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FEBRUARY 1922

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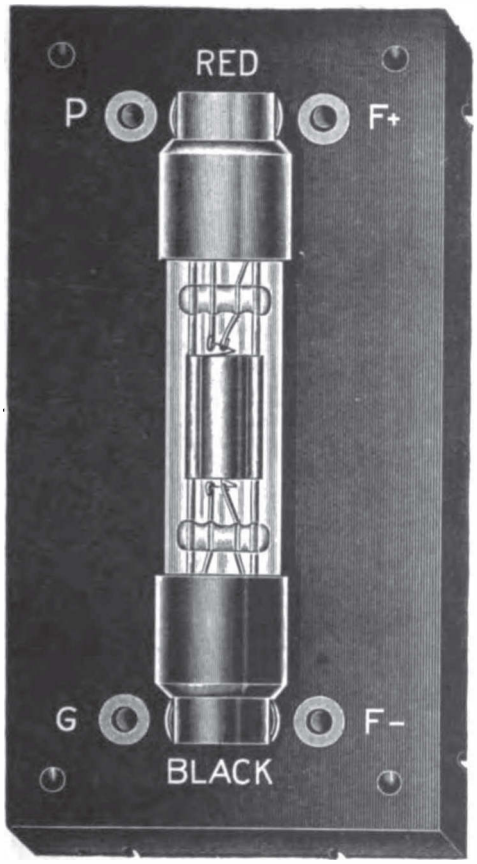

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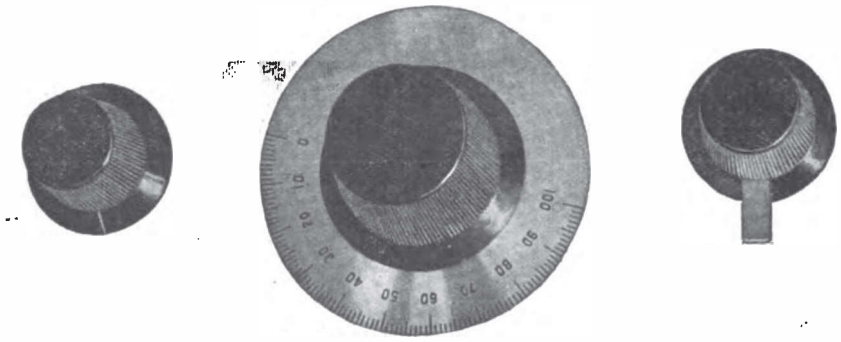

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QST

A Magazine Devoted Exclusively to the Radio Amateur

The Story of the Transatlantics

By The Editor

THE signals of some thirty-odd American amateur radio stations, working on the short wave lengths and low power permitted amateurs, were heard across the Atlantic Ocean in the second series of Transatlantic Sending Tests conducted by the American Radio Relay League in December, 1921. This is a story of that achievement.

The First Attempt

The possibilities of transatlantic tests were first presented to the amateur world in 1920 by Mr. M. B. Sleeper, at that time radio editor of "Everyday Engineering". It is a subject that intrigues the amateur—his greatest desire in life is to get "distance" with his equipment. It has wonderful possibilities, too, in opening the way to world-wide amateur radio. The arrangements for the first tests in February of 1921 were going merrily along, then, when "Everyday Engineering" unfortunately was obliged to suspend publication. Mr. Sleeper requested the A.R.R.L. to take over the management of the tests, which it did in order that his splendid idea might not be lost. In the limited time remaining after our Operating Department took over the management it was not possible to perfect arrangements as we would have liked, and the tests failed. Looking back at them now we believe we can ascribe this to two causes: the length of time assigned the transmitting stations was altogether too short, and most of them were spark stations. At any rate no signals were received which unquestionably could be attributed to American stations.

American ship-operators on transatlantic runs had heard our signals on the other side, however, and we of the A.R.R.L. were still firmly of the belief that signals could be got over on schedule. Gradually the determination crystallized to try it again, and we even made the boast in print that if a dyed-in-the-wool American ham could be sent across the water with a good American regenerator we knew signals could be copied; in fact, we bet our new spring hat on it. Ever since then we have been answering inquiries from England as to just what a "ham" is, particularly one who has been dyed while still in the wool. But we're used to questions.

To Try Again

And so the matter of additional tests was taken up with Mr. Philip R. Coursey, assistant editor of "The Radio Review", London, who had managed the British end of the first tests, and he, finding British amateurs desirous of giving the game a second go too, kindly agreed again to look after the reception end, which this year was perhaps to include France and Holland too. Plans went forward during 1921 and a brief announcement appeared in July QST, while an open invitation to all amateurs to enroll for the preliminary tests was published on page 12 of QST for September, in which the plan was explained and registration form appended.

About this time our First National A.R.R.L. Convention was held in Chicago and our Board of Direction had a meeting there at which plans for the forthcoming tests were considered. Since we were tackling the job we wanted to do a real good job of it and avoid any chances of a second failure. The desirability arose, then, of sending an American listener to Britain to supplement the efforts of the British amateurs, not only so that we might have a double chance of success and so that some comparisons might be made of the relative sensitivity of American and British amateur apparatus but also for a much more important reason—it would then be possible to make the tests really democratic,

PAUL FORMAN GODLEY
A.R.R.L.'s Successful Overseas Listener
from a recent photograph taken at his home in Cedar Grove, New Jersey

as befits our organization, for if only picked stations were to transmit on schedule, obviously the number would be limited, whereas if we could have an A.R.R.L. man there, one used to twirling a mean variometer all night long, the tests could be made a great popular event with free-for-all periods in which the whole country could be invited to participate. This idea was favorably considered and funds were appropriated to send a man to England to make it possible. An invitation was extended Mr. Paul F. Godley, of Montclair, N. J., to undertake the mission in the name of American Amateur Radio, and he was kind enough to accept. Mr. Godley is the man who first adapted the Armstrong regenerative circuits to short-wave work; he originated the variometer regenerators which have made possible the wonderful short-wave DX work of American amateurs since 1914; and he was chosen to go overseas because in the unanimous opinion of the Board he was America's most expert operator in the practical reception of short wave signals. Let it be clearly understood that an American representative was not sent merely because we feared the English amateurs weren't seasoned operators or weren't able to get us with their equipment; instead it was in order that the tests might be expanded into a big popular event without asking the British amateurs to stay up *all* night every night; and Mr. Godley went over as an auxiliary to the British efforts. The French magazine "La T.S.F. Moderne", commenting on the arrangements, suggests that we feared the British weren't sufficiently the hard-boiled owls, but that wasn't it. Incidentally, fellows, you ought to see the French for boiled owls: "des oiseaux nocturnes durs a cuire", literally, "nocturnal birds hard to cook". Have a hi wid us on tt, you tough nocturnal ornithic persons! The big idea was to make sure that American signals got thru to Britain, so that the possibilities of transocean amateur work might be helped along, and that is why Godley was sent.

The Preliminaries

Altho it was decided to divide part of each test night into free-for-all periods it was obviously desirable to give our best stations individual schedules of considerable duration so that careful tuning could be done in Britain and positive reception be recorded. To pick the best stations which would be assigned such individual schedules, eliminating tests were conducted, and the announcement in September QST was an invitation to enter these preliminaries, the books being kept open until Oct. 12th. The hours being limited, there was time for only the better stations in these individual final schedules, and the preliminary qualification was that the stations cover 1000 miles overland. Seventy-eight stations were entered in the preliminaries, which were conducted Nov. 1st to 5th, inclusive, an advance over the original dates made necessary by Mr. Godley's earlier sailing. The time being quite limited, arrangements for the preliminaries were conducted entirely by mail, without chronicle in QST. Instructions were given the transmitters and a thousand copies of the schedules distributed to picked receiving stations thruout our Operating Department with instruction to notify the Traffic Manager direct of all reception. Nov. 10th was set as the final date for the reception of qualifying reports, as the schedules had to be made up in advance of Mr. Godley's sailing. A station did not have to be reported by an official recorder to be eligible in the finals, however—any evidence that it had covered the requisite 1000 miles was sufficient. A number of stations participating in the prelims were heard over a thousand miles and have cards to prove it but still did not qualify, as the cards either came to them instead of to this office, so that no proof was offered, or came to this office too late. Some excellent stations, such as 1UN for example, failed of qualification thru such an accident. Other stations qualified at the last minute by rushing evidence to us, among which was 1AFV who, altho not reported a thousand miles by any of the recorders, filed a card with the Traffic Manager which showed he had covered the DX. Everyone who could show by Nov. 10th that they had made the grade was give a place in the finals, but for fairness' sake the Operating Department held rigidly to the original announcements.

The Finals

The complete scheme for the tests was published on pages 29-32, inclusive, of October QST. For six hours each night for ten successive nights, December 7th to 16th, inclusive, transmission took place and watch was kept on the other side. Each six-hour schedule was divided into two parts, the first part, from 7 p.m. to 9:30 p.m., Eastern Standard Time, being the free-for-all, consisting of ten periods of 15 minutes each and in each period of which all the amateurs in a given inspection district called "Test" and signed. The periods were rotated so that every night a district sent at a different time, sometimes early in the evening, sometimes late, so that if the hour mattered all would have an equal chance. The schedule for these periods appeared on page 30 of QST for October.

Then the second part of each of the six nights, from 9:30 p.m. Eastern Standard Time to 1:00 a.m. of the following date, was devoted to the individual stations who qualified in the preliminaries. Sealed secret

cypher combinations were assigned these stations, with a request that they not be opened until the first night of the tests, and no information was given out as to who had qualified except to the successful contestants themselves.

The following table lists the entrants in the finals:

Call	Location	Type	Wave	Cypher
1AFV	Salem, Mass.	C.W.	200	YLPMV
1TS	Bristol, Conn.	C.W.	200	AOTRB
1RU	W. Hartford, Ct.	C.W.	200	BPUSC
1DA	Manchester, Mass.	C.W.	200	CQVTD
1AW	Hartford, Conn.	Spk.	210	DRWUF
1BCG	Greenwich, Conn.	C.W.	230	GODLY
2BML	Riverhead, L. I.	C.W.	200	FSXVG
2FD	New York City	C.W.	200	GTYWH
2FP	Brooklyn	C.W.	200	HUZXJ
2OM	Ridgewood, N. J.	Spk.	200	JVAYK
2EL	Freeport, L. I.	C.W.	200	KWBZL
3DH	Princeton, N. J.	C.W.	210	LXCAM
4GL	Savannah, Ga.	C.W.	200	MYDBN
8BP	Newmarket, Ont.	Spk.	200	NZFCO
8DR	Pittsburgh, Pa.	C.W.	200	OAGDP
9KO	St. Louis, Mo.	Spk.	200	PBHFQ
9AW	Toronto, Ont.	C.W.	200	QCJGR
1ZE	Marion, Mass.	C.W.	375	RDKHS
2ZL	Valley Stream, L. I.	C.W.	325	TGMKU
8ZO	Parkesburg, Pa.	C.W.	360	UHNLV
5ZZ	Blackwell, Okla.	Spk.	375	VJOMW
6XH	Stanford U., Cal.	C.W.	375	WKPNX
7ZG	Bear Creek, Mont.	Spk.	375	XLQOY
8XK	Pittsburgh, Pa.	C.W.	375	YMRPZ
9ZY	Lacrosse, Wis.	C.W.	260	RZQMY
9ZN	Chicago, Ill.	Spk.	375	ZNSQA
9XI	Minneapolis.	C.W.	300	SFLJT

The three and a half hours for individual schedules was divided into fourteen periods of 15 minutes each, and times assigned to each station, the periods again rotating for fairness. At a suggestion from Mr. Godley the individual stations for the most part transmitted in groups on the same wave length, two stations sending at once permitting double the time for each without jeopardizing the chance of either to be heard. Most of the special schedule stations transmitted in pairs, three being the maximum going in any one period.

In England

These arrangements were by no means for the special benefit of Mr. Godley but were to govern the entire tests. The arrangements in England were entirely in Mr. Coursey's hands and the data on the schedules was communicated only to him. To avoid all criticism Mr. Godley was told nothing except the free-for-all schedule, which was public information, but Mr. Coursey supplied him with a schedule of the times and wave lengths on which to listen, the same as he broadcasted to all British listeners, and kept strictly to himself the identity and cyphers of the various stations. Mr. Coursey being in complete charge, Mr. Godley was on practically the same status as any British listener and was required to submit his reception to Mr. Coursey for verification and to report thru him.

Meanwhile the greatest enthusiasm seems to have greeted the preparations for the tests, on the other side. The Nederlandsche Vereeniging voor Radiotelegrafie (Holland) wrote us for particulars and published them in their magazine, "Radio Nieuws", together with recommended Armstrong circuits for short-wave reception; and "La T.S.F. Moderne" did the same thing for the French amateurs. "Wireless World" was the bulletin for the British amateurs, and it was here, of course, that the highest interest centered. Many amateurs seem to have gone to great lengths in their preparations, making special sets with many stages of tuned-output radio amplification—and we are very happy that the outcome of the tests justified their labor.

Godley Prepares

While these arrangements were progressing "Paragon Paul" was busy too, building special amplifiers, testing various tuning arrangements, and experimenting with different aerials. When he succeeded in making 5ZA work a relay in New Jersey without interference from New York amateurs he felt he had things around where they belonged.

On Nov. 14th, the night before he sailed, a very impressive little dinner was given for him at The Engineers' Club in New York City, where our A.R.R.L. officers and our directors within hailing distance and the officials of other radio organizations gathered to wish him success and bid him Godspeed. While the trial was to be a severe one and no man could with surety predict the outcome, optimism was distinctly the keynote and everybody was certain that if it could be done at all Paul would get signals. At this meeting credentials and written instructions were given him, together with a sealed packet for Mr. Coursey in which the secret codes and final schedules were given. There were but two copies of these documents in existence and the duplicate was locked in the Hartford safe. Until the writing of the article it was seen by no eyes in this country save those of our Traffic Manager—not even by the present writer.

Godley sailed on the "Aquitania" on Nov. 15th, amid cheers and waving handkerchiefs of assembled radio friends and relatives, and for a couple of nights out the amateur air was thick with farewells and good wishes for 2ZE, Godley's home call, for everybody knew he would be in the static-room on the "Aquitania".

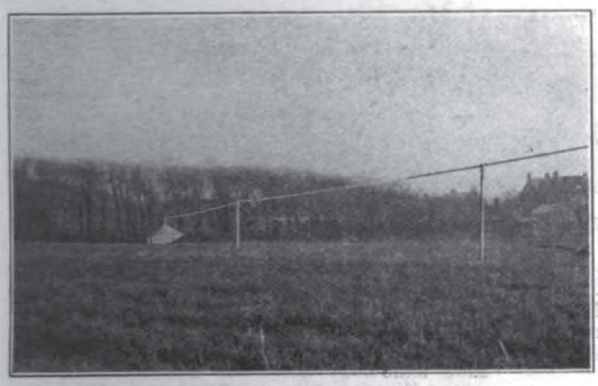
The second day out we radioed him:

"Bon voyage The entire radio world is pulling for you"—to which he replied:

Confidence increases as distance squared Broadcast my heartfelt appreciation".

Arrangements had already been made with the British authorities thru the kind co-operation of our own State Department and Department of Commerce for special authorization to Mr. Godley to bring in

apparatus and erect and operate a receiving station, and to one familiar with the British laws on radio it will be apparent that this was itself an accomplishment. Mr. Godley landed at Southampton on the 21st and proceeded to London, where he was shown every courtesy by the British radio men. He had originally planned to make use of the receiving station of Commander Phillips, near London, which was kindly placed at his disposal, but results there being discouraging he moved up into Scotland and located at Ardrossan, a thriving ship-building port and watering place on the coast to the west of Glasgow. There he erected his apparatus, accompanied by his official listener, Mr. D. E. Pearson, District Inspector of the Marconi company at Glasgow, who stood a constant watch



The Site at Ardrossan—Note the Tent.

with him during the tests and verified the reception of every signal.

Time was growing very short when Godley arrived at Ardrossan and there was no opportunity to build a shack or make any particular arrangements for comfort. Unfortunately the only good location was in an open field without buildings, and a tent was the only possible housing. This record-breaking reception, then, was done in just a tent, exposed to the elements, its only light a lantern and its only heat an oil stove, while the countryside rocked in the worst weather imaginable—cold and penetratingly raw, terrific down-pours of rain, and wild gales—the results of a cyclone which passed nearby. The physical strain and suffering must have been intense. What a debt we owe Godley for what he went thru for us!

Meanwhile it had been planned to file a message daily at Carnarvon, Radio MUU, addressed to the A.R.R.L. at Hartford and containing a brief report of reception or conditions. So great was the interest of the commercial companies in our undertaking that the Marconi officials very kindly arranged to send this report at a specified time daily, 7 a.m. British time or 2 a.m. Eastern Standard Time, and do it slowly by hand, so that the amateur world could copy it direct and so get first-hand word from Godley at the earliest possible moment. November QST told of this and gave suggestions on the reception of MUU. Carnarvon's signals are not very easy to receive, however, and so it was arranged that Godley should send "PC" messages, which means that they were to be repeated back for verification, and on this side of the water the same brand of very interested co-operation which marked the attitude of the Marconi officials in England was evident in the Radio Corporation folks and special arrangements were made that WII, the Corporation station at New Brunswick, should slowly repeat Godley's messages upon their receipt immediately after 2 a.m. Eastern Time. This made it possible for every amateur to get the dope instantly, and altho announcement of the arrangements was not published it was telegraphed our Division Managers and broadcasted thru the divisions by radio, so that thruout the country there were watch parties every night of the tests.

The Results

The tests are now a matter of history. In this issue we publish Mr. Godley's complete report, a wonderful document, which tells the interesting story from his end, and we do not intend to scoop it in this poor chronicle. His daily radio reports, which were delayed 24 hours thruout the tests, really told the story. These reports, by the way, were filed over his name by Mr. Coursey, Mr. Godley wiring coded reports of his reception to Mr. Coursey for checking, after which the latter passed them on to us.

Eight British amateurs were successful in copying American signals, and that is something that pleases us immensely. At this writing we have not yet received any detailed report from Mr. Coursey but he cables us that the secret codes were correctly copied by British amateurs from 1AFV, Salem, Mass.; 1BCG, Greenwich, Conn.; 2FP, Brooklyn; 2ZL, Valley Stream, L. I.; and 2BML, Riverhead, L. I.; that during the free periods they copied 1UN, Manchester, Mass.; 1RU, West Hartford, Conn.; 1XM, Cambridge, Mass.; and 2ZC, South Orange, N. J.; and that it is probable that 1ZE, Marion, Mass., and 2ZU were also heard; a total of eleven stations. Mr. Godley brings back the rumor that 1DA, Manchester, Mass., was also copied by the British amateurs but Mr. Coursey makes no mention of it. 1BCG was heard

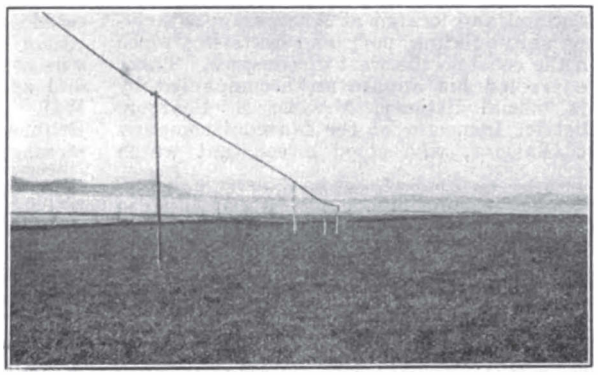
by five British stations. It is very interesting to note that all of these stations are C.W.—not a spark was heard by the British amateurs.

The spark stations heard by Mr. Godley are Canadian 3BP, Newmarket, Ont.; 1ARY, Burlington, Vt.; 1AAW, not yet located; 1BDT, Atlantic, Mass.; 2BK and 2DN at Yonkers, N. Y.; 3FB, Atlantic City, N. J.;; 9ZJ, Indianapolis; and 8BU of Cleveland. The C.W. stations reported by him are 1RU, West Hartford; 1RZ, Ridgefield, Conn.; 1ARY, Burlington, Vt.; 1BCG, Greenwich, Conn.; 1BDT, Atlantic, Mass.; 1BGF, Hartford; 1BKA, Glenbrook, Conn.; 1XM, Cambridge; 1YK, Worcester; 2EL, Freeport, N. Y. (spark or C.W.?); 2EH, Riverhead, L. I.; 2FD, New York City; 2FP, Brooklyn; 2ARY, Brooklyn; 2AJW, Babylon, L. I.; 2BML, Riverhead, L. I.; 3DH, Princeton, N. J.; 8ACF, Washington, Pa.; and 8XV, Pittsburgh.

Mr. Godley also brings back the rumor that on Dec. 9th British amateurs in London heard a phone signing WQM play the "Humoresque" at 10:45 p.m. G.M.T., and at 10:55 a piano solo, the wave length was 200 meters. WQM is listed as the broadcasting station of the Wichita Electric Light & Power Co., Wichita, Kansas, but at this writing they have made no response to our attempts at verification.

1BCG is reported from Holland and Germany during the tests, and we are informed that 2ZL was also heard in France. Some DX!

1AAW was originally reported as 1AAY, thru a mix-up in the separate code used between Messrs. Godley and Coursey, and was later corrected by cable to us. When the report of the first night came thru, advising that 1AAY had been heard, excitement reigned supreme at Hartford headquarters. Shown by our call-book to be in Bridgeport, Conn., he could not be located by telephone nor could any other Bridgeport amateurs. So we got E. H. Armstrong, from 1BCG, to drive there in an effort to locate him, which Mr. Armstrong did in the wee sma' hours of that same morning, only to find that 1AAY had moved to New Jersey. Radio Inspector Kolster was routed out and advised us that the call had been reassigned to Fitchburg, Mass. Later that day the Chief of Police of Fitchburg, whose name incidentally also is Godley and whose people are from New Jersey (wonder if he's red-headed?), located the Fitchburg lad and got him on the telephone wire for us, but he had only a quarter-inch coil and no aerial. With what fear and trembling he must have answered the summons to report to the Chief of Police! Then the correction came from Godley and we were off again, this time after Roxbury, Mass., with Mr. Entwistle doing the Sherlock act. Meanwhile former 1AAY from Bridgeport comes in with the dope that he has moved to Belleville, N. J., where, altho it is the Second District, he operated on that test night with four amps in the aerial and signed 1AAY. But in view of Mr. Godley's correction he was very QRZ hr. And



The "Beverage Wire," pointing out to sea across a low island.

1AAW in Roxbury hadn't operated a transmitter for six months! We thot we were up a tree at first but 1AAW and numerous Boston amateurs advise that the call *has been heard* on the air around there and that somebody else has appropriated the call. Whoever the would-be 1AAW is, he is sticking tight under cover now, as he knows he is a law-breaker, and to date he has not been located. It is a pity, too, for if he were within the law he could claim the honor of being the first station heard overseas in the tests.

1BCG seems an easy winner as the star station. In addition to being heard all over the map they got thru a coherent message on broadcast, at 3 a.m. G.M.T. on Dec. 12th, which was acknowledged by Godley by cable to this office. The first amateur transatlantic message ever sent read as follows:

"Nr 1 NY ck 12 to Paul Godley, Ardrossan, Scotland. Hearty congratulations. Burghard Inman Grinan Armstrong Amy Cronkhite."

Speaking of results of the tests, another result was that we won a perfectly nice spring hat from W. W. Burnham, of London, who took us up on our editorial bet before refered to, that a good U. S. ham could get signals over there. When the tests were over Burnham wired us:

"Congratulations Cable size of hat"

and we expect soon to publish a picture of our editorial self in the new London Lid.

Many prizes were offered by British firms to the successful receivers over there, and Messrs. Burnham & Co. have offered one of their Ultra III receivers to the most successful American contestant, the award of which has not yet been determined.

The Test Nights

It was wonderful to sit in on the tests. Goodness knows how many transcontinental records were broken, for an amateur never misses the opportunity to listen for fellows on the other side of the country when he knows they are sending on schedule. During the free-for-alls one could hear district after district start up, as regular as clockwork. First the air would be full of 2's, then it would change to 3's, and as the last 3-station shut down he would wind up with a "Go ahead, 4's, give her juice!".

Those were wild nights in Hartford. A little group of us were on the job every night at the Traffic Manager's static-room, waiting on a long-wave set for MUU to send the nightly report. The air was so thick with tobacco smoke that it was hard to see how a signal could get into the room, but WII with his tape transmitter could be heard tearing along in the background, and regularly at 2 o'clock he would slow down and say "Give me Godley's message". And then with what tenseness, with what wobbly hands and stifled breathing we listened as MUU started his hand-sent report! Here she comes, fellows! Will there be call-letters? Who has been heard? That was the absorbing question! Later in the tests we got so that we knew that a check of 17 or some such small number probably meant nothing but a report of weather conditions but you should have seen us when the big message came thru with a check of 94. Oh, Boy, that meant *signals!* And there were eighteen of 'em! And of course the same scene was being enacted in countless radio shacks all over the country.

About 2:05 the telephone line would be getting hot and what with press reports, telegrams to file, countless long-distance calls from everywhere, there was no use going to bed. The newspapers are wild for radio dope these days and our A.R.R.L. got lots of publicity and Amateur Radio a big boost up the ladder from these tests.

