.	8700	22150	27000	81.00
DL-1500	1670	4.00"	180.	10000	25450	31100	97.00

Martin Robbins

An Inspiring Story of Heroism

By Lawrence Mott

(Dedicated to KJM)

FATE—or whatever it is that seemingly controls the destinies of Man, sometimes with harsh severity—had laid ruthless hands on Martin Robbins, only —and hence Chief Radio Operator on the *Bloomton*, an irresponsible, waggly, creaking old steam lumber schooner that had worn a path of her own into Pacific waters, between a northern port to that of San Pedro. Up in ballast, and back in lumber—Plimsoll mark more than awash on pressing occasion, she drudged her weary way, pushing her scarred fore foot clumsily through the heaving water spaces.

Captains came—and went. Cooks stood the old, rattle-trap range, and the dearth of proper utensils, for a time, and then departed, vowing her "a d—— slob of a ship!" Mates, crews—all changed with periodic brevity.

But Martin Robbins was a fixture on board. And for the reason that an accident had made of a splendid, virile lad of 19, a hopeless cripple, who could navigate, after a fashion, on a badly-fitting wooden leg and two heavy walking sticks. Radio, as a profession, had never been his ambition, but by the force of unhappy circumstance, it was practically all that he could do—and the stipend thus earned went far toward the support of the idol of his heart—his mother—and himself.

Robbins was a good operator, with a Class A-1 Commercial. The owners fully realized this, and—being kindly men, albeit intent worshippers of the almighty dollar—they had made things as comfortable for him as lack of space permitted.

But, at best, it was a rough, wearyingly-monotonous existence, with little or nothing to do, and Robbins would hunch himself into a comfortable position abaft the squat funnel, and sit there for hours on end, all alone, watching the graceful flight of the swooping gulls and listening to the crooning lullabies of the wind, droning from the great distances —into them again. He never complained —nor railed—child-fashion—at the immutable cross that was his to bear during this existence, for he was of good stuff—was Robbins—going about his duty thoroughly and conscientiously.

Only once did the cry of a tortured, aching heart burst forth. It was in Grays Harbor, on a hot afternoon. Loading had been delayed, and the foreman was driving the crew. One of them—a burly figure of a man, perfect in wind and limb—stopped at the door of Robbins' quarters and asked for a drink of water. Wiping the sweat from his face, this whole-limbed tower of human strength broke out in a string of curses at the hardness of the work, at the penny-grabbing owners—at anything and everything.

Robbins listened—then:

"How would you like to be—*me*?" The tense passion in his voice checked the other's outburst.



"God ought to strike you dead! You have health! You are a *whole* man! You can earn a real day's wages, without feeling that you are accepting charity! *You* can dance—sing—be happy—while I . . . " a sob choked him and he threw himself on the narrow bunk. The other tiptoed away, shocked into thinking.

* * *

HOW well Robbins remembered when *she* had come on board—at San Pedro—for the run, North!

Captain Malcolm's Elsie was of that clean-cut, fine type of young womanhood that instantly appeals to the finest in a man. Full of fun, with a contagious spirit of gayety, she owned the ship from the time that the San Pedro breakwater was turned, and course set—up coast. He watched her as she passed about the grimy vessel, investigating everything, and a greater sense of his physical condition bit, deeply.

The radio apparatus had to be explained. She listened-in, and he showed her how to distinguish *dots* and *dashes*. At her insistent demand he printed the code, that she might learn it. With a woman's quick intuition she read his burden in his big grey eyes, as though they were the open pages of a book, and her heart ached for him, in his bare and drab existence.

One night she tactfully led him to talk of his mother, and the girl's eyes went wet as he told, quite quietly, of the difficulties of keeping both their bodies and souls in comfortable relationship; of his one-time hopes of being a marine engineer—and so forth.

"This is about all that I can do—now," he finished unheroically, merely making a statement of fact, and unseeking of sympathy.

She went out on the little after-deck, where a full moon swathed the world in steel-white light, and as she leaned against the grubby rail, listening to the

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The Fable of the Frenzied Feline

With apologies to Lem N. Ade

By Dave Gibbons

ONCE upon a time there lived in a Small Town a youth named Katt. His folks spelled it with a "K" and two "t's" and that Helped Some. He was an Eager Reader and perused all the Popular Periodicals of a Mechanical Nature to be found on the newsstands.

He knew How to Use old phonograph records for eleven different purposes, besides the original, and Quite a Number of ways of making Fords Useful. But it was the Back Pages that captivated him. For a long time he tried to decide whether to be a Finger Print Expert in Six Lessons or a Hawaiian Guitar Player in Four. The Traffic Manager Dope and the Traveling Salesman Stuff gave him several Exalted Moments.

But what finally hypnotized him was the Double Page Dream of the publicity agent of the Grand Supreme Wireless University of Kankakee, Mo. He swallowed the Whole Business and filled out the Coupon. He enrolled for the Special Six Weeks course at so much down and so much per, and received Free in Addition their Marvelous Patented Battiometer. Seven or eight months later he amazed the entire Katt family by getting a License.

All he needed then was a job. He packed His Things and Came On to San Francisco. For many days he haunted the Various Offices and finally one morning there was an Opening. He felt that he was In Luck but forgot that there are Two Kinds of luck. The second on the steamship Jessie Jay had quit as he couldn't seem to get along with the second steward and Katt was put in his place.

After parking his toothbrush and his Other Collar in the Operator's Cabin Katt went on watch. He felt fine and had No Misgivings as he knew the game from A to Z, and had often seen sets work.

They headed north bound for Seattle and other Foreign Ports and met a Moderate Westerly Swell. The motion was Unpleasant and Katt was Uneasy. He hoped strongly that it wouldn't Affect him. A few minutes after noon, and as he was deciding he didn't Feel like eating as he had a Late Breakfast, the telephone from the bridge rang and a rough voice wanted to know what was the matter with the Time Tick and how was the weather at Table Bluff. Katt wasn't aware of any time-tick or other trouble and hoped the weather at Gable Ruff, or whatever he called it, was pretty nice, but he had no definite information to go on.

He woke up the first and told him the Circumstances. The first had been out at the Beach the night before delivering some Real Stuff he got at a Bargain in Vancouver for twelve a quart. He wasn't quite over it yet and Katt couldn't Make Much of his Explanation. He gathered however that he had Missed Something.

He also realized that the good ship Jessie Jay was a Poor Performer in a little sea, and he thought it strange he hadn't heard any signals yet as there ought to be some other ships around. The motion of the ship Increased and Katt's enthusiasm Waned, and when the first relieved him and pointed out that he could hear better if he had Both Terminals of the Phone connected to the Binding Posts he was only Mildly Interested.

Next day he received his first message from another one of the company's ships but all he could make out was the Best Regards part until the fourth repetition and even then he was a Little Doubtful about the Names. He had Quite a Time with his key too as it wasn't nearly so Easy to Work as his practice set. He heard Marshfield call QST alright but the beginner on duty there was a very Snappy Sender with a very Individual Fist of his own and Katt didn't get the rest of it. Afterwards he figured it might have been a storm warning, but anybody could see the wind was getting worse right along.

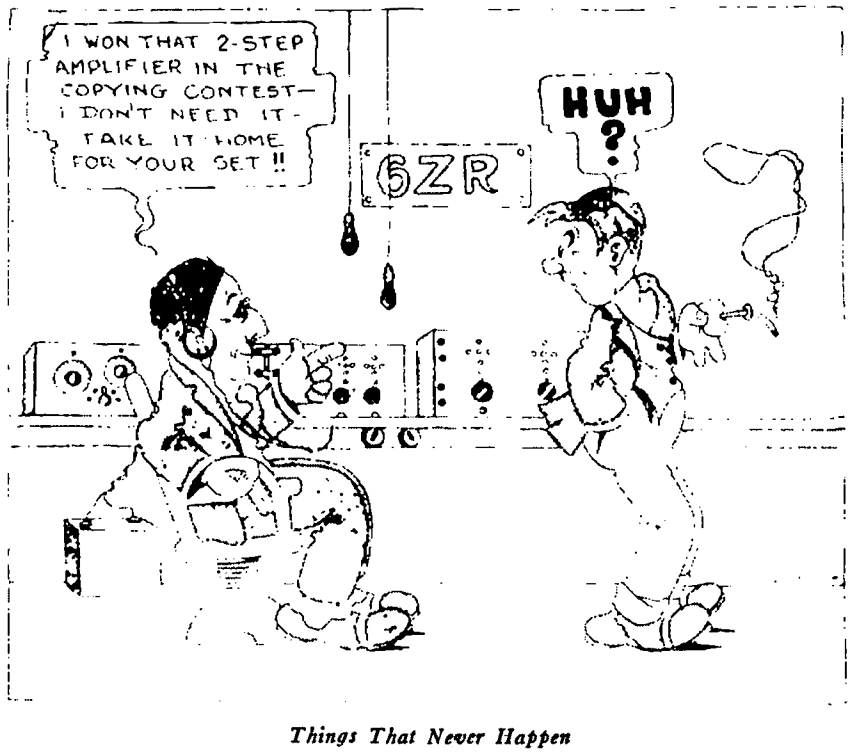
The skipper then wanted to know the weather at North Head and how was the Bar. He came in and sat in the shack while Katt Called and Called and Called. And every time he called he Knocked His Detector. There was only one Good Spot on that lump of coal and It was Hard to Find. He finally gave it up and the Old Man grunted and left. Katt had not been told that NPE never answers until at least four ships call him Twenty Minutes Each, as it's lots of trouble Starting Her Up.

When they got to the bar there was Considerable Sea running and Katt didn't like the Looks of Things. After a couple of hours of such Rolling And Pitching as Katt never believed possible, the Jessie Jay tried vainly to roll All The Way Over and at last got inside into smooth water. Katt thought there couldn't be anything worse than the Awful Experience he had been through and when the freight clerk told him it was always Much Easier going in than coming out he made up His Mind.

When they tied up at Astoria he didn't wait for the gang-plank. He took his tooth-brush along but left all his Other Stuff on board. He headed directly for the Interior of Oregon and although many years have passed he has never since returned to Civilization. It is said that after a time Katt became quite wild, and that his Descendants are all wild too.

The Natives claim that this is the True Explanation of the Origin of the Wildcat, but as there still exists Some Doubt everybody is entitled to Their Own Opinion in the matter.

Moral:—You learn a lot After You Leave School.



Things That Never Happen

International Allocations of Frequencies

Reviewing the Report of the Meeting of the Interallied Technical Committee on Radio Communication, Paris, 1921

A LENGTHY draft of the recommendations of the Interallied Technical Committee on Radio Communication, which conferred at Paris from June 21 to August 22, 1921, has been issued by the U. S. Department of Commerce. The recommendations, together with any changes that may be proposed by any of the five governments represented, will be submitted for adoption at a world conference which will probably be held during 1922. The views of American commercial and private radio concerns were presented at a meeting called by Secretary Herbert Hoover at New York City on November 25th.

The committee's report consists essentially of answers to a set of fourteen questions that had been prepared by the 1920 Washington conference and answers to four questions subsequently introduced. These questions have to do with the classification and allocation of waves, restrictions on damped waves and on radio telephony, and the determination of the normal range of a radio station.

NOMENCLATURE

A preliminary series of recommendations on nomenclature are given for the attention of the International Electrotechnical Commission. Herein it is suggested that "atmospheric disturbances" be used instead of "statics" or "X's" this designation being reducible after first mention to either "disturbances" or "atmospherics."

"Electron tube" is recommended as the generic title of the thermionic tube, of any number of electrodes and in any of its recognized modes of operation. The three-electrode tube is called a "triode," being further designated as a rectifier triode, an amplifier triode or a generator triode, depending upon the use for which it is intended.

"Radio-telegraphy" or a "radio-telephony" are substituted for "wireless." In describing couplings of antenna systems or triodes use "resistance coupling," "inductive coupling," "auto-inductive coupling," "capacity coupling" or "capacitive coupling," as the case may be. In describing an instrument for determining the direction of propagation of waves use "direction finder" or "radiogoniometer."

An "antenna is the electrical conductor, or system of conductors, for receiving or emitting electromagnetic waves. The term antenna is not understood as including mechanical supports, a 'tower' is a self-supporting structure, a 'mast' a non-self-supporting structure.

"It is believed that in many cases there is a distinct advantage in the use of frequencies rather than wave lengths." Cycles per second is abbreviated as c/s, kilocycles as k/s, and megacycles as Mc/s.

"In regard to 'wired wireless,' the representatives of France, Great Britain and Italy state that the terms 'high frequency telegraphy' and 'high frequency telephony' have already been adopted in their respective countries. The Japanese representatives were also in favor of these terms although other terms have been used in Japan. The American Delegation was stated to favor the term 'line radio.'"

CLASSIFICATION OF WAVES

The different classes of waves and their definitions are:

Type A—Continuous waves—Waves which, after reaching the steady state, are periodical, i. e., the successive oscillations are identical.

Type A1—Continuous waves, key modulated—Continuous waves of which the amplitude or frequency is varied by the operation of keying in telegraph transmission.

Type A2—Continuous waves modulated at audible frequency—Continuous waves in which the amplitude or frequency is varied in a periodic manner at an audible frequency.

Type A3—Continuous waves modulated by speech—Continuous waves in which the amplitude or frequency is varied according to the characteristic vibrations of speech.

Type B—Damped waves—Waves consisting of successive wave trains in which the amplitude of the oscillations, after reaching its maximum declines gradually.

These definitions do not refer to types of transmitting apparatus. They do not exclude, for example, from type A1 emissions from spark apparatus which produce real continuous waves. They also do not exclude from type A2, spark apparatus which may produce real modulated continuous waves.

In the case where bands of frequencies are allotted to a service, or to a station, or to different nations, each administration should ensure that the stations under its jurisdiction employ frequencies which are sufficiently far removed from the limits of these bands, in order that no objectionable amount of interference be caused to traffic of other services or stations employing frequencies outside the bands.

Within each type, waves are classified according to the degree of interference they produce at any distance.

A particular emission will be considered as coming in a given class, regardless of whether the interference is caused by high-signaling speed, modulation, spacing wave, actual decrement, harmonics, variation of frequencies of the generator, etc.

At present, four such classes are admitted, these being defined by their *equivalent decrement.*

No difficulty exists in the definition of *equivalent decrement* when the resonance curve is such that a sufficiently, nearly constant value is obtained for the quantity

$$S = \pi \frac{f_1 - f_2}{f_r} \sqrt{\frac{I^2}{I_r^2 - I^2}}$$

where f_1 and f_2 are the frequencies at which I is measured, and f_r is the resonance frequency at which I_r is measured; it being conventionally accepted that the frequencies be selected over the range between the limits 0.9 f_r and 1.1 f_r, and that the values of I^2 do not exceed one-half of I_r^2.

When the value of S is found to be not independent of the frequency, the largest value of S given by the formula should be taken as the *equivalent decrement.* Account should be taken of the effects introduced by the measuring apparatus. It is desirable, if possible, that the determination of the resonance curve should be made at a distance greater than one wave length, in order to secure freedom from local disturbance.

The four classes are then as follows:

Class 1—
Equivalent decrement 0.000 to 0.005
Class 2—
Equivalent decrement 0.005 to 0.02
Class 3—
Equivalent decrement 0.02 to 0.08
Class 4—
Equivalent decrement 0.08 to 0.16

In order to eliminate emissions which produce unnecessary interference it was recommended that each administration should assure itself that all the stations under its jurisdiction be operated in accordance with the best practice of the art. Even Type A waves can be purified by the employment of loose coupling, filter circuits, absorption circuits and other selective arrangements.

The extent of interference caused by a station is approximately indicated by its equivalent decrement, although this does not take into account slow variations of wave frequency or the emission of frequencies differing from the frequency of transmission (harmonics, etc.). It is therefore recommended that each administration should fix an upper limit of permissible variation. With regard to harmonics it is recommended that the electromagnetic field measured at any frequency less than 0.9 or greater than 1.1 of the frequency employed shall not exceed a definite value at a specified distance. It is requested that experiments be made to determine the proper value and distance.

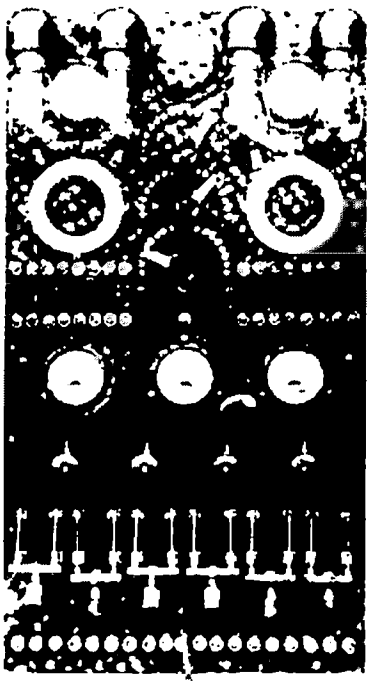
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Four-Tube C W Transmitter at 2 BAK

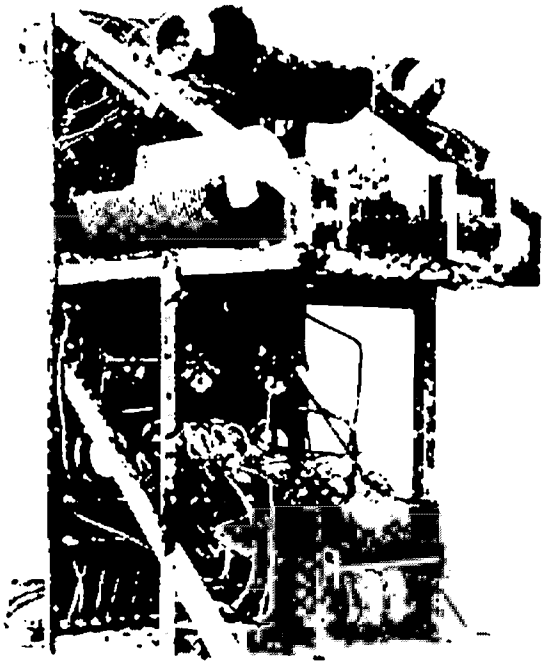
By Frederick Koenig

HEREWITH is a picture and diagram of a continuous wave transmitter at 2 BAK, Tarrytown, N. Y. This two panel transmitter is part of a larger cabinet also including an arc transmitter, amplifying set and receivers. It was designed by Frederick Koenig and is operated by Joseph B. Slavin.

The Heising-Colpitts circuit is used for the phone or buzzer and the Colpitts circuit for C. W. or I. C. W. The circuit is similar to that used by J. O. Smith, 2Z1, with some modifications.



Front View of 2BAK C. W. Transmitting Panel



Rear View of 2BAK C. W. Transmitting Panel

Using five watt tubes with 500 volts, 200 milliamperes space current, 0.9 ampere radiation is employed on phone, and using 600 volts, 250 milliampere space current on C. W., 1 ampere radiation is obtained. All the adjustments are variable.

The transmitter is made up in two units. The upper panel contains the transmitter proper, while the controls are mounted on the lower panel. In the upper panel on the left and back of the tube are the grid milliammeters, radio frequency is in center, while the plate milliammeter is on the right. The three double-throw switches under the first three tubes are to change from C. W. to phone or vice versa. Switch points under fourth tube is a variable 5000 ohm Ward-Leanord grid-leak with taps every 500 ohms.

The three rows of switch points in the center are for the inductance, which consists of 34 turns of hard drawn copper wire wound on a Formica tube 4 inches in diameter and 72 inches long, which has been previously grooved. A tap is taken off every other turn and goes to each switch point common to wave length, plate and grid coupling switches, top row wave length, middle row plate and bottom row grid coupling.

The condenser on the left is .0015, feed back condenser and on the right is .0015 grid condenser. These condensers were made up specially by the General Radio Co., and are tested to 1500 volts.

In the lower panel are mounted the controls, the meter on left is a 0-5 A. C. ammeter for the two modulator tubes, while the meter on the right is 0-5 A. C. ammeter for the two oscillators. The center meter is 0-15 A. C. voltmeter. A Century buzzer is mounted between the voltmeter and ammeter.

The single-throw double-pole switches at the bottom of the panel are as follows: The first one is for C. W., second for I. C. W., third for phone, fourth for buzzer, fifth A. C. for filament heating and sixth for D. C. for plate.

The filament heating transformer is mounted in lower panel and is an Acme 10 and 12 volt. Also in this panel is mounted a relay that operates by a switch in the microphone. In one of the leads from the transformer is placed a one ohm resistance which keeps the filaments always heated slightly and when the relay is closed the resistance is cut out and they then heat up to the proper degree. The idea of this is that the tube is always warm and ready for transmitting. It also takes away the shock when the plate voltage is applied, especially where the tube is rushed with high voltage. This relay also connects the receiver or the transmitter with the antenna, applies the plate voltage, and either heats or puts out the amplifier tubes. It will be thus noted that everything is automatic in this station.

A ground system was used at first, but due to the long lead .6 amp radiation could not be obtained, so a counter-poise system was installed and .4 amp. more radiation was obtained.

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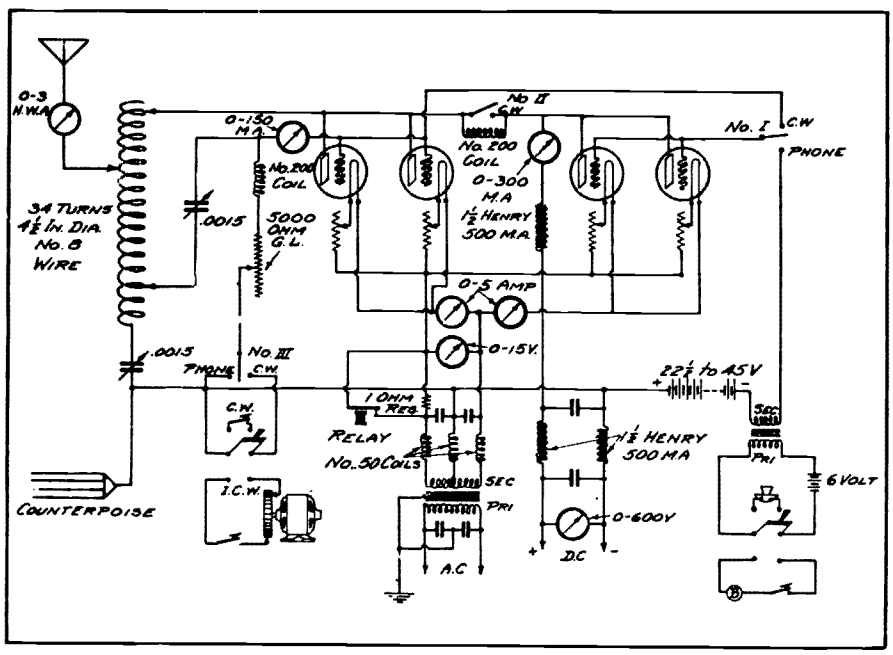


Diagram of Connections for 2BAK

C·W·CLUB OF AMERICA

CONDUCTED BY

LAWRENCE MOTT

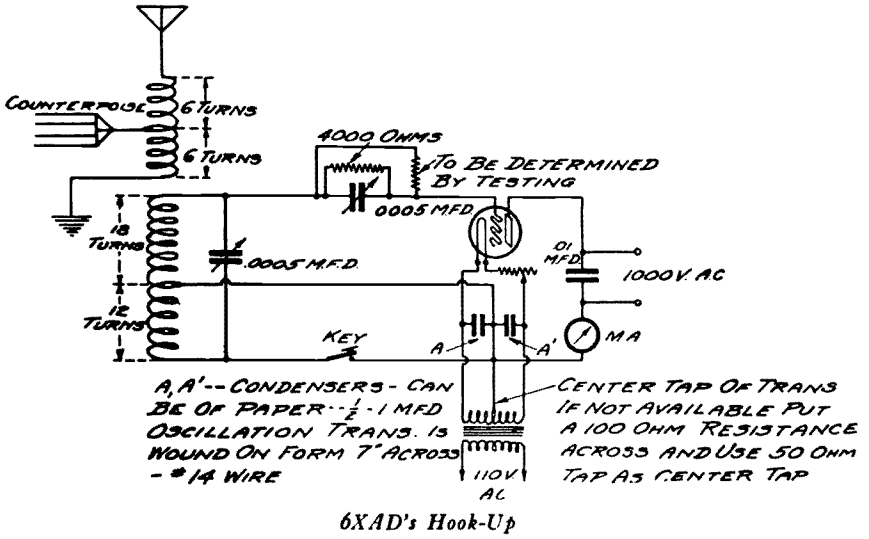
AN EFFICIENT SMALL TRANSMITTER

By Lawrence Mott

It has so often been asked of me what I am using on my smaller transmitter at 6 X A D that I am impelled to give herewith the exact hook-up and a brief explanation. This for the reason that there are many amateurs who have the erroneous impression that a great deal of power, and a very expensive plant, is required to do long-distance work.

Let me say that I am in effective touch with 9AMB, 9ALG, 9XAH, 9WD, 9ZAC, 9DVA, 7ZU, 7YJ, 7JD, etc.—without straining apparata at all! All of these stations are over the 1000 mile range from Catalina Island, that is situate 30 miles from the port of San Pedro, Southern California. 9ZN has reported me, by mail, and—it will be admitted that to reach Chicago on but 20 watts is a very interesting achievement—proving, as it indubitably does, the great possibilities of the *low*-powered, inexpensive, CW transmitter.

The hook-up is, I think, clear. A few words as to the out-of-doors equipment may not be amiss. My aerial is of 4 wire, Navy-type, 7-strand material, with a slightly inclined flat-top of 90 feet in length, and a lead-in of 58 feet. The taller spar is 91 feet high and the lesser 62 feet. Ground systems consist of 30 metal plates, buried under the antenna, 5 feet down and soldered together with 1-inch copper ribbons. Stand pipes 3 inches in diameter, go down to these plates at regular distances, and into these I turn the salt water hose every few days, thus keeping the sub-strata thoroughly moist all the time. I am also using that which is said to be the latest "wrinkle" in transmission efficiency, viz.: a counterpoise of exactly the same length as the aerial and directly under it, made of the same size wire, and parallel to the ground 9 feet above it—most carefully insulated, etc. Besides this system I have a fan effect of 1-inch copper ribbons, running from a center, directly under the transmitter, and—of course—the usual soldered connections to the Avalon water



6XAD's Hook-Up

NEW DX RECORDS REPORTED

6 A L E, W. W. Lindsay, Reedley, Calif., was heard by I E S, Brookline, Mass., at 5:14 a. m., Nov. 23, 1921, eastern standard time, while he was calling 9 C P on schedule. One 50-watt Radiotron with 1500 volts a. c. 60 cycles on the plate was used in a master oscillator circuit.

6 A M E, Robert H. Potts, Riverbank, Calif., heard 8UJ (CW) working 5 L A, at 9:15 p. m., Nov. 4, 1921, Pacific time, and again on Nov. 9th he heard 8 U J working 9 Z Y. 8 U J is Clarence R. Witte, 1182 Lewerenz Avenue, Detroit, Mich., who confirms the reception. He is using two 5-watt Radiotrons, radiating 2.2 amps. 6 A M E is using one Cunningham tube, honeycomb coils and Murdock phones with a 1-wire aerial, 90 feet long, 40 feet and 25 feet high at either end.

9 A M B on Oct. 29th, while calling 8 U J and working 9 A A O, was heard by G. C. Farmer on board S. S. West Prospect, 2500 miles from San Francisco. Mr. Farmer also heard 8 L F on Oct. 30th, while 2750 miles from San Francisco.

[illegible] connection that, I [illegible] is the chiefest cause of the very excellent antenna current that I attain: with 1-VT2 equals 1.5 amps.; with 2 tubes equals 1.9; with 3 tubes equals 2.2 and with 4 tubes equals 2.7 amps.

Such a transmitter as this is NOT "strenuously" expensive, and it is—as I have said — remarkably effective. At least, I have found it so. The transmitter was built to order for me by the Western Radio Electric Company of Los Angeles, and a very handsome piece of work they did. Be it noted that although I have mentioned only the WE-VT2 tubes, I also use, and with as good effect, the Radio Corporation UV202-5 watt tubes. These, of course, are to be had for the buying, whereas the others are more difficult to be "got at."

Call Heard and Worked at "6XAD."

(N. B.—The entire list of Stations that I have heard, and worked, is too long for publication purposes. Hence I have chosen a fairly representative night's efforts. The occasion was in late November.)

"Five" Stations: IF, CR (Canadian).

"Six" Stations: EA, EB, EF, GM, ZN, ZA, GN, OC, KA, GI, MZ, FK, GT, ZU, ZZ, UO, GR, WV, EN, AT, ALE, AQT, AUN, AKL, ABA, GP, JX, AJS, BAF, ALU, XAC, ME, XAK, ZB.

"Seven" Stations: ZU, YJ, MF, XD, JD, EX.

"Nine Stations: ZAC, ALG, ZN, DVA, HT, WD, AQR.

ELIMINATION OF AC HUM

A bit of very important information comes through from E. E. Bucher, commercial engineer of The Radio Corporation of America. Quoting from a letter of his:

"If any of your friends use Fig. 1 in the 2d or 3d revised edition of our catalog, where two 5-watt tubes are energized from the rectified A. C. source, will you please tell them that they can greatly reduce the A. C. hum—indeed, reduce it almost to zero—by putting 5 micro farads on the filter—that is to say, 3 micro farads on one side and 2 on the other. Do you know that it is perfectly possible to obtain 50-watts output from four of our 5-watt tubes, without excessively overloading them? It is being done every day in this vicinity."

In connection with Radio Corporation apparata, in general, I have heard a great many bitter complaints anent the tardiness of deliveries, and so forth, and I would point out that the demand for all manner of CW material has been so great that the Corporation and all other manufacturers have been very hard pressed in turning out an adequate supply.

Governmental Approval of Amateur Radio Activities

Some Significant Letters from Secretaries Denby and Wainwright, Major-General Squier and Commissioner Carson

THE SECRETARY OF THE NAVY
WASHINGTON

November 2, 1921.

Dear Sir:

In reply to your letter of October 17th, 1921, concerning the efforts of RADIO, of which you are Associate Editor, to assist the Government in every way by fostering a spirit of enthusiasm on the part of amateur Radio Operators, I am pleased to state that your efforts meet with my hearty approval.

In the event of an emergency, a large number of radio operators of experience will be immediately needed for service in the Navy. It is apparent that a large percentage of them will necessarily have to come from the rank and file of amateur operators.

If RADIO can increase the number and efficiency of qualified Radio Operators it will have performed a most patriotic service.

Sincerely yours,
Edwin Denby.

TWIN SUNSHINE
AVALON, CATALINA ISLAND, CALIF.

October 27, 1921.

My Dear Mr. Carson:

It is with apologies that I begin this missive, as I fain would not take of your time, but hereinafter set down for your consideration are certain things that—sooner or later—will have to be officially recognized and acted upon.

As department rulings now stand, the amateur wave-length of 200 meters, is woefully overcrowded. So much so that it is next the impossible—if in, or near, a city of any size—to do any research, experimental or long-distance work. I do not mean to infer that experimental stations, with their permission to use higher wave-lengths are seriously hampered, but as it is almost out of the question to keep ALL the thousands of amateurs, operating each night, on exactly 200 meters, the result is a confusion in the ether that is exasperating, and that does NOT tend for amateur radio progress and development. Another resultant of the clamor, and infernal din, is that there is a very strong tendency on the part of spark operators to open up on FULL power—and sometimes a little "fuller" —in order to "get through," and your imagination will convey the rest.

It is, I think, an admitted fact that Continuous Wave transmission is the coming thing. Perhaps this may be pointed out very strongly in that the Radio Corporation of America, for instance, are putting vast quantities of CW apparata on the market—to the almost complete shelving of instruments for spark transmission. As you are, of course, aware, sir, CW lends itself to the sharpest sort of transmission, its decrement being practically nothing—if the apparata is properly set up.

Therefore, would it be possible to grant CW operators the range of wave lengths between 200 and 280? The 20 meters between that and the commercial 300 is PLENTY, and to spare, in order to avoid any possibility of infringing on the commercial wave. As an aside: it is a fact that 300 meters is not much used—that of 600 being the principal carrier of all commercial traffic—save in comparatively few cases.

Then again: between 300 and 600 meters is a range of wave lengths that would be a God-send to the CW operators, and that would, in the aggregate, not interfere with anyone. From 600 to 1000 meters is another commercially "bare" space.

Continued on page 70

WAR DEPARTMENT
WASHINGTON

October 25, 1921.

My Dear Mr. Mott:

The devotion shown by the amateur radio men of our country in the building up of a reserve for the Signal Corps is worthy of the highest commendation. Their service to their flag is not limited to that which they will give in case of war, but extends all through the years of peace.

Radio communication as an art and a science, and as a factor in developing the national spirit of team work, is receiving a great impetus from the enthusiasm and intelligence of the thousands of amateur radio men throughout the country.

I wish you the greatest success in your work of fostering this patriotic movement.

Yours very truly,
J. M. Wainwright,
Acting Secretary of War.



Geo. O. Squier
Maj. Gen'l. U.S.A.

WAR DEPARTMENT
OFFICE OF THE CHIEF SIGNAL OFFICER
WASHINGTON

November 14, 1921.

My Dear Mr. Mott:

The universal support which the amateur radio operators of America have accorded the Radio Reserve has been to me the source of great satisfaction. The fact that thousands of patriotic and intelligent men stand ready to help the Signal Corps in case of an emergency is an important part of the armor of preparedness.

But we must also remember that the Signal Corps is a branch of our Army whose work is not limited to strictly military duties and activities. In the world of commerce and science it plays no unimportant part. The far-flung Alaskan system of communications is for miner and military commander, alike. The constant search for new methods of electrical communications, new conceptions of meteorological principles, new photographic procedure, and even new and improved types of message bearing pigeons, brings to our country a considerable return of scientific achievement. In this peace time service, the radio reservist is a prominent factor. All of his hours of patient study and investigation go to swell the total of our national communication abilities.

I wish to commend you in your endeavors to help build and improve this spirit of service which pervades the Signal Corps Radio Reserve.

Very sincerely,
George O. Squier, Major-General,
Chief Signal Officer of the Army.

DEPARTMENT OF COMMERCE
BUREAU OF NAVIGATION
WASHINGTON

November 23, 1921.

My Dear Mr. Mott:

I have received your letter of the 27th ultimo in which you have suggested that a little more latitude in the wave-length range be given to amateur stations using continuous wave transmitters. I regret that because of many matters recently coming before me, requiring my immediate attention, I have been unable to reply to your letter sooner.

As you know, the most recent legislation we have on radio is the Act of August 13, 1912, and the International Radio Convention of 1912, since which time there has been so much done in the development of radio apparatus that the present laws are difficult to apply.

Several matters have come before me recently illustrating the urgent need of additional radio legislation and I am of the opinion that such legislation may be considered by Congress as soon as the present important problems before it have been disposed of.

Any new legislation or amendments to the present laws will undoubtedly result in new regulations by this Department and when this is undertaken your suggestion will receive due consideration.

Sometime ago the Radio Inspector at San Francisco suggested for the amateur stations using spark transmitters that a wave-length of 150 meters be assigned to an amateur station when first licensed; that after one year this wave-length be increased to 180 meters and after two years be increased to 200 meters which would place the beginners on a wave-length which would not interfere with the older amateurs.

This suggestion seems to have merit and will also receive due consideration, but because of the limited appropriation and small force this Bureau must be careful not to make any changes which will involve to any great extent additional inspection work or additional clerical work until it has some assurance of being prepared to fully enforce the laws and regulations, which you state appears to be difficult at this time on the Pacific Coast.

The suggestion that continuous wave stations be allowed a range of wave-lengths between 200 and 280 meters seems to be reasonable.

You can be sure I will take pleasure in doing anything I can to further the interests of the amateur radio operators.

Respectfully yours,
D. B. Carson.

Queries and Replies on Continuous Wave Practice

By Gerald M. Best

Question: I have two antennæ; one for short wave transmission and reception, and the other for long wave reception. I accidentally connected the long wave antenna in parallel with the transmitting antenna while the 20 watt C. W. set was operating, and noticed an increase of .5 ampere in the antenna ammeter. Is this increased radiation, or just a false alarm?—L. M.

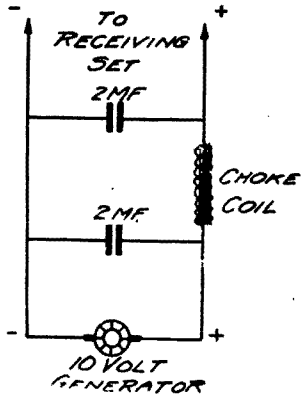
Answer: My inclination would be towards the latter reason. You did not state what happened to the wave length when you made the change. If the wave length was increased, perhaps it placed your antenna circuit in a better state of resonance with the primary circuit, which may not have been exactly tuned to the short wave antenna alone. The chances are that it was a case of circulating energy between the two antennæ, and the additional current was not radiated into the ether.

Question: What is the object of the counterpoise-ground connection to the oscillating circuit of 6XAF's transmitter, as shown in December Radio?—W. L.

Answer: To fully explain the reason for this combination would require considerable space. Briefly, it is to reduce the antenna resistance, and consequently to increase the radiation. Measurements have shown that this combination of antenna and counterpoise has reduced the antenna resistance to only one-fourth the resistance of the ground alone. For a theoretical discussion of this subject, read the article by H. H. Beverage in the new catalog of the Radio Corporation of America. This article describes such an arrangement, giving complete data, except that in Mr. Beverage's station, condensers are used in the ground and counterpoise leads to keep the high plate voltage off the ground system. As the plate voltage is kept off the helix in the Hartley circuit, such as is used at 6XAF, no such condensers are necessary.

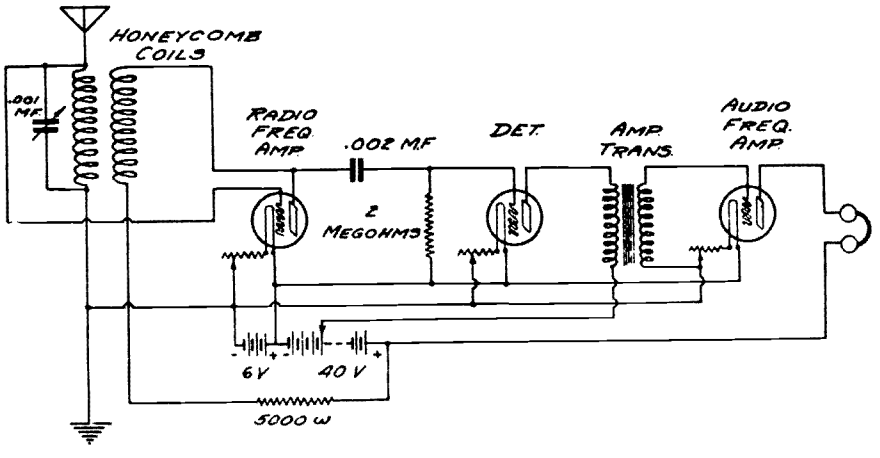
Question: I have a 10 volt, 6 ampere D. C. generator, which I would like to use for furnishing the filament current for my receiving tubes. As there are only 24 segments on the commutator of the machine, I get a prohibitive amount of commutator ripple in my phones. How can this noise be eliminated?—L. F. S.

