

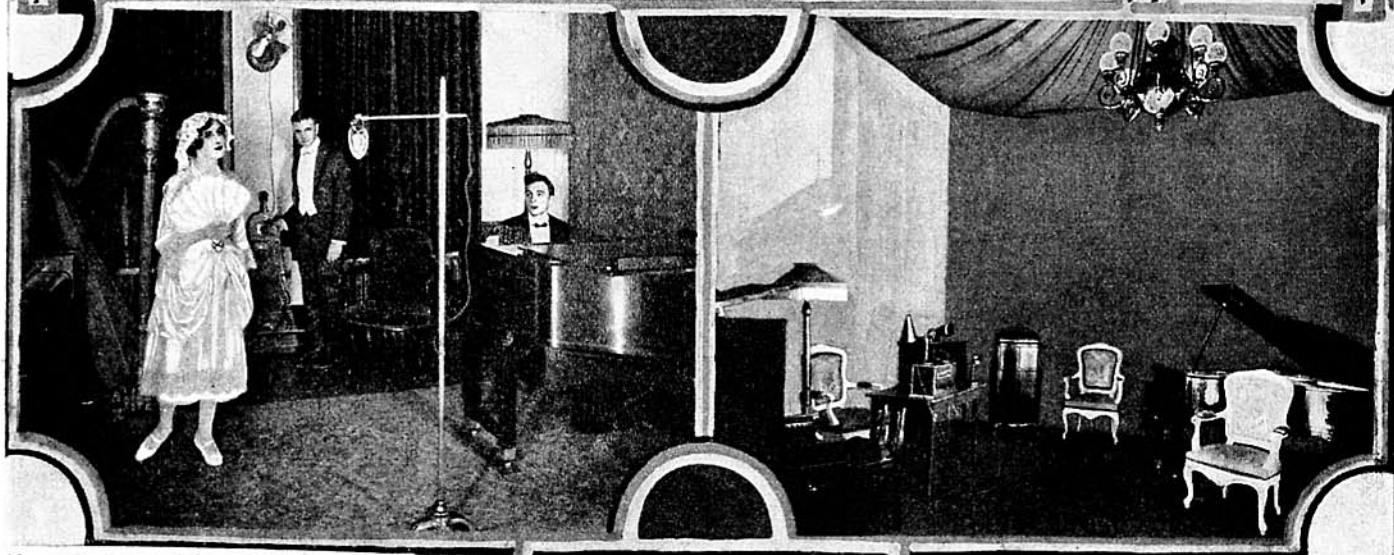
# Broadcasting Methods

Apparatus, Equipment, Studios, Programs and Administration of Big Stations a Radio Art

By C. E. LEMASSENA

Right: The New Studio of the Well-known Broadcasting Station WJZ at Newark, N. J. The New Type of Microphone Is in Use and the Voice Amplifier Is in the Vertical Phonograph Cabinet.

Below: Studio of the Broadcasting Station WWZ of John Wanamaker's Store, New York City. This Department Store Was One of the First to Install a Broadcasting Station in the East. Photo at Bottom of Page Is of the Old Studio at WJZ With Its Hanging Curtains and Different Type of Microphone.



Above: Studio at WGY, Broadcasting Station of the General Electric Co. at Schenectady, N. Y. The Controller and Announcer Is Seen in the Background.

AS soon as the radiophone's adaptability for broadcasting reports, concerts, lectures, religious services, news and other forms of entertainment became recognized, a new field of endeavor was created, known as Radio Art. The beginnings were crude and, therefore, subjected to any and frequent changes in method and in kind. The developments in a single year have been so astonishing as to warrant the assumption that another twelve months will be even more fruitful with respect to improvements and functions. It is estimated that there will be 25,000,000 receiving sets in use at that time, which presages a world enmeshed in radio. The possibilities for the extension of culture, education, knowledge, advertising, entertainment, religion, politics, etc., are limitless, and therefore beyond man's power to prophesy. It is a tremendous, an astounding outlook, with magnificent opportunities if rightly and correctly employed.

