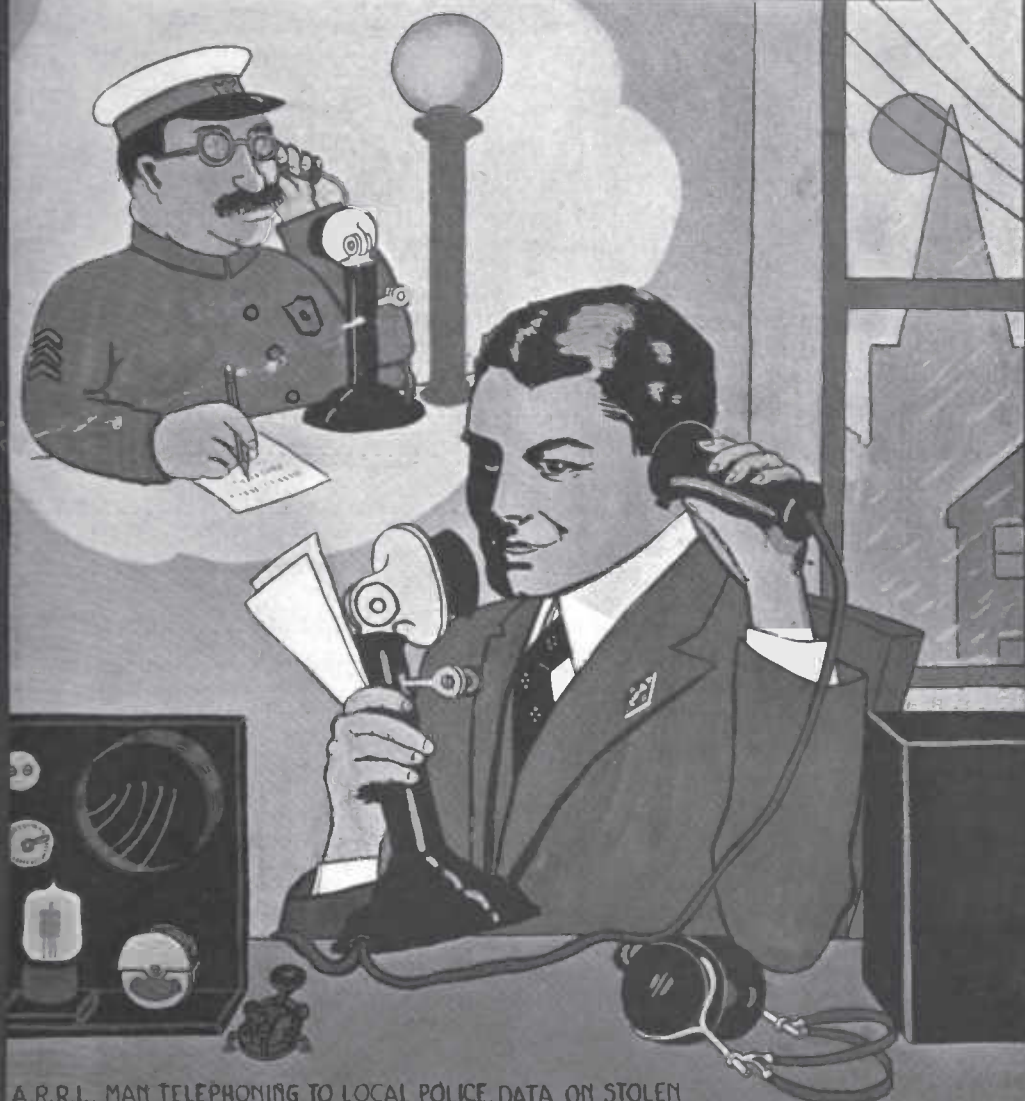


November 1920 - 20¢

QST

A MAGAZINE DEVOTED EXCLUSIVELY TO THE WIRELESS AMATEUR



A.R.R.L. MAN TELEPHONING TO LOCAL POLICE. DATA ON STOLEN AUTOMOBILES THAT HAS BEEN BROADCASTED BY AMATEUR RADIO

DR. HOFFMAN

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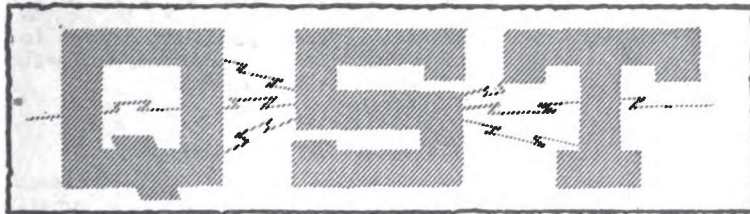
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THE OFFICIAL ORGAN OF THE A.R.R.L.



NOVEMBER, 1920

VOLUME IV

No. 4

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QST is published monthly by The American Radio Relay League, Inc., at Hartford, Conn. Kenneth B. Warner (Secretary, A. R. R. L.), Manager and Editor.

Subscription price, \$2.00 per year, anywhere. Single Copies, 20 Cents.

Entered as second-class matter May 29, 1919, at the post office of Hartford, Connecticut, under the Act of March 3, 1879.

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THE AMERICAN RADIO RELAY LEAGUE, Inc.
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A Magazine Devoted Exclusively to Amateur Radio

The Bureau of Standards---A.R.R.L. Tests of Short Wave Radio Signal Fading

By S. Kruse

Assistant Electrical Engineer, Bureau of Standards

Presented at meeting of the Radio Club of America, Columbia University,
September 24, 1920

PART I.

THE Bureau of Standards—A.R.R.L. tests of short wave radio signal fading were run co-operatively by the Radio Laboratory, Bureau of Standards, and the American Radio Relay League for the purpose of gaining information useful in determining the cause of the swinging or fading of radio signals. The work was divided between the two organizations, the selection of stations and actual performance of the tests falling to the A.R.R.L.; while the work of general supervision, preparing the recording forms, correspondence, and the analysis of the results were done by the Bureau of Standards.

Test signals were transmitted by six stations each Tuesday, Thursday and Saturday night, from June 1 to July 17, 1920, inclusive. Five of the transmitting stations were A.R.R.L. stations. The sixth was the station at the Radio Laboratory of the Naval Air Station, Anacostia, D. C.

It is perhaps best to begin a discussion of this kind by defining the term "swinging" or "fading" of signals. This can best be done by example. Supposing that we are listening, at the Radio Laboratory in Washington to station 1HAA at Marion, Mass. 1HAA will call and be received with normal intensity, will begin the preamble of his message still at normal intensity, and then, as he starts to send the text, the signals rapidly become very much louder until within a few seconds they can be heard all over an ordinary room. Then as he proceeds the signals become fainter and may become so weak as to be unreadable or even inaudible for a number

of words, and then again begin to become louder, so that by the time the station signs off, the signals are again very loud. It can readily be seen that this kind of thing makes communication very difficult, and on many occasions requires repetition time after time of a message which could otherwise be copied "solid" the first time. In short-wave work swinging is so prevalent that a standard abbreviation has been devised to inform the sending station that his signals are swinging, and at present, in amateur communication this abbreviation, "QSS", is heard quite as often as QRM and QRN, which mean respectively "interference" and "atmospherics," the other two worst difficulties encountered in short wave communication. It is then of interest to attempt to find some explanation as to the cause of swinging, with the possibility in mind that if we know the cause, there may be a remote chance of avoiding the difficulty. Swinging has not been much investigated in the past, for several reasons. It is primarily a long-distance phenomenon, that is to say, long-distance compared to the range of the station which is sending. Most commercial communication is done well within the range of the transmitting station where not much swinging is encountered. In addition to this, commercial communication is done on long wave lengths on which swinging is not very severe nor very rapid. At present, however, the use of short-wave sets is very much on the increase, not only in amateur practice but also by airplanes, in military work, and in low-power ship communication. It seems worth while to

attempt to investigate fading at short waves particularly. Naturally, since our ideas as to the cause of fading are rather vague, an investigation depending on a network of stations (rather than one sending and one receiving station) would be the most instructive. The thought that data on the fading of radio signals can be secured by co-operation with a network of amateur radio stations follows at once, as it is here only that one can find a large number of well equipped short-wave stations whose operators are thoroughly familiar with the apparatus and also able

with amateur stations. It has developed since that Mr. H. P. Maxim, and Mr. K. B. Warner, respectively President and Secretary of the A.R.R.L., had discussed a similar plan and were about to write to the Bureau when our letter was received.

The plans for the tests were completed at a conference in the Bureau of Standards Radio Laboratory on April 7 at which there were present: for the American Radio Relay League, Mr. H. P. Maxim, and Mr. K. B. Warner; and for the Bureau of Standards, Dr. J. H. Dellinger, Mr. L. E. Whittemore, and the writer. Commander

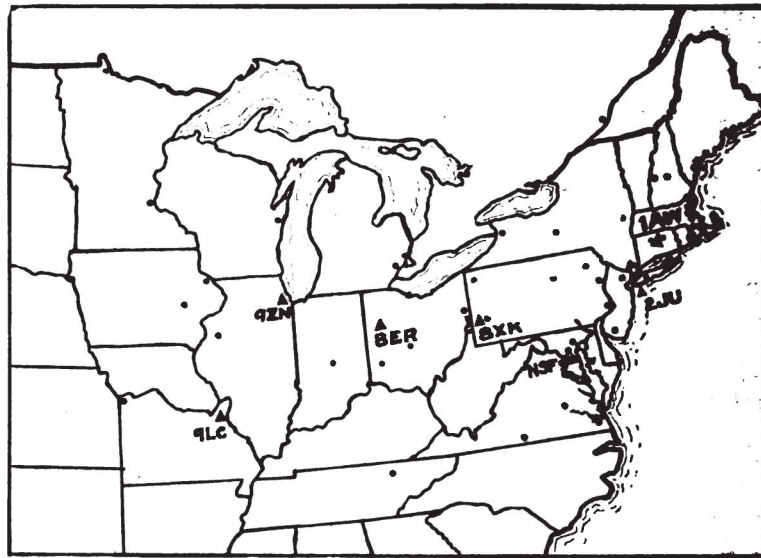


Fig. 1—Map of Station Network.

to give time and effort to the performance of an investigation. Last spring, therefore, I suggested to Mr. L. E. Whittemore of the Radio Laboratory of the Bureau of Standards that we place before the American Radio Relay League a plan for a system of fading tests in which the A.R.R.L. stations would do the transmitting and receiving, while the supervisory and clerical work and the analysis of data fell to our laboratory. During the following week such a plan was worked out tentatively by Mr. L. E. Whittemore, Miss H. H. Smith and myself.

Laboratory tests of the method of recording the variations in signal intensity having shown that satisfactory results could be secured without the use of any instruments other than the regular receiving equipment, the Bureau of Standards then officially proposed the plan to the A.R.R.L. The plans were received favorably, especially as they offered an opportunity of finding out with some definiteness what could be done in the way of summer transmission

A. H. Taylor, USNRF, in charge of the Radio Laboratory, Naval Air Station, Anacostia, D. C., as well as Dr. S. J. Mauchley and Mr. A. Sterling of the Department of Terrestrial Magnetism, Carnegie Institution, Washington, were present and offered valuable suggestions. The tentative plans were brought into working shape, and the sending stations agreed upon. Mr. Maxim and Mr. Warner offered the use of their station 1AW at Hartford, Conn., and Commander Taylor the use of station NSF at Anacostia, subject to the approval of the Navy Department. Commander Taylor's offer of NSF was opportune as there was no Washington station capable of good 250-meter transmission which was available for the tests. Both 1AW and NSF did excellent work in the test series, the transmission of the latter station being at times little short of phenomenal.

During the following weeks, Mr. K. B. Warner and the officers of the Traffic Department of the A.R.R.L. did much hard

work in selecting recorders properly located, and known to be well enough equipped as to apparatus and experience, who could also find time to take part in the tests.

The Station Network

The station network finally developed is shown in Fig. 1 where the sending stations are indicated by triangles with the call of the station alongside, while the recorders are indicated by circular dots. There were seven sending stations and fifty-one recorders.

Considerable criticism of the lay-out of the fading system was occasioned by the fact that only the northeast quarter of the United States was covered. There were reasons for this. There were almost no stations in the southeast part of the country and not a great many in the southwest. Also such stations as there are, report comparatively little fading. It seemed, then, that not a great deal of information would be obtained from the southern stations. In addition, there is a limit to the number of curves which can be analysed. The amount of work involved in handling the 1260 curves which were received can hardly be appreciated by anyone who has not attempted a job of this kind. The decision to confine the tests to the northeast was a unanimous one in the conference, and the results have shown it to be sufficiently correct. Experimentally the A.R.R.L. has run some nationwide tests, largely to see what transmission conditions were. The reason for the wider spacing of stations west of Pittsburgh is a double one. To begin with, there are fewer stations west of Pittsburgh, and although it might have been possible to secure as many west of Pittsburgh as we did to the east, we did not think this was necessary. The winter range of stations in the Mississippi and Ohio Valleys is enormous compared to that of eastern stations. It did not occur to us that the Mississippi Valley summer conditions are enormously different from the winter conditions, while on the eastern coast ranges do not change particularly with the season. The station arrangement, therefore, which would have been satisfactory for a winter test was not so for the summer test. The western stations, 9ZN at Chicago and 9LC at St. Louis, were working under a considerable handicap, and it became necessary later to add station 8ER at St. Marys, Ohio, in an effort to secure more complete records.

Station Description—Senders.

1AW—Station 1AW at Hartford, Conn., is operated by Mr. H. P. Maxim, President of the A.R.R.L., and Mr. K. B. Warner, Secretary of the same organization. 1AW does not need much advertising. The station location is directly to

the east of a large hill toward which the antenna is directive. There are no hills to the north or south and the country is level to the east for about two miles, after which it drops sharply to the Connecticut River. The soil is a heavy clay which is usually very wet in the winter. The station is surrounded by houses at a distance of about 75 feet, and there are trees in all directions except east. The antenna (Fig. 2)¹ is a bent fan of 17 wires spaced three feet apart at the high end and which is elevated 80 feet. All wires are continued through the spreader at the low end (elevation 50 feet) to the anchor gap at the transmitting apparatus which is located in the basement. The ground system consists of a network of buried wires as well as wires to ground rods and to all the metal pipes in the building. The radiating system has a resistance of 5 ohms and a capacity of 0.0011 microfarad. The sending set (Fig. 3)¹ is of the 60-cycle non-synchronous rotary gap type. Either an Acme or Thordarson transformer is used. In either case the input is about 780 watts. A Dubilier mica condenser of 0.01 microfarad capacity is used. The rotary gap is unusual, consisting of a shaft mounted in bronze bearings and carrying 4 metal arms revolving between two fixed electrodes. The rotor diameter is 15 inches and the speed 7000 RPM. It will be seen that while the spark rate is low the peripheral speed of this gap is very much higher than usual. Because of the high speed, or perhaps because of the compressed air traveling before the rotating electrodes, unusually good quenching is obtained so that close coupling with consequent high efficiency may be used. The normal antenna current is 5½ amperes and the decrement quite low.

The second station, 2JU, operated by Mr. C. J. Goette, is located in Woodhaven, L. I., near Jamaica Bay. There are no large buildings or trees in the neighborhood and the land is very level and slightly marshy.

The antenna is a four-wire L, 50 feet high, 85 feet long, and 10 feet wide. The ground system consists of a lead to the water pipe and an eight-wire fan buried directly under the antenna which is directive eastward.

The sending set (Fig. 4)² employs a United Wireless 1-k.w. open-core transformer with a 30,000 volt secondary. This transformer is well known among amateurs under the nickname of "the coffin," which its box resembles. The condenser consists of two Dubilier mica units in series. Each unit has a capacity of 0.014 microfarad. The oscillation transformer is the familiar "pancake". The rotary gap is of

1. Omitted. See July 1920 QST, page 35.

2. Omitted. See August 1920 QST, page 35.

the gear type, having eight teeth, and is driven by a synchronous motor. A tone differing noticeably from that of a non-synchronous rotary is obtained.

NSF is the Naval Aircraft Radio Laboratory at the Naval Air Station, Anacostia, D. C. This station is under the direction of Commander A. Hoyt Taylor, USNRF. The transmitting set at NSF employs two electron tubes of the General Electric type P (Navy type CG916) operating in parallel. The filament and plate circuits are fed by the same motor generator set, and the total input to the tubes is about one kilowatt. The plate circuit supply is at 2000 volts direct current, the tone being produced by a motor driven chopper disc, which is placed in series with the key as a shunt to the grid condenser so that the tubes block and cease oscillating whenever either the key or the chopper opens the circuit. The circuit is the familiar one sometimes referred to as the Meissner circuit, both grid and plate circuits being untuned and coupled to the common antenna coil. The antenna is a multiple tuned one 75 feet high and 235 feet long with three down-leads, to the center one of which the sending set is coupled. At 250 meters the current in each down-lead is 2.3 amperes, thus giving a total of 6.9 amperes in the antenna.

For transmitting speech the above described set is used as a power amplifier, the grid being adjusted so that the set does not oscillate. To the grid is coupled the output circuit of a small aircraft radio telephone set. The antenna currents are nearly the same for telephone as when using the set in the ordinary manner.

8XK, the fourth testing station, operated by Mr. F. Conrad of the Westinghouse Electric and Mfg. Co., Pittsburgh, Pa., has become very well known during the past winter as one of the very few short-wave, high-power, ICW stations. The antenna system at 8XK consists of a 6-wire L antenna 120 feet long, suspended 50 feet from the ground over a similar counterpoise elevated 12 feet. A third network buried beneath the counterpoise is used as a ground.

The sending set (Fig. 5)³ employs two transmitting tubes of a type similar to the General Electric Company's "U" type in the familiar circuit using one coil as a common antenna, plate and grid coil. The plate power is obtained from a ½-kilowatt 110-volt, 900-cycle generator from an airplane transmitter of the type employed on the NC planes. This generator is driven by a direct current motor at such a speed that the frequency is 700 cycles. A transformer steps the 110-volt supply up to 3000 volts which is applied to the plates

of the tubes through a high-frequency choke coil. No chopper is necessary to secure an audible tone with this type of transmitter. The antenna current is normally about 5½ amperes. This is measured in the antenna lead.

9ZN—Station 9ZN at Chicago, operated by Mr. R. H. G. Mathews is perhaps the best known station in the network, 9ZN having operated under the present call since several years before the war and during the time doing excellent long-distance work. 9ZN is located in a vacant block on Sheridan Road within 30 feet of the sea wall of Lake Michigan. The aerial (Fig. 6)⁴ hung between two steel towers is a vertical fan of 10 wires spaced 15 feet apart at the top and brought together near the station roof; all wires continue through to the antenna switch. The height of the fan is 95 feet. The grounding system consists of 28 wires 30 and 150 feet long buried inshore from the station. In addition, two 100-foot wires in the lake and a considerable number of ground rods near the station are used. The fundamental wave length of the antenna is 300 meters. For miles around 9ZN the country is some of the most level in the United States. The soil is very thin and is underlaid by many feet of sand, which is moist at all times. Two transmitting sets are used at 9ZN, one of which is a 500-cycle Telefunken set, (Fig. 7)⁴ no detailed description of which is available. In the 60-cycle non-synchronous rotary gap set the transformer is a United Wireless open-core "coffin" similar to the one used at 2JU. The condenser is of plate glass in oil with about 0.008 microfarad capacity, the rotary gap a seven-point gear type driven at 3600 r.p.m. The antenna current at 9ZN is unusually high, about 8.7 amperes at 250 meters, and somewhat over 9 amperes at 425 meters. This is probably an indication of very low antenna resistance.

8ER—Station 8ER at St. Mary's, Ohio, is operated by Mr. and Mrs. Charles Candler. 8ER under its pre-war call of 8NH established a record, unequalled, I believe, by any other amateur station, of being heard in every state of the Union. The location of 8ER is unusually favorable. The country about St. Mary's is absolutely level. There are no hills for many miles in all directions. Even along the streams the land is very flat. There are no tall buildings near 8ER and only a few large trees to the east. All stations in this portion of Ohio are able to do unusually good work. The antenna is a six-wire L, 55 feet high and 65 feet long. The grounding system consists of a number of 7-foot ground rods also connected to the water

3. Omitted. See September 1920 QST, page 32.

4. Omitted. See January 1920 QST.

pipes and to a cistern. No information is available as to the antenna characteristics. The sending set is of the non-synchronous type with 60-cycle supply, Thordarson transformer, gear type rotary, and glass plate condenser in oil.

9LC—9LC at St. Louis is the only one-half kilowatt station in the system. It is operated by Mr. W. E. Woods, who has become well known in connection with his work at the Otter Cliffs receiving station of the Navy Department and his pre-war work with station 9HS at St. Louis. There are no tall buildings or trees near 9LC. There is a street car line about 200 feet from, and parallel to, the antenna but no interference has been experienced. Not much is known about the topography near 9LC. In general the country about St. Louis is flat. The antenna is a five-wire

a shunt condenser but by means of a variable inductor in series with the secondary. A great increase in sensitiveness is secured, as the ratio of inductance to capacity in the circuit is much improved over that obtained when using a shunt condenser. The plate circuit of the tube contains another variable inductor by means of which the degree of regeneration can be controlled. For spark or ICW reception the set is usually operated with the largest degree of regeneration which will not distort the spark tone. Far more regeneration can be used with low spark tones than with high. It is possible that this is the reason why a low spark rate has been found far more effective in amateur practice than the high pitches favored in commercial work. Almost without exception the recorders used a "soft" or gas

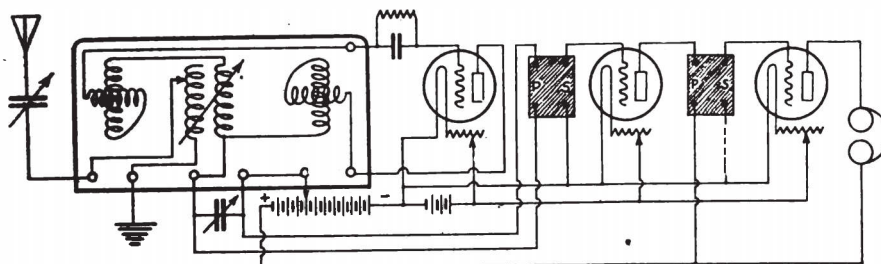


Fig. 8—Paragon receiving set circuit.

L, 55 feet high, 65 feet long, and 12 feet wide. The sending set consists of an Acme $\frac{1}{2}$ -kilowatt transformer, six Murdock condenser sections, of 0.0017 capacity each, connected in parallel and oil immersed to prevent brushing between leads. Either a quenched gap or a Benwood enclosed rotary is used. The Benwood rotary is a gear type gap enclosed in an air-tight aluminum case which serves not only to muffle the crash of the discharge but also provides a more favorable atmosphere for good quenching. The radiation is $4\frac{1}{2}$ amperes at a decrement of 0.03. 9LC had, during the past winter, a range attained by very few one-kilowatt stations. During these tests, however, the unusually severe summer conditions of the Mississippi Valley did not give this station the opportunity to perform as well as some of the others in the system.

Station Description—Recorders.

With a single exception every recording station used a short wave receiving set of the type originally put on the market under the name of the Paragon receiver by the Adams-Morgan Co. The circuit of this set is shown in Fig. 8. The tuning of the primary circuit is accomplished by means of a switch on the inductance and a series condenser in the antenna lead. The secondary circuit is not tuned by means of

tube as the detector and "hard" or high vacuum tubes for the amplifier. Minor variations of the circuit occurred, such as the provision of taps on the B battery as a means of varying the plate voltage of the detector tube.

The recorders, with few exceptions, used four or six wire L antennas about 60 feet high and 60 feet long. These were suspended by means of electrose insulators and, in most cases, copper wire, No. 12 or thereabouts, or 7 strand phosphor bronze, was used. The ground connections in most cases were to water pipes; in some cases to buried networks. A few recorders used harp antennas.

All of the transmitting operators except the one actually sending at the time acted as recorders. The stations which served as recorders only are listed below:

Additional Recorders.

- 1AE S. B. Young, 294 Ashmont St.,
Dorchester, Mass.
- 1AK H. C. Bowen, 168 Belmont St., Fall
River, Mass.
- 1BG G. Faxon Shorey, Melrose, Mass.
- 1CK P. F. Robinson, 149 Hollis Ave.,
Braintree, Mass.
- 1CM H. B. McLane, 342 Union Ave.,
Laconia, N. H.
- 1DG Stuart Briggs, 94 Walnut Place,
Brookline, Mass.

1EK Robert D. Huston, 19 Nevens St., 1SN Wm. E. A. Dodge, Beverly, Mass.
 Portland, Maine. 1TS Donald H. Mix, 40 Stearns St.,
 1FB Lawrence C. Cumming, Prout's Neck, Bristol, Conn.
 Maine. 1YB F. L. Southworth, Sec., Dartmouth
 1HAA Irving Vermilya, Marion, Mass. College Radio Assn., Hanover, N. H.
 1NAQ J. C. Randall, 23 Harrison St., 2BG A. J. Lorimer, 243 Mackay St.,
 Hartford, Conn. Montreal, Quebec.

A. R. R. L. FADING REPORT

Receiving station call _____ Location _____ Date _____

Time observations begin _____ General reception this date _____

General character of strays

("static") this date _____

Transmitting station call _____ Wave length _____ m.

Weather, wind direction, and strength, indicated by check mark below.