Answer: This may be accomplished by means of a filter in the positive side of the filament supply. As there is no such article on the market at this time, you will have to build one yourself. The approximate dimensions of the filter coil are as follows: Wind approximately 500 turns of No. 14 single cotton covered wire on a core of at least 1 1/2 square inches cross section. This core should be of the closed type, similar to those used in spark or C. W. transformers. The size and shape of this core is optional, just as long as the cross sectional area is at least 1 by 1 1/2 inches. The object of this choke is to obtain the highest possible inductance with the minimum possible D. C. resistance, and a coil such as the above will have an inductance of approximately .25 henrys and a D. C. resistance of 1.25 ohms. If No. 12 wire is available, you may wind 1000 feet on the core with a D. C. resistance of only 1.5 ohms, and probably double the inductance. The circuit of the filter is shown herewith, the condensers being ordinary paper condensers of 2 M. F. capacity.



Question: Could a one-stage radio frequency amplifier be hooked ahead of my regular detector and one-step audio frequency amplifier. I use honeycomb coils for receiving and would like to use these in such an arrangement as described above.—S. H. J.

Answer: The circuit is given herewith.



THE IMPORTANCE OF KNOWING V. T. CHARACTERISTICS

A Simple and Practical Account of How to Improve Your Tube Reception

By Gerald M. Best

MANY articles have appeared in recent radio publications on the subject of vacuum tube characteristics, and methods by which the amateur may determine them for himself. All the methods, however, call for a relatively large outlay of apparatus and the writer presents an idea which he has incorporated into his own receiving set, by which he may obtain the operating characteristics of any of his tubes at any time, without a great deal of additional equipment.

The principal characteristic of a vacuum tube is its grid-voltage-plate-current curve. This will indicate two important facts—the maximum input voltage which the tube will handle without distortion, and the proper negative grid potential, so that the tube may be worked on the right portion of the grid-voltage-plate-current curve. As most amateurs know, a vacuum tube when used as an amplifier, must have its grid negative with respect to the filament, this voltage being obtained either by a biasing resistance in the filament circuit, or a series of dry cells in the grid circuit. A milliammeter and an ammeter are necessary for these measurements and the writer will attempt to justify the addition of this apparatus to the regular receiving set, to be used in the operation of the set as well as for making tests on the tubes.

Let us consider the average amateur receiving set, employing a soft tube for a detector and one or more amplifiers, the latter tubes having a high vacuum. With possibly one or two exceptions, receiving sets which can be purchased in the open market have no means of measuring either the filament or plate cur-

Continued on page 64

AMATEUR RADIO LABORATORY MEASUREMENTS

By D. B. McGown, Assistant Radio Inspector

WHEN one hears the words "Radio Laboratory," he usually pictures a solemn place, filled with thousands of dollars worth of special and delicate apparatus, presided over by a spectacled ogre, who would enjoy nothing more than to seize and cruelly shock to death some poor innocent victim, who happens to wander within the walls of the sacred building, by hooking his ears up to a high power arc set, or singeing the hair from his head with some deadly and unknown radio ray, and leaving his brains (?) exposed; or actually a radio laboratory may be the smallest hole in the attic or basement, with a few dinky pieces of absurd looking junk lying around with a few simple connecting wires. However, there is a happy medium. After a young man has played around for a time with "bought" apparatus, he generally becomes interested in the actual making of it, or, as more often happens, he has to make his own apparatus from discarded door knobs and picture moldings.

A great need for measurement is usually felt from the very beginning, starting from "How big a tuning coil shall I use to get the concerts, if I wind it with strips of biscuit dough?" to "That coil's all right for looks, but is its distributed capacity too high?" It is realized that most radio experimenters would like to know some of the performance of apparatus they may wish to use, but the usual measuring appliances are costly, and the use for them being less urgent than radio instruments for the station, there are few radio experimenters who have apparatus of this kind. As a result, a great deal of hit and miss work, coupled with some very "shaky" calculations, is about as far as most amateurs get in measurements of even the most common quantities used in their sets.

In this, and the rest of the articles of this series, an attempt will be made to so simplify the measurements and quantities that anyone, with the most common apparatus, can obtain results that will be accurate enough for ordinary purposes. Many quantities measured will even compare favorably with those measured by instruments of high precision.

The first step will be to construct a standard of capacity. If we take two true plane surfaces, both of which are conductors, each being exactly 12 inches square, and separate them by ⅛ inch, this air-dielectric condenser will have a true capacity of .0003 micro farads.

The simplest way to make such a condenser is to coat a piece of glass, preferably plate glass, ON ONE SIDE ONLY, with a piece of tinfoil exactly 12 inches square, using turpentine, or banana oil, as an adhesive. Prepare a second piece of glass in similar manner. Now solder leads of fine wire to the tinfoil by taking a very hot soldering copper, and dropping a bit of solder onto the tinfoil, the wire being held so the solder will drop on it also, some rosin being applied as a flux. Then procure four blocks of any kind of material, (the author used small pieces of sheet bakelite), but be sure they are exactly ⅛-inch thick. Put these blocks on the glass, OUTSIDE of the foil-covered area, the foil being up, and lay the other plate down, foil side down, and you will have a standard condenser of .0003 capacity, with air dielectric. Be sure the two tinfoil sheets coincide with one another exactly, leaving no margin of foil which has no opposite coating.

This will be used as a basis of all our future experiments, or at least will be used to determine the exact capacity of a variable condenser, which will be used as a measuring capacity, as we progress. Several of these condensers would be handy, and of considerable help, so the reader is advised to make up several in his leisure time. With four of these condensers, a number of capacities can be made up. Two in series will give a total capacity of .00015, two in parallel, .0006, three in parallel, .009, etc.

The next step will be to make up a small inductance. This will not be used for direct measuring purposes, yet, but for comparison purposes only. Any kind of inductance will do for our purpose, provided it is made up so it will stand a reasonable amount of handling. A 50 or 75 turn honeycomb, or similar coil will serve nicely, altho if not available, a coil of say 50 turns can be wound on a cardboard tube, and carefully shellaced, the leads being brought to binding posts at the ends of the tube. Allow this to dry, or still better, put it in a warm oven (about 150 degrees, F.) and bake the coil for an hour or so.

We are now ready to proceed with a calibration of a variable condenser, which will be taken up in the next installment.

RENEWED YOUTH—

By The Associate Editor

The other evening a most charming, grey-haired gentleman came to my Station and introduced himself—with quaint whimsicality—as: "The father of 6——" Naturally, I was delighted to welcome him.

The conversation was all of radio effort and its betterment. I suggested that he operate a bit. He joyously accepted and sat himself at the instruments.

And I watched him.

No youth, in the full prime of the right-side-of-30-years, could have been more enthusiastic.

Time passed.

He turned to me, excitedly: "I'v got 6——" (a station in the far north of the State).

For two hours he sat at the key and I enjoyed having him there!

Midnight—as he left me—a touch of wistfulness in his voice:

"Do you know that this radio is a God-send! It keeps me in touch with my boy's active interests, and so we have one common ground to meet on, at least! Also—" he hesitated—"also it keeps me young and enables me to enjoy my boy's youth."

And I watched him walking briskly away in the soft moonlight—in very truth a father with youth renewed—because of his pathetic desires to "stay young with the boy."

To me, it was a touching bit of paternal sentimentality, and one that fathers—generally—would do well to ponder over!

FEDERAL TELEGRAPH COMPANY

TELEGRAM

E. P. SCHMERIN, Pres.

The Federal Telegraph Company transmits and delivers this message subject to the terms and conditions accepted by sender.

D 1 ND SD 50 SH CO
PORTLAND, OREGON, SEPTEMBER 28, 1921.

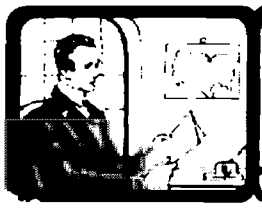
MR. P. P. SCHMERIN.
PRESIDENT, FEDERAL TELEGRAPH COMPANY,
SAN FRANCISCO, CALIF.

THIS MESSAGE MARKS THE FIRST COMMERCIAL APPLICATION OF PRINTERS IN THE RADIO FIELD AND DENOTES A BIG ADVANCEMENT IN RADIO COMMUNICATION. IT WAS PRINTED BY THE WORKRUM TELETYPE, THE OPERATION BEING MADE POSSIBLE BY THE HALL RADIO RELAY.

WITH BEST WISHES FOR A BRILLIANT FUTURE FOR YOUR MOST PROGRESSIVE COMPANY.

HALL RESEARCH CORPN.

9.56 P.M.



With THE U-S-Radio Inspector

CONDUCTED BY MAJOR J. F. DILLON

A MONTHLY DEPARTMENT OF INFORMATION FOR OUR READERS



AN IMPORTANT RULING

To the Editor—Sir: The licenses of an Amateur Operator have just been suspended and may be revoked for installing and operating his set at a point other than the place specified in the license.

Will you kindly inform your readers that a license issued to cover the operation of a station at a specified locality authorizes the use of apparatus described at that location only and hence if the equipment is operated at any other place without specific authority, the law is violated in the same sense as if no license had ever been issued to the person.

Such violations in the future will jeopardize the continuance of any license held by them.

Whenever a change of location is contemplated, applications should be submitted in advance for authority to operate the apparatus at the new location, and the transmitter should not be used until the necessary authority is obtained.

Operators signing their station call at stations other than their own will thereby forfeit their licenses.

Respectfully,
J. F. DILLON,
Radio Inspector.

San Francisco, Dec. 2, 1921.

RADIO TELEGRAPH TIME, PRESS, AND WEATHER SCHEDULES

By EDWARD M. SARGENT

Time (120th M.)	Call	Transmitter	Location	Wave	Service
0000	NPG	Arc	San Francisco	4650	Px to NPL
0000	NPG	Spark	San Francisco	1905	Weather
0100	NPG	Arc	San Francisco	8600	Px to NPM
0115	NPG	Spark	San Francisco	1905	Px to QST
0200	NBA	Arc	Darien, C. Z	10500	Time
0200	FL	Spark	Eiffel Tower	2700	Time
0200	NPL	Arc	San Diego	9800	Px to QST
0249	FL	Spark	Eiffel Tower	2700	Time
0300	NPG	Arc	San Francisco	8600	Px to NPM
0330	NBA	Arc	Darien, C. Z	10500	Px to QST
0400	FFZ	Spark	Shanghai, China	600	Time
0400	NPG	Spark	San Francisco	1905	Weather
0405	JOC	Spark	Otchishi, Japan	4750	Time
0600	NPO	Arc	Cavite, P. I	5000	Time
0600	NPG	Arc	San Francisco	8600	Px to NPM
0800	NPG	Spark	San Francisco	1905	Weather
0900	NAA	Spark	Washington, D. C	2500	Time & wtr
0900	NSS	Arc	Washington, D. C	16900	Time
0900	NAT	Spark	New Orleans	2400	Time & wtr.
0900	NPG	Arc	San Francisco	8600	Px to NPM
1000	NBA	Arc	Darien, C. Z	10500	Time
10:36:20	XDA	Spark	Mexico City	2400	Time
1100	NPG	Arc	San Francisco	8600	Px to NPM
1200		Time Signals and Weather Forecast, as follows:			
	NPG	Spark	San Francisco	1905	Repeat on 600
	NPL	Spark	San Diego	2400	Repeat on 600
	NPW	Spark	Eureka, Calif	2400	Repeat on 600
	NPF	Spark	Marshfield, Ore	1905	Repeat on 600
	NPE	Spark	North Head, Wn	1905	Repeat on 600
	NPC	Spark	Bremerton, Wn	1905	Repeat on 600
	NPG	Arc	San Francisco	4650	Time only
	NPL	Arc	San Diego	9800	Time only
1300	NPG	Arc	San Francisco	8600	Px to NPM
1500	NPG	Arc	San Francisco	8600	Px to NPM
1549	FL	Spark	Eiffel Tower	2700	Time
1600	NPM	Arc	Pearl Harbor	11500	Time
1600	NPG	Spark	San Francisco	1905	Weather
1700	NPG	Arc	San Francisco	8600	Px to NPM
1735	XDA	Spark	Mexico City	5500	Px (Spanish)
1800	NAH	Spark	Brooklyn, N. Y	1500	Px to QST
1900	NAA	Spark	Washington, D. C	2500	Time, wtr., px.
1900	NSS	Arc	Washington, D. C	16900	Time
1900	NPG	Arc	San Francisco	8600	Px to NPM
1945–2000	6XC	CW	Cal. Theater, S. F	1250	Px to QST
2100	NAY	Spark	Pt. Isabel, Tex	2000	Weather
2100	NPG	Arc	San Francisco	8600	Px to NPM
2200		Time and Weather Forecast (See 1200)			
2300	NBD	Spark	Bar Harbor, Me	1905	Px to QST
2300	NPG	Arc	San Francisco	8600	Px to NPM

SAN FRANCISCO BAY RADIO - TELEPHONE SCHEDULE

Broadcasted on 360 meters

Every afternoon except Sunday	2:30— 3:30 P.M.—Hobrecht's, Sacramento, News and Concert.
	3:30— 4:30 P.M.—Atlantic Pacific Radio Supplies Co. Concert.
	4:30— 5:30 P.M.—Leo J. Meyberg. Press, Market and Concert.
Every night except Sunday	7:00— 7:10 P.M.—Atlantic Pacific Radio Supplies Co. Press—Sports and Foreign.
	7:10— 7:20 P.M.—Hotel Oakland. Press—General News.
	7:20— 7:30 P.M.—Leo J. Meyberg. Press—Financial and Weather.
Sunday	10:00—11:00 A.M.—Leo J. Meyberg. Concert.
	11:00—12:15 A.M.—Trinity Center. Sermon.
	12:15— 1:00 P.M.—Warner & Linden. Concert.
	7:00— 9:00 P.M.—Presidio. Concert and Instruction.
Monday	7:30— 8:30 P.M.—Colin B. Kennedy. Concert and Industrial News.
	8:30— 9:00 P.M.—Leo J. Meyberg. Concert.
Tuesday	12:15— 1:00 P.M.—Warner & Linden. Concert.
	7:30— 8:15 P.M.—Hotel Oakland. Concert.
	8:15— 9:00 P.M.—The Radio Shop, San Jose. Concert.
Wednesday	7:30— 8:15 P.M.—Atlantic Pacific Radio Supplies Co. Concert.
	8:15— 9:00 P.M.—Herrold Laboratory, San Jose. Concert.
Thursday	7:30— 8:30 P.M.—Leo J. Meyberg. Concert.
	8:30— 9:00 P.M.—Colin B. Kennedy. Concert.
Friday	12:15— 1:00 P.M.—Warner & Linden. Concert.
	7:30— 8:15 P.M.—The Radio Shop, San Jose. Concert.
	8:15— 9:00 P.M.—Hotel Oakland. Concert.
Saturday	7:30— 8:15 P.M.—Warner & Linden. Concert.
	8:15— 9:00 P.M.—Atlantic Pacific Radio Supplies Co. Concert.
Sunday	2:00— 3:00 P.M.—Oard Radio Laboratories, Stockton. Concert.
Tuesday and Friday	8:00— 9:00 P.M.—Oard Radio Laboratories, Stockton. Concert.

N. B.—Trinity Center schedule will probably start at date to be announced later.

Questions and Answers

By the Radio Inspector

Question: Should not amateurs be careful about sending S O S's and obscene language on a practice buzzer in the vinicity of the receiving set described in the preceding question.

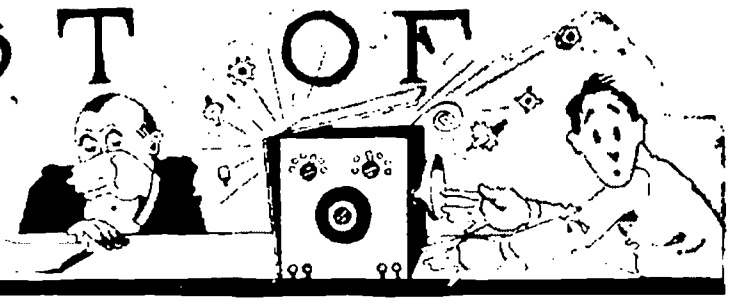
Answer: Yes. Amateurs should NEVER send the distress call under any circumstances, even on a practice set, as there is a chance that if sent, some station listening might pick it up, and start a false alarm. This call should never be sent, unless there is actual necessity for its use, and then only under the direction of some one who realizes the full significance of the matter. The regulations forbid the sending of obscene language. "Par. 210. No person shall transmit or make a signal containing obscene words or language." Amateurs, or other persons disregarding this regulation may expect to have proper remedial action taken against them.

Question: I am operator at a limited commercial station. We have very little traffic here, and I would like to know if I can work with special and general amateur stations in my spare time?—G. J., Visalia, Cal.

Answer: Limited commercial stations are licensed for communication with certain other stations, and are LIMITED to correspondence with these stations ONLY, and can work with no others, unless required to do so in the case of a vessel in distress in the vicinity, when they will be only acting as emergency stations. No authority can be granted by any radio inspector for these stations to work with any others, than those provided as above. If the station is to be used for general amateur work, a regular amateur license will be required, and the station must work on 200 meters. Operation as you propose would be the same in every way, as working without a license.

Continued on page 40

DIGEST OF RECENT RADIO PATENTS



Prepared by White, Prost & Evans, Patent Attorneys, San Francisco, who have been particularly active in the radio field for many years, and from whom may be obtained further information regarding any of the patents listed below.

William C. White, 1,393,594, Oct. 11, 1921. Means for producing high frequency oscillations.

This patent describes a receiving system using the heterodyne principle. An evacuated thermionic tube 1 is used to generate the local oscillations, and the feature of the invention is the production of these oscillations without any coupling between the grid and plate circuits. The oscillations are described as due to the effect of slight traces of residual gas in the vessel. The oscillations may be produced at will by causing the grid 4 to have a negative potential of the proper value. This negative potential is obtained by the aid of the battery 7. The input circuit including the grid 4 and filament 2 is coupled to an antenna circuit at 5, and the output circuit includes a source of potential 12 and the telephone receivers 13.

Goldsmith and Weinberger, 1,396,571, Nov. 8, 1921. Radio receiving system.

This patent describes a scheme for preventing a transmitting antenna from affecting a receiving coil placed near it. Thus it is possible to receive and send from the same place. The interference is due mostly to the electrostatic coupling between the transmitting antenna 1 and receiving coil 2. By the arrangement shown, any current induced from the antenna in coil 2 passes off to earth and does not interfere with the receiving circuit including the thermionic device 5 and receiver 8. This result is obtained by having an earth connection at the center of coil 2, the two halves of which have good mutual inductance, and by connecting the receiving circuit only to one-half of this coil which should for best reception have large horizontal and vertical dimensions. It is found that with such an arrangement, the interfering currents are neutralized, but those due to electromagnetic waves from a distant station are not.

G. M. Wright, 1,394,600, Oct. 25, 1921. Wireless telegraph receiver.

A vacuum thermionic tube *a* is used as a receiver. The filament *b* is not heated to full brilliance but is left dull so as to produce no magnification. In this way the atmospherics are limited in loudness to that of the signals. A magnet 9 may be utilized to advantage for directing the stream of electrons along a narrow path.

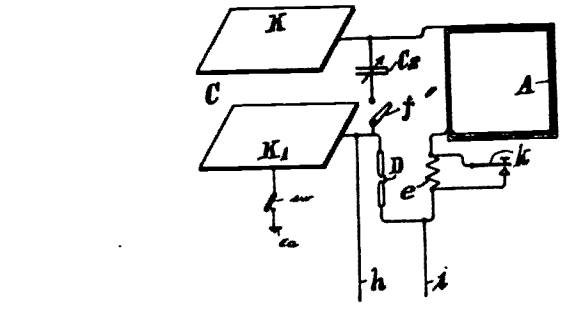
G. M. Wright, 1,394,601, Oct 25, 1921. Thermionic device.

This patent describes an amplification of signals by means of thermionic tubes. The grid filament circuit of the first tube is connected to an oscillatory receiving circuit LC. The grid-plate circuit includes a battery H and resistance r, the negative pole of the battery being connected to the filament. Point *m* is so chosen that preferably there is little or no potential difference between *n* and *m* when the device is working. Variations of internal resistance between the filament and plate, produced by the signals, disturbs this condition, and *m* and *n* do not remain near the same potential. The points *m* and *n* are included in the grid filament circuit of the second tube, where the same arrangement exists. It is stated that the effects of atmospherics are also reduced by this scheme.

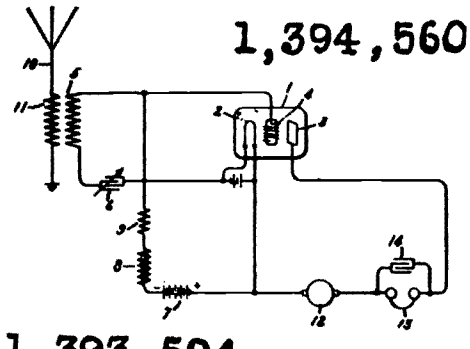
F. A. Kolster, 1,394,560, Oct. 25, 1921. Apparatus for transmitting radiant energy.

This patent describes a transmission system using a closed radiating circuit having low resistance and lumped inductance and capacity; the lumped inductance is in the form of a flat coil A; the capacity may be supplemented by a pair of widely separated plates K-K, to assist radiation. Since there is little distributed inductance or capacity, tuning can

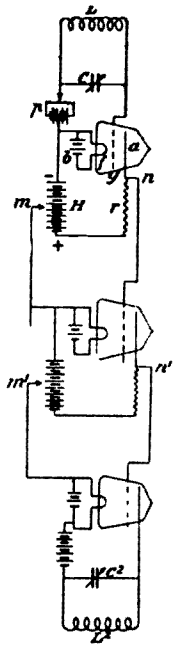
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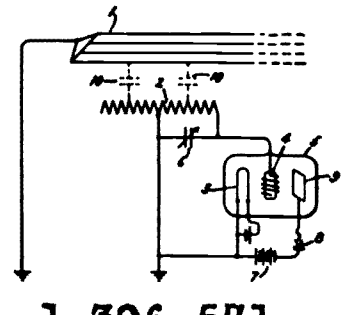
1,394,560



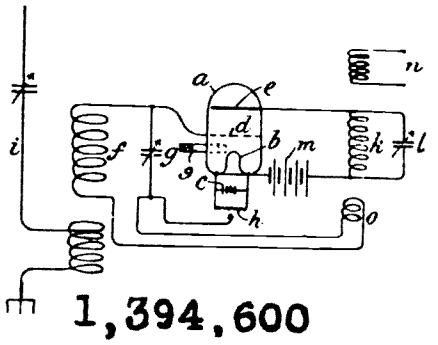
1,393,594



1,394,601



1,396,571



1,394,600

MONTHLY BROADCAST OF RADIO NEWS

Radio 9XM, operated by the physics department of the University of Wisconsin, Madison, is broadcasting weather forecast and market reports daily during the noon hour on 800 meters, radiophone concerts on Friday evenings on 800 and 375 meters, and relay message traffic on other evenings of the week on 375 meters C. W. The market reports are sent out on a special code which may be obtained from the Wisconsin Department of Markets at Madison. The station is in charge of Malcolm P. Hanson, under the direction of Prof. E. M. Terry. Professor Terry has designed eight new power tubes with a rating of from 75 to 100 watts each which are expected to greatly increase the station's range.

6BBO, Harold B. Chambers advises that his address is 780 Rialto Avenue, San Bernardino, Calif., and not Pasadena, as previously reported.

6JQ, R. B. Norton, formerly at Napa, Calif., is now manager of the Western Radio Electric Company store at Oakland, Calif.

Urguha E. Le Fevre, Los Gatos, Calif., advises that her call is 6BCF and not John Fishback's as previously reported.

Sidney Glasson, 6AOR, 2319 Ashby Avenue, Berkeley, Calif., is also 6BDD, Bolinas, Calif., the latter station being his summer home and being erroneously reported in December RADIO with the Berkeley address.

Wilbur R. Cramer and Fred W. Swain, the personnel of the alleged C. & S. Radio Electric Company, and the Glenhurst Research Laboratories of Omaha, Neb., were indicted by a Federal grand jury at Omaha on November 12, for fraudulent use of the mails in the sale of radio equipment. There is little probability that they can liquidate their debts, but the Post Office Department has put a stop to their further use of the mails. The case will be called for trial at an early date.

As a means of affording the maximum of protection to mariners, the United States Hydrographic office and the Naval Communication Service are prepared on and after November 10 to collect and distribute hydrographic information by naval radio.

The navy department will make no charge for receiving messages containing hydrographic information. Vessels co-operating in this service are requested to transmit messages direct to the various radio stations.

The service will cover all waters of the world. Captain L. R. de Steiguer of the U. S. navy, is in charge of the undertaking.

The Northern Orange County Radio Association of Fullerton, Calif., has passed a resolution that the members shall not transmit or relay messages which may be construed as commercial or as encroaching upon the commercial telegraph or radio field.

The Pacific Radio Trade Association has held two enthusiastic meetings at San Francisco since the last report of its activities were given in these columns. The October meeting was addressed by R. L. Eltringham, manager of the California Electrical Cooperative Campaign, on the benefits of cooperation. The November meeting was addressed by Albert H. Elliott, secertary of the Pacific Coast Electrical Supply Jobbers' Association, on ideals for accomplishment. Dr. Herrold of San Jose also gave some interesting radio reminiscences. The association committees are functioning well along their several lines of activity.



LESTER PICKER—6AJH

Lester Picker (6AJH) of San Ysidero, Calif., on November 27, fell from his pole at a distance of over 40 feet and suffered a fracture of the spinal column. The pole collapsed while he was working. He clung to it and was dashed against the roof of an adjacent building. The deepest concern is felt by all Lester's friends in San Diego county and every amateur who knows him or who has heard 6AJH on the air is waiting news of his condition with anxiety. He is paralyzed from the waist down, according to reports and is now in the National City Hospital. The Editor suggests to the fellows of the Sixth District that they write Lester a short letter of encouragement and good wishes. Mail will be forwarded from his station address. Lester is noted among the amateurs of Southern California as being not only one of the most courteous on the air but having one of the most polished fists, his transmitting being most accurate and always brief and to the point. His ideals were those of a first-class A. R. R. L. operator.

Aside from our sympathetic regret for the sad accident to 6AJH, we cannot too strongly emphasize the hazard that the amateur takes in climbing a pole. Under no circumstances should amateurs ascend 2 x 4 poles more than twenty feet high. The danger to life and limb is too great to warrant taking a chance.

At a recent meeting of the B. C. Radio Association, steps were taken to organize a trans-Canada Amateur Radio Relay League.

On several occasions within the past month amateur radio station 4CB, located at Morse, Saskatchewan, has been heard by William D. Wood, who has the station at the Barron Hotel. On the last occasion the amateur in Morse, Sask., was heard calling and talking to another amateur in Winnipeg, Man., but only one side of the conversation could be heard in Vancouver. Station 4CB uses only fifty watts power "input," which is about one-fortieth of the power used by ship stations, but his signals were quite readable, both to Mr. Wood and other amateurs who also heard him.

Radiophone communication has been successfully maintained to and from a free balloon during a 150-mile flight from McCook Field, Dayton, Ohio, to a voluntary landing near Cambridge, Ohio. The radio equipment in the balloon consisted of a SCR-75 receiving set, a 300-foot antenna hanging over the side of the basket, and a counterpoise of copper screen and 50 feet of antenna wire hanging from the basket, opposite the antenna. The transmitter was a laboratory model five 50 watt Western Electric tube set and a 90-foot umbrella antenna radiating about 4.5 amperes. The wave length was 425 and 600 meters. The signals and music were received in the balloon with such strength as to allow the receivers to be hung up in the basket so that the four men on board were able to hear distinctly.

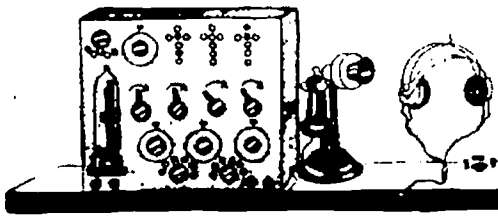
An automobile stolen in Newton, Mass., was recovered the next night in Nashua, N. H., when the police, upon looking over their list of police items broadcasted from Boston by radio and received by Henry E. Hall, a local amateur, they were able to identify the machine and return it to its owner. The broadcasting by wireless of stolen automobiles, missing individuals, etc., by the Boston Police Department has been in operation nearly nine months. The broadcasting is done nightly by the American Radio and Research Corporation, Medford Hillside, Mass.

A radio system designed to give information to aviators of weather conditions along their routes of flight, in the air as well as on the ground, has been approved by the army air service, and soon will be extended over the entire continent. Actual construction has begun at Mitchell Field, Long Island; Langley Field, Moundsville, W. Va., and Wilbur Wright Field, at Fairfield, Ohio.

Army aviation officials hope through operation of the system to prevent in the future such disasters as that which occurred last May near Morgantown, Md., and cost the lives of seven persons, by an airplane flying into a violent storm of which its occupants had no knowledge. Plans for installation of the new safety devices, which will function as a network of electrical waves covering the country, provide for the dissemination of weather reports, storm warnings and of all information affecting flying. The army air service contemplates the extension of the net eventually to every field and station in the country.

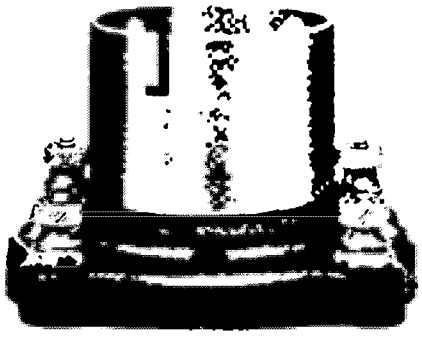
Continued on page 54

NEW APPARATUS AND SUPPLIES FROM THE RADIO MANUFACTURERS



NEW APPARATUS

The Chelsea Radio Company have recently designed a universal type of Vacuum Tube Socket. The insulation of the various parts has been arranged so as to permit the operation of power tubes up to 1,000 volts. The receptacle embodies a specially drawn highly polished metal tube attached to a moulded bakelite base. Features of great convenience claimed for this device are phosphor bronze contact springs of heavy gauge, assuring positive contact and permanence of adjustment, together with four binding posts externally arranged to permit quick and positive connections to be made even though the socket be fastened to the table or panel.



Chelsea Vacuum Tube Socket

NEW HOME OF THE WIRELESS SHOP, LOS ANGELES, CAL.

A new and most up-to-date radio manufacturing plant has just been constructed by The Wireless Shop of Los Angeles, which will better enable them to take care of the large demand for "Wireless Shop Variable Condensers" and other high grade apparatus which this company manufactures. This new plant is one of the finest of its kind and only the most modern machinery will be found in this new daylight factory. The mechanics employed are the best obtainable.

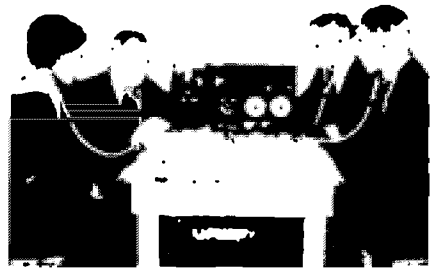


With a complete die making shop the company will turn out all of their own dies for stamping metal and Formica parts which are used in their products. Limited space has made it necessary to have part of this work performed on the outside in the past, but with the greatly increased floor space now available, everything will be manufactured in the new shop.

A retail store and offices are built into the front of the new factory, and a complete radio phone and CW set will soon be in operation.

PHONOSCOPE NOW ADAPTED TO RADIO

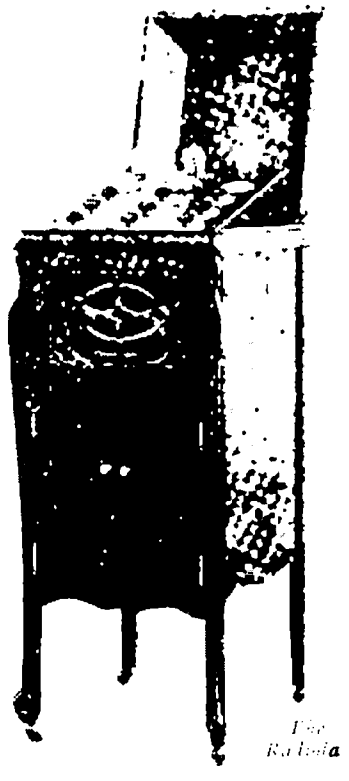
The Phonoscope, an instrument made for use on telephones, and recently placed on the market, has been adapted to use with radio receivers. The Phonoscope resembles the doctor's stethoscope in size and shape and consists of a nickel plated binaural with properly fitting ear tips, attached by special rubber tubing to a "Y" piece and by another tubing to the special bowl. The radio receiver is laid in this bowl and the sound is transmitted through the orifice in the bowl thence through the tubing and binaural to both ears. The bowl holding the receiver is lined and insulated so that no sound of the message is lost and outside sounds are not collected or heard. Thus the message can be heard distinctly in places where there may be noise from conversation, typewriters, machinery, or traffic. The construction of the Phonoscope is such that extra binaurals with the rubber tubing may be attached and a number of people can hear the message at the same time. The Phonoscope is made by the E. R. Benson Manufacturing Company of Portland, Maine.



Phonoscope As Used for a Radio Listening-In Party of Four

THE RADIOLA

The "Radiola," a radio concert receiving set de luxe, is a new product from the new shop of Wilson-McGuire Co., Inc., San Francisco, formerly the McGuire Radio Laboratory. In addition to its compact and beautiful assembly in the form of a mahogany phonograph cabinet, which makes it an ornament to any home, it embodies an intelligent application of radio engineering experience to produce an instrument that is at once simple and efficient.



The set has a range of from 180 to 3000 meters. It employs three stages of amplification and will, of course, reproduce concert music, radiophone press reports, and both spark and continuous wave radio telegraph messages. It is equipped with Weston ammeters, an eight-day, rim-wind, rim-set clock for time signals, a Tungar rectifier and 60 ampere-hour storage battery. Tuning is accomplished by a new and original method and the sound is reproduced by a Magnavox. All of the equipment is self-contained and of the highest grade.

An instrument exhibited at the recent Industrial Exposition at San Francisco has been installed in the office of Dr. J. M. Forrest of San Francisco.



Fig. 1. General Arrangement of Antenna

DIRECTIONS FOR ANTENNA CONSTRUCTION

IN line with the recommendations of the Pacific Radio Trade Association that all radio equipment sold be accompanied by printed directions for its installation, the Westinghouse Electric & Mfg. Co. has published a poster to go with its Type AD receiving equipment from which the text and illustrations are herewith reproduced for the benefit of the radio amateurs. This equipment is sold complete in one convenient package and includes 150 ft. of No. 14 copper weld antenna wire; 50 ft. of No. 14 insulated copper wire; 50 ft. of No. 18 rubber covered ground wire; 1 Type PA antenna protective device; 1 insulating bushing; 2 Type 1A Micarta in-

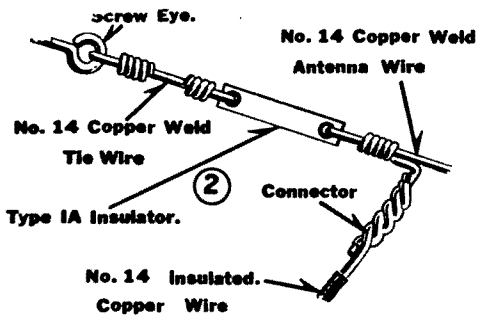


Fig. 2. Lead-In Connections

sulators; 2 screw eyes; 1 ground clamp; 3 porcelain knobs with screws; 1 connector, and 12 insulated staples.

The directions state that the location for the antenna should be selected so as to be as free as possible from trees, buildings, towers, etc. Objects under antenna or in close proximity to antenna wire shunt part of energy to earth. Except at ends, antenna wire should not come closer than ten feet to any of these objects. Wire may be supported from buildings, poles, or trees. If trees are used, make tie wires long enough to permit type 1A insulator to clear branches by at least ten feet.

Uncoil Copper Weld antenna wire and lay along the ground between supports. Measure off about two feet from end nearest to room where instruments will be located and insert wire in one hole of type 1A insulator for about fifteen inches, bending back and twisting over as shown in Fig. 2. Approximately one foot of wire should be allowed for connecting to No. 14 insulated lead-in wire. Bend free end at right angles to antenna, clean with sand paper and insert into connector, allowing it to go entirely through. From opposite end of connector, insert skinned and cleaned end of No. 14 insulated copper wire, allowing it to extend entirely through connector. Now twist connector tightly with pair of pliers making good joint.

Attach screw eye to support (preferably gable of house) and fasten type 1A insulator to it using piece of Copper Weld wire.

Attach screw eye to distant support. Draw antenna wire tightly and measure off approximate length, allowing one foot for inserting through Type 1A insulator and twisting. If tree is used for distant support, be sure that end of antenna wire does not come closer than ten feet from branches when antenna is complete.

Attach type 1A insulator to end of antenna wire and insert piece of Copper Weld wire in other end sufficiently long to reach to screw eye when antenna is up. Antenna should not be drawn up too tightly but some slack should be allowed. Twist tie wire securely as shown in Fig. 3.

Bore hole in wall (if frame house) or through window casing using a 5/8 inch bit. Insert insulating bushing, run No. 14 insulated copper wire through bushing leaving a loop as shown in Fig. 4 so that rain will drip off. If lead-in must be run any considerable distance outside of house, it should be supported on porcelain knobs.

Attach type PA protective device to window casing or to some other convenient place using screws provided. Do not place protective device near inflammable material. Wire to radio tuner using diagram shown and run No. 18 rubber covered ground wire from pro-

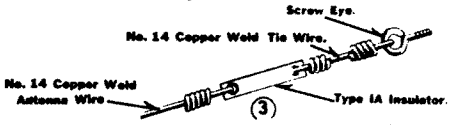


Fig. 3. Antenna Support Connections

tector direct to water pipe in the basement. Ground wire may be held by insulated staples.

Clean water pipe with sand paper. Adjust ground clamp to pipe size and tighten screw. Skin end of ground wire and clean with sand paper. Place under nut on ground clamp and tighten down nut securely.

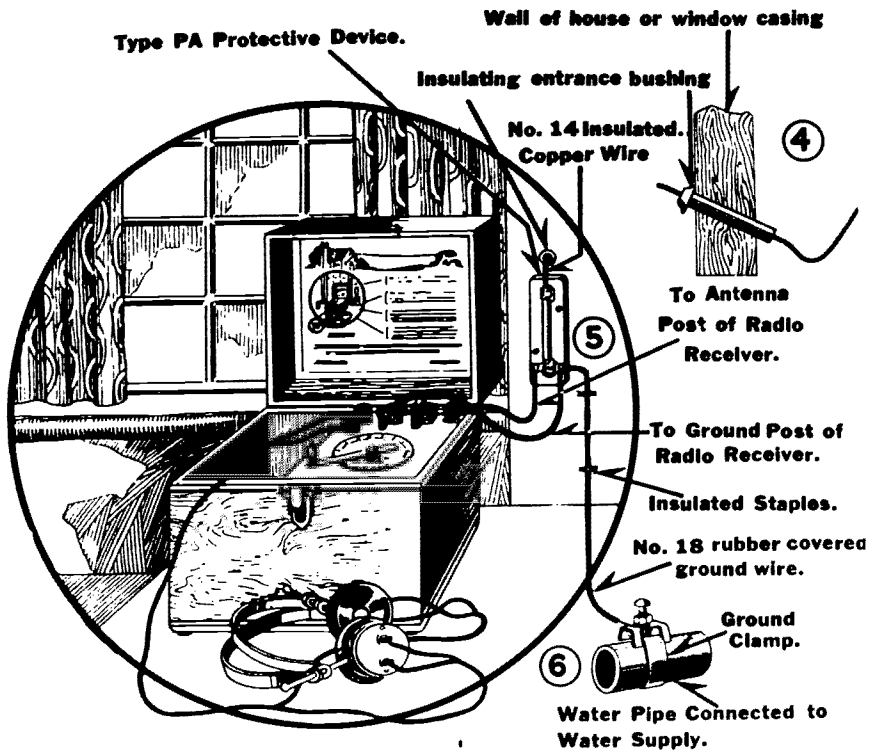


Fig. 4. Entrance, Instrument and Ground Connections

KNOW YOUR DEALER

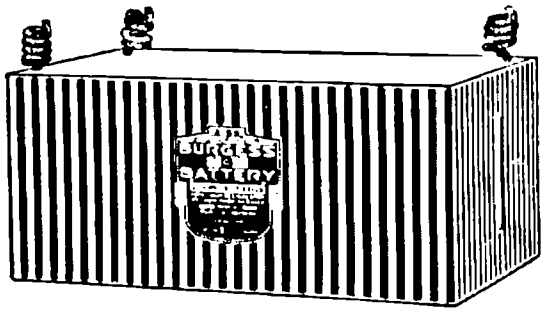
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CALLS HEARD



Calls Heard at 6AWP, Everett W. Thatcher, 407 West First St., Santa Ana, Calif.