In Appreciation

Paul Godley returned to America on the "Olympic" on Dec. 28th, a conquering hero! He was met at the pier by many of those who saw him off and an informal luncheon was given in his honor at the Hotel Pennsylvania. The faith that his friends put in him had been more than justified. His niche in the Radio Hall of Fame is secure forever. With deepest gratitude we acknowledge our binding indebtedness to Mr. Godley, for the personal sacrifices he made to act as the representative of American amateurs overseas; for the suffering he went thru in their name; for the wonderfully successful job he did in spite of difficulties. And our congratulations, Paul —long may you radiate!

Our deep thanks are also due to Mr. Coursey for the admirable way in which he organized the British end; to Mr. Coursey and numerous British radio men for the courtesies shown Mr. Godley; to the British listeners, one and all, for the interest that made the tests possible; to our own Secretaries of State and Commerce for their kind co-operation in getting Mr. Godley thru the miles of red tape; to the British post-office authorities for the permits so graciously granted; to the commercial companies on both sides of the water, Radio Corporation men in general, and in particular to Traffic Manager W. A. Winterbottom of the Radiocorp and Mr. Henry W. Allen, joint general manager of Marconi's, Ltd., for the co-operation that made the special MUU and WII broadcasting arrangements possible; and to Canadian and American amateurs themselves for their good sporting spirit—and our congratulations to the successful ones! All share in writing a glorious page in the history of Amateur Radio.

The Future

It is with much trepidity that we venture to talk of the future. Who can say? But surely these accomplishments open the road to broader field of Citizen Radio. The scientific world is startled at our A.R.R.L.'s achievement. In the most graphic way we have demonstrated the high radiation efficiency of the short waves. To put a message across the Atlantic on less than one kilowatt! *It was done.* To cross the Atlantic on antenna powers of fifty watts or less! *It was done.* To get over on wave lengths sometimes under 200 meters, with our aerials that are as grasshoppers to the commercial stations! *That too was done.*

Some of the stations had remarkably low power. But they used C.W. and one of the greatest lessons to be learned from these tests is how very much better C.W. is than spark.

We sincerely hope that as a result of these tests amateurs not only in Britain but on the Continent as well will be inspired with the ambition to get into the relay game and duplicate our feat in the reverse direction, giving us the opportunity to repay our debt to them; that, being shown possible, one-way amateur traffic to England and other countries may begin soon on schedule; and that the British authorities in particular will be so impressed by the potentialities of such work as demonstrated by our tests that the amateur restrictions in that country may soon be sufficiently modified to give hope of successful two-way amateur communication across the Atlantic.

That will be the fun, eh, fellows—to sit

at the old set on a cold winter's night, the bulbs burning cosily in front while the generator purrs sweetly in the corner, the old cob pipes neatly filled in advance and set in a row for a hard night's work—and then clear England, Scotland, France, and Holland in turn! (No, we never take a drop of stuff like that, and we really believe that such things some day will come to pass.)

Surely radio has been given added impetus by these tests, and certainly the day of International Private Radio has been brought closer!

Official Report on the Second Transatlantic Tests

By Paul F. Godley

MENTAL processes during great moments are extremely complex and I shall never be able to fully recount those of mine, either upon the memorable occasion when, amidst the insipiring farewells of a host of renowned amateurs, the "Aquitania" bore me towards an unknown professional fate, or those of that other and greater moment, when without regard for the atrocities of the Scottish night the first American amateur signal fiinished its 3,500 mile journey at Ardrossan.

On the first occasion I was overwhelmed with a wish that some fairy power might sweep twenty thousand "hams" to a place beside me, while on the second it was with the utmost difficulty that I restrained a joy which cried for the slam of a switch, the mad whine of a motor, and the crazy stuttering of a key. No sinking tramp at sea ever bewailed its lack more than I bewailed it then.

The "Aquitania's" sailing marked the beginning of a short respite from a physical strain under which work, plan and preparation had placed me. No one else will ever know how much I needed sleep, and I began taking it in large doses. On the other hand, the first signal brought with it welcome and almost complete mental relief, for five nights of listening to static and high power station harmonics near London had left me in a somewhat dubious frame of mind, which may be judged from the fact that all thoughts of sight-seeing were dropped forthwith—a trip to Paris which had been planned was given up, and I began to muster meteorological "dope" from every quarter.

The first signal also ushered in a new period of physical strain, for it was found necessary to set up equipment under an indifferent tent, in an open field near the beach, and the test period was attended throughout by high, gusty, changing winds, heavy downpours, and a chill damp which drew heavily on one's reserve energies. So far as I know, for an American, there is but one comfortable place in winter in all the British Isles. That place is in bed—with a hot water bottle at your feet. Hospitality, of which I found a plenty everywhere, will warm the cockles of your heart, but it's no good for the joints, so those whose hospitality I sampled secretly complained of gas bills.

It seems to me now that the most remarkable phase of the entire undertaking lay not so much in its complete success but rather in the thoroughly whole-hearted co-operation encountered at every step—both during the formation of plans and during their execution—and before following through this narrative every American relay man will be glad to recognize a debt of gratitude towards all those men and those organizations who seemed to find *pleasure* in doing *anything* to insure success.

It was generally known that various American manufacturers had lent their full support to the project. Sensitive, rugged Baldwin 'phones did their excellent bit. None in England could equal their ruggedness, and none were more sensitive. The small precision wave-meter of the General Radio Company checked to a hair on 200 meters with the unusually fine standard owned by Mr. Frank Phillips, of Wembly Park, London. Burgess batteries took to the wet and muck without a whimper. The A. P. amplifier tubes I had used in tests on this side were still intact and carried on throughout the whole procedure. The Radio Corporation's U.V.200 detectors functioned as gas content tubes in a way which was surprising to British amateurs who saw them working, while the Paragon Super-heterodyne and regenerative receivers pulled in signals in a manner which astounded everyone including Inspector D. E. Pearson, of the Marconi Marine Communication Company, Ltd., who was checking operator throughout the test.

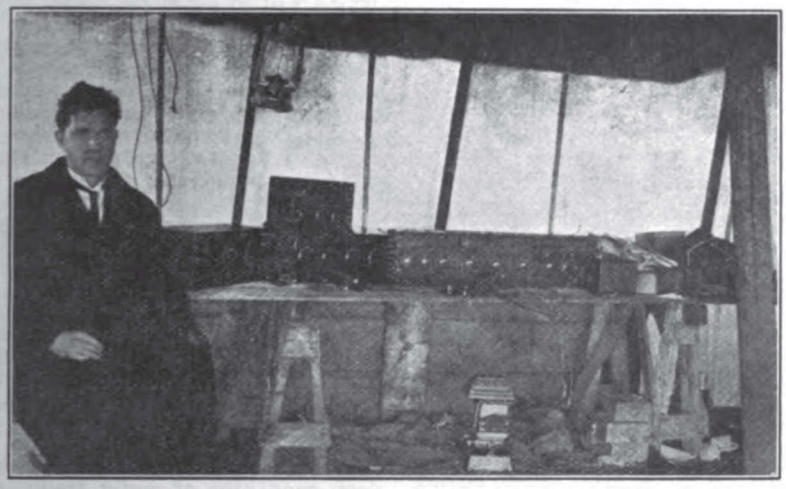
During formation of plans, encouragement was offered by a full score of prominent radio engineers, and everyone was

delighted with the generous attitude displayed by W. A. Winterbottom, Traffic Manager, Radio Corporation of America, whose efforts made possible the daily reports via Carnavon and New Brunswick—reports which passed as paid messages but which were never paid for, because Mr. Otto Rochs, Marconi's (England) able traffic manager, informed me there had been no intention of accepting payment. Messrs. Allen and Bradfield, Marconi's joint general managers, took a fatherly interest in the whole program. No amateur could wish for better friends, and tho very busy men they found time to be lavish with suggestion, assistance and real hospitality. Their assistance took the form of men and materials at Glasgow, and the services of Mr. Pearson at Ardrossan. Capt. H. J. Round, of the same company, and whose valued contributions to the art are quite familiar to all American amateurs was also greatly interested in it all and offered anything he had in the way of equipment, such as a 22-stage amplifier, and proved an exceptionally fine host during my visit to the Chelmsford works of Marconi Co.

Of course, amateurs both in America and England were always ready with assistance. We dared to expect that, but certain amateur services stand out a bit from the rest. On this side it seems to me considerable credit should go to E. H. Armstrong for the keen interest he displayed prior to the tests, and the amount of time and energy which he expended in an effort to insure the success of this great undertaking. I feel that I should also call attention to the generosity displayed by the Adams-Morgan Company in releasing the writer's services for this work at a season, when, as all radio manufacturers know, every effort counts.

In England Mr. P. R. Coursey, editor of "Wireless World," and his associates labored cheerfully to properly organize England, and Commander Frank Phillips opened his home and placed his very complete station at my disposal, while all manufacturers did their share toward boosting the interest in the tests in England by offering prizes.

I wish also to express my thanks for the assistance unwittingly given by one Mr. Louis Falconi, station 5ZA, of Roswell, New Mexico. It will probably be a great surprise to him when he learns that covering a period of about one week prior to my sailing, during which time the apparatus which I was to use was under test, I used his very uniform signals to check and recheck the operation of the equipment. I not only received his signals during this period on the regenerative receiver, using the detector and two-stage amplifier, but also was able to get him nicely on a nine-turn loop in conjunction with a super-heterodyne receiver, when his signals were of such strength and regularity as to enable the operation of a four-ohm sounder by the insertion of relays in the circuit. The results of this reception greatly surprised several members of the Radio Association of Northern New Jersey, who chanced to visit my home very early one morning.



Inside the tent at Ardrossan—Mr. Pearson, checking operator.

A thing which stands out in great prominence is this: the American amateur has given his British cousin a surprise. I am quite certain there wasn't an amateur in all Britain who thought it could be done. I can well imagine the glad surprise which must have spread out from London, when it became known that signals *were* being received. British men came in on it too, and as a result of all these signals from

America, there is a good deal of speculation in Britain at this moment on the endless possibilities of amateur radio on short waves. Whereas in the past they have been thinking in terms of 1,000 meters, they are now thinking in terms of 180 meters. They are limited to ten watts input, and their antennas must have no more than 160 feet of wire total.

Wasteful coils are necessary to load such a small antenna to 1,000 meters. Also, waves of this length do not travel at night like the shorter ones. Many will listen for us on 200 meters, and I hope soon we may be receiving *them* on 180. Good engineering on their part and a bit of luck will make it possible even with ten watts.

Good fortune seems to have followed everywhere. To begin with, there was that very impressive dinner the night preceeding my departure, and the farewell party at the dock. An account of these doings has already been printed, but a part which was not staged was that I should meet on the deck of the "Aquitania" as she left New York Harbor, one H. H. Beverage, receiving engineer of the Radio Corporation of America, and by the way one who qualifies as being a "hard boiled ham." Needless to say, I had not been with Beverage long before we got around to that thing which is nearest his heart, to wit, the Beverage wire, as a static reducer.

Now, to those of you who are uninitiated an explanation of this term "Beverage Wire" will be necessary and it will be forthcoming later. The point I want to bring out here is that the thought of this Beverage wire served as a great buoy during the period previously mentioned when, after listening five consecutive nights near London, I had heard nothing but static and harmonics.

Before the "Aquitania" had been away many hours the great interest displayed in the undertaking began to be manifested by the radiograms sent by many amateur and professional radio men. The first of these came in over the signature of J. Andrew White, editor of "Wireless Age" and read:

Just an added slap on the back old man to emphasize my sincerest wish that this trip of yours will go down in radio history.

This was followed by several others among which was a greatly appreciated one from my old friend Harry Sadenwater, who, it will be remembered, served as radio officer on the ill-fated NC-3 during the transatlantic seaplane flights. He heartily wished me a "bon voyage and wonderful success."

Late in the evening of the first day I learned that Mr. H. M. Short, Superintendent, Marconi Int'l. Marine Communication Co., Ltd., had requested the Aquitania's radio men to extend all courtesy to me and they proceeded to do all possible in making me feel at home, with the result that twenty-four hours later I found myself taking the following from WBF:

From Hartford, Conn.
To Paul F. Godley, SS Aquitania via WBF.
Bon Voyage! The entire radio world is pulling for you!
(Signed) Warmaxnell

while on the fourth day (Saturday) the High School Radio Club of Montclair, N. J. passed out a "73" via VCE (Cape Race).

Contrary to what may have been the general idea of this trip, at no time had I viewed it as anything even remotely resembling a lark, for there were sacrifices which had to be made. But, it was these radiograms—each bubbling over with sincerity and a *will* for success which first brought home to me the extent to which all these eyes reddened by long watches on the relay routes must be following me. As I tossed about in bed during the wee hours of Sunday morning the 19th of November I took note, too, of the veiled interest which had been shown in engineering circles, and before dropping away to sleep I remember mentally repeating over and over the resolve to *get signals or bust!*

The voyage was not rough—neither was it particularly smooth. Fortunately the state of the sea concerned me not at all. A good portion of my time was spent with the three very likable men in the radio cabin, Messrs. Maudesley, Farnam and Porter, respectively Chief, 2nd and 3d operators. It was impossible to do any real listening on amateur waves however. The vast quantities of radio traffic and book work which is to be found on the ocean greyhounds make this impossible, and I had, for the most part, to imagine the "bon voyages" and "73s" and "good luck" messages which were being passed out on short wave lengths, and I understand there were many of them.

As we neared the French coast I filed a message to a staunch League member, Mr. Leon Deloy, of Nice, France, extending greeting on behalf of his American contemporaries to which he promptly replied: "Radio greatly appreciated wish you complete success would be delighted to meet you".

I was very much surprised upon reaching the dock in Southampton to find Mr. H. J. Tattersall, Superintendent of the Marconi Company in Southampton, waiting to help me through the customs, and I was indeed glad to have him. It happens that a very heavy duty had just been placed on all radio equipment. Under these circumstances, British custom officials were inclined towards placing all of my apparatus in the warehouse in order that within the next two to four weeks some customs

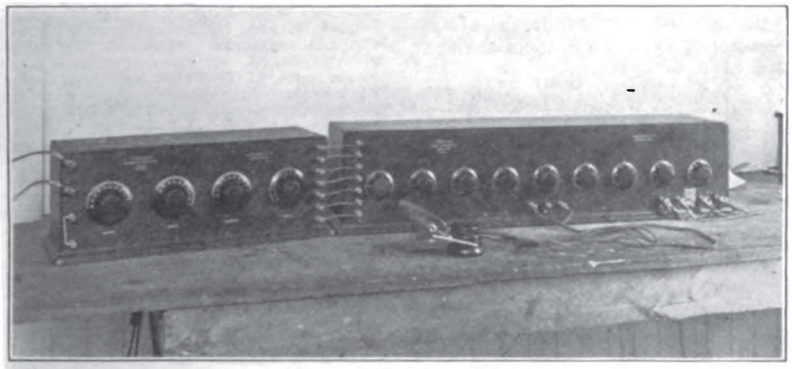
officer might go over it at his leisure, place a proper valuation upon it, and exact duty accordingly. After considerable running around to various officials, and after a great deal of pleading with the Chief Customs officer of that port, we were told that if I cared to leave $100 with the customs people, they would pass the equipment through, the $100 to be returned at that time when the equipment was again taken from the country.

And so I finally reached London on a funny little train, and began to meet the various notables in and around London. I consider it of extreme fortune that it was possible for me to attend a meeting of the Wireless Society of London, and latter to hear an extremely interesting lecture by Dr. Fleming at a meeting of the Royal Society of Arts, and to meet and chat with such men as Senatore Marconi; Admiral Sir Henry Jackson, president-elect of the Wireless Society of London; Mr. Campbell-Swinton, past president of the society; Prof. E. W. O. Howe; Mr. E. K. Shaughnessy of the Wireless Section of the G. P. O.; Mr. F. Hope-Jones, Chairman of the Wireless Society of London, and many others.

Just prior to the meeting of the Wireless Society I was led into a large room adjoining the lecture hall and to my surprise found a long table heavily laden with various attractive things to eat and behind which several young ladies were wielding the tea things. It was time for a regular meal, so my stomach said, but it didn't quite look like a regular meal. However, after being assured that it was safe to do so I managed to personally superintend the rapid movement of a considerable portion of the commissary, notwithstanding that most everyone made great efforts to get me to talk.

At the close of Dr. Fleming's lecture I met Marconi. He showed a flattering interest in a recital of the events which had led up to my visit and in amateur accomplishments in the States. He expressed every hope and seemed to feel confident that the tests would prove successful, and as I left him he asked me to pass on to American amateurs his good wishes, for, he said: "I, too, am but an amateur!"

As we passed out of the old building which had housed the Royal Society of Arts for many decades, I again felt myself being steered, and again we approached a long table in the balcony of a gaily colored restaurant. This, apparently, was to be a little dinner party in my honor, and so it proved—and it was a merry, long-to-be-remembered time we had while I managed to put away another big feed all in the same evening. And would you believe it—there were two "O.W's" in the gang! and they, too, joined in the toast to American Amateur Radio and to the success of the Transatlantic tests



The tuner and amplifier which made up the Super-Heterodyne used at Ardrossan. As connected for use with Beverage antenna, the special regenerator shown on page 25 was inserted between this tuner and the antenna.

As far as I was concerned, British hospitality had never been properly advertised. I had never expected so great an effort to make me feel at home, and while I was thinking this all over I was at the same time noting the glances on every hand which I understood as meaning that these British amateurs had been unable to decide whether I was just a "nut" or whether I was really confident of our ability to put the thing over.

Preliminary arrangements for an operating permit had already been made by Coursey and two days after arriving in London I set up the regenerative receiver and super-heterodyne at the station of Commander Frank Phillips above mentioned. British amateurs are very keen on radio-frequency amplification. Remember, most of their work is done on 1000 meters which

makes it a somewhat simpler matter. Phillips, the designer of the "Burndept III" receiver, thinks very highly of his fine little outfit. Before many hours, however, he agreed that the Paragon regenerative combination gave signals somewhat better than those obtainable on the outfit he was using, and that it was a thing not to be lightly passed by.

The vast numbers of harmonics from single circuit tube transmitters and Poulsen arcs, which one picked up at all times, struck me forcibly. Atmospheric conditions, too, were of an unusual type. I have never before encountered anything like it. During the winter time here in America we expect atmospherics will be negligible, or, if present at all, quite uniform in their habits. At Wembly Park I found them suddenly increasing during certain short periods of the night, and suddenly decreasing to appear again in another quarter, and in a new form.

Later, we got the Super-Heterodyne going, and it was quite apparent that all who saw it in operation were greatly impressed. Cmdr. Phillips showed particular delight when we picked up a 10-watt radio phone station at a distance of 18 miles on a coil having 8 or 10 turns and a diameter of 3 inches. We revolved the coil about on a pivot, and in this manner got the direction of the transmitting station. During our work with the super-heterodyne, I decided to make alterations in the mechanics of the capacitive feed-back. Accordingly, I put a bushing through the panel, placed a shaft in the bushing with a spring washer

to hold it firm, and so arranged this shaft that it controlled the small condenser. During the initial test of this little device the amplifier began to squeal vigorously. Phillips immediately jumped up from his chair and rushed to another room, to appear a few minutes later with an oil can from his wife's sewing machine, whereupon he proceeded to oil this shaft in its bearing. He maintains that there is no connection between the squeal of the amplifier and the idea which he got that oil was needed, and it may be that he is right; nevertheless, it is too good to keep.

London newspapers began to show a considerable interest in the tests very shortly after my arrival, and I was greatly amused to find the following printed on the editorial page of the "London Star" on November 30th:

THE FAR CALL

Prospects of the New Trans-Atlantic Wireless Test.
By "Nautacore."

"On December 8 there begins a series of Trans-atlantic wireless tests similar to those which took place last February. As then, American amateurs, using small power and short wave-lengths, will try to get into communication with this country.

"The stations taking part are purely "amateur" but must be proved capable of bridging at least 1,000 miles in the States or Canada. With an amateur's small power, and short and theoretically inefficient wave-length, 1,000 miles is a big achievement; yet it has been done. In theory, a station can do little without a fair amount of power behind it, but, in fact, American stations, with a nominal maximum range of 250 miles, are often plainly heard in this country, whilst Valentia (west cost of Ireland) has kept up a brisk correspondence with British ships entering New York Harbour, although the official lists state that she cannot exceed 600 miles.

"Last February's tests were unsatisfactory from the point of view on both sides. In the States too many persons "tried their hands." On this side, the delicate, finely-tuned instruments employed were interfered with by wireless novices using receivers which acted as miniature transmitters—drowning the feeble pulsations of American aerials. Americans, however, reject that excuse for our non-reception, declaring that incompetence had a lot to do with it; and to make certain of really good reception this time they are sending over one of their hardest of "hard-boiled hams" with a brand-new bag o'tricks and their good wishes. He will show us how it should be done.

"The wireless magazines have made their last appeal to those not taking part in the contest to "earth" their aerials and go out for a walk during the specified hours and nights, so that interference may be reduced to a minimum. Those who have entered their names will conscientiously avoid "regeneration." Will all respect to the "hard-boiled ham" I invite him to do likewise—avoid 'regeneration.' Then we all might get something."

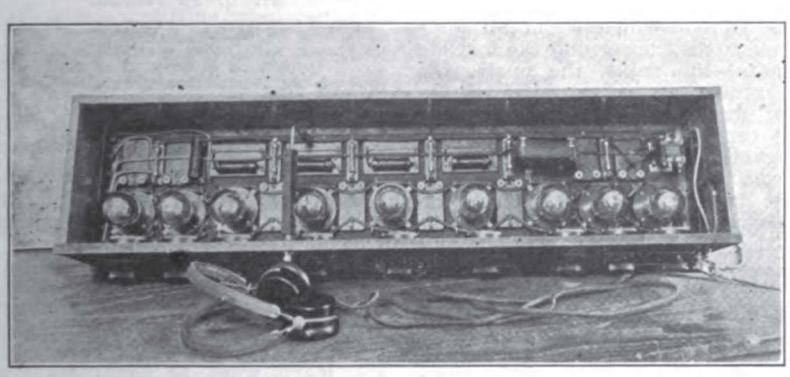
(And now you know why I went to Scotland!!)

I was most anxious during all this period to gather what information I could concerning the handicaps under which British amateurs were working. The situation is something like this. Prior to the war British amateurs were allowed wave lengths of 180 meters and were limited to an input of but ten watts, licenses to use transmitters being granted only in a few cases. Subsequent to the war, due to some processes in the British Post Office which I was unable to analyze, British amateurs were given a choice between an operating wave length of 180 and 1,000 meters. There was a time during pre-war days when we ourselves no doubt would have welcomed operation on 1,000 meters, and it is I presume only natural that British amateurs availed themselves of this opportunity to choose the longer of the two. In view

of what we have learned concerning the efficiency of antennas, and in view of the fact that the total length of wire in their antennas must be less than 160 feet, however, it is quite apparent that any transmitters operated by amateurs on a wave length of 1,000 meters would be operating at a very low efficiency. Further, our experience with short wave transmission has taught us that we may expect phenomenal distances under night-time conditions, particularly during the winter.

I believe that as the result of these tests, and as the result of some discussion during my visit to England concerning the relative merits of the two wave lengths, British amateurs are now studying the possibilities in connection with transmission on 180 meters, and in fact men repeatedly asked me for such pointers as it was possible for me to give them regarding transmission on short waves.

As mentioned previously, I met Mr. E. H. Shaughnessy, chief engineer, wireless section, G. P. O., and got, in an offhand manner, some of his views concerning amateurs and amateur work. Briefly, I should say that if Mr. Shaughnessy's attitude is representative of that of the G. P. O., British amateurs have a hilly road ahead of them. Mr. Shaughnessy showed great interest in amateur development in America—in fact, he seemed greatly surprised by the rapid strides which have been made in connection with radio-phone broadcasting since the war; but expressed the opinion that whereas American amateurs were so fortunate as to be situated on a large continent, set apart by itself, British amateurs found themselves on a small island, close to many foreign lands, with the result that no liberties could be given them without first considering what effect these liberties might have on various international radio communication problems. At this time I suggested to him that amateurs could cause very little disturbance, even if given the greatest of freedom, provided they were kept to 180 meters. His reply was to the effect that the shorter the wave length the greater the number of stations there were which could be operated within a narrow band, at the same time overlooking the fact, apparently, that all waves below 275 meters are at present almost completely blanketed by harmonics from various high power spark, arc, and tube transmitters; and, in this connection, I was highly amused a day or so later to be able to count up to the 39th harmonic radiated by a G. P. O. station which is located in the north of Scotland. This station is transmitting a great portion of every day.



Interior arrangement of amplifier cabinet of Super-Heterodyne used at Ardrossan.

It is most reasonable to assume that British as well as American men are able, eventually to get that thing which they go after, and there is no doubt in my mind that British amateurs are going after a more liberal G. P. O. policy. Neither can I believe that the British public can long remain blind to the almost limitless possibilities and advantages to be derived from a liberal radio-phone broadcasting program. I wonder if even here in America we amateurs realize that today the state of the art makes it possible for the President of these United States to speak directly to every citizen in the land? One's imagination cannot help but see the immense value of such an arrangement during times of national peril.

During the entire first week in London everything was blanketed with heavy fog. On one morning in particular upon coming from the "Underground" onto the Strand, the fog and smoke was so thick that it was impossible to see more than twenty feet ahead. Accidents of all sorts were occurring in the streets, and finally traffic had to be entirely abandoned, not withstanding

the fact that at all main street intersections huge flares were going continuously. At this time the fumes in the atmosphere were so violent as to make one cough continually, and the tears run down one's cheek.

