

QST

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HARTFORD, CONN.

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The American Radio Relay League, Inc., is a national non-commercial association of radio amateurs, bonded for the more effective relaying of friendly messages between their stations, for legislative protection, for orderly operating, and for the practical improvement of short-wave two-way radiotelegraphic communication.

It is an incorporated association without capital stock, chartered under the laws of Connecticut. Its affairs are governed by a board of seventeen Directors, elected every two years by the general membership. The officers, in turn, are elected by the Directors from their number. The League is non-commercial and no one commercially engaged in the manufacture, sale or rental of radio apparatus is eligible to membership on its Board.

"Of, by and for the amateur," it numbers within its ranks practically every worth-while amateur in America and has a history of glorious achievement as the standard bearer in amateur affairs.

Inquiries regarding membership are solicited. Ownership of a transmitting station, while very desirable, is not a prerequisite to membership; a bona-fide interest in amateur radio is the only essential. Correspondence should be addressed to the Secretary.

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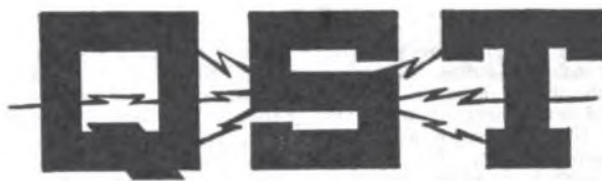
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A Magazine Devoted Exclusively to the Radio Amateur

Loop Transmission

By Leon W. Bishop, 1XP

At last! This is splendid material, especially when joined to 3ZY's loop receiving paper of page 27 of QST for April, 1922. We need every possible paper on 200-meter loop sending. Help us get them.—Editor.

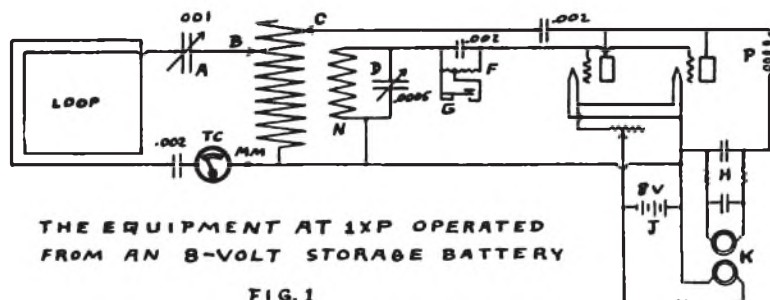
YOU fellows all read QST's recent editorial which said in effect, "Thou shalt not cause QRM between 7:00 and 10:30 P.M." It is up to us amateurs to dope out some way of handling short-distance traffic quietly. A sending loop seems to be the solution.

Last spring at the Boston Radio Show I was asked to equip an educational booth with a small transmitter to play music for the exhibitors. This I did, using a transmitter consisting of two 5-watt tubes supplied from an 8-volt storage battery and a 350-volt dynamotor and working into a loop consisting of two turns of No. 24 magnet wire on a 3-ft.-square frame.

The set developed a current in the loop of about 1.75 amperes and I was doubtful

people who had heard the music in various parts of the city; and finally we received four reports from a distance of 25 miles and one at a distance of 80 miles from New Hampshire. The loop showed directional characteristics, as the average distance in the plane of the loop was 15 miles, while 3 miles was about the limit to the sides.

Here is what will interest you fellows. While we were transmitting at 275 meters, exhibitors 20 ft. away were receiving WGI without any interference. Why can't we handle our local traffic in the early evening with loop C.W. transmitters and receivers? To do this we need no special equipment, only a low-resistance loop which is connected to the aerial and ground terminals of our regular transmitter thru series con-



if this would cover the hall, since Mr. Charles Kolster, the First District Radio Inspector, had agreed with me that the loop was nothing but a dummy antenna. We tuned to 275 meters and rushed around the hall to see if it was being heard. Everyone was receiving it nicely. A program was arranged and concerts started. Then the fun began. First someone from Wellesley, a distance of about 15 miles, called on the phone and asked us to repeat a number; then came reports in person by

densers. It is a good idea to keep the loop well away from the antenna lead, otherwise considerable energy will be put into the aerial by induction and our purpose defeated.

Since the radio show I have put in a large loop of low resistance at 1XP and have been able to transmit for a considerable distance. Figure 1 shows the circuit used. *K* is a 6-volt-to-350-volt dynamotor operated by a storage battery, *J*, which also lights the filaments of the tubes. *H*

is a filter to keep the commutator hum of the generator out of the tubes. *P* is a 150-turn honeycomb, which acts as a R.F. choke. *F* is a grid leak, part of which is shunted by a key *G*. *TC* is an ammeter for reading the loop current. Be sure to have a meter of sufficient range, as the loop current may be much larger than your normal antenna current.

The wave-length adjustment is obtained by varying inductance clip *B* and variable condenser *A*, which latter should be oil-

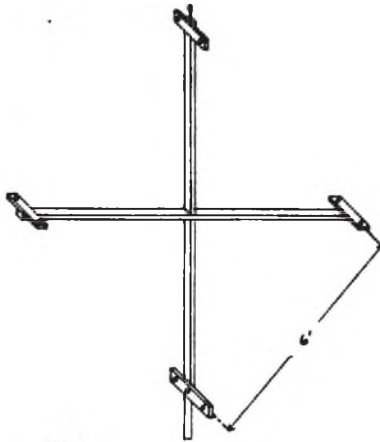


FIG. 2

immersed or liberally spaced. The plate clip, *C*, the grid tuning condenser, *D*, and the position of the grid coil, *N*, are then adjusted until maximum loop current is obtained.

To produce minimum interference it is desirable to use pure C.W. This of course demands more than ordinary care in filtering the rectified A.C. or the generator output. The smoother the plate supply can be made, the less likely the curse of the neighborhood is to fall upon us. Precautions should also be taken to avoid abrupt changes in the loop current by a method of keying which blocks any of the circuits. It is therefore unsatis-

factory to key the plate supply or the grid leak. Since it is illegal to use a compensation wave, our keying must depend upon producing a slight change in the loop current, without altering the wave length. This may be done by shunting the key around a portion of the grid leak, as shown in Fig. 1. The point at which the grid leak should be tapped is that which will produce a 25% difference in loop current when the key is depressed. For example, if you get 1.5 amperes with the key open, you should get 2 amperes when it is closed.

We have tried a large variety of loops but have had best success with 2 turns of 1-inch copper ribbon spaced 3 inches apart on hard rubber strips, on a 6-foot frame as shown in Figure 2. The loop is supported by a silk cord and rotated by a shaft and handle extending down to the operating table. We have also had good results with a 3-ft.-square loop.

Here are some of the stations which have been worked in the last three months on the loop: 10E, 1PT, 1ADN, 1ANQ, 1BGF, 1BKQ, 1CAK, 1CHJ, 1CMK, 1CNE, 1CSO, 2AEH, 2AWF, 2AZY, 3BX, 3BM, 3ANO, 3BIT, 8CCX, and 4EA. We got 4EA one night but have not been able to do it again, altho we have tried frequently.

At 1XP we also have a T antenna 40 ft. high and 106 ft. long, used with a counterpoise and a buried ground. The antenna current is 1.9 amperes, while the same set puts 3.4 amperes into the loop. We can work 900 miles with the antenna. The loop does not equal this but has covered several hundred miles. This takes patience and one DX record per evening is good work, but we can work 70 miles consistently if we are careful to turn the loop in the proper direction. The range could be increased by enlarging the loop and using fewer turns, but we would then approach the effect of an antenna with the consequent interference, and that is what we are trying to avoid.

Let us use this article as an introduction to a new field of amateur work, and compare our results thru QST in order that we may realize the maximum possibilities from loop transmission.

1923 FASHIONS IN RADIO HAIRCUTS



For those who use a single headband



Or this - if a double headband is preferred



For those who like a close crop or shave, a few hairs left as phone locators are useful.



In Which We Get Across

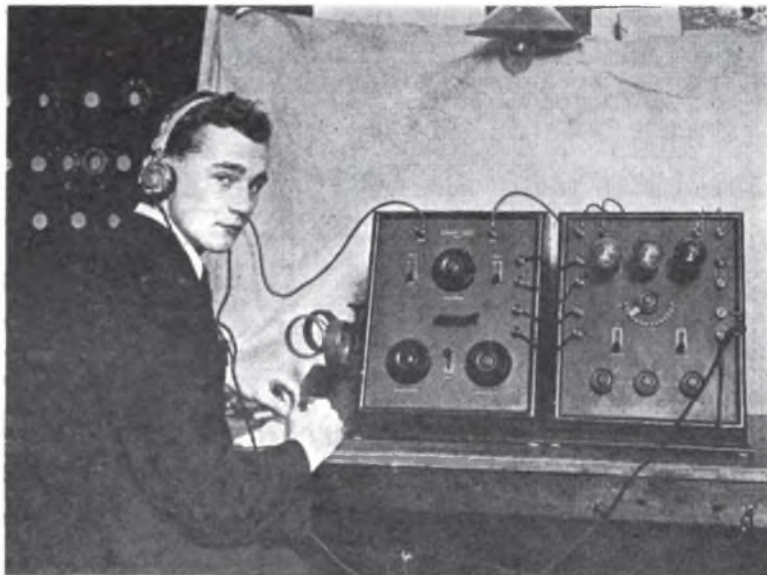
WELL, well well! We don't even need to have Transatlantic Tests to be heard in Europe. All we need do is prepare for them, and our comrades across the ocean copy us while we're trying to make our entry requirement of 1200 miles. During the preliminaries a total of 91 calls were reported informally to the Traffic Manager, and doubtless a great many others were heard.

Credit for the bulk of this reception belongs to the Manchester Wireless Society, a group of whose members, containing Mr.

remarks), 8CYB, 8IP (erroneously reported at first as 8IH), 8BO, 8NM, 8AMM, 8BXS, 8UK, and 9DVB.

On Nov. 23rd: 1BDI, 1BET, 1XM, 2ZL, 2ZS, 2AWL, 2BSL, 2BIC, 3BL, 3BFU, 3YK, 3ABY, 4EA, 4BY, 5BYD, 8UN, 8ATU, 9AAP.

On Nov. 26th: 1BES, 1BW, 1ZE, 1BDI, 1DC (erroneous; station not operated), 1GM, 1CN, 1XM, 2GK, 2AHO, 2CKN, 2AGC, 2AMM, 2BLP, 2AWL, 2BFU, 3JJ, 3AWY, 3WF, Canadian 3CO, 4BY, 4XC, 4ASP (obviously incorrect), 5TA, 5TJ, 8AQO, 8BEO, 8AD, 8AK, 8ATU, 8SP,



Mr. J. H. D. Ridley, chief test operator of Burndept, and the set on which he copied nine American amateurs during the Preliminaries. (Photo from World Wide Photos.)

Y. W. P. Evans, Hon. Sec'y of the British Wireless Relay League, Mr. W. R. Burne, 2KW, Mr. Allan Cash, 2GW, and three other gentlemen, rigged up a 7-valve receiver at the Society's station at Baguley, 5MS. This set used 3 to 5 radio amplifiers, a detector, and one stage of audio amplification. At our request Mr. Evans has radioed us the following lists of stations copied by them:

On Nov. 19th: 1GN, 1MK, 1BID, 2AJC, 2AJ, 2ZS (yes, Runyon is back!), 2GK, 2GV, 2CPD (originally reported in error in this country as 2CHD), 3XM, 3BLF, 4EL, 4EA, 4BY, 4DL, 6TF (see further

8CRB, 8ACF, 8AMM, 8BFM, 8MAP (obviously incorrect).

Mr. Leon Deloy, French 8AB, reports the reception at Nice of 1ARY's C.W. signals on Dec. 10th, calling a "3" station.

And on the early morning of Nov. 26th, London time, Mr. J. H. D. Ridley, Chief Test Room Assistant of the firm of Burndept, Ltd., Blackheath, London, copied nine American amateurs on a Burndept III using an extra stage of R.F.A., operating on an aerial 180 ft. long by 37 ft. high. Mr. Ridley's list consists of 1CMK, 1XU, 2AWL, heard calling 5LV and 9ZY; 2LM, 8BPL, sending a message to 4XY; 8ATF,

8AQO, calling British 5MS; 8XAK sending a weather report; and 9LG. And from 0105 to 0331 G.M.T. on that morning the entire program of WJZ was copied, the signals at some times being audible 12 ft. from the phones.

Fine business! Some of the calls look a little suspicious and one is inclined to believe that some of the numerals are twisted, especially between some 2's and 3's, but this is attributable to bum fists and perhaps will teach a lesson to some of our men—it is evident that if they send distinctly they will be reported correctly. We don't know quite what to think of the report on 6TF. It is queer that this call should appear when there are no other 6's, no 7's, and so few 9's. We have been told that the operator of 6TF was visiting an 8th district station at the time in question and was heard signing his home call on that set, but we hope that this is not true. Regardless of errors, however, the list shows that we are getting over this year in fine shape, and we only hope America will show as good reception when it comes her time.

The British amateurs are just as enthused as we are. 2KW writes the Traffic Manager as follows:

Springfield, Thorold Grove,
Sale, Cheshire,
21/11/22.

Dear Mr. Schnell:

Just a few lines to confirm the great news! You have heard it. eh what? I can scarce realize what has happened yet. But say, OM, isn't it just great? This has been the day I have been waiting for, and I hope we'll have some more like it only more so. Well, I'll give you a list of call signs we managed to log and you will receive a detailed log also under separate cover. But why do you fellows QRM so? It was the best exhibition of 600 meters that I've yet heard on 200 m.! It was just splendid to hear you fellows punching it away like that and be able to hear your little remarks. Anyway I should like to know if 4DL is "balled up" yet.

There were many more stations, some pure C.W., which we could not read, as 8CYB, 8BXS, 1BDI, 3BLF, and last but not least 2CPD, were kicking up such a shine. The last station readable 4 yards from the phones whilst the others varied up to R9. From 2:20 when we started up till 5:45 we were not without a good old American chap's noise in our phones. Sometimes we could hear five or six different stations going at once on nearly the same wave. These signals were copied at our new station in Baguley and I might say that it was the first occasion on which the station had been used. 2CPD has the honour of being the first station to be logged at Baguley by 5MS.

I shall be making another set and erect-

ing a special aerial at 2KW very soon and it will be equipped as a further listening station. We mean to strain every nerve to make these tests a success and before you get this it is very probable that you will have received another cable or two.

Well, Cheerio and Good Luck.

Yours very sincerely,

W. R. Burne, 2KW.

P.S.: I enclose also a cover from QST which mag. was with us. We were so short of paper that I had to note 2CPD and 4EA and 8NM on it, so I've added the other sigs as we heard 'em and hope you will hang it up in your office as a souvenir!

FLASH—FINALS SUCCEED!

As we go to press with this issue, the official reports from France and Britain have just been received for the transmission of the first night, Dec. 11th.

Mr. P. R. Coursey, reporting for the Wireless Society of London, advises of the British reception of 1BGF, 1YK, 2EL, 2GK, 2NZ, 2XAP, 2ZK, 2ZL, 3ZW, 8AQO, 8AWP, 2BML, 2LY, 3BGT, 3HG, 3ZY, 4FB, 4OI (Porto Rico), 4ZS, 4ZW, 2ZS, 3XM, 4BX, 7PO, 8GQ, and the phone signals of 2ZK.

Dr. Pierre Corret, reporting for the French Committee, radios the reception in France on the first night of 8AQO, 1YK, 1BGF, 1BCG, 2XAP, 2ZK, 3HG, 1NX, 3FX, 2EL, 3HM, 2ZS, and the B/C fone of WJZ (hi!).

It looks like a boatload of Calls Heard before the tests are over! Big story in next QST of course; don't miss it.

—K.B.W.

Bureau of Standards Calls Standardization Meeting

The Bureau of Standards of the Department of Commerce has called a conference on radio standardization to be held on Friday, January 12, 1923, in New York City. This conference has been called at the request of the following organizations: Institute of Radio Engineers; National Radio Chamber of Commerce; Radio Apparatus Section, Associated Manufacturers of Electrical Supplies, National Retail Dry Goods Association; American Radio Relay League; and the Radio Corporation of America.

These organizations have pointed out that there is need for greater uniformity in the methods of describing, rating, and testing of performance of radio apparatus.

The purpose of the conference is to consider (1) whether a formulation of standards for radio apparatus and service shall be made, (2) What general classes of ap-

(Concluded on page 41)



10,000 Miles in 4 Minutes

ON November 22d 1AW of Hartford, Conn. sent a message via 9AWM at Sleepy Eye, Minn., to 6ZAC at Wailuku, Hawaii, and received a reply by the same route in four minutes and eighteen seconds. Think of that! It slashes all previous amateur records into small pieces. It makes our transcontinental record of six minutes and some seconds look utterly sick. Yet it was done without any preparation. No one stood by, no one helped, three stations did it entirely unaided.

On the morning of November 21st, Traffic Manager Schnell at the key at 1AW, the station of our A.R.R.L. President Hiram Percy Maxim, at Hartford, worked 9AWM at Sleepy Eye, Minn. 9AWM had previously worked 6ZAC in Hawaii and they arranged a date between 1AW and 9AWM in the hope that it might be possible to relay thru. About twenty-four hours later on the morning of November 22nd, 9AWM got in touch with 6ZAC at 4:00 o'clock Eastern Standard Time. Half an hour later 9AWM called 1AW. Mr. Schnell at once roused Mr. Maxim, who came down and took the key.

At 4:58:37 A.M. with "HPM" himself at the key of 1AW the following message left Hartford:

*Nr. 1 Hartford
6ZAC.*

Clear and cold here tonight how with you?

Maxim.

At 5:00:32, 9AWM finished his acknowledgment to 1AW, and at 5:00:53 A.M. started the same message to 6ZAC and finished it at 5:02:10 A.M. Then there followed anxious minutes in the radio room at 276 North Whitney Street, Hartford, Connecticut. All of you can guess the

thrill that followed when at 5:04:40 A.M., 9AWM called 1AW and sent the following message:

*Nr. 1 Wailuku
1AW.
Fair and warm.*

Dow.

The total elapsed time for that message and reply was six minutes and thirty-eight seconds which is just eight seconds more than the time made in the transcontinentals of January, 1921, above referred to. As soon as the celebration had died down somewhat another message was started out. At 5:14 A.M., 1AW called 9AWM and started the following:

*Nr. 2 Hartford
6ZAC.
What time is it there?
1AW.*

That message was finished at 5:15:24 A.M., 9AWM acknowledged this at 5:15:25 A.M. and started it to 6ZAC at 5:15:45 A.M., finishing at 5:16:27 A.M. At 5:17:43 A.M., 9AWM called 1AW and sent the following message:

*Nr. 2 Wailuku
1AW.
Eleven thirty five.*

Dow.

This was acknowledged at 5:18:18 A.M., making the total elapsed time 4 minutes and 18 seconds.

Just think of it fellows! Four minutes and eighteen seconds! Let's repeat that. *Four minutes and eighteen seconds.*

And now let's look at the distances! Taken by air lines they are as follows:
1AW to 9AWM—1100 miles
9AWM to 6ZAC—3800 miles
6ZAC to 9AWM—3800 miles

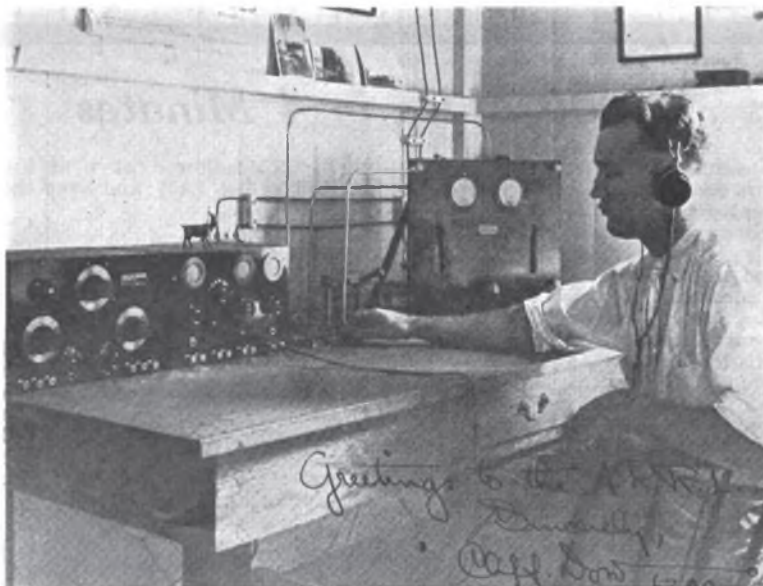
and finally, 9AWM to 1AW—1100 miles again.

A total of 9,800 miles for a message that started in Hartford on Wednesday November the 22nd, arrived in Hawaii on Tuesday, November the 21st, and came back again into Wednesday in Hartford and landed there only four minutes and eighteen seconds afterwards.

Not a bit of this was pre-arranged except the casual twenty-four hour date between 1AW and 9AWM; there was no special equipment used at any of the stations, just their ordinary transmitters. None of these transmitters were phenomenally large. A $\frac{1}{4}$ kilowatt tube worked below its rating

The complete little transmitter panel conceals two 50-watt tubes which are supplied with rectified A.C. Strictly speaking that is not correct, for one of those 50-watt bottles has cashed in and the record-making relay was handled on a single tube with 4.4 amperes in the antenna.

The antenna is a six-wire cage 90 feet high at the mast and slanting down toward the house. The counterpoise is composed of two small wire cages, one on each side of the antenna, and directly underneath it. The counterpoise is 35 ft. off the earth at the mast and 25 ft. off the house end. No ground connection whatever is used for either sending or receiving, the counter-



6ZAC and Its Operator

was used at 9AWM, a single 50-watt tube at 6ZAC and a quartet of little 5-watt bottles at 1AW. Let's have a better look at the sets themselves.

Mr. Clifford Dow, Hawaiian Division Manager, has in 6ZAC a station he may well be proud of for other reasons than its participation in the four minute Hartford-Hawaii-Hartford relay.

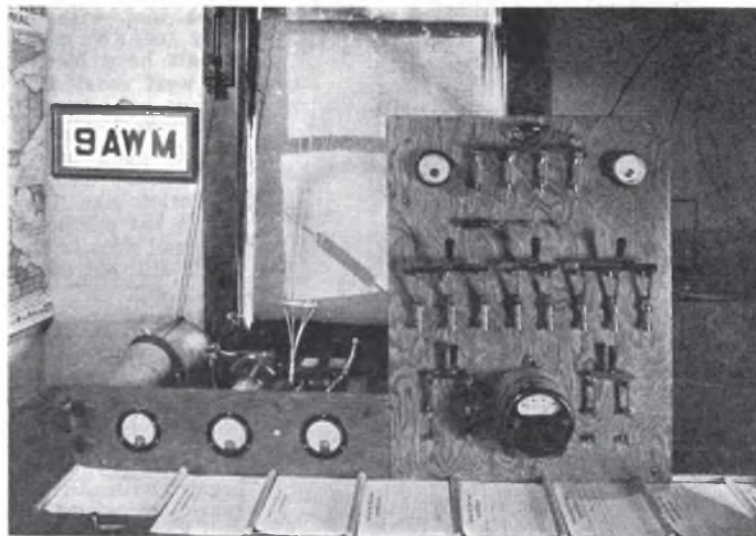
6ZAC is one of the stations that is helping to render obsolete our old traditions that a good station must always be in a wild mess. The photograph renders further comment on the station arrangement unnecessary.

The tuner is a single circuit "regen" with two-steps of audio amplification employing R.C.A. transformers and tubes.

poise being used in both cases. Both antenna and counterpoise are constructed of seven-strand No. 22 phosphor bronze. Unfortunately Mr. Dow was not able to supply us with photographs of the radiating system. The lead-in insulators are constructed of maple wood and have been boiled in linseed oil. The antenna insulation is of glazed porcelain. We are going after some more information about this for the antenna number of QST.

The bottom section of the mast is made of redwood 6" x 6" bolted to some redwood 6" x 6" stubs set into the earth. The next two sections are 4" x 4" and the entire mast has five sets of fence wire guys broken up with porcelain knobs. The mast is perfectly rigid and may be climbed with safety.

At present the Hawaiian Division con-



sists of 6ZAC and 6TQ in Honolulu. Mr. Dow says they have excellent conditions and that 6ZAC has a regular working range of 2300 to 3000 miles. The station has been reported in every district except the 1st and 4th and 6ZAC tuner's has heard stations in every radio district. The Hawaiian Division is turning in a nice traffic report this month. The present DX record of 6ZAC is 9AWM on 50 watts. Mr. Dow says that they do not brag about this and their only boast is that every message given to the Hawaiian Division is *delivered*. Come to think of it, that is a considerable boast and about 94% of the rest of this A.R.R.L. may take a lesson from it.

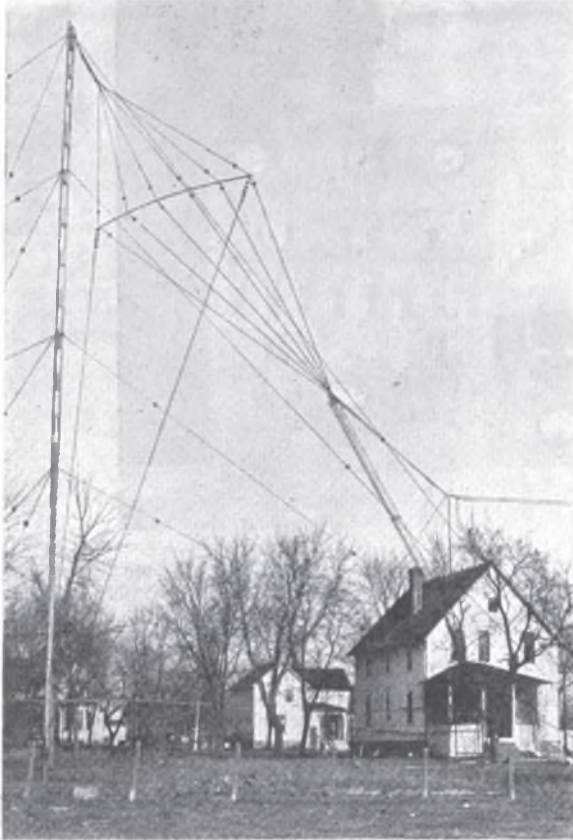
9AWM at Sleepy Eye, Minn., is constructed and owned by Mr. Lloyd Berkner and is about the prettiest thing in the way

of amateur tube sets that we have yet seen. Of course, after his participation in that unreasonable four-minute relay, we would praise 9AWM if it were an absolute junk pile. But fortunately it is a beauty instead.

The operating room is beautifully arranged. By running the receiving table at right angles to the transmitting table, everything is put within immediate reach of the operator. The receiving set almost explains itself. It is a three-coil set using spiderwebs instead of the more common honeycomb coils. The receiving antenna is a four-wire cage 3" in diameter which runs from the pole on the house and in the direction opposite to the sending antenna for 250 feet. More than detector and one step audio is seldom used.

The beautiful arrangement of the sending set is so utterly obvious that it seems needless to comment on it. The single U.V.-204 Radiotron, when operated somewhat below its rating, puts 8 amperes into the antenna. The circuit is a modified 1DH. The power supply is from an old 2200-220-volt 60-cycle transformer which has been reversed and whose output is rectified by means of a 64-jar chemical rectifier. A synchronous rectifier was formerly used but insisted on sparking and putting mush on the emitted wave, hence was discarded. The electrolytic rectifier requires care but it does the business in much better shape. The beautiful freedom from tangled wires, the systematic way in which message





The Antenna at 9AWM

blanks are filed, and the fact that the cage lead-in comes right down to the business end of the tube, are all in keeping with the general excellence of the set.

Long before the reader reaches this point the picture of the splendid antenna system will have attracted attention. It is a pathetic fact that Mr. Berkner has left us utterly in the dark as to its dimensions. Close inspection of the original photograph shows that much careful thought was put on its construction. The insulators in the different wires of the fan top are not at the same distance from the spreader but are so spaced as to make all the wires of the same length. The cage lead, as previously mentioned, goes clear down to the transmitting set. The counterpoise is much harder to make out, but unless we are badly mistaken it too has a cage lead which goes directly to the set. Just at this minute we would give about two dollars to know how tall that skyscraper mast is.

9AWM has worked the west coast thirty-five times, has 4 reports from distances over 4,000 miles, has worked 6ZAC ten

times and with him handled forty messages. 9AWM's signals have been reported on the west coast 125 times and the record distance is 4,600 miles. Mr. Berkner says that this is good luck. We must emphatically disagree with him. A station like 9AWM, though put in the middle of that famous dead spot in Scranton, Pa., would still put out fine distance work.

Traffic Manager Schnell began to operate Mr. Maxim's station, 1AW at Hartford, on the 20th of October with the intention of making a record for the number of messages handled in one month by one station if it could be done. He began with the famous old spark set whose voice was so well known at most points east of the Mississippi River, and was making good headway when on the second night the big high-speed gap at last went bad. To keep from breaking up the program it was necessary to get something on the air at once and a small C.W. set was hastily thrown together, using four 5-watt tubes supplied with rectified A.C. at 800 volts. Because this set could not be operated by remote control as had been the custom with the spark, it was necessary to place it in the operating room, to which the antenna was extended. As the

antenna had a large fan top (see cover and page 35 of July, 1920, QST) this raised the wave length so that it was no longer possible to get down to 200 meters. After one attempt at pruning the fan top, the big antenna was dropped and a single wire hurriedly run up to the top of one of the 80-foot masts. Altho the set was the most hurried sort of a thing and the antenna current but 1.8 amperes, this outfit handled 743 messages during the traffic month.

The single wire has been replaced by a tiny four wire cage run to the top of one of the masts just as was the single wire. This cage is exceedingly slender—only about 2½ inches in diameter—but has been doing rather good work.

This same set handled the Hartford end of the record-breaking relay. It is not permanent and is accordingly not shown here. The showing of the little set was however so good that Mr. Maxim says the voice of the spark set at 1AW will not be heard again. When a change is made it will be to a permanent tube set. —S.K.

Vacuum Tube Amplification

By S. E. Anderson*

A Paper Presented Before The Radio Club of America, Columbia University, New York, December 1, 1922

EVERYONE in any way associated with radio, excepting possibly the very newest of the new radiophone listeners, is more or less familiar with the manifold applications of the vacuum tube, in all of which it contributes in generous measure to make radio what it is today.

Probably more vacuum tubes are used as amplifiers of one sort or another than in any other capacity, such as an oscillator, modulator or detector. Indeed, a vacuum tube could not be an oscillator were it not first an amplifier, which has been pointedly, though somewhat inaccurately, described as something into which one puts nothing and gets out a lot of things he didn't expect. Modulation and detection are special modifications of this amplifying characteristic. By far the largest application of vacuum tube amplifiers, from a numerical standpoint at least, has been in the telephone repeater. It is this which has made transcontinental telephony possible and it has

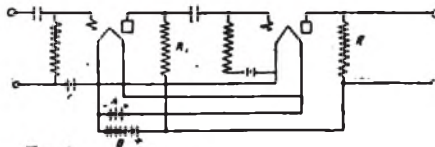


FIG 1
RESISTANCE COUPLING.

also enabled us to put in compact underground cables the telephone circuits between large cities, such as New York and Chicago. The number of telephone repeaters in a single office, such as Newark, may run well into the hundreds and the vacuum tubes necessary for these repeaters would keep the amateurs stocked up for some time to come.

But we are interested in amplification as applied to radio. I am going to assume that we are all sufficiently familiar with the "bottles" to enter at once into a discussion of the circuits in which they are employed as amplifiers. Before taking up in detail the various types of amplifiers as distinguished by the frequency range in which they operate, let us first consider the three general types of amplifier circuits.

*Engineer, Western Electric Co.

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We first have the "resistance-coupled" amplifier as shown in Figure 1. This was possibly the first type of coupling to be employed and is still used extensively for some purposes. The resistance R_c is of the same order of magnitude as the internal impedance of the tube, or from 10,000 to 50,000 ohms. This means that the plate

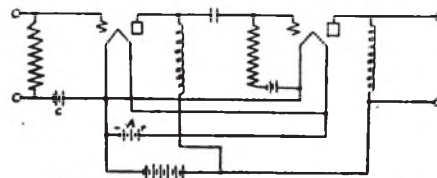


FIG 2
IMPEDANCE COUPLING.

potential is about half the "B" battery voltage and this excessive battery waste is the chief disadvantage of this circuit. Another disadvantage is that the fraction of the pulsating voltage developed in the plate circuit of the first tube which is impressed on the grid of the second tube is proportional to the coupling resistance and if we make this small to save "B" battery we decrease the amplification. Making this resistance equal to that of the tube simply represents a reasonable compromise and with coupling resistances of this value the voltage amplification for each stage is obviously half the amplification constant of the tube. A minor disadvantage is that a condenser and grid leak are required for each tube but this is also true of impedance-coupled amplifiers. The big advantage of the resistance-coupled amplifier is that it

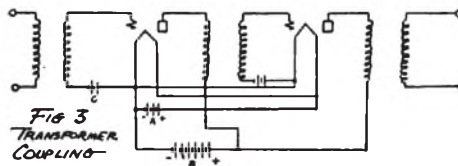
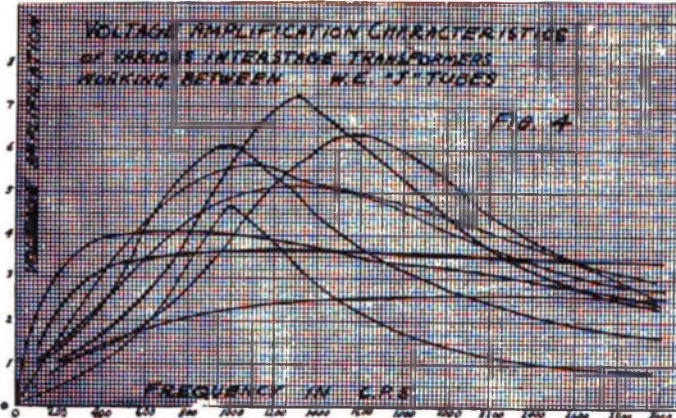


FIG 3
TRANSFORMER COUPLING.

is practically independent of frequency up to the lower radio frequencies of 20 or 30 kilocycles. Here the efficiency begins to decrease rapidly and at a frequency of 1000 kilocycles, corresponding to a wave length of 300 meters, the amplification with ordinary tubes is exceedingly small.



Audio Frequency Amplification

It is natural that amplification at audio frequencies should be the first to be developed, both because of the relative simplicity of the task and because there are numerous applications of the vacuum tube amplifier where only the lower frequencies are involved.

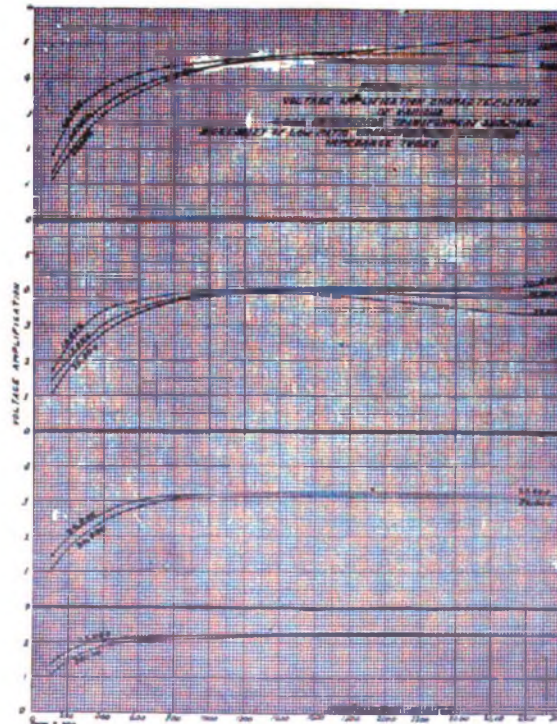
For very special purposes where it is desired to have uniform amplification over a wide range of frequencies, say from as low as 10 cycles per second to as high as

An "impedance-coupled" amplifier is shown on Figure 2, in which the resistances of Figure 1 are replaced by inductances whose value depends upon the frequency at which the amplifier operates. Until recently this type of amplifier was used for audio frequency amplification where it was desired to cover a wide range of frequencies without the battery waste of the resistance coupled amplifier, as the D.C. resistance of the choke coils is comparatively small. Recent improvements in transformer design, however, make it possible to get a very good frequency range with much greater amplification, as it is obvious that in an impedance-coupled amplifier the amplification per stage can never exceed the amplification constant of the tube unless resonance occurs, which destroys the desirable frequency characteristic. The impedance-coupled amplifier is used to some extent for radio frequency amplification, but even this use is declining as we learn more about transformers because of the extra apparatus—condensers and grid leaks—required by the impedance-coupled amplifier.

10,000, the resistance coupled amplifier is used. For this purpose, in order to overcome the inherent inefficiency of this method of coupling, a tube having as high an amplification constant as possible is usually employed. One standard tube used for this purpose has an amplification constant of 30, this being adopted after a tube with an amplification constant of 40 had been found impractical.

It may be well to point out here that a high amplification constant does not neces-

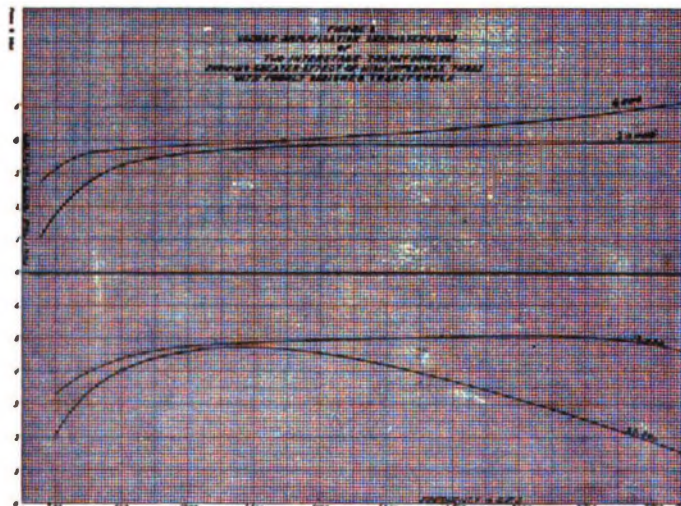
An amplifier using transformer coupling is shown in Figure 3. This type of amplifier is coming more and more into general use for several reasons. *First*, by means of a step-up transformer an amplification of several times the amplification constant of the tube may be obtained at moderate frequencies. *Second*, it is economical of plate battery. *Third* the frequency characteristics may be made as good as those of an impedance-coupled amplifier at all frequencies. *Fourth*, the grid condenser and grid leak are eliminated.



sarily mean a superior tube. For most purposes the excellence of a vacuum tube, aside from those general points of construction which tend to increase the stability, uniformity and life, is measured by a factor called its "mutual conductance," which is proportional to the change in plate current caused by a given change in grid voltage. Probably the most desirable amplifier tube from all standpoints, except use in a resistance coupled amplifier, is an oxide-coated filament tube having an amplification constant of about 5 and a plate impedance of about 6000 ohms. The tube with an amplification constant of 30 has a plate impedance of 60,000 ohms, so, although the voltage amplification is higher, the mutual conductance is only 6/10 that of the 6000 ohm tube.

former-coupled amplifiers, let us consider what is necessary in a good audio-frequency amplifier. The audio frequencies, or those frequencies which produce audible sounds, range from about 16 cycles per second to about 16,000 cycles per second. The lower limit is rather definite, as below this frequency the ear perceives the sound, not as a single low note, but as a series of sounds close together. The upper limit varies with different persons and with the same person under different conditions. Almost anyone can hear a frequency of 10,000 cycles per second and a few people can hear as high as 18,000 or 20,000.

In connection with ordinary telephone apparatus it has been found that for the transmission of good understandable speech it is necessary to use only the frequency



Impedance-coupled audio frequency amplifiers, as previously pointed out, are practically obsolete, though some splendid multi-stage amplifiers of this type have been built. The writer recalls one four-stage amplifier using tubes with an amplification constant of 30 and choke coils having an inductance of 350 henries with a minimum distributed capacity. At a frequency of only 80 cycles per second the impedance of such a choke coil is approximately 175,000 ohms, with the impedance at other frequencies in proportion. This impedance being three times the tube impedance, 75% of the plate voltage at 80 cycles is impressed on the following grid, so that the amplification per stage is nearly equal to the amplification constant of the tube over a wide frequency range. Incidentally the total voltage amplification of this amplifier was approximately 800,000 times.

Before considering in some detail trans-

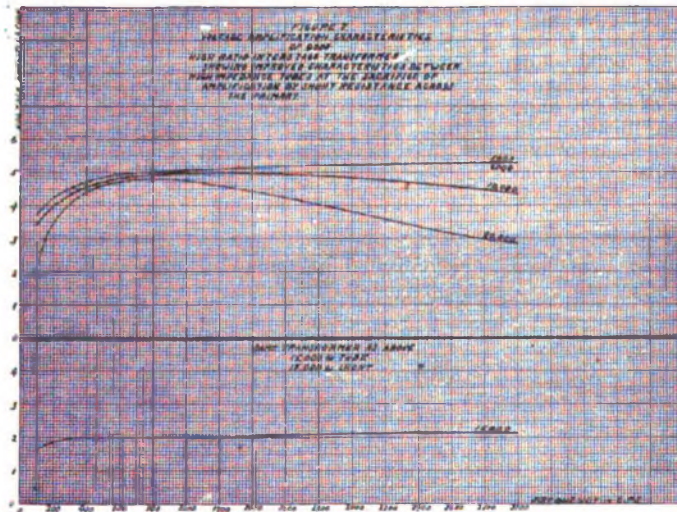
band from 200 to 2000 cycles, and the first radio transmitters were designed on the same basis. It was soon found, however, that music transmitted by means of these sets had an undesirable "tin pan" effect due to the absence of the higher and lower frequencies. It has been found that to transmit good quality music the frequency band must be extended to include all frequencies from 100 to 4000 cycles, and if it is desired to transmit perfectly such music as is produced by a large organ, the lower limit must extend down still lower to about 30 cycles. Not only must all frequencies within this band be transmitted, but they must, within limits, be transmitted uniformly so that the amplitudes of the various frequencies in the emitted wave correspond to those in the original sound wave.

Obviously it does us no good to transmit nearly perfect music if the receiving apparatus amplifies some frequencies with-

in the desired band five or ten times as well as other frequencies. This is exactly what happens with many of the amplifying transformers on the market. In Figure 4 are shown the characteristics of a number of these transformers, the amplification shown being that of the transformer alone when working between Western Electric "J" tubes, which have an output impedance

the lower the transformer ratio the more uniform is the amplification when working out of this impedance. When the impedance is increased to 30,000 ohms, the superiority of the lower ratio coil is obvious.

Merely making the ratio low does not suffice, however, though it is much easier to make a good low-ratio transformer than



of about 15,000 ohms. Of these transformers only two could be considered satisfactory and one of these falls off too much at high frequencies.

The maximum amplification of any transformer represents approximately its turn ratio. It is worthy of note that all the transformers having a ratio higher than 4 are very poor, while only one having a ratio less than 4 is bad and it is not nearly as bad as the others. It has been found by experience that a ratio of 4:1 represents the maximum which can be used and still give uniform amplification, and this is too high for most tubes.

On Figure 5 are shown a number of transformer characteristics representing the most advanced design. The upper curves are of a transformer having a ratio of 4.75:1 working out of the impedances shown on the curves. Comparing these with the curves below which are of a transformer having a 4:1 ratio, it may be noted that the difference in characteristics caused by using tubes of different impedances is much more pronounced in the higher ratio transformer. The same is true, to a lesser degree, of the two lower sets of curves showing transformers having a 3:1 and 2:1 ratio. There is one value of tube impedance—20,000 ohms—common to all the curves and it will be noted that

a good high-ratio one. At the bottom of Figure 6 is shown a poorly designed transformer having a 5:1 ratio working out of a 10,000 ohm tube. This transformer is very fair with this tube, but out of a 20,000 ohm tube it is most unsatisfactory, though not as bad as some of the transformers on Figure 4. The upper curves of Figure 6 show a well designed transformer with a 4:1 ratio and the excellence of the characteristic when working out of a 6000 ohm tube, the amplification being both high and uniform, emphasizes the desirability of using low impedance tubes. It is to be noted, however, that even with a 20,000 ohm tube this transformer is much better than the other, though not as good as a lower-ratio coil would be. This transformer was designed to amplify the higher frequencies more strongly and actually continues to do so up to 6000 cycles in order to compensate for the fact that the average loud speaker discriminates strongly against these high frequencies.

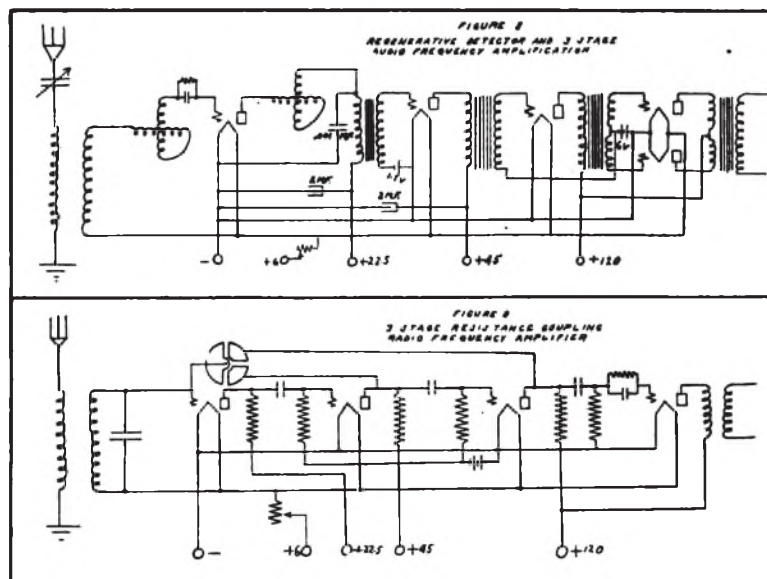
If one has a high-ratio transformer which is being used with high impedance tubes, and it is suspected of amplifying the frequencies around 1000 cycles more than the others, the characteristic may be greatly improved at some sacrifice in amplification by connecting a shunt resistance of 10,000 or 15,000 ohms across the primary or plate

winding. The results with one transformer which was designed only for low impedance tubes are shown in Figure 7.

The writer is glad to be able to say that a number of the transformers made by reliable companies have very satisfactory characteristics. It should be remembered that a good audio frequency amplifying transformer having a turns ratio of more than 4:1 has never been produced except for very low impedance tubes. A transformer having a 3:1 ratio is a very good compromise when working with most of the amplifying tubes available. It would be a good plan for the manufacturers to furnish, either in their advertising or with the transformers, curves showing their characteristic with moderate accuracy so that the transformers could be intelligently selected to work to the best advantage with the tubes available.

In Figure 8 is shown a standard two-variometer regenerative receiver followed by three stages of audio frequency amplification, which is the maximum number

The circuit of Figure 8 differs from the circuits usually employed in three details. *First*, grid biasing batteries are used on the amplifier tubes. *Second*, audio frequency by-pass condensers are used across the plate batteries. *Third*, the last stage of the amplifier uses two tubes connected in a balanced or push-pull circuit. If it is desirable to obtain the best possible quality, all of these changes from the usual circuit will be found well worth while. One thing that should always be borne in mind when building cascade amplifiers intended to produce a large output and which is very seldom considered, is that the available power in each stage should be greater than in the one preceding it. Speaking in terms of the tubes available to the amateur, suppose we have a U.V.200 as a detector, it is well followed by a U.V.201 with 45 volts on the plate as an amplifier. The second stage should be a U.V.201 with 120 volts on the plate and the third stage should use two U.V.201 tubes with 120 volts on the plate. It should be remembered that the



which should ever be used by the amateur. Indeed, the elimination of the second stage, leaving only two stages, is quite desirable when used with a regenerative receiver because it is very easy to ruin the quality by overloading the amplifier. For the large loud speakers used outdoors as many as nine stages of amplification may be employed, the last stage using four 50 watt tubes. Such an amplifier, of course, is far beyond the needs of the amateur and requires very careful shielding and balancing to prevent howling.

plate impedance of a tube decreases with an increase of the plate battery voltage. For ordinary purposes the use of 5 watt tubes in the last stage will be unnecessary and undesirable unless they are used with much less than normal plate voltage, say not over 150 volts, as it is very easy to overload any loud speaker with a small horn. For the first stage a grid battery of 1.5 volts will be satisfactory and for the last two stages 6 to 9 volts may be used. It may be pointed out here that more than one stage of audio frequency ampli-

fication will not increase the sensitivity of the set. It will merely increase the output of signals which a detector and one stage will bring in. The reason for this is that the output of the detector is proportional to the square of the input and there is a limiting minimum input below which the output is negligible and no amount of audio frequency amplification will make it audible. The minimum output, however, while it can be heard in the receivers, is distinctly below comfortable volume and one stage

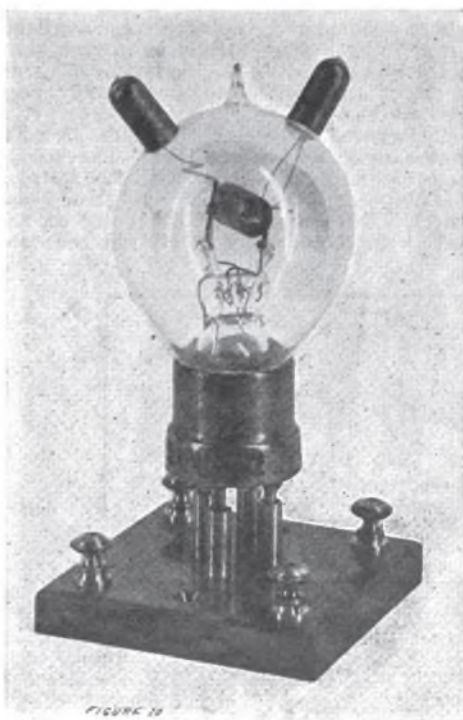


FIGURE 10

of audio frequency amplification will, therefore, materially increase the useful sensitivity of the set. It is well to bear in mind that a signal gives about the same apparent loudness in a pair of "cans" on the ears when connected to the input of a two-stage audio frequency amplifier as is produced on a loud speaker connected to the output and used in an average sized room.

Just a word regarding the circuit layout and we will pass to radio frequency amplification. There is no better layout for amplifiers of all kinds than the "long and skinny," but this is not always practical. In any type of construction adopted, however, the output should be as well separated from the input as possible. There are two wires in each stage which must be as short and direct as possible—the wires to the plate and grid of the tube. This becomes

increasingly important in the final stages and, in general, the grid connections are more sensitive than the plate connections. For a three-stage audio frequency amplifier shielding between stages should not be necessary if the cores of the transformers are grounded. The outside connections of the transformer windings should be connected to plate and grid for maximum amplification, but reversing some of these connections may cure a persistent howl which refuses to yield to more rational treatment.

Now, although it is desirable that the plate and grid wires be short, direct and separated from everything else, all the other wiring should be bunched closely together, including the leads to the low side of the transformers. From an alternating current standpoint, all of this wiring should be at ground potential and bunching it together helps to keep it thus by virtue of the capacity between the wires and the elimination of inductive loops, remembering that the inductance of a circuit is proportional to its area. This bunching of the low potential wiring is especially effective in high frequency amplifiers.

In view of the fact that one stage of audio frequency amplification actually does increase the useful sensitivity of a receiver and that additional amplification is useful only in connection with a loud speaker, it is recommended that one stage of audio frequency amplification be always embodied in a receiving set itself, while additional stages of amplification are mounted in a separate unit. If a regenerative detector and two or three stages of audio frequency amplification are embodied in the receiver unit itself, it is very difficult to eliminate undesirable howling and squealing.

Radio Frequency Amplification

Remembering the fact that the output of a detector is proportional to the square of the input, it is obvious that amplification of the signals before they reach the detector will produce most satisfactory results.

This is a very simple job for long wave lengths but it is a serious problem on wave lengths below 600 meters, corresponding to a frequency of 500,000 cycles. While the final solution has by no means been found, much progress has been made in the last year and very satisfactory results have been obtained. In all fairness, however, I shall have to point out that the claims of some manufacturers concerning the wave length range and amplification of their transformers are rather optimistic.

The fundamental obstacle in radio frequency amplification is the very high frequencies involved. At audio frequencies the input capacity of a vacuum tube—from 5 to 15 micro-micro-farads—may be entirely neglected, but at short wave lengths it becomes very important. At 200 meters,

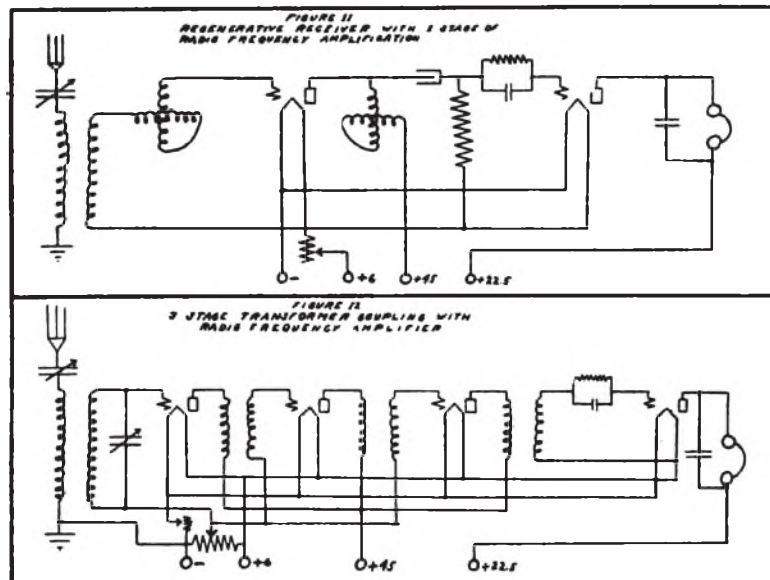
for example, corresponding to a frequency of 1500 kilocycles, the input reactance of the average tube in a good socket is only about 10,000 ohms, which is the same order of magnitude as the output impedance. Due to the effect of the output circuit on the input circuit, the input impedance of a tube with a high amplification constant may be reduced to as low as 2000 ohms. Unfortunately, the higher the amplification constant of the tube, the lower is the input impedance. These conditions make it necessary to employ some sort of resonance coupling, which uses the tube capacity in the resonant circuit to obtain a decent amplification, and this restricts the efficient wave length range to a relatively narrow band.

Let us consider first the resistance-coupled radio-frequency amplifier, which

This method of regenerative control is very satisfactory.

If one wishes to use half a dozen stages of resistance-coupled radio frequency amplification, it may be all right on 200 meters. It would certainly have the advantage of fairly uniform amplification over a wide range of wave lengths, the amplification increasing gradually with the wave length. But, in view of the fact that vacuum tubes cost more than a quarter apiece, most of us are content to use fewer vacuum tubes to get the same amplification for a smaller wave length range.

Some special types of tubes have been developed in order to minimize the inter-electrode capacity. The Meyers audion is an example of this type of tube and should show materially better radio frequency am-



has been developed extensively in Europe where most of the work is at longer wave lengths. A typical circuit of a three stage amplifier used in France is shown in Figure 9. The chief point of interest is the "compensator." This consists of a three plate condenser connected as shown. As the capacity between the grid of the first tube and the plate of the third tube is increased, regeneration occurs and the circuit oscillates readily with further increase of this capacity so that the amplifier may be used for C.W. signals. Increasing the capacity between the first grid and the second plate reduces the regeneration and tends to neutralize any undesirable oscillating tendency due to the capacity of the wiring.

plification in a resistance-coupled circuit. Figure 10 shows a photograph of a French tube developed for this purpose. It is popularly called a "Kamerad" tube because its arms are in the air. The grid and plate leads are brought out through the two "horns" which are copper sleeves cemented firmly to corresponding projections of the glass bulb through which the connections pass.

Even with these specially-constructed tubes resistance-coupled amplifiers have proven most unsatisfactory for wave lengths below 500 meters and practically all recent developments in this country have been in the direction of tuned interstage coupling. With this type of coupling the

capacity of the tube is used to resonate the coupling coil or transformer at the wave length for which the maximum amplification is desired and thus a fairly large capacity up to about 15 m.m.f. is not a disadvantage. If this capacity is further increased, however, such as by careless wiring or poorly designed tube sockets, the interstage tuning will become very sharp and the wave length range of the amplifier will be exceedingly limited.

At this point the writer desires to call attention to a very satisfactory method of adding one stage of radio frequency amplification to the type of regenerative receiver using a tuned plate circuit. The tuning may be either by a variometer or a coil and variable condenser. The circuit using a variometer, which will generally give better amplification, is shown in Figure 11. This circuit has been published in a number of magazines but has not received the attention it deserves. We have here the very best type of coupling for radio frequency amplification and its use adds no adjustments to the receiver. When adjusted so regeneration occurs the impedance of the tuned plate circuit is very high and the coupling is very efficient. A multi-stage amplifier using the same type of coupling between each stage would be an excellent amplifier except for the difficulty of tuning so many interstage circuits and the impossibility of obtaining a suitable circuit that did not oscillate. The addition of one stage of radio frequency amplification to such a regenerative circuit requires only one tube, a few accessories, and minor changes in the existing circuit. It will give a voltage amplification of about five or an increase in the detector output with weak signals of about 25 times. Surely this is very much worth while.

We will consider briefly impedance-coupled radio frequency amplifiers. They have one big advantage which is of considerable importance. Choke coils having moderately sharp characteristics may be used and the number of turns and consequently the wave length range may be changed by means of a simple switch. The switches of several stages may be mechanically interconnected, thus requiring only one adjustment. By tuning each stage rather sharply excellent selectivity is obtained, but, although the amplification in each stage may be fairly high, it is necessary to throw most of it away in some sort of "stabilizer," which has more properly been termed a "losser" by one of my associates, in order to prevent oscillation. This is because with the sharp tuning we have grid and plate circuits tuned to nearly the same wave length with the capacity of the tube for feedback, and at a million or more cycles there is no better oscillator than this combination. A minor disadvantage is the necessity for grid leaks and condensers, the capacity of which to ground is serious at radio frequencies. In general, the imped-

ance-coupled radio frequency amplifier will give somewhat less amplification but greater selectivity than an amplifier using flat resonance transformers and to cover the same wave length range will require an additional adjustment.

A three stage transformer-coupled radio frequency amplifier using a stabilizer is shown in Figure 12. The stabilizer could probably be replaced with profit by the "compensator" of Figure 9. Certainly the latter is much to be preferred from a mechanical standpoint, though there is some difference of opinion as to which arrangement gives the best regenerative control. The stabilizer functions by making the grids of the tubes more or less positive with respect to the filament, as when the grid becomes positive over a portion of the cycle current flows and power is consumed, thus placing a sufficient loss in the circuit to prevent singing. The compensator, operating as it does by merely changing the phase of the feedback potential, seems to the writer a much more rational solution of the problem.

The best solution of all is to design the circuit so stabilizers, compensators or other "lossers" are not necessary. It is possible to do this with a two-stage radio-frequency amplifier and we are not convinced that it is impossible for three stages, though it has not been done yet. It simply means the painstaking elimination of parasitic feedback capacities and inductive loops. Make the grid and plate wires short, straight and clear. Make all the other wiring as direct as possible, but bunch it together. After an amplifier is obtained which is free from singing or oscillation, a regenerative control, such as the compensator, may legitimately be added, but we cannot consider that any amplifier represents a real solution of the problem if we have to decrease the amplification in some way to prevent our amplifier from becoming an oscillator.

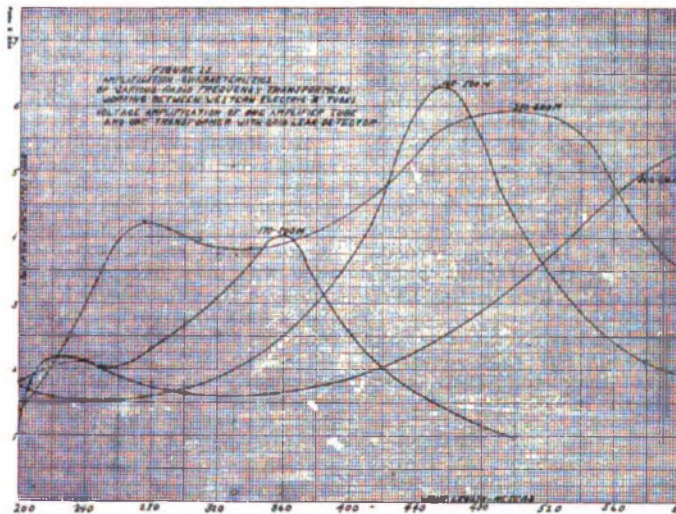
Now a word as to the amplifying transformers themselves. To the best of our knowledge and belief, no radio frequency transformer has yet appeared giving even approximately a uniform amplification over a much greater than 2:1 wave length range and the best transformer covers the wave lengths from 250 to 600 meters. Figure 13 shows the characteristics of a number of transformers with the rated wave length range marked on the curves. At the time the curves were taken measurements could not be made below 200 meters, but from the shape of most of the curves it was apparently unnecessary. Despite the fact that such a rated wave length range is obviously rather optimistic, the best of these characteristics represent fairly good transformers and, far from accusing the manufacturers of misrepresentation, the transformers actually do amplify over their entire rated wave length range, though

rather feebly at some portions of it. We honestly think, as with audio frequency transformers, that the characteristics should be made public by the manufacturers. The designing of transformers which are good at 200 meters merely awaits the lessening of the demand for transformers good at 360 and 400 meters. While

that obtainable by any other method—if one has six tubes.

Summary

We will summarize very briefly. For sensitivity, direct radio-frequency amplification should be used by all but millionaires. One stage of radio frequency amplification in a non-regenerative circuit gives



the best results at 200 meters will probably not be as good as the best results at 400 meters, the 200 meter results will soon be far ahead of the present 400 meter results. Improvements in design are constantly giving us an increase in wave length range without sacrifice of amplification.

It was previously noted that radio frequency amplification at long wave lengths was a very simple job. In fact, it is in some ways easier to handle the frequencies between 20 and 50 kilocycles than audio frequencies because the amplifier is tuned to the superaudible frequencies and tube noises are greatly reduced.

It has proven most satisfactory by means of a local oscillator and a modulating tube to change the frequency of the incoming signal to a much lower frequency. This may then be amplified to almost any desired degree without difficulty, the maximum practicable voltage amplification being about 10,000 times, which increases the final output 100,000,000 times. After amplification the signals may be detected just as if they were long wave signals. With a set of this type the weakest winter static sounds like a thunder-storm in the middle of July, so it would be foolish to build a more sensitive receiver. This type of receiver will probably remain the last word in sensitivity for some time to come. At least six vacuum tubes are required, but the sensitivity per tube is far ahead of

about the same sensitivity as a first class regenerative receiver. Two stages with good transformers will be about five times as sensitive as a simple regenerative circuit, and the regeneration in the amplifier will multiply this by about three. One additional stage of audio frequency amplification will bring the weaker signals up to a more comfortable volume. Additional stages of audio frequency amplification—never more than two—should be used only for operating a loud speaker, as they add nothing to the sensitivity of the receiver.