There are over 19,000 licensed radio transmitters, 15,495 being amateurs engaged in sending and receiving

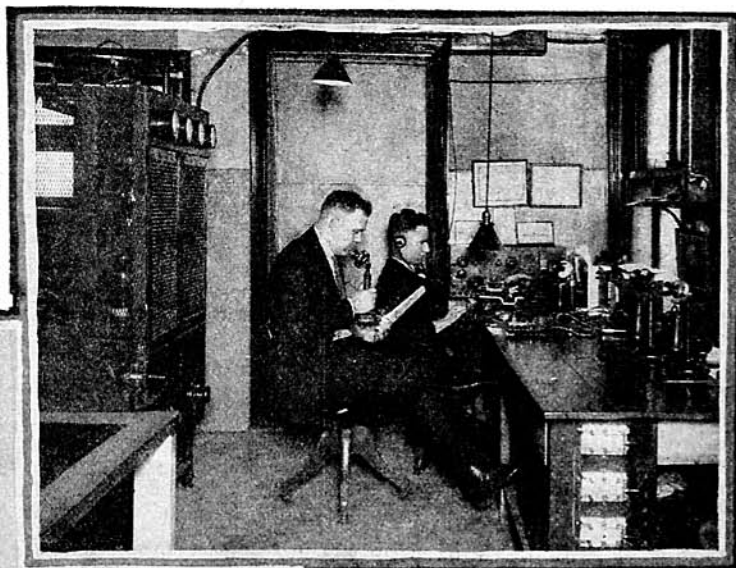


messages for personal amusement; 2,783 American shipping; 439 commercial; and 348 experimental. Of the 15,495 regular stations, the most important are located in the East: Pittsburgh (KDKA), Newark (WJZ), Chicago (KYW); Springfield, Schenectady (WGY), operated by the General Electric Co., and New York City (WWZ) by John Wanamaker.

While the methods employed by each of these stations are similar in many respects, there are numerous details in which they differ; it will be interesting to compare such methods. There are five distinct stages of broadcasting: (1) object, (2) apparatus and equipment, (3) studio, (4) programs and (5) methods. Under each of these heads may be considered the various phases pertaining to it. For example, "Object" includes selling, revenue, expense, advertising, publicity, market for apparatus and public benefits. "Apparatus and Equipment" comprises technical arrangements, amplifiers, microphones, operators, antennae, counterpoise, oscillators, modulators, station, wavelength, tuning, generators, motors, etc. Under "Studio" we have management, arrangement, reception,

outfit, accessories (pianos, organs, phonographs), transportation of artists. "Programs" include make-up, hours, booking, personnel, requisites, policy, management (impresario), expense. "Methods" embraces a large accumulation of items, such as vocations, criticism (outside and inside), letters, suggestions, improvements, advertising, publicity, compensation, expense, grouping, experiments, and particularly direction upon which the success of the work depends materially. An able guiding mind and hand is the back-

Right: Operating Room of the Broadcasting Station KYW at Chicago. The Transmitter Is Seen to the Left.



Above: Control Room of the Transmitter at WGY.

Right: Studio at KDKA, Pittsburgh, Pa., the Pioneer Broadcasting Station. The New Microphone and Speech Amplifier Are Shown.



bone of radio broadcasting during this present period of florescence.

All large broadcasting stations are operated by a staff under the supervision of one responsible person. This radio impresario carries a heavy load upon his shoulders, for the position is such as only one possessed of knowledge, understanding, experience and ability can fill. Upon the kind of service he and his staff devise and upon the way it is handled depend the success of their endeavor. The only financial return from such costly service is of course the sale of receiving apparatus in which other manufacturers and all dealers participate without cost. But without this service there would be fewer sales, therefore it is imperative that it be kept up and in the best manner possible. To install a broadcasting outfit and maintain adequate service runs into big money. Without going into details as to this particular matter, let us turn to the methods employed by the six big stations.

As the pioneer in the art, the Westinghouse Company is entitled to first consideration. KDKA has been in operation since November, 1920, and it is due to the experiments and developments of this station that radio art has advanced so rapidly. Comparing broadcasting of to-day with that of a year ago, the improvement is as remarkable as it is satisfactory. There still are limitations and problems to be overcome, but the listener-in-

is getting better results every day and radio fans are increasing more rapidly than manufacturers can supply sets. Radio art is a constructive force, so it is the duty of everyone to support it and assist in its progress toward perfection, which ultimately means much to the world at large.