Weather:	Clear	Wind Direction:	N	Wind Strength:	Calm
	Cloudy		NE		Light
	Rain		E		Medium
	Snow		SE		Strong
	Sleet		S		Storm
	Fog		SW		
	Lightning		W		
			NW		

SIGNAL STRENGTH RECORD. Indicate average strength for each letter by a check mark (✓) in the proper square below.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z		
Very strong 9																											9	
Strong 8																												8
Good 7																												7
Fair 6																												6
Rather faint 5																												5
Faint 4																												4
Just readable 3																												3
Very faint, unreadable 2																												2
Just audible 1																												1
Nothing 0																												0
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z		

Fig. 9

Receiving Operator

- 2BK C. E. Trube, 6 Livingston Ave.,
Yonkers, N. Y.
- 2FG F. H. Myers, 45 Albany Trust Bldg.,
Albany, N. Y.
- 2JE J. L. Eddy, Jr., 19 Washington St.,
New Rochelle, N. Y.
- 2OE S. L. Raynor, College Court, Free-
port, N. Y.
- 2TT A. Rechert, 181 Waverly Place,
New York City.
- 2YM YMCA Radio Club, 153 E. 86th
St., New York City.
- 2ZM L. M. Spangenberg, 25 South Fourth
Lake View, N. J.
- 3BZ W. T. Gravely, Danville, Va.
- 3EN T. C. White, Jr., 303 Riverview
Ave., Norfolk, Va.
- 3JR H. A. Snow, 1656 Newton St., NW.,
Washington, D. C.
- 3NB Marcus Frye, Jr., Box 187, Vine-
land, N. J.
- 3SU A. B. Chism, 3729 M St., N.W.,
Washington, D. C.
- 3UA E. B. Duvall, 4004 Park Heights
Ave., Baltimore, Md.
- 3ZA C. A. Service, Jr., Bala, Pa.
- 3ZS C. H. Stewart, St. Davids, Pa.
- 4AT O. A. Gullledge, Ft. Pierce, Fla.
- 5DA W. C. Hutcheson, Wind Rock, Tenn.
- 8AAN A. H. Benzee, Jr., 207 Sumner Pl.,
Buffalo, N. Y.
- 8ABI Harrison Daniels, 424 W. First St.,
Dayton, Ohio.
- 8BQ H. M. Walleze, 234 Vine St., Milton,
Pa.
- 8CE R. C. Ehrhardt, 117 South Blakely,
Dunmore, Pa.
- 8DA A. J. Manning, 252 McKinley Ave.,
Salem, Ohio.
- 8ER Mr. and Mrs. Charles Candler, St.
Marys, Ohio.
- 8IB R. C. Higgy, 50 E. 18th Ave.,
Columbus, Ohio.
- 8WY Lord Bros., 531 Beach Ave., Cam-
bridge Springs, Pa.
- 8XU Sibley College, Cornell University,
Ithaca, N. Y.
- 8ZW J. C. Stroebel, Jr., Wheeling, W. Va.
- 9DT C. W. Patch, Villa St., Dubuque,
Iowa.
- 9ET W. L. Tomson, 1163 North Broad
St., Galesburg, Ill.
- 9NQ J. H. Burke, Galesburg, Ill.
- 9ZC J. A. Gjelhaug, P. O. Box 154,
Baudette, Minn.
- 9ZJ F. F. Hamilton, North Alabama St.,
Indianapolis, Ind.
- 9ZL H. J. Burhop, Naval Radio Station,
Manitowoc, Wisc.
- WWV S. Kruse, Radio Laboratory,
Bureau of Standards, Washington.
- NSF L. C. Young, Radio Laboratory,
Naval Air Station, Anacostia, D. C.

Operation

The network performed excellently throughout. After the first two days in which the usual delays occurred, no send-

ing station failed to transmit its test schedule excepting on a very few occasions when the cause of the failure was beyond the control of the operator. The average distance of transmission was 400 miles. When it is considered that no station in the system used an input of over one kilowatt, that communication was at 250 meters where static is usually at its worst, and that the season was the most unfavorable for radio work, it would seem that only very meager results could be expected. Actually, however, an average of 26 recorders stood watch every evening and on no occasion were less than 20 on duty. This performance did not decrease during the period of the tests, the operators having the necessary interest to spend night after night at their instruments struggling with the uproar due to atmospherics. More than half of the schedules listened for were copied in the form of 1260 curves sufficiently good to be used in the final analysis.

The tests were all made at a wave length of 250 meters, under permits issued by the Radio Inspection Service, Department of Commerce. These permits were not necessary for the special amateur stations 9ZN and 8XK nor for the Naval Station NSF. The method of recording the variations of signal intensity is shown in Fig. 9. The test schedule consisted of the alphabet, each letter sent five times at a speed equal to eighteen words per minute, so that the alphabet required about three minutes for transmission. As each letter was received the operator indicated on this chart the intensity at which it was heard, so that when the schedule was complete a curve had been secured showing the swinging during the three-minute period. The intensity scale used may not seem especially satisfactory but its use was unavoidable since an audibility meter cannot be used satisfactorily with a regenerative receiving set, and as a matter of fact, the performance of the method is very good under severe tests. A laboratory test of the method can be seen in Fig. 10. Buzzer transmission of the actual schedule was sent through the primary of an ordinary coupler to the secondary of which two headsets were connected in series. The operators independently recorded the intensity of signals which was varied during transmission by altering the coupling. It will be seen that the curves are alike excepting as to the judgment of the average strength of the signals, so that one curve lies higher on the chart than the other. Many such tests were made, and in no case were the results less satisfactory than those shown on this chart. A test of the method under actual operating conditions is shown in Fig. 11, where Mr. K. B. Warner and H. P. Maxim, at 1AW, Hartford, Conn.,

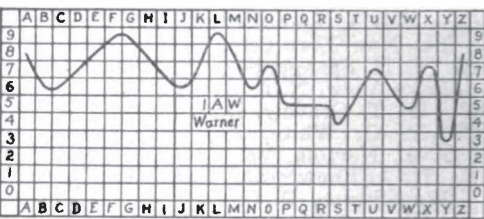
recorded the signals from 2JU at Woodhaven, Long Island, simultaneously. The curves do not represent variations in received power since a receiving set operating near the critical point at which it begins to regenerate has something of the characteristics of a generating set and amplifies weak signals more than strong ones.

Method of Testing

The method of running an actual test was as follows: At 10 p.m., eastern standard time, all the sending stations listened for time from Arlington. At 10:10 the first station, 1AW, at Hartford, Conn., (Fig. 1) made a long QST call, saying repeatedly "Bureau of Standards—A.R.R.L. Fading Test." Both the call and the notice were repeated, then the station started to send the test schedule, repeating each letter five times as has been mentioned. All recorders able to hear 1AW tuned in during the QST, and thereafter left all adjustments alone and recorded signal intensity. After the schedule 1AW signed off.

Three tests were made each week, on Tuesday, Thursday and Saturday evenings, the transmission by 1AW coming at 10:10 p.m. eastern standard time, 2JU at 10:20, NSF at 10:30, 8XK at 10:40, 9ZN at 10:50, 9LC at 11:00. After being added to the list of senders, 8ER also transmitted at 11:00. The ranges are sufficiently small in the Mississippi Valley during the sum-

mer time so that no interference occurred between 8ER and 9LC.



Transmission by 2JU - July 1, 1920

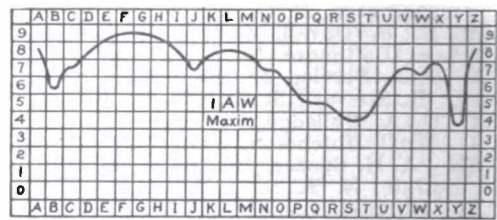
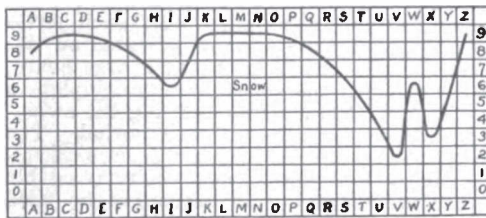


Fig. 11—Two operators receiving at same station. general reception conditions on various waves, and any special conditions. Most of them did this very well and also used this space for indicating general static conditions during the evening. The exact method of recording varied, as it was modified during the tests by reason of improvements suggested by the observers. At first our impression was that the swinging would be very slow, hence the intention was to use a check mark for each group of five letters. This was not adequate as the swinging was often more rapid than could be so shown. Several observers suggested a different observation form in which one column was allowed for each letter, that is to say, five times as many columns as in the present form. This would have been good but clumsy; even the present form is exceedingly unhandy when large numbers must be analyzed. Another suggestion was that a continuous curve be drawn by moving the pencil slowly as the signals come in. This sounds well, but in practice is subject to violent errors when long slow fading takes place, as the temptation to keep the pencil moving in the same direction is irresistible when the curve has continued in the same direction for, say, 20 seconds. The result of this tendency, which appeared both in the field and in laboratory tests, is that slow

(Continued on page 37)



Laboratory Test of Recording Method

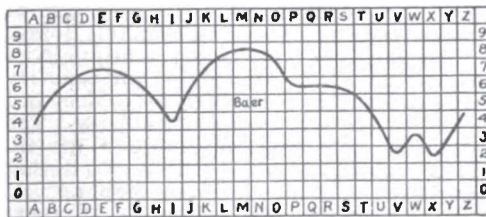


Fig. 10

On every test night each recorder who was on watch filled out one curve sheet (Fig. 9) for each sender that he could hear. At the close of the week he sent in all the sheets made during that week. The origi-

The Young Squirt's Second Epistle to The Old Man

By QRU

Say fellows, this bird is getting GOOD. In this story he visits T.O.M. and we know you'll get a rib-ache from it. It seems to us it's high time our grouchy old friend had something to say about these things, too. Next month.—Ed.

BY the ever living Ohm Sifter and Most High Dingle Snatcher, also by my most holy Halidom, our September magazine is a humdinger! I'm tickled foolish and have been prancing around the house in such delirious delight that I have just knocked the kid's bank off the shelf. The Fourth of July has gone and went, Doc Cook's shadow has grown less, George Washington is dead, Charlie Ponzi has gone broke, Charlotte Corday has murdered Murat, and last but by no means least, prohibition is prohibiting; still I'm as happy as a new born lark, and that's some joyful. I dance with supreme joy, don't care if my iron wire antenna comes rattling down. "Why", say you, and I'll affirm right here that you've got a darned good right to make the gentle inquiry. So here's where I let you all in on the song and dance. "Whoopee", as our mutual friend, Bill Hart, would say. The September issue of our QST has no "Rotten" article. I guess that Old Beeswax has melted and run. Howl children, all t'gether:

The Wouff Hong has gone
All yell in high pitch,
Yea, he has skeedadled;
The Darned Rettysnitch.
Rah, rah, rah,
Who are we?
We're the boosters
For QST.

My mind is free to act. That was some load to get off it, Eddie. I shall proceed. However, there is something else I want to dispose of, as the old maid said when she tried the chowder out on the family cat. I'm here to tell you of a dream that I had the other night. Now, there are dreams and dreams, and some dreams are great dope. This dream that I had the other night was the outcome of a very large lobster salad, copiously bathed in vinegar and accompanied to my chow hall by a large and delicious dish of chocolate ice cream.

Let us begin at the beginning. All things have beginnings with the possible exception of that howling old mannikin from the west. He just growed, I guess. We are darned well sure he's here, however. Before I had this remarkable dream,

I escorted a dream home. I mean one of those dreams who magnanimously allows you to take her to the theatre, then gets you to blow her to a good feed and allows you to lean over the fence and look into her dreamy eyes. Your heart goes out to her in fond regard. You say "Good-night" and with muffled oar, silently beat it home. Another week's salary gone wrong. What you had spent would have bought a darned good amplifier.



"..... lean over the fence and look into her dreamy eyes."

Well, I had arrived home and had been greeted by Tiny, our Siberian bloodhound. I beat it up stairs and was sitting on the edge of my Ostermoor humming, "I'm But a Stranger Here, Heaven is my Home", when the tranquillity of my bump of amativeness was disturbed by a dark twinge of the stomach. With my usual fortitude and a touch of fiftytude, I ignored this warning of an outraged stomach. I bent my strong will to the task of sleeping, realizing that my boss would raise Cain with me on the morrow if I didn't show my usual degree of semigiliousness. After counting all the little sheep into their folds that ever could be wandering, I fell into a fitful doze. I say fell, perhaps it were well that I say precipitated.

My first impression was that I was going

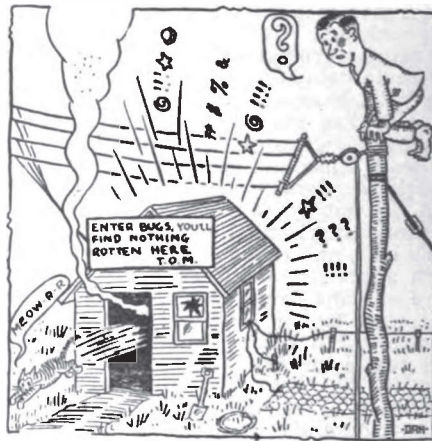
far away, and with great speed. My mind cleared. I had, in some manner unknown to myself, been transported to the top of the antenna at 1AW. Mr. Maxim was below. He had a large telegraph key in his hand, on the end of which was a gadget that looked like unto a large Turkish fountain pen. He looked up at me and yelled, "You are now about to embark on a rash undertaking, young man. Me and Tuska are going to try to shoot you west in search of THE OLD MAN. We have pooled in and have managed to scrape together enough kale to purchase a large pail of kilowatts and in a few moments you will be on your way." I looked at him and tried to maintain my gravity, I mean gravity. Summoning out my USNRFF, or in other words, my reserve, I responded, "Sir Hiram, I go in the pursuit of knowledge, and if I ever find that howling Old Knowledgebox, It's me and him. But for the love of mud, what in tarnashun is that thing that you've got there that looks like the east end of a hickey." His chest swelled with the pride of Josephus when reviewing the navy. "That", said he "is my silencer, to be used to aid you in maintaining silence while you are propelled through the ether accompanied by old man Hertz." I confess that momentarily I was ill at ease, but having called out all the Class Four reserves, I resigned myself to fate, realizing that the regular navy was too busy to bother with me. So I yelled at him in unmistakable bravado, "Shoot, old kid, I go to enlighten the heathen." The next thing I knew, I didn't know anything. When I recovered, I realized that the secret of the gas turbine had been discovered, for I was being propelled along at a terrific rate; dash—but I couldn't get my old faithful mouth open to save Robespierre from the gelatine. On and on I sped. I wasn't going at feet per second, kind reader, I was making meters. 186,000 per second and that's some faster than Weston ever could turn 'em out.

Finally I noted with some degree of comfort that I was slackening speed somewhat and that I was volplaning down to a thing that looked like an immense pigeon trap. Upon getting closer I could see that it was composed of chicken coop netting and old odds and ends of hay wire. It was suspended in the air by very rickety looking Czecho Slovaks, or to be explicit, Poles, which howled in anguish with every gust of wind. With a swoop I was seated on this miserable looking contrapshun and tried to compose myself to take a slant below. My speech could not be coaxed to make itself heard.

Beneath this mess, which I now realized served as an antenna, was a little house over the door of which was written, "Enter

bugs, you'll find nothing rotten here.—T.O.M." "T.O.M.!" Where had I seen these letters before? I mused, yea I meditated. All at once it dawned on me, as the Kaiser said when the sixteen inch shell went down the back of his neck. "The Old Man's dump, by ginger". I sat very quiet because I couldn't do otherwise. Finally smoke began to issue from the back door; no, no, not the chimney. This darned house didn't seem to rate any chimney.

The next thing that I remember a cat let out an awful howl and came flying through the door with the speed of a Haytian revolutionist chasing a Chinaman



"I tried to compose myself to take a slant below."

through the streets of Cape Town. Then the air was disturbed by cussing emanating from the house. I bent to listen and here is what I heard. "Well, darn you, Betsy, I get you moting and every blankety time I press my key you shoot a field coil. Darned if I don't send you back to the junk shop where I got you in New York. Turnsback's got to come coco on this deal. The whole blankety blank works are on the bum" Period. "#\$%—&'()

I meditated, "Wonder who in the name of Guglielmo is Betsy" when my equanimity was disturbed by a jolt in the west side of my trousers. Then I heard a shout and another choice collection of cussing. "What the blankety blank's the use, I'm going outside to see what my decrement is." Through the door issued (and "issue" is the proper word, the darn thing didn't walk, I'll be bound) the funniest looking specimen of—shall I say—manhood; that I ever clapped my hypermetropic specs on.

It had short stubby white hair beneath which was a weazened old phizog that looked as though it had beat it from home at the time that Pharaoh was frying Cheops. On the dome was a silk hat,

much battered, probably a remnant of the Blaine and Logan campaign. From beneath this hat protruded a pair of head phones which looked as tho they might have seen service on The Carlo Alberto. The shambling figure was attired in a form fitting suit probably purchased for the aforementioned campaign from the Tiers Sawbuck catalog. Around the emaciated calves I noted a pair of linemen's climbers. This bird was smoking a corn cob pipe, and I will say that he didn't have any regard for the amount of tobacco that he smoked. Did I say tobacco? I mean the rubber from the tops of storage cells, if I am to judge by smell. This, I guess was the smoke that I had previously observed coming from the door. Well, if that bird came from the rib of a man his father must have had a lot of children to bring him up.

He paused and I now noted that he had a tape measure in his hand and that his dried up lips were moving. "I got to find out what my decrement is. Milt West says that I'm disturbing the whole doggone rotten neighborhood." With that this old dingbat started to climb one of the rickety masts with the aid of his climbers. He

made a half hour every twenty minutes. Finally he reached the top and was shaken back and forth by the breezes. After getting his breath he commenced to yell to his friend wife. The poor abused lady came out of the house and Old Jingle yelled as follows. "Old Woman, I want to get the Napierian Logarithm of decrement of this beautiful antenna of mine. Now I shall hold the end of this tape measure and I want you to take it into the kitchen and let it go up thru the skylight, after which you go onto the roof and jump from there to me and bring the tape with you. After that we will multiply our results in meters by pi and then by heck, I'm sure that we'll have the dope so that we can give Milt a good bawling out." The poor lady hesitated. Gathering up her already shaken nerves the deluded being protested as follows. "Thomas, yesterday you had me break out all the table salt in the house because you said that you couldn't spare the change to buy Sal Ammoniac to charge the battery on the front door bell. Then you had me go in the cellar and turn over five tons of coal looking for some lead sulfide that might have gotten mixed in it by
(Continued on page 22)

Bulb Oscillators for Radio Transmission

By L. A. Hazeltine

Professor of Electrical Engineering, Stevens Institute of Technology

PART II.

Circuit Design

When the various bulb adjustments have been decided on, and when the constants of the load are known for a specific case, we may proceed with the design of oscillator circuits. The numerical calculations in a radio-frequency circuit are simpler than in a low-frequency circuit because the reactances are usually so high in comparison with the resistances that the latter may be neglected in computing impedances, except when the reactances are cancelled by tuning. Thus, with resistance neglected, the impedance of a coil is ωL , that of a condenser is $(1/\omega C)$. That of a coil and condenser in series and tuned to resonance is r . Here the symbols having the meanings indicated in Table I and are expressed either in standard units or in the more convenient radio units.

Let us calculate, for example, the proper circuit constants for a 300-meter radio transmitting set using for oscillators two type T pliotrons (Navy designation CG-1162, Signal Corps designation VT-14),

and a 20-ohm (0.20 kilohm) 0.0005-microfarad (0.5-millimicrofarad) antenna, first with the connections of Fig. 9 and secondly with those of Fig. 10. A test of a bulb of this type operated below normal rating to increase the life, gave at a heating current of 1.7 amperes the optimum values of Table II, corresponding approximately to the condition of Fig. 7. The last three items of this table are needed in the radio-frequency calculations and are copied in Table III, together with the antenna data. The lower part of this table gives the calculations for the circuit of Fig. 9, employing the "convenient radio-frequency units" throughout. Similar calculations for the circuit of Fig. 10 are given in Table IV. (In this latter case M , signifies the mutual inductance between the portion of the coil included in the plate circuit and the portion included in the antenna circuit.)

For simplicity's sake in the above calculations, no account has been taken of the inherent capacities of the various parts. This can best be done by reducing such capacities to the equivalent values in

TABLE I. Notation

Symbol	Quantity	Standard Unit	Convenient Radio Unit	
			for low power	for high power
E	Voltage	Volt	Volt	Kilovolt
I	Current	Ampere	Milliampere	Ampere
P	Power	Watt	Milliwatt	Kilowatt
r	Resistance	Ohm	Kilohm	
C	Capacity	Farad	Millimicrofarad	
L	Self-inductance	Henry	Millihenry	
M	Mutual Inductance	Henry	Millihenry	
ω	{ Angular Frequency 2 π \times Frequency	Radian per second	Radian per microsecond	

TABLE II. Bulb Test Data

Plate supply voltage	E_b	252 volts
Plate current (direct)	I_b	21.3 milliamperes
Grid bias voltage	E_c	44.5 volts
Grid bias resistance	R_c	15.66 kilohms
Plate alternating voltage	E_p	122 volts
Grid alternating voltage	E_r	84 volts
Useful power output	P	3220 milliwatts

TABLE III. Calculations for Fig. 9.

Bulb Data (2 bulbs)	Antenna Data
$P = 6440$ mw. $E_p = 122$ volts $E_r = 84$ volts	$\lambda = 300$ meters $C = 0.5$ millimicrofarads $r = 0.02$ kilohms
$\omega = \frac{1885}{\lambda}$	$\omega = \frac{1885}{300} = 6.28 \text{ rad}/\mu\text{sec.}$
$\omega L = \frac{1}{\omega C}$	$L = \frac{1}{(6.28)^2 \times 0.5} = 0.0507 \text{ mh.}$
$P = I^2 r$	$I = \sqrt{\frac{6440}{0.02}} = 568 \text{ ma.}$
$E_p = I \omega M_p$	$M_p = \frac{122}{6.28 \times 568} = 0.0342 \text{ mh.}$
$E_r = I \omega M_r$	$M_r = \frac{84}{6.28 \times 568} = 0.0235 \text{ mh.}$

the main oscillating circuit, by multiplying each by the square of the corresponding ratio of voltages. Such capacities usually amount to a few hundredths of a millimicrofarad and so are appreciable. For example, let us assume in Fig. 9 and Table III the following capacities:

Plate and connections,	0.03	} 0.05 μf.
Plate coil,	0.02	
Grid and connections	0.02	} 0.035 μf.
Grid coil,	0.015	

Antenna coil, 0.02 μf.
Then the total effective capacity to be added to the antenna capacity is

$$0.05 \times \frac{M_p^2}{L^2} + 0.035 \times \frac{M_g^2}{L^2} + 0.02 = 0.05 \text{ μf.};$$

so that instead of 0.5 μf. we should have used (0.5 + 0.05 = 0.55 μf.)

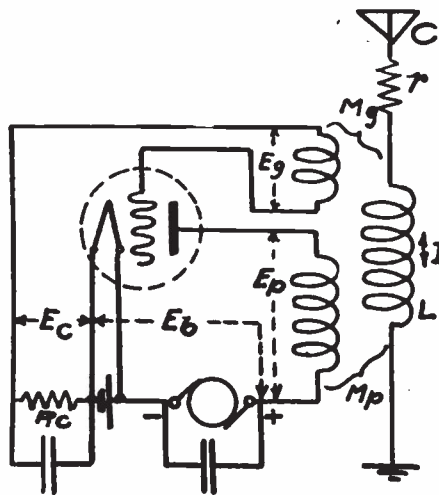
For the coil design we may employ the empirical formula,

$$L = \frac{0.0008 a^2 N^2}{6a + 9b + 10c} \text{ mh.},$$

where N is the number of turns and a, b and c expressed in inches are respectively the mean radius, the axial length and the radial depth of the winding section. (In single-layer coils c is then zero.) The mutual inductances are given in terms of the self-inductance and the coefficient of coupling k by the usual formula,

$$M_{12} = k \sqrt{L_1 L_2}.$$

The calculation of k is beyond the scope of this paper. It will be nearly unity when,

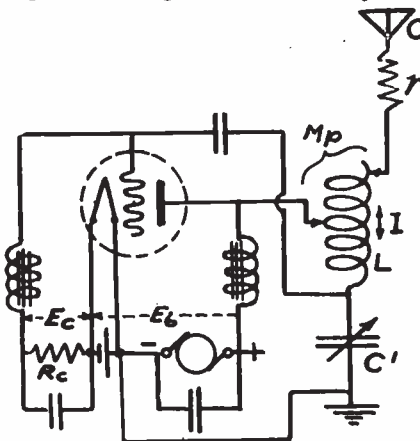


-FIG. 9-

as with M_p in Fig. 10, the two coils have a large portion in common. For two like single-layer coils placed end-to-end in contact, k will be given approximately by the formula,

$$k = \frac{a}{a + 3b}$$

In Fig. 9 care should be taken to couple the plate and grid coils closely to the



-FIG. 10-

antenna coil and less closely to one another, to prevent a short-wave oscillation in which the antenna does not take part; and where the values of L and M, come out nearly alike (as in the example) it is convenient to connect the plate and the antenna to taps on the same coil, as in Fig. 10.

Symmetrical Oscillators for High Outputs.

As explained previously in connection with Fig. 1 and 2, high efficiency of a bulb oscillator requires that the plate current should flow only during the time while the plate potential is low; and this result can be attained with the usual bulb circuits only by limiting the plate current to a small portion of the cycle. The plate current must have a high maximum value, therefore requiring a high filament temperature, and will be rich in harmonics. The ideal condition would be that of Fig. 1, where the plate potential and plate current are substantially constant for half of each cycle, the plate current being zero for the other half. This condition has been attained by the author with the symmetrical circuit arrangement of Fig. 11a.

In Fig. 11a the plate coil L_p and the grid coil L_g are coupled as usual to produce an oscillation which is transformed to the load essentially as in Fig. 9. Taps from the centers of these coils lead to the filament through the impedance coil Z and

plate generator and through the resistance R_c , respectively. The impedance coil Z is designed to choke out practically all alternating plate current and to pass only a non-pulsating direct current. If the grids of the two bulbs are so highly negative for alternate half cycles as to reduce the corresponding plate currents to zero, then the constant current of the generator will flow to one plate for one half cycle and to the other plate for the next half cycle, giving a rectangular plate current

R_c will be so high compared with the internal resistance of the grid circuit in this half cycle that the grid potential will remain very low; moreover, the grid potential will then be nearly constant, as it varies only slowly with the grid current. In the other half cycle, when the grid is negative, no grid current flows and the grid potential will be negative by the half voltage of coil L_r plus the nearly equal voltage drop in R_c . Hence the grid potential will vary as represented by the wave

TABLE IV. Calculations for Fig. 10.

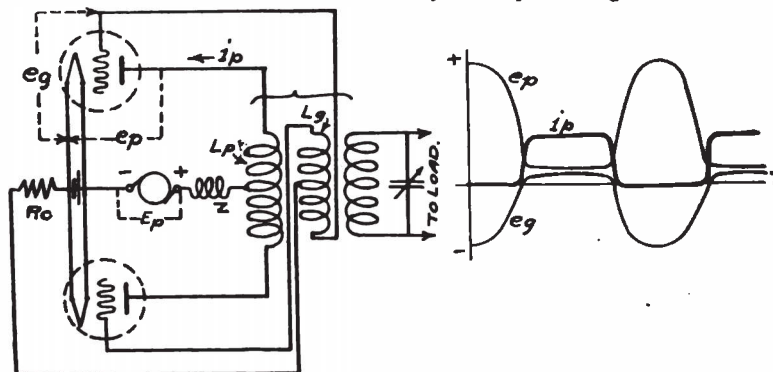
Same Data as in Table III	
$\omega = \frac{1885}{\lambda}$	$\omega = \frac{1885}{300} = 6.28 \text{ rad}/\mu\text{sec.}$
$P = I^2 r$	$I = \sqrt{\frac{6440}{0.02}} = 568 \text{ ma.}$
$E_p = I \omega M_p$	$M_p = \frac{122}{6.28 \times 568} = 0.0342 \text{ mh.}$
$E_s = \frac{I}{\omega C'}$	$C' = \frac{568}{6.28 \times 84} = 1.076 \text{ m}\mu\text{f.}$
$\omega L = \frac{1}{\omega C} + \frac{1}{\omega C'}$	$L = \frac{1}{6.28^2} \left(\frac{1}{0.5} + \frac{1}{1.076} \right) = 0.0743 \text{ mh.}$

wave as indicated by i_g , Fig. 11b.