Trans-Pacific Amateur Reception

THE American amateur has made short work of spanning the Atlantic Ocean, which between our country and Europe offers a distance of but little over 3000 miles, and those interested in ascertaining the maximum range of their C.W. sets are listening anxiously for reports from the westward, where the broad Pacific affords much greater distances. QST is in receipt of several letters reporting reception all the way across the Pacific—reception that makes an amateur's hair stand on end with the sheer thrill of the thing, records that will bring joy to the station-owners who read here what their little bottles have done.

There's not the slightest excuse for further waste of space on our part in introducing the letters—they tell their own rousing story. Hr nr 1:

S. S. Easterner,
Brisbane, Australia,
Nov. 10, 1922.

Editor, QST:

The enclosed list gives the amateur stations picked up aboard this vessel during the trip across the South Pacific from Panama to Brisbane. Having been interested in amateur activities myself in the past, I took advantage of the opportunities for research in amateur reception on this trip and packed a small receiver of my own particular design in the hopes of hearing someone. The results, needless to say, are far beyond my fondest expectations.

You will note that in all 78 stations have been heard, practically all at distances greater than 3000 nautical miles. Bear in mind the difference between nautical and statute miles. Stations were heard over the entire trip, in the central states as well as the western, and some in the eastern states, the main obstacle in the latter case being the difference in time, which means that the eastern stations have all closed up for the night before it becomes dark out here.

Propagation and antipodal theories were nicely verified, it being observed that the most difficult distance to hear amateurs was just about 6000 miles, after which the waves again converge, and, on account of very little absorption over sea water, the signals again become louder. Twenty stations were heard over 5000 miles, 10 over 6000, and a couple over 7000. Of these, those deserving credit for being able to penetrate thru the 6000 mile circle are 6KA, 6CC, 6TI, 6BCR, 7SC, and 9ZAF. At 6000 miles 6KA comes in very loud and is with-

out a doubt the best station heard, altho 9ZAF comes very near the laurels on account of the intensity of his signals and the land traversed in his case. 7SC comes in about as loud as 9ZAF at the same distance but has only water to cross. It should be noted that 9ZN covered 5100 miles on I.C.W.

Mid-Pacific is particularly favorable for radio work because of the almost complete absence of static and interference, and probably this accounts largely for the unusual results, but I believe the receiver deserves some credit too. Only a detector tube was used except for the few stations noted on the separate list. The receiver consisted only of a vario-coupler and a variable condenser for tuning down from the ship's aerial of 300 meters fundamental. As practically all the stations were C.W., any tube which would oscillate did the trick. Both Radiotron and VT-1 were used with no difference noticeable. Attempts at reception were not made until well this side of the Canal, due to the severe static which paralyzes the set and makes reception impossible. The set was sufficiently sensitive, at any rate, that imperceptible static on the commercial tuner with one step amplifier becomes moderate, and induction from generator commutators in the engine-room becomes annoying. All the stations listed were heard more than once and verified, but occasional bad fists were encountered and it was almost impossible to guess what call was meant, in which case the one actually being sent was recorded rather than that which it seemed might be meant. On the whole I think most of them are quite accurate.

I have come in contact with several prominent amateurs in this city who informed that plans are under way for trans-Pacific tests with the Australians. Except for static and difference in time I consider reception of American amateurs here practically an accomplished fact already. The last night out of Brisbane, only 100 miles away, I heard dozens of stations in many districts and identified six of them. Static was unusually bad that night and many calls were partially obliterated. However, I expect to be in Australian waters for one or two months and shall endeavor to copy some stations in some of the ports to clinch the argument, altho Saturday night is about the only time as the amateurs work late enough then to be heard after dark in this country. The difference in time between California and Eastern Australia is 6 hours. As we progress further south conditions will obvi-

ously become more favorable, and I will inform you of later results.

Yours very truly,
R. E. Roesch,
Radio Operator.

Stations heard aboard S. S. "Easterner," detector only. All distances in nautical miles. United States dates.

Oct. 11—2000 mi. SW Panama—2FP (ICW), 6CC, 6ZX, 9BJI, 9OCV.

Oct. 14—2700 mi. SW Panama—5IA, 6JM, 5SF, 5TM, 5UK, 5UO, 5VI, 5VY, 5ZH, 6BQG, 6BUM, 6ZX, 7LU, 8BFK, 8BFX, 8BO, 8CF, 8ML, 8SP, 8ZZ, 9AMB, 9BCF.

Oct. 17—3400 mi. SW Panama—5EK, 6ADM, 6FT, 6KA, 9AFD, 9AJP, 9AOG, 9AUL, 9CKO, 9CXM, 9GK, 9XAC, 9XL, 9YAJ, 9ZN (ICW).

Oct. 19—3900 mi. SW Panama—5SM, 5UK, 6ATG, 6BUN, 6CC, 6EN, 6KA, 6PL, 6RD, 6XAD, 7ZF, 9AJP, 9CCV, 9ZN (ICW).

Oct. 20—400 mi. east Tahiti, Society Isds. — 5SK, 6BUM, 6BUN, 8SP.

Oct. 21—200 mi. south Tahiti — 5PX, 6AJH, 6APW, 6AWT, 6BCR, 6KA, 6XAD, 7SC, 7ZO, 9ANQ, 9AON, 9AWM, 9CPX, 9ZAF, 9ZN (ICW).

Oct. 22—3000 mi. E. Australia — 6AJF, 6KA, 6XAD, 7AD, (probably AD-7, Omaha; 7AD not working—Ed.), 9GK, 9ZAF.

Oct. 24—5 mi. east Raratonga, Cook Isds.—6AAQ, 6AD, 6ATG, 6KA, 7SC, 8BFM, 9AWM, 9AYS, 9BDS, 9KG, 9ZAF.

Oct. 28—500 mi. SE Fiji Isds.—6AVR, 6CC, 6GF, 6KA, 7SC, 9ZAF.

Oct. 29—1500 mi. east Australia—6BCR, 6CC.

Oct. 30—1200 E. Brisbane, Australia—6BCR, 7LR, 9AWM, 9ZAF.

Oct. 31—1000 E. Brisbane—6AK, 6AVD, 6CC, 6XAD.

Nov. 1—800 E. Brisbane—6EZ, 7SC.

Nov. 2—600 E. Brisbane, 6BCR.

Nov. 3—350 E. Brisbane—6TI.

Nov. 4—100 E. Brisbane, 5PX, 5QY, 6BCR, 6CC, 6KA, 9CXP. (Distance to San Francisco about 6800 statute miles; to Chicago about 8400 miles.—Ed.)

Also heard on Navy SE-143 tuner with 1 step audio amplifier:

Oct. 12—2250 mi. SW Panama—9YAK (spark).

Oct. 14—2700 mi. SW Panama—6ZZ, 9YAK (spark).

Details concerning any of the above reception may be obtained by writing to R. E. Roesch, 356 William St., East Orange, N. J.

Oh Boy! can you imagine that! Ama-

teur sigs running over a third of the way around the world! And here's a little more of the same:

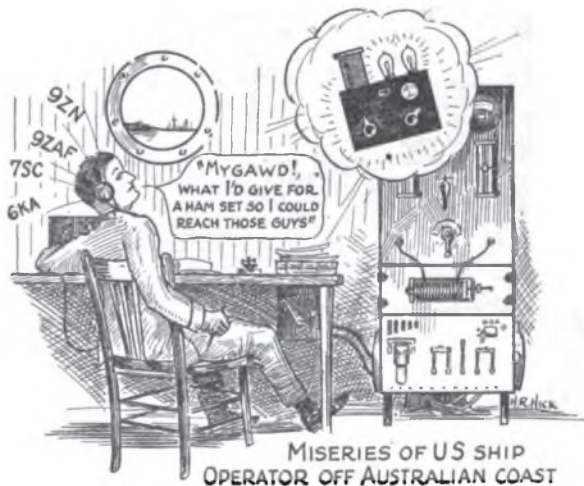
S. S. "China,"
At Sea off Kobe, Japan.
Nov. 11, 1922.

Editor, QST:

Since my last letter in which I wrote you that we had heard several eastern stations while in the harbor of Honolulu, I have done some pretty good receiving while west of Honolulu.

Oct. 28—91 mi. W. Honolulu—6CC QSA 10 ft. fm. fones; 6AHR QSA all over room, cussing his MG set; 6TI; 9ZAF, Denver.

Oct. 29—361 mi. W. Honolulu—8YD,



MISERIES OF US SHIP OPERATOR OFF AUSTRALIAN COAST

East Cleveland, Ohio, "test de 8YD test de 8YD ex 8AGZ" etc., sigs QSA and good for another 1000 miles, distance approximately 5300 mi.; 6XAD; 5JH doubtful; 9ZN doubtful.

Oct. 30—650 mi. W. Honolulu—6TI.

Did not listen after the 30th on account of heavy induction from ship's generator. Last night while we were in Yokohama my partner suggested that we give the 200-meter boys a whirl for a few minutes. On listening in on the 2-step audio and single-circuit tuner, static fair but QRM mush from JAA arc. Didn't expect to hear anything but sure enough here comes some amateur from the States coming in good. But he was one of those birds who think it necessary to send 40 words per to get thru. I think he was calling 1BQM. As for the rest of it, ND—absolutely couldn't be done. We are both positive he was a "3" station but his call was all jumbled up in sending. You know the kind. When he sends it sounds like a new code has been invented. If he had been sending even stuff, I am sure we could have logged him. But no matter who that station was, it was an

American amateur using self-rectified A.C. C.W. and that American amateur was getting across the Pacific. (DX Yokohama to Washington, D.C., about 6800 statute miles.—Ed.)

I am positive the limit has not yet been reached with C.W. If you could have heard those signals as I did and heard their steadiness I know you would agree. I have been a commercial operator since 1912 but

voice was readable easily 4 feet from the phones. Also I have a letter of acknowledgement here from 9DJG, stating that the sigs I heard from him, and which check exactly with his log in every respect, were sent to me via the 5-watt route, using AC on the plate at that. Can you imagine that—4230 miles with an ampere of 30-cycle C.W.? And they give up the perfectly good ether to broadcasting! And again, 4EH, heard here during October, acknowledges and confirms, and tells me his transmitter uses three 5-watters, in the Sure-Fire circuit, using chemical rectified AC, 750 volts. Atlanta, Ga., across the U.S. and 2300 miles of ocean on 15 watts! It's about 5000 miles, roughly estimated. I wonder, if it's my receiver or their transmitters? I'm inclined to favor both, 50-50. But it seems I hear fellers like 9DJG, who have a previous DX record of probably 500 miles, and it must take a receiver. I logged stations in every radio district last month and sent QST the list. Have confirmations here this A.M. from 1XM and 2GK. Both came to me on 100 watts.

I'm going to get real QRW here now and junk my present transmitter and rebuild it into a decent, civilized, DX go-getter. I'm going to find some sort of a motor on this island and rewind

it for DC hi-voltage. Have a chemical rectifier in now but having lotsa *pilikia* (Hawaiian for "trouble") with it lately. Last evening several of us here were listening at my house to the "all-star" concert being rendered by the Star-Telegram of Ft. Worth. He comes regularly here and was especially good yesterday from 4:30 P.M. on, about 2 hours before dark. KHJ, the Los Angeles Times, was also good and we alternated between them. Also 6XB was going strong, but punk modulation. He called me at 10 P.M. and sed he'd call me later and that 6ZAF would call; also that K. B. Warner was with 6ZAF. FB. I tried to raise 6XB and 6ZAF but tho they were both QSA here, they unheard me. However, 6ZAF sed to QRX for 6ZE's I.C.W. on 200, and we worked. Gosh, 6ZE was QSA, and he copied me fine single; sent one and received two QRQ from him. K.B.W. is going to work me from 6ZE at 11:30 tonight, and he'll have something interesting to tell when he gets back. Well, I sent 8 msgs. to 6BSA, with considerable difficulty thru the arc mush at his end, and at midnight here sed "GM" to 6AJF, using 15 watts, and as QSA as 6KA's 250-watter. That's a sample evening at 6ZAC. Sometimes I feel like logging, so I just twist the little dial and



I've changed my "Sweetie" and when I go back to the ranch I'm going to have an amateur C.W. set.

Hoping this letter will interest you, I remain

Respectfully yours,
Howard A. Cookson,
Operator.

And that isn't all the Pacific dope, at that, for here is some interesting accounts from 6ZAC on how the gang rolls in in Hawaii:

Wailuku, Maui, T. H.
Nov. 18, 1922.

Dear Mr. Maxim:

Yours of Oct. 31st just arrived, and many thanks for the cheering word, OM. Have heard the boys calling you night after night but cannot seem to find you. Mebbe there's a limit to this C.W. stuff...I dunno. I worked 6BSA several times lately on his 5-watter and he's a much better signal than lotsa the 50 and 100-watt stations. Last night he was audible 40 ft. from the phones on 2 steps on C.W., and by gum, he talked to me, TALKED, 2300 miles with his voice propelled by a dawgone 5-watter, for 20 minutes, and I didn't miss a word! If I wuz 9ZN I'd trade my 250-watt ICW for a real transmitter. 6BSA's

write 'em down fast as I can. Guess the boys get a real thrill from my reports of their sigs—every card and letter sez it's better'n a check. Hi! I sure enjoy the letters too, and I boast that every one is answered.

Say, when can we have the "Provisional" taken off our Division? I sent Schnell a traffic report of 133 messages handled for our 2-station division, and the QSO is 2300 miles at the shortest. And we have a dandy big C.W. station coming right along in Honolulu—6ZY. He gets mainland stuff fine and will be QSO coast soon.

Very best wishes, OM, and hope I can work you some day.

Sincerely,
Cliff. Dow.

What next? Gosh, we don't dare think! But we have a bird of an idea! Hasn't some rich A.R.R.L. member a steam yacht he'd like to lend us to send out on a long cruise thru the South Indian Ocean and the far-distant corners of the world, just to see where these sigs do go? We'll supply the operator and the set—but shucks, all he'll need will be one tube!

—K.B.W.

"The Amateur Is Doomed"

A message relayed from Hartford to Hawaii and return, 10,000 miles, in 4 mins. 18 secs. total elapsed time, a new speed record.

Over 50,000 messages handled in November, the greatest number ever reported.

About 80 calls heard in England during the Transatlantic Preliminaries, several times as many as in last year's Finals.

A flock of amateurs heard off Australia and China, at distances of 7000 miles.

Amateur radio locates and saves storm-bound trains, and gets recognition for its valuable services.

Are We Downhearted?

The Department of Commerce's 1922 Cup

HAVE you had a postcard from 5ZA recently? We say, have you seen the boy's card with the illustration of the cup which was awarded him by Secretary of Commerce Herbert Hoover himself, when the A.R.R.L. adjudged 5ZA the best all-around amateur station in the United States in 1921? If you haven't received Falconi's new postal, take a look at page 32 of November QST, where we tell all about it.

Now this is an annual trophy awarded by Secretary Hoover, under the auspices of the A.R.R.L., and it is time to award another

one for 1922. *This is a call for entries—* they are now in order. As we have said in QST before, Mr. Hoover desires that the cup be awarded primarily for the best amateur radio equipment in major part constructed by the amateur himself. This is typical of Mr. Hoover, who is an engineer and realizes that the greatest benefits come to any line of endeavor when initiative and individual effort in design and construction are encouraged. All necessary information concerning the matter is contained in the following extract from the original announcement in QST for January 1922. The

cup will be awarded to AMERICA'S BEST ALL-AROUND AMATEUR STATION, the major portion of which is home-made, as determined by a consideration of the following features:

- (A) Extent to which the apparatus actually is made by the amateur himself.
- (B) Ingenuity displayed in design, construction, and arrangement of the station.
- (C) Over-all electrical efficiency of the transmitter, as determined by test or supported by acceptable affidavits.
- (D) Consistent transmitting range thru the preceding year, as will be known to the Operating Department of the A.R.R.L. or determined by test.
- (E) Performance of the receiving equipment, as evidenced by the station log or determined by test.
- (F) Record of the station in obeying the Radio Communication Laws of the United States in every respect, and in complying with whatever local co-operative regulations are in effect in its community.
- (G) The quality of the "sending" of the operator, particularly as regards "readability," brevity, and the quality of judgment displayed in operating.
- (H) The amount of relay traffic handled in the preceding year, as will be known to the A.R.R.L. Operating Department.
- (I) Accuracy, completeness, and neatness of the station's log. A log must be kept and submitted as an exhibit in this contest. It will be returned to the owner.

Regulations

The following regulations shall govern the contest and awards:

- (1) Any licensed amateur radio station in the United States or its possessions shall be eligible.
- (2) The particular idea of this contest being to encourage original design and construction by the amateur himself, the greatest consideration shall be given to the extent to which the apparatus is "home-made," and stations in which the major portion of the apparatus is purchased ready-made shall not be considered favorably.
- (3) The calendar year shall be the basis for the annual awards. To be eligible for any year's award, a station must be in actual existence on December 31st of that year, and its operation during the preceding year will be considered primarily with a view to determining how good a station it actually is. There will be an award each year for four years, the presentation to be made by the Secretary of Commerce on March 1st to the successful entrant of the preceding year.

(4) To enter a station in this competition the entrant shall file the following exhibits at the office of the American Radio Relay League in Hartford, Conn., not later than February 1st following the end of a calendar year:

- (a) A manuscript containing a complete description of the station and its apparatus, particularly of those portions made by the amateur himself, and giving such data on features A to I hereinbefore referred to as



The 1921 Cup, Won By 5ZA

will likely be of aid to the Judges in determining the merit of the station.

- (b) The station log.
- (c) Photographs of the transmitting equipment, receiving equipment, antenna equipment, and such other photographs particularly of home-made features of the station as will assist the Judges in determining the merit of the station.
- (d) Wiring diagram of the entire equipment, with constants.
- (e) Sketches of any unusual equipment, if desirable.

(5) A Committee of Judges will be announced by the Board of Direction of the American Radio Relay League and shall take charge of the entries and determine the winner. Their decision shall be final.

(6) In determining awards, the Judges shall take into consideration the wave length and power allotted competing stations under their licenses.

(7) These regulations shall be subject to change up to Dec. 31, 1922, as regards the awards for 1923 and 1924; and up to

Dec. 31, 1923, as regards the award for 1924.

The race is now on. The Hoover Cup is the biggest honor available in amateur radio. We earnestly urge upon A.R.R.L. men the desirability of preparing exhibits covering their stations and sending them forthwith to Headquarters. Remember that a rich man's station hasn't a ghost

of a show in this contest—it is purely for the amateurs who build their own apparatus. If you have a pretty good station in which you made most of the apparatus yourself, we want your entry. Read carefully the features which count and the regulations, particularly paragraph 4 telling what should be submitted. Entries must be in by February 1st, so immediate action is necessary.

The Daylight Transcons--Preliminary Report

THE "preliminary" in the title could have been a "final" if everybody had come right across with complete logs. We suspect the following of having information and will be mighty thankful when it comes—1AWF, 1BRQ, 2BG, 2BLP, 2FC, 2AWH, 3BLF, 3LR, 3MB, 3PZ, 3OT, 3TJ, 3YI, 6AK, 7OT, 8BWA, 8CM, 8CUR, 9AMB, 9XA, 9XAD, 9XAQ. Of course there are a lot of others that are holding out on the gang as can be seen from the wide gaps in the report. What's the matter? No ink in the bottle? *Come on and snap out of it.*

Reports lacking essential details such as station calls, dates or hours, were received from 1AFP, 1QP, 3XM, 6ZX, and 8AXN. Now by way of pleasant contrast we got complete logs from 1BQD, 1RC, 2AJF, 2AWS, 2FS, 3ZO, 4AS, 4FT, 6CC, 7BK, 7TH, 8OAL, 8CTN, 8HJ, 8QK, 9ABV, 9APW, 9BRI, 9DCR, 9DJB, 9MO, and 9OX. And finally there was a small group of REAL A.R.R.L. ops that sent in logs properly tabulated and dated and which gave all calls, times, message numbers and message texts, and which arrived ON TIME. They rate a *Roll of Honor*:

1BES	2BLP	3AEV	3CA	3JJ
4FS	5XY	7LU	7ZO	8AGR
9AOG		9AWM		9CXP

Because of the general lateness and incompleteness of the reports the following is all that we know at present:

NOVEMBER 30th

Msg. Nr. 1 East
Supposed to have started in Northwest Division but never heard of.

Msg. Extra Nr. 1 East (unofficial)
From Walnut Grove California
To 1AW.
Congratulations of the West Coast.
6ZX.

No information as to starting point or route until 3:30 P.M., after which it moved 8ARG-1BES-1AZW-1QP-1AW, where it was delivered at 4:06 P.M. E.S.T. As far as we know at this writing this was the only successful message.

Msg. Nr. 2 East
From Walnut Grove, Calif.
To H. P. Maxim, Hartford, Conn.
Wire news if transcons a success.
Wise.

No information whatever as to route or place where this one died.

Msg. Nr. 3 East
From Denver, Colo.
To F. H. Schnell, care 1AW.
Glory to the doomed hams.
Hood.

This of course was not a transcon at all but was lost just as effectively and not a thing is known about it.

Msg. Nr. 1 West
From Worcester, Mass.
To Los Angeles, Calif.
Hope this makes the record.
1CPN.

Moved 1CPN-????-1QP-8CKN-????-1AWB-2AWS-2BG-????-3AAO-3PZ, also 3LR & 3JJ-8AIO-8CUR-????????????????

Msg. Nr. 2 West
From Wilmington, N. C.
To 6ZK, Sunnyvale, Calif.
The amateurs of the Roanoke Division greet you.
Parsley 4FT.

Started at 4FT at 5 P.M.—a solid 8 hours late—which gave it only a fighting chance for arrival in daylight. Moved 4FT-3BLF-9OX-9DJB-9ABV-9AMB-6CC-6AK-6ZX—where it arrived at 5:50 P.S.T. The delivery to 6ZX was a mistake, as the msg. was not addressed to 6ZX but to 6ZK. Because of this and the fact that it traveled right in the sunset, this msg. must be rated as a failure.

Msg. Nr. 3 West
No information.

DECEMBER 3rd

Msg. Nr. 1 East
No information whatever available—not even msg. text or point of origin. Msg. probably never started.

Msg. Nr. 2 East
From Walnut Grove, Calif.
To Hiram Percy Maxim, Hartford, Conn.
Have you many sixes on your log?
Wise.

No information.

Msg. Nr. 3 East
From Denver, Colo.
To F. H. Schnell, care 1AW.
Watch our smoke.

Rocky Mountain Division.
No information as to early part of travel but after 10:00 A.M. C.S.T. traveled 9AMB-9ABV-9XAQ-9AWM-9DCR, but at the same time was handled by 9CCV, 9AEQ, 9CKP and 9APW, in a manner that is not sufficiently explained by the logs of those stations. Never arrived 1AW.

Msg. Nr. 1 West
From Lewiston, Maine
To George F. Dorner,
1611 Fern Road, Berkeley, Calif.
When do you start for here?
Linewood.

Moved-????-1AWB-????-3MB-???? and, at the same time, also 1BQD-2BLP-2FC-

2AWH—then missing till 4:20 P.M. C.S.T. when it turned up at 8AGR-8BWA-????-9AWM-9XAQ and 9BRI at 5:15 P.M. No further dope.

Because he suspected that Msg. Nr. 1 West was not getting started, Traffic Manager Schnell initiated another message:

Msg. Extra Nr. 1 West
From Worcester, Mass.
To 6ZX, Walnut Grove, Calif.

Your thanksgiving message received here at 4:06 P.M.

Schnell.

This traveled 1CPN-1KC-1AFP-???-1QP-2AWS-3XM-3ATQ—and then was lost.

Msg. Nr. 2 West
No information at all.

Extra Nr. 1 East of November 30th was the only msg. that made a bona-fide daylight crossing. It is probable, however, that some of the others got much further than the present spotty records show. The texts of the messages have been supplied for the information of those who may be confused as to the exact msg. they handled. Now PLEASE give us the complete logs of the wanderings of these incomplete msgs. so we can have a really good report next month. And in those logs for the love of Mike TABULATE the stuff and give all message-texts, hours, calls, the kind of time your clock reads, and the DATE you did the work on. Even if you did not do any sending, let's have the log if you heard anything happen.

A Snowstorm Emergency and the A.R.R.L.

ON November 4th a tremendous snowstorm swept down upon Wyoming and Colorado. With the snow came wind and sleet. By midnight the snow was fifteen feet deep in the cuts along the C. & S. railroad. Somewhere out in those drifts were train No. 29 of the 4th and train No. 30 of the 5th. No one knew where they were, for the ice-laden telegraph wires had gone down long ago. If the dispatcher at the northern end at Casper could only locate the lost trains it might be possible to do something for them. But neither telegraph nor telephone were available. It seemed possible that the C. & S. dispatcher at Denver might know. But between Casper and Denver all wires were down.

In the emergency the railroad turned to amateur radio. At about 2:00 o'clock in the afternoon on November 5, 7ZO was asked to attempt to reach Denver. It was

explained to the dispatcher that this could not be done in daylight so he waited until evening. As soon as darkness fell the air around Casper was thick with C.W. signals. How many hundred times Denver was called not even the log books will show. Denver did not answer. A ground on a high voltage line was creating such an uproar that no one in Denver was able to copy anything. Finally at 11:30 P.M. 9ANQ, L. V. Wells at Kansas City, Kansas answered 7ZO's calls. It turned out that he probably could reach Denver by wire and he was at once given a message from A. W. Parker, the Casper dispatcher of the C. & S. R.R., to W. P. Wilson, the chief dispatcher of the C. & S. at Denver. The message requested information as to the whereabouts of the lost trains, stated that drifts from five to fifteen feet deep blocked the right of way, and finished "It does not seem possible to get No. 29 thru. Advise

if you wish help from Northern end." 9ANQ at once telephoned this message to the railroad wire operator of the Chicago, Burlington and Quincy Railroad at Kansas City, Mo. But that operator was completely hardboiled. He flatly refused to believe that a radiogram regarding the matter could have been received. He had evidently been born somewhere in the sixth century and had never gotten up to date. Everything possible was done but this dumbbell refused to take the message. Wells sadly got back on the key at 9ANQ to see what could be done about it and had the good luck to pick up AD7 at Fort Crook, Omaha, Nebraska. AD7 said that he had copied the entire message from 7ZO, and had given it to the C.B.&Q. operator at Omaha who had sent it to Scott's Bluff, Nebraska. Evidently the Omaha operator was not in the same class as the Kansas City dumbbell. In the meantime 7ZO had been camping sleeplessly at the set hoping for an answer, but at 5:00 A.M. nothing had developed. However, the next afternoon at 4:50 P.M. (the afternoon of the 6th) the reply did come from Scott's Bluff. Casper was again in touch with Denver! The missing trains had been located!

The evening of November 6th again saw the wires still entirely out of commission and with no indication when they would come in. Again the air was full of signals. This time the luck was better. At 6:30 P.M., 9DTM, W. L. Fick of Denver, answered with his 100-watt C.W. set and said that he was ready to help. Several messages were now put thru and a schedule of calls on the even quarter hours arranged. 9DTM now had to leave suddenly and was unable to notify 7ZO. However, he hurriedly telephoned 9AMB, Donald and Lewis Hathaway, of 1575 Pennsylvania Street, Denver and asked them to take the schedule. 9AMB was entirely without a set in operative condition. At 9:30 7ZO began to call 9DTM again but of course got no answer. The Hathaways went frantically to work and in less than an hour had their set operating. They say that the table was so full of loose wires that it was almost impossible to reach the key but they called 7ZO and got him. A seventy-two word message immediately came thru from Casper and was replied to by Mr. W. P. Wilson, chief dispatcher at the C.&S. at Denver. Wilson stated that a rotary snow plow was leaving Cheyenne so as to get thru to No. 29. Thereafter the two isolated dispatchers stayed in touch thru 7ZO and 9AMB. At 8:30 more messages were put

thru. Intermittent contact was then maintained until about 10:30 on the night of the 6th, when having putting thru over 300 words of vital railroad work, 7ZO and 9AMB thought that at last their work was over. They were slightly ahead of the facts, however. A.R.R.L. had more work to do in this emergency.

Shortly after midnight at 12:30 A.M., J. S. Carpenter of 9ZAF at Denver, roused out a newspaper editor and took from him the story of the souther end of the storm. As he took it he sent the installments to 7ZO. Over 500 words of this matter were transmitted and used in the "Casper Sunday Morning Tribune." This material was not all obtained at the same time and the last of it got into Casper at 3:30 A.M. From Friday night until that time Hood had gone entirely without sleep.

Chief dispatcher Wilson at Denver states that the amateur radio service in this case

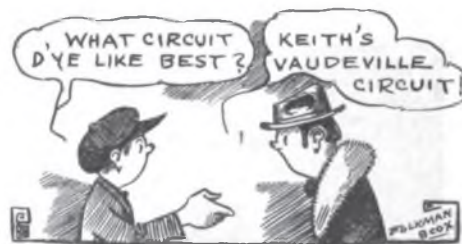
was invaluable. Not only did it locate the two trains with fifteen carloads of people but it also prevented the loading of over forty carloads of stock at Wendover, Wyoming, which would otherwise certainly have gone out into the storm and been caught by it. The fate of cattle crowd-

ed into open cars during such weather is not a pleasant one to contemplate. Dispatcher Wilson is recommending that the C.&S. install radio telegraph stations of their own.

In the meantime the Union Pacific Railroad too had been struck by the storm. Their wires had gone down and their traffic too had been handled by radio, and by amateur radio at that. Messages signed by the General Manager of the U. P. had gone thru 9ANQ. Unfortunately, thru excessive modesty of Wells of 9ANQ and Jolliff of 9AUS, we haven't the story of the Union Pacific tieup. Maybe we can pry them loose from it later.

But whether we even hear the complete story or not, the fact remains that amateur radio has again proven its value.

It is the same story as ever, fellows; when the stress comes it is the amateur radio man that is ready for the emergency; the A.R.R.L. man is the one who loses sleep, pay, and food, that he may help those who are in difficulties. It is he who thru heart-breaking delays, interference, static and fading, sticks to the job and does his unrewarded best. He asks for no publicity and the story has to be taken away from force before we can tell our own members about it. The part that



Wells and Jolliff at Kansas City played, is even now a bit hazy. But we are just as proud of them as if we knew every detail, and we certainly take off our hats to

9th and 7th district. And while we have them off let's make a bow to the sleepless wonder of 7ZO, Norman R. Hood.
—S.K.

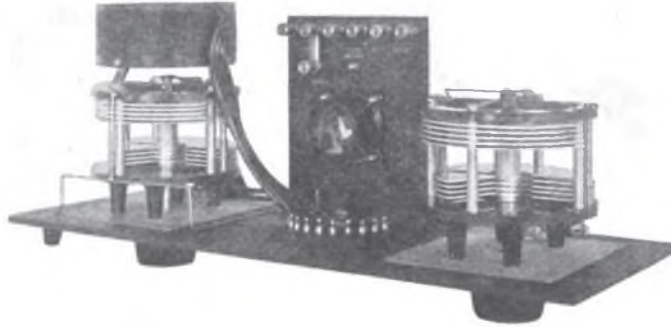
A Tuned Radio-Frequency Amplifier

By Wm. F. Diehl*

THE amplifier described in this article is the result of a lengthy consideration of the problem of radio frequency amplification. R.F.A. is not new—many types of such amplifiers were used during the war. However, these were mainly designed for reception on a definite wave length or over very narrow frequency bands, the lowest wave length being 300 meters. Furthermore the vacuum

core for broadening the wave length band. This method, while very satisfactory as far as a fair degree of amplification was concerned, had the disadvantage of amplifying over but a very narrow wave length band. Transformer coupling was next considered, but here again while the amplification at the desired wave length was exceedingly high, yet even when using fine wire and iron-dust the wave length band was very narrow.

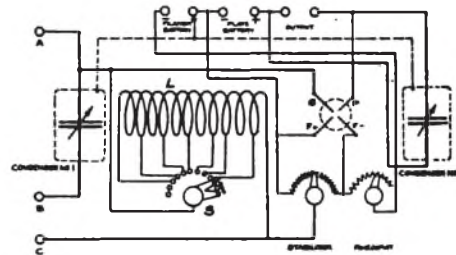
With these facts in mind attention was directed towards the development of an amplifier which would function over a range which would include the most useful wave lengths. The instrument shown herein is the result. It gives equal amplification over its entire wave-length range of 150 to 3000 meters. It is an amplifier of what might be termed the "tuned coupled-circuit" type. It has a tuned grid circuit using a variable condenser and inductance, with the inductance switch so arranged that either a loop or antenna may be used. The plate circuit is tuned by means of another variable condenser and an output inductance which may be either (a) the primary



tubes used on these wave lengths were especially designed so as to have low capacity between elements.

During the past year several manufacturers have attempted to solve the R.F.A. problem by designing transformers or choke coils of such characteristics that resonance is obtained at the desired wave length and using iron cores and resistance-wire windings to broaden the band of response. Tests were made in our laboratory using numerous types of circuits and employing various types of coupling elements. It was clearly demonstrated that the resistance type was out of the question for reception below 1600 meters, the reason being that at the higher frequencies the plate current, instead of flowing thru the coupling resistance elements, takes its path thru the capacity circuit afforded by the tube elements, so that practically no voltage is applied to the grid of the succeeding tube. The impedance type of coupling was next considered, using either an air-core choke with fine wire winding or with an iron-dust

condenser and inductance, with the inductance switch so arranged that either a loop or antenna may be used. The plate circuit is tuned by means of another variable condenser and an output inductance which may be either (a) the primary



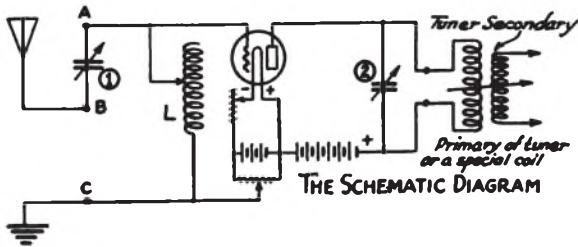
INTERNAL WIRING DIAGRAM

of the variocoupler of the usual loose-coupled tuner or (b) a special inductance coil supplied with the amplifier which may be placed in any location where it is in in-

*Chief Engineer, A. H. Grebe & Co.

ductive relation to the secondary circuit of the usual tuner, of whatever type. The first method, of using the primary of the

filament rheostat, and stabilizer for adjusting the grid potential, and is shielded in the usual manner. Binding posts are provided whereby either an aerial or a loop may be used.

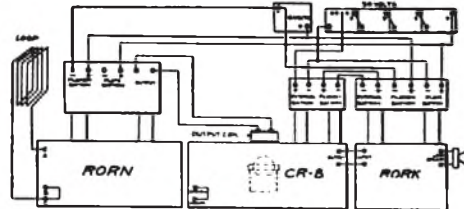


A square loop 3 ft. on a side, with turns 1/2 inch apart, gave a wave length range, with the variable condenser provided in this set, of from 160 to 375 meters when 4 turns were used, and a range of from 220 to 600 meters when 9 turns were employed. Our tests have shown this amplifier comparatively simple to operate; using a solenoid loop of 12 turns on a 2 ft. square, C.W. and spark stations up to 1000 miles distance were copied during two nights of listening.

two-circuit variocoupler as the output inductance, may be used on any standard tuner in which this primary circuit is not grounded to filament, but in Grebe three-circuit tuners the primary is grounded and therefore this connection cannot be used. Accordingly a set of four output inductance coils is provided, having wave length ranges, respectively, 150 to 400 meters, 250 to 800 meters, 725 to 1600 meters, and 1500 to 3000 meters. By this method it is possible to make use of any type of tuner for the tuned circuit feeding into the detector.

were copied during two nights of listening.

The amplifier unit contains a tube socket,



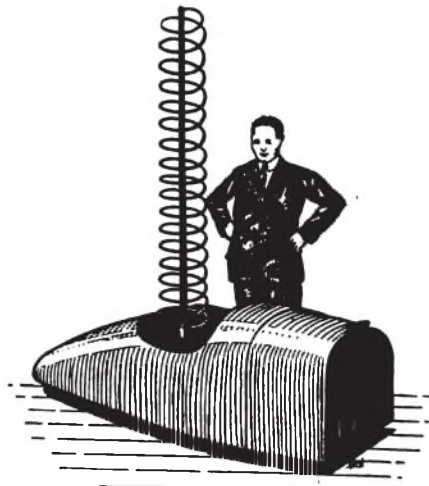
How the Amplifier is Used

The "Radio Hound"

DURING the preparations for the Seattle Radio Show this past summer the DX gang decided they would like to have a radio-controlled car as a novelty attraction. Such a device has been exhibited at numerous eastern shows and has attracted wide attention. Altho supposed to be extremely complex and involving secrets of design and complex mechanical and electrical apparatus, the Seattle lads pitched in to work and in three weeks' time one of their number, Kenneth G. Field, the fifteen-year-old operator of 7QB, had designed and built a successful radio-controlled vehicle, which was dubbed "The Radio Hound." It was enormously popular at the show, and its construction reflects much credit on its builder.

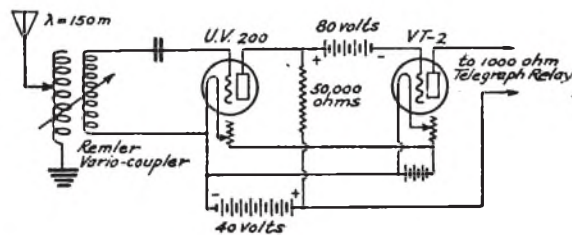
model the control was simplified to four actions: start, right turn, left turn, stop. Any one of these is chosen at will by an

The idea is so simple that many of our readers may be interested, so we present a hook-up of the radio portion of the device and will briefly explain its operation. A small car, mounted on rubber-tired wheels and bearing a light racing-auto body, is arranged to be driven by an electric motor operated by a storage battery, and to be steered by the operation of another motor which actuates a drum upon which the steering cable is wound. In this particular



electrical device known as a "selector," well known in railroad signal and auto-

matic telephone work. In principle it consists of a ratchet wheel bearing on its shaft an arm which makes contact with numerous switch-points; the ratchet wheel is advanced a tooth at a time by a pawl mounted on the armature of an electromagnet. Thus by sending a certain number of electric impulses thru the magnet, the ratchet wheel will be advanced the same number of teeth and its switch-arm will make contact with a certain stud. The selector used by 7QB actually had 24 contacts, so these were paralleled up, the 1st, 5th, 9th, 13th, 17th, and 21st being con-



nected together, and the others similarly, so that the series of 4 actions (start, right, left, stop) might recur all around the travel of the selector arm. The impulses to the selector magnet were supplied by a local battery upon the closing of a relay, the relay being actuated by the radio receiving apparatus, and to this we will now turn our attention.

The car bears a spiral aerial which, with the primary of a vario-coupler, gave to the open circuit a wave-length of about 150 meters, which was the wave-length of the secondary. The first tube con-

nected to this is the usual detector but the second tube presents an unusual arrangement, forming in conjunction with the first tube a balanced valve relay. The resistance and the "B" and "C" battery are adjusted so that normally no current flows in the output circuit of the second tube. When, however, a signal is received, the balance is destroyed, the potential on the grid of the second tube is no longer sufficient to cut off the current, and the plate current flows thru the coils of a 1000-ohm telegraph relay placed in that circuit. It is the local circuit of this relay which controls the selector. Thus whenever a dot is sent out from the transmitter, the relay trips and the selector moves one step; two dots, two steps, etc.

A small spark transmitter is used as the control, the operator merely sending out the proper number of dots to move the selector to the proper switch-point for the desired manoeuvre. Thus, the car being started, to steer it to the left the operator sends two dots, this moving the selector to the proper position before the steering motor would have time to act towards turning the car to the right.

Many other combinations, such as reversing, lighting lamps, ringing bells, etc., are possible—they merely have to be wired up to other selector contacts. It is decidedly advisable to leave a dead contact between every live one on the selector, so that immediately upon the completion of an act the control can be brought to neutral simply by sending another dot, leaving the apparatus all ready for the next control.

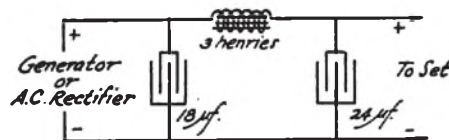
K.B.W.

Data Wanted on Filters

DO you own a filter that really works, DOM? We're having a hard time locating really accurate data on the construction of a filter good enough for the job and still capable of being made at a reasonable cost. It's one of the biggest needs of amateur radio right now, and QST will esteem it a special favor if all persons owning what they consider a good filter will send us a description of it in order that we may determine therefrom what apparatus is serving well and present it in our columns for the benefit of the craft in general.

The theory of the Campbell filter was excellently outlined in the leading article in QST for October last, Figures 1 and 4 showing the low-pass type necessary in our problem of smoothing out a rectified supply. It is suggested that for a 60-cycle-rectified supply, the cut-off frequency might be

taken as 50, the capacities C put at 4 micro-farads, and L thereby computed. However, we understand some of the big companies working on this problem have had all their needs completely met in a simple filter arranged as in the diagram here shown.



What we need, of course, is a filter capable of taking our rectified A.C. and smoothing it out until it is substantially the same as battery voltage. Then there will be no "burr" on our C.W. sets, they will sharpen up immediately, the local "smother" which non-filtered rectified sets

make will disappear, and we will be able to operate our C.W. sets at any time of day or night without even local interference. Who's got the dope?

And, by the way, has anybody got results which approach what we need by the use of

self-rectifying sets with a tube "on each half of the cycle," satisfactorily smoothing out the 60-cycle modulation by means of a reactance in the common supply? If so, what are the particulars, please?

K.B.W.

Reminiscence

By The Old Boy

*Some for the glorious days of yore; and some
Sigh for the jazz-lade days to come;
Ah, take the tube and let the spark alone,
Nor heed the squeakings of a distant fone!*
—Rubaiyat of T.O.B.

SONNY, you talk many words of would-be wisdom concerning the marvelous advance of this radio game. You spout eloquently of stupid degeneration, feedbacks, periodically detuned aerial systems, decrements and increments. Your thorax bulges as you learnedly expound the principles of "the radeeo" to the novice on the next block. Ah, yes, it is quite a game, this radio, but sonny, I had some radio experiences of my own way back in '88!

This was back when I was the star reporter for *QST*, in the good old days when my pins were able to hold me up, and when coherers were good (especially since they hadn't any "concerts" to blame on the receivers).

One day Eddy calls me in and he says, sez he:—

"Old timer, I've a job for you. We've been looking up some of these DX records we've received for "Calls Heard," and I'd like to have you beat it over to this address and interview the op there."

"Yezzar," sez I, and off I hops to the address on the slip of paper he gives me. Springing up the stairs in the blithe manner becoming a young man of 67 summers, I rang the doorbell and was ushered in by the landlady.

"The radio room? Oh yes, right upstairs ten flights and knock on door number 71." After much loss of hot air I reached the door mentioned and knocked.

"Come in," cried a voice, and I twisted the door knob—

Bam !!! — — —

When I came to I sat up in astonishment. Before me stood The Old Man, glaring at me with the most malignant expression imaginable. I seized my hat, muttered "My mistake," and scrambled toward the door.

"Come hither, my boy," he boomed. Involuntarily I turned.

"What dost thou here?" quizzed the

Patriarch, and I answered feebly, "Eddy sent me to get a write-up for next year's *QST*."

"*QST*?" shouted the O. M., and then burst into a smile which covered his features as a dollar covers the cost of a UV-2135.

"Whynell didn't you say so before? You from *QST* and me thinking you were another broadcast listener coming to tell me why I must QRX from 6 P.M. to 6 P.M. except Sundays during leap years when I can transmit from 7.00 to 7.01!"

Life seemed brighter and I adjusted my collar to meet my Adam's apple, which had risen three and a half feet in the excitement. After searching a while I found my composure and then pulled this one:

"Say, OM, I hear you made a distance record on your transmitter? Howabout—



it?" "Oh, that?; why, I worked a ham three miles away at ten o'clock E.S.T. which is 3 o'clock G.M.T., and gave him a whole message without killing the cat or biting my pipe in two."

"Wonderful! How did you do it?"

"Shh—I can't tell—it's a secret."

"Hexx! Well, anyway, OM, show us your junk, willya?"

Thereupon T.O.M. led me into a small room off to the left. At the threshold I paused in amazement. Goddlemitey, what a collection! The "receiver" was the first thing that caught my eye. A large screen door was hung up in the air with one corner submerged in a tank in which a gold fish was swimming about lazily. T.O.M. saw my look of incredulity and hastened to explain:

"You see, this screen door is very susceptible to osculations of great frequency and catches them like a net catches fish, and the oscillations shake the screen and cause a commotion in the water, whereupon the goldfish rises to the surface to see what the trouble is. Since the hams around here send at the tremendous speed of four point naught seven a year, the fish will rise for every dot and dash, staying longer for a dash, and so I can read the code very easily."

"Marvelous, OM, and what do you call this wonder?"

"This is the super-fishgenerator, and I prophesy that it will revolutionize the world."

"Let me get out before the revolution starts," sed I, but my wit evoked only a frown from T.O.M. So I turned to the transmitter. In one corner of the room was a cage and therein lay a black cat on a velvet cushion; on either side of the cage was a monstrous electrode, and the ends of these were connected to the hot water heater in the kitchen. I could see two leads from the heater where they went out through the window.

As I watched in mute astonishment, things began to happen and the goldfish started to show signs of excitement and then began to rise to the surface.

"A message—shh!" cried T.O.M., and seizing a piece of paper began to write dots and dashes to correspond to the fish's movements.

"Migosh, real DX at last, at last. Wait!"

With that he seized his key and then I did gape. First he turned to the cage and deliberately spat on the helpless cat. At this atrocious action the cat reared itself and yowled and the sparks started to fly from its fur. These were blown against the electrodes by a fan fastened to T.O.M.'s left foot, and then he began to pound the key. The oscillations immediately became so violent that the coil in the water heater started to shimmy and was on the point of flying off and banging T.O.M. on the head. Then he stopped and looked at the gold fish.

"Hexx" he cried, "He sez QRM from NAH!" Sadly he arose and turned to me. "Whynell do these darned amateurs always QRM us poor little novices anyway?"

"I dunno—but say, what do you connect the key to?"

"Well, you see, I'm using a system of incorrect control, developed by Prof. Turnsback, and lemme tellya it's the football's pigskin!"

With that he led me outside and pointed upward. From the center of the garden rose a high stream of water and in the top of it a small boat floated, held high in the air by the force of the stream. A small aerial was erected on this boat and a flexible braid led from the end of this down into the house.

"Watch," said T.O.M. and re-entered the house where I could see him at the key. He pressed it and the column of water



lessened in force, the boat dropping about ten feet. He released it and the boat rose again. When he came out he explained: "You see, the key operates a relay which reduces the flow of water and thus lowers the aerial, changing the wave on which I transmit."

"Fer gosh's sakes—what next!"

"Nothing—you've seen it all."

"Where—well, say, OM, pse tell me how you worked that DX of yours, willya?"

"Well, all right, you see it was this way; I used the same city water mains that he did and when I pressed my key it made his bathtub faucet thump dots and dashes.

"Oh yes," I cried, enlightened, "quite a novel manner of transmi—"

"Lookout, the aerial's coming down!"

He cried and leaped for the door. I tried to follow but the breaking water column knocked me flat. Realizing that the falling boat would hit me, I grabbed blindly for The Old Man's hand, and was snatched thru the door just as it banged shut. Then I opened my eyes. A woman was bending over me, and I recognized her as the landlady who had admitted me.

"T.O.M.," I cried, "is he safe?"

She looked at me in blank amazement and then turned to a boy who stood beside her.

"Poor man, I guess he's delirious. Jack, don't you ever dare connect a spark coil to the door knob again! I don't care if you did think it was that boy next door! You heard me! Now march!"

And to me:

"I'm sorry but Jack will not be able to see you tonight. I'm sending him to bed

for that stunt. You wanted to see him about his set, didn't you?"

"No," I barked, and went out, slamming the door behind me.

So, sonny, you see everything isn't so new or wonderful in radio today as it seems. Whazzat? How have I lived so long? Well, son—I never listened to KYW.

Antenna Resistance Measurement

By Boyd Phelps, Assistant Editor

AN TENNA resistance is something that is probably more generally misunderstood by the amateur than any one other thing. We have read and heard many misleading discussions, and, although the author makes no claim for originality of the following, it is hoped that this may serve to straighten out many erroneous conceptions of radiation resistance and antenna current. Many amateurs are wont to brag on getting high antenna currents from their sets. To these this article is dedicated; especially the class that boast they are "radiating three amperes" when ten chances to one only a small part of the antenna current of three amperes goes to make up useful radiation.

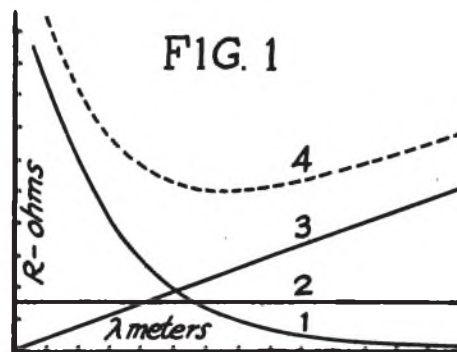
In order to understand what is to follow, it is necessary to have a clear conception of the factors that go to make up antenna resistance, and how these factors affect the range of a transmitting antenna, so a brief review of this will refresh our memory and form an understandable working basis.

Of the three components of total antenna resistance, radiation resistance is the only useful kind. The energy "lost" in the hypothetical radiation resistance is lost in a practical way. This energy actually produces the signal at the distant station. The greater the value of this resistance for a given antenna the greater the proportion of the antenna energy which will "get out" from the aerial. This resistance varies with the shape of the antenna, and with a given antenna it varies inversely as the square of the wave length, being therefore maximum at the fundamental wave length and decreasing rapidly when the antenna is loaded. Referring to Fig. 1 in which resistance in ohms is laid out on the vertical axis and wave length on the horizontal axis, starting with the fundamental wave length, curve 1 shows the variation of antenna resistance with wave length.

Ohmic resistance in an antenna is a heat loss and is not useful by any means. This includes the losses in the resistance of the antenna wires, ground, loading coil, etc.

The resultant of these resistances, combined under the term ohmic resistance, is practically a constant value for a wide range in wave length and is represented by the straight line 2 in Fig. 1.

The third resistance represents another useless power loss and is called dielectric absorption. It is the result of the antenna capacity acting as a poor condenser. The magnitude of this loss depends upon the nature and position of imperfect dielectrics in the field of the antenna, such as trees,



buildings, wooden masts, etc.* The loss of power due to dielectric absorption is represented by a resistance which is proportional to wave length, as the straight line 3 in Fig. 1.

From the above brief discussion it will be seen that radiation resistance is the only desirable resistance. Adding the curves 1, 2, and 3 produces curve 4 which is the total or antenna resistance. Unfortunately in actual measurement we can not segregate the components as in Fig. 1, and must

*No attempt is here made to take up the numerous factors that cause an increase or decrease in any of the above resistances; frankly, because there is not a wealth of information available. Mr. S. Kruse, now at QST headquarters, has been engaged for some time in collecting data on everything concerning amateur transmitting antennas and the "Antenna Symposium" is now nearing completion. Any of our readers who feel they have information they would like to contribute are invited to get in touch with Mr. Kruse.

content ourselves, for the present at least with measuring only the total resistance and estimating how this total is distributed among its three components. Failure of the minimum point to come down to a very few ohms would indicate high ohmic resistance, while a steep slant to the curve at waves higher than this minimum point would, in general, indicate high dielectric absorption. Regarding radiation resistance, a vertical cage would have very high radiation resistance near its fundamental, as compared with a low high-capacity antenna.

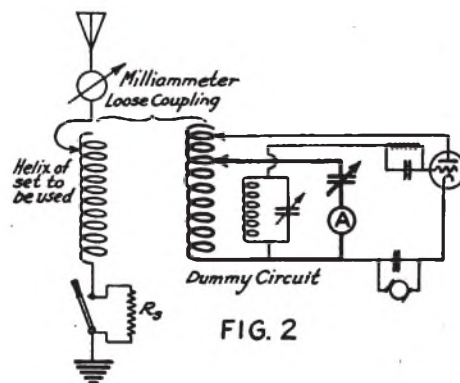
The idea that should everlastingly soak in is that the best operating point of an antenna is not the adjustment where the antenna current is the greatest, but the point at which the radiation resistance is the highest. As the number of watts put into an antenna is the product of the square of the antenna current and the resistance at that wave ($W=I^2R$), it will be seen that raising the radiation resistance by working near the fundamental results in a decrease in antenna current for the same power input, but more power goes into useful radiation and a stronger signal is bound to result at the distant station. Ballantine* says that the loading coil inserted in the antenna lead for coupling to the power circuit should be as small as possible and its effect in raising the wave length above the fundamental compensated for by inserting a series condenser having low losses. The value of this condenser will lie somewhere between 0.003 and 0.0003 mfd. and should be built of mica or glass to stand 8,000 volts.

The efficiency of a transmitter cannot be measured without knowing the input and output. The input being easy to determine, it becomes necessary to know the antenna current and resistance to find the efficiency and know when the set is working at its best. The chap who is heard across the country on a 5-watt set rates much more consideration than the fellow who does it with two 250-watt tubes. By keeping the efficiency high, higher voltages may be used and greater outputs obtained from small tubes without undue heating of the plates.

An antenna resistance curve may be drawn from measurements made with simple apparatus. The following instruments are needed: A C.W. oscillator, and accurate low-reading R.F. ammeter, and a non-inductive resistance whose value at radio frequencies is known. The resistance should have a value of about 10 ohms. It can be made of a piece of German Silver or other resistance wire, of some size smaller than No. 30 B&S, so that the direct current resistance may be assumed to be

equal to the r.f. resistance. For most work the d.c. resistance may be found closely enough from the wire tables, without measurement. As the length of resistance wire required will be quite small in any event, it is generally desirable to stretch it out in somewhere on the table away from the field of the transmitter, rather than to attempt a complicated method of non-inductive winding. The figure of 10 ohms is not essential, but merely convenient in calculation.

The regular C.W. transmitter of the station may be used for the oscillator or driver. However, this driver must be very loosely coupled to the antenna and it is essential (in order that the resistance curves mean anything) that the antenna circuit resistance be measured with the inductance coil of the regular transmitter in place in the antenna circuit. It is



therefore necessary to disconnect the tube equipment from the transmitter inductance, insert this inductance in the aerial circuit as shown in Fig. 2, and connect the tube equipment to a temporary dummy antenna made up of any convenient inductance and a shunt variable condenser, with the usual antenna current meter in series. The condition then reached is that the tube equipment is operating into a phantom antenna, and the inductance of this phantom is loosely coupled to the inductance normally belonging to the set, which has been disconnected and placed in the aerial circuit.

It is very important to have the two circuits very loosely coupled, as the changes in the resistance of the antenna circuit would otherwise be certain to affect the current in the dummy circuit. The antenna current meter previously mentioned as inserted in this dummy circuit should be watched to see that no appreciable changes in current take place while resistance measurements are made on any given wave length. However, it should not be expected that the dummy current will re-

(Concluded on page 41)

*"Radio Telephony for Amateurs," page 67. A description of this book appeared in a Book Review in August QST.

EDITORIALS

de AMERICAN RADIO RELAY LEAGUE



Excelsior!

BY T.O.M. but this has been a month of accomplishment! Honestly, fellows, our head simply swims from the staggering blows the old A.R.R.L. bunch has been administering. We slipped out of the office for a few weeks to make a little trip around the country and by the time we got back so many things had happened that we haven't yet had time to get thoroly posted. Oh boy but it's the gnat's gnipples!

Here our noble Operating Department has gone over the top with a definite record on 50,000 free messages handled, more than ever before in our history. Hot canine! Heavens knows how many more msgs. we never got a line on. Attaboys; up and at 'em—make it a million!

And derved if kid Schnell didn't get busy with HPM and pull off a new speed record while we were away. Ten thousand miles in four minutes! We don't see how it could be any prettier unless they had waited until we could have got in on it too.

And these dinky little oceans that lie on either side of North America—they got their's last month too. The poor Pacific has been entirely annihilated, as graphically described elsewhere in our columns with signals reported from Japan and Australia; and the Atlantic—pooh! Nothing to it, fellers, when around a hundred calls get over to our British colleagues while we're merely tuning up for business and getting set for our Finals. Do you realize that it's just a step more and we will have to confine Calls Heard to reports from the Antipodes, diametrically opposite on this little old globe of ours?

One final accomplishment remains before us to add to the glory of 1922—reception by us of European amateur signals. At this writing no such signals have been reported but we face the rapidly approaching listening period with the calm consciousness that the A.R.R.L. will not fail.

Now trot out your greener pastures—we're hungry for more.

Presenting Mr. Babcock

THE old west-coast coal-burner of 6ZK, Mr. A. E. Bessey, has gone into the radio business and, as a result of the regulations in our A.R.R.L. constitution

prohibiting commercial radio connections for its directors, has been obliged to tender his resignation. We've hated to do it but there has been nothing to do but accept it, and Mr. Bessey retired from the Board of Direction at its last meeting, with the sincere appreciation of that body for the good work that he did for the League idea on the coast when he was an active amateur.

To succeed him for the remainder of his term of office the Board appointed Mr. A. H. Babcock, 6ZAF of Berkeley, Calif., well known in radio circles around San Francisco. Mr. Babcock is a man of mature years and judgment, a nationally known electrical engineer, and consulting electrical engineer for the Southern Pacific Lines. Amateur radio is his hobby and he has won his spurs in it. In assuming the West Coast leadership in A.R.R.L. thought, Mr. Babcock tackles a difficult proposition, for the League idea has been misunderstood there and altho there are thousands of A.R.R.L. members along the Coast they have not heretofore functioned as a homogeneous whole as amateurs have elsewhere. But Mr. Babcock is a splendid leader and we know he will have the confidence and support of all good amateurs.

There are a few Coast amateurs who in some unexplained fashion have come into the idea that the League is a dictatorial body "run" by a few higher-ups who dictate "thou shalt" and "thou shalt not" to the poor membership. It is strange how an idea so entirely contrary to the League spirit could have arisen, when the very principle of League organization is self-determination of all community matters. This A.R.R.L. that we amateurs have built is a *national* organization and the basic idea is that it provides a medium in which amateurs work together in all matters of common national interest, such as representation in radio legislation, the relay activities of the station net-work of our Operating Department, and such nationwide amateur problems as the need for co-operative action between the transmitting amateur and the novice listener, which latter problem is a particularly trying one on the Coast at the moment.

Amateur Radio in the Pacific states needs the A.R.R.L., and we are there to help. Give Mr. Babcock a hand, men, and we'll

have better conditions all along the line, with Amateur Radio setting firmly on its own right to exist.

"McWilliams vs. Bergman"

THE little town of Dwight, Illinois, is supplying the actors in a very interesting radio episode. In Dwight there lives G. Wiley Bergman, loyal member of our A.R.R.L., District Superintendent for Northern Illinois under the Central Division Manager, and operator of spark station 9CA. A few blocks away is a novice listener, a banker named Edward McWilliams. A few weeks ago the papers of the country blazed forth the fact that the first radio lawsuit between users of the ether was about to come to pass, for Mr. McWilliams had started legal action to restrain 9CA from transmitting and busting up his concerts.

It is a beautiful case from the amateur viewpoint. Bergman of course has a licensed station and his wave has been checked by the inspector and OK'd. It is true he has a spark, but sparks are legal and he cannot afford just yet to change to C.W. However, knowing that he must cause some interference to some of the broadcast listeners in his home town, particularly those with single-circuit tuners, and being a good A.R.R.L. man, he applied the doctrine of co-operation that we have outlined in *QST*, voluntarily kept his transmitter silent in the early evening hours, as District Superintendent saw to it that every other station in his vicinity did the same thing, published an announcement in his home paper over his signature as Superintendent to the effect that local amateurs would preserve a voluntary QRX period until 10:30 P.M., and went to see Mr. McWilliams when he learned that the latter was complaining to the radio inspector about him. But did this satisfy Mr. McWilliams? It did not! Mr. McWilliams is a banker, a wealthy gentleman, probably used to having his own way about a great number of things, and in blissful ignorance of the useful work that amateurs do he seeks in effect to have 9CA's transmission branded as a "public nuisance," refuses co-operation and makes no bones about the fact that he objects to transmission after 10:30 as well as before, and asks the Court to restrain 9CA from transmitting at any time at which he is likely to want to listen. Can you beat it?

Even before the "Rochester Plan" was announced, quiet air had prevailed around Dwight all the early evening, but you understand that is not satisfactory—amateurs mustn't transmit at all. Bergman is only an eighteen-year-old lad, and even tho he is planning to make radio his life work isn't it obvious that he must not be allowed

to use his station when a banker might want to listen? This makes us pretty wrathful. We know Bergman; he has a good spark station which he made himself; he's a fine, clean, studious lad, typical of all that is good in A.R.R.L. members; he has played the game more than squarely, gone out of his way to try to help, willingly QRX'd half the night. But Mr. McWilliams seeks to prevent him from using the ether at all, in order that he, McWilliams, may have the air all the time! It seems to us Mr. McWilliams has taken on a rather large contract. It is a rule in equity proceedings that he who seeks equity must first himself do equity. Has he done this? The trouble is that Mr. McWilliams is entirely ignorant of the truth of the matter concerning amateurs and their status.

But, fellows, it means something to belong to the A.R.R.L. The League is squarely behind Bergman in this matter, not particularly anxious to make a knock-down-drag-out affair of it with a disruption of the entire radio situation in these United States, but fully prepared to do so and see the thing thru to a show-down if that is Mr. McWilliams's desire.

"And right will rule the earth!"

The White Bill

WHILE we're talking about laws, there's the matter of this White Bill, HR-11964, now before the House Committee on Merchant Marine & Fisheries, and its companion bill laying in the Senate's Interstate Commerce Committee. This bill, it will be remembered, is based on the exhaustive study of the radio problem made by Secretary Hoover's Radio Telephony Conference of last spring, and is the project which would do away with rigid classifications of stations and specification of their technical requirements and in their stead substitute an administrative scheme which would delegate authority to the Department of Commerce to make and enforce the regulations and to change them as progress in the art demanded, with the advice of a Technical Commission.

The present radio law of 1912 is a wholly satisfactory thing from the amateur standpoint. It specifies amateurs as one of the classes of stations, defines their rights, and covers their needs as well as it ever did. It is lamentably defective from every other viewpoint but the amateurs', however, and it is a foregone conclusion that it will have to be changed soon. The broadcast situation is chaotic to say the least, and the features respecting commercial and military stations need patching badly, none of which can be done until a new law is substituted for the present one. The White Bill represents the best effort that has been brought forth

to change things. Of course it is not a perfect document; it contains some ambiguous language and a double negative or two, it lacks some safeguarding features very desirable from the amateur point of view, it would give to all "government" stations the privileges intended only for military stations entitled to them for national safety, and practically every civilian radio interest is concerned about the provision which would authorize the President, rather than the Secretary of Commerce, to assign the wave lengths of government stations, with consequent danger of demoralizing all the work that Commerce might do. These things, however, are matters of words, things that can be remedied in a few minutes time.

Now this radio situation needs some strong medicine right now. If we accept it as inevitable that the 1912 radio law is going to be changed speedily, there are two reasons why we amateurs should boost the passage of the White Bill if amended in the particulars mentioned. The first is simply that there probably never will be a bill proposed more fair to the amateur. The second reason is that it is to the interests of us amateurs to have the broadcast mess unscrambled, for if this service can be put on diversified wave lengths instead of confined to the regions around 360 and 400 meters, it will be impossible for all the concerts to be jammed at once and the lot of an amateur transmitter in a community thick with novice listeners will be a happier one. Our Board of Direction expended lots of thought on this question at their last meeting and came to the conclusion that, subject to the exceptions they have taken to the bill and which are being conveyed to Washington by our Legislative Committee, the League ought to back it and make use of its great power for good by helping to create better radio conditions in our country.