Five nights of this sort of thing were quite enough. I was not at all at home under circumstances such as these, and since I could get no assurances from anyone that these conditions were not to continue indefinitely, I came to the fixed conclusion that the vicinity of London—even southern England for that matter—was no place for *me*, and arranged accordingly to proceed to Scotland, having previously chosen Ardrossan as the location providing conditions near London did not warrant remaining there.

Immediately my decision to change locations became known, wild tales of all sorts began to come to me, concerning the terrible Scotch climate—the rains, the mists, the chill temperatures, to say nothing of the ill effects of the Scotch whisky which one would most certainly be unable to dodge. Even taking all of this with a good grain of salt, I was not sure that I looked forward to the trip into the "Scotch wilds" with any particular pleasure, particularly in view of the fact that even after having been in England a week, I cannot remember at this time of having found a sufficiently warm spot.

The first problem which presented itself subsequent to this decision was the necessity for procuring an extension of the operating permit, or in lieu of that, a new permit which would allow the operation at Ardrossan. Messrs. Coursey, et al., were not at all enthusiastic concerning the possibilities of such extension within the few hours available, and were unable to see by what process such an extension could be pried out of the G.P.O. Several efforts were made to put me in touch with Capt. D. Loring of the G.P.O., and they failed, and finally deciding that we must have action, I myself went to the General Post Office Building, and by good fortune obtained an interview with Mr. J. W. Wissenden, Assistant Secretary, who proved to be a very good listener and a very amiable gentleman, but who was unable for some little time to see just how he could comply with my request. After an interview lasting about thirty minutes, he proved himself to be a thoroughly good fellow, and assured me that the required permit would reach Glasgow the first of the following week—in time to enable me to institute the program as scheduled. I remember telling him, after he had announced his decision, something to the effect that "I could expect no more from my own father", and I still feel that way about it. I do not know what sort of magic wand Mr. Wissenden waves, but I do feel sure that he is apt to prove a real friend to British amateurs in the not too distant future. Coursey and the other men in his office at the time seemed greatly surprised to find me back so quickly with the good word, and someone remarked something to the effect that it must be great to be an American. I wonder what he meant?

The permit reached me in good time, via Coursey, and here it is:

184562-21 GENERAL POST OFFICE,
LONDON, E. C. 1.
2 December, 1921.

Mr. C. F. Phillips is hereby authorized to install and use for receiving wireless signals for experimental purposes during the month of December, 1921, at a station within 40 miles on land of Glasgow (but not within 1 mile of any Government Wireless Telegraph Station), apparatus for that purpose (including valves), and any aerial which may be considered necessary for the experiments. Mr. P. F. Godley may use the apparatus as the agent of Mr. C. F. Phillips.

It is necessary to stipulate that the apparatus shall be used in such a manner as to cause no interference with other stations, and that this permit is subject to withdrawal or modification at any time at the Postmaster General's discretion should occasion arise.

(signed) J. W. Wissenden
for the secretary.

About the time I was ready to shift for Scotland it began to look, as the result of cablegrams received from members of a committee of the Radio Club of America, which had been appointed to investigate the reported reception of station 2QR in Scotland, that it would be desirable for someone to go to Aberdeen, make the acquaintance of Messrs. Miller and Benzee, and learn what he could concerning this reception. Final conclusions reached partly as a result of this trip have already been reported, and I greatly admire the sportsmanlike spirit shown both by Messrs. Miller and Benzee, and by the Messrs. Robinson on this side. The tendency on the part of British amateurs near London is to believe that the gentlemen in Scotland had heard a *British* amateur phone, and this would seem quite likely.

The Miller brothers were located in Aberdeen at their attractive little general store where they carry a full line of handy electrical appliances, clocks, watches, etc. They had dismantled their original station, but had in operation sufficient paraphanalia to enable their getting time signals. And, after a long drive by motor into the country I found Mr. Benzee at work in his radio shack beneath two very fine looking 80-foot masts. He had the best looking amateur antenna which I saw in either England or Scotland, and as I entered his station and had a look around I wished it were possible to place in front of him some of the fine equipment which is available to American amateurs, for he seemed to be doing exceptionally good work with a great deal of ingeniously gotten up but clumsy and, I fear, rather inefficient home brewed "gear". He was greatly interested

in everything we fellows over here are doing. He had the bug badly, and would come nearer to feeling at home were he to be suddenly dropped into the thick of amateur activities on this side than any other whom I met.

On Saturday evening Dec. 3d I arrived in Glasgow from Aberdeen and got quickly into bed at the Central Station Hotel. I had been nursing a cold, and was very desirous of resting up a bit, and shaking as much of it as possible.

On Sunday, December 4th, I came out to find the temperature about 30 degrees, and a very chillingly heavy fog. My log book reads as follows:

"Slept until noon in an effort to get warm. After mid-day meal, went out to look over Glasgow, but so chilled, gave it up after two hours. Returned to the hotel and hugged open grate fire in lounge, wrote a letter, had dinner, and went to bed to keep warm. No heat in hotel rooms. All shops in Glasgow closed tight on Sunday. During evening, also made schedules for following day, since tests began in 60 hours. To properly locate and make all necessary preparations calls for some hustling."

"Monday, December 5th, Central Station Hotel, Glasgow. Weather, 34 degrees and overcast. No fog. Present letter of introduction from Mr. Allen of Marconi house to Mr. J. A. Carswell of McNaughton Bros., Ltd., and found him busy, interested and agreeable. He sends his secretary with me to meet Mr. D. Sutherland, superintendent, Marconi International Marine Communication Company, Ltd., to whom I also have letter of introduction from Mr. Allen. Mr. Sutherland takes me in tow and I get tent, wire, insulators, accumulators, etc., etc., in very short order. Carswell, Sutherland and self lunch together. Very enjoyable. Leave Glasgow 4 P.M., Caledonia Railway for Ardrossan, arriving 5:30 P.M. (Eglinton Arms Hotel). Get large scale maps of Ardrossan, and try to choose likely site. A walk out in dark after tea shows all beach sites unsuitable account tides. Getting local color from Mr. Lee, proprietor of Eglinton, until 1 A.M.

Weather warmer and clear spots in sky when I turn in."

Mr. Sutherland was not particularly struck with the chances of my being able to secure the necessary materials and get them to Ardrossan within the time limits which I set. In fact, it took him about 20 to 30 minutes to get used to the idea, when suddenly he seemed to take great interest in the thing, and began to make the dirt fly. I was greatly pleased a few days later when he called me on the 'phone. The opening of the conversation ran something like this: "'Ello, 'ello, who are you? I say, Gadley, I want to congratulate you. I didn't think you would do it." (Meaning getting my equipment into operation in so short a time.) Neither Mr. Sutherland's nor Mr. Carswell's interest stopped here, and they took advantage of every opportunity to get me on the telephone, to send mail and packages down by messenger, etc., etc., and they expressed a genuine delight when the good news reached them to the effect that our tests were successful.

I soon found myself with Mr. Wood, the town clerk of Ardrossan, and police officials, as well as several other worthy citizens enlisted in my cause. The day in Glasgow had been a foggy one, and I began to wonder whether or not my trip to Scotland was to be proved useless. At Ardrossan, however, the fog had cleared and was replaced by rain in great abundance. High, gusty winds were blowing, and although the tendency upon arrival was to sit tightly by the fire at the hotel, and bundle myself up, I went forth into the night in an effort to get the lay of the land. There remained but 30 hours before the tests commenced, and I was extremely anxious to locate that bit of ground upon which I might decide to erect the Beverage wire. The exploration of the night included a patrol of the beach south of Ardrossan, as well as the beach north of Ardrossan, both of which places on the map showed promise of being suitable for the purpose. I was very much downcast to return after three hours in this weather and after having found that both beaches were almost completely covered with water at high tide. The following morning further exploration was made, and at nine o'clock I met Mr. Carswell from Glasgow in the office of Mr. Wood, and the three of us proceeded to tramp around in an effort to locate a suitable site. The north beach was once more explored, and then at this point we were caught in an unusually heavy downpour and soaked to the skin, but not until I had finally decided that a certain field upon which we had had our eye would be suitable for the set-up. At this juncture we were invited into the home of Mr. Charles Murchie, and offered chairs beside a warm fire. I still shudder when I think of the awful thing we did to Mr. Murchie's rugs and polished hardwood floor.

We also used the telephone, got a Ford automobile, after some delay, and went off up into the country to locate the owner of the particular piece of farm land which I had chosen. I had been congratulating myself all along on the good fortune of having two interpreters with me, because I must admit I found considerable difficulty in understanding English as spoken in Scotland. When we finally reached the home of Mr. Hugh Hunter I greatly regretted my inability to talk the "brogue", because I was very grateful to Mr. Hunter for the great interest displayed by him in our project, which resulted in his allowing us to use the field.

At noon, Pearson, above-mentioned, came on the scene, and we immediately began transferring huge bundles of tent, storage batteries, trunks, floor boards, poles for the antenna, etc., etc., on to this field. It proved to be a very slippery field. It had been covered almost entirely with a heavy coating of seaweed which is used as fertilizer; and those who have had experience in walking over seaweed know that it is a very difficult matter. The one-horse wagon which we got to haul our paraphanalia on to the field was stalled several times, and it was only by unloading a portion of the equipment and carrying it, and

later by putting our shoulder behind the wagon that we were able to finally reach our destination. The poles were scattered down the field at 125-foot intervals, they having already been drilled to take insulators. Floor boards were spread on the ground, trunks and paraphanalia placed on them, and the tent erected. A laborer began digging holes for the poles, while Pearson, myself and one other man started erection of the tent. The tent had just been gotten nicely into position when an unusual heavy gust of wind lifted the whole affair and carried it away.

My log reads as follows: "Ardrossan, Scotland, December 6th. Weather warm, variable gales, with heavy squalls. Meet Mr. Carswell at office of Mr. Wood, Ardrossan Town Clerk, at 9 A.M., after further reconnoitering. Wood, personal friend of Carswell. We looked over maps, beaches and shoreward fields, and finally choose grass-covered fertilizer-covered field property of Mr. Hunter, about one and a quarter miles north of Caledonian Railway Station. Soaked in rain. See Police Sergeant and present credentials. Police find me a watchman. Arrange for transportation of tent, materials, trunks, etc., and order wire supporters from timber yards. Interview Mr. Hunter, and find him agreeable. Lunch. Inspector-operator Pearson arrived for checking results. Get men and all materials on field at 3 P.M., and attempt to erect 12 x 18 foot tent in gale and rain fails. Make very poor progress. Dark at 4 P.M. Continue work until 6:30. Distribute wire support poles, and lay out line for 1300 foot wire, supported 12 feet above earth, on a line running approximately 26 degrees north of west (which is directly towards 9ZN). Rain and darkness finally drive us in. Pearson returns Glasgow for clothes, and I rig up small Western-Electric tube on Burgess batteries at hotel, and listen with makeshift regenerative receiver and an emergency 60-foot single wire antenna, and get gas pipe ground. Hear a good many 600-meter stations, and a great deal of heavy static on shorter waves. Small lighting battery expires after two hours and twenty minutes, and this, together with heavy cold and sore muscles, puts me to bed in a greatly depressed frame of mind, inasmuch as I had fully expected to get going full blast tonight. The chill and the whistle of a switch engine beneath my window prevents what should have been a sound sleep."

The following day, having enlisted additional labor, things were going in proper style. A line was laid out something under 1300 feet in length, and ten poles equally separated were erected, each pole being twelve feet above the ground and carrying a standard Post Office patern insulator. A phosphor-bronze wire was then run the entire length of the line and grounded through a variable non-inductive resistance, the ground plates themselves taking the form of several short lengths of iron piping buried some four feet in the earth, at which depth we found one of the holes filled with water.

My log for December 7th reads as follows: "Weather warm, high winds, and driving rain with occasional slacking. All my clothes wet and heavy cold on chest. Two laborers meet me at hotel at eight (just getting light) and we proceed to the Lynn field. Rain has slackened to a drizzle, but walking on field extremely difficult because of its sogginess, and because the field is covered with slimy sea plants. By noon tent is erected, side walls up, and four poles up, the fourth one guyed. Pearson comes on the scene. We plant two more poles, and go to lunch. Darkness finds poles up and wire strung. We continue work in light rain, and bury several ground plates in wet, sandy soil at a depth of four and a half feet. End of line about 200 feet from telephone line (a good stone's throw from beach). Returned to tent, fixed lead-in, and then to hotel for late supper. Procured coffee, sandwiches and a bottle before returning to tent. Made table of boards, and trestles, chairs were boxes and apparatus trunk served as a back rest. A lantern and oil stove were set going, and we made ourselves as comfortable as possible, though small stove did little by way of heating big tent. Tubes, apparatus, high tension battery and storage battery unpacked and found all OK after their long and varied journey through

England and Scotland.

"By 11:30 the 3,000 meter amplifier, which will be used throughout in conjunction with super-heterodyne receiver, was going and "FL" (Paris) was picked up with no antenna connection. In completing set-up his time signals were missed but POZ (Nauen) at 12 midnight served as a check on timepieces. After time signals a 60-foot piece of wire was thrown into a tree for use in adjusting to short waves.

"Picked up many, many 600-meter stations immediately it is connected, and, using them, go through and carefully adjust all apparatus for maximum sensitivity. By about 1 A.M. we were on Beverage wire and feeling for short wave signals, and picking up harmonics from FL's spark and many high power continuous wave stations, although harmonics much less severe than near London, with the exception of Clifden-Ireland's, which are very strong.

"At 1:33 A.M. picked up a 60-cycle synchronous spark at about 270 meters, chewing rag. Adjusted for him, and was able to hear him say "C U L" and sign off what we took to be 1AEP; but atmospherics made sign doubtful! **That this was an American ham there was no doubt! I was greatly elated, and felt very confident that we would soon be hearing many others!** *Chill winds and cold rains, wet clothes, and the discouraging vision of long vigils under most trying circumstances were forgotten amidst the overwhelming joy of the moment—a joy which I was struggling to hold within!* I suggested hot coffee at once, and Pearson volunteered to warm it on our stove. He had pot and bottle in his hands when I called sharply to him to resume watch! Our welcome American friend was at it again with a short call for an eighth district station! **His signal had doubled in strength, and he was booming through the heavy static and signed off clearly** 1AAW, at 1:42 A.M.! Pearson only in time to get the AW on the tail end! We decided at once to leave settings and lay for him. About 1:50 he was in again, but recognizable only by virtue of his tone—totally unreadable!

"Having heard no more of him at 2:35, I returned from a five-minute run down the line to report a pole broken short off, and the line on ground at a point about 700 feet from tent. Winds very high.

"We shut down at 2:35 A.M., and repaired a break in wire, reset pole, and resumed watch at 3:10 A.M. Atmospherics were rising, and although no short wave signals from America, 600-meter signals were booming in with Cape Race readable with telephones on table at times. Closed watch at 6 A.M., after nearly twenty-one hours work of the worst sort.

"Wired Coursey: 'Rains, winds, atmospherics heavy. Working under tent. Beverage antenna, which fell during night. Heard 1AAW calling eights 1:42 Greenwich, 270 meters, fading, sink gap. Ask him continue same time nightly. Keep all signals coming. Happy.'"

It might be well here to say something concerning equipment. I do not feel qualified at this time to enter into a technical discussion of the Beverage wire. I decided to use it because atmospherics, in the neighborhood of London, had been so strong as to make the use of the super-heterodyne impossible. The same atmospherics were encountered in Scotland, and although at one time I had intended to erect a fairly respectable vertical wire as a companion to the Beverage wire, thoughts of this were dismissed. For best reception at any given wave length, this wire should have a length equal to one wave length, and according to the dope given me by Beverage, should be grounded at the end toward the station at which the signal orginates through a resistance of between 250 and 400 ohms. At the other end the wire is grounded through an inductance having an effective value of about 0.1 milli-henry (for 200 meters). This last inductance is coupled to the receiver, and adjustment of the resistance gives to the wire a decidedly directional characteristic, thus enabling the elimination of a great deal of interference and static. (I now doubt whether or not we ever had this wire properly adjusted for any wave length other than that on which station 1BCG was working, since in order that we might get proper adjustment it was essential that we have some signal to work on.) To make adjustments on this wire it was necessary to run back and forth from one end of the line to the other, and this was rather tedious work. But I have the satisfaction of knowing that we received the signals on the first night that the antenna was in operation, and that we had received a great number of signals prior to the time when British or Dutch amateurs had received any, notwithstanding the fact that according to calculations which Beverage has made, *the effective of height of our antenna could not have been more than 65 or 70 feet.*

The possibilities of the Beverage antenna in connection with reliable trans-continental and trans-Atlantic relay work are very well worth looking into. At this time I am satisfied that a goodly portion of my success is directly due to the use of this type of antenna. It is hoped that before long complete data concerning it will be available to amateurs.

As to the receiving equipment itself the only apparatus which I carried with me was a Paragon regenerative receiver, together with a Type DA-2 detector-amplifier, and a super-heterodyne receiver, which, including the external beat oscillator, had a total of ten tubes.

The Beverage wire was inductively coupled to the input circuit of No. 1 tube, which was a detector. The plate or output circuit of this tube was tuned regeneratively in order that advantage might be taken of regenerative radio-frequency amplification. The output circuit of this detector tube also included a closed oscillatory circuit, tuned to a frequency of approximately 100,000 cycles. The second tube was used as driver for an oscillatory circuit which, by virtue of its coupling to the input side of the first tube, supplied the detector circuit with oscillations of such a frequency as to produce beats of the order of 100,000 per second with incoming oscillations, this beat frequency being passed to tube No. 3, which is the first tube of the five-stage 100,000-cycle radio-frequency amplifier; all of the stages, excepting the last, are resistance-coupled, while the last is coupled through an air core transformer to a second detector, which in turn feeds one stage of audio-frequency amplification.

The complete circuit for the set-up as used is shown herewith. Inasmuch as various descriptions of this type of equipment have been printed in American magazines, no attempt will be made to go into great detail. Suffice it to say that the coupling resistances have a value of 100,000 ohms; the grid leaks a value of about 2 megohms, the grid condensers a value of about 250 micro-micro-farads. The air core transformer which couples the amplifier to the second detector is tuned to the frequency of amplification. Regeneration at the 100,000-cycle frequency is effected by capacitive back-coupling from the plate of the last radio-frequency amplifier to the grid of one of its predecessors. The cabinets containing the super-heterodyne equipment are lined with sheet copper. All condensers, resistances, leaks and tubes which go to make up this amplifier are selected with great care, and in addition it frequently proves advantageous to shield the cords and cases of the telephone receivers, the shield being connected to the negative terminal of the "A" battery.

For reception of continuous wave signals it will always prove more convenient to set up a tenth tube which drives an oscillatory circuit for this purpose. Usually is is better to set this oscillator so that the third or fifth harmonic of the oscillation which it produces falls near the frequency of amplification—this because it is difficult to control the amount of energy fed into the amplifier when the fundamental frequency itself is used for beat production.

On Dec. 8th my log reads as follows: "Weather: High winds and heavy rainfall, changing to clear with northwest winds at midnight. Star-filled heaven and a half moon—a welcome and beautiful sight. Such a night should be ideal for our purposes.

"Line properly repaired during day and early evening spent trying to get dry at Hotel. Apparatus found in good shape, and constant watch kept until 6 A. M., with no amateur signals heard. Cape Race on 600 meters much weaker than last night. At 4:30 A.M. Pearson goes out and makes a shift in line to ground lead but no signals result.

"Attempt to receive C.W. stations blanketed by high power station harmonics, and the few breathing spells which Clifden takes are welcome ones. If poor weather instead of clear is required for signals it is to be hoped that we have poor weather.

"Clear spell brings greater chill and we shift table a bit and hang canvas to our backs to keep the wind off. A heavy cold which I have been fighting settles further into my lungs. Pearson being a Scotchman seems to be immune, and no doubt would suggest that I don't drink enough of Scotland's Honeydew.

"Wired Coursey: 'Cooler, clear; moderate atmospherics, no signals.' Closed down at 6 A.M., somewhat disappointed, but thankful for yesterday's great encouragement."

December 9th the log reads as follows: "Weather again wet and boisterous and at midnight on cutting in, find atmospherics very heavy, but wind dies away by 2 A.M.; rain continuing to fall, and atmospherics falling off to moderate strength.

"At 12:50, after listening some time for free-for-all sparks, we swing over to C.W. and it is indeed a thrill we get when 1BCG is picked on 230 to 235 meters. A harmonic from Clifden is jamming but after some adjustment this is partially nullified. Signals from 1BCG very steady and reliable. *Remarkable performance* and I wonder what power he is using. Lose him many times in an effort to 'feel out' the Beverage wire, but get him much better after adjustments terminated at 1:33. He is caling 'PF test' and signing. Sweetest song I have ever heard. Calls separated by (?). Changed operators at 1:45 A.M. His sending steady in all cases. He fades out for 30 seconds every 3 or 4 minutes, but always comes back strong and steady.

"At 1:59 A.M. he calls 2BGM and says 'Phone us now', then shuts off. Measures between 230 and 235 meters on little General Radio meter.

"Pearson and I relax, laugh with glee, and start looking for something to eat and drink.

"Continue through night to hunt for more, but without avail. Static fairly bothersome, and Clifden is sending a great deal, and am unable to shake him.

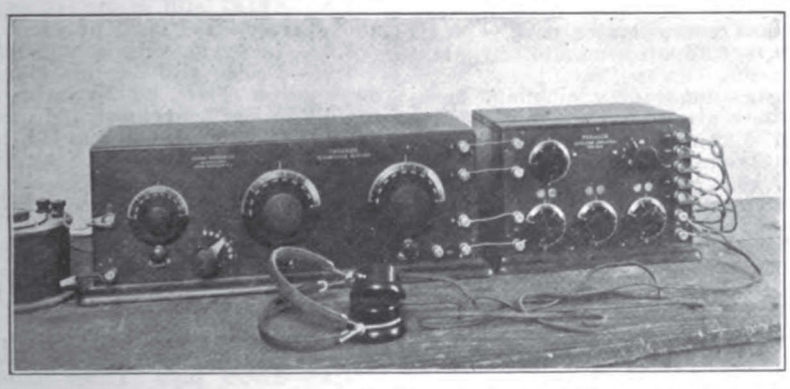
"Shut down 6 A.M. but start up again after talking it over, to copy MUU. MUU sends 'Godley's message'. It comes home

to me that ours *is* a history making set of tests—that American amateur radio has the world by the ears. I would give a year of my life for a 1-KW tube transmitter, a nice, upstanding aerial and a British Post Office license to operate it on 200 meters. To be forced to listen to a Yankee ham and *only* listen is a hard blow.

"Wired Coursey: 'Burnham owes Warner new hat. Warm rains, calm, decreased atmospherics. 1BCG calling me ending two Greenwich. Undamped two thirty, strong, steady. Congratulations.'"

The performance of 1BCG had filled me with a lot of very wonderful feelings. Pearson and I spent considerable time in talking it over and trying to figure out what his equipment might be. It was hard for Pearson to believe that only 1 KW had been used, while I felt quite certain that the legal limit had not been exceeded. The frequency of the wave was *unusually* steady, and for this reason it had been possible to build up excellent signals by taking advantage of resonance in the telephones. To offset this belief, however, there remained the fact that we had not even heard indications of other stations after 1BCG shut down at 1:59 A.M. and I began to wonder whether or not 1BCG might be the only station which would get over in real style. I then decided that no one thing would forever redound to the credit of amateur radio more than the transmission and successful reception of a complete message and I wired Armstrong direct as follows: "Signals wonderful send messages starting one Greenwich" and went to bed with a singing heart and thoughts of the coming night when we would be copying (perhaps) messages via 1BCG from Hartford, and my home, and even from Warren G. Harding himself—who could say.

And, when we were on watch again it was "Allah be praised!" Nature was in a kindly mood! Signals were there! But, alas, I had not counted correctly on the vagaries of men's minds! Some British telegrapher against whom I shall carry a grudge to my grave had "bulled" my cable, for it reached Armstrong reading "SEND MGES", and he did! He sent "MGES" over, and over, and over until I was sick! He kept it up the entire night, regardless of schedule, and no earthly way of stopping him! I remember getting a laugh out of it by conjuring up pictures of the "Old Man" spitting on the cat, but I could not forgive myself for exercising so much thrift. I wished that I had sent cables to Hartford and home and to Warren G. himself apprising them of the facilities available, for then I am quite sure my ideas on the subject would have been, finally, correctly interpreted.



Special regenerative receiver, range 160 to 500 meters, used at Ardrossan and London.

My log for December 10th-11th reads: "Got on job a bit before twelve feeling very fit as a result of extra bit of sleep during afternoon and evening. Was most worn out. Take time signals from POZ and then do a bit of rearranging. I rig up external heterodyne for beating on my amplification frequency, hoping this will be better than using amplifier as autodyne, because of greater ease of adjustment.

"Get set at about 12:50, and at a few minutes past one, pick up 1BCG, sending 'Mges' over and over. Signal very strong and steady. Static very strong too, and have considerable difficulty to get signal-to-static ratio up. He fades more than last night. At 1:14 he says: 'three minutes'. I expect him to start sending messages, so anchor on him, making adjustments for improvement from time to time, and am very thankful for such a fine signal to work on.

"Pearson makes frequent excursions up and down the line, and endeavors by every means to get the static out and get the signal, but at 1:15 he faded out.

