Price 20 Cents

May, 1917

THE WIRELESS AGE

THE ELECTRICALLY CHARGED BARBED-WIRE STOCKADE AND DETAIL OF ARMED GUARDS PROTECTING THE NAVY'S NEW SAN DIEGO WIRELESS STATION

THE WIRELESS AGE

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

MAY, 1917

The Washington's Birthday Relay

Story of the Successful Interchange of Messages by Radio Between Mayors of the East and West,

By 9 XE

National Chief of Relay Communications

NATIONAL AMATEUR WIRELESS ASSOCIATION

SUCCESSFUL results marked the Washington's Birthday Relay, held under the auspices of the National Amateur Wireless Association, when a wireless message from Mayor Mitchel of New York to Mayor Woodman of Los Angeles, Cal., was transmitted and a relay by radio was flashed. Thousands of amateurs throughout the country copied the messages.

Special stations sent the westbound message from New York from 2 ZK at New Rochelle, using 8 YI, 9 ZM and 9 ZF to 6 EA (Los Angeles). When the time (an hour and a half) and the great QRM and repetition of messages because of misspelled words are taken into consideration, the achievement was not inconsiderable.

We had good wireless weather as far as the Rocky Mountains on the night of the relay. However, I had studied the weather conditions thoroughly and looked for trouble southwest and west. That I was not mistaken was shown by the fact that a small cyclone was sweeping over Texas, Arizona, New Mexico and California, and the tail end of a regular old-time QRM storm was disturbing the amateurs in the Far West. Notwithstanding, 6 EA received the message directly from 9 ZF. 6 DM, who volunteered to help 6 EA, put on full power and blew the fields of his gap motor. This left the work to be handled by 6 EA.

Seefred brothers delivered the message of Mayor Mitchel to Mayor Woodman and received the reply promptly. QRM and QRN were so bad by this time, however, that it was impossible to transmit the message through to 9 ZF. The amateurs who remained awake all night waiting for the return message will be particularly interested in learning that 6 EA remained in his station and transmitted the message through the following night, but the hour was so late that 9 ZF could not find any one awake. 9 XF arranged for all eastbound amateurs to be alert and the message came through, being delivered to Mayor Mitchel by George C. Cannon (2 ZK) early in the morning.

In responding, the total time consumed on each message was reckoned and the race between specials and the amateurs

> To the Mayors of Los Angeles, Cal., and Seattle, Wash.: On behalf of New York City, I send cordial greetings to Los Angeles and Seattle and best wishes for the success of the radio system.
> (Signed) John Purroy Mitchel,
> Mayor of New York.
>
> To the Mayor of New York City: On behalf of the City of Los Angeles I return your greetings and wish you continued prosperity. Congratulations to amateur radio on the successful message.
> (Signed) Fred I. Woodman,
> Mayor of Los Angeles.

The mayors' radio messages

The station of E. B. Duvall and A. P. Smith at Baltimore, Md.—Winners of the First Prize

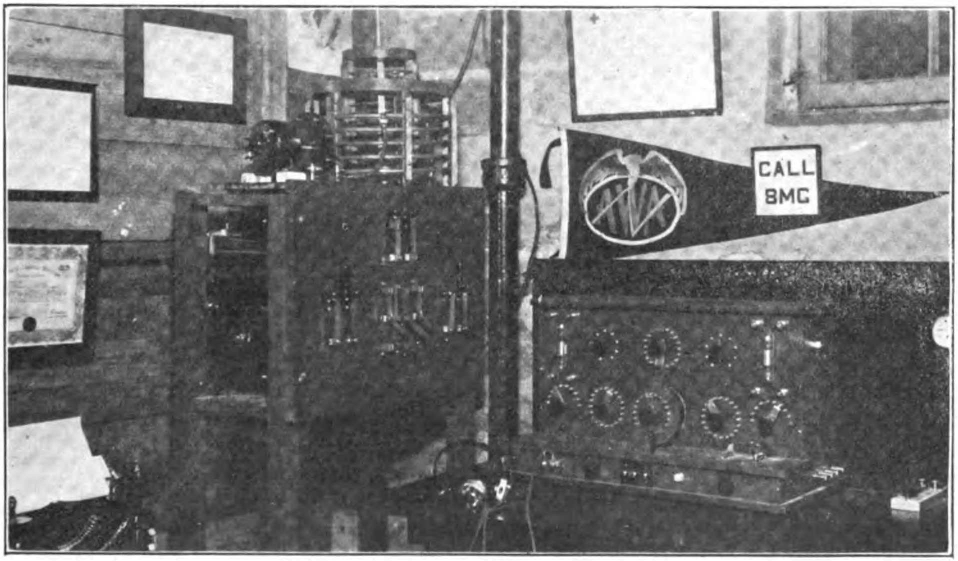
was found to be a tie. The handicap of the low wave of the amateurs gave them a slight preference in the decision. However, my former contention that the amateurs are not yet prepared to handle transcontinental messages with as great a degree of certainty as the specials, unless they arrange for emergency stations in the long jumps in case of bad QRM, still holds.

The following notice signed by 9 XE and distributed in advance of the relay, makes clear the conditions under which the event was held:

"Msg starts from 2 ZK—325 M.—10:30 P. M. 2-24-17 Eastern time. 2 ZK calls 8 YI on 325 M. 8 YI calls 9 XM on 440 M. 9 XM calls 9 ZF on 2200 M. 9ZF calls 6 EA on 425 M.

"In case of QRM or QRN, 2 ZK calls 3 ZS on 325 M. at 10:30 P. M. 3 ZS calls 8 YZ on 425 M. as soon as he gets MSG. 8 YZ calls 8 YO on 425 M. as soon as he gets MSG. 8 YO calls 8 YI on 400 M. as soon as he gets MSG. 8 YL calls 9 ZN on 425 M. as soon as he gets MSG. 9 ZN calls 9 XN on 425 M. as soon as he gets MSG. 9 XN calls 9 XF on 425 M. as soon as he gets MSG. 9 ZF calls 6 EA or 6 DM on 425 M. as soon as he gets MSG.

"In case of QRM or QRN at 9 ZF: 9 XN calls 9 XV on 425 M. 9 XV calls 5 ZC on 950 M. 5 ZC calls 9 ZF on 425 M. In any event 8 XA will repeat MSG on QST after 9 ZF has it O.K. and given QSL. Send once only, and this only for westbound MSG on 700 ing alert for the return MSG. No one but the sending amateurs east of 9 ZF



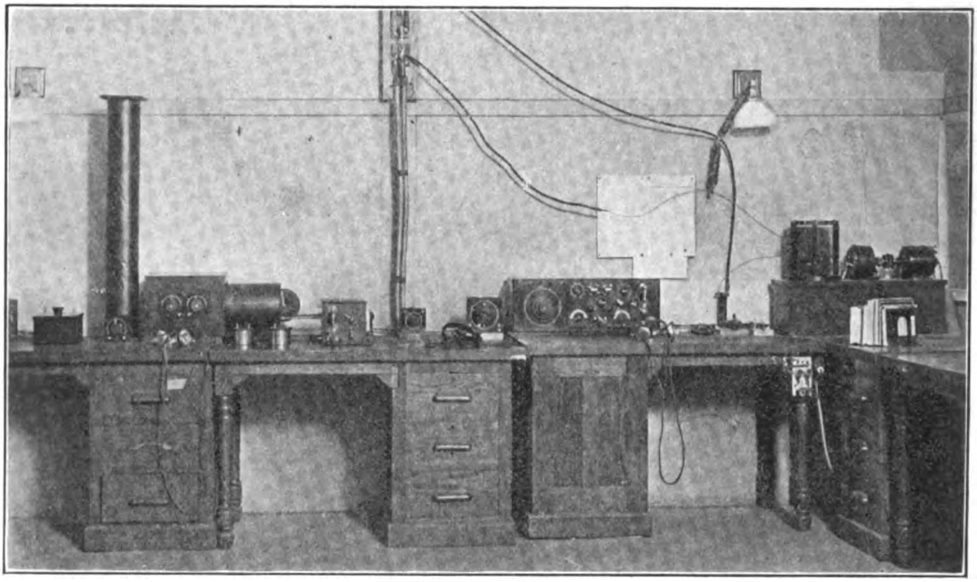
Kenneth Briggs' station at Rochester, N. Y.—Winner of the Third Prize meters. 9 XV will give MSG to 5 ZC after 8 XA sends it once only. 5 ZC will send MSG once only on QST for benefit of stations in New Orleans and Shreveport.

"As special stations are fighting against time, we prefer the first arrangement and that all others keep quiet and check strength of sigs.

"6 EA will have MSG ready from Mayor of Los Angeles and give it to either 6 DM or 9 ZF, according to QRN. 9 ZF gives MSG to 5 DU on 425 meters. 5 DU gives MSG to 9 ABD on 200 meters. 9 ABD gives MSG to 9 GY on 200 meters. 9 GY gives MSG to 8 AEZ on 200 meters. 8 AEZ gives MSG to 2 AGJ on 200 meters. 2 AGJ gives MSG to 1 IZ on 200 meters. 1 IZ gives MSG to 1 ZM on 200 meters. 1 ZM gives MSG to 2 ZK on 200 meters. 2 ZM gives return MSG to Mayor of New York. 8 NH repeats westbound MBG on 200 M. 3 times on QST after 9 ZF has it. 8 NH repeats eastbound MSG on 200 M 3 times on QST after St. James, 1 IZ has it.

"Interest everybody in helping the United States naval authorities get recruits for the Radio Reserve. Report all QRM."

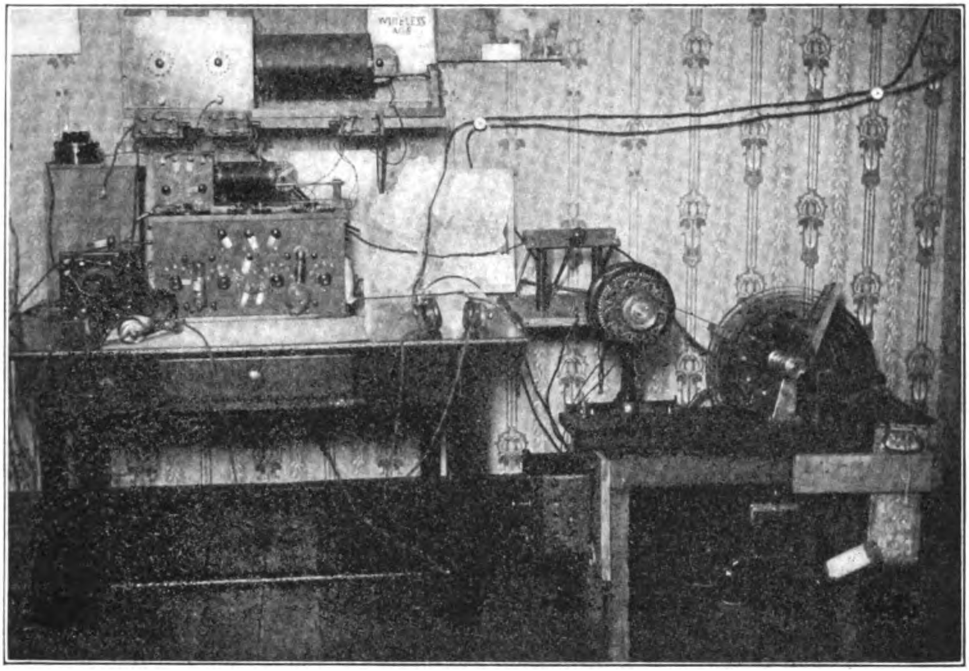
The reports made by those who took part in the Relay deserve mention, but lack of space prevents me from giving a detailed account of these compilations. Hoyt of Hayward, Cal. (6 SI), who is a prize winner, made one of the best reports that I have had the priviledge of reading. Stewart of St. Davids, Pa. (3 ZS), a member of the Radio Association of Pennsylvania, remained awake till almost six o'clock in the morning in order to make his report complete. Emerson of Dallas, Tex., formerly a member of the navy, wrote a report filled with interest and the log of the members of the San Francisco Radio Club was well worth reading.



Scott High School station, Toledo, O.— Winner of the Fourth Prize

The names of the prize winners follow:

First Prize—E. B. Duvall and A. P. Smith were awarded the donation of the Electro Importing Company, a "Nauen POZ" radio receiving set. Duvall and Smith operate jointly 3 AK, in Baltimore, Md. This prize was awarded for the quickest delivery of both messages, and particularly for be-



Mr. and Mrs. C. Candler's station, St. Mary's, O.—Winner of the Sixth Prize

knew when the eastbound MSG was coming through.

Second Prize—W. B. Pope (4 AA) of Athens, Ga., was awarded the professional wave meter, donated by the Electro Importing Company of New York. It was awarded for long distance reception, prompt, business-like delivery and for perfect indexing, timing and marking both east and westbound messages, received in approved commercial style.

Third Prize—Kenneth Briggs of Rochester, N. Y. (8 MG), whom you all remember as almost catching up with C. E. Hughes, the presidential candidate, with a copy of the relay message on October 27th, was awarded the 1 k.w. Thordarson transformer, donated by the Thordarson Transformer Company of Chicago. The QRM map showed marked interference, particularly on westbound messages.

Fourth Prize—Scott High School of Toledo, Ohio, was awarded the William B. Duck's Arlington tuner for long distance reception with moderate apparatus, diligent and persistent listening for the return message and a complete business-like report.

Fifth Prize—Leander L. Hoyt of Hayward, Cal. (6 SI), was awarded the Chambers No. 749 tuner, for the reception of arc and spark signals. This prize was awarded for long distance work and incessant effort to bring the amateurs in that neighborhood to a realization that California would be put on the Relay map.

Sixth Prize—Mr. and Mrs. C. Candler (8 NH) are located in St. Mary's, Ohio, but their sigs. do not stay at home. During the Presidential Relay this station received six hard earned credits, although its transformer was not working properly. If it had not been for this station amateurs south and west would not have received the westbound MSG. Some who did not know 8 NH was supposed to help on relay reported that station as QRM.

This station was awarded the donation of the Perfection Radio Laboratory of Clinton, Ia.—one short wave amplifying tuner. The writer used a tuner of this make during the last relay and could hear the sigs. of 4 CL and 2 PM very QSA.

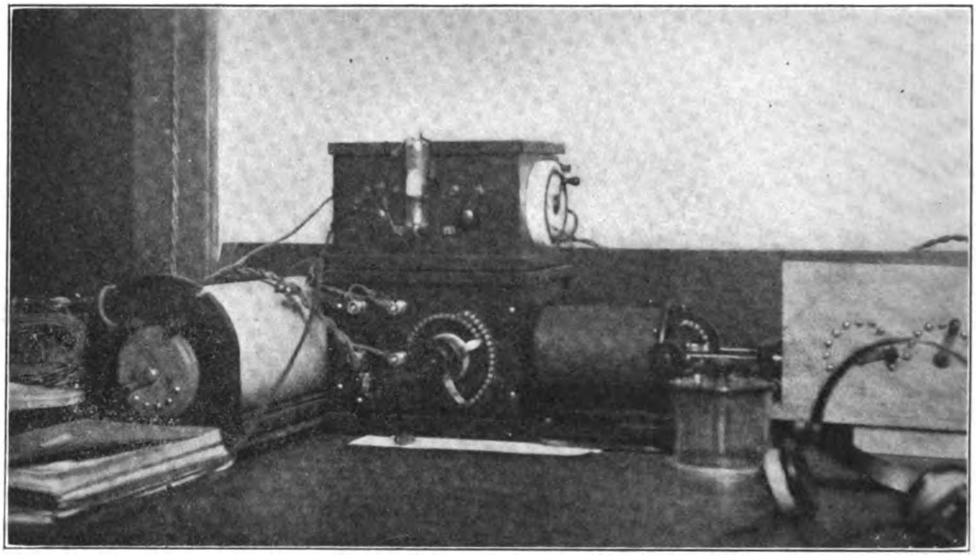
Seventh Prize—O. R. Terry of Stoughton, Wis., was awarded the prize of the Manhattan Electric Supply Company of Chicago. This is a pair of 3,000-ohm Mesco phones.

much for granted and not filing the time received on their reports. The names of the operators and the stations that made perfect scores will be found in the following list:

Arkansas—John M. Clayton, 5 BV, Little Rock.

Arizona.—R. A., 6 FD, Phoenix; L. E. Glenn, 6 IT, Alhambra; J. Giraud, 6 EO, Phoenix; R. Higgy, 6 DM, Phoenix.

Colorado.—E. F. Doig, 9 ZF, Denver; W. H. Smith, 9 ZF, Denver.



O. R. Terry's station at Stoughton, Wis.— Winner of the Seventh Prize

Eighth Prize—The Phoenix Radio Club of Phoenix, Ariz., was awarded the donation of Philip E. Edelman of St. Paul, Minn. This is his latest book, "Experimental Wireless Stations." The prize was awarded for long distance reception, co-operation in the relay and keeping quiet when necessary.

The prize winners may obtain the prizes by writing to the donors, giving their names and addresses and referring to this magazine.

In awarding the prizes the location of the station, QRM, neatness of the report, diligence in seeking the return MSG, judgment in making the reports and length of time spent by the operators as experimenters were taken into consideration. Many in the Relay failed because of misspelled words, taking too

California.—Seefred brothers, 6 EA, Los Angeles; L. Lynde, 6 UG, Long Beach; C. H. Hirst, Stanford University; F. Terman, 6 FT, Stanford University; L. L. Hoyt, 6 SI, Hayward.

Connecticut.—H. Haugh, HH, Derby.

The Dakotas.—M. Tuve, MT, Canton, S. D.; P. C. Green, PG, Aberdeen, S. D.; D. Cottam, DCL, La Moure, N. D.; E. Worthington, 9 APG, Aberdeen, S. D.; E. R. Isaak, 9 TZ, Eureka, S. D.; A. Shaw, AS, Parkston, S. D.

Florida.—J. C. Cooper, Jr., 4 EI, Jacksonville; C. M. West, U. S. N., St. Augustine.

Georgia.—D. L. Gaston, CWW, Commerce; A. F. Hood, CWW, Commerce; C. H. Williams, 4 CY, Covington; J. R. Shumate, 4 EC, Tomasville; W. B. Pope, 4 AA, Athens.

Indiana.—G. Decker, 9 QNO, Ligonier; L. B. Wilcox, 9 KH, Angola; L. Gehring, 9 AAS, Bluffton; P. K. Romey, 9 QR, Columbia City; J. E. Williams, JW, La Grange.

Illinois.—S. W. Pierson, 9 PY, Carrolton; R. H. G. Mathews, 9 ZN, Chicago; E. E. Boynton, 9 ARA, Sycamore; L. A. Kern, 9 GY, Matoon; H. Klaus, HK, Eureka; R. W. Beard, 9 GK, Pleasant Plains; E. H. Giddings, 9 MK, Lanark; H. A. Mackley, 9 AIM, Peoria.

Iowa.—W. E. Slauson, 9 AMI, Monticello; H. O. Ainsworth, 9 AMI, Monticello; S. U. of Iowa, 9 YA, Iowa City; Don Bailey, 9 RD, Clinton; Lester Fawcett, 9 AIF, Independence; C. Tumwall, CT, Ottumwa; W. Harper, WH, Ottumwa; H. M. Ennis, HME, Ottumwa; Kent brothers, 9 ARF, De Witt; The Old War Horse, 9 RD, Clinton.

Kansas.—W. S. Ezell, 9 YE, Wichita; Karl Keller, 9 ADE, Kinsley.

Louisiana.—P. E. Grenlaw, 5 BB, Franklinton.

Massachusetts.—R. T. St. James, 1 IZ, Great Barrington; P. C. Smith, Haverhill; E. B. George, 1 ANA, Framingham, B. H. Moran, 1 AAM, Natick.

Minnesota. — Peter Hansen, PH, Chisolm.

Michigan.—J. L. Munger, LM, Sturgis; W. Benson, 8 ANR, Battle Creek; Ed Holby, 9 OE, Marquette; Y. M. C. A., 8 QJ, Ann Arbor; M. B. Rann, 8 ADR, Lansing; W. Koivanen, WK, Chisolm; D. G. Carter, 8 WR, Grosse Point.

Missouri.—W. Corwin, 9 ABD, Jefferson City; Washington University, 9 XV, St. Louis; H. Longmire, Monroe City; B. Emerson, Monroe City.

Maryland.—C. E. King, 3 SV, Baltimore; E. B. Duvall, 3 AK, Baltimore; A. P. Smith, 3 AK, Baltimore; L. W. Passano, Marconi operator, M. & M. Co., Baltimore.

Montana.—A. C. Campbell, 7 ZC, Lewiston.

Nebraska.—Bradford Telepea (No call), Tekomah.

New York.—J. N. Simpson, 8 CM, Rochester; W. C. Ballard, 8 XU, Ithaca; Genesee Radio Station, 8 OZ, Rochester; Dr. H. E. Fitch, 8 ZE, Elmira; O. W. Saxton, 8 FY, Buffalo; A. C. Young, 8 ARB, Buffalo; H. Blower, 2 HB, Brooklyn; Kenneth Briggs, 8 MG, Rochester; J. Weiss, 2 FH, Port Washington; G. M. Benas, 8 CC, Utica; W. J. Vickery, 8 SE, Gloversville; J. K. Hewitt, 2 AGJ, Albany.

North Carolina.—W. S. Rothrock, 4 DI, Winston Salem; J. T. Moorehead, JM, Greensboro.

Ohio.—Fred Travis, Defiance; R. Hoffman, Defiance; D. Israel, 8 ANC, Cincinnati; G. D. Howsare, 8 ASC, Eaton; D. Schellenbach, 8 IF, Wyoming; R. A. Duerk, 8 AHI, Defiance; C. Linxweiler, 8 IJ, Dayton; (no name), 8 ATG, Tiffin; C. Candler, 8 NH, St. Mary's; L. Berman, 8 ML, Cincinnati; Scott High School, 8 ZL, Toledo; Merle Sager, 8 ASW, Tiffin; N. Thomas, 8 FX, Marietta; M. B. West, 8 AEZ, Lima; J. F. Eckel, 8 PL, Cincinnati; J. O. Hibbett, 1113, Ottawa; L. M. Clausing, 8 YL, Lima.

Oklahoma.—A. and M. Steddon, 5 AB, Oklahoma City.

Pennsylvania.—H. T. Mapes, 3 AUC, Carlisle; Chris M. Bowman, 3 PC, Lancaster; High School station, 8 JS, Bellefonte; L. and H. Alexander, 8 ALE, Grove City; R. R. Goodwin, Roulette; M. H. Mandelkern, 3 MR, Philadelphia; Peabody High School, 8 YZ, Pittsburgh; W. and R. Shoop, Vandergift; F. J. Anderson, QD, Reading; F. H. Brian, Smithport; C. H. Stewart, 3 ZS, St. David's; Nassau Brothers, 3 CT, Philadelphia; Karl E. Hassel, 8 YI, Pittsburgh; R. C. Clement, 8 AJT, Washington; St. Joseph's College, 3 XJ, Philadelphia.

Rhode Island.—C. E. Davis, Edgewood; M. V. Pollys, Jr., 1 EMG, Bristol; H. W. Thornley, 1 AI, Pawtucket.

Tennessee—S. H. Sheib, 5 CY, Nashville; C. B. Delahunt, 5 ZD, Memphis.

Texas—B. Emerson, 5 DU, Dallas; R. Corlett, 5 ZC, Dallas; J. L. Antry, 3 ED, Houston; C. W. Gilfillan, FM, Austin.

Virginia.—R. R. Chappell, 3 ST, Richmond; G. C. Robinson, 3 ST, Richmond; J. F. Wohlford, 3 WE, Roanoke; W. T. Gravely, 3 RO, Danville; J. E. Krone, 3 TY, Newport News; A. N. Johnson, 3 TY, Newport News.

West Virginia.—J. E. Law, Clarksburg; H. E. Burns, 8 AGH, Martinsburg.

Wisconsin.—H. J. Crawford, 9 WT, Wausau; C. Quinn, 9 ARD, Neehah; M. P. Hanson, 9 XH, Madison; E. H. Hartnell, 9 BV, Salem; A. Rufsvold, 9 ADI, Marinette; O. R. Terry, 9 HQ, Stoughton.

In conclusion, attention should be called to the fact that fifty miles, worked absolutely sure, with a considerable number of relay stations, is more reliable than a few stations with long jumps between, operating only when conditions permit.

As follows are descriptions of some of the stations, the owners of which were awarded prizes:

The station of Edward B. Duvall and Allan P. Smith, 3d, winners of the first prize, contains a vacuum valve cabinet, an auditron bulb, a bunnell 43-plate variable condenser, a cabinet receiving set with a small reconstructed and rewound Murdock receiving coupler, crystal detectors, a Blitzen variable condenser and loading coils which are inside the cabinet and are controlled by the change-over switches mounted on the front. Two of these switches also cut out unused parts of the small coupler which makes it efficient for short wave reception. A large reversing switch on the table throws the tuner either to the crystal detectors or the vacuum valve circuits. A large marble key of the Marconi and Murdock 2,000-Ohm receivers are employed.

The reception of signals is carried on through the secondary of the oscillation transformer. No large aerial change-over switch is used, a small rubber base pole changing switch being employed. The transmitter is contained in a large panel on the front of which are mounted switches for power control and a rheostat for rotary gap speed control. The transmitting set is made up of a ½ K.W. Clapp-Eastham Company transformer, a Hytone rotary quenched gap and motor, a Clapp-Eastham Glass plate condenser and an oscillation transformer, pancake style, insulated on hard rubber. All connections are of heavy brass ribbon, those in the closed circuit being extremely short. Marconi kick-back preventors are used in the primary circuit of the transformer. Clapp-Eastham hot wire ammeter is used. The ground is to water pipes, driven into the earth, and a heavy brass strip soldered to a roof. The main ground lead that connects to these grounds consists of six stranded phosphor bronze wires. The aerial is about 70 feet long, made up of two wires, suspended 30 feet above the grounded at both ends. The wires are standard-6 roof at both ends. The wires are standard-6 strand No. 18. Hard rubber insulators insulate each wire and are used wherever necessary.

The transformer input operating at full power is 340 watts and the aerial current is 2.5 amperes. The station has been heard over 300 miles, north, west and south, and has worked 2 AGJ Albany, N. Y.; 8 VX, Buffalo, N. Y.; 2 PM, New York City; 8 ALE, Grove City, Pa.; and others. The receiving range for amateur stations has not yet been determined. The owners are members of the National Amateur Wireless Association, the Institute of Radio Engineers and the Baltimore Radio Association.

The station of W. B. Pope at Athens, Ga., winner of the second prize, has an antenna of the "T" type, 70 feet in height at one end and 60 feet at the other. There are three wires of 7/22 hard drawn copper, 140 feet in length, spaced four feet apart. Other parts of the equipment include a special short wave inductively-coupled tuner, a single-valve Armstrong circuit, 2,000-ohm phones and two variometers, one in the grid circuit and one in the plate or wing circuit.

The station of Kenneth Briggs in Rochester, N. Y., winner of the third prize, has a transmitting set in the form of a panel. On the lower shelf is a Thordarson 1 K.W. transformer, and a plate glass, oil-immersed condenser. Above are the rotary gap and oscillation transformer. On the panel are the switches controlling the power for the transformer and gap motor, the antenna switch and a switch for the A. C.

On a table are the key and the receiving cabinet which is made of cherry. The cabinet contains a 3,000-meter coupler, and the primary and secondary loading coils, which will load the coupled up to 12,000 meters. There are two oscillations and a mineral detector with switches so that both damped and undamped waves can be received. The mineral detector can be used alone, one vacuum valve alone, and a vacuum valve with the amplifier. There is a variable condenser across the secondary, and in the cabinet are high voltage batteries for the vacuum valves. The phones are of the Brandes trans-Atlantic type.

The aerial, which is of the inverted "L" type, has four wires 55 feet in length. It is about fifty feet in height.

The entire set is home-made with the exception of the transformer, antenna switch, phones and detectors.

The transmitting outfit of the Scott High School station (8 ZL), at Toledo, Ohio, winners of the fourth prize, consists of two sets, one being a ½ K.W. Hytone outfit and the other a 2 K.W. rotary equipment. Three receiving sets are employed. One is for undamped waves with a range of from 600 to 15,000 meters. A vacuum valve set is employed for waves of from 600 to 1,500 meters. On 200-meter work a W. B. Duck specially-designed short wave regenerative receiver is used.

Two commercial first grade operators are in charge of the station, and Monday, Wednesday and Friday afternoons are devoted to message work with 8 NH. The operators in charge of 8 ZL request that all stations within a radius of 100 miles send a memoranda of the signals heard.

Leander L. Hoyt, winner of the fifth prize, whose station is located at Hayward, Cal., has a transmitting set consisting of a variable power step-up transformer. The power used for all work last year did not exceed ½ K.W. and the input variation permits power from ½ K.W. to 10 K.W. to be used if necessary. Power is supplied to the primary at 220 A. C. The oscillation transformer is of the conventional helix type. The condenser is of the rack type of flint glass and has a capacity of .008 microfarad. The rotary gap consists of a bakelite disc, 1 foot in diameter, run by an induction motor at 1,800 r.p.m. There are sixteen plugs mounted on a disc.

The receiving set is of the regular loose-coupled type. The Electron Relay is used. The loose-couplers employed are well adapted to vacuum valve circuits. Regenerative circuits have been employed recently, marked results having been obtained on low wave-lengths. The vacuum valve and regenerative circuit apparatus with the required number of variable condensers and the addition of a pair of Brandes phones complete the set.

Crystal detectors are used for ordinary and short range working. Good amateur sets within 1,000 miles and some beyond that distance are easily read at night. Many stations in the Ninth District have been copied. The sending aerial is of the "fan" type, being 60 feet in height and 70 feet in length. The receiving aerial is of the same height, and contains two wires. It is 250 feet in length.