And so, with the modifications which our representatives are putting before the authorities at Washington, we're for the bill, and for the betterment of radio in general we want to lend our weight to the general plan suggested by Mr. White. Members are urged to use what influence they may have with their Senators and Congressman to secure the passage of the bill when modified as outlined.

ANTENNA RESISTANCE MEASUREMENT

(Concluded from page 38)

main constant when the wave length is changed—the important point is that the coupling to the antenna circuit should not be close enough to let the dummy current change when the aerial resistance is varied on any given wave length adjustment.

The known resistance is inserted in the

ground lead and arranged to be shorted by a switch. For each wave length the driver is tuned to secure maximum current in the antenna but the coupling to the antenna and the power supplied to the driver must not be changed during the entire series of measurements. The coupling should be set at such a value that an antenna current of not over 50 milliamperes is produced when the resistance switch is closed. A hot-wire or thermocouple milliammeter with a scale of about 100 mils will accordingly be required in the antenna circuit. When resonance is secured and time allowed for the reading of the milliammeter to come to full value, this reading is noted and recorded as I_1 . The resistance-shortening switch is then opened and the reading of the milliammeter again noted and recorded as I_2 . The antenna resistance, R_a , at this particular wave length, is then given by the formula.

$$R_a = \frac{I_1 \times R}{I_2 - I_1}$$

where R_a is the value of the known resistance in ohms.

Readings should be taken 10 meters apart, from the fundamental to about three times this wave. It is best to make several sets of readings for checking purposes, as it is easy to make errors. A curve can then be plotted as curve 4 in Fig. 1. Humps in the curve indicate the presence of circuits in the neighborhood (such as guys, metal building frames, lighting wires, other antennas, etc.) that are in resonance at the wave length where the hump occurs. If the low point of the curve is excessively high, it probably denotes a high-resistance ground connection. Finally, if the curve to the right of the low point slopes upward very sharply, it denotes excessive dielectric absorption, probably due to the proximity of trees and houses, etc., and the antenna should be moved further away from these objects if possible.

With a resistance curve of the antenna one can tell not only how many watts are being put into the antenna but also just how good a radiator the antenna is, especially on the wave on which it is desired to operate.

BUREAU OF STANDARDS CALLS RADIO STANDARDIZATION MEETING

(Concluded from page 10)

paratus or service should be included, and (3) What procedure shall be recommended for carrying out the conclusions reached by the conference? If the conference decides that radio standards should be formulated, it is expected that they will ultimately be adopted by the American Engineering Standards Committee as an American standard.

The Operating Department

F. H. SCHNELL, Traffic Manager
1045 Main St., Hartford, Conn.



50,929 messages! That is our big talking point for this month. That figure represents the combined effort of every A.R.R.L. Official Relay Station to reach the figure we knew was possible, and which we foresaw several months ago when our organization assumed such proportions, that nothing could stop our rush to this big unheard of record breaking figure.

* H. A. Beale, Jr., (3ZO) *
* Parkesburg, Pa. *
* Atlantic Division *
* 928 messages. *

Many long-standing records have been pushed far into the background this month.

Message Traffic Report By Divisions NOVEMBER

Division	Stns.	C.W. Mgs.	M.P.S.	Stns.	SPARK Mgs.	M.P.S.	Stns.	TOTAL Mgs.	M.P.S.
Atlantic	95	7101	75	40	2230	56	135	9331	69
Central	111	7899	71	44	2248	51	155	10147	65
Dakota	29	2027	70	13	222	17	42	2249	53
Delta	16	705	44	3	248	83	19	953	50
East Gulf	30	1970	66	9	653	72	39	2623	60
Hawaiian	2	133	67	—	—	—	2	133	67
Midwest	69	5034	73	21	1481	70	90	6515	72
New England	49	4998	102	16	886	55	65	5884	91
Northwestern	26	1400	54	12	282	24	38	1682	44
Ontario	23	694	30	4	147	37	27	841	31
Pacific	38	1585	42	24	705	29	62	2290	37
Roanoke	45	2829	63	4	399	100	49	3228	66
Rocky Mountain	17	1633	96	1	27	27	18	1660	92
Vancouver	3	32	11	1	36	36	4	68	17
West Gulf	37	2708	73	20	388	19	57	3096	54
Winnipeg	3	225	75	1	4	4	4	229	57
Total,	593	40973	69	213	9956	47	806	50929	63
C.W. Messages,	40,973—88%								
Spark Messages,	9,956—12%								
Total,	50,929								

Every American and Canadian amateur of this Operating Department has done his bit to put our message traffic over the top by reporting his work. Men, this shows what can be done when we set out to do a thing.

After everything is boiled down, our entire success is due to the well-worn expression "co-operation." Without it we may well have an organization of several thousand men who would not produce the same results that are obtained with about eight hundred men and splendid co-operation.

Up to this time, January of 1922 was our best traffic month, when we handled 29,964 messages. In the same month 5ZAB handled 664 messages which has stood until now, when 3ZO with 928 messages, and 1AW with 743 messages knocked that record into a cocked hat. To 3ZO we tip our lid! The operator who signs "J" was on the air every night moving messages in big chunks and he has carved his sine at the top of the honor roll where it shall remain until some other good amateur surpasses this excellent exhibition of operating.

Were we to have a batting record as is kept in the baseball leagues, we would have some hitters if they could hit as high in the percentage columns as they do in handling messages. Ty Cobb, Babe Ruth, George Sisler, and Rogers Hornsby would have to go some to reach a few records which follow:

300 Hitters or Better in the Brass Pounders League			
Call	Mega.	Call	Mega.
3ZO	928	9AOG	376
1AW	743	8VY	374
*2OM	562	1XM	367
9ZAF	536	2AJE	366
*1CNI	432	*8BDA	361
1CMK	425	8AIM	338
1BKQ	406	5XAD	329
9AWM	506	5TC	318
9OX	403	5IX	314
9AON	400	9BED	312
8AQ	388	9BMN	308
		9DQU	308

(*) indicates spark stations.

Tremendous strides in traffic handling are shown in the Midwest, New England, and Ontario Division. Indications are that these divisions are not yet satisfied with their traffic totals and threaten to show increases next month. If that be true in these particular divisions, the others certainly will not stand idle long enough to be out-distanced in traffic handling, but until we catch our breath we hesitate to predict what the coming months have in store for us.

TRAFFIC REPORTS FROM A.R.R.L. OFFICIAL RELAY STATIONS

ATLANTIC DIVISION—C.W.: 2BBB, 96; 2AJA, 85; 2AJF, 180; 2ANZ, 5; 2RZ, 20; 2BOI, 27; 2AOS, 47; 2UE, 50; 2BWW, 5; 2BVD, 24; 2ALY, 156; 2AHO, 25; 2AFA, 81; 2CQZ, 116; 3JL, 29; 8CG, 74; 2BNZ, 15; 2CQZ, 117; 2AFP, 54; 2CKL, 48; 2TT, 5; 2ADV, 10; 2AUY, 87; 2BNL, 31; 2AQL, 7; 2CPO, 14; 2KP, 21; 2BRO, 7; 2AEO, 33; 2NZ, 215; 2TS, 61; 2BQU, 50; 2AGC, 10; 2IG, 20; 2CJJ, 1; 2AEQ, 57; 2OF, 48; 2AER, 10; 2BJP, 33; 2AYV, 26; 2CMG, 64; 2CGK, 6; 2FC, 70; 2ARS, 30; 2BUY, 18; 2AWL, 134; 2BMS, 122; 2AZZ, 2; 2AFA, 31; 2WR, 18; 2IG, 20; 2CGS, 41; 2BFE, 11; 2LE, 5; 2GR, 31; 3XM, 164; 2CEC, 8; 2CIM, 9; 2FZ, 4; 2BNC, 12; 2AVE, 76; 2AEH, 34; 2HW, 20; 2ANM, 8; 2AWP, 21; 2BQD, 33; 2CKN, 26; 2AJW, 9; 2AWS, 79; 2BRC, 78; 2BLP, 32; 8BEO, 14; 8CNE, 44; 8AGR, 21; 8RC, 2; 8ALF, 25; 8CI, 73; 8ZE, 15; 8ZD, 76; 8BLT, 11; 8QC, 9; 8AIO, 22; 8OW, 17; 8AGO, 76; 8CFB, 5; 8CKM, 145; 8BJV, 56; 8BJX, 64; 8CEJ, 32; 8XE, 164; 8CON, 3; 8VH, 2; 8BLU, 25; 8ADQ, 25; 8ADP, 9; 3YO, 90; 8BNU, 213; 3AAY, 143; 3GK, 4; 3BJY, 11; 3FS, 85; 3SM, 210; 3HX, 8; 3ZO, 928; 3KD, 17; 3MB, 68; 3LP, 26; 3BIT, 274; 3AAO, 33; 3CCU, 70; 3ANJ, 71; 3OE, 156; 3QV, 32; 3RB, 102; 3VW, 18; 3AJA, 4; 3BHM, 145; 3JJ, 82; 3IL, 25; 3ZW, 24; 3PZ, 24; 3OD, 8; 3SU, 51; 3AJH, 26; 3AC, 44; 3APT, 31; 3AJD, 31; 3WF, 28; 3HG, 94; 3AVD, 62. Spark: 2EX,

6; 2BQZ, 31; 2AJA, 2; 2CJX, 89; 2OM, 562; 2SQ, 102; 2BOI, 6; 2KK, 47; 3CS, 9; 2AXH, 25; 2AER, 6; 2QC, 12; 2AWZ, 12; 2CDR, 142; 2AAF, 91; 3FP, 78; 2AJE, 366; 2AEO, 23; 2DI, 34; 2CEV, 69; 2ND, 8; 2CT, 56; 2IF, 13; 2PY, 30; 2BY, 67; 8VW, 43; 3ZS, 7; 3QN, 38; 3UD, 55; 3GT, 54; 3GM, 8; 3TA, 4; 8HY, 4; 8EV, 8; 8ZD, 55; 8CEJ, 30; 8AGY, 5; 8VH, 15; 8ARO, 14; 8UC, 8.

CENTRAL DIVISION—C.W.: 9ZN, 252; 9OX, 403; 8QK, 383; 8VY, 374; 9DQU, 308; 8AIM, 338; 8FT, 287; 9APA, 268; 9IL, 248; 8IJ, 293; 9BRK, 190; 9CA, 187; 8ZY, 174; 9LQ, 163; 8CGX, 158; 9DDY, 144; 9CBA, 142; 9EL, 142; 8CAZ, 135; 8ZZ, 134; 8ZAG, 127; 8IB, 125; 9UU, 121; 9DCR, 120; 8BXH, 110; 8ANB, 103; 9BHD, 90; 8BNE, 86; 8CMI, 87; 8BCY, 80; 8BIZ, 75; 8BVR, 67; 8ALC, 75; 9AJH, 75; 9DBV, 63; 8AZD, 61; 8BTL, 61; 8CF, 63; 9ALW, 60; 9AFK, 16; 9BJT, 57; 9DYN, 56; 8BWK, 56; 8CFX, 53; 8ZF, 49; 8ZAF, 50; 9PQ, 50; 9CP, 50; 9BCT, 45; 8REN, 45; 9AAP, 37; 9BLU, 3; 9DJO, 3; 8ACO, 2; 8CZZ, 1; 9BDA, 1; 8OGM, 43; 8BCL, 41; 8BHO, 41; 9ASE, 40; 8AER, 40; 8CAK, 39; 8BUC, 37; 9ALR, 6; 9YB, 36; 8WV, 35; 9AMQ, 32; 9DVW, 29; 8BEK, 27; 9ACE, 26; 8TK, 30; 8AND, 26; 8CBX, 26; 8TK, 23; 9BRO, 23; 9BDZ, 24; 9AHQ, 22; 8CWF, 22; 9CTE, 22; 9DGQ, 20; 9DCT, 20; 9VK, 17; 9DLR, 17; 8BZQ, 17; 8ATX, 17; 9EJ, 16; 8BYT, 16; 9BIL, 15; 9BYX, 15; 8CWC, 15; 8TT, 14; 8CXK, 14; 8BFB, 13; 8AZF, 14; 8AN, 14; 9DFE, 12; 9CLZ, 11; 9AKD, 10; 8BWS, 10; 9DWM, 7; 9ALP, 7; 8AWX, 7; 8HW, 7; 9BCH, 6; 9BLC, 6; 9YJ, 6; 9NQ, 5; 9BXD, 5; 9BHX, 5; 8BEP, 5; 8BYF, 4. Spark: 8TJ, 266; 8BEP, 195; 8ZY, 191; 9AAW, 161; 8AWU, 122; 8AIZ, 115; 8UC, 112; 9WX, 103; 9DHZ, 86; 9AMK, 75; 8BAH, 63; 9CP, 59; 9ASK, 32; 8CKV, 58; 9AZF, 52; 9AFN, 43; 9DXE, 38; 8CVD, 38; 9AZA, 31; 9ASJ, 31; 9DEL, 14; 9DHG, 19; 9NC, 23; 9NQ, 18; 8CMI, 15; 9AMQ, 15; 8BEJ, 14; 9DAY, 12; 8BBU, 10; 9DLN, 9; 8BEK, 8; 9VV, 7; 9BLU, 6; 9AKU, 6; 8AZF, 37; 8FI, 4; 8BR, 4; 8IS, 2; 8ZF, 1; 8BYN, 2; 9CD, 10; 9BBL, 15; 9CIZ, 28; 9DXT, 2.

DELTA DIVISION—C.W.: 5ZAZ, 65; 5JB, 82; 5HB, 85; 5ER, 50; 5FV, 35; 5AAB, 5; 5EK, 70; 5NV, 61; 5MO, 11; 5DO, 58; 5WO, 16; 5RE, 16; 5XK, 75; 6HL, 23; 6MB, 20; 6DA, 33. Spark: 5XAC, 164; 5JF, 78; 5BW, 6.

EAST GULF DIVISION—C.W.: 4LA, 15; 4FQ, 25; 4JK, 32; 4EG, 66; 4FB, 145; 4AS, 25; 4BB, 5; 4BK, 10; 4HW, 30; 4YA, 125; 4EH, 56; 4CG, 191; 4EL, 137; 4BY, 78; 4GE, 34; 4EB, 448; 4XK, 50; 4JY, 42; 4NU, 35; 4HZ, 26; 4IZ, 21; 4JZ, 77; 4OB, 7; 4KO, 4; 5XAE, 54; 5XA, 159; 5ZAS, 56; 5BQ, 44; 5ES, 18; 4CY, 45. Spark: 4FD, 65; 4GN, 62; 4MY, 72; 4HX, 30; 4BI, 55; 4MZ, 10; 5XA, 107; 5GT, 15; 4HS, 237.

HAWAIIAN DIVISION—C.W.: 6TQ, 47; 6ZAC, 86.

MIDWEST DIVISION—C.W.: AD7, 67; 9DSM, 41; 9CMK, 6; 9ATC, 24; 9BXT, 80; 9BWE, 18; 9CJJ, 63; 9DPF, 50; 9YU, 234; 9AFD, 76; 9AYS, 79; 9CIN, 5; 9CFI, 30; 9CCV, 115; 9BHN, 110; 9DTA, 112; 9AOG, 376; 9CKM, 94; 9DUN, 78; 9BZ, 15; 9DSD, 119; 9ABV, 147; 9PS, 32; 9CWC, 9; 9DKY, 171; 9AHH, 120; 9ARZ, 117; 9AMI, 114; 9HRS, 108; 9DSL, 73; 9AOU, 68; 9FK, 62; 9BZI, 56; 9BGH, 50; 9BIK, 54; 9APG, 33; 9BCF, 27; 9CXP, 25; 9CHN, 11; 9BDR, 9; 9DJM, 6; 9BZE, 5; 9AXA, 5; 9BFG, 2; 9DYI, 2; 9DSL, 80; 9HK, 9; 9BLG, 119; 9CEE, 22; 9DXN, 48; 9NU, 5; 9CTR, 26; 9DFQ, 8; 9CGK, 20; 9BED, 312; 9BIE, 114; 9DZY, 42; 9FM, 100; 9AQR, 91; 9HJC, 2; 9BJB, 8; 9EX, 57; 9SJ, 70; 9ANO, 16; 9CTG, 9; 9BDS, 150; 9AON, 400; 9YM, 78. Spark: 9ALK, 19; 9DNC, 249; 9DRA, 80; 9BAL, 36; 9AFW, 48; 9BXZ, 9; 9ARG, 12; 9DMJ, 30; 9EAF, 9; 9DXV, 24; 9CUF, 6; 9DCW, 30; 9ACB, 8; 9RR, 96; 9AHZ, 54; 9AYL, 150; 9BKK, 21; 9BMN, 308; 9YM, 64; 9HO, 93; 9AOJ, 135.

NEW ENGLAND DIVISION—C.W.: 1YK, 49; 1AZD, 33; 1CBJ, 47; 1ADN, 55; 1LL, 30; 1BVH, 71; 1BNP, 27; 1AZW, 32; 1CBP, 43; 1AWO, 10; 1CSW, 3; 1ABC, 3; 1IH, 191; 1GV, 145; 1BQD, 56; 1ZE, 278; 1VK, 2; 1BDU, 22; 1CJD, 36; 1CPN, 33; 1BKQ, 406; 1BYN, 135; 1BEA, 43; 1AW, 743; 1CK, 24; 1XM, 367; 1CM, 3; 1XK, 72; 1COT, 35; 1CMK, 425; 1AWW, 15; 1BDI, 36; 1CDO, 94;

1ACO, 16; 1KX, 10; 1BNL, 55; 1BAS, 125; 1BRQ, 139; 1ARY, 23; 1AGH, 65; 1AYQ, 76; 1IV, 11; 1QO, 6; 1BOQ, 58; 1AJU, 76; 1AYU, 417; 1CR, 57; 1QP, 211; 1BHW, 44. Spark: 1BVB, 104; 1AHT, 9; 1CJN, 2; 1SD, 45; 1CK, 86; 1CM, 7; 1CNI, 432; 1RX, 25; 1LZ, 3; 1CIB, 30; 1BJS, 18; 1ACO, 24; 1AFT, 24; 1FM, 76; 1BRQ, 3; 1ARY, 8.

NORTHWESTERN DIVISION—C.W.: 7OT, 182; 7BK, 181; 7BJ, 123; 7TQ, 119; 7WM, 102; 7MF, 92; 7TH, 67; 7JW, 57; 7BB, 55; 7DP, 52; 7ZU, 50; 7HM, 44; 7LR, 42; 7AEM, 36; 7QE, 31; 7TS, 31; 7OE, 28; 7JG, 20; 7EX, 20; 7UU, 16; 7QT, 14; 7OO, 12; 7FD, 11; 7JF, 9; 7AGF, 5; 7NG, 1. Spark: 7GE, 129; 7AW, 83; 7ZU, 25; 7BG, 21; 7EX, 15; 7TW, 14; 7MU, 18; 7AGI, 12; 7AFN, 8; 7AIC, 6; 7ZK, 4; 7NC, 2.

PACIFIC DIVISION—C.W.: 6ZH, 203; 6EC, 48; 6AVR, 19; 6AUB, 11; 6BJY, 71; 6AVX, 11; 6BBC, 6; 6XAS, 16; 6GD, 6; 6BPZ, 28; 6JD, 45; 6KA, 37; 6CU, 57; 6FT, 18; 6ALU, 20; 6BRD, 8; 6RR, 24; 6EB, 41; 6BJC, 7; 6BKO, 18; 6PI, 25; 6BUN, 22; 6BDW, 15; 6EN, 32; 6APW, 38; 6BKB, 20; 6ZN, 10; 6AOR, 78; 6TI, 44; 6ASJ, 54; 6ABX, 58; 6ZX, 85; 6AK, 94; 6GR, 60; 6GX, 22; 6FH, 106; 6CC, 103; 6TC, 25. Spark: 6AGK, 35; 6AVR, 26; 6AOW, 21; 6BJU, 6; 6OD, 40; 6ALD, 30; 6AMN, 22; 6BAE, 13; 6KE, 30; 6WI, 23; 6PL, 7; 6ADG, 6; 6AWM, 6; 6OL, 25; 6ABU, 20; 6ALV, 18; 6ABK, 6; 6EX, 73; 6AQU, 104; 6AOA, 106; 6HP, 15; 6ANM, 22; 6GR, 21; 6FH, 30.

ROCKY MOUNTAIN DIVISION—C.W.: 9ZAF, 536; 9DTM, 211; 9AMB, 172; 9XAQ, 144; 9DTE, 85; 9BXQ, 54; 9BXA, 45; 9BUN, 35; 9BVO, 21; 9CCJ, 13; 9AFW, 33; 9ZV, 5; 9LU, 143; 9ZO, 61; 9ATQ, 50; 9ZM, 20; 9SJ, 5. Spark: 6BKE, 27.

VANCOUVER DIVISION—C.W.: 5CN, 7; 5CT, 14; 4DQ, 11. Spark: 5DX, 36.

WEST GULF DIVISION—C.W.: 5ZA, 273; 5IS, 43; 5GN, 4; 5ZH, 55; 5EL, 7; 5LB, 19; 5TC, 318; 5SF, 184; 5DI, 110; 5QI, 45; 5SK, 35; 5PK, 30; 5IX, 314; 5QS, 145; 5IR, 68; 5XB, 36; 5XV, 194; 5NK, 140; 5ZX, 7; 5BA, 10; 5FA, 10; 5XAD, 329; 5JM, 47; 5FO, 21; 5KP, 110; 5TM, 8; 5ZAD, 3; 5ZACA, 4; 5ZAR, 4; 5FT, 4; 5VM, 5; 5TT, 35; 5TO, 6; 5LB, 16; 5ZM, 24; 5ZG, 5; 5ZAV, 20. Spark: 5ACQ, 20; 5IS, 12; 5AL, 3; 5ZH, 22; 5TU, 127; 5QS, 37; 5IR, 44; 5UG, 10; 5RP, 10; 5FI, 5; 5QT, 2; 5XB, 6; 5YK, 18; 5ADI, 10; 5ZAE, 15; 5HC, 4; 5AEW, 6; 5AEY, 8; 5ADB, 4; 5AQ, 25.

WINNIPEG DIVISION—C.W.: 4BV, 148; 4HH, 70; 4BR, 7. Spark: 4CE, 4.

ONTARIO DIVISION—C.W.: 9BS, 39; 3XN, 2; 9BJ, 26; 3SX, 10; 3CO, 17; 3KP, 31; 3GK, 12; 3FC, 16; 3JK, 21; 3TA, 5; 3DE, 22; 9AW, 1; 9AL, 95; 3JH, 9; 3GE, 19; 3JT, 80; 9BS, 8; 3KO, 28; 3XN, 74; 3TB, 4; 3BV, 116; 3DH, 106; 3FA, 3. Spark: 3GN, 121; 9BS, 16; 3VW, 6; 3RV, 5.

ROANOKE DIVISION—C.W.: 4KC, 148; 4FT, 154; 4BX, 122; 4NT, 117; 4LJ, 122; 4GH, 86; 4EA, 64; 4DC, 37; 4GW, 14; 4DQ, 15; 4GX, 6; 4OI, 24; 4KT, 4; 4JE, 2; 3MK, 284; 3BLF, 258; 3Z, 186; 3APR, 140; 3IW, 105; 3CA, 101; 3BZ, 96; 3BVC, 65; 3AAG, 57; 3BHL, 52; 3BOF, 46; 3TJ, 36; 3AUU, 28; 3ASP, 27; 3BNE, 25; 3RF, 20; 3BMN, 15; 3ATZ, 12; 3AEV, 7; 3BIY, 5; 3AFW, 4; 3BFE, 1; 3SK, 1; 3SP, 37; 3AFD, 32; 3AUE, 74; 3BPU, 32; 3CHO, 21; 3AMD, 3; 3BKE, 38; 3CAY, 11. Spark: 3BDA, 361; 3IC, 9; 3ACK, 20; 3AOV, 9.

DAKOTA DIVISION—C.W.: 9AVZ, 91; 9YW, 68; 9PI, 54; 9BRI, 30; 9ASF, 11; 9GK, 74; 9BFQ, 3; 9GW, 3; 9EA, 2; 9AOR, 20; 9BAV, 12; 9BAF, 20; 9ABB, 8; 9BKP, 137; 9AWM, 506; 9AUA, 37; 9APW, 223; 9DGE, 20; 9AJP, 201; 9CCV, 15; 9AWS, 28; 9BJV, 51; 9AUL, 25; 9GD, 1; 9CRW, 5; 9DR, 128; 9BBF, 50; 9BKJ, 49; 9YAJ, 160. Spark: 9DKQ, 32; 9CGA, 19; 9FX, 19; 9AAU, 12; 9DLF, 2; 9XT, 24; 9FH, 5; 9EAU, 1; 9ZC, 15; 9DOT, 3; 9DGW, 34; 9DAG, 41; 9ATV, 15.

ALASKAN DIVISION

R. A. Anderson, Mgr.

Nothing has been heard from any of the Alaskan members. Several amateurs in the

states have written regarding work in this division. From information contained in letters received from the amateurs in Prince Rupert, it appears that they will soon have at least one or two stations which should be capable of reaching Ketchikan, at least.

7IP, formerly of Craig, Alaskan Division, is now at Neah Harbor, Northwestern Division. In a letter received from him recently it appears that he is now doing just the kind of work that we would like to have seen done in the Alaskan Division.

KETCHIKAN: The school plans on constructing a receiver some time in the near future, and it is probable that by next winter this will branch into a five or ten watt C.W. set which surely should be capable of carrying telegraph over the eighty miles which separates Ketchikan and Rupert.

Thanks for your support and encouragement, DX men.

ATLANTIC DIVISION

C. H. Stewart, Mgr.

We regretfully announce that Mr. Stewart suffered the loss of his mother, and then because of the illness of his wife, he has not been able to give much time to the Atlantic Division affairs in the past month.

State reports are missing from New York and New Jersey. However, information reaches us that Runyon, 2ZS, is back on the air, as is 2GR. We welcome them with open arms. The fact that state reports are missing should not cause any alarm as this entire section is running like clock-work on high.

WESTERN PENNSYLVANIA: About the only report received, was from district No. 9. 8ALF who is attending U. of P. operates week-ends. 8CEJ, who recently installed C.W., has been reported on the Pacific coast. 8OW is "MIM" in every district. 8AGO and 8BJV continue to reach out very well. The U. of P. station 8ZE is in operation from midnight to daylight every morning. 8SE is installing a 100 watt C.W. set. 8ZD also has been heard in every district.

EASTERN PENNSYLVANIA: Eastern Penna. piles up a big total of message traffic with the honors to 3ZO who handled 928 messages, thereby breaking all previous records for an individual station during one operating month. 3LP, 3MB, 3BJ, 3AHF, 3BIT, 3AAY, and 3BNU are stations which can be heard nightly; in addition to Philadelphia stations 3OE, 3FS, 3QV, 3ANJ, 3GK, 3KD, 3HX, 3SM, 3BJY, and 3UD. These stations are the ones that move traffic.

DISTRICT OF COLUMBIA: Traffic has taken a considerable jump and several new stations are in operation. 3SU, 3AJH,

SARO, 3BHM, 3LR, 3ZW, and 3BSB are the leading traffic handlers in D. C.

MARYLAND: The majority of traffic in this state is handled by 3AC, 3APT, 3WF, 3AJD, 3AC, 3JJ, 3AFB, 3SF and 3UC.

CENTRAL DIVISION
R. H. G. Mathews, Mgr.

For the first time in many months a complete report of every state of the division is presented herewith.

All the assistant division managers are co-operating splendidly with the division manager and if they receive the same co-operation from the district superintendents, and they in turn from city managers and official relay stations, our division report will keep on becoming more complete.

KENTUCKY: Three consistent daylight routes have been established. 9EI, 9AOT, 9OX, and 9YC are doing most of the extreme distance work. More reports from the district superintendents of Kentucky will be welcomed.

WISCONSIN: Dist. 1: Nothing definite in the way of a report with the exception that things are beginning to open up in and around Milwaukee and that reports may be expected in the future. Dist. 2: Mr. Maas reports that it is impossible for him to locate in his district very many stations that are able to handle traffic to any extent. Stations in this district please take note and communicate with Mr. Maas. 9CHE will have a ten watt C.W. set on the air. 9CHK has a half K.W. spark but does not seem to get out. 9CPT has a ten watt C.W. set but is hampered by a power leak and cannot work after 6:00 P.M. Dist. 3: Traffic is improving daily. A great deal of help to the men of the established relay routes is given by new spark & C.W. stations. 9ZL is on the air again with I.C.W. 9AMQ is reaching out and is quite consistently on the job. Several old stations have taken new life and it looks as though the old Lake Shore route which runs up Lake Michigan is on the job again. The beautiful part of this route is that the stations have never forgotten the example set by ex 9ZL. Dist. 4: This district is being rounded into shape gradually. There are three good stations in La Crosse now, 9AZN with 15-watts C.W., 9AKY with 10-watts, and 9ZY, the station of the Wisconsin Manager, with two new transmitters just completed. One is 500-watt C.W. and the other a 15 watt. Dist. 5: Mr. Krusel has been making a trip in the surrounding territory for the purpose of finding some new relay stations in his district and reports some satisfactory results. Old 9YAC of Superior seems to be off the relay list at present. This is the Superior Normal School and since Mr. Krusel's departure the interest seems

to be lacking. 9PN is certainly on the job with three fifty watters is open for traffic every night, and has worked 27 states to date.

NORTHERN INDIANA: Dist. 1: A few of the stations now in operation are 9DAX, 9II, 9QR, 9DFB, 9PC, 9DEB, 9AJH, 9ME. Despite this number, the message total is rather small. Come on you Fort Wayne stations. 9AKD has been on the job only two nights. (Smatter AKD? —A.D.M.) Dist. 2: 9BLC, who is now in the hospital at Indianapolis, will be back on the job soon. 9CP has been heard in California about ten times in the past two months and has been reported QSA by 4OI. 9AIU is back on the job and has been heard in Nevada on fifteen watts. 9AWZ is again on the job. The Division Manager wishes to call attention to the unusual report received from 9II at Fort Wayne, Ind. A complete message report itemized by dates was forwarded by radio from 9II to the Division Manager at 9ZN, this message being relayed and delivered through 9AAV at Evanston, Ill. This is the first time that a complete report has ever been received by the Division Manager.

SOUTHERN INDIANA: J. E. Hall, Assistant Division Manager may be reached at 116 W. Tipton St., Seymore, Ind. His name and address are published herewith with the request that reports from stations in southern Indiana be sent to him in the future so that southern Indiana may be given real representation. Traffic in southern Indiana has been picking up greatly of late and excellent work has been done by 9BRK, 9LQ, 9BCT, 9DXE, 9ASJ, 9YJ and 9YB, also 9CBA. (But what 9LQ did to the text of my msg from 9AOG to Washington was awful. Sig "L.Q."—i. e. pre-war 9LQ). 9DCU is out of commission temporarily. (If I can get it by the Traffic Manager, this will include the complete Illinois report from N. C. Smith as the recent tremendous activity in Illinois (which has lifted it from the worst state in the Central Division to a runner-up as best) is solely due to the efforts of Smith and his District Superintendents. Please note the message total of 2030 for Illinois for November—D. M.)

ILLINOIS: Dist. 1: C. M. Schalkhauser reports that 9PQ with two 50 watt tubes is leading the roll this month. 9PQ is doing good work and has been reported FB by 6AFO and 6FY. 9AMK, spark, is still high man in Mendota. 9AHQ is the only other man to report. In Galesburg, 9NQ, the district superintendent, is trying out a new 100-watt C.W. Dist. 2: Rankin, 9BXD is doing fine work. The District Superintendent wants to know where that much touted sink gap is. Champaign; C. M. Weeks reports he handled

8 via C.W. 9DOG is on but gets no range out of his 5 watt tube. Champaign Urbana; Fine work is being done by all the stations, but 9DCR wins the cup. 9DHZ comes second on his rock crusher. 9DHZ has three operators and can be heard in the early hours of the morning. 9ASD has some QRM from school work and a nawsty storm brought down his antenna, so no messages. Dwight: The D. S. 9CA handled 187 messages on spark working as far as 1300 miles on 2 amps. in the antenna. Ole 9CCM, the wonder boy, on 5 watts is working every district but 6 and 7. He squeezes 2 amps. out of one 5 watt bottle and is getting every station he calls. (Congrats OM, more power to u—D. S.)

La Grange: 9AJH, is making preparations to put out real juice as he is increasing to 100 watts. Cabery: 9DDY the spark coil C.W. phenomenon is working 1000 miles with one bottle and a 4D spark coil. We will hear him next with dynamotor and 10 watts. Kempton: Martin Kempton of Kempton Bros. operator at 9DYN had to go to the hospital. Well he packed along a set to keep his hand in. He says "Gosh I couldn't have stood it except for the old set." 9DYN heard in 4OI (Porto Rico) Many congrats OM.—D.S.O. Danville: C. M. Fairhall reports he is having a hard time securing reports from stations under his jurisdiction. Roodhouse: 9MC is in the east on a pleasure trip. A good report was received from W. Fraley, assistant operator at 9MC. Quincy; No city manager, no report. Springfield: City Manager Schnepf failed to report this month. Dist. 4; Marshall: D. S. Nash reports that his station is now ready for business and he warns the rest of the districts to watch their laurels. O. M. Nash has every one on edge in his district and turns in 364 messages on his first report. He is a hard worker and when he promises he usually fulfills. (Let's hit the ball, D. S.'s. The more the merrier—A.D.M.) Decatur; 9DQU did not report to the A.D.M. Olney: 9DDZ at Olney, a newly appointed O.R.S. handled 24 C.W. Dist. 5: O. M. Hicks the D. S. hands in two cards form 9DLR and 9BDA. East St. Louis; No City Manager, no report. Dist. 6: Slogan, "Where we have real stations." 9BHD is still going strong with his 100 watts. He has DX report cards from the T.A.P. prelim tests that make one envious. One is from a ship 200 miles out of Los Angeles. 9BHD reports traffic moving nicely in Wisconsin via 9CHK and 9CWZ. Lena: 9CDB and 9CUO have installed 5 and 10 watts respectively, but no traffic was reported this month. Morrison: 9ALW reports going. He handled everything OK except west. 9FK and 9ATN are good but QRM is terrible. (A few more stations are needed up this way—D.S.) 9DHD reports his

burg DEAD. But here's one for the C.W. hams. 9DFX was reported almost every night in February 1922 in Berkeley, Calif. 9DFX uses a rock crusher. He is now erecting a T cage. 9DFX and 9DHD are up in the air with gap trouble, but are going to be on with the old TNT and perhaps a few bottles, no traffic. Freeport: As usual 9AKU is out with breakdowns. He worked 1100 miles on 1 amp. spark and handled 6 msga. 9AFN remodelled for fall and hands in a total of 43 via spark too. DeKalb; 9AMR has canned the spark and is on with a 10 watt whistle. 9AMR had a scrap with the B.C.L.'s who called him over to listen to amateurs. 9AMR listened and what did he hear? None else but NAJ working NUK! How can it wuz? Rockford: 9BQW going strong but no message report. 9DVW blew his bottle in the T. A. Prelim TESTS but is back on. 9DQR is putting in a whistle. 9DVW has been recommended as City Manager of Rockford. The recommendation has been forwarded for Matty to sign.

MICHIGAN: (Michigan bursts into the limelight with a total of 1500 which is the high water mark for this state. Keep up the good work—D.M.)

Please note that this is the heaviest month we have had despite the fact that we had ten nights of QRXing for the Preliminary Tests.

Detroit amateurs have voluntarily closed down their transmitters from 7:00 until 10:30 each night. Michigan Dist. is now in better shape than ever and things are rapidly developing to the point of being in the big League. 8AN was heard off the coast of California and worked New Orleans. 8CAZ worked 6XAD and 6KA on a five watter. 8ZZ was heard in Porto Rico and off the coast of California.

The Michigan A.R.R.L. Convention will be held in Flint in January. (Let's see the whole gang there—T.M.)

OHIO: All relaying is carried on by a few stations, which, however, are doing the job very well. 8QK on C.W. is heard clipping them off every morning and helps boost the League's traffic total. Apparently, the spark is on its last legs in this district. Only 8BEP and 8BVX retain the old rock crushers. Even at 8BEP a ten watt C.W. is stepping around the spark. The spark at 8BVX however, is doing very fine DX work now, being reported from as far as 7ZG QSA.

From Lima comes a letter from 8CCB, Mr. Van Gunten, which is very welcome, as Lima has been a dead town this season. There are now three C.W. sets in operation there, namely; 8CCB, 8ER and 8AA. Of these 8AA is doing the best work, working boiled-owled tricks and handling the traffic nicely. 8CCB, when he is on, is doing nice traffic work and 8ER will

be a good DX station as soon as the operator becomes a little more proficient. Mr. C. E. Nichols, Weadock Ave., Lima, has been given the City Manager appointment.

We want to chronicle an event which will cause the old spark hounds to lament. The old super-spark at 8ZY now reposes nicely under six feet of sod, while a little dynamite tube is setting the U.S. on fire. Fact, a single fifty watt tube, with an antenna current of 7 amperes is working the west coast every night. The nightly trick from eleven to six A.M. is worked by the two ops. The D.S. and the second op. Mr. W. K. Fischer of 8ANL of Cleveland, who signs WF. Dist. 3: Exceptionally warm weather and broadcasting has made quite an inroad upon the message work. The stations have not yet settled down to good consistent work. Through sickness, fixing up stations for the Trans-Atlantics, and putting up new stations, etc., the number of messages handled has fallen rather low this month. V. D. Getts, City Manager of Warren, having recently moved to his present location, found the city without a single radio station. He has erected his own station and is now doing relay work and has also lined up a couple of others who will put in C.W. sets. W. F. Warden, 8BWA, has been appointed Akron City Manager. Dist. 4: Under the able supervision of L. E. Furrow is going in fine shape. More stations are lined up for reports this month and all doing good work. The bulk of the traffic through Dayton seems to be handled by 8BFX. 8CGX and 8AJM, also 8BDO. 8UC and 8AIZ our old spark standbys are also doing excellent work. Dist. 5: This district has slowly been picking up. Superintendent M. F. McDowell has lined up some stations in Lancaster which are breaking into the relay game. They are 8AER, 8BHO and 8CWP. Messages for Newark must be routed via 8YM at Granville.

The Columbus stations are all doing good work. 8IB, 8BXH, 8BYN, and 8TJ all turning in excellent reports of messages handled. 8TJ is in the air again after moving his station to an open space south of Columbus, to get clear of interference. He erected two 80 foot masts and has housed his set in 14' x 18' building. Both spark and C.W. are used. Incidentally, the bulk of his 289 messages were handled by spark. 8IB and 8BXH are both working the sixth and seventh district stations direct. 8ARV is back in the air with the new call 8BYN. Dist. 6: This district is at present without a superintendent due to the resignation of R. D. McCommon. No one has as yet been appointed in his place. Stations in this district will please report direct to the A.D.M. until the appointment can be made. Only one report

received from this district, that of R. W. Sears, 8BKN. His aerial is undergoing changes which will put him in better shape for more work next month. 8CMI is doing good work both as Marion City Manager and in message work. Attendance at Ohio State University, prevents Mr. Whysall from operating 8CHI except during week ends. 8IJ also in district 2, managed to handle 203.

DAKOTA DIVISION

N. H. Jensen, Mgr.

Many of the relay stations in this division are not sending their reports of traffic handled to the District Superintendents promptly, and some stations make no report at all. Fellows, if you want your division to receive credit for all traffic handled, you *must* send a report to your District Superintendents *promptly* at the close of business on the 15th of each month. All of the Superintendents in this Division are working hard to increase traffic in their respective districts, and the least that station operators can do is to send their reports promptly. Write to your district superintendent for traffic cards and information about relay work.

MINNESOTA: Dist. 1: Traffic is being moved with fair regularity throughout the district. A new station, 9EAU, owned by Mr. Bruce at Chisholm is now in operation and is a big help in filling the long jump between Duluth-Superior stations and north to 9ZC. In Duluth a very satisfactory arrangement has been made between the amateurs and the two broadcasting stations, WJAP and WMAT. Both stations have agreed to shut down at 10 P.M., 9CO has installed a 15 watt C.W. Set and Mr. Lampe, formerly 8OP reports that he is going to put in a 50 watt set this winter to help move traffic and put Duluth on the map. The Superior stations failed to send in a report, although it is known that traffic has been handled there. 9XT has a fine station and reports that they have a sure range of 600 miles. They will maintain a watch from 2:30 A.M. to 6 A.M. on Tuesday, Thursday and Saturday nights, and from 9 to 10 P.M. on other nights. Glad to get a report from 9XT. 9BAV, reports traffic moving in good shape. He will soon have an early morning schedule with 9AUA. 9FH has been handling some traffic lately. He is handicapped however, in getting enough power for DX work. 9EA has sold his old C.W. set and will soon be on with a new and more powerful outfit. 9ZC has not been on for a while on account of a delay in getting his license renewed.

NORTH DAKOTA: Relay work is picking up in this district. 9GK is doing very good work with 100 watts and is reaching out to both coast. Four operators stand

watches at this station as follows: Wick on Sunday; Lucas on Tuesday, Reinicke on Thursday; and Hance on Saturday. It seems to be almost impossible to work Montana stations this year. 9AEJ, City Manager of Fargo, reports that another 50 watt station will be going in Fargo very soon.

SOUTH DAKOTA: Traffic is going through in good shape, but it seems next to impossible to work any 7's. QRM from eastern stations is very bad. 9PI works all over the country with a 250 watt tube. 9BRI is increasing his traffic handled, and has been reported on three coasts. 9YW is doing good work and reports that a motor-generator will be installed. 9ASF is getting a lot of juice into his aerial with 15 watts and is reaching out in good shape. 9DKQ is doing very good with one of the few sparks left around here, as also is 9CGA of Huron with a $\frac{1}{4}$ K.W. 9AVZ lost his 75 foot mast during a bad wind storm and some message were on his hook. The aerial was fastened to the barn 30 feet high and the amps jumped to $4\frac{1}{2}$. After getting electrocuted a number of times, got the rectifier to percolate and raised the antenna current to $5\frac{1}{2}$ amps. DX was less with the low aerial, although reported on Pacific Coast four times. No report received from 9YAK, 9CXV, a new station at Yankton owned by Wm. W. Eymer, is reaching out with 10 watts.

DELTA DIVISION
J. M. Clayton, Mgr.

All sections of the division continue to show a steady increase in activity. A good deal of active relaying is being accomplished in spite of the Trans-Atlantic Tests, etc.

ARKANSAS: 5ZL is off the air. Some brilliant joker, late Halloween night, playfully released the top set of guys on his seventy foot pipe mast. 5JF, while not on a regular schedule, is handling a lot of traffic like a hardboiled oldtimer. He is reaching out in excellent style and doesn't clutter up the air with a lot of useless hash. 5WK, C.W. is heard once in a while, as is 5WE, also C.W. 5CB is having trouble of some description, as he has been heard only once this month. 5XAC continues to handle a good amount of traffic. 5ZAZ, D.S. of district "B" has nothing to report. 5JB has been offered the job of D.S. for district "D" but has not replied yet.

LOUISIANA: New Orleans continues to be well represented, by 5HB, 5ZAP, 5UK, 5AA, 5RH and a few others. The most phenomenal work is being done by 5HB who works 7SC of Seattle, Washington with apparent ease, and also stations in every district of the United States. The Pullens at Houma continue to maintain an unbroken silence. They may have a

surprise to spring on us, but they're going to be a disappointed couple when they read this and learn that information reached us to the effect that Brother Joe is about to launch his matrimonial bark. Who's the happy girl Joseph?

MISSISSIPPI: 5YE is experiencing a little difficulty in getting his C.W. transmitter tuned properly.

TENNESSEE: Many new stations have come to life with a corresponding addition to the total of messages handled. 5IK has installed 50 watts. 5MO has discarded his good old spark for 100 watts C.W. 5EK is going strong with 100 watts C.W. and reaches the West coast frequently. 5DO and 5NV are busy stations these days and are to be commended on the way they put the stuff across. 5BW has gone back to the spark and 5RZ also. Wassamatter fellows? 5FV has added another bottle and now has 100 watt. 5ER and 5FV are going out to the west coast every night and are not slow in handling traffic. 5AAB has gone to C.W. 5EG has installed 50 watts C.W. and being an excellent operator, will be able to handle considerable traffic. Welcome EG. The bunch has taken exception to the last report and is beginning to show activity. 5XK, 5RE and 5WO are all going fine and will be able to handle traffic during the cool weather. 5UU will have his new 100 watt set in operation very soon. 5RE has been appointed City Manager to succeed 5WO. 5WO has left the city to attend college. 5WS has a new generator and soon will be with the gang using 20 watts C.W. to refute the statements regarding the stillness of the ether around Knoxville. Plans are now under way to establish daylight routes through eastern Tennessee to connect with Nashville, Tennessee, Louisville, Ky., Atlanta, Ga., and Savannah. 5HL is going fine with 10 watts and 5MB, the City Manager, is going strong with 100 watts. 5AAG is a new station and has just been completed. 5CU has left for school in Washington, D. C. 5DA has been spending a few spare moments with the old set and handled a small amount of traffic. The old set is reaching out very well and stations in New England and the west coast are worked consistently.

EAST GULF DIVISION
B. W. Benning, Mgr.

FLORIDA: It is very gratifying that the true Amateur spirit is gaining strength in Florida. Through the efforts of the A.R.R.L. members, many B.C.L.'s are being taught the proper spirit, and are becoming real boosters for AMATEUR RADIO.

Florida is again open to relay traffic, with relays at Jacksonville and points

south. The number of stations in operation, and the number of messages being handled, are steadily increasing. 4HZ is on regularly with his C.W. and is clearing traffic in all directions with ease. He is to be commended on his excellent work; although using but 5 watts, he works regularly over distances of 900 miles, and has worked 800 miles in daylight. Jacksonville is also represented by 4EZ, spark, just reopened. Central Florida is alive with good stations: 4JZ, 4JY, 4IZ, 4XK, and 4NU are all doing good work and handling messages on C.W. while 4DL, C.W., and 4BC, spark, complete the chain which is proving a speedy traffic route for the Peninsula. The Assistant Division Manager is pleased with the progress being made by his men, and is jubilant over the outlook for the future.

The following appointments have been made: R. C. Bender, 4DL, District Superintendent of District No. 4, vice 4DZ, resigned; Gifford Grange, 4HZ, City Manager of Jacksonville; and Thomas Litschauer, 4JI, City Manager of Orlando and Winterpark. These men are working diligently, and their efforts are getting results.

ALABAMA—Dist. 1: 5ZAS, 5BQ and 5CP are the leading traffic handling stations in this district.

Dist. 2: In addition to 5ES who is handling most of the traffic, 5ABT and 5NL do some little work.

Dist. 3: About the only station here is 5XAE who works rather consistently.

Dist. 4: 5XA, in addition to reaching out all over the United States, shows a decided increase in messages handled for the past month.

GEORGIA—4FD and 4AS continue to bat them out regularly. 4AK is on with 15 watts of C.W. 4BB also is doing some good DX work, as is 4BK who just came back on the job. 4DH has not completed his set as yet. 4GN has over-hauled and is reaching out from coast to coast.

SOUTH CAROLINA—The decreasing activity is due to the fact that many stations are being remodeled, while 4EG has kept the traffic moving. 4KI and 4JK are all set now, but 4FE has blown so many tubes it will take him months to recuperate from the financial shock. 4FQ and 4LA will be heard from now on with increased power. Traffic has opened up in all directions and 4EG has daylight schedules with 4EB, 4FJ, 4JK, 4LA and 4FQ. In the evening schedules are maintained with 8BDA and 4FS. About the only remaining spark stations are 4MY and 4BI. 4HX and 4HW moved some traffic but were not right up to their regular schedule.

HAWAIIAN DIVISION
C. J. Dow, Mgr.

6ZY, the new C.W. station of Radio Gunner, Thomas A. Marshall, of Honolulu, is just about ready for some excellent work to the mainland. A 250 watter is putting out about 10 amps, and should create quite a disturbance in the air. Mr. Marshall is an ardent A.R.R.L. member, and we hope our next traffic report will include a good number of his handling.

6ZAC still working with one 50 watter, and a recently constructed chemical rectifier, which has increased his efficiency a great deal. It will prove of comparative ease to maintain a schedule with 9AWM direct with the advent of a little better radio weather. 9AWM reports 6ZAC, QSA always.

MIDWEST DIVISION
G. S. Turner, Mgr.

MISSOURI: The "SHOW-ME" state, true to its name, is showing the other states the way.

O. S. McDaniels, 9YM and 9HO of Columbia, Mo., is route manager and has all official stations working overtime. McDaniels is reaching all points from his location in the center. He reports that cross state routes are in fine shape. He has 11 points connected up by good reliable routes and has Missouri ready to handle traffic at all hours of the day or night. He



is especially to be commended for the good daylight routes he has succeeded in lining up. 9YM works 9AON regularly at 11:30 A.M. 9HO works 9BNM and 9DNC in the early morning. 9BMN then works 9FM in Kansas City this completing the old reliable central Missouri route. Other routes outlined and made up with the cooperation of both district superintendents

are shown in the district superintendent's report below. 9DZY is always on the job and is certainly taking care of his neck of the woods. 9BED has even such cubs as 9BLG handling over 100 messages a month, not mentioning some of the other fellows who have dusted off their sets and are literally sitting on the key. 9CEE, 9BEI, 9DCW, 9DXN, 9NU, 9DMJ, 9C'E and others are swinging into line and working. Formerly 9PW and 9CGK were seldom heard. Now these same stations are working ones, twos and sixes.

The Western half of the state is ably taken care of by 9RR. Kansas City always known as a wide awake, thriving, business city, has been lagging in radio activity, especially League activity but since 9RR took hold of the reins, K.C. is rarin' to go. 9FM is the King C.W. operator of that city. 9ANO is having a time trying to adjust his differences with the light department. All others there are in the same fix. St. Joseph still uses arc lights, the original QRMer. In spite of this however, the boys are getting out in great style and relay traffic is improving. 9EX has been keeping the town in the radio field. He is on practically every night and does considerable daylight work. 9CTG is a newcomer in relay circles, although an old timer at the game. He is doing fine. Glad you're back again OM. The following operating schedule has been arranged: 9ANO in early A.M. 9EX at Noon, 9ANO and 9CTG in the P.M. and 9FA, 9DRW, 9ANO at night. 9AON is working consistently every hour in the 24. 9BDS is coming through in fine style as is 9DWK. 9ACB is on the job as often as his dad will stand for it. 9BMN is an ORS that between school and the broadcast listeners he is certainly doing fine. 9BMN is a real official relay station. 9AUK is perhaps not well known but surely will be soon. The old man is too busy with this A.R.R.L. stuff, the St. Louis Radio Assn. and lastly his profession to be on the job regularly and handle DX. 9LC was recently heard tuning up a C.W. and phone set. Let's hope Bill becomes serious and comes back to earth like he uster to in the GOOD OLDEN DAYS. (Atta Boy, Bill, let's see her perc—T.M.)

Relay routes: Route A as follows: 9YM-9BMN-9SJ-9RR, -9CKM-9BSA-9DTA-9AOG-9CFI-9CCS-9DUN and 9DXD. Route B as follows: 9YN-9EX-9BHN-9CKM-9ANQ-9FM and 9RR. Route C as follows: 9DAE-9BMN-9AVK-9AYL.

The only new appointment made for the past month was that of Boyd Laizure of Kansas City as District Superintendent of Western Missouri in place of Abercrombie. All you fellows of Western Mo. please write Laizure at 1117 Askew, K.C. Mo. and get

lined up on relay routes, etc.

Again station 9AON wins honorable mention in the Missouri report having handled the largest number of messages in the Division. Great work OM.

The A.D.M. believes that the above shows a material improvement of conditions in Missouri. The members of the A.R.R.L. in this state are certainly entitled to thanks for their ardent work and tireless efforts in putting Missouri on the map.

KANSAS: Traffic has been going strong this month with nearly twice the number of messages handled as last month. Several new stations have gotten into action, i. e. 9BZZ and 9CWC. 9DTA opened up with a C.W. set after being off the air since last spring. 9AEY made his 50 watter oscillate by building a new counterpoise. 9BSA has blasted the air a few times but he says he will have C.W. installed soon. The first annual convention of the Kansas Radio Relay League was held November 16-17 at Hutchinson. Approximately 75 members were present from all parts of the state. The program included talks by S. Kruse, C. A. Stanley and Wilber Cooper, Jr.

Considerable trouble has been experienced lately in getting QSR west. The Denver stations seem to have all died off this month and are heard only at rare intervals of ten days or so. What is the matter with your fellows over there? If you guys want some juicy bunches of traffic,—just call most any Kansas station.

New appointments this month: 9DTA Clifford Peters, Tonganoxie, Kansas-Official relay station.

Again the A.D.M. handled the most messages in Kansas and again wins honorable mention. (Good work OM—D.M.)

NEBRASKA: Never before has such co-operation been extended on the part of the different district officers. The following men have made possible this report: Porter H. Quimby, Omaha City Mgr., Sgt. Stenback, Fort Omaha, Neb. AD7, and Edwin R. Anderson, Nebraska route manager.

The route manager wishes to call particular attention to the station of AD7. This is the station of the E & R School at Fort Omaha, Neb. This station is under the supervision of Sgt. Stenback whom many of us will remember as 5YH in the old spark days. AD7 is working both coasts consistently. We wish to take this opportunity to thank Sgt. Stenback publicly for his interest in the A.R.R.L. and his co-operation in handling our traffic.

The district superintendent of northern Nebraska says that the bulk of the traffic handled in his territory goes by way of the Omaha stations. 9DSM, 9CKM, 9ASO and 9ATC are handling the bulk of the traffic. 9AIN has been in the hospital. 9BZK has made a few changes and his sigs

are stepping out in great style now.

The Route Manager wishes that all transmitters of any size or description out in western Nebraska would get in touch with him if interested in handling traffic for the A.R.R.L. Address all communications to E. R. Anderson, Route Manager, Nebr. 308 North 27th Ave., Omaha, Nebr.

Omaha is adhering strictly to the Rochester Plan with much success. The City Manager of Omaha has obtained permission to broadcast bulletins concerning the League's activities from one of the stations. It furnishes an excellent means of disseminating amateur propaganda to the general public and the broadcast fans. F.B. old man.

9DNC and 9YU are commended on the amount of traffic handled. 9DNC wins honorable mention in the Nebraska report, for handling the largest amount of traffic.

IOWA: 9ARZ is especially commended for his excellent report.

9BIK and 9CXP are keeping Waterloo open for traffic east. 9CXP is a new man in this state. He was formerly an operator at 9ZT. Both stations are using 100 watts C.W. 9APG, 9BDR, 9BCF, 9AXA, and 9DAH are keeping Ft. Dodge open. 9AHH has opened up with C.W. 9AOU is using 50 watts. 9CHN and 9BRS are doing good work. 9AFW is back with the gang again. 9AMI has increased his power to 100 watts and 9DKY to 50 watts. 9BXI is back stronger than ever with a new 50 watter. 9DJM also has 50 watts. 9BGH is going again. The best routes for daylight are as follows: 9BGH and 9AEQ can take traffic from Nebraska and can pass it on to 9AXU, 9DCF, 9AOU and 9AHH. These fellows work 9BZI, 9BIK or 9CXP who can QSR to 9FK or 9XAC. Another good route is 9BGH via 9ARZ. 9DKY or 9AMI to 9XAC, 9BIK or 9BHD. 9DSL is using ten watts and getting out in great style. 9MS has moved from Davenport. 9FK is doing some excellent work. 9HK is temporarily out of commission; likewise is 9DMH, who is installing a 200 watt set.

Traffic is moving very well throughout the state. The daylight routes as outlined, are working in fine style. Several of the operators have daylight jobs which throws the bulks of the daylight relaying on a few stations.

9AEQ is back on the job again and going strong. The following were appointed ORS: 9YA, 9ARZ, 9CS, 9BSG, 9BGH, 9AEQ and 9FK. 9ZAA surely rips in again.

9DKY handled the largest amount of traffic in Iowa.

NEW ENGLAND DIVISION I. Vermilya, Mgr.

Good night! was there ever anything quite so thrilling as this before? Think

of it—a total of 5884 messages in the New England Division.

We must give our Headquarters station, 1AW, the blue ribbon this month. It is also noticeable that we find 1AW under the C.W. class. The second honors go to 1CNI.

MAINE: A good report comes from our friends up near the border, the C.W. boys having 475 to their credit, and the sparks 170.

NEW HAMPSHIRE: This state is now coming through in good form, and by next report we hope to have the honor of announcing a new and active Assistant Division Manager. At this writing, these arrangements are under way.

New Hampshire reports a quiet period between seven and ten P.M. 1CM handled 3 messages on his old stone crusher. 1IX, C.W., handled seven messages. 1YB advises that they will soon be going with a 500 watt C.W. set, with an antenna 100 feet high, on a 100 foot building. This set should work Asia. 1CIK comes forward with a report of some DX work as far as 5FV. Their's is a 20 watt C.W. set.

VERMONT: Vermont has also come into line, and Mr. R. P. Slayton of the University of Vermont has been appointed Assistant Division Manager for this state. We now look forward to some good snappy reports from this district. Mr. Slayton has divided the state into two districts, a northern and southern, and has appointed Jennings. 1AIQ, the District Superintendent of the Northern, and Eaton, 1CJH, District Superintendent of the Southern district.

Traffic handling stations are 1ARY, 1AIQ, and 1BHC.

MASSACHUSETTS: This old state still continues to bubble and boil over with amateur enthusiasm, till now, it well sounds like a mill pond full of C.W. peepers on an August night. As stated before, 1CNI spark, walks off with the honors in this state. He is closely followed by 1CMK, as if not to be outdone by a spark.

A. S. McLean, Assistant Division Manager for western Massachusetts, sends in a good report. He reports 1CMK using 100 watts and working the 6th district; also, the appointment of Bloom as District Superintendent for Holyoke district. 1AWW reports a noon schedule with 1BEA, at North Adams, and 1MY at Hartford, Conn. 1IL, 1CGR, 1BSJ, 1BWY, 1EO, 1BVR and 1BLN all handled a few messages and promise a full report next month.

Sylvester J. Connolly, of old 1MD, who gained fame working DX on one-quarter inch spark coil, heads the 1XK as their chief operator. It is also announced that 1XK holds a boiled owl's session every Friday night, from seven P. M. to nine A.M. 1XM announces that they are run-

ning on G.M.T. now. Our old friend and standby, Phil. Robinson, of 1CK, handled 110 messages. I'll bet he is glad he hasn't got to write this report up. 1BKQ deserves special mention for fine work done. 1DY will be on the job in a week or so, and we look for some good DX work from his direction. Not wishing to toot our own horn too loud, we wish to announce that 1ZE is ready with 750 watts, and a 200 volt, 1500 watt generator, giving off an antenna current of 18 amperes on 212 meters.

RHODE ISLAND: This little state still measures up to TNT standard. 1II would like to have a schedule with Massachusetts stations. 1AFR says that some C.W. hams are threatening to close him up because he uses a stone crusher, but so far, there is no such law, and we hardly believe he has any ground for fear. You C.W. men—be sports, don't, for goodness sake, start anything between hams. 1BVB reports rebuilding his O.T. and also a muffler for his spark, so as not to keep the neighborhood awake all night.

CONNECTICUT: As per usual, 1QP, is asleep at the switch, nothing being heard from him. However, one or two, who know this Reinartz tuner wizard, and his failings, slipped their reports in to ye Division Manager, by the underground route, and he takes pleasure in reporting 1AW with 743 messages. This report came in after a general razz from all over the country, that our Headquarters station was not on the air enough.

In conclusion, let me thank you all for your reports, and to add—do not fret, if they are not acknowledged, for there are more than five thousand daily different matters that require personal attention, and this report is only one of the them. We will do our very best to get you all. Let's put over 10,000 messages next month.

ONTARIO DIVISION

A. H. K. Russell, Mgr.

The Ontario Division is FB, boys, and we got there in the transatlantic prelims too. Two of our stations copied in Honolulu and reports to date indicate that six others at least qualified.

In Western Ontario, which looks as if it was going to take away the Ontario Division honors, 3GN-9BS runs a regular schedule with 8BGT clearing west bound traffic. In London the only one who is on regularly is 3XN who is a big noise all over and handling much traffic. He has been appointed City Manager. Other London stations 9BF, 3OV and 3TB are yet in preliminary state. In St. Thomas, the only one is 3FA, who was working spark much to the disgust of the B.C.L.'s. He has changed over to C.W. with good results to himself, and the ears of the said B.C.L.'s.

In Windsor we have two big sets in 3BV, City Manager, and 3DH, both 100 watts, and doing excellent work, (which I wish they would tell me about—D.M.) 3DH and 3XN are QSA in California. Others in the western district are 3AD, 3NB, 3KO, 3FM. 3NB, was copied on Pacific coast during the prelims. 3TA in Tillsonburg, local Manager, is going strong with 5 watts.

In Central Ontario district, GOSH. Well—the boys are good, that's all. 9AL and 9AW reported from Hawaii during prelims and 3GK, 3GE (spark), 3JK, 3JT, 3CO, all pushed the old bottles to the tune of over 1200 miles. The said 3JK used ten watts for his trip to California. The boys are right there with the traffic handling too and they have helped to again break the record of the Ontario Division for traffic, even though we haven't the message report of the western district to help it along.

Eastern Ontario is still low man in Ontario. No real DX is being done there and comparatively few new prospects. 3IL has a big mast and 20 watts C.W. but is not yet on the air for work.

NORTHWESTERN DIVISION

H. F. Mason, Mgr.

For the first time in months, we have reports from all states. This month seems to mark the beginning of a new era in amateur radio in this division. Traffic is being moved on C.W. and message reports are pouring in. In the past, although we managed to get traffic through, it was hard going as a rule, owing to the long distances between the reliable stations and the QSS and QRM. Traffic is going thru so well, and with so little delay, that the problem of routes takes care of itself. Some stations, by their operating ability, higher power, and good watches gradually are being looked to as traffic clearing stations, and these stations in turn naturally pick their most reliable station in each direction to handle the bulk of the relay traffic on schedule.

There are also a large number of stations, mostly 5 or 10 watt C.W. stations, who experiment, and handle a little traffic, but not with any particular station, or on any schedule. Honestly, these stations are getting to be so numerous, and are so scattered, that we find it hard to count them in on our relay organization. However, they are the big stations of the future, and we extend a hearty welcome to every little five watt tube on the air as a step towards a more perfect organization of our division. So if you are not now reporting activities, get in touch with one of the division officers, and they will help in every way possible to get DX out of your set and become a dependable relay station. Get the A.R.R.L. spirit, fellows, and co-operate. Its FB.

Now that we are moving traffic so well, let's advertise the service we are giving the public. Explain our system to the B.C.L.'s and get their messages. It helps wonderfully. There are dozens or more stations on that can put traffic through. The route; 7BJ-7BK to 7OT, thence to 7LU seems to be the slipperiest, and once started on this route, nothing can stop a message until it is delivered or else goes out of the division.