OCTOBER

SPARK—5HK, 5IF, 5ZA, 6AE, 6AK, 6AR, 6AS, 6CH, (6DA), 6EA, 6EB, (6EC), (6EN), 6ER, 6EV, 6EY, 6FH, 6FK, (6FT), 6GE, 6GF, 6GI, 6GN, 6GP, 6GR, 6GT, 6GX, 6HM, (6HY), 6IC, (6IF), 6IK, 6IM, 6IV, 6JE, 6JY, (6KA), 6KC, 6KP, 6KS, 6KV, 6KY, 6LC, 6LU, 6MD, 6MH, 6MM, 6OC, 6OD, 6OH, 6OL, 6OM, 6PJ, (6PQ), 6QR, (6SK), 6TF, 6UH, 6UL, 6UO, 6VH, 6VV, 6VX, 6ZB, 6ZE, 6ZM, 6ZN, 6ZO, 6ZR, 6ZX, 6ZZ, 6AAH, 6AAU, 6AAW, 6ABM, (6ABP), 6ABX, 6ABZ, 6ACR, 6ACY, 6ADF, 6ADL, 6ADP, 6AEH, 6AEZ, 6AFN, 6AFO, 6AGF, (6AGN), 6AGP, 6AHK, 6AHO, 6AHP, 6AHQ, (6AHU), (6AHV), (6AIB), 6AID, 6AIO, (6AIU), (6AJH), 6AKL, 6AKR, (6ALK), 6ALJ, (6ALP), (6ALU), 6AMN, 6AMQ, 6AMW, 6APE, 6APH, 6ARK, 6ARW, 6ASQ, 6ATQ, 6ATV, 6AUS, 6AVD, 6AVR, 6AVT, 6AVD, 6AWF, 6AWH, 6AZU, (6BAC), 6BAF, 6BAU, 7BP, 7CB, 7CW, 7ED, 7FI, 7IN, 7KB, 7LY, 7MF, 7MO, 7MP, 7TJ, 7XD, 7ZA, 7ZL, 7ZP, 7ZS, 7ZU, 7ZY, 9BD, 9OP, 9AEG, 9AEY, 9AYU.

C W—(6EN), 6JE, (6KA), 6KH, 6MK, 6RR, 6XD, 6XG, 6ZN, (6AAG), 6ABG, 6ALE, (6AQT), 6AVY, 6AWT, (6XAD), 6XAK, 6ZAD, 9AMB, 9ZAF, any one hearing 6AWP SPK, or CW PSE QSL.

"7KP," Seattle, Wash., Sept. 1-Nov. 25.

Heard on one bulb, 27 nights during above dates.

CANADIAN—4CB-C.W., 5BR, 9BD, XEQ, XEV, 9AX.

SPARK—5ZA, 6AE, 6AH, 6AK, 6CO, 6CP, 6DP, 6EA, 6EE, 6FH, 6FN, 6GF, 6GR, 6GT, 6GX, 6HC, 6IC, 6IM, 6IV, 6KA, 6KC, 6KM, 6LC, 6LU, 6MZ, 6OC, 6OH, 6OP, 6OW, 6PJ, 6PR, 6QR, 6QT, 6TC, 6TU, 6VX, 6WL, 6WZ, 6ZB, 6ZU, 6ZX, 6AAR, 6AAU, 6AAW, 6ABM, 6ABX, 6ACR, 6AEG, 6AER, 6AEW, 6AEZ, 6AFN, 6AGF, 6AHM, 6AHV, 6AID, 6AIU, 6ALV, 6APE, 6APH, 6AQT, 6ARK, 6ATQ, 6AWH, 6AWT, 7AW, 7BA, 7BG, 7BH, 7BJ, 7BP, 7BR, 7CB, 7CE, 7CW, 7ED, 7EO, 7FI, 7GA, 7GJ, 7HI, 7HF, 7ID, 7IN, 7JF, 7JT, 7JU, 7JW, 7KB, 7KE, 7KG, 7KM, 7KS, 7LN, 7LU, 7LW, 7LY, 7MF, 7MO, 7MP, 7MU, 7MW, 7NC, 7NJ, 7NL, 7NN, 7OZ, 7PV, 7TJ, 7TO, 7TQ, 7XD, 7YA, 7YS, 7ZB, 7ZG, 7ZJ, 7ZK, 7ZM, 7ZS, 7ZT, 7ZU, 9AIF, 9AMB.

C. W.—6EN, 6KA, 6OO, 6WZ, 6AAT, 6ALE, 6AOZ, 6ASJ, 6ATQ, 6AUL, 6AWT, 6AWV, 6XAD, 6XAC-VOICE, 7CE, 7NC, 7XF.

Heard by 6AWT from October 25 to November 28.

6EA, 6EB, (6EF), (6KA-C.W.), (6KY), (6AGF), 6AQT-C.W., 6AOY-C.W., 7BA, 7BB, 7BJ, 7BK, 7BP, 7CE-C.W., 7ED, 7FI, 7GJ, 7HF, 7IN, 7JW, 7KB, 7KS, 7LU, 7MF, 7MP, 7OZ, 7RN, 7TJ, 7XD, 7XF-C.W., 7YA, 7YG, 7YJ, 7ZG, 7ZK, 7ZJ, 7ZM, 7ZP, 7ZU, (9BD Canadian), anyone hearing 6AWT PSE QSL.

6AUN Reports the Following Heard from October 21 to November 29, 1921:

5ZA (CW), 6DA, 6EA, 6EB, 6EF, 6FH, 6FK, 6FX, 6GF, 6GP, 6GR, 6GT, 6GX, 6HY, 6IC, 6IS, 6JS, 6JY, 6KA (CW), 6KC, 6KY, 6LC, 6MH, 6NL, 6OD, 6OH, 6OL, 6PJ, 6QK, 6QR, 6WI, 6ZB, 6ZU, 6ZX, 6ZZ, 6ACY, 6ADL, 6AEH, 6AEZ, 6AGC, 6AGF, 6AHP, 6AIE, 6AJR, 6AMV, 6AOY (CW), 6APE, 6AQV, 6AVB, 6AVD, 6AVV, 6AVY, 6XAK, (CW-Music), 6XAM, 7AD, 7BA, 7BB, 7BH, 7BJ, 7BK, 7BP, 7ED, 7FI, 7GJ, 7HF, 7IM, 7IN, 7JM, 7KB, 7KE, 7KS, 7LU, 7NN, 7MF, 7OZ, 7TJ, 7ZJ, 7ZK, 7ZM, 7ZP, 7ZU, 7YA, 7YG, 7YJ, 7YS, 7XF (CW), 9BD (Can.), 9ZAF (Voice-CW), 9PM (Would like to know who it was—calling 9AMB—) Will be on with C. W. first of year. Anyone hearing me PSE QSL. C. Messineo, 1730 Page Street, San Francisco, Calif.

Calls Heard by 6ASZ on One Bulb.

6AC, 6AI, 6CH, 6GC, 6MH, 6MM, 6MN, 6PJ, 6PO, 6SK, 6ATX, 6AVB, 6AWH, 6AWS, 6XAC, 7BK, 7ED, 7IN, 7JW, 7KJ, 7MF, 7TO, 7XD, 7ZK, 7ZJ, 7ZU.

Stations Heard at 6JX, 109 Greenbank Avenue, Piedmont, Calif., during November.

Less than 250 miles too numerous to list.

SPARK—6ED, (6EF), 6FK, 6LC, 6MH, 6OL, 6QR, 6ZB, 6ZU, 6ACY, 6ADL, 6AIF, 6AOA, 7BK, 7BP, 7HF, 7IS, 7KJ, 7KR, 7MF, 7TJ, 7YA, (9BD) Canadian.

C. W.—6BF, 6ER, 6ALE, 6AQT, (6AOY), (6AOZ), (6XAD), 6XAK, 7XF, 9ZAF.

Heard by 6GZ, Los Angeles.

The following were heard on an aerial 35 feet high at the lead-in and 8 feet high at the other. One stage of amplification was used:

5ZA, 6AK, 6AL, 6AS, 6AT, 6CP, 6CO, 6CV, 6CZ, 6EX, 6FH, 6FQ, 6GE, 6GF, 6GR, 6GX, 6HG, 6IC, 6IM, 6JE, 6JI, 6JX (CW), 6KC, 6KM, 6OC, 6PC, 6PJ, 6PR, 6QR, 6QT, 6VC, 6VG, 6VS, 6VX, 6WV, 6WZ (Music), 6XM, 6XV (CW), 6ZB (CW), 6ZU, 6ZZ, 6AAU, 6AEH, 6AEI, 6AGF, 6AHP, 6AID, 6AIP, 6AJH, 6AKP, 6ALE (Fone, CW), 6ALV, 6AOY (CW), 6APW, 6AQX, 6ARF, 6ARW, 6ATV, 6AVV, 6AWH, 6AWL, 6AWT (CW), 7BP, 7ED, 7GA, 7IN, 7KB, 7MF, 7MP, 7YA, 7YG, 7ZM, 7ZN.

Calls Heard at 7ZU G. E. West, Polytechnic, Montana from October 18 to November 18, 1921.

5AW, 5FO, (5HK), 5LA, 5XU, 6AAT, (6ABX), (6AEZ) 6AK, (6ALE), 6ALW, 6AOF, (6APE), (6AS), (6ASK) (6ATQ) 6ATZ, (6AWH), 6AWS, (6CV), (6DN), (6EA) 6EB, 6ED, 6ET, (6GR), (6IC), 6IR, (6IV), 6IY (6KA), 6LNcw, 6LZ, (6OC) 6OJ, (6SJ), 6TEZ, (6WV)phone 6XACcw and phone (6XADcw), 6XGcw, ph, 6XJ, 6ZA, 6ZC, 6ZM, 6ZN, 6ZR, (6ZU) (62X) (7ED), (7EG) (7EX) 7GO, (7IN) (7IM) 7JD, (7LU) (7LY) 7MO, (7MP) 7NL, 7RNcw, 7RY, 7TW, 7XFcw, (7YA), (7YJ) 7YL, 7YS, 7ZJ, (7ZK) (7ZM) (7ZO) (7ZP) 8DJ, 9ABUcw, 9AEG, (9AEY) 9AIF (9AIG) 9ALO, 9ALS, 9ALU, (9AMBcw), (9AMQcw) 9ANF (9ANG) 9APN, (9AQE) 9ASN, 9AUO, (9AVE) (9AXU) 9AY, 9AYE, (9AYV) (9AYW) 9DEH, 9DGE, 9DFC, (9DOC) 9DSG, 9DUD, (9DUG) (9DVAcw) 9EL, 9ETG, 9EW, 9FUcw, 9GR, 9HT, (9HM) (9HT) 9IC 9IG, 9JT, 9LW, 9MIG 9MS, (9NR) 9NX, 9OHB cw, 9OI, 9ON, (9PS) 9PU 9RNcw, (9RY) (9TI) (9WI) 9WL, (9WU) 9XI, 9XMcw 9YA, (9YAE) (9YAK) 9YAL, 9YM, 9YO, 9YR, 9YY, (9ZACcw) 9ZAFcw, 9ZC, 9ZH, 9ZJ, (9ZN) 9ZO.

Heard at Radio 6BM, 223 Lincoln St., Grass Valley, Cal., Oct. 18 to Nov. 21. Honeycombs and One Tube.

SPARK—5XB, 5ZU, 6AAU, 6ABM, 6ABP, 6ABX, 6ACY, 6AEW, 6AEZ 6AFN, 6AGF, 6AHP, 6AHU, 6AHV, 6AI, 6AIB, 6AID, 6AIK, 6AIO, 6AJH, 6AK, 6AKT, 6ALV, 6AML, 6ANP, 6APE, 6APH, 6ATH, 6ATQ, 6ATS, 6ATV, 6AVB, 6AVM, 6AVV, 6AWH, (6BBR), 6BW, 6CP, 6CZ, 6DA, 6DG, 6EF, 6EN, 6FH, 6FN, 6FT, 6GI, 6GP, 6GR, 6HY, 6ID, 6IF, 6IM, 6JE, 6KA, 6KC, 6KS, 6KX, 6LU, 6MK, 6OC, 6OL, 6PO, 6PJ, 6PR, 6QR, 6SG, 6SK, 6TF, 6TO, 6TU, 6VM, 6VV, 6VX, 6ZB, 6ZU, 6ZX, (7BH), 7BJ, 7BR, (7CW), 7ED, 7IN, 7GA, 7IW, 7JD, 7JU, 7JW, 7KB, (7KJ), 7LW, 7MF, 7MO, 7MU, 7MW, 7XD, 7YA, 7YG, 7YJ, 7YS, 7YG, 7ZJ, 7ZP, 7ZS, 7ZU, 9AX, 9YAL.

CW—5ZA, (6ALE), 6APO, 6ATG, 6AWE, 6AQT, 6AWV, 6EN, 6JE, 6WV, 6XAD, 6XH, 6ZA, 6ZN, 6ZZ, DDFV.

FONE—6ALE, 6JE, 6XAC, 6XC, 6XAJ, 6XAK, 6XD, 6XG, 7XF, 9ZAF, AG-1, WJK.

If you hear 6BM pse QSL—you'll get an answer.

Calls Heard by 7SN, Seaside, Ore., on one tube Nov. 1 to Dec. 1

SPARK—6AK, 6AM, 6AS, 6BM, 6CP, 6CZ, 6DR, 6EB, 6EX, 6FN, 6FH, 6GR, 6GX, 6GF, 6GO, 6HC, 6IM, 6IB, 6IC, 6KM, 6LU, 6OC, 6OH, 6PJ, 6QR, 6TU, 6UO, 6VX, 6VM, 6VK, 6WZ, 6XH, 6ZX, 6ZU, 6AAU, 6AAL, 6ABX, 6ABM, 6ABH, 6ACM, 6AEW, 6AEI, 6AFO, 6AFN, 6AFY, 6AGF, 6AID, 6AJW, 6AKT, 6ALW, 6ALV, 6ALA, 6AMZ, 6ANG, 6ANI, 6APH, 6APE, 6ARK, 6ATV, 6AVB, 6AVV, 7BK, 7BH, 7BS, 7BJ, 7BP, 7CW, 7FI, 7GJ, 7HF, 7IN, 7JF, 7JB, 7KE, 7KS, 7KB, 7MF, 7MP, 7NL, 7NJ, 7OZ, 7TQ, 7TJ, 7ZS, 7ZU, 7ZM, 7ZT, 7ZK, 7YL, 7YA.

CW and PHONE—4CB, 6ET, 6JX, 6SC, 6ZA, 6KM, 6XW, 6XH, 6XG, 6awT, 6AAT, 6ASJ, 6ZAD, 6AAK, 6AAT, 6XAC, 7RN, 7XF, "MC".

Calls Heard by 6GF and 6GR Sept.-Dec. 1921, Sacramento, Calif.

CANADIAN (9BD).

(5ZA) (6AH) (6AR) (6AS) (6AAH) (6AAU) (6AAW) (6ABM) (6ABR) 6ACH (6ACM) (6ACR) (6ACY) (6ADA) (6ADL) 6AEA (6AEH) (6AEI) 6AEL (6AEY) (6AEZ) 6AFO (6AGF) 6AGI 6AGK 6AGR (6AGP) (6AHP) (6AHU) (6AHV) (6AIB) (6AID) (6AIK) (6AIO) 6AIP (6AJH) (6AJW) (6AKL) 6AKT 6ALA 6ALD (6ALP) 6ALU 6ALV (6AMK) (6AMN) 6ANG 6ANI 6ANK 6ANP 6ANV 6ANW 6APE (6APH) (6AQT) (6AQU) 6ARE 6ARK 6ARP (6ARW) 6ASO 6ATB (6ATQ) (6ATV) 6AUH 6AUL 6AVD 6AVN 6AVR 6AVV 6AVY (6AWH) 6AWI 6BA 6BB 6BQ 6BW (6BAC) 6BAK (6BDS) (6CH) (6CP) 6CW (6CZ) (6DA) (6DP) 6DN 6DY (6EA) (6EB) 6EF (6EN) (6ER) (6EX) (6FK) 6FN (6FT) 6FX (6GI) (6GP) 6GT 6GZ (6HP) (6HY) 6IB 6ID 6IK (6IM) (6IS) (6IVS) 6JI 6JQ 6JX 6JY (6KA) (6KC) (6KE) 6KK (6KS) (6KY) 6KX 6LC (6LU) (6MH) 6NG 6OD (6OC) (6OH) (6OL) (6OM) 6OT 6PC 6PI (6PJ) 6PQ (6PR) (6QR) (6QS) (6QT) 6QAD 6RR (6SK) 6TS 6TU 6TV 6UV 6VE 6VJ 6VM (6VX) (6WI) 6WO (6WZ) 6ZE 6ZR (6ZU) (6ZZ) 6ZAF (7BH) (7BH) 7BJ (7BK) 7BR 7CW (7ED) (7FI) (7GA) 7HF (7IN) (7IU) 7IY (7JW) 7KB 7KD 7KE (7KM) 7LY 7LU 7LW (7MF) (7ML) 7MP 7MV 7NL 7OM (7OZ) 7QN (7TJ) 7TO 7YA (7ZM) 7ZS (7ZT) 9AYV 9HM.

C. W. CANADIAN 4CB.

5ZA (6AG) (6EN) (6JE) 6MK 6OO 6SC (6WZ Busser) 6AAT (6ABG fone) (6ALE) (6ANJ fone) (6AOY) (6ARC) 6ASJ (6AWT) (6AWV) 6BAF 6XG fone 6XH 6XAC (6XAD) 6XAF 6ZA 6ZB (6ZN) 6ZZ (7XF) 9AMB WJK NCE.

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Who knows what a piece of apparatus is worth without actually trying it? Who can tell how long a piece of apparatus will last, what kind of service it will give, merely by looking at it? No one. But you can do this for your protection—**buy all your apparatus from the California Electric Supply Co.**, who guarantee every bit of equipment they sell. You do know the value and serviceability of apparatus you buy of the California Electric—"Radio Supplies That R Right."

The Radio MAGNAVOX

——"The Reproducer with the Movable Coil," the only loud speaker which will reproduce Radio speech, music and messages in any volume desired without distortion and without injury to the apparatus. Printed instructions and diagrams free with each outfit.

Type R-3 Magnavox, with the new 14" horn, rated input 5 watts, uses one ampere in field—price complete—$45.

Type R-2 Magnavox, with 22" horn, rated input 20 watts, uses one-half ampere in field—price—$110.



MAGNAVOX 2 and 3-Stage New Power Amplifiers

The volume to be attained from your Magnavox depends upon the power input. The New Magnavox Power Amplifiers assure your Magnavox getting the largest possible power input. Can be used with any transmitting tube with any voltage up to 1000, and sets either flat or on ends. Master switches, no jacks.

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Type AC-3 Model C Magnavox 3-Stage Power Amplifier in solid mahogany case—$110.

Special temporary low prices on the following five de Forest items:

de Forest CV 500-.0005 Condensers	$3.70
de Forest LC 101 Coil Mounting	9.25
de Forest P 300 Detector and 1 Stage Amplifier	40.00
de Forest T 200 Tuner	50.00
de Forest P 100 Audion Control	35.00

The items listed above are but a few from our large stock of standard apparatus.

No matter where you are situated you can buy ALL your apparatus here and be assured of getting "Radio Supplies That R Right." We ship anywhere in the U. S. or abroad. Those who live in the vicinity of San Francisco will note our convenient location in the heart of the business district.

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25c
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Newman-Stern Bldg Cleveland, Ohio

"B" BATTERIES

AN
EVEREADY
PRODUCT

43V. Batteries, tapped.....$4.50
22½V. Batteries, Navy Type..... 3.00
22½V. Batteries, Commercial Type..... 2.00
Latter two types especially adapted to Cunningham and Radiotron Tubes.
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Assemble Your Own Apparatus

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Triple Honeycomb Mounting (for panel mounting).....$5.00
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Miniature D. P. D. T. panel Switch... 1.00
Vario-coupler Rotor..... .60
"Paragon" equipment is not merely assembled - - - but BUILT.

Send 10 cents for Bulletin and future announcements.

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NEW UP-TOWN RADIO STORE

With a Full Line of

Quality Radio Supplies

HAVERKAMP'S
1148 Market Street
SAN FRANCISCO
Between 7th and 8th Sts.

FIGHTING FOREST FIRES WITH RADIO

Continued from page 6

"The radio has proved its efficiency as a medium of communication; and not only is it valuable for transmitting messages direct from the planes to the ground, but I believe we could make a very good use of it for communication between ground points where we do not have adequate telephone service. Of the fifteen forest stations in California this season, there are probably three or four that do not render satisfactory service, due to being located in canyons or other reasons that can be remedied next year. We have also found that we can get amateurs—boys and young men from 16 to 25 years of age—who are well qualified, ambitious, and interested in the work, for a reasonable salary for the summer period, and that if necessary they will furnish their own equipment.

"If desired, an emergency radio station can be established on the fire line, and direct communication may be had from the plane to the ground. All pilots are radio operators, so that if the forest officer who is flying as observer is not qualified in this respect, he can write out his messages and hand them to the pilot for sending."

500 Volt Generators $35.00

125 Watts, ball bearing 42 segments in commutator, shunt wound, our own make.

IF YOU DO YOUR OWN WINDING

We supply parts complete excepting wire, for $18.00.

¼ H. P. 1800 R. P. M. 60 cycle 110 V. Motors, $18.40 each.

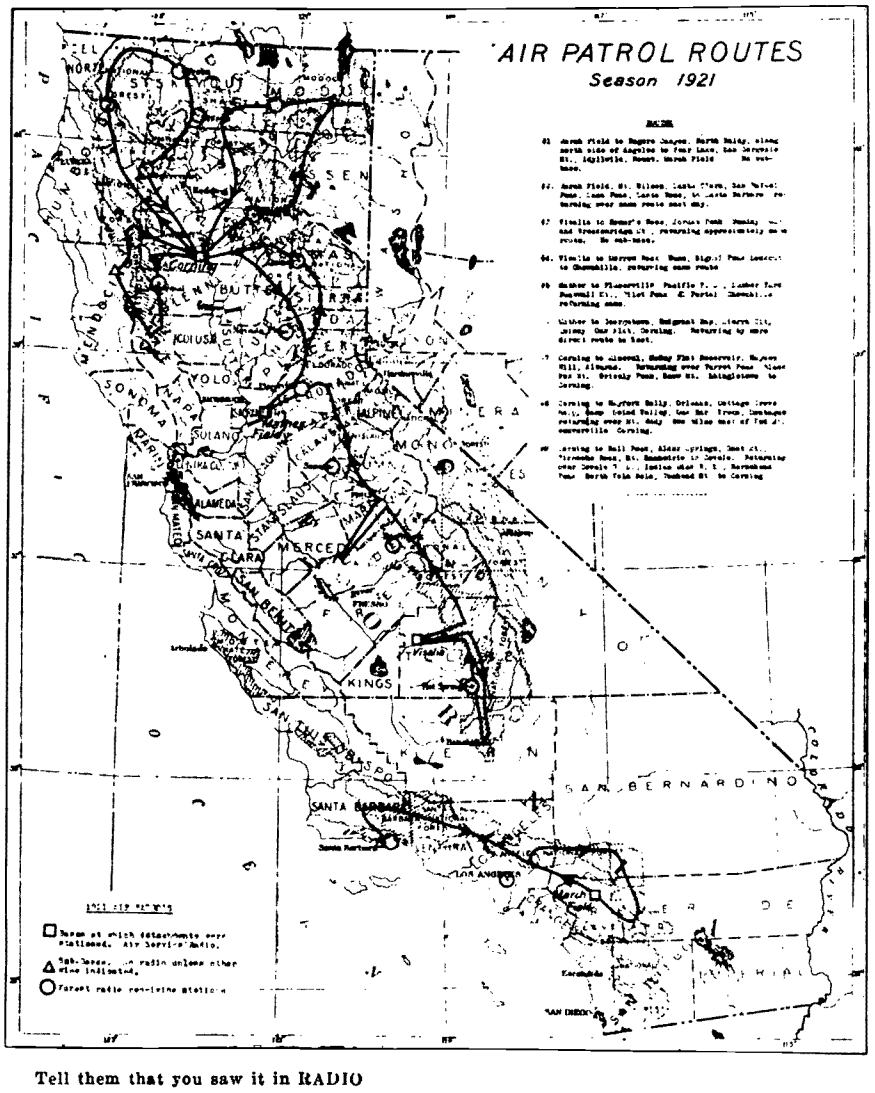
STORAGE BATTERIES; heavy duty 60 ampere hour, large plates; can be used for automobiles, $21.00 each.

All of the above F. O. B. Canton, O.

The Electric Motor & Engineering Co.

CANTON, OHIO

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You Should Be A Subscriber



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MOST COMPLETE STOCK IN THE PACIFIC NORTHWEST

SEATTLE ★ INTELLIGENT—RADIO SPEEDY—RADIO RELIABLE—RADIO ★ SEATTLE

Chelsea

No. 1 Mounted 0011	$5.00
No. 2 Mounted 0006	4.50
No. 3 Unmounted 0011	4.50
No. 4 Unmounted 0006	4.00
3/16 Bakelite Dial and Knob	1.00
¼ Bakelite Dial and Knob	1.00
21 Variable Grid Leak	3.00
31 Oscillator	3.00

General Radio

0-1 Hotwire Meter	$7.75
02½ Hotwire Meter	7.75
0-5 Hotwire Meter	7.75
0-10 Hotwire Meter	7.75
231A Amplifying Transformer	5.00
231M Modulation Transformer	5.00
214 2½ Amp. 2 ohm Rheostat	2.50
214 1½ Amp. 7 ohm Rheostat	2.50
156 Socket Bakelite	1.50

Vacuum Tubes

C300 Cunningham Detector	$5.00
C301 Cunningham Amplifier	6.50
C302 Cunningham 5 Watt Power	8.00
C303 Cunningham 50 Watt Power	30.00
AP ELECTION RELAY	5.00
AP VT Amplifier	6.50
DE FOREST Rectifier	9.75
RADIOTRON 250 Watt Power Tube	110.00

Sockets

92 REMLER Socket	$1.50
156 GENERAL RADIO	1.50
550 MURDOCK	1.00
R300 DE FOREST	1.60
DE FOREST Moulded Bakelite	1.40
RADIO SERVICE Triple Socket	3.50
RADIO SERVICE Double Socket	2.50
VICTORY Shell-Less Socket	1.00
CROSLEY Porcelain	.60

Variometers

REMLER 505 Moulded Bakelite	$6.00
RADIO SHOP	5.75
RADISCO	7.00
CLAPP-EASTHAM	6.50

Vario-Couplers

REMLER 503 Vario-Coupler	$5.40
MURDOCK Vario-Coupler on Unit Panel.	8.50
REMLER 505 Coupler on Unit Panel	12.75
RADIO SHOP Vario-Coupler	4.75
CLAPP-EASTHAM	6.50

Westinghouse Apparatus

RA Short Wave Tuner	$65.00
DA Detector Two Stage Amplifier	65.00
CB Loading Coil	5.00
RC Short Wave Receiver with Det. 2 step	125.00
DB Crystal Detector	5.00
RE Aeriola Jr. Receiver	25.00
AD Antenna Outfit	7.50
PA Antenna Protective Device	2.00
SA Lightning Ground Switch	4.00
ME 100 watt MG Set 500VDC 110-V., 60 Cycle, Ac.	85.00
MH 250-watt MG Set, 1000VDC, 110-V., 60 Cycle, AC	145.00
Rectigon 2½A Battery charger	18.75
Rectigon 6A Battery Charger	29.50
Rectigon 2½ Renewal Bulb	4.40
Rectigon 6A Renewal Bulb	8.80
LS Victrola Attachment	15.00
LS Grafanola Attachment	15.00

BALDWINS NEW PRICES!

Type C, Set	$12.00
Type E, Set	13.00
Type F, Set	14.00

Amplifying Transformers

UV-712 Radio Corporation	$7.00
231A GENERAL RADIO	5.00
226W FEDERAL	7.00
A2 ACME, unmounted	4.50
A2 ACME, semi-mounted	5.00
A2 Fully mounted	7.00

Jacks and Plugs

FEDERAL 1421 Open Circuit Jack	$ .70
FEDERAL 1422 Single Circuit Jack	.85
FEDERAL 1423 Double Circuit Jack	1.00
FEDERAL 1435 Automatic Filament Control Jack	1.20
FEDERAL 1438 Automatic Filament Control Jack	1.55
WESTERN ELECTRIC Plugs	2.00
FEDERAL Plugs	2.00
PACENT UNIVERSAL	2.00
NEW FEDERAL Universal Plug	1.75
RHAMSTINE Plug and Jack, complete	1.50

Remler Apparatus

810 Jr. Rheostats	$1.00
811 Rheostats	1.75
813 3 Amp. Rheostats	1.75
92 VT Socket	1.50
330 Audion Detector Panel	8.00
331 Amp. Panel	6.00
333 Amp. Panel	9.00
400 3 Coil Mounting	6.50
96 Variable Grid Leak	.60
97 Grid Condenser	.35
503 Variocoupler	5.40
500 Variometer	6.00

Wireless Shop Variable Condensers

	Approximate Maximum Capacity	
No. 20	2 Plate, Vernier Condenser	$2.00
No. 70	7 Plate, .0001 m. f.	2.35
No. 130	13 Plate, .0002 m. f.	2.75
No. 170	17 Plate, .0003 m. f.	3.15
No. 230	23 Plate, .0005 m. f.	3.60
No. 310	31 Plate, .0007 m. f.	4.30
No. 430	43 Plate, .001 m. f.	5.25
No. 630	63 Plate, .0015 m. f.	7.50

Remler QSA Honeycomb Coils

Type Number (No. of Turns)	Wave Length Range with .001 Mf Cond.	M't'd	UnM't'd
L25	170—375	$1.40	$0.50
L35	200—515	1.40	.50
L50	240—730	1.50	.60
L75	330—1030	1.50	.60
L100	450—1460	1.55	.65
L150	660—2200	1.60	.70
L200	860—2850	1.65	.75
L200	1120—4000	1.75	.80
L300	1340—4800	1.75	.85
L400	1860—6300	1.80	.90
L500	2340—8500	2.00	1.00
L600	2940—12000	2.15	1.15
L750	3100—15000	2.35	1.35
L1000	5700—19000	2.60	1.60
L1250	5900—21000	3.00	2.00
L1500	7200—25000	3.50	2.50

Rheostats

REMLER Jr.	$1.00
FADA—with new Knob	1.00
GENERAL RADIO No. 214 7 ohm or 2½ Amp. 2 ohm	2.50
DEFOREST, new type	1.75
PARAGON	1.75
MURDOCK 560	1.00

OUR PRICE LIST BRINGS RADIO SMILES O'ER MANY RADIO MILES
HAVE WE SENT YOU YOURS?

Northern Radio & Electric Co.

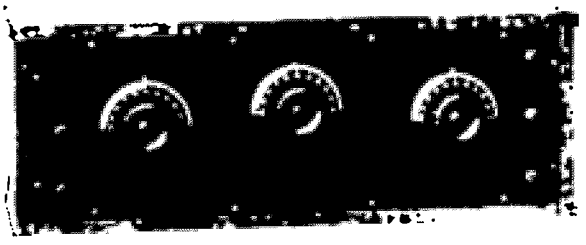
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OPERATING THE SEATTLE POST INTELLIGENCER'S RADIO TELEPHONE NEWS AND CONCERT BROADCAST

Send for Concert Schedule

Tell them that you saw it in RADIO

When Better Receivers Are Made
RADIOMART Will Make Them!



These receivers tune from 180-600 meters. New model has 8 point switch. Chelsea dials. Formica Insulation, Variometer rotors, hardwood turned, stators of Formica.

"I want to tell you that the receiver is working O. K. and that it exceeds our expectations. Last night we heard the Colin Kennedy Experimental station at Los Altos, 40 miles from San Francisco. News reports and music very distinct and clear." Upland, Calif. NAME ON REQUEST.

Price of Receiver, $30. Write for circular

These Receivers sold un-wired if necessary

The Radiomart Co., 1236 American Ave., Long Beach, California

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Radio—7XC

The Northwest Radio Service Co., the largest Radio Supply house in the Northwest has moved to

1637 Westlake Avenue, Seattle

where a larger stock of up-to-the-minute radio equipment has been received. If you want fast *Service*, send your order to us. Service is our middle name, and incidentally the corner stone of our success. Remember the new address.

Murdock, DeForest, Radio Corporation, Radisco, A.-P. and other standard lines.

Builders of "PUGET" RADIO PRODUCTS—None Better

MOST MILES PER DOLLAR

With ATLAS CW Radio Apparatus

Make your money talk to the tune of 15 miles per dollar

Money back guarantee

1000 Miles $70.00

PT-2 CW trans.	$11.00	Inductance	$ 8.00
2 tube sockets	2.00	2 tubes	16.00
1 meter	8.00	1 key	1.00
2 variables	10.00	2 fixed cond's	3.00
1 double choke	5.00	2 switches	2.00
2 rheostats	4.00		30.00
	40.00		40.00
Total			$70.00

Send ten cents for complete catalogue

The American Radio Sales and Service Co.

MANSFIELD, OHIO, U. S. A.

Tell them that you saw it in RADIO

Calls Heard at 6BF, Santa Paula, Cal.

5ZA, 6AK, 6BB, 6CZ. 6EA, 6EX, 6FD, 6FJ, 6GF, 6GP, 6GR, 6GX, 6IC, 6IG, 6IS, 6IV, 6JW, (6JX), 6KC, 6KM, 6KS, 6KY, 6LC, 6LU, 6MB, 6MH, 6MF, 6MZ, 6OC, 6OD, 6OH, 6OL, 6OM, 6OO, 6PD, 6PJ, 6PO, 6QC, 6QK, 6QR, 6QY, 6TF, 6TO, 6TU, 6UO, 6VX, 6WO, 6WZ, 6AAH, 6AAU, 6ABM, 6ACV, 6ACY, 6AEH, 6AEZ, 6AFN, 6AGF, 6AHP, 6AHU, 6AID, 6AIO, 6AIV, (6AKL), 6AKT, 6ALA, 6ALE, 6ALU, 6ANG, (6AOZ), 6APO, 6ARW, 6ASR, 6ATQ, 6ATV, 6AVB, 6AVV, 6AWS, 6BAK, 6BBR, 6BCJ, (6BCP), 6XA, 6XD, 6XG, 6XH, 6XAC, 6XAD, 6XAE, 6XAG, 6XAK, 6ZB, 6ZU, 6ZN, 6ZX, 6ZZ, 6ZAD, 7BJ, 7MF, 7XF, 7YA, 7YJ, 7ZU, 9BEX, 9XAF, 6WV.

Calls Heard and Worked by 6AMK, Los Gatos, Cal.

(6AE), 6AN, (6AT), 6AH, 6AS, 6AY, 6AO, 6AR, 6BB, 6BQ, (6BW), 6BU, 6CC, 6CO, (6CP), 6CQ (6CZ), 6CH, 6CD, 6CV, 6DD, 6DP, (6DR), 6DY, 6DN, 6EA, 6EB, 6EC, 6EJ, 6ED, 6EP, (6EX), 6EL, 6EN, 6FH, 6FK, 6FN, (6GF), (6GY), 6GP, 6GX(cw) 6GK, (6GF), (6GR), (6HC), 6HH, 6HP, 6IG, (6IO), 6IN, 6IM, (6IB), 6IK, 6JD, 6JR, 6JF, 6KP, 6KW, 6KA, 6KS, 6KF, 6KX, 6KY 6LC, 6LL 6LA, 6LE, 6LY, 6MK, 6MX, 6NG, 6NO, 6OC, 6OH, 6OW, 6PJ, 6PR, (6PO), (6QR), 6RN, 6RT, 6RQ, 6RE, (6RG), 6SK, 6SR, 6SV, 6SL, (6TU), (6TV) 6TF, 6UV(cw) (6UW), 6UM, 6UX, (6VM), (6VX), 6VE, 6VH, 6VD, (6VK), 6WM, 6WH, 6WZ, 6WG, 6XW(cw) 6XZ(cw) 6XAJ(cw) (6XFcw), 6XG(cw) (6XAG) 6XAC(cw) YA, 6YT, 6ZK, 6ZN, 6ZR, 6ZS, 6ZX, (6ZU), 6ZAA, 6ZAE, 6ZF, 6AAK, 6ACR, (6ALV), 6ACA, 6AQU, 6ACH, 6ABP, (6AEL), (6AGC), 6AIK, (6ACM), (6ACI), 6ACU, 6AOM, 6ABM, 6AGF, 6AKH, (6ANR), (6AOB), 6AAQ, 6APH. (6AATcw), 6AAR, 6AEV, (6AGT), 6ALA, (6ALM), 6ABU, (6AFI), 6AOC, 6AEY, 6ATO, (6AAU), 6AFC, (6AFK), 6ALX, 6AIH, 6AFN, 6ABW, 6ASH, 6AGJ, 6AOL, 6ABK, 6AOH, 6AUP, 6ANK, 6AQX, 6ASX, 6ADE, 6AWYcw, 6AGU, 6ALY, 6ABX, 6APE, 6ACY, 6BBK, 7BQ, 7CC, 7CW, 7FT, 7FI, 7IM, 7IN, 7HN, 7DP, 7OZ, 7HW, 7KW, 7NL, 7BW, 7LW, 7IW, 7YJ, 7KB, (7MF), 7BP, 7ID, 7KJ, 7DA, 7XFphone, 7XD, 7ZJ, 7ZS, 7ZT, 7ZA, 7ZU, 7ZM, 9YW, 9ALE. Anyone hearing 6AMK, please QSL.

Calls Heard by 6EA, Sept. 25 to Nov. 25

HEARD—2FPicw, 6AK, 6AR-"NK", 6CH, 6CV, 6CZ, 6DP, 6FH, 6FN, 6GX, 6IM, 6JC, 6JXicw, 6KM, 6LU, 6MZ, 6OT, 6PR, 6QR, 6QT, 6SK, 6TU, 6UO, 6VK, 6WZ, 6ZB, 6ZU, 6ZX, 6AAH, 6AAU, 6ABM, 6ABX, 6ABYcw, 6AEZ, 6AFN, 6AGF, 6ALA, 6ANI, 6ANO, 6APE, 6ARW, 6ASJcw, 6ATQspark and icw, 6ATV, 6XAFicw, 7FI, 7HF, 7TO, 7XD, 7XFcw, 7YA, 7ZM, 7ZP, 7ZT, 9AMBcw, 9LR, 9ZAC and WJKicw.