Each grid circuit, including the common resistance R_c , will receive half the alternating voltage of coil L_r , and will permit current to flow during the half cycle in which the grid is positive. The resistance

e_s Fig. 11b, consisting approximately of a straight line and a half sinusoid. The voltage across R_c will consist of half sinusoids and will be of double frequency.

The plate potential, during the half cycle of positive grid will be low and near-



-FIG. 11a.-

-FIG. 11b.-

ly constant, since it has to produce a constant current with the aid of a nearly constant grid potential; during this interval most of the half voltage of coil L_p and most of the generator voltage E_g will appear across the impedance coil Z . In the other half cycle, when the grid is negative and the plate current is zero, the plate will be positive by the half voltage of coil L_p plus the voltage across Z plus the generator voltage. Hence the plate potential will vary as represented by the wave e_p , Fig. 11b, consisting (like the grid potential) approximately of a straight line and a half sinusoid. The voltage across Z will consist of half sinusoids with a displaced axis and will be of double frequency.

Conditions in Fig. 11 are complicated when the bulb and coil capacities are appreciable, as would occur especially at short waves. Instead of the single coil Z , it might then be desirable to use two coupled coils directly adjacent to the plates, thus eliminating the double-frequency potential of the coil L_p .

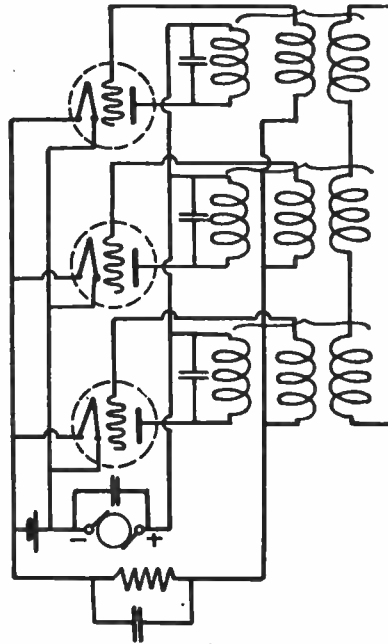
The arrangement of Fig. 11 is most useful for high-power bulbs, in which the plate potential during the flow of plate current is a small fraction of the direct supply voltage, and in which the output is limited by plate heating; for here the lowering of the plate loss would be relatively great and would make possible much higher outputs per bulb. It is doubtful whether this arrangement would result in any great improvement when applied to low-power bulbs operating on short waves, as in most amateurs' stations.

Polyphase Oscillators.

It is well known that two or more bulb oscillators having approximately the same frequency will tend to pull into synchronism when coupled. If three coils, one supplied from each of three oscillators, are connected together to constitute a closed circuit, the three oscillators will be coupled and brought into synchronism. The vector sum of the alternating voltages of these three coils must be zero; so in general the voltages will be in polyphase relation.

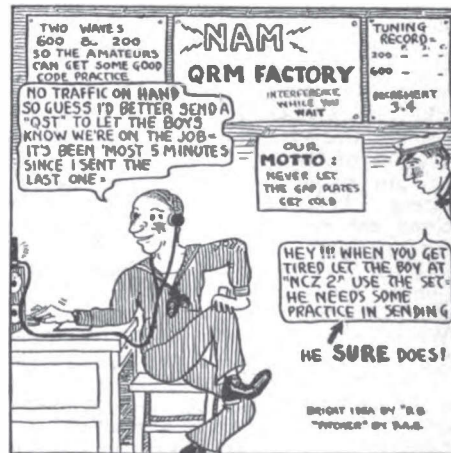
The above principle has been applied by the author to produce three-phase oscillations with the connections of Fig. 12. The three oscillators are alike throughout and produce equal alternating voltages in the three synchronizing coils at the right of the figure. These voltages then combine to form a three-phase equilateral triangle. It is found that the frequencies of the separate oscillators may differ greatly without preventing their being pulled into synchronism when the circuit through the synchronizing coils is closed; for a correcting current will flow through the local

circuit of these coils to satisfy the electrical relations required in each oscillator circuit. The same action takes place in case loads of unlike phase angle are connected across different phases since the plate current and plate potential of each bulb must be in phase.



-FIG. 12-

It does not seem unlikely that polyphase bulb oscillators may be useful in supplying power to a number of suitably spaced antennas for sharply directive radiation.



Some More C. W. Ideas

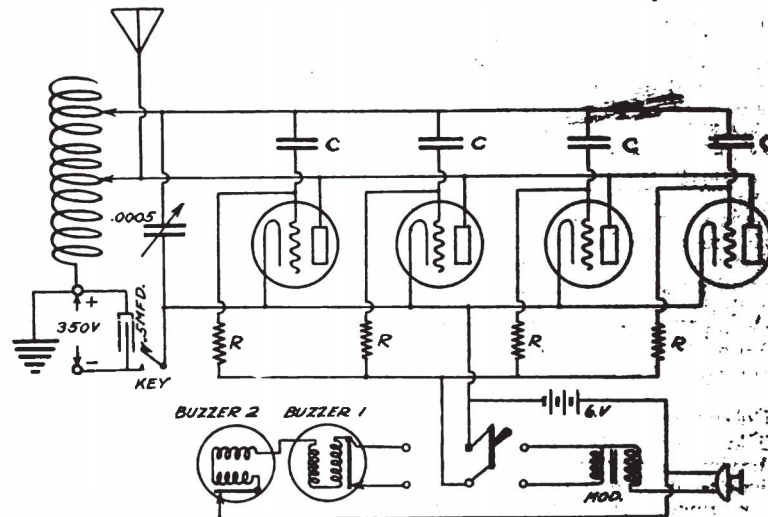
By Arthur J. Funk

Assistant, Dept. of Science, Senior High School, Savannah, Ga.

I have read much in our magazine about continuous wave and modulated C.W., and inasmuch as I have done considerable work with tube transmitters it is but right that the cream of my efforts should be given my fellow workers.

Of over twenty-five circuits thoroughly tried, I have at last concluded to use the electrostatic circuit in preference to all others; first of all, because of its high efficiency, and secondly, on account of its simplicity. The circuit I am now using at 4XB is shown in the attached diagram. The switching arrangement is such that

grid-to-filament resistance is apt to get the entire discharge, which means that the other tubes will continue to draw current without oscillating, causing them to heat. The installation of individual condensers and leaks in our station increased our radiation over 100% and stopped all tube heating. The condensers, C, for VT-2's at least, should be not less than .0005 mfd. and not more than .0008 mfd., preferably of mica. The grid leaks, R, are made of glass tubing, about 2 mm. inside diameter, 4 in. long, packed with lampblack, with brass plugs at each end.



one DPDT switch closes the circuit for either phone or buzzer.

I believe that under no circumstances should tubes be used without grid condensers, because the space current will travel to the grid and thru the grid coil instead of going direct to the filament, since the resistance of the grid winding is much less than the space resistance from grid to filament. This would cause the grid to become hot and bombard the filament by secondary emission, endangering the life of the tube, as evidenced in oxide-coated-filament tubes so used when the filaments begin to sputter.

When more than one tube is used, individual grid condensers and leaks should be employed so that each tube will get the proper grid discharge and leakage—which is impossible with a common grid condenser because the tube with the least

The best value for VT-2's is between 8000 and 10,000 ohms, depending on the filament current.

The best buzzer modulation is obtained by breaking the grid leak circuit with the contacts of a buzzer whose fields are in series with another buzzer, the second buzzer controlling the frequency, as shown in the diagram. When using the contacts of but one buzzer to open the leak circuit, it is seen that the chopping is poor since, while the contacts are open, the circuit is still closed thru the key and battery side.

For telephony we use a large transformer of about 15 watts input, in the leak circuit as shown, and in order to handle the primary input at least three microphone buttons are used in parallel, on a potential of 6 volts.

(Concluded on page 39)

Radiophone-Telephone Linking

OUR readers have read of the many successful experiments in linking a radio phone set and the ordinary wire telephone whereby speech may be transmitted over both systems, but we know of no work done in that line by amateurs. Now that radio phones are becoming popular, there are some interesting possibilities in this work. When listening to a radiophone concert, haven't you wished that you could call some friend on the wire phone and let him hear it too? And, going a step further, if two of you have radiophones, wouldn't it be interesting to have a system whereby each of you could link up the land phone to your sets so that any one with a telephone in their house could be reached direct by you, the other operator, or any part in his town?

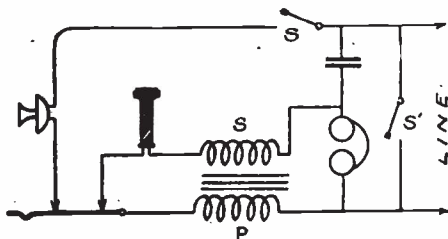


FIG 1

With a little care this can be done without the slightest trouble to the telephone company.

Such systems of course require an operator at each radio station to tune in the signals and to throw the change-over switch at each conversation, as breaking-in as done on the ordinary phone is of course not possible by ordinary radio. The idea, then, is to take the incoming speech from

thru the secondary of the telephone transformer, as shown in Fig. 2. When a phone line is idle, the circuit is open to d.c. (altho ringing is accomplished by a.c. thru the large paper condenser). Removing the receiver closes the circuit and attracts the attention of Central, so that if any experiments are to be made which might result in closing the circuit, it would be well to insert a switch in the circuit as shown at S, to temporarily open the circuit. Likewise, when connection is once established, breaking the circuit is the signal to Central to disconnect the line, and if any changes in circuit are to be made while a connection is held, it would be well to arrange another switch to short the line, as S'. Leads, then, are taken from the secondary of the transformer and run to the radio set, and the headset, of at least 2000-ohms, connected across them.

In the writer's experiments it was desirable to make no changes in the radio set and it was consequently necessary to perform the modulation thru the usual microphone circuit of the radio set. This made it necessary to step up the incoming speech thru a one-stage amplifier (see Fig. 2), the output of which was connected to a step-down transformer whose secondary was of fairly low resistance. This secondary was connected in place of the microphone in the radio set. For receiving, the same amplifier was used to amplify the radio-received speech, which was then impressed on the line thru the telephone transformer secondary as previously mentioned. The diagram is self-explanatory, and shows a 4PDT switch for the change-over.

Considerable success has been had with

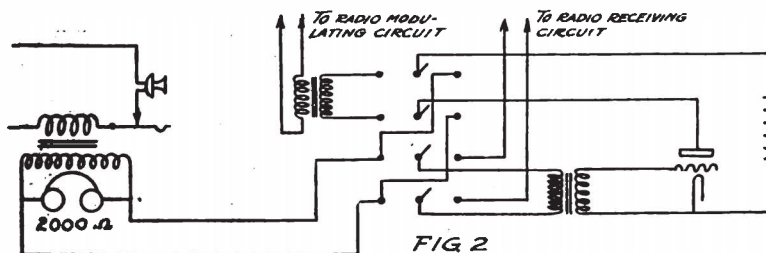


FIG 2

the line, use it for modulating the radio output, and, at the receiving station, to impress the received speech on the line, with an operator listening in all the time at each station.

The circuit of the usual central-station-energy telephone is shown in Fig. 1, and in the writer's experiments the best method of coupling to the line was found to be

mechanical "couples" formed from a Baldwin mica-diaphragm receiver and carbon-granule microphone, by removing the microphone diaphragm and adjusting the two pieces of apparatus (either by taping together or mounting in an improvised stand) so that the receiver diaphragm rests with proper pressure on the movable electrode of the microphone, thus forming a

very sensitive mechanical amplifier. Substitution of such a "couple" in place of the step-down transformer in the circuit of Fig. 2 will give much more vigorous modulation, and it can also be used as a mechanical amplifier in receiving, but has the objection that often it is impossible to find an adjustment satisfactory for both the transmitted and received speech, since generally they are of different orders, and like all such devices its adjustment is critical.

This work was done with sets employing the Heising d.c. method of modulation. Grid-leak modulation is much more common in amateur sets, however, and it is suggested that if the fluctuating potential set up across the terminals of the telephone transformer secondary were conveyed directly to the grid-leak circuit, the amplifier and transformer might be eliminated. With tube repeaters and other apparatus, the Navy and some of the commercial radio companies have been able to perform this linking with utter nicety, and the arrangements described herein are at best but crude experiments, but they show the possibilities for the amateur, with even limited equipment.

THE YOUNG SQUIRT'S SECOND EPISTLE TO THE OLD MAN

(from page 15)

mistake. But I draw the line on this Wright Brothers stuff. You can write Milt West and tell him that I draw the line on the acrobatics. I'm gonna finish baking them pumpkin pies, after which I'm gonna play Beethoven's Sonata on the old melodeon".

Upon hearing this, Old Parchment Face let out a tremendous roar. He shouted, "Woman, when you married me in 1801 didn't you promise to love, honor and obey?" The lady snapped out of it with a start and muttering, "You're my lord and master", by heck, she took the end of the tape measure and proceeded to carry out the wishes of this ancient lump of clay. Then did he grin. I distinctly heard him say, "When I speak, the whole rotten lot of 'em stand around."

Whereupon the lady started to wail and moan while Old Hatchet Face, sitting on his perch, chuckled with hellish glee. Grasping the end of the tape line she shambled into the house, only pausing to trip over the aforementioned bruised and battered cat who had temporarily taken up its abode in the doorway. She stooped and carried Tabby within.

Finally she emerged from the doorway and placed a ladder against the wall of the house and got to the roof. With much effort she moted to the skylight, opened it and by the great horn spoon, who should emerge but the cat with tape securely

knotted to her tail. Then Old Drybones commenced to coax the cat to jump to him. "Pretty kitty", said he, "Come to dadda". Fine language for the lord and master. After much coaxing Tabby jumped and the bird on the mast caught her. He took note of the reading on the tape and slid to the ground accompanied by his cat and many moans and groans.

Upon reaching terra cotta he made a kick at the poor animal—removed a slip stick from his pocket and tried to delude the world at large into believing that he knew how to use it. He muttered at great length about Alpha and Omega—finally got to Pi and Lambda—took off the Blaine and Logan cheapeau and threw it on the ground, stamped on it and otherwise worked himself up into a rage. He was fussing and fuming around when a yell came from the roof. The Mrs. Old Lady had slipped and was falling to the ground at express rate speed. Old Whiskers looked up and said; "Hold on, I can't afford a funeral this year"! Whereupon the party of the second part replied in a woeful tone, "I die in the name of science and now you won't get any pumpkin pies". Jingle howled in anguish, and hurried as fast as he could to the spot where his faithful tho antique spouse lay on the ground. She looked into his dim eyes and gently murmured; "I go to a better world, Thomas, but before I go will you please see if the pies are done and tell me what you decrement is?" And he answered, "Aw, you go to Hoboken!" Could a worse curse be put on anyone?

During these tragic moments I was vainly trying to get down from my perch but could not seem to break the spell which held me.

Finally the Old Man took a slant aloft and let out a demoniacal yell. "By the living gods, what kind of a rotten looking animal is this I see astride my mast? I'll tear you limb from tree." He deserted the spouse of his buzum, and went into the house, all the time launching invectives that his serenity should have been disturbed by a "Rotten Young Squirt from the East." He came out in a few minutes with a shot gun, took a good careful aim at me and pulled the trigger. "Boom!" went the gun, and I was awakened from my fitful doze. I was in a cold sweat and was pulling Dempsey stuff on my pillow. I caught myself yelling, "you darn Old Uggermuff, I'll beat the living daylight out of you, providing you've got any in you."

So I arose from the Ostermoor that I had purchased on the installment plan, went below to the kitchen and broke out the raisins. I'll fix 'em up in a little luke warm water and in a coupla weeks I'll be prepared to fly Old Electricity alive.

I'm all excited now!

Addendum to Mr. Groves' August Article

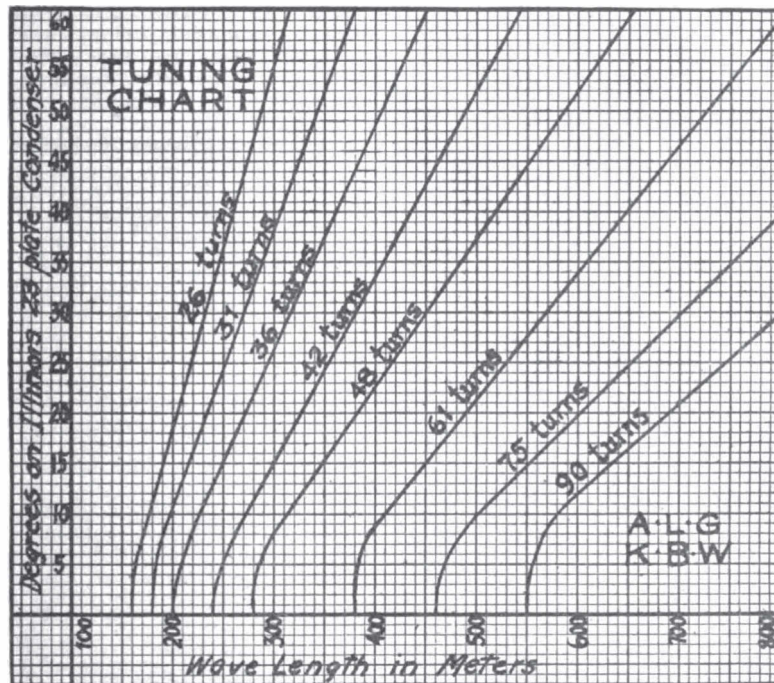
SINCE writing the article in August QST, I have conducted some careful experiments with the hand wound coils for short waves as described therein and the accompanying chart shows the wave length range of a number of them over 60 degrees of the Illinois 23 plate condenser. I have adopted the 23 plate condenser exclusively now for the secondary circuit as it gives better tuning on the short waves and at the same time allows tuning to 17,000 meters with ease when using the Honeycomb coils

to at least 400 meters.

Coil 61 operates nicely on all waves between 400 and 500 meters, and for extreme selectivity may be used as high as 600 or even 800 meters.

Coil 75 may also be used on any wave between about 460 meters and 800 meters. Its maximum range is about 1700 meters with condenser at 180°.

Coil 90 is designed especially for 600 meter work and is extremely efficient on waves between 550 and 650 meters—the tune where all the so-called 600 meter



The numbers at the top of each curve show the number of turns of wire on the cylinders.

Each cylinder is exactly 5¼ inches diameter, of XX Bakelite.

As can be seen, the 36 turn coil is used for practically all amateurs for maximum strength signals, as its minimum wave is almost exactly 200 meters, and it is very efficient for all waves between 200 and 230 meters—where most amateurs are tuned. For greater selectivity on these waves and a somewhat lesser strength of signals, Coils 26 or 31 are used.

Coil 42 has a minimum wave of about 240 meters and will operate efficiently up to at least 300 meters.

Coil 48 is designed especially for 300 meter signals and it will operate efficiently

stations may be located. It also operates nicely on 800 meters—the radio compass wave. It has a maximum wave length of about 1900 meters with the condenser at 180 degrees.

In actual practice a coil of 18 turns is used in the plate for 200-300 meters and the 36 turn coil for 600-800 meters. Coils 26 and 31 are used in the plate for waves between 300 and 600 meters.

With a large 115-plate variable in the primary only one coil is necessary for all waves between 200 and 800 meters. This coil is composed of 12 turns.

I hope this will clear up some of the tuning mysteries of short waves for a lot of your readers who may be just breaking into this interesting game.

—A. L. Groves.



Stolen Autos

HAVE any of you fellows ever thought of the possibilities of amateur radio in helping recover stolen automobiles? The matter was brought up here at headquarters recently and we took it up with the Chief of Police of Hartford. He is taking it up with the City Police Commissioners and we hope soon to have a regular schedule for broadcasting police alarms covering stolen automobiles. In practice the scheme is to have certain definite hours during the day if possible, and anyway, during the night, when everybody will be at his station on the lookout for police or other important alarms. Of course everybody cannot be on but there will always be some who will. The Police Departments in all the different towns and cities of a certain zone will know these hours and if they want any alarms broadcasted all they have to do is to telephone a few minutes before the hour set. Whether it is in Hartford, or Springfield, or New Haven, or Bridgeport or New London would make no difference. The alarm would be spread everywhere. Brief details of the number, make, style, and color of the stolen machine will be given and not only will every Police Department in the entire zone be apprised of the facts, but in addition several hundred radio amateurs would also have the data and unconsciously will be on the lookout. It would certainly seem that it would be more difficult for the thief to make a safe getaway than it is now. At the present time when an automobile is stolen and the local Police Department notified, each town and city has to be telephoned to separately. This takes time and costs money and all towns and cities are not notified. We amateurs are located in all sorts of places and all of us would be reached instantly and at no cost whatsoever.

Our idea of the best way to put the scheme into practice all over the country is for the local radio clubs to take it up with their local Police Departments and other radio clubs and work in zones. It would be a fine thing for all concerned except the thief. It would be the first time

that amateur radio stations would be put to a real practical use all over the country. Here is something for every club officer to bring up at the next meeting of his radio club. The scheme is a good one fellows, and let's do something with it.

The Midwest Convention

THE Midwest Division just couldn't stand it, and we don't blame them. So they are going to have a convention of their own, and we are glad. St. Louis is the place, and the time is the 28th, 29th, and 30th of December, the last of the Christmas Holidays, when the fellows will be home from school and when everybody will have some spare time. The energetic Bill and Benny are in charge, of course, and that means assured success and a whale of a good time for everybody who attends. We're going to try to get out ourselves, although it is a mighty long way from the Quist Factory.

The two young gentlemen mentioned are sawing off a job for themselves in trying to outdo the Chicago Convention, yet they swear they will make that Classic look like a meeting of the Knitting Club, and darned if things don't look like they would. St. Louis is a great place for a convention, and it is the first meeting of that kind in that territory. It will be a splendid opportunity for the amateurs of the valley states to get together and chew the fat, and to them we say "Go! It's the best thing you could possibly do—there's nothing on earth like meeting the gang face to face and talking things over." Good luck, fellows!

Distance Records

SAY, who has the amateur long distance record, anyway? Blessed if we know here at GHQ. It is claimed that pre-war 2PM, New York, was copied in Los Angeles at about the declaration of war. Old 2AGJ at Albany, we understand, was copied by a ship off lower California; 9ZN was reported by a ship 200 miles south of Balboa, 8DA was heard by a vessel off Venezuela, 6EA got through to Honolulu, an operator on a ship 3000 miles below

Frisco has reported a whole flock of stations, and now it looks like NSF has been heard in Bristol, England. But just what constitutes the supreme amateur DX record for approximately 200 meters?

All of us want to find out, so you fellows are invited to send in your claims to QST and we will co-ordinate the dope. Tell us the date, the input in watts, the wave length, the location of the recorder, and the distance claimed, and submit anything that may help to prove it. We'll publish an article on the subject when the material comes in. Let's do it right, so we'll actually know, and then in months to come we can keep record of the new marks that are made and know who is the title holder. Remember this is not a miles-per-watt record, but a pure distance classic—the most miles on an amateur wave length.

Au Revoir—Et Soyez Le Bienvenu!

THE month of September brought many changes in radio matters, none of which was more unexpected than the resignation from the Department of Commerce's staff of Mr. H. C. Gawler, Radio Inspector for the First District.

Starting in 1911 with headquarters at Long Wharf, Mr. Gawler became the first government radio inspector of us here in New England in the old days of disorder and any wave length and power. Later we found him on the seventh floor of the Custom House at Boston, with spacious quarters and a splendid view of the harbor. There amateurs and prospective operators displayed their skill to his satisfaction and in most cases received the coveted license. During the border uprisings in Mexico he served as a Captain in the Signal Corps, where he acquired an uncanny fondness for mules. As Communication Officer for the U. S. Navy he served as Lieutenant at the Azores during the late war. He now enters the amateur sales department of the Radio Corporation of America, with offices in New York, where he launches into the new field of amateur C.W. development. At a convention of amateurs in Portland in September, Mr. Gawler announced that the R.C.A. was preparing to soon put on the market a complete line of high-grade bulbs, including power tubes from five to two hundred and fifty watts, at prices within the reach of the average amateur. It is to superintend the sales of this equipment that he has entered upon his new duties.

Few radio inspectors have been more beloved by the amateurs than Mr. Gawler. He is a prince. His many friends regret to see him leave the First District, but are glad to see him better himself, and he has our heartiest good wishes.

Succeeding Mr. Gawler is Mr. Charles C. Kolster, formerly of the Ninth District, and brother of Mr. Fred Kolster, the decremeter wizard. A better successor we feel we could not have—it is our gain and the Ninth District's loss. Mr. Kolster's radio experience dates back to 1905, and he has seen much of radio in his work with the old Stone Tel. & Tel. Co., the DeForest Company, the United Fruit, the Bureau of Posts in the Philippines, the Naval Re-



Capt. H. C. Gawler, U. S. A.

serve, and with the Department of Commerce. Except while in uniform during the war, he has been a Radio Inspector since 1914, serving at Washington, New York, New Orleans, and Chicago, and now returns to his old home city, Boston. QST regrets that no photograph of Mr. Kolster was available in the short time we had, but our readers are referred to the illustrations in the story of the Chicago Convention in our last issue, where Mr. Kolster is seen as Chairman of the Trial Board of the Chicago Executive Council. This is a fair indication of the co-operation he has extended the amateurs of the country during all of his service—his administrations have been wonderfully successful. He is assured of the strongest support from the A.R.R.L. and we welcome him to the First District.

Our New Traffic Manager

ON August 27th Mr. J. O. Smith resigned as our Traffic Manager, and Mr. F. H. Schnell, A.R.R.L. City Manager of Chicago, has been elected as his successor.

The duties of the position of Traffic Manager in our rapidly expanding organization have grown to such proportions that for some time past it has been impossible for them to be done justice in the spare time of a busy business man, regardless of his unlimited enthusiasm for the work. This, and the many new things we as a League are undertaking, and the unlimited possibilities of our future growth, made it seem very desirable that, in electing a successor to Mr. Smith, a change be made in our League policy and someone be secured who could devote his entire time and energies to the work. Such a man, of course, would have to earn his living from our work, so that it was necessary for us to make the position a paid one. Two years ago all the work of our League was done by an enthusiastic few in their spare hours, and we really doubted that we would ever be able to afford a paid secretary. But that venture has proved successful, and our affairs have now expanded to the point where we feel that engaging the services of a man who can make A.R.R.L. relay progress his daily concern is the best possible step we could take. There are many things before us, and the correspondence of our Headquarters office is so intricately bound up with our Operating Department work that it has become imperative for our future growth that the Traffic Manager be located right here in Hartford along with the Secretary, working hand in hand. We feel that this marks a most important step forward in our affairs and will be of far-reaching benefit.