MONTANA: 7EX is still supporting us and will be counted on all winter, with both spark and C.W. 7ZU has a new 150 watt C.W. He is maintaining schedules with 9AWM and 9CNS. 7LY is back on the air, and can QSR east and west, spark or C.W. 7HS has signed on as 2nd Op. and this station is open for traffic every night. 7HM is very consistent throughout the division.

IDAHO, Dist. 1: The only station doing relay work in this district is 7JF. Dist. 3; 7CG and 7LN sent the reports of the Nampa-Boise football game to 7YA at Boise, where they were broadcasted. Stations in Nampa are generally inactive at present. Dist. 4: Stations handling traffic are 7PJ and 7LO on spark, and 7AEM, 7HJ, and 7OT on C.W. Boise is an important relay point for traffic in this division because of its central location.

OREGON: Efforts up to the present time to fill the office of Assistant Division Manager for Oregon have been fruitless. Although there seems to be quite a bit of activity on the part of individual station, the general spirit of co-operation does not seem to prevail to the extent that it usually does. It's up to you, fellows, put your shoulders to the wheel.

District 1; Stations handling traffic are 7JW, 7DP and 7BB. 7BB has just moved to Billings. Show the good old A.R.R.L. spirit, fellows, and co-operate 100%. Don't be stagnant. There's a vacant space in QST for your report each month. Fill it. Dist. 2: 7KS and 7SN are installing C.W. 7ABU is coming to the front. Trouble is being experienced at 7HD in working out, on account of QSS. (Better put in C.W., OM—D.M.) Dist. 3: 7QT and 7YJ are reported as doing DX, with 7MU also handling messages. 7BH is on with 5 watts regardless of matrimonial troubles. Dist. 5: 7LR, 7TW, and 7MF are all doing good work on C.W. 7TQ is a regular piece of furniture on the air, as he is sure on the job. Dist. 7: 7KE has a five watt set in operation and has already done DX work, having been reported in Waterloo, Iowa. 7MC is handling traffic on ½ K.W. spark.

WASHINGTON: There has been a great increase in traffic in this section during the past month. Many new stations are coming on the air and messages are begin-

ning to move over definite routes. Kitsap County has been made a separate district, and will be known as No. 13. 7OE is District Superintendent and is sure right when he says that there's a bunch of stations in Bremerton that are hard to beat. F.B. Dist. 1: 7OJ is handling traffic on spark. 7GP is the only station reaching out of Olympia, as far as we can tell. Dist. 5: 7BJ has worked as far east as Kansas City (even though it costs a new disc on that synk rectifier every day.) (hi. D.M.) He reports 7ZK, 7AIC and 7BJ handling traffic in Vancouver. The route east is better than ever before. 7HJ at Boise seems to be working out on his C.W. Dist. 6: 7AW, 7BG and 7AFN, also 7AGI are handling business on spark, while 7WM, BT3, and 7QE are holding down the C.W. end of the game. 7WM's 50 watt bottle has departed to the great beyond (we can't say which place). BT3 at Camp Lewis is doing fine work with 20 watts working north to Canada 9AC, east to 7LU, and south to 7ZK. One of the original old timers of the any-wave, any-power ways is back on the air with 20 watts of C.W. He will sign 7AII and will be remembered by old timers as "Hammond of Tacoma." Dist. 7: Traffic in the Seattle district was moved almost wholly on C.W. this month. 7BK has 20 watts and finds that traffic moves in a way the spark never thought of. (We live and learn, 'eh!—T. M.) 7FD is breaking through on 50 watts. 7EQ, 7PF and 7ABB are holding down the job in Everett. On November 23rd, 7UU turned in at night and left four messages each with the check 13 on the hook uncleared. Next morning he awoke to find the top 40 feet of the 108 footer in his back yard, reclining peacefully. Others who are superstitious would do well to profit by this example. Dist. 8: This district includes the counties of San Juan, Skagit and Whatcom. Dist. 9: This district takes in the territory of Okanogan, Ferry, Stevens, Douglas, Chelan, and Pend Oreille counties. Dist. 10: This is dormant as far as A.R.R.L. activities are concerned. Come on your Yakima fellows. Don't let a few dollars derived from the broadcasting craze keep you out of the great game. Dist. 11: 7TH has been appointed an official relay station, and works regularly with 4BV and 7ZO, so give him a share of your eastern traffic, fellows. 7GE has moved to 110 South 7th St., Pasco, and will be on shortly with C.W. He says the spark will stay, tho it's too good to discard yet. (Willit?) Dist. 12: The work around Spokane seems to be entirely local. We've got a place in QST for your report though, and we're after 'em, so don't be bashful.

Dist. 13: During the past month, amateur activities in this district have taken

on fresh impetus. Message traffic is increasing daily, as the public becomes acquainted with our service. At present 7NG and 7OE are the only ones doing any amount of DX. The spark stations in this vicinity are changing over to C.W. as they find the latter far better owing to the close proximity to NPC. Some of the stations are using 110 volt lighting AC on the plates and are getting through to Seattle very well.

PACIFIC DIVISION
J. V. Wise, Mgr.

There are three trunk lines in the Pacific Division, known as trunk A, B, and C. Trunk A, from the southern extremity of the division via Douglas, Phoenix, Ariz.; San Diego, Santa Barbara; the Bay cities, Colusa, and north to the extremity on the northern end of the division. The following stations so far are appointed on trunk A. 6ZZ, 6ZH, 6ZB, 6AAK, 6TU, 6VX, 6AOR, 6AK, 6ABX, 6TC, and 6CC. Trunk B, from Douglas, Ariz, via Los Angeles to Colusa, Calif. Stations, 6ZZ, 6EN, 6ZX, 6GR, 6GF, 6TC and 6CC. Trunk C from San Francisco to the eastern extremity of the division. Stations 6ZAF, 6HP, 6AK, 6ZX, 6FH, 6AJR and 6QR. As the appointments on the trunk lines are made the same will appear in the following report.

ARIZONA: H. L. Gooding is appointed A.D.M. of this state. His station 6ZZ is a 100 watt C.W. working on both 200 and 375 meters. The districts in Arizona will be laid out by him in the next report. 6ZD and 6AAH, the former C.W. on 200 and 375, and the latter a spark on 200, are on the job doing good work. All routes via this state are in splendid working shape.

CALIFORNIA: Dist 1: 6AHF has junked his spark for a 50 watt lamp. In this district as in nearly all, C.W. greatly outnumbers the spark. 6AVR is both C.W. and spark. 6IV, C.W. only. 6AIH will be known as 6ZH and is working on 200 and 375 meters, pure C.W. being used. The fellows of San Diego are learning the advantages of co-operation. Thus our old trouble is being smoothed over. Dist. 2: The total of 747 messages is self-evidence of activity among the fellows in this district. A few points of interest: 6CU has worked 9UU, 9AWM, and Can. 4BV on 3 five watters. Our old friend 6IS has given up radio for a wife. Dist. 4: 6ATC and 6UW are doing fine DX with their tube sets. 6TU and 6VX both spark are also doing their share of work. Traffic north goes through 7BK, south to any Los Angeles station, and to the immediate bay points, via 6AOR. 6AUU gets on the job occasionally, otherwise Santa Cruz remains dead. Dist. 5: 6AS, has resigned his office as district superintendent due to

lack of time to give to radio. His successor will be named in next report. Dist. 6: The spark still leads in the message report in this district. 6ALV and 6ABU are on the job doing fine work. 6EX and 6AQU are clearing 6ZAC. 6VK is off the air rebuilding. For C.W. 6ASJ, 6CP, 6AOR, 6BCR, 6BSZ, and 6TI are doing the best of work. 6ASJ is handling traffic on schedule with 9's. 6BCR, 6BSA and 6CP clear with 6ZAC with ease. H. Becker, 1512 Oxford Ave., Berkeley, Calif., is Assistant City Manager of Greater Oakland. Between Becker, Steffen, City Manager, and Pooge, district superintendent, we should have a healthy report, if the fellows will give any one of them a few words of interest each month. 6HP is now C.W. the old spark gone the way of such animals. Dist. 7: There are only one or two spark sets left in this entire district. 6ABX has 2 50's in operation. 6GF and 6GR are 20 and 30 watts, respectively, pure C.W. having done away with the A.C. idea. All routes in perfect working order. Dist. 8: The only two stations working are 6CC and 6TC, both 100 watt C.W. 6CC is handling traffic with 6ZAC on schedule.

NEVADA: 6QR has been appointed A.D.M. He is again with us on the air with the old rock crusher. 6AJR is now completing his C.W. outfit of 50 watts. The arrangement of districts will appear in the next report.

ROANOKE DIVISION
W. T. Gravely, Mgr.

Our box for this month is a repetition of the last one.

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*****
Spark
Stealey and Morris,
Parkesburg, W. Va.
361 msgs.
C.W.
A. B. Brown,
Norfolk, Va.
284 msgs.
*****
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PORTO RICO: A.D.M. Rexach sends us his first report in this capacity. He says that with the inauguration of the traffic route with Continental U. S. on September 15th great increase in interest has been shown by the Porto Rican Amateurs in the activity of the A.R.R.L. 4JE has just received all the necessary equipment for a new 200 watt set. This will give Porto Rico another dependable station capable of handling traffic directly with the mainland. 4KT has been able to reach the U.S. and is reported QSA and steady by 3BZ.

WEST VIRGINIA: Reports for the past month have been very good. Dist. 1: There are five active stations in this dis-

trict: 8SP and 8AFD, running neck and neck with 8AUE. 8CHO managed to get in some daylight work. Dist. 3: Only one station is working here, 8CAY. Dist. 4: 8AMD is too busy at School to give much time to the set. Dist. 5: 8BKE says that he has been heard in 24 west coast stations. 8BDB has "9initis" which is keeping him busy. Two new stations are coming up, 8BXM and 8CQH. Dist. 6: This is spark headquarters. 6BDA has been reported by 6AKT, 6ZX, 6EX, 7LR, 7ZU, 7ADJ, and Porto Rico. 8IC another and 8TH, spark, have been getting good DX. We wonder if there are any B.C.L.'s in this neighborhood. They must live an awful life amid all that spark traffic.

NORTH CAROLINA: We have no detailed report. 4FT, and 4BX are suffering from the B.C.L.'s. 4KC and 4GH are very active. 4LJ turned in his largest traffic report since opening up in Winston-Salem. 4DQ, 4DC and 4GW are all active, and 4NT is very much so.

VIRGINIA: We have reports from every section except Richmond proper. Virginia leads the division this month with a total of over 1500 messages. This is the largest traffic report this state has ever had and is only an indication of the great work to be carried on this winter. Our technical advisor, Groves, 3BID has just put up a beverage wire 1100 ft. long. Dist. 1: 3ZZ has been very active and getting exceptional DX. He has a good bit of trouble with excessive fading of his signals. 3AAG is doing the boiled owl stuff. 3BBC is handling a great deal of traffic with Richmond on Sunday. 3BNE is going good after erecting a new aerial. The only spark in this district 3ACK is moving to Roanoke and will open up with a 10 watt C.W. 3ATZ is getting out, but business interferes with his work. Dist. 2: This bunch is very much alive now and handling more traffic than ever before; the largest portion of it being in daylight. All the Richmond bunch get on during the day and all over the Roanoke Division practically every station is on during Sunday afternoon, much traffic being handled. 3AUU, 3BNM, 3ATB, and 3SG are all live wires. 3SG is R. E. Decker, at Petersburg, and not as listed in the call book. 3TJ has been logged at 4OI and will start the boiled owl stunt and handle more traffic. Richmond has the usual kicks from the B.L.'s wanting everything to shut down for them, but ND. Dist. 4: 3BLF is using his 100 watt set with MG supply. He is working in all directions but Washington. By maintaining a daylight schedule with 3APR much traffic is handled. Dist. 5: 3IW is still handling a big bunch of traffic. 3SK with 100 watts has just opened up. 3AFW is getting out and is increasing to 15 watts. 3CER has just completed a new shack and

set. Dist. 6: 3BHL is on the job every night and wants all traffic for Charlottesville, Va. 3BFE fell from B.L. to the C.W. stuff at one jump. Dist. 7: 3ZK is out with a busted condenser. 3ASP is now using C.W. and handling traffic right along. He is specializing on daylight work and is reported all over Virginia. Dist. 8: 3APR works a great deal in daylight and after midnight. He is QSO all over Virginia and North Carolina on Sunday afternoon. 3BZ is very active handling quite a lot of traffic. He is now on 200 flat and has difficulty in raising stations that he formerly worked. Dist. 9: There are two new C.W. transmitters, 3CW and 3AIR. 3RF is back on the job much to the discomfort of the B.L.'s. 3BIJ is back in the game with a 20 watt C.W., I.C.W., and phone. (FB. but use the C.W. most please). 3CA is doing a great deal of daylight work especially with 3BZ. Dist. 10: 3AOV still sticks to the spark. How about that station in Pocahontas? Let's get 3BWY on the "radio map" with the rest of the gang. Your Division Manager is highly gratified with the great relay work the fellows are doing and firmly believes that he could boost our traffic up to 4,000 a month having gone well over the 3,000 mark this time. Go to it.

ROCKY MOUNTAIN DIVISION N. R. Hood, Mgr.

Up and at 'em men, we're coming with horns a blowing. We had a tune of 1633 messages for November and our goal for January is 1800. Blow your Bazoo's as hard as any jazz band ever thought of doing. We amateurs have our rightful place in the wind and we are going to keep it. We have our plan of quiet hours now. Let no petty single circuit grumbler squelch that sig of yours. We will have to fight men; and hold the ship, because she ain't a leaking yet. This old division has the pep of any wild cowpuncher. We are red blooded out here among mountains and sage brush so shoot 'em up in the old style. What say, do we make it? We will have to kick up dust, but we have the stations and the men behind them so the job can be done. Colo. and Wyo. is 100% C.W. and Utah is about 75% C.W. Now step on it, remember it is 1800 for January or bust. There will be lots of Xmas and New Year messages then which should swell our totals. Chronic keyitis is a good disease as long as it is moving traffic. Remember your local plan of quiet hours and the minute it is up hop to it if it does hit "Aida" or "Faust" in the middle of a scene.

From now on the states in this division will be run in competition to each other, each fighting for first place. the winner for each month will be decided by the num-

ber of messages handled per station. In this way each state will have a fair chance. So it behooves every mother's son of us now to get behind our A.D.M. or Dist. Supt. to put our state on top. The state that leads for the month will be listed first in the report and so marked. Watch for your place and if you do not rest on top of the gang, just go at it a little harder. Also behold our special box seat for the individual traffic honors. It goes to 9ZAF this time. We have several broadcasting stations in this division handling traffic and more power to 'em. 6ZM also KZN in Salt Lake is another of our good broadcasting stations handling A.R.R.L. traffic. More power to you men you lie deep in the hearts of us hams for it. So hop to it, gang, this division has just "gotta" fizz and pop from now on.

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*****
*                               *
*           Colorado           *
*       Reynolds Radio Co.     *
*           9ZAF               *
*       Denver, Colo, 536 msgs. *
*                               *
*****
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Colorado has emerged from a so called "dead relay station state." This is proven by the message report for November. Compare it with all previous reports in the history of the division and see for yourself. Denver still holds honors for the most messages handled. But the great number of stations in the city account for their totals. Boulder and Colorado Springs look like very promising competitors. 9BUN using one five watt tube is doing a wonderfully fine job of papering his room with cards and messages handled. Then comes 9DTE who is 9BUN's close second. When one hears him locally they think that it is one of the so-called "Transmitting receiving combinations" or in "ham language" a blooming single circuit receiver." But when he calls 9DTE gets an answer and it isn't South Denver or Englewood either. The old Manual High School received the call 9ECF. The old timers 9DTM, 9AMB, 9ZAF, etc. still hold the fort in Denver in the same old way.

WYOMING. Radio activity seems to be up to par, all stations in operation now, ready to make Wyoming's largest and best radio season. 7GK has moved his spark set to Laramie and has it installed at the State University. A 10 watt C.W. set is used at 7GK also and the power will be increased. Old man 7ZV is back on the air with 100 watts and his sigs are already QSA over the entire U.S. 7AFW has been experimenting with phone lately and during the A.R.R.L. tests was QSA in Buffalo, N. Y. on 10 watts. With the Voluntary Lid taking effect most of the stations in this section are finding it necessary to revise schedules to avoid confusion and con-

fusions and as soon as these difficulties are adjusted everyone will be ready for the season and show just what Wyoming stations can do. Daylight storm routes run through Wyoming which are being extended into Colorado which will give this division a route paralleling the railroads from Denver, Colo., to Billings, Mont.

UTAH: The men in Northern Utah do not seem to be giving their District Superintendent any support at all. There will have to be some pep shown up there, gang, or we never will lead the states in this division. (Some official relay stations will be minus a certificate if some interest is not shown—D.M.) 6ZT is on the air now. Dist. 2: Traffic came through this month better, although 50% of the stations handled traffic and just a few stations reported. 6ATQ got through fifty messages in fifteen nites. 6BKE continues with his rock crusher. (Things have to move faster in this division from now on and those who do their part will receive due credit—D.M.)

WEST GULF DIVISION

F. M. Corlett, Mgr.

It seems that the Division Manager's efforts of pounding the faithful old Corona instead of the brass on the old rock crusher is beginning to bring results in boosting the message traffic. Well I am glad to see it fellows, and keep up the good work, but honestly I am just aching to get a chance to sit and handle a few like old times. Can't make a living, get a little "shut eye," write letters and more letters, and operate the old set too, there are not enough hours in a day. Used to have one or two girl friends that used to write to me, but I think they have all given it up as a bad job, they never get an answer. Northern Texas got away with first place last month.

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*****
*                               *
*           Gray & Gray       *
*           5XAD—329 msgs.    *
*                               *
*****
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NORTHERN TEXAS: 5EL is getting reports from all over the country (our sympathy with you OM for the last of your noble 5 watter, better luck to you next time.) 5UN is being reported from both coasts. 5CY on his 5 watts is getting splendid DX reports. 5ZADA is getting everywhere with his 100 watts. 5HQ has just received his license and hasn't got started good yet. 5UO is being reported from both coasts. Wichita Falls' motto: "shoot us tfc, if we cant' handle it no one can." 5IX and 5TC are doing fine DX work. 5DI is confining most of his activities to handling long distance traffic with the west coast. He has schedules with 6AWT and 6JD every A.M. He also works 6KA of Los Angeles, has worked

4KC, 4EB, 3QV, Can. 3BV, and 4BP. His hours are from 3:30 to 6:30 A.M. 5PX and 5SK are doing good work. 5BE is out for the present rebuilding. 5QI is somewhat stale on account of football and bum generator.

The District Superintendent for district 1 is Arthur West, who is operating at 5TU. 5ACQ has been doing some real DX work on spark. 5IS has installed C.W. 5AL has had hard luck with his condenser but is sticking on the job with reduced power. 5ZH is anxious for traffic and will QSR for all western states and Hawaii. Traffic regular through 6ZZ, 9DSD, 9ABR, 5ACF and 5BA.

SOUTHERN TEXAS: With a certain degree of pride we make our report this month; all of the four districts in this section have turned in their reports on time and each of them have shown renewed interest in traffic work. This is that same feature of "rebuilding" which detracts so much from our efforts to make a good showing; seems as tho all the real good stations that we have down this way have the growing fever—the five watters of today will be 20 watters tomorrow, and so on. 5NK is bringing scores of reports home from all points, even Hawaii. District Superintendent E. A. Sahn at New Braunfels, reports 5KP as the honor station in his district this month. 5ZU with his "mile a minute" fist is working well up into Minnesota on a fifty watter. 5TM is working well up into "9dom" on 15 watts. 5YK is still operating spark on 375 meters with good DX results. District Superintendent L. D. Wall of San Antonio makes a snappy report telling of a 50 watter opening up at 5SS. This point is a most desired one in the extreme southwest as it gives easy access to Laredo and the Vally stations out of San Antonio, and especially with 5ADI. 5ZAE has got his C.W. set percolating. E. R. McCracken makes his first report and gives foremost credit to 5FA for traffic handled during the past month. 5ADB has given up the spark idea and will make a showing next report as a C.W. station. El Paso is one of the lucky (?) towns to have an amateur with a four letter call 5ZACA. Sounds like code practice. Hi. 5FT has been down in old Mexico and reports sigs good from 5FA and 5ZACA. EL Paso relay men have decided on a 9:30 P.M. (MST) to begin DX work as it will coincide with the (CST) of east Texas.

OKLAHOMA: 5WX seems to have given up the game for the winter. 5SR is working nicely but a great deal of traffic doesn't go through this station. 5SG has his 10 watt set running, although no DX records have been made. 5TO, 5LB, 5MP, 5ADQ, 5DW, 5AEC, and 5TA are off spark for life and are to stay with C.W., fact is, they

are all working further on one five watter than was ever possible with the old "light blinkers." 5ZM is the only other live station of this section and to him goes the credit of keeping things alive around Enid. 5ZZ and 5ZQ are away at school and 5PU hasn't been heard from for moons and moons. At Norman two new stations have begun to get out, 5TJ and 5VM. Believe us, you won't get much sleep if you try to stay up with 5TJ.

WINNIPEG DIVISION

J. A. Gjelhaug, Mgr.

MOOSE JAW: 4HH reports hearing 9AW or Toronto calling (U. S.) 4NT and we hear that 4BV of Loreburn was heard on the Atlantic Coast, so prospects look good for the "ALL CANADIAN Transcon" this season.

REGINA: Here we have C.W.'s in the stage of being built. 4AQ is getting a 10 watt bottle-set on the air and 4BR is reaching out with his English lantern.

LOREBURN: What is all this coming to, every time we hear from 4BV he has broken his last DX record, now he is being heard consistently by 6ZAC working 6XAD and 5SP, and has been heard at Yonkers. N. Y. Next thing we know he will be working French 8AB. More power to you OM.

SASKATOON: 4FB is having a little trouble but will have the set percolating soon. 4FN will be a 10 watt set.

WINNIPEG-MANITOBA: 4AS has sold his spark set and is thinking of C.W. 4CJ has 5 watts but did not get a chance to do much. 4CJ and 4CX are combining transmitters and will have 10 watts. 4DK has worked many stations in the states and has hooked up with 4BV. 4CN will have 50 watts going soon. 4CE is doing good work on his spark, having worked 9ZC of Baudette in daylight.

The Winnipeg gang are up to something as they say they will give the Saskatchewan end of the division a surprise before long. Go to it, fellows, and we will probably see that "ALL CANADIAN" Transcon come through soon.

VANCOUVER DIVISION

J. T. North, Jr. Mgr.

The "All-Canadian Route" is becoming less of a pipe dream these days as 4BV, 4GB, 3BV, and 3XN are QSA at 5CN and 5AK.

VANCOUVER: 5CN has worked 9AWM and 9AUL with little trouble, as well as many sixes and sevens. 5EJ is another C.W. station of promise, and 5EB will be on with 5 watts shortly. 5BQ is punishing the ammeter on ten watts but can't raise anyone across the border with any regularity. 5AK has his spark assembled.

(Concluded on page 59)



QRA WQL es WQM?

Our readers will recall many reports in *QST* of the reception by British amateurs of radiophone signals from stations WQL and WQM, first during last year's Transatlantic and on several occasions since. Now we have a letter from Mr. C. G. Williams, British 2JF at Sefton Park, Liverpool, England, with a copy of his log for Nov. 27th recording these stations:

11:48 WQM clg WQL—C.W.—215/225 m. Audibility 6. "WQL v WQM—Aerial current laaa2 1000 volts 45 milliamps—WQM".

11:52 "CQ v WQM—Here laaa2 amp in the aerial."

11:53 WQM on speech "Hello", etc. Speech audibility 4.

11:56 WQM "VA".

Mr. Williams indicates these times as G.M.T. but also speaks of "P.M.", from which we imagine he refers to 11:48 to 11:56 at night, London time.

These calls are assignable by the United States but as previously reported in our columns the Department of Commerce advises that there are no phone stations so licensed in this country. We can secure no information on them. Mr. Williams used a detector and 2 audio amplifiers and with such low audibilities it is reasonable to expect that the signals came from considerable distances—which is in line with the impression of other British amateurs who have heard the same stations.

Can anybody shed any light on this matter?

WJZ, the broadcasting station of the Westinghouse and Electric Manufacturing Co., at Newark, N. J., appears to be the most consistent broadcasting station in this country to be heard in England, judging from the logs of amateurs overseas. WJZ has been heard for two hours continuously in the afternoon and amateurs looking for our "Z" stations on 375 meters frequently run across WJZ.

Letter From France

This month we take pleasure in presenting a letter from Léon Deloy, French 8AB. This was of course written before the tests actually started and we know from the reports coming over at this writing that

dozens of our stations are being heard nightly in France.

Dear Brother Amateurs:

I have not much to say this month but the news is good. The December Transatlantic Tests have been given quite a lot of publicity in the great press and are arousing much interest. It can be safely said that the entrants for reception at least will be numerous.

Transmitters are being hurriedly put together and interesting results are being obtained, and at this writing half a dozen French stations have been reported from England and several French amateurs copy signals regularly from their British comrades. According to unofficial reports at hand several American stations have been heard in France during the preliminary tests.

Personally my 1 K.W. set is progressing. The new masts have been finished. The three in the yard are 25 meters high and the one on the roof is of 10 meters and the aerial will be up on them shortly.

I met Mr. Armstrong in Paris last month and he was awfully nice to me. He was in Nice a couple of weeks ago and honored 8AB by a long visit.

With best 73's to all and CUL,

Very sincerely yours,

Léon Deloy, French 8AB.

Nice, Nov. 19, 1922.

In our October number we gave a wrong impression in this department to the effect that Mr. Philip R. Coursey had left *The Wireless World & Radio Review* to go into the employ of the Dubilier Condenser Co., Ltd. Although with Dubilier as Chief Engineer he still retains the title of Research Editor on the magazine.

The station of the Manchester Wireless Society, 5MS, started broadcasting to us on November 14th for the first fifteen minutes of each hour, starting at 8 P.M. E.S.T. and ending at 1:15 A.M. with a wave length of 270 meters. At this writing no definite reception has been reported in America but only half power has been used so far. Although we look for the best signals from this station there are other stations in England which should make themselves heard.

London Letter

Dear Friends:

You may be interested to know that we have just set up a new record for low power telephony, carrying on inter-communication for one and a half hours between London station 2ON, Major Parker, and Aberdeen station 2JZ, Captain Spence, on a wave of 195 meters. The power input was 50 watts, antenna current $1\frac{1}{4}$ amperes, aerials 45 to 50 feet high x 60 feet long, and earth made to the main water pipes. I personally supervised the tests and listened with the first two valves of a Burndepth Ultra III; that is to say, a H.F. magnifier and rectifier. The distance is somewhat over 500 miles and Aberdeen is surrounded by mountains. The whole of the communication was perfect and not accompanied by any tendency to fade.

You may also be interested to hear that 2JZ sent C.W. telegraphy to Mr. Deloy, 8AB, Nice, France, where he was received on one valve. This is a distance of approximately 1000 miles so it would seem, therefore, a comparatively easy matter to send C.W. telegraphy across the ocean using one kilowatt on a properly designed aerial and counterpoise system.

One transmitting tube only was used on each of the transmitting sets and telephony was done on the grid control system, no modulation tubes being used.

Broadcasting is now controlled by the Broadcast Company which has been formed for this purpose. Shares are being sold to all manufacturers but the Post Office is stipulating that the maximum dividend to be paid is $7\frac{1}{2}$ per cent. No manufacturer will be allowed to sell apparatus for broadcast reception unless he has shares in the scheme, and of course must also be licensed under the Marconi patents. For revenue, a tax on all receiving sets, loud speakers, head telephones, etc., will have to be paid the Broadcast Company, this tax being in the neighborhood of 7/6d for each crystal set up to about £3 for a four-valve set. If it is found at the end of a year that these charges are too high they will be reduced but it is estimated the cost of running the eight broadcast stations will be in the neighborhood of £20,000 each per annum. The proposed broadcast stations will be located at the following centres: Bristol, London, Manchester, Plymouth, Glasgow, Birmingham, and Newcastle. The power of each station will be about three kilowatts and the wave length 350 to 425 metres. The cost of operating may appear to be very high but you must bear in mind that in this country we have a great many vested interests, e.g., there is the music copyright association demanding payment for the singing of their songs and performing their operas, artists fees and over-riding fees in cases where artists are retained by theatrical impressarios or music

hall controllers. However, we shall see how it all turns out.

All apparatus designed for the reception of broadcasting will have to have the British Broadcast Company's badge and must be passed by the Post Office as being suitable for the purpose and will also bear the Post Office registered number. Although these sets may be adapted to receive on any wave length, they must not, on any account, contain reaction, tickler coils, or regeneration of any sort, so that in order to receive C.W. telegraphy a separate heterodyne must be used. The Post Office is now taking a firm hand in the issuing of amateur and experimental licenses. Anybody may purchase a broadcast license from any Post Office and with this license may use broadcast apparatus only. The amateur and experimenter must apply to the Post Office for his license which will enable him to use regenerative circuits but he will have to show that he knows something about wireless and must give some reason for his wish to experiment. This system will have its advantages inasmuch as the ether will be kept clear of continuous screeching and heterodyning which goes on when regenerating valves are used, and it will encourage the production of super sets using radio frequency amplification.

This, I believe, covers the situation here as it now stands. Before many weeks I hope we will be sending personal messages by C.W. across the seas instead of letters.

Very sincerely yours,
W. W. Burnham.

First Ham: "Sa Bill, is the average British amateur much good at receiving?"
Second Ham: "Coursey's all right."

The *Wireless Society of London* is changing its name the first of the year to the *Radio Society of Great Britain*.

THE OPERATING DEPARTMENT

(Concluded from page 57)

VANCOUVER ISLAND: This is an extension of the former Duncan district and W. F. Reeves, 5CT, is D. S. 5CT is the only active station at present as 9BG and 5DX in Victoria are putting up new aerials. 5DX handles some traffic. 5CT reports DX with 4DQ difficult on account of QRM, but as both stations are owned by resourceful men, the difficulty should soon be overcome.

ALBERTA: 4DQ, reports that he is lining up some DX stations. 4DQ says his normal range is 500 miles, and he has worked Portland, Ore. which shows that 5 watt transmitters are worth the price anyway.

PRINCE RUPERT: No report from 9BP, so we conclude he is tinkering up that 100 watter at every spare moment.

Who's Who in AMATEUR WIRELESS



J. V. WISE

Mr. J. Vance Wise, our Pacific Division Manager, was born in Oakland, California, in 1898 and first started in "wireless" with a string-line tin can phone when only a lad. Graduating to the telegraph, he ran a peanut line down to the local depot, with three instruments on the circuit. About three years later he found himself with a three-slide tuner and other alleged apparatus of the vintage of 1912.

In pre-war days many two letter calls were signed, until in 1915 the call 6VQ was landed. 6VQ was not a bad station for those days and was heard in six states. After the war the call was 6EJ, which was reported heard in eleven states. 6ZX is the present call and it has so far drifted over half the country, Honolulu, up the coast to Alaska, and 2600 miles south of San Francisco, the station being 40 miles northeast of San Francisco. Wise has passed thru the many stages of the modern

(Concluded on page 80)

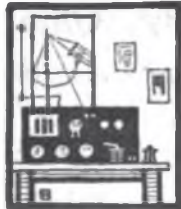


A. A. HEBERT

Mr. Arthur A. Hebert, president of the Ulster Foundry Corporation, while well known in the foundry field is equally well known in amateur radio. Educated as a mechanical and foundry engineer, in 1906 he took up the study of wireless as a pastime, whereby he rates as a real old-timer; and since 1908 he has taken an active interest in all affairs relating to the improvement of short-wave relay communication.

Of course he is a pioneer in our A.R. R.L., at present being both Director and Treasurer, the watch-dog of the finances. In our earlier days, between the formation of our original Board of Direction and the reorganization providing for a titled Traffic Manager, which went into effect just before America entered the World War, Mr. Hebert was the General Manager of the A.R.R.L. and in active charge of all the field work, in which time he rendered ser-

(Concluded on page 67)



Amateur Radio Stations



9ZAF, Denver, Colo.

9ZAF is the station of Dr. Wm. D. Reynolds, Jr., president of the Reynolds Radio Co., of Denver, Colo. 9ZAF, ex 9WH and 9JE, is one of the pioneer amateur stations of the west. It was the first station to send out daily news bulletins by phone in this territory and later as KLZ was the first commercial broadcasting station in the Rocky Mountain Region.

cage is made up of a top strand of steel cable supporting the five strands of copper cable. This top steel strand supports the weight of the rings and the heavy copper wires with practically no sag. A small cage lead-in is brought from each horizontal cage and joined together making a Y about 15 feet below. From this junction a single 8-inch cage passes direct



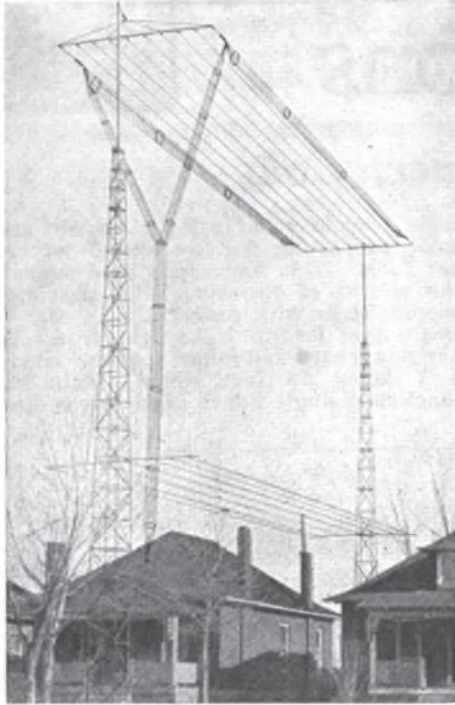
The transmitter was constructed by the operators at 9ZAF and is a composite phone and telegraph set. It uses two 250-watt tubes and a 50-watt voice amplifier for phone. On C.W. it uses a single 250-watt tube or two in parallel. The hook-up is a modified Meissner circuit giving an antenna current of six amperes. When used as phone a 50-watt voice amplifier is used in conjunction with the Heising system of modulation.

The antenna is an "L" type double cage eighty feet high and ninety feet long. Each

to the transmitter. A large fan counterpoise composed of twenty No. 14 bare copper wires runs over the house to the back yard. The counterpoise is used exclusively.

The towers are 60 feet high with a 20 foot pole on top making a total height of 80 feet. They are constructed of 1 1/2 inch pine braced with 1x2 braces. They taper from a four foot base to a one foot top. The towers were built in three twenty foot sections which were bolted together on the ground and raised in one piece by means of a thirty foot "gin" pole.

For receiving a Grebe CR-8 and a Kennedy 220 are used on a single wire aerial 85 feet long and 30 feet high.



9ZAF is the gateway to the west coast and handles west coast traffic from Canada to the Gulf. The operating staff of the station consists of three men all of whom hold commercial licenses. They are from left to right, Thompson (TH), Carpenter (DX), and Dr. W. D. Reynolds (DR). 9ZAF has been reported on C.W. from every district and on voice as KLZ from 50 states and provinces of the U. S., Canada, Mexico, and Apia, Samoa, which is more distant than England.

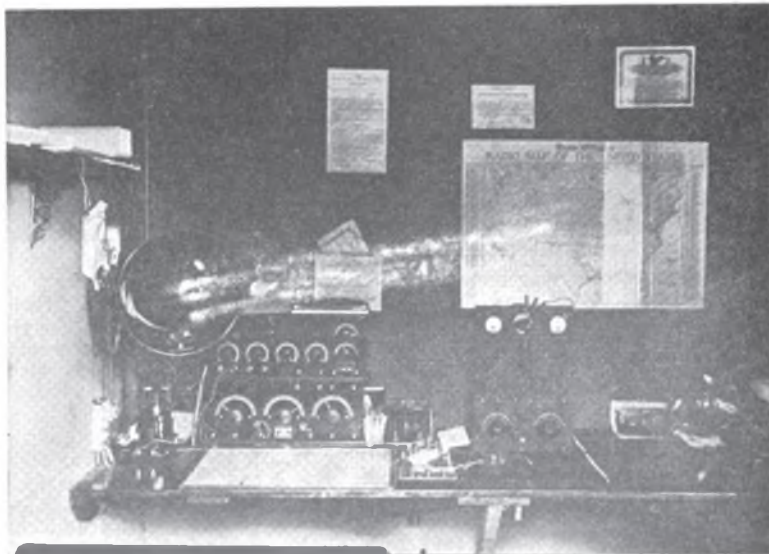
8BAS, Antwerp, Ohio

Station 8BAS, located at Antwerp, Ohio, is owned and operated by Herbert L. Gordon, and is a very neat arrangement.

The antenna is of the inverted L type, containing four 7-22 cables spaced two feet apart. It is 60 ft. high and 50 ft. long and is well insulated. The ground system is composed of copper strips buried three feet underground and a wire soldered to a well nearby.

The receiving equipment comprises a Z-NITH CRL regenerator and an AGN-3 Amplifigon with three steps of audio amplification. Either Murdock phones or the Magnavox may be used. The 6-volt storage battery and Tungar rectifier are located behind the partition, which is a convenient feature as it makes the leads short and eliminates the possibility of the acid eating away the bottom of the operator's trousers, as is too often the case where the battery sits under the operating table. (Except for the J. O.'s)

The spark set at 8BAS was a husky kilowatt that kept the neighbors awake and blinked their lights, so it was withdrawn in favor of C.W. Now a neat little tube set of Benwood manufacture sits alongside and chirps to the tune of 15-watts. Filament voltage is supplied by a Thordarson step-down transformer delivering 8-volts A.C. An Emerson motor-generator rated at 250-watts and 600-volts is located beneath the transmitter. Judging by the dog-eared call book and the messages on the hook, this is a typical amateur station.



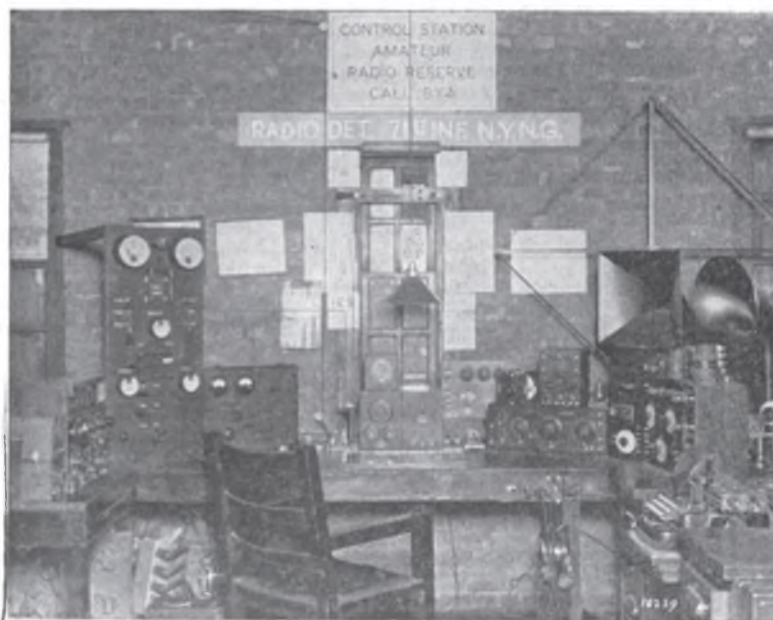
BY4, New York City

The Headquarters Company of the 71st Infantry, N. Y. N. G., at the Park Avenue and 34th Street Armory has taken over the control and operation of the Amateur Radio Reserve Net of the Second Corp Area, U.S.A. This net consists of Amateur stations whose owners are members of the reserve and provides a means of communication via amateur relay with all the important military centers in the Eastern States.

The apparatus was installed by the Headquarters Company of the 71st Regiment.

To the left of the antenna switch there is first a 250 to 500 meter tube transmitter using a 5 watt speech amplifier, a 50 watt modulator and a 50 watt oscillator operating on a 12 volt storage battery that supplies the filaments and operates a 750 volt dynamotor for plate supply. A single switch provides for the use of C.W., I.C.W. or phone. This set has been reported QSA thru the entire Eastern half of the United States.

Next is the switchboard carrying all the station controls except the antenna switch. From this board are handled the charging of the batteries, the transfer of the antenna to the sending set in use at the mo-



An emergency storage battery is provided so that the station may operate intermittently for ten hours after the city power is interrupted.

Beginning at the antenna switch in the center of the photo and going to the right, the first set is a Westinghouse "R C" with associated two step audio amplifier. Next (just behind the keys) is a Western Electric two step audio amplifier used in conjunction with the loud speakers on whatever set may be operating at the time. Next is an Adams Morgan "R A 10" with an antenna series condenser, detector and two step audio amplifier on top. The amplifier looks like a Navy type SE 1000. Last to the right is a universal-wave set used with honey-comb-coils on long waves or with a "Tunit" on short waves. This set was built by the H. Q. Company.

ment and the power supply from the batteries and the line.

To the left of the switchboard is the familiar Western Electric 5 watt phone set, Signal Corps type BC32A. This set employs a 5 watt modulator and 5 watt oscillator, for speech transmission over short ranges at waves from 500 to 1100 meters. Built into the set-box is a tuner with detector and three steps of audio amplification.

The antenna at BY4 is a cage, 100 feet long, suspended from the armory tower.

Operators who are interested in joining the Amateur Radio Reserve are requested to communicate with Lt. Layng of the 71st Regiment, or to call at the Armory personally on a Tuesday or Friday night.



It gives us great pleasure to announce the affiliation of the following societies as of December 8, 1922:

Germantown High School Club, D. K. Kinnier, President, W. E. Gilbert, Secretary; Pioneer Radio Society, Cyril Rooks, President, A. C. Gary, Secretary; Southeast Missouri Radio Assn., H. B. Deal, President, E. J. Furlong, Secretary; Lorain Radio Assn., L. Kress President, J. Perusek, Secretary; Kitchener & Waterloo Radio Club, G. Hainsworth, President, H. H. Gowan, Secretary; Toledo Radio Club, R. J. Togel, President, E. E. Pearson, Secretary; Radio Club of Saskatoon, T. T. Fyfe, President, C. H. Pirie, Secretary; Kokomo Y.M.C.A. Radio Club, W. F. Lanterman, President, V. Guerin, Secretary; The Harding Radio Club, C. C. Whysall, President, C. B. Kerr, Secretary; Amateur Radio Operator's Club of Bremerton, W. R. Wood, President. E. Bailey, Secretary.

Olean Radio Club

New officers for the coming term are: T. Ryan, President, W. Brown, Secretary-Treasurer, A. Cameron, Traffic Manager.

At a meeting held November 16th the "Rochester Plan" was presented to the club, and was adopted by popular vote.

I Tappa Key Radio Club

At a recent election the following officers were elected for the coming term: M. Nicoll, President, H. Bennett, Secretary.

Asbury Park Radio Club

New Officers are as follows: F. Fisher, President, R. Conover, Vice-President, Treasurer C. Weaner, Secretary F. Clayton. The club recently adopted the A.R.R.L. policy of quiet air from 7:00 P.M. until 10:30 P.M.

Hub City Radio Assn.

The semi-annual election of officers was held on November 9th and the following men were elected: A. H. Rosvold, President, N. J. Lawson, Secretary-Treasurer, F. D. Chapman, Vice-President, T. F. Anderson, Corresponding Secretary. The A.R.R.L. policy of quiet air from 7:00 P.M. until 10:30 P.M. has been endorsed and is observed by members of this club.

The following societies elected new officers which list is given for the benefit of recording secretaries of other societies:

West Philadelphia Radio Assn.

G. Owens, President; R. Fach, Vice-Pres.; C. R. McLaughlin, Secy.-Treas.

Haddonfield Radio League

J. L. Barners, President; E. Braddock, Vice-President; J. T. Neath, Secretary; and T. O. Pierce, Treasurer.

Minersville Amateur Radio Assn.

H. A. Stokes, President; C. F. Connelly, Managing Secretary; W. C. Diehl, Publicity Director.

So. California Radio Assn.

H. Herringer, President; V. M. Bitts, Vice-President; C. Filstead, 2nd Vice-President; H. A. Duvall, Secretary; H. Fink, Treasurer.

Chelsea Radio Assn.

G. B. Latchford, President; J. Nason, Vice-President; N. Mazziotta, Treasurer; Secretary A. Rechart.

3rd District Radio Council

Convention plans are practically complete for the 3rd District Radio Convention which will be held in Baltimore, Friday and Saturday of the second week in April, 1923. The meeting place will be at the Belevedere Hotel. Information regarding the convention can be secured from H. A. Beale, Jr. (3ZO) Parkesburg, Pa.

The A.R.R.L. would like to see the entire gang at this convention, as it is expected it will be the biggest convention ever held in the 3rd district.

Hudson City Radio Club, Inc.

At a recent meeting Professor Myers, inventor of the Myers Tube delivered an interesting lecture on "Radio and Audio Frequency." A non-oscillating receiving set consisting of 4 steps of R.F., detector, and 3 step of A.F. was demonstrated, and on a 2 foot loop very good results were obtained. The code instruction has been started and members are being prepared for Government operators license.

St. Louis Radio Assn.

St. Louis Radio Association Plan for radio transmitters for the regulation of broadcast reception:

Monday, Wednesday, Friday and Saturday of each week all types of radio transmitters may operate from 6:00 A.M. to 7:00 P.M.

From 7:00 P.M. to 10:00 P.M. only straight C.W. and radio phones with good

modulation may operate. Spark and I.C.W. stations are not permitted to operate during this period.

From 10:00 P.M. to 6:00 A.M. all types of transmitters may operate under the regulations for radio traffic.

Tuesday, Thursday and Sunday of each week all types of radio transmitters may operate from 6:00 A.M. to 7:30 P.M.

From 7:30 P.M. to 11:30 P.M. absolute quiet will be observed. No transmitter of any type will be permitted to operate.

From 11:30 P.M. to 6:00 A.M. all types of transmitters may operate subject to the traffic regulations.

It is specifically stipulated that all amateur transmitters be on a legal wave and decrement as provided for in their U.S. Radio Licenses.

No amateur transmitter may operate at any time if he is tuned above his legal wave or decrement.

Poultney Executive Radio Council

The following schedule will hold in force unless arrangement is made by consent of its members until its use over a period of time proves unsuitable, and then it may be revised by a majority vote of the members.

- 6:00 A.M. to 11:55 A.M. free air
- 11:55 A.M. to 12:45 A.M. no traffic
- 12:45 P.M. to 7:45 P.M. free air
- 7:45 P.M. to 10:00 P.M. no traffic
- 10:00 P.M. to 6:00 A.M. DX transmission

Ithaca Radio Club

The following traffic schedule has been adopted by the Ithaca Radio Club:

- 7:00 A.M. to 11:55 A.M. working hours for all stations
- 11:55 A.M. to Noon quiet air
- 12:05 P.M. to 2:00 P.M. DX hours only
- 2:00 P.M. to 7:00 P.M. free air
- 8:00 P.M. to 10:10 P.M. quiet air
- 10:10 P.M. to 7:00 A.M. DX hours only

Southern Minnesota Radio Assn.

The Southern Minnesota Radio Association met in the Commercial Club Rooms at New Ulm, Minnesota. The following officers were elected: L. V. Berkner, President; J. Pfau, Vice-President; N. A. Canfield, Secy.-Treasurer.

The following traffic regulations were adopted:

- Noon to 1:00 P.M. DX C.W. traffic only
- 1:00 P.M. to 7:00 P.M. free air
- 7:00 P.M. to 10:00 P.M. quiet air
- 10:00 P.M. to 6:00 A.M. DX only
- 6:00 A.M. to Noon free air.

Kansas City Cleans Up

The radio club of greater Kansas City has just done an excellent piece of construction work. Under the guidance of

Mr. Robert R. Moore, the President of the club, and Mr. L. B. Laizure (9RR) and Mr. Sidney J. Blum (9FM), traffic men, the club collected evidence against three outlaw stations in Kansas City. This was done by personal visits to the station, by listening in at various other stations, and by conversations with the operators of the outlaw stations. Because of the excellent shape in which the evidence had been put, Mr. Beane, 9th district Radio Inspector was able to proceed at once against the stations. The outlaws in question were all using low power phones, which, while they caused no tremendous interference, were yet outside the law and were both bad precedent and bad manners. They were stations "BB," "EP," and "SPR," operated respectively by Dr. Bebe, Edwin Price, and the South Prospect Auto Repair Company. The other two appear to be closed for keeps, but the operator of EP was not at home during the inspector's visit so that the place cannot yet be regarded as definitely closed. We hope he sees the handwriting on the wall.

Fine work, Kansas City.



The above is the exhibit of the Houston Radio Club at the Houston Fair and Exposition, Nov. 9th to 19th. Among other things, a complete station with the call letters 5TY was installed and operated, using 100 watts of C.W. From left to right the members are: Lynch, Melton, Chinski, Quinby, Dupree, and Wright.

CLUBS wishing information on how to become affiliated with the American Radio Relay League can secure same by addressing a letter to the Traffic Manager, A.R. R.L., 1045 Main St., Hartford, Conn., who will be glad to furnish the necessary application blanks. There is no charge for affiliation. Every good radio club, society, or association is eligible for affiliation.

The Junior Operator

(A department formerly known as "With Our Radio Phone Listeners.")

What is DX?

In days gone by we used to think that a chap located in the central part of the country was lucky when he could hear amateurs on both coasts. Not so very long ago we thought it great to get a message across the continent and in January, 1921, with the co-operation of every amateur in the country, the A.R.R.L. put a message from Hartford to Los Angeles and received the answer back in Hartford in six and one-half minutes from the time the original message started. This was hailed as wonderful, not only because of the wonderful co-operation of the whole amateur world, but because of the few relays in handling the message over the then considered long jumps. This particular route was 1AW, Hartford, Conn.; 9ZN, Chicago, Ill.; 5ZA, Roswell, N. M.; and 6JD, Los Angeles, Calif. Then came the Transatlantic Tests and the excitement as to whether any American amateurs would be heard across the ocean, and lots of them were. Even handling a message across the country by amateur relays in daylight was impossible a short while ago. It is getting so that we are beginning to wonder what is the ultimate limit.

The advent of C.W. is of course responsible for most of this, as even the few remaining spark enthusiasts admit that C.W. reaches out on remarkably small input. Then, too, there are many more stations than in the old days and our knowledge of building and adjusting apparatus has improved. Our "Calls Heard" department was considered blessed not so very many months ago when it contained a few lists in which every district was heard. Now a list hardly gets printed unless it includes every district and amateurs in the central part of the country can hardly hear *far enough!* A few days ago a chap wrote us stating that his local paper featured someone as making a record by hearing 38 stations in one evening but that he (the writer) had heard 57 in one evening and notified us of this record. It so happened that a good "hammy" letter had drifted in the day previous from an amateur who casually said, "Rdo wx fb nw. Copied 124 stns last nite." We are inclined to think that around three hundred stations heard in one night would constitute a record, although we have not the slightest intention

of starting a competition to see who can hear the greatest number, as life is too short to try to *prove* the claims that would drift in to headquarters office.

But what we started to say was that whereas in the pre-war days a record consisted of being heard with a power of a "watt per mile," nowadays there are so many new and heretofore-thought-impossible stunts being pulled off that any record made is short-lived and we wonder what the end of this thing is really going to be.

—B.P.

Series-Parallel Switching

With a record of seven requests for the following in one week, we present two simple methods of switching a condenser from the position of being in series with the aerial to the shunt connection across the primary coil.

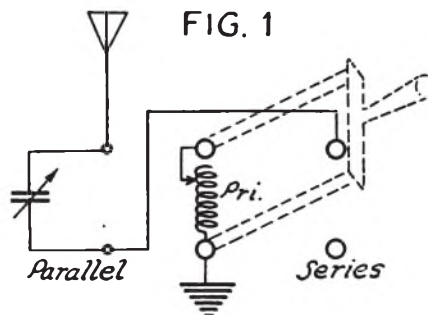
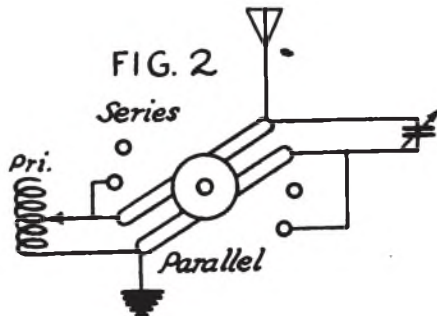


Fig. 1 shows the method of connection where a double-pole double-throw (D.P. D.T.) knife switch of the battery type is used. Exactly the same thing may be accomplished with a telephone key lever switch but it preferably should be of the "anti-capacity" type. In Fig. 2 the same circuit is adapted to the panel type switch having two blades insulated from one another and extending the same distance to either side of the knob. Of the three methods mentioned, the first is best if the apparatus is laid out on a board for experimental use, and the others are designed for panel mounting and work out nicely with the cabinet type receiving set. The inductance marked "Pri" in the accompanying sketches may be either the primary of a three-circuit tuner or the antenna coil of

a single-circuit tuner. In cases where it is desired to receive wave-lengths below the fundamental or free oscillating wave of the aerial plus the addition to the wave by reason of having added some inductance, the series connection should be used. A series condenser *reduces* the wave-length of the antenna circuit to a value lower than it would tune if it were not in the circuit.



The other position of the switch places the condenser across the primary coil, where the wave-length is *increased* above that obtainable without it. In cases where the receiving antenna is very short and it is desired to receive especially long waves, more than obtainable by adding all the inductance in the primary circuit of the tuner, the shunt connection is the one to use. With honeycomb coils such a switching arrangement is almost a necessity and with a receiver having only a rough variation of the antenna inductance (a single switch) it will enable much closer tuning to be effected.

Sending With the Receiver

It has been quite popular of late to handle local traffic during the early evening by simply using the receiver with the tube oscillating and a telegraph key in the ground. This gives a surprisingly sharp C.W. signal that carries all over town and should not cause the slightest interference with broadcast receiving next door. Using an amplifier tube and several score volts on the plate results in louder signals and greater distance. Beautiful "break-in" can be worked by two stations adjusting their receivers so they heterodyne each other.

One thing must be remembered, however. The radio law of the United States does not say one can transmit on any old wave length and without a license. Legal transmission is carried on with a license, using a licensed call, and operating on 200 meters or below. Getting up in the neighborhood of 400 meters and operating with initials for a call is not according to Hoyle. It may be true that such work will cause no one any direct harm, but little slacknesses of this kind damage our general morale.

We are today about as near to complete observance of the radio laws as any group in radio; let's keep right on occupying that position. We hope therefore that this little article will not have the same effect as was the case in the old story where a mother went down town and the last thing cautioned her children not to put beans in their ears, which was something they had never thought of before.

Radio Makes Flying Safer

A modern airplane is fairly safe as long as the pilot can see the ground but when this becomes obscure because of darkness or fog, the situation becomes a dangerous one. Location is unknown but the radio compass does much to eliminate this hazard. To know the altitude above the landing field, the flyer must depend on the altimeter under these conditions. An altimeter is nothing more nor less than an aneroid barometer with a scale in altitude, and like any other barometer it changes not only with altitude but with weather as well and gets these two things inextricably mixed. A change in weather may change its reading by an amount corresponding to a hundred feet or more in altitude—a serious error in a fog.

A new altimeter developed by the Bureau of Standards has the usual fixed scale and it has also a movable scale the zero of which can be set at any point on the fixed scale. In approaching the landing field the operator gets the barometer reading at the field by radio and sets the zero of his movable scale to that reading on the fixed scale. His altitude will then tell him accurately how high he is above the landing field and will enable him to get down safely in a fairly thick fog. When airplanes become more common it will not be necessary for pilots to have transmitters on the planes as the barometer readings will be broadcast regularly along with the weather and compass transmissions from the ground.

A. A. HEBERT

(Concluded from page 60)

vices to amateur radio for which we are indebted to him in no small measure. He is a charter member of the Institute of Radio Engineers, a member of the Board of Directors of the Radio Club of America, president of the Nutley (N. J.) Radio Club, and president of the Second District Executive Radio Council. The latter responsibility was acquired in the recent Council reorganization and Mr. Hebert now has the difficult task of guiding the destinies of one of the largest and most powerful bodies of amateur radio men.

But in spite of these responsibilities Mr. Hebert manages thoroly to enjoy his radio and says "There is nothing like it to keep a man young—it is superior even to golf."

Strays



QST has great pleasure in announcing the acquisition on its staff of Mr. S. Kruse, as Technical Editor. Mr. Kruse, or "LQ" as his personal sine goes, is so well known to most A.R.R.L. members that introduction is needless. Hailing from Lawrence, Kansas, real old-timers will remember him as pre-war 9LQ; newer friends know him as 3ABI of Washington, where he resided for several years as an assistant physicist in the radio laboratory of the Bureau of Standards. From there he joined the research staff of John Hays Hammond at Gloucester, Mass., and did field experimental work in Mexico and the Gulf during the past year. He is a member of the A.R.R.L. Board of Direction and of its Advisory Technical Committee, author of many papers in QST, and representative of the best in Amateur Radio. His connection on our staff is assurance of a better and more interesting QST.

Mr. J. Kenneth Bolles has also joined the A.R.R.L. headquarters personnel as Publicity Manager. Mr. Bolles is a journalist of many years experience and comes to us from the *Hartford Courant* where he has been doing special work. For some time past the League has been in need of a special department to take care of the dissemination of amateur news to the general public. Mr. Bolles arrives just at the beginning of the Transatlantic Tests and there is every indication that he will have to use a steam shovel to dish out the news as fast as it is created this month.

Station DN4 has been closed up indefinitely because of interference, we are told. It is alleged in one instance that 600 meter Naval traffic on the Pacific coast was held up for 45 minutes, not to mention interference with amateur communication.

The price of the government call book "Amateur Radio Stations of the U. S.," has been increased from fifteen cents to twenty-five cents per copy.

Ex-spark enthusiasts can easily use their old spark transformers for C.W. with some changes. For example, with the old Packard transformers so popular before the

war, two or three 1500-turn honeycomb coils can be slipped on in place of the old secondary and will deliver about 600 volts each, with excellent cooling and without changing the primary winding in any way. Or if this same transformer is desired for filament excitation, wind on 24 turns of No. 14 wire to supply two fifty watt tubes. This may be easily done by threading the wire thru the core without taking it apart. At 1HX a two ampere General Radio rheostat is used in the *primary*, which together with the primary taps, furnishes complete filament control from five to eighteen volts. With a transformer about which nothing is known as to primary turns, thread thru a couple dozen turns or so and measure the voltage on load. Divide this voltage by the number of turns to find the voltage per turn, which is the same for any coil put on the core, and by following Babcock's dope printed last month, any spark transformer can be renovated to make a perfectly good C.W. transformer.

Wud U Believe It?

1KX caught a squirrel trying to get into his cage.

8LX has a trained cricket that chirps "CQ".

8EW has a dorg that bawkes "Hi, Hi."

8BRL has a rooster who crows "Q" but we don't know why.

8LF has a phord that can rattle off the whole alphabet in a hundred feet or less, but the alphabet isn't the only thing it rattles off.

It appears that if canary birds could be taught to whistle the code they could be rented out to B.C.L.'s who want to become amateurs. Maybe a parrot would be a good auxiliary to interpret the code.

A sweet young thing called 8BRL on the phone and asked if he would help her with her station whose call letters were FADA. Needless to say he kindly consented and found a single slide tuner, a pair of mud hooks, and a crystal detector bearing the trade name "FADA." Herb is trying to figure out why a crystal detector rates call letters.

Read 'Em and Weep.

2AWL on four fifties has been heard in all states but four, England, France, Switzerland, and Honolulu.

6ZX, Walnut Grove, Calif., heard and complete msg copied at Apia, Samoa, DX 4,230 miles on four five watters.

8BEO on the same power has been reported from Hawaii, 6ZZ, 6IV, 6AMI, 6XAD, 7AGF and England.

9ZAF, Denver, Colo., (see description this month) has been reported in Apia, Samoa, which is about 1500 miles more distant than England.

6ACB and 8BEX have been heard across the continent on five watts, and 9BVP has been heard in 28 states on the same power.

6KA, 6XAD, 7ZO, 7ZU, 6ASJ, 6BES, 6ZM, and many others from the west coast are regularly heard up and down the Atlantic coast. Ditto 1XM, 8BFM, 8BK, 8BEO, 8BKE, etc., on the west coast. (See also the lists of 6ZAC and 6ZY in the *Calls Heard Department* this month.)

Dere Eddy: A fellow came in today and wanted to buy a 1 K.W. spark transmitter complete. After I came to, I went and got a shovel and dug it up from the dust. Then he asked me what distance he could expect from a test buzzer. Mygawdwatin-ellnext?—L. P.

Mr. E. C. Adams, our Advertising Mgr., is now the proud daddy of a fine little daughter. QST may never be out on time again! Subscribers who smoke may clip out the cigar coupon from page 152 and mail it to Ed Adams.

For our newcomers who are trying to learn the code but are hushed up when the buzzer starts for fear of waking the baby, it has been suggested that the crystal detector be carefully adjusted, one of the switches run off the contacts, and the key or omnigraph connected in the antenna lead of the receiver.

3XM and 3DH are back again, owned and operated by the Princeton University Radio Club, Princeton, N. J.

There is a statement often quoted around Chicago stockyards that in the modern abattoirs all of a pig is used but the squeal. Science has evidently progressed to the point where even this has been saved, and now seems to be supplied as an accompaniment to concerts.

9CA wishes fewer sets were installed in the nursery as judging by some sending the gang must sit on rocking horses.

8AOT needs shielded amplifying transformers as the mice have eaten the coils in several transformers. He swears it isn't a radio bug either.

Concerning Funny Routings

"J" of 3XM suggests that we start a department for bonehead plays in QST and razz the fellows that route msgs from Dallas to San Francisco, via Kansas City and Princeton, N. J. Honestly we would love to have the gang help us razz a few of the funny and stupid things that happen if it could be done in absolute good spirit and without malice.

But we wonder if the funny routings are really always as crazy as they seem. It may seem idiotic to a Chicago man when he is passed a message from Lawrence, Kansas, for delivery to St. Louis but the sober fact is that there is no better routing—it cannot be done direct. It surer than heck is that way in New England. Msgs to New York from Boston are sent in all sorts of wierd ways. And in the 3rd district it used to be the same way—the best possible method of getting traffic from Washington to Baltimore (40 miles) was to give it to 9ZN many miles west. In the days of spark Washington and Baltimore never hooked up direct but both were QSO 9ZN, 8BO, and 8ER quite regularly. Wonder if the same thing is not true in the Rockics. How about it? 6's, 7's, 5's and 9's now have the floor.

Wow! We spoke about the government getting short of calls and assigning half calls, but there seems to be a further shortage. 5AAR didn't like his call because when he signed off with 5AAR K everyone wondered if it was 5A or what so he went after a "Special" and—zowie—drew the call 5ZADA. He is afraid he will get a worse one if he tries again (5ZUKEM or 5ZCBXQ) so is making the best of it. If you hear him struggling thru this hypocroncial call, get the per and drop Zeigler a card.

Furthermore the call shortage is world wide. In Holland the government had none to give the amateurs so they manufactured their own using the prefix "O" (zero). But that is nothing, up in Canada calls are assigned starting with "10" (ten). 'Spouse we will be dished out negative calls next with a minus sign in front of the numeral.