1:16—There, but unreadable.
1:17—There, but unreadable.
1:18—Faded out.
1:20—Returned a bit. Static getting heavier and adjust to reduce. Now have him saying "Mges" over and over.
1:22—Faded out 10 seconds and back.
1:23—Faded out 20 seconds and back.
1:24—Faded out 10 second and back.
1:25—Weaker.
1:26—Weak but steady.
1:27—Very weak and very steady.
1:28 and 1:29—Coming up very strong and steady.
1:30—Fades a bit.
1:31—Long dash, very strong and steady.
1:32—Fades a bit, but back again.
1:33—1:45—Very strong and very steady. Says 'GE PF' and stops.
1:50—Back again, after five minutes shutdown, and new operator now.
1:51—Says "Minute, minute sn" and shuts off.
1:53—Long, unsteady, bubbling dash, and imediately much stronger than at any other time. Can read him throughout tent with 'phones on table, and wind howling outside. "Tests VV Mges de 1BCG", etc., etc.
1:57—Falls off a bit, but still good, saying "R R Mges de 1BCG."
1:58—Fades to just audible for 20 seconds.
1:59—Coming up.
2:00—Just audible and out five seconds.
2:01 to 2:04—Strong and steady.
2:05—Almost out for 20 seconds.
2:06—Readable—back to normal and now reading 'phones down.
2:07—Subnormal—slowly weaker, out five seconds, rising and falling. Static still quite severe, much worse than last night.
2:08 to 2:12—Readable, rising, falling, weak. Suddenly jumps to normal for ten seconds, and fades to readable.
2:14—Stronger.
2:15—Says "Three minutes."
2:18—In again, now another operator sending.
2:21—Continuing good and steady.
2:23 and 2:24—"PF PF de 1BCG Test Test", etc., etc. Fine, steady and strong, fading a bit, but never out.
2:27—We jarred oscillator off setting and lost him, but back OK.
2:31—Says "Min bi 3 mins" but starts immediately and says "QRV".
2:32 to 2:38—Weaker but readable.
2:40—Accumulator failed, lost him in making change.
2:53—Going OK "Godley Mges."
2:56—"QRV"
2:59—He pauses. Very strong and steady during this period.
3:02—We talk and miss a phrase.
3:00 to 3:15—Very strong and steady. Says "Bi 3 mins de 1BCG 30." We go out and stretch.
3:27—He is just now starting with another long dash and says "QRK Godley?" Another operator now. Signals thoroughly uniform. He sends "PF" in American Morse, probably John Grinan.
3:40—"PF" in American Morse twice.
3:43—"2ZE" twice. He has been wonderfully uniform since 3 A.M.
3:49—Pick up 1ARY, saying "QRV".
3:53—1BCG comes in again. Also following from 1ARY: "From 1ARY to 2VA—we will play again at football next fall. No sig." "2AJF from 1ARY No sig. HW 2AJF de 1ARY ar."
3:55—1ARY very slowly: "next fall no sig. 2AJF de 1ARY". Very steady.
3:57—1BCG still going *strong*, steady, and sharply, says "30" at exactly 4 A.M.
4:02—In again, very strong and steady.
4:05—Decide 1BCG is not going to send messages so leave him. Static fallen off rapidly in last hour, and wind has gradually shifted from southwest to northwest. Getting colder. Clears up a bit, but begins raining again about 4 A.M.
4:10—Some continuous wave calling 4GY. Can't read him for static.
4:17—1BCG still steady and *strong*.
4:18—Stops for a few minutes.
4:19—1ARY calling 1UN (CW) weak.
4:21—1ARY still calling 1UN.
4:23—1BCG still in; sends few V's.
4:26—1ARY calling 9BBF. "Here msg."
4:30—1BCG says "Three minutes AS". Some spark in too, but unreadable.
4:35—Several CW's and spark in, one CW quite loud but jammed. He is saying something about a message from "Richmond for West Palm Beach". From his fist suspect it is 4GL.
4:37—"R R Hello, Godley de 1BCG." Still very steady and fine. 1ARY calling 9BBF again, *seems fully as strong and steady now as 1BCG.*
4:43—"Hello Paul de 1BCG".
4:49—2FD calling 9XAH (CW). Fine, clear and strong. Pearson marvels at proficiency of amateur operators.
4:53—8ACF calling CQ (CW).
4:54—2FD calling 9XAH, says "GE".
4:58—1BCG still *very steady.* "Bi".
5:03—1BDT (spk) calling 2OM says: "GE 73 QTC." 1ARY (now spk) calls 1BIS. Both above fading.
5:09—Several sparks in too faint to read.
5:10—1BDT calling 1DY.
5:14—1BDT calling 1DY. (FFU jamming.)
5:15—Some buzzer calling 3PU.
5:18—2FP (ICW) in strong, very fine, steady signals. Sending his code word "HUZXJ."
5:23—1RU (CW) in strong and clear sending his code word "BPUSC". 1RU signs off at 5:25 A.M. 2FP still going

and can hear him all over tent. Very steady. Signs off at 5:30 A.M.

5:30—2BML in strong, steady, but his note varies considerably. Must be blowing at Rocky point and I wish Beverage could come up from Chelmsford and listen to his rotten note. However, Beverage is "there" on the antenna design. 2BML is sending his code word over and over very carefully and slowly, "FSXVG". He is much easier to read unheterodyned.

5:37—2BK is in (spark) working locals he says "OK tried anything yet OM".

5:40—1BDT in working a 3 station.

5:43—1BGF calling eight station.

5:44—1BCG still *going strong.* "V's".

5:49—8XV sending "Test" (CW.)

5:53—1YK calling 8AQV (CW). "LXCAM" coming through the QRM but cannot get his call due to jamming and his fades.

5:55—3BP (spark 60 cycle synchronous) Very strong.

5:57—LXCAM in again, but don't get his call. (500 cycle modulated CW).

6:00—1BCG "Test Godley". Still steady.

6:03—1XM signing off, ICW. 2EH (CW) calling 9ZJ—both good, but don't hear 9ZJ sign, although recognized his note and his fist.

6:05—2BK calling 8AYN. Strong.

6:19—2DN calling 8AYN; also strong.

6:23—1XM in, 500 cycle note, may be spark.

6:31—Someone says "Must put some wood on fire, old man." Think it is 2EH again.

6:39—A squeak box freaks in, and I am dumb-founded until I learn it is a French vessel. (FFV jamming.)

6:43—2EH (CW) calling 8AAH.

6:50—Close down to get a check on MUU. Colder; wind now in north. Very dark. A glorious night! And I hope that some of the English boys have had a look-in too. Surely, with their high frequency magnification they should do wonders on a night like this. I hope they have. I get a great deal of pleasure out of thinking about the glee with which MUU's message will be received tomorrow morning. How Warner will measure his head for the new spring hat! How old man Maxim will carry a face split from ear to ear. How Armstrong, Grinan, Burghard, King, Amy, Cronkhite and Inman will go around with chips on their shoulders and chests stuck out. 1BCG is *some* station, and Pearson and I both agree 1BCG was commercial signal 3 to 6 A.M. Some of the boys will be very much surprised too, because have heard some who never dreamed of getting over.

"The feature of the evening was the very fine and steady signalling from 1BCG. His continual transmission enabled a series of careful adjustments all along the line for a maximum effectiveness of antenna and apparatus. Towards the last of test static had decreased, and was able to get "clear air.

"The patience and clocklike precision of shifts at 1BCG is deserving of great credit. Pearson is greatly impressed both by the enthusiasm displayed by all amateurs in America, and by the way this receiving outfit works.

"I am anxious for news from home, and cabled 1BCG as follows: 'Send home news.' Wired Coursey: 'Heard 1RU BPUSC, 2FP HUZXJ, 2BML FSXVG, also spark 1ARY, 1BDT, 2BK, 2DN, 3BP; undamped. 1ARY, 1BCG, 1BDT, 1BGF, 1YK, 1XM, 2FD, 2EH, 8ACF, 8XV, strong, reliable, thrilling.'"

In connection with this night's results, the following is to be noted, that the reception of so many signals was a combination of adjustments resulting from having station 1BCG to work on, and of transmission conditions which seemed, after several hours' hesitancy, to have decided finally to let through a great number of stations. The extent to which this condition persisted is evidenced by the fact that, whereas during the early evening and prior to a series of adjustments of the Beverage wire it was just possible to read 1BCG through static, later the combination of static-eliminating adjustments and conditions made it possible to read *at least two stations whose output is not greater than 30 watts.*

Subsequent to 4:30, many sparks and CW signals would come flicking in for short periods of time and then go out again, before it was possible to get their signs, and in many cases to even hear what they were calling.

I cannot at this time too heartily condemn the practice of stations working locally without using their call letters. On at least a dozen occasions I very carefully tuned in stations to listen to them for periods ranging between one and three minutes, to find that my effort had gone for naught, since the stations in question suddenly stopped working without using their station calls.

Between 4:30 and 6 there were times when so many stations came in that it was impossible to read any. At such times as these I was very strongly reminded of the interference conditions near New York City. These conditions were duplicated exactly, excepting that the strength of signals was not as great. The number of stations audible; however, was fully equal to the number audible when listening in, in the vicinity of New York.

Monday, December 12th:

"1 A.M.—In late, account finishing up log. On at 1 A.M. adjusting on 600 meters. Partly cloudy, north wind all day, now southwest, but remains cooler. No rain today.

1:25—Go to short waves. Static intermittent, medium heavy clicks. Several American amateurs in too weak to read. 1BDT sending "Test", spark very strong and steady. "Transatlantic tests". Strong harmonic from some H.P. station, sending press and fading in and out. 1BKA sending "test" (CW). FFU jamming. 1XM (ICW sending "test". FUU jamming. *Dozens* of them in working, wonderful.

1:45—1XM in again.

1:50—1BCG says "Bi 1 hour."

1:55—2EH (CW) "Test." Lots of jamming from the Holland stations.

1:58—2FP in strong. (ICW).

2:05—2ARY (ICW) "Test". Lots of QRM from Poldhu's press on harmonic. Other press schedules also going, and all seem to have harmonics. Makes it difficult.

2:11—3FB spark. "Test." (QRM FUU.)

2:19—2AJW calling 2OE (CW). (30 watts.)

2:24—2EH (CW) calling 8AKV. (UAT arc jamming.)

2:35—2EL calling. (Weak.)

2:39—1ARY (CW) working.

2:50—2EH calling 8AFD very steady. 1BCG in with messages.

2:52—He starts: "Nr 1 de 1BCG words 12, New York. Date December 11, 1921, to Paul Godley, Ardrossan, Scotland. Hearty Congratulations. (Signed) Burghard, Inman, Grinan, Armstrong, Amy, Cronkhite." Received from 1BCG finishing at 3 A.M. He says "Bi two hours". (Last heard of him.)

3:03—2EH working 2XQ. Very steady.

3:11—1RZ in (CW), readable; also many weaker ones jammed by high power stations.

3:15—Shut down for slight shifts. Had small regenerative receiver in. Heard several CW stations faintly, but only one readable.

4:05—Back on super-heterodyne receiver. Apparently all faded out. Hear only an occasional 20-second amateur spark or continuous wave, and no more. Weather again changing here. FFU, who has been jamming all evening, is rising and falling rapidly, being very weak most of the time. Battery getting low, but do not blame it.

5:54—Heard nothing more.

6:05—Nothing more. Close down. Wired Coursey: 'Code LXCAM call jammed, also 1BKA, 1RZ, 2ARY, 2AJW and 3FB.'"

"December 13, Tuesday—On 1:30 A.M. account oversleep, after up 24 hours straight. Partly cloudy. Bright moon. Wind northwest with occasional squall. A bit frosty.

1:30—Nothing in on short waves. Go through amplifier adjustment. Medium static. Medium to moderate clicks, and a good deal of interference from high power press-sending stations.

1:45—Wind begins rising rapidly and cold getting intense. Ship stations going strong and static quite heavy on 200 meters, though much better than on vertical aerial. Nothing in on short waves which can be read.

2:10—Static growing worse. FL's arc jamming too.

2:15—Continuous wave station in on 225 meters, but can't make him out; and it is even difficult to get him turned on account of atmospherics. Atmospherics seem to have reached a sudden peak, and now are steady, louder crashes having flattened out into continuous roar.

2:40—Static killing everything, can't even read harmonics nearby from high power stations.

2:55—Swapping tubes for improvement of amplification. No marked improvement over those picked initially.

3:00—Static increasing, still bright moonlight, and partially cloudy. Wind still in northwest. Out for eats.

3:15—Static increasing and occasional squalls and cold rain.

3:22—Carefully tuning oil stove and succeed in increasing output 50 per cent.

3:25—On 600 meters, comparatively quiet.

3:30—FFU on 600 meters. Have not heard him on 240 tonight.

"Note: Although on all previous nights we have looked diligently for stations on 250, 275, 325, and 375, none are to be heard even when conditions seem at their best, at which time very fine signals are coming through from Cape Race on 600 meters.

3:30—Pearson calls this a "proper washout."

3:40—Harmonics from high power stations only. Clifden's very loud.

4:00—Static continues heavy and continual muffled roar. Hearing nothing on short waves.

4:01—Fairly strong, unsteady CW signal on 1BCG's wave, send V's; fading fairly strong at times. Lose him entirely trying to better him.

4:24—FFU begins floating in on 240 meters.

4:30—FFU faintly through static on 450 meters.

4:45—On 600 meters, static heavy there too, and not much doing. Hear no sign of Cape Race.

4:50—Some 500 cycle spark on 200 meters calling CQ, but do not get his sign.

4:52—Non-synchronous spark, loud, sounds like British commercial station, but don't get his call.

5:05—Nothing coming through, static falling off a bit, but rather severe yet.

5:15—Nothing doing.

5:30—600 meters very quiet. Static clicks coming in again. Pearson getting very sleepy. Shut down to go over the line and eat a bit.

(Continued on page 36)

Station 1BCG

A Paper Presented by George E. Burghard at meeting of Radio Club of America, Columbia University, Dec. 30, 1921.

Here is a complete description of a station that has shattered all kinds of amateur records. 1BCG has been heard in places where a "1" never got before; it has handed messages three nights running to the Pacific Coast; it has been copied solid in Scotland; heard in Holland on a tuned-plate regenerator and detector-two-step; and has just been reported by a ship's operator as QRK at dock in Hamburg, Germany, on the ship set.—Ed.

BEFORE going into the description of station 1BCG it may be well to consider for a moment the history of transatlantic amateur communication.

The idea of transmitting American amateur signals to the Continent originated with one of the prominent members of the Radio Club of America before the world war when Mr. L. G. Pacent presented the matter for the consideration of the board of direction. Nothing definite was accomplished, however, and when Mr. Thomas Styles went to France after the war, Mr. Pacent suggested that the club erect a station to attempt communication, but the proposition was abandoned as too costly at the time. Some time after this Mr. Philip Coursey of "The Wireless World" took up the matter with Mr. White of the Wireless Press with like result, everyone being sceptical as to the success of the affair. Then Mr. M. B. Sleeper, at that time radio editor of "Everyday Engineering", took the idea up in earnest and laid the plans for the first amateur transatlantic test but was later forced to give it up. The American Radio Relay League took up the task at Mr. Sleeper's request, where he left off, and the first test was run under their auspices. The periods of transmission, however, were too short and no signals were heard in Europe. Then it was decided by the League to have another test the following winter, making the periods of transmission longer, and to send a representative to England to receive the American signals. Mr. P. F. Godley was selected as the logical man to go to England. He sailed for England in November, 1921, and it is here that the story of 1BCG begins.

On November 18th six members of the Radio Club of America at an informal meeting decided to build a transmitting station that would be heard in Great Britain. The six men were E. H. Armstrong, E. V. Amy, John F. Grinan, Walker Inman, Minton Cronkhite, and G. E. Burghard.

Various locations for the station were suggested and it was finally decided to build at Greenwich, Conn., on the site of Mr. Cronkhite's station 1BCG. Thru the courtesy of Mr. E. P. Cronkhite the necessary land and facilities were obtained. The antenna and transmitter were designed and decided upon and work was begun at Greenwich on November 19th. The staff worked night and day in snow and rain until finally on November 30th the antenna and counterpoise were in place. The transmitter, which at that time was of the self-rectifying type, was also well under way and the first signals were sent out at 10:40 p.m. November 30th, with expectedly poor results. Much trouble was experienced from then on until on Dec. 5th it was decided to supplant the A.C. system with a D.C. master-oscillator set.

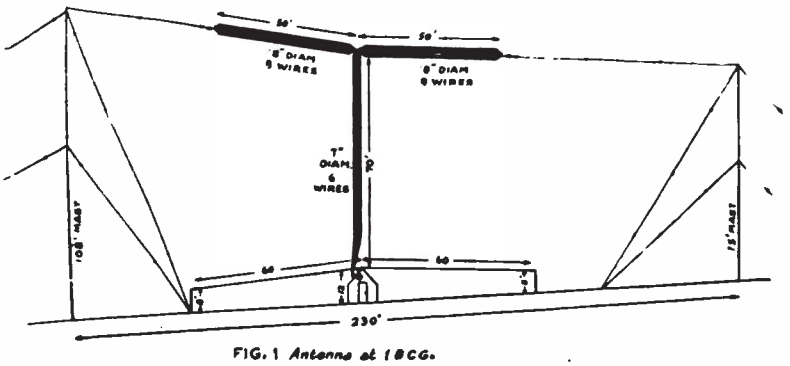


FIG. 1 Antenna at 1BCG.

This system, which will be described in detail later, was made permanent and was used in the transatlantic tests and is still in use at 1BCG at the present time.

The antenna system used is of the type T cage with a radial counterpoise. The dimensions are as shown in Fig. 1. The antenna proper is hung between two pipe masts 230 feet apart and 108 and 75 feet high, respectively. The two horizontal sections of the cage are each 50 feet long, 18 inches in diameter, and consist of eight phosphor-bronze wires. The vertical section is 70 feet over the top of the counterpoise, 7 inches in diameter, and consists of 6 wires. The counterpoise wires can be seen in relief stretching from the top of the transmitting shack which was located directly under the middle of the antenna, thus placing the transmitter in the center of the system. A bird's-eye view of the counterpoise is shown in Figure 2.

As can readily be seen the system is divided into two fan-shaped halves, each containing 15 wires all of equal length, i.e., 60 feet, and radiating from the transmitter as a center. The reason for this division of the counterpoise is of no importance since it was intended to prevent harmonics in a predesigned system which was never put into practice. The natural period of this system of antenna and counterpoise from actual measurement proved to be between 190 and 195 meters.

The resistance of the antenna and counterpoise thru a range of wave lengths from 200 to 330 meters was found to be as follows:

Wave Length Meters	Resistance Ohms
200	40
210	31
215	18
225	16
230	15.5
240	14
270	12.5
290	17
310	12
330	9

Unfortunately no further readings were taken but since the working wave length of the station was 230 meters a fair idea of the antenna efficiency can be obtained from the figures at hand. The sudden rise in

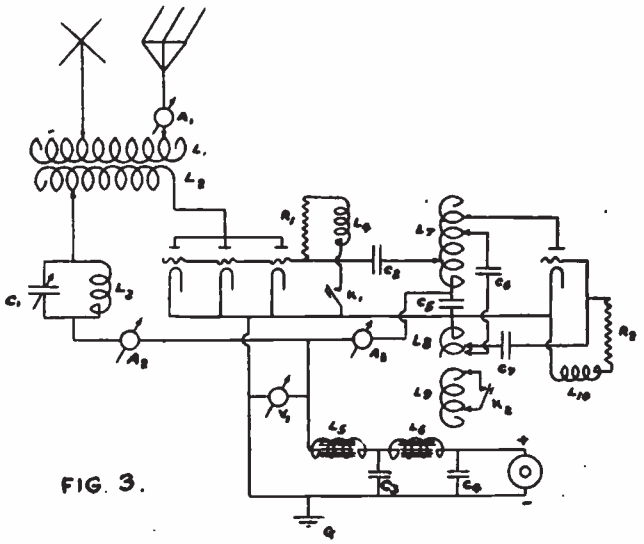


FIG. 3.

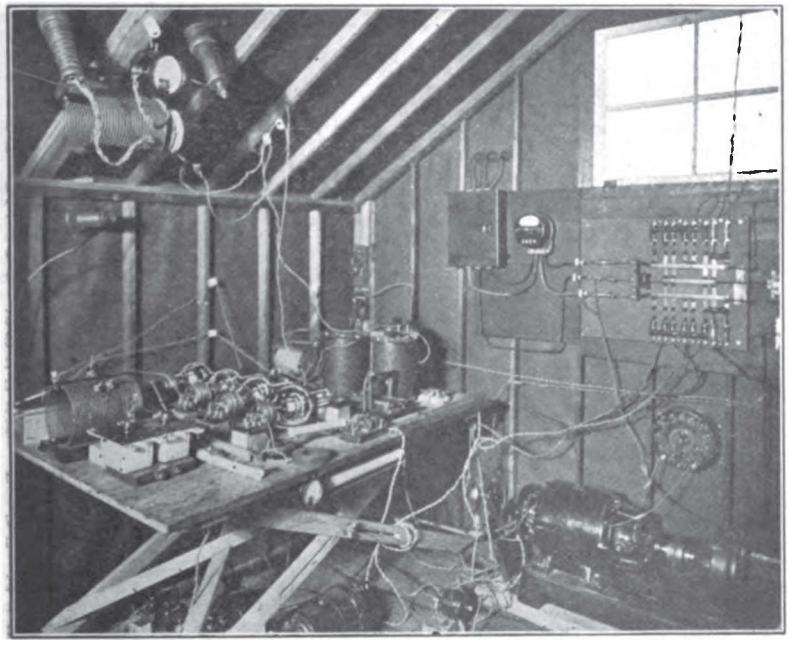
Constants for Fig. 3

A_1.....0-15 thermo-couple ammeter
A_2.....0-3 ammeter
A_3.....0-500 milliammeter
C_1.....variable
C_2.....0.002 mfd.
C_3.....0.250 "
C_4.....0.0017 "
C_5.....0.250 "
C_6.....0.001 "
C_7.....0.002 "
L_1.....5½ turns, UL-1008
L_2.....36 turns, 5" diam.
L_3.....3 millihenry choke
L_4.....3 millihenry choke
L_5.....9 henries
L_6.....9 henries
L_7.....16 turns, UL-1008
L_8.....3 turns, UL-1008
L_9.....3 turns, UL-1008
L_{10}.....3 millihenry choke
R_1.....2500 ohms
R_2.....1000 ohms
V_1.....3000 volt meter
K_1 K_2.....relay signalling keys

resistance at 290 meters was later found to be due to the receiving antenna which had a fundamental wave length of approximately 290 meters.

No real earth ground was used in the station except to ground the filaments of the transmitting tubes, and for receiving; this consisted of several four-foot ground stakes driven into the ground.

The design of the transmitter centered about one main idea, the production of that type of 200 meter wave which would be most effectively handled by the superheterodyne method of amplification and that type of audible signal which would be most effective on the combination of the telephone and the human ear.



Interior view of the station.

To meet the first condition, that is, the electrical requirements of the superheterodyne, a pure undamped wave must be used. It is obvious that the superheterodyne with its great selectivity and highly resonant system cannot give its maximum response when there is any discontinuity or variation in amplitude in the transmitted wave. Undamped waves must be used, waves of a type which can be obtained only from a vacuum tube oscillator with a continuous current plate supply.

To meet the second condition (the combined electrical characteristics of the telephones and the physiological characteristics of the human ear) a current must be produced in the telephones which corresponds with the natural period of the diaphragms and which remains constant within the narrow limits permitted by the resonance curve of the diaphragm and the physiological characteristics of the ear. There must be no variation in this frequency which will disturb the mechanical resonance of the diaphragm, nor flutter in note which will disturb what may be called the physiological resonance of the ear. The permissible limits of variation in frequency for a 1000 cycle note are well under 100 cycles. Hence for heterodyne reception at 200 meters or 1,500,000 cycles, a variation of frequency of less than 1/100 of one percent would be extremely disturbing to the operator and a variation of 1/20 of one percent would be sufficient to carry the note into an inaudible frequency.

The whole proposition therefore comes down to the construction of a vacuum tube transmitter producing undamped waves of an absolutely constant frequency which stays constant with an instantaneous application of a load of 1 K.W. There is but one type of transmitter which can possibly meet this condition—the master-oscillator-amplifier type with a motor-generator for the plate supply.

The general layout of the transmitter is illustrated by Figure 3. Four type U.V.-204 Radiotrons were used, one as the master oscillator, three in parallel as amplifiers. The filaments of these tubes were connected in pairs of two in parallel and each pair was lighted by A.C. obtained from the ordinary type of filament-lighting transformers. The plate supply was ob-

tained from a double-commutator 2200 volt 1.5 K.W. continuous current generator with A.C. drive.

The master-oscillator circuit employed was of the standard split inductance type with a fixed tuning condenser of the rather large value, for 200 meter work, of .001 mfds. The inductance consisted of a helix of 25 turns of copper strip wound edgewise, having a diameter of about 6" and a length of 9". This choice of constants was arrived at largely on account of an accident to several condensers of smaller

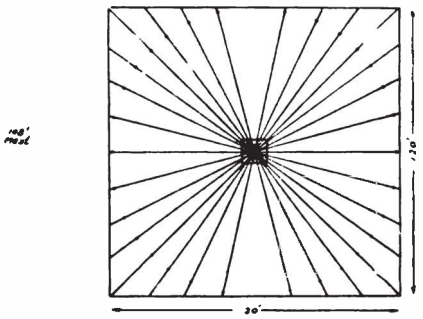


FIG. 2 Counterpoise at 1BCG

capacity in the master oscillator circuit on the first night of the tests. The only available condensers capable of standing the required voltage were two .002 mfd. mica condensers which were connected in series to give .001 mfds. The other constants of the circuit were then adjusted to fit this capacity. The usual grid condenser, with a high resistance leak and choke coil connected between grid and filament, was used.