WORKED—5ZA, 6AS, 6CP, 6EX, 6FK, 6GF, 6GR, 6GYcw, 6HC, 6IC, 6KC, 6OC, 6PJ, 6PO, 6QK, 6VM, 6VX, 6WO, 6WV voice and music, 6ZZ spark and icw, 6ABH, 6ABU, 6AJH, 6AKL, 6AOYicw, 6ALEicw, 6ALTicw, 6AVB, 6AWH, 6AWTcw and icw, 6XAD icw, 7BP, 7ED, 7IN, 7IU, 7TJ and 7ZU. Reported heard consistently by 9ZAC.

Calls Heard by 6EB:

6AI, 6AK, (6AR-NK), (6AS), 6BB, 6CO, (6CP), 6CV, (6CZ), (6DN), 6DP, (6EX), 6FH, 6FK, (6FN), (6GF), 6GRicw, (6GRspark), (6GX), 6GM, (6IC), (6IK), 6IM, (6JE-Aris.), 6JXspark and icw, 6KC, 6KMspark and icw, 6LU, (6OC), 6OH, 6OOicw, 6OW, (6PJ), (6PO), 6PR, 6QK, 6QR, (6QT), (6SK), (6TU), (6UO), 6VK, 6VX, 6WO, 6WV voice and music, (6WZ), 6ZB, 6ZE, 6ZU, 6ZX, 6ZZ.

6AAH, 6AATcw, 6AAU, 6ABH, (6ABW), 6ABX, 6AEZ, (6AGF), (6AJF), 6AJH, 6ALA, (6ALEicw), (6AOYcw), 6APH, 6ARW, 6ASJicw, 6ATQ, 6ATV, 6AULcw, 6AVB, 6AVV, (6AWH), (6AWTcw and icw), (6AWVicw), (6XADicw), (6XAFicw), (6ZADicw).

AG1cw (vygsa), 5ZA, 5HK, 7BK, (7BP), (7ED), 7FI, 7HF, (7IN), 7JW, 7MF, 7MO, 7TJ, (7TO), (7XD), 7XFcw and icw, 7YA, (7YJ), 7ZM, 7ZP.

Calls Heard by 6EX, Berkeley, Cal.

NOVEMBER

SPARK—(6DA), (6EA), (6EB), (6EF), (6FK), 6FT, (6GP), (6GV), (6IS), 6IV, (6KA), 6KC, (6KS), (6KY), 6LC, (6LU), (6MH), 6OD, (6OL), (6QK), (6QR), 6SK, (6UO), 6VZ, (6ZU), 6ABX, (6ACY), (6ADL), 6AEW, 6AEZ, (6AGF), (6AHP), (6AIO), (6AKL), (6ALD), 6ALU, 6AMN, 6ARW, (6AVD), 6BCP, 6OH.

7BA, 7BJ, (7BK), (7BH), (7BP), 7BZ, 7ED, (7FI), 7HD, (7HF), 7HG, 7HN, (7IN), 7IW, (7JW), 7KB, 7KE, 7KS, (7MF), 7MP, 7NN, (7OZ), (7TJ), 7VO, 7YA, 7YG, 7YJ, 7YL, 7ZK, (7ZM), 7ZP, (7ZT), 7ZU, 7XA, Canadian (9BD).

CW—(6KA), 6ZN, 6ALE, 6AOY, 6AOZ, 6AQT, (6XAD), 7XF-voice.

Calls Heard at 6GZ, Los Angeles, during November.

2ZL (not verified yet) (cw) 5ZA(cw).

6AH, 6AK, 6AS, 6CZ, 6EX, 6FH, 6FK 6FN, 6GD (icw), 6GG(cw) 6GM, 6GT, 6GR, 6HT(icw), 6ID, 6IM, 6IS, 6JX(cw) 6KC, 6KM, 6LZ(cw), 6OC, 6OH, 6PJ, 6QK, 6QR, 6SK, 6ST, 6WV (music) 6VX, 6VZ, 6ZA(cw), 6ZU, 6ZZ (spark cw) 6AAT(cw), 6ABM, 6ABX, 6AGF, 6AGK, 6AHP, 6AKL, 6ALE (voice cw), 6AMK, 6AMX(cw), 6ANG, 6APW, 6ARW, 6ASE(icw), 6ASJ(cw), 6AUD, 6AVB, 6AWY.

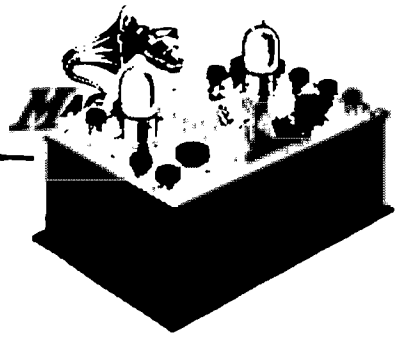
7FI, 7HG, 7MK, 7IN, 7XF(cw), 7YA, 7ZJ.

9AMB, 9ZAF (both cw).

Calls Heard and Worked by 6FK, San Diego, Calif. from Nov. 1st to Dec. 1st, inclusive.

SPARK—5IF, (5ZA), 6AH, 6AK, 6AS, 6AU, 6AX, 6CG, 6CU, 6CV, (6DA), (6EA), 6EB, (6EF), 6EN, 6EX, 6FH, 6FN, 6FR, 6GF (6GM), 6GR, (6GX) 6IC, 6IF, (6IS) 6IV, 6JY, (6KA) (6KY) (6LC) 6LR, (6MH) (6OC) 6OD, 6OH, 6OL, 6PJ, (6PR) (6QR) 6SE, (6SK) 6TF, (6VX) 6WZ, 6ZA, 6ZU, 6ZX, (6ZZ) 6AAB, (6AAH) 6AAN, 6AAY, 6ABB 6ABG, 6ABP, (6ACY) 6ADF 6ADL, 6ADZ, 6AEW, 6AEZ, 6AFN, (6AGF) 6AGX, (6AHP) 6AHV, (6AIB) 6AIC, 6AIF, 6ALU, (6AMN) 6AMZ, 6AOY, 6ATF, (6AVD) 6AWP, 7BK, 7ED, 7GA, (7HF) (7IN) 7IW, 7KB, (7MF) (7TJ) 7ZJ, 7ZM, 9BD (Canada).

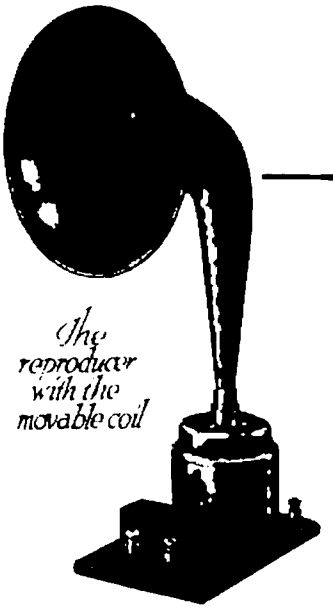
CW—5ZA, 6EN, 6GG, (6JD) 6JX, 6KA, (6KM) 6WV (voice and music qsa, very.) 6XA, 6ZA, 6ADK, 6ALE, 6ALU, (6AQT) 6AWT. 6AWV. 6XAD. 9AMB. 9BEX



The NEW Magnavox 2-Stage Power Amplifier

Designed for use especially with Radio MAGNAVOX for the distortionless amplification and reproduction of radio telephone speech and wireless music. Note the master switches to make stage to stage switching quick, simple, and easy. No jacks. Sits flat or on edge, as desired. Can be used with any transmitting tube with any voltage up to 1,000. *Type AC2, Model C, with solid mahogany case, price $80.* At your dealer or direct.

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Volume without distortion—

There is one way and only one way to reproduce wireless music and messages in volume without distortion—that is with MAGNAVOX EQUIPMENT. **There is no substitute for the Radio MAGNAVOX.** Used in conjunction with the new MAGNAVOX Power Amplifier, it reproduces in perfect, bell-like tones the slightest modulations of music or voice and swells them in volume a hundred fold, if desired, so many people may hear and enjoy simultaneously. You can attain maximum results from your MAGNAVOX with this new power amplifier. Buy from your Radio dealer or write us direct. Be sure it's a MAGNAVOX, "The reproducer with the movable coil." Look for the trademark on the horn.

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—illustrating and describing complete MAGNAVOX equipment, and explaining the principal of the famous movable coil. FREE. Write for it.

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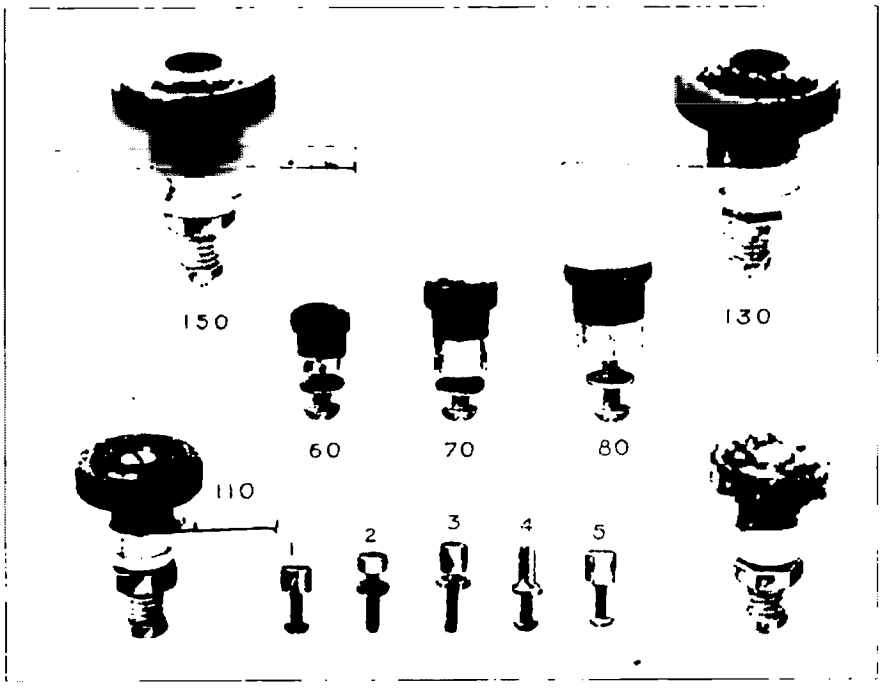
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No.		
1	Switch point, 3/16" x 1/4", nickel plated with 4-36 brass screw	$0.05
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5	Switch point, 1/4" x 1/4", nickel plated, with 4-36 brass screw	.15
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Manufacturers and Distributors of Radio Apparatus.

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Fellow Amateurs--

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WRITE TODAY!

"THE OSCILLATOR," Radio Engineering Society of Pittsburgh, Inc.

The Dispatch Building, 1333 Fifth Avenue

Pittsburgh, Pa.

MARTIN ROBBINS

Continued from page 13

musical *plash* of disturbed waters, the girl's very soul was stricken at the misery and hopelessness that had looked out at her from his earnest grey eyes.

* * *

THE crash sent him hurtling from his bunk, to the floor. He groped for the light switch, but nothing happened when he turned it. Shouts drifted to him from somewhere for'ard. He found one of his sticks and pulled himself to the door. It was jammed, and try as he would, his feeble strength could not open it. But he managed to drag down the wooden shutter of his window. He peered out.

Darkness and fog. So thick that he could not discern the staunchions that he knew were a scant three feet from him. Footsteps came tearing along the deck.

"For God's sake, Sparks, Cap'en says send an SOS! We're sinking fast—some damned steamer, going full speed, has cut us 'most in two!" a hoarse voice shouted. And the figure that had loomed as a black wraith before him was gone.

Without a thought of self, Martin Robbins groped to his apparatus, and threw the send switch.

"Fool!" he muttered. "No lights, no power, of course!"

Painfully, as moving without his supports wracked his harassed body, he managed to find and connect the auxiliary storage batteries, and pressed the key. Sputtering harshly, the old-fashioned spark gap crackled in thin, jagged blue incandescence, its glow causing his face to be of a strange pallor.

"*S-O-S!*"

The call of dire distress went out into the blackness.

No one had thought to give him the exact position of the ship, but so many trips had he made that he knew, to within a very short distance, where the *Bloomton* wallowed crazily on the heavy ground swell that hove down from the northeast.

"*S-O-S*"—and his position. Again and again, unhastily—very carefully—the message disturbed etheric space unto the four quarters of the world.

* * *

THE operator on 600 metres at NPG (San Francisco) was contentedly pondering the fact that his relief would come on in ten minutes—when a strange, very feeble, stuttering signal came to his ears. Instantly he was alert.

"*SOS!*" he called sharply—and everyone within hearing was instantly silent.

The *Bloomton's* position and situation received, he opened up on his fullest power "to all ships within 500 miles S. and S. W. *de* NPG"—repeating that which he had caught. Then he sent a cheering message to the *Bloomton*—and the great land station was on the *qui vive.*

TEN-THIRTY! Lord, but it's a thick night!" grunted the operator on watch on board a trans-Pacific liner, bound for San Francisco from Far Eastern ports, and Honolulu. He peered outside, and then cocked his feet again on the operating table, and his eyes fell once more to the pages of a magazine. He settled the phones more comfortably over his ears.

Suddenly he sat up with a jerk. The magazine flew from his hands, and he bent forward, head almost touching desk, phones pressed to his head, straining to hear.

And he got it. Rapidly he copied the *SOS*, called a quartermaster, and sent him scurrying to the bridge with the message, while he called the *Bloomton* over and over again, giving him *"R's"*, the liner's position—and re-broadcasting the *SOS* for any vessel that might be nearer the sinking ship.

* * *

UNUSED to quick maneuvering of life boats, and their launching at sea, the heterogeneous crew of the *Bloomton* made a sorry mess of getting the larger of the two boats into the water—the smaller one having accidentally been badly stove' in by a timber falling on it, some time previously, and never repaired.

Water-logged, with a huge gash that cut her from water line nearly to keel, the awkward craft was almost on her beam ends, and nearly awash, when the Captain, Elsie, and the crew of seven men pulled away. So thick was the fog that at two boats' lengths the vessel was entirely invisible.

* * *

AND Martin Robbins had heard them go!

Not a cry for help had he uttered. Crouching at the steep-slanted operating table, he methodically sent his *SOS*. He had heard NPG answer him—and he had also heard the liner's prompt response. He had tried to call out to the others not to row far from the *Bloomton*, as his distress signals had been received and help was on the way. But the crews of lumber schooners are not sailors. Frantic haste—fear-driven—put everything else from their minds, and Robbins' voice was lost in the clamor of shouts and oaths, to whose accompaniment the larger life boat had, at last, been got to the water, crowded with the living—and hurriedly rowed away.

"I don't cut much ice—alive, so I suppose they forgot all about me!" Robbins whispered—but not with bitterness, for there was not an iota of it in his twisted frame.

Steadily the *SOS*, and position, went forth.

Then, from the impenetrable fog, he heard the girl's cry. It rang sharply:

"Martin Robbins! Where is he?"

FREE ONE YEAR'S SUBSCRIPTION TO "RADIO" **FREE**

With every "Chi-Rad K-D variometer set purchased from us during January. This set gives you all parts necessary to build two variometers and one variocoupler. ALL WINDINGS ARE IN PLACE! Alone, it is the BIGGEST value on the market! With RADIO!!! Price complete only $10.00 (include postage on 6 lbs.)

Other High-Grade Chi-Rad Products and Prices:

Complete K-D short wave regenerative includes the above-mentioned set, dials, switch points, binding posts, panel, and a handsome very dark oak, hinged-top, cabinet. (Cabinet not K-D.) The price is only $20.00. Now you can get that short wave regenerative you've always wanted—not be broke for six months after—and yet get as high grade a set as is obtainable. Also, we'll give two years' subscriptions with the complete K-D regenerative.

S. W. Regenerative, above set, assembled, $30.00. 150-600m.
Chi-Rad Variometer, K-D, $4.00. Chi-Rad Coupler, K-D, $3.00.
Chi-Rad Variometer, assembled, $3.00. Chi-Rad Coupler, assembled, $4.00.
Chi-Rad Binding Posts, moulded composition top, 12c each; $1.30 dozen.
Chi-Rad Switch Points, ¼ in dia. 3/16 in. high n. p., 5c each; 60c dozen.
Chi-Rad Switch Stops, nickel plated, 8c each; 2 for 15c.
Chi-Rad Switch Lever, metal parts nickel plated, 60c each.

WATCH for the PARL *Unusual-Unit* line. Radio frequency amplifiers, audio frequency amplifiers, detectors, unituned regenerative units, radiofone and C. W. units, crystal units, regular regenerative units, and others from time to time. Prices will be the very lowest and quality equal to the best. Write now and get on the list for the first bulletins. Everything will be DIFFERENT.

WE HAVE Fada 6 ohm receiving tube rheos., $1.00. Power tube rheo., 1½ ohm, 5 amp., $1.35. These are the cheapest and of the highest quality on the market.

The VICTOR unusual socket for that vt of yours, perfect contact and fused for 1 or 3 amp., $1.00. Specify fuse size. *Dealers*—Write for discounts on this non-competitive fast selling product.

The KLAUS original panel switch. The blade and knob, of the whole switch assembly, are the ONLY moving parts. Perfect contact at all times with absolutely no parts to come loose and every metal part visible from panel side, handsomely nickel plated. Only an eighth inch hole need be drilled to mount the KLASSY-KLAUS original panel. The price, also, is an innovation—60c.

DEALERS: Write for the discounts on the KLAUS non-KOMPETITIVE line. Remember! The points mentioned above score heavily with the amateur who makes his own.

Formica, mica, copper foil, crystals, Baldwin's, SacoClads, Murdock's, and so on, write for list.
Oh, yes! Radiotron and Cunningham tubes to 50-watt capacity.
Let us calibrate that wavemeter to 1000 meters at 35c per point.
Ship well packed and insured.

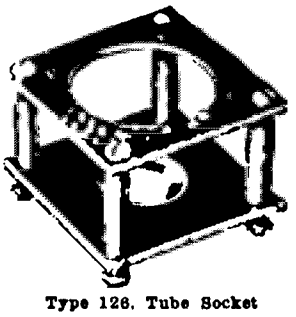
Port Arthur Radio Laboratory

Harris Building **Port Arthur, Texas**

SOMETHING NEW

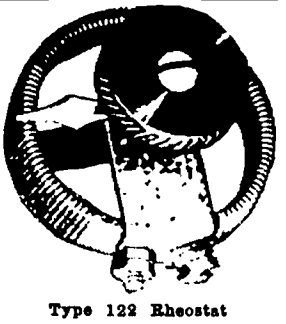
Made to Please You and Priced to Please Your Pocketbook

By departing from conventional design in audion sockets we have combined the advantages of all, the disadvantages of none and a price lower than any. Think of it—a sturdy, easily mounted socket that is heat proof, has bakelite dilecto insulation, handy binding posts, etc., all for 75c.



Type 126, Tube Socket
Price 75c Postpaid

And here's a smooth running rheostat that takes panel space 2 inches in diameter, needs one hole to mount, has six ohm resistance, all off and all on positions and a brass panel bushing. Priced at 90c.



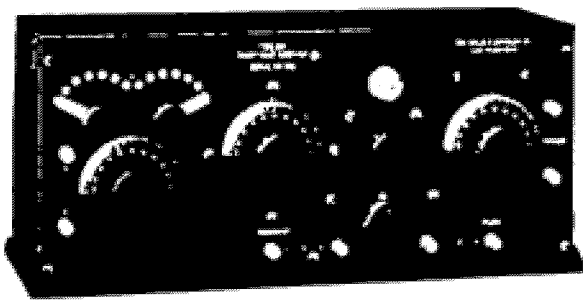
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TYPE 281
SHORT-WAVE REGENERATIVE RECEIVER

Licensed under
Armstrong U. S. Patent No. 1,113, 149

THE Kennedy trade-mark on radio receiving apparatus is recognized as symbolical of the highest standards of quality and the maximum of value.

THE new Type 281 Short-Wave Regenerative Receiver was developed especially for those who want the optimum of performance in short-wave reception. Its effective tuning range is 175 to 620 meters; it has a self-contained vacuum tube control unit and we believe that it offers the most for its price of any short-wave receiver to be found on the American market.

ASK your dealer to show it to you. The leading radio distributors in most of the larger cities are selling Kennedy Equipment and others are being supplied from day to day. If *your* dealer has not yet put in his stock, send us his name and we will mail you a copy of Bulletin 201 describing this unit.

THE COLIN B. KENNEDY COMPANY
INCORPORATED
RIALTO BUILDING SAN FRANCISCO

CORRECTION

The advertisement for the Continental Radio & Electric Corporation in the December issue of "Radio" states that the

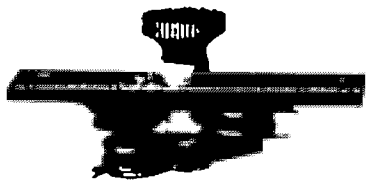
FAMOUS PARAGON RA-10 RECEIVER

has been reduced from $85.00 to $69.00.

The reduced price should have been $69.50 instead of $69.00.

BUY THAT PARAGON NOW & SAVE $15.50

AMRAD VERNIER VARIOMETER



Essential for CW and Phonework:
Panel Mounting Model.....$1.50

Send us your order for

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Special: Mention "Radio" and get a Somerville VT Socket with every 5 Watt Radiotron you buy from us in January

New Prices.	Somerville 4" Dial Indicator	$1.75
	Somerville 3¼" Dial Indicator	1.60

Somerville Radio Laboratory
Retail Sales Division
176-178 Washington Street, Boston, Mass.
Dealers get our Wholesale Price Sheet

Tell them that you saw it in RADIO

"She's sunk—long ago!" a gruff voice answered.

"Cowards!—to leave a helpless cripple—while you save yourselves! Let me go — I —— "

Silence.

A wan smile played about his lips, and a feeling of warmth crept round his tired heart.

"She didn't forget the cripple!" he said—very softly.

* * *

THE batteries — never of the best, and in a worn condition—had expended their last strength. Nothing came of his pressing the key.

Outside, the muffled surge and grumble of rolling waters was almost flush with the deck, and from below came ugly, sodden sounds.

"Once a 'ham'—always one!" Martin Robbins said aloud, throwing the ancient switch to receive, and tuning down to 200 meters.

Only some 100 miles lay between the sinking ship and the shore. Memories of youth's enthusiasm at his first, home-made, receiver came to him as he heard amateur stations working—from the usual: "How do I cum in tonite OM?" to more pretentious stations, American Radio Relay League men, getting their night's messages through.

He listened.

The *Bloomton* rolled more heavily and he heard the water splash up against the wall of his cabin, outside.

Then Operator Martin Robbins looked upward. He did not see the dingy, low cabin ceiling. His eyes saw—beyond. Saw the stars glistening above the pall and fog of earth's creation. And Martin Robbins spoke aloud:

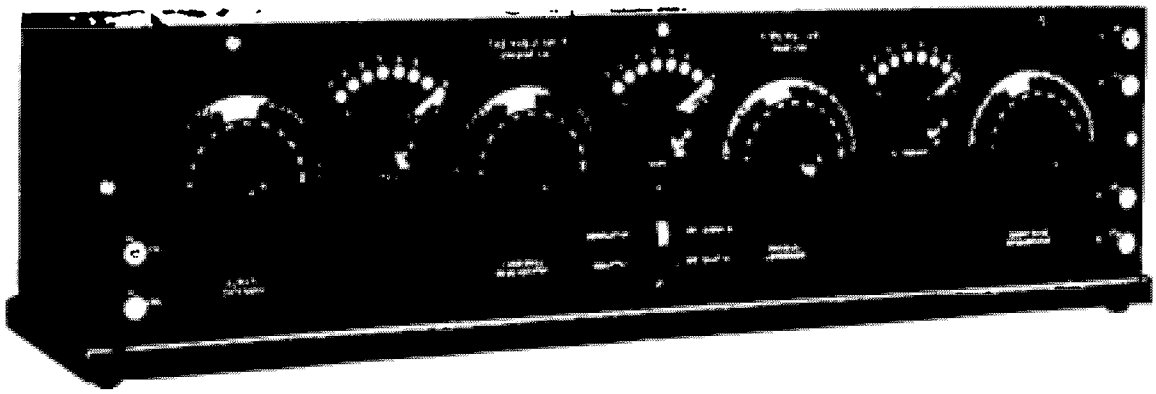
"I never dared suicide, God—for there was mother to think of," he said slowly, as though to a human entity. "And I have done my best. I am glad that"—his voice shook—"that the time has come for me to—to go, for this life holds nothing for me. I have always believed on You, and I know that You will look after—mother, otherwise You would have let me stay on here. I am not afraid—for I have done my best. Please, O Father, to whom mother taught me to pray—please take care of her—*Amen.*"

He felt entirely at peace, and his fingers idly moved the condenser knobs on the receiver. The sound of music came faintly. He tuned it in sharply, and he heard some jazz record being played. It stopped, and a voice from the living came to him, who was about to cross the Golden Threshold:

"The next, and last, record this evening will be Victor Record No. ...., 'Tosti's *Goodbye,*' sung by Geraldine Farrar."

A scratching sound, and the singer's voice floated to him with crystal purity and sweetness.

The 1922 Model Type "RS 1-24" Receiver



The New Type "RS 1-24" Receiver is the LAST word in Radio tuning devices. Although our first model was a complete success and proved absolutely satisfactory to all our purchasers, still, continued experimentation has made it possible to combine features in the new model FAR EXCEEDING anything yet developed.

While ALL features of the original model are incorporated in the improved model of the "RS 1-24," still some NEW and very ESSENTIAL qualities are added to take care of the increasing demand for a REAL C.W. AND TELEPHONE RECEIVER. For this work, a special combination of tuning is provided which makes the "RS 1-24" an absolutely "fool proof" Receptor for such work. This is accomplished through a newly developed method of regenerator which permits the vacuum tube to be kept in a CONSTANT state of oscillation, or semi-oscillation, over a wide range of wavelengths.

The New "RS 1-24" incorporates both Inductive and Conductive tuning with two regenerators; one for use up to 3,000 meters and a second for wavelengths up to 24,000 meters.

The Inductive or "Three Coil Circuit" covers a range of from 100 to 3,000 meters and gives exceptionally sharp tuning, permitting of the elimination of practically all interference.

The Conductive Circuit is divided into two groups: 100 to 3,000 meters and 3,000 to 24,000 meters. Both circuits give PERFECT regeneration ON ALL wavelengths covered.

The circuits are so arranged that "dead-end" effects are overcome, resulting in a remarkably efficient receiver.

A FEW PERTINENT FACTS ABOUT THE "RS 1-24" RECEIVER:

There is absolutely no **sacrifice of efficiency** on any of the wavelengths covered.

The **RADIO SHOP Short Wave Receiver** is the most highly efficient short wave receiver on the market. The **"RS 1-24" is equally efficient on amateur wavelengths, if not more so.**

Tuning is accomplished **quicker**, and in a **cleaner** manner, than in any other receiver ever built. **There are no faulty "combinations."** Note the simplicity of controls. Only three dials and two switches are in use on any of the three groups of tuning.

Absolutely no "holes" in the tuning range. **A consistent and mighty oscillator** and **capable of instant non-oscillation when so desired.**

Simplicity of connection to the vacuum tube control. Only **four** leads required, two to the grid input and two to the plate circuit.

Same vacuum tube suffices for long as well as short waves due to the **remarkable flexibility** of oscillation control.

The elimination of all plugging in and out of coils. Absolutely no other accessories required except the vacuum tube and its attendant controls.

Will enable you to hear commercial ship and marine land stations that were heretofore unheard. **The 600-meter section is equally efficient as the short and long ranges.**

Has a "stan-bi" position that will enable you to "find" stations that you missed entirely before.

No element of "luck" necessary for the successful operation of the **"RS 1-24."** It is a **positive** receiver designed by practical radio engineers **who knew what was wanted.**

Interior construction that is right, and in keeping with the **exterior** appearance. **No Seals.** We want you to **know your set.**

Produced and sold at the lowest possible price consistent with the best of materials and a fair profit, by systematic workmanship.

Last but by no means least, **licensed under Major Armstrong's regenerative patent (Patent No. 1,113,149, and U. S. application serial No. 807,388), and applying his unapproachable circuit to its utmost effectiveness.**

MECHANICAL AND CONSTRUCTIONAL POINTS OF SUPERIORITY:

Grained Formica panel; plentifully Gorton engraved and filled in with brilliant white.

Large, true running dials with an easily manipulated knob.

Genuine hand wound **bank windings** in connection with special form concentrated inductances that utilize every iota of the incoming energy.

Heavy "bus bar" wiring of hard bare copper **reducing resistance** to the minimum and insuring **permanence.**

Balanced type variable condensers constructed especially for the **"RS 1-24."** As non-shorting as a condenser can be made.

Genuine Oak or Mahogany cabinets as desired. Hand rubbed finish.

All exposed metal parts satin nickel plated.

Over-all dimensions 7x7x25 inches. Shipping weight approximately 30 pounds.

The installation of the **"RS 1-24"** receiver will end **all** of your receiving troubles. You will have an instrument that will enable you to cover the **entire** wavelength range with **a greater ease and efficiency** than is possible with any other tuning arrangement you can buy or build. It will be the best investment you ever made from a financial as well as an efficiency standpoint.

Full instructions and blue prints accompany each receiver. In ordering **be sure and specify whether oak or mahogany case is desired.**

1922 Model Type "RS 1-24" Receiver f.o.b., San Jose, $125.00.

DEALERS

We can make you an interesting proposition on this new Receiver. Write us.

The first lot of this new model "RS 1-24" will be ready for shipment January 1, 1922. Place your order NOW and be assured of PROMPT delivery.

See this New "RS 1-24" and other Radio Shop Products at the Radio Show, December 29th and 30th, in San Francisco.

San Jose **The Radio Shop** **California**

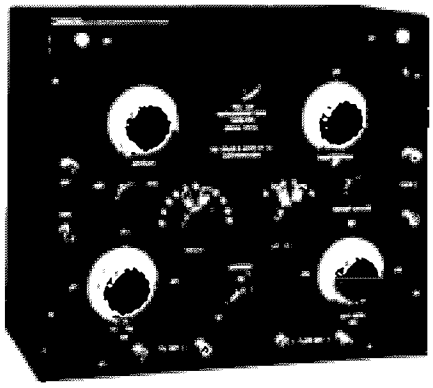
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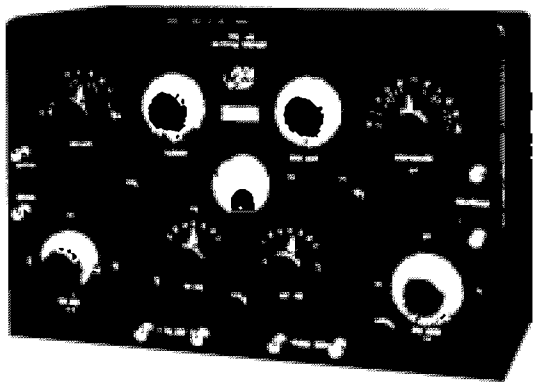
Complete radio sets that tune to any wavelength

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Short, Intermediate and Long Wave Kennedy Receivers and Amplifiers.

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Our Special Amplifier and Detector Panels are ideal for every use. Drop in and look them over.



SOMETHING NEW!

Have you seen our Soldering Iron Electric Heaters?

They heat an iron almost instantaneously.

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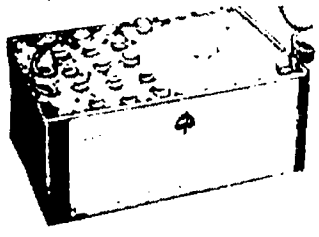
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The new "Ace" ♯ 627-45 Volt Variable "B" Battery is rapidly creating a remarkable reputation as to "Price," Quality, Service and Weight. The special size cell construction guarantees from 50% to 75% longer life than any 2 small size "B" Batteries. 16 Taps, 30 Voltage readings of from 1½ to 45 Volts obtained. Absolutely the best "B" Battery offer ever made. Size 6 in. x 5 in. x 2⅜ in. —weight, 3¾ lbs. Price, $3.50. Demand "ACE." If your dealer does not carry "Ace" write to us. This list contains the six popular type "ACE" "B" Batteries.

Write for Cat. ♯ 20. Ace Batteries are silent, moisture proof and absolutely guaranteed.

DEALERS:
Get in on this fast selling item.

Cat. No.		Size	Voltage	Lbs.	Taps	Price
623	Plain	2½x2x3¾	22½	1		$1.50
623	Variable	2½x2x3¾	22½	1	5	1.75
625	Plain	3 x4x6¾	22½	5		2.50
625	Variable	3 x4x6¾	22½	5	5	3.00
626	Plain	3 x8x6¾	45	10		5.00
626	Variable	3 x8x6¾	45	10	6	6.00

NO RADIO SET COMPLETE WITHOUT "ACE"

264 Atlantic Ave. ACE BATTERY MFG. CORP. Brooklyn, N. Y.

As the last note faded away, the *Bloomton* lurched over. Operator Martin Robbins did not struggle against the furious inrush of waters. Rather did he again look up, as they rose round him, and the ship lunged forward:

"Goodbye—world of pain! I am free —at last!"

* * *

THE newspapers, two days later, carried this:

"On the night of the 16th, the steam lumber schooner Bloomton was struck by an, as yet unknown steamer, while on her way to San Francisco from San Pedro, and sank soon after. The Captain, his daughter, and the crew got away in a life boat and were picked up by the S. S. ....., whose operators had heard the SOS of the stricken ship. Martin Robbins, the radio operator on the Bloomton, stuck to his apparatus until the last minute. As he was a cripple it is reported by the Captain that he must have been injured and fallen overboard in the fog and darkness while trying to reach the life boat."

The End.

NEW RADIO CATALOGS

Catalog No. 5 from Detroit Electric Company, 434 Shelby Street, Detroit, Mich., is devoted to Radio Telegraph and Telephone Equipment for Reception and Transmission. This is a complete illustrated price list of material from all manufacturers, carefully arranged for reference. It includes the code, conventional signals and list of abbreviations.

Signal Electric Manufacturing Company, Menominee, Mich., has issued a new catalog of High Class Wireless Apparatus to meet the requirements of all classes of users. It covers both spark and CW equipment.

The Benwood Company, Inc., St. Louis, Mo., is distributing a handsome folder giving description and prices of Benwood Apparatus, including synchronous motors, batteries, battery charges, rotary quenched synk and spark gaps, rotary discs and stationary electrodes. This company has also published an interesting price list and specifications for a radiophone transmitter giving 2 amps. with two 5 watt tubes on 200 meters.

Bulletin No. 6 from the H. H. Eby Manufacturing Company, Philadelphia, illustrates and describes "The Leader" binding post for radio equipment and laboratory use.

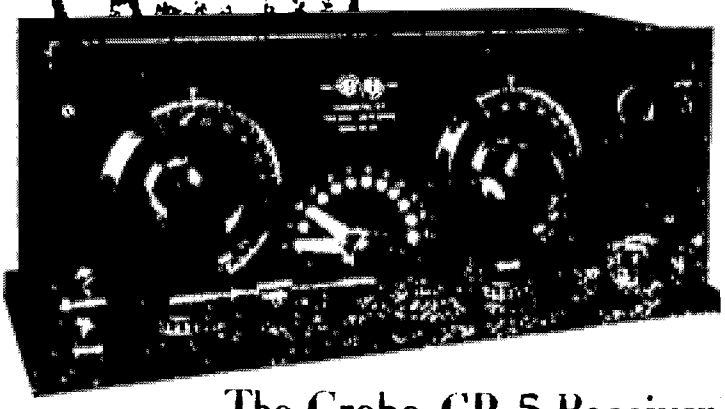
Bulletin No. 60 from the France Manufacturing Company shows their new ⅛-h.p. synchronous motor for synk gap dx work. The motor is equipped with ball bearings and is designed for continuous service at 1800 r. p. m. on 110 volts.



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 Why

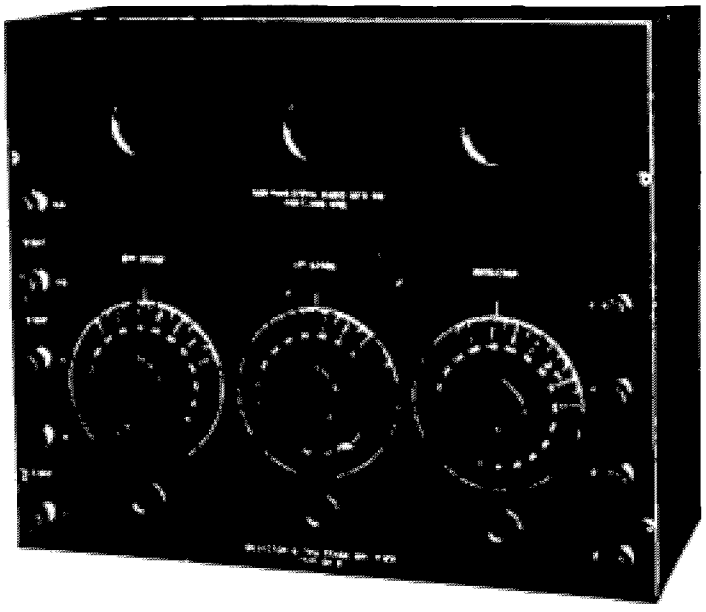
GREBE RADIO



The Grebe CR-5 Receiver

NORTHWESTERN RADIO

A Superior Line of Receiving Apparatus



Detector and two stage amplifier Type SR-2. Size of panel 10 1-2x12 3-4. Complete less tubes and battery $70 f.o.b., Portland.

A detector and two stage amplifier that will give you results. This instrument is in use in many stations in the Northwest and its performance is a proven fact. You must see this set to appreciate its value. Material and workmanship are the best.

Specifications — Panel quarter inch grade XX bakelite dilecto. Gorton pantograph engraving. Oak Cabinet finished in flemish oak.

Knobs and dials are machined from sheet bakelite and turn TRUE. All socket supports are constructed of bakelite and cast aluminum.

Write for Catalog

NORTHWESTERN RADIO MANUFACTURING CO.

1556 East Taylor Street **Portland, Oregon**

NEW BREAK-IN SYSTEM

An improved method of enabling a transmitting operator to listen-in while communicating with another station is shown in the accompanying diagram. The method of short-circuiting the receiving equipment when the transmitting key closes the primary circuit of the power transformer has met with good success. The use of a 150 ohm relay and a carbon lamp shunted across the relay windings to prevent short-circuiting of the relay battery, is the latest addition to the break-in system.

It will be seen from the diagram that the carbon lamp is not brought into play until the 3 P. S. T. switch is thrown into the operating position. This switch also acts as a precautionary method in the prevention of probable depression of the key while receiving is in progress.

Two contacts are mounted on the main transmitting key, one on the key lever and the other on the key base. These contacts operate the 150 ohm relay with every action of the key. When the key is in the upper, or receiving position, the relay contacts are open, but every time that the key is depressed the relay is closed and the receiving set short-circuited, thereby preventing damage to the equipment.

The ordinary relay contacts will suffice to short the receiver, but if the relay is used for breaking any part of the transmitting circuit, larger contacts must be substituted. The wiring diagram shows the use of the relay to short the receiving equipment only. It is evident that a separate receiving aerial must be used. By the use of a separate transmitting aerial it will be possible to use one of short length, a method so successfully used by many operators.