Every broadcasting station, aiming faithfully to transmit radio news or entertainment, must be equipped with high-class apparatus. In the six big stations particular attention has been paid to the installation of material of highest quality, such as is not found in smaller stations. At the beginning it was soon discovered that an equipment giving satisfactory oral results was inadequate for music transmission. Therefore much experimenting and changing had to be done to improve the quality of transmission so that both voice and music could be faithfully reproduced. The scientific problems of broadcasting having reached a stage of comparative satisfaction, attention could be given to methods.

The four plants of the Westinghouse group, growing out of the company's experience in equipping American aeroplanes in France with radiophones, are conducted upon the same principles and embody practically the same ideas. It will not be necessary to describe each, therefore we will select the WJZ station as representative, although it did not begin to broadcast until eleven months after its sister station KDKA at Pittsburgh. The apparatus at Newark is efficient, consisting of a six-wire counterpoise antenna, which provides for multiple tuning on far end. There are eleven wires, 150' long and 124' above the roof, which is 100' above the ground. The natural wave-length is reduced to 360 meters by the use of special condensers in series on the Westinghouse aerial. An ingenious arrangement obliterates inherent distortion of the vacuum tube transmitters so that the speech and music is of unusual clarity, limited only by characteristics of the microphone, which transfers the sound-waves in electrical form to the amplifier.

The station is complete with respect to studio and arrangements. The old broadcasting room has been replaced by one of larger and more adequate dimensions. It is attractively furnished and located on the first floor, convenient to artists and organizations. A grand piano, an organ, a phonograph and other musical instruments form part of the equipment. An interlocking system of switches and light signals connects the studio with the transmitting room on the roof. The microphone used is the cup style suspended from a movable arm attached to a portable stand. The sound-waves are sent through the microphone to an amplifier box in the same room in which they are amplified many times and then transferred to the roof, where they are increased to the required amplification. This is a new method by means of which transmission over a long telephone wire from microphone to main amplifier is eliminated, an obvious advantage.

The daily program is arranged in accord-

(Continued on page 498)



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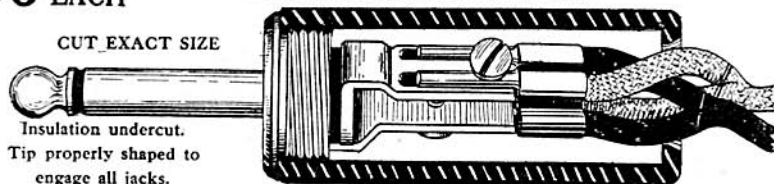
## Carter *TU-WAY* Radio Plug

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Special designed terminal permits TWO phone sets to be connected at the same time. Positive contact made with ALL types of tip cord terminals or wires.

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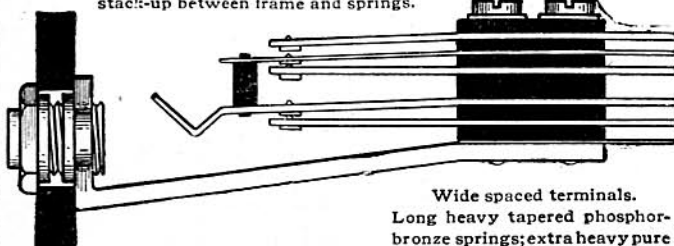


Black finish, non-breakable, round, one piece handle not affected by body capacity; no screws used to hold handle in place.

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Long heavy tapered phosphor-bronze springs; extra heavy pure silver self-cleaning contacts.

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THESE AND OTHER CARTER PRODUCTS SOLD BY THE BEST KNOWN ELECTRICAL AND RADIO JOBBERS

This gave a good smooth metal surface for a brush to connect with and one was mounted so as to make contact with it, the other being left to rub on the edge. This greatly reduced the resistance and increased the radiation to 1.4 amperes when using chopped C.W.

This home-made chopper is in use at station 8AMQ, and is giving good results. The advantages of I.C.W. are being appreciated more and more by those who have trouble raising a station due to the sharpness of the wave emitted by a C.W. set. The use of a chopper broadens the wave considerably and this kind of modulation will probably be used entirely in the high power C.W. set of the near future.