The amplifier consisted of three tubes with their respective grids and plates connected in parallel. The grids were connected thru a series condenser to a tap on the plate side of the master-oscillator inductance. The usual grid leak and choke coil were connected between grid and filament. The plate circuit was coupled to the antenna thru a two-coil oscillation transformer. The primary or plate side of this transformer consisted of a coil of 36 turns of litz, having a diameter of 5" and a length of 3½". The secondary or antenna coil consisted of about 6 turns of edgewise-wound strip 6" in diameter. The plate circuit of the amplifier was tuned by means of a capacity consisting of three .005 mfd. variable air condensers connected in series to withstand the voltage. The path for the continuous current in the plate circuit was completed by a choke coil connected across the three condensers.

The filter circuit consisted of a two stage series inductance, shunt capacity filter, both inductances being placed in the positive generator lead. These inductances were of the open-core type, wound with No. 22 B. & S. wire, each having an inductance of 9 henrys and a direct current resistance of 85 ohms. The capacity of the two shunt condensers was .25 mfds. each.

The method of signalling used was as follows: The master-oscillator was connected permanently to the generator and ran continuously whenever the motor-generator was running. Its circuit was never broken. Signalling was accomplished by means of two magnetically-controlled keys. The first opened the grid leak circuit of the amplifiers. The second simultaneously shortened the wave length of the master-oscillator about 5 meters by short-circuiting a couple of turns of a coil in inductive relation with the master-oscillator circuit. Under steady operating conditions this transmitter maintains 6 amperes in the antenna with an input of 990 watts into the plate circuits of all four tubes. The power in the antenna for this current is 558 watts, corresponding to an antenna resistance of 15.5 ohms. This gives a plate efficiency of about 56% with 2200 volts on the plates. On account of various breakdowns in different parts of the apparatus this output was not obtained and the set was not in condition for steady operation until 1:10 A.M. of December 9th.

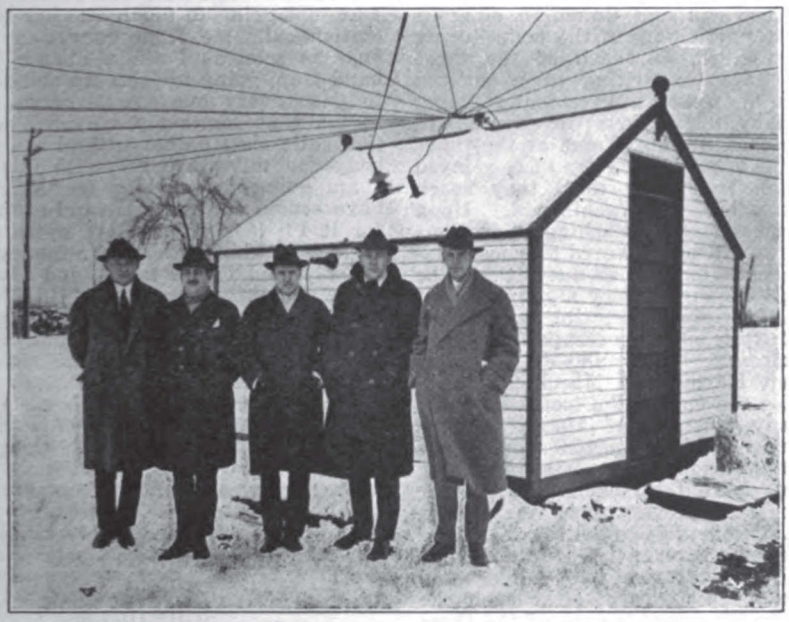
There are some points of interest about the set which are novel. Probably the most important is the stability of the master-oscillator. This is due to the type of oscillating circuit and the relatively large power of the master-oscillator, and to the tuning of the plate circuit of the amplifier which permits the neutralization of the reaction of the amplifier on the master-oscillator system. This is accomplished by adjusting the tuning of the amplifier plate circuit and the coupling with the antenna until the plate current of the master-oscillator tube remains unchanged when the key is closed.

In addition to this effect the series tuning system in the amplifier plate circuit has the very important advantage of increasing the transfer of energy to the antenna circuit when the antenna coil has but a few turns. It therefore assists in operating the antenna system close to its fundamental wave length.

It is interesting to note here that great difficulty was experienced in the first few days of operation in obtaining reliable information regarding the steadiness of the note. This was due to the fact that signals from 1BCG were sufficiently strong to affect and alter to a considerable degree the frequency at which receiving sets with-

in a radius of fifty miles were oscillating. This resulted in a bad note. The solution to this difficulty was found by setting up a self-heterodyne detector in the station with 150 volts on the plate, without a stopping condenser, and with a tuning circuit of small inductance and large capacity. By adjusting the frequency of this circuit to one third of the frequency of the station, beats were obtained between the fundamental of the station and the third harmonic of the receiver. This enabled the frequency of the station to be observed perfectly. Observation on a windy night, when the notes of all C.W. stations heard were varying so badly as to be almost unreadable, showed the frequency to be absolutely unaffected by the motion of the antenna. The reports on this set from all parts of the country show beyond question that radiation of this kind is superior to very many times the energy radiated from the ordinary types of C.W. transmitters.

In connection with the actual operation of the station it will be interesting to quote from the engineering log in order to give an idea of the difficulties encountered: "Dec. 6th—During the evening the master oscillator is connected up. Two amplifiers in use. Tubes running very hot. A CQ was sent out at 3:30 A.M. and condensers boil over." "Dec. 7—One tube is found to be defective leaving only one amplifier. While we are adjusting the master-oscillator for cooler operation many stations are heard sending in Transatlantics. Finally sent CQ to Godley with 3 amps. in antenna. More tubes arrive—set is in operation until condensers in the master-oscillator circuit heat up so that it is advisable to shut down." "Dec. 8—Much trouble is experienced with condensers in master-oscillator circuit. Tested for adjustment all nite. 1:12 A.M. finally got condensers fixed with 6 amps. radiation and worked until 6:35 A.M. All OK now". From this it can be seen that the station was actually not in operation until the 9th of December and in the short period of three weeks to date has accomplished some amazing long-distance feats.



The station building at 1BCG and five of its owners. Left to right, Messrs. Amy, Grinan, Burghard, Armstrong, Cronkhite. Mr. Inman is missing in this photo. Note the counterpoise radiating from the top of the station, and the lead-in from it and the antenna.

1BCG's signals have been heard in practically every state in the Union; in Scotland on Dec. 9, 10 and 11; England, Holland, Porto Rico; Vancouver, B. C.; California and Washington. The greatest distance covered is to Amsterdam, Holland, approximately 3800 miles, mostly over water, and 2600 miles over land to Smith River, Calif. Last but not least 1BCG has established new records by sending three complete messages to 6XAD in Avalon, Catalina Island, Calif., and one 12-word message to Ardrossan, Scotland, at 9:45-10:00 P.M. Dec. 11, 1921; all with an input of 990 watts and wave length of 230 meters.

Photographs of 1BCG, thru the courtesy of Mr. J. Edw. Brown, of 1BKA, Glenbrook, Conn.

Governors'-President's Relay

By The Traffic Manager

ON March 6th, 7th, and 8th we are going to test our network of relay stations throughout United States and Canada by relaying a message from the Governor of every State in the Union to President Harding at Washington, D. C.

Every American and Canadian amateur is invited to participate in the tests during the three nights. On each of the three nights, messages consisting of about ten words each, addressed to President Harding and signed by the various Governors, will start from the different states at the times shown on the schedule and are to be relayed from station to station until they reach their destination at Washington. Upon receipt of messages by Washington stations the messages will be delivered to some amateur in Washington whose duty it will be to collect all messages every night; see that the office of origin, date, time and check are correct; type out all messages on official A.R.R.L. message blanks and deliver them to President Harding on March 9th. Accordingly, at the end of the tests on March 8th or early morning of March 9th the central station in Washington should have 48 complete messages. The reason for using three nights is that atmospherics or other interference may prevent good relay work, and we want to be able to deliver the entire 48 messages, one from each Governor. However, the central station will deliver only one copy of each message, altho each one will travel to Washington each of the three nights. Washington stations will keep an accurate check as to time of receipt of each message on each night and since we know the exact time each message will start we can get an excellent idea of how much speed we can make with the various messages.

One very important point to remember is that we urgently request every amateur who participates in the tests to keep a complete log in regard to what messages he handled, what stations he heard, from which stations he received his messages, and to what stations he gave them. It is requested that copies of all logs be mailed to Hartford in order that we may give credit where it is due and know the routes over which the messages were relayed. We must have all logs in the Hartford Office not later than March 15th. Mail them to F. H. Schnell, Traffic Manager, A.R.R.L., 1045 Main St., Hartford, Conn. A complete story of the affair will appear in QST.

I expect to sit in at 1AW during the tests and I expect to operate on one of the nights and here is what I suggest you do, at least this is what I am going to do: About 9:55 P.M. Eastern Standard Time I am going down and oil up the old gap and "start up". Then I'm going to pick out some good strong reliable signals from the direction of Washington and keep those call letters before me for future reference. I am not going to touch the key until some station calls me from over east or north. Just as soon as I see a chance to lend a hand I am going to open up and do my best to push every message through to Washington that comes my way. When a station calls me I do not intend to jam everybody for miles around with idle chatter; I am going to ask him to "K". When I have copied his message and acknowledged for it I'll look on my list which gives me an idea of what stations are coming through reliably and consistently, and give one of them a call. If he says, "QRK" I'll give him my messages and then "pipe down" until it is time to lend a hand again. If my first man says signals are not QRK I'll try some other station.

Let us not be an ether hog. Let's give every man a chance to do his bit and if he falls down let's help him along. There is no reason why we should have jamming with messages coming from two States widely separated.

The following schedule gives the starting time for each State in Eastern Standard Time.

SCHEDULE
March 6-7-8.
Eastern Standard Time.

10:00 P.M.—Louisiana and Ohio
10:05 P.M.—Wisconsin and Florida
10:10 P.M.—Illinois and S. Carolina
10:15 P.M.—Arkansas and W. Virginia
10:20 P.M.—Missouri and Virginia
10:25 P.M.—Iowa and Kentucky
10:30 P.M.—Minnesota and Tennessee
10:35 P.M.—Texas and No. Carolina
10:40 P.M.—Oklahoma and Indiana
10:45 P.M.—Kansas and Georgia
10:50 P.M.—Nebraska and Michigan
10:55 P.M.—So. Dakota and Alabama
11:00 P.M.—No. Dakota and Mississippi
11:05 P.M.—New Mexico and Maryland
11:10 P.M.—Colorado and Pennsylvania
11:15 P.M.—Wyoming and Delaware
11:20 P.M.—Montana and New Jersey
11:25 P.M.—Arizona and New York
11:30 P.M.—Utah and Connecticut
11:35 P.M.—Idaho and Rhode Island
11:40 P.M.—Nevada and Massachusetts
11:45 P.M.—Washington and Maine
11:50 P.M.—Oregon and New Hampshire
11:55 P.M.—California and Vermont

Practical Radio Amplification

By Robert C. Higgy

RADIO frequency amplification until very recently has been an unknown thing in the average short-wave station. Some of its advantages have been pointed out from time to time, but very little data on actual operation have been given. The following has been written in an endeavor to throw a little more information into the melting pot and give a few very definite ideas on the subject.

Radio amplification is possible on 200 meters, contrary to general opinion, with all of the present tubes now available. It is entirely practical from an operating standpoint and does not necessarily entail complicated adjustments nor special low capacity tubes.

A few of the advantages are:—

(1) *Increases weak and strong signals by the same ratio and is not dependent upon the square of the applied voltage as in a detector, which repeats the strong signals much louder than the weak ones.*

(2) *Boosts signals before rectification which would be otherwise inaudible, regardless of the amount of audio amplification.*

(3) *Gives less amplification of extraneous and tube noises.*

Amplification at radio frequencies on 200 meters may be accomplished by two different circuit arrangements which are shown in Figures 1 and 2. Figure 1 shows a circuit arrangement using a two-winding transformer while Figure 2 is a circuit using a single-coil transformer, the same coil being common to the plate and grid circuits of the two tubes which it couples.

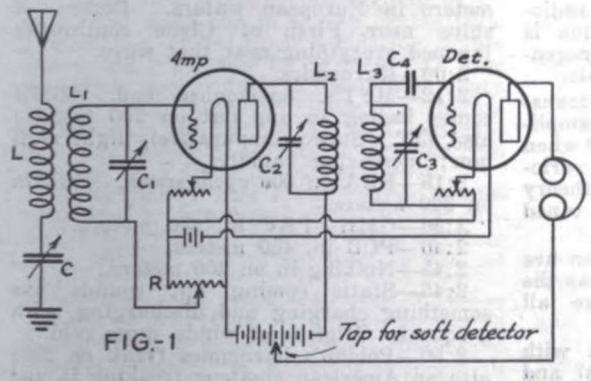


FIG.-1

It will be seen from Figure 1 that when the coil in the plate circuit of the first tube is tuned to the same frequency as that of the grid circuit and incoming signals, the condition for maximum amplification, the tube will oscillate, similar to the standard regenerator principle. In order to keep the tube from oscillating three methods may be used: (1) detuning the transformer enough to keep it from oscillating; (2) by using a stabilizer or C-battery potentiometer to vary the grid potential similar to the method in which we use an A-battery potentiometer to vary the plate voltage on soft detector tubes; (3) by inserting a resistance in the plate circuit or winding the transformer with very fine wire. Another possible method employed in one of the new radio-frequency amplifying transformers now available is that of using an iron core which, in effect, introduces a resistance in the circuit. However, this requires very careful design and construction. As a rule it is advisable to use both the stabilizer and a high-resistance transformer winding to get the greatest amplification in untuned repeating circuits. However, it is possible to get very good amplification with the plate circuit detuned enough to keep the first tube from oscillating, although the amplification is much less than at resonance. Greatest amplification is to be had when the transformers are tuned to the wave length of the incoming signals but obviously this means two additional adjustments. Fortunately introducting resistance in the windings has the effect of broadening the resonance curve, by virtue of the increased decrement, and makes the circuit assume a semi-aperiodic state and gives us fair amplification over a broad range of wave lengths without tuning for each individual signal, altho the amplification per

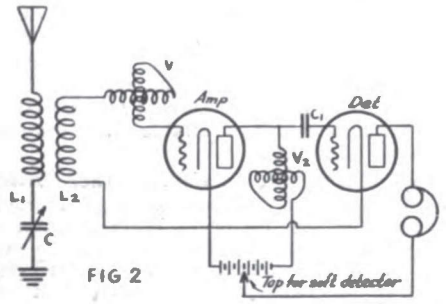


FIG 2

tube is nearly twice as much with tuned transformers as with untuned ones.

Reducing Fig. 1 for practical operation, L and L_1 may be the primary and secondary of a variocoupler similar to that of the standard regenerator. C is the series condenser generally used and C_1 is a secondary tuning condenser. L_2 and L_4 the transformer primary and secondary respectively, should consist of 30 turns of No. 20 magnet wire on about a 3 inch diameter and preferably arranged so that the coupling may be varied. C_2 and C_3 are the tuning condensers for the transformer and should have a capacity of .0005 mfd. C_4 is the detector grid condenser, usually of .0003 mfd. R is the stabilizer or C-battery potentiometer and should have a resistance of at least 200 ohms. One of the A-battery potentiometers now available will serve the purpose admirably.

The circuit will be found rather critical in adjustment but should give good amplification on 200 meters. Since the transformer has low resistance windings and hence a sharp resonance curve, it will only cover about twenty meters with good amplification for a set tuning adjustment of condensers C_2 and C_3. In adjusting, a buzzer exciter may be coupled very loosely to the ground wire until proper transformer tuning and adjusting has been found.

Figure 2 shows an arrangement that has given remarkable amplification making use of the standard regenerator. L_1 and L_2 are the variocoupler primary and secondary, V is the grid variometer and V_2 the plate variometer. C is the usual series condenser and C_1 the detector grid condenser. The plate variometer acts as the radio-frequency transformer. The operation is identical with that of the standard regenerator with *no additional adjustments.*

In all of the circuits using tuned transformers (as above) a regenerative amplification is experienced in the first tube when the transformer primary or the plate variometer is brought near resonance, the theory of which is similar t that of the tuned plate regenerator.

The principles of radio amplification are ideal for our short wave work whereas the principles of audio amplification are all wrong.

In comparing radio amplification with other methods, choose a weak signal and not a strong one as from the above it will be seen that weak signals are amplified as much as strong ones, which is not true of the other methods.

But little data is available on short wave radio amplification and it is hoped that the above information will at least lead to further discussion on this most important subject.

Official Report of the Second Transatlantic Tests

(Continued from page 28)

6:00—Nothing in.

7:00—Copy MUU's report.

"Wired Coursey: 'Include yesterday's 8BU stop. Heavy atmospherics today.' (8BU logged by Pearson.) Coursey added to this: 'Many your stations heard by British amateurs. Details later.'"

December 13th—14th:

"In bed all day trying to keep warm and catch up on sleep. Get out a bit late. A cable from Clement via Coursey saying 2XB will transmit 450 meters continuously, CW, ICW and telephone 1 to 7 GMT this morning. A letter from Coursey saying 'They have been heard' in London, on British equipment and 'small British aerial'. I am very much pleased.

12:45—Find line and tent OK Inspect grounds and start stove. Cold west wind, overcast, fleecy clouds. Static grinders. Clifden's harmonics particularly bad. POZ also has a strong harmonic going. FFU in good and strong and fading at 240 meters; also a harmonic from Poldhu, good and strong.

1:03—Some spark in, jammed by FUU and Clifden.

1:09—GMH in strong on 200 meters harmonic, also FFU.

1:25—Nothing of 2XB. Harmonics pretty bad on 450 meters.

1:30—GMH in. Also someone starting an arc.

1:45—Harmonics exceptionally bad; signals numerous on 300 and 600 meters. A great deal of intership work done on 300 meters in European waters. Dozens of ships near Firth of Clyde continually jammed everything near that wave.

2:00—Harmonics.

2:12—MFT's harmonics bad. GMH comes fading in and out on 200 meters; also JJT. Static comparatively light until now; increasing rapidly.

2:15—FBA on 500 cycle spark. FGR in on 320 meters.

2:30—GMH—PAF in, 450 meters.

2:40—PCB in, 450 meters.

2:45—Nothing in on 450 meters.

2:45—Static coming up; sounds like something charging and discharging, with a squeak. High west winds, quite cold.

2:50—Poldhu's harmonics freak on 200; also an American amateur freaking in and out. Non-synchronous gap. (Later more like GMH.) FFU fading in and out. This is a harmonic of his 600 meter wave, as is GMH's signal.

2:55—Very tired and sleepy.

3:02—Wind rising rapidly, and getting very cold.

3:10—Decide to turn in, nothing doing, and both greatly in need of rest.

"Wired Coursey: 'Colder, high winds, faint signals only. No reception.'"

It was on this night that Pearson had fallen asleep. The cold was particularly hard to bear. The wind whistled around our feet and came down in gusts on our heads. We pulled the oil stove around (it was directly underneath the table) and turned our boxes over so that our heads just stuck above the table. In this way the greatest possible portion of our bodies was exposed to what little heat was radiated by the stove.

Some time between 3:10 when we decided to turn in, and five o'clock, when we actually did turn in, I also threw my hands across the table and fell asleep. How long I slept I do not know, but I awoke suddenly with thoughts chasing around in my head to the effect that the "works" was on fire. In coming to I also awakened Pearson, who looked at me with eyes aghast. I immediately asked him if I had startled him, and he replied "What is the matter with your face? It is as black as ink."

The oil stove had taken a notion to smoke, and a good many of the papers, the log book, and a part of the apparatus, as well as the under side of the table, were thoroughly smoked up. My face laid across a crack, and when I had reached the hotel and had an opportunity to examine myself in the mirror, I could well understand Pearson's surprise.

It is growing rapidly difficult for me to remember the lack of enthusiasm on the part of both Pearson and myself to drag ourselves out of a warm corner by the open fire in the lounge at the hotel, in order that we might don rubbers, overcoats, and rain coats, and march out into the awfulness of the Scotch night, only to sit on a hard wood box in a very drafty tent. I remember several times wondering if this test would ever, *ever* be finished. As long as signals were coming in, there was plenty to keep one interested, and the nights passed very rapidly, but it was a continual fight against static and harmonics and cold and wet that drove one almost crazy.

In addition to this I was having to contend with a very heavy cold. I was subject to coughing spells which shook me from head to foot, and after which I felt as weak as a baby.

On Wednesday, December 14th, I almost decided to give it up. I had no hankering for an attack of pneumonia in Scotland, and I was advised on two occasions to forget all about radio and go to bed, unless I wished to be confronted with a serious illness of three or four weeks, with hospital attendance which was none too good. I am quite sure at this time if I had seen any weakening on Pearson's part I would have been only too glad to take advantage of it. I would like to say that I not only have the highest regard for Pearson's ability as an operator, but also for the courage—and courage is the word—which he displayed in sitting up night after night, in a leaky tent, with high winds blowing, and heavy rains falling, and nothing but an occasional "wee drappie" and a very unreliable two-dollar oil stove to keep him warm.

At this time I was suffering from pains in the back, sore muscles, headaches, and a very stiff neck. However, towards the end of the week the weather was quite like summer, being very warm, and gentle southerly breezes were blowing, and we managed to carry on.

On Wednesday and Thursday, December 14-15, my log reads as follow:

"10:30—Very light static. Only thing to be heard on amateur waves are harmonics from 600 meter stations and harmonics from "Olympic's" tube set. Listening diligently on all waves, up to 12:10, nothing doing.

12:30—Dead silence, except for Clifden's harmonic, and an occasional 600 meter harmonic.

12:45—Go to vertical antenna. FFU's harmonic stronger and static heavier. No signals. Winds changing from west to north.

At 1 A.M. Poldhu's 200 meter harmonic comes in on his press schedules. Fading in and out. Static coming up rapidly since change of wind.

1:13—FFI in on 200 meters (harmonic.)

1:15—Static worse. Pearson goes to end of line and readjusts resistance, resulting in marked improvement in static.

1:30—MPD, FFU, and FFI in on harmonics. Nothing more.

1:45—Ditto.

2:00—Go to 450 for 2XB.

2:30—Nothing from 2XB. Static again getting stronger.

2:45—FFU in occasionally, nothing on short waves.

3:15—Absolute void of signals.

3:30—Both getting so sleepy we can hardly see.

3:45—Still sleepy. Still no signals.

4:00—Ditto. Ditto.

4:30—Conditions have been the same for hours. No signals. We decide to turn in.

"Wired Coursey: 'Bright moon shine, summery weather; only weak signals since the 12th.'"

Thursday and Friday, December 15th and 16th, log reads as folows:

"12 Midnight—600 meter signals more abundant than usual, but considerable static; go to 200 meters, and find static much worse. However, FUU's harmonic a bit stronger than usual, and FFI in occasionally on harmonic. Been like a summer's day here, and wind blowing from east and a bit south. Up all day getting photos of set-up; also had several visitors during afternoon, and for their benefit got signals from WKQ and POZ and several others.

12:30—Static heavy and no signals.
12:45—Ditto.
1 A.M.—600 meters going strong, static bad on 200.
1:15—FFH and FFI in on harmonic. Clifden very noticeable account his absence tonight.
1:30—Now raining hard, and wind rising. Static so bad can't read FFU, which is unusual.
1:45—Static seems worse, but Poldhu's harmonic on his press schedule comes in very loud.
2:00—Static very strong on 200.
2:07—"Pace" and FFI working, also KBH working on 300 meters.
2:11—Clifden starts up.
2:15—Static so bad we shut down for a look around.
3:30—Static very heavy. No signals.
3:45—Clifden and FFU only, latter unreadable.
4:05—FFU in—readable. Nothing else.
4:11—GCC harmonics in, just readable through heavy atmospherics. Wind blowing fairly hard, and getting cold in tent.
4:30—Harmonic from some Marconi CW ship-set in, swinging badly, but loud; also GCC's harmonic.
4:35—YBV calling ZAZ; somebody calling YBV.
4:40—Static continues heavy. No signals. Weeps! Shut down. Blowing and raining like Old Harry.
5:15—Static continues to increase, and much colder, and blowing and raining hard.
5:30—FFU in, and Clifden going, also bubbles from some arc. Can't read FFU, though his signals are fairly strong, at 5:45.
6:00—Closed down. Wired Coursey: 'Atmospherics, no reception.'"

When the original schedules were laid out, it was with a view to enabling me to complete tests and return home in time to be with my family on Christmas Day. These plans were made on the spur of the moment, and on the assumption that it would be possible for me to pack up my apparatus, get it aboard train, and reach Southhampton by noon of Saturday, the 17th. After it was too late to change these plans it became obvious that such a course would be impossible, and so, before leaving London, I had booked passage on the Olympic, which sailed on the 21st. In order to catch the Olympic, pay proper respects to various men who had been of great assistance, and get my apparatus checked out by the Customs Officials in Southhampton, it was necessary that I arrive in London not later than Monday.