CROSLEY RADIO APPARATUS "Better—Costs Less"

Crosley V-T Sockets	$ .60
Crosley Variable Condenser without knob and dial	1.25
With knob and dial	1.75
Mounted in cabinet with knob and dial	2.50
Harko Radio Receiver	9.00
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Complete set	15.00
Crosley Magfon	10.00
Crosley Cabinets—	
In gum	$2.50 to 5.25
In mahogany or quartered oak	$3.85 to 10.60
Crosley Rheostats Model "A"	.60
Model "B"	1.25
Crosley Binding Posts, each	.08
Dozen	.90
Crosley Tap Switch, each	.40
Switch Taps, each	.03
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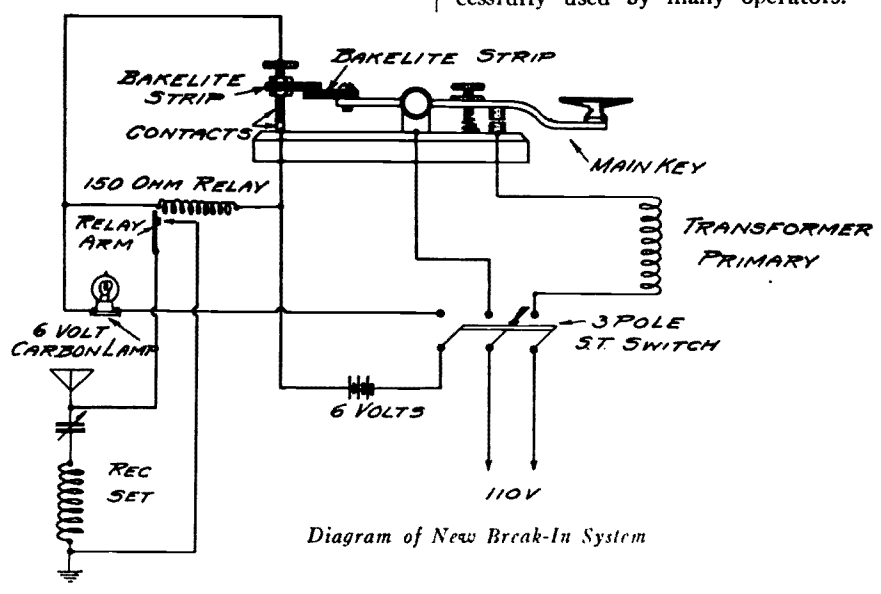


Diagram of New Break-In System

Prices Reduced on
Eveready Wireless B Batteries

Eveready Wireless B Batteries, the long-lived, moisture resistant batteries that are designed and made especially for radio uses, are now offered at better prices. All of our wireless B Batteries are included in the reduction.

The new prices, effective immediately, are:

No. 774—A 43-volt Battery with 6 positive terminals, allowing a range of from 18 to 43 volts in steps of 4½ volts $4.50

No. 766—A 22½-volt Battery with 5 positive leads, giving a range of from 16½ to 22½ volts in steps of 1½ volts $3.00

No. 765—A 22½-volt Battery with one positive terminal. A dandy Battery for beginners..... $2.00

No. 746—The big 108-volt Battery for amplification..... $15.00

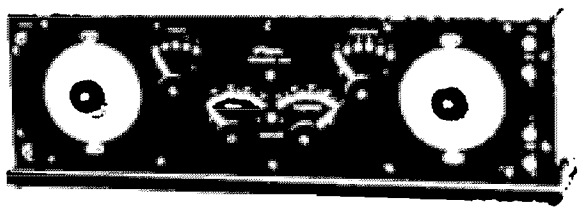
These batteries have made good. Amateurs and seasoned operators may specify Eveready Batteries with an assurance that they will be found equal to every demand.

National Carbon Company, Inc.
599 Eighth St., San Francisco, California

Latest Products of the "Signal" Laboratory Told in the New Signal Literature!

Whether like the novice, the Art of Radio is a great *"game,"* or like the experimenter, it is to you the great *Business*—in either case, you want to keep abreast of developments in apparatus and equipment.

SIGNAL LABORATORIES continue to bring forth more modern and efficient radio equipment, yet there is no let-up in the demand for earlier popular SIGNAL instruments such as have helped make wireless history.



A popular Signal Product—The new short Wave Tuner, R-37-C
Described in the new Bulletin

Therefore, the new SIGNAL Bulletin covers the whole field of Signal Wireless Products—and it is free to you if you use the attached coupon or a postcard.

TEAR OUT AND START THIS COUPON NOW

Signal Electric Manufacturing Co.
Menominee, Michigan

COUPON

Send me the new SIGNAL WIRELESS BULLETIN

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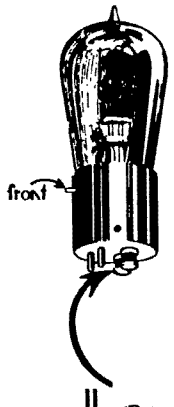
CITY .....

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RADIO

Died

A New Vacuum Tube Died from Excessive Amperage. Age 1 Day. Death Due to Neglect.



Here's the M. D. That Saves Them-

Thousands of live, active, efficient Vacuum Tubes will never die because they are protected with the

Radeco Safety Fuse

Slips directly on filament terminals of any standard tube used in any socket. Protects against shorts and destructive amperage.

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Buy RADECO Safety Fuses today and stop future Vacuum Tube expense. Ask your dealer or order direct.



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Radio Equipment Co.
630 Washington Street
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Send Your Order *Today*

A new, practical, efficient fuse that your bulb needs. In ordering specify sizes. 1, 1½, 2, 2½, 3 amps.

FOUR FOR $1

500 of these beautiful panel sets all assembled but not wired. Federal jacks used in all Amplifiers.

1-Step Amplifier $ 9.75; with detector $14.80
2-Step Amplifier 19.70; with detector 24.60
3-Step Amplifier 29.55; with detector 34.50
Detector Panel 4.95

OT. and Condenser Copper any size ½c square inch. Knocked-Down Inclosed gap with 6 point disk 6000 RPM. 1/12 HP. motor and OT. 22 inches in dia., using 3 inch copper on pri. 2 on secondary, all when assembled makes a unit split type no-lead set. all for $55. Beautiful Short Wave Receiver with Detector as a unit all assembled (not wired) on 9x14x 3/16 panel, $25. Order at once. Enclose money order and save time. Many other bargains. Large catalog, 5c.

SOUTHERN RADIO LABORATORY
Dublin, Texas
5XJ Testing Station. We use above equipment

You Get a Genuine Bakelite Socket With One Subscription to "RADIO"

Questions and Answers From the Radio Inspector

Continued from page 21

Question: Please give me data on the new government call books. When will they be ready for distribution?—H. E., Los Angeles, Cal.

Answer: The book "Commercial and Government Stations of the U. S." is just off the press, and can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 15c per copy. The list of amateurs' stations is understood to be nearly ready for distribution, and probably will be out by the first of the year. It will probably be the same price, and can be obtained from the same place. (Note—Stamps NOT accepted for these books.)

Question: How old must an amateur be to apply for license?

Answer: No age limit. Anyone can apply, and if successful in passing the examination, they can be licensed, that is, assuming they are American citizens.

Question: Why did 2QR use up to 600 meters when he was heard in Scotland on radiophone? He has no special license.—E. B.

Answer: This office has no information concerning this. It seems probable, however, that he had special permission to use this wave length, for this test only.

Question: How may I get into communication with Guglielmo Marconi by mail?—E. B.

Answer: If you address him care Marconi's Wireless Telegraph Co., Marconi House, Strand, London, England, it is believed you will reach him, and if not, the letter will be forwarded from there.

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YOUR NEW TOWERS

Made of structural Steel.
Self-supporting.
No Guys to absorb energy.

ERECT IT YOURSELF

Step Bolts provided.
Standard Tower 60 feet high and 7 feet square at base.
$100.00 f. o. b. San Francisco.
Ask your dealer or send for folder.

S. S. HERRICK CO.
Towers, Buildings, Bridges.
Foot of Adeline St.
OAKLAND, CAL.

$ $ S-A-V-E $ $ 50% DISCOUNT

C-W inductance (edgewise-wound copper strip, 25 turn) $5.00. Modulation transformer $4.25.

BULBS: UV-200 detectors.....$4.25
UV-201 amplifier..... 5.35
UV-202 Power Tube, 5 watt. 5.95

Universal "VERNIER" Attachment, fits any Standard Dial. (There is no set in existence that is not improved wonderfully by the addition of this little device).. 45c
Six for $2.50

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"Write for Bulletins"

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No. UV-201 Radiotron, Amplifier	6.50
No. UV-202 Radiotron, 5 Watt tube	8.00
No. UV-203 Radiotron, 50 Watt tube	30.00
No. UV-204 Radiotron, 250 Watt tube	110.00
No. UT-501 End-mountings for UV-204	2.50
No. UT-502 End-mountings for UV-204. Per pair	2.50 4.50
No. UR-542 Porcelain Socket	1.00
No. UP-552 Bakelite Socket	1.50
No. UT-541 Porcelain Socket for UV-203, and UV-217 "Kenotron" tubes	2.50
No. UV-216 20 Watt "Kenotron" tube	7.50
No. UV-217 150 Watt "Kenotron" tube	26.50
No. UP-1368 325 Watt C. W. Trans.	25.00
No. UP-1016 750 Watt C. W. Trans.	38.50
No. UL-1008 Oscillation Transformer	11.00
No. UT-1343 Magnetic Modulator, ½ to 1½ Amps.	9.50
No. UT-1357 Magnetic Modulator, 1½ to 3½ Amps.	12.50
No. UT-1367 Magnetic Modulator, 3½ to 5 Amps.	17.00
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No. UP-1627 Filter Reactor, 300 MA	15.75
No. UP-415 Plate Circuit Reactor	5.75
No. UC-1631 Filter Cond., ½ MFD, 750 volts	1.35
No. UC-1632 Filter Condenser, 1 MFD, 750 volts	1.85
No. UC-1634 Filter Condenser, ½ MFD, 1750 volts	1.50
No. UC-1635 Filter Condenser, 1 MFD, 1750 volts	2.00
No. UP-1719 Trans. Grid leak, 5000 ohms	1.10
No. UP-1718 Trans. Grid leak, 5000 ohms for UV-203 and UV-204 Tubes	1.65
No. UM-530 Hot Wire Meter, 0-2½ Amps.	6.00
No. UV-533 Hot Wire Meter, 0-5 Amps.	6.25
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No. UV-712 Amplifying Transformer	7.00
No. PR-536 "A" Battery Potentiometer	2.00
No. UC-567, .00025 MFD Grid and Plate Condenser	1.20
No. UC-568, .0005 MFD Grid and Plate Condenser	1.35
No. UC-569, .001 MFD Grid and Plate Condenser	1.50
No. UC-570, .0025 MFD Grid and Plate Condenser	2.00
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No. UX-543 Grid leak mounting	.50
Note—Radio Corporation's C. W. Instruction Book giving hook-ups and complete information	.25

GREBE APPARATUS

No. RORH Audion Control panel in cabinet with tickler connections	$17.00
No. RORK Two step amplifier with automatic filament control jacks	55.00
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No. CR-3 Regenerative receiver, 175-680 meters, "Relay Special"	65.00
No. CR-3A Reg. Receiver, 175-375 meters, complete set, knock-down	19.95
No. CR-5 Reg. Receiver, 150-3000 meters, complete set, ideal for phones, music and time signals	80.00
No. CR-6 Reg. Receiver, 175-680 meters with 2 step amplifier self contained, complete set, splendid unit	200.00
No. CR-7 Reg. Receiver, 500-20000 meters, complete set, ideal for arcs	210.00
No. CR-8 Reg. Receiver, 175-1000 meters, "Relay Super-Special," complete set	80.00
No. CR-9 Receiver, 150-3000 meters, with 2 step amplifier self contained, complete set. Grebe's latest	130.00
No. ROCC Fixed mica condenser, .0002 MFD	1.00
No. ROCD Fixed mica condenser, .0005 MFD	1.20
No. ROCE Fixed mica condenser, .001 MFD	1.60
No. ROCF Fixed mica condenser, .005 MFD	3.80
No. ROCA Grid cond., .0002 MFD and ½ Meg. leak	1.20
No. ROCB Grid cond., .0002 MFD and 3 Meg. leak	1.20
No. RPDB Crystal Detector, dustproof	2.75

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No. RA Short Wave tuner, 180-700 meters, very selective and desirable unit	$65.00
No. CB Loading Coil, for use with Short Wave Tuner for time signals	5.00
No. DA Detector and 2 step amplifier, for use with Short Wave Tuner	65.00
No. RC Short Wave tuner and Det. and 2 step amplifier, complete set	125.00
No. DB Double crystal detector	5.00
No. DE Spare crystals for above detector.	1.00
No. DD Spare crystals for above detector.	1.00
No. RE "Aeriola" JR., Crystal Receiver, complete set, ideal for music	25.00
No. ME Motor-generator set, 100 Watts, 110 Volts, 60 cycle, AC motor, 500 Volts DC Generator	85.00
No. MH Motor-Generator set, 250 Watts. 110 Volts, 60 cycle AC motor, 1000 Volts DC generator	145.00

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In order to accommodate our ever increasing business we take pleasure in announcing the opening of OUR NEW STORE at PROVIDENCE, R. I., in the WOOLWORTH BLDG., at 193 Westminster Street, the very heart of the business section.

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Altadena Radio Laboratory

PAUL F. JOHNSON, Owner

▼ ▼

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Western Electric Company
Westinghouse Electric & Mfg. Company
Weston Electrical Instrument Company
Wireless Manufacturing Company
The Wireless Shop
Z-Nith Radio Apparatus

VACUUM TUBE TRANSMITTING CIRCUIT

Continued from page 10

ing the coupling between input and output without materially changing the period of oscillation of the circuit.

The standard Heising circuit found in practice is shown diagrammatically in Fig. 9. It will be observed in this figure that only two movable contacts on the inductance are necessary as compared to three in the case of Hartley's circuit. This simplifies the design to a certain extent. It may be well to state in passing, that admirable as this circuit is for low powered installations, it is not so well adapted to installations requiring great flexibility at high powers—this by virtue of the facts, that the inductance is all "hot," and that

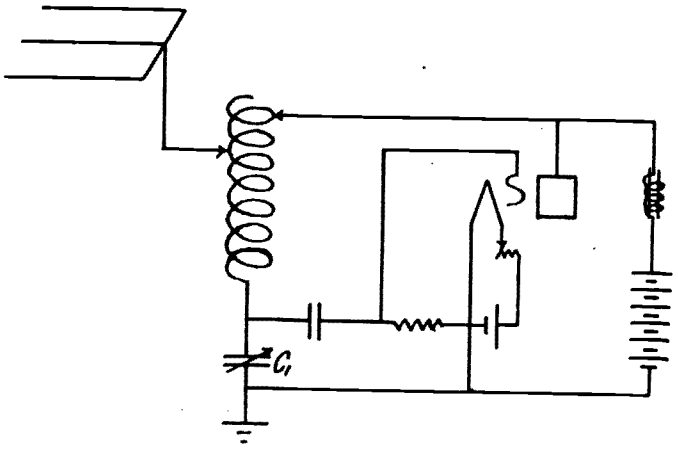


Fig. 9. Heising Circuit in Practice.

it is difficult to design a continuously variable capacity such as the one required at C without resorting to oil for the dielectric.

The Heising circuit employed by the Western Electric Company in the much used CW 938 sets is shown in Fig. 10. Here one finds that instead of connecting the negative side of the plate supply circuit to earth as in Fig. 9, it is connected to earth thru the capacity C_2. This is a protective

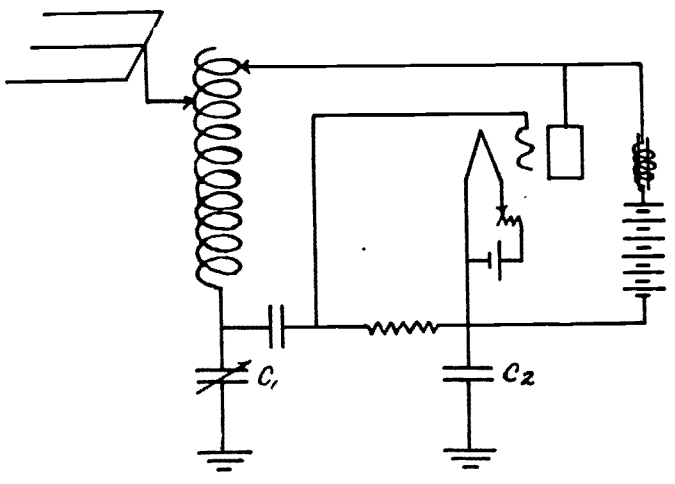


Fig. 10. Heising Circuit as Applied to the 938 set.

measure since in Fig. 10, if either the antenna becomes grounded or the capacity C_2 breaks down under an electrostatic or mechanical strain, the generator supplying the plate potential will not become short circuited. The condenser, C_2, should have a capacity in excess of 0.2 micro-farad.

To be continued

REGENERATIVE RECEIVER

Continued from page 11

loading coil was tapped at the 1st, 6th, 12th, 18th, 30th, 42d, 60th, 78th and the 95th turn, the three-bank winding starting in with the 43d turn.

The primary of the vario-coupler is wound single layer with 34 turns tapped at the 3d, 8th, 12th, 17th, 22d, 28th and the 34th turn, using No. 18 double cotton-covered copper wire. A primary switch of 16 points is mounted as shown in Fig. 1, giving a very large overlap in tuning this circuit. The secondary of the vario-coupler is wound with 20 turns of

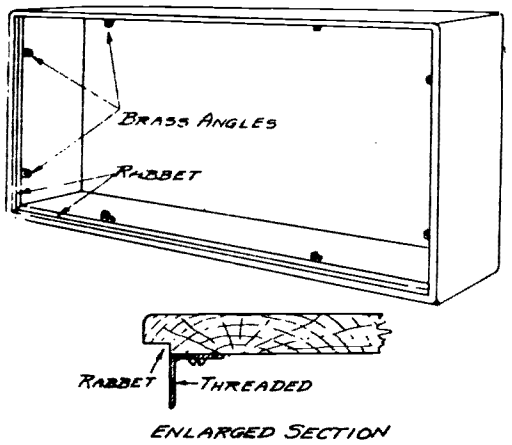


Fig. 3. Cabinet Construction

No. 20 double cotton-covered copper wire and it is found that this gives ample coupling even on the upper range of this receiver.

The series parallel switch and the short and medium wave switch are of the anti-capacity design, which were found to be very satisfactory for this work.

All units are mounted on a panel 11 by 22 by 1-4 inches, after it was polished in the following manner: It is grained by first sandpapering the surface with a piece of fine sandpaper and oil, in long even strokes the full length of the panel. Then steel wool and oil is used in the same manner until the surface is perfectly smooth. Next the panel is wiped off dry and then given a final polish with a clean piece of soft cloth. This will remove all scratches and roughness so common in the material on the market today.

The box can be built in many different ways, but it is suggested that it be made with a rabbet cut in the edge so that the panel can be made flush with the box. Fasten small pieces of angle brass by wood screws to the inside of the box as in Fig. 3. The panel is then secured to these by flat-head brass machine screws countersunk in the panel. This construction allows the panel to be removed from the box without disturbing the box if it is secured to the table or by other apparatus is mounted on the top or sides.

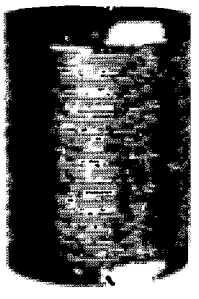
RADIO CENTRAL

Continued from page 7

The magnetic amplifiers installed at Radio Central meet these exacting requirements by providing a non-arcing control with a minimum current in the key circuit and by taking within themselves only a small proportion of the total antenna output. Briefly, the instrument may be called a variable impedance connected with the external circuit of the radio frequency alternator. This function is to reduce the voltage of the alternator and to detune the antenna system when the sending key is opened and to perform the opposite function when it is closed. Thus, when the sending key is opened, the magnetic amplifier short circuits the alternators and detunes the antenna system, thereby reducing the antenna current to a negligible figure. When it is closed, the output of the alternator is fed to the antenna system.

< STANRAD >

6EN Works 1000 Miles on 10 Watts CW
You Can, Too!
With Apparatus Designed for
RESULTS EFFICIENCY SERVICE



The "STANRAD" inductance is built for RESULTS — that's what you want—RESULTS!

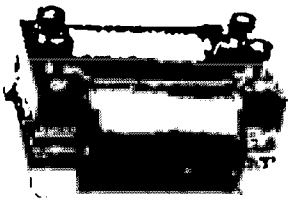
It has 54 turns of copper wire wound on a 4-inch threaded formica tube. The wire cannot slip or come loose.

The margin at each end makes it easy to mount by means of brackets, mounting posts, etc.

One or two-coil winding....$5.00
Threaded tube only..... 3.75
Inductance for 100 watts...10.00

The choke coils are wound on fiber spools. This eliminates breakdowns. Binding posts are provided for connections, and aluminum feet to simplify the mounting. The inductance, approximately 3 henrys, is enough to clear the worst hum.

500 M. A.....$7.50
150 M. A..... 6.00



If your dealer cannot supply you, write direct.

STANDARD RADIO COMPANY
1048 So. Olive St., Los Angeles, California

MURDOCK No. 56
RADIO RECEIVER



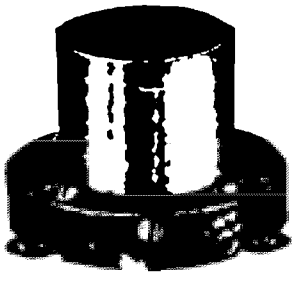
2000 Ohm Double Set **$5.00**
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CW Transmitter and Receiver Parts



TYPE 156 SOCKET

The experimenter who has had previous experience with the assembly of receiving and transmitting sets has learned the necessity of having every unit perfect. Entirely aside from the gain in efficiency, he has found the advantage of using apparatus in which the greatest care has been given to construction details.

General Radio apparatus is designed with this end in view. A noteworthy example is the Type 156 Vacuum Tube Socket.

This socket is adapted to any of the standard American four-prong transmitting or receiving tubes. It is adapted to the Western Electric VT-2 tube, as well as to the Radiotron UV-200, 201 or 202 tubes. The contact springs are sufficiently rugged to carry the filament current of the five-watt transmitting tubes without arcing.

Price $1.50

This is but one example. Others are Amplifying Transformers, Modulation Transformers, Tuning Inductances, Hot Wire Meters, etc. SEND FOR FREE BULLETIN 909-C describing these and other instruments.

General Radio Company

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Standardize on General Radio Equipment Throughout

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Special: **Both heavy nickel plated**
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A unique and practical preparation for the Resistance of Grid Leaks and resistance Units

Resistohm—Makes it possible for anyone to make grid leaks, and in various values from 10,000 to 3,000,000 ohms resistance.

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Resistohm—Appreciated by those who desire the highest efficiency in their detector circuit and in each stage of amplification. Ideal for the grid leakage of the power amplifier, where a low resistance leak may be required.

Resistohm—Will popularize the use of resistance coupled, radio frequency amplifiers, due to the simplicity of resistance variation.

It cannot be stated offhand the proper value for the resistance of the grid leak for any particular set. However, with RESISTOHM the proper value may be quickly arrived at by experiment and the added efficiency realized.

Experts concede that the grid leak is the most practical way of controlling and maintaining the proper potential of the grid.

One bottle of RESISTOHM will furnish enough resistance material to construct numerous grid leaks and carry on many experiments, where a reliable resistance compound is required.

$1.00 prepaid, United States and Canada

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Dealers—Here is something new, easy to sell, and proposition is good.

PACIFIC RADIO EXCHANGE

439 CALL BLDG., S. F. CAL.

THE HAMBURGER RADIOPHONE

The radiophone installation at Hamburger's Department Store, Los Angeles, is broadcasting press and concerts from 4 to 5 p. m. daily and from 8 to 9 p. m. on Monday, Thursday and Saturday. This equipment is operated by the Leo J. Meyberg Co. under the direction of Hall Berringer, manager of their Los Angeles store.

The installation is a duplicate of the 5-watt set operated by the Meyberg Co. at the Fairmont Hotel, San Francisco. Two 50 ft. poles erected on the roof of the store support a 60 ft. "T" aerial leading to a special radio room especially built for this purpose.

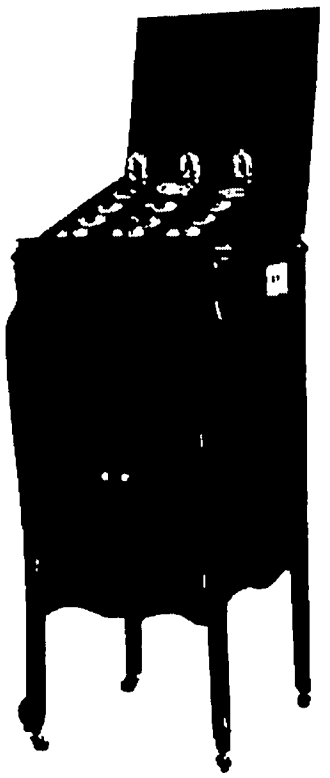
Some excellent long-distance work has already been accomplished, two of the Pacific Mail steamers reporting that it was heard at Panama. It was also heard 1800 miles west of Los Angeles by S. S. *West Nixton,* and 1500 miles out to sea by the operator on S. S. *Richmond.*

An important and novel service furnished in addition to the usual broadcasting from this station is a free school of instruction for radio amateurs. This school has accommodations for fifty students, there being individual booths for each student. Three hundred students are enrolled, they being given instructions once a week. Mr. G. A. Helmer, an old time commercial operator, is in charge.

NEW RADIO BOOKS

Quiz Book—By James E. Smith, 107 pages, 6 x 9, 81 illustrations, paper cover, published by National Radio Institute, Washington, D. C., for sale by RADIO, Pacific Bldg., San Francisco. Price, $1.

This excellent compilation of practical questions and answers is just what is needed for study by the man intending to take the examination for a radio operator's license. While it is by no means a text-book, it systematically reviews the operating principles, constructive features, diagrams of connections, maintenance and repair of radio equipment used in commercial stations. Its contents also include the essential laws governing radio communication, together with useful formulæ and tables used in the solution of radio problems. Questions 1-13 are devoted to measuring instruments; 14-107 to spark transmitters; 108-113 to impulse transmitters; 114-137 to arc transmitters; 138-147 to tube transmitters; 148-172 to damped wave receivers; 173-175 to undamped wave receivers; 175-207 to radio laws and regulations; 208-214 to the radio compass; 215-244 to storage batteries, and 246-250 to miscellaneous matters.



Merely connect this receiver to an aerial and ground—push a switch—that's all. A child can operateit

The Radiola

A non-regenerative Receiver that reproduces radio concert music to the highest degree of satisfaction

MAGNAVOX

Reproducer with the movable coil attached to a specially constructed sound box results in maximum volume of sound with a minimum of distortion.

No home is complete without a Radiola.

THERE is radio music in the air during several hours of the day and evening. This music can be brought directly to your home—the living voices of your favorite artists reproduced by radio in the privacy of your drawing-room. The symphonious preludes and sonatas—the eccentric movement of the fox-trot or jazz—the regular broadcast of radio news of the world—market reports—stock quotations and instructive radio lectures—all of these, and more, can be enjoyed by you if your home includes a Radiola.

No knowledge of electricity or radio is required to operate this instrument. No complicated tuning or electric circuits to juggle—nothing to get out of order. Simplicity has been the keynote in constructing and developing the only instrument of its kind on the market—The Radiola. It is not an experiment. Extensive research work by radio experts in our laboratory has resulted in offering to the public the highest type of radio concert receiver known. It must not be confused with the usual type of phonograph as no records, disc or cylindrical, are used. It has been named the Radiola because it picks up the concerts from the air—the best in music that is broadcasted daily for the pleasure of mankind.

The Radiola is a complete radio receiver. The tuning instruments, amplifiers, batteries, loud speaker and adjustment controls are all combined into one unit. A storage battery for filament lighting and a rectifier for battery charging, as well as a hydrometer test set, are compactly arranged in the lower portion of the Radiola cabinet. A storage battery charge and discharge switch is connected in such a manner as to allow charging of the battery whenever necessary. In view of the fact that the various radio telephone stations in and around San Francisco are all operating on the same wave length it will not be necessary to make bothersome tuning adjustments to pick up these stations. Just push the switch—and listen. Three steps of power amplification in conjunction with the Magnavox Radio Reproducer will allow of any desired intensity of the receiving signals. Suitable connection posts are provided for the aerial lead and ground wire—the only exterior devices necessary for operating the Radiola. The complete equipment can be installed in any home in a few hours and expert radio service will be rendered to the purchaser of every Radiola.

The World Brought to Your Home With the Radiola

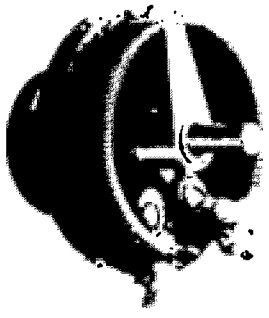
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PRICE $1.25

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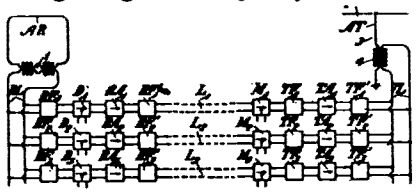
RECENT RADIO PATENTS

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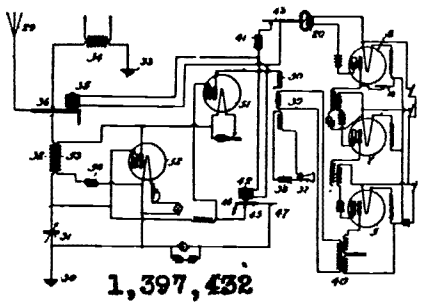
be made much sharper than with ordinary open circuited systems. The apparatus may also be used for directive signaling.

L. Espenschied, 1,397,093, Nov. 15, 1921. Radiorepeating system.

A multiplex repeating system is described, so arranged that there should be minimum interference between the received and transmitted signals. One manner in which this may be effected is by making the receiving antenna AR of loop form, with its plane perpendicular to the line drawn between the receiving and transmitting antennæ. A plurality of lines, L_1, L_2 and L_3 are used for transmitting the several signals simultaneously received. Filters RF_1, RF_2 and RF_3 are used for separating the several frequencies into their proper channels. Detectors D_1, D_2 and D_3 of special construction may be used to transmit only the low frequency signals and not any of the high frequency carrier. Amplifiers RA_1, RA_2 and RA_3 are used to amplify the signals, and filters RF_1', RF_2' and RF_3' for insuring that only the magnified signaling low frequency current is



1,397,093

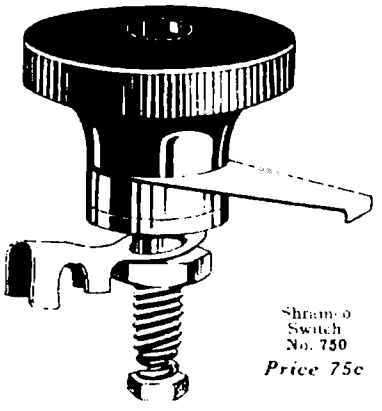


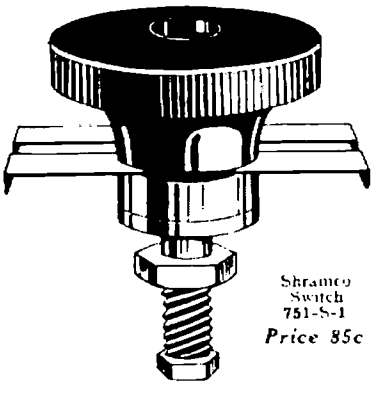
1,397,432

transmitted. In order further to reduce the interference between the two antennæ, there are provided modulators M_1, M_2 and M_3 for translating the frequency of the signals. Amplifiers and filters TF_1, TA_1, TF_1', etc., may also be used at this point. Due to the change in frequency of the signals, and the construction of the antennæ, but a very small amount of energy is impressed from the transmitting antennæ TA upon the receiving antenna RA.

C. V. Logwood, 1,397,432, Nov. 15, 1921. Signaling system.

A 3-stage thermionic amplifier including tubes 5, 7 and 8 is utilized to control a polarized relay 20. This is effected by allowing the last audion 8 to become "paralyzed" due to the accumulation of a negative charge on the grid of this au-





Two Shramco Switches

YOU can hardly afford to take chances of losing efficiency by getting along with poor switches. Either of these two styles will distinguish itself by smooth operation and sure contacts, in addition to the handsome appearance. Both have polished nickel finish and are furnished with large Marconi type knob. Bearing block and panel bushing ¾ inch in diameter. For use on all panels up to ½ inch thick. Blades, spring phosphor bronze. No. 750 type has spring tension adjustment; switch radius, 1½ inch.

No. 751-S-1 type is provided with split lock nut; blades have 1 inch radius, ½ inch from center to center, and are securely held in place. If your dealer cannot supply you, send your order direct, postage extra. Dealers who have not a supply of Shramco switches should write for proposition at once.

SHOTTON RADIO MFG. CO., Inc.

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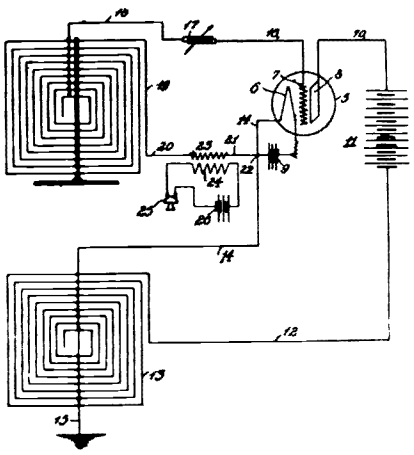
SCRANTON, PENNSYLVANIA

Catalogue "K," listing a complete line of high grade parts at reasonable prices, sent to any reader of Radio for five cents in stamps.

dion. The circuits controlled by relay 20 are so arranged that the antenna 29 may be used either for reception or transmission, depending upon whether the audion 8 is paralyzed. In the conditions shown the antenna is connected to a receiver circuit 33, 34, the relays 20, 35 and 42 being energized. Upon transmitting audible signals to the telephone transmitter 37, the audion 8 is paralyzed, relay 20 opens its contact at 43, and relays 35 and 42 drop their armatures. The antenna is then connected to the transmitting circuit including audions 51 and 52, and may radiate signals transmitted through transmitter 37 and coil 50.

Henry K. Sandell, 1,391,855, Sept. 27, 1921. Wireless transmitting system.

A transmitting system is described, in which the oscillations are produced by an electron tube 5. The main feature of this patent is the manner in which this tube is made to oscillate, consisting of



inductively coupling the input and output circuits of the tube. This coupling is effected by the looped antennæ 13 and 19, placed near each other and located respectively in the output and input circuits. Both loops are adjustable so far as length is concerned, and loop 19 is furthermore rotatably adjustable, to obtain the best effect. Signaling may be effected in any well-known manner; for example, by varying the current in the input circuit by means of the telephone transmitter 25 inductively connected to it.

6XAD was heard Dec. 11 by 8LX, Crafton, Pa. Full results and announcement of reward in prize contest will be published in February RADIO.

TYPE HR Regenerative Receiver

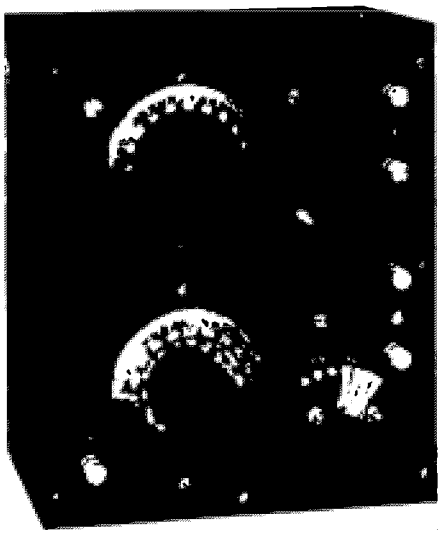
Wavelength 180-825 Meters. Perfect Regeneration at all wavelengths. No capacity effect from the hand or body. Antenna condenser built as a Vernier. Compartment inside cabinet for "B" Battery, or External "B" Battery may be used. The control is wonderfully simple—the best you have ever used.

We absolutely guarantee this set to give results equal or superior to any on the market regardless of price. Set includes tube socket and rheostat and is completely wired ready for use. Cabinet of dark oak with hinged cover. We believe it represents the greatest value ever offered in radio and the owner of this set will have a surprise for the owner of more expensive equipment.

Next month we will show in this magazine another unusual development—watch for it!

Our complete catalog in three parts is full of equally attractive items and describes every radio essential from the smallest item to the largest.

We absolutely guarantee this set to give results equal or superior to any on the market regardless of price.



COMPLETE SET $35

Licensed under Armstrong U. S. Patent 1113149

Remember you can not buy greater performance at any price and this equipment is backed by the oldest manufacturers of radio in the United States. Order from your dealer or from us if he won't supply you. You don't have to experiment with unknown products unless you want to. The price of H. R. Regenerative Receiving Set complete with tube, B. Battery, 2000 ohm telephones and storage battery, $65.00, includes everything except antenna and ground.

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RADIO ENGINEERS AND MANUFACTURERS

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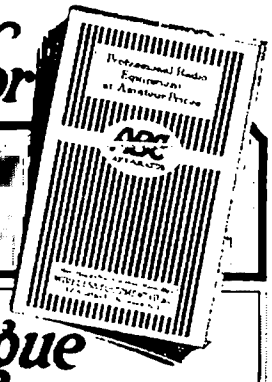
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Unwired Regenerator $22.50



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These apparatus are constructed with the best materials and workmanship. They have no superior at any price. Apparatus fully guaranteed. Send for descriptive bulletin immediately.

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C.W. TRANSMITTER AT 6BAK

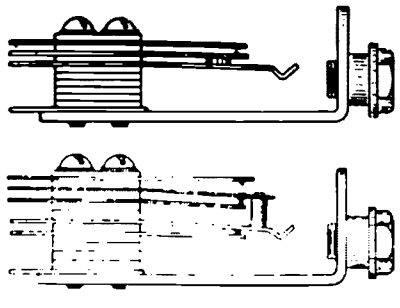
Continued from page 6

The antenna consists of a five wire inverted "L," spaced 2½ ft. and 70 ft. long, mounted on iron supports on top of the old Post Road Garage. It is 40 ft. above the counterpoise, which is placed under the floor on insulators. It is made up in the shape of a wheel and the lead-in is taken from the center.

Some great distance work has been done both on phone and C. W. and all reports are very little QSS and very QSA.

Music has been heard in Chicago when the set was only radiating .8 ampere.

The high frequency choke coil in each of the secondary leads of the filament heating transformer keeps the high frequency out of the ground system. When one realizes that we are only radiating from .8 to 1 ampere and that stations in the 8th and 9th districts report our signals very QSA we certainly are to be congratulated on this transmitter.



Simplify Your Radio Set

Eliminate innumerable switches and complicated controls by equipping your radio Detector and Amplifying units with

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Filament Control Jacks

Simplify operation; save current; make your set up-to-date and efficient.

Write for illustrated circular describing Federal Filament Control Jacks and Plugs

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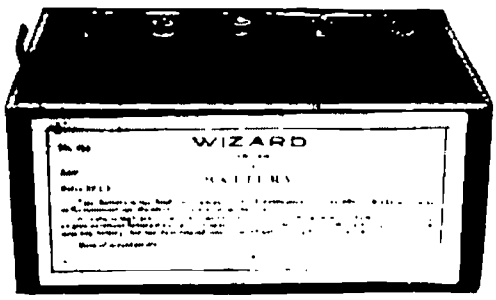
Buffalo, N. Y.

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Wizard's 2 new improved type "B" Batteries

No. 1632, 1 Tap, 45 Volt Variable Battery. Size 6 in.x6 in.x2⅜ in. Price $2.80. Weight 3¾ lbs.

No. 1630, 6 Taps, 27 Volt Variable Battery. Size 6x3x2⅜in. Price $1.80. Weight 2½ lbs.

These new types are not made of the same size cells as a small size "B" Battery. The volume of a cell used in these types is 4.7 cubic inches, as compared with 2.5 cubic inches, the volume of a cell used in the small "B's".