Mr. Smith is one of the best-known amateurs in the east, as he was long before he became our first Traffic Manager. During the years that he was in charge of our Operating Department it has been brought up by his efforts into the big, strong, effective, international amateur radio relay organization which it is today. Mr. Smith is entitled to feel highly gratified over the success of his hard labors—our Operating Department is what it is through the conscientious and intelligent work that he has done in perfecting the organization. For this his name will ever stand in A.R.R.L. history, and he has the gratitude of every A.R.R.L. man.

In Mr. Schnell we have a man extremely well qualified to fill his place, a man who has been phenomenally successful as an A.R.R.L. organizer, and whose achievements in A.R.R.L. work are already well known. As Chicago City Manager and

Chairman of the Chicago Executive Council, he has been personally responsible for the successful co-operation which has made Chicago an example in amateur affairs for the entire country. We know that he has the co-operation now of all our membership, and we regard his acquisition as a big gain toward a stronger and better A.R.R.L.

Mr. Anthony

WE welcome to our Board of Direction Mr. Harvey Mitchell Anthony, head of the Department of Applied Electrical Engineering of the Muncie (Indiana) Technical High School. Mr. Anthony is well known in amateur circles in his territory and we feel is a strong addition to our governing body. His professional work is consulting electrical engineering but his great interest in educational work holds him to his present school work, and in addition to this and his amateur activity he is a member of a number of scientific societies here and abroad. He brings to us vision, experience, and technical attainment, and we offer him the right hand of fellowship.

Straight C. W.

WHEN QST undertook the boosting of Amateur C.W. a good many months ago, we said that it was probable that, at first at least, we would have to use chopped or modulated transmission, because most amateurs assiduously avoid permitting their receiving bulbs to oscillate, and the transition would take time. We feel now that the time is ripe to make the plea for straight undamped, which is what we have had in mind all along. When we get that we have something! The straight C.W. is amazingly effective, even to one who has become accustomed to I.C.W. tube transmission. It is good for easily three times the distance that the same energy, modulated, will work over to a non-oscillating detector, with the superlative advantage that spark QRM is greatly reduced. In addition, as a great engineer has said, the best known minimizer of QRN is the oscillating audion. It takes less apparatus, and the efficiency is improved in another particular that one no longer worries about the percentage of modulation.

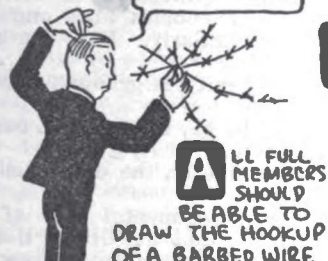
Every such problem has its bad points, and the receiving is the "nigger" in this case. It is hard to heterodyne such high frequencies as we use, yet it may be done if we have precision of adjustment. There are two improvements which must be made in our receivers: vernier tuning adjustments, and a shielded cabinet to avoid capacity effects from the operator's hands (Concluded on page 59)

WHAT TO DO AT YOUR RADIO CLUB


FURTHER MISINFORMATION

BY D.A. HOFFMAN


LESSEE NOW—



ALL FULL MEMBERS SHOULD BE ABLE TO DRAW THE HOOKUP OF A BARBED WIRE FENCE. IF THEY CANT— ANYTHING SIMPLE LIKE A SHORT WAVE REGENERATIVE TWO STEP AMPLIFIER HOOK-UP WILL DO.



MAKE A MOTION THAT TWO-THIRDS OF THE CLUB'S FUNDS BE SET ASIDE FOR REFRESHMENTS ON THE GROUNDS THAT IT WILL INCREASE ATTENDANCE

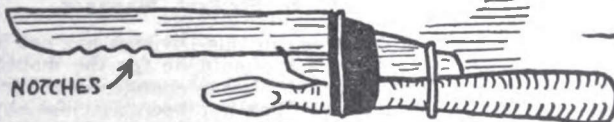


ONE MORE THING BEFORE I CLOSE— ETC. ETC

YOUR RADIO CLUB DANCE SHOULD HAVE RADIOPHONE MUSIC. IF THE RADIO PART OF IT DOESN'T WORK OUT O.K. YOU CAN RUN A WIRE TO THE CELLAR AND USE A MICROPHONE AND PHONOGRAPH INSTEAD. THE LADIES WILL NEVER KNOW THE DIFFERENCE ANYHOW.



MAKE A SPEECH LASTING AT LEAST TWO HOURS ON "WHICH SIDE OF THE METER YOU SHOULD GROUND YOUR SET."



THE ORIGINAL WOUFF HONG

DNVITE YOUR LOCAL "OLD MAN" (EVERY RADIO CLUB SHOULD HAVE ONE) TO ADDRESS A SPECIAL MEETING OF THE SPARK COIL QRM'ERS OF YOUR VICINITY. HAVE HIM BRING ALONG HIS WOUFF HONG FOR A DEMONSTRATION. THE MEETING SHOULD BE A LIVELY ONE !!



CODE PRACTICE SHOULD ALWAYS BE HAD. THOSE WHO ARE ALREADY HIGH SPEED OPERATORS ABLE TO RECEIVE TEN WORDS PER MINUTE MAY MONKEY WITH THE TESLA COIL ON THE SAME TABLE AS THE BUZZER. THIS WILL FURNISH REALISTIC INTERFERENCE.

THE OPERATING DEPARTMENT

F. H. SCHNELL
61 Waverly Bldg., Hartford, Conn.
TRAFFIC MANAGER



GREETINGS, fellow amateurs and members of the American Radio Relay League.

I have been appointed Traffic Manager of this great body of radio amateurs with the view in mind of increasing operating efficiency and increasing membership. This can be accomplished most reliably by the earnest co-operation of each and every member of the League. To that end I heartily solicit your suggestions concerning anything that you think will be an improvement in the Operating Department, and will welcome frank constructive criticism.

It is my intention to give your suggestions and complaints every consideration necessary to satisfy the majority.

Each division desires representation, no doubt. Bearing that in mind, members of the Operating Department personnel must realize that it is absolutely essential that reports from the Division Managers be in this office not later than the first of each month.

At this time the good winter season is upon us and we must make the best of atmospheric conditions that prevail. Let us strive for the greatest year in the history of the American Radio Relay League by co-operating with each other.

Reports for the Divisions follow:

NEW ENGLAND DIVISION G. R. Entwistle, Manager

The warm weather has hung on in New England later than ever this year, retarding amateur activity in general.

On October second, 1386 amateur licenses of all grades had been issued in the First District. The latest call was 1HBK.

The papers say Edison is trying to perfect very sensitive apparatus to communicate with departed spirits. Perhaps it will be useful in QSOing Worcester and Springfield from the rest of New England.

A. D. M. Donald Mix reports Brown University's C.W. set as coming QSA out his way. Boston-New York traffic is moving O.K. 1BBL is doing commendable work. The volume of traffic handled throughout this section is steadily increas-

ing. 1QN of New Haven has a C.W. set in operation. 1TS copies 8DA and 8ZV C-W sets quite regularly. Both are using but a single VT-2.

Boston and vicinity is gradually becoming C-W-ized.

Robinson, A. D. M., reports 2ZL coming QSA in Braintree.

1DBU sounds fine on the undamped set. He is in Boston.

1XD is the experimental lab. of the Western Electric Co., at Green Harbor, Mass. They can be heard on 395 working the KQ boats of the Merchants and Miners Line, several of which are equipped with wireless telephone sets. This work is being done in co-operation with the Independent Wireless Telegraph Co.

1DH is shining up his 1000 volt D. C. generator in anticipation of the arrival of a couple of limejuice tubes. Whittier reports the addition of a couple of half K.W. spark transmitters in his neighborhood, to help matters along.

When 1OAT and 1RYE get together with 1HOP someone will have 1BUN. (His address please).

Bates and McLean were in Boston for the big Odd Fellows parade Sept. 29th. Both have the C-W bug.

1AE will probably return to Boston from New Bedford where he has been "learning the business". 1FB has returned from Maine.

ATLANTIC DIVISION C. H. Stewart, Manager

Relay work in this Division has not been as active as it should be for the month of September. Owing to changes in the traffic officers there has not been as close supervision of traffic conditions as is necessary in order to properly co-ordinate the efforts of the various sections comprising the Division.

Reports have not been received this month for the territory of New York and New Jersey, as this is a very important part of the Atlantic Division viewed from the radio standpoint. An effort will be made to see that this does not occur in the future.

Mr. Chas. A. Service, Jr., has found it

necessary to resign as Division Manager. Mr. Charles H. Stewart (3ZS) St. David's, Pennsylvania, has been appointed, and desires to state that suggestions looking toward the improvement of relay conditions and the League work in general will be most gratefully received by him, as it is only by receiving criticisms that improvement may be brought about.

In order to fill the vacancy existing in the office of District Superintendent for Eastern Pennsylvania, Mr. Samuel W. Place (3BH), 622 Stanbridge Street, Norristown, Pa., has been appointed Superintendent for this District. It is his intention to extend the activities of this territory, in which a large number of amateur stations are located by the appointment of several Traffic Assistants as well as a City Manager for Philadelphia. The idea is to have more assistance in carrying out the detail work of the organization. Furthermore it is believed that a live Traffic Assistant with a restricted territory in his charge would be in much closer touch with the various stations in his section than is possible where the District Superintendent has to cover the whole territory himself or with the aid of only one Traffic Assistant.

It is hoped that it will be found practical to extend this idea to all Districts of this Division. It is the strong conviction of the Division Manager that a division of the work in the manner outlined above could be carried out in all the Divisions with much advantage to the League work.

With regard to the Trunk Lines in this District—A, B and D, the information we have at hand does not show that satisfactory through work is done on any of these Trunk Lines. Lines A and B (Northern and Central routes east and west) can by no means be considered as complete, for, in order to get traffic through, it is at present only accomplished by relays that are too long to be reliable under all conditions. In order to change this state of affairs it is necessary to communicate with by letter and interest in the work of the League a larger number of station owners, and the suggestion that more Traffic Assistants be appointed is in line with this thought. Considerable traffic has been handled between Ohio and Western Pennsylvania and the seaboard over lines A and B, but only in most instances by long jumps.

On Trunk Line D, reliable communication can be carried on between New York and Wilmington, Del. It is believed that traffic can be freely handled between these points and for Philadelphia and the large adjoining suburban district. The real problem on this Trunk Line, which still exists, is to do satisfactory relay work between Philadelphia, Baltimore and Wash-

ington. Mr. Service (3ZA) has recently been in communication with Linthicum (3KM) at Washington, and McNaughton (3HJ) at Haverford, Pa. There are a number of other stations in and near Philadelphia that are being heard at a distance, 3EH-3DS-3EV, etc., and with their help and that of the recently re-opened station at Princeton University (3DH) there is no reason why the interchange of messages between New York and Philadelphia can be considered otherwise than reliable.

On Trunk Line B to the West there is much room for additional stations, as satisfactory short relays have not yet been found to take care of message work via this Line, and results can only be accomplished by long jumps from New York and Philadelphia to Pittsburg and stations on Pennsylvania Branch Line No. 2 (Washington, Pa., to Erie, Pa.) such as 8WY-8DV-8RQ, etc.

The monthly report of Mr. R. C. Devinney, Superintendent Western Pennsylvania, states that relay work in his District is taking a decided turn for the better, and advises that 8WY and 8DV will be working Sept. 25th, and also that 8RQ is back. There is a new station at Washington, Pa. (8ACF) which he says bids fair to take the place of old 8JQ.

In addition 8MT at Uniontown, Pa., is again in operating condition. Williams, 8ZD, traffic Assistant of this District, is again on the job, with his recently acquired wife as an assistant operator. Considerable QRM is being experienced in Pittsburgh from spark coils, which Devinney says are operated from 6 a. m. to 3 a. m., and which hamper distance work. Devinney states that from present indications Branch Line No. 2 will be the best branch line in the country.

Mr. Herbert M. Walleze (8BQ) has been appointed District Superintendent for that District. Mr. Walleze states that so far as his District is concerned conditions are far from satisfactory to him, but that he is doing the best he knows how. These conditions are due to no lack of enthusiasm on his part, but can be attributed to the scarcity of radio stations in the central portion of Pennsylvania. He advises that 3ABD at Danville, Pa., has his station nearly completed.

Mr. E. B. Duvall (3EM), Superintendent Eastern Maryland District, advises that his address has been changed to 3909 Cottage Avenue, Baltimore, Md., and that he soon expects to have a transmitter in operation there. He reports that there has been a general increase in activities in his District and that Yearley (3AN) has erected a higher and stronger antenna to replace the one blown down. Nothing has been heard by him of Cooke (3GZ) or Dichmann (3HG). Primrose (3AA), Fal-

coner, Hart and Geiglein are so busy with a playlet, which they are getting up as a benefit for the Radio Section of the Maryland Academy of Sciences, that they won't do any operating until it is over. Mr. Duvall states that information has been received by him that there will be an efficient station shortly in operation at Frederick, Md. (20 miles northeast of Baltimore) owned by Mr. L. I. Kennedy, 219 East 2nd Street.

Call letters of this station as yet unknown. Conditions between Baltimore and Washington have not changed since an attempt was made to get something across during the Summer static. Tests were made by Mr. Kruse at the Bureau of Standards (WV) and Duvall. It was learned by Duvall that signals from WV were heard at 2PL during these tests. Duvall again emphasizes the fact that he would certainly like to learn of some good stations north of Baltimore and between that city and Wilmington. Baltimore will boast of having a Ham (F) this coming winter, but Duvall says he is a little skeptical as to the use of the word "ham", as he is informed that she is equipped with a First Grade Commercial License. He won't give out her name or call letters yet, but says if anyone mentions the name he'll whistle. It is hoped that the amateurs of Baltimore will give their hearty support to Mr. Duvall this winter, and help him place Baltimore on the active radio map. Come on Baltimore fellows, and let us see that you are able to overcome the natural difficulties of your position.

Several changes in call letter assignments have been noted recently by the Division Manager of stations in this Division, as follows: Ehrhardt—8CE changed to 8ZQ; Williams—8EN changed to 8ZD; Seuffert—3AX changed to 3ZG; Snow, Washington, D. C., pre-war call 3JR changed to 3ZE.

ROANOKE DIVISION W. T. Gravely, Manager

With the approaching winter months close at hand, there is decided activity being manifested by the amateurs throughout this Division. Stations are being overhauled, new plans are being projected, and new stations under way. The prediction is, the greatest season ever known to amateur circles.

Reports are slow coming in this month from the various District Superintendents, and I want to remind the Superintendents that, if we are to maintain a well regulated, active Division, monthly reports must be made consistently and regularly. The Division Manager is dependent upon the District Superintendents for the happenings in their respective Districts, with-

out which, report cannot be made to Headquarters. I will, therefore, request that the personnel please bear this in mind, in future.

Effort is being made, at this time to open up the main trunk line to the South, but whether this can be accomplished without a circuitous route depends upon the stations in Central Virginia and North Carolina. However, if it is found necessary, 3BZ will take a certain amount of traffic intended for Southern points, from all other points North, and clear through 5DA, who will in turn clear through 4AG, 4YA, or some others. We realize that this isn't the proper way to route the Southern traffic, but unless the North Carolina and South Carolina situation clears up, we can see no other way. It is our desire to get away from long jumps wherever, and whenever possible. We still have our hopes of a daylight line, and with persistent effort, it is an assured fact.

The situation to the North of Danville is not as good as might be expected, but Mr. Blair, 3HO, District Manager, Richmond, assured me that Richmond will be a relay point this winter, and if such turns out to be the case, will prove a valuable adjunct to the main line. Traffic should easily be handled from Washington, Richmond, Danville, Greensboro, Charlotte to points South. North-bound traffic should easily follow the same route. However, it is desirable that Lynchburg, Roanoke, Williamsburg and points in between Washington and Richmond, and between Richmond and Danville, be linked in. Also, Winston and Salisbury in North Carolina. To work the routes out properly the stations interested must pay attention to test work, and co-operate to the utmost. Definite lines will not be created until this test work has been carried out, as it is very necessary to know how each station can handle traffic from another station.

Mr. Wohlford of Roanoke, 3CA, District Superintendent, states that he is making a desperate effort to get the South West Virginia section in shape, and is working on Bluefield.

Mr. Clarke, Assistant Division Traffic Manager, Danville, is now busily engaged in installing his station, and will soon be in shape to handle traffic to the North or to the South. He will be very glad to arrange tests throughout the Division, and to assist individuals who will write him. Address communications to A. S. Clarke, Pine Street, Danville, Va.

Late advices from Mr. F. L. Bunker, District Superintendent, North Carolina, Charlotte, are to the effect that there will be three stations located in Charlotte, two of which will operate with C.W. sets. Mr. Laxton, 4DD, will assist Mr. Bunker in handling traffic going through Charlotte.

All North Carolina stations which expect to participate in relay operations will please confer with the District Superintendent immediately.

EAST GULF DIVISION
E. H. Merritt, Manager

The new Division Manager is having a hard time getting started. He has written quite a number of radio men throughout the Division, but only a few letters have been received in reply. Unless we have a little more co-operation, it is going to be hard to secure good results from this division, so I ask all men concerned to please get in touch with me as soon as possible. The winter season with its DX work is fast approaching, and we want to be ready to do good work as soon as 'static' lets up on us. Already we have been able to do a little work from Atlanta this fall and indications are that we can work now, nearly every night.

There are two of the original trunk lines passing through this Division—one coming down the Atlantic Coast from the north to southern Florida and another from Jacksonville westward to San Francisco. We want to begin in this Division by opening these routes for traffic and also, a route coming down from Ohio, Kentucky, Tennessee to Atlanta and then on down to Florida, and a route from Virginia, North and South Carolina to Athens and Atlanta and then west to New Orleans. The route west from Jacksonville has been placed in the hands of Mr. C. D. Short, 233 Washington Avenue, Macon, Ga., (4DA) who is the Assistant Division Manager. All men in line for this work in Florida, South Georgia, and Alabama are requested to please write him immediately as we know of very few stations on this route and there are a number of very long jumps that must be filled in.

The route through South Carolina is being held up on account of no stations there being known. There must be at least one or two stations in South Carolina capable of doing work with stations in the adjoining states but we have been unable to discover any of them yet. Any men having radio sets in the state and especially those capable of transmitting to out-of-state stations, are earnestly requested to write to the Division Manager and tell what you can do. It is now necessary to relay to 5DA from 3BZ or to attempt the jump from 3BZ to 4AG to get traffic through and these routes are not satisfactory. A short jump route should be arranged that will be much more satisfactory to all.

We hope to have routes open before long as follows: Coast Route, 3BZ, 4CE (Charlotte, N. C.), 4AG, 4BK and 4DA (Macon, Ga.) to Savannah or 4AN (Boston, Ga.),

Jacksonville, 4AT, to Miami, to Key West. Inland Route, 5DA (Wind Rock, Tenn.), Chattanooga, 4BQ (Rome, Ga.), 4YA and 4XC (formerly 4BZ), to Macon, etc.

Our old friend and stand-by, 4AG, will be with us again with a few improvements that should make his spark easier to copy.

There will be two good stations in Macon, Ga., this fall, 4BK and 4DA. 4BK was heard occasionally last spring, but the early summer season of "static" closed him down before he made himself known to many of us. 4DA, the Assistant Division Manager is a new man and is unknown to most amateurs. He has had quite a bit of experience in both Navy and Commercial Radio, and we are counting on him having one of the best relay stations in the Division.

In regard to the situation south of Macon, we have very little information. This part of the Division seems unusually slow in getting into operation and we have not been able to hear from them about the relay work. They are probably being held up by the severe "static" we have had during the summer.

5DA, of Wind Rock, Tenn., has his set going again and is QSA, as usual, in Atlanta. We are trying to work up the route from Wind Rock to Atlanta and we will probably depend upon 4BQ and some new station going up in Chattanooga.

4YA expects to put in a 2 k.w. transmitting set this fall and will also have an up-to-date regenerative receiving set. Georgia Tech in conjunction with the Atlanta Radio Club, has published articles in the newspapers of the state about the work we hope to do this fall and have requested that all men owning sets write us at once. They are making a register of the radio stations of the state with a view to putting on a definite program of communication with all these stations according to plans that are now being worked up.

The Division Manager requests that all men in South Carolina, Georgia, Florida and Alabama get in touch with him at once, so that short jump relay routes may be worked out and be put into operation.

DELTA DIVISION
J. M. Clayton, Manager

At last the summer QRN season in the South has come to a close. The weather has cleared up and traffic is going through in fine shape.

The stations South are working under a handicap that none of the Northern stations seem to have to contend with. In connection with the QSS tests for this division the Division Manager wants to especially thank 5YH, 5ZP and 5YE for their faithful attempts to get something through.

Louisiana is getting lined up in great

shape. Before the season has been going far, relay work through the larger cities of Louisiana will be a nightly accomplishment.

Barrow of 5EA was laid up with a stroke of lightning which knocked his station completely out.

Buehler, of 5HA, has a new 1KW set that promises to reach all over the country.

De Ben, being a senior at Tulane has found it necessary to find an assistant to keep 5ZP open each night.

Mr. Greenlaw still lacks juice at Franklinton but will be "on hand" with something.

As to 5YH, he will be in with both feet and a couple of hands. He is out of the Little Rock "QRM Zone" and will be counted on to handle a larger portion of the traffic coming through this.

The Division Manager's station is now open for business.

MIDWEST DIVISION L. A. Benson, Manager

The writer wishes to thank all the District Superintendents for getting their reports in on time this month.

9DU, Independence, Mo., is fixing up for the big start. Routes have already been arranged with all of the District Superintendents. Although the route from Independence to St. Louis has not been completed it has been perfected to such an extent that relay work over it may be carried on continuously. Stover, 9JA, and Turner, 9DU, have been discussing means whereby the District Superintendents of the division may co-operate this coming winter instead of going at relay work in a haphazard manner and let each District Superintendent and his Assistant be responsible for the delivery of any messages that have their destination in their respective territories. It seems in this way we can keep messages from growing stale on the hook.

9EL, H. L. Owens, has been ill the past few weeks he reports. 9AEG and 9AEQ have proven dependable relay stations the past few weeks. 9RY, O. A. Kimball of Topeka has been appointed Assistant District Superintendent, Eastern Kansas. Mr. Kimball reports that stations in Topeka are beginning to wake up. 9NO will be on for relay work in the near future. 9RY has been experimenting with a quarter inch spark coil. Mr. Owens desires to have it known that weather reports are sent out daily by 9YV of Manhattan Kansas 9:55 A. M.

9LR, P. E. Thurman, Anthony, Kansas, has been appointed District Superintendent Western Kansas, and all stations in that territory kindly get into communication with Mr. Thurman at once for posi-

tions on relay routes through western Kansas.

9JA, P. A. Stover, has changed his location and any communication to him in the future should be addressed to 213 East Market, Iowa City, Ia.

9HT, Omaha, Nebr., reports things picking up in his territory in the way of traffic handling. A dependable station has been located at Freemont. Mr. Palmquist and Mr. Johnson of Oakland are both operating stations and are ready to handle traffic. Mr. Smith of Tilden, is forging ahead and is destined to become an important factor in the handling of traffic on Route No. 3. A meeting between the amateurs of Omaha and the Power Co. officials was held this week in the office of the City Electrician and it was decided that every amateur in Omaha will have to undergo a cost of over one hundred dollars for separate pole transformers if they desire to continue operation of their sets.

9IF, Giltner, Nebr., will make an effort to induce several schools in the western part of the state to install good apparatus for relay work.

9LC, Mr. W. E. Woods, the City Manager, reports that he has the city of St. Louis lined up in excellent shape for the coming season. He takes great pride in pointing out the fact that St. Louis has more dependable DX stations than any other city in the country. There will, at all times throughout the season, be at least two good DX men on the job, thus assuring stations in the neighboring states that their traffic can always be cleared through this city.

DAKOTA DIVISION R. H. Pray, Manager

Relaying has taken a new lease of life and routes and Trunk Lines are shaping up as never before. The outline suggested for the Trunk Line A last month, namely BQ, to 9ZC, to 9ZX, to 7IM seems to be the one route that is handling traffic and will continue to act as Trunk A while relaying is gaining speed. Trunk Line B is commencing to gain some semblance of form as 9EE at Ellendale, N. Dak., and 9AIG at Sioux Falls, S. Dak., are both doing commendable DX work.

From all reports the Central Division Convention was a huge success and fully worth the effort put forth by the Chicago Executive Council. Although it is not feasible to hold such a convention in this Division at present we hope to be able to put on a meeting of some sort within the next year. An invitation is extended to all amateurs, especially in Manitoba and Dakota Division, to attend the Annual Convention of the North Dakota Radio Association to be held at Grand Forks, November 26th and 27th, the Friday and Saturday

after Thanksgiving. Further information will be found elsewhere in this issue. Can anyone tell us why there is so much of this QSX stuff drifting around in the Central Division? It seems that invariably the Central Division Stations reply QSX. (Whasitmeen Eddy?)

Superior, Wisconsin has been placed in the Dakota Division and will be in the Northern Minnesota District as formerly. Mr. W. C. Bridges of Superior, has been appointed Assistant Superintendent in the Northern Minnesota District under Mr. J. A. Gjelhaug. Mr. Bridges was appointed Assistant in the Wisconsin District when Superior was a part of the District in the Central Division and will now act in the same capacity in both Divisions. All amateurs near Duluth and Superior should get in touch with Mr. Bridges, addressed to Naval Radio, Duluth. Mr. Gjelhaug, 9ZC has been remodeling his station and his spark is heard over a wide range.

Mr. Harold Larson, Superintendent of the South Dakota District, reports a number of new stations in his District but mostly limited to the southeastern corner of the state. Station owners in all parts of South Dakota should hasten to get in touch with Mr. Larson.

Mr. Boyd Phelps, 3344 South First Street, Minneapolis, Superintendent of the Southern Minnesota District, has been doing some very commendable work along the line of talks to Twin City Radio clubs. He says that all they needed to start things booming was an explanation as to the workings and aims of the ARRL. For, starting as it may seem, many did not have any idea of the principles or ideals for which the League stands. Mr. Phelps said "Maybe I can't beat N. Dak., in summer relay routes but I bet I can set the pace in affiliations and keep the other districts in my dust" and dared me to tell it. So here it is. And from all indications that district will set the pace in memberships as well as from the number of application blanks which have been sent there, they must be eating them. It looks as though the Twin Cities would soon be in a fair way to equal Chicago as an ARRL city.

Stations outside of the cities are beginning to appear. 9HM of St. Paul is fast coming to the front and reports having worked stations as far east as New York State. Although Mr. Otterholm, 9HM, has only this fall come into prominence he is an experienced operator and will no doubt take an important part in the Dakota Division Operating personnel this winter.