According to a newspaper clipping, Texas amateurs use no aerials but simply hook onto a door knob. Upon further investigation "Rip" tells us that down Texas way they just put a crystal in their ear and stand near an open window and, say, the DX stuff comes in great!—Next.

Awrf!

The CQ formula for the Southern Minnesota Radio Assn. is, 3 (3CQ + 3 signs) + CQ + sign = CQ. Example: CQ CQ CQ de 9AWM 9AWM 9AWM three times and then CQ de 9AWM.—Q.E.D.

Calls Heard



HEARD DURING NOVEMBER Unless Otherwise Specified

Instructions to reporters:

(1) Typewrite or neatly print the calls "double spaced," on a separate sheet of paper, running them across the sheet, not down a column, and writing on but one side of an 8½" x 11" sheet.

(2) Arrange alphabetically thru each district, from 1 to 9, and then Canada, with no break between the districts, using commas to separate calls and parentheses around calls of stations also worked—as in examples below.

(3) The period covered by the report shall be so stated and shall be approximately from the first of one month to the first of the following month. All lists must be received by us the 8th of the following month for publication in the next QST.

(4) In order to distinguish between spark and C.W. stations, list spark stations from 1 to 9 in the usual manner and then make a second paragraph in identical form listing the C.W. stations. Commercial calls will not be published.

Now that everybody knows how to do it, let's have a better grade of lists with some real DX and fewer nearby calls. However, be absolutely sure of the calls you log and report.

H. A. Cookson, S. S. China. (1 step)

October 27th. In addition to those reported last month the following have been heard in Honolulu Harbor: 9YF7, 9GK, Canadian 9AL in Toronto, 9AWM, 8AWP in Syracuse, N. Y., and 8AQO, Cazenovia, N. Y., the 5100 miles distant, rolled in like a ton of bricks and every word sent was copied clear as a bell. Only calls more than 4500 miles distant reported in this list. [Hot dog! Wish every list had such DX—Ed.]

5XAD, 5QY, WEG, SS Trinidadian 100-150 miles S. S. W. Burwood, La.

Sunday Dec. 10, 1922—8:43 A.M.—4:15 P.M.: 5XV, 9BCF, 5DI, 5KC, 9KP?, 5YG, 9ANZ, 4IZ, 5MY, 5VY (calling 5JI by voice 10:42 A.M.), 1AJJ working 3FS, 9FM "Hv dalite schedule wi Hutchinson", 9AWM 3:50 P.M. "can't get them on fone, wI call them tonite", 3BVL, 2AVU, 3MB, 3BOF. Several other 6s and 9s hrd but not logged. Detector and 1step used. Sig.—Gray & Gray, Orange, Texas.

Harold T. Mapes, Guanajuato, Gto., Mex

(All over 600 miles away. Two tubes.)

C.W.: 4CG, 4HW, 5AAR, 5ACF, 5AFC, 5AFO, 5DA, 5EK, 5EN, 5IR, 5JB, 5KP, 5LA, 5MY, 5MO, 5NK, 5NO, 5PO, 5QY, 5SM, 5TC, 5TJ, 5UN, 5UJ, 5UK, 5VO, 5VA, 5XB, 5XA, 5XD, 5XAD, 5ZS, 5ZAV, 5ZB, 5JM, 6AH, 6APW, 6AKL, 6AGP, 6ALU, 6IV, 6BEQ, 6CC, 6EN, 6IV, 6NY, 6XWI, 6ZZ, 6ZF, 6ZH, 6ZA, 6ZO, 6ZB, 6HUM, 8ATU, 8AMM, 8XE, 8AR, 8FT, 8QK, 9AMI, 9ASF, 9AWN, 9AWM, 9AVL, 9AQR, 9AWS, 9ANQ, 9BJI, 9BED, 9BJU, 9BEY, 9BRK, 9BDS, 9BZI, 9BIK, 9CFY, 9CCU.

9CCV, 9DQM, 9DKY, 9FM, 9GK, 9PI, 9PN, 9XAQ, 9YAJ, 9ZAA.

Canadian 3JE, Toronto, Can.

C.W.: 1AW, 1BS, 1FW, 1GV, (1II), 1RD, 1XM, 1XU, 1ZE, 1ZX, 1AKG, (1AWB), 1AYQ, 1AZL, (1BDI), 1BET, 1BKQ, 1BWJ, (1BOM), 1BRQ, (1BYN), 1CAZ, 1CBY, 1CJH, (1CMK), 1CNF, (1CRQ), 1CXK, 2GR, 2KF, 2NZ, 2TS, 2UD, 2WB, 2XX, 2AFB, 2AGK, 2AHO, 2AJA, 2AJW, 2ASF, 2AWL, 2AYZ, (2AYV), 2BGI, (2BBB), 2BGM, 2BMS, 2BQE, 2BRB, 2CBV, 2CBW, 2CPW, 2CKN, 2CKR, 2CQZ, 2XAD, 3BA, 3BG, 3BX, 3BZ, 3CC, 3CG, (3CM), 3CP, 3FS, 3GF, 3HD, (3HGF), 3HL, 3IW, 3JJ, 3LP, 3LR, 3NH, 3OT, 3SM, (3QV), 3TJ, 3XM, 3YO, (3ZS), (3ZO), 3AFB, (3AHP), 3AJH, 3AJJ, 3ANJ, 3ANS, 3AQR, 3ASP, 3AUU, 3AVW, 3ATZ, 3AWE, 3BNU, (3BHM), (3BLF), 3BIJ, 3BVA, 3BUM, 3BVC, 3BUP, 3CGN, 4BK, 4BX, 4BY, 4EL, 4DA, 4DL, 4GH, 4GL, 4ID, 4JM, 4JY, 5DA, 5DO, 5DJ, 5EK, 5ER, 5FV, 5QV, 5XA, 5AAG, 5ZAV, 6BSA, 6KA, 6XAD, Eighta too numerous, the following worked: 8HH, 8HN, 8IQ, 9KG, 8LS, 8ON, 8QB, 8SB, 8VY, 8ZD, 8AFL, 8AGO, 8AII, 8AII, 8ASV, 8AUA (QRA?), 8AVD, 8AXN, 8AZF, 8BMY, 8CRC, 8CCS, 8CFP, 8CGU, 8CGV, 8CGK, 8CM, 8CKO, 8CPX, 8BF, 9CP, 9CR, 9EI, (9GK), 9II, 9LZ, 9MC, 9NU, 9OX, 9UC, 9UU, 9ZV, (9ZL), 9AAP, 9AFD, 9AFK, 9AHH, 9AII, 9AJP, 9AMI, 9AMK, 9ANQ, 9AQZ, 9AVA, (9ATN), (9AUL), 9AOG, 9AOJ, 9AON, 9APW, (9AOU), (9ACT), (9APS), 9AQM, 9AWL, 9AWM, 9AWS, (9BCT), (9BDS), 9BED, 9BES, 9BFG, 9BHD, 9BIE, (9BIK), 9BJT, 9BJV, 9BKJ, 9BLT, 9BLY, 9BWF, (9BQW), (9BVL), 9BXL, (9BZI), 9CEE, 9CUC, (9CTE), 9CK, (9CTR), (9DBL), 9DFB, (9DJM), (9DGE), 9DGG, 9DRB, (9DGN), 9DYN, 9DKY, 9IY, 9XAC, 9YAJ.

Daylight: 1BDI, 1AZI, 1ZE, 1ZX, 1CJH, 2BBB, 2BIS, 2CNF, 8KP, 8NB, 8UE, 8SB, 8UF, 8QC, (8KU), (8AII), (8AXN), (8AUA), 8ASV, 8BXX, 8BEO, 8BXA, 8CUU, 8CUR, (8CFP), 8CAN, 8XAC, 3IW, 9AYS.

Canadian 4DQ, Vulcan, Alberta, Canada.

C.W.: 1AZW, 1BDI, 1BNT, 1BWJ, 1CY, 1CDO, 1CNF, 1XM, 2AGC, 2AWL, 2AXK, 2BQU, 2CCD, 2CP, 2GK, 2LO, 2XQ, 2UD, 2WB, 2ZG, 3AFB, 3AGC, 3APD, 3BFU, 3BIJ, 3BNU, 3GK, 4BV, 4DK, 4EH, 4FG, 4FT, 4ID, 4TM, 5ACF, 5BN, 5EK, 5MO, 5NK, 5PX, 5RH, 5SK, 5TJ, 5VY, 5XT, 5ZA, 5ZS, 6ANX, 6ALU, (6AOL), 6ARB, 6ARF, 6ATQ, 6BCL, 6HJQ, 6BMD, 6HOE, 6BOQ, 6BQC, 6BUM, 6BVG, 6CC, 6DD, 6EC, 6GR, 6GX, 6IV, 6KU, 6LX, 6NX, 6TC, 6TI, 6UW, 6VM, 6ZH, 6ZI, 6ZU, 6ZZ, 7ABB, 7ABY, (7ADF), (7ADP), (7AEM), 7AFS, 7AFW, (7AGF), 7AIC, 7ALX, 7AW, (7BJ), 7BK, 7DC, (7DF), 7DU, 7EK, (7EQ), (7HM), (7KE), 7KG, (7LU), 7LY, 7MF, 7NN, 7NY, 7PF, (7QT), (7RI), 7RN, 7SC, 7SY, 7TH, 7TU, 7TW, (7TQ), 7WM, 7WW, 7WX, 7ZU, 7ZV, 8AZD, 8BEF, 8BFM, 8BTR, 8BYT, 8HWA, 8DAT, 9AAP, 9AC, 9ABB, 9AEN, 9AFD, 9AHH, 9AJP, 9AMB, 9AMI, 9AOP, 9APR, 9AOU, 9APW, 9ASE, 9ASF, 9ATN, 9AUA, 9AUL, 9AWM, 9AXU, 9AYS, 9BAV, 9BBF, 9BCF, 9BED, 9BEY, 9BFG, 9BJI, 9BJR, 9BJV, 9BGH, 9BIK, 9BKW, 9BLT, 9BRI, 9BSZ, 9BUD, 9BVL, 9BVO, 9BXA, 9BXT, 9BXQ, 9BZI, 9CBA, 9CEH, 9CFI, 9CCV, 9CFY, 9CGK, 9CHN, 9CMK, 9CXF, 9DKY, 9DPF, 9DQM, 9DTE, 9DYG, 9DZW, 9DGE, 9EBT, 9FM, 9HM, 9IG, 9NU, 9PW, 9QF, 9UH, 9YU, 9ZAF, 9ZN, fone 6ZA, 6ZX, 6XB, 7ZU, 9EBT, C.W. (BT3).

Canadians: 3BV, 4AQ, (4BR), (4BV), 4DK, 5CN, (5CT), 5BQ, fone 4BV.
Spark: 6ACR, 6AO, 6BIP, 6FH, 6QR, 7AFN, 7AW, 7KJ, 7LY, 7TW, 7UR, 7WG, 9AUA, 9AQE, 9CTW, 9FX, 9PN, 9XT, 9ZX, Canadian 4FW.

Canadian 5CX, Prince Rupert, B. C.

C.W.: 5IS, 5TJ, 5ZA, 5AEC, 6QR, 6QY, 6UW, 6VA, 6VM, 6VW, 6ZI, 6ZO, 6ZR, 6ZX, 6ZZ, 6ABX, 6AOI, 6ARB, 6AZF, 6BCG, 6BIQ, 6BUM, 6BNK, 6BVN, 6AM, 6BC, 6BJ, 6BK, 6BQ, 6EB, 6EP, 6FZ, 6JW, 6KE, 6LU, 6MF, 6NN, 6NY, 6OE, 6OT, 6PF, 6QE, 6QN, 6RI, 6SC, 6SG, 6TQ, 6UD, 6WM, 6ABB, 6ADE, 6AEK, 6AFS, 6AIC, 6BKM, 6AB, 6BK, 6VM, 6ZY, 6AZF, 6BIQ, 6BP, 6CP, 6DG, 6GK, 6II, 6VV, 6YI, 6ZT, 6AIX, 6AMI, 6ANQ, 6APW, 6ATN, 6AWL, 6AVZ, 6AWM, 6AWT, 6BFF, 6BCF, 6BEY, 6BIK, 6BJV, 6BQW, 6BZI, 6CCV, 6GSF.

Spark: 5CN, 7HD, 7KJ, 7TM.
Canadians: 4AB, 4BT, 5BQ, 5CK, 5CN, 5CT, 5DI, 5AC, (all C.W.)

1AW, Hartford, Conn. (All C.W.)

1ARY, 1BAS, (1BIY), (1BHW), (1CMK), 1BRQ, 1CFN, 1BRH, (1QP), (1BOM), (1BKQ), 1AHZ, 1AGK, 1CGO, 1PR, (1XMM), 1XP, 1BDI, 1XU, (1BGF), (1ZE), 1OK, (1ON), 1BWJ, (1BET), (1BWY), (1AJU), 1II, 1BEP, 1GV, 1ASF, 1FM, 1BZP, (1IL), 1BAG, 1RU, 1RD, 1BEA, 1MD, 1CCZ, 1BYN, 1CQZ, 1AZW, 2AAB, 2AGK, (2OM), 2XAP, 2KW, 2XQ, 2UD, 2BEA, 2LO, 2ZL, (2FP), 2BGM, (2BML), 2CKL, 2GK, 2AYV, 2CQZ, 2CCD, 2BUM, 2RZ, 2EL, 2CMG, 2ZK, 2APA, 2HJ, 2NZ, 2TO, 2AWF, (2AWL), 2BQD, 2AVO, 2AFP, (2BRB), 2BFX, 2CMS, 2RM, (2RY), 2ABD, 2CNZ, 2AXK, 2KF, 2CBW, 2BBB, 2AWS, (2WB), (2AJF) (3AUW), (3CN), (3ANJ), (3ZO), 3ARO, 3FS, (3BHM), 3ZW, 3BVC, (3JH), 3CG, 3BG, 3GR, (3JJ), 3AFB, 3QV, 3HX, 3BZ, 3LP, (3HW), 3CC, 3APD, 3APR, 3IW, 3BV, 3BIT, 3RF, 3BIY, (3BNU), 3GN, (3XM), 3BAR, 3AJD, 3WF, 3OT, 3BA, 3BLF, 3ATG, (3AGN), 3BJI, (3HG), 3BVA, 3BX, 3BQX, 4DL, 4YA, 4NT, 4IV, 4GH, 4BX, 4DL, 4ID, 4DC, 4EA, 4BY, 4KM, 4HW, (4LJ), 4IV, 5EK, 5XA, 5ZA, 5SK, 5XK, 5FV, 5ER, 5AA, 5GD, 5AAG, 5QY, 5EJ, 5XAD, 5ZAS, 5EA, 5ZAV, 5XAD, 6KA, 7ZO, 8ZV, 8XE, 8BNJ, 8YD, (8AWP), (8BO), 8CEI, 8CJH, 8QI, 8BCY, 8AXC, (8AQO), 8CGX, 8AWZ, 8ZZ, 8AMQ, 8IB, 8XHX, 8WR, 8QK, 8CFP, 8ASK, 8FM, (8NB), 8ASV, 8BXX, 8AM, 8FJ, (8ADG), (8ZY), 8CWP, 8AAB, 8EO, 8BJV, 8BPM, 8CJX, 8BVT, (8CSE), 8CNW, 8AFG, 8ZAE, 8BPH, 8CTP, 8BJC, 8DR, 8BAH, 8AIO, 8CBC, 8BUM, 8CGU, 8BZY, 8BJX, 8ML, 8ALC, 8AAF, 8SB, 8ZD, 8AKP, 8ACF, 8APT, 8SB, 8BZY, 8CEN, (8QM), (8CUR), (8BXX), 8CNW, 8SB, (8HH), 8ARB, 8AIM, 8PD, 8UK, 8XH, (8ATU), 8BEF, 8CF, 8QK, 8OW, 8BPL, 8BVR, 8IQ, 8ZX, 8CJY, 8BMM, 8BFH, 8LT, 8CYT, 8BRL, 8ZAF, 8AGO, 8VY, 8CTN, 8BU, 8JQ, (9ZN), 9ZAA, 9APS, 9CP, 9YAJ, 9DYN, 9IO, 9UU, 9BSL, 9CP, 9LZ, 9EI, 9PI, 9BED, 9UC, 9XM, 9AAP, 9GL, (9II), 9QR, (9AWM), 9BRK, 9GK, 9DWK, 9AKD, 9CGK, 9DKY, 9BDS, 9AMI, 9YAJ, 9PI, 9VK, 9BVL, 9DP, 9AYW, 9BCT, 9EBI, 9BCE, 9IY, 9AIX, 9DOZ, 9OX, 9CPY, 9CBA, 9FM, 9AFN, (9CTE), 9BRO, 9BCF, 9XL, 9CR. Canadians: 9AL, 9BH, 9BS, 9BP, 9PB, 9DH, (9DS), 9KO, 2BG, (2AM), 9AW, 9CO, 9CN, 9JK, 9CP, 9JE, 4BV.

1TS, Bristol, Conn. (1 tube, 44 states)

Spark: 8ABL, 8ACF, 8AD, 8AEO, 8AFG, 8AIB, 8AJT, 8AOI, 8APA, 8AWP, 8AWU, 8AXN, 8AXQ, 8AXZ, 8BAH, 8BCC, 8BDA, 8BEP, 8BFV, 8BGT, 8BM, 8BOV, 8BFG, 8BXC, 8BYP, 8CDI, 8CEB, 8CER, 8CKV, 8COA, 8CVH, 8CYU, 8EO, 8EU, 8EV, 8IN, 8JQ, 8KU, 8KY, 8LH, 8MZ, 8OI, 8PU, 8RQ, 8TC, 8TJ, 8UC, 8VQ, 8VW, 8YN, 8YU, 9AAW, 9AC, 9ACB, 9AFK, 9AIR, 9AIU, 9AMK, 9AMQ, 9AOJ, 9AVP, 9AZA, 9AZE, 9BRO, 9BQ, 9BTX, 9BWS, 9BXC, 9CA, 9CDZ, 9CP, 9CW, 9DAG, 9DHG, 9DHz, 9DPP, 9DPJ, 9DWA, 9DXH, 9DXT, 9JN, 9JX, 9KI, 9LF, 9MC, 9OF, 9ON, 9OR, 9PN, 9TV, 9VZ, 9XF, 9YAK, 9ZC, 9ZN, 9ZV. Canadians: 9BP, 9FO, 9GE, 9GN, 9RO.

C.W.: 4BK, 4BQ, 4BX, 4BY, 4CG, 4DC, 4DL, 4EA, 4EB, 4EH, 4EN, 4FG, 4FT, 4GH, 4GL, 4HW, 4ID, 4JK, 4JM, 4KC, 4KL, 4KM, 4NT, 4YA, 5ADE, 5AEC, 5DA, 5DI, 5EK, 5ER, 5ES, 5FV, 5GB, 5HK, 5HL, 5IK, 5IR, 5JB, 5MB, 5MO, 5MY, 5NN, 5PV, 5PX, 5QY, 5SK, 5SM, 5SU, 5TJ, 5UN, 5XA, 5XAD, 5XK, 5XR, 5XT, 5YV, 5ZA, 5ZAA, 5ZAS, 5ZAV, 5ZB, 5ZS, 5ZY, 6BBH, 6BCR, 6KA, 6XAD, 6XH, 6ZH, 6ZO, 6ZZ, 7NY, 7ZO, 7ZU, (voice), 7ZY, 9AAF, 9AAV, 9ACE, 9ACY, 9AEP, 9AEY, 9AFD, 9AFK, 9AFN, 9AFT, 9AHH, 9AIP, 9AIU, 9AIX, 9AIY, 9AJD,

9AJP, 9ALP, 9ALW, 9AMB, 9AMH, 9AMI, 9AMK, 9AMU, 9ANF (voice), 9ANI, 9ANQ, 9AOG, 9AON, 9AOT, 9AOU, 9AP, 9APN, 9APS, 9APW, 9AQM, 9AQZ, 9AR, 9ARU, 9ARZ, 9ASE, 9ASF, 9ATE, 9ATI, 9ATN, 9ATX, 9ATZ, 9AVZ, 9AWF, 9AWM, 9AWS, 9AWZ, 9AYS, 9BB, 9BBF, 9BCE, 9BCH, 9BCT, 9BDB, 9BDS, 9BED, 9BEY, 9BFQ, 9BGH, 9BIE, 9BIG, 9BIJ, 9BIK, 9BIL, 9BIZ, 9BJ, 9BJT, 9BJV, 9BLC, 9BLO, 9BLT, 9BOG, 9BP, 9BPS, 9BQW, 9BRK, 9BSP, 9BVF, 9BVZ, 9BWS, 9BXC, 9BXL, 9BYA, 9BZI, 9BZN, 9CAH, 9CBA, 9CCM, 9CDB, 9CEB, 9CEH, 9CFK, 9CGD, 9CGK, 9CGN, 9CIT, 9CIY, 9CJA, 9CJC, 9CLN, 9CNE, 9CNS, 9CTA, 9CTR, 9CP, 9CPY, 9CR, 9CTB, 9CTE, 9CVO, 9CXP, 9CZY, 9DBL, 9DCT, 9DDY, 9DFB, 9DGE, 9DGG, 9DHz, 9DJB, 9DJM, 9DKY, 9DMJ, 9DNH, 9DOK, 9DPF, 9DPJ, 9DQU, 9DR, 9DRR, 9DTE, 9DVN, 9DXT, 9DYN, 9DZY, 9EBH, 9ECI, 9ECP, 9EI, 9EJ, 9FM, 9FW, 9GK, 9GL, 9HM, 9IL, 9IL, 9IO, 9KP, 9LH, 9LQ, 9LZ, 9OF, 9OX, 9PF, 9PI, 9PQ, 9QU, 9SJ, 9UC, 9UF, 9US, 9UU, 9VK, 9VZ, 9WA, 9WX, 9XAC, 9XAK, 9XL, 9YAJ, 9YB, 9YF, 9YM, 9YW, 9ZAA, 9ZAF, 9ZL, 9ZN, 9ZT.

Canadian: 2AM, 2AN, 2AZ, 2BG, 2DN, 2EI, 2HG, 3ACJ, 3AQ, 3BV, 3CO, 3CZ, 3DE, 3DH, 3DS, 3EI, 3FC, 3GE, 3GK, 3JE, 3JH, 3JI, 3JK, 3KO, 3KP, 3NB, 3OE, 3PB, 3SI, 3SX, 3TA, 4BE, 4BV, 9AJ, 9AL, 9AW, 9BV, 9EI.

1CMK, Holyoke, Mass.

C.W.: 4BK, 4BQ, (4BX), (4CG), 4CO, 4CY, 4DL, 4DQ, (4EB), 4EH, (4FT), (4GE), 4GL, 4GZ, 4HI, (4HW), 4IV, 4JK, 4JL, 4JM, 4KK, 4LJ, 4MN, (4NT), 4BSB, 4YA, 5BN, 5DA, (5DI), 5DO, 5EG, (5EK), 5EL, 5ER, (5FV), 5HL, 5HY, 5IR, (5JB), 5KC, 5MO, 5MY, 5NB, 5NN, 5NV, 5PB, (5PX), 5QI, 5QY, 5SF, 5SK, 5SM, (5TC), (5TJ), (5UK), 5UO, 5VA, 5AAG, 5ADE, 5XA, 5XK, 5XT, 5XV, 5XY, 5ZA, 5ZB, 5XAD, 5XAE, 5ZAB, 5ZAP, 5ZAS, 5ZAV, 6CC, 6KA, 6PD, 6BBH, 6BSA, 6ZH, 6ZZ, 6XAD, 7SC, (7ZO), (8AA), (8BO), 8HH, (8HN), (8IJ), 8JQ, (8KU), 8LS, (8NB), (8OE), 8OM, 8ON, 8OW, 8QC, (8QK), (8SB), (8SP), 8SZ, (8UK), (8UR), (8VQ), (8VY), 8ABX, (8ACH), 8ADZ, 8AER, (8AFM), (8AGO), (8AHK), 8AHR, (8AII), (8AIW), 8ALF, (8AMM), 8AMR, (8ANE), (8ANN), (8APF), (8ASK), (8AWT), 8AWZ, (8AXC), 8AXX, (8AZD), 8AZF, 8BDO, (8BDV), 8BEP, 8BFR, 8BFX, (8BHO), (8BJV), (8BK), (8BMK), (8BMM), (8BNI), (8BNT), 8BOA, 8BOW, (8BPN), 8BRC, 8BRM, 8BSY, (8BTL), 8BTR, 8BUT, 8BVR, 8BVT, (8BWA), (8BWK), (8BYF), 8CBC, (8CBX), 8CCR, 8CEI, 8CGM, 8CGN, (8CGQ), (8CGU), 8CIA, 8CIM, (8CIK), (8CJH), 8CJS, 8CKN, (8CKO), (8CRM), 8CMTY, 8CNW, 8COI, 8CPX, 8CQO, 8CQY, 8CRB, (8CTP), (8CUM), (8CUR), (8CUS), (8CUU), (8CYT), 8CYV, 8CZC, 8CZZ, 8DAA, (8DAE), 8DAT, (8XE), 8YN, 8YU, (8ZZ), 8XAU, 9AP, 9AR, 9BP, 9CG, 9CP, 9CR, 9DV, (9EI), 9EJ, 9GF, 9GK, 9GL, 9HM, (9II), 9IY, 9KM, (9LE), 9LH, 9LQ, 9LZ, 9OX, 9PF, 9PI, 9PN, 9PS, (9PW), (9QF), 9UG, (9US), (9UU), 9VK, (9VZ), 9WC, 9WX, 9AAG, (9AAP), (9AAV), 9AAW, 9ABU, 9ACE, 9AFD, 9AFK, 9AHH, 9AIP, (9AIU), (9AIX), (9AIY), 9AJF, 9AJP, 9AKD, 9AKU, 9AMH, 9AMI, 9AMO, 9AMT, 9AMU, 9ANF, 9ANQ, 9AOG, (9AON), 9AOT, (9AOU), (9APS), (9APW), 9APZ, 9AQM, (9AQZ), 9ARG, 9ARK, (9ARZ), (9ASE), (9ASN), 9ATN, 9ATZ, (9AUA), (9AUL), 9AVM, (9AVZ), (9AWM), (9AWS), (9AXA), (9AXU), (9AYH), (9AYS), 9RAH, 9RAK, 9BCH, 9BCT, (9BDS), (9BED), (9BFG), 9BHD, 9BIA, (9BIE), (9BIJ), (9BIK), 9BIL, 9BII, 9BJR, 9BJT, 9BJV, (9BKJ), (9BLC), (9BLG), 9BLT, 9BLY, 9BNO, 9BQY, 9BRK, 9BRL, 9BRO, (9BTA), 9BVL, (9BVP), (9BWF), 9BWS, 9BZI, (9BZN), 9CAH, (9CBA), 9CBS, 9CCM, 9CCS, 9CCV, 9CEE, 9CEH, 9CFK, (9CGK), 9CGN, (9CHN), (9CIP), (9CIY), 9CJA, 9CJC, 9CLZ, 9CMK, 9CNF, (9CNS), 9CNV, 9CPY, 9CQM, (9CTE), (9CTR), 9CUC, 9CVI, (9CVO), 9CWO, 9CXP, 9CXV, (9DBL), 9DBV, 9DCF, (9DCT), 9DDY, (9DFB), 9DGE, (9DGG), (9DJB), (9DJO), (9DKY), 9DNH, 9DOF, 9DPL, 9DQU, 9DSL, 9DSM, 9DSW, (9DSX), (9DUG), 9DYN, (9DVW), 9DWM, 9DWQ, 9DWW, 9DXN, 9DXT, 9DYN, 9DYY, 9EBH, 9EBI, 9ECE, 9XL, 9YB, 9YM, (9YU), (9ZL), 9ZN, 9XAC, 9XAK, (9YAJ), 9ZAA, 9ZAF.

Spark: (9HO), (9XT), (9ZN).

2CAD, Bayonne, N. J.

C.W.: 1AW, 1CK, 1CY, 1GV, 1HK, 1MA, 1MV, 1ON, 1PM, 1QP, 1RD, 1XU, 1XX, 1XZ, 1ZW, 1ACD, 1ADP, 1ARY, 1ASF, 1AUB, 1AUN, 1AZW, 1BAS, 1BDI, 1BES, 1BGI, 1BHO, 1BJN, 1BQI, 1BRQ, 1BSZ, 1CAC, 1CJA, 1CIK, 2XI, 2AWF, 2CHG, 2AB, 2BG, 2BV, 2BX, 2BZ, 2CO, 2GK, 2JJ, 2OE, 2RF, 2SU, 2SZ, 2ZZ, 2ACQ, 2ADP, 2APR, 2AUU, 2AVA, 2BHL, 2BLF, 2BNG, 2BNU, 2BSB, 2BVA, 2BVC, 2BX, 2BY, 2CG, 2FT, 2JD, 2JK, 2JY, 2KK, 2KM, 2NT, 2DA, 2DI, 2EG, 2EK, 2ER, 2FV, 2HH, 2SM, 2TJ, 2XA, 2XK, 2ZA, 2ZB, 2AAAG, 2ADE, 2AFO, 2ZAS, 2TU, 2ZZ, 2XAD, 2XU, 2AX, 2CF, 2FQ, 2FT, 2HH, 2IQ, 2KG, 2KM, 2MZ, 2NB, 2NV, 2OE, 2OW, 2RJ, 2SB, 2SP, 2SZ, 2TX, 2UF, 2UZ, 2VE, 2VY, 2XJ, 2YD, 2YN, 2YM, 2ZD, 2ZY, 2ZZ, 2ACF, 2ACH, 2AFD, 2AFF, 2AGO, 2AIO, 2AIW, 2AJP, 2ALC, 2AME, 2AMM, 2ANB, 2ANY, 2APV, 2AQO, 2ASL, 2ASV, 2ATU, 2AUE, 2AVJ, 2AWX, 2AWZ, 2AXB, 2AXC, 2AXR, 2AZD, 2AZF, 2BDU, 2BEF, 2BEK, 2BEO, 2BFR, 2BFX, 2BGJ, 2BJS, 2BKE, 2BLC, 2BMK, 2BMM, 2BNU, 2BOR, 2BRC, 2BRF, 2BRL, 2BSE, 2BTU, 2BTX, 2BUC, 2BUM, 2BVR, 2BVT, 2BWA, 2BXH, 2BXT, 2BYN, 2CAZ, 2CCU, 2CEL, 2CEP, 2CEV, 2CFP, 2CJX, 2CIX, 2CKM, 2CKO, 2CLK, 2CMI, 2CRB, 2CTL, 2CTN, 2CUC, 2CUD, 2CVE, 2CXT, 2CYU, 2DAE, 2DAT, 2AA, 2AP, 2BP, 2CR, 2DR, 2EI, 2EP, 2FM, 2GL, 2II, 2IO, 2KM, 2LQ, 2OF, 2OX, 2QB, 2QF, 2UC, 2UH, 2UU, 2XU fone, 2ZN, 2AAP, 2AEN, 2AFT, 2AHH, 2AIX, 2AIY, 2AMI, 2AMT, 2AOU, 2ARZ, 2ASD, 2ASE, 2AVP, 2AWF, 2AWM, 2BDS, 2BED, 2BFG, 2BHD, 2BIE, 2BIK, 2BRK, 2BTT, 2BVN, 2BVP, 2BZI, 2CAN, 2CBA, 2CCV, 2CFI, 2CJA, 2CLN, 2CTE, 2CXP, 2CVE, 2DBV, 2DCU, 2DFE, 2DGE, 2DJM, 2DKY, 2DOJ, 2DQU, 2DVN, 2DVK, 2DWM, 2DWW, 2DXN, 2DZW, 2XAC. Canadians: 2DH, 2XN, 2KO.

Spark: 1CNI, 2ACY, 2AIC, 2BEI, 2TJ, 2BDA, 2BFG, 2CP, 2AVP, 2AAW, Can. 2BP.
Daylight C.W.: 1XM, 1AGH, 1AJF, 1AUD, 1AYQ, 1AZL, 1BKA fone, 1BFT, 1BOM, 1BWJ, 1CMK, 2CC, 2CG, 2HK, 2OT, 2QV, 2XM, 2YO, 2ZO, 2ACC, 2AFB, 2AJJ, 2BEC, 2BHH, 2BIJ, 2BTK, 2HJ, 2VQ, 2XE, 2AMQ, 2AXN, 2BEP, 2BFM, 2CUR, 2CP, 2AUA.

2PK, New York City (One WD11)

1AW, 1CV, 1DV, 1GL, 1IL, 1JT, 1PR, 1SD, 1SQ, 1XU, 1XZ, 1YK, 1ACH, 1ADP, 1AFP, 1AIL, 1AJU, 1AOK, 1APE, 1AUN, 1AWE, 1AWF, 1AWW, 1AYZ, 1AZL, 1AZW, 1BDI, 1BEA, 1BEF, 1BES, 1BKA, 1BKQ, 1BLN, 1BOM, 1BQI, 1BRQ, 1BWJ, 1CAC, 1CDO, 1CIK, 1CJA, 1CJH, 1CMK, 1CPN, 1CIV, 1AB, 1AK, 1BA, 1BV, 1BG, 1BX, 1BZ, 1CG, 1FS, 1GO, 1GK, 1HG, 1IW, 1MB, 1MK, 1OE, 1OK, 1OT, 1QV, 1RW, 1SU, 1VV, 1WF, 1WS, 1XM, 1YO, 1ZO, 2AAY, 2AAO, 2ACQ, 2ACY, 2AFB, 2AFM, 2AFW, 2AGD, 2APR, 2ATG, 2ATM, 2ATV, 2AUW, 2AVA, 2AVC, 2BEI, 2BFU, 2BFQ, 2BHM, 2BIF, 2BIJ, 2BLF, 2BMJ, 2BNU, 2BVA, 2CAO, 2CAQ, 2CBN, 2CDG, 2BY, 2BX, 2EB, 2EH, 2FT, 2KM, 2NT, 2YA, 2DO, 2EG, 2EK, 2ER, 2FV, 2KC, 2MO, 2SG, 2SM, 2XD, 2YK, 2AAAB, 2AAAG, 2ZAS, 2KA, 2ZO, 2ZZ, 2ZO, 2AB, 2BK, 2CC, 2CK, 2FQ, 2GT, 2HH, 2IB, 2KG, 2KH, 2OR, 2OW, 2PT, 2QC, 2QK, 2RJ, 2SB, 2SF, 2UH, 2UK, 2XE, 2XU, 2YM, 2YU, 2ZC, 2ZD, 2ZN, 2ZV, 2ZY, 2ZZ, 2AAC, 2AAD, 2AAF, 2ABX, 2ACH, 2ADG, 2ADP, 2AER, 2AFD, 2AFE, 2AFG, 2AGO, 2AGV, 2AHR, 2AIG, 2AIO, 2ALU, 2ANB, 2AMP, 2AMQ, 2APT, 2APY, 2AQO, 2ARD, 2ASV, 2ATU, 2ATX, 2AUE, 2AVD, 2AVK, 2AWP, 2AWR, 2AWT, 2AZF, 2AXR, 2AZD, 2AZT, 2BDA, 2BDV, 2BEF, 2BFN, 2BGJ, 2BGL, 2BJC, 2BJX, 2BLF, 2BNU, 2BNY, 2BPL, 2BRN, 2BRQ, 2BTR, 2BUZ, 2BVT, 2BXH, 2BYF, 2BZH, 2CDZ, 2CGM, 2CKO, 2CLK, 2CMI, 2CNN, 2CPD, 2CRB, 2CUD, 2CUN, 2CUI, 2DAA, 2DAT, 2AP, 2BG, 2BP, 2CA, 2EI, 2FM, 2GK, 2II, 2IO, 2JN, 2LE, 2LZ, 2OX, 2PI, 2UC, 2WC, 2YB, 2YM, 2ZL, 2ZY, 2AAF, 2AAP, 2AFD, 2AFK, 2AFN, 2AHI, 2AIP, 2AIX, 2AIY, 2AJP, 2AKU, 2ALW, 2AMI, 2AMT, 2AMU, 2ANQ, 2AOM, 2AOT, 2AQF, 2AQM, 2ARG, 2ARZ, 2ASF, 2AUL, 2AWM, 2AWS, 2AXU, 2AZA, 2BA, 2BDS, 2BET, 2BEH, 2BHD, 2BIE, 2BIK, 2BJV, 2BKY, 2BLT, 2BRM, 2BNG, 2BNO, 2BPS, 2BRK, 2BTH, 2BUE, 2BZI, 2CAO, 2CBA, 2CCM, 2CCN, 2CJC, 2CRD, 2CTE, 2CTR, 2CUR, 2CVO, 2CVR, 2DBL, 2DDW, 2DFB, 2DGE, 2DKY, 2DNH, 2DRR, 2DTH, 2DVN, 2DWM, 2ECR, 2YAJ, 2ZAC. Canadians:

2AM, 2BV, 2DH, 2GK, 2NB, 2NS, 2XN, 2AJ, 2AL.

3AIH, Audubon, N. J. (One Tube)

Spark: 4FB, 4FD, 4GN, 5XA, 5AAB, 9CP, 9JN, 9LF, 9OF, 9TV, 9VZ, 9YJ, 9ZN, 9AAW, 9AIB, 9AMK, 9AQE, 9ARG, 9AVP, 9AWT, 9AZA, 9AZE, 9AZF, 9BOO, 9CZL, 9DHG, 9DHz, 9DMJ, 9DXT, Can. 2BP.

C.W.: 4BB, 4BX, 4BY, 4CC, 4DC, 4DL, 4DQ, 4EA, 4EB, 4EH, 4EL, 4EU, 4FG, 4FJ, 4FT, 4GH, 4GL, 4HZ, 4JK, 4JM, 4KC, 4KL, 4KM, 4NT, 4OB, 4DA, 4DN, 4DO, 4EG, 4EK, 4ES, 4FV, 4IK, 4IR, 4JL, 4KP, 4MA, 4MO, 4NV, 4PX, 4QV, 4SM, 4TC, 4UE, 4WE, 4XA, 4XB, 4ZB, 4ZS, 4AAB, 4ABH, 4ADE, 4AEC, 4AWS, 4XAD, 4ZAS, 4ZAV, 4KA, 4XAD, 7AD, 7ZO, 7ZU, 9BP, 9CP, 9CR, 9DZ, 9EI, 9EP, 9FM, 9GK, 9GL, 9HM, 9HW, 9II, 9IO, 9LE, 9LF, 9LZ, 9NU, 9OX, 9PF, 9PI, 9PQ, 9QF, 9S, 9UC, 9UF, 9US, 9UU, 9VZ, 9WC, 9WX, 9YW, 9YM, 9ZN, 9ZY, 9AAP, 9ABB, 9ABM, 9AIX, 9AIY, 9AJP, 9AJU, 9AKG, 9ALP, 9ALW, 9AMB, 9AMH, 9AMI, 9ANQ, 9AOG, 9AOU, 9APO, 9APS, 9APW, 9AQA, 9AQM, 9AQZ, 9ARG, 9ARR, 9ARZ, 9ASD, 9ASE, 9ASF, 9ASN, 9ATN, 9AVZ, 9AWF, 9AWM, 9AXA, 9AXU, 9AZP, 9AZW, 9BAA, 9BAK, 9BBB, 9BCF, 9BDR, 9BDS, 9BED, 9BFG, 9BHD, 9BIE, 9BIK, 9BIL, 9BIZ, 9BII, 9BJT, 9BKH, 9BKJ, 9BPS, 9BRE, 9BRK, 9BRS, 9BSZ, 9BTA, 9BVP, 9BWA, 9BYA, 9BZI, 9BZN, 9CBA, 9CCV, 9CEB, 9CEE, 9CFI, 9CGK, 9CGN, 9CIN, 9CKM, 9CTE, 9CTF, 9CVI, 9CVO, 9CXP, 9CZ, 9CYM, 9DBV, 9DCR, 9DCW, 9DFB, 9DGE, 9DGN, 9DQG, 9DJB, 9DJF, 9DJM, 9DKY, 9DNH, 9DPJ, 9DQU, 9DVN, 9DVW, 9DZY, 9DVK, 9DWM, 9DWO, 9DXN, 9DYW, 9DZW, 9DZY, 9ECR, 9XAG, 9ZAA. Canadians: 2HG, 2BV, 2CO, 2DE, 2DH, 2DS, 2EI, 2JT, 2XN, 2YH, 2AC, 2BJ, 2BV.

3CDG, 142 N. 50 Street, Philadelphia, Pa.

C.W.: 1FD, 1GV, 1LL, 1IT, 1QP, 1RD, 1WZ, 1XM, 1XP, 1XU, 1YK, 1ZE, 1AHZ, 1AOK, 1AWB, 1AWW, 1AWZ, 1BDA, 1BDC, 1BDU, 1BJN, 1BWJ, 1BNT, 1BOM, 1BKA, 1BKQ, 1BWJ, 1CBJ, 1CCZ, 1CDO, 1CGO, 1CJA, 1CNE, 1CNI, 1CSM, 1CWP, 5DA, 5DL, 5EK, 5ER, 5FE, 5SA, 5TC, 5ZA, 5AAM, 5ADE, 6KA, 6OR, 6ARD, 6BKA, 6XAD, 7LU, 7NY, 7AEA, 8BO, 8BT, 8EO, 8GV, 8HH, 8HJ, 8IB, 8JO, 8OW, 8PU, 8PT, 8QK, 8SB, 8SP, 8VY, 8XE, 8ZA, 8ZZ, 8ACQ, 8AGO, 8AIM, 8ALT, 8ANB, 8AQO, 8ASV, 8ASY, 8AWZ, 8BBE, 8BDV, 8BCE, 8BCK, 8BCY, 8BGF, 8BJX, 8BXH, 8BZ, 8BZZ, 8CBC, 8CEI, 8CEK, 8CGM, 8CGO, 8CGP, 8CGU, 8CLK, 8CMI, 8CUK, 8CWR, 8CYO, 9EI, 9HJ, 9II, 9PF, 9PW, 9TM, 9UA, 9UU, 9XL, 9AAP, 9AAQ, 9AAX, 9AEK, 9AFK, 9AHH, 9AIX, 9AIY, 9AMA, 9AWM, 9ANG, 9ANU, 9APS, 9ARK, 9AWF, 9AXY, 9BCF, 9BED, 9BEO, 9BHW, 9BIZ, 9BJR, 9BMK, 9BRK, 9CAH, 9CBA, 9CCM, 9COI, 9CXP, 9DDJ, 9DDY, 9DMM.

4KT, Carolina, Porto Rico

All O.W.: 1AZW, 1BET, 1BGF, 1BRQ, 1CDO, 1CMK, 1CNF, 1CRQ, 1CY, 1II, 1XZ, 2AAO, 2ABD, 2AFP, 2AJW, 2AYV, 2BLF, 2BJO, 2BRB, 2BRC, 2CBW, 2CCA, 2CCD, 2CFB, 2CQZ, 2EL, 2UE, 2WB, 2ZK, 2ZL, 2AAY, 2ANJ, 2AQR, 2BA, 2BFU, 2BLJ, 2BG, 2BLF, 2BZ, 2CG, 2DH, 2JJ, 2OT, 2XA, 2XN, 2ZO, 2BC, 2BX, 2BY, 2DL, 2EA, 2EB, 2EL, 2FT, 2ID, 2JZ, 2CK, 2DA, 2KB, 2MO, 2QM, 2TJ, 2XAD, 2ZAP, 2ZAV, 2ZB, 2AD, 2AFD, 2ASV, 2ATC, 2BUT, 2CUR, 2HJ, 2K, 2MM, 2QK, 2UF, 2XE, 2ANB, 2APW, 2AUL, 2AXB, 2BDS, 2BED, 2BIK, 2BP, 2BXH, 2CFI, 2CJA, 2CKO, 2DEF, 2DVK, 2LQ, 2LY, 2PF, 2PI, 2XAC, 2ZN, 2ZT. Pse write if interested.

4OI, San Juan, P. R.

Spark: 4BC, 8BDA.
C.W.: 1CY, 1GV, 1HK, 1ZE, 1AZW, 1BAS, 1BDI, 1BET, 1BKA, 1BRQ, 1BWJ, 1CIK, 1CNF, 1CXX, 2FF, 2GI, 2HJ, 2LO, 2UD, 2AGC, 2AHO, 2AJW, 2ATB, 2AVU, 2AYV, 2AZC, 2BJO, 2CBW, 2CCD, 2CKI, 2CPD, 2CQZ, 2AS, 2BG, 2BZ, 2DI, 2OT, 2AQR, 2BHM, 2BIJ, 2BLF, 2BX, 2BY, 2DL, 2EA, 2EN, (4FT), 4GL, 4JM, 4OB, 4YA, 5FV, 5IK, 5PX, 5SF, 5TJ, 5ZB, 5ZS, 5AEC, 6KA, 6XAD, (no sevens), 8AB, 8AM, 8BK, 8FQ, 8FT, 8GK, 8IR, 8OW, 8VE, 8VQ, 8XE, 8ZZ, 8ACU, 8AFD, 8AIM, 8AMM, 8AQO, 8ASV, 8ATU, 8AXB, 8AXC, 8BFM, 8CUR, 8DXN, 8XAE, 9AA, 9AL, 9AW,

9CP, 9EI, 9EJ, 9II, 9LQ, 9PN, 9PS, 9ZN, 9AAP, 9AFK, 9AHH, 9AMI, 9AOU, 9AQN, 9AUL, 9BDS, 9BEY, 9BTT, 9BZI, 9DFB, 9DKY, 9DQU, 9DWQ, 9DYN, 9ZEI.

4MY, 4 East 13th Street, Atlanta, Ga. All Spark: 1B0Q, 1CJA, 1CNI, 2FP, 2GV, 2NS, (2OM), 2WB, 2AJE, 2JK, 2OT, 2SU, 2ZM, 2ACV, 2AHK, 2A0V, 2ARN, 2AWP, 2BVC, 2CCB, 2FB, 2FD, 2GN, 2SK, 2EL, 2AE, 2AL, 2AO, 2AQ, 2BE, 2DA, 2DG, 2DO, 2EK, 2FP, 2FV, 2GD, (2GK), 2IO, 2IR, 2IS, 2JB, (2JF), 2JI, 2JL, 2KM, 2LB, 2MD, 2MX, 2NC, 2OI, 2OW, 2OZ, 2PE, 2PP, 2QQ, 2QS, 2QY, 2RO, 2RZ, 2ST, 2TL, 2TP, (2TU), 2UC, 2UD, 2UE, 2UK, (2XA), 2XV, (2YG), (2ZA), 2ZC, 2ZL, 2ZR, 2AAB, 2AAR, (2ACQ), 2AEC, (2XAC), (2ZAW), 2KA, 2XAD, 2BB, 2OT, 2AJ, 2AR, 2CO, 2CS, 2EO, 2EV, 2EW, 2JG, 2JX, 2KJ, 2MZ, 2RQ, 2RR, 2SB, 2TV, 2UC, 2VQ, 2VW, 2YU, 2ZE, 2ABL, 2AEO, 2AFG, 2AHV, 2AIB, 2AIT, 2ANB, 2ARS, 2AVI, 2AWU, 2AXN, 2AYM, 2AZQ, 2AZW, 2BAH, (2BBU), 2BVD, (2BEP), 2BGT, 2BVV, (2BXC), 2CAH, 2CGV, 2CKV, 2CKX, 2COA, 2CYD, 2DWA, 2AU, 2BP, (2CA), 2CP, 2CY, 2DX, 2EX, 2GF, (2HO), 2HT, 2HZ, 2IV, 2KY, 2LF, 2MC, 2OF, 2ON, 2OR, 2PD, 2PE, 2RR, 2TV, 2UH, 2UU, 2UZ, 2VZ, 2YG, 2YM, 2ZN, 2AAR, 2AAW, 2ABM, 2ABV, 2ACB, 2AEG, 2AFK, 2AFW, 2AHO, 2AHZ, 2AIP, 2AIR, 2AIF, 2AJB, 2ALK, 2AMK, 2AMX, 2AOA, 2AOJ, 2AOT, 2APS, (2AQE), 2ARG, 2ARZ, 2ASG, 2ASJ, 2ASE, 2ATX, 2AVH, 2AVP, 2AWP, 2AZA, 2AZE, 2AZF, 2BAB, 2BAH, 2BCX, 2BED, 2BEF, 2BEP, 2BEY, 2BIK, 2BKK, 2BLG, 2BME, 2BMN, 2BOO, 2BPV, 2BRT, 2BRW, 2BVO, 2BWS, 2BSN, (2BXC), 2BXE, 2CBU, 2CTW, 2CZL, 2DAJ, 2DAK, 2DAP, 2DAY, 2DBK, 2DCY, 2DCP, 2DCW, 2DDZ, 2DFE, 2DFZ, (2DGV), 2DHE, (2DHz), 2DKQ, 2DMJ, (2DNC), 2DQX, 2DRM, (2DSD), 2DSM, 2DUA, 2DWA, (2DWW), 2DXE, (2DXK), 2DXV, 2DZY, 2XAC, 2YAK, 2ZAF.

SBD & STI, Arlington, Texas. (All districts on 1 tube) C.W.: 1BWJ, 1CNF, 1BNL, 2APP, 2BWJ, 2BJO, 2CCD, 2WB, 2WR, 2ZK, 2ARC, 2BLF, 2BZ, 2SU, 2TJ, 2YO, 2BK, 2CY, 2DL, 2EB, 2EH, 2EL, 2FT, 2IV, 2JF, 2TA, 2XD, 2ABH, 2AEF, 2DO, 2GM, 2GN, 2IK, 2JB, 2NK, 2QT, 2RR, 2SZ, 2TJ, 2VO, 2XV, 2BBH, 2CC, 2XWI, (2XAD?), 2ZO, 2ZZ, 2PF, 2ZQ, 2RA?, 2ZO, 2AEA, 2AGO, 2AHE, 2AHR, 2AMB, 2ANB, 2AIX, 2AIO, 2AJH, 2AJY, 2ASV, 2ATC, 2AWS, 2AXB, 2AXC, 2AZB, 2AZH, 2BGJ, 2BHO, 2BK, 2BO, 2BRM, 2BJV, 2BYE, 2BZD, 2CAB, 2CGM, 2CGX, 2CIA, 2CKO, 2CF, 2CVE, 2DAK, 2ER, 2EP, 2FG, 2FV, 2GF, 2HF, 2HH, 2IF, 2MP, 2PT, 2QK, 2SB, 2TT, 2WU, 2XAK, 2ZN, 2ZW, 2ZY, 2AHE, 2ASE, 2AMU, 2APW, 2BIE, 2BWS, 2CCM, 2CDA, 2COW, 2CWC, 2DDY, 2DKW, 2DYG, 2INF, 2JC, 2OT, 2OX, 2YAD, Canadians 2BV, 2DH, 2TY.

SZAV, Oklahoma City, Okla. (Every Dist. Worked) C.W.: 1BDI, 1CY, (1II), 2BMR, (2BQD), 2FP, 2GK, 2QV, 2OM, (2AAY), 2APE, 2APW, 2BGO, 2BLF, (2BVA), 2HD, (2HG), 2CC, 2KF, 2OT, 2XM, 2BR, 2BY, 2CG, 2EB, 2EI, 2EH, 2FT, 2GH, 2JK, 2JM, (2KC), 2KF, 2YA, (2JB), (2MY), (2PO), (2XV), (2ZA), 2ATQ, 2BCR, 2BSA, (2BVG), 2CC, 2EA, 2EB, (2IF), 2JD, 2KA, (2TC), 2KAD, 2ZH, 2ZI, 2ZZ, (2ABB), 2JW, 2ZO, 2ACF, 2ADY, 2AER, 2AAF, 2AGC, 2AFD, (2AIT), 2AII, (2ALC), 2ALT, 2APT, 2AQO, 2AKC, 2ASD, (2ASV), 2AWP, (2AWZ), 2AXB, 2AXC, (2AZD), 2AZF, 2BDV, (2BCH), 2BDB, (2BEO), (2BEP), 2BEK, 2BFM, 2BOI, 2BTL, 2BSC, 2BTR, 2BTV, (2BVR), 2BVT, 2BSY, 2BWL, 2BYF, 2BWK, 2BPL, (2CAB), 2CGX, 2CKM, (2CMI), (2CYB), 2CYT, 2CUR, 2DAE, 2DEY, 2AB, 2AD, 2BO, 2BF, 2BK, 2CF, 2CI, 2CQ, 2CY, (2FT), (2FQ), 2HT, 2HH, (2IQ), (2ID), 2IB, 2JU, 2KG, (2NE), 2OI, (2QK), 2SE, 2SP, (2UZ), 2VY, 2WV, 2XE, 2YU, (2ZAF), 2ZW, 2ZY, 2ZZ, (2AQZ), (2BJV), (2BEO), (2BSZ), (2BZI), (2BFG), (2BDS), (2BVY), (2CVO), (2DJB), (2BP), (2ECI), (2CR), (2UD), (2YU), 2ZN, Canadians (2BV), 2CO, (2DH), 2DR.

SDI, 2200 Aris Ave., Fort Worth, Texas C.W.: 1AW, (1II), 1XM, 1XU, 1XZ, 1XX, 1AAW, 1BA, 1BWJ, (1CMK), (1CNF), 1CX, 2BV,

2CC, 2EL, 2GR, 2NZ, 2OS, 2QV, 2UD, 2WR, 2ZK, 2APP, 2ASO, 2BQD, 2CBW, 2CCD, 2CKR, 2CMA, 2CQZ, 2BZ, 2CA, 2HG, 2HL, 2JT, (2OT), 2QV, 2FZ, 2SD, 2XM, 2YO, 2ZW, 2AAY, 2APR, 2ATZ, 2AUW, 2BEF, 2BGT, (2BHM), 2BIP, 2BLF 2BVA, 2BZA, 2BX, 2BY, 2CG, 2CO, (2EB), 2EH, 2ES, 2FG, 2GL, 2GS, 2HW, 2ID, 2JZ, (2KC), 2NT, 2UR, 2YA, (2EK), (2EL), 2FV, 2IS, (2JB), (2PV), (2TA), 2TJ, 2UO, 2VY, 2XK, 2XU, 2XV, (2AEC), 2ANO, 2AE, 2CC, 2FT, 2GR, 2GL, (2JD), 2LJ, 2IU, 2ZH, 2ZX, 2AAG, 2AJH, 2ALG, 2ANF, 2AVD, 2AWP, (2AWT), 2BAW, 2BCR, 2BMD, 2BOE, 2BQC, 2BQZ, 2BSA, 2BUG, 2BVC, 2XAD, 2ZAC, 2GW, 2ZO, 2ZU, 2AA, 2AE, 2BK, 2BO, 2CF, 2HJ, 2IB, 2IX, 2ML, 2QK, 2RO, (2VY), 2XC, 2YD, 2YU, (2ZY), 2ZX, 2AED, 2AGZ, (2AIM), (2ALC), (2AME), 2ANB, 2AQO, 2AXC, 2AXD, (2AZD), 2AZF, 2BDV, (2BJK), 2BKE, 2BNZ, 2BTL, (2BVR), (2BWA), 2BXA, 2BXX, 2BYF, (2BYN), 2BZY, 2CFX, 2CGX, 2CJD, 2CKM, (2CKO), 2CPD, 2CUR, 2CUU, 2CYT, 2ZAG, 2EL, 2GR, 2II, (2YU), 2ZL, 2ACB, 2AGZ, 2AGR, 2ALY, 2ANW, (2AOG), (2AON), 2APS, (2APW), (2AQM), (2ARJ), 2ASE, (2ASN), 2ATE, (2ATZ), (2AWM), (2AYS), 2BHD, 2BIE, (2BIK), (2BVY), 2BZZ, 2CBA, (2CCV), 2CES, 2CFC, 2CFG, 2CGK, (2CGL), 2CIY, 2CKP, (2CLZ), 2CMA, 2CTR, 2CVO, (2DBV), (2DDY), (2DEF), 2DKY, 2DTA, 2DYN, (2ZAA), Canadians: (2BY), 2DH, 2GK, 2BK, (2BV), 2AI.

5ADL, 601 Asia St., Baton Rouge, La. (1 tube) (Every District) C.W.: 1ALW, 1CMK, 1CYJ, 1XU, 2AWL, 2BNZ, 2BSL, 2CCD, 2EL, 2NZ, 2UD, 2WB, 2ZK, 2ZL, 2AFB, 2AQR, 2BHL, 2BIJ, 2BIY, 2BLF, 2BZ, 2CU, 2HG, 2JJ, 2OT, 2TJ, 2ZW, 2BB, 2BK, 2BQ, 2BX, 2BY, 2BZ, 2CG, 2CY, 2DC, 2DL, 2DQ, 2EA, 2EB, 2EH, 2EL, 2FG, 2FS, 2FT, 2GE, 2GH, 2HX, 2IZ, 2JK, 2JY, 2KK, 2KN, 2LJ, 2NT, 2SK, 2XK, 2YA, 2AAG, 2AAM, 2AAT, 2ABY, 2ACF, 2ADE, 2AEC, 2AEG, 2BQ, 2DA, 2DE, 2DN, 2EG, 2EK, 2EN, 2FT, 2FV, 2HL, 2IA, 2IK, 2IM, 2IR, 2IS, 2IX, 2JB, 2JL, 2JM, 2KC, 2LB, 2LO, 2MA, 2MB, 2MC, 2MO, 2MX, 2NB, 2NK, 2NN, 2NV, 2PF, 2PO, 2PV, 2QM, 2SF, 2SR, 2SS, 2TC, 2TJ, 2TM, 2TY, 2UJ, 2UO, 2VM, 2VO, 2WE, 2XA, 2XAD, 2XB, 2XK, 2XV, 2ZA, 2ZAG, 2ZAS, 2ZAT, 2ZB, 2ZH, 2ZO, 2ZS, 2ZU, 2ABX, 2AEH, 2AWT, 2ZZ, 2LY, Can. 2BV, 2CO, 2DH, 2XN. Phones: 2AAT, 2XAJ, 2XB, 2ZS, 2CGS, 2DYN. Spark: 2BI, 2DF, 2FB, 2GN, 2ACQ, 2AWS QRA?, 2BW, 2CJ, 2FP, 2GQ, 2HU, 2JE, 2MD, 2MO, 2NC, 2QS, 2RA, 2RO, 2SM, 2TF, 2TU, 2UE, 2WG, 2XA, 2XAB, 2XAC, 2YG, 2ZAE.

6ZY, Thos. A. Marshall, Waikiki Beach Honolulu. 1BKA, 2AFB, 2BGM, 2FW, 2FZ, 2GO, 2AWL, 2LO, 2AUU, 2CO, 2DH, 2KM, 2FG, 2ID, 2GH, 2BY, 2AG, 2AEG, 2DI, 2EK, 2EO, 2GV, 2KC, 2NK, 2PX, 2PB, 2SF, 2SK, 2SM, 2TC, 2UO, 2ZAU, 2AK, 2ALU, 2AVR, 2ATC, 2ADA, 2AQU, 2AWT, 2AKT, 2ARF, 2ABX, 2AHQ, 2ASJ, 2ARB, 2AAT, 2AVD, 2BUN, 2BCR, 2BJY, 2BAC, 2BU, 2BIQ, 2BQL, 2BQC, 2CP, 2CC, 2CU, 2CN, 2EN, 2EA, 2EC, 2EB, 2EK, 2GF, 2GX, 2IK, 2IV, 2JD, 2KA, 2PI, 2QY, 2TC, 2TW, 2TI, 2ZG, 2SC, 2BK, 2HM, 2BJ, 2UU, 2ZO, 2LR, 2ANB, 2AQO, 2AIO, 2ANJ, 2AMD, 2AWM, 2BO, 2BPM, 2BXA, 2BEF, 2BXH, 2BEO, 2CAZ, 2CGP, 2CMI, 2CF, 2CBD, 2ML, 2ND, 2OW, 2PD, 2XAE, 2YD, 2AUL, 2AMB, 2AWM, 2AXU, 2AOG, 2AWS, 2AVZ, Can. 2AW, 2AWL, 2AM, 2AUX, 2BRQ, 2BB, 2BRG, 2CP, 2AG, 2CCV, 2CFY, 2CIF, 2DPA, 2DTC, 2DSM, 2DKY, 2DTM, 2DPA, 2GK, 2LZ, 2UU, 2WU, 2YAJ, 2ZN, 2ZAF.

6BIP, Winnemucca, Nev. C.W.: 1BCG, 1BCK, 2AYU, 2BGM, 2BJO, 2BMR, 2BRB, 2BUM, 2CCD, 2CPD, 2EL, 2LO, 2NZ, 2XG, 2AAY, 2AFB, 2BZ, 2CC, 2CO, 2DS, 2LR, 2YO, 2ZN, 2BY, 2BY, 2FG, 2GL, 2JY, 2TV, 2AAK, 2CQ, 2CY, 2DI, 2DO, 2EK, 2EO, 2EX, 2FV, 2KC, 2NK, 2NV, 2UO, 2UJ, 2ZA, 2A and 7's too numerous to mention, 2AK, 2AGO, 2AIM, 2AMM, 2AMQ, 2ANB, 2APT, 2APY, 2AQO, 2AXB, 2BDO, 2BEF, 2BIP, 2BK, 2BPL, 2CA, 2CF, 2CGP, 2CNW, 2IB, 2OU, 2PD, 2XE, 2XL, 2ZAE, 2ZZ, 2ABN, 2AEP, 2AFK, 2AIU, 2AL, 2AMI, 2ARZ,

9ASH, 9ATQ, 9AUA, 9AUL, 9AUM, 9AVZ, 9AWM, 9AXQ, 9AXU, 9BBF, 9BCF, 9BED, 9BHG, 9BIK, 9BKJ, 9BLO, 9BVO, 9BRI, 9BRK, 9BRN, 9BTE, 9BTT, 9BUD, 9BXT, 9CBA, 9CBB, 9CCS, 9CCV, 9CFY, 9CIE, 9CIP, 9CK, 9CMK, 9CPY, 9DCU, 9DKY, 9DSM, 9DSW, 9DTM, 9DYN, 9DZY, 9GK, 9GP, 9II, 9KP, 9MX, 9OX, 9PI, 9PS, 9NU, 9GF, 9SUU, 9XL, 9YAJ, 9ZAA, 9ZN, 9ZX.

6ZAC, Walluku, T. H.
 C.W.: 1BCG, 1XM, 2AWL, 2AGC, 2FP, 2GK, 2GR, 2BFX, 2NZ, 2XAP, 3ZW, 4EH, Canadian 4BV, 5DI, 5EK, 5KC, 5SF, 5TJ, 5QY, 5PX, 5XD, 5XV, 5ZA, (6AK), 6AJH, 6ASJ, 6AVR, (6AWT), 6ADA, 6ATG, 6BCQ, (6BCR), (6BSA), 6BQG, 6BJU, 6BDW, 6BVQ, (6CC), 6CU, (6EA), (6EN), 6EB, 6GF, (6GR), 6GX, 6KA, 6NX, 6PI, (6TC), (6TI), (6TQ), 6WI, (6XJ), 6XAD, 6ZB, (6ZG), 6ZH, (6ZL), (6ZI), (6ZX), (6ZY), 6ZAF, 6ZAL, 6XAW, 7BB, 7BK, 7BJ, 7ADP, 7GK, 7RN, (7SC), 7SY, 7ZU, 7ZV, 8AMM, 8APY, 8AWP, 8AZD, 8BEF, 8CF, 8CUR, 8BKE, 8CUZ, 8IB, 8NB, 8UK, 8XE, 8ZY, 8XH, 9AW, (9AWM), 9AUL, 9ARZ, 9AXM, 9AMI, 9AWT, 9AQE, 9AYS, 9AMB, 9AVZ, 9APW, 9APS, 9AOG, 9BJI, 9BBF, 9BEY, 9BCH, 9BRI, 9BDS, 9CNS, 9CCV, 9CFY, 9CGK, 9DGJ, 9DYN, 9DSP, 9DSM, 9DTM, 9DFB, 9GK, 9PI, 9YAJ, 9YW, 9ZN, 9ZAF, 9ZX.
 Spark: (6AQU), (6EX), 6OH.