You can easily see that the life of these two types are almost double the life of the small "B's".

No. 1632 has one tap at 22½ volts.

These prices seem unbelievable, as do all other "WIZARD" prices, but are made possible only by dealing direct with the consumer.

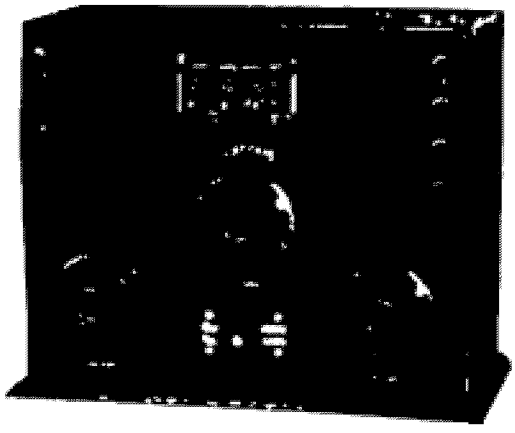
Look for our February issue ad for low prices on wireless apparatus.

Cat. No.		Size.	Taps	Volt-age.	Wt. lb.	Price
1623	Plain	3⅜x2½x2		22½	1	$1.00
1623	Variable	3⅜x2½x2	5	22½	1	1.20
1625	Plain	6⅝x4 x3		22½	5	1.85
1625	Variable	6⅝x4 x3	5	22½	5	2.25
1626	Plain	6⅝x8 x3		45	10	3.75
1626	Variable	6⅝x8 x3	6	45	10	4.15

Send all money orders to

Wizard Battery Co.
1315 42nd St., Brooklyn, N. Y. Dept. B

ASSEMBLED-BUT NOT WIRED



Multiple Wave Tuner—Here you obtain in a single instrument the equipment to receive all classes of signals on all known wave-lengths,—150 to 25,000 meters. It responds to both damped and undamped waves, and is equally efficient for both wireless telephone and telegraph. Minimum number of controls provide extreme simplicity of operation, yet the design renders the tuning especially sensitive and selective. Equipped with DeForest triple-coil mounting and Chelsea condensers. Enclosed in handsome oak cabinet.

Price, completely assembled. F.O.B. New York, $45.00

Set of 18 DL Coils, to receive all the most used wave-lengths, **$40.00.**

Complete set of parts, ready for assembly, **$39.65.**

With the addition of a Crystal Detector, the "Standard" Audion tube control for **$12.50,** or the Detector and two-step described below, you have a complete receiving station, lacking nothing in range or efficiency.

WIRE YOUR OWN—SAVE MONEY

"Standard" radio instruments—*assembled, but not wired*—solve your problem of getting commercial grade apparatus at prices but little more than the cost of the parts. Here, briefly, is the "Standard" plan:

There are two distinct parts in building complete radio instruments: the actual panel drilling, mounting, etc., which is essentially machine work; and the wiring, which is hand work.

The Standard Assembling Company buys the parts at wholesale prices, and does all the assembling work with the proper machine equipment. This, of course, requires a well-equipped machine shop, not available to the average amateur, and produces a quality of work you could not possibly duplicate.

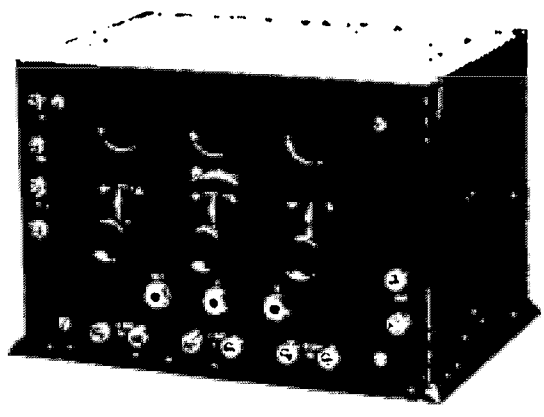
But the wiring is hand work, and *you* can do it as well as it can be done at the factory. And because it *is* hand work, it is the most expensive part of the assembly. So right here is where you save the biggest part of the expense. Besides, you probably have your own ideas about wiring.

By buying "Standard" instruments you get the appearance and results of high-grade, correctly assembled apparatus, and at the same time you save all the expensive wiring costs. Only in this way can you secure the combination of machine work where it is necessary, and a price that is only slightly more than a miscellaneous group of parts would cost you. The two instruments shown on this page are excellent examples of the "Standard" plan. Where else could you ever hope to get such handsome, efficient instruments for the prices quoted?

Either of these instruments will be shipped to any part of the United States on receipt of one-third the purchase price. Examine it carefully. Then if you are fully satisfied that it is the best radio purchase you ever made, remit the balance. Otherwise, simply return the instrument and we will refund your money, less carrying charges. Could we make any fairer offer? Then

Take this Opportunity to try the "Standard" Plan at Our Risk.

Detector and Two-Step Amplifier—Your choice of two types, Commercial or Amateur. The commercial type is assembled from the most costly, efficient units available. Radio Corporation UV-712 transformers and General Radio tube receptacles typify the quality thruout. The Amateur type is an exact duplicate, except that transformers and sockets of high efficiency, but lower cost, are used.



Prices, F.O.B. New York:
Commercial type, unwired.....$55.00
Amateur type, unwired..... 47.00

Here is clear saving of $10.00 in either case, thru the "Standard" Plan.

Also offered, fully wired, ready-to-operate, at
Commercial type, wired.....$65.00
Amateur type, wired..... 57.00

Complete set of parts, ready for assembly:
Commercial type.....$42.00
Amateur type..... 35.00

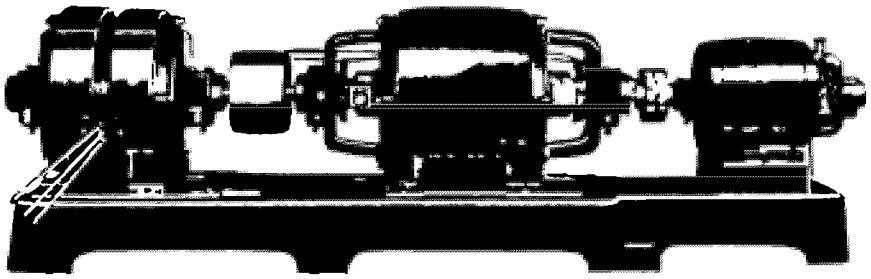
Send 2c stamp for literature describing the complete line of Standard instruments.

STANDARD ASSEMBLING COMPANY

19 Bridge Street, Dept. A, New York

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GENERATORS—MOTOR-GENERATORS—DYNAMOTORS



4 to 32 Volts for Filament—350 to 2000 Volts for Plate.
Capacity 20 to 2000 Watts—Liberal Ratings.
Write for Bulletin 237, which lists over 200 Combinations.

MOTORS AND GENERATORS DEVELOPED FOR SPECIAL PURPOSES

PIONEERS IN MANUFACTURING

High Voltage Direct Current Radio Generators

Electric Specialty Co.

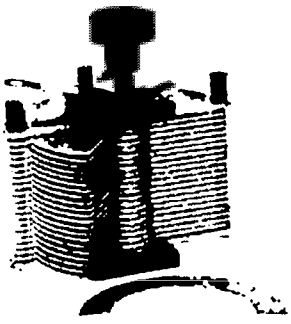
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217 South Street

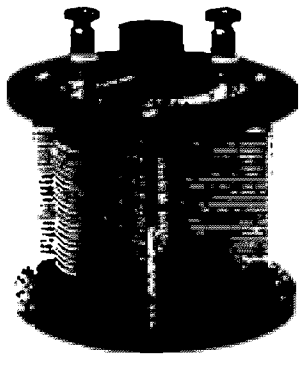


"ILLINOIS" THE RELIABLE

MADE RIGHT - STAYS RIGHT



STYLE No. 1.



STYLE NO. 2.

Three Styles: No. 1, Panel; No. 2, Open Type as shown; No. 3, Fully Encased. Anti Profiteer. Less than pre-war prices. Fully assembled and tested.

	Style No. 1	No. 2	No. 3
67 Plates,	$7.00	$8.00	$8.50
43 "	3.50	4.50	4.75
23 "	2.75	3.75	4.00
13 "	2.25	3.25	3.50

Money back if not satisfied. Just return condenser within 10 days by insured Parcel Post.

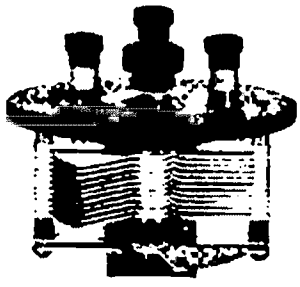
Options:—With Style No. 1—Instead of Scale and Pointer, a 3. inch Metal Dial at 50 cents extra, or a 3. inch Bakelite Dial at $1.00 extra. Large Knobs. Both excellent values. Or we will, if desired, supply the Condenser with smooth 3/16 inch center staff, without Scale, Knob and Pointer, at 15 cents off the list to those who prefer to supply their own dial.

Vernier with single movable plate applied to 13, 23 or 43 plate condenser, $3.00 extra.

We allow no discounts except 5 per cent on orders of 6 or more.

Sent Prepaid on Receipt of Price

Except: Pacific States, Alaska, Hawaii, Philippines and Canal Zone add 10c. Canada add 25c.
Foreign Orders other than Canada not solicited.



VERNIER

G. F. JOHNSON, 625 Black Ave. **Springfield, Illinois**

Tell them that you saw it in RADIO

ALLOCATION OF FREQUENCIES

Continued from page 15

As present information on the spacing of waves does not justify present action it is recommended that the paragraph concerning spacing waves in Article LXXXII of the Washington draft be suppressed.

Allocation of Long Waves to Fixed Stations

As a general rule, the lower frequency waves should be used for the longer distances and the higher frequency waves for the shorter distances. For ranges below 4,000 kilometers no wave length above 12,000 meters should be used and for ranges above 4,000 km. no wave length below 8,000 m. should be used. For distances above 1,500 m. the wave length in meters should not exceed three times the range in kilometers.

Each nation should use only the smallest possible number of wave lengths necessary to carry out its radio communications, and this number should be based on its traffic requirements. Radio telegraph stations are bound to exchange traffic with the minimum of radiated energy necessary to ensure good communications. Waves emitted should be as pure and as uniform as possible, and especially as free as possible from harmonics.

It is desirable that some equitable distribution of frequencies below 105 kc/s (wave lengths above 2850 m.) should be made. In order to permit the study of the world needs for these each nation should furnish its representatives to the next International Conference with a table, giving the data, relative to each station on its own territory in actual operation, or to be placed in operation during the subsequent period of five years.

A nation, before employing a new frequency, should endeavor to utilize the directional properties of radio, whereby its communications may be increased by employing the same frequency a plurality of times.

Distribution of Wave Lengths

The distribution of frequencies and wave lengths to the various services is graphically shown in the accompanying diagram. Note *a* in the diagram refers to the fact that the 429 kc/s (700 m.) damped wave should not be used by ships because of its liability to interfere with 600 and 800 meter damped waves and with 700 meter continuous waves. Its use was not prohibited but left for the decision of the receiving land station as to whether the 725 or 700 meter wave be used if it is not interfering with other traffic.



32 Long Hours

he wore Brown Phones

H[illegible] Powell [illegible] at the [illegible] Brown Phones [illegible] SOS

[illegible] light weight [illegible] Brown Phones [illegible]

You can enjoy this same comfort and light weight daily. Brown Phones, with [illegible] and rugged protecting shells, are now for sale at leading radio dealers at these reduced prices

Type A (adjustable) was $22.00, now $18.00
Type D (for phone work) was $20.00, now $16.00

(Either type equipped with Extra Round Cord for $1.00 extra)

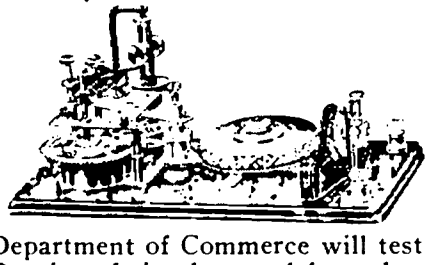
John Firth and Co. Inc. 68 Broadway N. Y. Distributors.

BROWN PHONES

LEARN THE CODE
With the OMNIGRAPH

If you own a Receiving Set and don't know the Code, you are missing most of the fun. It's just like owning a watch with no hands.

The **Omnigraph** Automatic Transmitter will teach you the Code—at home—in the shortest possible time and at the least possible expense. Connected with Buzzer or Buzzer and Phone, the **Omnigraph** will send you unlimited Radio messages at any speed you desire. No hard, laborious work—just learn by listening.



The **Omnigraph** will bring an expert operator right into your home, ready at all times to send you perfect Code messages at from 5 to 40 words per minute.

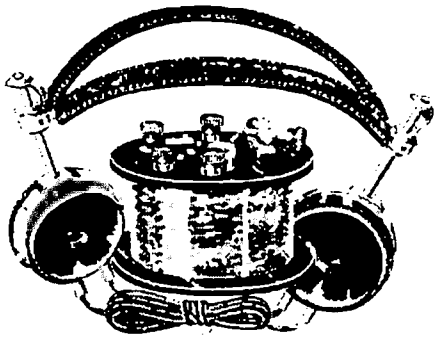
The **Omnigraph** is not an experiment, but a proven success. It is used by several Departments of the U. S. Government. In fact, when you apply for a Government license—and you will some day—the Department of Commerce will test you as to your ability to receive by means of the **Omnigraph.** The **Omnigraph** is also used by a large number of the leading Universities, Colleges and Radio Schools throughout the country. Thousands of Amateur and Commercial operators owe their success to the **Omnigraph.** Send for free Catalog describing three models—$14 to $30—or order through your favorite Wireless dealer. Do it today. The **Omnigraph** is sold under the strongest of guarantees—if not as represented, your money back for the asking.

THE OMNIGRAPH MFG. CO., 26-E Cortlandt St., New York City

We also manufacture the OMNIGRAPH RADIO RECEIVING SET. A complete Vacuum Tube Set including Tube, a pair of 2,000 ohm Phones, A and B batteries, Aerial Wire, Safety Switch, Insulators and Ground Clamp. Enclosed in a carrying case, handsome enough to install in your parlor or sitting room. Price $47.00. Not the best set on the market, but nothing to approach it at anywhere near the price. Complete in every detail, nothing additional to purchase. Erect your Aerial in a couple of hours' time, place the Phones to your ears and listen-in. Sold under the same strong guarantee as we sell its brother—**The Omnigraph Transmitter.**

Say Radio to the Advertiser, it will help you.

Special Complete Receiving Set



1 pr. Murdock No. 56-2000 ohm phones	$6.00
100 ft. pure copper aerial wire	.75
2 pr. glazed cleat insulators	.10
1 approved ground clamp	.25
1 portable-600 meter receiving set and guaranteed crystal detector	5.00
Total	$12.50

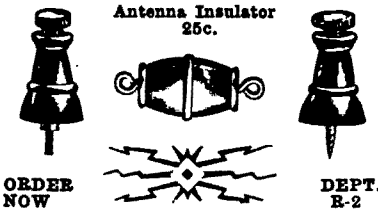
FOR A SHORT TIME ONLY, $10.50

We carry a full line of all the best Wireless Apparatus and Parts.

Murdock	Firco
Acme	Federal
DeForest	Eby
Westinghouse	Brandes
Grebe	Baldwin

Binding Post for C. W. 82c — Wall Binding Post 80c

Antenna Insulator 25c.



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BEACON RADIO AND ELECTRIC CO.
246 Greenwich St., New York City.

Arnold Radio Service Station

Any make of wireless set repaired, remodeled or rewired. Apparatus built to order. Parts and accessories always on hand. Send 3c stamp for catalogue.

J. F. ARNOLD
2082 Lexington Ave., New York City
Near 125th Street — Established 1910

You Should See

RADIO TOPICS

In its new Rotograve form

It is the most attractive and interesting Radio Magazine that you have ever seen.

The November number is published in this new modern Artgrave style.

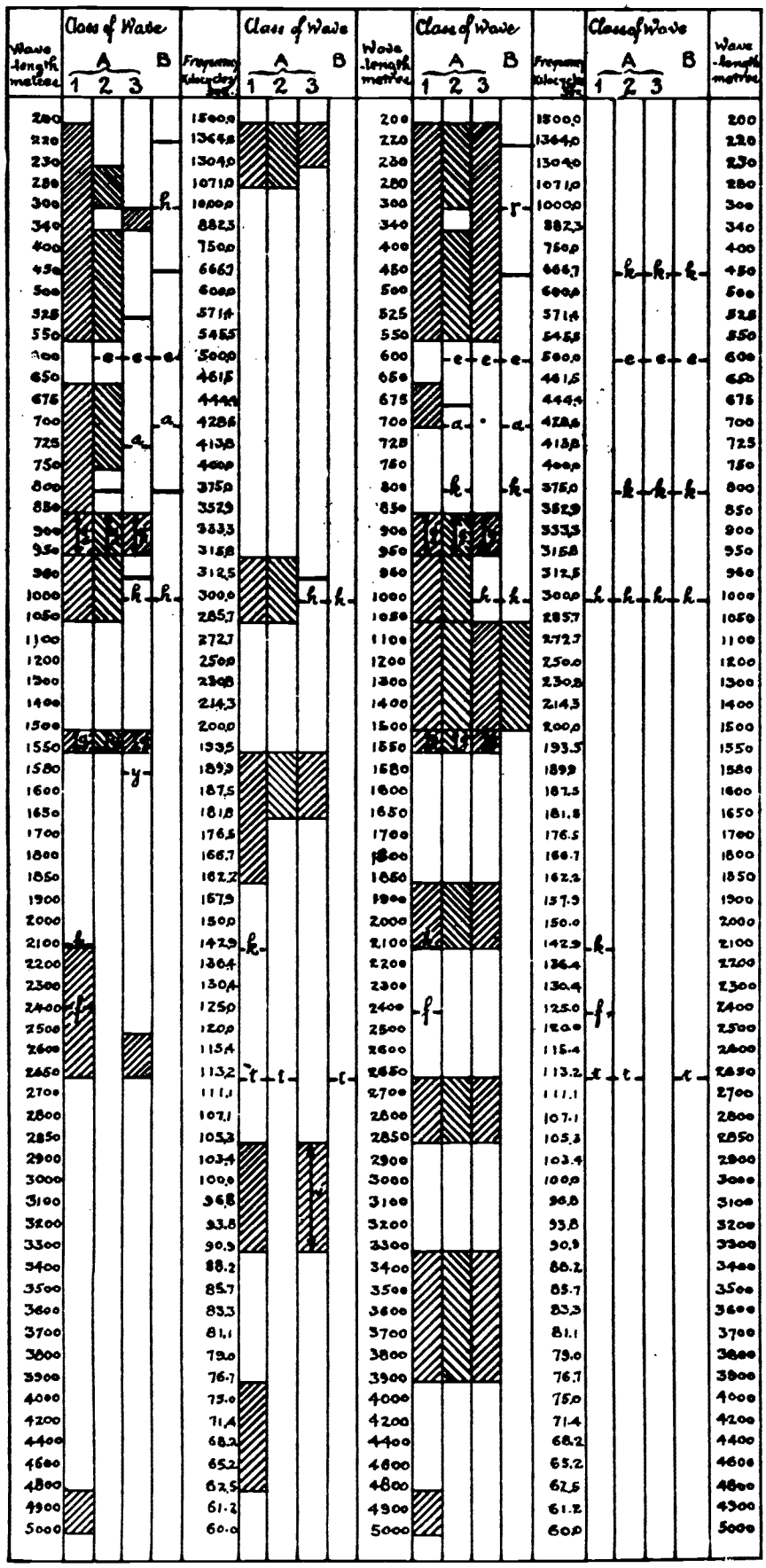
Send 15 cents for a Sample Copy.

RADIO TOPICS

RADIO TOPICS
4533 N. Sawyer Ave., Chicago, Ill.

GRAPHICAL REPRESENTATION SHOWING DISTRIBUTION OF FREQUENCIES AND WAVE LENGTHS TO VARIOUS SERVICES

Mobile Services *Fixed Services* *Military Services* *Special Services*



Tell them that you saw it in RADIO

Note *e* refers to the fact that the 600 meter wave may be used only for calling distress or radiogoniometric service.

Note *f* is to emphasize the fact that the band from 2100 to 2650 meters is a calling wave for mobile and military services only. Note *g* likewise calls attention to the fact that 850 to 950 meters are reserved for aircraft services only; note *h* that 960 to 1000 is reserved for beacons which should not exceed a range of 10 nautical miles for mobile radio beacons, 30 nautical miles for fixed radio beacons and 200 nautical miles for long range radio beacons.

Note *k* refers to reservation of 700 to 850 meters for radiogoniometric service; note *r* to the suppression of 300 meter damped waves after Jan. 1, 1923; note *t* to reservation for time and metereological signals. The bands "w" and "y" may be used as shown if they do not interfere with communications of fixed stations using a wave of type A1.

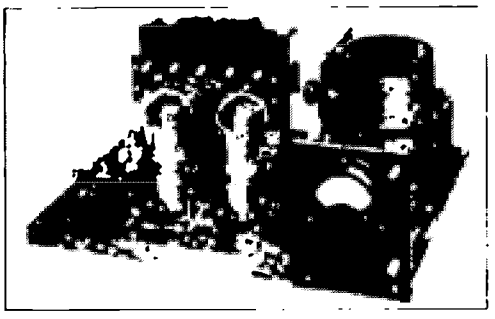
It is recommended that 300 to 340 meters be used for radio telephony in general; that 725 meters for mobile services; that 1500 to 1550 meters for radio communication between fixed stations and that no radio telephony be permitted for trans-oceanic service on waves between 7000 and 8000 meters, although experiments may be conducted thereon if they do not interfere with normal radio services.

After a date yet to be fixed, it is recommended that the 600 meter wave shall not be employed for time signals, metereological bulletins and warnings to navigators except by mobile and land stations for telegrams of an urgent character involving the safety of navigation.

The Administration concerned may determine whether radiogoniometric coast stations should give bearings to ships on 450, 600 or 800 meters. All such stations must be able to receive bearings on 600 meters.



An Amateur C. W. Set That You Can Easily Assemble Yourself



Connects directly to 110 volt A. C. lighting circuit—Approximate Range 400-500 Miles – Conservative Range 250 miles. The approaching Radio season will well show a decided increase in C. W. transmission.

The remarkable ranges which may be obtained by even the most simple C. W. transmitter have changed the entire amateur outlook. Previous to the event of C. W. transmission a range of 50 to 100 miles was average work. Today an amateur—skilled or unskilled—can assemble a simple C. W. transmitter which will surpass his expectations. The illustration above shows a simple C. W. set, the parts of which are attached to a baseboard. Anyone can assemble this outfit and wire it up. We have selected the necessary units for assembly, as follows:

Parts for Amateur C. W. Outfit

1 "Acme" 200 watt power transformer	$20.00
2 Radiotron UV 202 5 watt transmitting tubes	16.00
2 "General Radio" tube sockets	3.00
1 "National" Rheostat, 3 ohms, 6.5A	5.00
1 "Tuska" 3-circuit inductance	12.50
1 Grid Leak. 10,000 ohms	1.25
3 Condensers	3.00
1 C. W. Key	3.00
1 Radiation meter 0-2.5A, T. A. W.	5.00
1 B. D. Panel for meter (with pole and binding post)	1.50
1 Wood base (stained)	1.50
Complete parts, packed, ready for shipment	72.25

ATLANTIC RADIO CO., Inc.

727 Boylston Street
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We have a liberal supply of the Radio Corporation's new Instruction Book on C. W. Operation, and will gladly send you a copy direct, at once, on receipt of 25 cents.

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Portland, Me.

THE MODULATOR

Published by Members of the
RADIO ASSOCIATION OF GREATER NEW YORK
"Written for Amateurs by Amateurs"

THE MODULATOR

Is the only Magazine devoted exclusively to C. W Real practica
"How to Make" articles, written by men who know.

Subscribe now at $1.00 per year, as the rate will soon be raised to $1.50. Help your brother amateur put it over.

THE MODULATOR PUBLISHING COMPANY
179 Greenwich St., New York City.

Tell them that you saw it in RADIO

BUILT WITH BLUE PRINTS

1 A D R Boston, Mass.,
Oct. 25, 1921.

Experimenters Information Service,
45 Pinehurst Ave., New York City.

Gentlemen:

Have recently finished my 160 to 1000 meter Improved Armstrong Regenerative Receiver in accordance with your BLUE PRINTS Nos. 30021, 22, 23, 24.

I believe you will be interested in the success I have experienced in the initial tryout. On Oct. 22nd between 10:25 PM and 11:00 PM the following 600 meter stations were heard. In all instances the signal strength was remarkable. Most of them were quite easily read with the phones on the table:

GDLB, WCC, KIJJ, WCY, WLC, WNY, MTK, MSA, WSA, NAH, PEC, GBZW, FTS, KEKD, KXC, IBE, VBG, GCTN, WCI, NRH, KEXM, VBH, KDHS, KDFO, KOJR, NBD, NAJ, NGE.

On the following evening, Oct. 23rd, between 11 PM and Midnight the following amateurs were heard between 200 and 350 meters. Second district amateurs are not listed as there were over 30:

3ZA, 3KM, 3ACE, 3ZY, 3CN, 3HA, 3OU, 3BEA, 3UQ, 3AEE, 3BP (C), 4GL, XFI, NMW, 5DL, 5XO, 8SP, 8AGK, 8AYN, 8AHH, 8AFD, 8XE, 8ZZ, 8BAB, 8AU, 9ZJ, 9LQ, 9AWU.

The only amateurs that I have listed are those that were sufficiently loud to enable continuous reception. There were many others in the 4th and 5th district that could not be distinguished because of local and 2nd district QRM.

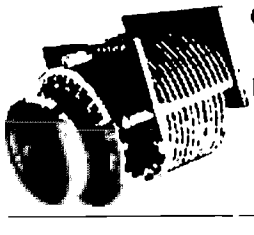
The results on 600 meters are infinitely better than any observed while operating for the commercial companies and U. S. A. Transport Service where I had the opportunity for comparison of the best types of American, English and German receivers.

The results on 200 meters speak for themselves. I have never been able to even approximate this with any type of two variometer receiver.

The ability of your receiver to isolate and make readable distant stations thru QRM is proof of its great selectivity. This work was all done on an antenna 40' high and 40' long using standard detector and 2 stage amplifier.

Yours very truly,
Signed: EDWIN E. TURNER, JR.

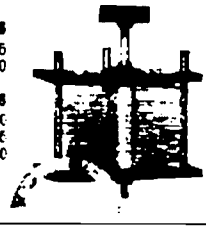
Bulletin K describes BLUE PRINTS covering 22 designs, free



C. W. Condensers
.004 M. F....$4.75
.006 M. F.... 5.50

K. D. Condensers
Plate.....$1.80
Plate..... 2.25
Plate..... 3.20

Add P. Post



Tresco Binding Posts, 10 for $1.00
Add P. P.

A 24-Page Catalog for 10c

TRESCO

[Davenport, Ia.



Phone Kearny 2778

PACIFIC RADIO SCHOOL

ARC & SPARK SYSTEMS

Hours:
1 to 5 P. M.
7 to 9 P. M.

433 Call Bldg.,
San Francisco, Cal.

Send for descriptive circular.

Tell them that you saw it in RADIO

BROADCAST OF RADIO NEWS

Continued from page 23

The Central California Radio Association of Fresno opened its club activities for 1921-1922 with a lot of QRM and static at its first meeting of the season held a few weeks ago. A large attendance helped to make the meeting a success. Walter Lauritzin, 6OH, was elected president; Henry Craig, vice president; John Avery, secretary-treasurer, and Lloyd Martin, 6ZU, inspector. A membership campaign was planned and later adopted. Several valuable pieces of radio equipment were offered as prizes. A club set was planned and means for raising the funds were discussed. A permanent home for the club was also discussed and several central downtown halls were offered.

The Westinghouse Electric and Manufacturing Company has announced a plan of covering the entire United States with a service to the home that will allow anyone, anywhere in the country, to enjoy the many benefits of radio.

In order to cover certain parts of the country not reached by this station, and to intensively service other parts, the Westinghouse Company has laid out a complete program, and it already has four stations: at East Pittsburgh, station KDKA; at Springfield, Mass., station WBZ; at Newark, N. J., station WJZ, and at Chicago, Ill., station KYW. Although operating a full year, station KDKA continues to interest more people as time progresses. The service started with the transmission of presidential election returns in November, 1920, and has progressed through the broadcasting of phonograph music, entire church services, speeches of prominent men, acts from theatres, musical recitals, reports of boxing contests, results of baseball, football and basket ball games, complete minstrel shows, Government market reports, New York stock market reviews, national and international news from the station at East Pittsburgh. At Springfield, Mass., in addition to many of these features, there is a periodical talk to farmers about market and stock conditions. A feature of the Newark, N. J., broadcasting station has been bedtime stories for the children, marine information, and talks on radio. The complete transmission of grand opera from the Chicago Opera Company productions has been the feature of the recently established station on the Commonwealth-Edison building in Chicago.

SUNSET RADIO CLUB
SAN DIEGO, CALIF.

With the adoption of new traffic regulations which coincide with those in effect throughout the southern counties, San Diego is now organized as never before for the successful handling of traffic. Station 6JI has resumed operation after a lapse of several months and still seems to produce the same old jazz.

The appointment of 6FK, S. P. Trimm, as deputy radio inspector, was announced and his selection was unanimously endorsed by the club in a letter to Major Dillon. 6FK has installed a brand new station at his new residence and is now reaching out better than ever.

6MZ is putting the finishing touches onto his synchronous spark set, having installed a liberal counterpoise and most ingenious home-made gap and condenser. From all reports 6MZ is to be the real long distance unit in this section.

6AJH, who has an enviable location for both reception and transmission, suffered during the recent high wind by the loss of his mast. He will shortly be in the game again.

The new traffic committee consisting of

VARIABLE CONDENSERS
AND
THE WIRELESS SHOP
A. J. EDGCOMB

are only a few ordinary words, but the combination of the two means a whole lot when speaking of quality instrument work. AND—more and more every day the two subjects are mentioned as one —"Wireless Shop Quality Variable Condensers," is the way they are known to most every amateur throughout the world.

Mr. Amateur—Isn't this quality worth something to you? Isn't this what you are really always looking for when you buy wireless apparatus? BUT—Do you always get it? YES—IF YOU BUY FROM THE WIRELESS SHOP. Why not be sure when you buy.

Mr. Radio Dealer—Are you aware of the ever growing demand for these QUALITY instruments, or are you letting the business go elsewhere because you cannot supply them? If you have not already written for our proposition, do so at once, as there is a lot of good business you are missing. Other dealers are taking advantage of this proposition. WHY NOT YOU?

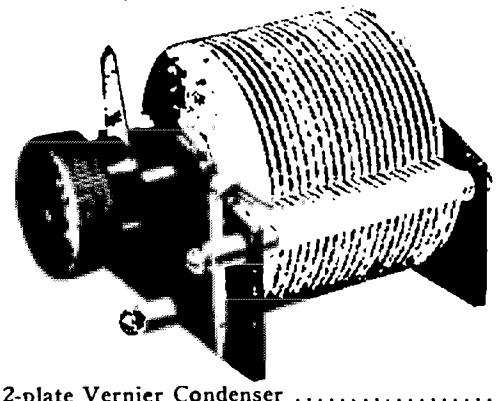
RADIO MEN

The following dealers now carry "WIRELESS SHOP VARIABLES" in stock. If your dealer doesn't stock them, order direct from this ad, and send us his name, if he is a live one:

Atlantic Pacific Radio Supplies Co., 638 Mission St., San Francisco, Cal.
Cal. Electric Supply Co., 643 Mission St., San Francisco, Cal.
Carter Electric Co., 63 Peachtree St., Atlanta, Ga.
Central Radio Co., 575 Grand Ave., Kansas City. Mo.
Detroit Electric Co., 434 Shelby St., Detroit, Mich.
Electric Shop, Fort & Beretania Sts., Honolulu, Hawaii.
Federal Tel. & Tel. Co., 1738 Elmwood Ave., Buffalo, N. Y.
J. C. Hobrecht Co., 1014 Sixth St., Sacramento, Cal.
Ideal Apparatus Co., 1901 E. Louisiana St., Evansville, Ind.
Paul F. Johnson, 32 W. Colorado St., Pasadena, Cal.
Kilbourn & Clarke Mfg. Co., Seattle, Wash.
Manual Arts Radio & Elec. Shop, 4154 S. Vermont Ave., Los Angeles, Cal.
Leo J. Meyberg Co., 428 Market St., San Francisco, Cal., and 950 S. Flower St., Los Angeles, Cal.
Northern Radio & Electric Co., 418 Union St., Seattle, Wash.
Northwest Radio Service Co., 609 Fourth Ave., Seattle, Wash.
Pacific Radio Supply Co., 638 Mission St., San Francisco, Cal.
Reynolds Radio Co., 613 Nineteenth St., Denver, Colo.
Harry A. Snyder, 337 F St., San Bernardino, Cal.
Stubbs Electric Co., 6th at Oak St., Portland, Ore.
H. C. Tafel Co., 236 W. Jefferson St., Louisville, Ky.
Taft Electric Co., Taft, Cal.
Warner & Linden, 350 Market St., San Francisco, Cal., and 22nd & Telegraph Ave., Oakland, Cal.
Western Radio Electric Co., 550 S. Flower St., Los Angeles, Cal., and 274 Twelfth St., Oakland, Cal.
Winner Radio Corp., 1710 Glenarm Place, Denver, Colo.
Wireless Mfg. Co., Canton, Ohio.

SERIES "T"

Three-inch stationary plate. For receiving circuits. Easy to mount back of your panel. Fitted with knob and pointer.

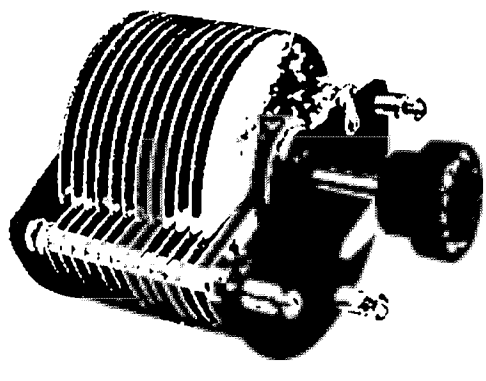


No. 20 2-plate Vernier Condenser	$2.00
No. 70 7-plate, approx. .0001 m. f. maximum capacity	2.35
No. 130 13-plate, approx. .0002 m. f. maximum capacity	2.75
No. 170 17-plate, approx. .0003 m. f. maximum capacity	3.15
No. 230 23-plate, approx. .0005 m. f. maximum capacity	3.60
No. 310 31-plate, approx. .0007 m. f. maximum capacity	4.30
No. 430 43-plate, approx. .001 m. f. maximum capacity	5.25
No. 630 63-plate, approx. .0015 m. f. maximum capacity	7.50

Include postage for one pound to your postal zone and insurance.

SERIES "CW"

Four-inch stationary plate. Wide spacing for "CW" work. Fitted with knob and pointer. Solid Formica end supporting plates.



No. 1500 15-plate, approximately .0004 m. f. maximum capacity	$6.00
No. 2500 25-plate, approximately .0006 m. f. maximum capacity	7.50
No. 3500 35-plate, approximately .0008 m. f. maximum capacity	9.00

Include postage for two pounds on No. 1500 condenser, and for three pounds on No. 2500 and 3500 and insurance to your postal zone.

And, Remember, That Quality Will Always Predominate With

1262 West Second St. The Wireless Shop Los Angeles, Calif.

Tell them that you saw it in RADIO

1000 Strong

THE SAN FRANCISCO RADIO CLUB, INC.
invites the many Pacific Coast Radio
Clubs to the 1921 Radio Convention

For the Purpose of Establishing the "PACIFIC PLAN" of Traffic Regulation

RADIO CLUBS should send as many delegates as possible. The Chairman of each delegation should bring with him a complete draft of the plan that his radio club favors.

Pacific Coast Radio Convention

THE entire affair will be held in the Auditorium of the San Francisco Gymnastic Building, 2460 Sutter Street, San Francisco.

All Pacific Coast Radio Clubs Are Invited to Partake

December 29-30

BE THERE at 1:30 P. M., December 29th. All Radio Club Delegations must present credentials to be entitled to vote. Report to Credentials Committee before 2 P. M. on December 29th.

PROGRAM:

Dec. 29. Convention comes to order at 2 p. m.

Dec. 29. Radio Banquet at Convention Headquarters 6 p. m.

Dec. 30. 1 p. m. Radio Show open to general public.

Dec. 30. 9 p. m. Radio Ball at Convention Headquarters.

Everything Free excepting the Radio Banquet

Official Hotel Bus will meet all incoming trains. Reception Committee will receive delegates at Hotel Stewart

Be One of the 1000

Publicity Committee
S. F. Radio Club, Incorporated

6EV, 6KC and 6AJH are kept busy enforcing and obeying local traffic regulations!

? ! ! * ! — — . . — —

6KC has done very creditable work on his set which is entirely home-made.

6AKL has increased his distance in the last month almost double, recently working 5ZA without difficulty.

6ZB, in addition to the old spark set, is again in the field with C. W. By request of the club, concerts are broadcasted on 200 meters Sundays and Wednesdays from 7:30 to 8:30 p. m. ZB is demonstrating the new Surdam Gap on the spark set and claims it is the best ever. CWD is on 375 meters.

6VL, having been overhauled, is to be placed promptly on the map by the Boy Scouts during the coming winter.

6IZ and 6AL of Coronado will be in the air during the coming months after a silence of many moons. 6AL will make the most of his Clapp-Eastham outfit. 6IZ is devising a new spark combination and will rebuild his antenna.

The old license 6AG has been reissued to Dr. A. B. Wessels, Timken building, San Diego. The station has been equipped with complete Grebe short wave 2 step and magnavox and a most elaborate ½-kilowatt panel using Acme transformer and Dublier condenser. Station photographs will be forthcoming shortly.

6AHS with one Ford coil reaches out better and has a better note than many ¼-kilowatt stations boast, having worked 6SK at Laguna Beach, some mileage for a Henry!

Station 6BAZ, our solamente Y. L. "ham" in these parts, with her ¼-k.w. Thordarson on an 80-foot antenna puts 3 amps on the wire and is reported QSA at unbelievable distances. Her QRA is Mrs. Mary Houston, Box 58, San Diego.

On the evening of November 19, the Sea Scouts of San Diego with the portable station 6ANH camped at the Coronado Islands and established communication with San Diego, using a 12-volt storage battery for power. Even with a water ground this is going some. Figure it out for yourself. The transmitter is 2 Ford coils in parallel.

Another epidemic of 500 cycle hams struck town recently. With a buzzer one could work a station giving a call listed hundreds of miles away. The conversation usually ended with "What ship are you on, is she in the harbor or my backyard?" The Club feels that these fake calls should be eliminated.

The Club extends Christmas Greetings and Best Wishes for the New Year to all Pacific Coast clubs and amateurs, and particularly to its out-of-town members, 6XAD, 6ZK, and old 6BS, who is now attending university in Oregon.

The Radio Club of Hawaii has been organized with the following officers: President, Donald Larnach; vice president, Dr. A. Romberg; secretary and treasurer, C. E. Warriner; traffic chief, K. A. Cantin; sergeant-at-arms, N. Asahina; board of directors, Prof. C. O. Smith, R. A. Carlyle (Marconi), Mr. Cook (Mutual), Mr. Worley (U. S. N.), Mr. Hall, Mr. Denham, Lieut. Cameron (U. S. A.), Mr. Lee, Mr. Ching. The membership of seventy-five includes seniors, who are licensed amateurs, or professionals and juniors, who must qualify for seniorship in one year's time. Meetings are to be held monthly.