This announces the opening of Trunk Line A to the Pacific Coast handled BQ, to 9ZC, to 9ZX, or 9HM to 9ZX to 7IM, Billings, Montana. 7IM has gotten messages through to 7CU the same evening

they were received from 9ZX and works 7CC also so that traffic should be handled regularly over this route.

WEST GULF DIVISION
F. M. Corlett, Manager

At last the Summer static is beginning to show signs of easing up and giving us a chance to hear the distant stations again. We know that long distance relay work, during the Summer months in this section of the country, is impossible over any great distances. We had this fact impressed upon us more than ever last Summer. Next Summer we are going to work right along over the Trunk Lines, and to this end we are going to begin laying our plans now. We are going to develop the SHORT RELAY PLAN to its fullest extent. Now let's all get down to actual business of moving the traffic in a systematic way. Say the first station was working with the next station in line on a trunk line under favorable conditions and the second, third, and possibly fourth station on this line could copy the first station, PROVIDED some fellow close by did not open up with something from a Ford coil to a one K.W. For the sake of argument let us suppose that the second, third and fourth stations were clear and listening to the first station send five messages to the second. Being close together and QRM being reduced No. 2 gets all five O. K., and calls No. 3. No. 3 HAPPENED to get them all O. K. EXCEPT the address to one of them, so when No. 2 calls and asks him QRV?, No. 3 answers giving him an O. K. on what he copied from No. 1, and asking for the missing address. No. 3 clears No. 1 in a few minutes' time and calls No. 4. No. 4 only got three of the five O. K. when No. 1 sent them and would probably be still asking No. 1 for the other two if they were working direct, instead he QSL's the three he has received O. K. and No. 3 G.A.'s with the other two getting an O. K. on them the first time. Now this work was all done on reduced power; all FIVE messages have been received at No. 4 ACCURATELY in far less time than if No. 1 had sent each word twice or three times and then repeated a couple of times. The short jump system is by far the best plan if we are to move any volume of traffic.

TRUNK LINE RELAYING is going to be the real traffic moving plan. With that in view this Division is going to develop an efficient TRUNK LINE SYSTEM. The Trunk Line Stations are going to be selected by the actual work they can do. In order to determine the stations best suited for Trunk Line work nightly tests are to be conducted over each Trunk Line in each direction. There are two Lines crossing this Division, Line "F" Grand Forks, N. D. to Houston, Texas, and Line

"C", Jacksonville, Fla., to Los Angeles, Calif. This Division is directly interested in Line "F" from the Northern boundary of Oklahoma to Houston, Texas, and Line "C" from the Eastern boundary of Texas to the Western boundary of New Mexico. The stations selected as Trunk Line stations nearest these boundaries will be considered Division Terminal Stations on their respective Trunk Lines. The Traffic Rules of the A.R.R.L. say that relay work shall be conducted from 9 P. M. to 12 midnight. 9 o'clock is the starting time for all relay work. The Division Terminal Stations will start a test message to the next station in line as soon after 9 o'clock as possible, the message to be forwarded to the next station and so on until it reaches the Division Terminal Station on the opposite side of the Division or until some station can not forward it further, in which case that station will forward it BY MAIL to the Division Manager. In no case will a test message be held over from one night to another, but forwarded from the last station that received it. The last station receiving it should not fail to forward it immediately as that gives his station credit for being on the job.

In order to easily distinguish the test messages and that their distinguishing marks shall have a definite meaning and serve as an address, test messages on Line "F" will be known as "FOX" and on Line "C" they will be known as "CAST". A "FOX" will be a test running NORTH or SOUTH and a "CAST" will be a test running EAST or WEST.

This test system will be adopted October 1, 1920. Test messages will be considered as filed at the Division Terminal Stations at 9 P. M. regardless of what time the Terminal station forwards it to the next station.

Radio conditions throughout the division look more encouraging than they have for some time. Oklahoma continues to come to the front and with more "observing" some good relay stations are going to be selected before long. As a starter the station of Arnote & Poor, 5EF, McAlester, Okla., has been selected as a Trunk Line station. Mr. M. C. Poor is manager and operator and W. J. Arnote part owner. We need more stations in Oklahoma on Line "F" North and South of McAlester. Mr. Lowrin Dill, 5HL, Oklahoma City, has a good station under construction.

Mr. Falconi announces two appointments. Mr. R. W. Goddard of Las Cruces, N. M., has been appointed Assistant District Superintendent of the Las Cruces Territory. Mr. C. E. Noll, El Paso, Texas, has been appointed Assistant District Superintendent of the El Paso Territory which includes the counties of EL PASO, HUDSPETH, CULBERSON JEFF DAVIS,

PRESIDO, REEVES, LOVING, WINKLER and WARD. Mr. Falconi says the prospects for the Southern Route, Line "C" look good. With Harrison old 6GQ of Phoenix in California and Trump, old 9BT in Phoenix the Pacific Division should be able to unload a few of these "baskets" of West bound traffic.

The Amarillo Territory is progressing rapidly under the direction of A. D. S. Martin, many of the enthusiasts are becoming members of the League and a live club in Amarillo proper has begun to take form in a satisfactory manner. The Pilot Point Territory under A. D. S. Mosteller is coming forward. 5IS, John W. Cain and E. C. Simpson of Denton deserve mention. 5CG at McKinney has purchased the sending equipment of 5ZG at Dallas and now has it installed at McKinney. 5AL, Cecil Butcher of the Greenville Territory unfortunately has a position that requires his time during the early part of the evening but states he will be on hand after midnight.

Max Pierce, 5IA, ADS of Corsicana Territory is installing a C.W. set.

Mr. Fate Sherrill has moved his station from Kernes, Texas, to Corsicana, call, 5IB. Roy Miller, 5FE of Corsicana has recently installed a quarter K.W.

District Superintendent Tilley reports relay communication has started in earnest it seems for the air is full of amateur sparks nightly not waiting for the complete disappearance of our old enemy QRN.

Have had fine reports from all districts except San Antonio that they were all ready. Nearly all the Austin operators are back from the sea where they learned a lot about the efficient handling of messages.

College Station, 5YA will be on as soon as school opens.

5ZR of San Antonio has promised us some help in the way of a splendid station there but so far N. D.

New Braunfels is well represented by 5HH at the New Braunfels High School with Mr. E. A. Sahm in charge of the operation.

Things in the Houston Territory are in fine shape for DX work.

5ZW is now in better shape, having finally gotten up on 375 after considerable difficulty in getting the proper size O.T. 5ZW will be working his C.W..

5EO has improved his antenna system 100 per cent. and with a few more changes which he is now making, will be a class A station.

5GH is still building his station.

Goose Creek Oil Field has a splendid receiving station, and a similar set is being installed at Cedar Bayou, by the same operator, Mr. Hartis. He hears practically all Fifth District Amateurs on one bulb.

Beaumont, Texas, is silent.

5AE, although never having transmitted, has been reported from Chicago and numerous eastern stations, and as the result, has made the threat that he intends to let himself be heard just as soon as his set is completed.

PACIFIC DIVISION

E. G. Arnold, Assistant Manager

At last it seems that the west coast is coming back to its own again. Each night the conditions seems to grow better. Very good work is being done considering the amount of QRN and the number of new beginners in this section around the Bay Cities. Traffic is coming from the north via 7CU, 7CW, 7BP along with others.

A very promising station is being set up in Colusa, Calif., station 6TC which will help a great deal to bring the traffic from the north down with less difficulty. This station will lighten the work that has fallen to 6EJ and 6AK of Walnut Grove. A great deal of credit is due these two amateurs as they have been handling a great deal of traffic.

6BQ is back again. He is installing a short wave regenerative set and two step amplifier, which will further increase the good work that he has been doing. Work to Reno has been rather uncertain but through the efforts of 6BQ and 6QR reliable service will soon be insured. 6QR is a very promising station in Reno.

6ZA of Salt Lake reports that he will be ready again.

A number of Bay City amateurs have been doing very good work, working direct with 6EJ, 7CU, 6JM, 6JD, 6JI and a number of others. Most of the relay work is being handled through 6BN the station of H. Shaw and H. Hollway. Shaw is operating the set.

A. E. Bessey, 6BR of Sunnyvale, has installed a new panel type transmitter designed for 150, 200 and 375 meters. This will greatly relieve the QRM situation. This is what we long needed in this section, and we now have it under able management.

Traffic to the South is being handled by a number of stations in and around Los Angeles, and San Diego. A great deal of trouble was experienced there due to QRM from the arc at NPL. A number of the stations doing good work in the south are 6JM, 6JD, 6JI, 6EN, 6ER, 6KP, 6SK and 6CO. 6AT will be with us stronger than ever with his new apparatus.

Traffic to the East has been almost an impossibility, no practical work being accomplished via southern route. Better luck has been found to the north. 6EJ reports getting messages from the east through 7CU of Vancouver, Wash., and further states that 7CU is now ready to

take east bound messages.

A number of the amateurs have recognized the merits and taken sides with High Power Receiving in the cases of High Power Transmission versus High Power Reception and have arranged their sets accordingly with a resultant increase in efficiency.

NORTHWESTERN DIVISION

J. D. Hertz, Manager

The month of September has been marked by important changes in relay conditions in this division. Lessening of atmospheric was apparent early in the month, and traffic is now handled with comparative ease, "sixes" being worked with regularity from Oregon points, and frequently from Idaho and Puget Sound districts. Ninth district stations are now being worked from stations in eastern Montana.

The most important and far reaching event of the month is the reopening of a transcontinental relay route on trunk "A" through Idaho and Montana. This happened on the night of September fifteenth when 7IM, L. J. Sims, Billings, Montana, connected with 7CU, Mumford Brothers, Vancouver, Wash., thereby completing the route from the coast to 9ZX, who is QSO east. The route has been open almost nightly via 7IM and 7CU at Moscow, Idaho. With the appearance of 7HS, at Glasgow, Montana, and the prospect of having JN, A. C. Campbell, (ex-7ZC) at Jordan, Montana, the route east over trunk "A" will be materially strengthened. O. M. Heacock, 7ZH, of Enterprise, formerly 7ZH of La Grande, Oregon, is with us again. Having completed his new station, he will be on nightly, using two wave lengths, 200 and 375 meters. He also will be a great help in maintaining trunk "A", especially since he has no trouble working 7YS at Lacey, Wash.

At Moscow, Idaho, 7CC, Jack Woodworth, District Superintendent for Northern Idaho and Eastern Washington is back after a summer without a transmitter. He reports:—"The prospects for the northern transcontinental trunk line 'A' have infinitely brightened this fall. A station, 7IM, at Billings, Montana, has been QSA here for some time, and recently has been connected with. He appears to work 9ZX with comparative ease."

C. N. Teed, District Superintendent for Southern Idaho, at Kuna, reports:—"Things are beginning to liven up to some extent. Amateurs are overhauling their stations in preparation for the fall opening."

"7YA has installed new and higher masts which will probably give an increased range. As 7YA will have three stages of amplification available this winter it should make a valuable relay station."

Royal Mumford, Assistant Division Manager, to whom all credit is due for A.R.R.L. organization in this division during the past summer, reporting for Portland, Oregon, and Vancouver, Wash., says:—"LD radio communication has assumed regular winter proportions with the coming of favorable weather. More and more stations are taking the advantage of these static-less nights.

"We have noticed the difficulty with which we copy Seattle and Tacoma stations which is a characteristic of winter weather. We often hear 'sixes' working them when we cannot hear the Seattle boys ourselves.

"The route east on trunk line 'A' has been definitely opened. From here ready communication is maintained with both 7CC at Moscow, Idaho, and 7IM at Billings, Montana. 7IM maintains communication with 9ZX at Valley City, N. D. A permanent schedule is being worked out for this route.

"Work with 'sixes' as far south as they exist is carried on with remarkable ease. Regular A.R.R.L. traffic is handled direct with Los Angeles just about as easy as with Walnut Grove, Ukiah, or San Francisco.

"Local stations who have been handling traffic the past month include 7DS, 7ZI, 7DP, 7BP, and occasionally 7BR. 7DS has been on quite regular, as has 7DP. 7ZI has a spark that gets through, and also has been trying some low power CW experiments, having worked 6OH using a VT2, but is bothered by poor receiving conditions at his station. 7DA has also gotten through south. 7FH in Vancouver is on more or less regularly, and gets through both north to Seattle, and south into the sixth district. 7CU works one or more of the several Los Angeles stations almost nightly. 6JD, 6JM, and 6JI of Los Angeles are the ones most easily worked there, especially 6JD. They all three use high pitched sparks which are very QSA here in the late evening. Unlike many sparks of its kind, 6JD seems to carry fine, and is easily readable through QRM.

"7FV at Everett, Wash., is easily worked from here and we expect to handle regular traffic with him from now on."

Olfan DeGuire, 7CW, District Superintendent at Silverton, Oregon, reports:—"Most of the traffic handled south from here the past month went via 6EJ. Other sixth district stations have been worked, but lacked traffic to give them.

"Have worked 6QR, 6AV, 6BJ, and 6FS. I do not experience any great difficulty moving LD traffic as I did before, so lay it to a change in conditions."

In Seattle, 7BK and 7AD continue active, working through to the sixth district, though experiencing more difficulty in working Portland stations. Howard F. Ma-

son, 7BK, District Superintendent reports:—"Gradually there seem to be more and more stations on the 'active' list, although there are few of them who can handle relay traffic.

"It seems as though etheric conditions are reverting back to the way they were last winter:—That much difficulty was experienced in working Portland stations, while 'sixes' further south are worked with comparative ease.

"6BJ continues to tear things up around here, some times it is hardly possible to work locally through him. Other sixes are heard here regularly and come in fine, especially 6BN, 6BQ, 6AK and 6EJ.

"7CC has been heard here for the first time in several months."

7FV, also of Everett, promises to be a good connecting link with British Columbia.

Our old friend 6EJ of Walnut Grove, Calif., reports the following interesting information on the audibility of seventh district stations, as received at his station:—"The QSA ones first: (7CU) (7CW) (7AD) 7ZI, 7BK, 7BP, 7CE, 7CC. The last three same QSA."

ONTARIO DIVISION

A. H. K. Russell, Manager

September seems to have been a particularly barren month for news and for wireless work. Owing to the fact that reports have not been received from the several district managers this month this communication must of necessity be short, and can only speak of Toronto and vicinity.

The establishment of C.W. stations is going on fast, and from inquiries of wireless manufacturers in the city it appears that many of the Toronto amateurs are going in for transformers and rectifying bulbs, instead of the more expensive generators. One generator set, that of Mr. E. Rogers, (3BP) is already in operation. The Marconi Company has installed one of their ½ K.W. 500 cycle sets in the wireless school in Toronto. The manager also hopes to have his generator set working in a short time, as soon as the delivery of the generator is made.

The manager heard from Mr. Carter of Windsor, who advises that the C.W. germ has bitten deep into the radio life of Detroit, Windsor and vicinity. It is expected that two large transmitting sets are to be installed in Chatham, and the District Manager, Mr. Carter, is very anxious to get into the C.W. game as soon as he can.

From Brantford comes the information that wireless in general is experiencing a great uplift, and it is confidently expected that communication may be established between there and Toronto before many months have passed. Brantford is still sticking to spark sets, but if energetic work

and interest count for anything, they should be heard from soon.

All in all, prospects look very bright for a successful year in the Ontario Division.

CENTRAL DIVISION

R. H. G. Mathews, Manager

The Central Division Convention being over, Chicago is again settling down to preparations for the long distance season. A number of changes have been made in the personnel in this Division during the past summer.

Extensive preparations for handling traffic will be made by all the Superintendents and it is expected that everything will move with even greater speed and less friction than during the past season. Attempts are being made as far as possible to create short distance routes in order to insure message relay work, but in some sections of the Division such routes are practically impossible due to the scarcity of stations.

Mr. Wendell Holst, former president of the Ravenswood Radio Association has been appointed Chicago City Manager; Mr. Adams, 9AT, Mr. Marco, 9CD, and Mr. Stolte, 9NJ, Assistants. Mr. Holst is taking up Mr. Schnell's work and hopes to carry on the Chicago organization as effectively as it has been carried on in the past.

Mr. Melvin Herman, 1419 South 9th Street, Sheboygan, Wisconsin, has been appointed Assistant District Superintendent for the state of Wisconsin, relieving Mr. C. F. Bates of Milwaukee.

Mr. Cecil Bridges, formerly of 9ZL, found that a good long distance station was needed in Superior, Wisconsin, and accordingly, being in the Navy, he requested transfer to the Naval Radio Station at that place and now has an amateur station going, temporarily signing BQ until his license is issued. By this action Bridges has opened up the entire Northwest to the Lake Shore Route and we are now able to handle messages for this territory with the greatest ease from Chicago where connections can easily be made with southern, eastern or western routes. We are especially proud of Mr. Bridges and wish to take advantage of this opportunity to thank him both personally and on behalf of the Division for the sacrifices which he has made for the efficiency of our relay system.

Mr. W. S. Taylor of 9GA, being a hard working Western Union man with inconvenient hours, has resigned as District Superintendent of Illinois. He has done excellent work while holding this position. The Division Manager will be pleased to receive letters from operators who believe they are so situated as to handle the job of District Superintendent of Illinois, such communications being addressed care of Radio Station 9ZN, 5525 Sheridan Road,

Chicago, Illinois.

9ZN has started its regular winter schedule and is now in operation from 10:00 P. M. on, every night when weather conditions permit. In addition to Messrs. Mathews, Hassel, Buck and FitzSimons, 9ZN now has as operators Mr. F. J. Marco of 9CD, who signs FJ, and Mr. C. H. Zeller of 9AU, who signs ZO. With these six men on the job the Central Division distributing station should be in a position to handle traffic with great efficiency and we will therefore welcome your heaviest traffic.

CW sets are coming into wider use throughout the Division, 8DA using such a set entirely for relay work, using the spark set only for calling. Many other stations are also making such installations, notable among these being 9BY of Rock Island, Illinois, and 9FF of Urbana, Illinois. In addition to the 2 k.w. 60 cycle non-synchronous and 500 cycle Telefunken panel quenched sets 9ZN now has in operation a De Forest radiophone and CW transmitter putting out 1 1/4 amperes on a wave length of 375 meters. It is intended to use this set as far as possible for medium long distance work in order to avoid creating interference locally and the Division Manager will therefore appreciate co-operation of the various relay stations in trying to carry on work with this set wherever possible.

The October Bureau of Standards fading tests are being carried on at the time of this writing and we feel honored in that two of our stations have been chosen as transmitters on these tests, and in addition to this the Division was assigned 80 recorders which is in excess of the number assigned any other section of the country. The response to the letters of the Division Manager requesting participation in these tests has been very gratifying and we wish to express our thanks to all of those who have so willingly come forward to help.

The report in the next issue of QST will contain convenient operating schedules to be followed in this Division and the attention of all relay stations is called thereto.

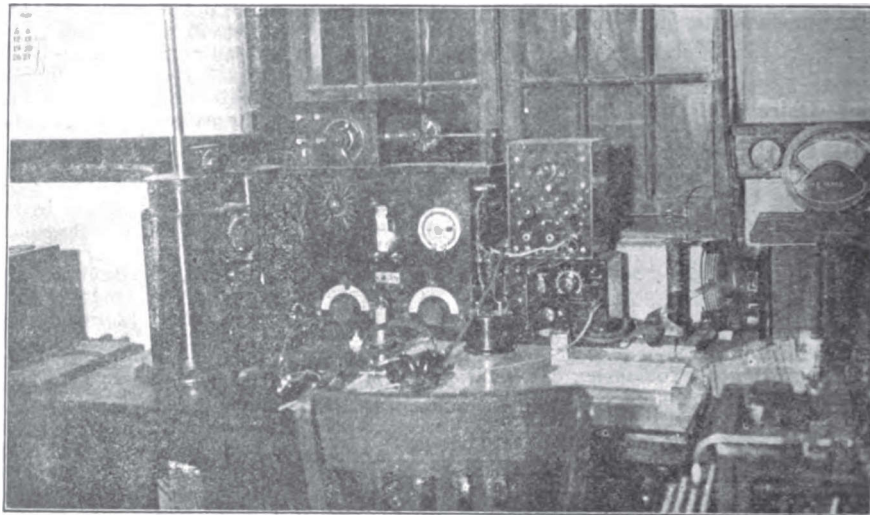
BUREAU OF STANDARDS—A.R.R.L. TESTS OF SHORT WAVE RADIO SIGNAL FADING (Concluded from page 12)

swings are exaggerated, turns in the curve appear too late, and small variations are omitted. Mr. L. C. Young of NSF suggested the method which proved best in practice, that of using dots for each letter and drawing in the curve later. In this way, attention is paid to each letter, and the tendency for the pencil to acquire a "drift" is checked.

(Part II, to be presented in the December QST, will describe the results of these tests, illustrated with curves of various classes of fading.)



5GJ, WACO, TEXAS



5GJ is the station of Mr. Henry M. Harris, A.R.R.L. Asst. District Superintendent, at Waco.

The transmitter is contained within the oak cabinet at the right and comprises a $\frac{1}{2}$ K.W. Packard transformer, 3 sections of Murdock condenser, and a Murdock O.T. The leads are short and heavy, and the antenna current 3 amperes. 5GJ did not tell us what kind of gap he uses, but we imagine he employs one of some sort.

The aerial is 6 wires, 80 feet long, on 30-foot masts on a two-story building, giving a total height of 65 feet.

The receiving set speaks for itself—long waves as well as short. Since this picture was made a short wave regenerative receiver has been added.

5GJ's signals have been reported by the S.S. "Hugoton" while 1500 miles south of San Francisco—good work.

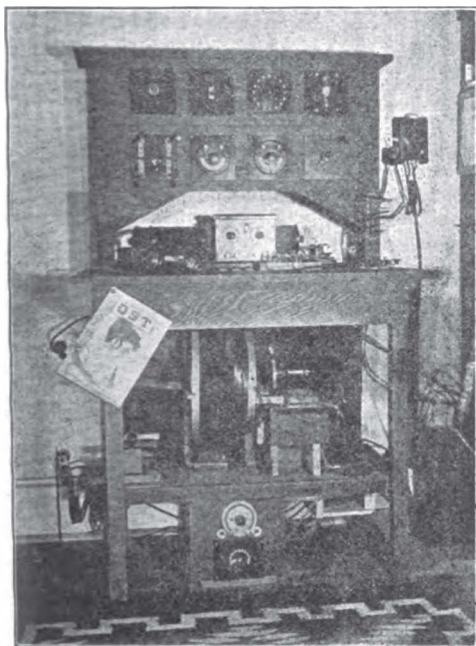
6WN, SAN DIEGO

This is the station of Mr. B. Alexander in San Diego, Cal. The arrangement of the set is novel and will present a few new ideas to constructors. Personally, we'd feel much more comfortable with a sheet of half-inch bakelite between our skinny knees and that closed circuit, but maybe 6WN just took it off to make the photo. He writes us about local affairs as follows:

"I'm but a small ham (hamlet); my name is BonAmi—'haven't scratched yet', but want to chirp now and say that I am going to bite holes in the air so big that it will make a doughnut look sick.

"Per Operating Dept., Pacific Division, August, QST: Some one put on the soft pedal when they played that tune 'The Arc'. Man, that thing is a wonder. NPL

—Noisiest Plant Loose. It stopped once for a whole half hour and the Tower of Babylon was a side-show compared with the multitudes trying to use the air from San Diego. I have cussed and discussed



that Poulsen; in fact, so have others, but —. I tuned into her once for a little practise in receiving. Say, a gatling gun doesn't shoot as fast as I thought it did. The run that stuff thru a sausage machine. Wouldn't it be wonderful—if the Old Man could get an ear full of it! More waves than the ocean has—that's what makes the ocean roar so (and us hams, too.)

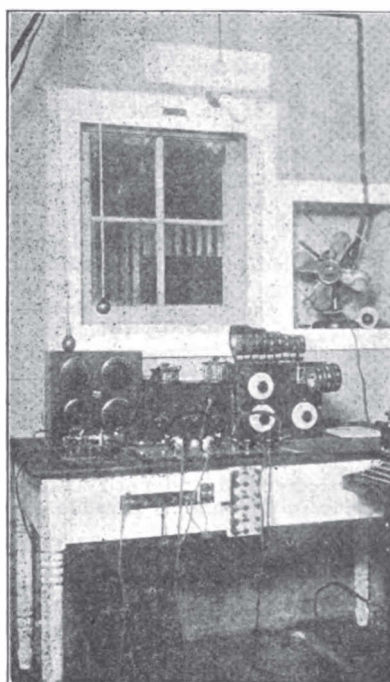
"Now that I have that off my chest I'll say that enclosed you will find a picture of my station. Note my two doughnuts and circular buzz saw on the second floor; first floor my steam gauge. Does it work? Well, if it does it's got me beat—I haven't worked for two months. Oh yes, there's a two-step, variometers, and some other trinkets that are not in the picture. If you don't want to spoil a good magazine, just drop the photo in the basket."

5AE, HOUSTON, TEXAS

5AE is the station of Mr. L. Peime, Treasurer of the Houston Radio Club, and promises to be a prominent figure in relay work this winter.

The photograph shows only the receiver, which consists of a Grebe CR-4, homemade detector and two-stage, homemade long wave receiver using honeycombs, and Baldwin phones. The transmitter is

mounted on a shelf near the ceiling, with the changeover switch controlled by the cords with knobs as shown—rather an unusual idea in amateur construction. The noise-maker consists of a 1KVA Thordarson transformer and oil condenser, homemade OT and homemade rotary, the latter having 4 stationary studs set in a ring, with a 2-stud rotor turning 6000 RPM. The antenna is a 4-wire inverted L, 50 ft. long, 35 ft. high at one end and 70 ft. at the other, with the lead-in from the lightning switch of $\frac{1}{2}$ in. copper tube.



SOME MORE C.W. IDEAS

(Concluded from page 20)

I have found that the most satisfactory conducting cable for this work can be made of eight strands of No. 26 DCC wire, twisted with a hand drill; but if one is using over 100 watts, about 12 strands of No. 26 spaced with paraffined cord will give good results.

Our antenna inductance, for a wave of 375 meters in connection with an antenna of about 300 meters natural period, is five inches diameter and has 80 turns, 16 of which are in the plate circuit. It is essential that a variable of about .0005 mfd. be shunted across the inductance as shown.

Using four VT-2's with a filament current of 1.2 amperes each, our present antenna current on 375 meters is $2\frac{1}{4}$ amps. 4XB works on CW every evening at 10:15 Arlington Time—375 meters.