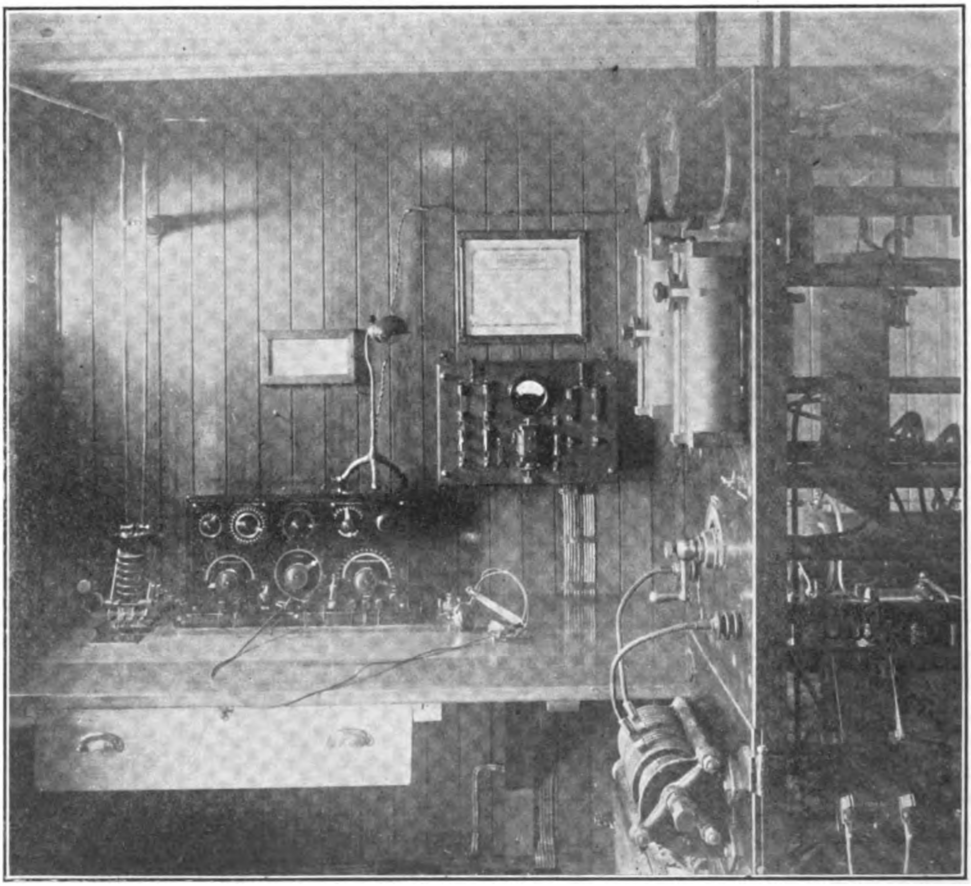
The transmitting set of Mr. and Mrs. Charles Candler, winners of the sixth prize, is composed of a 1 K. W. Thordarson transformer, an oil condenser having twelve 10 inch by 12 inch glass plates, coated on both sides with tinfoil, 7 inches by 9½ inches, a rotary gap composed of a 7-inch Micarta disc fitted with ten studs and driven by a belt to a motor at about 3,000 to 3,400 r.p.m., and a pancake type oscillation transformer.

The receiving set is made up of a cabinet in which are mounted both a vacuum valve and an audiotron, the latter being arranged to work on either the plain or oscillating circuit, two loose couplers, several variable condensers and two head-sets. Any wave all the way from 180 to 10,000 meters can be tuned in.

The aerial is of the T-type, 87 feet in length, 58 feet in height, having six wires, spaced 27 inches apart. The set is grounded to water, gas and waste pipes.

The transmitting set of O. R. Terry or Stoughton, Wis., winner of the seventh prize, consists of a 1 k.w. Thordarson transformer, a home-made oil-immersed condenser, a pancake type oscillation transformer and a rotary gap made up of a 5-inch disc, running at about 3,000 r.p.m. The disc contains six plugs.

The receiving set is made up of a pair of Brandes 2,800-ohm phones, one large and one small loose coupler, a variable condenser, one in series with the aerial and one shunted across the secondary, an audiotron bulb used with a regenerative hook-up and two large loading inductances for undamped wave stations.



The 2 k.w. Marconi radio panel set as installed on the steamship H. H. Rogers. ***An unusual*** *picture as it gives a detailed reproduction of the apparatus in the wireless cabin*

Radio the Highest Form of Engineering Expression

The Washington Section I. R. E., Dinner Records a Noteworthy Message of Patriotic and Scientific Inspiration to Workers in the Field of Wireleess Communication.

THE spirit of co-operation that finds science united for the protection of the nation as it goes to war, was eloquently foreshadowed at the dinner tendered on March 3rd to Brigadier General George O. Squier by the Washington Section of the Institute of Radio Engineers. An assemblage representative of the highest engineering skill in the art of wireless communication mentally and orally dedicated itself on this occasion to making available to the Government a system of radio unsurpassed, and even unequalled, throughout the civilized world.

Lieut. Commander S. C. Hooper, to whom is given a large proportion of the credit for the reorganization of the Navy's radio system and the installation of efficiency methods, began the addresses of the evening with an appreciation of the manner in which the workers in the wireless field had made ready industrially for preparedness of a high order. It was significant of the times, he said, that this newest of arts had a material representation in manufacturing circles and it was inspiring to know that the serious situation had effected a whole-souled mobilization of production effort for the mechanical equipment of the Navy. As to valuable personnel to be drawn from the field, he felt certain that quick response would be made to the call to the colors, with such anticipated acceleration in fact, that he hoped to make it understood that the nation's best interests would be served if the engineers would remain in their places as producers of equipment, allowing the less skilled workers who had not reached the plane of scientific standing to go to the front for the execution of the actual communication.

George H. Clark, expert radio aid for the Bureau of Steam Engineering of the Navy Department, echoed these sentiments in an after-dinner speech that carried an eloquent appreciation of the contributions to science of General Squier, the guest of honor, and Lee de Forest added a further testimonial on the cable inventions of the scientist soldier. Mr. Clark emphasized the fact that there now existed the closest co-operation between the Army and Navy Departments and through their co-ordinated effort the very highest type of equipment had been secured. That every engineer engaged in wireless work would offer his services to the nation unreservedly, was the prediction of Dr. Louis Cohen, of the Bureau of Standards, who followed the speakers with a review of the efforts of the engineers and their accomplishments. Recent inventions, he stated, were of the greatest importance and it was unquestioned that still greater refinements would follow fast in the crucible of wartime effort.

Further inspiration to effort was added by H. E. Knight, a patent attorney, who gave unstinted praise to the men who had set aside the isolation of the sea. A contribution of a more efficient type of apparatus so that ships and men at sea could be instantly controlled by the naval strategist, he characterized a more valuable gift than another ten million dollar battleship. The execution of these principles, the tearing aside of the curtain of ignorance, had been the aim and purpose of the Institute of Radio Engineers, added its secretary, David Sarnoff, commercial manager of the Marconi Company. Its rapid growth to the point where members who were none too friendly in the battle for commercial supremacy met on the common ground of enlightenment where scientific research was concerned, he believed justified most enthusiastic predictions for the acceleration of progress in the art itself. Mr. Sarnoff reiterated the praise due General Squier for his contributions to science, and noted that in the testimonial dinner tendered in recognition of his accession to the high office of Chief Signal Officer of the Army, the Institute was honoring one of its most active workers and heartiest well wishers.

An ovation marked the introduction of the guest of the evening, and General Squier responded immediately with a message of inspiration that pointed out a double incentive for every engineer present. The keynote of his address coincidentally lay in the toast carried on the menu, titled "To the Radio Engineer of Tomorrow."

Here is a toast that we want to drink to
a fellow we'll never know—
The fellow who's going to take our place
when it's time for us to go.
We wonder what kind of a chap he'll be
and we wish we could take his hand,
Just to whisper, "We wish you well, old
man," in a way that he'd understand.
We'd like to give him the cheering word
that we've longed at times to hear;
We'd like to give him the warm handclasp
when never a friend seems near.
We've gained our knowledge by sheer
hard work, and we wish we could
pass it on
To the fellow who'll come to take our
place some day when we are gone.

It was the spirit phrased as "we've gained our knowledge by sheer hard work" which General Squier sought to emphasize. It was all hard work, he believed, so intensive that it gave little opportunity for the worker to realize that he was making scientific and industrial history. He noted that, almost without exception, the engineers of the art were young men, yet their research was conducted in a field which encompassed conduction and transfers of radiant energy, striking the very highest form of electrical engineering. He compared radio investigation with other forms of electrical engineering, pointing to the fact that the power and transmission engineers restricted themselves to the production or transfer of currents, whereas their finest productions were required to generate and control the high frequencies employed in wireless transmission. The radio engineer therefore was employing the most advanced expressions of other branches of power engineering; yet he could not remain satisfied with their perfection since it was his function to utilize them in a still higher form of development. In this lay the wireless man's great opportunity, he observed, and it was his belief that it was all too little appreciated among the workers in the art that their investigations represented the supreme expression of signal engineering. As an instance, he cited the control of currents through the employment of the vacuum valve, stating that in its study to define the theoretical action the engineer bordered on the highest form of physics. He advocated recognition of radio experts as signal engineers, a fuller designation of their field being thus expressed, since, in the pursuit of their research they first had to learn all that signal engineers know about power transmission, radio embracing all these forms and the additional form which was peculiar to their restricted field. In this necessity for wide knowledge lay the wonderful opportunities for the young man, he believed, and with the expansion of the art he looked for the attraction to the field of the best engineering brains of the country.

The General then commented on the new spirit which had swept the country during his absence abroad. The high type of patriotism evidenced everywhere had proved a revelation to him, he said. To his office in the War Department, for instance, had come the representatives of practically all the nation's greatest industries, offering to the Government their equipment and personnel without reservation. Men whom he had believed so engrossed in the magnitude of their commercial affairs that they could give only partial consideration to defense needs had placed at Government disposal everything they had, declaring their willingness and anxiety to serve the nation with all the facilities under their control. This spirit was inspiring, he declared, and promised well for the efficiency of the military establishment in war time.

With characteristic enthusiasm for scientific study, General Squier concluded his notable address with a suggestion to engineers. He called attention to the fact that the field was well acquainted with the result attained by signaling with oscillations above the point of audibility; he then noted that using the microphone he had transmitted signals by submarine cable below the point of audibility, and found this method efficient, not better than at high frequencies, but good. The suggestion was then in order, he thought, that American engineers try communication at a point in between, using the microphone. The result, he believed, would be interesting and would contribute valuable data to the field.

General Squier was the last speaker, and at the conclusion of his inspirational message the diners arose and recited in concert the vigorous expression of patriotism, "The Flag We Love," particular significance being attached to its delivery amid the distant rumble of a great nation preparing to go to war:

"Your flag and my flag, and how it flies today
In your land and my land and half a world away;
Rose red and blood red its stripes forever gleam,
Snow white and soul white, the good forefathers' dream;
Sky blue and true blue with stars that gleam aright;
The gloried guidon of the day, a shelter through the night.
"Your flag and my flag, and oh, how much it holds!
Your land and my land, secure within its folds;
Your heart and my heart beat quicker at its sight,
Sun kissed and wind tossed, the red and blue and white;
The one flag—the great flag for me and you,
Glorifies all else beside—the red and white and blue.

ANOTHER VIEWPOINT ON THE STATION IN MEXICO CITY

In El Pueblo, a government organ published in Mexico City, was published the following article on March 28:

"In the last few days the wireless station installed at Chapultepec, in this city, has been communicating directly with the North American city of Houston, in the State of Texas, and with some cities of South America, especially Panama.

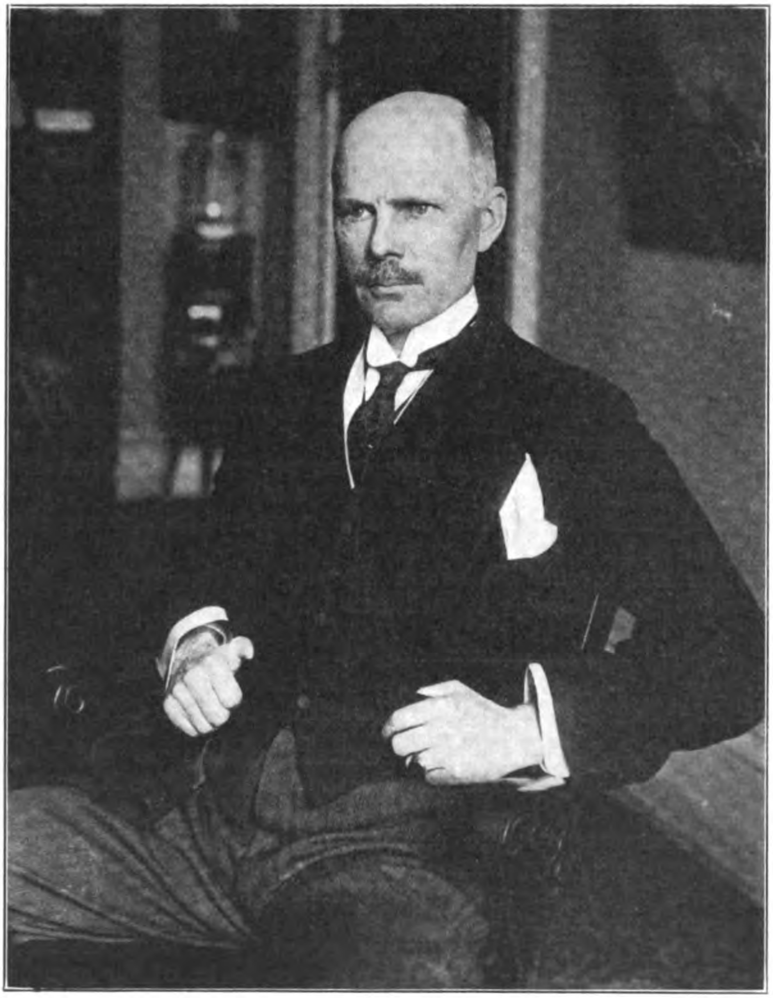
"This fact signifies that our wireless service is improving daily and that its field of action is extended more and more.

"In order that our readers may appreciate this progressive evolution of our wireless service, we will say that since the constitutional government controlled the greater part of the territory of the republic the service in question, with the ships arriving at our ports or to be found in national waters, is double what it was in former times."

This inspired "explanation" of why Mexico has suddenly added such a powerful station to its wireless service—to be prepared to report merchant ships after the war ends in Europe—was received with some amusement by foreigners who read it in Mexico City in the government organ. It was commented that the station might be of far greater value to German submarines in Gulf waters if possibly the Zimmerman note inviting Mexico to become an ally of Germany should prove to be something more than a mere "scrap of paper."

It is known that Mexico City has been holding wireless communication with San Salvador and also with Colombia, and it is also known that the German Minister in Havana has received mysterious wireless messages having to do with Mexican affairs.

General Squier, Scientist, Inventor and Soldier



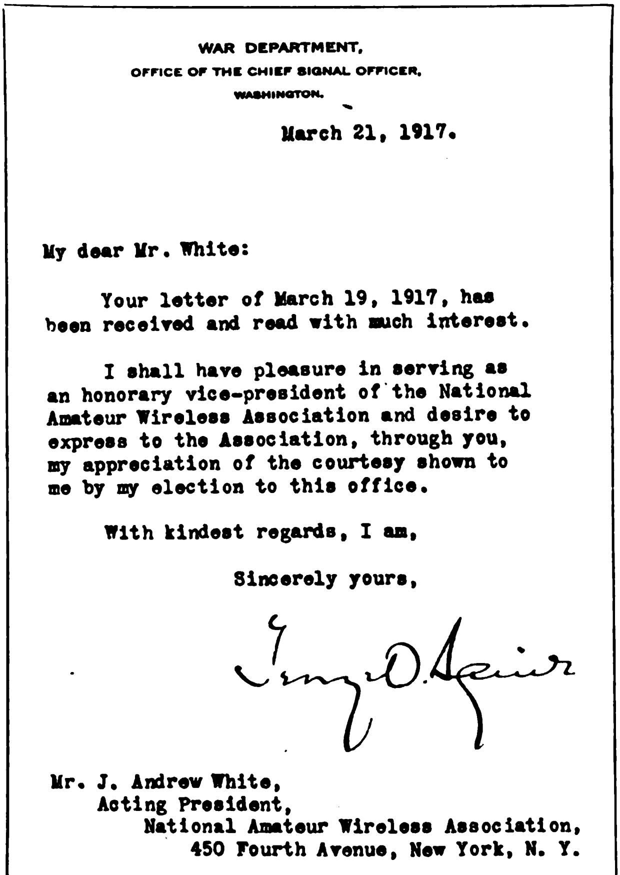
Activities of the Newly Elected Advisory Board Vice-President of the National Amateur Wireless Association

MEMBERS of the National Amateur Wireless Association will be gratified to learn that Brigadier General George Owen Squier, Chief Signal Officer of the Army, has been elected one of the vice-presidents of the National Advisory Board of their organization. The National Amateur Wireless Association thus obtains all the benefits of the advice of an energetic officer of high scientific attainments.

Among the important researches made by General Squier are the electro-chemical effects due to magnetization; the polarizing photo-cronograph; the sine wave systems of telegraphy and ocean cabling; the absorption of electro-magnetic waves by living vegetable organisms, and multiplex telephony. He is the co-inventor with Professor A. C. Crehore of the polarizing photo-cronograph and of two systems of rapid telegraphy, both employing the alternating current. The polarizing photo-cronograph, which is based upon the principle of the electro-magnetic polarization of light and was devised for the measurement of the velocity of projectiles, formed the subject of several papers contributed to the Journal of United States Artillery, of which periodical General Squier was one of the founders. The earlier system of rapid telegraphy, described in a paper read in 1897 before the American Institute of Electrical Engineers, was based upon the employment of the alternating current and on the use of the polarizing photo-chronograph as the receiver. This system was experimentally operated over the lines of the British post office with satisfactory results. The later system, described in a paper read before the same body in 1900, was one for submarine telegraph service, and involved the use of sine wave e. m. f's. This sytsem also gave excellent results in experimental operation over a commercial submarine line. The transmitter used with this latter system was the subject of a paper read before the International Electrical Congress of Paris, 1900. General Squier and Professor Crehore also devised an alternating-current range and position finder.

Among the more recent work of General Squier is a study of the absorption of electro-magnetic waves by living vegetable organisms, and an investigation of the use of trees in wireless telegraphy as antenna, which latter has resulted in some remarkable, practical developments.

His chief and most recent invention is popularly known as the "wired wireless." Its principal value lies in the fact that it enables the cable to transmit a number of messages at the same time. It is also possible to telephone a number of messages at the same time. It is even possible to telephone at the same time while the message is being telegraphed, without interference. What General Squier's invention has made possible—and this is his most important contribution to the wireless art—is that it puts a high frequency current into the line and controls it by the use of the vacuum valve, receiving it through the same instrumentality and controlling it to


WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
WASHINGTON.

March 21, 1917.

My dear Mr. White:

Your letter of March 19, 1917, has been received and read with much interest.

I shall have pleasure in serving as an honorary vice-president of the National Amateur Wireless Association and desire to express to the Association, through you, my appreciation of the courtesy shown to me by my election to this office.

With kindest regards, I am,

Sincerely yours,

George O. Squier

Mr. J. Andrew White,
Acting President,
National Amateur Wireless Association,
450 Fourth Avenue, New York, N. Y.

General Squier's letter accepting honorary vice-presidency of the N. A. W. A.

normal along the line. This arrangement permits him to have more than one alternator and more than one receiver.

This invention has another great advantage. It makes cable signals audible. They can be read faster and with less possibility of error than through sight reading, under which system cable messages have hitherto been received.

General Squier, who has been attached to the aviation section of the Signal Corps, was born in Michigan, March 21, 1865, and is a graduate of the U. S. M. A., class of 1887, when he was promoted in the Army to be second lieutenant, 3d Artillery. He was appointed a first lieutenant in the Signal Corps February 23, 1899. He took a course of instruction in electric engineering at Johns Hopkins University and holds the degree of Ph. D. from that institution. He has served as instructor in the department of electricity and mines at the Artillery School, Fort Monroe, Va., and was signal officer of the Department of the East. During the war with Spain he served as a captain and lieutenant colonel and signal officer of volunteers, and was chief signal officer of the 3d Army Corps. General Squier served in the Philippines, 1900-1902, through the entire rebellion. He was in charge of the captured Spanish ship Rita, which he refitted as cable ship (U. S. S. Burnside), and he designed and constructed the first ocean cable made in America and laid in two years, under the late General McArthur, all the cable system in the Philippines. He founded and was first assistant commandant of the Signal Corps School at Leavenworth. At the outbreak of the present war he was assigned as U. S. censor to New York City, and was later detailed as military attache to the American Embassy at London.

In 1910 Colonel Squier invented the "multiplex telegraphy system," the patent for which he took out in the name of the whole people, thus throwing aside a comfortable fortune. His ability as an expert in his line was early recognized abroad. He was made a fellow of the London Physical Society, and before this body, in 1915, he read a paper, describing a new method of cable system which since has been officially adopted by the British government. General Squier was chief signal officer of the maneuvers division on the Texas border in 1911, and also wrote the specifications for the first airplane bought by any government (the Wright machine), and was the first passenger ever carried in an airplane.

GENERAL DYER HEAD OF NEW YORK STATE HOME DEFENSE

It has been announced that the new head of the Home Defense Department of the Mobilization Research Bureau in New York state will be Brevet Major General, George Rathbone Dyer, commanding officer of the Junior American Guard, with which the National Amateur Wireless Association is affiliated. The selection was made by Adjutant General Stotesbury. General Dyer will have under his direction the organization, equipment and training of the Home Defense Corps, together with the recruiting for the regular army and navy and the National Guard. A dinner of the officers of the Junior American Guard took place in New York City on the evening of April 12th, when General Dyer outlined their duties now that the United States has declared war against Germany.

A powerful wireless outfit was discovered by men of the 71st New York Infantry near their headquarters in New York State on April 7th. Electricians dismantled the apparatus.

The information upon which Colonel Bates acted came to him early in the morning. At three o'clock in the afternoon a bugle blew assembly and a company swung off down the road toward the suspected farm. The wireless was owned by the occupants of the house, whose records are being looked up.

The War Spirit of the Signal Corps

A Dramatic Account of the Units in the Field Under Fire in Flanders.

SOMETHING of the sensations of signalmen of the British troops is given in a narrative by "Perikon" in The Wireless World. With the call to arms sounded, this article will interest all wireless men who contemplate taking the field in the service of their country.

* * *

The final inspection at the wireless depot is in full swing. Across the stretch of flat ground a small limbered wagon is careening, drawn by a four-horse team. Ahead and behind the swaying limber ride a posse of horsemen.

The glittering hubs and shining wheels are as clean as emery, "elbow grease" and "oil-preserving wood" can possibly make them. The horses have all the glossy satin coat which comes of decent treatment, feeding and grooming. The harness and saddlery glitter. Buckles, irons and bits gleam silver in the sun. The men themselves are spick and span, and sit their saddles well.

A number of whistle blasts, and the canter changes to a gallop. The cavalcade takes the prepared ditches and banks without slackening speed—the team horses straining into their breast collars and their traces taut. A second blast, and the troop halts abruptly. The team is swiftly unhooked, the "single mounts" are passed to the drivers and the horses move off in a bunch and "stand easy" some hundred yards off—snorting and blowing and generally having a breather.

The wagon is left with the station crew, who fall in smartly in the rear, and next second are busy "erecting station." Three minutes later the first mast is raised, stayed and secured. The second follows, and in a brief space there is a sudden road and a hiss as the motor starts, and Number One depresses the transmitting key.

"Station ready and working—six and a half minutes—not so bad," remarks a dapper officer of Engineers standing some hundred yards off—"Dismantle." The order is conveyed by whistle blast, and eight minutes later the pack trots past *en route* for stables and dinner—the dreaded ordeal over and with the conviction that they've done well and will surely soon be across the Channel.

* * *

Two weeks later sees the limber, then the trail, being swung aloft by a giant crane and swiftly lowered into the spacious hold of a "trooper." The horses are "'tween decks" with their saddlery on, but with loosened girths. The station crew are squatting on deck and doing their best to avoid the various white-hot steam pipes with which the decks of a tramp seem to abound, and in drawing their life-belts from the roomy chests on deck and elsewhere.

* * *

Ten months later the advance guard of the 160th Corps rattles through the deserted little village. First a troop of lancers, then four wicked-looking Q.-F.'s with ammunition limbers apiece, and a couple of baggage and forage wagons behind. Then a small limbered wagon with a small posse of horsemen ahead, and behind—the wireless wagon. If you looked closely you'd recognize it as the same one you'd noticed at the home depot undergoing its final inspection. But there's a drastic change in everything. The wagon is encrusted in dry mud and dust, and small pieces of turf are adhering to wheel and limber. The horses have lost much of their satin, and the metal fittings of the harness no longer shine silver, instead they are thick in rust. No glittering buckles, irons or bits now. Then men look thinner perhaps, and stubbly beards and unwashed appearance almost convince you that they can't really be the same men. You note a difference—a vague something in their way of looking at one, and you decide they're *not* the same men.

Behind them another troop of grimy cavalry clatter—horses in a lather, and horsemen blue-chinned and hollow-eyed. For three days they've pushed on, pressing and worrying the rearguard of the crack East Prussian Corps directly opposed to them. The great retirement has begun and the Germans so far have conducted it in a swift and businesslike manner. Another twenty kilometres perhaps, and they'll swing round and make a stand, for the black-eagled frontier posts begin just beyond that—*then* there's a possibility of firework displays on a large scale. Meanwhile the grey Uhlans of the rearguard can sometimes be picked out with the naked eye crossing fallow, or silhouetted for a fleeting instant on the sky line.

The leading troop of our advance and the four wicked-looking Q.F.'s suddenly swing through a gap in the roadside hedge and canter in the direction of a small plantation. The rest of the cavalcade follows and halts in the shade of a row of tall elms. A "fleeting opportunity" target has offered itself in the shape of a dense blue-grey smudge toiling like a big lizard into the heat haze some two miles ahead. An instant later the Q.F.'s are showering them with douches of whining metal. Smoke obscures the lizard, but when it clears nothing can be seen distinctly by the naked eye—perhaps it's better.

We turn round and see the pack crew hurrying to and fro at the double, "erecting station," much as they did on the depot ground more than ten months ago. Important "stuff" must be got through to Corps' Headquarters, and that within the next fifteen minutes, for the seeming impossible has happened. The enemy has been strongly reinforced—Heaven knows how or from which quarter—and is turning and slowly crawling back in his tracks. Squardron after squadron of apparently fresh cavalry can be picked out deploying in extended order from spinney and hedgerow, looking much like hurrying ants at the distance. It means our advance guard falling back perhaps ten kilometres, unless at least a cavalry division and the Corps' "heavies" can be rushed up in time to meet the oncoming wave and send it staggering back. Two troops of the finest cavalry and four Q.F.'s of small calibre can do some considerable damage, but it's suicide to attempt to stem an entire enemy division equipped with well over thirty light pieces maybe.

The enciphered message goes hissing out into space, and a yawning operator at Corps Headquarters (a tumbledown farm some four miles in the rear), takes down the message group by group, hands it to his superintendent, and signals the pack to go on with his "stuff."

Meanwhile the Q.F.'s have abruptly ceased firing, and their teams are trotting over to move them. The cavalry outposts have galloped in. A ranging shell bursts over the trees a decent hundred yards to the right, and occasionally spent bullets go whinny overhead. An orderly canters over to the wireless station, and next minute the masts are down and being packed, the aerial is running home on its drums, and the gear is being loaded.

Just as the orderly is gathering his reins to canter off, a giant billowy ball of saffron-hued smoke springs out of nothingness about ten feet off the ground. a deafening crash is heard—smoke and explosion occur at precisely the same instant. The orderly and horse appear to lift some three feet in the air and thud inert to earth. Three of the pack crew go down, ripped up in hideous strips. Two others attempt to get up and roll over with curious gurgles. They have crossed into calmer water. A horse shrieks and lies lashing at the lifeless carcass of his teammate. The wagon is splintered and the fore limber is wrecked. Only three of the pack crew are unscathed. Smart gunners these enemy horse artillerymen—not exactly blacks. Suddenly the Q.F.'s limber up and gallop towards the gap in the hedge.

"Come on, you people, get a horse and move yourselves, their patrols are three fields off," yells a Major of Artillery.

"No time to repair"—the rest is lost in the rumble of limbers and sog-sog of the hoofs. The pack crew hastily unstrap their axe and pickaxe and do a seemingly curious thing. They smash into the apparatus, and next second the shining fabric of ebony and nickel, of which they were so proud, lies in a tortured heap. A tin of petrol is ripped up and the pile drenched, a light applied, and a crimson tongue of flame shoots up, stationery, messages, etc., are thrown on top. Two minutes later three horsemen are tearing down the poplarlined pave in the wake of the fastly moving Q.F.'s and cavalry. Mauser bullets hum and whine about their ears and occasionally crack into the poplars with loud whiplike snaps.

One grimy rider turns to his comrade: "Anyway we got the message through, and the swine can't use our gear—get up, Billy boy"—as his weary horse stumbles and picks up his stride again.

Three kilometres farther on a loud close-at-hand rumbling assails their ears—our heavies about a kilometre off by the sound. Suddenly the Q.F.'s halt, unlimber, and send salvoes of shell shrieking into the strung-out advance guard of the enemy. Our cavalry reinforcements have arrived, too. To right and left they can be seen streaming and deploying. Eighteen-pounders, too, battery on battery are coming up at the trot through stiff plough, and unlimbering and beginning to spit and cough. Machine guns rattle, rifles and carbines crack, riderless horses tear insanely and aimlessly in all directions. The enemy's patrols wheel round, and in a few minutes they can again be picked out, their squadrons lighter, hurrying into the shimmering haze, much like scurrying ants.

The Q.F.'s gallop back on their tracks in a fog of choking dust, a squadron of lancers, more horse artillery, another dragoon and hussar squadron, and cantering hot in their wake with limber and trail swaying, and an eddy of dust astern, another pack wagon clatters. Everybody looks fresher and cleaner than the advance guard. They've all come up in response to THE message.

All Amateur Wireless Stations Being Dismantled

ACTING under instructions from the Navy Department at Washington, on April 8th, the military and police authorities throughout the country began dismantling all sets of wireless apparatus, with the exception of those used by the Government or under the direct supervision of United States officials.

Previously, on March 28th, Secretary of Commerce Redfield ordered, as a precautionary measure, that no further licenses were to be issued for the operation of amateur wireless stations until further notice. The order, as sent out by the Radio Service of the Department of Commerce, read as follows:

"The Commissioner of Navigation has instructed that no amateur station licenses be issued until further orders as a measure necessary for the public defense. Your application and forms for a station license have been received in this office, but no action will be taken thereon and they will be held in the files of this office for future consideration.

"Under the conditions it will be unlawful for you to do any transmitting with your station equipment, but the above regulation does not prevent your using your receiving apparatus until instructions to the contrary are issued."

Since the issuance of this order, however, came the declaration of war against Germany and the new instructions, ordering the dismantlement of all amateur apparatus.

Wireless Instruction for Military Preparedness

A Practical Course for Radio Operators

By Elmer E. Bucher

Instructing Engineer, Marconi Wireless Telegraph Company of America

With President Wilson's declaration of war with Germany, loyal Americans bend their energies to serving their country. The true American begins to think to what branch of the military (or naval) service he shall offer himself when the call comes.

Of course, the man whose trade or profession is such as is not required by any branch of the war service will enlist as a private. But to the man skilled in a particular profession useful in the army or navy an opportunity is now offered to enroll with the military forces in the particular field in which he is already qualified. Also, if there be any who by reason of physical disabilities or who for other causes are unable to take the field as privates, yet in whom the spirit of patriotism burns and the desire to serve seeks for expression, they, too, can qualify themselves for service in a skilled branch of the service.

Physicians, dentists, electrical engineers, civil engineers and other professionalists will all find their service in demand by the Government. And of equal importance with these professions will be that of radio operator.

Radio telegraphy is regarded as one of the most efficient and most rapid means of establishing communication in the field, and more and more reliance is being placed upon it by military authorities.

There is a clamorous demand for radio operators. Not only are they required for service at sea with the battle fleets and on land with the troops in the field, but there is an urgent demand for them on merchant ships, and coastal stations, as well. In probably no other branch of the Government service is there such a pressing need at this date for *skilled* workers.