6KA, Los Angeles, Calif.
 1AQW, 1XZ, 2XY, 3ABD, 3BHM, 3BLF, 3XW, 3ZO, 4FJ, 4GH, 4XC, 4YA, 5AEC, (5DI), 5EK, 5FV, (5KC), 5NK, 5OD, 5QY, 5SK, 5TJ, 5UJ, 5XAD, 5XD, 5ZA, 5ZAI, 5ZADA, 5ZH, 5CN, (6ZAC), 7BJ, 7CZ, 7FD, 7JW, (7LU), 7FF, 7SC, 7TQ, 7WM, 7YG, 7ZB, 7ZO, 7ZU, 8AB, 8ALC, (8AQO), 8ASV, 8ATU, 8AWX, 8AXB, (8AXC), (8AZD), 8AZF, (8BEF), (8BFM), 8BK, 8BKE, 8BPL, 8BRC, 8BSS, 8BUM, 8BVR, (8BXH), 8BX, (8CAZ), 8CF, 8CGM, 8CGX, 8ID, 8JU, 8KC, 8KG, 8QK, 8SB, 8UE, (8XE), (8YD), 8ZAF, 8ZD, 8ZW, 8ZX, (8ZY), 8ZW, 9AA, 9AAP, 9AIY, 9AJF, (9AMB), 9AMI, 9ANQ, (9ANS), 9AOG, 9AON, 9AOR, 9AOU, 9APS, 9APW, 9AQM, 9ASF, 9AUL, 9AVZ, 9AW, (9AWM), (9AXU), 9AYH, 9AYS, 9BAC, (9BED), 9BEY, 9BHD, 9BIK, (9BJI), 9BLO, 9BM, 9BTI, (9BUN), 9BXA, 9BXQ, 9BZI, 9BZN, 9CCV, 9CFY, 9CGP, 9CMK, 9CNS, 9DFB, 9DKY, 9DP, 9DPM, 9DR, 9DSM, 9DTM, 9FM, (9GK), (9II), 9IK, 9PI, (9PS), (9UU), 9XAC, 9XAI, (9XAQ), 9XAY, 9YAJ, 9YAT, 9YI, 9YU, 9ZAA, (9ZAF), (9ZN), AD-7 Canadian (9AC), 9AL, 3CO, (4BV).

6XAD, Catalina Island, Calif.
 C.W.: (2EL), (3BLF), (3BFM), (3BHM), (5IK), (5DA), (5XAD), (5EK), (5BXI), (8ALC), (8ZY), (8ASL), (8BEO), (8AWP), (8AQO), (8ZY), (8AXC), (8CQX), (8CKO), (8AOL), (8ASV), (8NB), (8ADT), (8YD), (8CK), (8BKE), (8BUM), (8CAZ), (8CGX), (8BXH), (8LT), (8ALT), (8AM), (8BVR), (8AZF), (8CKM), (8BDV), (8ALT), (8VY), (8BSS), (8AME), (8XE), (8BF), (8ZY), (8BSS), (8AXI), (8ZY), (8ASL), (8CKM), (8CKO), (9BED), (9YAJ), (9DR), (9ZN), (9AWM), (9DFB), (9ECR), (9ARZ), (9CTR), (9BFG), (9BIE), (9BDS), (9DFB), (9EI), (9DKY), (9CTR), (9CNS), (9BZI), (9BIK), (9DFB), (9BZI), (9APS).

7GE, 110 So. 7th St., Pasco, Wash.
 (Every district on 20 ft. wire and one step)
 C.W.: 1X?? (Funny fist), 2ZS, 3DH, 3HG, 3OT, 3SU, 3YO, 4JM, 5NR, 5TJ, (6AK), 6AV, 6CU, 6EN, 6GF, 6GR, 6GX, 6GY, 6KA, 6KU, 6NX, 6PI, 6RM, 6TC, 6TI, 6VM, 6XJ, (6ZF), 6ZH, (6ZF), 6ZH, (6ZX) 6ZZ, 6AAT voice and CW, 6ABX, 6AHQ, 6AIX, 6AIY, 6AME, 6AWN, 6AOI, 6AQW, 6ABR, 6ASJ, 6ATC, 6ATG, 6AUI, 6AVE, 6AVR, 6AWT, 6BAZ, 6BBC, 6BCJ, 6BCL, 6BCO, 6BES, 6BIN, (6BIP), 6BJQ, 6BJR, 6BPZ, 6BQ, 6BRF, 6BUM, 6BUN, 6BVQ, 7's too numerous, 8XE, 8XJ, 8ZM, 8ZY, 8ZP, 8AAF, 8AQO, 8AZB, 8BTV, 8BXH, 8CCP, 8DTA, 9DY, 9GK, 9II, 9KP, 9PN, 9PS, 9VE, 9XU, 9YW, 9ZN, 9ZY, 9ZX, 9AHH, 9AIY, 9AJF, 9AMB, 9AMI, 9ANI, 9ANG, 9AOU, 9APW, 9AQR, 9ARZ, 9ASF, 9ASN, 9ATN, 9AUL, 9AVZ, 9AWM, 9AYS, 9BBF, 9BCF, 9BCH, 9BCV, 9BDS, 9BED,

9BHD, 9BIK, 9BJI, 9BJV, 9BLT, 9RI, 9BVY, 9CCV, 9CEH, 9CHN, 9CFY, 9CMK, 9CNS, 9COW, 9CKP, 9DEL, 9DGE, 9DKY, 9DSM, 9DTE, 9DTM, 9DYG, 9DYN, 9EBS, 9XAA, 9ZZA, 9ZAF, Canadian 4BV voice and C.W.

Spark: 6AO, 6EW, 6GR, (6LU), (6QR), 6RK, (6TU), 6VX, (6ABK), (6ABW), (6AKT), (6AMK) (6AMW), (6AMZ), 6AOS, (7BH), (7HD), (7IA), (7KJ), 7LY, (7OF), (7OJ), (7QH), (7RO), (7VE), (7VF), (7ZE), (7ZU), 9AUI, Canadians: 8EC 9AX.

7JF, Moscow, Idaho.
 4DK, 5AK, 5CN, 5KC, 5TC, 6AJT, 6AWT, 6BQC, 6FF, 6KOF, 6XAD, 6ZK, 6ZF, 6ZO, 6ZNC, 7AF, 7ACQ, 7AEK, 7BK, 7CU, 7QT, 7PF, 7WF, 7WG, 7LU, 7LY, 7YL, 7ZK, 7ZU, 8BSS, 8TT, 9ARA, 9AWM, 9BJ, 9BR, 9BED, 9BDS, 9BQC, 9CF, 9CN, 9CNS, 9CG, 9CLQ, 9DKY, 9DTM, 9KC, 9QA, 9XAD, 9ZII, 9ZN.

7AFH, Monroe, Wash. (1 tube)
 C.W.: 1BDI, 2AWL, 5AA, 5DI, 5EK, 5FV, 5HB, 5JL, 5KC, 5KP, 5NK, 5PX, 6QI, 5SK, 5XT, 5ZA, 5ZAV, 6AAG, 6AAT, 6AAV, 6AAK, 6ABX, 6ACF, 6AHD, 6AHQ, 6AII, 6AJF, 6AJH, 6AK, 6ALU, 6ALV, 6ALX, 6AOI, 6APW, 6AQJ, 6AQW, 6ARB, 6ASJ, 6ATC, 6ATQ, 6AUI, 6AVR, 6AW, 6AWE, 6AWT, 6BCD, 6BCJ, 6BCL, 6BCR, 6BEG, 6BEJ, 6BCI, 6BIN, 6BIQ, 6BJC, 6BJQ, 6BJR, 6BK, 6BMD, 6BNT, 6BOE, 6BOO, 6BPZ, 6BQC, 6BQD, 6BQF, 6BQG, 6BQZ, 6BRG, 6BSA, 6BTD, 6BUD, 6BUM, 6BUN, 6BVQ, 6BZB, 6CC, 6CN, 6CP, 6CU, 6EC, 6EN, 6FH, 6FT, 6GR, 6GX, 6GY, 6, 6JD, 6KI, 6KU, 6LV, 6NX, 6PI, 6QM, 6RD, 6RM, 6TC, 6TI, 6UW, 6VF, 6VM, 6XAD, 6XH, 6XJ, 6XAS, 6ZF, 6ZH, 6ZO, 6ZS, 6ZX, 6ZZ, 8AB, 8AFD, 8APY, 8ASU, 8ASV, 8AXB, 8AZD, 8BDU, 8BEF, 8BK, 8BNJ, 8BUM, 8BXH, 8BXR, 8BYT, 8CFZ, 8CGX, 8CIA, 8CM, 8CMI, 8CMK, 8CSR, 8CUR, 8DAK, 8GF, 8IB, 8KG, 8OW, 8QK, 8VK, 8XJ, 8YD, 8ZAG, 8ZY, 8ZZ, 9AAI, 9AAU, 9ABU, 9AFK, 9AHH, 9AIY, 9AJH, 9AJF, 9AMB, 9AMI, 9ANI, 9ANQ, 9AOU, 9APS, 9APW, 9ARZ, 9ASU, 9ASV, 9ATN, 9AUL, 9AWM, 9AXU, 9BAZ, 9BBF, 9BDS, 9BED, 9BEY, 9BHD, 9BHK, 9BIK, 9BJI, 9BJV, 9BSZ, 9BUD, 9BXA, 9BXQ, 9BZI, 9CCV, 9CKM, 9CMK, 9CNS, 9CR, 9CNS, 9CFP, 9DBV, 9DDJ, 9DDY, 9DG, 9DGE, 9DGL, 9DIM, 9DJM, 9DKY, 9DR, 9DSM, 9DVK, 9DYN, 9EJ, 9GK, 9HM, 9II, 9KP, 9PI, 9PN, 9PS, 9RK, 9UP, 9UU, 9UX, 9XAC, 9XAJ, 9YAJ, 9ZAA, 9ZAF, 9ZX., Canadians: 3CO, 3DH, 3NB, 3XN, 4BV, 4DQ, 5BQ, 5CN, 5CT, 5DO, 9AC, 9AW, 9AL, 9BG.
 Spark: 6ACR, 6ALA, 6AMK, 6AMW, 6AO, 6ARK, 6AWH, 6BIP, 6BTB, 6CC, 6GR, 6IC, 6KM, 6QR, 6TC, 7AD, 7BK, 7FR, 7GE, 7GO, 7HD, (7IM), 7JF, 7NE, 7NW, 7OT, 7OW, 7TQ, 7TW, 7VE, 7VF, 7VO, 7YH, 7YL, 7YR, 7ZK, 7ZU, BQS, 9ZC, Can. 5DX, 9BD.

BT3, Cpl. R. E. Jenkins, Camp Lewis, Wash.
 Spark: Canadians, 3EC, 3KO, Americans, 5TU, (7GE), (7TW), (7VF), 9DAG.
 C.W.: Americans, 5DX, 5EK, 5ER, 5ES, 5EO, 5NK, 5PX, 5SK, 5TO, 5XD, 5XT, 5XAD, 5ZA, (6AJF), (6AWT), (6BCR), (6CC), (6LO), (6LV), (6EA), 6XAC, (6XAD), (6ZX), (7AEM), (7AIM), (7BJ), (7LU), (7MF), (7OT), (7QT), (7SC), (7SY), (7NY), (7TN), (7TH), (7TQ), (7ZB), (7ZO), 8AN, 8AX, 8ASV, 8DAG, 8QK, 8SB, 8TDZ, 8UK, 8WR, 8XB, 8XE, 8ZY, 8ZZ, 9AEZ, 9AIN, 9AJP, 9AMB, 9AMI, 9ANQ, 9APW, 9APZ, 9ARZ, 9AUL, 9AVZ, 9AWM, 9BCF, 9BDS, 9BHD, 9BJI, 9BJV, 9BRI, 9BSP, 9BXA, 9CCM, 9CCV, 9CNS, 9DCR, 9DGE, 9DKY, 9DOZ, 9DSM, 9EI, 9EBT, 9GK, 9HM, 9II, 9KJ, 9LZ, 9PI, 9PS, 9UU, 9UCU, 9XM, 9XAQ, 9YF, 9YG, 9ZAA, 9ZAF, Canadians: 4BV, 4IQ, 4GR, (5BQ), 5CN, (5CT), (9AC).

8KW, Buffalo, N. Y.
 (Every District on 1 tube)
 1BKA, (fone), 2BRB, 3BNU, 4BX, 4DY, 4EA, 4FT, 4GL, 4KC, 4KT, 4LJ, 5AAG, 5DA, 5EK, 5ER, 5ES, 5FV, 5JD, 5MD, (5PK), 5NV, 5PV, 5SA, 5SM, 5TJ, 5VA, 5XA, 5XT, 5XK, 5ZA, 5ZAS, 5ZX, 6ACR, 6AVD, 6XAD, 7ZO, 9ZN, Can. (3P).

8CEM, Beaver Falls, Pa.

(One tube. All Districts)
Spark: 1AHZ, 1CJA, 1CNS, 1RV, 2OM, 3CN, 3IS, 5MD, 5WE, 5XA, 5XAC, 5XB, 5XY, 9AAW, 9ABM, 9ABV, 9ACB, 9ACN, 9AFW, 9AIY, 9AMK, 9AMQ, 9AQJ, 9ARG, 9ASJ, 9AU, 9AVP, 9AWT, 9AZA, 9BAH, 9BHR, 9BMN, 9CBU, 9CP, 9CTN, 9DAY, 9DCW, 9DHG, 9DHz, 9DMJ, 9DPB, 9DXT, 9EJ, 9HJ, 9HT, 9JN, 9NQ, 9OF, 9ON, 9OR, Canadian 3GE, 3GN.

C.W.: 1AJN, 1AJU, 1AWE, 1BDI, 1BES, 1BET, 1BGF, 1BKA (fone), 1BMS, 1RQI, 1BWJ, 1CN, 1CY, 1CDO, 1CDR, 1CJH, 1CKU, 1CMK, 1GV, 1HK, 1IV, 1LL, 1QP, 1XM, 1XU, 1XZ, 1ZE, 2AGC, 2AHO, 2AVC, 2AVR, 2AWF, 2AWL, 2AYV, 2BGI, 2BJO, 2BLP, 2BMS, 2BNZ, 2BQB, 2BQH, 2BSC, 2CBT, 2CCD, 2CFE, 2CGS, 2CKR, 2CMV, 2FP, 2FW, 2HG, 2KE, 2KF, 2QV, 2UD, 2WB, 2XB, 2XF, 3ABW, 3ACQ, 3AUU, 3AWJ, 3BFU, 3BG, 3BLF, 3BNU, 3BVA, 3CDG, 3CM, 3FS, 3HX, 3JJ, 3OE, 3OT, 3PQ, 3TJ, 3XA, 3ZO, 4BB, 4BX, 4BY, 4CG, 4DL, 4EA, 4FG, 4FT, 4JK, 4KC, 4KM, 4YA, 5AAM, 5ADE, 5DI, 5EG, 5EK, 5ER, 5ES, 5FV, 5HA, 5JH, 5MO, 5NV, 5PV, 5QM, 5SK, 5TJ, 5XAD, 5XK, 5XT, 5ZA, 5ZAS, 5ZAW, 5ZAV, 6CC, 6KA, 6AJH, 6AVD, 6XAD, 6XAV, 6ZF, 6ZO, 6ZZ, 7ZO, 9AAB, 9AAP, 9AFN, 9AHH, 9AIK, 9AIX, 9AJP, 9ALR, 9AMI, 9ANF, 9ANM, 9ANS, 9AOG, 9AOU, 9APS, 9AQJ, 9AQM, 9ARR, 9ARZ, 9ASF, 9AUL, 9AVM, 9AWF, 9AWM, 9AWS, 9AXU, 9BAA, 9BRF, 9BDS, 9BED, 9BLG, 9BIE, 9BIK, 9BIL, 9BIZ, 9BJK, 9BJT, 9BJY, 9BLG, 9BIT, 9BOG, 9BP, 9BRK, 9BRS, 9BSA, 9BVP, 9BYA, 9BZI, 9CAO, 9CCS, 9CCM, 9CEB, 9CGD, 9CGL, 9CIY, 9CJI, 9CNS, 9CR, 9CTE, 9CTR, 9CXP, 9DQ, 9DJM, 9DKY, 9DQU, 9DVN, 9DXN, 9DYN, 9DZW, 9EGR, 9EL, 9EP, 9FM, 9FP, 9GA, 9HM, 9IG, 9II, 9IO, 9JG, 9IE, 9LH, 9LQ, 9MF, 9NU, 9OX, 9PI, 9PN, 9PQ, 9PW, 9QF, 9SJ, 9UC, 9US, 9VZ, 9XAC, 9XAQ, 9XO, 9ZAA, 9ZN, 9ZT, 9ZY, Canadian 3BP, 3CO, 3JH, 3NB, 3XN.

8EV, Vandersgrift, Pa.

Spark: 1AKG, 1AMD, 1AR, 1AZK, 1BJS, 1BOM, 1ROQ, 1CC, 1CJA, 1CM, 1CN, 1FM, 1IRV, 1YK, 2ACY, 2ACW, 2AJE, 2AKY, 2AX, 2BOI, 2BY, 2CJX, 2DN, 2FP, 2JH, 2KK, 2OM, 2SQ, 2UA, 3ACY, 3ARM, 3ARO, 3AWF, 3CCB, 3CN, 3FP, 3HJ, 3SF, 3UC, 3UD, 3WT, 4H, 4EG, 4FB, 4FD, 4GN, 4SK, 5XA, 5XAC, 5XB, 9ABM, 9ACN, 9AFK, 9AFW, 9AIF, 9AIR, 9AIU, 9AMK, 9ASJ, 9ASO, 9AU, 9AUU, 9AVP, 9AZA, 9AZF, 9AYK, 9BP, 9BPV, 9HSI, 9BX, 9CA, 9CER, 9CUF, 9DAG, 9DAY, 9DCW, 9DHG, 9DHz, 9DLX, 9DMJ, 9DPJ, 9DRA, 9DSY, 9DTN, 9DWX, 9DXT, 9JX, 9LF, 9OF, 9TV, 9VZ, 9XT, 9ZN, Can. 3BP.

C.W.: 1ACR, 1BDI, 1BET, 1BKA fone, 1BMJ, 1CMK, 1XM, 2BFX, 2EL fone, 3BNU, 3BLF, 3HG, 3OE, 3OT, 3SU, 3SZ, 3YO, 3ZO, 4CG, 5AAG, 5UK, 5QY, 5ZY, 6ZZ, 7ZO, 8AB, (8AWP) fone, 8BSY, 8VY, (8ZY), 9APS, 9BDS, 9BIK, 9BZI, 9CCM, 9XAQ, 9ZN, Can. 8DH.

8CYT, 434 Perkins St., Akron, Ohio

C.W.: 1BKQ, 1GV, 1AZL, 2CQZ, 2AJF, 3ADT, 3BLF, 3BZ, 3PB, 3AVY, 4BK, 4JM, 4LJ, 5NN, 5JL, 8DAE, 8DAA, 8CXK, 8AJP, 8AMP, 8NB, 8BWK, 8QV, 9BRK, 9DKY, 9BIK, 9XAU, 9DQC, 9DCY, 9BED, 9DDW, 9IY, 9BDB, 5MB, 5DI, 5ZAY, 5NN, 5JB, 5XAD, 5XK, 5XA, 5DA, 5FV, 5XAD, 6KA, 6BBH, 6CC, 6JD, 6YN, 6AMP, 6ZX, 7ZU, 7ZO, 7AB, 7LU, 1, 2, 3, 4, 8 and 9's too numerous.

8BYN, 694 Carpenter St., Columbus, Ohio.

C.W.: 1AGH, 1AGI, 1ASF, 1AW, 1BAS, 1BET, 1BJN, 1BKQ, 1BOM, 1BWJ, 1CMK, 1CNF, 1DV, 1ER, 1GV, 1I, 1ON, 1PR, 1QP, 1RU, 1RR, 1XM, 1XU, 2AAB, 2ABD, 2ADT, 2AFB, 2AJA, 2AJW, 2ANG, 2AQC, 2AUZ, 2AVE, 2AWL, 2BBB, 2BFK, 2BJO, 2BMR, 2BMS, 2BNZ, 2BFJ, 2BQD, 2BRB, 2BRC, 2BQ, 2CCD, 2CGZ, 2CKL, 2CKN, 2CKR, 2CMS, 2CPD, 2CQZ, 2CUL, 2EL, 2FC, 2FD, 2GK, 2GR, 2HJ, 2IG, 2KU, 2NZ.

2OM, 2QK, 2SU, 2UD, 2WB, 2XQ, 2ZK, 2ZL, 3AAO, 3AFB, 3AHQ, 3AJH, 3AJI, 3ANJ, 3APR, 3ATB, 3BHL, 3BHM, 3BIJ, 3BIT, 3BLF, 3BLU, 3BSB, 3BUV, 3BVA, 3BG, 3BZ, 3CCU, 3CC, 3CG, 3BG, 3BS, 3CA, 3GF, 3GN, 3HQ, 3HK, 3HL, 3HX, 3JJ, 3JK, 3LJ, 3OT, 3PB, 3QV, 3SM, 3TJ, 3XM, 3YO, 3ZO, 3ZW, Can. 8NB, 8GN, 8BV, 8XN, 4BB, 4DQ, 4EA, 4EB, 4EL, 4EU, 4FC, 4FG, 4FT, 4ID, 4JK, 4JM, 4LJ, 4NT, 4OI, 4YA, 4BQ, 4BX, 5AAG, 5AAM, 5AAT, 5ABA, 5ABH, 5AEC, 5ACQ, 5DAG, 5DA, 5DI, 5DO, 5FG, 5EK, 5ER, 5FV, 5HK, 5IK, 5IS, 5JB, 5KC, 5KD, 5NK, 5NN, 5NQ, 5NV, 5PF, 5PK, 5PV, 5QI, 5QY, 5RH, 5SM, 5SF, 5TJ, 5UN, 5XA, 5XK, 5XR, 5XV, 5XAE, 5ZAG, 5ZB, 5ZY, 6ABX, 6BX, 6CC, 6FT, 6KA, 6XAD, 6ZA, 6ZD, 6ZI, 6ZL, 6ZZ, 6ZAC, 7LU, 7ZU.

(8ADT), (8ADZ), 8AFD, 8AGC, 8AGO, 8AGR, 8AIM, 8AIO, 8ALT, 8AME, 8AMQ, 8ANB, 8ANN, 8AV, 8ATC, 8ATU, 8ATV, 8AWJ, 8AXB, 8AXC, 8AXN, 8BCL, 8BY, 8BDO, 8BDU, 8BEN, 8BEO, 8BFM, 8BGJ, 8BGL, 8BHO, 8BKN, 8BLQ, 8BNH, 8BNI, 8BNZ, 8BOG, 8BJS, 8BTL, 8BUC, 8BVR, 8BVT, 8BWA, 8BXX, 8BYF, 8BYT, 8CAG, 8CBC, 8CBX, 8CDZ, 8CFN, 8CGM, 8CGQ, 8CGX, 8CGZ, 8CIA, 8CIJ, 8CJZ, 8CK, 8CMI, 8CMY, 8CPX, 8CTJ, 8CTN, 8CUN, 8CVE, 8CVM, 8CVY, 8CWP, 8CYT, 8BK, 8CI, 8DR, 8DZ, 8ER, 8EO, 8FT, 8HH, 8IJ, 8JD, 8KG, 8KR, 8NB, 8OE, 8OM, 8QK, 8QW, 8RV, 8SB, 8SP, 8UF, 8XE, 8ZD, 8ZF, 8ZX, 8ZY, 8ZZ, 9AEH, 9AEP, 9AFK, 9AHH, 9AHQ, 9AIU, 9AIX, 9AJP, 9AKU, 9ALQ, 9AMB, 9AMI, 9AMO, 9AMT, 9ANQ, 9AOG, 9AON, 9AOT, 9AOU, 9APS, 9APW, 9AQM, 9AQZ, 9ARG, 9ARQ, 9ARZ, 9ASE, 9ASU, 9ATO, 9ATZ, 9AVZ, 9AWF, 9AWM, 9AWP, 9AXU, 9AXS, 9BCB, 9BCF, 9BCT, 9BDS, 9BED, 9BFG, 9BGW, 9BHD, 9BHI, 9BIE, 9BLJ, 9BIK, 9BJK, 9BLG, 9BRO, 9BTL, 9BVL, 9BVZ, 9BWF, 9BWS, 9BXL, 9BZI, 9CAH, 9CBA, 9CCM, 9CCS, 9CCV, 9CGK, 9CIJ, 9QRA, 9CIN, 9CJC, 9CKM, 9CKV, 9CMK, 9CNS, 9CPY, 9CTE, 9CTF, 9CTT, 9DBL, 9DHW, 9DDY, 9DFB, 9DGM, 9DQ, 9DJE, 9DKY, 9DNH, 9DQU, 9DTA, 9DWM, 9DWQ, 9DWW, 9DXN, 9DYG, 9DYN, 9E, 9CR, 9EI, 9FK, 9GO, 9II, 9IO, 9LN, 9NU, 9OX, 9PK, 9PW, 9QF, 9SJ, 9UC, 9US, 9UU, 9VK, 9WC, 9YI, 9YU, 9ZG, 9ZN, 9ZX. Spark: 1CNI, 2AJE, 2OM, 5XAC.

8AER, Lancaster, Ohio.

1AW, 1AGH, 1ATA, 1AZE, 1BER, 1BKA, 1BKN, 1BWK, 1CMK, 1CNE, 2FP, 2NZ, 2RZ, 2WB, 2ZE, 2ZS, 2AGC, 2AIM, 2AJA, 2AWL, 2BBB, 2BFE, 2BGU, 2BLP, 2BJO, 2BRB, 2BUE, 2BXP, 2CBW, 2CDA, 2CCD, 2CKR, 2CFB, 2COL, 3BG, 3FM, 3FS, 3IW, 3JT, 3LP, 3SU, 3SZ, 3AAO, 3ACQ, 3ADT, 3AFB, 3APT, 3BIY, 3BLU, 3BHM, 3BNU, 4BB, 4BK, 4BY, 4BX, 4CG, 4FL, 4FT, 4HZ, 4KC, 4LJ, 4YA, 5DA, 5DI, 5DO, 5DM, 5EG, 5EK, 5FV, 5HC, 5HL, 5MB, 5NN, 5EM, 5TA, 5TJ, 5UK, 5XA, 5AAG, 5ABY, 5AEC, 5XAC, 5XV, 6KA, 6XAD, 6AWT, 7ZO, too many 8's and 9's. Cans. (8XN), (3JE), 9AL.

9AIY, Milwaukee, Wis. (All C.W.)

1XU, 1AJP, 1AJU-QRA, 1AZW, 1BES, 1BKQ, 1BRQ, 1CMK, 1CMZ, 2BP, 2FS, 2NZ, 2XB, 2XI, 2ZK, 2AFP, 2AGC, 2AHO, 2AYV, 2BQH, 2BTW, 2CCD, 2CHG, 2CKR, 2CMS, 2COZ, 2CPD, 2XAP, 3OT, 3SU, 3YO, 3AAO, 3BHM, 4BX, 4EB, 4JY, 4KM, 4YA, 5AA, 5DI, 5EK, 5LO, 5NK, 5NV, 5OX, 5PO, 5PX, 5TN, 5UA, 5VA, 5XK, 5XT, 5ZA, 5ZL, 5ZU, 5AAG, 5ACF, 5AEC, 5XAD, 5XAJ-QRA, 5ZAT, 6KA, 6ZZ, 6AAT, 6AWT, 6XAD, 6ZC, 7MF, 7ZO, 7ZU, too many 8's and 9's. Canadian: 3BV, 3CO, 3DE, 3XN, 4BV, 4FS, 5RH, 9AL, 9AW.

9DBL, Hampton, Iowa.

C.W.: 1AGH, 1AJW, 1AZW, 1BAS, 1BRQ, 1BYN, 1CJH, 1CNF, 1CMK, 1II, 1XZ, 2AGD, 2AJF, 2ANM, 2APW, 2AQL, 2AWL, 2BFX, 2BGM, 2BJP, 2BLF, 2BLP, 2BRB, 2BQU dilite, 2BZV, 2CCD, 2CDG, 2CKR, 2GK, 2IG, 2SM, 2WB, 2WR, 2XG, 3AAO, 3ABB, 3AFB, 3ATG, 3AUU, 3BFQ,

(3BHM) dalite, 3BIJ, 3BLF, 3BLU, 3BVA, 3BX, 3BZ, 3CC, 3CK, 3CMS, 3FP, 3HD, 3JH, 3OE, 3OT, 3PZ, 3SW, 3SX, 3UI, 3XN, 3YO, 3ZO, 4BK, 4CG, 4CQ, 4EL, 4BG, 4FT, 4JN fone, 4MI, 4OI, (4XC) fone, 4VA, 5AAH, 5AAG, 5AEC dalite, 5AX, (5DQ), 5DR, 5ER, 5ES, 5IX, 5JB, 5JO, 5MA, 5MO, 5MY, 5NK, 5NN, 5GY, (5TA), 5TC dalite, 5UK, 5UO dalite, 5XA, (5XAC), 5XK, 5XT, 5XO dalite, 5XAS, 5ZAV, 5ZB, 5ZS dalite, 6BJT, 6BVG, 6IF, 6TI, 6XAD, 6ZO, 6ZR, 7AFW, 7JW, 7OT, (8AHA), 8AIQ, 8ALC, (8AME), 8AMP, (8ANB), 8AOL, 8APQ, 8AQC dalite, (8ASV), 8AWC, 8AWP, 8AMR, 8AWS, 8AWZ, 8AVD, 8AZF (8BDC), 8BDU dalite, (8BDV), 8BEO, 8BFR, (8BGL), 8BHO, 8BJV, 8BKE, 8BKN, 8BRL, 8BUT, 8BVT, 8BXM, 8CAK dalite, 8CBC, 8CBX, 8CCR, 8CEP, 8CHM, 8CGU, 8CJZ, 8CK dalite, 8CKO, 8CNW, 8COZ, 8CPD, (8CPK), 8CQX, 8CRB, 8CVM, 8CWL, 8DAA, 8DAE dalite, 8DAK, 8EO, 8ER, 8FS, 8HH, (8HJ), 8KG, 8KS, 8ML dalite, 8NB dalite, 8QK, 8RR, 8UF, 8WF, 8XAK, 8XE, 8YU, 8ZAE, (8ASE), (8OX), and many others. Canadians: 3CO, 3DH, (3DS), 3GK, (3JE) 3JK, 3TY, (4RV), 4DK, 5CN, 8XN, 9AL, WUBA.

9ARZ, Clear Lake, Ia.

C.W.: 1AW, (1II), 1XU, 1XZ, 1AJU, 1AVC, 1BRQ, (1CMK), 2RZ, 2CK, 2UC, (2UD), 2WB, (2WR), 2AFP, 2AHO, (2AVU), 2AWZ, 2BMS, 2BRB, 2CCD, 2CKL, 2CNK, (2CQZ), 3AZ, 3BG, 3BI, 3BV, 3BZ, 3CM, (3IW), 3MB, (3OT), 3VW, 3XM, 3YO, 3ZO, 3AFW, 3AJH, 3APR, (3AQR), 3BHM, 3BLF, 3BNU, (3BVA), 3BVL, 4BK, 4BQ, 4CC, 4CO, (4CY), 4DC, 4EA, 4EH, 4GH, 4GZ, 4HS, 4HV, 4JK, (4KC), 4LJ, 5CI, 5DI, 5DO, 5EK, 5ER, 5IK, 5IS, (5KP), 5LB, 5MO, 5OU, 5PB, 5PV, 5PX, 5QM, 5RJ, 5QM, 5RJ, (5SF), (5SM), (5TA), 5UO, 5WE, 5XA, 5XK, 5XT, (5XV), (5ZA), 5ZB, 5ZH, (5AAM), 5AAG, 5AAR, (5AEC), 5XAC, 5ZAG, 5ZAI, 5ZAP, 5ZAS, 5ZAV, (6JD), 6IF, 6ZN, 6ZZ, 6ASO, (6AVR), (6XAD), 6ZAC, 6ZAF, 6ZAI, 7GK-sp., 7ZU, 7ABB, 8AB, 8BK, 8CF, 8CG, (8ER), 8FM, 8FT, 8HJ, (8OE), 8QQ, (8VQ), 8SB, 8UE, 8UZ, 8XE, 8XJ, 8YN, 8ZD, 8ZY, 8AEA, 8AER, (8AFV), 8AIM, 8AIZ, 8ASL, 8ATU, 8AVD, (8AXC), (8AXB), (8AXN-sp.) 8BEU, 8BDA-sp., 8BDU, 8BFM, 8BFS, 8BHO, 8BKS, (8BNY), (8BTL), 8BVX, (8BWA), 8BWP, 8BXT, 8BXX, (8BYN), 8CBC, 8CCM, 8CEP, 8CIA, 8CQJ, 8CPD, (8CUR), 8CVY, 8CWF, (8CZZ), 8DAT. Canadians: 3DH, 3GN-sp., (4BV), (4DK), 9's too numerous.

Hard During daylight Transcons: 1XU, Can. 3DH, (3SU), 3BVA, 4BQ, 5GI, 5PX, 5TA, 6UN, (5UO), 5AEC, 8BO, 8QK, 8ZY, 8ADZ, 8AIO, 8APE, 8AXC, 8BDU, 8BNU, 8BXY, 8ZAG, 9AF, (9BP), 9IL, 9OX, 9PI, 9VK, 9ZL, 9AAW, 9ABV, 9AEQ, 9AEY, 9AHH, 9APW, 9AMB, 9AON, 9AOU, 9AQR, 9APS, 9AUA, 9AWS, 9ASD, 9ASF, 9ASN, 9AZF, 9BAL, 9BCF, 9BDR, (9BGH), 9BHD, 9BHN, (9BKK-sp.), 9BSP, 9BSZ, 9BTT, 9BRK, 9BYC, 9BXJ, 9CCV, (9CEH), 9CFI, 9CFY, 9CTR, 9CXP, 9DBV, 9DDY, 9DKY, 9DFB, 9DJB, 9DQU, 9DSM, 9DTJ, 9DTA, 9XAQ.

9DKY, Mason City, Iowa, (1 tube)

C.W.: 1GV, (1II), (1RD), 1AKP, 1ASF, 1AZL, (1AZW), 1BET, 1BGF, 1BKA, 1BRQ, 1CJA, (1CLF), (1CMK), 1CNF, 1XM, 1XU, (1XZ), 2CM, 2EL, 2GR, 2HW, (2IG), (2LO), 2OE, (2RZ), 2TS, 2VW, 2WB, 2WR, (2AAG), (2AFP), 2AHO, 2AJP, (2ANM), 2AWF, (2AWL), (2AYV), (2BFX), (2BGV), (2BNZ), (2BRB), 2BNR, 2BOF, (2CCD), 2CCX, 2CHG, 2CKR, 2CPD, (2CQZ), 2XB, 2XQ, 2ZK, 2XAP, (3AB), 3BB, 3EG, 3CC, 3HG, 3HK, 3JJ, 3KD, 3LP, (3LR), 3MK, (3OE), (3OT), (3SN), 3TJ, 3AFB, 3AJD, (3AJH), (3ANJ), 3AQR, 3ATZ, 3AUU, (3AWF), (3AYV), 3BBA, 3BFA, (3BHM), 3BIT, (3BLF), 3BNJ, 3RSB, (3RVA), 3CMS, (3YO), (3ZO), 4BB, 4CM, 4EB, 4FT, (4KF), 4KM, 4BK, 4HI, (4FG), (4CG), 4JK, (4YA), (5DN), (5DO), (5EG), (5EK), (5HB), (5IS), 5FV, (5IK), 5JL, (5KC), (5MO), (5MX), (5NV), (5PO), (5PY), (5PV), (5PX), (5SM), (5SZ), (5TC), 5TU, 5UE (5UK), 5UN, (5VY), (5AAB), 5AAT, (5ABH), (5ADE), (5AEC), (5ZA), 5ZB, (5ZAZ), (5XAD), (5XA), 6HM, 6AAT, 6ABX, 6ATC, (6AVR), 6AUU, 6BBH, 6BRG, (6BQC), 6BUM, 6BUN, (6ZO), 6ZR, 6ZZ,

6ZAC, (6XAD), (7LU), 7ABV, 7AFS, 7AFW, 7ZO, 7ZU, (8AR), (8AZ), (8BK), 8CP, (8FT), (8HH), 8IB, (8IJ), 8KG, 8LF, 8ML, (8OE), 8QK, (8SP), (8NB), 8AAF, 8AAK, 8AEA, 8AEC, 8AFD, 8AIM, (8AIG), (8AIW), 8AMM, 8AMP, (8ATU), (8APY), 8AWP, (8AWR), (8AWZ), 8AXC, (8AYD), (8AVD), (8AUO), 8AXB, (8BDE), 8BDP, (8BDV), 8BDU, 8BEF, (8BEI), (8BLO), (8BKH), (8BYN), (8CAB), (8CBC), 8CGA, (8CGX), (8CKO), 8CKM, 8CTP, (8CUR), 8VE, (8CVT), 8CYT, (8DAT), 8YD, 8ZX, (8ZZ), 8YM, (8ZD), (8XE), 8XAK, (8ZAG), Nines too numerous. Canadians 2AM, (3CO), (3DH), 3DS, (3YH), 3GE, (4BV), (4DK), 5GI.

9DVL, Box 77, Naperville, Ill.

1AFB, 1AGH, 1AIP, 1AJA, 1AJU, 1AW, 1AWB, 1BEP, 1BES, 1BET, 1BGF, 1BKA, 1BKO, 1BNT, 1BQI, 1BRQ, 1BWJ, 1CDO, 1CIY, 1CJA, 1CJH, 1CMK, 1CNF, 1CNR, 1II, 1PR, 1RD, 1XM, 1XP, 1XU, 1XZ, 1YK, 2AGC, 2AHO, 2AJA, 2AWL, 2BAS, 2BFX, 2BGM, 2BJO, 2BLP, 2BMR, 2BMS, 2BPF, 2BRB, 2BRW, 2BXP, 2CBW, 2CBW, 2CCD, 2CKL, 2CKM, 2CKR, 2COA, 2CPD, 2CQZ, 2EL, 2FP, 2GN, 2IX, 2LO, 2LT, 2NZ, 2TS, 2UD, 2UE, 2WB, 2ZK, 2ZO, 2ZS, 3ADT, 3AFB, 3AQR, 3ASP, 3ATG, 3AUU, 3AVC, 3AVW, 3BAV, 3BFU, 3BH, 3BHL, 3BHM, 3BIJ, 3BVC, 3BWT, 3BZ, 3BSB, 3BT, 3BUV, 3BVA, 3BV, 3BWT, 3BZ, 3CC, 3DH, 3DS, 3FS, 3HJ, 3IL, 3JH, 3LP, 3OT, 3PQ, 3RF, 3SM, 3ZO, 3ZW, 4BB, 4BG, 4BV, 4BX, 4BY, 4CA, 4EB, 4EH, (4EL), 4FT, 4GH, 4HW, 4ID, 4JK, 4JY, 4KC, 4KM, 4LJ, 4LP, 4OI, 4OT, 5AAT, 5ACF, 5AS, 5BA, 5BM, 5DA, 5DI, 5DO, 5DP, (5EK), 5EL, 5FV, 5GA, 5IK, 5IS, 5IX, 5JB, 5JL, 5JM, 5KC, 5LB, 5MO, 5NE, 5NK, 5NN, 5NV, 5OI, 5PB, 5PF, 5PV, 5PX, 5QI, 5QY, 5RH, 5RS, 5SA, (5SF), 5SG, 5SK, 5SM, 5TC, 5TJ, 5TO, 5TP, 5UC, 5UO, 5VM, 5XA, 5XAC, 5XAD, 5XDO, 5XV, 5ZA, 5ZAG, 5ZAS, 5ZAV, 5ZAW, 5ZB, 5ZS, 6ABX, 6AJH, 6ARB, 6ASJ, 6AWT, 6BUN, 6BUM, 6CC, 6CU, 6EN, 6EO, 6GX, 6KA, 6LS, 6PI, 6UW, 6XAD, 7AD, 7AFW, 7LU, 7ZO, 7ZU, 8AAV, 8ABN, 8ABX, 8AFG, 8AHK, 8AIM, 8AIW, 8ABZ, 8ACH, 8AEA, (8AER), 8AGO, 8AGR, (8ALF), (8ALC), 8ALR, 8ALT, 8AMJ, 8AMM, 8ANB, 8AOM, 8APN, 8AQO, 8ASK, 8ASV, 8ATO, 8AWP, 8AWT, 8AWX, 8AWZ, 8AXB, 8AXC, 8AXN, 8AZD, 8AZF, 8AZO, 8BCA, 8BCE, 8BCY, 8BDM, 8BDO, 8BEF, 8BEI, 8BEK, 8BEO, (8BFM), 8BHO, 8BHQ, 8BJX, 8BKE, 8BKH, 8BNF, 8BNU, 8BOS, 8BOX, (8BOZ), 8BPU, 8BRM, 8BSU, (8BTL), 8BTR, 8BTZ, (8BUC), 8BUX, 8BVR, 8BVT, 8BVX, 8BWA, 8BWB, 8BXC, 8BXH, 8BXT, 8BXZ, 8BYF, 8BZY, 8CAB, 8CAK, 8CAU, 8CAZ, 8CBC, 8CEF, 8CF, 8CGF, 8CGU, 8CGX, 8CGZ, 8CH, 8CJY, 8CJY, 8CKO, 8CLD, 8CMY, 8CN, 8CNA, 8CNX, 8COO, 8COX, 8CP, 8CPZ, 8CTP, 8CTN, (8CUR), (8CVE), 8CVT, 8CYT, 8CYU, 8CZC, 8DAG, (8DZ), 8FA, 8FF, 8FM, 8FT, 8GT, 8GV, 8HB, 8HH, 8HJ, 8HW, 8IB, 8IJ, 8IQ, 8JO, 8JU, 8KG, 8LW, 8ML, (8OE), 8OK, 8OW, 8PD, 8QB, 8QK, 8SB, (8SP), 8TX, 8UK, 8UZ, 8VE, 8VY, 8WA, 8XAE, 8XE, 8XN, 8YN, (8ZAF), 8ZD, 8ZX, 8ZZ, (9AAP), (9AAV), (9ABM), 9ABL, (9AFK), (9AFN), 9AHE, 9AHQ, 9ANQ, 9AOY, 9APH, 9APS, (9ASA), (9ASU), 9ATC, 9AUA, 9AWF, 9AWM, 9AXO, 9AYH, 9AYM, (9AXU), (9BEF), 9BFX, (9BHD), 9BIK, (9BIZ), (9BJT), (9BJV), 9BJU, (9BKJ), (9BLG), (9BQI), 9BQW, (9BRE), (9BRO), 9BRL, (9BSC), 9BSZ, (9BTA), (9BWS), (9BXD), (9BZO), (9CA), 9CCS, 9CCV, (9CDZ), (9CEB), (9CEH), (9CEW), (9CFC), 9CFY, 9CGD, 9CGK, (9CHK), 9CHN, (9CIN), 9CJI, (9CLO), (9CF), (9CTF), 9CTR, 9CUC, 9CVO, 9CVD, 9DBX, 9DCQ, (9DCT), 9DFB, (9DJG), 9DMK, 9DPE, (9DQE), (9DTC), 9DTJ, (9DVW), (9DWQ), 9DXN, 9DYN, 9DZB, (9DTJ), (9FK), (9GL), (9GT), 9IO, 9KM, (9OH), 9EW, (9FK), (9GL), (9GT), 9IO, 9KM, (9OH), 9AW, 3BP, 3CO, 3DH, 3DS, 3JI, 3LK, 3NB.

The Ravenswood Radio Club Razz, published in Chicago, is a mighty interesting little sheet. Wendell L. Holst, 2450 Linden Place, is its editor and we know it will continue to get across big.

Radio Communications by the Amateurs

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More on Filament Adj.

G. E. Research Lab.,
Schenectady, N. Y.

Editor, *QST*:

Mr. Chisholm's letter in the December issue on tungsten filament volt-ampere relations gives some conclusions that do not apply to the tungsten filaments of vacuum tubes.

It is a fact that during life the tungsten evaporates from the surface and the filament diameter decreases. It is also a fact that at constant filament current the temperature and electron emission increase and the life is greatly reduced.

At constant voltage, however, there are two effects which take place that make operation by this method the most satisfactory.

1. At constant voltage the temperature does not drop to the extent indicated by the simple theory, because of the fact that the resistivity of the tungsten slightly decreases during life of the filament.
2. Satisfactory operation of the tube in radio equipment requires that the electron emission rather than the filament temperature be maintained above a certain value. The relation between filament temperature and electron emission is subject to considerable variation, depending upon conditions on the surface of the filament. During life the surface conditions change so that with a constant temperature there is a slight increase of electron emission.

Actual tests on a considerable number of tubes of different types indicate that at constant filament voltage the current drops during life from five to ten per cent, but that the value of electron emission on the average remains practically constant. The two factors listed above account largely for this action.

These remarks do not apply strictly to the UV-200 tube, because its gas content introduces complicated features.

The heavy filaments of high power tubes, however, show this same advantage of operation at constant voltage.

Filament voltmeters are of less practical value in the case of receiving tubes, because there are so many different circuit

combinations and voltages used on the plates that there is often an optimum filament adjustment below the rated value. In such cases, of course, this lower value should be used.

In general, a filament ammeter is but of little value for any size of ordinary tungsten filament tube, and is likely to do more harm than good.

Very truly yours,
William C. White.

Favoring the Voltmeter

Pacific Union College,
St. Helena, Calif.

Editor, *QST*:

In the October number of *QST* I notice a letter by R. O. Miles on "Ammeters vs. Voltmeters." Mr. Miles recognizes that there is some condition that must be duplicated to duplicate results in a receiving tube, but does not seem to know, at least did not say, just what it was that must be kept constant.

The action of the vacuum tube depends upon the electrons emitted from the filament, and it is identity in the number of electrons emitted per second that should be preserved in order to duplicate results. But the rate of emission of the electrons depends largely upon the filament temperature, and so to keep the emission constant, the temperature of the filament should be a constant. Does a constant current fulfill this condition? I believe not. As the filament is burned, it gradually vaporizes and so becomes smaller in cross-section and mass, and of course the resistance goes up. As the heat produced depends upon the current squared times resistance, this increase of resistance will increase the amount of heat produced. Also, temperature depends upon the ratio between the number of calories produced and the mass to be heated, so as the mass of the filament becomes less, even the same amount of heat would raise it to a higher temperature while an increase in the amount of heat produced, would give the temperature quite a boost.

On the other hand, does constant voltage across filament fulfill the requirement? I believe it does, very nearly at least. A numerical example would perhaps help. Suppose the cross-section is reduced to one-half its original value by vaporization. Then the resistance is doubled. But the mass is cut in half. If the resistance is

doubled, and the voltage held constant, the current will be cut in half, and current squared will be only one-fourth its original value. Our relation between units is ex-

pressed by the formula, $\frac{I^2 R}{M} = \text{a constant}$,

(or should, to keep temp. constant). Substituting the fractions found above, $\frac{1}{4} \times 2$

$\frac{1}{2} = 1$, in other words, is the same as in the original value. So it seems to me that voltage across filament terminals is what we want to keep constant.

As to poor contacts, they must be eliminated to secure satisfactory operation anyway, so constitute no objection to the voltmeter. What about it?

Sincerely,
Julian L. Thompson.

"Our Etiquette Column"

Dear Editor:

I have recently been at several receiving stations where the owner of the set insisted on listening to broadcasted concerts. At least once in every concert the Star Spangled Banner is played. The audience always seems to be greatly worried about the proper thing to do; half of them remain seated and the other half get up and stand about uneasily while the piece comes in.

Please advise me as to the correct procedure.

9NK.



Dear 9NK:

If the operator can separate the Star Spangled Banner from other things, you should stand. If, however, the piece comes out badly mixed up with the Lord's Prayer from the Church of the Covenant in Washington, that heavy generator hum from KYW at Chicago, a negro melody from

WSB in Atlanta, and some California weather boosting from Los Angeles, you need not stand. Never under any circumstances stand when you are sure that the noise is a howl from WGI at Medford Hillside, Mass., even tho the entire gang with you insists that it is the national anthem.

Personally we think the playing of the Star Spangled Banner should be reserved for patriotic occasions where its playing will be accorded proper respect. We have no enthusiasm for hearing our national anthem tangled up with the price of hogs.
—Ed.

Well, Well!!

Editor, QST:

Since it is all the style these days to raise an awful kick, I'll take this chance to tell you of some things that make me sick. Now in regard to radio there's nothing I don't know, because I've had a wireless set about two months or so.

Now first I'd like to tell about these pesky fellows who, begin to operate their sets before the hour of two. Now anyone with half an eye can very plainly see, that broadcast listeners ought to have the air from seven till three. Why should these operators fill the air with clicks and hums, and want to sit and pound a key whenever midnight comes, so I can't understand a word that John McCormick hollers, and I've just bought a radio set that cost me twenty dollars.

I understand you've got a league, or something of the kind, that numbers as its members all these chaps I have in mind, and so I thought I'd warn you first, as it seems only right, before I write to Congress and have you closed up tight. And also when I write to them I'm going to recommend that laws be passed which have the power to totally suspend the action of this "static" and "fading" signals too, for anything that conflicts with my concerts is taboo.

Now that you've had fair warning, and I have had my say, please do not be a bit surprised if you're closed up some day, for though some things in radio, to me, are 'neath a fog, the concerts are the important thing.

Yours truly,
Ima Hogg.

Beat This One!

5723 Winthrop Ave.,
Chicago, Ill.

Editor, QST:

I am bothering you again a lot sooner than I had intended to. Something mighty unusual has happened to me. After trying for two years I have finally by pure luck managed to hear *nine consecutive stations, one from each district.*

After finishing the "Calls Heard" list and getting the letter off to you and Phelps,

I slipped on a bathrobe and took my usual "pre-hay" listen-in. The clock said exactly 11:50 P.M. C.S.T. A couple of these awful unfiltered A.C. C.W.'s—locals—were frantically scrapping around so I disconnected the loop from the set (for even on a loop some of these fellows bust me badly) and listened without loop antenna or ground. I can hear a good many C.W. stations this way.

The first station was 3AUW calling some 5 at 11:51. Then I tuned down a bit and heard 2FR (I.C.W.) chewing with someone; he didn't call but just signed at 11:52. Then I went back up a little and caught 6XAD with his A.C. plate set signing off—signals about 30 feet from the phone. Then 4GL busted in calling 4FT, rather slower than his usual nervous fist; this at 11:53. Now it occurred to me that I was doing something unusual, and I began to get excited, and began combing up and down the tuner for the rest of the bunch. At 11:54, 9APS and 8ZY, came roaring in. At 11:55, 1XU rattled the phones with his foolish sounding generator, or chopper, or whatever the thing is, and Oh, boy! I began to get wild. The very next thing was 5AAG, C.W., calling an 8. Boy, my heart was in my mouth, here I was with eight stations, one from each district. Now if I got a single duplicate, the whole business was ruined.

It was 11:56 and there was not a seven in sight. I shoved the phones down hard, shut my eyes and held my breath while I wiggled the tuner knob where Kid Hood usually comes in—AND WAS GREETED BY A STEAM CALLIOPE CALLING 9ZAF AND SIGNING WITH THE CALL THAT CLINCHED THE WORKS—7ZO—AT EXACTLY 11:57 P.M.!

"Come Seven!"



Howzat, O.M.? Doesn't that constitute the weirdest piece of luck you ever laid your eyes on? Nine stations copied, nine districts logged, all in seven minutes by the clock, and with no duplicates. I don't think that it has ever been done before and I don't

think that that kind of luck is ever likely to happen again. Guess that's about all I have got to rave over this time. I simply had to tell it to someone and haven't seen a radio man all day so your the goat.

Now to come back to earth; I have written the gang to ask for confirmations on the transmissions, for tho there is no doubt in my mind about the calls, I want to have something to nail on the wall with a big red line around it.

QSL if you get a minute, I am always glad to get a letter with a little red patch in the corner of the envelope; that means it is from one of the gang. Best of 73's.

(Signed) Fred Marco,
9ZN's "FJ".

P.S.:—Remember there is nothing exceptional about hearing this gang. They are all consistent here night after night. The really weird thing about it is the order and the time and getting them without antenna or loop.

FJ.

A Static Eliminator

rt. Hon. mistur ed:

haveing saw in yewr QST ware yew rekwest that sum of us wise end eckspert radeeo engenears kick in with sum gud artikles 2 fill up sed QST, i take grate plesure in complying with yewr rekwest by giving owt sum info. abowt my new static elimonater.



Static Eliminator "XZ"

thee idea is to innokulate thee tubes so that thee static will not go threw them. this iz dun bi use of thee simpul cirket showing in thee drawing, thee only nessessarey instermints being a tewbe sokit and a spark or cw transformur, abowt 1 kw giveing thee best rezults. i have used this skeem on three tewbes end awl uv them have pruverd hily suksessful, no static being herd on enny of them oweing teu sumthing wich i am werking on now, but haven't figgered owt yet, the felimints of thee innokulated tubes dont seam teu lite and i awlso havent herd enny sigs ovur them yet.

in sineing off, i mite sa that if thee foregoeing artikle finds favur in thee i's of thee hon. ed, i may favor thee gang with another teknickel art. on the "correkt valyew for a S/R grid cond. in a crystle receever."

Oscillatingly,
XYZ

J. V. WISE

(Concluded from page 60)

ham—spark coil, spark, and finally C.W.—and most of the time and money he could get ahold of went into radio. As for occupation, he may be classed as a farmer, but Fred Schnell says, "He shoots with both hands and rides anything that grows hair!"

**Kellogg Radio Equipment
For Better Results**



The Kellogg Variable Condenser is of the decimeter type and is unusually well built throughout.

A customer writes: "It's in a class by itself."

- No. 601. 11 plate with 5 plate Vernier. Knob and 4 in. Dial. Each \$6.75
- No. 602. 11 plate without Vernier. Less Knob and Dial. Each 4.50
- No. 603. 23 plate with 5 plate Vernier. Knob and 4 in. Dial. Each 7.75
- No. 604. 23 plate without Vernier. Less Knob and Dial. Each 5.50
- No. 605. 43 plate with 5 plate Vernier. Knob and 4 in. Dial. Each 8.75
- No. 606. 43 plate without Vernier. Less Knob and Dial. Each 6.50

**KELLOGG SWITCHBOARD
& SUPPLY COMPANY
CHICAGO**



**You Need This
"MAC - RADIO"
TEMPOMETER**

An accurate, easily operated device by which you can instantly compare the Standard Time used in all points of the World. An absolute necessity for all radio operators who are receiving either telegraph or phone station schedules throughout the World. IT TELLS YOU WHEN TO LISTEN FOR THAT CONCERT OR MESSAGE. FOR A LIMITED TIME ONLY with each tempometer we will include FREE OF CHARGE our folder giving: Standard Time Meridians of the World, also U.S. time zones and time sending stations, Broadcasting stations of U.S. and Canada with time used by each. Radio Tempometer Price \$1.00. Delivery return mail. Dealers write for discounts.

McCALLUM APPLIANCE CO.
Silver City, New Mexico

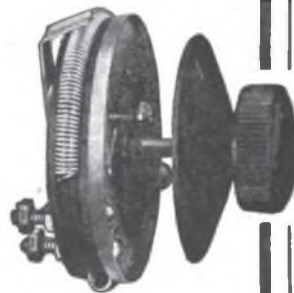
**Hear it
with**

Sterling

The Fine Adjustment Rheostat
Brings Out Everything Clear
and Loud

WHEN working long distance concerts or codes this rheostat makes radio receiving a real pleasure.

The unusually large number of turns give a fine regulation of current. The rheostat is built around a rigid circular supporting frame of nickeled brass carrying two mounting screws. The contact arm is noticeably smooth running to aid in giving fine adjustments. The Sterling Filament Rheostat is known from coast to coast as representative of the Sterling family of radio devices—especially designed for filament control of detector and amplifying tubes. It will not heat up.



**STERLING
FILAMENT RHEOSTATS**

are used everywhere by commercial and amateur radio users. Adaptable to either panel or table mounting by mere loosening of a set screw.

List Price \$1.00

- Other STERLING Radio Devices
- Portable Rectifiers
 - Audio Frequency Amplifying Transformers
 - Radio Frequency Amplifying Transformers
 - Pocket Voltmeters for testing "B" Batteries
 - Filament Ammeters and Voltmeters.

Over 2½ Million Sterling Devices
in use today

THE STERLING MFG. CO.
2845 Prospect Ave., Cleveland, O.

Burgess, the *Radio* Battery —designed by wireless specialists

It doesn't take long for a radio engineer to tell the difference between a Burgess and an ordinary battery. The Burgess begins to perform at once like a *radio* battery should—and a Burgess *continues* for a longer time.

The reason is that Burgess Radio Batteries are designed, made and sold by *radio* engineers. Burgess didn't rush into the field with merely a collection of flashlight cells. Burgess experimented and perfected the most efficient "B" battery *a long time* before the present popularity of radio began. Don't take our word for it—*ask any radio engineer*.

Leading manufacturers of radio equipment specify "Burgess." Burgess "B" Batteries are handled by all progressive jobbers and dealers. "Look for the Black and White Stripes." And if your dealer doesn't handle Burgess Radio Batteries, just address:

BURGESS BATTERY COMPANY
Engineers — Dry Batteries — Manufacturers
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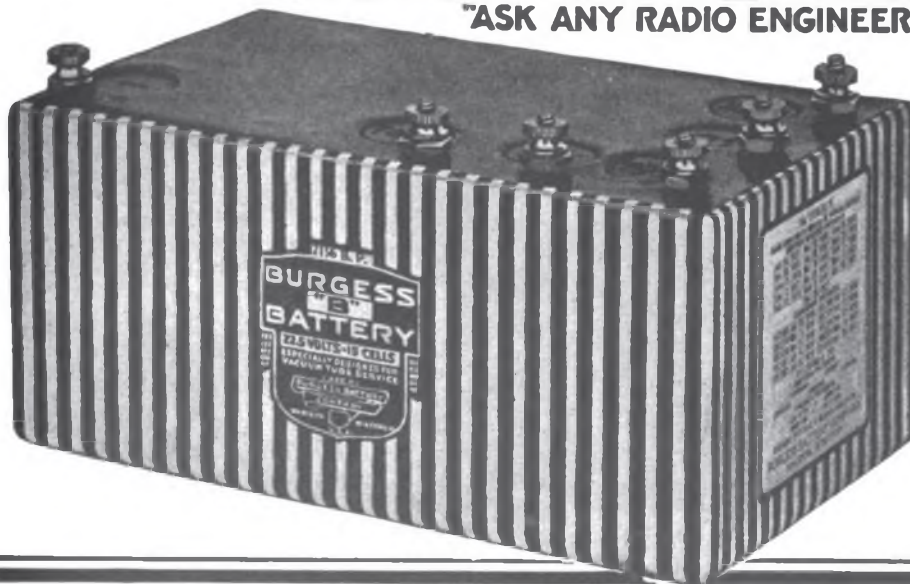
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RADIO BATTERIES

"ASK ANY RADIO ENGINEER"





—if you can afford to pay more—you will still prefer CROSLY efficiency

From the most humble home to the elaborate drawing room, Crosley Instruments are preferred. Regardless of the many higher priced instruments on the market, the man who knows—even if he can afford to pay more—will choose Crosley.

There is no secret in this. Crosley instruments are the acme of efficiency and simplicity and their construction is based on sound fundamental principles. Numerous tests by disinterested parties all over the country will bear us out in this statement.

Your dealer should be able to furnish you with Crosley Apparatus. If not, send us his name and order direct.

If you are a Jobber or Dealer and do not already handle Crosley Instruments, you will be wise to satisfy the demand that our national advertising has created.

CROSLY
BETTER-COST LESS
RADIO

Complete sets from \$25 up, all kinds of parts and experimental units.

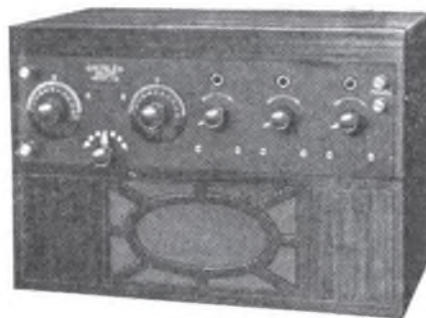
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CROSLY MFG. CO.
118 Alfred St., Cincinnati, Ohio

CROSLY RECEIVER MODEL X. A four tube outfit the same as shown in the above scene. It consists of tuner, one stage of Tuned Radio Frequency Amplification (the feature that has made this set so popular) Detector and two stages of Audio Frequency Amplification in a beautiful mahogany cabinet. It will bring in distant stations loud and clear. With this set, listeners in Florida have heard Winnipeg, San Francisco and Honolulu. Price without phones, batteries or tubes\$55.00

Announcing
Several New Crosley Units That
will be very Popular

Three Instruments
made to accommo-
date 1½ volt Tubes



CROSLEY RECEIVER MODEL XII-S
 A four tube set the same as our Model XV with amplifying chamber. This, however, is constructed to use 1½ volt dry battery tubes and do away with the storage battery. Consists of one stage of Tuned Radio Frequency Amplification and Detector in mahogany finished cabinet. Price without phones, batteries or tubes \$65.00.



CROSLEY RECEIVER MODEL VI-S. A two tube set adapted to use 1½ volt dry battery tubes. This is the same as our Model VI but eliminates the use of a storage battery. Consists of one stage of Tuned Radio Frequency Amplification and Detector in mahogany finished cabinet. Price without phones, batteries or tubes \$30.00.



CROSLEY RECEIVER MODEL VIII-S. A new three tube set adapted to use 1½ volt dry battery tubes and eliminate storage battery. Consists of one stage of Tuned Radio Frequency Amplification, Detector and one stage of Audio Frequency Amplification in mahogany finished cabinet. Price without phones, batteries or tubes \$50.00.

CROSLEY
Better---Cost Less
RADIO

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CROSLEY MANUFACTURING CO.
 118 ALFRED STREET, CINCINNATI, OHIO

Two New *Portable* Instruments



CROSLY RECEIVER MODEL VI-P. A very light and compact outfit. Designed especially to be carried around without the usual bother of extra batteries, antenna, etc. Consists of a two tube receiver patterned after our Model VI and adapted to use with 1½ volt dry battery tubes. Has compartments for "A" and "B" batteries, aerial and head phones. Made up in neat mahogany finished case. Price without phones, batteries or tubes \$40.00.