Calls Heard by KOZR (Former 6AIW, Roseville), on motorship "Culburra," while at anchor off Nanoose, B. C., 140 miles north of Seattle, between 8 and 10:15 p. m., Dec. 2 and 3, 1921: 2FD (calling 8AY), 2FP (calling 9TL), 2AWL (calling 8AJW), 2EH, 4CB, 5FT, 6AAB, 6AAT, 6AFN, 6ALE, 6AQR, 6QR, 6XG, 6XW, 6ZX, 6XAD, 7BH, 7BK, 7LY, 7MP, 7KS, 7MF, 7MY, 7SC, 7TJ, 7VZ, 7XF, 7AR, 8APT, 8AWP, 9AW, 9DWJ.

CONTINENTAL NEWS

JANUARY, 1922

PUBLISHED EVERY MONTH IN RADIO BY THE CONTINENTAL RADIO AND ELECTRIC CORPORATION

PARAGON

R. A. TEN

Unexcelled for C. W. reception:

As 2ZL recently wrote, "The Paragon is especially satisfactory in C. W. work, because of the entire absence of capacity effect." To receive the numerous wireless telephone broadcasting stations, you can do no better than invest in a genuine Paragon R. A. Ten. For, as 2ZM, 2ZL, and hundreds of other prominent amateurs have found, Paragon brings in the human voice with all its clear, natural qualities unimpaired. And the exceptionally sharp tuning you achieve eliminates a large part of the unpleasant QRM in the midst of a concert.

Incidentally, the recent price reduction from $85.00 to $69.50—a clear saving of $15.50—makes Paragon today a better buy than ever before. Call or write for descriptive booklet.

Genuine Paragons are also on exhibition at

Ray-di-Co.
1547 N. Wells St., Chicago

The Benwood Company
13th & Olive Sts., St. Louis
and

A. H. Corwin & Co.
27 Halsey St., Newark



$3.25 $3.25

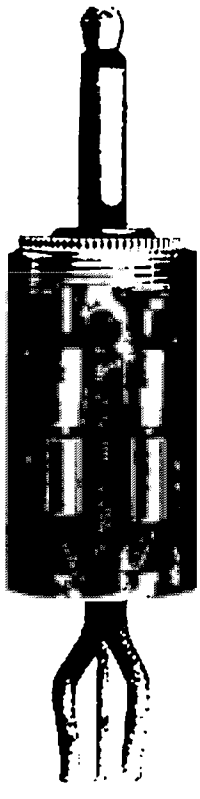
CRECO TRANSFORMER

a good instrument at a new low price

If you are building a Vacuum Tube Set, you can save enough by buying Creco Amplifying Transformers to pay for another step of amplification. Read these important features:

Unequaled audibility and amplification
No holes in core, eliminating magnetic leakage
Utmost mechanical and electrical efficiency
Developed purposely for present-day VTs
No castings used anywhere, etc., etc.

Such a simple, but efficient, transformer should interest you at any price. But at only $3.25 complete, ready for mounting, how can there be any question? Hundreds of these transformers are already in use. The satisfaction they are giving encouraged us to greatly increase the production. But even so, we advise ordering at once.



RADIO PLUGS

Be up-to-date! Equip your set with plugs and jacks thruout. Beside using plugs for your telephone head-sets, loud speaker, loading coil, microphone transmitter, transmitting keys, etc., scores of other uses will be found by the ingenious amateur. The three makes of plugs shown here, all designed specifically for radio work, are a great improvement over the ordinary telephone switchboard plug. They fit all standard jacks. Order today from our liberal stock of each make.

FIRCO "*Bull-Dog-Grip*" PLUGS

Slight pressure on chucks instantly releases telephone cord tips. No soldering. Instantly interchangeable, and *"The harder you pull the tighter it grips."*

Round type . . . $2.50 each
Flat type . . . . 2.00 each

FEDERAL PLUGS

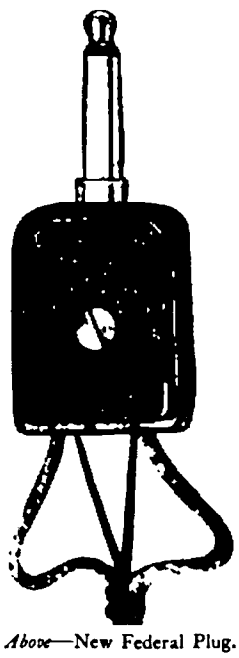
Made of Bakelite and designed to hold any type of conductor without soldering.

Price . . . . . $1.75 each

PACENT *Universal* PLUGS

Accommodate all telephone cord tips and similar solid conductors. Sure contacts—no soldering!

Price . . . . . $2.00 each



Above—New Federal Plug.

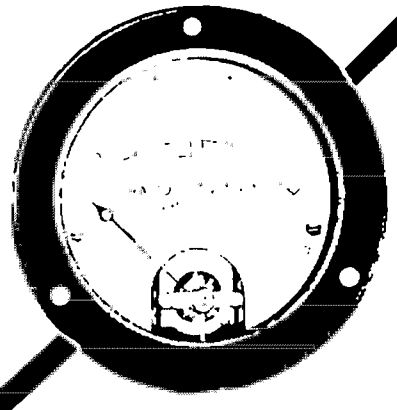
Left—Cross section view of FIRCO "Bull-Dog-Grip" interchangeable telephone plug round type.

Right—Pacent Plug.



Immediate shipments by mail of all apparatus shown here. ***Catalogue 25 cents, Address Dept. G-1***

CONTINENTAL RADIO & ELECTRIC CORP. ***6 Warren St., New York***



Use Thermo-Couple Instruments for C.W.

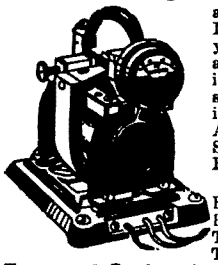
¶All long distance C. W. operators use thermo-couple ammeters. ¶Precise electrical measurements are the basis for the successful operation of any C. W. set. ¶Unreliable and inaccurate instruments will result in the unreliable operation of any set. ¶Government Bureau of Standards tests have shown Jewell thermo-couple instruments to be accurate and reliable.

Price $12.00

Get Our New Radio Instrument Circular From Your Dealer

JEWEL ELECTRICAL INSTRUMENT CO.
CHICAGO

10c Charges Your Storage Battery AT HOME WITH AN F-F Booster



and your Wireless Station will never be closed because of a discharged battery. Is it not gratifying to feel that your filament Battery will always be ready when you want it and that you will never have to give up in disgust when working a distant station? The F-F Battery Booster is a Charging Apparatus, unfailing in its ability to deliver service day and night; is rugged, foolproof, requiring no skill to operate; charges automatically and operates unattended. Screw Plug in lamp socket, snap Clips on battery terminals and watch gravity come up. Ammeter shows amount of current flowing. Everything Complete in Compact Self-Contained Portable Charging Unit. The F-F Battery Booster is a Magnetic Rectifier for 105-125 Volt 60 Cycle A. C. Lasts a Life Time. New Models.

PRE-WAR PRICES:

Bantam Type 6 Charges 6 Volt Battery at 6 Amperes..... $15
Bantam Type 12 Charges 12 Volt Battery at 5 Amperes..... $15
Type 166 Charges 6 Volt Battery at 12 Amperes..... $24
Type 1612 Charges 12 Volt Battery at 7 Amperes..... $24
Type 1626 Combination Type Charges both 6 and 12 Volt Batteries at 12 and 7 Amperes..... $36

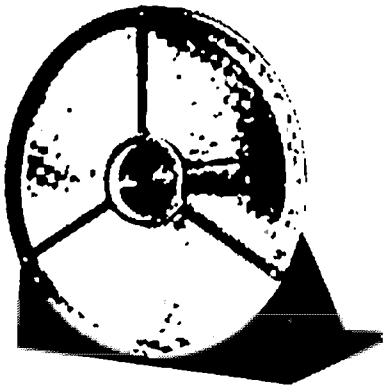
The Larger Types are recommended for large batteries, or where time is limited. Shipping weights Complete, 12 to 15 Pounds. Send check for Prompt Express Shipment. If via Parcel Post have remittance include postage, or order us to ship C. O. D. Order Now, or Write immediately for Free Descriptive Booster and Rotary Bulletins 33.

FRANCE MFG. CO. General Offices and Works: Cleveland, Ohio, U. S. A. Canadian Rep.: Battery Service & Sales Co., Hamilton, Ontario

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PAT. APP. FOR

The Amplitron is a product of the Radio Service laboratory and has been designed and constructed especially for radio work. It gives surprising results. The Amplitron has been developed to meet the long felt want for a loud speaker which, at the same time, meets both the requirements of price and efficiency. It reproduces radio phone speech and music without distortion—equally good for code.



No exciting batteries or adjustments necessary. Uses a Baldwin Type "C" single phone.

JUST WHAT YOU NEED TO ENTERTAIN YOUR FRIENDS ON CHRISTMAS

Amplitron less telephone receiver.....$10.00
(use your own Baldwin Type "C")
Amplitron equipped with Baldwin Type "C" phone and cord.....$16.25

For sale by all reliable dealers or direct from us.

Radio Service & Mfg. Co.

Sales Division
110 West 40th St., New York City

Factory
Lynbrook, L. I.

Resonance Charts for Quick Tuning

A Helpful Article for the Novice in Radio Practice

By Chas. K. Fulghum

FEW amateurs have a definite procedure for tuning. To see some of them "juggling" the dials about on the panel of their receiving set would give an operator worthy of the name the "willies." In the old days when it was possible to hear that little Ford coil on anything from 50 to 700 meters these "static hounds" would have been in their glory, but with the advent of C. W. and the sharply tuned spark set, they are feeling a bit miserable. Give one of them the wave length of a particular station and ask him to get it for you. As a rule, after a period of ten minutes of the usual tactics, he will announce that they are not transmitting or else he will have had good luck, meaning that in the course of his wrist work he has succeeded in picking them up.

To attempt the practical operation of a station on such lines is not in keeping with the present day practice and at the same time is very unsatisfactory. The tuning of a set for C. W. reception is a matter of patience and the operator not possessing such is doomed to disappointment when he wants to pick up that "concert by XYZ or the press from ABC." Only the proper manipulation and care in handling will bring in these sharply tuned stations and often the blame is placed on the tuner when by proper working the desired results could have been obtained.

Often the question that the amateur asks is "why don't they calibrate their sets?" A little thinking on this matter will bring to light some facts that perhaps have not before seemed of much importance to the questioner. Suppose you were to mark an ordinary regenerative set, with wave length calibration. It would be necessary for the manufacturer to know the capacity of your antenna and the ground that you would use and the surrounding conditions that affect the wave length of the antennæ. How many of you are prepared to measure the wave length of your antenna?

Few have the apparatus and knowledge that is required to measure to any degree of accuracy the constants of their antennæ and then one cannot be sure that the results obtained will remain so. I have had under my observation ships whose natural wave length varied as much as 25 meters under various proximities to surrounding conditions.

Considering that the average regenerative set requires at least three separate adjustments, it is readily seen that

the calibration of three dials would be necessary and that changes affecting the calibration would not affect each one of the adjustments alike. It is only with the invention of a practical receiver that has single control that the marking of a set in wave lengths will be feasible.

There is one practical and easy way out of the "muddle," and that is merely a systematic usage of the common practice of noting the adjustments of your set when receiving from some station from which it is possible to obtain the wave length that they were transmitting on. Many amateurs try this but few put it on a practical basis.

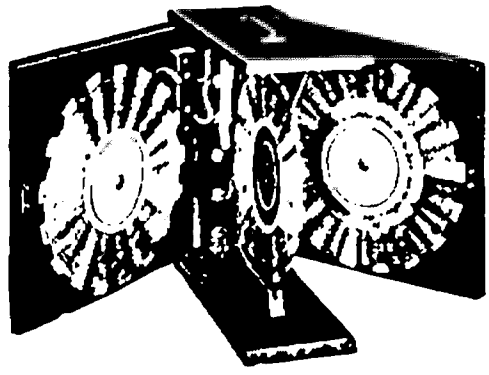
The placement of this on such a basis is best done by preparing a set of "resonance" charts for your set. This method is feasible with any type of receiver and may even be extended to the transmitter although it is not the object of this article to include that portion of the station. The method of procedure is the same with all sets and the outline below should give the amateur a working basis that will enable him to prepare a set of these charts for the receiver he possesses.

The set given as an example is the usual regenerative receiver consisting of a grid and plate variometer, a tapped vario-coupler and a variable condenser in the secondary circuit of the same. In such a set there are five adjustments to make, i. e., grid V., plate V., primary of V. C., secondary condenser of the V. C. circuit, and the filament temperature. Should you be the possessor of a variable B battery there is that to be considered as well. It is assumed that the receiver covers a wave length range of 75 to 500 meters. Two types of these charts will be described, and the reader may choose between them. The procedure for preparing and using both is the same.

The chart that is first described is the one that will be more convenient for the average amateur to use. It can be framed and hung over the operating table where it can always be easily referred to. The other is in notebook form and having to hunt through it for the settings rather detracts from its usefulness.

For the first chart a piece of Bristol-board or other similar white paper may be used. It should measure about 10 by 15 inches. It is ruled with six spaces of an inch in width parallel to its longer dimension and with twenty spaces of a half inch in width parallel to the shorter dimension. Each of these is marked with a wave length, the total of which covers a range of 100 to 500 meters. This will allow the markings to be made in steps of 20 meters, which should be neatly done on one side of the chart. The six spaces of the other dimension are for the various instruments. It is convenient to have these run in the order the adjustments are made, should you

SPIDER WEBS



Cut Shows Front Panel Removed

WONDERFUL REGENERATIVE SIGNALS

NO MAGNETIC LEAKAGE

$5.50

Plus 30 cents Postage

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New Duplex 1000 Meter Set on Hand

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With each of the listed tubes—RADIOTRON U. V. 200, $5.00, and A. P. Moorhead Detectors, $5.00; RADIOTRON U. V. 201, $6.50, and A. P. Moorhead Amplifiers, $6.50; we will supply free of charge your choice of either of these four premiums—Latest FADA Rheostat, $1.00; No. 810 Remler Bakelite Smooth Running Rheostat, $1.00; R. C. of A. Porcelain V. T. Socket, $1.00; Murdock V. T. Socket, improved contact type, $1.00. Either of the FEDERAL single, closed or double circuit jacks listed respectively at $0.70, $0.85 and $1.00, will be given as premiums with each R. C. of A. or FEDERAL amplifying transformer, $7.00. Fada 5 ampere Nichrome power rheostats, $1.35, or R. C. of A. porcelain V. T. Socket supplied free of charge with each $8.00 U. V. 202, 5 watt Radiotron power tubes for C. W. or Radiotron Transmission. We absolutely guarantee the foregoing apparatus. Only new and high grade equipment carried in stock. Unsatisfactory goods returned in five days replaced at once. All orders are filled within twelve hours and shipped postpaid and insured, thereby saving time and money. Remember us, THE KEHLER RADIO LABORATORIES, Dept. R., Abilene, Kansas.

A Mica Grid Condenser in your detector circuit will bring them in. Capacity .0005 Mfd. 30c, with leak 45c. Bakelite cut to size. Witteck Radio Supply. 3417 N. Hoyne Ave., Chicago.

Federal Arc Radio Manuals are just the thing for every radio amateur who wants to learn about this modern system of Radio Communication. The book is prepared in the simplest possible manner so that the beginner can understand every word of it. Don't be satisfied with hearing the Arc stations. Learn how they do it. Send $2.50 for a copy of this helpful book. RADIO, Pacific Bldg., San Francisco.

"Elements of Radiotelegraphy," by Lieut. E. W. Stone covers most of the modern radio systems. 400 pages and a good number of excellent illustrations. Known as "The Best Book on Radio." You need a copy. $2.50, postpaid anywhere. RADIO, Pacific Bldg., San Francisco.

WANTED! Back copies of the November, 1921, issue of "RADIO." We will send you two copies of future issues free if you send us one copy of the November RADIO. Pacific Bldg., San Francisco.

SLIGHTLY USED APPARATUS—1 Colin B. Kennedy Co. 200-2000 receiver, $100.00; original price $215.00. Two Metro Transformers half K. W., $11.00 each. One two K. W. 120 cycle Motor Generator, Kilbourne and Clark, $125.00. One three stage or detector and two stage Amplifier, French Type, $30.00. Pacific Radio Exchange, 439 New Call Bldg., San Francisco.

FOR SALE—Multiple Wave Regenerative Receiver. Wavelength 150 to 17,000 meters. $30.00. Short Wave Regenerative Receiver. Wavelength 150-600 meters. $20.00. For particulars phone West 1357, San Francisco.

CHEMISTS ATTENTION—My complete chemical Laboratory for sale. Write for particulars. Avery Wood, 209 Maple Ave., Watsonville, Cal.

BKUMA YRLSBUG—TWO HUNDRED beginners tell how memorized wireless code in thirty minutes to two hours. Booklet, 10 red stamps. Dodge. Box 220, Mamaroneck, N. Y.

RADIO CABINETS—Mahogany or oak finished or unfinished, to your design. Send rough sketch for quotation. Prompt service. Formica cut to size. Radio supplies, parts, etc. Pacific Radio Exchange, 439 Call Bld., San Francisco, Calif.

BARGAIN—Triple Coil Tuner, $31.50. Duolateral coils from L25 to L1500, $30.00. Write for details. D. C. Strawn, Calexico, Cal.

Short Wave Regenerative Receiver, including audion and one step amplifier, all self-contained, as described October Radio News, page 292, with six volt storage battery, tubes and phones, for $75.00. W. R. Snyder, P. O. Box 671, Vallejo, Calif.

DID YOU READ OUR AD LAST MONTH! Here's another. Audion Controls, $5.00. Amplifiers, $9.50. We pay transportation on these anywhere in the United States. We carry a complete line of parts and we pay the transportation on a $10 order or more. Send for lists. Devore Radio Supply Co., Gibson City, Illinois.

WANTED—Radio amateurs everywhere to secure subscriptions to "Radio" on a very liberal commission basis. Many agents making good money in spare time. Write today for full particulars. "RADIO," Pacific Bldg., San Francisco.

Save and have, fellows. 10% discount from the list price of any radio apparatus that you may order from us. We are a company of amateurs in game. Try us and see for yourself. Mack's Radio Shop, Ansonia, Conn.

The Amateur Electrician. Pocket size. 20c. Joe Tillberg. Proctor, Vermont.

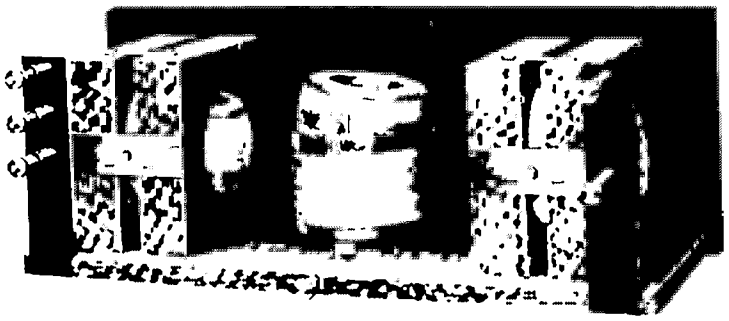
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TELEGRAPHY—(Morse and Wireless) and Railway Accounting taught thoroughly; big salaries; great opportunities. Oldest, largest school. All expenses low—can earn large part. Catalogue free. DODGE'S INSTITUTE, Hass St., Valparaiso, Indiana.

Tell them that you saw it in RADIO

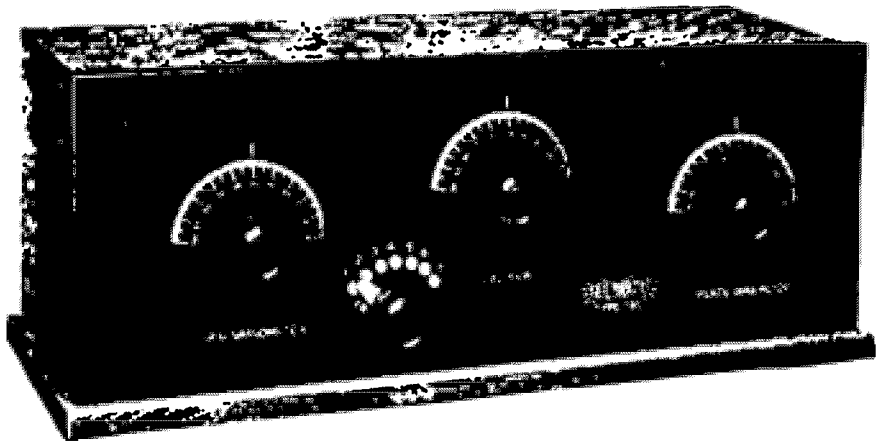
Discriminating TELMACO Radio Men Insist on Telmaco Short Wave Receivers

Telmaco's policy is to give better values. That is why we are forced to work overtime to fill orders. Last month we were compelled to make slight delays in shipments in a few instances. This we very much regret. We have now increased our facilities so that **everybody will receive his Telmaco Apparatus promptly.**



The **Telmaco Short Wave Receivers** are completely assembled; lugs are in place on which to solder wires; No. 14 silver finished wire, as well as necessary tubing is furnished.

The **Cabinet** is constructed of quarter sawed oak, stained inside and out, with waxed finish. **Panel** is of grade M 3/16 in. **Formica**, 6⅛ in.x16¾in. satin grained finish, mounted on special drawer sub-base. Metal parts are nickel plated and oxidized. **Binding Post Construction** is of **Telmaco** special design extending through back of cabinet, thus removing all external wiring from front of panel.



TR-1 Telmaco Short Wave Receiver, Unwired.....$35.00
TRD-1 Telmaco Short Wave Receiver and Detector Combined, unwired... 45.00

Telmaco Variometers and **Vario-Coupler** with flush type bearing plates and spring washer bearing contactors are used, thus assuring perfect electrical connections, permanently for ball windings without "pig-tailing." **Dials** are **Remler** 3-in. polished molded bakelite. **Lettering** on panel in pantograph machine engraved, filled with the best grade white enamel.

DETECTORS AND AMPLIFIERS

to match the above. Same general construction, height and depth. All amplifying transformers **fully mounted** and all amplifying units furnished with full **Automatic Filament Control** jacks. and special **Radio plug.**

Type TDA-1 Detector and Single Stage Amplifier Unit.....$35.00
Type TA-2 Two-Stage Amplifier 40.00
Type TDA-2 Detector and Two Stage Amplifier 45.00

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Satisfaction guaranteed always or money refunded. Send for our complete, catalogue, "P." You'll find it interesting.

Your Panels engraved with our **Gorton Engraver.** Price 5 cents per letter. Minimum charge $2.00.

DEALERS! We are distributors for nearly all Standard Lines. Write for our Special Proposition.

RADIO DIVISION

TELEPHONE MAINTENANCE CO.

17 N. LaSalle Street, Chicago, Ill.

use a regular method of tuning. The chart is then ready for calibration, and considerable care should be used in the process.

To calibrate the chart, carefully tune in a station that is transmitting and when a maximum signal strength is obtained the adjustments of the various instruments noted. If the wave length of this station is on hand and it falls on one of the wave lengths that the chart covers, the settings of the various instruments are noted in their proper columns, opposite the wave length they have been made for. It is always well to verify these adjustments once or twice before they are marked on the chart. Should you be in doubt as to the wave length that the station transmitting was using, and that is often the case, they will as a rule be glad to let you know if you drop them a card. Since sharper tuning is required on C. W., it is well to calibrate the chart on that reception as a rule. Of course if the set is not for C. W. reception that is out of the question. In case a station transmits on a wave length which lies between two on the chart, either may be marked or the chart extended to accommodate it.

The other set of charts consists of separate charts for each instrument, the curves for the various wave lengths being plotted in a manner similar to that in the preceding paragraphs. It is often more convenient to prepare this chart first and then to make the other, using the curves in order to mark the adjustments. If a friend that has a wave meter and a C. W. set that can easily be adjusted to any wave length happens to be near, the making of such a chart is easily simplified.

Once such a chart is in use the amateur who is the possessor of it will feel repaid for the time and work spent on it. In case the set that you have is desired to be used by others than yourself, they can easily do so without any troublesome and unnecessary adjustments.

One thing is to be noted. If you are using an ammeter to adjust the filament temperature, don't forget to include a column for its readings. Often the failure of C. W. and 'phone is traceable to inaccurate adjustment of the filament temperature. It is well worth the while to provide your filament rheostat with a dial if it has none, and then to use it.

The Northwest Radio Service Company, formerly of 609 Fourth Avenue, Seattle, has moved to new quarters at 1637 Westlake Avenue, in the heart of the retail district. They are distributors for the A. H. Grebe Company and the Atlantic-Pacific Radio Supplies Company. They have installed a radiophone at 7XC, the experimental station of Vincent I. Kraft. This station broadcasts concerts each Tuesday, Thursday and Saturday evenings, from 8 to 8:30.

STATIC STATISTICS

By Squawk McGuff

Shhhh, this is going to be good. Don't tell anybody. You see it was told to me and they told me not to tell so I'm telling you and I know you won't tell. Keep it dark.

Well it's like this. The steamer *Buford* has an operator that can work POZ.

Shhhh—shhhh—not so loud.

Well this guy called POZ for the weather because somebody told him to.

Shhhh—shhhh. For the love of mike keep quiet.

Well he called POZ from Honolulu last week, and—

Shhhh—shhhh—this is rich.

Well, he didn't get POZ. But he had nerve enough to try it.

Shhhh, shhhh, shhhh, ain't that the Turtle's pajamas?

Don't tell anybody. Shhh, shhh, shhh.

6OC had a little pig. He named him INK. Because he run out of the pen. This way out, please.

INSPECTOR: So you're qualified for a license, are you?

HAM: Yes sir, no sir, yes sir.

INS.: What determines the voltage of a storage battery?

HAM: Voltmeter—and they let him live!!!

His sidekicker, who also wished to adorn the walls with a certificate, was next.

INSPECTOR: What is the law regarding superfluous signals?

HAM: August, 1912. Holy smoke, what yuh radiatin'.

INSPECTOR: Explain this two-circuit dingus with this lead coming in and that lead going out.

HAMBITIOUS ONE: Why, that's as clear as mud. Just like my one-circuit pocketbook, except that nothing comes in and it all goes out.

Dear Squawk:

Being my first little epistle seemingly pleased you, here is another:

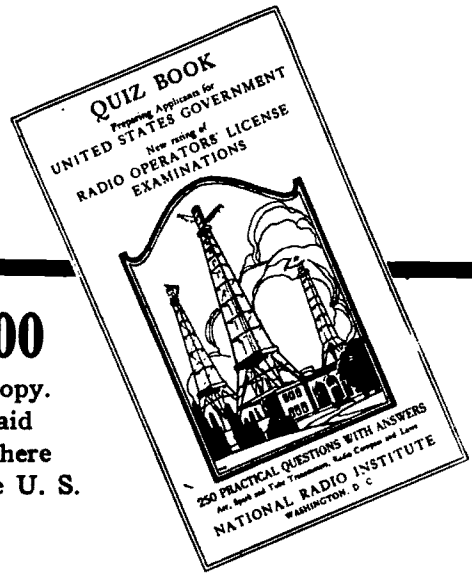
Buck sez:

When it comes to hash, I don't know which has the best of it, a Greek restaurant or an A. C. radiophone.

The saddest record I've heard concerted was a little song entitled: "Forty Volts on the Filament"; music by B. Battery, words by Oper Ator.

Whenever I hear Tavers say: "Just a minute and we'll have another one," I want to shout: "Make mine Scotch!"

Who will head a subscription list to buy 7ZU a new omnigraph record to replace the CQ one he is using now?



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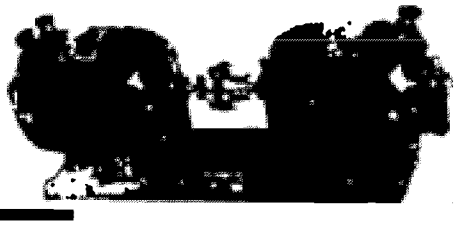
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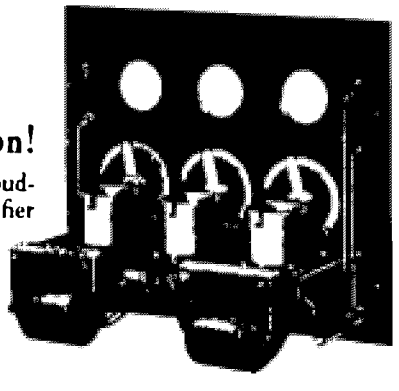
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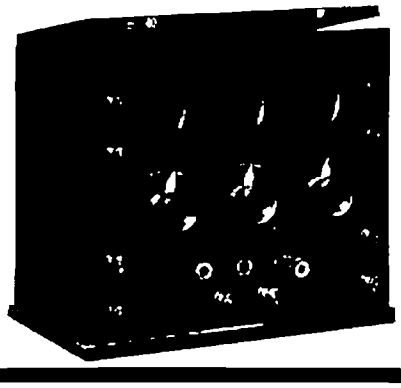
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There was a ham in Crockett
Whose tube got turned in its socket.
When he turned on the juice
She smoked like the deuce,
Now isn't that H—— on his pocket?
Come again, Woodland, we like your style.

TACOMA

The Radio Club of Tacoma has given much time and thought to the idea of "Amalgamation." Amalgamation is, we think, the password to success. Mr. Halloran's idea of a sort of convention in San Francisco in January to form plans for such an amalgamation appeals to us strongly and if such a thing happens we promise that we will have a representative there.

7BC reported at the last meeting he would be off the air for a few days as he was moving. Say, Woody, is this the fourth or fifth time this month? It surely must be cheaper to move than pay rent.

Was that really 7CE we saw out on the roof last week shaking the nine inches of snow off his aerial so the messages wouldn't freeze?

Olympia has re-organized a club now and is reported growing every day. Next Wednesday night the Radio Club of Tacoma is going to take its saxaphone quartet, a keg of cider and a raft of doughnuts and go down and surprise them. Arrangements have all been made for the use of one of the big social halls in Olympia and dancing and a program of singing and clog-dancing will be featured.

The Radio Club of Tacoma held election of officers at their last regular meeting. The new officers as elected are: President, Howard Reichert; Vice-President, Karl Weingarten; Secretary, Winifred Dow (re-elected); Treasurer, Neville Benoit; Press Agent and Ass't Secy., Alvin Stenso. The past officers believed a banquet given them wouldn't be at all out of order!!!

The Radio Club of Tacoma sends its Christmas greetings to all its friends and wishes them the greatest possible success in radio for the coming year.

The Kuebler Radio Company of Toledo, Ohio, are the successors to the retail department of the Marshall-Gerken Company.

The Pacific Radio Exchange, 439 Call Bldg., San Francisco, are marketing a new and unique preparation in the form of a liquid known as "Resistohm" for making grid leaks and resistance units of any desired resistance.

Western Radio Electric Co., of Los Angeles and Oakland, Calif., have issued the fifth edition of their Stock Bulletin and Price List of Radio Telephone and Telegraph Apparatus.

The Outstanding Specialties of the Season

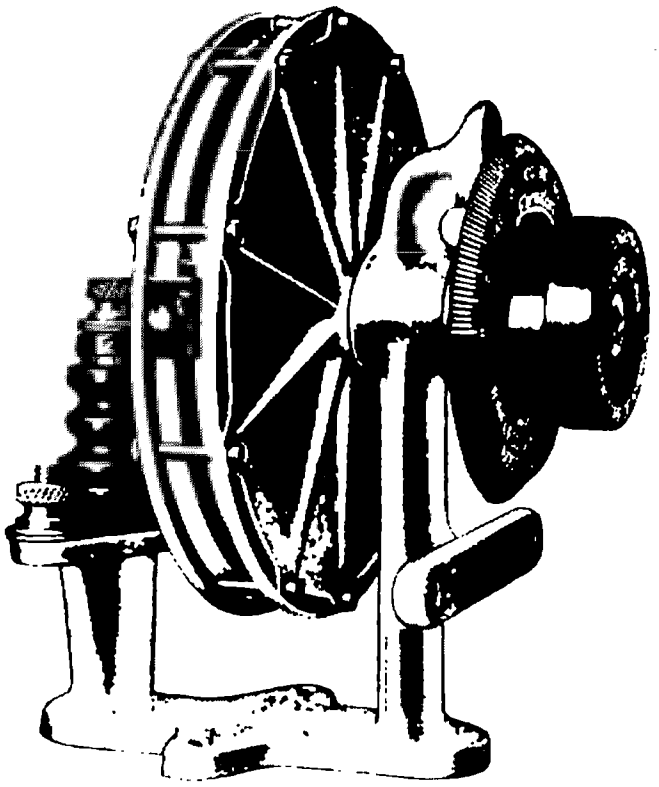
Announcing FARADONS UC-1819 and UC-1831

FOR RADIO RECEIVING SETS

Model UC-1819

Capacity

Minimum .0001 *mfd.*
Maximum .005 *mfd.*
***Price*, $8.75**



Overall Dimensions 4½ x 5½ x 4¾

FOR TUBE TRANSMISSION SETS

Model UC-1831

Capacity

Minimum .0001 *mfd.*
Maximum .0012 *mfd.*
***Price*, $9.00**

These novel and unique condensers operate on an entirely new principle. They are less than 1/5 the size of air condensers of the same maximum capacity, and are suitable for back of board mounting as well as for open mounting.

The dielectric losses are extremely low—the power factor being less than 1/3 of 1%. There is no danger of warping plates as in the ordinary air condenser.

FOR RECEPTION—Model UC-1819 provides a capacity small enough to act as a grid condenser and large enough for radio frequency circuits up to 30,000 meters. It has the unusually high ratio of maximum to minimum capacity of 50 to 1. It may be used as a primary or secondary tuning condenser or as a plate circuit by-pass condenser with equal effectiveness.

FOR TRANSMISSION—Model UC-1831, which has the same appearance as UC-1819, was designed as a series antenna condenser for a C.W. tube transmitter. It will stand 5 amperes of C.W. at its maximum capacity setting and it will vary the radiated wave of the amateur set by 50 to 100 meters. By employing the C.W. circuits shown in the RCA catalog and inserting Condenser UC-1831 in the antenna circuit, the radiated wave length can be changed instantly and continuously by simply turning the drum. This is an ideal way to work through interference. The close capacity variation of UC-1831 and its resultant fine tuning means more antenna current for the average station. This condenser has been tested at 4000 volts maximum by the manufacturer.

Permanent Calibration—
Unusual Capacity Range—
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Pattern 33, 3¼″ dia. Flush Type Milliammeters, D. C. for plate current, 0-100, 0-200, 0-250, 0-300, 0-500 mill.....$6.50
Ammeters D. C. for filament current and battery charging. 0-1, 0-1½, 0-2, 0-2½, 0-3, 0-4, 0-5, 0-8, 0-10, 0-15, 0-20, 0-30 amps.....$6.50
Voltmeters D. C. for transmission and reception. 0-3, 0-7.5, 0-10, 0-15, 0-20, 0-25, 0-30, 0-40, 0-50 volts.....$6.50
0-150 volts..... 8.75
0-300 volts..... 9.75
0-500 volts.....14.50
0-1000 volts.....21.50
0-1500 volts.....27.50

Pattern 54 3¼″ dia. (new type) Flush Mtg. Milliammeters D. C. for plate current. 0-100, 0-200, 0-250, 0-500 milliamps.....$8.40
Ammeters D. C. for filaments and battery charging. 0-1, 0-1½, 0-2, 0-2½, 0-3, 0-4, 0-5, 0-8, 0-10, 0-15, 0-20, 0-30, amps.....$8.40
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0-150 volts..... 9.60
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Pattern 64, same case as pattern 54 Thermo Couple Radiation meters. 0-1, 0-1½, 0-2, 0-2½, 0-3, 0-4, 0-5 R. F. Amps.....$12.40

Pattern 74 same case as patterns 54 and 64 Ammeters A. C. For A. C. Power Supply and Filament Current. 0-1, 0-1½, 0-2, 0-2½, 0-3, 0-5, 0-10, 0-15, 0-20, 0-25, 0-30 Amps.....$8.30
Voltmeters A. C. for A. C. Power Supply and Filament Voltage 0-10, 0-15, 0-20, 0-30, 0-40, 0-50, 0-75 volts.....$8.30
0-150 volts..... 9.60
0-300 volts.....12.25

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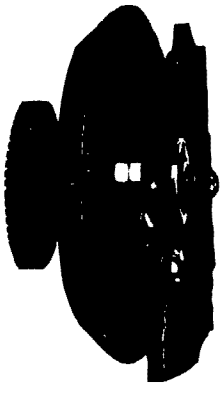
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H-K Modulator choke coils proper size for 5 watt tubes mounted. From your dealer or postpaid in U. S. A. $4.25

Choose your meters for your set from the list above. We recommend patterns 54, 64 and 74. The proper source of plate current for 5 watt tubes is the Robbins & Meyers 100 watt, 500 volt, D. C., 110 volt A. C., 1725 R. P. M. motor generator at $74.75 from our stock.

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All figures and graduations are filled with brilliant white enamel. All brass parts nickel plated. Bakelite knob. Resistance is 5 ohms, carrying capacity 2 amps.

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IMPORTANCE OF KNOWING V. T. CHARACTERISTICS

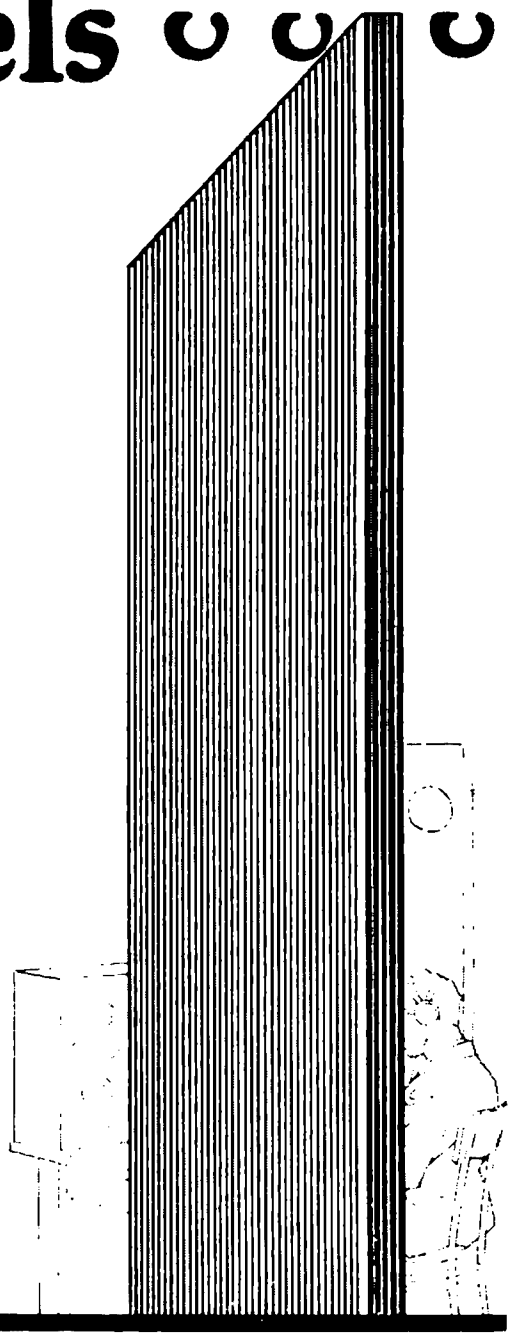
Continued from page 19

rents, and this is generally the case in the home made receiver. The operation of the filament is determined by its brilliancy, or in the case of the soft detector tube, by the point where the tube begins to hiss. The filaments may be operating at 25 per cent or more above normal current consumption without appearing abnormally bright, and yet the amateur wonders why he burns out his tubes so easily. If jacks were provided in the filament circuit of each tube, an ammeter could be temporarily inserted in the circuit and the filaments adjusted to their proper values. The argument is immediately raised that this adds to the cost of the set, and the amount of apparatus, which is all very true. However, when one considers the saving that will result when the tubes show a large increase in their life, due to having been operated at or slightly below the rated operating value, the addition of this equipment is certainly justified. The jacks may be wired in accordance with Fig. 1 and an ammeter having a scale of 0 -1.5 amperes will cover the range of filament currents of those tubes which are on the market at this time.