One thing that may have tended in the past to keep many men (and women) from seriously taking up the study of wireless telegraphy is the lack of proper facilities for learning the profession. Radio schools are situated mostly in the larger cities. This means that the young man living far from the city has had to satisfy himself with whatever instruction could be gleaned from such radio textbooks as were at hand.

And yet here another obstacle presented itself. For up to the present time many of the writers on radio telegraphy have contented themselves with addressing an exclusive coterie already well versed in the art. Some authors have attepted only to write what amounted to a historical review of radio telegraphy, others have confined their efforts to disclosing the art as practised in Europe and still others have devoted their work to the mere theoretical principles of radio-frequency circuits. In fact such textbooks as have been written applicable for training the young man are so old as to be obsolete and of little aid in the study of present day wireless apparatus and manipulation.

Those of us actually engaged in practical radio telegraphy know well that an operator's course in wireless telegraphy includes vastly more than a theoretical discussion of radio-frequency phenomena. In fact, a commercial operator is not qualified to handle a radio equipment unless he has knowledge of dynamos, motors, motor generators, storage batteries, charging panels, antenna construction, installation of power circuits, installation of sets, etc. Beyond this he must have a theoretical knowledge of the principles of transmitting and receiving circuits in order that he may manipulate the apparatus with understanding.

From this it can be seen that a modern common-sense book on radio telegraphy addressed specially to those wanting a practical course in the art was urgently needed. In an effort to meet this need, the writer out of his practical experience as a lecturer and instructor to radio employees of the Marconi Company has brought out a book, which under the title, "Practical Wireless Telegraphy" will shortly be placed before the public.

In the meantime, however, the crisis so suddenly brought upon the country has moved him to compile a condensed version of this book and it will be published in serial form in the pages of the WIRELESS AGE.

This condensed version will be the forerunner of a new method in the teaching of radio telegraphy. It will consist of a presentation of only the absolute essentials of the art and is intended for those who want to acquire the knowledge and ability to qualify in the least time as practical radio telegraphists. All theory and detail—however interesting and valuable—which has no pointed relation to the practical manipulation of a radio set will be omitted. This should not be taken to mean that the course will be incomplete and will skimp over things. Far from it. Every point that is at all necessary and desirable that the commercial wireless operator shall know will be covered. Every detail that concerns the actual adjustment of the apparatus will receive mention. All this will be in harmony with the purpose to train efficient wireless operators who will be prepared to serve at wireless stations conducting Government or commercial radio telegraphic traffic, when the call comes to them.

Reference at the student's leisure to the author's more complete book will give an insight into the theory of the art which the need of the moment does not require of the condensed version. Still it should be kept in mind that "Practical Wireless Telepraphy" is strictly an operator's textbook and devoted in a large measure to descriptions of practical commercial apparatus of all types and kinds in use by the Marconi Company.

In compiling the short version of this book, the author has held before him the requirement that upon the completion of this condensed course, the student shall be prepared to take up duty at a commercial or government wireless station. With this in mind, the course will include minute instruction in the equipment, care and maintenance of such a station.

Adjustments of apparatus necessary when traffic is being handled; the operation of the set under ordinary and extraordinary working conditions—these are the matters that will receive spcial emphasis, for it is in these things that the student will be interested and most in need to know.

As an invaluable aid in grasping the lessons to be published in THE WIRELESS AGE, drawings, pictures and sketches will accompany each installment of the course. Wiring diagrams, commencing with the most elementary circuits and gradually leading up to the more complicated circuits and illustrations of the various parts of the set will appear in each issue to help to a better understanding of the printed text.

The manner of presenting the text itself will be entirely different than that of previous instruction courses. The reading matter will be in short and crisp sentences, easily understood and remembered, and the text on each page will be devoted to the particular diagram on that page. In fact, it will be the first time that a course in radio telegraphy has been presented so briefly as to shorten the period of study necessary to secure a mastery of wireless telegraph operating.

Some of you may doubt your ability to complete successfully a course in radio telegraphy. To those let me say that if you have had a common school education, if you are of average intelligence and have an ambition to learn, and the persistence to stick out the course and not be side-tracked by shiftlessness, you can and will finish the course with profit to yourself and with pride in your abilities.

This serial course will be complete, starting at the very beginning with exact instructions as to the material needed for a start and working on, step by step, into the more detailed and interesting phases of wireless. Anyone (man or woman) who applies himself steadily to the study of the lessons presented each month in THE WIRELESS AGE, and faithfully practices as directed, will soon find himself engaged in a most attractive and profitable profession, and one which will bring honor to himself and benefit to his country.

PRELIMINARY PROCEDURE

MATTERS TO HAVE IMMEDIATE CONSIDERATION:

(1) All commercial radio operators must possess U. S. Government License certificates.

(2) Operators' Licenses are graded according to the ability of the one being examined.

(3) Examinations for licenses are taken at one of several examining posts (such as Custom Houses, Navy Yards, etc.).

FIRST REQUIREMENTS:

(1) The ability to send and receive signals in the International Telegraph Code. (The Continental Code.)

(2) Knowledge of the International Radio Telegraphic Convention Rules. (These are printed in "Traffic Rules and Regulations" issued by the Wireless Press, Inc.)

(3) Knowledge of the U. S. Radio Act of August 13, 1912. (This is printed in "Traffic Rules and Regulations" issued by the Wireless Press, Inc.)

(4) Information concerning the requirements of operators license examinations. (This can be obtained in Chapter 8 of "How to Pass U. S. Wireless License Examinations; also from the pamphlet "Radio Communication Law of the U. S.," a copy of which can be purchased from the Government Printing Office, Washington, D. C.)

GRADATION OF COMMERCIAL OPERATORS' LICENSES:

GRADE.	CODE SPEED REQUIRED.	SCOPE OF TECHNICAL EXAMINATION.
Commercial Extra 1st Grade	30 words per minute American Morse 25 words per minute International or Continental Code	Wider in scope than examination for original first grade certificate. (Passing mark 80%.)

Commercial 1st Grade	20 words per minute Continental Code (5 letters per word).	(a) Adjustment, operation and care of commercial apparatus. (b) Correction of faults. (c) Use and care of storage batteries and auxiliary apparatus.
Second Grade	12 words per minute Continental Code (5 letters per word).	Same as examination for first grade but less in scope.
Cargo Grade	Approximately 5 words per minute Continental Code. (Sufficient to enable "watcher" to interpret S O S signals and call letters.)	Must be able to explain adjustment of receiving apparatus and draw simple fundamental wiring diagram of transmitter and receiver.

GOVERNMENT CODE TEST (FOR LICENSE CERTIFICATE) WILL INCLUDE THE FOLLOWING:

(a) Call letters.

(b) Regular preambles.

(c) Conventional Signals.

(d) Abbreviations.

Reading matter will not be allowed. The test shall continue for five months at the rate of twenty (20) words per minute.

CREDITING OF GOVERNMENT LICENSE.

(75% constitutes passing mark for first grade certificate; 65% for second grade certificate.)

	Points Awarded.
A—Experience	20
B—Diagram of Transmitting and Receiving Apparatus	10
C—Knowledge of Transmitting Apparatus	20
D—Knowledge of Receiving Apparatus	20
E—Knowledge of the Operation and Care of Storage Batteries	10
F—Knowledge of Motors and Generators	10
G—Knowledge of the International Regulations Governing Radio Communications and the U. S. Radio Laws and Regulations	10

HOW TO OBTAIN CODE PRACTICE:

(1) Join the nearest telegraph school (practice Continental Code only).

(2) Purchase or construct a "buzzer practice outfit," consisting of buzzer, ½ microfarad condenser, 75 ohm head telephone and telegraphy key. Have a friend familiar with the code send character for practice.

TIME REQUIRED TO BECOME PROFICIENT IN THE CONTINENTAL CODE:

(a) 20 words—3½ to 6 months.

(b) 30 words—6 to 12 months.

BOOKS TO BE PURCHASED:

(1) Practical Wireless Telegraphy.

(2) Traffic Rules and Regulations.

(3 Practical Electricity (By C. Walton Swoope).

STUDENT OPERATORS' ENTRANCE QUALIFICATIONS ACCORDING TO THE MARCONI COMPANY:

(a) Age—17 years up.

(b) Education—applicant must be a graduate of a grammar school.

(c) Reference—two satisfactory letters of reference from parties of recognized standing.

QUES. What does a commercial radio operator's technical course include?

ANS. It includes study of,

(a) Principles of electricity and magnetism.

(b) The fundamental principle of the dynamo and motor.

(c) The operation and care of motor generators.

(d) The functioning of the induction coil and the alternating current transformer.

(e) The operation and care of storage batteries and charging panels.

(f) The production of radio-frequent currents by condenser discharges.

(g) The radiation of electric waves.

(h) The process of tuning. (Sender and Receiver.)

(i) Adjustment and functioning of receiving apparatus.

(j) Location of faults and troubles.

(k) Antenna or aerial construction.

QUES. What does a traffic course include?

ANS. It includes study of,

(a) Marconi traffic regulations.

(b) The International Radio Telegraph regulations.

(c) U. S. Naval regulations.

(d) The method of abstracting and accounting for tolls.

(e) Charging of tolls.

(To be Continued.)

The Navy Needs You

Amateurs residing in the Second Naval District—from Barnegat to New London—who can qualify as radio electricians now have an opportunity for service on "submarine chasers." Write to the Editor of THE WIRELESS AGE, stating your qualifications for the reserve explained on page 596 of this issue. A number of readers have already been enrolled. Don't delay.

Radio Telephony

By ALFRED N. GOLDSMITH, PH.D.

Director of the Radio Telegraphic and Telephonic Laboratory of the College of the City of New York

ARTICLE V

CONTINUING our discussion of radio telephony by means of radio-frequent spark transmitters, we consider next a system developed by Dr. E. Leon Chaffee in conjunction with Professor George W. Pierce. This system will be found to be unique in certain respects.

The wiring diagram of the transmitter is shown in its essentials in Figure 44, and presents no unusual features. The direct current generator supplies 500 volts (and from 0.3 to 0.8 ampere; i. e., from 150 to 400 watts) per gap. The resistance provided in the supply circuit is made in two parts, in series, one roughly variable in considerable steps and the other smoothly and continuously variable. This is desirable, since the operation of the gap, though steady, depends on a proper choice of the current, this current partly determining the inverse charge frequency. The phenomena of an inverse charge frequency (that is, a whole-number ratio between the secondary oscillation frequency and the primary impulse frequency) has been treated above, and is illustrated in Figure 31. It constitutes a distinctive feature of the Chaffee gap, and depends on the intrinsically great damping in the gap.

The primary condenser *C* need not be a high tension condenser with the usual low power sets, and generally has a value in the neighborhood of 0.009 microfarad. The coupling between L_1 and L_2 is close. Ordinarily, the microphone *M* is an ordinary Bell transmitter, though Chaffee has stated that this type of microphone deteriorates somewhat under radio frequency currents of one ampere or more.

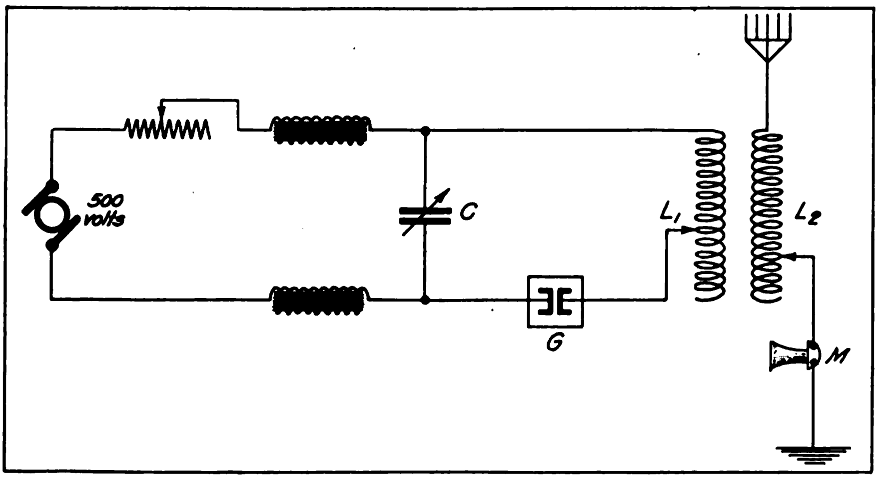


Figure 44—Chaffee radiophone transmitter

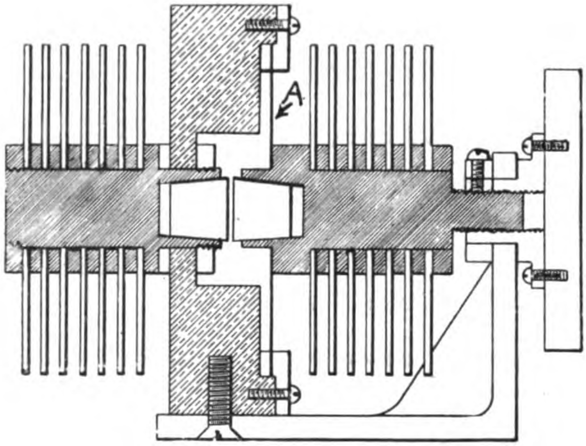


Figure 45—Cross section of Chaffee gap. Designed by Cutting and Washington

The cross section of a Chaffee gap, constructed by Messrs. Cutting and Washington (under patent license from Dr. Chaffee) is shown in Figure 45. The gap consists of plugs of aluminum and copper respectively, one or two square centimeters (or roughly two or four-tenths of a square inch) in area, larger dimensions being undesirable in the stationary forms of the gap. Originally the gap was run in an atmosphere of moist hydrogen; but hydrogen being difficult to obtain in ordinary practice, it was found by Cutting and Washington that alcohol vapor could be substituted provided it was distilled into the gap, by the gap heat, from a wick entering the bottom of the gap chamber. The form of gap shown is made air-tight by the use of the flexible phosphor bronze diaphragm *A*, which is held in place against a soft rubber gasket by a brass ring. Such a diaphragm permits the necessary movement required in adjustment of the gap electrode separation. The external appearance of the gap with its adjusting handle and cooling fins is given in Figure 46. For larger powers, a still later modification of the gap is used wherein the discharges pass between a rapidly rotating aluminum disc and a stationary copper plate, in hydrocarbon vapor. High efficiency (up to 60 or 70 per cent.) can be obtained with these last gaps.

The discharge begins when the switch is closed, provided the distance between the electrodes is not over 0.1 mm. (0.004 inch). It is a noiseless and fixed arc of a vivid violet or purple color. Occasionally it moves to a fresh point on the electrodes. The explanation of the extreme quenching action lies, according to Chaffee, in "the practically instantaneous re-establishment of the high initial gap resistance when the current becomes zero, due probably to the formation of an insulating oxid film on the aluminum; the high cathode drop of the anode metal; and the absorption of energy by the secondary, although rectification usually takes place without this aid. The best operating gap lengths are from 0.04 to 0.09 mm. (0.0016 to 0.0036 inch).

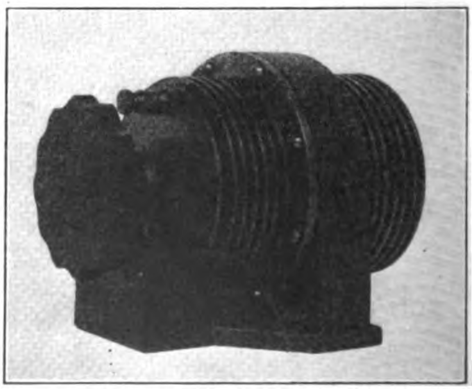


Figure 46—Chaffee gap. Designed by Cutting and Washington

The primary discharge is a half loop of current, and, as correctly indicated in Figure 31, is not half a sine wave. Its duration does *not* depend on the primary supply current, which latter affects only the time between successive primary discharges. The time between successive primary discharges is also dependent on the primary capacity, since the charging phenomena connected therewith largely determine the successive break-downs of the gap. For an inverse charge frequency of 2 or

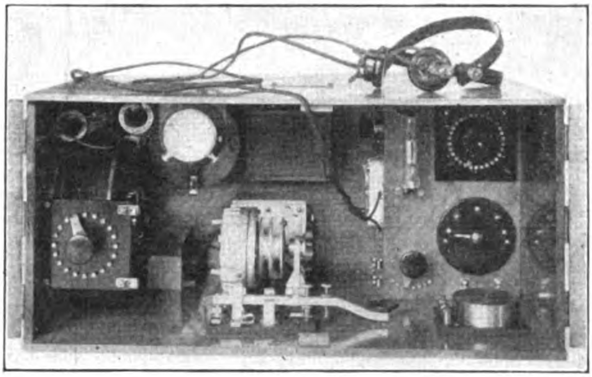


Figure 47—Aeroplane set with Chaffee gap. Designed by Cutting and Washington

3, the secondary oscillations differ only imperceptibly from truly sustained oscillation, as is evidenced by the interesting fact that when received on a normal beat receiver, a clear musical beat tone is obtained.

It is worthy of note that even with this absolutely aperiodic primary discharge, a definite relation between the primary period and the secondary period is required for maximum secondary response. This relation is, however, far from being one of even approximate equality being, in fact, a ratio of 1.71 for primary period divided by secondary period.

The radio frequency output per gap is about 50 watts, and the efficiency is given as between 30 and 40 per cent. Two or three gaps may be operated in series on 500 volts, and four gaps on 1,000 volts. The actual voltage drop across the individual gap is about 150 volts.

The Chaffee apparatus as developed for commercial work by Cutting and Washington is illustrated in Figures 47, 48, and 49. The first of these is a 150-watt aeroplane set, with the special gap in the center. The primary condenser is behind the gap, and the primary-to-antenna coupler is mounted to the left. In the latter two figures, a somewhat larger set is depicted. Here two gaps in series are used, and a variometer type of coupling. Telegraphic communication was maintained with one of these sets 78 miles (125 km.) with 1.5 amperes in the antenna at 480 meters wave-length. It should be noted that, in marked contrast to almost all sustained wave generators, the Chaffee arc drops but slightly in output at very short wave-lengths.

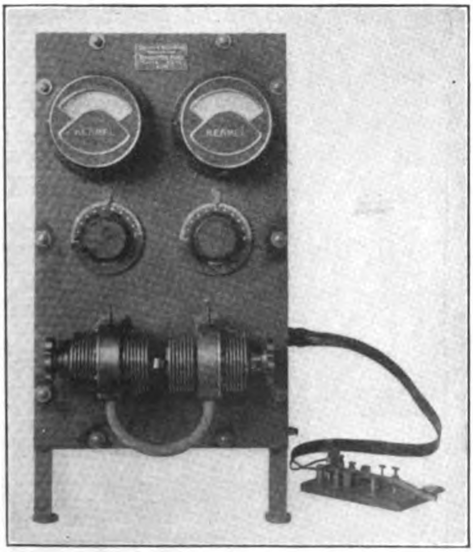


Figure 48—Front view, 0.25 k.w. Chaffee gap set. Designed by Cutting and Washington

It has been pointed out elsewhere by the Author that a marked tendency exists in radio development toward having all stations operate with sustained radiation. This tendency is much to be encouraged because of the remarkable possibilities in the direction of selectivitiy with beat reception at the short wave-lengths. While beat reception is not particularly suited to radiophone work, it is to be hoped that ship and small shore stations, and all amateur stations, will at least employ sustained wave generators. If this is done, the Chaffee arc would seem to be a suitable device, and has marked possibilities.

In the radiophone experiments described by Chaffee, great simplicity of apparatus was achieved. The regular tests were carried on over a distance of one mile (1.6 km.). A single gap was used with from 0.2 to 0.5 ampere

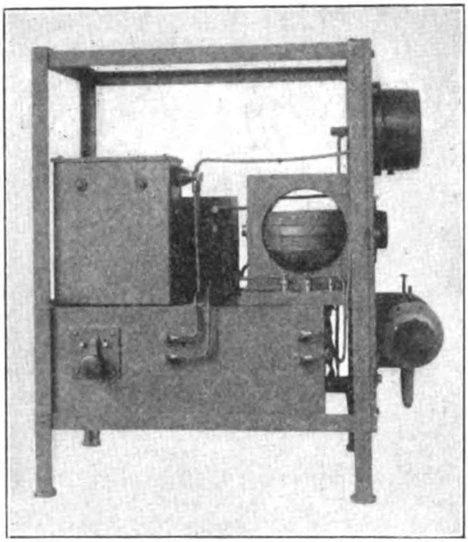


Figure 49—Side view, 0.25 k.w. Chaffee gap set. Designed by Cutting and Washington

through it. The voltages at all portions of the set in the station were comparatively low, say under 1,000 volts. It is stated that when the receiving station was properly tuned, only a slight hum or hiss, was heard in the receivers, which was tuned out, if desired, and in any case drowned by the voice. The articulation was very good, and communication was maintained for hours without losing a word or making any adjustments.

The speech was heard at a distance of 40 miles (64 km.), but it is believed that this distance is by no means the limit of the system, even when oniy one gap is used.

Mr. Washington has informed the Author that using two gaps and an antenna current of 2.7 amperes modulated by a water-cooled transmitter, music from a phonograph was clearly distinguishable on shipboard at a distance of 110 miles (180 km.).

Another system of somewhat similar characteristics was developed by Lieutenant W. T. Ditchman in 1912, and presents some features of interest. There was used a gap the cathode of which was aluminum, hard copper, or bronze, the anode copper or steel, each electrode about 1 cm. (0.4 inch) in diameter, and the discharge taking place in an atmosphere of carbon dioxid under pressure. Four such gaps were used in series, at a voltage of 1,000 and a current of 1.5 amperes. The capacity in the primary oscillating circuit was 0.012 microfarad. The multiple microphone transmitter employed is shown in Figure 50. It consists of four pairs of two microphones each, the microphones in the individual pair being simultaneously actuated by the voice and connected in series. A knob on the side of the holder (or, in some types of the apparatus, an automatic push-button arrangement) enables changing from one set of microphones to the next about every two minutes, thus preventing overheating. Antenna current up to 10 amperes have thus been handled without overheating of the microphones and consequent deterioration of articulation.

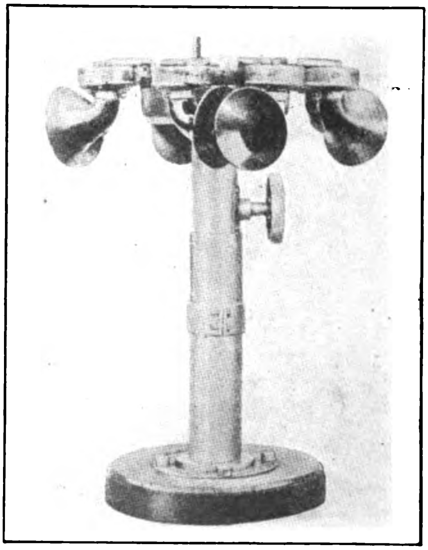


Figure 50—Ditcham multiple microphone transmitter

The description of the apparatus given by the inventor makes it clear that he was aware of the advantage of securing an integral inverse charge frequency, and attempted to secure this advantage in designing the apparatus.

The antenna fundamental was 460 meters, and its capacity 0.0007 micro-farad. It was normally used at 550 meters with an antenna current of 8 amperes. The antenna was lower than desirable, and probably had only small true radiation resistance. The normal distance of communication was from Letchworth to Northampton, a distance of 55 km. (34 miles). However, signals have been received 175 km. (110 miles) over land. In reception, a crystal detector (namely, Pickard's silicon-arsenic combination) was used.

It is interesting to note that the maximum radiation was attained in the system when the primary was tuned to 830 meters and the antenna to 550 meters, a ratio of 1.51 between them. his ratio is not far from 1.71, the value found by Chaffee for most efficient operation. Coupling to antenna as high as 40 per cent. is used.

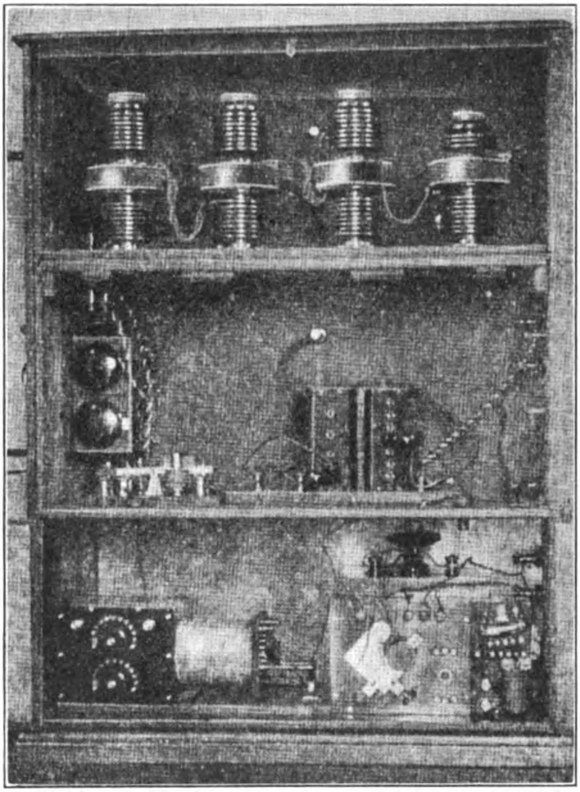


Figure 51—Ditcham radiophone transmitter and receiver

We are indebted to Lieutenant Ditcham for important previously unpublished data on the operation of these gaps. With hard copper or bronze electrodes in carbon dioxid under pressure, the gaps apparently had two functions: (a) cooling by expansion; (b) the formation of a hard crystalline film on the electrodes. This film permitted actual contact of the electrodes without "short-circuiting" or arcing. When the film was once formed, the gas could be shut off, and the spark would continue active for five or ten minutes before an arc started.

The entire transmitter is given by Figure 51. On the top shelf are mounted the four series gaps. On the shelf below are seen tuning inductances and a relay, while on the bottom shelf is mounted the receiver and a call-bell system. This last consisted of a Brown telephone relay fed from the crystal detector and, in its turn, supplying the current for a moving coil relay of no great sensitiveness. A long musical dash is sent for calling, the pitch being regulable by variation of the speed of the rotary make-and-break device ("chopper") which is inserted in the coupling between the closed and antenna circuits. A selective method of calling, permitting ringing any one of a number of stations within a given zone, was experimented with, but no details are available as to its success in operation.

A system of radio-frequent spark telephony has been devised by Messrs. Wichi Torikata, E. Yokoyama, and M. Kitamura. The spark or arc terminals in this system are composed of magnetite (oxid of iron) and brass. Other alternatives are aluminum, silicon, ferro-silicon, carborundum, or boron against minerals such as graphite, meteorite, iron or copper pyrites, bornite, molybdenite, marcasite, or others. Usually the electrodes are of small surface, this being regarded as essential by the inventors. The power supplied per gap is 500 volts and 0.2 ampere. A capacity of approximately 0.05 microfarad is used in the primary oscillating circuit. About 1 ampere is modu-

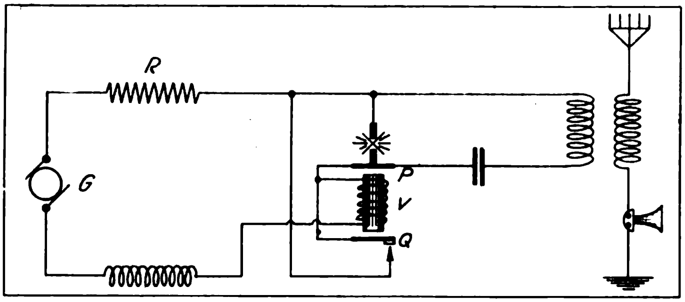


Figure 52—T. Y. K. radiophone transmitter

lated in the antenna by the microphone, and the every-day range is given as 10 to 15 miles (25 km.). Ordinary crystal detector reception is employed.

The wiring diagram of the apparatus is given in Figure 52. It will be seen that the starting device is of an unusual nature. It seems that a high-resistance film forms on the surface of the electrodes, as in Lieutenant Ditcham's system, and it is necessary in consequence to have some means of obtaining a momentary high voltage to break down this surface film, and start the discharge. This is accomplished by having a steady current flowing normally (before oscillations are desired) in the inductance *V* as indicated, this current being quickly broken at *Q* when it has once fairly started. The gap electrodes being in contact, the high inductive voltage breaks down the surface film, and the armature *P* draws the electrodes apart and serves as a sort of automatic arc length regulator thereafter.

Figure 53a illustrates the transmitter proper and receiver. A normal heavy-current microphone transmitter is used (mounted at the top in front of the equilibrator). The primary oscillating circuit, capacity control switch is directly below the microphone. The receiver is mounted in the lower case, together with the "sending-to-receiver" switch. The crystal detector is enclosed in a metal housing, the door of which appears at the lower left side of the receiving apparatus case. A usual test buzzer and normal tuning and coupling coil switches are provided. The equilibrator is shown in Figure 53b, with the alternative spark gaps (aluminum-brass or aluminum-magnetite), at the lower left corner. A small lamp with cover is mounted at the rear to indicate antenna current. The lamp resistance and choke coil box for the high voltage generator, supply circuit to the gap appears in Figure 53c. The 100 volt (and 2.7 ampere) to 500 volt (and 0.2 ampere) rotary converter is illustrated in Figure 53d.

In June, 1913, there were established eight land stations of this type in Japan and seven stations were installed on board ship. It is stated that commercial service was initiated at this early date.

A type of oscillator due to Mr. W. W. Hanscom operates with the gap surfaces immersed in alcohol. Their separation is automatically regulated by an electro-

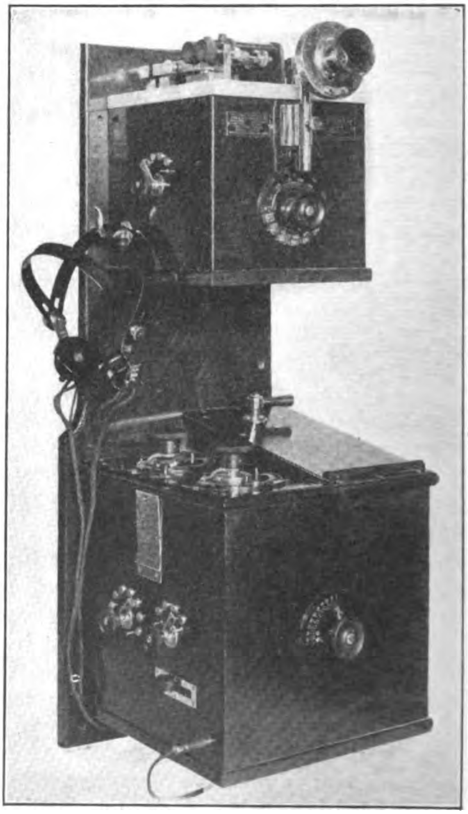


Figure 53a—Front view of T. Y. K. radiophone transmitter and receiver

magnet plunger, a gravity adjustment by means of a sliding weight being provided for initial installation. The gap voltage is low (of the order of 100 volts). It is stated that steady automatic operation for hours has been secured. Only an occasional supply of alcohol and infrequent renewal of the gap surfaces are required.