In order to do this, it became more and more apparent that we would have to dismantle on Friday and forego the additional night of listening which should have come in according to schedule. All business houses in Glasgow close promptly at noon on Saturday, and it would have been impossible for me to return batteries, tents, wire and other paraphanalia which we had borrowed, get my apparatus back and aboard train *prior* to Saturday noon. After considerable indecision, and after waiting most of Friday to see whether or not the summertime conditions which had been with us would change for more favorable ones, it was finally decided, after 3 P.M. on Friday, to dismantle. This we started to do, and by seven o'clock that evening we had everything packed and were loading it aboard a wagon. By nine o'clock everything was in Ardrossan, properly packed and labeled, and we were all set to take the first train in the morning for Glasgow.

During the night, Friday, the tail end of the cyclone which had passed across the Atlantic during our tests hit Scotland, and we were indeed happy that we *had* dismantled our equipment, because the winds that night were higher than at any time during our tests.

This same storm by the following morning had backed the waters in the English Channel up until the tide stood at a depth of two feet in the streets of Hull, this being the same storm which had battered the Olympic in her voyage across, resulting in the death of two men and the destruction of several thousand dollars' worth of equipment on board.

It may very well be that this storm played some part in the success of our Transatlantic Tests. Starting in the Gulf of Mexico on December 9th, the storm passed up our Atlantic Coast to Newfoundland, and then out to sea. A clipping from the London Daily Express, under date of December 20th, reads as follows:

"Cyclone breaks loose. Demon career of gales and floods. Hurricane and raging seas in the Atlantic! Tidal floods on the northeast coast of Britain, and destructive gales in Scandinavia were widely scattered. Weather phenomena that it is now possible to trace to one cyclone which swept across from America to Europe. It originated somewhere about December 9th in the Gulf of Mexico, and swept northwards out to sea, gathering in fury on its way, and then it continued its career to the northeast, and no more was heard of it until three days later. It was rediscovered on Friday evening, however, approaching from the southwest, and about 1 A.M. on Saturday morning the liner Megantic, steaming on a northerly course to pass the north of Ireland, was caught in its giant grip. It then flung eastwards, and swept across to Norway" * * * *

Now, as it happens, all of the signals heard at Ardrossan were logged during the time when this cyclone lay between the receiving station and the United States. After it had passed to the north, no further signals were heard. Weather reports clipped from British newspapers during that period seem to give little bearing on this particular storm, although it has been admitted that the weather during the entire period was under its influence.

Some time during the test I received a

letter from London, which included the following poem:

If our climate is un-Godley,
If the weather seem to Paul,
If our static strikes you oddly,
If you hear no sigs at all,
If you get harmonics down the scale,
As far as tuners go,
If the dialect in Scotland,
Doesn't sound like Ohio,
If twenty thousand hard boiled hams
Are waiting on your word,
If but the thought of hearing them
Seems very near absurd,
If,—in the chilly morning hours,—
The faintest sigs come thru,
We'd like to hear about it,
If it's all the same to you!!

I met the fellow who wrote this. His name was Harris, but his initials I don't recall. He didn't look the poet either, although he does, I believe, edit one of Britain's best popular scientific magazines called "Conquest", at which he shows even greater proficiency than at writing poems.

And some chap in Belgium bravely showed his mastery of English by coming through with this:

A wise old owl lived in an oak.
The more he saw, the less he spoke.
The less he spoke, the more he heard.
"Hams" should imitate that old bird.

Which I had a great notion to forward to Harris with his name substituted for the first word in the last line.

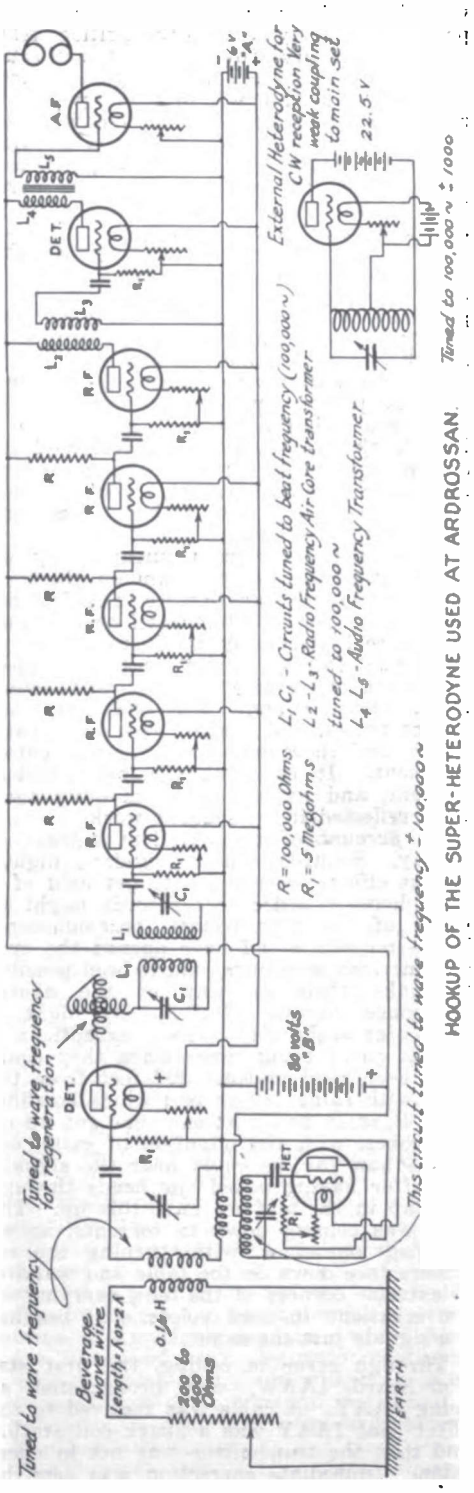
Coursey began to "ride" me a bit about this time too, with: "Aren't you sorry you didn't stay down here in the warm? Signals have been heard here *on our small aerials*", etc., ad nauseum!! I would have enjoyed nothing more than to have had the London crowd on that seaweed-covered field.

Congratulations began to come in too, not only from England and America, but also from France when our friend Deloy showed that he was on the job by the following:

"Hearty congratulations for your success. Here atmospherics very bad especially last night".

Such things as this helped when we needed it. It was quite the rule to get on the job during the afternoon and find that, for some reason, several poles were flat on the ground. We were never able to ascertain whether they had been broken off by some "animal" or whether the winds had reached sufficient velocity to do it. On many occasions the wind *was* strong enough to bend the 2 x 4's which we used for poles several inches out of line, and their continual "working" in the soggy ground as the result of gusts probably had a great deal to do with their falling. We finally had four stays on each pole, after which no further trouble was experienced.

Prior to leaving Ardrossan, Mr. Martin of the "Ardrossan & Salt-Coats Herald" interviewed me concerning the import of the tests and their success. This interview



HOOKUP OF THE SUPER-HETERODYNE USED AT ARDROSSAN.

was followed by general publicity which pretty thoroughly covered the British Isles.

The hospitality shown at Ardrossan could not have been excelled. Everyone seemed anxious to do all within their power to make things easier for us. We were invited on two or three occasions to visit the Murchie home, which was quite near to the scene of operations, but we never had the nerve to drag our muddy selves into anyone's home again.

During one afternoon a very amiable Scotch gentleman, along with other of the town's people visited the test station. This particular gentleman possessed the enviable ability to consume large quantities of Scotch liquor. He listened during a period of several minutes to various high power stations picked up, having been told in each case "That is Berlin", and "Here is New York", etc. At the conclusion of the demonstration his remarks ran something like this: "'Sall right, young man, y'understand I know a bit o'American swank when I see it."

Some real enjoyment unexpectedly included itself in our program on the next to the last night that we were in Ardrossan. Mr. Lee of the Eglinton Hotel proved himself a real friend by producing three of Scotland's fairest lassies who entertained us during one entire evening, with songs, music and dancing. All had very excellent voices, and I shall ever feel grateful toward those who provided this entertainment. It came at the psychological moment, and its effects, I am quite sure, were reflected in subsequent work.

On account of the excellent signals of Friday, Saturday and Sunday nights, violent efforts were made to get hold of a dictaphone in order that records might be taken of the transatlantic transmissions. These records would have opened the eyes of American amateurs, had it been possible to make them on any of the above-mentioned nights. On Sunday night in particular signals were exceptionally strong, there being times when they could have been read at least 300 feet from the tent, with rains falling and winds howling. Both Pearson and I at one time got up off our boxes, with the intention of going out to see how far we could hear the signals, but after having poked our heads through the flap in the tent we gave this up. The rain was coming down in torrents, so we satisfied ourselves with turning the receivers face down on the table and walking to extreme corners of the tent, carrying on conversations in loud voices, and reading the signals just the same.

Through error in coding, the first station heard, 1AAW, was broadcasted as being 1AAY. A cable was received to the effect that 1AAY was a spark coil station and that the transmitter was not in operation. Immediate correction was sent by cable to the effect that 1AAW, not 1AAY was heard.

On reaching London, it was possible for me to go over two or three of the logs which had been handed in by British amateurs to Mr. Coursey. From these logs, and from what additional information Coursey had, it was apparent that the following stations had been heard by British amateurs: 2ZL, 1DA, 2BML, 2FP, 1AFV, 1UN, 1XM, 2ZC, and 1BCG. 1BCG was also heard in Holland, and I understand that it is reported that this station has also been copied on board ship, while the ship was at anchor in the harbor at Hamburg, Germany. A postscript on one of Mr. Coursey's letters, received during the course of the test, read as follows: "1BCG seems to be the star turn! ——— Kilowatts?"

The Holland station copied No. 1 from 1BCG complete, with the exception of the first word in the text. He was using a regenerative receiver of the American pattern, together with two stages of audio-frequency amplification. British stations were using radio-frequency amplification, and one amateur had 18 tubes in operation.

On reaching London, I had only a few hours, which I had hoped to spend in looking around, providing the fog had lifted. The fog had lifted, but I found that it would be impossible for me to pass through London without giving Coursey a complete story on the test, and to this end I spent about ten hours in his office dictating. What time was left was spent in rushing around saying good-byes to those whom I could reach, and I shall always regret that it was impossible for me to reach everyone.

The return trip on the Olympic was rather an uneventful one, except for the reception of a radiogram dated Hartford, Conn., requesting information as to date of arrival and also advising me that a reception committee would be on hand at the dock.

In due time I found myself emerging from the side of the huge ship, and fell into the arms of press correspondents, photographers and friends. Needless to say, everything was confusion, and it was with considerable relief that I presently found myself at lunch in the Pennsylvania Hotel, recounting amusing incidents to these more than welcome American "hams".

We have just finished making a real bit of radio history. What we have done means, first of all, that it now lies within our power to communicate frequently with our British cousins, provided we show the will to do so. I feel quite certain that there will be every inclination on the part of the British to co-operate to this end. I strongly urge upon those men whose transmitters showed up so well during these

(Concluded on page 46)

EDITORIALS
de AMERICAN RADIO RELAY LEAGUE

This Issue of QST

AGAIN we have one of those queer issues of QST in which we have omitted some of our regular departments, boiled down others, and in general reduced our distributed capacity to make way for a lengthy special article. Our October number, telling the story of our First National Convention, was an issue of that kind, and this one is another.

This month we have the complete official story of our A.R.R.L. Transatlantic Tests. Strictly from the standpoint of good business in magazine publishing it would have been wiser to run the Transatlantic story in installments and make each issue of QST a well-balanced one with its usual quota of technical articles, departments, and stories. But, thank heaven, QST is not a business magazine and it belongs to us amateurs to operate in the way that serves us best and everybody is so intensely interested in the report of the tests that it has seemed by long odds best to publish the complete story in one issue even if it crowded "Calls Heard" thru the rear cover.

And so here we are, with the report on the tests in full in this issue. We will have supplementary data soon on the characteristics of the stations which got across, and there will be a more detailed report from England on the British results, and minor corrections may develop for our present story, but this is the official report of our achievement for posterity and has been checked and rechecked until we believe it is correct thruout. The reports in the press and stories in other magazines unfortunately have been conspicuous in their inaccuracies and we have been careful to make our official record an exact one.

The story of our tests is echoing around the world. Godley is famous. Our A.R.R.L. is being mentioned in the technical press of every country. We have put over a big thing, fellows, one that we can well be proud *of*, and one certain to prove a stepping stone to truly wonderful things in our ever-advancing hobby, Amateur Radio.

That Hoover Cup

THE glad announcement that Secretary of Commerce Hoover is going to award a cup annually to one of us amateurs appeared in the last issue of QST, along with all the particulars concerning just how the award was to be made. Secretary Hoover wants, thru our A.R.R.L., to promote individual effort and encourage design and construction of radio equipment adapted to short-wave communication. He is an engineer and fully realizes the problems that confront us, so much so that he is offering the cup to the amateur who each year produces America's best all-around home-made amateur station, with the best solution of our problems.

We must bear in mind that the Secretary is not trying to find America's "best" station but the one in which the greatest individual effort has been set forth. The fellow that makes his own is the man who wins this cup.

The conditions under which the cup will be awarded were fully outlined in the January issue of QST. Read them again carefully, then if you've made most of your apparatus yourself forward complete information on your station to A.R.R.L. Headquarters so that we may enter you in the competition. And remember that the man who doesn't forward his information can't expect to get the cup!

Our Board of Direction is naming a committee that will have charge of examining the entries and determining the winner, and an announcement will be made next month of the men who will constitute the committee.

Start right away and get all your "dope" together and see if you can't win that cup. Remember that all entries must be in this office by March 1st, 1922, for the determination of America's Best All-Around Amateur Station of 1921, the major portion of which is home-made. It will be a great honor to have that cup and be known as the station in which the greatest individual effort has been shown.

QRV here—QRQ!

The Operating Department

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

SINCE the story of the Transatlantic Tests really is a part of our Operating Department, we have boiled down the division reports considerably. This we can afford to do since the tests were epoch making, and too, we have division reports every month. Oh no! Brother, we do not have Transatlantic Tests every month to report. That is why we make this clear to you fellows who would be apt to ask why this and that did not appear as it was written.

We only wish to take an Armistice Day shot at those spark hounds who gradually are seeing the light of CW, and who criticised us, almost unmercifully, for boosting CW. Truthfully, we were partial to CW—but why? Only because experiments and practical demonstrations showed us which path to follow. In our humblest opinion CW has established itself and we seek new fields. Those of you who have not been convinced of the worth of CW after looking over the list of stations heard across the Atlantic, need a prodding. The DX records that are being made by CW are further proof. What is needed to stabilize these DX records? We think radio frequency amplification will do it where audio has failed.

There is no question but what our traffic suffered at the expense of many hours testing the Transatlantic Tests. For the first time, the Delta Division take individual honors in traffic this month.

PULLEN BROTHERS, 5ZAB
Houma, La.
400 Messages.
Delta Division.

The Central, Midwest, Dakota, and Rocky Mountain Divisions failed to send in their reports this month.

NEW ENGLAND DIVISION
G. R. Entwistle, Mgr.

NORTHERN SECTION: A remarkable increase of amateur activity is prevalent in New Hampshire and Vermont which is indicated by many new ARRL stations. Activity centers around 1CHJ, 1MZ, 1AYT, 1ARY, 1APX, 1AWX, 1CM and 1FV, which stations have been handling the bulk of message traffic. Activity in Maine is represented by the good work of the following stations: 1BRQ, 1UL and 1ACO who continue to handle traffic with Canadian 9AK in Prince Edward Island, 1UL, 1BDI, 1APO who reaches out remarkably well, 1VT, and 1UQ the station of "Hot Wire" Castner, the Asst. Div. Mgr.

WESTERN SECTION: A marked increase of traffic in this section is due to the fact that more stations are reporting their work. Two new stations have made possible relaying into Northwestern Massachusetts. These are 1BEA in North Adams, Mass., and 1BUA in Williamstown, Mass.

Message Traffic Report By Divisions—DECEMBER

	CW			SPARK			TOTAL				ARRL	Aver.
DIVISION	Stns.	Msgs.	M.P.S.	Stns	Msgs.	M.P.S.	Stns.	Msgs.	M.P.S.	%TFC	Stns.	M.P.S.
West Gulf	9	203	23	137	2819	206	148	3022	24	.269	248	12.2
Delta	1	10	10	8	1096	137	9	1106	123	.099	96	11.5
East Gulf	9	436	48	11	316	29	20	752	38	.067	81	9.3
Northwestern	0	0	0	9	582	72	9	582	72	.052	148	4.0
Roanoke	10	402	40	3	58	19	13	460	35	.041	182	2.5
Pacific	2	29	15	7	673	97	9	702	77	.063	338	2.0
Atlantic	55	2773	50	16	778	48	71	3551	50	.316	1849	1.9
Ontario	2	30	15	2	103	52	4	133	33	.011	109	1.2
New England	12	543	45	13	374	29	23	917	40	.082	810	1.1
	90	4426	50	206	6799	33	296	11225	38	1.000	3861	2.9

Total Spark messages, 6799—60%
Total C.W. messages, 4426—40%

Both stations, CW, make possible the link to Schenectady, Troy, and Albany with westbound traffic. 1COK ex-1BIS at New London offers its services for getting traffic into that city and points east. This is the first time a reliable station has been in operation in New London and we welcome it. 1BWY continues to handle traffic for Springfield although several new stations are in operation. Connecticut traffic is being handled in all directions by the following stations who have done good work in spite of the fact that the T/A Tests took up considerable time: 1RU, 1BGF, 1AW, 1ANQ, 1QP, 1ADP, 1CKI and 1TS.

The old spark at 1ZE has been sold to 1AEV who handled quite a bunch of traffic. 1ZE now consists of a 100 watt CW set. (You came to, didn't you, VN?—T. M.)

New England stations heard over the Atlantic were 1ARY, 1BCG, 1BDT, 1BGF, 1RU, 1AVF, 1BKA, 1YK and 1XM, which were reported by Mr. Godley. It is reported that British Amateurs also heard three New England stations—1AFV, 1DA, and 1UN, making a total of 12 stations getting over. 1ARY and 1BDT were heard on both spark and CW. Congratulations to you all. We thank all those who took part in the tests and were not successful and wish you better luck next time.

ONTARIO DIVISION
A. H. K. Russell, Mgr.

It is rumored that the Naval Department is contemplating a revision of amateur wave lengths that will exceed the American allotment. We hope it is true.

DISTRICT No. 1: 3DH has changed over to CW and is doing very good work in handling relay traffic. No reports were received from other stations.

DISTRICT No. 2: 3BA, 3PM, 3SP, and 3DS continue to handle their share of message traffic. Several improvements in the way of spark conversion to CW have been made.

DISTRICT No. 3: The only report was received from 3JL, who has been heard in Lawrence, Kans. Evidently Rogers, 3BP, has stored up for a rest after pounding away untiringly with his traffic. (Maybe the fact that he pushed everything he had into his old set to cover the Atlantic Ocean blew something in the works. Why the silence, OM?—T. M.)

ATLANTIC DIVISION
C. H. Stewart, Mgr.

Traffic in this division took a slump due to the time taken by the T/A Tests, but it was worth while and we can afford to let our traffic suffer for one month.

NORTHERN SECTION: 2OM, our traffic leader, was out for three weeks with a fallen mast, but is back with a higher one and a ten watt CW set has been added. General conditions around New Jersey show an inclination toward more CW stations. Much traffic was handled by 2OM, 2ALY, 2ARB, 2BDC, 2DX, 2FC, 2BCC, 2AML, 2AQU and 2AWL. Long Island is being well represented by such good stations as 2EH, 2AJW, 2AWS, 2CY, 2BSC, 2BRS and 2FD. In Brooklyn we find the following stations always ready to take traffic and these same stations are handling the bulk of it; 2TS, 2MJ, 2ACG, 2IG, 2PF, 2FP, 2KE, 2CAN, 2RM and 2WB. 8AWP in New York State leads in traffic handling with 329 messages and 8AMZ comes second with 299. 8QM has peddled his spark set and is doing good work with ten watts of CW. C. F. Nichols of Webster, N. Y., has been appointed City Manager of Rochester and vicinity. It is rumored that 8AGK has sold his spark and is installing 500 watts of CW. Stations heard on the air handling traffic are 8ANR, 8AMB, 8MZ, 8AXQ, 8WO, and 8KU.

SOUTHERN SECTION: No report was received from Baer of the District of Columbia. Stations in Eastern Maryland are practically the same as last month while most traffic was handled by 3AHK, 3HG, 3AC, 3EM, 3UC, and 3SQ. Central Pennsylvania stations maintained their good reputation through the efforts of 8BYZ, 8HR, 8PQ who is not on the air very much, 3AQR, 8BQ who has just finished a new mast and cage antenna, 3AGT, 3BIQ, and 3DM in the South Central part. Traffic east has ben geoing via 3AWW, 3DM and 3ZO; west via 8RQ, 8HR and 8ZAC; north via 8HR and 3AWW . 3DM and 3ZO maintain a schedule with 4EA for the south. 3AJZ is handling some traffic. 8XE is installing 500 watts of I.C.W.

Western Pennsylvania stations have been most conspicuous during the past month. 8EW operates Friday all night and from 2:00 A.M. to 4:00 A.M. on Saturday. Any one of the following stations can be relied upon for QSR and most of the traffic was handled by these same stations during the month of December: 8QC, 8PT, 8WY, 8AJT, 8EO, 8JQ, 8ACF, 8BJZ, 8AYC, 8RQT, 8BRL, 8AIO, 8EV, 8AKW, 8HY and 8LF the station of the Dist. Supt.

Eastern Pennsylvania stations have been troubled with QRM from Philadelphia making it impossible to carry on relay work before 11:00 P.M. Traffic moves north and west via 3CG and 3PU; south via 3AUW, 3GX and 3AIC. 3ZA made quite a record this month with 100 messages. Other traffic handlers are 3BG, 8ZQ and 8FW. 3ZO is the QSO station for 8UJ, 1BDI, 4CX, 4EY, 3AAN, 3BIY, 8AWP, 8ADR, 3ABI, 2EH, 2KL and numerous other stations and not the least bit of trouble should be experienced with traffic in any direction. Our old friend Rau is

QSO Canadian 3BP, 9HY, and 4GL. He keeps on the job from 1:00 A.M. to 3:00 A.M. A new station is in operation under the call 3ZV, the station of the Dist. Supt.

ROANOKE DIVISION
W. T. Gravely, Mgr.
Reported by 3MO

Even though the Transatlantic Tests bid fair to break up our traffic, the sign, "business going on as usual" was hung out in this division.

VIRGINIA: While 8SP leads in message traffic, good work was done by 3CA, 3RF, 3BIY, 3APA, 8EF, and 3AOV. 8BDB wanted more amperes in the antenna and in his anxiety blew up his condenser and transformer. Hard luck, OM.

NORTH CAROLINA: Bunker and White failed to report. XF1, whose call has been changed temporarily to DF1 awaiting assignment of a three letter call, handled most of the traffic and this station has proved its value to the division. 4EN and 8BZ maintain a daylight schedule as does 4DQ with 4CX. 4GX is again ready for work. No reports were received from 4EA and 4EY. (4EA came through every night during the T/A's extremely QSA in Hartford—T.M.)

The trend of all stations is to CW. Probably being so close to the East Gulf Division which is commonly and rightfully dubbed the "CW Division" this division feels the need of more CW stations.

The entire "gang" is going to the 3rd and 4th districts convention where many faces will be seen and many hands will be shaken.

EAST GULF DIVISION
B. W. Benning, Mgr.

A club in Montgomery is formed for the purpose of controlling QRM in the Alabama District. We need help in the southern part of Alabama! Also, we need a live wire City Manager for the city of Birmingham. Applications are in order. 5ON is out of commission because of condenser trouble. 5XA is doing practically all of the relay work for this section, working eastern stations direct, which was not the case a year ago.

GEORGIA: Savannah stations lead in traffic work with those excellent CW stations of 4GL, 4BY, 4EL and 4GE. One points with pride to the fact that the above four named stations work consistently and reliably without interference which was not the case with spark stations. 4DH will act as intermediate relay between Atlanta and Macon. 4DT, 4DY, 4GN, 4FD, 4AS, 4BK, 4GU, 4JH, and 4BW are also handling their share of traffic and what is more they are reporting it properly. In Atlanta we find excellent means of communication through stations 4CO, 4XC, 4ZF, 4AU, 4CG, 4HW, 4FJ, 4YA, and 4GM. It is reported that 41 other stations are not interested in relay work. How come?

SOUTH CAROLINA: 4IB, the station of East Gulf's Y.L., is ready for business and don't fool yourself if you tell her to speed up and find that she can handle traffic at 35 W.P.M. We welcome you Miss ———? Another station on which we have no report is 4HR. New stations in Greenwood and Spartanburg will be in operation by the time this appears in print. 4EG must move his tin roof before he can hope to reach out. The tin roof seems to affect his antenna efficiency.

FLORIDA: 4ZE assisted by 4BP and 4JK, is accepting traffic for Jacksonville while 4AW, 4DL and 4BO take care of West Palm Beach. 4II is so busy organizing Florida stations that he is limited in his operating hours, hence no report from him, but we know that he is on the job.

DELTA DIVISION
J. M. Clayton, Mgr.

The past month has been a record one for this division and radio seems to have taken a new lease on life. Practically all of the old timers are back stronger than ever and their good work is appreciated. The most representative report was received by the Division Manager for which he wishes to extend his thanks. (Keep up the good work, fellows—T. M.)

TENNESSEE: 5MB with CW is ready for traffic for Chattanooga. Schedules for control of traffic were put into effect by the Nashville Radio Club which club boasts no deadheads. Guess 5CU is spending his time listening to KDKA. We haven't heard a peep from him. 5DA, 5ER and 5FV continue to move traffic. We want some light from Memphis. Is there anyone alive in that burg? If so please come forward and get in touch with the Division Manager.