CROSLY RECEIVER MODEL VIII-P. Another portable Unit the same as that shown on the left but with one added stage of Audio Frequency Amplification. This is the same Receiver as our Model VIII but adapted to use with 1½ volt dry cells and with compartments for all accessories. Especially recommended for long range receiving where one desires to take his instrument from place to place. Price without phones, batteries or tubes \$60.00.

New Units For Experimental Purposes



CROSLY CONDENSO-UNIT. Here we have incorporated a Crosley Model "C" condenser in a mahogany finished cabinet and hard rubber panel with the necessary connections. Can be added to any outfit. Price \$5.00.



CROSLY DETECTO-UNIT. Consists of socket, Rheostat, grid condenser, leak, etc. with the proper binding post connections. It will add an audion detector to any set. Any standard tube can be used, or with a Crosley adapter, a 1½ volt tube can be used. Price without tube \$4.00.



CROSLY TUNO-UNIT Consists of a vario-coupler mounted in a neat mahogany finished cabinet and hard rubber panel. The primary and secondary are connected to the binding posts. Tap switch furnishes 7 variations of the inductance. Can be used in any hook-up. Price \$7.00.

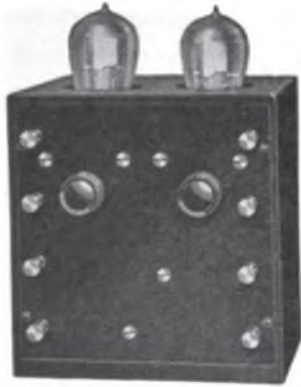
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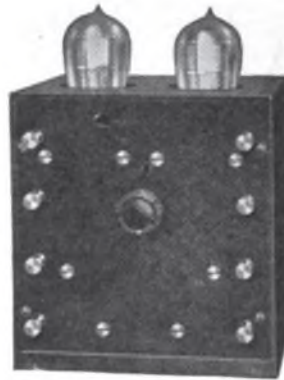
CROSLY MANUFACTURING CO.

118 ALFRED STREET,

CINCINNATI, OHIO



CROSLY DE-AMPLIFIER UNIT. Consists of audion detector and one stage amplifier neatly mounted in a mahogany finished cabinet. Crosley standard parts are used throughout including Crosley Sheltran Transformer. All the necessary binding posts are provided to connect up in any hook-up. A very convenient unit to add to a crystal detector set or used in connection with the experimental units shown here. Price without tubes \$11.00.



CROSLY DUO-AMPLIFIER UNIT. A two stage Audio Frequency Amplifier using genuine Crosley Sheltran Transformers. Unlike some of the more costly units, this amplifier is not resistance coupled, but is the highest type of modern construction. The standard tubes can be used, or, by means of the Crosley adapter, 1½ volt dry cell tubes can be employed. Price without tubes \$14.00.



New Crosley Socket Adapter

Complete with necessary screws and washers. It will fit any standard socket making it possible to use 1½ volt dry battery tube. This is a great boon to those who do not want to use a storage battery. When used with the Crosley V-T Socket, it can be mounted on either panel or base. Price complete \$.70.

Some Notable Price Reductions

CROSLY HARKO SENIOR MODEL V. A unit consisting of tuner, tapped inductance and audion detector that has given wonderful results. One listener in Minnesota hears Schenectady. In beautiful mahogany finished cabinet and formica panel. New price without phones, batteries or tubes, now \$15.00.

CROSLY TWO STEP AUDIO FREQUENCY AMPLIFIER in mahogany finished cabinet and formica panel. Price now \$17.00.

Handled by jobbers and dealers everywhere. If your dealer does not handle Crosley instruments send us his name and order direct.



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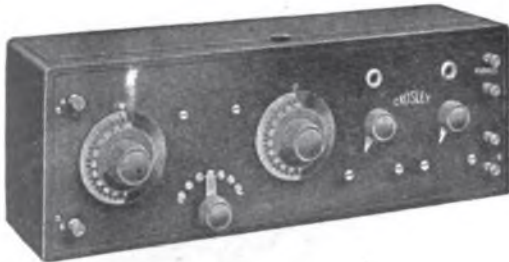
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118 Alfred Street,

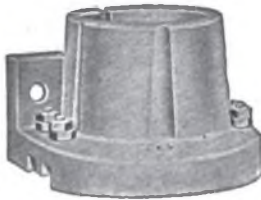
Cincinnati, Ohio



CROSLY MODEL VI. A two tube set similar to the Model "X" shown on the first page. This unit has approximately six times the range and volume of the Harko Senior. It consists of one stage of Radio Frequency Amplification and Audion Detector. It eliminates static to a large extent and distant stations are brought in clear and sharply. New price without tubes, batteries or phones \$28.00.



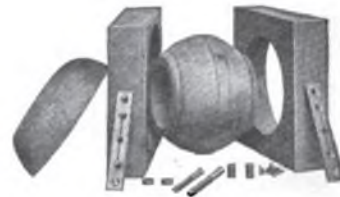
CROSLY RADIO FREQUENCY TUNED AMPLIFIER. Originally designed to be used in connection with the CROSLY HARKO SENIOR MODEL V. Hook ups have now been worked out for its efficient use with Westinghouse, Grebe, Clapp-Eastham and other receiving sets. Complete instructions showing these hook-ups are furnished with each Radio Frequency Amplifier, or will be sent upon request to anyone free of charge. New price \$12.00.



CROSLY V-T SOCKET. This socket has been pronounced by many radio engineers as the best socket on the market. Ever since its announcement, its success has been phenomenal. Although the success has been largely due to the price, its real popularity is based on its high quality, efficiency, service and practical unbreakability. Patents pending. Beware of imitators. Made of porcelain for base, or panel mounting. New price \$.40.

CROSLY VARIOMETER PARTS.

Consists of two stators and one rotor with necessary hardware. Stator can be readily wound with our winding form. Dia. of Rotor 4 in., over all dimensions 3" x 4 1/4". Made of poplar wood, well shellaced. New price \$1.25. Winding form \$.30.



**CROSLY VARIO-COUP-
LER PARTS.** The CROSLY VARIO-COUP-
LER is made with the same accu-
racy as the CROSLY VARIOMETER, and is de-
signed to function perfect-
ly with it. Each Vario-
Coupler set consists of a
formica tube, rotor and
necessary hardware. Com-
plete as shown in illus-
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CROSLY RHEOSTAT. Note
the new Crosley Rheostat with
ball bearing contact. This
rheostat permits exceptionally
accurate and delicate variations
of the filament current. Unique
construction allows the CROSLY
RHEOSTAT to be mounted
on a panel of any thickness up
to and including 3/8 inch. New
price \$.50.



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118 Alfred Street,

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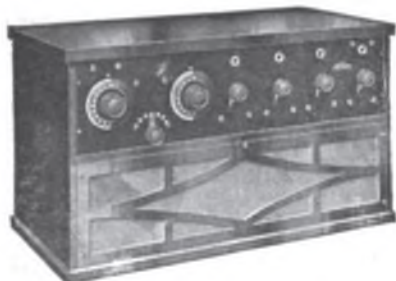
ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

Three Beautiful Cabinet Models With the Model X Receiver



CROSLEY MODEL XXV

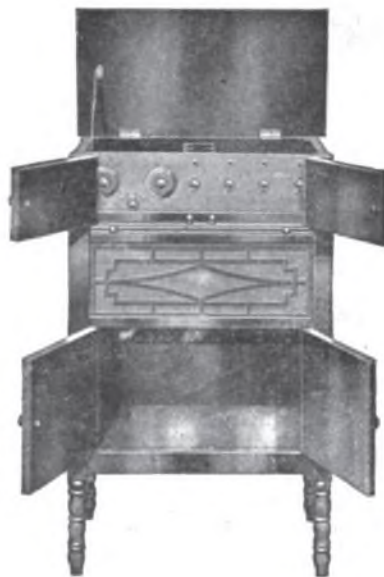
This beautiful mahogany cabinet is equipped with four tube panel incorporating the same units as the Model X. This cabinet is arranged to take the Model R-3 Magnavox that can be quickly installed and hooked up to the set. Cabinet also contains space for "A" Battery, "B" Battery and battery charger if desired. A throw-over switch is provided to change from head phones to loud speaker. It is guaranteed to bring in broadcasting stations up to one thousand miles or more, loud enough to be heard all over the room. This beautiful instrument without tubes, batteries or phones, sells for \$150.00.



CROSLEY MODEL VX

Incorporates the same receiving apparatus as the other instruments on this page. Has special sound resonating chamber but without compartment for batteries. Will fill your room with music or other broadcasting. Mahogany finished. Price without tubes, batteries or phones \$70.00.

~~CROSLEY~~
Better—Cost Less
RADIO



CROSLEY MODEL XX

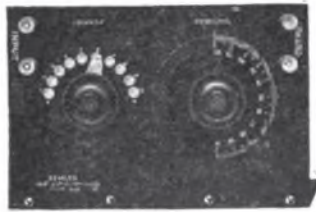
The same as CROSLEY RECEIVER MODEL X in an upright cabinet with special sound resonating chamber. A hinged lid, when raised, allows the operator access to every part of the receiving apparatus. Directly under the receiving apparatus is a highly finished board that slips in and out, forming a desk for the person operating the instrument. Has the same volume and range as the MODEL X. Mahogany finished. Price without tubes, batteries or phones \$100.00.

Your dealer or jobber should be able to furnish you with Crosley Instruments. If not, send us his name and order direct.

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CROSLEY MANUFACTURING CO.
118 Alfred Street, Cincinnati, Ohio

REMLER



Remler Type 505 Panel Mounted Vario Coupler Price \$12.00



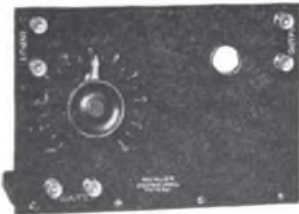
Remler Type 502 Panel Mounted Variable Transformer Price \$10.50



Remler Type 330 Detector Panel Price \$4.50



Remler Type 433 Amplifier Panel less transformer Price \$20.00



Remler Type 331 Amplifier Panel less transformer Price \$6.00

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In placing these panels on the market Remler has put a high quality receiving set within the financial reach of everyone.

When designing these Remler panel-units, Remler engineers combined every point necessary for efficiency in receiving, together with special features of construction for the convenience of the user. No process of manufacturing that would make these panels efficient in operation, beautiful and uniform in appearance has been neglected. Each panel is a complete unit mounted on a hardwood base for table use but so designed that any number of panels may be easily mounted in a single cabinet.

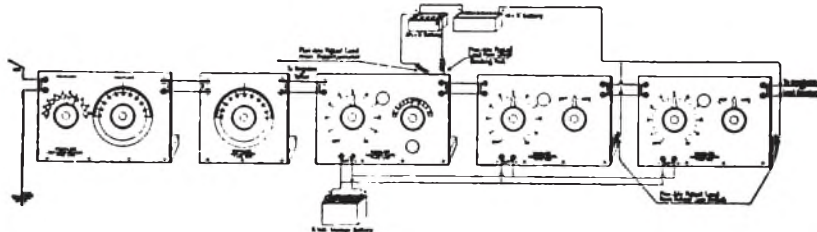
Remler standard parts are used exclusively in their assembly—hence it is possible, by using combinations of Remler panel units, to obtain a complete receiving set, using the same circuit employed in the most expensive receiving set on the market, at only a fraction of the cost.

You can Start with only three panels:

A complete and efficient receiving set for local work is obtained by connecting together Remler panels types 505-502 and 330. For long distance receptions other panels may be added one at a time to suit the convenience of the owner until the most complete and efficient circuit possible is obtained. The cost is nominal.

The diagram below shows five Remler panels connected to form a complete inductively coupled receiving set and two-stage Amplifier.

Send 10c for new Remler 40-page catalog giving prices and complete descriptions of every Remler article.



The Remler Technical Bureau is at your Service. Address your problems to Dept. Q

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EASTERN SALES OFFICE
154 W. LAKE STREET
CHICAGO, ILLINOIS



**AMPLIFIES
AS IT
DETECTS**

Cunningham tubes

Give Clearest Reception

Cunningham Tubes used in any standard receiving set will enable you and your friends to listen to news reports at breakfast, stock market quotations at lunch, and in the evening sit in your comfortable living-room by the fireside and enjoy the finest music and entertainment of the day.

Send 5c for new 32-page Cunningham Tube catalog, containing detailed instruction for the operation of Cunningham Tubes as well as numerous circuit diagrams and graphic illustrations of tube action.

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San Francisco, Calif.

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Cunningham tubes are covered by patents dated 11-7-05, 1-15-07, 2-18-08 and others issued and pending. Licensed only for amateur or experimental uses in radio communication. Any other use will be an infringement.

**TYPE C-300
Super-Sensitive
DETECTOR**

\$5.00

**TYPE C-301
Distortionless
AMPLIFIER**

\$6.50



The trade mark GE is the guarantee of these quality tubes. Each tube is built to most rigid specifications.

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Representatives:—**

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of the

THIRD RADIO DISTRICT

Auspices

AMERICAN RADIO RELAY LEAGUE

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EXHIBITS BY MANUFACTURERS OF
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MOST PROMINENT MEN IN RADIO

A GRAND REUNION OF THE BOYS WHO
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\$5.00

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BALTIMORE, MARYLAND

THIS IS YOUR CONVENTION
LET'S GO AND PUT IT OVER

BIG

ANNOUNCEMENT

Our new Radio Department is now open,
and we can save you money on your
supplies or complete sets.

SPECIALS FOR THIS MONTH

Radiotrons UV200 \$4.40

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Try us and be convinced.

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Compact — Interchangeable
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60
Cents
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60
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Unit

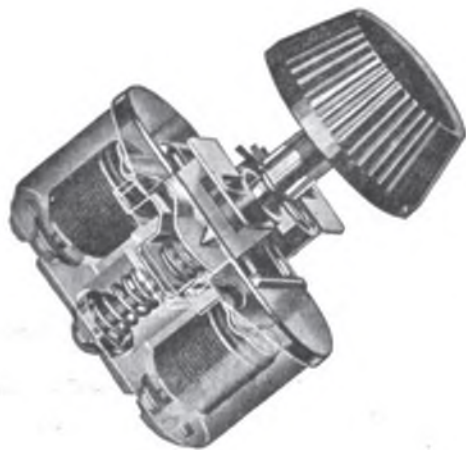
Mica Condensers — Grid Leaks
Mountings:

Interesting Proposition for Dealers

EUROPEAN RADIO CO.

1342 East 22nd Street, Brooklyn, N. Y.

The New Bradleystat - a Phenomenal Success



A Phantom View, Showing the Discs

These graphite discs, scientifically prepared, contain the secret of the Bradleystat. No wire rheostat can possibly give the noiseless, smooth control so eagerly sought by radio men. For both 6-volt and 1½-volt tubes, Bradleystat control is unsurpassed.

The discs have no inductance. They last forever, and laboratory tests reveal that they maintain better adjustment than the wire rheostat. Try one, tonight, and enjoy the supreme delight of Perfect Filament Control.

Allen-Bradley Co.
Electric Controlling Apparatus

277 Greenfield Avenue · Milwaukee, Wisconsin
Member of the National Radio Chamber of Commerce

Some Distinctive Features

The new Bradleystat is creating widespread interest among radio enthusiasts. Several refinements in the new model makes the new Bradleystat pre-eminent in the field of filament rheostats.



The new knob, beautifully proportioned and fluted to match the finest radio equipment, distinguishes the new Bradleystat for its splendid appearance. The new porcelain container is smaller than the older model, but the range of control is better than ever.



The name, "Bradleystat" is embossed on the new container to protect you against spurious imitations. Safeguard your radio set by insisting on genuine Bradleystats. An adjusting screw has been added in the base for setting the "cut-off" switch as you desire.



Retail Price
\$1.85
P. P. 10c extra

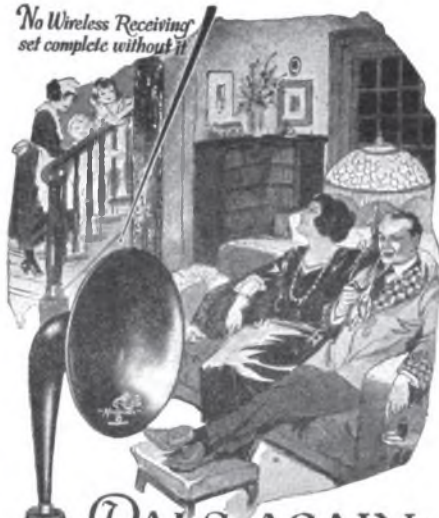


Bradleystat

REGISTERED U.S. PAT. OFF.

PERFECT FILAMENT CONTROL

No Wireless Receiving set complete without it



PALS AGAIN
Never a dull evening in the home

WITH the Magnavox Radio, the volume of sound is limited only by the amount of power input.

Magnavox Power Amplifier—Model C (2 or 3 stage) is especially designed for true power amplification, and gives marvelous results.

R-2 Magnavox Radio with 18-inch horn: this instrument is intended for those who wish the utmost in amplifying power; for large audiences, dance halls, etc. **\$85.00**

R-3 Magnavox Radio with 14-inch horn: the ideal instrument for use in homes, offices, amateur stations, etc. . . . **\$45.00**

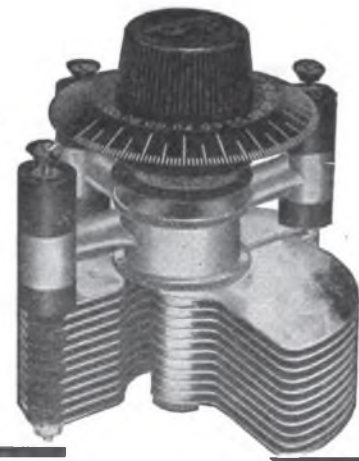
Model C Magnavox Power Amplifier insures getting the largest possible power input for your Magnavox Radio. 2 Stage **\$80.00**
3 Stage **110.00**

Magnavox products can be had of good dealers everywhere. Write us for copy of new illustrated booklet.

THE MAGNAVOX CO.
Oakland, California
N. Y. Office: 370 Seventh Ave.



MAGNAVOX
Radio
The Reproducer Supreme



Cotoco

TRADE MARK REG. U. S. PAT. OFF.

The Variable Air Condenser that Gets the Best from your Set

Thousands of good sets are giving their owners pitiful results for only one reason, namely inefficient Variable Air Condensers. Did you buy a cheap condenser? Not cheap in price perhaps, but cheaply made; a condenser in looks but not in action. Go to your dealer and ask to see this one. It is as efficient as it is clean cut in appearance. Take it home. Try it. You'll be rewarded.

Insist upon

COTOCO PRODUCTS

- AMPLIFYING TRANSFORMERS FOR AUDIO FREQUENCY, and RADIO FREQUENCY**
- SOCKETS, DIALS**
- COTOCOILS, THE ORIGINAL CONCENTRATED INDUCTANCES**

If your Dealer Fails you, Write us Direct

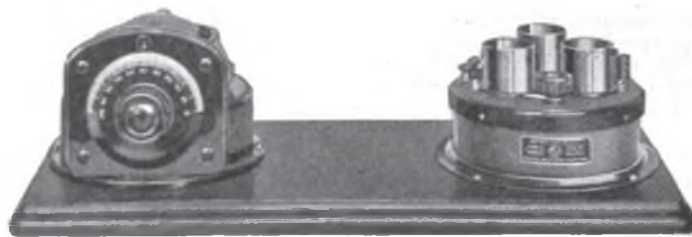
Accept no substitutes. You can't afford to. Ask for Cotoco Quality and get it if you have to write us.

COTO-COIL CO.

87 Willard Ave.,
Providence, R. I.

ATWATER KENT

RADIO RECEIVING SET



THE above set, consisting of Coupled Circuit Tuner and Detector 2-Stage Amplifier, is an ideal set for either phone or loud speaker use. Note that this set includes two stages of audio frequency amplification.

Complete Outfit, as above, wired, \$35.50



The Mounted Variometer carries through the standard quality of ATWATER KENT products. For an open set it supplies a finished instrument unsurpassed in appearance and performance.

Mounted Variometer, \$10.00

ATWATER KENT MANUFACTURING COMPANY

4945 STENTON AVE.

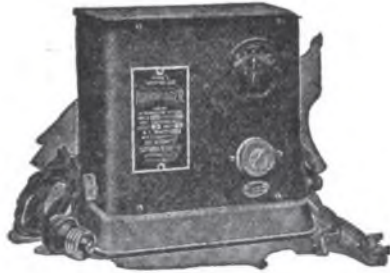
Radio Dept.

PHILADELPHIA, PA.

"We Are Now Signing Off--Good Night!"

Now Attach

**THE
HOMCHARGER**



To your AC lamp socket, snap the clips on your storage battery and "turn in." While you sleep, the RADIO HOMCHARGER DE LUXE is silently charging your battery—the charging rate being governed automatically. In the morning it is fully charged; ready for another evening's entertainment, and the cost has

been less than a nickel for current consumed.

No muss, trouble, dirt—no moving of battery—loss of time. You can't connect it up wrong—it can't overcharge nor harm your battery in any way. Its beautiful mahogany and gold finish will harmonize with any living room.

Furnished complete with Ammeter, Attachment Cord and Plug, Charging Cable and Battery Clips, by all good dealers handling radio and electrical equipment, for \$18.50.

Ask your dealer for Bulletin No. 637, illustrating the new HOMCHARGER in actual colors, or write direct.

CAUTION When buying a Rectifier insist upon the following:

- 1—SELF-POLARIZING feature, otherwise your battery may be ruined through reverse charging.
 - 2—AT LEAST FIVE AMPERE CHARGING RATE, otherwise it will require several days to fully charge your battery.
 - 3—UNDERWRITERS' APPROVAL, otherwise in case of fire your insurance may be void.
- The HOMCHARGER is the only Rectifier at any price which combines the above, three NECESSARY HOMCHARGING features.

The Automatic Electric Devices Company, 127 West Third St., Cincinnati, Ohio

Largest Manufacturers of Vibrating Rectifiers in the World

HERBERT H. FROST, Inc.
154 WEST LAKE STREET, CHICAGO, ILLINOIS.

FROST-FONES

Super-Inspected Quality Fones and Radio Parts

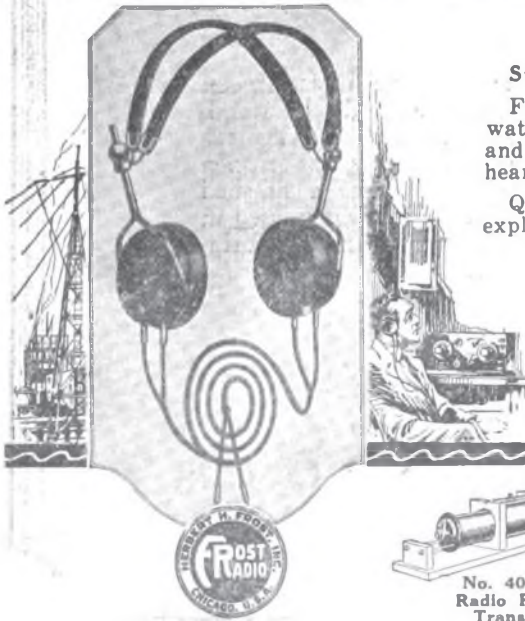
Frost-Fones are built as precisely as a delicate watch. Specially inspected to insure sensitivity and permanent strength. Frost-Fones excel for hearing local broadcasting stations or distance work.

Quantity production and efficient factory methods explain the low price of Frost Quality Fones.

America's leading jobbers and dealers sell Frost-Radio Equipment. Save money and insure satisfaction by insisting on Frost-Radio.

HERBERT H. FROST, Inc.

154 W. Lake Street, Chicago



No. 137—Frost Radio Cord Tip Plug, \$1.25

No. 400—Frost Radio Receiving Transformer, \$8.50

No. 131—Frost Radio Double Circuit Jack, 90¢

No. 138—Frost Radio Multi-Phone Plug, \$2.50

ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS

Q.—What is the most important thing in a wireless outfit?

A.—The wire!

YET we've seen wireless apparatus that seemed almost to take its name literally—as far as having had any serious attention paid to its wire.

Magnet wire is the basic material of radio equipment. For the manufacturer it holds a dual significance. It must perform *economically* in his plant, in the hands of his operators; and it must perform *efficiently* in the finished jobs, in the hands of his customers.

Acme Magnet Wire was made—long before the days of practical radio—to meet these two standards in the field of general electrical manufacturing. It winds easily and economically, because it is uniform, free from imperfections, and its insulation is scientifically applied to insure smooth, rapid production. Its long-continued use by the leading makers of standard electric equipment is ample testimony of its quality in performing the work expected of it.

Acme has pioneered in the development of the finer sizes of enameled magnet wire for radio use and, in winding *hundreds of thousands* of transformer coils in the Acme plant, has gained the practical experience in this field that is of such inestimable value in improving the quality of Acme Wire and maintaining the Acme Service in radio work.

THE ACME WIRE CO., New Haven, Conn.
NEW YORK CHICAGO CLEVELAND

Acme Wire

“It goes in the space”

ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS

Acme Radio Users

Acme Apparatus Co.
 Adams Morgan Co.
 Atwater Kent Mfg. Co.
 Auth Electrical Specialty Co.
 Chicago Telephone Supply Co.
 Connecticut Telephone & Electric Co.
 Chas. Cory & Son, Inc.
 Dictograph Products Co.
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 Standard Transformer Co.
 States Co.
 Thordarson Mfg. Co.
 Walls Mfg. Co.
 Westinghouse Elec. & Mfg. Co.

Acme Electrical Insulations

Flexible varnished tubing in all sizes and colors; standard or special.

Acme Radio Specialties

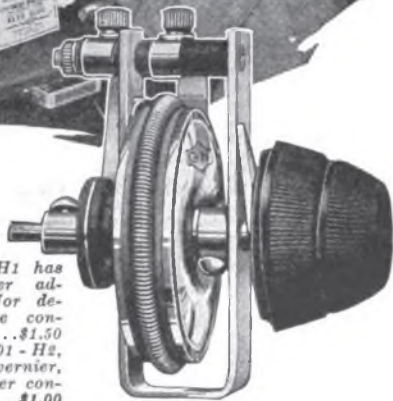
Audio Transformer windings.
 Radio Frequency windings.
 Magnet windings for Head Sets.
 Enameled wire—especially the finest sizes, 40-44 B & S gauge.
 Silk and cotton-covered magnet wire.
 Enameled Aerial wire—single wire and stranded.

Acme Wire Products

“Enamelite,” plain enameled Magnet Wire; “Cottonite,” Cotton-covered Enamelite; “Silkenite,” Silk-covered Enamelite; Single and Double Cotton Magnet Wire; Single and Double Silk Magnet Wire. We also have a complete organization for the winding of coils in large production quantities.

Illustrated Catalog will be sent upon request to Purchasing Agents and Engineers.





Type 11601-H1 has the vernier adjustment for detector tube control\$1.50
 Type 11601-H2, without vernier, for amplifier control\$1.00

Dealers Point with Pride to the C-H Trade-mark

One of the first things any dealer will point out in showing you a genuine Cutler-Hammer Radio Rheostat is the famous C-H trade-mark engraved in the satin-nickel body.

As a practical electrical man, the dealer knows the protection this trade-mark gives the buyer—he knows that “radio rheostats built by rheostat builders” means perfection as the result of years of experience, not hasty design to meet a sudden demand.

For more than a quarter of a century the engineers of Cutler-Hammer have been the aggressive pioneers in the development of rheostatic control, and their signature of approval—the C-H trade-mark—is known and respected in every industry the world over.

The dealer is proud to show, as representative of his stock, these rheostats of recognized and guaranteed quality, and he recommends them with full confidence, knowing that they were designed by specialists to give you un-failing satisfaction.

THE CUTLER-HAMMER MFG. CO.
 MILWAUKEE - WISCONSIN

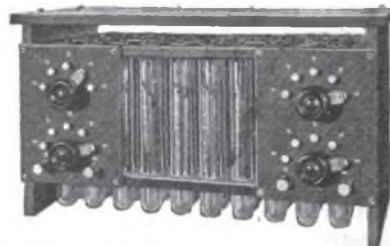
Over a Quarter Million in Use

CH RADIO RHEOSTATS
 “BUILT BY RHEOSTAT BUILDERS”

“Member, Radio Section, Associated Manufacturers of Electrical Supplies.”



“B” Battery with Panel Control Storage Batteries designed for **RADIO**



KICO Storage “B” batteries are used by thousands of amateurs who understand radio and consequently buy nothing but the most efficient equipment.

A FEW REASONS

1. Alkaline type. Unlimited Life.
2. They eliminate noises caused from “Bs” that are rapidly deteriorating.
3. The switch control allows single cell variations from 12 volts up. (A critical plate adjustment is essential on your detector bulb for C.W. and Radiophone reception.)
4. Rechargeable from your 110 Volt A. C. line in connection with the rectifier supplied with each battery.
5. Will last from three to six months on a single charge while in the detector plate circuit.
6. NOT an experiment. All batteries sold with the privilege of receiving your money back if unsatisfied within a 90 day trial.
7. Neat, Efficient and Compact.

	(Plain)	(With Panels)
16 cell 22 volts	\$6.50	
24 cell 32 volts	8.00	\$12.00
36 cell 48 volts	10.00	14.00
50 cell 68 volts	12.00	17.00
78 cell 100 volts	16.00	21.00
108 cell 145 volts	21.00	26.00

F.O.B. Buffalo, N. Y.

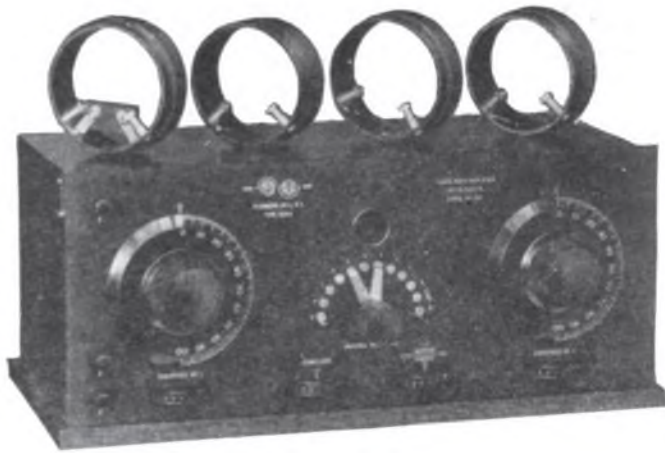
Literature gladly furnished

We distribute KING Chargers

KIMLEY ELECTRIC CO.

1355 Fillmore Ave., Buffalo, N. Y.

**Ready for
Delivery
New
GREBE
RORN
Amplifier
\$6000**



This new **tuned R. F. Amplifier** equals two steps of audio frequency amplification, entirely eliminates QRM and will bring in stations you never heard before.

Perfectly designed for use with Grebe CR-3, CR-5, CR-8 and CR-9 receivers,—four inductances covering range of 150-3000 meters. Gives splendid results with other standard receivers or with your home-built outfit. Conservative range 500 miles used with loop aerial, detector and one amplifier tube.

Booklet with each RORN shows in detail how to connect to all types of receivers. Requires one amplifier tube and 90-volt B. battery for operation.

Price complete with four inductances, \$60. Immediate delivery on mail orders.

BEST SELLERS

New Magnavox-copper horn	\$45.00
Fada Varlo-Couplers	4.75
Klooner Vernier Rheostats	1.80
Acme Pot-Rheo	3.00
DeForest D-7 Reflex Set	112.00
Single Baldys-Type "C"	7.75
WD-11 Tubes 1.5-V Filament	6.50
Sockets for above	.75
Adapters for standard base	1.50
Amrad Broadcast Receiver	125.00
Gold Grain Detectors	2.50
For panel mounting	2.00
Reinartz Tuner Coils	2.00
Amrad 2-step Amplifier	40.00

New Year's Gift

Bakelite VT socket free with each vacuum tube sold during January.

CHICAGO ARRL MEN can always find the latest apparatus and most courteous service at "Radio Center."

DX MEN—we offer you the same service by mail. Try us for items listed or any **NATIONALLY ADVERTISED EQUIPMENT**.

LYNN RADIO COMPANY

STANDARD NATIONALLY ADVERTISED

Phone Harrison 7293 **RADIO EQUIPMENT** L. L. Lynn, Pres.

Sixth Floor Consumers Building
220 South State St — Chicago, Ill

For Best Super-Regenerative Results

Use Coils Armstrong Chose



PACENT DUO-LATERAL COILS

The Last Word in
INDUCTANCES

For the Armstrong Super-
regenerative circuit.

Size	Price
US 400 Unmounted.....	\$1.20
US 1250 Unmounted.....	2.70
US 1500 Unmounted.....	3.20

Don't Improvise
PACENTIZE

Major Armstrong selected PACENT Duo-Lateral Coils as the best to use in his original super-regenerative equipment. Other leading authorities endorse his selection. Genuine Duo-Lateral Coils are distinguished by their characteristic staggered winding, are labeled "DUO-LATERAL COIL" and marked "Patented June 1920."

Send for Descriptive Bulletins (Q.J.103)

PACENT ELECTRIC COMPANY

INCORPORATED

Manufacturers & Distributors of Radio & Electrical Essentials

Executive Offices: 22 Park Place, New York, N. Y.

BRANCH OFFICES

Philadelphia, Bourse Bldg.
Chicago, 38 So. Clinton St.

Wash., D. C., Munsey Bldg.
San Francisco, Sheldon Bldg.

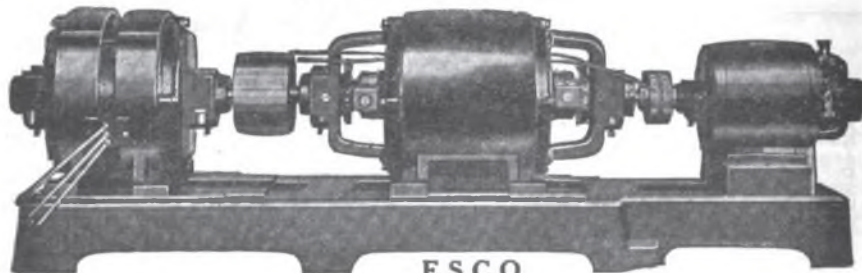
Members, Radio Section,
Associated Mfrs. of Electrical
Supplies



Can. and British Licensees:
COLONIAL RADIO, Ltd.,
Hamilton, Canada

TRADE ESCO MARK

QUALITY ALWAYS HAS BEEN, AND ALWAYS WILL BE, THE WORLD'S
SAFEST INVESTMENT



ESCO

HIGH VOLTAGE MOTOR-GENERATORS STAND PRE-EMINENT
Used by Leading Educational Institutions, U. S. Army and Navy Academies, Research Laboratories.

Newspapers, Dept. Stores and Broadcasting Stations.

BULLETIN 287 LISTS OVER 200 COMBINATIONS

Special Apparatus Developed for Special Requirements

MOTORS—DYNAMOTORS—GENERATORS—MOTOR-GENERATORS

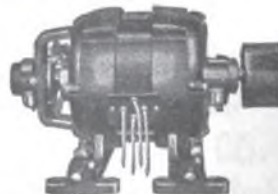
Sold by Principal Dealers Everywhere



Electric Specialty Co.

215 South Street

Stamford, Conn., U.S.A.



A.R.R.L. ANNOUNCEMENT



GEARED CONDENSER



POWER AMPLIFIER

The General Radio Company has been supplying the needs of the experimenter for nearly a decade. It antedates QST and the A.R.R.L. Since the formation of the A.R.R.L. this Company has used QST to announce whatever new radio instruments it has produced. Several new instruments have just been developed that are now ready for the experimenter. They are so new that we have not obtained the advertising cuts as yet. Here is a list of them:

TYPE 300-A AMPLIFIER UNIT

A compact unit consisting of our Type 231-A Amplifying Transformer, Type 255 Filament Rheostat and Type 282 WD-11 Tube Socket mounted on a nickel finished brass mounting. These parts are all wired ready for the external connections. The mounting is so designed that the unit may be used on a table or mounted behind a panel with only the rheostat knob projecting.

PRICE, COMPLETE\$7.50

TYPE 282 WD-11 TUBE SOCKET

A socket of moulded bakelite arranged with positive contact springs to take the WD-11 tubes. This is a socket in itself, not an adaptor.

PRICE80 cents

TYPE 255 RHEOSTAT

A rheostat of moulded bakelite, not a substitute, for panel or table mounting. Smooth in operation and attractive in appearance. Resistance 6 ohms; current carrying capacity 1.25 amperes.

PRICE\$1.00

TYPE 272 POWER AMPLIFIER

A two stage amplifier for use with loud speakers. Operates from 110 volt A.C. lighting supply. Uses power tubes and requires no storage battery.

PRICE\$40.00

TYPE 247 CONDENSERS

These already popular condensers may now be equipped with gear providing a vernier adjustment with but a single setting. A low loss condenser with a micrometer adjustment. Made in 8 types.

PRICE\$3.25 to \$7.75

Send for NEW FREE RADIO BULLETIN 912Q and learn about these instruments.

GENERAL RADIO COMPANY

MASSACHUSETTS AVENUE AND WINDSOR STREET

CAMBRIDGE 39

MASSACHUSETTS

Do not confuse the products of the GENERAL RADIO CO. with those of other concerns using the words "General Radio." The General Radio Co. has been manufacturing radio and scientific instruments for many years. It has no affiliation with any other company.

Standardize on General Radio Equipment Throughout

Regenerative
RadioCraft
Radiophone*
Type D-4

A compact and efficient Receiver that looks good and works better!



The Principle is only Half the Battle

YES, it's regenerative. But there's one other point you want to know. What parts make it up? De Forest parts go into RadioCraft sets—and that tells the whole story. Here is regenerative equipment inexpensive in price and so efficient that it will bring in broadcast within a radius of 150 miles and upward. D-4 is designed for the user who wants a compact portable outfit for camping or touring. It is also ideal for the family which desires to purchase a tuner and detector unit, and after becoming accustomed to its use adding the 2-Step Amplifier, D-5, shown below, for the purpose of actuating a loud speaker. The two units are so designed, being exactly of the same size, that they can be placed

one beside the other and connections made by means of short wires.

De Forest dealers carry RadioCraft Regenerative equipment.



RadioCraft
Radiophone*
2-Step Amplifier
Type D-5

* By permission of
De Forest Radio Tel. & Tel. Co.

The RadioCraft Co., Inc.
139 Franklin St., Jersey City, N. J.



Recharge Your Battery at Home

Charges both A and B Radio Batteries

Don't be without the use of your Radio Receiving Set while your battery is being charged. Get a Valley Charger and charge your battery right at home.

Attach the Charger to your home lamp socket—attach the clips to the battery terminals and you will get a quick, tapering charge which just exactly charges your battery, but cannot overcharge it or harm it in any way.

Will charge the A 6 volt battery at a 5 ampere rate, and the B 22 1/2 volt battery at the required 1/2 ampere rate. 45 volt B batteries may be connected in parallel so that they can also be charged.

SATISFACTION GUARANTEED.

If your local distributor cannot supply you, write direct to

VALLEY ELECTRIC COMPANY
Department Q, ST. LOUIS

- - - - Mail the Coupon - - - -

Valley Electric Co., Dept. Q, St. Louis, Mo.

Gentlemen: I am enclosing money order (or check) for \$18.00, for which send me a Valley Battery Charger with five-panel glass display case and indicator. If not satisfactory I will return it and get my money

Name

Address

\$18.00

F.O.B. St. Louis





This Panel Will Improve Your Set

CONDENSITE CELORON

The best panel made is none too good for your set. Dependable insulation is vital because it has a direct bearing upon the clearness and sensitivity of both transmission and reception.

Every thinking radio enthusiast certainly wants the highest type panel he can obtain and the surest way to get it is to insist upon Condensite Celoron.

This strong, handsome, jet-black material is not merely an insulating material—it is a radio insulation made to meet high voltages at radio frequencies. That is why it will give you greater resistivity and a higher dielectric strength than you will ever need.

Make your next panel of Condensite Celoron. It machines readily, engraves with clean cut characters and takes a beautiful polish or a rich dull mat surface.

An Opportunity for Radio Dealers

Condensite Celoron Radio Panels and Parts offer a clean cut opportunity to the dealer who is keen on building business on a quality basis. Write us today. Let us send you the facts. You'll be interested.

Diamond State Fibre Company
Bridgeport (near Philadelphia), Penna.
Branch Factory and Warehouse, Chicago.

Offices in Principal Cities

In Canada: Diamond State Fibre Co. of Canada, Toronto, 245 Carlaw Ave.



Radio Frequency Amplifying Transformers

200-600 METERS—AIR CORE

Made by Foremost Amplification Experts



Three Types
 Type T-11 for the first stage. \$6.00
 Type T-11A for the second stage. \$6.50
 Type T-11B for the third stage. \$7.00

The best recommendation of Mu-Rad Radio Frequency Transformers is their use in Mu-Rad Receivers. When you listen in with a Mu-Rad Set, you appreciate the difference this greatly superior transformer makes.

No iron losses, capacity effects and eddy current loss. Wonderfully accurate, performance varies less than a half of one per cent. Designed by amplification specialists. Admittedly the best.

Write for comprehensive leaflet on Mu-Rad R. F. Amplifying Transformers and Mu-Rad Receivers. Well worth the effort. Do it NOW! Sold by all GOOD radio stores and departments.

MU-RAD LABORATORIES, Inc.

804 FIFTH AVE.,

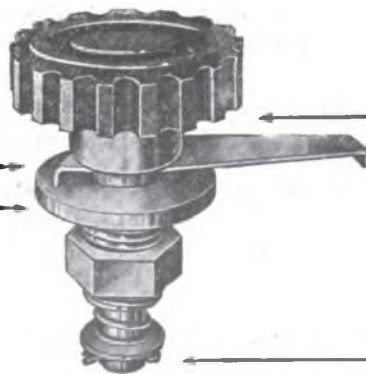
ASBURY PARK, N. J.

Already Hundreds in Use!

The Ace type LS panel lever switch has met with immediate popular favor all over the country. The reason is its many exclusive features as shown. Polished nickel plated finish—postpaid for 65 cents.

Perfect Self Cleaning Wipe Contacts.

Generous Contact Surface.



Hard Rubber Knob Molded-in HEXAGONAL Shaft-Blade CANNOT turn.

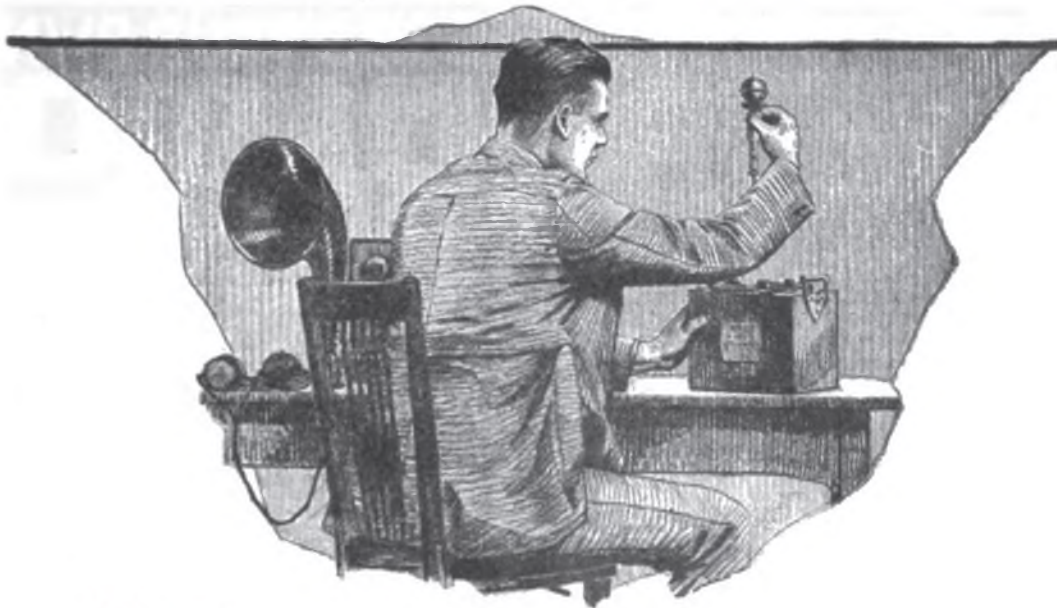
Perfect Self Cleaning Wipe Contacts.

Spring and Cotter Pin Lock—No Nuts to Work Loose.

Dept. Q

THE PRECISION EQUIPMENT COMPANY
 2437-39 GILBERT AVENUE,

CINCINNATI, OHIO



Tungar

Your Battery

Should be Kept Fit

The Tungar Battery Charger makes it a simple matter to keep your storage battery tuned-up and fit. With it you can recharge your battery at home—and at little cost.



This enables you to keep batteries fit, right at home. With simple attachment, it will also charge "B" storage batteries.

Tungar is a small, compact rectifier, which can be connected with any a-c. lighting circuit. It is easy and safe to operate—in fact, requires no attention after starting. And when properly connected, the current can go only the one way, eliminating any danger of ruining the battery.



This is the way "B" Storage Batteries are charged with Tungar and attachment.

There is no excuse for allowing your battery to run down and spoil the evening's fun. A Tungar doesn't cost much—and it charges the starting and lighting battery in your automobile also.

Send for our new booklet on Tungars for radio, if your dealer cannot supply you.

Address Merchandise Dept., General Electric Company, Bridgeport, Conn.

General  Electric
Company Sales Offices in all large cities 35A-70C
 General Office
 Schenectady, N.Y.

The Standard Idea

An Old Firm With a New Policy

On and after November 1st "Standard" apparatus will be sold only direct from the manufacturer and the following reduced prices will be in effect:

A BIG SAVING ON EQUIPMENT

Multiple Wave Tuner... \$30.00
(former price \$45.00)

Short Wave Tuner... \$23.50
(former price \$47.00)

Detector and Two Stage
Amplifier \$35.00
(former price \$49.00)

The foregoing is but a partial list of the items manufactured and distributed by us.

The apparatus is not changed in any way, carries the same guarantee and is sold on the same terms, namely one third cash with order and balance C.O.D. after examination at your express office.

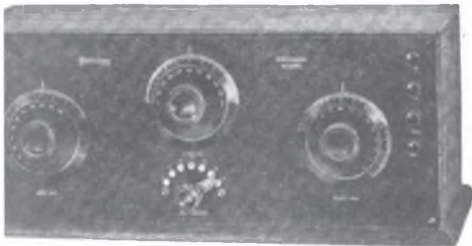
Write for booklet "The Standard Plan" showing how you can obtain quality apparatus at a price within your means.

Watch for our new line of "Novice Type" instruments.

STANDARD ASSEMBLING
COMPANY

3 Stone St.

New York, N. Y.



BUILD YOUR OWN RADIO

The Radio Specialty Company — RASCO for short—specializes in small orders: in fact, 50% of our orders are less than one dollar. 24-hour service guaranteed.

This Company specializes in small parts for radio, selling only the highest class of materials. This Company is aware of the fact that very high prices prevail in radio now. By buying material from us you not only save anywhere from 50 to 75% on the cost of the instruments, but you have the fun and instruction of making them yourself.

Our quick, 24-hour service means satisfied customers. We have no Complaint Department. Hundreds of letters such as the following, unsolicited, are in our files:

41 Rodney St., W. St. John, N.B.

Dear Sirs:

Enclosed you will find one (1) dollar for which please send me 1 dozen binding posts No. 201 at \$1.00 per dozen and oblige.

Geo. B. Ingraham
P.S.—Rasco Service is sure all it is cracked up to be. I have received three different orders from Rasco and I am still waiting for an order from another Company which was sent in before the first Rasco order.

Yours truly, 64 page catalog
G. B. I.

Our prices are low and all goods are shipped prepaid. You deal with the oldest and only Company exclusively manufacturing the small parts in their own two big factories. Our big 64-page catalog, No. 7, containing over 300 illustrations will save you money. This catalog also contains

75 Diagrams of Vacuum Tube Hook-Ups

not to be found in any catalog, only found in expensive text books. This catalog sent only upon receipt of 15¢. Once you have tried the RASCO service you are a customer for life. 85% of our customers always come back.

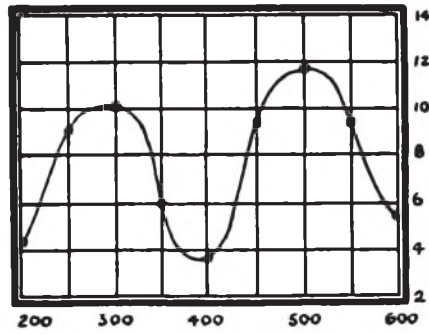
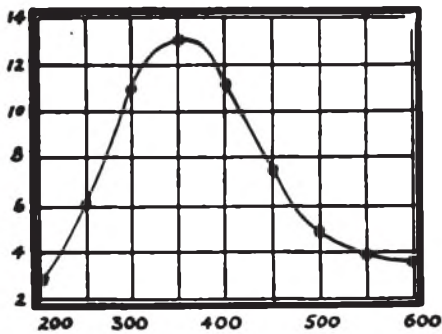


Detector 50c

Radio Specialty Co.

98-100 PARK PLAGE, NEW YORK CITY

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS



Find this out

Before you choose your radio frequency transformer

DOES it have marked depressions and peaks in its amplification range curve between 200 and 500 meters (indicating absence of amplification at the depressions)—or does it keep the amplification range curve uniform with its maximum efficiency around 360 meters—the place you need it most.

A test

THE two charts above tell a graphic story of tests made on radio frequency transformers in the laboratories of a well known concern. The chart at the left plots the amplification range curve of an Acme R-2 taken from stock. The chart at the right represents a composite plot of the curves of 6 ordinary types of different makes taken from stock. The superiority of the Acme R-2 is self evident. Note its steadily increasing amplification curve with its maximum at 360 meters—just where it is most needed.



ACME R-2 Radio Frequency Amplifying Transformer.
Price \$5.00 (East of Rocky Mts.)

Getting greater distances

EQUALLY important is the greater distances over which you can get broadcasting when using the Acme R-2. The R-2 used in a radio frequency amplifier builds up wave energy before passing it on to the detector. You hear signals that would ordinarily be inaudible. Even the simplest and most elementary type of set, either vacuum tube or crystal receiver type, will have its range tremendously increased when the Acme R-2 is employed in conjunction with a vacuum tube.

The best method

TO SECURE maximum results over long distances use both Acme Radio and Acme Audio Frequency Transformers. This insures maximum sensitivity and intensity, quietness in operation and freedom from distortion. A small indoor antenna or loop may be used and sufficient intensity obtained to operate the Acme Klear-speaker, providing perfect entertainment for a roomful of people.

You can get these and all other Acme Products at radio, electrical and many hardware stores. Write for booklet R-3 showing proper hook-ups and other information.

THE ACME APPARATUS COMPANY, Cambridge, Mass.

Pioneer transformer and radio engineers and manufacturers
NEW YORK, 1270 Broadway

ACME

~ for amplification

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Trade Mark Registered

GREBE distributors in Eastern Pennsylvania, Southern New Jersey, Delaware and Maryland. The Famous Grebe Receivers are renowned for their sensitivity and expert workmanship.

We carry complete stocks of R. C. A. Products and others of merit.

Have your dealer order from us for immediate shipment.

PHILADELPHIA WIRELESS SALES CORPORATION

Formerly Philadelphia School of Wireless Telegraphy

1533 PINE STREET,
WHOLESALE DEPT.

1326 ARCH ST., PHILADELPHIA
RETAIL DEPT.



RADIO TRANSFORMERS

An unusual Radio Frequency Transformer with an adjustable Silicon core—an exclusive patented feature, enabling reception at 200 meters as well as on the higher wave lengths. Daily establishing DX records. Price only \$4.50



DONGAN ELECTRIC MFG. CO.
DETROIT MICHIGAN



An amplifying transformer scientifically constructed to bring out full, clear tones. Top or side panel mounting. Price \$4.00.

LORAIN The Coupler with the PERFECT MOUNTING



Pat. Pend.

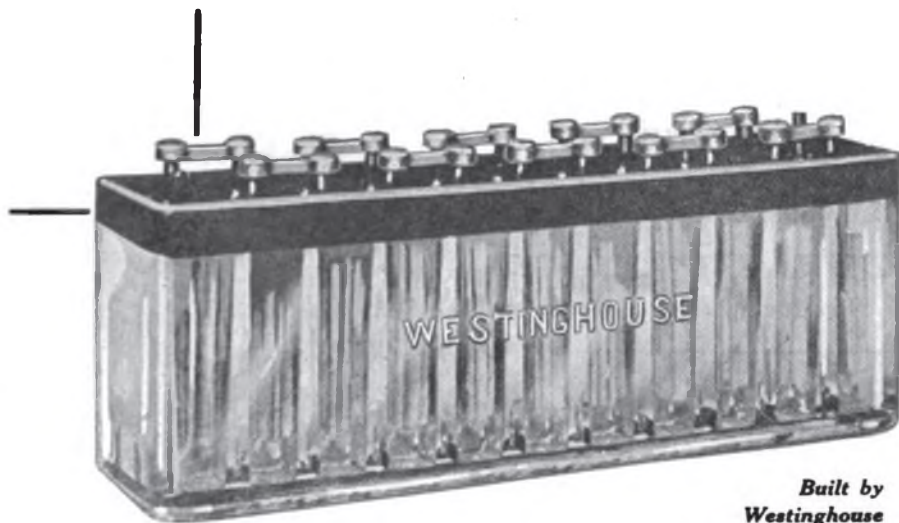
A coupler which is fast proving its superiority. A coupler designed to work correctly and give lasting satisfaction. Accept no substitute.

Price \$5.50

Send for complete description. Circular C.2.

If your dealer cannot supply you write us and send his name. Dealers write for discounts.

Lorain Radio Supply Co.
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*Built by
Westinghouse
—you know it's right*

THIS newest Westinghouse Radio "B" Battery is a 22-volt, glass-case baby storage battery that is a marvel for steady, noiseless, full-powered service. Lasts indefinitely because it can be recharged repeatedly—making it not only the most satisfactory, but ultimately the most economical type of "B" battery. Sold by radio dealers, and also by more than 2000 Westinghouse Battery Service Stations.

WESTINGHOUSE "A" BATTERIES. Ten sizes—27 to 162 ampere-hours' capacity; 4, 6 and 8 volts. Slow-discharge, long-life batteries built especially for radio work.

WESTINGHOUSE UNION BATTERY CO., Swissvale, Pa.

WESTINGHOUSE

RADIO "A" and "B"
BATTERIES



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ROCK BOTTOM PRICES

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Send Us Your Order With Money Order—
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WE WILL SHIP AT ONCE

Lamb Products Are Guaranteed

DESCRIPTION	OUR SPECIAL PRICES
WD-11 Adapter (Fits Radiotron sockets) . . . ea.	\$1.00
WD-11 Aeriotron Socket	
Style A—for Base Mounting ea.	.50
Style B—for Bracket Mounting ea.	.60
Polished Nickel Tube Socket Single ea.	.50
Polished Nickel Tube Socket Double ea.	.65
Polished Nickel Tube Socket Triple ea.	1.25
Bezels (Screen windows) ea.	.20
Contact Points with 1 nut per doz.	.25
Instrument Switch & Points complete . . . ea.	1.00
Switch Levers ea.	.35
Nickel Binding Posts per doz.	.35
Composition Cap Nickel Base Binding Posts (large size) per doz.	.60
Composition Cap Nickel Binding Posts (small size) per doz.	.50
LAMB 43-Plate Condenser (.001 M.F.) . . . ea.	2.45
LAMB 25-Plate Condenser (.0005 M.F.) . . ea.	2.20
LAMB 11-Plate Condenser (.00025 M.F.) . . ea.	1.90
LAMB 3-Plate Vernier Condenser ea.	1.70
Tuning Coil with two (2) Sliders ea.	2.75
Wound Inductance Tube 4" x 7" ea.	.60
Crystal Detector (Glass Tube) ea.	.75
1/4" or 1/2" Sliders ea.	.15
1/4" or 1/2" Rods ea.	.12
3" Genuine Bakelite Dials ea.	.50
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Q. R. Dial Adjusters ea.	1.00
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Cutler-Hammer Rheostats ea.	.90
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Spaghetti per yard fits #18 wire ea.	.20
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LAMB RVD-1 Vacuum Tube Receivers . . . ea.	20.00
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Grebe CR-9 Receiving Sets	110.00
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Clapp-Eastham HR Receivers	25.00
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We are Manufacturers and Jobbers of Radio equipment and accessories. If your dealer does not offer you LAMB Radio products, send us your orders direct. We GUARANTEE OUR PRODUCTS and we ship goods the day your order is received.

F. JOS. LAMB CO.
RADIO EQUIPMENT
DETROIT, MICHIGAN
1938 FRANKLIN ST.



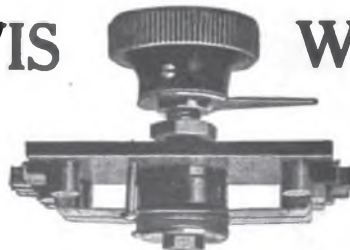
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The Jewell vernier rheostat is extremely simple and substantial in construction, employing a new principle of contact which we have patented. Made of the highest grade bakelite and using the best resistance wire obtainable. Very fine adjustments are obtained by a single turn of the knob. Ask your dealer or write to us for special circular.

PRICE \$1.00

Jewell Electrical Instrument Co.
1650 Walnut St., Chicago

WIS WIN



No. 764 SERIES PARALLEL

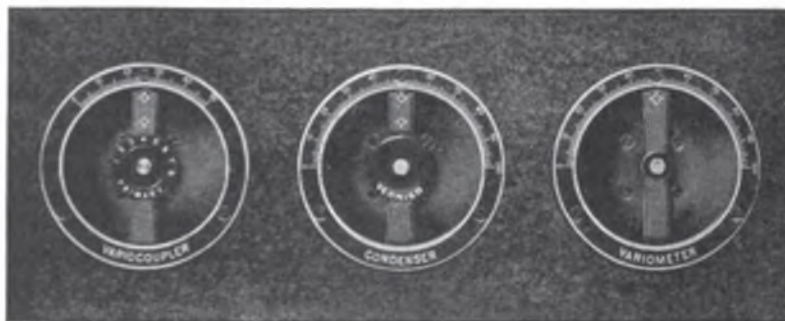
Concealed type, mounted on formica base, \$1.50. No. 754 visible type, switch alone, 65c.

Our sheet of diagrams showing the many uses of this popular switch sent free upon request.

Willis Switch & Instrument Co.
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Why Not Use Metal Panels in Radio Sets?



This question is constantly being raised and the solution is to be found in the use of Eisemann units. By reason of their complete self-insulation, they may be used on panels of metal, wood or any other material without introducing electrical losses. The concave dial itself serves as an adequate shield.

The illustration above shows

the attractive appearance of Eisemann parts when mounted. The control bar fits the hand and is ideally adapted for fine adjusting.

The absence of protruding knobs and dials, together with the many advanced features of design and excellent electrical characteristics, commend Eisemann parts to discriminating buyers everywhere.

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EISEMANN MAGNETO CORPORATION

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DETROIT

CHICAGO



"All American"

Audio and Radio Frequency Amplifying Transformers Are 100% Good



That's the verdict of seasoned radio experts who have dealt with this responsible house for years.

Our **RADIO-Frequency Transformer** (Type R-10—150 to 550 meter wave-length) strengthens weak signals many-fold; gives clear sharp definition; largely eliminates static and other disturbances.

Our **AUDIO-Frequency Transformers** give such powerful amplification that signals which could otherwise be heard only thru headphones come in clear and strong thru any good loudspeaker.

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R-10—Radio Frequency (150-550 meters).....	\$4.50
R-12—Audio Frequency (Ratio 3 to 1).....	4.50
R-13—Audio Frequency (Ratio 10 to 1).....	4.75
R-21—Audio Frequency (Ratio 5 to 1).....	4.75

Send for Bulletin No. 22. It explains the technical and mechanical reasons for the splendid performance of "All American" Amplifying Transformers. When you send for it, please give name and address of the Radio Dealer thru whom you prefer to buy. Don't let anybody sell you a Radio outfit at any price, with any other than "All American" Transformers.



RAULAND MFG. CO.
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Yours - get it!

—a free copy of "Chi-Rad's" 1923 loose leaf handbook.

With "Chi-Rad" a distributor for more than 21 leading radio manufacturers this catalog will be a comprehensive review of most of the noteworthy radio parts of recent manufacture. You will find it a big help in selecting those radio parts for that set you are building.

Because of expected additions only a limited number of catalogs have been published. Be sure to get your copy—send the coupon for it now!

Chicago Radio Apparatus Co.
415 S. Dearborn St., Chicago

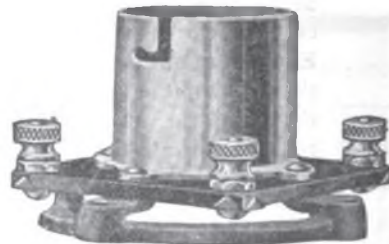
Gentlemen—Please send me, without obligation, a free copy of your 1923 catalog. 105

Name.....

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New V. T. Socket Illinois Cushion-Resilient



(Pts. Pend.)

This final improvement in Vacuum Tube Sockets is to *protect your vacuum tube from vibrations and shocks*, which cause distortions and many of the noises in phones, especially when amplified.

Furthermore, a sudden jar or shock has caused the parting of many an incandescent filament—*Save yours from this danger.*

The best authorities recommend Cushion-Resilient mounting and the most particular manufacturers use a mounting of this nature in their sets.

Bakelite base mounted on live rubber moulded ring sub-base, not in contact with electrical conductors. Long smooth-acting sure-contact springs. Metal parts N.P. Price \$1.00. Bracket for direct panel mounting 25¢. Ask Dealers or write direct to manufacturers for circular B.

ILLINOIS RADIO CO.
Springfield, Illinois



*The favorite—*from coast to coast

EVERYWHERE you will find up-to-date radio men who have taken the trouble to test all the various radio materials expressing a preference for Formica.

They like its beautiful finish. They like the wonderful uniformity of its dielectric strength. They like the way it works with ordinary tools. Many of them will show you high power, high frequency sets in which Formica panels and tubes have been used for years—and always given perfect service.

The preference for Formica is not confined to any one class. Manufacturers of the highest grade apparatus use it; so do skillful amateurs, and dealers everywhere prefer to sell it because of its high standing with their trade.

Formica is approved by the navy and the signal corps, and by the great majority of active radio men. Be sure to ask for it by name.

DEALERS: Formica cooperation with the dealer is complete and willing. We supply literature, counter cards, plates for advertisements. Our large capacity makes immediate delivery possible on all orders.

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FORMICA

A Laminated Phenolic Condensation Product
SHEETS TUBES RODS

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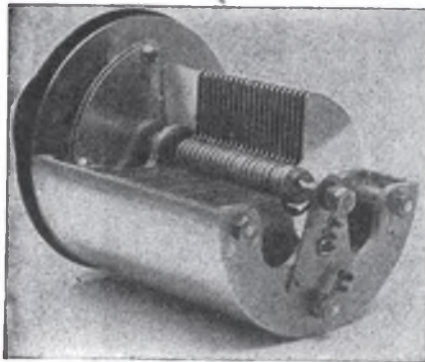
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QUALITY AND EFFICIENCY VERNIER CONDENSER WITH SINGLE KNOB CONTROL

Especially Adapted to the New Armstrong Super-Regenerative Circuits in which Variable Condensers play an important part and in which fine adjustments are Absolutely Essential.