In Figure 53e is shown such a set. The gap and regulator are mounted to the rear of the panel. The electromagnet winding is also used as a choke coil in the supply circuit. Direct current at voltages from 110 to 500 is supplied, and currents from 5 to 8 amperes pass through the gap. The system has been operated on wave-lengths between 300

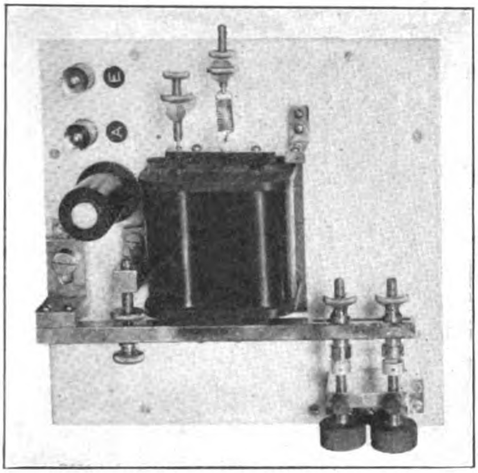


Figure 53b—Equilibrator and spark gaps of T. Y. K. radiophone transmitter

and 2,700 meters. For modulation, a water-cooled microphone transmitter carrying 2.5 amperes is used.

With vacuum valve reception, distances of 100 miles (160 km.) are covered, but it is claimed that distances of 260 miles (400 km.) are occasionally bridged. On one occasion, the 800-mile (1,300-km.) span from San Francisco to Seattle was covered.

Dr. Lee de Forest has done considerable work in connection with radio telephony. Originally he worked with a small arc of the Poulsen type, and communication over short ranges was obtained. More recently he has worked with several types of radio-frequent

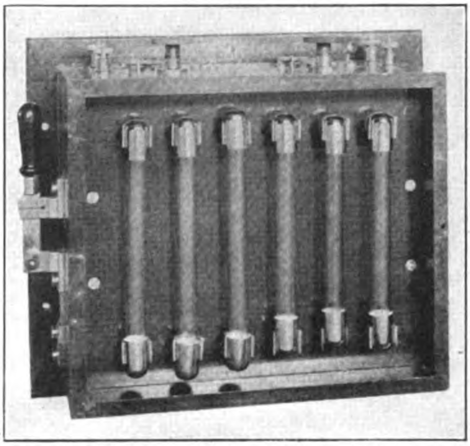


Figure 53c—Series resistance and choke coils for direct current supply circuit of T. Y. K. radiophone transmitter

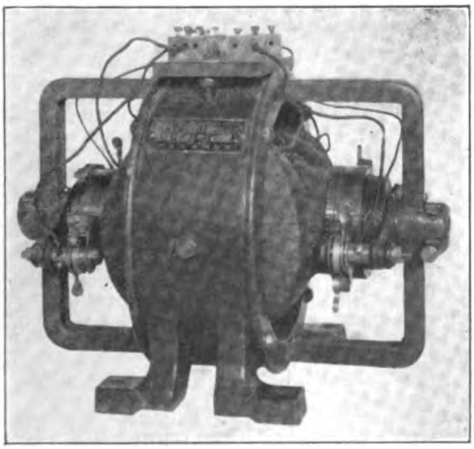


Figure 53d—100-to-500 volt direct current rotary converter of T. Y. K. radiophone transmitter

spark radiophone transmitters, and two of these types will be here described.

The first of these is a moderately high voltage, direct current system. The wiring diagram is given in Figure 54. As will be soon, a 1,000-volt, direct-current generator supplied a two-section quenching gap through a regulating resistance and choke coil. The ga pitself is made of parallel studs of tungsten in air, with minute but regulable separation. Shunted around the gap is an oscillating circuit which is directly coupled to the antenna. Two heavy current microphones (sometimes air cooled by a blower) are connected in series in the ground load of the antenna. A small set of this type is shown in Figure 55. It differs from that just described in that only one gap section is used and a single microphone in the antenna. The antenna ammeter is shown mounted on the upper left-hand portion of the apparatus box which contains the primary condenser, inductances, choke coils, and antenna switch. This sending-to-receiving transfer switch is controlled by the projecting knob on the upper right-hand portion of the apparatus box. The small 600-volt generator is shown separately. A 0.25-h.p. (200-watt) motor is recommended for driving the generator. The range is given as from 7 to 15 miles (10 to 25 km.). The set, as designed, operates at wave-length from 400 to 1,000 meters.

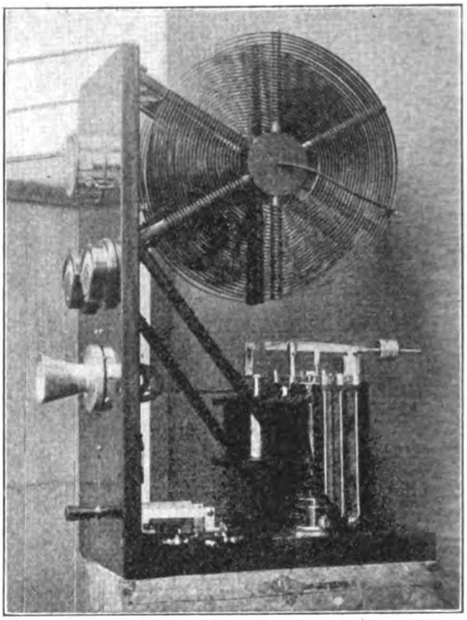


Figure 53e—One-half kilowatt Hanscom radiophone transmitter

A portable type of radiophone is shown, set up, in Figure 56. It will be seen that the double microphone transmitter is used in the set in question. The receiving set is seen at the left and toward the back of the instrument case. A somewhat larger set is illustrated in Figure 57, with an air-cooled, two-section gap. The antenna switch and direct coupling coil are mounted to the right of the panel. When used for radio telephony, an air-cooled, twin-microphone transmitter is mounted on the panel, usually under the supply circuit ammeter.

An alternating current system of spark radio telephony has been developed by de Forest. The circuit diagram is given in Figure 58. *G* is a 3,000-cycle alternator which supplies current to the primary of the transformer through the tuning condenser indicated, this latter having a value of approximately 8 microfarads. The transformer raises the terminal voltage from 100 to 5,000 volts. A number of gap sections similar to those previously described are used, and the primary is inductively coupled to the antenna. A double microphone is used in the ground lead as before. The audio frequency tuning to 3,000 cycles in the supply circuit is of interest. No data is available as to the extent to which the 3,000 cycle note can be eliminated and prevented from interfering with the speech in the arrangement under consideration. It is likely, however, that a square generator-wave form would be of assistance in this connection.

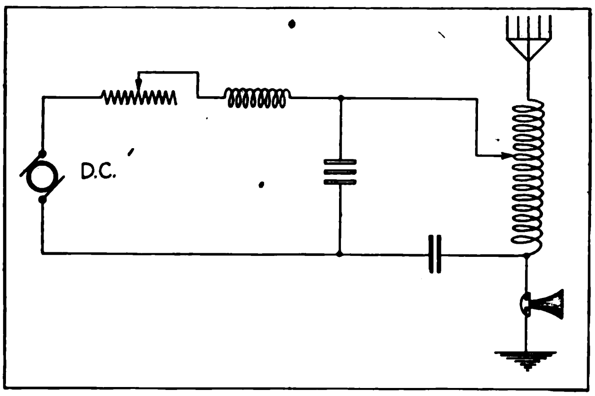


Figure 54—de Forest radiophone transmitter—D. C. type

When it is attempted to receive signals from the de Forest radiophone transmitters by ordinary beat reception, (no speech being transmitted) a

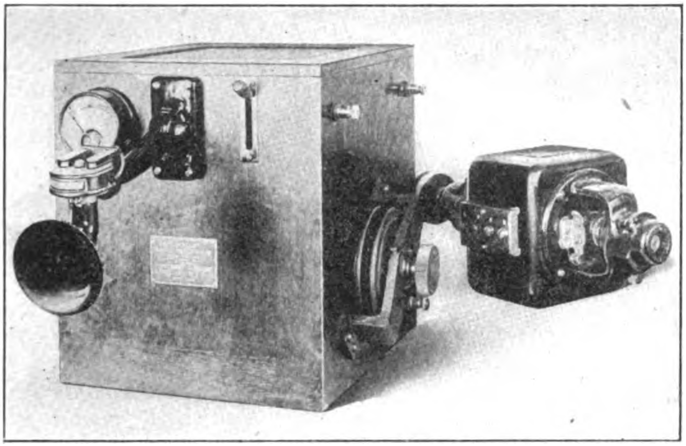


Figure 55—de Forest D. C. radiophone transmitter

very poor note almost without musical characteristics is obtained. This is accounted for by the absence of a definite inverse charge frequency and the consequent extremely frequent alterations in phase of the radiated energy.

A 1-k.w., direct-current equipment placed on a train of the Delaware Lackawanna and Western Railroad permitted communication from Scranton to a moving express train at full speed up to 53 miles (85 km.) De Forest Forest gives some interesting figures as to the average range of the sets. For the 2-k.w. set, using masts 100 feet (30 m.) high and at least 50 feet (15 m.) apart, the range over sea is up to 100 miles (160 km.) and over land up to 75 miles (120 km.) If 40-foot (13-m.) masts are used, these ranges are reduced to 0.3 or 0.4 of the values given. For the 5-k.w. sets, with similar 200-foot (60-m.) masts at least 100 feet (30 m.) apart, the sea range is up to 400 miles (640 km.) and the land range up to 300 miles (480 km.). This range is reduced to one-half the values given if the masts are reduced in height to 100 feet (30 km.). It is further stated that over heavily wooded and mountainous country, the ranges may be reduced 25 or even 50 per cent.

Excellent results have been obtained with a recent method of radio-frequent spark type using the Moretti "arc." The Moretti arc seems to be the most powerful generator of this sort yet discovered. It is a simple device, being shown in Figure 59. In the Figure, the arc is shown enclosed in an air-tight box of insulating material, but this enclosure is not essential. The arc may be used in the open air. Both electrodes are of massive copper, one with a plane surface, and the other *A* with a longitudinal perforation through which is pumped a steady stream of acidulated water. This jet impinges on the upper electrode (which is the negative one, usually); and the velocity of the stream of water can be suitably regulated by a

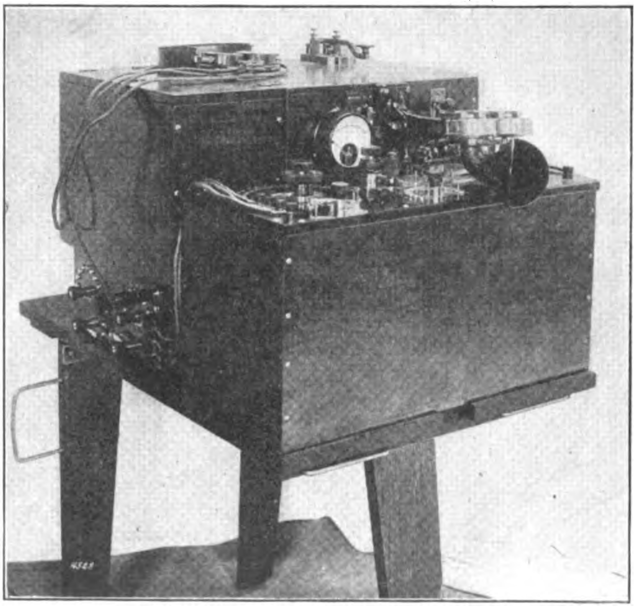


Figure 56—de Forest portable radiophone set

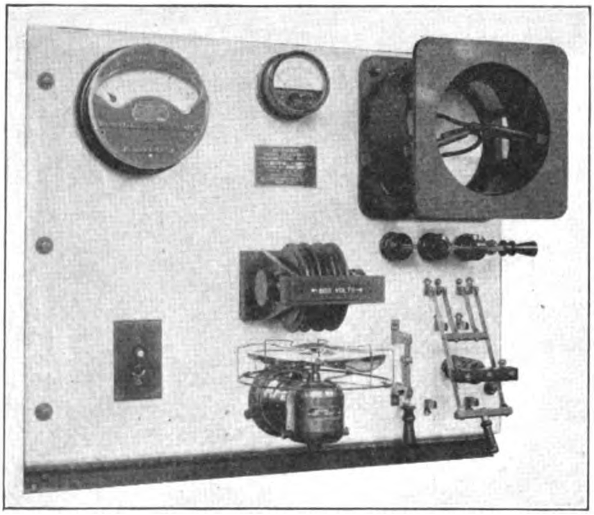


Figure 57—de Forest 2 k.w. radiophone panel transmitter

valve placed in the feed pipe. The theory of its action, as given by Professor Vanni, makes it a device somewhat analogous to the usual Wehnelt interrupter. He suggests that at the moment of formation of the arc, the water passes into the spheroidal state, vaporizing rapidly, and thus breaks the circuit very suddenly. At the same instant, the water is partly dissociated into hydrogen and oxygen; which, being an explosive mixture, quickly recombines, whereupon the entire cycle is repeated.

Whatever the action, the effect is to open the arc circuit at a radio frequency, which fact can be verified by an examination of the arc by a rotating mirror oscillograph. The spark frequency is thus found to be several hundred thousand per second. As in the Chaffee arc, the impulses are stated to be unidirectional, though whether an inverse spark frequency exists or whether syntony to wave form is evidenced is not indicated in the published descriptions.

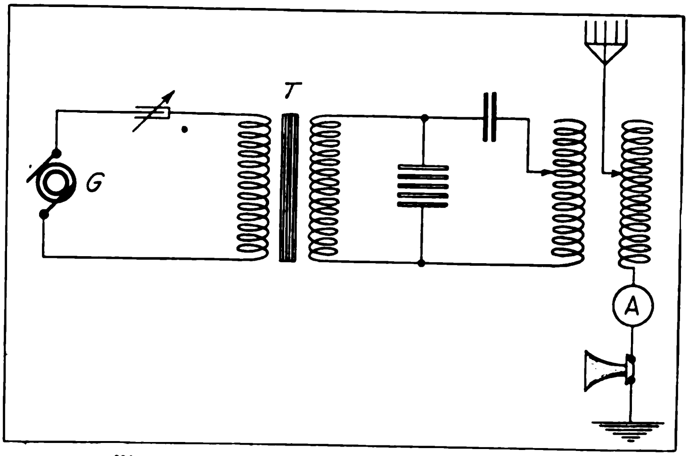


Figure 58—de Forest radiophone transmitter— A. C. type

This arc has been improved in construction by Mr. Bethenod in that a precision regulator of the arc length has been designed by him, and that a special direct generator has been used of high no-load e.m.f. and markedly lower load voltage. In this way, the series resistance in the supply circuit can be avoided and better efficiency attained.

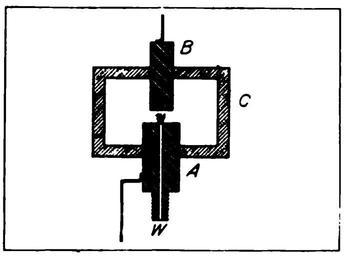


Figure 59—Diagrammatic representation of Moretti arc

As normally used, the arc is placed in series with resistance and inductance across the terminals of a 600-volt direct current generator. The energy supply in the following experiments carried on by Professor Vanni was 1 kilowatt. Across the arc is placed a usual oscillatory circuit, which is inductively coupled to the antenna. In the antenna was placed Vanni's special hydraulic microphone transmitter to be described hereafter. Unquestionably, the remarkable re-

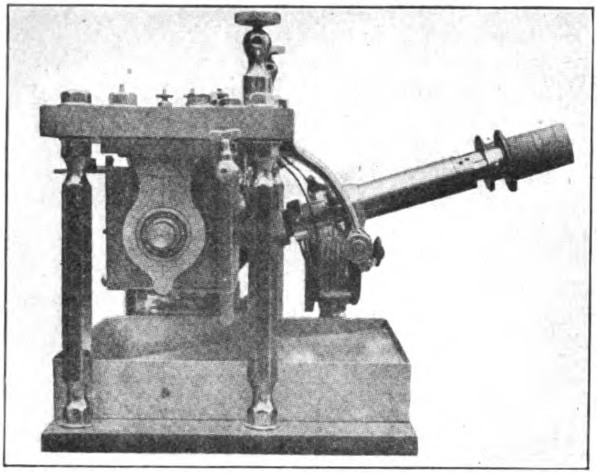


Figure 60a—Scheidt-Boon Moretti arc as used at Laeken station of Mr. Robert Goldschmidt

sults obtained are in large part to be ascribed to the development of this unusual form of telephone transmitter. The antenna current secured was 12 amperes.

In 1912, experiments were carried on by Vanni from the station at Cento Celle, several kilometers from Rome. The Island of Ponza, 120 km. (75 miles) away, was first reached, then Magdalena, 160 km. (100 miles) away; then Palermo, 420 km. (260 miles) away; then Vittoria, 600 km. (375 miles) away, and finally Tripoli, no less than 1,000 km. (625 miles) away. The results are noteworthy, and seem to be attainable without excessive uncertainty, as evidenced by the work done by Mr. Goldschmidt (of Laeken, near Brussels, in Belgium), and by the Merzi brothers in Italy.

The experiments carried on at Laeken early in 1914, before the unfortunate destruction of the station by its owners to prevent it from falling into the hands of an invading army, are of considerable interest.

As generator, a modified Moretti arc was used, fed with 600 volts. It is shown in Figure 60a*. One electrode was rotated rapidly. This was the positive electrode and consisted of a number of discs mounted on an axle. The negative electrode consisted of the surface of rods held in sleeves with screw adjustment so that the arc length was directly regulable. As stated previously, a water jet was injected into the arc. A special microphone heavy-current transmitter devised by the Marzi brothers was used, and this will be considered hereafter. Several Moretti arcs in series have been used by the Marzi brothers. With four arcs in series, running at 2,400 volts, radiophone transmission was effected between La Spezzia and Messina, the full length of Italy.

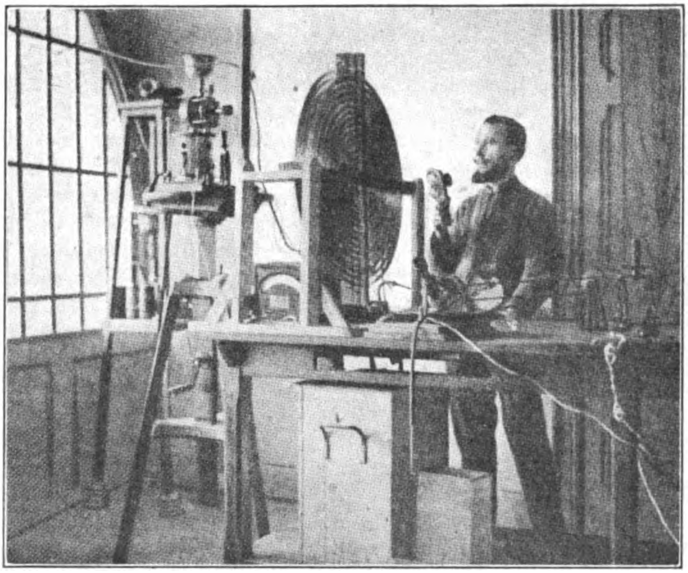


Figure 60b—Laeken (Brussels) station of Mr. Robert Goldschmidt, showing Moretti arc and Marzi microphone

* Figures 60a and 60b are reproduced by permission from the French journal "T. S. F.," based

The equipment used in the Laeken experiments is shown in Figure 60b. On the center of the table is mounted the Moretti arc, to the left of which are seen the coupling spirals. In the upper left-hand portion of the picture is shown the heavy-current transmitter, which is, in fact, controlled by the small transmitter held in the hand of the experimenter.

On March 13, 1914, using 3 amperes in the antenna, communication was established between the station at Laeken and the Eiffel Tower in Paris, a distance of 200 miles (320 km.) Tests were carried on regularly on wave-lengths of 300, 600, 800 and 1,100 meters. This arc shows the usual radio-frequent spark characteristic of satisfactory operation on short wave-lengths.

Reception was accomplished in various way, but it is interesting to note that the experimenters give the following as the order of merit of detectors in radiophone reception: sensitive crystals (such as galena), the audion, the Fleming valve, carborundum, and the electrolytic detector.

This is the fifth of a series of articles on "Radio Telephony," by Dr. Goldsmith, an eminent authority on the subject. In Article VI, in the June issue, he continues the discussion of radio telephony by taking up the subject of vacuum tube oscillators. He describes the experiments of Dr. Saul Dushman, and gives the latter's data in considering the current-carrying capacity of vacuum tube rectifiers. He treats of the development of the pliotron by William C. White, the studies of Dr. Langmuir, and Dr. A. Meissner's invention of a form of oscillating circuit of simple electrical nature.

Where Freak Conditions Prevail

Phenomena of Wireless and Expansion of the Art in Alaska

ALASKA occupies a distinct place in the mind of the wireless man who is familiar with that territory. He knows it as a land where radio conditions which do not prevail in any other part of the world are found. It is in this territory that the Marconi system has blazed the way of modern means of communication, bringing isolated points in the vast frozen wastes in touch with far distant places.

The unusual wireless conditions in Alaska may be due, it is said, to the geographical location of the territory and the continuous daylight during the summer. As an example of freaks, it may be instanced that at the Marconi station at Astoria, it has been observed that the atmosphere would be free from strays until about noon when they would appear, gradually increasing in intensity. The maximum would be reached at one o'clock in the afternoon and no change would be observed until four hours later. From that time until midnight conditions were the same as those prevailing at similar stations. The period of decrease in the evenings would vary occasionally, but the appearance of the strays at noon continued for several weeks.

The use of radio as a means of communication in Alaska seems peculiarly fitting to that territory, for the various topographical and geographical formations of the land place great difficulties in the way of the construction of telegraph lines and the laying of submarine cables. Along the coast volcanic disturbances are not of infrequent occurrence. These are not of a violent character, but they serve as a never-ending source of trouble to those in charge of the cables.

At Ketchikan, the first port of entry into Alaska; at Juneau, the capital city, and at Astoria, the Marconi Company has established semi-high-power stations. These stations will be among those of a chain that will some day extend along the Alaskan peninsula when the commercial development of the territory warrants the step. As an example of the speed and reliability of the service it may be mentioned that a mine owner in Juneau sent a marconigram from that city to Los Angeles, Cal., and received a reply forty minutes after the first message had been filed in Juneau. Besides the semi-high-power stations, a number of canneries and mining companies have had Marconi equipments installed, thereby establishing communication with the outside world.

Four towers of the self-supporting type for the antenna have been erected at Ketchikan. They face a strip of water—the Tongass Narrows—and are so located that they outline a rectangle, the dimensions of which are 300 by 600 feet. Three hundred feet in height, each of the towers is stepped with a wooden top mast, extending fourteen feet above the head of the steel portion. Eighty thousand volt, triple petticoat insulators carrying the antenna are mounted upon these masts. The antenna is made of two silicon bronze wires, each having seven strands of No. 18 wire. The tension of the latter can be fashioned to withstand the stress of the severest weather conditions. This antenna is employed both as a transmitting aerial for the marine service and as a receiving aerial for the 5 and 25 K.W. sets.

On triatics, between the towers, is suspended a twenty-wire antenna which leads to the reinforced steel concrete power house, 300 feet from the lower two towers, where it is connected to the 25-K.W. transmitter. The Ketchikan city power house is connected with the wireless station by a two-mile transmission line carrying 2,200 volts, single phase current, at a frequency of sixty cycles. About 300 feet distant from the power plant the line is brought into the building by means of an underground conduit. It is connected to the high tension switchboard and thence distributed to the various units, the transmitting apparatus and the lighting and heating transformers.

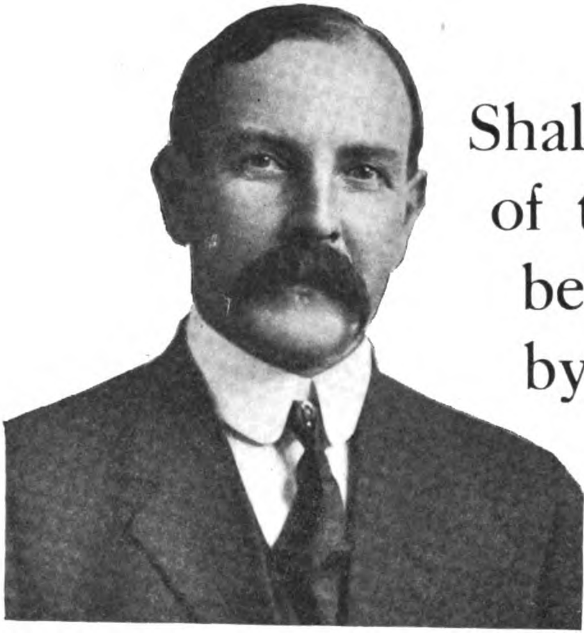
For furnishing seventy volt direct current for the operation of the solenoid keys and side disc motors, a synchronous rotary converter is used. By means of an extended shaft it drives a rotary discharger which controls the number and duration of the spark discharges. All the improvements for handling such currents are embodied in the disc discharger. The disc, which rotates at the rate of 1,79P revolutions a minute, is thirty inches in diameter. Equally spaced around the disc, close to its periphery, are inserted brass studs. The disc, in rotating, passes between two side discs set to give a clearance of 1/32 of an inch. Across this small air gap, that is, between the side discs and each of the revolving studs in turn the discharge takes place. Because of the fact that the discharger is rotated synchronously with the alternator which supplies energy to the condenser which is discharged, it is necessary to time the discharge to occur at, or near, the peak of the voltage wave in the alternator. The correct point on the voltage curve depends on several factors, arrangements being provided to permit adjustments of the interval between the time at which the revolving stud passes the side discs and the time when the machine voltage is at its highest. Thus maximum results are obtained.

The condensers consist of glass and zinc plates placed in earthenware containers filled with oil. A bank of thirty units is used in the circuit. Copper bus bars of ample dimensions lead from the condenser tank to the inductive coupler and to the disc discharger. The coils of this coupler are wound with a specially designed cable, and so arranged that each strand carries the same amount of energy, thus decreasing heat losses.

In the receiving office, which is seventy-five feet from the power house, are the operating key and the usual equipment, supplemented by two loose-coupled receivers (fitted for crystal and valve detectors), having ranges of from 100 to 4,000 meters, and from 100 to 7,000 meters, respectively.

The construction engineers found that the forests and the heavy rain fall, which in the vicinity of Ketchikan averages 168 inches yearly, added considerably to the difficulties of their work. However, the rain fall was advantageous as regards the ground system. The latter consists of 3,000 pounds of zinc plates buried in a circle around the power house, supplementing which are four foot strips running out on the beach to mean low tide level, thus insuring at all times good electrical ground.

The living quarters for the men detailed at the station are provided with the modern conveniences. A 12,000-gallon reservoir, located on high ground at the rear of the station, provides the water supply.



Shall the Interest of the Amateur be Suppressed by Injudicious Radio Legislation?

Arthur E. Kennelly, past president, I. R. E., vice-president National Amateur Wireless Association and professor of electrical engineering at Harvard University and Boston "Tech"

How Professor Arthur Edwin Kennelly Championed the Cause of the Young American Student of the Wireless Art Before the Committee of the House of Representatives

ONE of the most emphatic and convincing opponents of the proposed bill to regulate radio communication, on which hearings were lately held before a Committee of the House of Representatives, was Professor Arthur Edwin Kennelly, of Harvard University.

His practical career as a telegraph operator dating from his fourteenth year, the record of his remarkable life, showing how resolute effort and continued devotion to his chosen pursuits has led him to the front rank of the science of electrical engineering, will be read with vivid interest by every wireless amateur. And the amateurs will be still more interested in his views of the wireless art, since before the Congressional Committee he appeared as their especial champion. In fact, Professor Kennelly, who is a member of the National Advisory Board of Vice-Presidents of the National Amateur Wireless Association, informed the members of the House of Representatives that the proposed legislation was a blow to amateur invention and amateur application to radio study. "If you suppress the interest of the amateur," he said, "you will make a desolate world of it. I do not want to see that state of affairs in America, the land of freedom. The amateur needs to be protected just as the Navy needs to be protected and as the commercial stations need to be protected."

Professor Kennelly was born in Bombay, East India, a subject of Great Britain, and was educated in France, Italy and England. He was a telegraph operator at the age of fifteen, leaving school at the age of fourteen, to become an operator in cable telegraphy. He earned his living as an operator until about nineteen years of age, then being promoted to electrician on a cable ship. At twenty-one he was in charge of operations in laying and repairing submarine cables, which was his work for some seven years, during which time he was engaged in the laying and repairing of submarine cables all over the world between Great Britain and India. He also had charge of the laying of cables in this country, along the Mexican coast for the Mexican Government.

In 1886 Professor Kennelly came over to this country and became Thomas A. Edison's principal electrical assistant at his laboratory in Orange, N. J., and served for him and his companies about seven years. He left his employment to go into the business of consulting engineer with Professor Edwin J. Houston, of the Thomson-Houston Company, in Philadelphia. In 1902 he was appointed professor of electrical engineering at Harvard University and is now professor of electrical engineering at Harvard University and the Massachusetts Institute of Technology.

"It has been part of my work at these institutions to teach the principles of radio telegraphy," said Professor Kennelly, "not as an operator, never having trained as a radio-telegraph operator, although I have a small set in my house and am accustomed to listen in to messages and eavesdrop generally in that way."

Of his radio record this well-known authority noted that he was the retiring president of the American Institute of Radio Engineers; had been past president for two years of the American Institute of Electrical Engineers, and also past president of the Illuminating Engineering Society; also a member of many scientific bodies. "As retiring president of the Institute of Radio Engineers," he added, "I am very much interested in this bill. I am not interested commercially in any way; I do not own any stock, and I hold no commercial interest in any radio telegraphic concern; but I am profoundly interested in this as a past president of the Radio Engineers, as a member of the teaching profession, and as an American citizen. For all these reasons I am deeply and earnestly concerned in this bill and the question of its passage."

This vice-president of the N. A. W. A. observed that he had gone to Washington to urge his contentions that this bill should not be passed for a variety of reasons. "In the first place," he said, "if there is one thing of which this country ought to be proud it is that this country has taken such a shining position in the world in regard to telephonic communication. I do not mean radio telephonic communication, because that is a very young art, although it is coming along; but I mean telephonic communication generally. It was this country that first established communication with France by telephone and with Honolulu by telephone, and there is no other country in the world that has any such telephonic record.

"And that has been accomplished because the telephonic art in America has been fostered and developed under free institutions and not under government control!

"In those countries of the world where there is government control of the telephone and telegraph you will find them in a relatively backward state. I went to France a few years ago in company with an American gentleman. We stopped at a hotel in Paris. He was very anxious to talk with somebody on the telephone. I tried to dissuade him from doing so. I said, 'Do not waste your time trying to talk over the telephone, because the telephones are very unsatisfactory here.' He said, 'But I must telephone.' He had been accustomed to using the telephone constantly in his office in New York. I said, 'Well, if you insist, come with me'; and we went to the telephone bureau, so called—a very miserable little concern, like a shoeblacking box, in charge of a man who did not know much about it. He had a great deal of trouble in getting the central station at all. Finally, when he did get the central station, he abused them in unmeasured language, which would not have been tolerated in this country. The whole system is in a very backward state—largely because of Government ownership."