NORTH DAKOTA RADIO ASSN. Thanksgiving Convention

All amateurs, particularly in the Dakota Division and Manitoba, are hereby invited to attend the annual convention of the North Dakota Radio Association, to be held in Grand Forks, N. Dak., November 26th and 27th, the Friday and Saturday after Thanksgiving.

It has been decided that, inasmuch as the membership includes residents of several states, the name of the Association shall be changed to one more appropriate. A committee has been appointed to present this matter at the coming convention.

The program is not at this time fully arranged but it will be a bang-up good one, to cover the greater part of two days, ending with a banquet Saturday evening. For further information write the secretary, Mr. R. H. Pray, 813 Fifth Ave., Valley City, N. Dak., Radio 9ZX. All expecting to attend should notify the secretary as far in advance as possible.

THE PORTLAND CONVENTION

There is a red circle around Sept. 15 on the calendars of Maine amateurs. On that date they held their first Convention, with the New England Asst. Division Manager, Mr. H. W. Castner, presiding, in the city of Portland. About a hundred and fifty amateurs, from all over Maine and adjoining sections, were present. It was the grand get-together meeting to start off the season's work, and resulted in a great impetus to relay affairs. Great things are looked for from Maine this winter, for the eastern route to Canada runs thru there and several Maine stations have been QSO the Canucks. At this meeting valuable and instructive talks were given by Radio Inspector H. C. Gawler and Messrs. Hiram Percy Maxim and K. B. Warner, respectively president and secretary of the A.R.R.L. Mr. Gawler, incidentally, stated he was authorized to announce that in the near future the Radio Corporation of America would launch on the amateur market a full line of high grade tubes, both for receiving and for transmission, at reasonable prices. This announcement certainly got an enthusiastic reception. Most of the Maine District Superintendents were there to be heard from, and

all the amateurs wore tags bearing their call letters. Plans were made for the winter's work, and the route thru Maine seems assured.

Vermilya, of 1HAA, attended the meeting and was given a rousing reception. After he returned home he wrote us as follows:

Marion, Mass.
Sept. 16, 1920.

Editor, QST—

Trust you will allow me a few words to the Brother Amateurs that attended our Portland Convention. Our time was limited and I did not have the opportunity to speak with them all personally. I feel that QST is a good way to do so now.

You fellows made a most wonderful showing. I was indeed surprised at the number that turned out and we certainly had a wonderful time. You can look the whole country over and if you try your hardest it will be impossible to find a better, bigger or squarer Radio Inspector than rules our district. Fellows, he's with you, heart and soul. He is typical of the Amateur and QST—non-commercial. He'd rather have been with us last night than with any other bunch of radio men. It is truly wonderful, and we have much indeed to be thankful for in having such a liberal man as Mr. Gawler is.

Last night was my first meeting with Mr. Maxim, our president. Never have I met a more enthusiastic and loyal man to our cause. To have such a leader for our president is beyond the power of all words to describe.

Organization is our watch word—it's positively imperative! It's our duty! I am not trying to sell QST's or memberships to the A.R.R.L. and neither is Mr. Maxim or Warner—and I don't get paid for writing this letter or my humorous stories—it's a pleasure—I love the game. But do, fellows, for your own sakes, get in—subscribe for QST and join the league. It gives you and your station prestige even if you never handle a message. QST in my mind comes even before your tuner or your bulb or whatever it might be you are thinking of buying.

The very fact that you can read a minute description of such stations as 1AW, 2JU, etc., is worth the cost of a year's subscription. Think of being able to plan your station after these stations which have such marvelous success. Their junk pile represents their experience and hundreds of dollars. What they have found not of value has been cast aside. By following their stations you are spared the necessity of buying something to just "see" if it will work. Let their stations be a guide to your purchases.....

I thank you all most heartily for the kindnesses shown me while in Portland. 73's.

Very truly yours,
Vermilya, 1HAA.

THE RADIO RESEARCH CLUB OF NEW YORK CITY

The reorganization meeting of the R.R.C. was held on Friday evening Sept. 24, 1920. The members of the club were once more re-united after a suspension of

the club's activities during the summer. Many plans were made for the coming season and the club's set will be rewired and put in first class condition. As soon as the reorganization is complete the club will be able to become a link in the great chain of the A.R.R.L.

PHILADELPHIA AMATEUR RADIO ASSN.

The Philadelphia Amateur Radio Assn. opened their winter season with a meeting on Sept. 20th. The meetings this year are held at the Building of the Free Library of Philadelphia, H. Josephine Widener Branch, 1200 North Broad St., the first and third Mondays of every month, at 8 p.m. All amateurs and their friends are invited.

RADIO TRAFFIC ASSN., BROOKLYN

Copies of the first fall issue of the Radio Traffic Bulletin, our organ, have been mailed to more than 100 radio associations throughout the United States.

Fifteen of these associations are exchanging Bulletins with us or have requested the R.T.A. to place their names on the R.T.B. mailing list.

To the remaining clubs we invite an exchange of Bulletins believing that such action might be of mutual interest in the development of the club papers, which in turn would be to the general benefit of the members of the associations.

Bulletins received from other associations will be posted on the R.T.A. bulletin board at club meetings and it is understood that the R.T.B. will be made available to the members of other clubs.

To associations not issuing a Bulletin at the present time, but who are contemplating doing so, the R.T.A. will be pleased to furnish any information, gained thru the publication of the R.T.B., as to general expense, equipment required, etc., upon request.

Address Ernest K. Seyd, Editor, 531 Washington Ave., Brooklyn, N. Y.

ESSEX COUNTY RADIO ASSN.

One of the liveliest of the many clubs affiliated with the League is the Essex County Radio Assn. of the County of that name in Massachusetts. Mr. F. Clifford Estey, of Salem is their indefatigable president, and is accomplishing a splendid work for Amateur Radio. The club consists of a number of sections in the various towns within the County, and regular meetings are held by each section. The association is a real, peppy outfit, and deserving of the support of all amateurs in Essex County. If there are Amateurs in any part thereof which has not yet a section, they should communicate with Mr. Estey. Haverhill amateurs are requested to get in touch with Mr. T. T. White, 66

Portland St., Haverhill; Lawrence amateurs, with Mr. W. T. Nesbit, 13 Wellington St., Methuen, 1VAS; Andover amateurs, with Mr. Horace Goss, So. Main St., Andover, 1SAY; and Gloucester amateurs, with Mr. W. P. Wheeler, Y.M.C.A., Gloucester. Anyone interested in radio is welcome at any of the meetings.

The idea of County radio Clubs was expounded by Mr. Gawler before leaving the inspection service. It is a fine idea. The Cumberland, Essex County and Worcester County, radio associations speak well for the plan. The various cities in their respective counties get together and form the large organization. They each become chapters of the parent club. Meetings are held regularly at the various cities and all the members of the various city clubs, or chapters, meet together in that ONE city. The next meeting is held at another city. In this way a large assemblage is possible and outside speakers are more easily obtainable. Lets have more COUNTY radio clubs.

Boston has a C-W club whose members are C-W owners who are getting together to pool information from the practical side of the art. It is made up of the older amateurs and those wishing further particulars should address the Secretary, Room 20, 18 Boylston Street, Boston, Mass. The first meeting was held Oct. 14. Regular monthly meetings are planned this Fall.

The Northwestern Radio Association of Portland is assuming normal proportions with the opening of fall. Steps have been taken by the same organization with the view of doing away with unlicensed transmitting stations. A committee has been appointed and the city divided into a number of districts, with a prominent amateur in each district as supervisor. It is the duty of these supervisors to keep close tab on all stations in his district and to report all new ones being erected. These new stations are visited by the committee and if no license is procured within a reasonable time they are turned in to the radio inspector, who takes the case from there. This has been found quite effective, as very little trouble has been experienced from licensed stations.

NEW HAVEN RADIO ASSN.

The New Haven Radio Assn. in August commenced the publication of a monthly club organ entitled "Club News". Its pages are typewritten and neatly bound in a size about the same as QST, and all the local doings and gossip are chronicled. Splendid! A good idea for other societies.



RAYMOND L. WHITE

Introducing Raymond L. White, A.R.R.L. District Superintendent of Northern Texas, Ennis, Texas.

Born on August sixth, 1897, in Gurdon, (— — —) "Arkansaw", his people moved to Texas when he was only about one year of age, locating at Hillsboro, later residing in Dallas, and now located at Ennis, Texas, where he is the owner of station 5AP, which has done some splendid relay work during the past season.

Mr. White began his association with radioites at the tender age of about fifteen, and was inoculated by the bug in 1916 to the extent that he became the owner of a quarter K.W. station in Dallas.

He was formerly with The United Fruit Company, known as the old Tropical Radio Tel. Co., operating their well equipped wireless plants aboard ship between New
(Concluded on page 45)



CHARLES CANDLER

La-a-d-its and Gen-n-tle-men-n! Behold the Senior Operator from 8ER, St. Marys, Ohio whose spark is known over most of North America—Prof. Chas. Candler.

Mr. Candler was born in Ohio in January, 1884, and insists that most of his life has been uneventful. He made his A.B. degree at Miami (Ohio) University, and has been in school work ever since, being at present Principal of the St. Marys High School. He first became interested in radio six years ago, starting with a one-inch spark coil, crystal detector, and loose coupler, and in 1915 acquired 1 K.W. and an audion, and abused the ether with 133 cycle static and signed off 8NH. Since the war he has been at it again, this time with 60 cycle juice and the call 8ER, to whose phenomenal range most of us can
(Concluded on page 54)



Say Eddy:

Kid Useless out here wants to know if a Ham (F.) is a Lady bug. Answer per QST.

Yours, V.T.

Dear V.T.—

Questions concerning Anything (F.) are beyond us. We've found out that we don't know anything about 'em. But why not? Yours, Ed.

Don't bury chicken wire—try cutting out some of your ground resistance with an ohm-saw.

Several replies were received to our inquiry about log systems. Most of them use the same method—a sheet ruled with three narrow and one wide column, headed, respectively, "Station Heard", "Station Called", "Time", and "Remarks". Ye Ed used to reverse the order of the first two columns because it is the calling station whose sign is heard last, and he also found it more convenient simply to note the passing of each five minutes in the time column, eliminating the bother of clocking every entry.

The ratings of the Ediswan tubes mentioned in the September QST are the input watts, and not the output.

Why not a commutator interrupter, driven by a small synchronous motor, to give us a positive 240-spark note on the Amrad? And experimental synchronous motor can be made using an iron spider casting for an unwound rotor, with a simple two-pole field. Because the break would be much faster than the sine wave of the regular current, the induced voltage would be much higher, which is also desirable on these gaps.

Division Manager Pray, of Valley City, N. D., wants us to tell the bunch that he is no longer 9EE, that call having been re-assigned some time ago to H. J. Goddard, at Ellendale, N. D. Goddard is reaching out, and Pray gets all the post cards. Pray's present call is 9ZX.

Who was it a few months ago that heard FFF, or some station sending a string of

F's? Man, dear, FFF is in Sofia, Bulgaria. Dijah, honest?

In our October issue, Speedo Vermilya's aerial is described as having 20 wires, whereas our photo plainly shows it has only 14. Twenty is correct, and it's Vn's fault—he traced them in pencil, and Hick, our artist, did the rest. Anybody else wishing to lose 30% of their aerial in two minutes, please see Mr. Hick.

With regret we chronicle the death on August 3 of one of our members. Mr. Walter Blust, Radio 9ACG, Sheboygan, Wis. Blust was born in Rio de Janiero in 1901, came to the States in 1905, and became a ham in 1916. At the time of his illness he was engaged in preparing his station for this winter's work. He was a member of the Sheboygan Radio Assn. (affiliated), and his loss is keenly felt.

The June 24 issue of Hardware Age contains an interesting account of how the American Hardware Stores, Inc., at Bridgeport, Conn., came to handle radio apparatus and material for the local experimenters—all because they kept dropping in the store for binding posts or brass rod or something. Now they have a regular radio line, in charge of their enterprising Mr. E. J. Reidenouer.

This from a California newspaper:

"Exchanges are commenting quite freely on the enterprise of the Placentia jeweler who has installed a wireless telephone. This kind of work may be all right for kids and indeed has been quite general with them since the beginning of wireless, but seems "small potatoes" for a grown man. It amounts to simply eavesdropping, something not usually commended. Imagine a business man giving up his time to "listen in" on a telephone conversation"—Brea Progress.

Oh, Ignatz, if you only knew!

The Berne Bureau announces new international abbreviations as follows: QTC?: "Have you anything to transmit?" QTC: "I have something to transmit" or "I have one or more radiograms for—". QRU? is abandoned as a question, and QRU has the signification "I have nothing

to transmit" or "I have nothing for you". We're sure we don't know what was the matter with QRU? but let's keep up with progress, change our cards according to the above, and ask "QTC?" next time.

The A.R.R.L. is endeavoring to secure official international recognition of our amateur symbol, QSS, for the fading dope we now use it in.

This is Mr. Snorri P. B. Arnar, of Reykjavik, Iceland, for many years a reader of QST and highly interested in amateur radio. Mr. Arnar is employed at



the wireless station at that point, which from its photographs, seems to be Marconi-owned. He will probably be surprised to see his photograph in QST—we got it from Mr. Kirwan of Tresco.

On page 33, August 1920 QST, call 5CC was erroneously shown as Corlett, Dallas. Correct QRA of 5CC unknown to us, but Corlett is 5ZC, 200 meters normal sending and receiving wave, 375 meters sending when requested.

It is rumored that 1BBL is putting in a still.

A recent issue of our British contemporary, "The Wireless World", described experiments in loop reception making use of a much smaller loop concentric with the main loop and connected for feedback—a Reaction Coil, as the English call it. This makes the loop a regenerative set, with great increase in signal strength, and no serious effects on the D.F. qualities of the loop. We do not know why the simpler process of tuning the plate circuit with a variometer wasn't used instead—it should work better.

Mr. A. H. Wood, Jr., designing engineer for the Clapp-Eastham Co., has withdrawn from the radio field and entered the advertising business with the firm of Wood, Putnam & Wood, at 178 Fremont St., Boston. Our best wishes, A. H. You'll be back.

To work telephone a few blocks not a thing in the world is needed except a microphone and the regular receiving set. Put the microphone in the ground lead, start the bulb oscillating, tighten the coupling, and talk. (If the A. T. & T. don't like us amateurs, maybe it's because we keep thinking of things like this to do with pieces of their perfectly good telephones.)

From some bright answers to license exams which 8ZW, an ex-inspector, sent us, we present this gem: "More than one wire will increase the capacity of an antenna. Care must be taken that the wires are at least two feet apart, because all the wires are charged at the same time and would therefore repulse each other."

WOULDN'T IT BE WONDERFUL—

If the Navy would let radio legislation alone?

If 1DQ would come down off of 2500 meters?

If 5CD would loosen up that O.T.?

If Cutting & Washington would put some of their apparatus on the amateur market instead of talking about it so much? (Why not both, OM?)

If those U tubes would hurry up?

If 1HAA grew up?

Possibly our readers will be interested in a description and photographs of the store maintained by the Atlantic Radio Company of Boston, Mass., whose advertisements are a regular part of QST.

Although one of the newest radio concerns, its rapid expansion from the date of incorporation, July 1919, has been phenomenal. The original store was opened at 34 Batterymarch Street but before five months had elapsed it was evident that the floor space was too small to take care of the rapid growth of the business. Accordingly in April, 1920, the organization moved to its present quarters, 88 Broad Street, comprising an up-to-date store, a large shop for special work, and a laboratory on the top floor of the building. In addition an efficient antenna system was installed on the roof.

On July 6th the first branch store of the company was opened at 15 Temple Street, Portland, Maine under the management of Mr. H. W. Castner. Mr. Castner is a well known radio man in eastern radio circles and the company was exceedingly fortunate in obtaining his services.

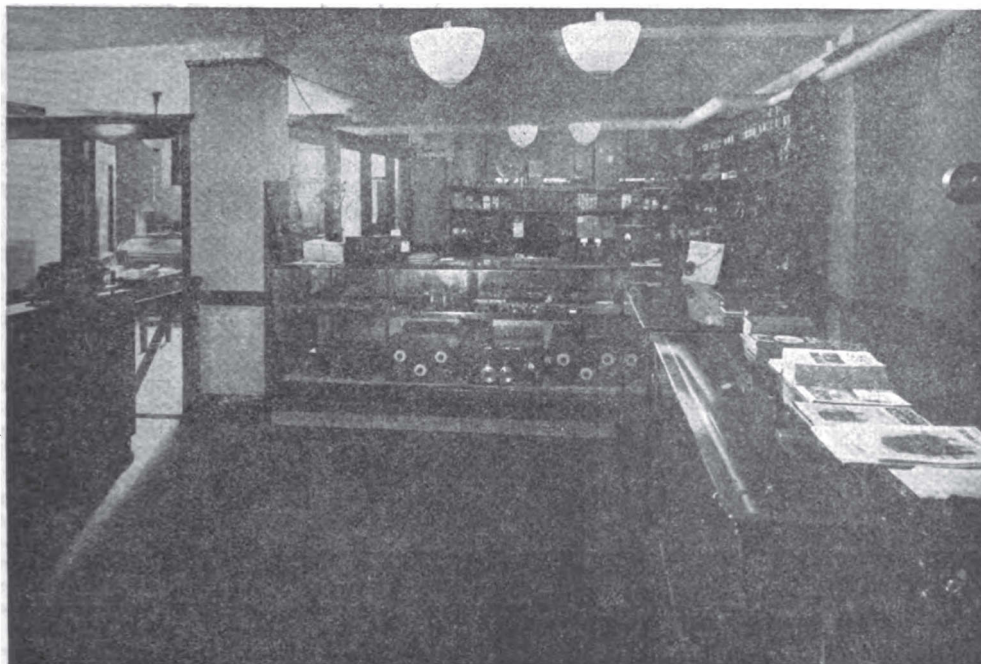
Two interesting products have been

brought out by this Company, notably the A.R.Co. variable condensers and the A.R.Co. amplifying transformer. Other units of equal value are promised in the future.

At the head of the organization is Mr. F. Wigglesworth whose personal interest in Radio is largely responsible for the

proved by listing alphabetically by calls in each district; miscellaneous information on rates; compass stations; press, time, and weather service, etc. This book fills a keen need—even if it does list 1AW as "Hartford, Mass."

5ZU has spent considerable time, money,



success of the Company; Mr. H. St. John Smith, purchasing agent; Mr. George L. Aspinwall, in charge of shipping and mail orders; and Mr. E. P. Gordon, advertising manager, are the remainder of the governing personnel.

New Books Received—Consolidated Radio Call Book, second edition. The only call book we have at present and the appearance of which has been expected month by month since March. 160pp., 6x9, paper covers, published by Consolidated Radio Call Book Co., 41 Park Row, New York, \$1.25. Contains comprehensive lists of ship calls alphabetically by names of vessels; shore stations alphabetically by countries, high powered stations of the world and their wave lengths; a recapitulating list of all classes of stations alphabetically by calls; a list of amateur stations ending with 1HAZ, 2AHN, 3PU, 4DB, 5WZ, 6PH, 7FZ, 8ABW, 9ACS; a list of "specials", alphabetically by cities for the entire group—a most unfortunate arrangement, as it is almost impossible to find a QRA as it is—would be much im-

proved by listing alphabetically by calls in each district; miscellaneous information on rates; compass stations; press, time, and weather service, etc. This book fills a keen need—even if it does list 1AW as "Hartford, Mass."

Houston Amateurs have been having considerable trouble with Amplifying Transformers going dead, stations not having adjacent transmitters experiencing the same trouble as those with them. A total of 21 transformers were lost by the club members during the summer. Can someone offer a remedy, a preventive, the cause or cure for this trouble?

RAYMOND L. WHITE
(Concluded from page 42)

York and Panama, and is known among the bunch as "AN". But this did not prove as interesting as the amateur work, so he resigned and came home and brought station 5AP into existence.

He is true blue A.R.R.L., a good booster, and a splendid organizer, and says he is with us henceforth and forever.



FAN AERIALS—WHO CAN HELP?

416 Court House,
Minneapolis, Minn.

Editor, QST:

Last spring you wrote me about our antenna at 9ZT requesting further information. At that time we were using a two wire vertical fan about 355 feet above the ground and 260 feet long, the station being on the fourth floor of the municipal building. This antenna ran up the side of a stone tower and, although there is no metal in the tower except the chimes and staircase, it seemed to shield us from all signals from the north. In fact I believe the tower reflected the waves to the south, as it seems unusual that a $\frac{1}{2}$ K.W. transmitter could work south as well as we did. As per June QST we were heard 2,200 miles in that direction over land and mountains mostly, while at the same time being rarely heard a hundred miles to the north. Lightning brought down this antenna, shattering the large insulators when it jumped from the ungrounded tower to the grounded antenna with a direct hit. In designing the present aerial, which is of the vertical fan type, I made a radical departure from all former designs of this type, believing it to be superior from a theoretical standpoint and my theory checked after it was constructed.

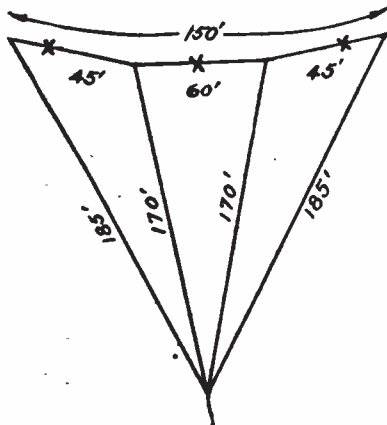
In looking at the picture of 9ZN I couldn't help but think how much longer the outside leads of his fan were than the middle ones. Now it appeared to me that if each wire were taken separately, their fundamental wave lengths would greatly differ and I fail to see how they could all be of the same wave length when connected together. Amateurs with "T" or "Inverted L" aeriels are always careful to have all wires of the same length, for we would laugh at an aerial with insulators strung along the flat top at different lengths from the lead-in. Imagine a "T" type with excessive sag or an "L" with the free end raised above the lead-in and you are not very far from the vertical fan type, but at what point in this gradual change does it matter whether or not the wires are all of the same length? Imagine an electron starting up each of the wires in the average fan antenna. These electrons all travel at the same speed and the ones that went

up the shorter wires will reach the nodes and get back to the lead-in by the time the ones on the outside track have just gotten well started down. If the antenna is grounded and of not too high resistance there will be free oscillation of electrons up and down the antenna until all the energy is dissipated due to radiation, absorption, and conductor resistance losses. The length of time for these electrons to traverse the antenna system is the determining factor of the wave length and if each wire has a different period of oscillation how can the fundamental wave length be definitely at one value? Continuing the discussion about these electrons, what happens when the electron from the center wire gets back first and starts up again on all wires, as they are all connected together, and meets the others coming down? Perhaps it neutralizes the second one and leaves the rest of them to fight it out among themselves as they arrive upon the scene in pairs later, but more probably it just takes some of the pep out of all of them, and the second likewise does the same to the third; that is, what there is left of it after the first combat. The resulting distributions of voltage after two or three oscillations become quite complex, it would appear. If the top and supporting wire of the fan has considerable sag in it, the fundamental wave lengths of the individual wires will differ greatly. As the wave length is about four times the length of the wire in each case, some idea may be obtained as to the probable broadness of the resulting wave of an antenna of a dozen wires each differing from the next by five meters wave length, which would be about four feet of wire difference. If my notes are correct, I believe I heard Mr. M. B. West, at the Central Division Convention at Chicago, remark that the more wires added to a vertical fan antenna, the less sharply its fundamental tunes. This was in connection with his explanation of his favorite hobby of chopping up a perfectly good antenna until it gets the "blues". He drew a curve which was very peaked, representing the tuning of a two wire vertical aerial, and another, much broader, with a poorly defined maximum point, which he said was the result of adding more wires in the form of a vertical fan. He said that he considered two wires of great height and diverg-

ing upward, the best antenna. Doesn't my theory explain this?

It appears to me that there are three possible remedies to the fan antenna to make it O. K. The first would be to make the support in the form of a circular arch bending upward with the wires as radii; the second method would be to place insulators part way down the outside wires making the active parts of all the wires the same length; and the third method would be to properly space the wires along the top wire. The first two methods are out of the question for constructional or efficiency reasons, so the last will be considered.

If a vertical wire is tipped somewhat out of its vertical position, its wave length is increased very slightly. It is impossible to say just how much this would be, but unless the deviation from the vertical was excessive it would not amount to an increase in wave length enough to be measured. Therefore, in the following, for simplicity the wave length is considered to be proportional to the linear length. The down wires of the fan should be in good electrical connection with the top supporting wire. That sounds simple enough, doesn't it? The only thing that requires any figuring is the spacing of the wires at the top. The whole thing, in a nutshell, is to so space the down leads that the total distance up one lead and across the top wire to the next lead and down that will be the same for any lead with its adjacent one. If these loops all have the same total length no matter between which two adjacent wires figured, the space between the wires near the center will be greater than between wires nearer the outside, measured along the top wire.



Perhaps the example of such an antenna at 9ZT will better illustrate what I mean. The top wire is 150 feet long and was first hoisted with cords attached and the length of these cords measured from different

points along the wire to the lead-in bushing with liberal allowance for sag due to the weight of the wires later. It was found that the final length of four wires would be 170 and 185 feet for each pair. Letting X equal the space between the two on each side of the center, the total distance around the inside loop would be 2 (170) plus X, which should equal the distance around one of the outside loops, which would be $\frac{1}{2}$ (150-X) plus 170 plus 185. It figures that making the space between the innermost wires 60 feet, and between each of these wires and the outside wires 45 feet, that the total distance around any adjacent pair would be 400 feet. Our little electrons may now scamper up and down the wires to their heart's content and will bump into each other after they have gone 200 feet and then will run down again, meeting at the same time at the lead-in. It is perhaps interesting to note that there are three places in the antenna at which there is no current flowing. These are 200 feet from the lead-in and come at the center of the top wire and 15 feet from each end. Insulators may be inserted at these points if desired but there would be no use as there would be no difference of potential across them. These points are the places of highest potential with respect to the ground or counterpoise, and are the nodes for current. I must admit I haven't tried connecting a hot-wire milliammeter across these insulators because I couldn't find a powerful enough telescope to watch the needle on the meter scale.

With the same wave meter and under the same conditions of excitation, I find that the fundamental tunes just as sharply as the old antenna of two vertical wires. Personally, I don't see the need of a large number of wires in an antenna, and believe that a few, of good high frequency conductivity, are all that is necessary. There is also a practical limit for each antenna, for as the number is greatly increased, the distance between those near the outside of the fan becomes smaller.

In conclusion, I wish to state that though I am not yet a radio engineer, I believe the above to be a fact as I see it from what I know about it. So far as I know, 9ZT has the only aerial constructed on this principle, but I would like to hear what other fellows think about this. I know there are lots of fan antennas constructed along the common lines of equal spacing at the top and I would like to hear from the many users of this type whether I am right or wrong, and what they think about it. Well, enuf for this time, Eddy. CUL 73.