## Broadcasting Methods

(Continued from page 421)

ance with air traffic regulations, and with a view to giving a variety of entertainment and instruction. This program usually consists of agricultural reports and prices, opening prices on stocks and bonds, weather forecast and standard time signals, interspersed with music, during the morning. Then come mid-day prices on stocks and bonds, shipping news, sporting scores and results, fashion news, more weather forecasts, agricultural reports and prices, shipping news, closing market prices and music in the afternoon. The evening is devoted to concerts, recitals, lectures, stories, talks, final scores, etc. A special feature of the WJZ program is the "Man in the Moon" stories for children every Tuesday and Friday, and the literary evenings conducted by the editorial staffs of several New York publications. The concerts heretofore have been of a high order, but lately, due to an inability to secure high-class talent because of the aversion of artists to give their services gratis, it has been impossible to maintain the former standard. WJZ broadcasted the first grand opera and the first operetta. The former was Mozart's "The Impresario," presented by William Wade Hinshaw, and the latter, C. E. LeMasena's "Pandora," presented by the composer. The time signals from Arlington are received by a standard Westinghouse medium wave receiver, using a long single-wire antenna and transferred electrically to the radiotelephone transmitter. This enables those with short-wave receivers to pick up the message. All stations have radio chapel services on Sunday, some in the morning, others in the afternoon. In addition to the sermon by a well-known preacher, there is usually excellent music by a choir and soloists, all of which is impressive and indispensable as a counteraction against Sabbath desecration. This is one of the most beneficial instrumentalities of radio service, and its influence for good is incalculable.

Upon arrival at the Newark station the artist is received by the announcer. If the artist be a woman she is introduced to the lady attendant, who looks after her comfort and entertainment. Artists are accorded every courtesy and instructed beforehand regarding the points to be observed after entering the broadcasting studio. It is the custom of the Westinghouse to defray all expenses, including transportation. Programs are arranged on schedule far in advance. There is a booking department and a canvassing department under the direction of experts. When one considers that each of the seven days requires a diversified program of ten to a dozen different items, with several cancellations and changes entering into the day's work, the magnitude of the enterprise is apparent.

In East Pittsburgh a single Westinghouse condenser microphone of two stretched steel diaphragms is used. The announcer in the studio is in constant communication with the operator on the roof, as at the Newark station. Artists are brought into the studio, which is heavily carpeted and with two thicknesses

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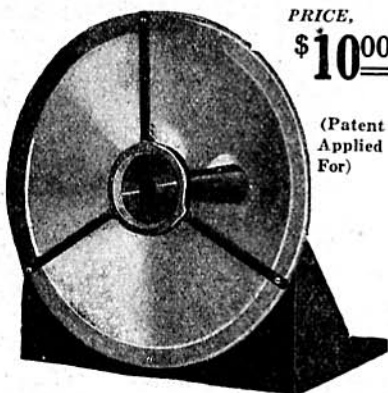
## AMPLITRON

(A Real Loud Speaker)

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Price WITH BALDWIN PHONE AND CORD.....\$16.50



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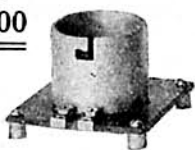
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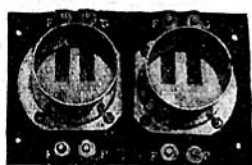
Grid Condensers .0005 mf. Type S15.....35c

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Type S3 \$2.00

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## THE CHART TELLS THE STORY OF