Some advocate the use of a voltmeter to read the voltage drop across the filaments instead of reading the current, and in the case of transmitting tubes, which consume a considerable number of watts, this is the best method, but for receiving tubes with small current consumption, an ammeter should be the most reliable.

The use of a milliammeter as a regular adjunct to a receiving set may not be so obvious as that of an ammeter and perhaps the best example of its usefulness in vacuum tube circuits is in the telephone industry. Here many thousands of tubes are in service in every conceivable type of circuit, including radio receiving and transmitting apparatus, wire repeaters, multiplex telephone and telegraph apparatus and loud speaking equipments. In all the above, milliammeters are either permanently wired in the plate circuits of the tubes, or arranged with a flexible cord and plug for insertion in jacks which are provided in series with the plate circuits. Daily observations are made on the plate current values, and certain standards are maintained, by which the operating personnel may reject tubes showing low plate currents, or excessively high values. If the tube is being overloaded by too much input current, this is indicated on the milliammeter by a violent agitation of the needle, and remedial measures are taken to reduce the input current to a proper value. This use applies to the amateur receiving tubes as well as for commercial purposes, and with a milliammeter available, the amateur could soon learn how to detect distortion in his amplifiers, and

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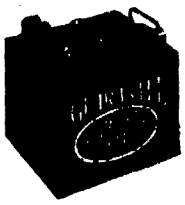
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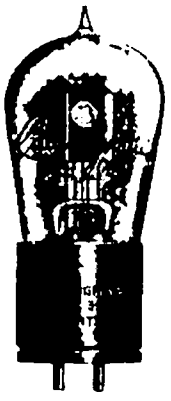
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The larger size battery is ideal for your three or four tube set.

Now

that you have purchased your Xmas Receiving Set, you will require a good set of vacuum tubes. We carry all kinds in stock.



Then

after you have the tubes you will need a Guarantee Storage Battery to brighten them up.

But

be sure to get one of our Guarantee Hydrometers for reading your battery. A Voltmeter will put you on the wrong trail. Be absolutely sure of the condition of the Battery. Use a Hydrometer.

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be determined without dismantling the receiving set, or setting up the testing apparatus separately. The variable grid battery shown in the sketch, range 0-15 volts, consists of ten ordinary dry cells, of 1½ volts each, or small flashlight cells of the same voltage will serve the purpose. To insert this battery in the grid circuit of the tube to be tested, remove the four prong base from an old discarded tube, and by means of flexible leads, connect the terminals of the base to the four terminals of an extra tube socket, which may be mounted loosely near the receiving set.

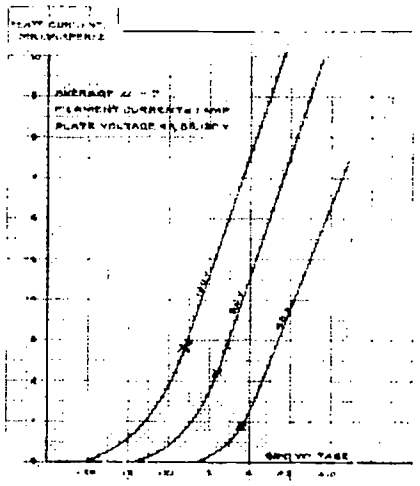


Fig. 2

The tube to be tested is inserted in the extra socket, and the base with its flexible connections can then be plugged into one of the sockets of the receiver, preferably one of the amplifier tube sockets. The variable grid battery can now be inserted in the grid lead without opening up the set, by placing it in series with the flexible wire leading from the spare socket to the extra base mentioned above. If the filament current is adjusted to the proper value, and the grid voltage varied in steps of 1½ volts, a corresponding change in plate current will be noted on the milliammeter, for each value of grid voltage.

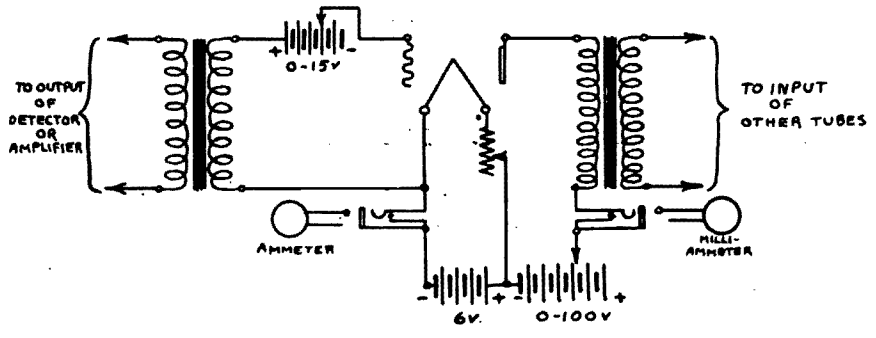


Fig. 1. Hook-Up for Testing Tubes

thereby greatly improve the reception of radiophone music and speech.

This shows that meters should be a part of the regular equipment of a receiving station. Fig. 1 shows how the characteristics of any receiving tube may

By plotting these values of grid voltage and plate current, a curve such as is shown in Fig. 2 will result. From this curve the proper value of negative grid voltage for a given plate voltage may be selected. The tube used in the curves shown in Fig. 2 was selected only because it was conveniently available. The

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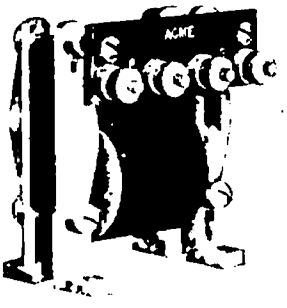
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C·W·APPARATUS



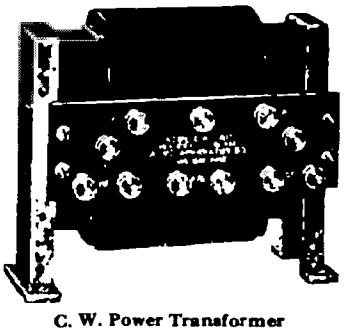
Amplifying Transformer

Has Stood the Test of Time

EFFICIENT ATTRACTIVE
DURABLE CONVENIENT

The First C. W. Apparatus on the Market. Ask Your Dealer, or Us, for ACME CATALOG describing

C. W. Power Transformers	Amplifying Transformers
C. W. Filament Transformers	Amplifiers
Modulation Transformers	Detectors
Choke Coils	Spark Transformers
C. W. Inductances	Anti-Light Blinkers


C. W. Power Transformer

ACME APPARATUS CO.

182 MASSACHUSETTS AVENUE
CAMBRIDGE, 39, MASS.
NEW YORK SALESOFFICE : 1270 BROADWAY

Transformers and Radio Engineers and Manufacturers

Announcement
The New
DeForest
Catalog
is now ready and includes cabinet receiving sets, panel sets, C. W. transmitters, radiophones and parts, for amateur use. Sent upon request and receipt of 10c in stamps.

RADIO TELEPHONE AND TELEGRAPH APPARATUS

Announcement
The New
DeForest
Receiving Sets
will be described and illustrated in this magazine next month. Do not buy until you see February issue.
DeForest Radio Tel. & Tel. Co., New York City

The "QSA" Line of Equipment

COMBAT

A Storage Battery especially designed for Radio work. The only Battery with non-corroding binding posts. Write for particulars and incidentally get your name on our mailing list to receive our monthly bargain sheets.

Here is one of the many items listed for December:

Dry Cell B-Battery 45 volts $1.85 ea.

INDEPENDENT RADIO SUPPLY COMPANY
3716 W. Douglas Blvd., Dept. P-12
Chicago, Ill.

"Better Results with Less Effort"

Phone San Jose 2126-J

Established 1909
1200 Students

OUR WAR RECORD—200 Men Trained—130 Placed in Service

HERROLD COLLEGE

OF ENGINEERING AND RADIO

SPECIAL ATTENTION TO EXPERIMENTERS AND AMATEURS

467 South First Street SAN JOSE, CALIF.

Tell them that you saw it in RADIO



FIRST!
BEST!
100%

PACENT UNIVERSAL PLUG

This is a radio plug. It fits all standard jacks—and pocketbooks. Of course, no solder is used to make a connection with the Pacent plug. The cord tips are held in such a way that pulling—up to and beyond the breaking of the cord—only tightens the grip. Yet the tips may be released instantly by proper manipulation of the springy strips. A soft, velvety black finish with polished metal parts makes the Pacent plug easy to look at; it is truly beautiful. Rugged construction makes the device good for a lifetime. There is only one Pacent plug and that is approved by the United States Government and used by the foremost amateurs. Don't forget to insist on the original, 100% plug.

From your dealer or direct..... **$2.00**

You should have a copy of our booklet Pacent Radio Essentials.

PACENT ELECTRIC COMPANY, Inc.
Louis G. Pacent, Pres.
Manufacturers and Distributors
150 NASSAU STREET NEW YORK, N. Y.
Member Radio Section Associated Manufacturers of Electrical Supplies

SPECIAL

"Q. S. T." and "RADIO" 1 year $3.25
Order Now and Save 75c

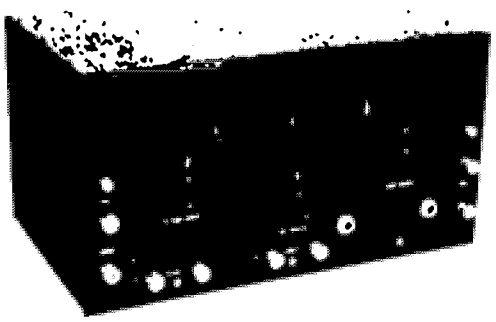
RADIO, PACIFIC BLDG., San Francisco

small crosses on these curves indicate the correct value of grid voltage for 43, 86 and 120 volts, which are the voltages commonly used.

This point must be selected so that, when the maximum alternating current voltage the tube is supposed to receive is applied, the grid will neither become positive with respect to the filament during the positive half of the wave, nor force the plate current too near to zero during the negative peaks. The proper point will generally fall on the straight line portion of the curve, just before it commences to slope in the form of an arc, towards zero.

If no negative grid potential were used, then no matter how small the input alternating current voltage, distortion would result, since the grid of the tube would become positive, and rectification would take place. Other characteristics, such as the filament current-plate current curve and the plate voltage-plate current curve may be obtained with this apparatus, but the grid-voltage-plate-current curve is deemed the most important.

If, when the amateur purchases a new tube, he will perform this test, and find out for himself the right value of grid voltage, or "C" voltage as it is sometimes called, he will eliminate distortion in his receiver, and obtain much satisfaction in the knowledge that there are no unknown quantities in his circuits.



Type JM Super-Sensitive Radio Audio Amplifier, $95.00

A RECORD BREAKER

16 Inch COIL Aerial
Brings in Music
From Radiophone Station
200 MILES AWAY!
Amateur Spark Stations
1500 MILES DISTANT
Read Four Feet from Phones!



DX Radio Frequency Amplifying Transformer

Wavelength Range.		Price.
150-650	Each	$8.00
650-2000	Each	8.00
2000-5000	Each	9.00
5000-12000	Each	9.00

Order Amplifier complete, or

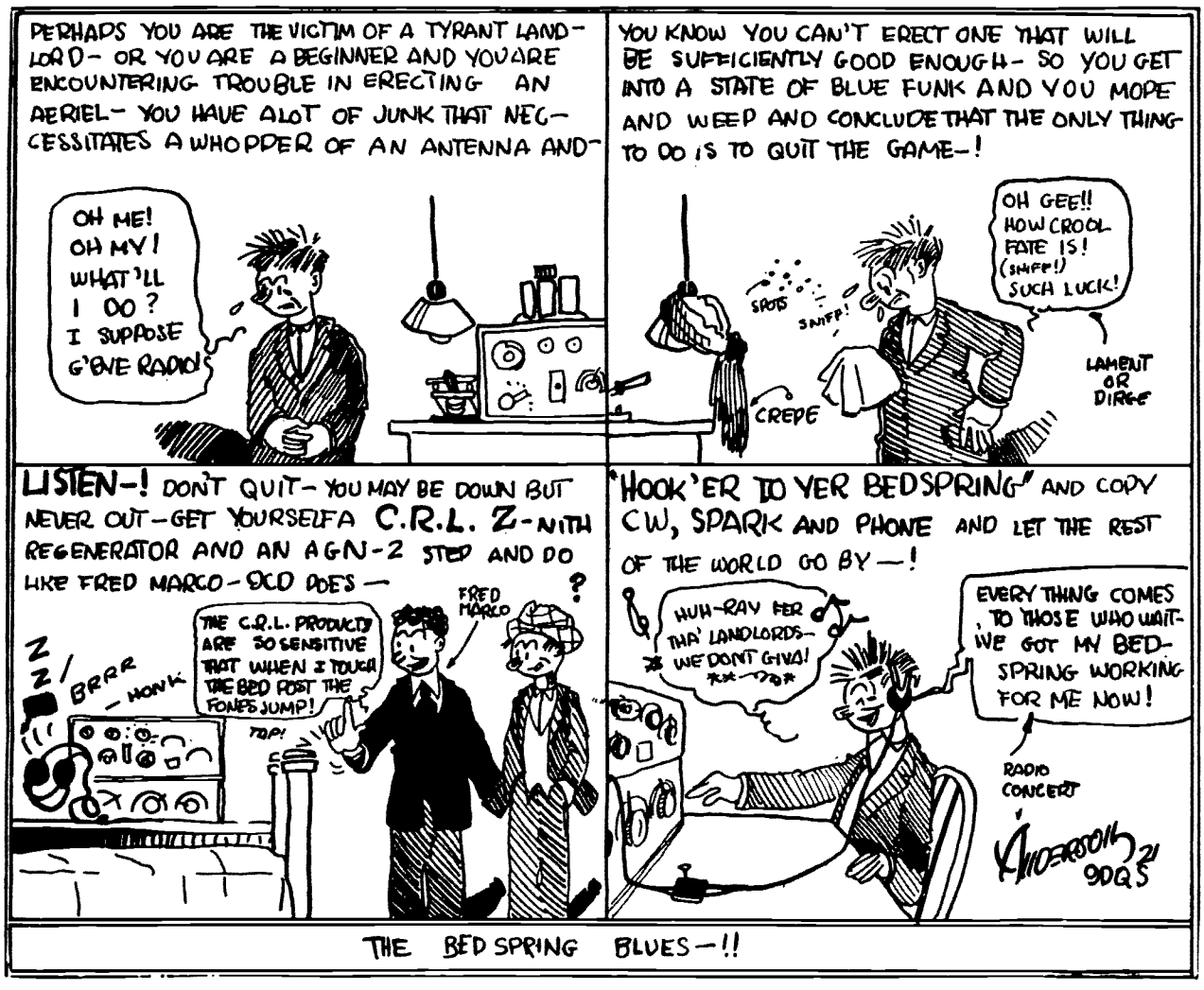
BUILD YOUR OWN

We supply all parts ready to assemble.

Standard Mounting for DX Radio Frequency Amplifying Transformer, $1.00.
Send stamp for Bulletin No. 11 P. Diagram Sheet of Amplifier Circuits, 25c.

RADIO INSTRUMENT COMPANY
Hutchins Bldg., 10th and D Streets, N. W., Washington, D. C.

Tell them that you saw it in RADIO



See If YOUR Call Is Here

WE DON'T EXPECT YOU TO JUNK YOUR AERIAL, BUT the attached call list shows just how sensitive the Z-NITH Regenerator - Amplifigon is.

You don't need a big complicated antenna system to receive radiofone, C. W. or spark signals when a **real** Regenerator is used, with balanced variometers, and a minimum of distributed capacity in the windings.

The pleasure of copying messages from amateur, commercial and broadcast stations throughout the country can be yours with a minimum of effort. Write us for full details.

Stations copied Oct. 30 to Nov. 26 at station 9CD, using Z-Nith Regenerator and Amplifigon AGN-2 on a BEDSPRING AERIAL, absolutely NO OTHER antenna being on or near the premises. (Signed) F. J. MARCO, 9CD. 5723 Winthrop Ave., Chicago.

SPARK:

1AW, 2BK, 2FP, 2OM, 2OX, 2TS, 2UE, 2AID, 2AQI, 2CAP, 3HJ, 3HX, 3PU, 3XC, 3XF, 3ZA, 3ZO, 3AHK, 3BFU, 4AG, 4AGR, 5EK, 5FO, 5HK, 5IF, 5JD, 5XU, 5YL, 5YM, 4ZL, 6EN, 6KA, 7XD, 7ZO, 7ZU, 8AL, 8AY, 8BM, 8DJ, 8DZ. 8EA, 8EB, 8FI, 8FT, 8GW, 8HU. 8HY, 8IN, 8JP, 8JQ, 8MZ, 8OI, 8PM, 8QQ, 8RQ, 8RU, 8SP. 8TK, 8TT, 8UC, 8VL, 8VQ, 8WA, 8XE, 8YN, 8YM, 8YO. 8ZA. 8ZF. 8ZN. 8ZP, 8ZY, 8ACF, 8AFD, 8AFS, 8AGG, 8AGK, 8AHS, 8AMB, 8AMZ, 8ANO, 8ARD. 8ARS. 8ASR, 8ATU, 8AVO, 8AYN, 8BDY, 8BEN, 8BEP, 8BRL. 8BVA, 9AR, 9DV, 9EE, 9EL, 9ET, 9GP, 9HM, 9HT, 9JN. 9JQ. 9JV, 9LW, 9MC, 9OF, 9OX, 9PB, 9PS, 9QJ, 9QR. 9RU, 9TL, 9UH, 9UW. 9VG, 9WI, 9WT, 9WU, 9XI, 9XM, 9YB, 9YO, 9YM, 9YQ, 9YAC, 9YAE, 9ZB, 9ZJ, 9SAA, 9ZAC, 9ACB, 9ACL, 9ACN, 9AEG, 9AEY, 9AGG, 9AGR, 9AIR, 9ALH, 9AMA, 9AMT, 9AMV, 9AOJ, 9AOU, 9AQE, 9AQM, 9ARG, 9ARZ, 9ASJ, 9ASL. 9AUE, 9AVP, 9AWU, 9AXU, 9AYV, 9AZE, 9BDE, 9BFR, 9DKV, 9DRJ, 9DSD, 9DQQ. 9DZI, 9DZZ, "MSP", CANUCK, 3BP, 3JL.

C. W.—I. C. W.—FONE.

1ID, 1TS, 1XE, 1AFV, 1AGI, 1CGG, 2DN, 2EH, 2FD, 2FP. 2KL, 2MW, 2QB, 2RU, 2WP. 2XA. 2XQ. 2ZL, 2ABR, 2AFP, 2AKO, 2AWL, 2BAK, 2BGM, 3BA. 3BZ, 3CC, 3EM. 3FM, 3GB, 3MO, 3RF, 3XM, 3ZN, 3ZO, 3ZY, 3ZZ, 3AAE, 3ASW, 3BIY, 4BK, 4BQ, 4BY, 4CD, 4GL, 4JI, 4XC. 4ZE, 5DA, 5ZA, 6ALE, 6WV (VOICE), 6XAD, 8BA, 8BK, 8BO, 8CI, 8DE, 8DR, 8GE, 8IB, 8II, 8IQ, 8JL, 8LF, 8LU, 8OH, 8QU, 8RU, 8TG, 8UJ, 8UK, 8ZD, 8ZG, 8ZN. 8ZZ, 8AAZ, 8ACF, 8AGZ, 8AIO, 8AKS, 8AND, 8AOA, 8AOU, 8AQF, 8AQR, 8AQZ, 8ARW. 8AWP, 8BDU, 8BEF, 8BFX, 8BJC, 8BNJ, 8BOW, 8BUM, 8BXU, 9AK, 9DV, 9FA, 9FM, 9HD, 9II, 9IO, 9JD. 9JI. 9LQ. 9RT, 9VE, 9XI, 9XM, 9ZY, 9ZAE, 9AAS, 9ADI, 9AKR, 9AMB, 9ARK, 9AXE, 9AZE, 9BHG, 9DWJ, NMW, NSF, NX4, XFI, KDKA, CANUCK, 2BF. 3BP, 9AW. *Every District*

BEST FOR C. W., PHONE OR SPARK—Look over this list and note that all classes of stations are represented from 1 AW's spark to 6 ALE's C. W. and 6 WV's 'phone.

If you've never heard one of the new improved Z-NITH Regenerators in action, visit the fellow in the next block who has one, and we will not need to use any more sales arguments on you.

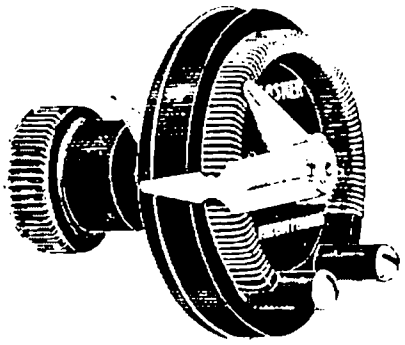
Our new catalog F-22 will be out February 1st.

If you are not already on our mailing list, write us.

CHICAGO RADIO LABORATORY

E. H. G. MATTHEWS, Pres. **6433 Ravenswood Avenue, Chicago, Illinois** K. E. HASSEL, Sec'y

KLOSNER
Vernier Rheostat



For the Modern Critical Tube

SIMPLE • QUICK • POSITIVE

Micrometer Rheostat with Only One Knob!

See this new instrument at your dealer's, or send direct to us mentioning his name.

Price $1.50, f. o. b. New York

Sold on a satisfaction or money back guarantee.

Dealers: *Send immediately for our attractive proposition.*

Klosner Improved Apparatus Co.

2404 Crotona Ave., New York, N. Y.

SIGNIFICANT LETTERS

Continued from page 18

As I have stated in a previous communication to you, it is the intent and ambition of the editors of RADIO to further amateur effort in every legitimate way in order that there may be a highly efficient citizen-operator reserve, that the Government can call upon, in case of need—and be reasonably sure of having a wealth of good material for the defense of the nation.

But—as Rulings are now fixed—the congestion is so severe that GOOD results are difficult—nay, almost impossible, to be got at!

If you, sir, could see your way to allocating unto Continuous Wave transmission a set of wave lengths solely for CW effort you would—pardon my temerity in presuming to advise you—be GREATLY assisting amateur progress.

It is a fact that the Department has not, at its beck and call, sufficient funds to pay the salaries of more Inspectors. This is to be regretted, as the officials now holding these responsible positions have so much territory to cover—aside from ship inspections, on the part of Inspectors at coastal ports—that heedless, and wilfully negligent amateur operators "get away" with various infringements of the law—excess power, illegal wave lengths, non-signing of calls, persistent—and selfish—interference—and so forth.

At the rate that is now apparent, unless something is done to relieve the jamming on 200 meters, there never WILL be any progress in amateur effort—the whole thing resolving itself into an infernal riot of sound—above, and through which only the most powerful spark stations will carry—and this, of course, leads conclusively to the evil that I have mentioned: the sly increasing of power, so as to BE heard!

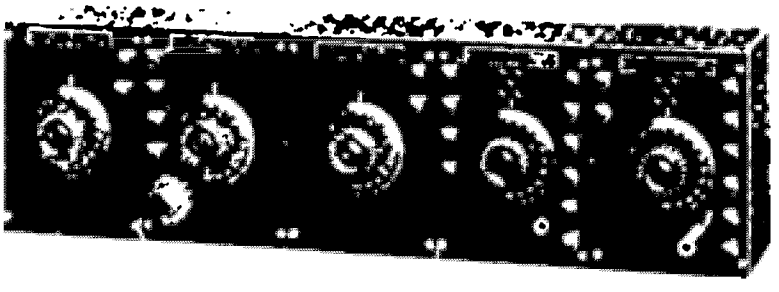
And, after all, this is but human nature! No one wants to be an "also ran!" What would you suggest, sir?

Cordially yours,
Lawrence Mott.

Calls heard at Radio 6AOZ, Santa Paula, Cal., Nov. 5th to 9th: 6AK 6AAH 6AAT 6ACY 6AEH 6AEI 6AFN 6AGF 6AHV 6AIO 6AKE 6ALE(CW) 6AOL(FONE) 6AOY(CW) 6APE 6AVV 6AVY(CW) 6BCP(CW) 6BF 6BM 6BX 6CL 6EN(CW) 6FN 6GEN 6GR 6JX(CW) 6KM 6LAD(CW) 6LU 6MF 6OH 6PE 6PJ 6QR 6RA(CW) 6RF 6SC(CW) 6UO 6VM 6VR 6VY 6VX 6VZ 6WL 6WV(CW) 6XAD(CW) 6YA 6ZL 6ZU 6ZA(CW) 6ZN(CW) 6RZ 7AF 7FT 7MF(CW) 7RA(CW) 7RF 7YA 7ZO 9ZAF(CW).

Stations heard and worked at 6AIB, Long Beach, Cal.: 5IF (5ZA) (6AK) (6AR) 6CH 6CV 6CP 6DP (6FH) (6FK) (6GF) (6GR) (6OC) 6OH 6PJ 6PO (6QR) (6RP) 6TU 6TV 6UO 6VM 6VK 6VX 6WO (6ZB) (6ZU) 6ZX 6ZZ 6AAU 6AAH 6ABH 6ABM 6ABR 6ABU 6ABW 6ABX (6ADA) 6AEI (6AEH) 6AEZ 6AFN (6AGF) 6AID 6AIW (6AJH) (6AKL) (6ALE-CW) 6ALP (6ANG) 6APE (6ARW) 6ATQ 6AUN 6AVV 6AWH (6AWT-CW) 7BH 7BK 7ED 7FI 7GA 7HW 7IN (7IW) 7IU (7KB) 7HF 7MF 7OZ (7XD) 7YA 7ZB (7ZJ) 7ZM 7ZS 7ZT 7ZU 9AMB 9AYV.

Service Radio Equipment



Service Unit Receiver

SERVICE equipment fills the needs of every Amateur. Built into each instrument is the care and precision that will insure perfect operation and long life. And to back this statement is a guarantee that absolutely protects the purchaser.

Send for our bulletins now and let your next order be for SERVICE EQUIPMENT. Register on our mailing list and keep informed of the latest in radio development.

We have three ideals—

The first is SERVICE—so are the other TWO

SERVICE RADIO EQUIPMENT

Box 340 Central Sta. Toledo, Ohio

THE BENWOOD WIRELESS TELEPHONE

TWO AMPERES WITH TWO 5 WATT TUBES ON 200 METERS

A Complete Radio Telephone at a Reasonable Price.
Sold Knocked Down With Full Set Instructions for Assembling and Wiring.

We guarantee this set to radiate at least 1½ amperes on average amateur antennae when assembled in accordance with our instructions. We also GUARANTEE this set to radiate 2 to 3 amperes when used with an antennae whose fundamental wave length is 225 to 300 meters.

The complete set of parts needed is listed herewith with prices applying to same. Wiring diagrams and full set of instructions accompany each outfit.

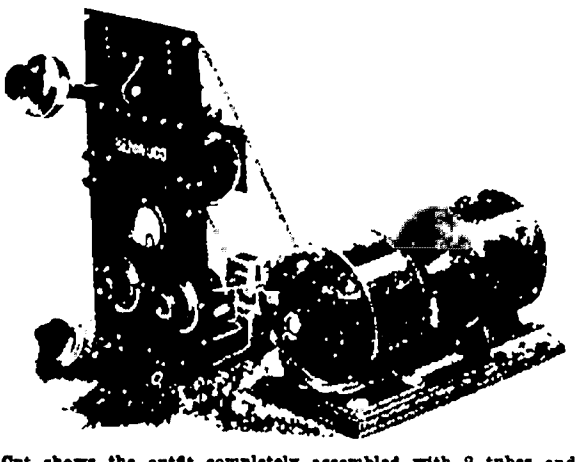
WIRELESS PHONE PARTS

2 UV 202 5 watt tubes, $8.00 each	$ 16.00
1 9 x 18 Formica panel, ¼-in. thick	3.75
2 brass panel support rods, set	1.50
2 Audion tube bases, Rhamstine, $1.00 each	2.00
1 Filament heating transformer, variable	5.00
1 modulation trans. Acme	5.00
1 BENWOOD CW inductance	7.00
1 Federal hand transmitter	7.50
1 panel type transmitter (one needed)	5.00
1 0-2½ radiofrequency meter. Jewell	6.50
1 0-300 milliammeter. Jewell	6.50
1 21 plate panel type condenser. Chelsea	4.25
1 43 plate panel type condenser. Chelsea	4.75
1 tapped CW condenser. Dubilier	2.00
1 1300 honeycomb coil (choke)	1.00
1 Federal 1000 volt tested condenser	2.00
Total—with panel transmitter	72.25
Total—with hand transmitter	74.75
Total—with both transmitters	79.75

Outfit Complete as Listed Above With All Holes Drilled in Panel, Full Set of Blue Prints for Assembling and Wiring and Operating.

$70.00 with panel transmitter. $74.00 with hand transmitter.

Outfit Complete with BENWOOD MOTOR GENERATOR AND TUBES, Boxed for Shipment $155.00 f.o.b. St. Louis, Mo.



Cut shows the outfit completely assembled with 2 tubes and motor generator.

SPECIFICATIONS. MOTOR-GENERATOR.

Motor—Rated at ⅓ hp., 1750 rpm, 110 volts 60 cycle induction type, exceptionally easy running. We can furnish similar motors for any current available, either AC or DC.

Generator—The finest ever constructed for CW work. Rated at 200 watt capacity and will stand a 300 watt load for 15 minute intervals.

Has 82 segments in commutator (an exclusive feature).

Generator under actual test gives following results:

Running cold, no load	610 volts
With 50 watt load	580 volts
With 100 watt load	550 volts
With 150 watt load	530 volts
With 200 watt load	510 volts
With 250 watt load	506 volts
With 300 watt load	500 volts

We can safely say that the complete unit is in a class by itself, it is of the highest grade workmanship and material throughout.

PRICES. F. O. B. St. Louis, Mo.

Motor Generator Complete as shown, $85.00.

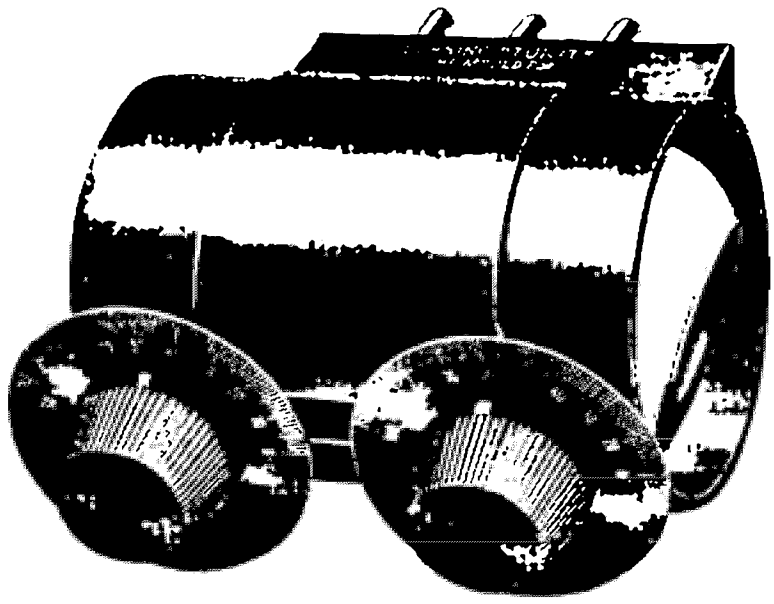
Generator only, $48.00.
Motor, $35.00.

We desire to impress upon the prospective purchaser that this is a very remarkable and attractive price for this high grade equipment as no expense has been spared in design and materials used in its construction and the low price is only due to quantity production.

THE BENWOOD CO., Inc.

ST. LOUIS, MO.

Patent applied for



Photographs, ⅔ actual size, of "TUNIT", the sensational new short-wave tuning attachment. Examine TUNIT at any of the Sorsinc branches listed below, or at your radio dealers.

To Dealers: If you haven't stocked TUNIT yet, it will pay you to wire at once for information. Good profits await you in handling this quick-selling, satisfaction-producing instrument.

for 160 to 600 meters, use

THE SORSINC TUNIT

THE SORSINC "TUNIT," when attached to your Honeycomb coil set, duplicates the performance of the most expensive short wave sets, on 160 to 600 meters, at a price any amateur can afford. It consists of a stationary coil and two rotors. Pig-tail spirals make perfect electrical contacts thruout. Black metal dials and moulded knobs are used. In fact, every *essential* is provided in highest quality and workmanship to give you best value per dollar!

Use the SORSINC "TUNIT" in your present standard triple coil mounting.

"TUNIT" will be on the market in December. Examine it at your dealers or at any of the SORSINC Branch Stores listed below. Price $15.00.

Write for Free descriptive folder.

SHIPOWNERS' RADIO SERVICE
INCORPORATED
80 Washington Street, New York City

SORSINC

Largest Radio Chain Store System in the World

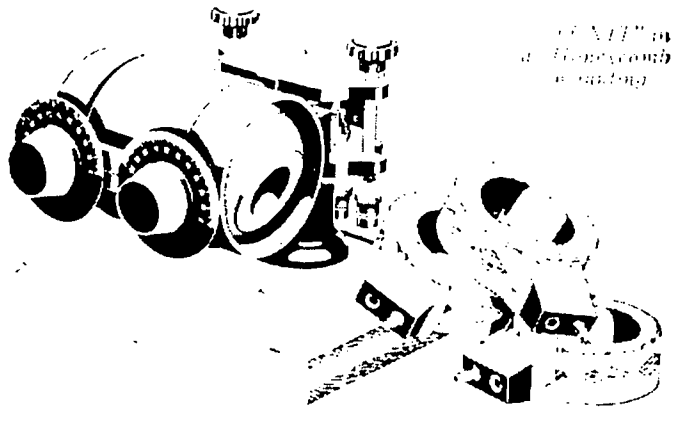
BRANCH OFFICE STORES

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Baltimore	403 Lobe Building
Norfolk	26 Haddington Bldg.
Savannah	230 Broughton St., East
New Orleans	710 Maison Blanche Annex
Portland, Ore.	622 Worcester Building
Honolulu	408 Boston Building
Seattle	215 James St.

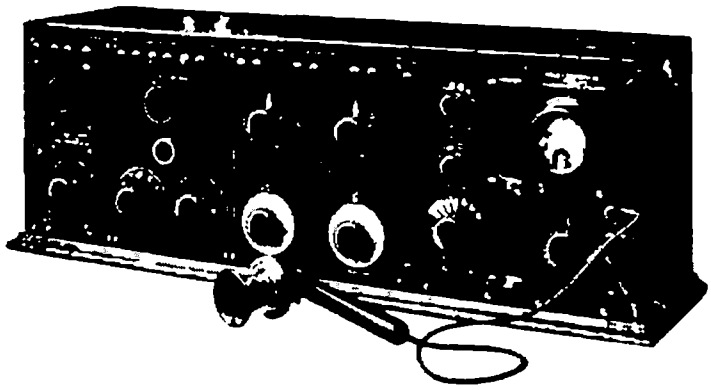
BRANCH OFFICES

Boston	175 Commercial Street
San Francisco	24 California St.
London	15 City Chambers, 65 Fenchurch St., E. C.

Your name and address on a postcard brings the new Sorsinc folder of latest apparatus at newest prices by return mail. Absolutely FREE. Send for it at once before you buy any new equipment. Prompt mail order service from each branch.



—for efficiency



"Use de Forest equipment for efficiency"

NEW de Forest CW Equipment

In buying Radio Equipment always specify *de Forest*. In that way you are assured of getting the best equipment that money can buy, at a price no higher than is charged for ordinary equipment. You get service. You get results. You get beautiful finish. You get value—when you specify *de Forest*. Remember that. There is *de Forest* equipment for every purpose, the same high unswerving standard quality throughout. If your dealer cannot supply you write us direct. Let us help you with your Radio problems, and assist you in the selection, set-up, and operation of apparatus that best fits your needs and means. "Use *de Forest* equipment for efficiency." The *de Forest* combination receiving and transmitting set illustrated above is composed of the following parts, which may be purchased either individually or combined in the set shown:

PACIFIC COAST PRICES

MP-200 de Forest one step amplifier equipped with transformer of the latest type to insure maximum efficiency, price **$18.80.**

MP-100 new de Forest Audion Control Panel designed especially for "soft" detector tubes now considered standard. Price **$14.30.**

MT-100 de Forest perfected short wave tuner. Range 150 to 600 meters. Ideal for Radiophone broadcasting. Price complete **$45.50. MT-200,** range 150 to 25,000 meters, **$50.00.**

OT-3 de Forest Midget Radiophone, designed to work on any source D.C. or A.C. supply up to 500 volts. Uses three 5 watt transmitting tubes, price **$106.**

For the best book on Radio ask your dealer or write us direct for "Elements of Radio-telegraphy," by Lieut. Ellery W. Stone, U. S. N. Written in simple, understandable terms and profusely illustrated with charts, diagrams and photographs. Price $2.50.

ATLANTIC-PACIFIC RADIO SUPPLIES CO., Inc.

638 MISSION ST.—SAN FRANCISCO—CALIFORNIA

Henry M. Shaw, President

Radio Engineers—Consulting—Designing—Construction

National Distributors for

MOORHEAD LABORATORIES, INC. . . . . **A-P Vacuum Tubes**

Sole Western Distributors

DE FOREST RADIO TEL. & TEL. CO. . . . . Radio Equipment
SHAW INSULATOR CO. . . . . Moulded Insulation
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REDMANOL CHEMICAL PRODUCTS CO. . . . . Insulating Paints and **Varnishes**
PACENT ELEC. PRD. CO. . . . . Radio Essentials
C. BRANDES, INC. . . . . Radio Head Receivers

DEALERS WRITE FOR PROPOSITION

—and "use A-P tubes for efficiency"

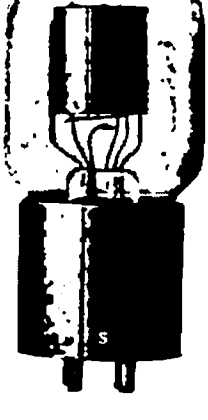


A-P tubes were chosen by PAUL F. GODLEY for the supreme test of International Radio communication between England and the United States. The new MAGNAVOX Power Amplifiers are designed for use with A-P tubes exclusively. The A-P VT Amplifier Oscillator [illegible] used by the U. S. NAVY. In the Westinghouse receiver cabinet at W J Z, the new Westinghouse High-power Radio Telephone Broadcasting Station at Newark, N. J., the WESTINGHOUSE Company are using A-P tubes *exclusively*. In *your* set "use A-P tubes for [illegible] used by those who know.

A-P tubes are licensed by the Radio Corporation of America under de Forest Audion and Fleming [illegible] for use in Radio communication.

The A-P VT Amplifier Oscillator—the Amplifier [illegible] the U. S. Navy. "Use the tube the Navy [illegible] Price **$6.50.**

The A-P Electron Relay—[illegible] tector of spark signals known to the radio [illegible] **$5.00.**



Abbott-Brady Printing Corp., S. F.