ARKANSAS: Mr. Kinsolving has been appointed District Supt. of Arkansas. R. L. White, formally of West Gulf, is with us and we welcome his coming. 5JD is getting to be a regular boiled-owl and is more than moving his share of messages. Other good relay work is being done by 5RO; 5SM, 5AK operator. Prospects look bright for 5JF and 5CR who have good stations but have not reached out as yet.

LOUISIANA: 5ZAB deserves much credit for clearing 400 messages during the month. (FB—T.M.) 5KC clipped off a bunch too. 5AA bears the brunt of traffic at New Orleans in spite of QRM from WNU and NAT. Old boy DeBen can step right along wid any of them.

MISSISSIPPI: 5YE is not in operation due to unavoidable circumstances, but promises to be on the air very shortly. We

are waiting for you and need you badly. Hurry up.

WEST GULF DIVISION
F. M. Corlett, Mgr.

With the exception of a report from New Mexico Section every one was in on time and the Division Manager wishes to express his thanks for the co-operation. A glance at the traffic report will show that many stations reported and a record breaking amount of traffic was handled.

SOUTH TEXAS SECTION: Due to decrease in QRN, traffic conditions have improved. Another feature is that practically all hands are turning to CW because of the demonstration it gave in the T/A Tests. Mr. H. C. Sundstrom has been appointed City Manager of Houston. Mr. L. W. Hatry has been appointed Asst. Dist. Supt. for the territory of Port Arthur. 5ZU, 5XU, 5ZAG, 5QY and 5QA keep the district in the limelight. San Antonio remains in the hit-and-miss class thus far. In the southwest 5ZAK remains the star and has been handling most of the traffic. 5ZR, 5HC, 5ZAE and 5XI have been handicapped for some reason or another. In Laredo 5MT on CW is moving traffic. 5ZN is doing more receiving than transmitting for the present because of business pressure.

OKLAHOMA SECTION: Too much cannot be said about the good work done by ex Asst. Div. Mgr. Dill who has left for U. of Wisconsin. In addition to supplying QST with good reports old 5HC [illegible] on the air regularly and always QRV. Considerable amount of traffic was moved by 5HK, 5JR, 5FO, 5BY and 5AQ. Improvements have been made in one way or another in the following stations who can be looked upon for reliability: 5JT, 5EF, 5NA, 5KE, 5BM, 5LO is credited with 301 messages for the month, which speaks well for that station.

NORTH TEXAS SECTION: Reports are lacking from Wichita Falls, Vernon, Quanah, Henrietta, Montague, Graham, Jacksonboro, Weatherford, Mineral Wells, Albany, Baird, Gatesville, Lampasas and Ballinger. City Managers are needed for the above towns and the Division Manager will be glad to communicate with amateurs in those places. No report has been received from 5YN. 5QQ, 5NS, and 5FI are doing good relay work for the League. 5AO is making changes for the better in equipment. 5RP with his spark coil is moving traffic in commendable style. 5LY is installing a large transmitter for real DX work. Nothing heard from 5OH nor 5OK. 'Smatter, fellows? Three stations in Dublin have reached California the past month, 5IR, 5QS, and 5XJ. We hear 5QT and 5UG quite often moving messages. 5ZAF seems to be the only station in Waco working DX. Ft. Worth is represented by 5QI, and 5LC. 5PE is afflicted with CQ-itis and would move traffic if he would cut out his CQing occasionally. 5ZAM, 5TU, and 5IU in Commerce are all good relay stations pushing messages hither and yon. The motor at 5IU went catawampus and is being repaired. In the meantime 5ZM is on the job.

NORTHWESTERN DIVISION
H. F. Mason, Mgr.

EASTERN SECTION: QRN is unusually slow in QRTing this season, but in spite of it commendable relaying is being done by 7ZU, 7ZG who has been bothered with power troubles, etc., and 7MP who keeps all night watch. Nothing heard from 7EX. Some assistance is needed from Helena, Mont., will someone please lend a fist? 7LY has been out due to a sick Benwood. 7LY works 9AGN in daylight with ease. A new station at Libby, Mont., is 7VZ who is QSO Seattle.

OREGON: 7ZT with his old sideswiper knocks out traffic with amazing speed along with 7KB, 7JW and 7ZJ. 7TJ, who has taken the place of 7IN, is making good. 7MF continues to come roaring through the QRM.

WASHINGTON: 7BK and 7ZS report that 7FI has been handling the bulk of traffic with 7NL next in line, who has been assisted by 7YL. School press is also sent from 7YL. Practically all of the eastbound traffic goes thru these stations, including 7YA, 7ZP, 7YS, 7BA, 7BC, and 7BG continue to clear traffic with equal regularity from Tacoma, and Seattle traffic is cleared by 7BF, 7LD, 7PO and 7BK. Traffic for the south goes through 6QR and 6VX, who are most consistent.

ARRL stations are playing an important role in the relaying of school news and press service at present, which consists of about 300 words per week.

ALASKAN DIVISION
Roy Anderson, Mgr.

7IP reports hearing more signals from the States and it looks like it may be a good scheme to try broadcasting messages into Alaska. The following stations are reported: 7MT, 6ANF, 6IK, 7XA, 6APE, 7BJ, 7JW, 7LJ, 7BK, 7MX, 7BS, 7KB, 7KS, 7HF, and 7XF. We suggest that the above stations attempt to broadcast messages for Alaska.

VANCOUVER DIVISION
Roy Anderson, Acting Mgr.

Canadian 4CB was heard by Canadian 5CZ of Vancouver and it is the first time that a Canadian amateur signal has passed

over the Rockies. It is reported that 4CB uses ten watts of CW. Mr. Wood's name has been recommended for consideration as manager of this division and since we are looking for a good man the T.M. requests further information from Mr. Wood. We can find places for several good live amateurs. Mr. Anderson has done much towards a Vancouver Division, but has his own to look after and still more and we would like to have a man on the ground.

PACIFIC DIVISION

J. V. Wise, Mgr.

Radio activity in this division is partly covered in this first report of the new Division Manager. At this early date it is rather a difficult proposition to gather more than a mere glimpse of what we are doing. Mr. H. L. Gooding, of Douglas, Ariz., has been appointed Superintendent of Arizona which is known as District A. District B includes the counties of San Diego, Orange, Imperial, and San Bernadino in California, of which Mr. J. F. Gray of Del Mar is Superintendent. District C under Mr. B. H. Dennis of San Fernando, Calif., has not been outlined as yet. Next month the complete outline will be given of those districts not mentioned here.

Stations north of Los Angeles who are heard handling relay traffic every night are 6AS, 6EX, 6HC, and 6HP. In the Sacramento and San Joaquin Valleys we find traffic being moved by the following stations: 6AK, 6KM, 6GF, 6FH, and 6ZX, with 6AFV and 6LU further north. In the vicinity of Fresno we find 6ALE on CW and 6ZU on spark always ready to QSR. A number of excellent stations in San Francisco and down the coast have not been heard from, but we will have more details in the next report.

6QR is about the only station in Nevada at this writing who is heard consistently. 6ZZ in Douglas, Ariz., continues to bat them out on both spark and CW.

Stations in and around San Diego are continually hampered in relay work by the mush from NPL, altho there are dozens doing the best they can through it. 6AJH had the misfortune, after he had climbed to the top of his mast, to fall with it, resulting in serious injury. 6AJH will be missed while he is recuperating.

Los Angeles will have a complete report next month. Come on, all of you. Let's show them that West Coast Amateurs in the Pacific Division are on the job.

OFFICIAL RECEPTION REPORT

(Concluded from page 40)

tests, to arrange for additional tests in conjunction with British amateurs, and as far as I am able to learn it will be possible at no distant date for British amateurs to transmit on 180 meters, signals which should have a good chance of reaching this side.

The part which British amateurs have played in the tests just completed has accomplished far more in the way of the creation of enthusiasm for this sort of thing than anything else could possibly have accomplished. It has been pointed out to them that American amateurs—all stations—are transmitting every night, day in and day out, and that what the British heard during the week of the test, they may hear again and again throughout the coming season, provided they listen with sufficient patience,—and, what is most significant, that some of the stations heard from in America were using an output of but 30 watts.

It is quite a common thing to read in the British daily papers of such, to them, unusual procedures as the broadcasting by radio-telephony of "The Evening Hour Story for Children by the Man in the Moon," or "A Wireless Church with an audience of 20,000 to 30,000 people," or "Grand operas which are available to any who care to listen."

Is it hopeless to expect that sooner or later Europe will follow with similar programs? Would it not be foolish to presume that Europe can much longer remain blind to the advantages of such programs?

At any rate, American amateurs are watching the progress of our British contemporaries with an interest which is far more real than it has ever been in the past. British amateurs have proven their mettle and there are a great many of them now ready to be welcomed into the great order of the "Hard-Boiled Ham."

ANOTHER TRANSATLANTIC

As we go to press word reaches us that F. Clifford Estey's station at Salem, Mass., 1AFV, described in January QST, succeeded in the second week of January in passing three messages in a row to W. W. Burnham at London, Mr. Burnham acknowledging them by cable.

Already our Transatlantic Tests are bearing fruit. Let us hope that very soon Transatlantic Traffic Schedules can be established.

Who's Who in AMATEUR WIRELESS

Bob Trump

No one anywhere in the Mississippi Valley will have the least difficulty in remembering old 9JW of pre-war days. When the late ones were thinning out 9JW was coming on for the routine business of taking them from Ohio and passing them to old 6DM at Phoenix, Arizona.

Robert Kitts Trump was born July 14, 1898, in Topeka, Kansas, where he resided until the fall of 1918 when he enlisted in the Navy and was sent to Cleveland for service. Later on he was transfered to the Great Lakes Hospital because of illness which resulted in the loss of his voice, which he has not recovered. He was sent to Arizona where he remained until 1919, and then returned to Topeka. Recently he has moved to Ottawa, Kansas, where he plans to stay if the power line induction doesn't get too bad.

Trump began at the age of ten to learn

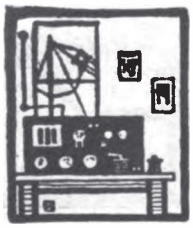
(Concluded on page 55)

Robert C. Higgy

Bob was born December 7th, 1902, at Columbus, Ohio, and when ten years old his folks moved to Lima where his radio activities were first begun. Early in 1912, 8PM was put in operation with the usual spark coil transmitter which gradually grew to be a full kilowatt, covering the customary long distance ranges of those good old days.

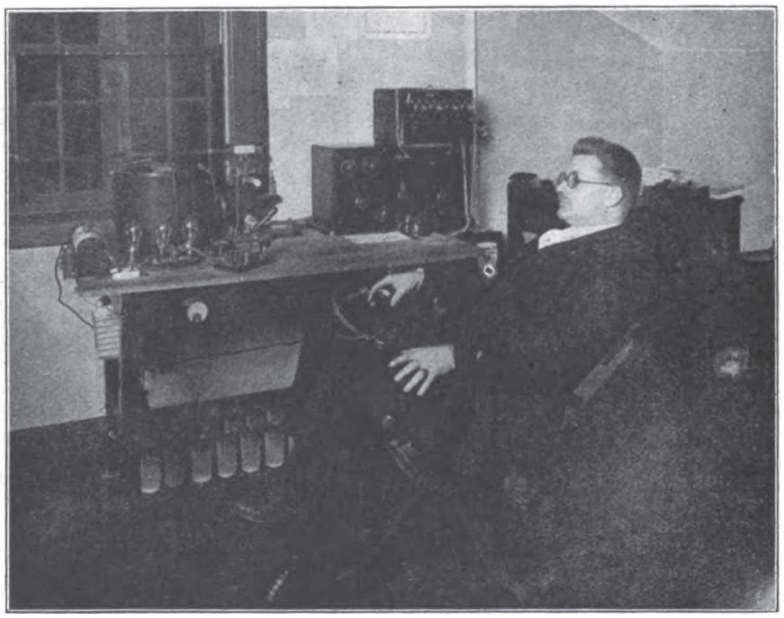
In March of 1915 he moved west, finally locating in Phoenix, Arizona, where old reliable 6DM was put in operation and many records made which to this day are not to be laughed at. There are not many stations today that can boast of being heard in every state west of the Mississippi and as far east as Ohio. 6DM was the missing link between the Pacific Coast and the East in its early days and had the honor of handling the first messages from one coast to the other on the old A.R.R.L.

(Concluded on page 55)



Amateur Radio Stations

4GL, Savannah, Ga.



Here is O.M. F. A. Hill and his wicked bug with which he is wont to murder the ether nightly at about 40 per. Mr. Hill did not send us any detailed description of his station and we suppose he thinks that the noise it makes is sufficient introduction. 4GL has made a wonderful name for itself in the last few months, handling traffic consistently over great distances and being reported inland to North Dakota and 2450 miles east at sea, which is almost to England. All of this work has been done on the output of three so-called 5-watt tubes. We don't know their actual output but imagine it is around 50 watts. The circuit is the now famous British air-craft circuit that is giving such excellent results among our amateurs, and the general arrangement of the apparatus will speak for itself. The anode supply is rectified A.C.; the electrolytic rectifier being seen on the floor beneath the operating table.

The receiver seems to be a modified Marconi type 106 but perhaps Mr. Hill is only using the panel because it is pretty and has some really efficient equipment behind it. The tube equipment consists of a home-made detector and three step.

Mr. Hill is a real operator and it is a pleasure to hear him clipping off traffic every night at high speed. His signals seem to reach out well in all directions but in particular he has solved a nasty traffic situation by establishing perfectly reliable communication with 3ZY, also CW, in Washington, bridging a gap that for a long time prevented the efficient disposition of Washington traffic destined south.

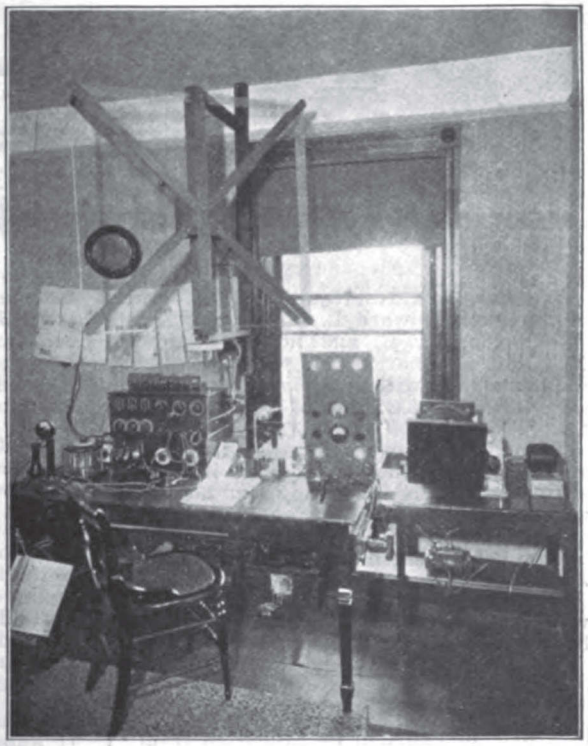
2BB, Ossining, N.Y.

Mr. I. R. Lounsberry's station is considered one of the old timers along the Hudson River Route of the A.R.R.L. and consistently handles traffic during the operating season.

Both spark and CW are used. The spark set consists of a ½ K.W. Packard transformer, Dubilier condenser, Benwood gap, and a Clapp-Eastham oscillation transformer, giving an antenna current of 3.5 amperes. The CW set is a standard direct-coupled circuit using a 50 watt Singer tube with rectified A.C. on the anode, with an antenna current of 1.25 amperes.

Tuning is accomplished by means of honeycomb coils loaded by series variometers. On higher waves the variometers are shorted and tuning is done with condensers. Mr. Lounsberry has found this very effective in short wave CW work.

The aerial is a "T" type of six wires, 60 ft. high, and a total flat-top length of 60 ft. Ground connection is made to water pipes and a chicken wire fence which parallels the aerial. The main purpose of the loop shown in the photo is to work duplex with 2XX, but it has also been found surprisingly effective for handling regular DX traffic.

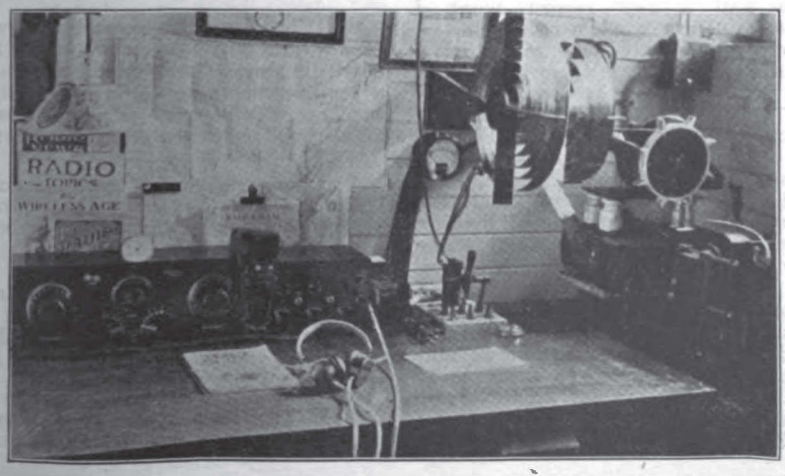


2WM, Ridgewood, L. I.

2WM belongs to William Leyh and is located at Ridgewood, L. I.

The antenna is a slanting fan, supported between two masts. The one at the open end is 60 ft. high and carries a 24 ft. spreader which supports five stranded wires, which run in one piece without joints from this mast to the apparatus, a distance of 120 feet. The inner mast is 40 ft. high

(Concluded on page 51)



We have lost from our A.R.R.L. Board of Direction Howard L. Stanley, 2FS, late of Babylon, L. I., and now of Caldwell, N. J., his resignation being made necessary in accordance with our Constitution when he entered the employ of Adams-Morgan Co.

Stanley was our shark on English, a man with an inborn horror of split infinitives, sentences couched entirely in negatives, and general loose language, and many a complex resolution or motion on the records of our Board meetings is the handicraft of Brother Stanley.

We are sorry to lose him but our good wishes are with him always, for he will ever be an A.R.R.L. booster.

A New DX Record

8LF of Crafton, Pa., reported from Avalon, Calif., on April 19th on an antenna power of 46 watts (yes, C.W.), has just doubled that distance. On the night of Nov. 6th last his sigs were copied 2750 miles west of San Francisco by G. C. Farmer, operator S.S. "West Prospect", KDUK, as reported in a service message to operator of KBEQ and mailed to Crafton upon arrival in port. Reported information checks with log of station 8LF.

All a hail a new record—what seems to be a new world's record for amateur DX—roughly 5500 miles on 46 watts!

The Diamond State Fibre Co. of Bridgeport, Pa., developers of the well-known insulating material Condensite Celoron, have established at their plant a radio station and laboratory for the purpose of making all kinds of tests upon their products. The station consists of a 1 K.W. spark transmitter, as well as a 300 watt C.W. and phone transmitter consisting of six 50-watt Radiotrons. This station is working on a regular schedule with other amateur stations. The company is also endeavoring to co-operate with the radio amateur by assisting in working out his experimental problems for him, and furnishing him with technical information as he may desire.

Condensite Celoron is a homogeneous compound of Condensite, one of the best insulators known, and fibre; a combination is produced which makes a very desirable insulator for radio panel work.

Westinghouse have a new detector tube designed with a special base for use in their new concert-receiving sets. The interesting feature is that the filament requires a potential of but 1.1 volt, drawing 0.2 amp., or less that ¼ watt. This means that a single dry cell will operate it for many hours, and makes it especially valuable for portable sets.

Incidentally, a full line of Westinghouse receiving tubes for general amateur work is expected on the market soon.

Wouldn't It Be Wonderful—

If antenna insulators wouldn't pull loose?
If waterpipes made good ground connections?
If 4GL would clip about 20 w.p.m. off his speed?
If the trolley companies would let us tap their lines and have all the juice we wanted?
If our call books were up to date?
If the QRM babies were really tied to the North Pole?
If 6DA would not look at the "picture on the wall" when he started to transmit.

3ZO has a return postcard which he mails out with received msgs for acknowledgment. On one side of the card is a regular message blank and on the return card there is a message receipt blank to be signed and returned by the addressee.

We have heard of quite a number of stations lately that have made attempts to operate on waves as low as 100 meters but can't find anyone that is listening that low. 9ZT reports he can get over an ampere CW on 125 meters and wants someone interested in working on that wave to listen for him. Just think of the possibilities of such a wave! Not a bit of QRM from the old rock-crushers.

The June, 1921, issue of the Department of Commerce's "Amateur Radio Stations of

the United States", is now available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at fifteen cents. Stamps are not accepted. It contains 203 pages of amateur calls, differing somewhat from the previous issues in that the station owner's name and address is included in the alphabetical list of calls instead of listing the addresses in the alphabetical list of station owners' names. It is good to have a complete call-book again.

A wild rumor is floating around that Armstrong has a new receiving scheme that does everything that the super-heterodyne does but uses only one tube. The reports have it that the amplification obtained on phone signals is 100,000 times that of an ordinary regenerative set, and that it is a cool million times better on telegraph signals. "Super-regeneration" of some sort seems to be the idea.

We await further particulars with what patience we can muster.

Amrad recently offered several prizes in a contest for a name for their new variometers. Munroe Cox, 1CJR of Swampscott, Mass., took the first prize, suggesting the name "Basketball Variometer".

Johnny Reinartz, 1QP, tells us that he used some real macaroni for "spaghetti" in one of his receivers and the mice cleaned it out one nite. Feed 'em rubber, John.

Ham ham ham, Jam jam jam,
Q R M
Wt the hx is the matter wid 'em,
They sit on the key and hold it there,
Wud make all the angels in heaven swear,
Ham! Jam!
Q R M!

Read 'Em and Weep!

8LX of Crafton, Pa., worked 6XAD Avalon, Santa Catalina Island, Calif., for twelve minutes on the morning of December 10th.

8ML, Murphy of Cleveland, using two 5-watt tubes, was copied in Long Beach, Calif., by 6ALP.

The radio telephone of the Radio Shop of San Jose, Calif., was heard by W. E. Long of Sterling, Illinois. Two fifty-watters were used at San Jose.

Mr. Wesley Robinson, Jr., of St. Marys, Ga., reports hearing the Long Beach-Avalon phone regularly. First time we've heard of its direct reception in the east.

Mix, 1TS of Bristol, Conn., has heard the CW at 6WV, Fresno, Calif.

Mr. H. S. Shaw, the author of "Some Comments On the Sure Fire C.W. Circuit" appearing in the January issue of QST, requests that the following be added to the third paragraph from the end, following the words "should be very small"; "In fact, if the antenna resistance is not too high, and the coupling of grid and plate is right, the tuning condenser may be dispensed with entirely, thus eliminating the only really critical adjustment in the whole circuit."

The Telephone Companies have agreed in the future not to place the usual "Property of the Wah-Hoo Tel. Co." on their transmitters, as they claim that it often causes the embarrassment of an honest C.W. man.

Scientific Paper No. 423 of the Bureau of Standards entitled "Operation of the Modulator Tube in Radio Telephone Sets" contains much valuable information that will be of use to the phone man. It is an excellent paper by E. S. Purington, Assistant Physicist, and may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for ten cents (stamps not accepted.)

Another recent Bureau publication that contains much interesting information is the "War Work of the Bureau of Standards," Miscellaneous Publication No. 46. It contains considerable radio matter relative to the development of apparatus for military purposes and new methods of making radio measurements. It also may be secured from the Superintendent of Documents, for seventy cents.

2WM, RIDGEWOOD, L. I.

(Concluded from page 49)

and on its 8 ft. spreader carries five large wooden pulleys, 5" in diameter, into which the wires of the fan are set in order to eliminate sharp bends and avoid extra connections. From this spreader the five wires go direct to the apparatus which is located in the basement 5' below the ground. The earth connection consists of water pipes and other buried pipes under the antenna, with separate leads which have been tuned onto the oscillation transformer to correct phase differences.

The transmitter consists of an Acme 1-kilowatt transformer, home-made synchronous and non-synchronous gaps, and a home-made condenser of .006 mfd. capacity. This condenser consists of 16 glass plates, 10" x 16" x ¼", with copper sheeting for the electrodes, the whole immersed in boiled linseed oil. The oscillation transformer has for its primary four turns of 3" ribbon and for its secondary seven turns of 2" ribbon, all mounted on bakelite. The apparatus is arranged for short leads, the longest being 6". Antenna current on a Jewell thermo-couple meter is 4¾ amperes and the decrement is 1.8.

Calls Heard

HEARD DURING DECEMBER
Unless Otherwise Specified.

SIGNALS HEARD IN HAWAII

Along with the good news of our transatlantic tests comes word that signals from west coast stations have been heard by Clifford J. Dow, 6ZAC at Wailuku, Maui, Hawaii. Mr. Dow will have a CW transmitter going shortly and then for a relay to China!

The following stations have been heard by Mr. Dow.

Hawaii Time Dec. 19th.
6:22 p.m.—CQ de 5QA
6:49 p.m.—7YG de 7YA
6:50 p.m.—6XAC de 6ZAF
7:52 p.m.—6ZX de 6ZB

Dec. 20th.
7:05 p.m.—6KA de 6ZB
7:16 p.m.—9NX de 9GK
7:25 p.m.—7NY de 7YG
7:25 p.m.—9AGN de 7ZU
7:27 p.m.—7YL de 7YG
7:35 p.m.—9AGN de 7ZU
7:45 p.m.—6UQ de 6ZE

Hawaiian time is two and a half hours earlier than San Francisco Time.