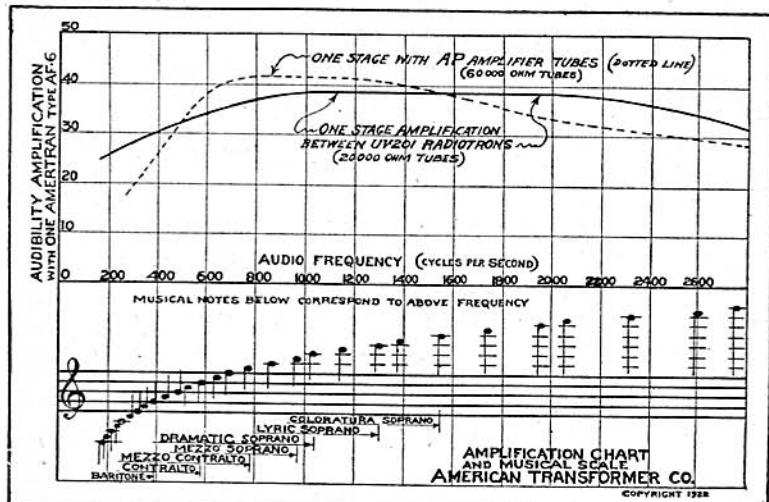
# THE AMERTRAN

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which has been recently developed to meet the critical demand of discriminating radio engineers.

NOTE the amplification curve in the chart below compared with musical scale frequencies—plotted from actual and authentic tests.

Highest Amplification Constant Over Broadest Band of Frequencies—Absolutely Without Distortion or Resonance Peaks.



UNEXCELLED IN OPERATION—UNIQUE IN CONSTRUCTION  
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of burlap on walls, similar to the recording room for making records. This differs from the Newark studio, which has rugs on the floor and undraped walls. One of the fundamental principles of acoustics is that intensity of musical tones is appreciably strengthened if the singer or instrumentalist stands on a bare floor and in a place devoid of draperies. It is, therefore, surprising that this point should have apparently escaped the attention of the studio directors. The Springfield station is undergoing important changes that will advance it to a position as commanding as that of the others.

Things are somewhat different at the WGY station at Schenectady, where the radio-transmitting apparatus and the studio are located in different buildings, about three-fifths of a mile from each other. This arrangement permits of considerable flexibility, inasmuch as it allows the broadcasting of programs from any point that can be connected to the studio by a telephone line. The main transmitting plant is on the top floor of one of the factory buildings, with a multiple-tuned antenna erected on the roof. This antenna is 350' long, supported by a 180' steel tower at each end. The counterpoise system, a few feet above the roof, consists of a network of wires that act as a "ground" for the antenna, resulting in a considerable decrease in effective resistance of the entire system. Two fundamental conditions for the successful operation of the radio-telephone transmitter—high frequency energy and its control in accordance with the audible vibrations to be transmitted—have been successfully fulfilled by the General Electric Co. at this station. The wavelength is also 360 meters.

Three rooms are utilized at the studio: one for reception, one for musical instruments and one containing the controlling and amplifying apparatus. The only electrical mechanism in the performing room are small microphones mounted on movable stands so that they may be placed in the best position for the selection to be broadcasted. These implements have been carefully designed with a view to clearly reproducing the true tone qualities of the music. The minute electric currents, which are set up in the microphone, are first transferred to the amplifying room. Here the intensity of the transmitted selection is varied at will by means of various controls on the amplifiers. At the output terminals of the last amplifier, an electric current that varies in accordance with the sound waves impressed on the microphone, is available and is transmitted, over a pair of wires, to the modulator tubes at the main station.

Censorship and supervision is exercised by those in charge. The studio director is able to cut off the microphones in or out of the circuit by means of a control switch. The illumination of a red lamp, as soon as the switch is closed, is the signal for quiet as the great invisible audience is then in contact with the studio. The censor is stationed in the apparatus room. He listens to everything that enters the microphone and makes such adjustments as he deems necessary to improve the tone quality. He is also in telephone communication with the transmitting department, which maintains a constant watch on the operator, who likewise keeps a sharp eye on his apparatus. All circuit adjustments are under control of the censor and no changes may be made without his consent. For broadcasting events that enlist the services of a number of participants, several microphones are used in parallel. The positions of the artists and the tonal variations are directed by a series of cards with such phrases as, "Please Sing More Softly," "Please Stand Nearer Microphone," "Please Enunciate More Clearly," etc. This station has found that the string quartet or the small symphony orchestra is reproduced the most perfectly, while the brass band is one of the difficult problems because of its "edge" in brilliant effects, but cornet, trombone and saxophone solos go over the radio in excellent

(Continued on page 505)



## Broadcasting Methods

(Continued from page 500)

style. A ladies' quartet does not broadcast well unless the number be unaccompanied and the singers employ considerable softness of tone emission. Violinists, pianists and tenors are easily managed.