B-1 .001015 MFD. \$7.50
B-2 .000545 MFD. \$7.00
B-3 .000295 MFD. \$6.50

Constructed With the Same High Standard of Quality in Materials, Workmanship and Design as Our Regular Variable.



NEW MODEL. Improved Construction and Design. Gives Maximum Rigidity. Thus Insuring Permanence of Alignment and High Efficiency in Operation.

A-1 .001 MFD. \$4.50
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A-4 .000045 MFD. \$3.00

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Jobbers and Dealers Write for Proposition.
Increase Your Sales.

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THE C. D. POTTER CO., Stamford, Connecticut

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Amazingly Clear!

—is amateur's or expert's verdict when speaking of Elwood Phones. They invariably sound the praises of this outstanding Elwood feature.

ELWOOD HEAD SETS

today are the choice of radio men who demand the utmost in tone clarity, sensitivity and head-fitting comfort.

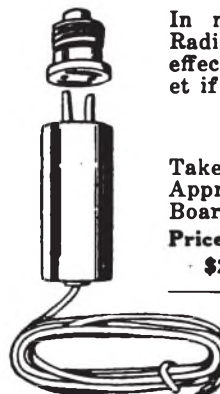
2000 ohms \$5.50
3000 ohms \$6.50

Sold by dealers everywhere. If yours is unable to supply you, we will ship direct on receipt of price. You are privileged to return them if not up to your expectations.

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AERIALS NOT ALLOWED



In many places, but your Radio Receiver will work as effectively on any lamp socket if you use a

"NO AERIAL" RAD-O-PLUG

Takes the place of an aerial. Approved by the National Board of Fire Underwriters.

Price:—

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SAVE YOUR BATTERY

Charge your radio and automobile batteries regularly at home with a

SILENT NILES Battery Charger

A necessity in every radio home. Increases life of Battery. Saves expense. Rugged, efficient, silent. Operates from lamp socket for few cents per charge. Price, \$17.50; West of Rockies, \$19.50; Canada, \$24.50.

Immediate Shipments

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The Need for Dependable Electrical Instruments



Filament Voltmeter



Antenna Ammeter.

WHETHER in transmitting or receiving—correct voltage or amperage information is of utmost importance to efficient and economical operation.

Control of the filament current or filament voltage makes it possible to prevent premature burnouts. Facilitates exact tuning. Duplicates results instantly. The Weston Filament Voltmeter and Filament Ammeter have been designed expressly to meet these requirements.

Accurate determinations of the plate voltage is also desirable. The Weston Plate Voltmeter is a necessity on every Transmitting Set and a convenience on all Receiving Sets.

Effective transmission depends upon the proper antenna current flow. The Weston Thermo-Ammeter is recognized as the most highly developed, scientific and dependable instrument for this purpose.

Booklet J, and other Radio Literature, describes and illustrates these various Weston instruments. Everyone interested in Radio should send for this important data. If your dealer cannot supply you with Weston instruments, we will gladly see that your needs are promptly supplied.

Weston Electrical Instrument Co.

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Electrical Indicating Instrument Authorities since 1888

WESTON



"STANDARD" The World Over

ELECTRICAL INSTRUMENTS

An Indicating Instrument for Every Individual Need and Industrial Purpose

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A NEW STANDARD ESTABLISHED



Audio Frequency
Price \$6.50

The advent of the J. T. Boone Mfg. Co.'s Radio Products has established a new Standard of Efficiency.

The "Boone" Radio Frequency Transformer is the materialization of the "DX Fiend's" dream. One or two stages added to your present set will produce almost unbelievable results in increasing your range.

The "Boone" Audio Frequency Transformer is a fit companion, producing powerful, distortionless amplification. Perfect shielding, correct impedance values of the windings, and careful manufacture account for its unusual high efficiency. If you wish to thoroly enjoy broadcast programs, be sure your Audio Transformers are "Boone."

These devices are compact and pleasing in appearance. They are carefully and rigidly tested and inspected. Instructions and proven wiring diagrams accompany each transformer.

For the man who desires a high efficiency complete set, a "Boone" Receiving Set is unquestionably "The Ultimate Solution."

Write for complete descriptive literature of our products.

J. T. BOONE MFG. CO.

3469 E. Jefferson Ave.,

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Radio Frequency
Price \$7.50



McTighe Alkaline Storage "B" Battery FOR RADIO OUTFITS



The McTighe Storage "B" Battery is now furnished in two sizes, the original 22 volt and a new 28 volt battery, having 30% more plate capacity. McTighe Batteries are absolutely noiseless, can be charged from any light socket, and are proof against damage by short circuit, overcharging or standing unused. They are furnished in oblong glass cases which nest neatly, each with its own size.

The McTighe Chemical Rectifier will charge one, two or three "B" Batteries at one time. Our Combination Magnetic Rectifier will charge 6 volt "A" Batteries or "B" Batteries up to 120 volts.

22 Volt Battery \$5.00
28 Volt Battery 6.00
Chemical Rectifier 1.50
Magnetic Rectifier 20.00

F. O. B. Irwin, Pa.

ECONOMIC APPLIANCE CO.
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BIG PROFITS IN R. T. S. EQUIPMENT

R. T. S. Equipment converts the one-time buyer into a profitable, permanent customer. By handling R. T. S. Standard and Special Equipment you can fill every demand promptly, with satisfaction to your customer and profit to yourself.

The R. T. S. Condenser, shown here, is proving unusually popular. They make the tubes perform properly, cut out "howling," and clear up phone speech. Furnished complete with mountings, ready for connection.



Made in three capacities, prices to retail trade as follows:

Grid Condenser .0005 MF.....30¢ each
Grid Condenser & Leak, Combined.....45¢ each
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R. T. S. CORD TIP JACK



This R. T. S. Cord Tip Jack leads the way in quality, service and price. Constructed of spring phosphor bronze, highly nicked. A wiping spring contact insures a clean, positive contact at all times. Where others sell from \$1.00 to \$2.50, this R. T. S. Cord Tip Jack

Retails at.....per pair, 50¢

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Dept. Q-1, 25 Sturgis Street
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Save \$4
*on the world's
 supreme Head Set*



**DICTOGRAPH
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Was \$12 - Now \$8

NOW you can get the world-famous Dictograph Radio Head Set at a clear saving of \$4.00! The tremendous demand, calling for quantity production, makes possible the new price of only \$8.00. Never before has a radio Head Set of like quality been offered for so little money. This is exactly the same Dictograph Radio Head Set that has always sold for \$12.00—made by the makers of world standard Dictograph products, including the marvelous "Acousticon" for the Deaf, the

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Note: Plans are now under way for the production of the new Dictograph SUPER-TONE Head Set, the most perfect instrument that can be made. Price, \$12.00.

The Standard of the World

**DICTOGRAPH
 Radio LOUD SPEAKER**

The perfect Loud Speaker for the home. A handsome instrument of superb quality and priced at only \$20, complete with 5 ft. flexible cord. Reproduces every sound in absolutely clear, natural tones, free from noise or distortion. Ask for a free demonstration at reliable radio shops.

\$20

complete with 5 ft. flexible silk cord. An overwhelming value at this low price.



DICTOGRAPH PRODUCTS CORPORATION

220 West 42nd Street

(Branches in all principal cities)

New York City

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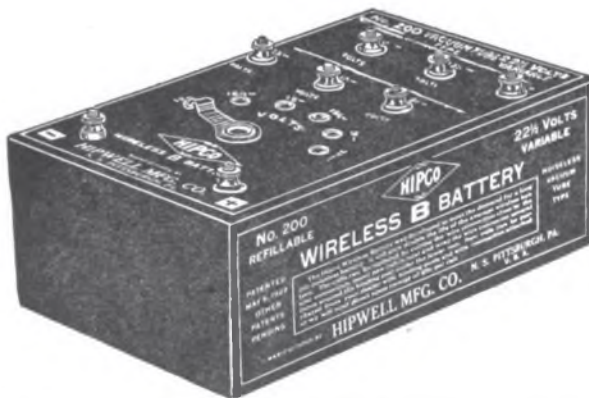
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PRICE \$3.50

THE NEW IMPROVED WIRELESS B BATTERY REFILLABLE VARIABLE NOISELESS IN OPERATION

The Switch Makes It 100 p.c. Perfect



Must be seen to be appreciated. It has all the features that made last year's B Battery the phenomenal success. Ask for catalogue describing our full line of B Batteries and other Radio Supplies.

For sale at all radio supply dealers.

HIPWELL MFG. CO
N. S. PITTSBURGH, PA.

The first man to listen over a telephone

didn't hear very much. Today he listens with comfort and complete understanding. The difference is due to better apparatus.

The AMERTRAN



super audio frequency
amplifying transformer

gives 88.6 times audibility in your receiving, without distortion. Two stages (2 AMERTRANS) give 1490 times audibility. It is doubtful if the substitution of any one thing in a radio set could make such a notable improvement as the installation of AMERTRANS.

Price \$7. Ask your Electrical Dealer, or sent carriage charges collect (Wt. 1 lb.)

American Transformer Company

Designers and builders of radio transformers for over 20 years.

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ALL UNDER ONE COVER

An Official List of all Amateurs, Special Amateurs and Broadcasting Stations of United States and Canada.

—ALSO—

A large map, size 24" x 36" printed in two colors, showing location of every Broadcasting Station in United States and Canada, and each district marked off.

—AND—

How to Construct and Operate a Honeycomb Coil Set, Detector and Two Step Amplifier.

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Order from your dealer—If your dealer hasn't them, send direct.

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Radio Directory & Publishing Co.

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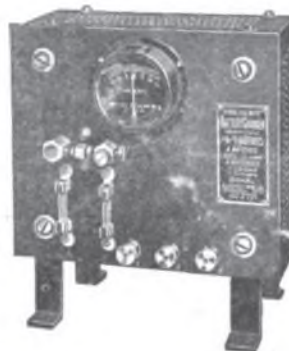
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LISTEN IN, everybody. This message is for **you**. Radio promises more than ever for the coming season. Are you going to get your share of the fun, the entertainment, the culture, and the many other advantages Radio now offers?

Then it's time to think of Radio equipment. When buying Radio parts or sets ask these questions:

Who Builds It?

Who Uses It?



**SIGNAL-HULBERT
BATTERY CHARGER**

If it's SIGNAL equipment you'll find that it was produced by a plant and an organization whose experience in making small electrical goods goes back over a period of 35 years—that it grew up with "wireless"—that men there have grown gray in their service and take old-time pride in seeing that nothing but the best in materials, workmanship, and finish leaves the SIGNAL plant.

And you'll find that it is used largely for commercial purposes, by the army and navy, by the professionals in Radio, as well as by the semi-professionals and the amateurs—most successfully and most satisfactorily.

Buy SIGNAL Radio Parts or Sets and you will buy Radio Service and Radio Satisfaction.

Charge 2 batteries in your home at the same time for 5¢—from any 110 volt A.C. lighting socket. Send for our Booklet and Special Bulletins — use coupon below if you wish.

SIGNAL Electric Mfg. Co.

Factory and General Offices:

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You'll find our local address in your Telephone Directory

(2064)

COUPON

for guide to radio satisfaction

SIGNAL ELECTRIC MFG. CO.

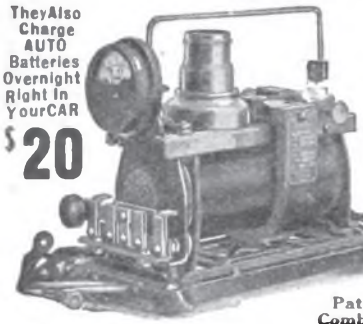
1915 Broadway, Menominee, Mich.

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RADIO "A" & "B" STORAGE BATTERIES CHARGED AT HOME

FOR A FEW CENTS, FROM ANY 100 to 130 Volt 60 Cycle LAMP SOCKET, WITH AN **F-F RADIO RECTIFIER**

It Charges All 6 Volt RADIO "A" & AUTO Batteries; & RADIO "B" Storage Batteries Up to 120 Volts, In Series, Inductively. Disconnecting Unnecessary. Nothing To Slop Over, Burn Out, or Cause Trouble. It Charges Automatically, Operating Unattended. IT WILL CHARGE A DEAD BATTERY. Leave Battery Wherever it is, Without Even Disconnecting it; Screw Plug in Lamp Socket, Snap Clips on Battery Terminals; Turn Switch & Battery will be charged in the morning. Is it not gratifying to feel that Your Radio Batteries will never fail & You are always Ready to Receive **RADIOPHONE** Broadcast Music, Sermons & News; never having to be careful of or to tell Friends Your Batteries are dead? **F-F BATTERY BOOSTERS**



They Also Charge AUTO Batteries Overnight Right In Your CAR

\$20

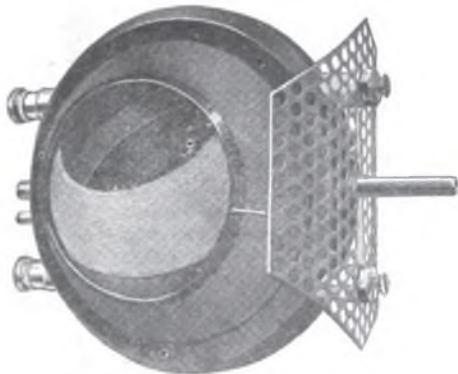
are Complete Compact Self Contained Portably Handy Full Wave Automatic Magnetic Rectifying Charging Units, for 100 to 130 Volt 60 Cycle A.C. Also For Other Cycles. No Skill is Required. **INFUSIBLE** Carbon Rectifying Brushes Maintain Uninterrupted Service. They Save More Than They Cost & Last Lifetime. **POPULAR PRICES**

- Type 6 for 6 Volt "A" Battery, Charging at 6 Amperes \$15
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- Type 12 for 12 Volt Battery, Charging at 5 Amperes \$15
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Eventually You Will Buy An F-F RECTIFIER. Why Not Now? The Sooner You Buy it: THE MORE YOU SAVE. All Types But "B" charge Auto Batteries. The Larger TYPES are for heavy Batteries, or Where Time is limited. Shipping Weights Complete with **AMMETER & BATTERY CLIPS** 11 to 15 lbs. Purchase from Dealer, or Mail Check for Prompt Shipment. If via Parcel Post add Postage & Insurance Charges. Or have us ship C.O.D. Other F-F Battery Boosters charge Batteries from Farm Lighting Plants & D.C. Circuits & For **GROUP CHARGING** use our 12 Battery 8 Ampere Full Wave Automatic **ROTARY** Rectifier described in **FREE Bulletin No. 31A.** ORDER Now or WRITE Immediately for **FREE BOOSTER BULLETIN No. 31.**

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THE LAST WORD IN



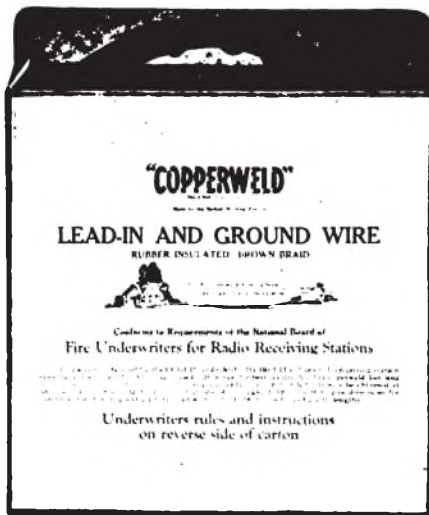
Precision Variometers

Spaced bare lacquered wire prevents leakage and capacity effects.
Shells of newly discovered composition only .025" thick prevent dielectric hysteresis.
Perforated shield plate prevents eddy current losses.
Absolutely guaranteed. A superlative instrument.
Price ready for mounting—Variometer... \$7.50
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How Far Can I Hear with MR-6?

Read What Happened in Wisconsin!

From Wisconsin alone during one month come reports of DeForest MR-6 Receiving Sets getting California, Colorado, Kansas, Texas, Tennessee, Georgia, Kentucky, Pennsylvania, and New York—distances up to 1500 miles. One man listened across the entire continent, getting Santa Cruz, California and Atlanta, Georgia the same evening. The unsolicited testimonials as to the way this efficient but inexpensive set "listens to the world" are on file in our office and copies will be sent to anyone interested in writing direct to the owners.

Multiply such experiences as these by the thousands of MR-6 sets in use all over the

nation—to say nothing of the DeForest Everyman and Radiohome sets—and you get an idea of the way DeForest is serving the nation with the joys of radio.

DeForest manufactures receiving sets all the way from the least expensive to the most elaborate, and laboratory tested high quality parts for those who "build their own." If it's DeForest, it's built in a way worthy to sustain the reputation of that great name.

If you want the best radio has to offer—the songs, the stories, the news of the world—more clearly than you have believed possible and from farther away—you can't go wrong on DeForest!

DE FOREST RADIO TEL. & TEL. CO. JERSEY CITY, N. J.



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Patented June 20, 1922

The Only Knob and Dial Without a Set-screw

The unsightly and troublesome SET-SCREW is at last eliminated. No more splitting the head of the set-screw or stripping of threads, perhaps ruining the dial.

To mount the TAIT-KNOB-AND-DIAL simply hold the dial with one hand and screw on the knob with the other; a few seconds does it. No tools are necessary. When fastened it is self centering and self aligning.

This beautiful patterned KNOB-AND-DIAL is made of the best grade of Bakelite.

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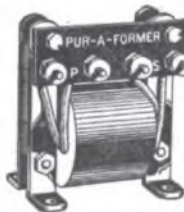
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Getting Astounding Results

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MODERN RADIO OPERATION

By J. O. Smith

No theory, no mathematics, no formulas, just a straight account of how it is done by C.W., not only at 2ZL, but also at other famous stations such as 1ZE, 8ZG and 9ZG which were installed by Mr. Smith. Also, the story of broadcasting from WDY, WGY and WJZ.

Receiving too—by all types of sets, including the Armstrong super-regenerative circuit.

DO YOU KNOW?—The proper proportion of grid and plate current in transmitters? The relative merits of D.C. on transmitter tube plates; of A.C. with half-wave rectification; of A.C. with full wave rectification; of Kenotron-rectified A.C.? How much you can gain by adding more tubes to your transmitter? How and why C.W. beats spark in purity, damping and economy? All these and many other vital questions answered.

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ACTUALLY—thousands are being snapped up on the strength of their pleasing voice tone and keen sensitiveness. The same hair-line refinement of design which for over eleven years has been so sharply pronounced in hundreds of Basco electrical units, here again shows itself in these skillfully constructed

BASCO **RADIO**
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They are built *right*, pitched *right* and priced *right*. Close examination is convincing proof. They embody every high priced quality—perfect balance, clear scratchless reproduction. Coils encased in aluminum shell—light weight, easy on the head. Employ solid horse shoe magnet—no laminations. Busbar connections, no loose hair-like wires.

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JOBBERS AND DEALERS! Write for our exceptional proposition, and name of our nearest factory representative.



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Milwaukee **BASCO** PRODUCT Wisconsin

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DX Type No. 58 R. F. Receiver

FOR
LONG DISTANCE
AMATEUR
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BROADCAST
RECEPTION
There is No Instrument
SUPERIOR



TO THE **Federal**
DX TYPE NO. 58 R. F. RECEIVER

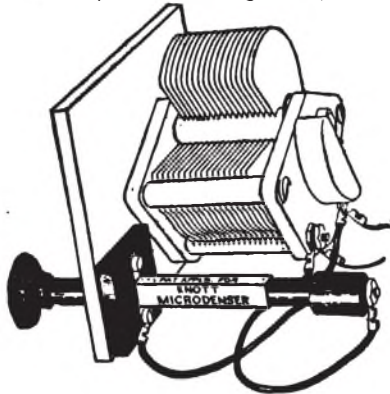
GREATEST SELECTIVITY OF ANY RADIO INSTRUMENT YET DEvised
FOR COMPLETE DESCRIPTION WRITE FOR BULLETIN NO. 119-W

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Showing you how to connect to your condenser
Super accurate tuning. This Micro will
stretch the critical tuning point on your vernier
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customers prompt, intelligent and satis-
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BOOST YOUR OUTPUT 400%

By Running Your Transmitter At 80% Efficiency

COMPARE THE RESULTS

TUBES	OUTPUT AT 50% EFFICIENCY (Maximum with present Sets)	Output at 80% Efficiency
One 5 Watt	7.8 Watts	31.2 Watts
Two 5 Watt	31.2 Watts	62.4 Watts
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Two 50 Watt	150 Watts	600 Watts
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Full details for all sizes and combinations of tubes shown in blue print 50 inches x 17 inches, #30140, \$1.00.

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Experimenters Information Service

Designers of the Highest Class Radio Apparatus in the World

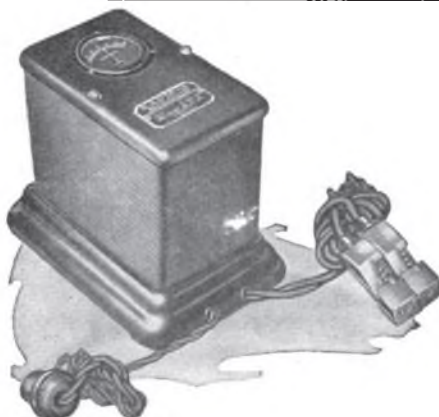
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+ Workmanship

+ Materials

- RELIABILITY



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This unit is the product of a firm of pioneers in the battery charging field. Our commercial apparatus is used in thousands of the best equipped battery service stations in the country. Materials and workmanship are the finest available.

RADIO "A" is built not assembled.

Simple to use—Just plug in at any 100 v. A.C. lamp socket—attach clips to battery—turn on current and

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The only Recharger with a one piece Removable Vibrator, can be replaced by a child.

Think of the convenience of not having to carry your battery to the

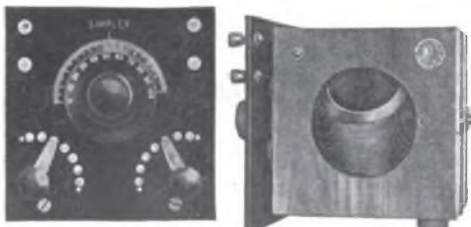


Service Station this winter. The Battery will always be full of pep.

A compact portable Recharging unit that will fully charge a 100 AH battery over night for 5¢ to 10¢. A useful and lasting New Year's Gift. Lasts a lifetime.

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DETECTOR PANEL AMPLIFIER PANEL
Also Unmounted Variometers & Variocouplers

Simplex Panel Units make it possible to try out many different hook-ups without disassembling panels. These highly perfected units eliminate much of the uncertainty of success in receiving radio broadcasts because they have been designed by men having years of experience in radio activities. Get them from your dealer.

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AUDIO FREQUENCY AMPLIFIER



MOUNTED TYPE M

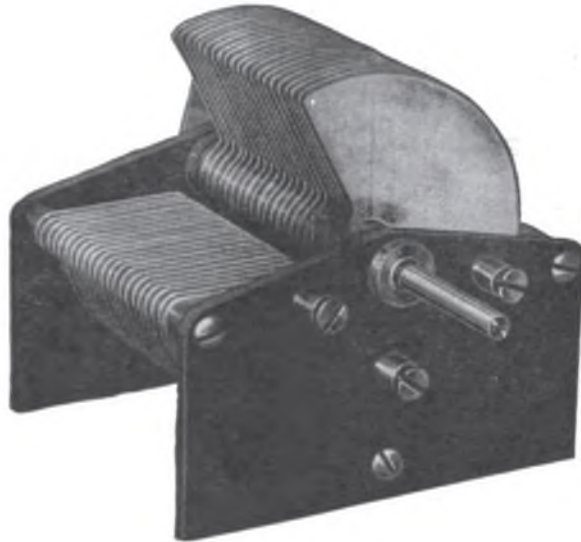
Silicon Steel Cores; Shell Design—Bakelite Terminal Board; Ratio—9 to 1; Insulation tests 1500 Volts.

Mounted Type M—\$5.00
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Discount 10% for cash with order

Designed by *Packard* Engineers—

A quality Name in Radio
THE STANDARD TRANSFORMER CO.
Warren, Ohio

Wimco Announces



THE WIMCO VARIABLE CONDENSER

After months of experimentation to produce a really good Variable Condenser, we take pleasure in introducing to the trade The WIMCO Variable Condenser, which will be furnished in 43, 23 and 3 plate type. Tests conducted by the Washington Radio Laboratory show that The WIMCO Variable Condenser of the 43 plate type has a resistance, at maximum capacity, of but .018 ohms, and the capacity at zero on the scale is but 15 micro-microfarads. These values, we believe, are lower than in any other condenser manufactured for general use.

The WIMCO Variable Condenser is now in production and your orders will have our best attention.

We have a very attractive proposition for the Jobber, and solicit inquiries. Write for complete price list and discount sheet.

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CANTON, OHIO

Manufacturers—Distributors

DAYTON RADIO PRODUCTS



MOULDED BAKELITE VARIOMETER

Price\$6.75
With Bakelite Dial 7.35

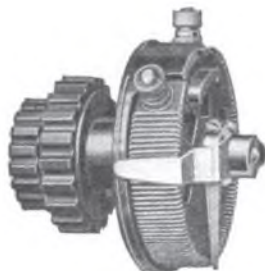


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PRICE\$1.75
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Hear all broad-casting through phonograph. Make your own horn. Attach B-K Phonadapter to YOUR phonograph. All can hear. Entire family, neighbors, guests can hear opera, lectures, latest news, with this adapter. Stretches over receiver of Baldwin or Brandes type head-set and attaches to tone-arm of ANY phonograph. Made of soft, pure gum rubber. Quickly attached and removed. Thousands in use. Absolutely no voice distortion. For single receiver..... .75
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Amplitone Loud Speaker

An inexpensive, loud speaking horn especially adapted for home use. Ample volume. Quality tones. Throat of horn consists of successive sound expansion chambers. Each chamber amplifies previous one. Furnished either with single or double B-K Phonadapter. Price \$8 only

Bell Horn

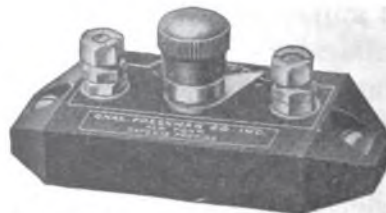
A Bell Horn with ball swivel. Turns up, down, to side—any angle desired. Automatic adjustment. Very simple. No screws, thumb nuts, etc. Black finish. Complete, with phone, ready to attach to two stage amplifier..... \$15



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The Latest and Most Essential Part of an Efficient Tube Set



Variable Grid Leak and Micon Condenser

(combined)

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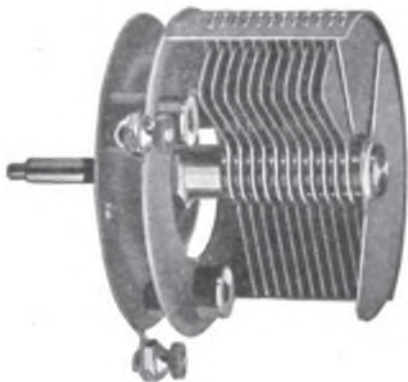
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The best, most flexible and most complete variable condenser on the market today at any price.

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Movable and stationary plates completely shielded.

Stationary plates spaced accurately by special punched shell.

Movable plates secured by an ingeniously assembled comb separator brushing against the bearing.

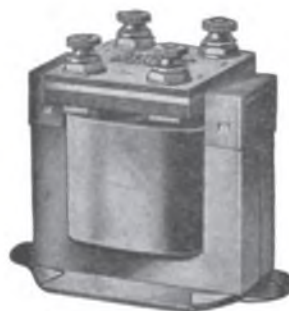
Single bearing fastened directly to the shielding base plate without any dielectric.

Assembled by machine.

Lowest possible zero capacity and dielectric loss.

A Vernier can be added by anyone at any time at a very small cost.

- 13 plate .00025 M.F. \$2.00
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A New Thordarson

6 to 1 ratio audio frequency amplifying transformer. Designed for those desiring a higher transformer ratio than our standard. Unusually high and constant amplification without distortion over a broad band of audio frequencies. Core is twice the cross section of that of the ordinary amplifying transformer and is made of special 36 gauge silicon steel. The coils have low distributed capacity. The high "Thordarson" standard has been maintained throughout.

6 to 1 ratio transformer . . . \$5.00

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A high grade article in Red Bakelite with Phosphor-Bronze Contacts and Alloy Resistance Wire.

For Base or Panel Mounting.

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**NOVO
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 Loud Speakers
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Send for Bulletins AG-10
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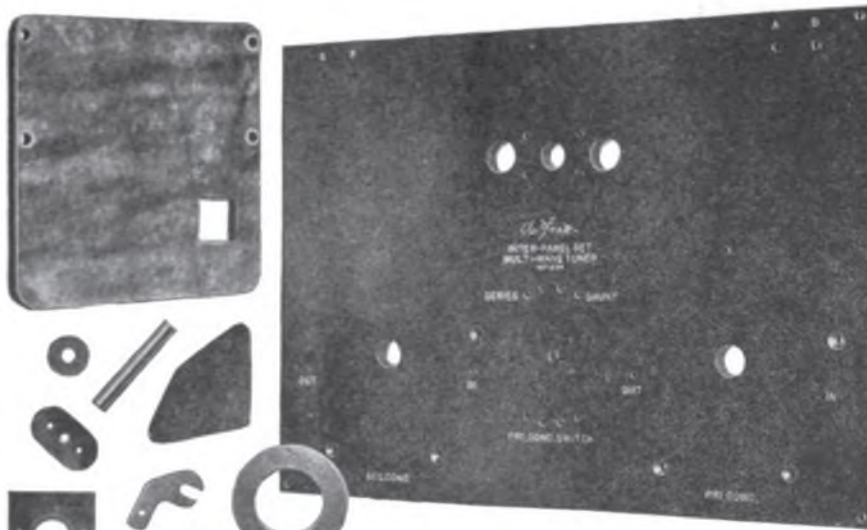
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The Material of a Thousand Uses

DUCK RADIO PIONEER ANNOUNCES STARTLING REDUCTIONS

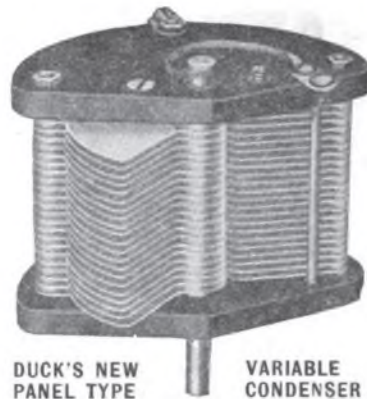
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FREE Illustrated pamphlet comprising sixty-two Duck radio instruments and sets with reductions averaging 30% mailed on request. Send postal today. Any old-time radio amateur will tell you who we are and our reputation. Only a few years ago almost one-third of the radio instruments sold at retail, exclusive of sales in only a half dozen large cities, were sold by Duck.

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Rheostat, 70¢; Bakelite moulded positive contact, 70¢; Bakelite moulded dial, 55¢; super-selective moulded variometer, \$4.65, worth \$8.00; radio frequency potentiometer, \$1.15; solid mahogany form variometer, \$3.60; 43-plate panel-type variable condenser, pigtail connection, \$3.15; detector panel, \$5.25; receiving set, mahogany cabinet, detector and two stages of audio frequency, \$59.50; radio frequency receiving set with one-step radio and detector, \$29.75.

SEND 25c. in coin or money order for our big 256-page combined radio catalog and text book. For radio information and hook-ups it is worth many times the retainer asked.



DUCK'S NEW PANEL TYPE VARIABLE CONDENSER

acclaimed by all that have seen it to be the peer of any on the market. Pigtail connections, i. e., no sliding contacts. Base and top moulded bakelite. Aluminum separators, i. e., even spacing and simple means of adjusting plates. Mounting screws furnished. Concealed by dial. Brass bearings; 1/4" shaft.

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AMPERITE

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RELIEVES YOU OF ALL
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Dec. 1927

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LARGE RADIO DISTRIBUTORS



The ultimate in
Radio Frequency
Transformers
Type 104-A —

A suitable comple-
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BEST AVAILABLE in the following respects**

- 1.—*MOUNTING*—Transformer Unit contained in moulded one piece Bakelite case.
- 2.—*PROTECTION*—Impregnated windings—Unit hermetically sealed in case filled with special insulating compound.
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- 9.—*PRICE \$4.50*—The price is the lowest possible for a Transformer embodying the above features of workmanship, material and efficiency.
- 10.—*IT'S A CARDWELL PRODUCT.*

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TYPE 104-A RADIO FREQUENCY TRANSFORMER
send your order to**

THE ALLEN D. CARDWELL MFG. CORPORATION

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Master Code in Minutes instead of Weeks—Qualify in Hours instead of Months—Succeed after failing with other methods.

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Usually pays to Investigate B4 U BI.

For one Dime will mail Code Memorizing Records of Beginners in 12 Radio Districts who QUICKLY made themselves Licensed Operators and reported experience to enlighten you.

FOR EVERY DIME OF COST OUR METHOD SAVES DOLLARS

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THE transformer itself is entirely surrounded with electrical wax inside a hard aluminum case. Moisture, temperature changes, hard knocks, abuse cannot in the least affect the efficiency of the Cole Transformer. No single resonant point. Equal amplification at all audio frequencies from 200 to 2000 cycles. The best transformer for WD11 Tube. None better for UV 201. Static and other noises eliminated by grounding case. Write for illustrated circular.

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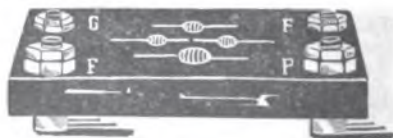
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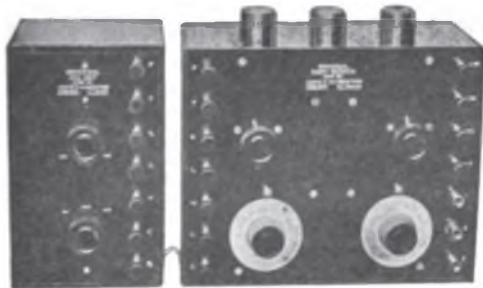
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This set has been designed to cover all the fine points of radio technique.

The wave length range possible with Coil Unit is 180 to 6200 meters. Wave lengths ranging from 200 to 2500 meters may be covered when using the standard coupled circuit.

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The terminals of various circuits are brought out to binding posts which allows the operator to use any of the following standard hook-ups; single circuit, two circuit, regenerative, or oscillating.

FINE TUNING OF THE SET is accomplished by means of the **VARIABLE CONDENSERS**.

Weak and strong signals may be received alike **WITHOUT DISTORTION**.

This set is very compact, flexible in adaptation of various circuits to any desired hook-up. It is easy to operate because of the convenient location of the various adjustments and, at the same time, the set has a very high efficiency. This set has been thoroughly tested and the results are highly satisfactory.

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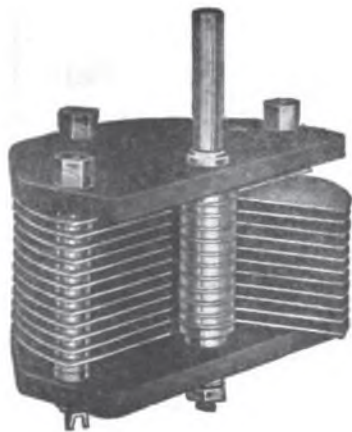
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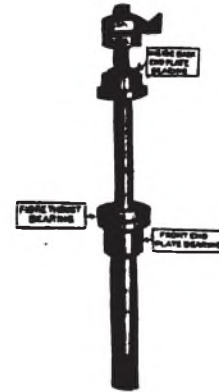


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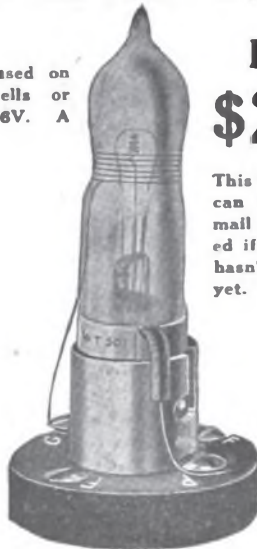
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THE TUBE WITHOUT A SQUEAL

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This sturdy Tube
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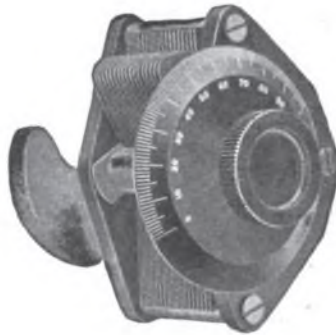
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Direct factory to user sales methods save you 50%. Highest quality material insures you 100% service. Every battery backed by our written two-year guarantee. You take no risk. Batteries shipped express C. O. D. for your inspection. Mail your order today—at once.

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UP 1719 Grid Leak	4	1.10	.65	263 Pacent Jack	81	1.00	.50
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SELL: Thordarson 1/4 K.W., \$5. Amrad 1/4 Quenched Gap \$4. Murdock O.T. \$1.50. Omnigraph \$5. Leighton Causey, 1528 Moran Ave., Norfolk, Virginia.

TWO STAGE amplifier transformer coupled \$20. A. H. Gудie, 329 East 36 St., Los Angeles.

WOULD YOU REFUSE opportunity like this??? Here is unusual chance to buy Complete Synch. Transmitter for \$185.00. Only few months ago, our price was \$500.00 for the very same Sets. The reason?... This is the last one. Picture and description on request. Chicago Wireless Equip. Co. 2312 Greenview Ave., Chicago.

FOR SALE: Grebe CR-5, slightly used, \$60; Short wave regenerative (Baldwin variometers and coupler in Grebe cabinet), \$40; General Electric detector and two-step (metal cabinet) type AA-1400, \$55; R3 Magnavox, \$35; Pair Seibt fones, \$12.50; Pair Western Electric fones, \$8; Three Mu-rad R.F. transformers, type T-11, \$3.50, T-11-A, \$4, T-11-B, \$4.50

Two DX R.F. transformers, with mountings, \$6.00 each. All apparatus guaranteed in excellent condition. Sent postpaid on receipt of price. Jack Dunham, 49 Overlook Circle, New Rochelle, N. Y.

500 CYCLES FOR THE PLATE—1/4 KW Motor Generator \$42.50; 1/4 KW Motor Generator \$45.00; 1/4 KW Navy Panel QUENCHED TRANSMITTER Complete including Motor Generator, fine for school instruction, cost \$150, Sell for \$85. 1/4 KW Marconi Synchronous Transmitter Complete including Motor Generator \$55.00. Above is all 500 cycle Apparatus. Navy Instruction Set, Consists of Seven Stations \$35. Army 53 ft. Sectional Pole \$25. Navy receiving Sets \$22.50 Quenched Caps \$4.00. Leyden Jars \$2.25. All Guaranteed Perfect Condition Prompt Shipment. George Eaton, 1915 South Twelfth, Philadelphia, Pa.

FOR SALE: High Voltage Generators 600 Volts-600 mills. Output Low voltage winding. 8 volts 1 1/2 Amps. for filament heating. These generators can be driven by a 12 volt storage battery and will supply 500 volts. These generators were made by the WESTERN ELECTRIC COMPANY for the U. S. Aviation Service. Price \$35.00. Ekraf Trading Company, 1515 Eastern Parkway, Brooklyn, N. Y.

WANTED: A complete 50 watt C.W. Set. Give description and price. George B. Faunce, 30 Caloris Ave., Millville, N. J.

EDISON STORAGE "B" Battery Elements, 5c per pair, 18 will make one 22.5 volt Battery. Gilman's Battery Shop, Chelsea Sq., Chelsea, Mass.

BURNT OUT Tubes Repaired. Satisfaction Guaranteed. Detector \$3.00. All Amplifiers, and WD11 \$3.50, 5 Watt tubes \$4.00. All makes. Cash with order. Gillmore, 46 Thomas St., Newark, N. J.

FEW GENUINE GERMAN TELEFUNKEN H.W. AMMETERS with scale reading 0-4 amps. Fitted with shunt for half scale reading and adjustment for temperature variations. Very accurate and sensitive. Brand new with original seals unbroken. Diameter 2 and 7/8 inches. While they last, \$3.50 each. Robert E. Goll, 1342 East 22nd St., Brooklyn, N. Y.

FOR SALE: New 1/4 KW spark set. Bargain. All letters answered. R. B. Greig, 1100 Wenonah Ave., Oak Park, Ill.

MEYERS TUBES, RACS, \$4.85, Receptacles \$1.00, Meyers Radio Frequency choke coils \$3.50, Meyers Audio Frequency choke coils \$3.50, Yellow spaghetti 5/8 foot. Prompt Shipments. Robt. J. Hanchett, Box 624, Santa Maria, Calif.

STOP, LOOK, READ,—1 K.W. Type R Thordarson \$18.00; 1 K. W. 25000 volt Dubilier Condenser .01 mfd, \$18.00; Hyrad rotary with motor, \$15.00; 10 amp A.C. Eldridge Ammeter, \$5.00; 110 volt A.C. Eldridge voltmeter, \$5.00; new 10 amp. Jewell thermo coupled ammeter, \$9.00; Amrad 1 K.W. Transformer resistance (new), \$3.50; 20 amp. Boston Key, (nearly new) \$4.50; Standard Key with dime contacts, \$2.00; 10 amp. Kernal Hot wire ammeter, \$4.00; 1/4 K.W. .01 mfd. Molded condenser, \$4.00; 1/4 K.W. Straight gap, \$1.00; A.M. Pancake type osc. Trans., \$2.50; 1/4 inch Coil, \$2.00; 17,000 meter Universal ULS Undamped receiver complete with bulb, etc., \$20.00; New DL 1250 coil, \$1.50; new DL 1500 coil, \$1.75; new Magnavox, \$30.00. Apparatus guaranteed good condition. E. H. Hartnell, Salem, Wisc.

8AXB'S CW TRANSMITTER 50 watts complete with rectifier and new tube \$180.00. All letters answered. A. N. Hubner, 414 Herman St., Cincinnati, O.

WANTED. Rectigon or Tungar Rectifier, Phones, Coil Mounting, etc. Will sell direct motor \$5.00. Premoette \$7.00. Orville Huish, 140 Byron, Youngstown, Ohio.

THE CALL 1FD has recently been assigned to my station. Will appreciate card from anyone hearing same. James L. Hubbard, Norwich, Conn.

8AZQ - QRA. Ludwig Hommel & Co., 205 Conniston Ave., Mt. Oliver Station, Pittsburgh, Pa.

WANTED: Wireless Specialty Co. receivers Type I.P. 500 and I.P. 501 with amplifier. A. J. Higsain, 84 Romaine Ave., Jersey City, N. J.

COLIN B. KENNEDY type 281 Short Wave Receiver; new; operates perfectly; includes detector socket and

rheostat; no amplifier; \$65.00. Grebe type CR-9 Receiver; new; never used except for test; contains detector and two stage amplification with filament

control; excellent receiver for radiophone reception; complete in one cabinet; \$105.00. Federal 28 Detector and One-Stop Amplifier, and one Type 9 Two-Stop Amplifier; intended to be used together, giving detector and three stage amplification; readily connected to any standard type receiver, and makes possible the use of three stage amplification without howling or other undesirable features; price for both \$75.00. First remittance received takes any or all of the above; others promptly returned. C. M. Huennkens, 4829 S. Kedzie Ave., Chicago.

EDISON B BATTERY ELEMENTS 10c a pair. Post Paid. Joseph Instone, 703 Carroll St., Brooklyn, N. Y.

SELL: Lot of new and used receiving apparatus—anything you want—cheap. Let me know what you want and I'll quote you a price. D. Kirchick, 409 Osborn St., Brooklyn, N. Y.

SPARK, CHEAP: 1 KW Acme Transformer 220 volt primary. Good condition. 85P.

FOR SALE: 1/4 KW Thordarson Transformer, 5 sections Murdock moulded condenser, 1/4 KW Amrad quenched gap, Murdock OT, 1 KW nickel plated key, Telephone condensers to prevent kick back. All excellent condition. \$38. F.O.B. Melrose, Mass. Address H. C. Knight, Box 29, East Walpole, Mass.

RECEIVER and three stage amplifier complete Bulbs Receivers \$75 each stage shielded. A. H. Gadio, 329 East 36 St., Los Angeles.

RADIO RECEIVING SETS REPAIRED. Made Mechanically and Electrically perfect. Work guaranteed, prices reasonable. F. H. Lunt Electric Co., Browns Valley, Minnesota.

FOR SALE: Saco two-stage amplifier with tubes \$45. Cost \$63. Ship C.O.D. Mark Moore, East Palestine, Ohio.

RADIOPHONE Transmitter For Sale. Four tubes. All necessary apparatus including filament and plate generators. Price \$150. Worth much more. Description by mail. F. Mann, 327 4th Ave., New York, N.Y.

8BJT complete 1/4 K.W. spark set for sale. Has excellent DX record. Priced right. Harry McCormick, Streator, Ill.

SELL—600-750-VOLT—250-Watt Generator. Fine condition, \$25. 30 one, two, three Microfarad Condensers 50¢ each. George Murphy, 20 Walnut St., Salem, Ohio.

EDISON "B" BATTERY—elements 5¢ pair; connected and with separators 10¢ pair postpaid. Have completed units also. Newing, Box 394, Buffalo, N. Y.

WANTED: Bell rotary gap 8 or 12 electrodes. State price. J. F. Perfetti, 613 Adeline St., So. Hibbing, Minn.

BEST RADIO LAMP YOU CAN BUY Detector Tubes \$4, Amplifying Tubes \$8.50, and you save a dollar. Guarantee them free from all tube noises and to use less current to give clearer and louder signals. Parcel post prepaid. Pittsfield Radio Lamp Supply Co., 48 Gale Ave., Pittsfield, Mass.

WHILE THEY LAST—\$45.00 Receiving Sets including Radiotron Detector \$32.00; Two Stop Amplifiers \$22.00; \$12.00 TransAtlantic Phones \$8.00; Loudspeakers \$12.00; Homchargers \$15.75; 43 plate variable Condensers with three plate vernier and dial \$8.50; Radiotron Detectors \$4.25 Amplifiers \$5.75; Other Bargains. QST Radio Service, Williamsport, Pa.

SAVE YOUR OLD "B" batteries. We have a charger that will make your old dry "B" battery like new again, only \$2.00. Vario-couplers, \$3.75; Amplifying Transformers, \$4.00. Complete radio sets, \$6.00. R. E. D. Electrical Co., 191 East Naghten Street, Columbus, Ohio.

ANNOUNCEMENT. We have moved our entire stock and shop equipment to Hamilton, Ind., where we will continue to manufacture high grade equipment. It will pay you to get our prices before purchasing your receiving equipment. The Radio Exchange, Hamilton, Ind.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

FOR SALE—Benwood 15 watt C.W. and fone transmitter. Used at station WNAC for two months. Heard in 12 states. Complete with tubes and motor-generator \$250.00. Ratherts Radio and Electric Shop, Cresco, Iowa.

— . — . — **BARGAINS** 3000 meter coupler \$5.00; Reinartz & 1 step \$35.00; Porcelain sockets \$0.50; Rheostats \$0.50. Radio 8MO.

FOR SALE, 1KW Thordarson transformer type R, New \$30.00; 1 Thordarson OT \$8.00; Kick back \$3.00. Leon Randall, Water Street, Keene, N. H.

SALE: 1/4 KW Transmitter complete with cabinet, \$75.00. Eighteen panel DeForest receiving set with added accessories, \$125.00. Wm. H. Randel, 14908 Euclid Ave., Cleveland, Ohio.

WE NEVER WON a beauty prize but 4GL Radio Frequency Transformers sure do the work. \$3.15 each, postpaid, from factory to you. Range 200-600 meters. Circuit with each transformer. Savannah Radio Shop, 1223 East Duffy Street, Savannah, Georgia.

TRADE—Set Watchmaker tools, for spark transmitter or other radio apparatus. Write. H. N. Stenson, Saskatchewan, Canada.

SALE: Grebe receivers, Magnavoxes, vacuum tubes, batteries, chargers, Federal filter coils, grid leaks, variometers, couplers, head phones, condensers, vacuum tube control units. For quick sale 10% discount. Sent upon receipt of N. Y. draft, money order or C. O. D. H. C. Stearn, 160 Salem Ave., Carbondale, Penna.

CLEARANCE SALE. Unusual bargains in new and used apparatus to make room for new stock. Bulletin S-3 for two cent stamp. The Radio Exchange, Hamilton, Ind.

GREBE CR-3 like new 150 to 680 meters, \$50.00. Elmer Scheer, 4452 Farlin, St. Louis, Mo.

20 WATT FONE & C.W. TRANSMITTER. Set at 1ASF complete with bakelite panel and four meters. Brass stand for power transformer, rectifier, etc. \$175.00 with tubes. For particulars, write Albert F. Size, 31 Powder House Road, Medford, Mass.

1 W. E. V. T. 1 \$6.00; 2 Jewell thermocouple radio frequency ammeters 0-5 and 0-2 \$10.00 apiece; 1 Signal Electric Co. Detector and two stop \$35.00 cost \$45.00; 1 Westinghouse Rectigon 1-6 Amps. with control rheostat and ammeter \$25.00. Above articles hardly used. Absolutely guaranteed. Ed. Searing, 499 Scott Street, Milwaukee, Wis.

EDISON "B" BATTERY UNITS one positive and one negative plate for 10¢. 18 sets will make a 24 volt battery. Wilkinsburg Wireless shop, 711 Penn. Ave., Wilkinsburg, Pa.

ITS NOT VOLUME you want but DX and clarity. 4GL Radio Frequency Transformers do the trick. Made right; priced right. Savannah Radio Shop, 1223 East Duffy Street, Savannah, Ga.

BARGAIN: Reinartz tuner \$25, Vibroplex \$12, Detector and two stop \$60, 3 8-Watters like new \$20, 5 ampere Tungar bulbs and socket new \$7, Single circuit tuner \$25, Honeycomb tuner \$5, Special Thor. 800 Watt 3000 Volt C.W. plate transformer \$30, Three new Eveready "B" batteries \$4, Three 7000 Volt .002 mfd. C.W. fixed condenser \$2.50 each. E. D. Smith, 219 Rittenhouse St., N. W., Washington, D. C.

9CNS is located at Rushville, Nebraska—Mr. T. C. Shipley—100 watts DCCW—see QSL all answd. Tax

RADIO STATIONERY—Cards printed to order, 250 \$2.00; 500, \$3.50; red call, black printing; color change 25c extra; Gov. postals 1c extra each card. Letterheads 8 1/2 x 5 1/2, 200, \$1.75; 500, \$3.25. Other printing in proportion. Write for prices. Rolland F. Sultze, Mendota, Ill.

FOR SALE 1/4 KW Thor. Amrad Quenched Gap, Murdock O. T. glass plate condenser, kick back preventer, 20 dollars. Honey combs and one step with 15 coils, handsome cabinet in fine condition. 75 dollars. Telephone 4361 Montclair. H. Smith, 191 Alexander Ave., Upper Montclair, N. J.

WANTED: Volume one of QST, must be in good condition. M. Stork, Box 155, Belleville, Ontario.

SBQ's DX. Spark transmitter cheap. Other equipment. All like new. H. Wallace, Danville, Penna.

SALE OR EXCHANGE—Two good regenerative receiving sets with two stage amplifiers at \$60 and \$70 or \$125 for both. E. T. Ballou, Ware, Mass

FOR SALE At most any price because thrown on my hands through foreclosure of mortgage. Three \$350.00 and six \$325.00 Hatfield receiving sets complete in every detail with Magnavox, etc. address Dr. Wesley C. Warner, 414 Sheaff Building, Ft. Wayne, Ind.

FOR SALE: Movette motion picture Camera, tripod and projector and 50 feet of unexposed film or will exchange for radio apparatus. Value \$50.00. Address Dr. H. E. Watkins, 28 Pleasant St., Worcester, Mass.

BARGAINS—Tungar Rectifier, \$15; Westinghouse tubes, \$6.50; Dictograph \$16; Horne variometers and variocouplers; \$2.95; Assembled Honeycomb coil regenerative set with two stage amplifier, handsome cabinet with jacks \$30.00; Peanut tube set \$10; Soldering kits \$1.50; Grid leaks, condensers, etc. 25% off; Thordarson 25000 volt transformer with gap and Murdock OT; \$21.50 (Used). J. M. Williams, Hamilton, Texas.

SELL CHEAP or Trade for CW stuff; Ranger Bicycle and Snare Drum. James Wilson, Gary Ave., Wheaton, Illinois.

INVENTORS: Protect your invention through A. M. Wilson, Inc., Washington, D. C. Over 20 years of efficient, expert, confidential service. Skilled in Radio-Electrical, Chemical, and Mechanical fields. Our 1922 illustrated Booklet, giving much necessary and very useful information which every inventor should know, will be sent free upon request. Prompt and careful attention. Highest references. Moderate fees. Send sketch or model for our careful opinion and preliminary advice. Write today to A. M. Wilson, Inc., (Radio SARH) 310-16 Victor Building, Washington, D. C. (Successors to business established in 1891 by A. M. Wilson).

TERMINAL PANELS. Neat Drawer Shelf terminal panels of correct design. Polished nicked binding posts mounted on grained HR panel 2"x5"x¼", complete with NP screws, REAL soldering lugs and connection template. See page 104 December QST and February ad. Write A. L. Woody (TERMINAL PANELS) Homewood, Illinois.

C.W. POWER Transformers 200 Watts, 500 Volt secondary, 360 Volt tap, \$6.50; 1000 Volt secondary, 500 Volt tap, \$12.00; 43 plate condensers, \$3.00. All post paid. Money back guarantee. M. Zumpfe, 824 North Sixth St., Lafayette, Ind.

FOR SALE complete regenerative and 2 step amplifier verniers ant. condenser \$100.00. Brewster Woodburn, Hampton, Ia.

MUST SELL. Unused receiving set with two stage amplifier in beautiful cabinet with hinged lid, removable back. B batteries in cabinet. Exceptionally good on broadcast reception. Complete with tubes, batteries, Baldwin loudspeaker, and aerial. No extras to buy. Price \$100.00. Will include new Magnavox instead Baldwin loudspeaker for \$25.00 additional. Photo ten cents. D. Aldrich, Hamilton, Ind.

COMPLETE Navy 500 cycle spark sets. Brand new Western Electric Sub-Chaser outfit complete with all spares, 3 KW Coffin \$20.00. Henry Kienzle, 501 E. 84th St., New York.

FOR SALE: Two ¼ KW Thors, \$7.50 each; five Murdock condensers, \$1.75 each; Benwood 12 stud Super gap, \$15.00; Eldridge H. W. Ammeter 0-5, \$5.00. Eliwood Hoepfner, Palmyra, N. J.

FOR SALE: One new pair Western Electric Phones, never used. \$8.50. W. B. Adair, 2182 E. Larned St. Detroit.

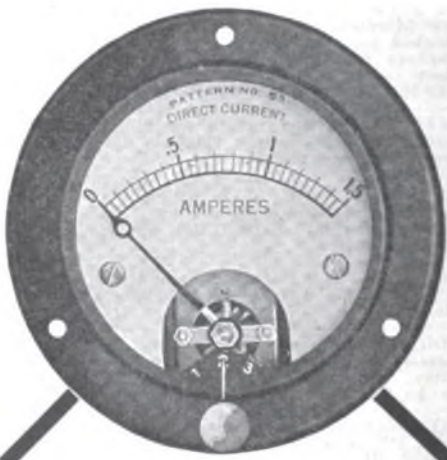
RADIOTRON Fifty Watt Power tubes. Brand new \$27.00. Northwestern Radio Co., Madison, Wisc.

FOR SALE: 4 kenotrons 216; 6 202 radiotrons; 1 A-P detector; 2 A-P amplifiers. All having filaments burnt

out. First two items due to doing work UV-50's. Walt Henrich, P. O. Box 511, Aberdeen, Wash.

ORA 75C, P. O. Box 511, Aberdeen, Wash. 100 Watts straight C.W.

BARGAIN! MUST SELL! United Wireless 1 K.W. "coffin" transformer. Variable transformer primary reactance. Large MARCONI copper-coated Leyden Jars, 12 in mahogany rack complete or single jars at \$2.90. MARCONI shipboard oscillation transformer also braided copper cable antenna tuning inductance on mahogany form. **SWITCHBOARD;** Genuine Italian white marble switchboard 2 by 3 feet on angle iron frame, stands 6 feet high, has pilot lights, 7 inch Weston 0-150 volt Voltmeter, 0-50 ampere ammeter, 4 milled Trumbull 50 ampere switches on bottom, also other switches; will sell below cost. **NEW OMNI-GRAPH** best model with 3 EXTRA sets of dials, cost \$40.00, sell all for \$19.00. Everything guaranteed to be in excellent condition. Make me an offer. John Allen Goodrich, Radio Station 9KF, 2316 Clybourn Ave., Chicago, Ill.



**TRIPLEX
FILAMENT METER**

Filament control by the use of proper instruments in receiving sets is the trend of the times. The Jewell triplex filament instrument, made as an ammeter or voltmeter, places on your panel the proper means for controlling the filaments of three tubes. It has a self contained mechanism for switching to either tube and being of small size, can be accommodated on the most compact tube set.

PRICE \$10.00

We were the first to supply a complete line of miniature radio instruments of uniform size. Ask your dealer or write to us for complete radio circular.

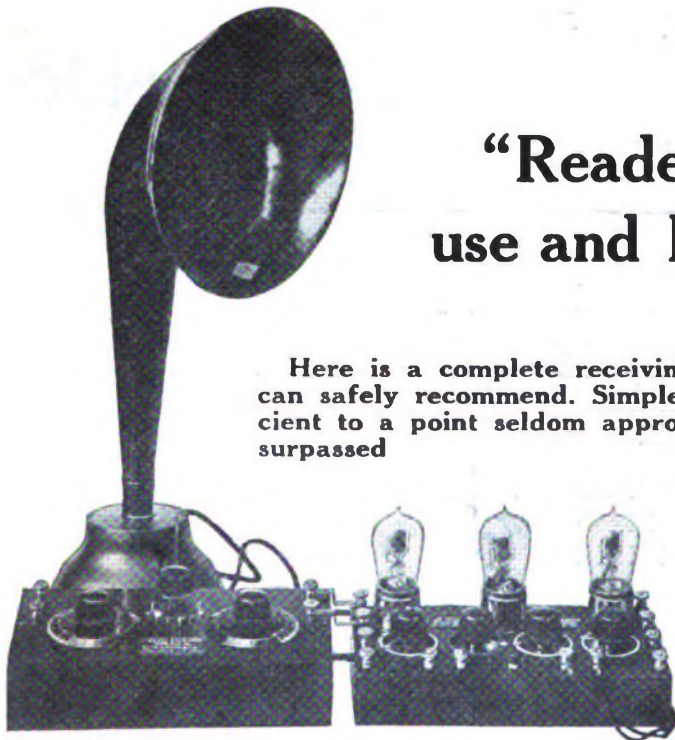
Jewell Electrical Instrument Co.
1650 Walnut St., Chicago

—FOR YOUR CONVENIENCE

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ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS



“Readers of QST use and Recommend”

Here is a complete receiving set which you can safely recommend. Simple to operate, efficient to a point seldom approached and never surpassed

Betts Special Tuner Type RC-11 is a complete tuner requiring no outside condensers or aids. A new and unique instrument, designed specially for the broadcasts at 360 to 400 meters or thereabouts, and operates in and near this range with startling ease, dependability and selectivity.

All tuning done with tap switch and two dials. A really high grade instrument in compact and specialized form. Price \$24.50. *Betts Visible Detector-amplifier Type D2A*. Since first shown, this unit has commanded respect and stirred enthusiasm. It is in a class by itself for efficiency, compactness, durability, and remarkable power and quality of signals. Built of a solid block of genuine Bakelite, with so many improvements and refinements that it may safely be called the most advanced ampli-

fier yet developed. Detector and two stages audio frequency amplification, with potentiometer and cut-off switch. No reader of QST can see and try this unit without heartily endorsing it to his friends. Price without tubes \$38.50.

Betts Loud Speaker puts real music and real speech where the whole family can enjoy it. Extra sensitive and powerful reproducer, positive and durable, with special non-vibrating horn, so superior in tone quality that it “speaks for itself.” Price \$24.50.

SPECIAL QST OFFER

The retail price of this complete and superior receiving outfit is \$87.50. We honestly do not know of any set as good at any price. QST readers are centers of radio advice. To acquaint them and their friends with the genuine quality and extraordinary value of this set, we will for a limited time send this outfit express prepaid to any address in the United States upon receipt of \$78.75. We want every amateur to know that this set is good enough for the expert, simple enough for the novice, and the first really fine complete receiving installation to be offered under \$300.

These sets will be shipped in the order in which orders are received. We may make delivery through local dealers where they are supplied. This special offer may be withdrawn at any time without further notice. To make sure—

Send YOUR order today!

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600 West 43rd Street,

New York

Established 20 years. Makers of the celebrated Betts 400 W Audio Frequency Transformer which is embodied in the Type D2A, and other high-grade Radio and Electrical Apparatus.



*CONNECTICUT Trans-
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A Transformer That Is Made Right

Perfectly shielded windings leave its field unaffected by neighboring fields.

Well separated terminal blocks of CETEC eliminate possibility of leakage between terminals.

High grade silicon alloy steel is used in the core. The windings are vacuum impregnated.

Designed to reduce distortion by perfectly balancing input and output circuits of tubes.

For appearance and for performance this transformer will satisfy the most exacting operator.

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CONNECTICUT radio apparatus*

CONNECTICUT TELEPHONE & ELECTRIC COMPANY
Meriden Connecticut

AMRAD

The Recognized Symbol of Superior Perform.

Wavemeter 2793



Price \$



Fixed Condenser 2618 (7 capacities)
Price each, 45¢



Send and Receive
Switch 2834
Price \$10.00

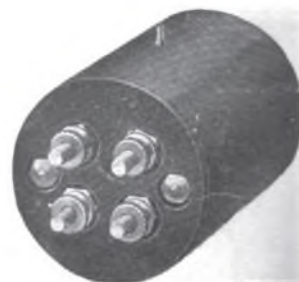
Specialties

IF you would complete your Station, investigate these Specialties at your nearest dealer's. If he is not supplied, write us for free Bulletins C and E, describing the entire line of AMRAD Receiving and Transmitting Specialties.

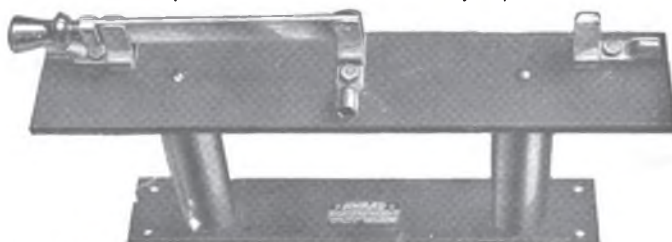
Do not purchase your Parts direct from the manufacturer. Patronize your local radio store and help build up a convenient and ready source of supply for yourself and your friends.

AMRAD PARTS are KNOWN and TESTED necessities, designed and manufactured by an organization of Radio experts, including some of the first licensed amateurs of the country—an organization that has devoted itself for years to Receiving and Transmitting Specialties expressly for amateur use.

Write for free Bulletins C and E. Complete AMRAD Catalog describing over 80 AMRAD radio Products, 10¢.



Amrad Radiformer (4 types)
Price each \$5.00



Lightning Switch 2796 Price \$5.00



Twin R Synchronous
Price \$25.

AMERICAN RADIO AND RESEARCH CORPORATION

205 College Ave., Medford Hillside, Mass.

New York District Office
13 Park Row

(4 miles North of Boston)

Chicago District Office
218 South State St.