The chairman inquired at that point if the telephone system in London was controlled by the Government.

"Yes, sir," returned Professor Kennelly; "at the present time it is. It was not a few years ago, but it is now, and it has become in a worse condition since the Government has taken control than it was before it was Government owned.

"Everybody admits the telephonic communication in London is defective and was better under free administration than it has been since it was taken over by the Government; although when it was under free administration it was so hampered by the Government that it could not properly develop. That is common knowledge."

Chairman Alexander of the committee here observed that he knew, from personal experience, that the service is very poor. Whereupon Professor Kennelly added: "It is, sir. I take pleasure in endorsing your statement."

To indicate how the workers in the wireless field felt about the proposed legislation, the distinguished opponent mentioned the Institute resolutions printed in THE WIRELESS AGE at the time of their adoption. He explained that "there was entire unanimity among the members of the board," adding: "They felt very earnestly and very forcibly upon this question, because they were representatives of the science and art of radio communication; not because they were interested in any particular commercial enterprise."

The resolutions referred to stated that the board opposed "competition by any department of the Government, and particularly by any military or naval department, with existing organizations."

Professor Kennelly stated that the deep concern of the engineers was due to the fact that they have charge of the engineering future of the art.

"This was puerly a scientific art a few years ago," he explained. "It has now become an engineering art, an applied science, in which money is expended in a definite way, under the control of engineers, for producing the best efforts in the service of the public. As you know, there are certain corporate interests in this country that serve the public by investing their money in stations for the transmission of news whereby we, all of us, including all in this room, are benfited. And this bill, if passed, will undoubtedly have the effect of stifling and arresting that work and that development. It will inevitably have the effect of crippling those stations and putting them out of business. Now, I have no commercial interest in this; but there are, to my knowledge, many people, good citizens like ourselves, who have invested their savings in these stations and in this work, partly, no doubt, because they hope to get some financial return, but also partly because they think they are being patriotic to this country by supporting a young and promising art; and they think by taking part and sharing in that stock they are helping along the whole interests of the world, and particularly of America, in this wonderful art.

One-Man Power an Everlasting Disgrace to Country

"This bill should not allow one man, a Government officer, to lay his hands upon all that property and suppress it, and then, after having suppressed the property and making it become of no value, thus enable it to be purchased by some department of the Government at scrap prices!

"I am not here to asperse anyone; certainly I have no rancor against the Navy or against any department of the Government; I simply have opposition to this bill. And I refuse to believe that any Government officer, or any naval officer, drew that bill for the purpose of confiscating this property in so mean and contemptible a manner. I refuse to believe it. I have many friends among the naval officers, and as a profession I have the highest admiration for them, and I refuse to believe any officer of the United States Navy drew that bill with the intention of doing such a mean and contemptible thing. Nevertheless, it will have that effect, and if passed in the form in which it lies before you it will be an everlasting disgrace to the Government of this country and to the people of this land!"

Legalized Permission to Transcend Limits of Fairness

Chairman Alexander asked the speaker to indicate the provisions of the bill which he thought would have that effect.

Professor Kennelly replied: "Certainly, sir. Section 6 states that after three months and within five years after the expiration of said three months, the Government, through the Navy Department, shall have authority to acquire, by purchase, at a reasonable valuation, any coastal radio station now in operation in the United States which the owner may desire to sell.

"There is nothing there to determine what is a reasonable valuation.

"After you have so far invalidated and destroyed your neighbor's property, he may be willing to sell at famine prices. And, of course, you have all heard the truism 'I do not care who makes the laws so long as I have the construing of them.' And with the permission for the Government to enter into competition with the coastal commercial radio stations, and with the power given them to regulate their opponents, it needs very little imagination to see what the effect of such competition and regulation would be upon their neighbors."

The Chairman's query as to whether Professor Kennelly understood the power to purchase and regulate would be accomplished by enactment of the bill met with the prompt rejoinder: "It certainly would have that effect."

The Hon. Frederick W. Rowe, one of the members of the committee, asked Professor Kennelly whether he held that the Government would be in a position to buy any station through the simple expedient of putting another station alongside it, or by competing with it.

"Without even doing that," was the reply. "They could accomplish it simply by taking the naval stations they now have, and then regulating the commercial stations."

"By using them for commerce?" asked Mr. Rowe.

"Yes," replied Professor Kennelly, "by using them for commerce, and then by regulating the other fellows who are in competition with them for that commerce. Of course, I believe they are all above any intention of doing that, but they will say, you must have this apparatus; you must improve this; that won't do; you must change this; and, by constantly harassing them and changing this, that and the other thing, and regulating them, they would eventually put their competitors out of business. They have that power; and the temptation to do so would be very great. I do not say that any officer of the Government has that in mind at this time; I won't asperse any officer of the Government to that extent. But I say this bill gives that power, and it would be a strong temptation, with that power, for any zealous man. If he felt zealous on behalf of his own department, he would undoubtedly transcend the limits of fairness and fair dealing in the exercise of his discretion. And we can not blame him.

Supreme Navy Power Means Massacre of a Necessary and Honest Public Servant

"This bill gives most oppressive and dictatorial powers. This kind of a bill is what we might expect of the German governor, Von Bissing, to promulgate for Belgium; this is what we might expect a military officer to lay before a conquered country and say, 'Do this or I will confiscate your property.' This is not the kind of a bill that we would expect from a free Government, which stands for liberty before the world, to lay before the people, its public servants, in time of peace, for their control. In time of war—that is another thing."

"You allude to the regulatory provisions running all through the bill which change the present existing law?" asked the Hon. George W. Edmonds, another member of the Committee.

"Yes, sir," replied Professor Kennelly. "I speak also against this bill, sir, on behalf of the Navy itself; or what I consider to be the best interests of the Navy itself. I hold that it is very important that in the next war this Navy of ours shall be supported and shall be strengthened to the utmost by all of our collective ability. I stand for that; I am heartily in favor of anything that will support our Navy in time of war. But I do not think in order to support our Navy in time of peace we should massacre a necessary and honest public servant.

"I think in order that the Navy shall be properly strengthened in time of war we must develop the radiotelegraphic art to the highest pitch. And if you give a monopoly of the radiotelegraphic art, under the possibilities of this bill, to any department of the Navy, you are giving it to somebody whose main interest is in something else. The Navy is a fine profession, but the Navy is not a radio engineering profession. You might as well offer a monopoly of the radio art to the professions of divinity or of law or medicine. It is not an aspersion on the medical profession, not an aspersion on the legal profession, to say that they are unfitted for the control and the monopoly of radiotelegraphy, as an art. The proposition only needs to be stated to be condemned; and yet the Navy is no more entitled to it.

Within Three Years the Air Would No Longer be Free

"Mr. Chairman," continued the speaker, "I have the honor to say I consider it is of the very greatest importance for the sake of the Navy itself that this art should be maintained at its very highest pitch and that America should be foremost and not hindmost in the international competition for the utilization of the ether and the surrounding atmosphere of the globe. Hitherto it has been a saying among all the people of the world 'The air is free.' This bill wants to make that saying a dead letter. If this bill passes, within three years the air will no longer be free from the use of anyone.

"The navy says, 'We are bothered by interference.' How much better is it for them to be bothered by interference in time of peace than to be bothered by interference in time of war. They say, 'Let us have no interference now; let us be comfortable and happy; and let us communicate with each other and with our brother officers on each other's ships.' But when foreign cruisers come over here, will they listen to those proposals? What happened off South America when the English commander, Admiral Craddock, was defeated in that fight? His wireless was jammed by his opponents. If he had had a superior wireless system, he would have been free from all radio hindrance and interference from his enemies. It was one of the circumstances that led to his defeat, that his wireless system was subject to interference.

"Now, what we must have, for the sake of ourselves and the Navy, for the sake of all of us, is a system which will be free from interference. And are you going to produce a system which will be free from interference by saying in time of peace that there shall be no attempt at interference? It is easy to have no interference when a monopoly exists. But the thing to seek is plenty of interference; so much that you will be forced to use your wits, to use your inventive genius to overcome it. And already great steps are being taken in that direction, and already the outlook in this direction is very hopeful for the future.

"Why, it is nothing by comparison with what the telephone has done in this country. It was in this country, in America, that all these important improvements have come about in the telephone, as a direct result of interference. I can remember, and I dare say my friends here remember, what it was in the early days of the telephone. You could not talk to your neighbor without hearing all the neighborhood. And that was a growing trouble. It was the haunting problem day and night of the telephone engineers—'What shall we do to get rid of this eternal eavesdropping of the world?' It has been now so thoroughly eliminated you could hardly realize from using the telephone today that there ever had been such a period. Why? Inventors came forward, all the brightest minds in the telephonic art were stimulated to do something to overcome this difficulty.

"But now if you are going to introduce a plan to suppress this interference because it has been causing a little trouble and been preventing some one Government officer from hearing another Government officer, of course, you will have a fool's paradise for the time being. But what of the hereafter; what of the radiotelegraphic art and the countless generations to come? We want the whole world to be benefited by this art; we want each neighbor to communicate with the other, and we want to have all of that progress in store for us hereafter. And therefore I say do not pass this bill, gentlemen."

Some Amateurs Will Discover Something Which Will be of Benefit

Professor Kennelly expressed the conviction that it was urgently necessary that the Navy be strengthened, but that it could not be strengthened in this way. "It can be pampered and weakened," he continued, "but it cannot be strengthened. The right way to do is to have the Institute of Radio Engineers and a lot of bright lads all over the country working on these problems and coming forward and offering various means for preventing interference, and saying 'I have now a scheme.' If it will serve, reward him by giving him encouragement. But if you attempt to do away with interference under the proposed régime, you would stifle that enthusiasm absolutely. Those men will not have any such enthusiasm if it is in control of some department of the Government, because they cannot hope to reap any benefit by finding a solution of these problems. They will say, 'Why, the Government takes, by confiscation, any invention it wants to appropriate; the Government takes my invention and gives me nothing.' They do that now. And what hope is there for reward or of benefiting our fellow creatures by having a solution of this problem?

"But if you leave them alone you can have this army of amateurs all over this country listening in with their little wireless stations and hearing the pulse beats of the world, as it were. All those young men are thinking, and some of them will discover something which will be of benefit. If you take this bill and use it as it will probably be used you will throw a pall of apathy and discontent and hopelessness over the whole situation. You will darken America and darken the atmosphere of the whole globe. Don't pass this bill!"

This vice-president of the N. A. W. A. stated that he wished to speak also on behalf of the amateurs. "It is not only the vested interests of people," he said, "who have put their savings into this enterprise for the benefit of the public; it is not only for the Navy, but it is on behalf generally of the amateurs of the country, for the young fellow who wants to communicate with his neighbors and utilize the atmosphere of the world—the circumambient ether, as it is called. It is him that I am thinking of; you will suppress him, too. So soon as you have scrapped and suppressed the power stations, the commercial stations, you will still be bothered in the antiquated system in undisputed control of the Navy that no longer has interference from power stations—it will still be bothered by this man here and this little amateur there, and some officer will say he cannot get rid of that interference or that he is being bothered by so-and-so, when 'John Smith is talking in Washington we cannot hear ourselves talking in New York.' And so they will appeal again to Congress to stop the amateur, and there will be no use of the circumambient ether except such as the Navy Department or some department of the Government wants."

The whole system, according to the speaker, would be one repression and star-chamber action and confiscation. There would be a dead silence in the air. It would be a silent globe.

"If you will go to some central radio station with a big tower anywhere in this country," continued Professor Kennelly, "and listen in, you can hear hundreds of people talking to each other, most of them without any interference at all—

only occasional interference. It is so when we are talking to each other in a room, using the same air. We have interference, don't we? One man has to be silent when another one wants to talk. We have to have etiquette; we cannot all talk at once. That is interference. For example, the same interference would result in the atmosphere in this council chamber; if you all talked at once, you could not hear me. And if you go to one of those stations and listen in, you will hear hundreds, perhaps even thousands, talking by radio, depending on how delicate the apparatus is and how far it can hear. If it was delicate enough and powerful enough, you could hear all the radio people in America talking; and they are all learning and all gaining some advantage. It only takes one-twentieth of a second from the time you close a key here for its impulse to get to Europe.

The Amateur Needs to be Protected Just as the Navy Needs Protection

"You will be putting all of that world of communication in time of peace in the hands of the Navy, to restrict for their own purposees, and suppress that interest of the amateur and make a desolate world of it. I do not want to see that state of affairs in America, the land of freedom. The amateur needs to be protected just as the Navy needs to be protected and as the commercial stations need to be protected. We all need to be protected. We have no quarrel, one against the other. We all have difficulties, but they are difficulties which sensible men can overcome. The only difficulties that cannot be surmounted are imaginary ones; the real difficulties are capable of being overcome. Here is a difficulty, the difficulty of interference, the difficulty that all messages cannot at present always be carried at the same time. Very well; let us be sensible. Come, let us take counsel; let us have representatives of the various parties in interest meet around a table, and when they shall have met around the same table we will find some intelligent means of overcoming this trouble. But don't give us a star-chamber means by which the Navy can issue the fiat that there shall be no trouble.

"In time of war the Navy wants the very best; it wants the very highest support, the most cordial support, of every one of us. Are we going to give that support by saying 'Take the whole radio art, and then slumber over it, because you are too busy with your own affairs to consider this and develop it. This is a mere detail to you; you have thousands of interests to take up your energy, and if you are going to fritter your time away upon this profession, you are no sailors; your profession demands you.'

"Take Captain Bullard. I had the honor of meeting him. Look at him. He was in charge of this naval radio service up to a little while ago. Where is he now? I understand that the Navy Department has called him away, and he has forgotten all about this by now. And by the time he is through serving on his ship, in his line of duty, he will find himself behind in the art. Are you going to put this art in the hands of officers who will be taken from one post to another and have all of their efforts thrown to the winds? You want the highest intelligence, the highest specializing in this work. It takes the best brains we have. We cannot be content with one-quarter of the brain of a man in another profession.

"We want the best the country can produce, and you will have that by leaving the country alone, by having national competition among the radio engineering profession fostered by the aid given it from commercial enterprises and the amateur. After they have developed it in time of peace, then should war come upon us, the Navy could come forward and say, 'Now, because the country is in danger, we want the whole thing.' And when that time comes, we will say, 'Everything we can do is at your command.' We will all doubtless support the Navy in that, and willingly. It is for the Navy's own sake, therefore, that I say, keep the Navy's hands off at the present time, in order that it can get a fuller control when the need comes."

Professor Kennelly called attention to the fact that this country has had war, on the average, every 30 years, and that it cannot be supposed we will never have another war, and we must look forward to having war again because a national habit of this sort can hardly be lost in a few generations.

"When it comes," he said, "we want to see America ready, gentlemen; we want to see the radio art supreme, and not to have it smothered by the restrictive monopoly of such a law. Should we have war, I want to see the naval officer helped; I want to see the Navy helped, not hindered, but assisted, and the best way to help is to keep hands off in time of peace and then give them the whole thing when it needs it, and when it will probably need it in a hurry.

The Commercial Company is Subject to the Call in Time of Need

"Now, let us have all the regulation you want. Let us have regulation to put the whole thing in the control of the President in time of need, so that the whole system can be taken over by the Navy for the protection of the country. In that I say amen. But in time of peace do not suppress everything in sight merely because a few men cannot get messages through with certain apparatus. That would be a crime, a great injustice."

"What would be the effect," asked the chairman, "should the Marconi Company monopolize the wireless? I mean any commercial company, not that company particularly, but any other commercial company?"

"Any commercial company?" repeated Professor Kennelly. "Any commercial company whatever that is a faithful servant of the public and doing its duty to the public and to the United States under the existing laws of the United States is subject to the call of all of its apparatus, operators, and equipment in time of need, is competent to carry out its work. There is far less danger of a single company's monopoly than of a Government monopoly."

The chairman then inquired whether there would not be some danger of the suppression of the development of the art from a monopoly.

"No; not anything like to the same degree," was the reply. "I would like to see several companies at work; I would not like to see all under one company, not even the manufacturing of apparatus all in the hands of one company. But even with one company in undisputed occupation of the field, there would still be an opening for every one to develop the apparatus which would find a purchaser in the open market. There would still be opportunities for everybody, under this Government and under the Constitution of the United States, to carry on reasonable radio communication in the use of the free atmosphere of this world. But to put all of that in the hands of the Government, to give the Government the power to suppress everything, then there will be no hope for any of us; we are all lost."

"You are assuming that the Government would pursue that very stupid policy," commented the chairman. "If I were an officer of the Government," responded Professor Kennelly, "in charge of stations which are competing for commercial service, to make a showing of returns on my books for the money I took in and turned in as cash receipts to the Treasury, I would do all I could to increase the amount of commercial service which I rendered. I would be doing my duty in enhancing that to the very utmost limit without injuring my conscience. And my conscience would probably be deadened if I were an earnest and zealous man, and I should probably trespass upon the rights of my neighbor and say, 'Look here; your rates are not suitable to me; your apparatus is not satisfactory to me; your wavelengths are not satisfactory to me; your decrement is not satisfactory to me. I want you to change this and that, and I want you to do so and so.' And I would hinder him and put all sorts of obstructions in his path. And in a little while, by following that policy, and by reducing my rates, I should own the whole thing.

"Without any further regulation at all for a good while everything needed can be accomplished. It has been the fact in the past and is now the fact that the only people complaining, apparently, are the people who have all the power now, who can take all the possible wavelengths from a meter to a hundred kilometers. The only people who cannot do the same thing are the commercial interests. The Government can use everything. The people who are complaining are the people who are not restricted; and the people who are not complaining are the people who are restricted. Is that fair? All we ask here is fair play, fair dealing, and fair play to the people who have their money in it; fair play to the Government; fair play to the departments; fair play to the amateur—fair play all around. Give us all a fair deal. And I say this bill, manifestly, is unfair."

"In your association you have, you say, about a thousand radio engineers?" asked Mr. Edmonds.

"Yes, sir," was the reply.

"And they are continually investigating and hunting up new methods in this art?" continued the questioner.

"More or less; I do not say all of them, but many of them are."

"And what you want to bring out particularly, I presume," commented Mr. Edmonds, "is that those men who are at present specialists are working ahead on the line which they will probably continue for the balance of their lives?"

"Yes, sir," was Professor Kennelly's response.

"But if this gets into the hands of the Navy, and it should turn out as you state it probably will, those men would, of course, go into other profession?" queried the representative.

Under Government Monopoly Engineers Would Have No Livelihood

"They would have no reasonable expectation of remuneration or livelihood by staying in their present profession," agreed the radio authority.

"Those Navy men are fine men, mind you, and nothing I am saying here is intended to reflect on them. But they are busy with their own affairs and busy with their profession, and busy with thousands of other things. A Navy officer's life is full of businesses and activities. And how can you expect a man with so many calls upon him to spend his time in developing the needs of this young and growing art. If he does, he is neglecting his duty."

"Has England, Germany, or France gone on and developed, independently, aerial stations for the navy?" asked Mr. Rowe.

Germany Aided Individuals Instead of Confiscating

"I understand," was Professor Kennelly's reply, "that all the Governments in Europe have Government apparatus and equipment. But some of them have permitted, and even fostered, individual ownership and individual development. For example, Germany has by its Government, instead of confiscating inventions or seeking to confiscate stations, helped private enterprise with her capital and with her brains and with her administration in order that when the Government wants to secure universal control, in case of war, they may be better off. That is the reverse of the policy that this bill suggests.

"The people in the commercial interests do not seek any legislative restrictions. They are getting along all right. They have no interferences to speak of. They have a little. But the only people who are complaining are the Navy Department, who naturally tend to get behind all the time. You cannot blame them. If we were in the Navy, we would do the same thing. We would have other business to attend to, and we would naturally tend to drop behind in these matters which are only little side issues to them. And it is vital to the whole world and vital to the Navy itself that it shall be kept up to the highest pitch by having as many of the brightest men as possible take it up and develop it; not just a few naval officers, here and there with a few hours to spare, taking it up and thinking about it."

"You are a radio engineer, I understand?" queried Representative Edward W. Saunders, of the committee.

"Yes, sir," was the reply. "Not by profession, but I am a radio engineer in the sense that I have taught radio engineering and have been acquainted with the art since its inception."

"Now, with respect to this art becoming a monopoly in the natural commercial development," continued Mr. Saunders, "is not there less reason for this becoming a monopoly in that way than either the telephone or the telegraph, by reason of the fact that this means of communication here is common to all the world without any expenditure, all the expense involved being in connection with the erection of transmitting and receiving stations?"

"That is right, sir," was the reply. "And if you leave it all alone and do not hamper it, this is far less likely to become a monopoly than any other existing means of communication."

"We hear more in this inquiry about the difficulties they have at sea on the vessels there," commented Mr. Saunders, "and, of course, we all agree it is very essential, so far as possible, that the communication with vessels at sea should be as uninterrupted and as definitely received as possible. Now, do I understand that that difficulty with respect to these vessels grows out of the character of the apparatus that they are using? Are they behind in the art in respect to the appartus they are using?"

The Worst Way to Advance is by Suppressing the Difficulties

"Partly so, sir," was Professor Kennelly's reply; "partly on account of the nature of the conditions. Ships naturally will be the last to benefit by improvements which are made on shore; because they must be standardized and more or less must all have the same kind of apparatus. You cannot be changing them all the time. But the improvements that are made on shore will gradually drift into the ships, so that they also will become in time the beneficiaries and sharers in non-interfering systems. The improvement is first made in the shore stations, and then it drifts into various ship stations and to the amateurs."

Professor Kennelly wound up his testimony by expressing the belief that it was the worst way to advance by suppressing the difficulties that have to be overcome. The commercial man, he said, naturally wishes to get in touch with the very latest thing in the commercial field, so far as he can, without being hampered. As for the inventor, Professor Kennelly held the same views as those expressed before the Committee by Professor Michael I. Pupin, namely, that experience has shown the inventor in the last few years that he has nothing to hope from the Government. The Government will help itself, and his only hope lies in gteting remuneration from a fair-minded commercial world.

AIRCRAFT AND WIRELESS ECONOMIC FACTORS

Wireless and the aircraft promise to be the two factors which will revolutionize the economics and sociology of the present generation, is the opinion of Henry Woodhouse, just as the railroad and the telegraph revolutionized the economics and sociology of the past generation.

The wireless telegraph and telephone and aircraft have opened unlimited possibilities. They promise to bring about the complete annihilation of space and distance, and in their prospective developed stage—which has been approaching in rapid strides—to do internationally what the railroad, the automobile, the telegraph, and the telephone have done within nations, rapidly mixing people and their interests, unifying interests and making the whole world truly a world nation.

Aircraft and wireless are to be the most influential factors in making the Pacific Ocean the world's central basin, succeeding the Atlantic, which became the central basin, succeeding the Mediterranean Sea upon the advent of the steamship. This will be brought about by the advent of aerial transportation and extensive use of wireless, combined with the commercial development of South and Central America, the northwestern part of the United States, Australia, Japan and China. This change is bound to come within ten years, and in the years that will follow the countries of South and Central America and Australia will develop into large nations.

An information bureau, from which weather reports will be sent by wireless to aviators and the vessel commanders of the Naval Coast Defense Reserve, will be organized by E. B. Dunn, the chief forecaster for the Government in New York.

From and For those who help themselves

Experimenters' Experiences.

The editor of this department will give preferential attention to contributions containing full constructional details, in addition to drawings.

FIRST PRIZE, TEN DOLLARS
How to Make a Receiving Tuner of Variable Range

How would you like to have a receiving tuner that would enable you to listen to Arlington or Key West, and then by a twist of a switch would permit you to hear a fellow amateur sending? Furthermore, suppose that you have tired of listening to these stations and wish to go back to the long wave-length stations at will. Would not such a receiving tuner be just the type you are looking for? By following the description and the accompanying drawings, you will be able to construct such a receiving tuner as I have, and one that will permit such things to be done.

The completed instrument is shown in Figure 1 in which is seen the loose coupler (preferably one of the Arlington type B transformers), the audiotron or some other vacuum valve detector, two .0005 microfarad variable condensers, the switch for changing from long to short wave-lengths and the switches for connecting either of the six small short lave loose couplers into the circuit.

Several small loose couplers (in this case there are six) are each wound with the exact amount of wire on them that is needed to receive from various amateur stations within range. The primaries are connected to the upper switch and the secondaries to the lower switch.

It will now be seen that by writing the call letters opposite the switch point any of six amateur stations can be listened to by simply shifting the double blade switch, obviating the necessity for shifting several switches simultaneously. This should be clear to the reader if he will examine the diagram of connections in Figure 13 where the position of all apparatus in the various circuits is shown.

The switch in the upper right hand corner cuts in and out the "A" and the "B" batteries. Figure 2 shows the hard rubber fibre or Bakelite panel and the positions of the holes to be bored for the switches and switch points. Figures 3, 4, 5, 6, and 7 show in detail the various switches employed and Figure 8 shows the back view. The sides of the top of the cabinet are shown in Figure 9 and 10 respectively. Figure 11 shows the pieces to be used inside to support the small loose couplers. In Figure 12 is shown an interior view with the side removed indicating the positions of the variable condenser and loose couplers, and the rods, which are employed to draw the primary and secondary windings apart, extending through the back of the cabinet.

The primaries of the coupler should

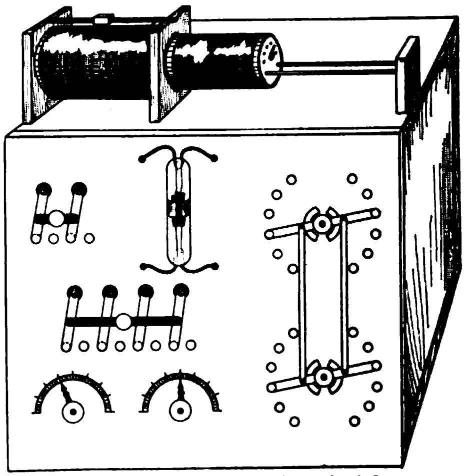
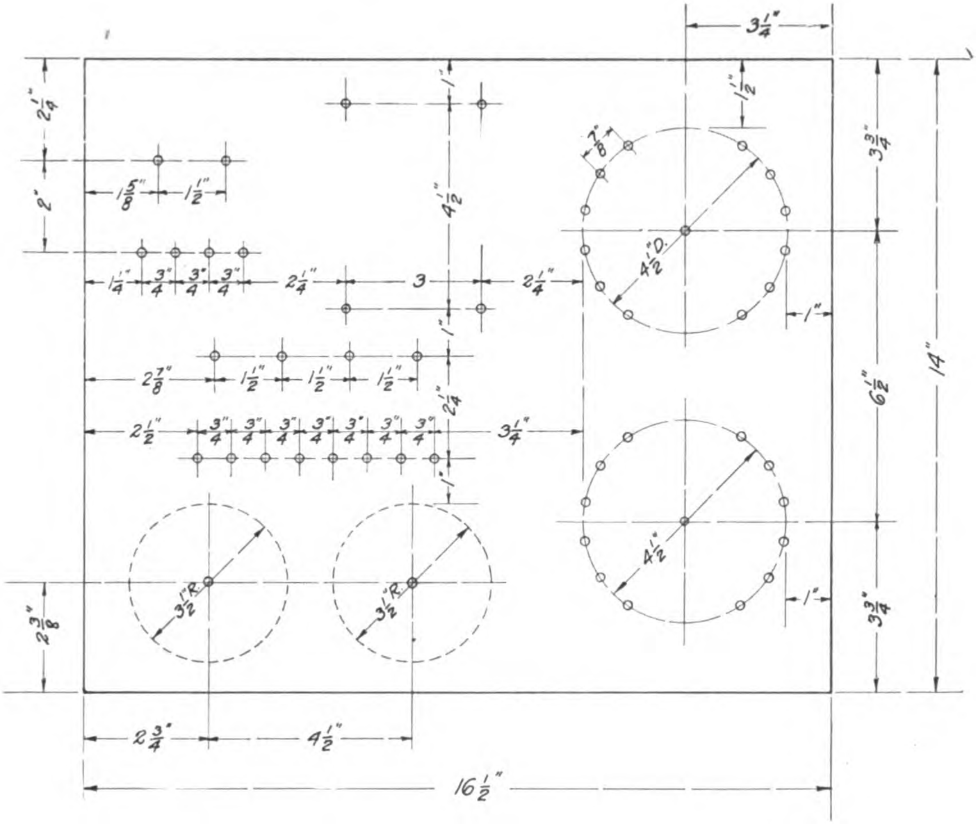


Figure 1, First Prize Article



— *Drilling Plan for Panel* —

Figure 2, First Prize Article

be wound with No. 24 S. S. C. or S. C. C. wire and the secondaries with No. 32 S. S. C. wire, on tubes 3 inches and 2½ inches in diameter respectively. They should be wound approximately to the wave-length of the desired station, which is found by connecting them to an aerial and adjusting the values of inductance until the maximum results are obtained. The leads should then be soldered to the switch points and the coupling varied till better results are obtained. Then, for more accurate adjustment, the variable condensers can be employed.

The builder of this apparatus may make changes according to conditions, but the general outline presented should be duplicated if a tuner is required in which the wave-length adjustment can be quickly shifted. The large loose coupler might, for instance, be placed inside of the box and its inductance values varied by a multi-point switch, or a greater or lesser number of small couplers may be employed on the interior, all of which depends upon the number of stations from which the builder desires to receive.

I have found a set of this type to be entirely practical and there seems to be no particular loss in efficiency in the use of several primary and secondary inductances.

ALBERT UPTON, *Minnesota.*

SECOND PRIZE, FIVE DOLLARS
A Precision Hot-Wire Ammeter That Can be Easily Calibrated

The hot-wire ammeter has in the past been a very much neglected part of the average amateur's transmitting outfit. Unless he possesses the necessary "ready cash" with which to buy a commercial instrument, he must content himself with some home-made makeshift that gives only comparative values of the current flowing in his antenna.

There are a number of fundamental calculations that depend on the exact

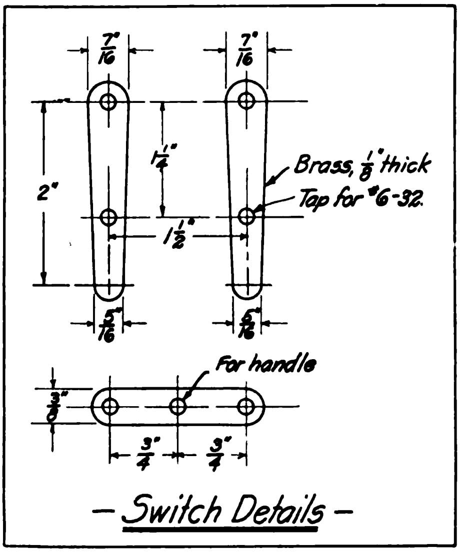


Figure 3, First Prize Article

value of the energy oscillating in the aerial, and a precision ammeter is therefore an essential to the advanced amateur's outfit. Most hot-wire ammeters (especially of the shunted

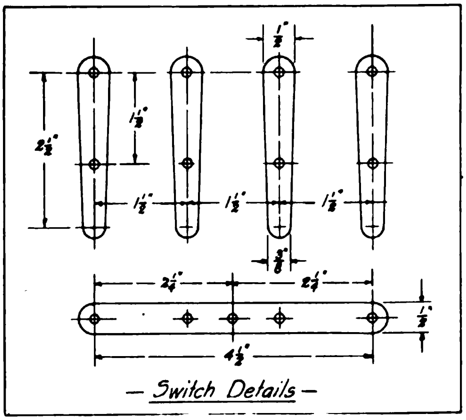


Figure 4, First Prize Article

type) cannot be calibrated on direct current and then be expected to indicate accurately on the very high frequencies employed in radio work unless mathematical corrections for "skin effect" are applied by means of the Kelvin formulae. Therein lies the chief drawback of home-made meters.