Yours till the Grid Leaks,

Boyd Phelps.

(We invite comment. There is a dearth of data on aerial design. We used to think

that the capacity of the whole aerial system was about all that mattered, but now we don't know.—Ed.).

REPORTS FROM SEA

S. S. City of St. Joseph (KOSM),
At sea enroute to Barcelona, Spain,
September 1, 1920.

Editor, QST:

I am sending you a list of wireless call letters of some Amateurs and the time which they were heard during this trip over, and I hope it will be of interest to readers of the well known QST.

While visiting my home last trip after coming back from Italy and Egypt I happened to be reading through a copy of the QST which is being sent to my home address as it was in the old days when it first started. I read an article asking for some of us "Comm. Ops" to listen down on a low wave once in a while, and still being an amateur at heart though in the commercial game, I said to myself "that is what I will do during some spare minutes at nite after getting NAA px". So OM here is what I heard:

4:30 GMT 8/25/20 i.e. 11.30 p.m. ur time 8/24/20. 8DV de 3JZ. His sigs QSA. Slight QRN.

5:00 GMT 8/25/20 i.e. Midnite ur time 8/24/20. 1AW. 9HR de 2NF. Sigs QSA. Slight QRN.

At this time we were 1000 miles east of Cape May, N. J.

Next nite.

4:10 GMT heard 3JU call an Eight station but was QRM by a ship on 300 so missed call.

4:15 GMT heard radio phone on 200 meters but voice faded.

4:30 GMT heard 3JU de 1HAA one msg. Then got the following of the message so he will know just how his signals are carrying. to A.G. Nic. . . . 15 Irving Place. . . (much QRM from ship close by on 300) Mabel leaving here Sunday regards. . . . Could have copied every word if it had not been for that ship on 300. Could hear 1HAA about three inches from the phones. At this time we were approximately 1275 east of Cape May, N. J.

Perhaps it will be of interest to know that only a one step was used and the receiver is of the well-known Navy Standard.

I hope that the above will be of interest to the owners of the radio stations and would be glad to hear from them as to what kind of transmitter they are using. My address is care of Baltimore-Oceanic S. S. Co., Baltimore, Md.

My radio station, which was 3UZ before the war, is now 3BA and operated by my brother, so if any of you fellows hear 3BA please drop a card.

Guess I have taken up quite a bit of

your valuable time OM so will close with best 73's to the "bunch" and wishing the A.R.R.L. and the "QST" the best of success in the world, I remain

Yours till the static dies,

Thomas W. Braidwood.

(Fine, KOSM, and we thank you cordially. Please keep it up and ask your operator friends to help. You can see it is mighty interesting both to you and us.—Editor).

WHAT HAPPENED IN EARLY OCTOBER?

Brooke, Va., October 9, 1920.

Dear Friend Warner:—

Would certainly like to know what has happened to the short wave radio now, or if the experiences observed here are the same elsewhere for ever since the 2nd of October conditions have been most peculiar.

As you already know, under ordinary conditions with my present aerial the Second district stations rank first, with the third district a close second, and the first district third, while the fourth, fifth and eighth and ninth are rather indifferent with the exception of a few "regulars" in each.

Now commencing with the second of October and continuing up to and including last night, not a sound has been heard from the first district and the second and third district stations are almost as quiet, and strange enough what few of the second and third I do hear are all stations I have never heard before. Even 3BZ does not come.

On top of this the fourth stations show a big improvement over ordinary conditions and the fifth and ninth are still better than the fourth while the eighth work indifferently—good one night and bad the next.

The most noticeable peculiarities were on the second the only stations heard at all were 9AEQ, 5ZL, 4XC and a few 2's. On the third all I heard was 9GN, 9LA, 8AJW, 4DM, three twos and one three. Such as this has been kept up night after night until last night where it seems the climax has been reached, when the only station heard at all loud enough to read through the QRN was 5ZP who was very QSA. Now 5ZP is nearly 1000 miles south of me, and why should this station pick its way through all that distance when nothing else at all would do so? It is also well to note that 5ZP was working 8DI, copying him without trouble while 8DI had trouble copying 5ZP, judging from the repeats that he was compelled to make, while 8DI could not be heard at all here but ordinarily is one of the best 8's I get, and was very QSA on the fifth.

Evidently the wires are crossed somewhere. I also note the following letter

from 3CA, Roanoke, Va., under date of October 4th.

"Tonight heard 2BB, 8IN, 8EN, 9GN, 9KU, 5BL and several other DX stations, but could not get a single one close to me, not even 3RF who is within 4 blocks of me".

Let's see if anyone else is having the same troubles.

Sincerely,

A. L. Groves.

ULTIMATE DX

East Orange, New Jersey,
August 10, 1920.

Editor, QST:

Perhaps some of your readers may be able to give me a little light on this subject!

John has a 1KW station. James only has a ¼ inch spark coil. John, of course, will hardly speak to James because he (John) claims he can transmit 2000 miles. He means to imply, I presume, that, with the average PRESENT-DAY equipment at the receiving end, his set will transmit signals that are audible 2000 miles away. For, the distance to which ANY station can actually transmit is, to my way of thinking, INFINITE! And all this REGARDLESS of the size or location of the transmitting station or the amplitude of the transmitted wave.

Take, for example, the analogy of a stone thrown into a pond of still water. When the stone strikes the water it causes circular ripples or waves to be sent out in all directions through the water; the point where the stone struck, forming the center of these circles or waves. Now, as the waves travel outward and away from this center of disturbance, they become less and less well defined until a point is reached where they are imperceptible to the human eye. We are led to believe, in consequence, that they are "absorbed". But, are we, therefore, to assume that, because they are APPARENTLY absorbed, that they, in reality, travel NO FURTHER? Had we delicate and sensitive enough instruments at our disposal, it seems highly probable to me that we could detect the presence of these waves at the VERY EXTREMITIES of this body of water, REGARDLESS of the size or magnitude of the transmitted wave. And we could detect the presence of these waves at the very extremity of this body of water entirely IRRESPECTIVE of the size of the body of water, providing, ONLY, that our instruments of reception were sufficiently sensitive. This seems to be a perfect analogy to the transmission of electro-magnetic waves termed "wireless". Given an infinitely sensitive receiver, what is to prevent the reception, in China (or Mars), of waves emitted from a BUZZER that is located in Alaska?

To me the development of a REALLY EFFICIENT receiver contains unbounded possibilities and comments from your readers will be doubly appreciated.

Cordially yours,
George N. Garrison.

D. C. FOR C. W. TUBES

701 West 179th Street,
New York City.

Editor, QST:

I was particularly interested in your article in the September issue—"A Few Ideas for Amateur C.W." From the tone of that article and conversations I have had with amateurs of my acquaintance, I judge that the greatest obstacle to be overcome is the obtaining of the high-voltage D.C.—were it not for the difficulty encountered here it is quite probable that C.W. would be employed practically universally. I have a little scheme, which while it may not be a complete solution, will at least form a new field for research and it ought to develop into something. While a patient at one of the largest and best-known sanatoria in this country, I studied X-Ray rather extensively, the institution being equipped with several very fine outfits. For the Coolidge tube, D.C. is essential and is used at potentials from fifty to seventy-five thousand volts and sometimes higher. This was obtained by shooting 110-220 volts A.C. into a transformer and stepping it up to the desired voltage, then rectifying it by means of a disc rectifier driven by a synchronous motor. It seems to me that this method of rectification ought to be O. K. for C.W. At any rate it has the advantages of rectifying both halves of the cycle, and being almost unlimited in the amount of current it will pass. At the voltages used in C.W. work, sparking at the contacts would be negligible. The only disadvantage that occurs to me is the uncertainty of the polarity, but this could be overcome by the insertion of a polarity reversing switch in the primary of the transformer.

If somebody got busy along these lines we might have a simple and complete solution of a problem which at present is preventing C.W. from spreading throughout all amateur radio.

Very truly yours,
Arthur K. Ransom.

A PATENT COMMITTEE

Tresco, Davenport, Ia.,
Sept. 29, 1920.

Mr. H. P. Maxim,
Hartford, Conn.

Dear Sir:

There is no real reason why QST cannot have an up-to-date legal department. A study of some of the lists available show-

ing the legal talent as members of the A.R.R.L. is convincing that all that is needed to organize this legal department is a call from yourself to the various members of the bar throughout the country to appoint a committee among themselves to serve without pay and give to our magazine regularly clear statements of the patent situation as it happens to be at that time. Without denying any of the inventors their rights under the law, we should surely state what their rights are.

The mere fact of attorneys writing the many manufacturers who are engaged in the manufacture of amateur wireless material demanding a royalty for such-and-such a client may mean that the client and the attorney are under the impression that such a royalty is due. Several interesting reversals of opinion have occurred recently and unless the manufacturers are enabled to employ legal talent to investigate the numerous claims arising they are at a disadvantage. With a great number of the larger dealers who appear to be afraid to take the chance of purchasing various material, this legal help would also mean that all claims would be further investigated.

The amateurs are the ones who are really paying this royalty and it is no more than fair to them that QST should invite such an organization among its members to act as a legal department in such matters, and get their information from the attorneys of the various claimants for these royalties.

Things were so complicated a short time ago that several lawyers for as many claimants were insisting on royalties for binding posts, and a rheostat which had been designed primarily as a dimmer for a Ford headlight. This committee of attorneys could act as a body to assist QST and its advertisers, without in any way compromising QST.

The outcome of this arrangement I feel sure would be of considerable benefit to all concerned and publicly air a subject that has been more or less of a mystery to all of us.

Yours very truly,

W. H. Kirwan.

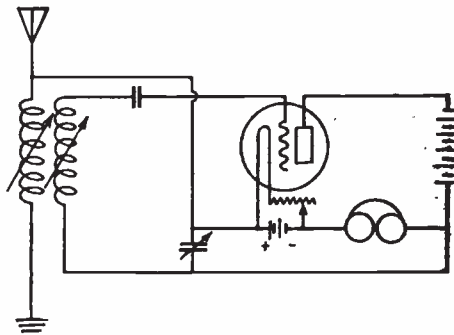
(QST would be glad to hear from any of its readers qualified to act for the good of Amateur Radio in the manner suggested by Mr. Kirwan, and will also be glad to have expressions of opinion from other manufacturers.—Ed.)

ANOTHER REGENERATOR

Manson, Ia.,

Editor, QST:

Possibly there is nothing unusual about this hook-up, but I have never seen it printed. Have tried about everything I have seen in print for use with an ordinary loose coupler without any variometers,



but this is by far the best I've ever used. It seems to have the advantage of maximum amplification of spark signals without distortion of the natural tone of the transmitter.

Yours truly,
Russell Virt.

INDUCTIVE FEEDBACK

Atlanta, Mo.

Editor, QST:

It will no doubt be of interest to those that have the QST regenerative receiver described in January, 1916, QST, to learn that the tickler system can be successfully applied to it, as described in Mr. Alexander's article in December QST. Wind 30 turns No. 26 D.C.C. wire on a tube 35" diam., 3" long. Place this inside the secondary load coil and use the Alexander hookup. It requires close adjustment but when adjusted the long distance amateurs sound like they were only a block away, and the C.W. come in as clear as a whistle.

Yours truly,
Claude E. Ronnjue.

A RECORD?

San Francisco, Cal.,

August 24, 1920.

Editor, QST:

Just a line to let you know that I believe I have broken a record for amateur work at my station 6ZE, working on 200 meters.

On the night of August 9, 1920, I was working with 7CU (Royal Mumford, Vancouver, Wash.) before the QSS test was sent. After 6DY had sent the test, I broke off with 7CU for a minute, and worked 6DY, reducing my power when I did so. After finishing with him, I again worked 7CU. On full power, 600 watts, I was radiating about 4.2 amperes with a decrement of about 0.14; on low power I radiated about 0.85 amperes, and the transformer primary input was 45 watts (FORTY-FIVE WATTS). You may judge of my surprise when I later received a note from 7CU saying that he had copied most of the message I sent to 6DY on this low

power tap, and that he, 7CU, was using a single tube without amplifiers.

I immediately wrote him for further confirmation, and arranged for the test to see if it was a freak or not. Last night I demonstrated that it was not an absolute freak, as I was able to do even better than that shown above. I called 7CU and worked him on full power, and then cut the power down to the lowest amount I can get a spark on, which is 20 watts, with a radiation of about 0.6 amps., and 7CU heard me, although he said that I was rather weak, and hard to hear through the static, and interference (several nearer stations going at the same time).

The distance from San Francisco to Vancouver, Wash., is about 600 miles, entirely over land, with many high mountain ranges and forests in the intervening country, and I believe that this will almost, if not quite, constitute a record for low power transmission, and shows what can really be done with a little energy properly used, on a carefully tuned transmitter.

I am using a CESCO 1K.W. transformer, 0.012 Dubilier Mica Condenser, a 12 plug rotary making 3600 RPM on an induction motor, and a simple oscillation transformer using 1.25 turns in the primary 10" in diameter, of $\frac{1}{2}$ " copper tubing, and 7 turns in the secondary 6" diameter of high tension rubber covered cable. The coupling is rather loose, there being about 4" separation between coils. Have two impedance coils in the transformer primary to reduce the power.

Yours very truly,

D. B. McGown.

GIVE THE FAIR SEX A CHANCE

New Orleans, La.,
August 14, 1920.

Editor, QST:

A great majority of radio bugs will no doubt disapprove of my suggestions in that behalf, because they would rather have the fair damsels where they can throw their lamps on em' now and 'en—so to speak. Especially so now-a-days with those low cut "everything's". You know what I mean. Then you young rascals must remember that there are the serious minded gentlemen who have either lost their eyesight or have been married so long that their only wish is to die. However, they want to see the Radio Female enthusiast given a chance and I am one of those type. I am not married long—well not more than two years (some call that decades) and I am quite sure my eyesight is not failing me in the least, from what I perceive. And furthermore I have just purchased a good new pair of tortoise shell glasses well protected. Getting our minds back on our subject, let me say that the young woman who has taken any interest in wireless and has pro-

gressed up to the rank of a Commercial Wireless Operator has absolutely no chance. I myself know of but one case where a woman was placed aboard a vessel and that was mainly because the Captain was her Father. This very good reason in most cases has nothing to do with it simply because it is the iron clad policy of most steamship concerns not to permit relatives on the same vessel. The reasons are quite evident most times being defined as "partiality" in favor of one or the other. Now we come face to face with a condition which surely should not exist. If a woman be so inclined to take up this fascinating work and as I said before progress to the point where she is able to obtain a first grade license, then why not endeavor to give her the chance she is willing to accept?

Some of you cons on the suffragist ticket might take offense at this, however, let me point out that this has nothing to do with suffrage, and all you women haters put your note books back in your pocket for I am going to suggest something in their behalf.

Everyone who has held an executive position in a Radio Corporation or in a corporation related to Radio in some way or another, knows only too well the trouble experienced in breaking in a female stenographer. The radio terms just make her sick—she never knows (nor cares to know) what you are driving at, and it is only a matter of "reference" to keep up with the work, causing much duplication of work, etc.—ad infinitum. Now then, suppose I suggest to the woman, who is so inclined, that she combine with her Radio Knowledge a thorough Stenographic course. When she obtains a first grade ticket and a diploma from the College or School which she attended, make application with a Radio Company stating that the applicant is the holder of a Commercial first grade license and a Graduate Stenographer. It seems to me that such a position should pay well, in fact much more than an ordinary Stenographer. I myself would prefer to have a woman of this type and it is my belief that it would prove a great asset to any radio department.

Why not then create a title for such skilled Stenographers, one which I will suggest is as follows: RADIO STENOGRAPHER at a salary of \$100 to commence and a gradual increase thereafter. What a relief to the already exasperated Radio Superintendent, Inspector, etc. Most of his letters could be handled intelligently without him having to dictate them. It would only be necessary to read such matters of less importance before they go to the mail Dept.

In other words, radio is exactly similar to some foreign language and Stenographers not versed in Radio cannot talk in-

telligently on the matter in 500 years or more. They are more or less mechanical in their work especially so in taking dictations.

I would certainly like to hear from others giving their views on this timely subject in behalf of the "weaker sex".

Yours truly,
Edward T. Jones.

THE HETEROGENEROPLIODYNATRON

2940 Maiden Lane,
Altadena, California,
August 16, 1920.

Dear Eddie:—

I wonder why Herbert Richter didn't finish his story in the August QST. Guess I'll have to finish it for him.

"The door slowly opened again and Bolsch cautiously stuck his head in. "Might maybe I listen by dat telephone vunce more already?" he asked. "Sure Mike, only look out for those short waves," I told him. He came in and carefully sat down, saying, "All right, I von't touch 'em, maybe you show me some long vuns, yes?" I tuned up on long waves and got POZ coming in strong about 35 per. Bolsch listened a minute, and then exclaimed "Py golly dat's meine liebe POZ!" He grabbed a pencil and started copying furiously, in German. Gonzl and I were flabbergasted and speechless. Finally Bolsch took off the fones, marched to the door, executed a right about face, and with a low bow said, in perfect English, "I was chief operator on the Vaterland and deserted before she was interned. Good evening gentlemen, may I call again?" Gonzl and I were still dumb, and pretty sheepish looking, so Bolsch disappeared through the door with just the trace of a smile, and a merry twinkle in his eyes."

Well OM must QRT. CUL. GN. 73.
("Dad") Paul F. Johnson.

NOTICE OF CONSOLIDATION

Stanford University, Calif.,
September 29, 1920.

Editor, QST:

I wish to take advantage of your columns to announce that stations 6SR and 6AE have been combined and now sign 6AE. Mr. Franklin, the owner of 6SR, and myself will operate the new station jointly, and hope by this change to be able to hold almost a continuous watch without missing many evenings. His sign will be JF and mine FT. We would greatly appreciate any cards that would be sent to us by amateurs outside of California who hear our signals.

Yours sincerely,
Frederick E. Torman.

AN ENGLISH AMATEUR

(The following letter is very interesting in that it chronicles the reception in England of NSF, Anacostia, D. C., which, while not an amateur-owned station, has confined most of its work to amateur wave lengths and has actively participated in our relay and QSS work. To the Old Guard who insist that "the spark is the thing", we present this with our compliments—NSF uses a bulb transmitter.—Editor).

6 West Mall,
Clifton, Bristol, England.

Tresco,
Davenport, Ia.

Gentlemen:

On the evening of July 10th, I was listening in with a companion, a Marconi Operator, using your 20000 meter tuner when we heard NSS with great clearness and copied the whole of the message. We also heard NSF in communication with a U. S. Warship. We also heard NFU, which we have been unable to identify. All these stations we heard quite distinctly and had no trouble in taking down the messages. The aerial used was 70 feet twin wire on a house in the city; the valves, Telefunken; the circuit, the one given by you. Altogether we were listening in five hours. The tuner was never silent for a moment and we received messages from dozens of stations. We considered these results excellent.

Yours truly,
(Signed) W. R. Wade.

EDISWAN TUBES

49 Nanton Avenue,
Toronto, Canada.

Editor, QST:

I noticed a few remarks you made in the Sept. QST concerning the English bulbs as made by the Edison-Swan Electric Co. You speak as if the powers as indicated were output, whereas they are not, and are input. This makes some considerable difference, and is the reason for the low prices.

I have succeeded in getting a batch of the 50 watt size, after waiting some 8 or 9 weeks for same. The tube is a very small one in size, and the elements are about the same size as the regular Marconi V.T. However, the output should be greater.

Hoping that the above may be of some use to your readers,

Yours sincerely,
E. S. Rogers.

Radio for San Diego Scouts

WITH the passing of the San Diego Exposition, which it will be remembered was held in Balboa Park, the future usefulness of some of the architectural wonders erected for housing some of the novelty exhibits become quite a problem. The Painted Desert was one of the most artistic attractions the San Diego Exposition afforded, consisting as it did of a complete and perfectly modeled Indian Village of the types found in New Mexico, Arizona and the South. Hundreds of thousands of dollars were put into its construction, and when inhabited by the Indian tribe, during the Exposition days, it was the most realistic exhibit conceivable. For some time following the closing of the Exposition the Indian Village passed into the custody of the San Diego Museum, but a greater usefulness was found for it as a headquarters for the Boy Scouts of America, and today we find that the various troops of Boy Scouts in San Diego County have been assigned to the different Indian buildings, while the Executive has his offices in the main building at the entrance, and has established a residence in the former Indian Agent's adobe bungalow at the north end.

Scouting is a movement with a great purpose, namely, the bringing of the boys and the great outdoors closer together than was ever possible before Scouting became organized. Scouting teaches many things, all of them useful, and among the important activities signalling has a prominent place. Now, the requirements for the promotion to 2nd and 1st Class Scout, so far as signalling goes, are not very strenuous. A Scout is merely obliged to familiarize himself with the various codes, and be able to receive and send letters at a low speed. Among the Boy Scouts are found the very best of America's boyhood and it is only natural to suppose that many Scouts have been interested in more advanced radio telegraphy than was ordinarily available thru contact with the everyday troop. San Diego has solved the problem of giving all Scouts the very best possible chance to acquire an up-to-date knowledge of wireless by establishing a first class radio station (6VL) in one of the buildings at the Painted Desert, thru the generosity of the Southern Electrical Company, which presented them with a complete $\frac{1}{2}$ K.W. transmitting set, a one stage amplifier receiving set, and a code practice set delivering a 500 cycle note (non-changing magnetic), and this together with a vertical aerial on a 125 ft. (one-piece) pole which alone cost \$450—has given local

Scouting a great boost.

The plans as worked out by the Director of Radio Signalling include the teaching of code to the student Scouts, followed by simple theory and the construction of apparatus. Classes are held each Thursday night. When a Scout has become sufficiently familiar with Continental code he is put into the station as an operator's helper. When qualified he is recommended for Government examination and when he has obtained his operator's license is then eligible to take a special examination as follows: 12 word code receiving and sending, a knowledge of Q Signals, knowledge of adjustment of apparatus, familiarity with message forms for relay work. Upon successfully passing this examination he is given a certificate of proficiency which the Scout takes to the local Court of Honor, the Chairman of which is a Judge of the Superior Court, and after being examined in open court is presented with a merit badge which is evidence that he is a 1st Class Scout operator and capable of operating the Painted Desert Station. The classes average about 50 Scouts and the progress made by these boys is astounding. During the first 3 weeks following the opening of the station three obtained Government licenses, and now 6 weeks after the work commenced six are ready to take their special examinations following the Government test.

A fairly complete reference library includes various text books and nearly all radio magazines published. QST will come regularly and is highly esteemed. The plan does not stop with educational work but contemplates the installation of troop stations for each of the several units throughout the County and also the construction and operation of at least one field set, portable, for each troop, so that during field maneuvers Scout Masters may be in touch with general headquarters at all times. It is understood that two other cities on the Pacific Coast have commenced work along the same lines. An official QST is broadcasted every Monday, Wednesday and Friday. Hopes are entertained that soon enough Scout operators first class will be available to stand continual watch, when A.R.R.L. messages will be handled with even greater certainty of "getting through" than is the case with many privately owned amateur stations.

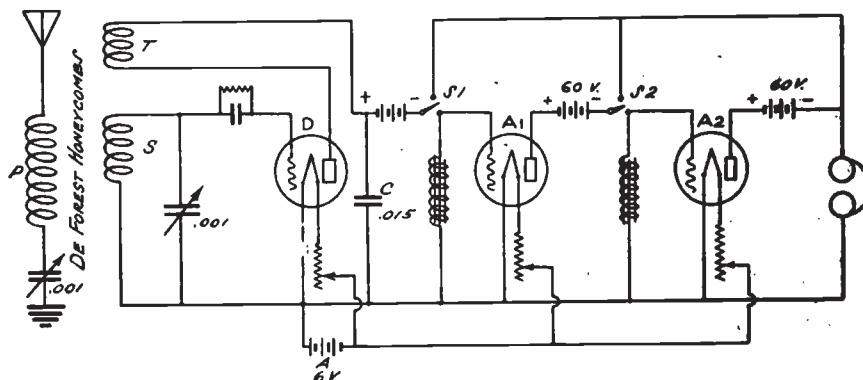
It may be of interest to know that during the period of the annual Summer Camp at Del Mar, a distance of 20 miles from San Diego, from one to four messages a day were relayed from Station 6VJ (Scout Camp) thru 6MZ and 6IY to
(Concluded on next page)

Amplification with Choke Coils

By Robert Muns

WHY are all the wireless concerns in the country trying to sell the poor amateurs expensive amplifying transformers? When I entered the Air Service Radio School and advanced as far as amplification, I was handed a diagram of a two-step amplifier using transformers but the instructor said, "We have discarded these sets as they are very inefficient, but you better look this over in case you should run into one some time." With this information we

should equal the internal input and output impedance, respectively, of the tube. Another advantage of great importance is the step-up in voltage secured by a proper turns-ratio, so that a transformer-coupled amplifier will reach the possible maximum of amplification with less tubes than one impedance-coupled. There is no question, however, that very satisfactory results may be obtained by the use of chokes, but it must be remembered that the turns-ratio is only 1 to 1.)



passed on to the use of choke coils for amplifying.

Since the war I have done considerable experimenting with various chokes and find them $1\frac{1}{4}$ to $1\frac{1}{2}$ times as efficient as amplifying transformers when using the hook-up shown. The best choke is a section of a 2" spark coil filled with core wire but the secondary of a Ford spark coil works very well. In this case the primary is not used at all. (How could we run a wireless if it were not for the Ford?)

The only disadvantage of this circuit is that a separate "B" battery is necessary for each tube but the increased results are worth it. Besides, the current used from each battery is less, so that the cost in the long run is about the same for batteries but reduced by the cost of the coils. A Ford coil costs about \$2.50 while an amplifying transformer is anywhere from \$4.50 to \$7.50.

I have used up to four tubes with this circuit with no trouble from howling, and think that many more can be added without trouble.

(Editor's Note: The main advantage of a two-winding transformer is that it makes possible the obtaining of impedances in both input and output circuits which are best fitted for the tube used. These values

RADIO FOR SAN DIEGO SCOUTS

(from page 53)

Headquarters, 6VL. This speaks well for Scout efficiency and was the final proof that those in authority would do well to place better facilities at the disposal of Scouts, in order to advance their knowledge. The Southern Electrical Company stepped in and gave them the apparatus. An interesting rule holds good at Station 6VL, namely, the station is to be used for traffic, and HAMMING is eliminated. The Scouts have, and will make good.

CHAS. CANDLER

(Concluded from page 42)

testify.

QST sincerely regrets its inability to secure a photograph of the far-famed "Mrs. 8ER" at this time, but hopes for better luck soon.

CALLS HEARD

On account of the vast quantity of calls reported we must ask your co-operation in the following.