Probably the most unique broadcasting station is that in the heart of New York City, known as WWZ. It is a constant reminder of that enterprising, far-visioned American merchant—John Wanamaker. Back in 1911 he installed a Marconi wireless telegraph station on both stores, thereby establishing direct communication between New York and Philadelphia. In December, 1921, the toy department of the New York store added a small radio section. In March, 1922, this was removed to the seventh floor as an adjunct to the broadcasting station under the direction of D. C. Smith. This was publicly opened on April 4th last. A musical program has been rendered every day and evening since. All activities, other than technical, are in charge of J. Thurston Noe, assistant to Alexander Russell, concert director of the Wanamaker industries.

The program is arranged on a somewhat different order from others. It follows a definite scheme and carries out a prearranged plan. There is a diversity of entertainment, including music, literature, sports and miscellany. Every afternoon at 1.40, Edna Beatrice Bloom, official soprano soloist of the Auditorium, gives a brief recital of three or four songs. At 2.40 there is a short recital of music by the Ampico piano or the victrola. At 3.40 another song recital or talk. At 4.40 on Tuesday and Thursday, one may hear the latest news on fashions, and on Wednesday and Friday, the children's hour is conducted by Elsie Jean. Beginning at 10.30 an evening musical program is given, the lateness of the hour affording listeners an opportunity to hear clearly, as all other stations are out of the air.

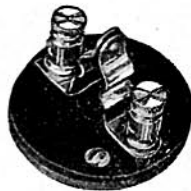
The concert broadcasting room is in the South building, on the auditorium floor. It contains a grand piano, an upright piano, a phonograph, the transmission set and appropriate furniture. It is of ample size for ordinary use and is encased in curtains. Instead of the familiar microphone, a pair of telephones are used. A small megaphone is inserted in the mouthpiece of the phone that stands on the switchboard box. The other phone may be shifted about to convenient points, being equipped with an extra long cord. In broadcasting piano music, this second phone is placed on a bench near the piano. The aim of the department is to develop radio service of a high standard, including timely discourses on interesting subjects. No effort is wasted on trivial experimenting. Applicants must pass a rigid test or be well recommended before they are granted permission to sing, play or speak. Auditions are frequently held in the Auditorium in order to ascertain the qualifications of the applicant, while others are drawn upon by reason of their having made successful appearances at Auditorium concerts. Radio Director Noe is a musician as well as a radio expert, with an intimate knowledge of the wishes of the music department and also of the Wanamaker policy, which permits of nothing mediocre or cheap. Therefore WWZ entertainments are of a quality in keeping with such standards.

The great organ dedicated in November, 1921, by two of the world's leading organists, is in line for broadcasting purposes. Experiments have been made as to its availability for transmitting the tones of this wonderful instrument via radio, but to date the results have been unsatisfactory. This furnishes one of the problems that probably will be solved in the near future and will give the station a distinct position among broadcasters. The big organ, located in the Philadelphia Wanamaker store, will also be used for radio broad-

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### "IMPROVED" ANTI-CAPACITY JACKS



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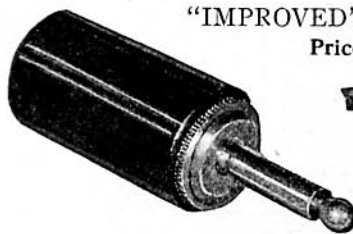


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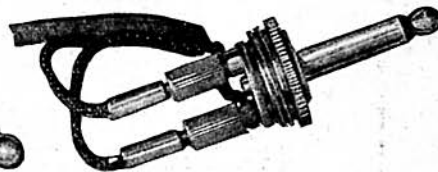
Double circuit  
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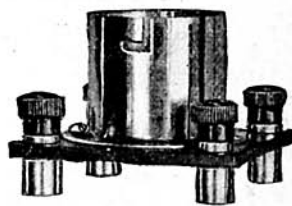


Capable of universal attachment, whether there is a metal tip on the telephone cord wires or not. Designed by a highly skilled engineer, it does away with the necessity of tearing off the metal tips usually soldered to telephone cord wires. Accommodates tips of any size. Requires no screw driver or other tools to make connections. Fits all standard jacks. Operates as binding post where telephone cord is not provided with tip.