It is hoped that the ammeter described in this article will fill a long-felt want in that it can be calibrated on direct current and when connected in the aerial circuit will read as accurately as the highest priced instrument in the market. At the same time it is far more rugged and extremely simple of construction. If intended for use in a university wireless station where, in calibrating the meter, access can be had to a physics laboratory equipped for electrical measurements, it can be made an instrument of the highest precision.

Regarding the principle involved in the meter's operation: The idea is a distinctly new one, first having been

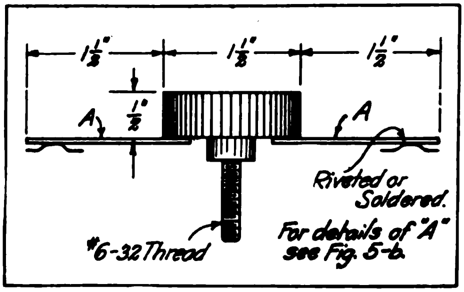
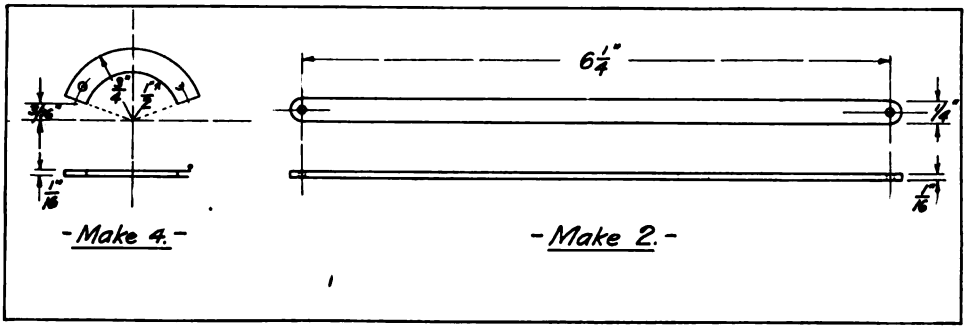


Figure 5, First Prize Article

suggested by Fleming in a foreign publication and afterwards developed further by the Marconi Company and by Charles S. Ballantine of the Radio Research Laboratory in Philadelphia. The ammeter for amateurs described in this article was designed from Mr. Ballantine's data.

All measurements of high frequency current depend on the heat loss developed in a small wire, this heat loss being commonly measured by some more or less crude mechanism which takes advantage of the expansion of the conductor. Now suppose we should solder a thermocouple to the center of this wire. The heat generated in the latter would give rise to a thermal E. M. F. in the couple and this E. M. F. could be measured by a millivoltmeter connected to its terminals. The scale

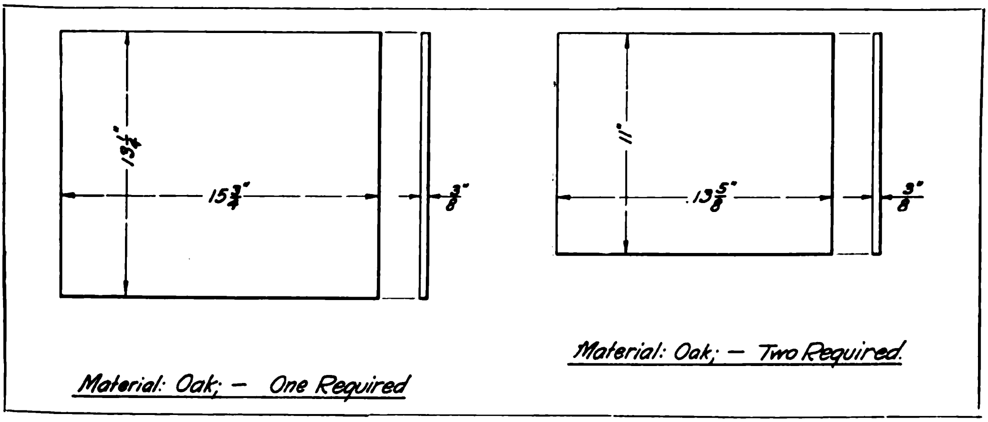


Figures 6 and 7, First Prize Article

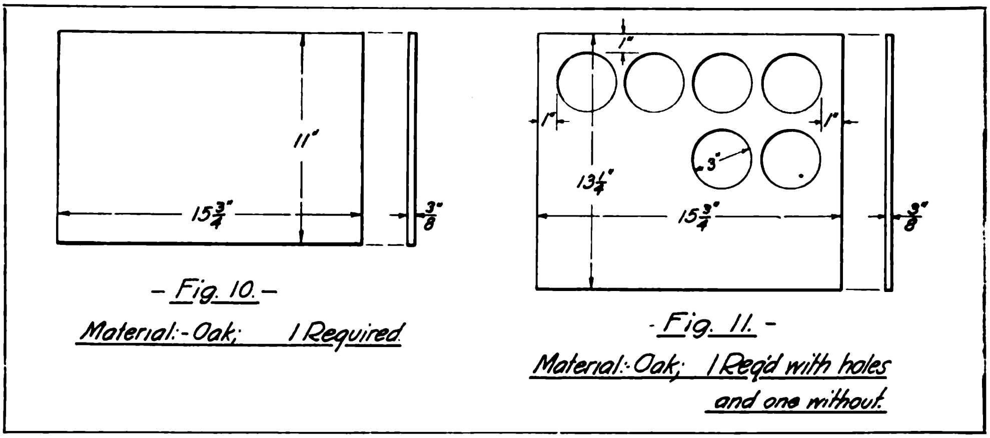
of the voltmeter could then be calibrated in terms of the root-mean-square current oscillating in the hot-wire. Such an instrument would be free from mechanical moving parts in the ammeter itself and the millivoltmeter could be located at any convenient distance from the high voltage leads. (See Figure 1).

But in order that an ammeter intended for wireless service may be calibrated on direct current, it is imperative that the high frequency resistance and D. C. resistance of the heating element be the same. This condition is approached in a wire of size No. 40 B. & S. On the other hand, a wire of this cross section cannot be used on currents in excess of 1.5 amperes, so that in constructing a precision instrument we are compelled to use a number of such wires in parallel. If the thermocouple be attached to one of them, the reading of the instrument will be proportional to a constant fraction of the total current, and this will be the same constant fraction as when used on high frequency. However, several wires in the same plane would lead to error when used in a radio circuit, due to the unequal distribution of the current in the system. If finally we eliminate this error by arranging the wires in the form of a cylinder, we have complete, in theory at least, the design of a precision ammeter.

Constructional details of such an instrument for amateur use follow: The hot-wires are six in number, each being a piece of No. 40 bare copper, 4 inches long. They are arranged in the form of a cylinder by spacing them at equal distances around the circumferences of two small metal discs (Figure 2), which form the terminals of the element. Turn these discs, 1 inch in diameter, from a piece of 1/16-inch brass sheet, and drill their centers for fastening to the posts A and B with



Figures 8 and 9, First Prize Article



Figures 10 and 11, First Prize Article

8/32 machine screws as shown in the perspective sketch of the finished instrument (Figure 3). At intervals of 60 degrees around the peripheries of both discs make small saw cuts with a fine hack-saw.

The terminal posts of ¼-inch square brass stock are drilled and tapped as indicated in Figure 2. The posts having been completed, secure the discs to them with the machine screws and fasten the assembled terminals in position 4¼ inches apart on a 6-inch by 2-inch base of ¼-inch bakelite.

The six No. 40 wires may now be placed in position by soldering their ends into the saw cuts in the edges of the discs, making certain that all of the wires are taut when the soldering is completed.

Procure a piece of No. 36 soft iron wire, 3 inches long, and another piece of German silver of about the same size for the thermocouple. Twist their ends carefully together for a short distance and solder both to one of the two lower No. 40 wires with a small bead of solder. The two free ends of the wires forming the couple are secured to a pair of binding posts at one side of the base. These posts form the terminals for connection to the millivoltmeter.

The entire element should be enclosed in some sort of metal case, as shown in Figure 3, to afford protection from injury.

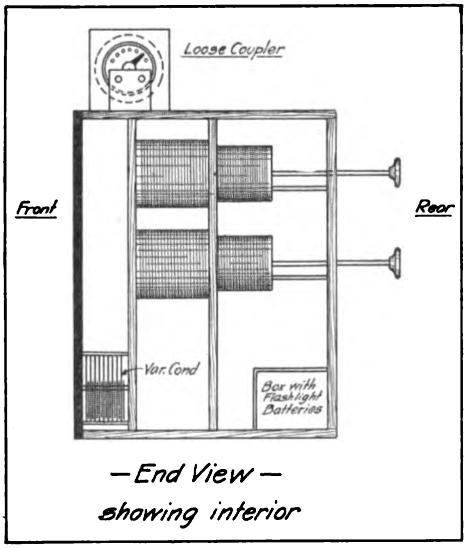


Figure 12, First Prize Article

A few words as to the calibration of the ammeter may not be amiss. The simplest procedure is to connect the element in series with a battery, a rheostat and an accurate ammeter with a scale range of from 0-15 amperes (Figure 4). For various values of current, the ammeter and millivoltmeter are read simultaneously and a curve plotted with the ammeter readings as ordinates and the voltmeter readings as abscissæ. Or, better yet, the voltmeter may be fitted with a new scale and the values of current, as shown by the ammeter, marked directly upon it. It will be found that the calibration is very nearly linear, making the scale quite uniform.

For the benefit of any advanced students who may have access to a well-equipped laboratory and who desire to make a very accurate hot-wire meter, it may be profitable to describe briefly a more refined method of calibration. The ammeter in Figure 4 is replaced by a standard resistance of about .1 ohm and the IR drop across this standard is measured with a Leeds and Northrup type K potentiometer. The reading of the potentiometer divided by .1 then gives the value of the current with great accuracy. This method eliminates the calibration errors of the ammeter used in the first method.

M. K. ZINN, Indiana.

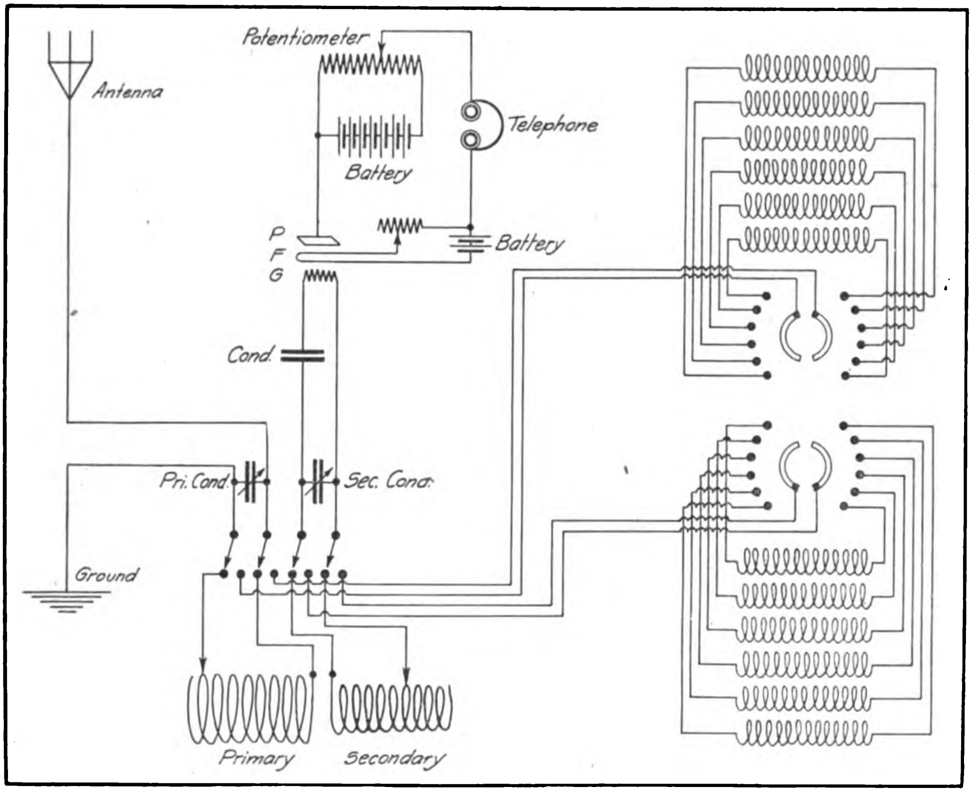


Figure 13, First Prize Article

THIRD PRIZE, THREE DOLLARS
An Arc Generator of High Frequency Current

Now that undamped transmitters are becoming so popular the amateur has no doubt wished to experiment with this type of apparatus, but has not been able to do so because of the difficulties of construction and the high cost of the commercial apparatus. The writer, not being able to purchase the latter, was forced to make use of the best material at hand to construct the apparatus. The purpose of this article is to describe the finished arc generator and to give information regarding how the different problems were solved. The results were gratifying and fully compensated the writer for his trouble.

The accompanying drawing fully illustrates the construction. The arc generator consists of a carbon and a copper electrode (Figure 1) burning in an atmosphere of alcohol vapor, the air tight chamber being formed by a piece of 4-inch pipe to the ends of which are clamped a fibre top and a slate base by means of 6¼-inch brass rods. The top carries the carbon electrode and the starting and regulating device, while the base supports the copper electrode. Asbestos packing in the form of discs is placed where the pipe comes in contact with the fibre top and slate base to assist in maintaining an air tight joint. These details are plainly shown in Figure 2.

The top of the arc chamber is a piece of ¼-inch fibre sheet cut to size, as per drawing, and bored for the six brass clamp rods, and the alcohol tube, one central hole being bored for the carbon rod holder. The base is a piece of slate 1 inch thick and cut to the size, as per drawing. Six holes are bored to correspond with the holes in the fibre top for the clamp rods. These holes must coincide with the ones in the fibre top and be true with them. A hole is bored in the center of the slate base to fit a piece of ¼-inch pipe. Two pairs of legs are attached to the base and the extremities of the legs are screwed to a sub-base, 8 by 10 inches, as per drawing. The asbestos packing discs are cut about ¼ inch greater in diameter than the pipe

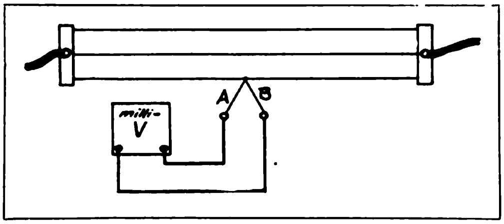


Figure 1, Second Prize Article

The hole in the center of the fibre top is tapped to fit the threads on the valve stem and when the latter is screwed tightly into the top, a good joint will result. Since the brass rod on the valve stem is ⅜ of an inch and the carbon ½ inch, a brass collar must be made, as shown in Figure 2, where a piece of brass rod is drilled on one end for the valve stem rod and at the other end for the carbon rod. Set screws are provided to hold the collar in place.

Some means must be provided to adjust the length of the arc and to start the flame. As shown in Figure 2, the adjusting device consists of an iron bridge, an adjusting screw and a spring. The bridge is bent, as per the drawing, and is clamped to the top by two of the six clamp rods. This is illustrated in

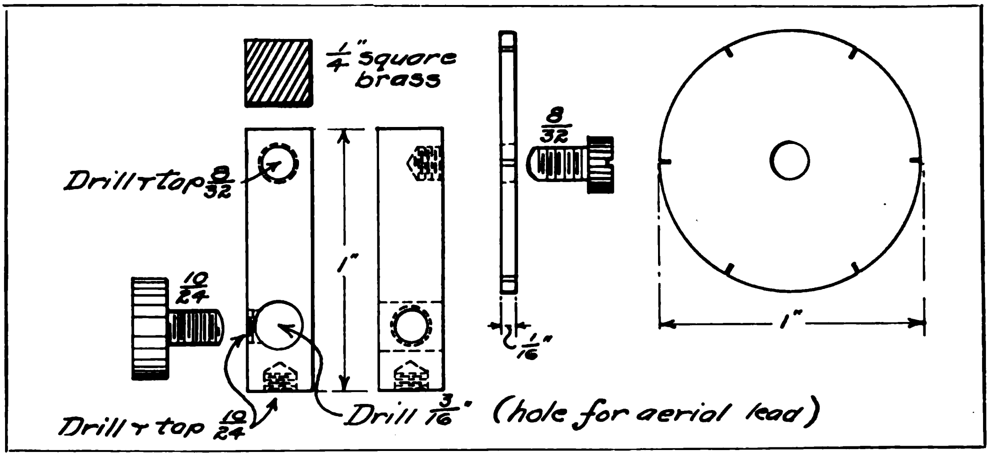


Figure 2, Second Prize Article

so that when clamped between the top and pipe and the base and pipe, the packing will project ⅛ inch over the edge. Use soft asbestos, not the wire laced type, as the latter is too hard.

The parts most difficult to construct are the carbon electrode adjuster and the starting device. The best way to obtain a gas tight joint at the point where the carbon holder passes through the fibre is to procure the packing stem from an old valve and fit it with a longer rod.

the top view (Figure 3). The adjusting screw is a piece of brass rod threaded the entire length and fitted with a fibre handle. The spring is steel or brass. A fibre handle is attached to the end of the brass rod carbon holder to hold the spring in check and to serve as starting handle. This handle slides between the legs of the iron bridge, thus keeping the carbon from turning. A piece of lamp cord which serves to maintain the electric circuit when starting the arc is sol-

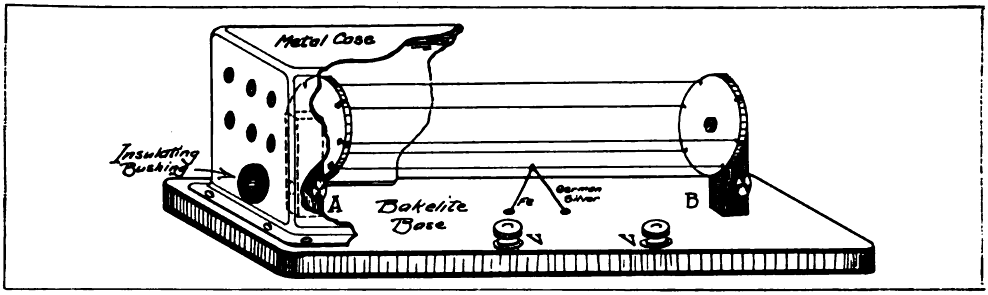


Figure 3, Second Prize Article

dered to the brass carbon holder just under the starting handle and the other end is soldered to either leg of the bridge.

The positive copper electrode is plainly seen in the drawing, but if made from copper it will prove expensive. One of cheaper construction can be made from an old brass lubricator as follows:

Remove all its attachments, leaving only the brass cylinder. The cylinder will have one opening at either end. The top opening is plugged with a copper plug which extends about an inch beyond the cylinder. The lower hole is bushed down to fit a ¼-inch pipe, but all other holes are stopped up with plugs. The ¼-inch pipe from the base of the cylinder passes through the center hole in the slate base and thus, by means of a nut on the pipe, the cylinder is clamped to the base. This pipe also serves as one side of the water circulation through the positive electrode, and to provide an outlet for the water a hole is bored in the bottom of the cylinder and a small pipe or tube fittted therein as shown in the drawing. It should be noticed that the copper electrode rests on the asbestos disc and before clamping the cylinder to the base some shellac should be placed on the packing to make a good joint

The alcohol container is an ordinary adjustable oil sight feed cup, mounted as shown in Figure 2. It is not important where the cup is mounted, provided it is out of the way. A small copper tube leads the alcohol to the arc flame. With the ordinary old cup it will be found impossible to stop the flow of alcohol entirely and as a remedy a small rubber washer may be placed under the needle stem.

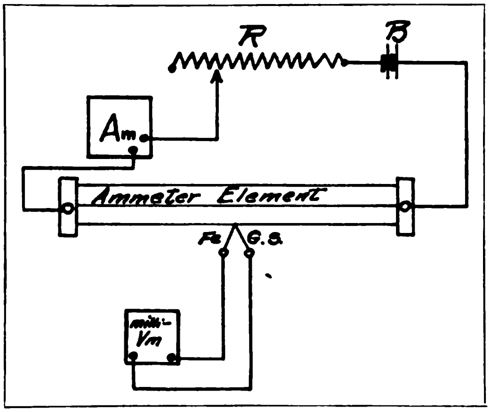


Figure 4, Second Prize Article

A very important attachment is the safety valve seen to the right of the completed arc. When the author first started the arc he was greeted by a loud report. Fortunately he had foreseen this and devised the valve shown. The safety valve is made from an upright brass valve to which is added a bridge arm and an adjusting screw which regulates the tension on the gate, thus determining the popping pressure. The brass arm is soldered to the valve proper.

If a little common sense is exercised in the construction of this apparatus no trouble will be experienced in the assembly. All parts are mounted on the top except the iron bridge. The slate base is attached by means of the legs to the sub-base. Then the 3-inch pipe forming the chamber is put in place so that the brass cylinder is exactly in the center and the asbestos disc projects evenly around the pipe. The top is next put on and the clamp rods are inserted. The bridge is held down by two of the rods and is next put in place after making sure that the starting handle moves up and down easily.

The packing in the valve stem should be just tight enough to allow the carbon

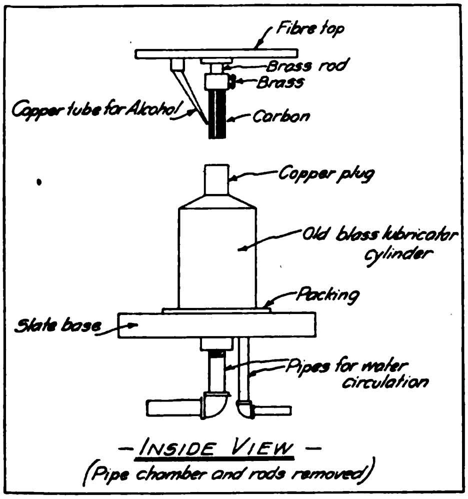


Figure 1, Third Prize Article

holder to be pushed up by the spring. The alcohol is adjusted so that one drop falls every thirty seconds. Connections from the D. C. source are made to the small tube attached to the brass cylinder serving as the positive electrode and from either side of the bridge. The additional apparatus required to complete the set consists of an oil-filled variable condenser, an oscillation transformer, a resistance limiting the current to 6 amperes when operated on 110 volts D. C. Two choke coils are also provided and serve to prevent the high frequency current from backing into the generator.

The arc generator which the author constructed, when used on 110 D C. consumed, 2 amperes and radiated 40 watts of high frequency current which is not so bad, but better results could be obtained if the arc is operated on higher voltages.

The writer would be glad to hear of the results obtained by others with this arc generator.

Louis Falconi, *New York.*

Although our contributor has described in detail the construction of an arc generator, he has neglected to give us the circuit for its operation. Generally such arcs are placed in series with the antenna circuit, but they function best with aerials adjusted for frequencies corresponding to waves of about 2,000 or 3,000 meters, and the use of such a transmitter would not be permitted by the Government authorities except in special cases. Some results will, of course, be obtained from the shorter wave-lengths, but usually the longer waves give the greater efficiency.—Technical Editor.

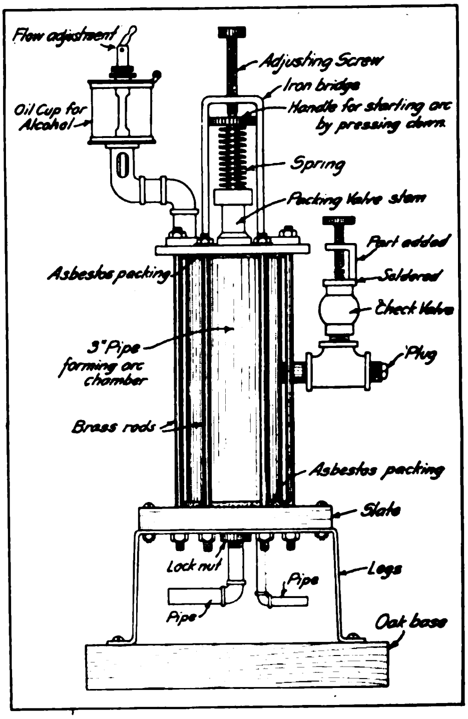


Figure 2, Third Prize Article

FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

A Vacuum Valve Regulator For Amateurs' Use

Amateur experimenters have no doubt frequently observed that the filament of the vacuum valve detector, particularly when used in step-up amplification circuits, requires exceedingly close adjustment. This is particularly true of the tubular type of vacuum valve bulb which requires a filament rheostat of the closest possible adjustment.

A rheostat that we have found to be of great value for the vacuum valve bulb is shown in the accompanying drawing where a drum, D, is wound with a number of turns of No. 26 German silver wire, there being in sliding contact therewith, a contactor, S, which is also

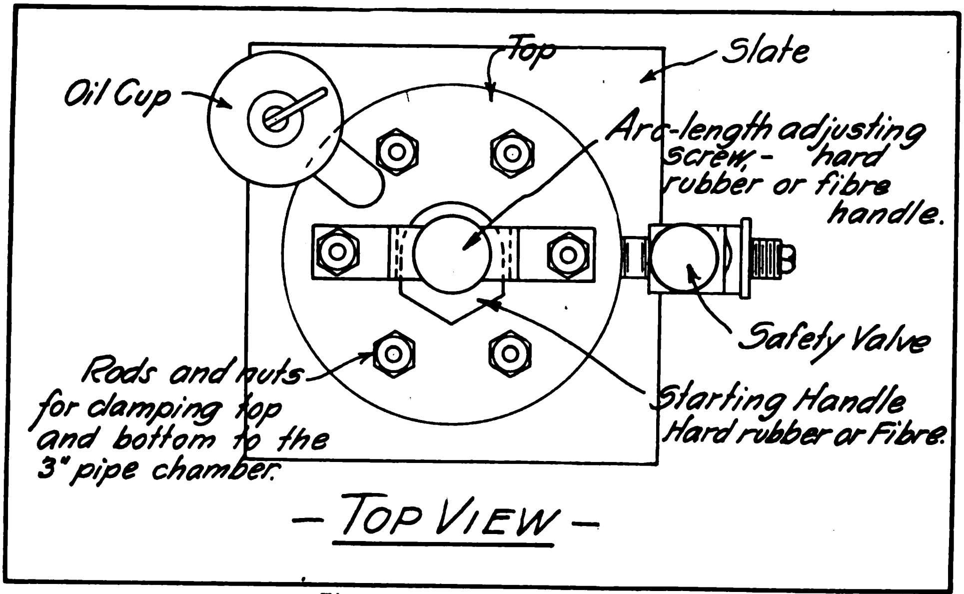


Figure 3, Third Prize Article

mounted on the threaded rod, R. By turning the knob, H, the gear wheel, A, acts upon the intermediate gear, B, and sets C into rotation, the contactor, S, moving from the front to the rear in accordance. One of the connections, that from the binding post, P-1, extends to the rod, R, but the other connection, that from the binding post, P-2, extends to the bearing upon which the rod, W, rests. By careful proportion of all parts, the contactor, S, will move at the proper rate to maintain contact with the wire on the drum at all times and throughout its entire length.

If a step-up vacuum valve amplifier is employed, one of these rheostats should be included in the lighting battery circuit of all valves. We feel that the builder of this rheostat will find it well worth while the labor and expense involved. Further, if it is neatly machined, and mounted on a hard rubber base, with the brass parts all lacquered, a very neat instrument will result.

F. E. FOWLER, F. W. MOORE, *Georgia.*

HONORARY MENTION

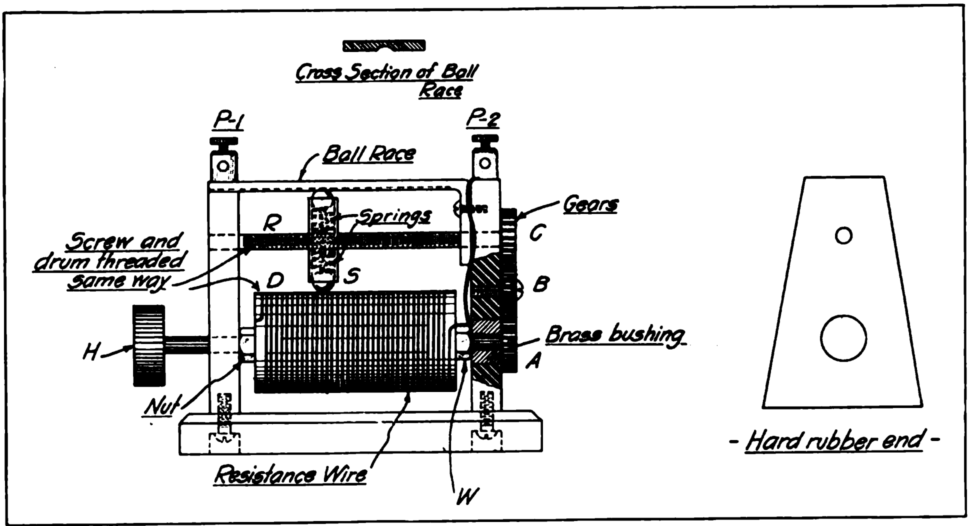
How to Use Burned-Out Moulded Condenser Sections

Not being content with throwing my burned-out sections of moulded condenser away and purchasing new ones to take their place (they cannot be exchanged after they have been burned out), I sought some means of restoring them to their normal condition, thus preventing them from going to the junk pile. I tried numerous heating processes and then discovered this simple mode of rendering them fit for active service.

After taking off the terminals and separating the lugs, I tested the lugs to find the location of the short-circuit (the break-down nearly always results in a short-circuit) which is generally in the middle of the section. The best method is to use a battery and phone.

After ascertaining the punctured plates, I placed the section on the table in an upright poston, and placed the sharp edge of a knfe along the line of one plate (these lines are easily seen along the edge of the section) and dealt it a sharp blow with the hammer. The section split along the punctured plate, which I easily removed.

I then placed the two parts together and after taping them, I replaced the terminals and found the section to be as efficient as a new one with the exception of a slight loss of capacity, which is accounted for by a slight increase in primary inductance of the oscillation transformer.



Drawing, Fourth Prize Article

Thus I overcame the one disadvantage of the moulded condenser, viz., having to discard it when punctured, and purchase new ones. I prefer the moulded condenser because it possesses all the advantages of the glass plate condenser, with the added efficiency of no brush.

JULIAN E. KRONE,
Virginia.