- (1) List the calls on a separate sheet of paper—do not embody them in a letter.
- (2) Arrange by districts from 1 to 9, and alphabetically thru each district; and run them across the page, not down a column.
- (3) Put parentheses around calls of stations also worked.
- (4) Omit initial or other unauthorized calls.
- (5) State the period covered by your report.

1AW, HARTFORD, CONN., Sept. 1 to Oct. 11.
 1BM, (1CK), (1CM), 1DY, (1GY), (1JQ), 1QN, (1QP), 1RQ, 1RZ, (1XT), (1XV), 1AAZ, (1BBH), (1BBL), 1DAP, (1EAS), 1FAQ, (1HAA), 1SAS, (2BG), (2CT), (2DA), 2DH, (2DN), 2RK, 2SH, (2WD phone and mod.), (2ZL phone and mod.), 3AB, (3BZ), 3CL, (3DH), 3HJ, 3HN, (3KM), 3LY, (3ZA), (3CB), (3EN), (3GS), 3HG, 3IC, (3JS), 3NI, (3RQ), (3XK), 3ZA, 3ZD, (3ZW), (3ACF), 9ZJ, 9ZN, (NSF).

1KAQ, ANVERS, MASS., Aug. 16 on Galena.
 1NAQ, 1TF, 1TS, 1UN, 1AW, 2TF, 2NF, 2DN, 2BG, 2EL, 2JZ, 3BG, 3GB.

1AE,
 2DA,
 (C.W.),
 2JA,
 (2OX
 (2RB
 2VK
 buzze
 and
 3HJ,
 3XK,

1AE,
 1RZ,
 3GX,
 3ABG.,
 3ER,
 3MT,
 3ZW,
 2JP,
 2ZF,

1FB,
 1AK,
 1BM,
 1DP, 1
 1GZ, (
 or tel.,
 2BM, 2
 2OA, 2
 2XJ, 2ZJ (C.W.), 2ZM, 3AA, 3AK, 3AW, 3BF
 (Canada), 3BH, 3BZ (QSA), 3CC, 3CP, 3DH,
 3EN, 3FB, 3KM, 3NB, 3NF, 3NV, (3HJ), 3OB,
 3PR, 3ZW, 3BM, 3AA, 3AK, 3CB, 3DA, 3BV,
 3DV, 3DY, 3EN, 3ER, 3EV, 3LX (C.W.), 3NG,
 3EL, 3KZ, 3FW, 3NI, 3XK, 3XU, 3ZW, 3ZA,
 3WY, 3AU, 3CI, 3CF, 3HR, 3ZL, 3ZN (very QSA),
 NSF.

**3DK, BRYN ATHYN, PA.,
 Oct. 1919 to Aug. 27, 1920.**
 1AD, 1AE, 1AS, 1AW, 1AZ, 1BAY, 1BBL, 1BM,
 1CK, 1CM, 1CS, 1DA, 1DE, 1EK, 1EO, 1EP, 1FA,
 1FQ, 1GA, 1HAA, 1JA, 1JQ, 1KT, 1PM, 1RE,
 1RH, 1RM, 1RN, 1RU, 1RZ, 1SZ, 1TS, 1ZS, 2AIM,

2AR, 2BF, 2BH, 2BK, 2BM, 2CM, 2CQ, 2CS, 2CT,
 2CY, 2DA, 2DF, 2DK, 2DM, 2DN, 2EL, 2ET, 2FI,
 2GR, 2IF, 2IR, 2JE, 2JU, 2JZ, 2KM, 2ME, 2MK,
 2NF, 2NM, 2NN, 2OA, 2OM, 2PL, 2QD, 2QR, 2RB,
 2RH, 2RK, 2SH, 2TF, 2UE, 2VU, 2WB, 2WX,
 2XB, 2XC, 2XH, 2XJ, 2XU, 2XX, 2XZ, 2YM, 2ZC,
 2ZH, 2ZM, 2ZS. 3AA (QSA), 3AF, 3AIE, 3
 (3ANC), 3AO
 3AVY, 3AW, 3
 3BH, 3BM, 3
 3BZ, 3CB, (3
 (3CS), 3CV,
 (3DF), (3DH
 (3DZ), 3EA,
 (3EP), (3EV)
 3FN, 3FO, 3F
 3GX, 3HE, 3H
 3IM, 3IR, 3IS,
 3KG, 3KM, 3LI
 3NB, 3NU, 3NI
 3PD, 3PG, 3PI
 3QC, 3QH, 3Q
 3RX, 3SQ, 3T
 3XC, (3ZA), 3
 3AK, 3ALE, 3B
 3CB, 3CC, 3CB
 3DO, 3DQ, 3DF
 3ES, 3EZ, 3FI
 3HP, 3HY, 3I
 3MN, 3MT, 3I
 3XA, 3XK,
 3DM, 3EP,
 AN,
 AV,
 3G,
 3Y,
 3Q,
 3E,
 3),
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 3K,
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 3E,
 3Z,
 3),
 3E,
 3),
 3Z,
 3G,
 3),
 3E,
 3R,
 3F,
 3C,
 3Y,
 3Z.

3LX, CRAFTON, PA., Aug. 23 to Sept. 12.
 1AW, 1FV, (1HAA), (1RZ), 1TS, 1TE, (2BK),
 (2JZ), 2LK, 2NF, 2RK, 2TF, 2TR,
 CT, 3EH, 3EN, 3GM, 3GN, 3GT, 3HJ,
 3NC, 3NV, (3VV), 3VW, 3WZ, 4AL,
 (3BP), (3BV), 3CB, 3CF, 3DA, 3DI,
 3A, 3ML, (3MT), (3WY), 3XP, 3ZW,
 3AT, (3AU), 3HR, 3KF, 3OZ, 3ZJ,

A CITY, IOWA, Sept. 5 to Oct. 5.
 CA, 4ED, 5AS, 5EB, 5HA, 5ZA, 5ZL,
 AAH, 9ABY, 9AEG, 9AEQ, 9AEZ,
 9AJ, 9AK, 9AOC, 9AT, 9AU, 9BC,
 9CS), 9DB, 9DT, 9EQ, (9EZ), 9FR,
 9R, 9JU, (9KI), 9KV, 9LC, 9LG, 9LK,
 9NU, (9NG), 9OE, 9PL, (9RX), 9SL,
 9ZC 9ZH, 9ZJ, 9ZS, 9ZV, (9ZQ),
 ad Phone).

IC, DETROIT, on Sept. 26.
 2FG, 2XG, 3DH, 3MU, 4FI, 3AFT,
 3XK, 3AP, 3AU, 3HR, 3LC, 3ZN,

ZH, RICHFIELD, UTAH.
 3E, 3EJ, 3ZG, 3AT, 3AK, 3BQ, 3AQ,
 3PQ, 3IY, 3IF, 3JI, 3KF, 3JM, 3EJ,
 3NI, 3UES, 3GI, 3EJ, 3GF, 3EA, 3IM,
 3EN, 3JT, 3KP, 3EA, 3HH, 3KA,
 3GE, 3QR, 3AB, 3AAW, 3IP, 3FS, 3ER,
 3EC, 3NE, 3JD, 3EJ, 3TX, 3IQ, 3AE, 3AAJ,
 3AY, 3SK, 3SR, 3CE, 3AN, 3AM, 3MZ, 3CT, 3AIG,
 3ABX, 3AC, 3CU, 3SK, 3ZC, 3CC, 3CE, 3AIG, 3EL,
 3IM, 3PI, 3AEG, 3BI, 3AIR.

2WG, BRONX, May 1 to July 31.
 1AD, 1AK, 1AS, 1AW, 1CC, 1CE, 1CK, 1CZ, 1DAY,
 1DY, 1DZ, 1FB, 1FW, 1GM, 1HAA, 1HJ, 1LAO,
 1MO, 1RZ, 1NF, 1TS, 1VA, (2ANN), (2JU),
 (2CE), (2EX), 2BG, (2DS), (2EL), (2JN), 2JT,
 (2JZ), (2ME), 2NF, 2RB, 2TF, 2UE, 2ZM, 3AW,
 3EN, 3GB, 3GO, 3GV, 3HJ, 3NN, 3NV, 3SJ, 3VV,
 3ZA, 3AT, 3BB, 3BKCW, 3BV, 3CW, 3DA, 3DV,
 3DW, 3HR, 3LX, 3MT, 3NI, 3TH, 3ZY, 3HR, 3ZN,
 NSF.

(Concluded on page 58)

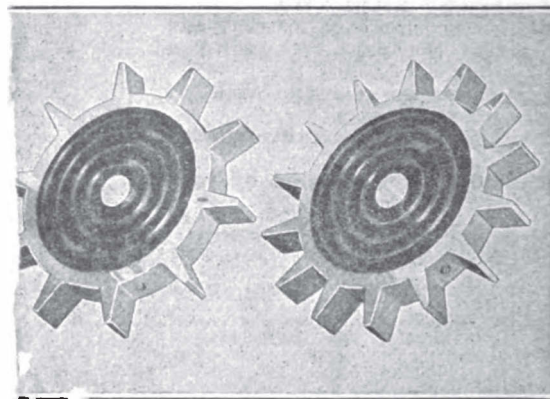
KNOCK 'EM DEAD

The Benwood Rotary Disc

Something entirely new

A real disc suitable for any 1 K.W. installation

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QSA or
your B

I use tl
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tations
YORK-

Discs are shown with 8, 10 and 14 points or teeth.

Discs are of solid cast aluminum, giving excellent wearing qualities and lightness. Complete disc weighs little over half pound.

Dimensions:—Six inches in diameter, three quarter inch in thickness. End of teeth only 3-16 inch thick. Gives the quick break so much desired.

The rotor is light enough for the smallest motor and yet large enough for the highest powers. Used in conjunction with the BENWOOD stationary electrodes, a beautiful clear soft note is obtained that is easily distinguishable thru the heaviest of QRM.

PRICE - - \$8.00

Specify size of motor shaft.

Every
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They
BENW
gap.

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judge

YH,
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ET,
STB,

SPECIAL

BENWOOD stationary electrodes, consisting of highly polished knob bus with copper sparking point with round brass shaft, minus support, exactly as used on the famous BENWOOD gap,

\$1.00 EACH, PREPAID ANYWHERE, QUANTITY LIMITED.

THE BENWOOD CO., INC., Co

If you use a Benwood please send us y

GET A BENWOOD

SEE OVER AND THEN ORDER YOURS

St. Marys, Ohio
 In my opinion, the best gap on the market. You should
 order the one I get concerning 8ER's signals.

Very respectfully yours,

Chas. Candler, 8ER.

Fall River, Mass.

Radio Station 1AK

1100 Miles, to Capeville, Tenn., where I was reported
 to have a loose and loose coupler hook-up, using a HALF KW with
 AP. This was due to the efficiency of the gap.

(Signed) Harold C. Bowen.

Danville, Va.

Radio Station, 3BZ

Ordered gap and find it superior to anything I have ever
 used. 3BZ's spark speaks for the BENWOOD. Saturday
 morning two stations, in the 1st dist., 5 or 6 in the 2nd, two
 in the 9th, all within one hour. Not one of these
 in a 300 miles of Danville. THIS IS NOT FREAK
 one most any night.

(Signed) W. T. Gravely.

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 P,
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 K.

PRICE . . . \$30.00

10th & Olive Sts., St. Louis, Mo.
 Dealers, write for proposition.

Send your order for this
 apparatus to any of the
 following dealers or to us
 direct.

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Arno A. Kluge Co.
 638 So. Figueroa St.
 Los Angeles, Cal.

Manhattan Electrical Supply Co.
 Chicago, Ill. St. Louis, Mo.

Northwest Radio Service Co.
 609 Fourth St.
 Seattle, Wash.

Phila. School Wireless Tel.
 Parkway Bldg.
 Phila., Pa.

Penn. Wireless Mfg. Co.
 507 Florence Ave.
 New Castle, Pa.

Anthony Electric Co.
 Anthony, Kansas

Chicago Radio Apparatus Co.
 3400 South Michigan Bl.
 Chicago, Ill.

Caesar Klaus
 Eureka, Ill.

Leo. J. Meyberg Co.
 428 Market St.
 San Francisco, Cal.

Western Radio Electric Co.
 550 So. Flower St.
 Los Angeles, Cal.

F. D. Pitts & Co.
 12 Park Square
 Boston, Mass.

The Radio Electric Co.
 3807 Fifth Ave.
 Pittsburgh, Pa.

3BZ, DANVILLE, VA., Sept. 15 to Oct. 1.
(1AE), (1AW), (1DW), (2BB), (2BK), (2BN), (2CE), (2CT), (2FG), (2GR), (2HN), (2JU), (2KT), (2ZL), (2RK), (2SH), (2WB), (2RV), (2JZ), (3BG), (3KM), (3HG), (3EN), (3GU), (3HJ), (3RW), (3DS), (3FG), (3EE), (3JK), (3HX), (3VV), (4YA), (4XB), (5XA), (5DA), (5DR), (5EE), (5NI), (5ACF), (5GB), (5NT), (5IK), (5RQ), (5EN), (5EV), (5FT), (5NZ), (5QM), (5CQ), (5HS), (5LD), (5HH), (5IB), (5DV), (5DZ), (5ZD), (5AJ), (5ZA), (5MK), (5GX), (5GK), (5QM), (5HR), (5KV), (5EQ), (5AAF).

5ZC, DALLAS, September.
(5AO), (5AI), (5IS), (5AP), (5CD), (5AL), (5CI), (5CG), (5DW), (5HA), (5FA), (5ZV), (5ZW), (5ZU), (5DA), (5C.W.), (5AEG), (5LR), (5LG), (5EL), (5OE), (5XJ), Catalina Islands and Los Angeles Fone.

6EB, LOS ANGELES, August 15 to Sept. 21.
6AK, 6AN, 6AT, 6BJ, 6BN, 6BQ, 6BR, 6CC, 6CI, (6CO), 6DK, 6DO, 6DT, 6DY, (6EJ), (6EP), (6EX), (6FS), (6IY-Day-light), (6JI-Day-light), 6JN, 6JQ, 6JR, 6MZ-day-light, 6OH, (6QM), 6QR, 6QU, 6SR, 6UM, 6ZE, (7CU)—August.

6EX, BERKELEY, CALIF.
6AK, (6AJ), (6AV), 6BQ, 6CM, 6CC, 6CS, 6CV, 6DH, (6DK), 6DP, (6EA), 6EB, 6EH, (6EJ), 6EM, 6EN, 6ER, (6FE), 6FI, 6FS, 6GH, 6GI, 6GM, 6GQ, 6HY, 6IF, (6IM), 6JD), (6JI), (6JM), (6JQ), (6KP), 6LQ, 6GR, 6MH, 6MZ, 6NS, (6OH), (6PQ), 6QR, 6RD, (6SK), 6TC, 6TX, 6UM, (6AAT), 6XZ, 7AN, 7CH, 7CR, (7BP), (7CU), (7CW), 7DK, 7DS, 7FH, 7YB, 7ZI.

CAN. 3FE, NAPANEE, ONT., September
On one V-24, Average Audibility 9:
1AW, 1BB, 1CK, C.W. 1CZ, 1EP, 1GY, 1HAA, 1NAQ, 1XD 'Phone, KQO 'Phone, 1XT, XFL, C.W., 2BB, 2BK, 2BM, 2GK, 2GR, 2JS, 2JU, 2JZ, 2NF, 2QV, C.W., 2TF, 2WB, 2ZL, mod. C.W., 2ZM, 3ABB, 3BPC.W., 3BZ, 3DH, 3HX, NSFC.W., 3AAN, 3ACF, 3AEG, 3AGLC.W., 3AM, 3BV, 3CBC.W., 3CE, 3CQ, 3DAC.W. and 'phone, 3DI, 3DR, 3EV, 3EZ, 3FEM, 3FO, 3FV, 3FW, 3GS, 3HA, 3HF, 3HG, 3ID, 3JS, 3LF, 3NI, 3OI, 3RZ, 3SH, 3XCC.W., 3XK, mod. C.W. and 'phone, 3ZE, 3ZVC.W., 3DF, 3GK, 3HA, 3HR, 3KF, 3ZQ.

1HAA, MARION, MASS., Sept. 1st to 25th
(1AK), 1AS, 1AE, 1AG, 1AR, (1AW), (1B), (1BL), (1BBL), (1CK), (1CZ), (1CM), (1CBJ), 1CBX, (1CBC), (1DY), (1DQ), (1DU), (1EAV), (1ES), (1EBS), (1EP), (1FV), (1FD), (1GAO), 1GY, 1GAW, (1HAX), (1HAL), (1IS), 1IAT, 1KAQ, 1KAW, 1LAV, (1NAQ), (1OAD), 1OJ, (1PAW), (1QAV), 1QR, (1RV), (1RZ), (1SN), (1TS), 1VAY, (1VAE), (1WAU), 1 (1XT), 1XD, (1XE), 2AEF, 2ARY, 2AVR, (2, (2AJW), (2BK), (2BG), (2BM), (2CT), (2DF), (2GR), (2HN), 2IT, (2JU), (2JZ), (2MP), (2OA), 2OE, 2OM, (2PL), (2PV), (2RK), 2SH, (2TF), 2TS, (2VA), 3BG, 3BH, 3DL, 3DS, 3DL, (3EE), (3EH), (3GX), (3HS), (3HG), 3KM, 3NB, 3PU, 3OB, 3PS, (3UC, 4AO, 4CP, 5AZ, 7HH, 8AFS, 8ACF, 8AC, (8BV), 8CB, (8DV), (8DY), 8DR, (8EN), 8FO, 8FT, 8HH, (8JS), 8LX, (8RQ), (8XK), (8ZD), 8OY, 8OI, 9HM, 9HR, 9ZL, 9

Heard By S. D. Browning,
Aboard Lighthouse Tender "Madrona"
Using Galena.

Sept. 15 to 16 in Suisun (San Francisco)
6EB, 6ER, 6IY, 6JD, 6JI, 6JM, 6NM, 6PL, 6SK, 6TC, 6TX, 7CC, 7CU.

8BV, LOCKPORT, N. Y., Feb. 1 to Sept. 30.
(1AW), 1BT, 1DQ, (1HAA), 1IR, 1JR, (1NAZ), 1QPmod., 1XD phone, 2AP, 2ARD, (2BC), 2BG, 2BK, 2BM, 2CA, 2ES, 2HO, (TJU), (2JZ), 2LU, (2NF), 2OA, 2OU, 2RK, (2RF), 2WB, 2ZM, 2ZL, (3BZ), 3DC, 3EH, (3HJ), 3LG, 3LO, (3NB), 3AAN, 3ACF, 3AM, 3BP, (3CB), 3CF, 3CV, 3DA, (3DI), 3DR, (3DV), 3EL, (3ER), 3FT, 3HH, 3JS, 3IA, 3LF, 3LP, (3LX), (3MT), 3MZ, (3NI), 3OI, 3OJ, 3OZ, 3RZ, (3SI), 3IK, (3WY), 3XA, 3XK, 3XU, 3ZD, 3ZK, 3ZV, (3ZW), (3ZX), 3AD, 3AEZ,

9AT, 9AU, (9CE), 9ER, (9HM), (9HR), 9ID, 9OQ, 9TP, (9ZL), (9ZN), 9ZQ, (NSF).

G. S. HOLLY, CAMBRIDGE, MASS.,

Aug. 7 to Sept. 26.

1AW, 1HAA, 1KAY, 1NAQ, 2AMZ, 2BG, 2BK, 2DN, 2EL, 2JU, 2JZ, 2OM, 2RK, 2RV, 3BG, 3BZ, 3HG, 3HJ, 3NB, 3ZE, 3ZW, 3KE, 3LF, 3NI, 3OZ, 3QM, NSF.

6JM, SAN FERNANDO, CAL., Aug. 15 to Sept. 15.
(6AE), (6AG), (6AK), (6AN), (6AT), (6BJ), (6BN), (6BQ), (6BR), (6CC), (6CO), (6CP), (6DK), (6DP), (6EJ), (6EP), (6EX), (6FE), (6FS), 6FX, 6GF, 6GO, 6GR, 6II, (6IY), (6JI), (6JJ), 6JK, (6JN), 6JQ, (6KM), (6MZ), 6NO, (6OH), (6QM), (6QK), (6TC), (6AAT), 6AAW, 6AAZ, 6AAZ, (6BAC), 7BP, (7CU), 9ZI.

4BE, WILMINGTON, N. C., Sept. 20.

8DJ, 1AW, 8EN, 2ZL, 8ZOW, 1XOF, 8ACF, 3KM, 8RW, 8NI, 4BZ, 3FG, 4AE, 5DA, Sept. 22: 8RQ, 8XK. Sept. 24: 9ZJ, 8ACF, 8RQ, 9ZV, 9EQ, 9AF, 2RK.

9CS, CLINTON, IA.

5CD, 8DI, (8FT), 8GD, 8TA, 8ZR, 9AL, 9AT, 9BC, 9BY, on radiophone, 9BY, (9CA), 9DC, 9EE, 9EL, 9EQ, 9EZ, 9FG, (9GC), 9HR, (9IA), (9IX), 9JL, (9KV), 9KY, (9LC), (9LU), 9MH, (9MS), 9NC, (9NQ), 9OR, 9QI, 9QQ, 9UU, 9WQ, 9YO, 9ZJ, 9ZN, 9AAV, 9ABZ, 9AEG, (9AEG), 9AEU, 9AEF, 9ACL, 9ANV.

8DA, SALEM, OHIO, May 1 to Sept. 22.

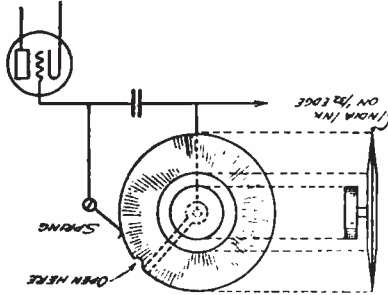
(1AW), (1HAA), 1TS, 1XD-voice, 2BK, 2BF-C.W., 2CE, 2CT, 2EL, 2GR, 2JE, (2JZ), 2JU, (2NF), (2RK), (2TF), 2ZM-C.W., 2ZL-C.W., 3AAP, 3BZ, 3CG, 3EN, 3GX, (3HJ), 3KM, (3NB), 3PS, 3ZA, (3ZS), 4BB, 4BZ, 4CC, 4YA, 5DA, 8BP, 8OJ, 8BO, (8DI), 9ALS, 9GS, 9HM, 9HR, 9JN, 9KV, 9MH, 9ZI, 9ZN, (NSF), KQO-voice, (KBN-2500 miles).

11BY, WOODS MOLE, MASS., August.
(1HAA), 1AW, (1EAV), 1BJ, (1AWU), 1WE, 3CE, 2XG, 3PB, 3ZS. Heard on board U.S.S. ACUSHNET during August: 1AW, 1HAA, 1KT, 4CC, 5ZA, Vessel off Sandy Hook, N. Y.

T. G. BORIGHT, SUTTON, QUE., Aug. 29-31.
1AW, 1BK, 1EZ, 1FT, 1FV, 1HAA (QSA), 1RV, 1SA (fone), 1XB (fone), 2AJ, 2AK, 2BK (QSA), 2BM, 2BV, 2DN, 2EL, 2EP, 2JZ, 2NF, 2TF, 3CT, 3KM, 3VV, 3WV, 3DE, 3EN.

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This handy device is made from a 2" disc of 1/8" fibre. A double bevel 1/2" wide is put on each side, reducing the edge to a width of 1/4", which is then given



several coats of India ink. The small place cut out in the rim is left uncoated, to open the circuit, and contact with one end of the coating is made by a narrow copper or foil strip. The disc is then mounted on the panel and a light spring arranged to make contact with the rim as it revolves.

—Contributed by C. L. Norman.

STRAIGHT C.W.

(Concluded from page 26)

and body. Swinging antennas may be a problem, but we can beat that too.

As proof that the time for the change is here, shoot around some night with the bulb oscillating and listen to the fellows who are already there, working on schedules of their own. In Connecticut we hear several 2's and a flock of 8's on straight C.W. and several of them we know are using but a few watts. You men with I.C.W.—ask somebody to listen while you change over to the pure undamped, and their report will make a believer out of you for life.

We have extolled the virtues of tube transmission. Now let's change it over to straight C.W., fellows, adapt our receivers to it, and reap the benefits that this system offers us—it is childish to spoil good C.W. by modulating it, but we must get the receivers to heterodyning if we are to move traffic. How goes it?

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of QST published monthly at Hartford, Conn. for October 1, 1920, State of Connecticut, County of Hartford.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared K. B. Warner, who, having been duly sworn according to law, deposes and says that he is the business manager of QST and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 448, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The American Radio Relay League, Inc., Hartford, Conn.; Editor, Kenneth B. Warner, Hartford, Conn.; Managing Editor, (none); Business Manager, Kenneth B. Warner, Hartford, Conn.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its names and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.) The American Radio Relay League, Inc., an association without capital stock, incorporated under the laws of the State of Connecticut.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) Hiram Percy Maxim, Hartford, Conn.; John S. Dunham, Brooklyn, N. Y.; C. D. Tuska, Hartford, Conn.; W. S. Browne, Brooklyn, N. Y.; C. R. Runyon, Jr., Yonkers, N. Y.; Nicholas Roper, Youngstown, Ohio; Chas. C. Godfrey, Bridgeport, Conn.; Frank Conrad, Pittsburgh, Pa.; F. M. Bookwalter, Springfield, Ohio; Chas. A. Service, Jr., Bala, Pa.; Miller Reese Hutchison, New York City; George M. Woodcock, Buffalo, N. Y.; C. Tefft Hewitt, Swissvale, Pa.; Leonard D. Fisk, West Hartford, Conn.; H. E. Rawson, Chicago, Ill.; Emma Candler, St. Marys, Ohio; Chapman Printing Co., Hartford, Conn.; Robert F. Gowen, New York City; E. C. Wilcox, Meriden, Conn.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceeding the date shown above is..... (This information is required from daily publications only.)

K. B. Warner

Sworn to and subscribed before me this 15th day of October, 1920.

F. L. Pratt, Notary Public
(My commission expires February 1, 1924.)

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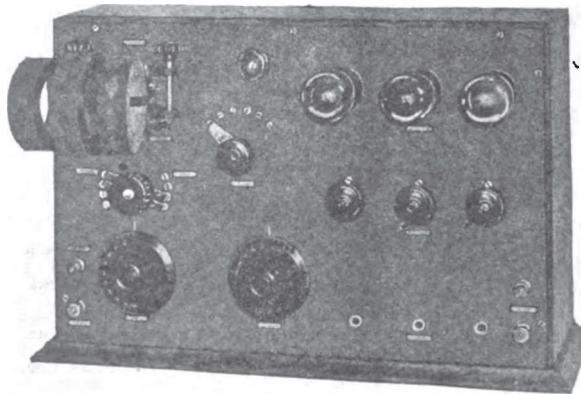


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