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This socket is of definitely superior design. Thumbscrews are provided for attaching wires quickly and easily. The socket is screwed firmly to the base, preventing trouble due to poor lamp contact. Base contacts cannot move sideways, as a locking tongue holds each securely in place.



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casting if certain variants between the low and high tones can be transmitted, which the microphone does not now receive accurately.

The transmitting room is equipped with three tubes of 50 watts each, an oscillator, amplifier and modulator. The instruments are enclosed in a roll-top desk. The antenna is 180' long, with counterpoise over the roof of the building between 9th and 10th Streets. In addition to the broadcasting department, the store maintains a complete radio merchandising section where one may obtain advice from experts, and purchase receiving sets as well as a full line of parts of standard make. The section will soon be enlarged to include receivers of large type.

When we contemplate the vastness of the radio world, when we figure the stupendousness of the industry now and calculate vaguely what it will be one year hence, when we realize the untold possibilities of this latest art-science, then we may say truly that we are living in a marvelous age. The momentum of radio is grandiose in the strength and velocity of its movement. It bends all to its will. If it is to be harnessed and controlled, we must deal with it as with Niagara, carefully and cunningly in order to compel its application to our needs and to avoid being swept aside by its irresistible might.

Price List		
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Crystal Detectors	-	3.00
Dials and Knobs	-	1.00
Grid Leaks	- -	.60

### Radio Digest

(Continued from page 451)

Last month the Department of Commerce authorized small additions to the radio equipment of several of its larger sea-going tenders to enable the crews to receive the radio broadcasting services for instruction and entertainment purposes, and consideration is now being given to making some similar use of the radio equipment placed on many of the lightships during the war, but not used since the Armistice, as well as on the principal outside lightships where a regular radio service is now maintained. These latter, such as Nantucket and Diamond Shoals lightships, are the outpost radio stations on our coasts, reporting incoming ships, forwarding messages, and sending word of vessels in distress.

With the cooperation of the Navy, radio telephones have recently been installed at several of the remote lighthouses in Alaska.

Some of the lightships are also equipped as radio fog-signal stations, with the new Department of Commerce system, used continuously during foggy weather to furnish accurate bearings to ships possessing the radio compass.

According to George R. Putnam, Commissioner of Lighthouses, radio should be a great boon in relieving the lonely and monotonous life of the faithful keepers at isolated stations both on lightships and at lighthouses. The keepers of the Alaska lighthouses at the entrance to Bering Sea remain at their posts for three years on a stretch; they have been without mail for ten months. At Tillamook Rock Light, off the Pacific coast, bad weather has prevented direct communication with the shore for periods of seven weeks at a time. On the offshore lightships supplies are received usually only once a month, and the tenders often work in remote localities. Relaxation at these stations depends chiefly upon libraries furnished by the government and donated magazines with an occasional phonograph presented by a thoughtful friend.



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The BEST evidence of the merit of the Telmacophone is the enormous demand for this loud speaker. Inverted horn, reflected tone. Equal to any other horn twice its length. Designed and perfected by expert acousticians.

Complete in every detail. No extras to buy. Nothing to get out of order.

Do not be satisfied with an inferior substitute. Insist on the best for your money—the Telmacophone.

Price, Complete, \$20.00, Fully Guaranteed

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Stores in Norwalk, Conn., Detroit, Mich., Newark, N. J., Brooklyn, N. Y., White Plains, N. Y.

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Seamless—Grey	Per Inch or Fraction	Per Ft.
2 1/2, 3 and 3 1/2 in. O. D.	3 1/2 c.	30c
4, 4 1/2 and 4 3/4 in. O. D.	4 c.	35c
5 in. Outside Diameter	4 1/2 c.	42c
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Postage Extra—Shipping Weight, 1 lb. per ft.

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Philadelphia has the youngest professor of wireless. He is William Noble Allen, 11 years old, a West Philadelphia boy, who has held a government radio license for more than two years. This is where the "professor" part comes in. He holds the chair of