HONORARY MENTION

Results Obtained With a Regenerative Amplifying Circuit

In reply to E. E. Bucher's query in the December N. A. W. A. Bulletin, concerning regenerative vacuum valve receiving sets, I should like to report as follows:

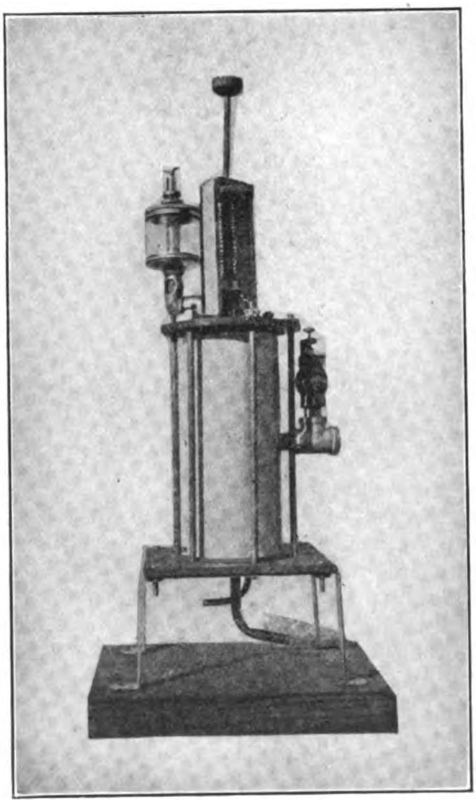
While my station was not in operation on the night of the big relay test, I have been getting some very satisfactory results, since then, with the hook-up supplied in the N. A. W. A. Bulletin.

For example: On the night of January 29th from half past eight until 11 o'clock (central standard time), I heard signals from amateur stations in sixteen different states, exclusive of my home state. These stations were distributed among all the districts excepting the sixth and the seventh.

A partial list of those heard on this one night, will be found on the following page.

Some of the nearer ones were read with the phones three or four feet away, while nearly all could, at least, be read with the phones pulled several inches from the ears.

It might be of interest to know that the aerial used was of the inverted L type,



The Assembly (Third Prize Article)

Call Letters	Location	Approximate Distance
5ZC	Dallas, Tex.	1100 miles
5AX	Shreveport, La.	1000 miles
5BV	Little Rock, Ark.	800 miles
9AI	Adams, Neb.	800 miles
9OC	Somerset, Ky.	450 miles
9GO	Duluth, Minn.	550 miles
9QK	Beaudette, Minn.	750 miles
9AMI	Montivello, Iowa	600 miles
9AGO	Davenport, Iowa	500 miles
9ALR	Waterloo, Iowa	500 miles
4AA	Athens, Ga.	650 miles
1ZM	Hartford, Conn.	500 miles
2AR	Poughkeepsie, N. Y.	450 miles
9MK, 9WO, and 9GV	Illinois	
9PI, 9OK and 9VM	Indiana	
8JL	Crafton, Pa.	350 miles
9XM	Madison, Wis.	700 miles
3NB	Vineland, N. J.	450 miles
8LJ, 8NH and numerous others in Ohio.		

consisting of six wires on 10 foot spreaders, 70 feet long and only 45 feet high at one end and 20 feet high at lead-in end. In addition the aerial had considerable sag, about half of it being not more than 20 or 25 feet from the ground. The station is in the basement. All of the instruments, with the exception of the phones and variable condenser, were home made.

I certainly believe it worth any amateur's time to experiment with regenerative amplifying circuits as they are simpler than a two-step amplifier and give very marked results.

F. J. SCUPHOLM, *Michigan*.

Twenty-seven St. Paul (Minn.) boys met at the Y. M. C. A. in that city recently and formed a radio club. The following officers were elected: President, Robert Hall; vice-president, Marlow Bergstrom; secretary-treasurer, Leon Fink.

CLOSE 800 STATIONS IN NEW YORK

More than 800 wireless plants have been dismantled by the police of New York City, who have been instructed to destroy all privately owned plants and to allow no station to operate except those controlled by the government, the military authorities and the police.

Rear Admiral Nathaniel R. Usher, commandant of the New York Navy Yard, has announced that he requested the co-operation of the Governors of New York, New Jersey, Connecticut and Vermont, as well as the Mayors of New York City, Newark, Jersey City and New Haven, in closing all private radio plants in the Third Naval District. This action, he said, was in accordance with the Executive order issued in Washington, April 6, directing that the radio plants not operated by the government or by its permission must be closed "to insure the proper conduct of the war against the Imperial German government and the successful termination thereof."

No distinction was made between outfits. All were dismantled, that of the schoolboy and the scientific man alike, and in each case the name, address and nationality of the owner of the plant were noted and will be forwarded to Washington.

With The Amateurs

In response to the call for men interested in wireless telegraphy and signal corps work, fifty-two men, representing the faculty as well as the undergraduates of Dartmouth College, met in Hanover, N. H., recently and organized the Dartmouth Radio Association. A constitution was adopted and the following officers were elected: President, R. S. Hayes, '19; secretary, J. R. Byers, '18; treasurer, K. W. Spalding, '20.

The Association aims to create interest in wireless and signal corps work, to train men in both branches, and to carry on wireless communication with the radio clubs of other colleges.

The members are divided into three classes: including respectively (A) men holding first grade commercial or amateur licenses; (B) men holding second grade amateur and cargo grade licenses, or who have had experience but have no licenses; and (C) beginners. Henceforth candidates for membership must present their names to an officer or member of the Association. The names must then be accepted by a two-thirds vote to elect the new member. It was decided that twenty-five cents should be collected from each member to cover expenses for the remainder of the year.

A call for fifty amateur wireless telegraph operators from Omaha, Neb., has been issued by Lieutenant W. W. Waddell, officer in charge of the Omaha naval recruiting station, as members of the Naval Reserve Corps. They will be used largely as censors of wireless messages, Lieutenant Waddell said.

Announcement has been made that Vassar College is in a state of "practical mobilization," wireless telegraphy being among the activities to which the students are devoting themselves as measures of preparedness.

A woman's class in wireless has been formed in Philadelphia by Miss Eleanor Bonsall. The members of the class are studying the art with the aim of utilizing their knowledge, if necessary, in war.

A published report is to the effect that atop a hotel, described as the tallest in the world, to be erected in Atlantic City, N. J., will be installed a wireless station for use by the Government.

C. W. Waggoner, an instructor at the University of West Virginia, lectured on "Wireless Telegraphy" under the auspices of the Coke Center Radio Club in Connellsville, Pa., on March 23d.

An informal discussion of the fundamental theories of wireless telegraphy took place at a recent meeting of the Radio Club of Union College in Schenectady, N. Y.

Twenty-five women and girls are planning to organize an auxiliary of the Connecticut Valley Radio Club of Springfield, Mass. A number of the prospective members of the auxiliary are students in Smith College.

The Peekskill (N. Y.) wireless amateurs have organized under the name of the Peekskill Radio Club. The officers are: President, John W. Dain; vice-president, Ernest W. Hawkins; secretary-treasurer, George I. Olson. The charter members of the club are John W. Dain, Ernest W. Hawkins, Clinton S. Ferris, Lester M. McCoy, William E. Murray, Donald S. Ferris, Arthur Mansfield, Harold Vogt, Charles R. Doty and Gilbert F. Oakley.

The North High Wireless Club, of Des Moines, Ia., has elected the following officers: President, Gerald Becker; vice-president, Malcolm Eaton; secretary, French Holbrook.

A wireless club has been formed at the Danbury (Conn.), High School, under the direction of Walter F. Burt. The following officers have been elected: President, Albert Verbyle; vice-president, Leslie Davis; secretary, Edward Van Hoesen; treasurer, Walter F. Burt.

Amateurs at West Grove, N. J., have organized the West Grove Radio Club. The names of the officers follow: President and treasurer, J. Robert Shafto; vice-president, Howard W. Jamison; secretary, William Yarrington, 113 Corlies avenue, West Grove. Meetings will be held the first and third Mondays of each month. Correspondence with other wireless clubs is invited.

Interest in wireless has grown to such an extent in Charlotte, N. C., that the Charlotte Radio Club has been organized. The officers are: President, Edwin Mathews; vice-president, Lowry Pressly; secretary and treasurer, Turner Finger, of 176 East Eighth street. Persons interested in the Club can obtain additional information by writing to the secretary. The Club expects to apply for a National Amateur Wireless Association charter.

Haddonfield, N. J., amateurs have formed a wireless club. Its headquarters are at 218 Park avenue.

The Utica (N. Y.) Radio Club has initiated a campaign to obtain $500 with which to obtain equipment.

Students of the University of Rochester, Rochester, N. Y., are planning to install a wireless set at the University.

A wireless club has been formed at the Lynn (Mass.) Classical High School. The following officers have been elected: President, Albert W. Quinn; vice-president, John O'Hara; secretary, Julian T. Webber. Albert W. Quinn, John O'Hara and Everett Philbrook have been named as members of a Committee on By-Laws and Rules.

The Onondaga Radio Association was formed recently in Syracuse, N. Y., at a meeting held at the home of Arthur Hinzpeter. The following officers were elected: President, Waldemar Vanselow; vice-president, Sydney MacKean; secretary, Arthur Hinzpeter; treasurer, James Newbold. All wireless amateurs in Onondaga County are invited to join the Association. Address communications to Arthur Hinzpeter, secretary, 234 Palmer avenue, Syracuse, N. Y.

The regular meeting of the Radio Traffic Association was held at its home, 486 Decatur street, Brooklyn, N. Y., on March 16th. The names of the officers of the Association follow: Chairman, Ferdinand C. W. Thiede; secretary, Albert R. Heyden; financial secretary, E. K. Seyd; treasurer, Clifford J. Goette.

The Radio Club of the Scott High School, at Toledo, Ohio, has thirty members. The officers are: President, Willis K. Wing; vice-president, Gardner Leach; secretary, Sewall Wright; treasurer, Carlton Mathis. Communications from other clubs are invited.

The Boy Scouts' Wireless Club has been formed in Memphis, Tenn. The officers are: President, Charles Wailes, Jr., of Troop No. 1-A; vice-president, J. G. Noshey, of Troop 3; secretary, James Sutton, of Troop 5; treasurer, Frank W. Ward, Jr., of Troop 21. C. A. De La Hunt will be in charge of the instruction.

The Bellevue Radio Chain, of Harrisburg, Pa., celebrated its third anniversary with a banquet held at the club's rooms at Rodgers avenue and Lincoln Highway. Charles A. Wray acted as toastmaster and the speakers included Charles C. C. Ragsdale, A. A. Rossmann, Samuel Thayer and W. V. Protzman. Mr. Rossmann described an instrument he has invented for amplifying signals. Mr. Rossman and Mr. Ragsdale were guests of honor. The officers of the club are: President, Charles A. Wray; secretary, G. Styber; treasurer, W. H. Hoobler.

A Medal of Honor to be Awarded by the Institute of Radio Engineers

THE Board of Direction of the Institute of Radio Engineers has decided to award annually a "Medal of Honor" to such persons who have distinguished themselves by unusual advances in the fields of radio telegraphy and telephony. It has been felt that some way should be found whereby valuable work in these fields of great and rapidly growing importance might properly be recognized by an authoritative engineering society. As is well known, the Institute of Radio Engineers, with more than 1,000 members here and abroad, and with sections in New York, Washington, Boston, Seattle, San Francisco (with others in contemplation), is the leading technical and scientific society in the wireless field. It is therefore recognized that a "Medal of Honor" from the institute will be a goal worthy of attainment by any investigator.

The appearance of the medal is shown in accompanying illustrations. The front is a symbolic representation of electromagnetic waves, indicating the interlinking of the magnetic and electric forces in their rapid path through the depths of space. The reverse side bears the inscription:

"To ...., in Recognition of Distinguished Service in Radio Communication" (followed by the date), the inscription being surrounded by a laurel wreath.

The medal is the work of the well known sculptor, Edward Sanford, Jr., of New York.

Medal of Honor to be awarded by the Institute of Radio Engineers

Inscription on the reverse side of the medal

The award will be made yearly at the April meeting of the institute to the person who, during the two preceding calendar years, shall have made public the greatest advance in the art of radio communication. The advance may be a patented or unpatented invention, but it must be completely and adequately described in a scientific or engineering publication of recognized standing and must be in actual, though not necessarily commercial, operation. However, preference is to be given to widely used and widely useful inventions. The advance may also consist in a scientific analysis or explanation of hitherto unexplained phenomena of distinct importance to the radio art, although the application may not be immediate. Preference will be given to analyses directly applicable in the art. In this case also publication must be full and in approved form.

The advance, furthermore, may consist in a new system of traffic regulation or control, a new system of administration of radio companies or the radio service of steamship, railroad or other companies, a legislative programme beneficial to the radio art, or any portion of the operating or regulating features of wireless. It must be described publicly in clear and approved form and must, in general, be actually adopted in practice. In all cases marked preference is to be given to advances made in the preceding year.

The medal is to be awarded under the following conditions:

At least thirty days before the April meeting the Board of Direction will call from a number of members and fellows of the institute, whom it may choose to consult, for suggested candidates. This provision will be waived wholly or in part for 1917 only.

In deciding upon the award the board at its April meeting, through those actually present or voting by mail, will nominate at least one, but not more than three candidates, in order of preference for the award. The names of these candidates will then be sent to each member of the board, who will have the privilege of returning a vote for one candidate. Four weeks after the April meeting the ballot will be read, and the candidate receiving the most votes will become the recipient of the award.

The official presentation of the medal to the successful candidate or his representative will occur at the May or June meeting.

COLUMBIA'S DEFENSE PREPARATIONS

Columbia University is preparing students to serve Uncle Sam by means of a regular course that will equip them in the art of wireless signalling operation of gasoline engines, piloting and seamanship and thus make them efficient as instructors in, or as members of the coast defence patrol. The class now contains 130 students.

Dr. George A. Sofer, of 391 West End Avenue, New York City, a graduate of Columbia, mapped out the course for the proposed school and agreed to take charge of it. The first thing he did was to turn over his seventy-foot gasoline boat for the use of the students in cruising about the Hudson River.

The school is divided into three groups. The first group is made up of those who are perfecting themselves in wireless signalling. It is composed of six Columbia men, all in the engineering department of the University, and all licensed wireless operators and signal men. They have had sea experience, having spent their vacations on ships. Professor Michael I. Pupin is the instructor.

The second group is made up of students which will become proficient in the operation of gas engines. The third group will devote its activities to piloting and seamanship.

The students are not to enroll in the navy, but are to prepare themselves to enroll at the end of their course of instruction as skilled men. Their course in the University will not interfere with their work in any way, and they are to devote most of their time to this instruction, which, it is agreed, is most necessary in view of the present situation.

Instruction in general signalling will take place in the open. Lectures, laboratory work and other instruction will be given in the University and a period of time will be spent on boats.

Just now the school has two boats at its command, Dr. Sofer's seventy footer and a deep sea fishing boat that has been chartered for the use of the students. Contributions are being made to a fund for the purchase of a fifty-four foot boat that will go thirty miles an hour. One of the students has contributed a hydroplane for the school.

Thousands of dollars will be required for the purchase of necessary equipment, and Dr. Sofer and others who are interested in the project hope that many patriotic Americans will lend their motor boats and yachts to the work that Columbia and her students are carrying on to help insure the safety of the country.

War Incidents

TO the list of wireless heroes that is daily growing as a result of the European war have been added the names of Marconi Operators Donnes and Taylor, of the steamship Laconia, which was torpedoed and sunk by a German submarine off the Irish coast on the night of February 25th, causing a loss of thirteen lives. Newspaper correspondents have called Donnes and Taylor the heroes of the disaster.

They were the last two survivors to leave the vessel, remaining by the apparatus to send out S O S calls until a British warship responded. They were picked up by lifeboats, little the worse for their experience.

More than ordinary interest is contained in perusal of the log books of wireless operators in days of warfare. The entries on the wireless log of the steamship Philadelphia during her voyage from New York to Liverpool and return well exemplify this statement. The Philadelphia left New York for Liverpool on January 27th and returned on February 22d. On February 3rd, just before eleven o'clock in the morning, the following entry was made:

"MBF (s.s. Saturnia, Donaldson Line) sends S O S many times and also this: Position 50.51 north, 12.20 west, S O S, torpedo just fired, chased, steering northeast by east."

"GCK (Crookhaven), answers him," runs an entry made two minutes afterward, "and then calls ZAAW (patrol boat) and sends particulars. I report to bridge."

"11.03 A. M.—MBF says: Still steering northeast by east, submarine on surface, chased."

"11.26 A. M.—MBF says: Course now northeast by north. Still chased and shelled.

"11.37 A. M.—MBF says: Submarine right astern now.

"11.44 A. M.—MBF says: We are steering northeast by north, position 51 north 12.13 west; have now lost sight of submarine.

"11.47 A. M.—MBF says: Submarine last seen 11.38 A. M."

Three ships were reported as being in distress on February 4th. The log book entries follow:

"9.10 A. M.—GLD (Lands End) says: S O S s.s. Floridian 8.55 A. M. 4th, position 50.42 north, 10.39 west, being fired on by submarine. (Newspaper reports are to the effect that the Floridian, of the Leyland Line was sunk on February 4th by a submarine.)

"February 4th, 3.30 P. M.—GLD (Lands End) says: S O S from GAV (s.s. Ghazee) off Galley Head, struck a mine."

Other little stories of the war on the sea are told in the folowing entries:

"February 15th, 8.54 A. M.—Some ship with a 60-cycle spark came in and said S O S and nothing more.

"8.55 A. M.—MLC (s.s. Celtic) gives S O S a few times and says B1.

"8.56 A. M.—MLC gives S O S and says struck mine, stand by for position.

"February 15th, 9.04 A. M.—MLC calls code station and gives position, 53.52 north, 4.38 west.

"9.16 A. M.—GLD (Lands End) sends MLC announcement out.

"9.18 A. M.—MLC says: Think we are sinking forward first.

"1.30 P. M.—GLD says: S O S from ZTN (not listed), fifteen miles northwest Fishguard; has been chased by submarine.

"February 21st, 9.10 A. M.—VCS (Camperdown, Halifax), sends following in message form to VCT (Sable Island): 12.23 GMT (Greenwich mean time) s.s. Sagona sends S O S signals reporting ashore on mud bank near Louisburg, probably to westward. Answer his signals, but take no further action as she is in good communication with VOR (s.s. Kyle), who will go to her assistance if necessary. MMB (s.s. Mackay Bennett) also in vicinity."

To be on a vessel that was twice menaced by submarines was the experience of C. C. Devin, Marconi operator on the steamship Rawson during a voyage from New York to Cherbourg, France and return. The following extracts from the operator's log graphically tell the story:

"October 25th, 5.15 P. M.—We are being chased by a submarine which has just sunk a vessel astern of us. Am standing by my wireless, awaiting orders. Ship rolling badly and making full speed ahead. Submarine following.

"5.45 P. M.—Went to bridge for orders.

"6.00—Broadcasted the following by captain's orders and signed no call: 'Submarine operating north 80, west true 23 miles. Carquets.' Ship's crew now in boats. GLD (Lands End) gives O. K. for submarine announcement.'.

"7.00 P. M.—The Rawson making for the French coast. (The submarine was later reported captured by destroyers which came to the vessel's assistance.)

"October 26th, 8.00 A. M.—Rawson anchored in harbor at Cherbourg, France."

The vessel left Portland, England, for New York, on December 6th, and on the following day Devins made this entry:

"The captain informs me that we were attacked at 5.30 A. M., while I was asleep by a submarine and hit by gunfire. Decides not to send messages as yet."

Evidently the attack of the undersea craft availed little, for Devin does not mention her farther. He made the following entry on the night of December 12th at fifteen minutes to ten o'clock:

"Hear some mysterious spark making V'S and signing no call. Spark sounds as if fixed roughly. Think it is German raider that is reported out in Atlantic. Sound rather near. Report to captain."

The Rawson arrived safely in New York Harbor on February 20th.

The American tanker Healdton was torpedoed by a German submarine and sunk off the coast of Holland on March 22. Among the survivors was the Marconi operator, Howard H. Parker, nineteen years old, a native of Philadelphia.

The Booth Liner Crispin was torpedoed by a U-boat on the evening of March 29 off the English coast. The vessel carried a gun and was equipped with Marconi apparatus. The wireless was wrecked by the explosion, and the Crispin afterward sank.

When the American freighter, City of Memphis was sunk by a torpedo from a German U-boat on March 17, there were two Marconi operators in charge of her wireless apparatus, J. Welch and P. J. Donahue. Both were rescued and landed at Queenstown.

A Petrograd correspondent says that a secret wireless station at Tsarskoe-Selo, which is suspected of having furnished communication in the past between pro-German Russian ministers and Berlin, has been discovered. Evidence which the new government agents have collected showed, it was said, this station was established by former Minister of the Interior Protopopoff, without the czar's knowledge.

SELECTED FROM MANY

I take this opportunity to say that the National Amateur Wireless Association is a wonderful organization, doing wonderful things. The Monthly Service Bulletin is full of interesting features and THE WIRELESS AGE is the only wireless magazine.

GEORGE E. BEECHER, JR., *Massachusetts.*

I received my charter member's equipment of the National Amateur Wireless Association, in good order and I wish to say that I am much pleased. The book "How to Conduct a Radio Club" is certainly a "hummer."

G. E. MORBUSCH, *New York.*

THE WIRELESS AGE is by far the best magazine I have ever read. I have seen comparisons made between the WIRELESS AGE and other magazines, but it seems to me that THE WIRELESSS AGE is so far superior to all other wireless magazines that no comparison can really be drawn.

OLIVER M. BLACK, *Massachusetts.*

Amateurs in the Navy

Real Recognition Given to their Value in the Reserve

By M. B. West (8 AEZ)

Member National Amateur Wireless Association, Radio Gunner, U.S.N.R.F.

THE nation is at war! The amateur has at last an opportunity to be of real service to the Government, and in a way that will not interfere with his career in civil life. The argument that the amateur would be of inestimable benefit in time of war has so often been made that it has at last been recognized.

It is clear to anyone that gives it a moment's thought, that without at least some preliminary training, most amateurs would fail miserably if suddenly placed in charge of a large radio station. It is with the intention to remedy this situation, that the Class 4, Naval Reserve, has been created.

As far as possible, it is hoped that amateurs enrolling in the reserve will at once ask for a short period of active duty so as to become familiar with the requirements of the radio work of the Navy. Then they will return home, and it is hoped will join one of the Drill Routes that have been organized in connection with the naval stations. The purpose of these drill routes is to perfect these amateurs in handling radio business according to the rules of the Navy.

And think what a difference it would make in amateur working conditions if all amateur business were handled in an orderly and efficient manner!

These drill routes will be placed under the direction of an officer of the Naval Reserves, and every effort will be made by them to assist amateurs in solving the many puzzling problems that arise in connection with their stations.

It is not necessary to enroll in the reserves, to join in the drill, but it is earnestly hoped that all will do so. So far this feature has been worked out more completely in the Middle West in connection with NAJ, the naval station at Great Lakes, Illinois.

Class 4, Naval Reserves, is a very liberal organization, and creates an opportunity that seems especially adapted to amateur needs. To enroll, you must be an American citizen, be able to send and receive at the rate of ten words per minute, and be able to pass the usual physical examination. On enrollment, members receive a yearly retainer fee of $12.00, until such time as they have perfected themselves sufficiently to be able to handle their work in a manner on a par with regular Naval practice. After such time they will receive an annual retainer pay equal to two months' pay of their corresponding grade in the regular Navy. In addition they receive travelling expenses to and from place of training, uniforms, meals and lodging and the regular pay from the time they leave their homes until they return to them. This is all clear money, and should be particularly attractive to students and others.

One feature that is especially liberal is that a member of the reserves, at his own request, will be discharged at any time during peace. Active service is not then compulsory, and orders to active duty are issued only at the request of members themselves, and will be arranged so as to interfere as little as possible with their regular business. The only time the reserves can be called for active duty is in time of war, when it is intended to use them at the less important land stations so as to relieve the regular officers and men for their active war duties. Information in detail can be secured from the nearest Naval Recruiting Officer, who will be glad to give any information required.

This is the first appeal to the amateur; if we are to live up to the reputation that has been made for us, we should respond gladly and willingly.:

At a meeting of the amateurs of Brockton, Mass., and vicinity held recently, Radio Inspector Gawler delivered an address. Inspector Gawler, who is enrolling recruits in the Naval Coast Defense Reserve, pointed out the need of radio men and urged the older members of his audience to offer their services.

The Annual Report of the American Marconi Company

THE annual report of the Marconi Wireless Telegraph Company of America for the year ended December 31st, which was made public on March 26th, says that after setting aside all reserves the net profits showed as increase of 46.56 per cent. over those of 1915. Included in the report is an account of the hearing on the radio ownership bill before the Congressional Committee on Merchant Marine and Fisheries during January, 1917, reprinted from THE WIRELESS AGE. The Hon. John W. Griggs, president of the Company, who signed the report, directs attention to this account and suggests that each stockholder communicate with his Congressman and Senator opposing the enactment of any legislation tending toward sole ownership by the Government of wireless stations.

The report of operations shows a net income of $336,040 before allowing for reserves, compared with $288,994 in 1915. Receipts for message traffic with ships indicated an increase of nine per cent. over the previous year.

"The income from investment of surplus funds, amounting to $98,107.98," says the report, "decreased $6,824.99 in 1916 in comparison with 1915, due to the fact that $8,961.48 interest was received on stock subscriptions during 1916, while in 1915 $17,922.96 was obtained. This reduction is explained by the fact that the stock previously subscribed for but not issued was during the year 1916 taken up.

"After setting aside all reserves the net profit for the year amounted to $259,888.80, or an increase of 46.56 per cent. over the profits for the previous year. This amount has been added to the surplus, increasing that account to $801,776.32 at December 31st, 1916, and the reserve set aside at that date against depreciation amounts to $439,716.63 additional."

Referring to the war, the following statement is made:

"The war conditions, preventing the operation of your transatlantic stations at New Brunswick and Belmar, New Jersey, and at Marion and Chatham, Massachusetts, remain unchanged. The British Admiralty still holds, for military purposes, the English plants constructed for exchange of traffic with this country. The continuance of the war has likewise rendered it impossible to inaugurate our direct service with Scandinavia."

The report refers to the successful inauguration of the service between the United States and Japan on November 15th, and says: ". . . . an increasing volume of traffic is being handled, under Government censorship, at a tariff one-third lower than that of the submarine cable. On the Pacific, as on the Atlantic, operations are restricted by war conditions, the Japanese stations being controlled by that Government. For the present, therefore, the new service is limited to traffic between San Francisco, Hawaii and Japan."

The Company's manufacturing activities as a result of the war are epitomized as follows: "Your company continues to manufacture apparatus for use by the United States army and navy, and recently has been awarded contracts for a large number of wireless sets of various types."

Brief reference is made to the suit involving the vacuum valve detector patented by Professor Fleming, in that part of the report devoted to the legal history of the year. "The Marconi patent, sustained by Judge Veeder in 1914," it is related, "is again in litigation with the Atlantic Communication Company and your company awaits an opportunity to examine Mr. Marconi as a witness in its behalf. This same Marconi patent is in litigation on the Pacific Coast, where an effort was made at Seattle to include a modified form of transmitting apparatus as being within the sustained claims, and we are appealing the case to the Circuit Court of Appeals."

That section of the report dealing with legal matters is concluded with the following two paragraphs:

"Under United States statute of June 25, 1910, your company is entitled to make claim for damages due to the appropriation of its patented property by the United States Government. Availing itself of its right, your company began suit in the Court of Claims of the United States in July, 1916, to recover its damages for the infringement of the patents of Lodge, Marconi and Fleming.

"The extent of the rights obtained by rival bidders for Government work under this statute of 1910 has been the subject of litigation. The United States District Court, Southern District of New York, construed the statute to authorize the making and selling by one Simon, a rival, unlicensed bidder for such work, and the Circuit Court of Appeals, Second Circuit, approved the decision. The Marconi Company promptly applied to the Supreme Court of the United States for a writ of certiorari, which was promptly granted, and we have, further, asked that court to advance the case on its calendar."

The action of Edward J. Nally, vice-president and general manager of the Company, in placing its organization, personnel and stations at the disposal of the President of the United States, following the severance of diplomatic relations between this country and Germany, is also related. "The officers of your Company are now in close co-operation with the officers of the various departments of the Government in order to render the best service possible in the event of national emergency," says the report.

Attention was directed to the fact that the Company had arranged to provide insurance for its employees. The details of this plan were related in a previous issue of The Wireless Age.

MARCONI MEETS EMERGENCY

The statement many times made that in emergency the Marconi Wireless Telegraph Company of America would place at Government disposal its facilities, equipment and personnel was acted upon immediately after the declaration of war. Division superintendents were instructed to apply for commissions in the naval reserve and to urge all operators under their jurisdiction to enroll under them. As we go to press numerous instances of prompt response to the call to the colors have already been reported. With the plan in full effect, the navy department will have at its disposal a great force of operators more skilled than any other professionals in the field.

Meanwhile, the manufacturing plant at Aldene, N. J., is being built up to three times its present capacity and a great force of workmen is engaged solely in turning out rush demands for equipment at the rate of forty complete sets a week. These wireless equipments vary from small power "submarine chaser" sets to 5 and 10 kilowatt installations for battleships and shore stations. Prominent officials in Government service have already given recognition to the indispensibility of this highly efficient auxiliary, under which the naval fleets will be radio equipped in record time.

THE SHARE MARKET

New York, April 10.

Bid and asked quotations in Marconi shares today:

American 2⅝-2⅞; Canadian, 1¾-2¼; English, common, 10-13½; English, preferred, 9-12½.

Queries Answered

Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of one reader can be answered in the same issue. To receive attention these rules must be rigidly observed.

Positively no Questions Answered by Mail.

T. B. R., Detroit, Mich., inquires:

Ques.—(1) Although you have no doubt answered queries similar to this many times in previous issues of your magazine, will you state once more what you consider to be the most efficient equipment for an amateur that will comply with the law in every detail, taking into consideration the fact that the apparatus is to be operated from 60 cycle alternating current?

Ans.—(1) Beginning with the power apparatus, we advise the use of a ½ K. W. 60-cycle transformer, the secondary voltage of which is between 15,000 and 20,000 volts. This transformer should be arranged to have a certain amount of magnetic leakage, either by means of a special magnetic leaking gap or by design of the transformer proper. The transmitting key should be capable of withstanding current flow at ten amperes and should be fitted with silver contacts.

Although the oil plate condenser is frequently employed at amateur stations, we advise the use of the four copper plated Leyden jars of the type manufactured by the Marconi Wireless Telegraph Company of America. Four of these connected in parallel will give a capacity of .008 microfarad which is the correct value for use at the wave-length of 200 meters. Smaller capacities, of course, can be used, provided sufficient turns are added at the primary winding of the oscillation transformer. If an oil plate condenser is employed, it should consist of four plates, 14 inches by 14 inches, covered with tinfoil, 12 by 12 inches. These plates should be connected in parallel when the voltage of the tranformer does not exceed 12,000 volts, but for voltages in the neighborhood of 18,000, the series parallel connection will be required. A condenser with the same sized plates and the same capacity would then require sixteen plates in all, eight plates being in each bank and the two banks finally connected in series.

The oscillation transformer for this set may consist of four turns of copper tubing or single braid rubber covered wire, wound on a mandrel about 8 inches in diameter. The secondary winding may have eight or ten turns wound on a form 10 inches in diameter; the two windings should be arranged so that they can be placed in variable inductive relation.

Various sized aerials may be employed for sending at the 200-meter wave, full data for which appears on page 108 of the November, 1916, issue of The Wireless Age. From the curves given on page 109 of that issue, you will readily understand that a T aerial can have much larger dimensions for a given length of radiated wave than an L aerial.

The rotary spark gap for small sets should consist of a disc 8 or 10 inches in diameter, fitted with eight spark electrodes and should be revolved at various speeds, from 2,400 to 3,000 revolutions per minute. This gap can be mounted on the shaft of the motor or can be mounted on separate shaft and bearings and driven by a belt.

Ques.—(2) What are the operating characteristics of the closed core transformer as compared with the open core transformer?

Ans.—(2) Their operating characteristics are similar, provided they are properly designed. Certain step-up voltage transformers will draw abnormal primary current when connected to a condenser and spark gap, and consequently, unless a primary reactance is connected in series with the primary winding the transformer windings will burn out. Many amateurs find it much more convenient to construct the open core transformer, but either type will do the work.

Ques.—(3) I understand that the arc transmitters employed in the United States Navy operate at wave-lengths between 3,000 and 4,000 meters. How are these wave-lengths obtained with ordinary aerials?

Ans.—(3) The largest possible aerial is erected in the space at hand and the radiated wave boosted to 3,000 meters by means of large loading coils.

Ques.—(4) Can I receive the signals from arc transmitters on an ordinary crystal rectifier?

Ans.—(4) If your receiving station is located within twenty or thirty miles of such transmitters, the signals can be received, due to slight damping of the wave train caused by inequalities of the arc gap resistance.

A. B. L., St. Louis, Mo., inquires:

Ques.—(1) I am a beginner in the amateur field and do not understand how to adjust a crystal rectifier to full sensitiveness. Will you kindly explain how this can be accomplished?

Ans.—(1) The most sensitive adjustment of the ordinary crystal detector is found by experiment when receiving from a distant station or by means of a test buzzer. Generally some part of the circuit of an active vibrating buzzer is placed in inductive relation to the receiving detector circuit. For example: The circuit from a battery and buzzer can be completed through one or two turns of the primary winding of the receiving transformer, and when the buzzer is in operation a potential difference will be set up across the primary turns which will charge the antenna and cause it to discharge at a natural frequency of vibration. Then, when the primary and secondary windings of the tuner are in resonance and the receiving detector is adjusted to maximum signals, the best operating adjustment is secured. Trying different spots on the crystal will aid in obtaining the best results, the adjustment that gives the loudest signals being held.

Ques.—(2) Do you advise the construction of two receiving tuners at any amateur station, one for short wave-lengths and the other for long wave lengths?

Ans.—(2) For amateur working, we advise that two distinct receiving sets be constructed, one for the reception of spark signals up to 3,000 meters and the other for the reception of undamped waves up to 10,000 meters. Such apparatus is fully described in the book "How to Conduct a Radio Club."

Ques.—(3) How can I canculate the wavelength of an aerial previous to its erection and without the use of a wavemeter?

Ans.—(3) A complete answer to this question appears in the December, 1914, and January, 1915, issues of The Wireless World. In an article by Professor G. W. Howe, a method for calculating the capacity and inductance of various forms of aerials was presented. The average experimenter generally finds these calculations beyond his understanding and consequently various empirical formulae are employed.

A full set of curves calculated from the formulae contained in Professor Howe's article appears on pages 108, 109, 110 and 111 of the November, 1916, issue of The Wireless Age. These show the natural wave-lengths of aerials from 30 to 120 feet in length and from 30 to 100 feet in height, and cover the requirements of the average amateur station. In such calculations it must always be taken into consideration that when the secondary winding of the transmitter oscillation transformer is connected in series with the antenna, the length of the radiated wave will be increased somewhat, depending upon the amount of inductance inserted at the base. In the curve of page 100 in the November, 1916, issue, the natural wave-length of the aerials is given with 10,000 centimeters of inductance in series at the base. This inductance can conveniently represent the secondary winding of an oscillation transformer.

* * *

D. B. A., Chicago, Ill., inquires:

Ques.—(1) Is the amateur in all localities required to operate his transmitting station at the wave-length of 200 meters?

Ans.—(1) Special licenses are granted occasionally for waves in excess of 200 meters if the station is found after investigation to be of use to the United States in the event of war or other emergency; or if the amateur is well versed in the art and will use his station for experimental determinations, a license may be granted for the use of any wavelength provided the Government authorities are assured that the operation of commercial or naval stations will not be interfered with.

Requiring the amateur to work his station at the wave-length of 200 meters, works no hardship, because many are enabled with small size transmitters to work up to distances of 1,000 miles during the favorable months of the year. Amateurs in the eastern part of the United States frequently communciate with others in the Mississippi Valley district.

Ques.—(2) How can one be positively assured that the radiated wave does not exceed 200 meters?

Ans.—(2) The safest precaution is to purchase or construct a wave-meter and actually measure the length of the radiated wave. In the book "How to Conduct a Radio Club" an amateur's wave-meter, which can be constructed by any experimenter, is described, and the dimensions of an inductance coil which will give the sufficient wave-meter range to cover ordinary amateur sets are presented. A calibration table for the wave-meter is also contained in "How to Conduct a Radio Club."

* * *

A. L. R., San Francisco, Cal., inquires:

Ques.—(1) Why is it that when a 10-inch spark induction coil of the type manufactured by the Marconi Company is connected in series with the antenna system and is shunted by a spark gap, the spark discharge is not over 1 inch in length, whereas with the antenna system disconnected, the spark will jump a gap 10 inches in length?

Ans.—(1) This is due to the shunt circuit afforded by the capacity of the antenna. The current flowing into the condenser (which in this case, is the antenna) immediately lowers the difference of potential, and the length of the spark discharge is limited accordingly.

Ques.—(2) What is the best antenna capacity for the operation of these coils?

Ans.—(2) An aerial having capacity of approximately .0015 microfarad will give the best results.

* * *

G. A. R., Boston, Mass., inquires:

Ques.—(1) Which system of vacuum valve amplification gives the louder signals, the cascade amplifier or the regenerative circuit?

Ans.—(1) The regenerative circuit is recommended for its simplicity and because of

the fact that it requires but one vacuum valve bulb. The step-up amplifier gives very good results indeed, but practically equal results can be obtained by the usual regenerative circuit.

Ques.—(2) Is the regenerative circuit applicable for the reception of 600-meter waves?

Ans.—(2) Very good results have been obtained at this wave-length by that circuit.

Ques.—(3) Where can I obtain dimensions of tuning coils for various ranges of wave-lengths?

Ans.—(3) Such data and method of calculation are contained in the book "How to Conduct a Radio Club." The fourth revised edition is now on the press.

Ques.—(4) I have often heard that better signals are obtained with the Perikon detector by sending a small battery current through the crystal. Is this true?

Ans.—(4) If a potentiometer that will give the necessary fineness of adjustment is available, better signals will be received by the application of a small local voltage. Care must be taken that the current flows through the crystal in a certain direction which can be determined by experiment.

Ques.—(5) What is the power of the Marconi trans-Atlantic station at New Brunswick, New Jersey?

Ans.—(5) Three hundred K.W.

* * *

C. A. L., Minneapolis, Minn., inquires:

Ques.—(1) Has the Marconi station at New Brunswick, N. J., ever been employed for commercial working?

Ans.—(1) A number of successful preliminary tests were conducted with the corresponding station in Carnarvon, Wales, but because the Wales station was taken over by the British Admiralty, experiments were discontinued. The station will undoubtedly be put into commercial operation at the close of the European War.

Ques.—(2) I have often heard that an ordinary buzzer may be used for making undamped oscillations audible in a receiving set. Is this correct?

Ans.—(2) If the buzzer is connected to a wave-meter, to set the latter into excitation at a frequency slightly differing from the frequency of the incoming oscillations, undamped oscillations can be made audible on ordinary receiving apparatus, but the signals are not as clear as those obtained by the standard Heterodyne receiver.

Ques.—(3) What is the power of the transatlantic station at Tuckerton, N. J.?

Ans.—(3) The output of the alternator at maximum is 200 K.W., but the station is normally operated at about 140 K.W.

* * *

D. R. Q., Albany, N. Y., inquires:

Ques.—(1) In addition to the wave-meter which I already possess, what apparatus can I add that will enable me to determine the logarithmic decrement?

Ans.—(1) A small hot wire wattmeter having a range of .01 to .1 watt connected in series with the wave-meter will permit the decrement to be measured, as explained in the book "How to Conduct a Radio Club." A small ammeter ranged zero to 200 milliamperes can also be employed.

Ques.—(2) Where in New York City can examinations for a first grade license certificate be taken?

Ans.—(2) At the office of the chief radio inspector, Custom House, Bowling Green.

Ques.—(3) What sized motor is required to revolve the disc of the rotary gap?

Ans.—(3) In the average case a 1/8 h.p. motor having a normal speed of 2,000 to 3,000 revolutions will suffice.

Ques.—(4) What should be the diameter of the disc?

Ans.—(4) It may vary from 6 to 10 inches and it should be fitted with six or eight spark electrodes.

Ques.—(5) Can the disc be driven by a belt as well as by direct coupling to the motor shaft?

Ans.—(5) Certainly.

* * *

T. R. A., Douglas, Ariz., inquires:

Ques.—(1) What type of receiving telephone is considered the most sensitive?

Ans.—(1) The Baldwin telephone with mica diaphragm is generally considered the most sensitive for the reception of radio signals.

Ques.—(2) Where can such telephones be purchased?

Ans.—(2) From the Manhattan Electrical Supply Company, New York City.

Ques.—(3) Where can I obtain information concerning the resistance of various sizes of German silver wire and its current carrying capacity?

Ans.—(3) The average standard electrical hand book contains this information.

Ques.—(4) Would there be any advantage in constructing a rotary spark gap having two discs revolving in opposite directions, both being mounted on independent motors or by gearing or belting driven from the same motor?

Ans.—(4) None whatsoever.

Ques.—(5) What should be the diameter of the spark electrodes on the disc for a 1/2 K.W. amateur set?

Ans.—(5) They need be no more than 3/16 of an inch in diameter.

* * *

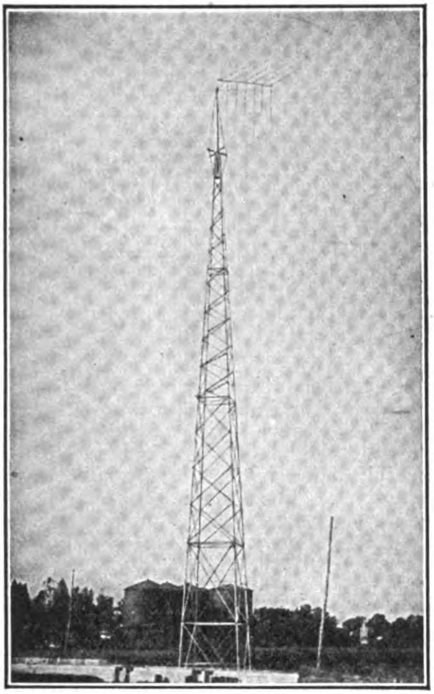
B. L. A., Washington, D. C., inquires:

Ques.—(1) Are tubular vacuum valve bulbs applicable for use in amplifying the circuit in the same manner as the oval types of bulbs?

Ans.—(1) They may be used the same way and will give practically equal results.

Ques.—(2) Is there any advantage in employing more than two bulbs in the cascade connection?

Ans.—(2) For ordinary amateur working, two bulbs will suffice. In any case there is no advantage in using more than three bulbs.



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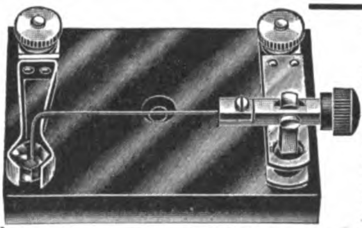

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Ques.—(3) I have been advised that a vacuum valve bulb is manufactured by the General Electric Company under a trade name, but I have forgotten it. Can you give me any advice?

Ans.—(3) The receiving bulb manufactured by the General Electric Company has been termed the "Pliotron," but we are not aware that it is being supplied to the market.

Ques.—(4) Where can I obtain information concerning the construction of the simple aerial ammeter for amateur use?

Ans.—(4) Note the instrument shown on page 101 of the December, 1916, issue of The Wireless Age.

Ques.—(5) Is a primary reactance coil required in all transmitting sets?

Ans.—(5) Not if the transformer is properly designed. Of course, if the primary power is to be reduced at certain intervals, a reactance regulator would be required, but not otherwise.

* * *

A. B., Chicago, Ills., inquires:

Ques.—(1) Where can I purchase a copy of a book devoted particularly to the construction of the induction coil?

Ans.—(1) The book entitled "Design and Construction of Induction Coils," by A. Frederick Collins, can be purchased from the book department of this magazine.

Ques.—(2) Please give the title of some book describing completely the construction of a Tesla coil?

Ans.—(2) The book entitled "The Construction of Tesler Coils," by Haller & Cunningham, can be purchased from the book department of this magazine.

* * *

T. B. A., Jacksonville, Fla., inquires:

Ques.—(1) I have noted from past issues of your magazines and books on wireless telegraphy, there seems to be a limit to the power consumed by an amateur's transmitting set irrespective of the Government laws. What is the upper limit?

Ans.—(1) The power input is limited principally by the dimensions of the closed circuit condenser which, in the case of the amateur's apparatus, can not exceed .01 microfarad. Even at frequencies of 500 cycles, the transformer cannot possibly consume more than 1 K.W. Power in excess of this value could only be used by providing a transformer with abnormally high secondary voltage, but this would require the use of a very long secondary spark gap which would introduce excessive damping and cause the set to operate inefficiently. The average amateur set cannot conveniently use more than ½ K.W. when operated at frequencies of 60 cycles. If power in excess of ¾ K.W. is employed, the set must be operated at a wave-length which exceeds the Government restrictions.

Ques.—(2) Is it necessary to obtain a license for a receiving station?

Ans.—(2) A license for such stations is not required.

A. B. L., Boston, Mass., inquires:

Ques.—(1) Please explain what is meant by a Marconi timed spark discharger and what is the function of such apparatus?

Ans.—(1) The Marconi timed spark discharger produces continuous waves by overlapping the antenna oscillations. If a number of rotary spark gaps, for example, are mounted on a common shaft, each of which is in series with a closed oscillation circuit and all are coupled to one aerial, then by revolving the disc at the proper velocity, the interval between sparks will be equal to the period of a group of oscillations, or it can be made a submultiple thereof. This will give practically a continuous flow of oscillations in the antenna circuit. The great advantage of this system over others lies in the fact that it does away with intricate high speed radio frequency alternators, does not require that the speed of the rotary disc be so carefuly maintained as in the case of the alternator, and, in addition, permits full use of the syntonic effects of the undamped wave systems. Usually the timed spark discharger consists of two large rotary disc dischargers mounted on a common shaft as well as a timing spark which performs the function of discharging the main disc discharger at the right moment. The condensers for these disc dischargers are generally excited with 5,000 volts direct current.

* * *

The "K" Brothers, Guttenberg, Ia.:

You are sailing in the same boat with a number of other amateurs, namely, your aerial is so close to the power wires that they act inductively thereon and induce interfering currents. Generally there is but one solution to this problem, and that is to either remove the power wires from the aerial or the aerial wires from the power line. You might try the balancing out system described in the book "How to Conduct a Radio Club" which in several instances has given good results.

* * *

O. G. E., Jr., Olympia, Wash.:

It would appear from your diagram that aerial B would receive the least induction from the high alternating current power line. Should considerable induction still be experienced, you might try the balancing out aerial described in the book "How to Conduct a Radio Club."

* * *

A. B. W., Belfast, Me.:

It is difficult to say just what station might have sent the press matter you copied. It would appear that some of the signals you have received were sent out by the spark station at Nauen, Germany. You might be able to hear this station if you had a very sensitive receiving set, but beyond this we can give no advice.

Regarding the two proposed earth connections: We believe that the 50 foot ground wire terminating in a well would give better results than the 150 foot ground wire which extends to the low water mark.

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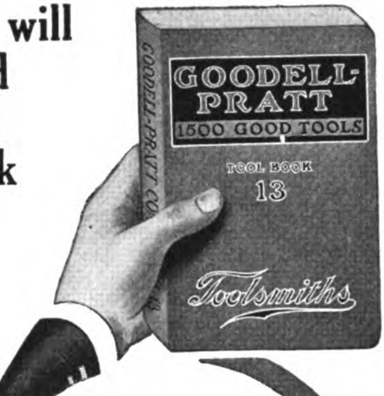

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There is no difference between the wiring diagram of a vacuum valve tube with the so-called grid element on the outside of the bulb and the type with a sealed-in grid.

The ground for portable transmitting stations consists of a number of bare copper wires spread underneath the antenna and having a surface equivalent of the flat top, or preferably greater.

* * *

E. M., Bloomfield, N. J.:

You failed to give us the dimensions of the secondary winding of your receiving tuner, but irrespective of this your apparatus should respond to undamped waves with little difficulty. If you are familiar with the Continental Telegraph Code and the apparatus is found to respond at all (which it should) there is no reason why you cannot ascertain for yourself the maximum range.

The wave-length of the antenna you describe is approximately 800 meters.

Regarding your wiring diagram: We advise that a small variable condenser be placed in shunt to the head telephone.

* * *

S. H., Bellville, Iowa:

There is no better way of ascertaining whether or not amateur stations exist in your district than by consulting the Government Call List or the monthly list printed in the Monthly Service Bulletin of the National Amateur Wireless Association.

A 200 foot aerial is generally too long for the satisfactory reception of amateur signals. One about 110 feet in length gives the best results.

* * *

I. T. W., Peterborough, N. H.:

A complete set of regenerative vacuum valve circuits appears in the third edition of "How to Conduct a Radio Club."

* * *

J. W. C., Macomb, Miss.:

It is outside the scope of this department to give the complete constructional details of a 110 volt alternating current generator. One K.W. 60 cycle generator can be purchased for about $125. Your aerial, 125 feet in length, with an average height of 56 feet, has a fundamental wave-length of about 245 meters and a condenser of approximately .0005 microfarad capacity may reduce the radiated wave to 200 meters.

Replying to your last query: Alternating current generators of different manufacture are built for different speeds. Generally the small size generators revolve at the rate of 1,800 revolutions per minute. We cannot advise concerning the speed of the driving engine unless we know the diameter of the driving pulley and the diameter of the pulley at the generator.

* * *

W. G. M., Springdale, Ark.:

Simply rewinding your telephones to a higher resistance will not necessarily increase the sensitiveness unless it is done in such a way as to increase the magnetizing flux. If there is sufficient room on the bobbins for winding No. 40 wire, it may increase the sensitiveness of the telephone when used with crystalline detectors; but if the 'phone is to be employed in the local circuit of the vacuum valve detector, equal results will be obtained by a lower resistance receiver which is well constructed.

* * *

F. R. L., Jefferson, Wis.:

The National Radio School at Washington, D. C., gives a complete correspondence course in wireless telegraphy.

The radio communication laws of Great Britain are published in "The Year Book of Wireless Telegraphy and Telephony" which can be purchased from the Wireless Press, Inc., 42 Broad street, New York City.

In times of peace you are not required to obtain a license for a receiving station or to notify the Government inspector that it is being installed; neither is it necessary to take the oath of secrecy for the operation of such a station, but it would be considered a violation of the law if information picked up in this manner were distributed broadcast.

* * *

F. Y. F., Latonia, Neb.:

It would require 1,680 plates of glass, 8 inches by 10 inches, covered with tinfoil, 6 inches by 8 inches, to make a condenser of 1 microfarad capacity.

Either mineral seal or transil oil is employed for high voltage condensers.

* * *

T. W. B., Harrisburg, Pa., inquires:

Ques.—(1) I have a small generator that is supposed to generate six volts at 2,000 revolutions per minute. Can this be used to recharge a four volt storage battery?

Ans.—(1) It can be so used provided the current output is at least five or six amperes.

Ques.—(2) Could this generator be used to charge the storage battery while the battery is connected to the filament in the vacuum valve?

Ans.—(2) Yes, but since the voltage of the generator is higher than that of the battery, care must be taken not to burn the filament out.

* * *

H. J. H., Philadelphia, Pa.:

The call letters of amateur stations are assigned by the chief radio inspector, Washington, D. C.

The Phillips Telegraph Code referred to in "How to Conduct a Radio Club" is an abbreviated set of commonly used words for the transmission of press dispatches.

* * *

J. J. G., Kingsland, N. J.:

It is quite likely that the induction from your buzzer testing system is so strong as to destroy the sensitive adjustment of the crystal, and consequently you should use a looser coupling between the testing circuit and the receiving set.

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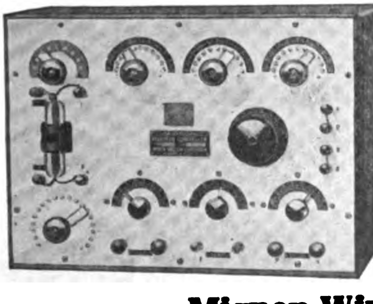

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Complete information concerning the construction of long distance apparatus for the reception of undamped waves appears in the book "How to Conduct a Radio Club," the fourth edition of which is now on the press.

* * *

C. H., Youngstown, Pa.:

The increase of capacity due to the use of shellac on tuning coils will not occasion great energy losses in the average amateur tuner.

The curves given in the November, 1916, issue of The Wireless Age will enable you to calculate the wave-length of your aerial or other aerials near this dimension.

* * *

J. Z. N. D., Port Jefferson, N. Y.:

It is not to be wondered at that you have had some discussion and argument concerning the wave-length of your aerial; simply knowing the length of the flat top will not aid in calculating the length of the radiated wave. The connections shown in your flat top are considered "freakish" and there is no advantage in zigzagging the terminal-connections in the way you have shown. It is well to adopt the usual construction; construct your receiving aerial of three or four wires in parallel, join them together at the base and connect the lead-in directly to the apparatus.

* * *

W. J. R., Dallas, Tex.:

The lead-ins of your flat top aerial should have conductivity equal to the wires in the flat top. It makes no difference whether the primary and secondary windings are wound in the same or opposite directions.

Regarding the taking of the taps from the two windings:

If the primary winding is on the left hand and the secondary winding is on the right, the first tap should be taken from the right hand end of the primary winding and the first tap from the left hand end of the secondary winding. This permits the used turns to be placed in direct inductive relation.

Insulated wire will do as well for a receiving aerial as bare wire. It will make no difference in the strength of signals.

* * *

P. L. B., New Haven, Conn.:

The diagram of connections you sent in is correct and there is no reason why the apparatus should not function properly. Try changing the connections in the inductively coupled transformer employed to repeat the oscillations of the wing circuit back to the grid circuit. Your diagram of connections is quite correct throughout and is the best we know of with the apparatus you have at hand.

* * *

A. W. H. Oklahoma City, Okla.:

The apparatus described on page 347 of the February, 1917, issue of The Wireless Age, connected to the arial you describe will respond to waves inclusive of 10,000 meters. As you suggest, the secondary loading coil should be wound with the same sized wire as the secondary winding.

A diagram of connections applicable to this apparatus is contained in the book "How to Conduct a Radio Club," the fourth revised edition of which is now on the press. A government call list of radio stations, including the United States amateur stations, can be obtained from the Government Printing Office, Washington, D. C., price 15c. per copy.

* * *

E. S., South Norwalk, Conn.:

If you will observe carefully how the laminations of an iron core transformer are stacked up, you will have no difficulty in understanding the Fourth Prize Article in the May, 1916, issue of The Wireless Age. The rectangular core when completed should have legs 3 inches square and the laminations should be piled up in the manner shown until these dimensions are obtained. There will then be sufficient room to wind both the primary and secondary windings.

* * *

J. E. S., Parnases, Pa.:

Your receiving transformer will respond to waves up to 7,000 meters provided a small variable air condenser is connected in shunt to the secondary winding.

A one pint leyden jar usually has sufficient capacity for a 1-inch spark coil.

The wave-length of the aerial you have described can be determined from the curves shown in the November, 1916, issue of The Wireless Age.

* * *

L. S., San Diego, Cal.:

A solution of carbon di-sulphide is generally employed to clean crystal detectors.

* * *

G. B. D., Merrick, L. I.:

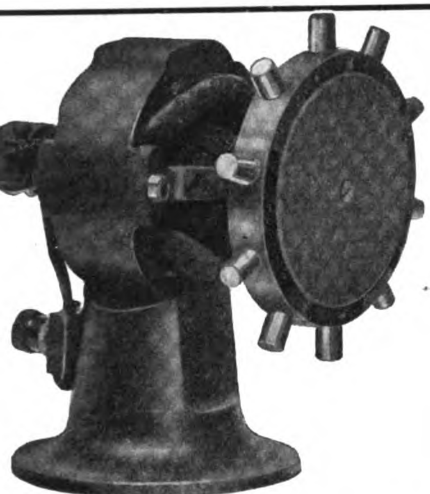
Your aerial, 220 feet in length, has a natural wave-length of approximately 320 meters, and it will be difficult to reduce its capacity sufficiently to radiate a 200-meter wave by means of a series condenser.

If this aerial were changed to have a flat top length of 110 feet with vertical height of 75 feet as you suggest, the natural wave-length would be close to 230 meters and a short wave condenser would be required to radiate a 200-meter wave. However, this aerial can be made to comply with the law by attaching the lead-in to the center; the natural wave-length will then be about 180 meters.

The correct condenser capacity for a 1-inch spark coil is best determined by experiment. A number of plates of glass, 8 inches by 8 inches, covered with foil, 6 inches by 6 inches, may be connected in parallel and different values of capacity tried out until the best spark discharge is obtained. Generally that capacity which will give a rather short discharge gap, not more than 3/16ths of an inch between blunt electrodes, will give the best results.

An oscillation transformer is not necessary, but is required by government law in order that the radiated wave may be pure and sharp.

A small oscillation transformer suitable for



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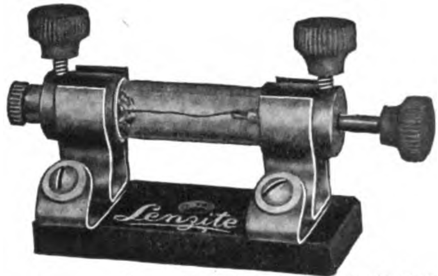

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Parkway Building Philadelphia, Pa.

spark coils is fully described in the book "How to Conduct a Radio Club."

Buzzer transmitters have often been employed in ship work for communicating at distances of thirty or forty miles. Such distances can only be covered when a vacuum valve amplifier is employed at the receiving station. Good results can be obtained by connecting a small fixed condenser of about .005 microfarad capacity in series with the antenna, the terminals of this condenser in turn being shunted across the contact points of the vibrator. The buzzer should be operated from a six-bolt storage cell.

You should be able to make these connections without a diagram.

* * *

H. B., Sheboygan, Wis.:

The natural wave-length of your aerial is about 125 meters. According to our calculations, the condenser connected to your thordarson transformer has capacity of .03 microfarad which is three times the size it should be to radiate a 200-meter wave. A condenser of .01 microfarad, or preferably of .008 microfarad, capacity should be employed for the 200-meter wave.

To determine the exact number of turns to be employed in the primary and secondary windings of your oscillation transformer, you should construct a wavemeter after the design given in the book "How to Conduct a Radio Club" and measure accurately the wave-length of either circuit. This will insure maximum efficiency, compliance with the law and will eliminate all guess work.

* * *

G. E. B., Lanesboro, Minn.:

According to our calculations the natural wave-length of your aerial, which has a total length of 1,200 feet, is approximately 750 meters, and will only be applicable to the reception of signals from long wave stations.

* * *

F. S. M. C. C., Mercer, Pa.:

So far as we are aware the tikker is the simplest device for making undamped oscillations audible.

Trans-Atlantic stations at Tuckerton and Sayville use some form of the oscillating vacuum valve circuit.

* * *

A. L. V., Cleveland, Ohio, inquires:

Ques.—(1) Where can I obtain a complete description of the Kolster decremeter?

Ans.—(1) A complete description of this apparatus was given in the Proceedings of the Institute of Engineers and also in Volume 11, No. 235, of the Bureau of Standard's publication (dated August 15, 1914).

Ques.—(2) Is it absolutely essential to employ an inductively-coupled oscillation transformer in connection with my armature set Can I obtain good distance effect by using a single helix?

Ans.—(2) The direct coupled helix will give as good results as the inductively coupled transformer, the only advantage of the latter being that the coupling can be very simply regulated by drawing the two windings apart. In order to radiate a pure wave with a direct coupled helix, you must provide three contact clips, one being connected to the antenna, the second to the earth connection and the third to the spark gap circuit. In this way the used turns of the antenna circuit can be placed at a distance from the used turns of the primary circuit which will reduce the coupling and therefore the damping of the radiated wave.

Ques.—(3) Where can I obtain a complete description covering the construction of the plates for a quenched gap?

Ans.—(3) This is fully covered in the fourth edition of the book "How to Conduct a Radio Club."

Ques.—(4) Will the quenched gap give good results on 60-cycle alternator current?

Ans.—(4) It will not give the high spark note obtainable from 500 cycle current, but in all other respects (if properly designed) will increase the efficiency.

* * *

G. W., Brandon, Wis.:

The two tuning coils you describe will not respond to waves of 1,700 meters unless they are connected in series, one being used as a loading coil and the other as a direct coupled oscillation transformer. If it is to be used with the linking circuit described in the book "How to Conduct a Radio Club" it would be advisable to wind the coil which is to act as the secondary winding with No. 28 S. S. C wire. The primary coil should be wound with No. 24 S. S. C. wire.

* * *

A. A. Laurium, Mich.:

Either the electrolytic rectifier or the mercury vapor rectifier could be employed in connection with the smoothing out condenser to operate your small arc. The mercury rectifier would probably give the best results. More specific information concerning the efficiency of these rectifiers can be obtained from the General Electric Company at Schenectady, N. Y., or from its New York City office.

* * *

A. O. Ames, Iowa:

We have no data on the composition of the glass used in the Leyden jar manufactured by a German wireless telegraph company. We understand that the capacity of their large sized condenser is .1 microfarad.

Complete information concerning the various types of arc systems appears in the series of articles on "Radio Telephony" running serially in this magazine.

* * *

R. W. E., Independence, Canada:

The book "How to Conduct a Radio Club" explains the construction of the iron core auto transformer employed in the Armstrong regenerative circuit. We do not know which of the amplifying circuits in question is referred to, but if the transformer be employed for transferring the signals from one vacuum valve bulb to another, one of this type may be purchased from the Manhattan Electrical Supply Company, New York City.

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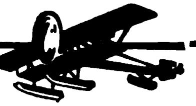

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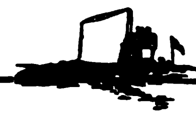

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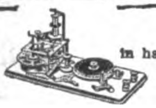

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