HEARD AT SEA BY "NV."

Dec. 5th. 35 miles south N. Y.—1AHL, 1ARY, 1APO, 1YD, 1XM, 1BFX, 1AW, 1BVB, 1FV, 2KL, 2DK, (plenty 2's in) (also plenty 3's not logged), 4EA, 4YA, 8AFG, 8AMZ, 8BVA, 8AXN, 8AFA, 8XE, 8RQ, 8XVA, 8FI, 8FT, 8WO, 8ZAC, 9MC, 9HR, 9TL, 9AWX, 9DLX, 9YAC, 9AWZ, 9AEK, 9ME, 9JN, 9DF. Dec. 6th. 150 mi. south N. Y.—1ARY, 1APO, 1ST ,1BIR, 1RV, 2AJW, 2DX, 2DK 2DN, 2ARK, 2TS, 2AIM, 2BY, 2FP, 8XM, 8XF, 8AKR, 8ARM, 8AHK, 8AMZ, 8BVA, 8AMB, 8XN, 8TK, 8AHU, 8XE, 8NO, 8JL, 9DLX, 9GX, 9UH, 9ACB, 9AMA, 9MC, 9ASJ, 9ZJ, 9AAP, 8IE, 4GN, 4BY. Dec. 7th. 465 mi. south N. Y.—1APO, 1XM, 1BCG, 2AID, 2DA, 2JU, 2EL, 2TJ, 8AGT, 8AIC, 8DH. 8AQR, 8AHK. 8BP Can., 4FD, 5FV, 5XA, 5ZAB, 5XU, 5DA. WL2 CW. 8BVA, 8AMZ, 8AHU, 8APB, 8XM, 9DWP, 9ASJ, 9ME, 9AWZ, 9TL, 9JN, 9DZE. Dec. 8th. 660 mi. south N. Y.—1XM, 1UN, 1BGF, 1BCG. 2AWF, 2XK, 3BP Can. 8AHK, 8AC, 4CG, 4EL, 4EA, 4GL, 4FD, 4BY, 5EK, 5XB, 5ZAK, 5NC, 5ZL, 5IR, 5QS, 5XA, 5HK, 8BVA, 8ZY, 8EF, 8XE, 8ZU, 8BK, 8RQ, 8ZG, 9AMA, 9TL, 9AAW, 9MC, 9DWJ, 9HR, 9ASJ, 9ZJ. Dec. 9th. 950 mi. south N. Y.—1BCG, 1AEV, 2AWL, 2BRB, 2FP, 2AIM, 8TH, 8AHK, 4EA, 4AU, 4FD, 4BY, 4GN, 5DA, 5ZAB, 5XA, 5FV, 5HK, 8EF, 8XE, 8SP. 9OX. Dec. 10th. 40 mi. west Key West—1BCG, 2FP, 4GL, 4EI. Dec. 11th. 175 mi. west Key West—1BCG, 1RU, 2FP very QSA, 2EL, 2ZL, 4EA, 4FD, 4DH, 4AU, 4AS, 4GL, 4GN, 4BQ, 5ZAM, 5IQ, 5HK, 5ZAB, 5IS, 5KC, 5QS, 5XA, 8ARY, 9AMA, 9ASJ, 9SY, 9LF, 9AMS, 9DQ. Dec. 12th. 350 mi. East Sabine, Texas—2FP, 4BY, 4BQ, 4GL, 4YA, 5ZD, 5YI, 5BY, 5IR, 9MC, 9NX, 9DQ, 9DPH, 9AEG, 9AMA. Dec. 13th. 125 mi. east Sabine, Texas—2FP, 4GL, 4BY, 4BQ, 5ZAB, 5XU, 5ZE, 9YM, 9WT, 9NX, 9MC, 9AEK, 9ARI, 9ANF, 9MC.

Can. 5BX, Vancouver, B. C.
CW: 1BCG. 6KA. 6JX, 6XAC, 6XAD, 6ZED, 7RN 8LX, Can. 4CB.
Spark: 6ACR, 6AIF, 6AMK, 6APE, 6EB, 6KM, 6ZAM, 6ZU, 6ZX, 7BA, 7BG, 7BH, 7BJ, 7BK, 7BR, 7CW, 7CZ, 7GE, 7HF, 7IN, 7JW, 7KB, 7KJ, 7LY, 7MF, 7NG, 7NL, 7VZ, 7ZS, 7ZT, 9HI.

Can. 3MR, Toronto, Ont.
Spark: 1AW, 1FF, 1GM, 1HK, 1NR, 1SN, 1XM, 1AAW, 1APO, 1ARM, 1AVI, 1AWO, 1AYL, 1AZK, 1BCX, 1BEA, 1CHJ, 2EH, 2EL, 2HG, 2KL, 2OM, 2PL, 2VA, 2XK, 2XQ, 2ZR, 2ACM, 2AER, 2AID, 2ARM, 2AWH, 2AWL, 2BRB, 2CCL, 2EAA, 8BG, 8CG 8DH, 8HJ, 8NB, 8UQ, 8YV, 8ZO, 8ZV, 8ADT, 8AFK, 8AHF, 8ASU, 8AUW, 8BKQ, 8CCZ, 4BY, 4CK, 4CO, 4CS, 4EA, 4HT, 4XC, 5DO, 5EK, 5XA, 5XK, 5ZZ, 8AG, 8BO, 8BU, 8BY, 8CF, 8DR, 8EB, 8EL, 8EV, 8EY, 8KJ, 8LH, 8NB, 8NO, 8OI, 8SP, 8SZ, 8TT, 8VC, 8VW, 8WE, 8XC, 8XK, 8YN, 8ACZ, 8ADR, 8AHH, 8AJN, 8AMQ, 8AMZ, 8ARD, 8ASZ, 8AWB, 8AWX, 8AXN, 8AXQ, 8AYC, 8AYR, 8BFX, 8BKO, 8BRL, 8YAA, 8ZAC, 9AG, 9AM, 9AU, 9DQ, 9DR, 9DW, 9DY, 9GO, 9HR, 9KG, 9LF, 9LN, 9ME, 9TL, 9WT, 9XJ, 9YY, 9ZN, 9AAW, 9ACB, 9ACY, 9AGR, 9AIR, 9AWX, 9AZV, 9BDS, 9BLO, 9DLX, 9DRX, 9DWP, 9DXM, 9DYC, 9ZAC.
CW: 1FF, 1OK, 1PD, 1QN, 1RH, 1RU, 1RZ, 1UN, 1WR, 1XJ, 1ZE, 1AMQ, 1ANY, 1AWP, 1AXI, 1BCA, 1BXG, 1BEA, 1BEP, 1BKA, 1BKQ, 1BWJ, 1CAK, 1CDR, 1DWJ, 1XQO, 2EL, 2FD, 2GB, 2GK, 2NN, 2NQ, 2QB, 2QG, 2QR, 2TK, 2UD, 2XQ, 2AAB, 2ADT, 2AEQ, 2AFV, 2AGB, 2AJF, 2AJU, 2AJW, 2ALR, 2ANZ, 2AUV, 2AWF, 2AWL, 2AYI, 2BEB, 8BFS, 2BFZ, 2BGH, 2BMR, 2BQT, 2BRB, 2BRG, 2BSC, 2BVE, 2BYS, 8FR, 8FS, 8MO, 8PN, 8AET, 8AJB, 8BEC, 8BHL, 4ID, 4IZ, 4ZF, 8BO, 8HJ, 8HW, 8II, 8IQ, 8IV, 8JL, 8JQ, 8KH, 8KM, 8KS, 8LS, 8ML, 8NB, 8NM, 8NT, 8OW, 8UJ, 8UZ, 8WR, 8XK 8XV, 8ZN, 8ZV, 8AAV, 8ABO, 8ADA, 8ADB, 8AFE, 8AHR, 8AIL, 8AIO, 8AKD, 8AMM, 8AMV, 8ANO, 8ANP, 8ATN, 8AXC, 8BFH, 8BFX, 8BLR, 8BMA, 8BOZ, 8BPX, 8BRL, 8BUJ, 8CBR, 8BQD, 8BMM, 8BQV, 8NAV, 9BL, 9FM, 9FZ, 9LQ, 9NX, 9WC, 9ZB, 9AAY, 9AJR, 9AKD, 9AKN, 9ARK, 9BED.

Can. 4BD, Winnipeg, Man.
Spark: 4BZ, 5HK, 5KM, 5XU, 8AC, 8BZY, 8YN, 8ZZ, 9ACG, 9ACN, 9AEG, 9AEY, 9AIF, 9AIG, 9AIR, 9AQC, 9ARZ, 9AVN, 9AYW, 9AXE, 9BLO, 9DKQ, 9DWP, 9XAM, 9XAB, 9YAC, 9YAE, 9YAK, 9EE, 9EK, 9HA, 9HM, 9JN, 9LM, 9MC, 9ME, 9MK, 9MO, 9NR, 9PS, 9TL, 9UU, 9WA, 9WI, 9WU, 9XI 9ZC, 9ZJ.
CW: 1BCG, 4BQ, 4BY, 5ZA, 7HS, 7ZK, 7ZM, 8ABO, 8BK, 8XJ 8ZG, 9AGN, 9AJA, 9AKR, 9AMB, 9AVM, 9AW, 9BBF, 9DOF, 9DTM, 9DZQ, 9HC, 9LW, 9NX, 9XR, 9ZY.

Can. 2BT, Montreal, Canada
Spark: 1AW, 1DY, 1RV, 1AEV, 1ARY, 1BIR, 2BK, 2DA, 2EL, 2OM, 2RL, 2AIM, 2AJW, 2ARK, 2AST, 2AZY, 3AC, 3BG, 3CG, 3FB, 3HJ, 3IW, 3XM, 3YV, 3ZE 3ZO, 3ZV 3ZZ, 3AHK, 3ARM, 3AUW, 3BFU, 4EY, 8AY, 8BK, 8CG, 8CI, 8FI, 8HR, 8SP, 8XE, 8AFB 8AXQ, 8AYS, 8BGT, 9UG, 9MC, 9WU, 9ZJ, 9AIR, 9ASJ, 9AZE, 9DHZ, 9DWP, 3BP (Can.)
CW: 1CF, 1RZ, 1UN, 1XM, 1AFV, 1AJM, 1ARY, 1AZW, 1BCG, 1BDI, 1BEP, 1BGH, 1BQE, 1CAE, 2BB, 2BC, 2EH, 2FD, 2FP, 2GR, 2NN, 2OM, 2RU, 2UD, 2XQ, 2ZV, 2AFP, 2AGB, 2AJF, 2ALR, 2ANZ,

1AWL, 2BAK, 2BEB, 2BML, 3BA, 3BZ, 3FS, 3HG, 3LO, 3AAE, 4BY, 4GL, 8BA, 8BB, 8HJ, 8XK, 8XM, 8AIL, 8ALY, 8AMM, 8AMQ, 8AQV, 8BFX, 8BOX, 9AKO, WL2, XF1, AN5.

1MD, Dorchester, Mass.

Spark: 1ADC, 1AEV, 1APO, 1ARY, 1AW, 1BCF, 1BVB, 1ABB, 1QO, 1YD, 1ZE, 2AHU, 2AID, 2AIM, 2APB, 2ANQ, 2ASL, 2AWF, 2AUY, 2AZY, 2BJP, 2BK, 2BM, 2CAP, 2CY, 2DA, 2DN, 2DR, 2DX, 2DI, 2EL, 2FP, 2GK, 2JU, 2OM, 2OO, 2PF, 2PV, 2TS, 2WB, 3AC, 3AHF, 3AHK, 3AIC, 3ALN, 3AMW, 3AQR, 3ARM, 3AUW, 3BFM, 3BG, 3BJP, 3CN, 3DM, 3FB, 3FJ, 3FM, 3HG, 3IW, 3OU, 3PU, 3TH, 3TJ, 3VW, 3XM, 3ZA, 3ZO, 3ZV, 4BQ, 4EA, 5ZA, 8ACF, 8AFA, 8AFD, 8AFG, 8AGB, 8AHH, 8AHS, 8AMZ, 8ANO, 8AOT, 8APB, 8ARD, 8AWP, 8AXO, 8AYN, 8BRL, 8BVA, 8BVR, 8CG, 8CH, 8DY, 8DMP, 8FI, 8HY, 8JQ, 8LH, 8OI, 8SP, 8VQ, 8WO, 8XE, 8YAA, 8ZAC, 8ZY, 9AIR, 9AWU, 9AWX, 9AWZ, 9CP, 9DWP, 9HG, 9HR, 9JN, 9KF, 9YB, 9YC, 9ZJ, 9ZN, Hrd in Daylite 1ADC, 1AEV, 1QO, 1ZE, 2AUY, 2AZY, 2CY, 2DA, 2DI, 2DN, 2DR, 2OM, 3HG, 3ZA, 8AMZ, 9CP, Canadians 3BP, 3GE, 3KD, 3LI.

CW: 1ARY, 1BKE, 1BCG, 1BDI, 1BKQ, 1BQI, 1BQT, 1QP dalite, 1YK dalite, 1ZE, 2AAB, 2AAX, 2ACQ dalite, 2AGB, 2AJF, 2AJW, 2AWL, 2BB, 2BEH, 2BRB dalite, 2DR, 2EH, 2FD, 2FP dalite, 2OM, 2XQ, 2XB ph, 2ZL, 2ZV, 3AHK, 3BAG, 3DH, 3FS, 3HG, 3LR, 3MO, 3RF, 3ZO, Can. 3BP, 4AI, 4EN, 4GL, 5ZAB, 2EX, 8AGZ, 8AHR, 8AMM, 8APT, 8AQF, 8AQV, 8AQZ, 8AWF, 8AWP, 8AXN, 8BET, 8BFX, 8BLT, 8BMW, 8BNJ, 8BUM, 8CI, 8II, 8IV, 8JQ, 8LJ, 8OJ, 8UJ, 8SP, 8XM, 8OH dalite, 8XV, 8YAA, 8ZAE, 8ZN, 8ZY, 8ZZ, 9AJH, 9II, 9ZY, XF1.

1CFJ, South Portland, Maine

1AW, 1FM, 1FV, 1GM, 1IA, 1OE, 1OL, 1OP, 1PT, 1QG, 1RT, 1RY, 1UM, 1UN, 1UQ, 1ZE, 1ABC, 1ACO, 1AET, 1AEV, 1AFV, 1AHD, 1AMD, 1AMI, 1AND, 1APO, 1APT, 1ASW, 1BAE, 1BAQ, 1BAS, 1BCG, 1BCX, 1BDA, 1BDL, 1BDX, 1BGF, 1BHG, 1BHJ, 1BIR, 1BJE, 1BJK, 1BMA, 1BQL, 1BRQ, 1CAK, 1CCH, 1CHB, 1CHK, 1CIB, 1BSD, 1XE, 1CK, 1ARY, 2AG, 2BF, 2BQ, 2EH, 2DR, 2FD, 2FP, 2HJ, 2OE, 2OM, 2RU, 2TS, 2WZ, 2ZV, 2AAX, 2AFV, 2AIM, 2AJW, 2BIS, 2XI, 2XQ, 2EL, 2DA, 2BB, 2AYI, 2BAK, WDY, WJZ, 2FF, 3AJ, 3BL, 3DH, 3FP, 3LW, 3MO, 3NN, 3PB, 3GE, 3ADT, 3ARM, 3AFR, KDKA, 4BY, 8BU, 8IB, 8TU, 8AHR, 8AQV, 8XK, 8XV, 8KY, 8ZC, 8BRF, 8ASF, 8AOX, 9AW, 9XM.

1VQ, New Haven, Conn.

Spark: 1ABB, 1ARY, (1ATT), 1AW, 1AZT, 1BII, 1BLE, 1BTH, 1BYA, 1HO, 1YD, 2ACD, 2AHK, 2AID, 2AJR, 2ASL, 2AZY, 2BJN, 2BJO, 2BJP, 2BK, 2BSC, 2DN, 2DX, 2EL, 2FP, 2JU, 2JZ, 2RL, 2TJ, 2TT, 2TU, 2UA, 2XH, 2XK, 2ZK, 3AC, 3ACE, 3AHF, 3AHK, 3AIC, 3AJO, 3AQR, 3ARM, 3ASK, 3BCQ, 3BFA, 3BFW, 3CC, 3CG, 3CM, 3DM, 3EH, 3EZ, 3FB, 3GX, 3HB, 3HG, 3IW, 3KG, 3KM, 3OU, 3PU, 3TH, 3UQ, 3VS, 3XF, 3XM, 3ZA, 4BC, 4BQ, 4BX, 4CX, 4EA, 4EY, 4GN, 4YA, 5ER, 5FV, 5XA, 8ACF, 8ADQ, 8AFD, 8AFG, 8AGK, 8AGX, 8AHH, 8AJT, 8AJV, 8AMQ, 8AMZ, 8AOT, 8APB, 8AQV, 8ARD, 8ARK, 8AUE, 8AVT, 8AXN, 8AXO, 8AYN, 8AYS, 8BEP, 8BHV, 8BRL, 8BVA, 8CH, 8EW, 8HU, 8HY, 8JP, 8KG, 8KY, 8LH, 8NO, 8OI, 8PQ, 8PX, 8RQ, 8RU, 8SP, 8WK, 8WO, 8XE, 8YM, 8ZA, 8ZN, 8ZO, 9ABH, 9AGH, 9AGR, 9AIR, 9ASJ, 9AZE, 9BDE, 9DWP, 9FS, 9HH, 9MC, 9ME, 9UH, 9XD, Canadian 3BP.

CW: 1AFV, (1AJP), 1AJU, 1AKW, 1AOL, 1ARY, (1AWB), (1AXM), 1AZT, 1BCG, 1BDI, 1BKA, 1BPB, 1BTH, 1BWK, (1BWU), 1II, (1IV), 1QP, 1RU, 1RZ, 1UN, 1XM, 2AAB, 2AAX, 2ABD, 2AJF, (2AJW), 2AGB, 2ANZ, 2AQJ, 2ASH, 2AVU, 2AWF, 2AWK, 2AWL, 2AXB, 2AYV, 2AYZ, 2BDU, 2BMI, 2BQH, 2BQT, 2BRB, 2BRC, 2BSC, 2BV, 2BVH, 2BZA, 2CA, 2DN, 2EH, 2EL, 2FD, 2FP, 2KL, 2KP, 2KV, 2NN, 2NZ, 2OE, 2OM, 2PE, 2TJ, 2UD, 2VA, 3AAN, 3ACM, 3ACS, 3AGL, 3AHK, (3AIS), 3AJB, 3ANO, 3AQR, 3BAG, 3BEC, 3BHL, 3BIY, 3CA, 3DH, 3EM, 3HJ, 3MK, 3MO, 3NI, 3RF, 3RI, 3SQ, 3VS, 3VX, 3XM, 3ZO, 3ZZ, 4BK, 4BY, 4EH, 4EN, 4FF, 4GL, 4GX, 4LE, 4NX, 8AAZ, 8AC, 8ACF, 8AGG, 8AHR, 8AIL, 8AIO, 8AMM, 8AOG, 8AQF, 8AQV, 8AQZ, 8ASV, 8AVW, 8AWF, 8AWX, 8AXC, 8BDP, 8BDU, 8BET, 8BFX, 8BJV, 8BK, 8BNJ, 8BO, 8BOW, 8BOX, 8BPU, 8BUM, 8CH, 8CI, 8DE, 8DR, 8FD, 8FQ, 8GV, 8IB, 8IH, 8II, 8IQ, 8JQ, 8KH, 8LJ, 8OW, 8QI, 8RO, 8SE, 8SP, 8UO, 8UZ, 8VJ, 8XM, 9ARK, 9IO, 9RT, 9WC, 9ZY, Canadian 2BG, Canadian 3BP, XF1, XK1.

1ES, Brookline, Mass.

CW: (1ABY), 1AJP, 1ARY, 1AWB, 1AZK, 1AZW, (1AZX), (1BCG), (1BDI), (1BES), (1BKQ), 1BLN, (1BSD), 1BUA, 1CAK, 1CJH, 1QN, 1RZ, (1ZE), (2AAB), (2AAX), 2ABD, 2ACQ, (2AEQ), 2AGB, (2AJF), 2AJW, 2ALW, 2AME, 2ANZ, 2AQH, 2AQU, (2AWF), 2AWL, 2AYV, 2AYZ, 2BAK, 2BAU, (2BEH), (2BFZ), 2BGH, 2BGK, 2BIS, (2BRB), (2BRC), (2BRE), (2BSC), 2BUA, 2BZE, 2CCP, 2DN (2EH), 2EL (2FD), (2FP), (2JJ), (2KL), 2KP, 2KV, 2MW, 2OE, (2OM), 2QR, 2RB, 2RU, (2UD), 2VA, (2VH), 2WP, 2XQ, 3AAE, 3AAN, 3ADT, 3AEQ, (3AGL), 3AHK, (3AIS), 3AKU, 3BC, (3BEC), 3BZ, 3CC, (3CG), 3DH, 3EM, (3FM), 3FS, 3GB, 3HG, (3HJ), 3IW, 3LR, 3MO, 3OB, 3SH, 3TJ, 3UH, 3VS, 3XAA, (3ZO), 3ZY, 4BY, 4CO, 4EL, 4GL, 4II, 4ZE, 5UU, 8ABO, 8ADG, (8ADR), 8AGZ, 8AHR, 8AIL, (8AIO), 8AKP, (8AMK), 8AMQ, 8AQF, (8AQV), 8AQZ, 8ARW, (8AWP), 8AWY, (8BEF), 8BFX, 8BK, 8BLT, 8BNJ, 8BNY, 8BNZ, 8BO, 8BOW, 8BOX, 8BOZ, 8BRF, 8BRL, (8BUM), 8BVR, 8BZC, 8CF, (8HJ), 8IB, 8II, 8IQ, 8IV, 8JL, 8JQ, (8JS), 8KS, 8LF, 8LX, (8NB), 8NI, 8OH, 8QY, (8SP), 8TB, 8UJ, 8UK, 8UO, 8VJ, 8XK, 8XM, 8XV, 8ZAE, 8ZG, 8ZN, 8ZV, 9AAV, 9AJA, 9AKR, 9BBF, 9BED, 9DWJ, 9FM, 9HW, 9II, 9KF, 9NX, 9XM, Canadian 3BP.

Spark: 1APO, 1ARM, (1BIR), 1BVB, 1COK, 1CHJ, (1HK), 1UL, 2ACD, 2AHU, (2AID), 2ARB, 2AZY, 2BK, 2BRS, 2CY, (2DA), 2DK, 2DN, 2DO, 2EL, 2FP, 2GK, 2HJ, 2JW, (2LX), 2MJ, 2OM, 2TK, 2TS, 2XQ, 3AHF, 3AHK, 3ALN, 3AQR, 3ARN, (3CC), 3CG, 3CN, 3FP, 3HG, 3HJ, (3QF), 3TA, 3VW, 3ZA, 8AFA, 8AKQ, 8AMK, (8AMZ), 8AOI, 8ARD, 8AWP, 8AXN, 8AYN, 8BFV, 8BRL, 8BXC, 8EA, 8IN, 8MZ, 8OI, 8QC, 8RQ, 8SP, (8WE), 8WO, 8ZAC, 9AGR, 9DKV, 9TL, 9VL, 9ZN, Canadian (2CI), 2JL, 3BP, 3JP.

1BDI, Augusta, Maine

Spark: 1ABB, (1ABC), 1ABR, (1ACO), (1ADC), 1AEV, 1AFZ, (1AHD), 1AHK, 1AHL, 1AIT, 1ALK, 1AO, (1APO), (1APT), 1AQJ, 1AR, (1ARY), 1ASF, 1ASL, 1AVL, 1AW, 1AYB, 1AZ, 1AZK, 1BAS, 1BCQ, 1BDC, (1BDQ), 1BDT, 1BGF, (1BGI), (1BHR), (1BID), 1BIR, 1BIS, 1BJE, (1BJS), 1BQL, 1BQR, 1BRQ, 1BRW, 1BWY, 1CHJ, 1CK, 1CKQ, 1CM, 1COK, 1DY, 1DZ, (1EZ), 1FV, 1GQ, 1HK, 1HO, (1IA), (1OT), 1RV, 1RX, (1SD), 1SN, 1TJ, (1TS), (1UL), 1WQ, 1YD, 2ABD, 2ABM, 2AER, 2AHK, 2AHL, 2AIM, 2ANM, 2AR, 2ARB, 2ARK, 2ARY, 2ASL, 2AST, 2AWF, 2BG, 2BK, 2BM, 2BY, 2CI, 2CT, 2DA, 2DK, 2DM, 2DN, 2DX, 2EL, 2FP, 2GK, 2JH, 2KE, 2KU, 2LC, 2LX, 2MV, (2OM), 2PF, 2PV, 2QC, 2RL, 2RM, 2TS, 2TJ, 2UM, 2XM, 3AHF, 3AHK, 3AIS, 3AJB, 3AJD, 3AQR, (3ARM), 3AUW, 3BFU, 3BG, 3CC, (3CG), 3CN, 3FB, 3FG, 3HJ, 3LP, 3OU, 3PB, 3PU, 3QP, 3QW, (3RW), 3UC, 3UD, 3US, 3VW, 3XM, 3ZA, 3ZV, 8ACF, 8AHU, 8AKQ, 8AMZ, 8APB, 8AVT, 8AXO, 8AXZ, 8AYN, 8AYS, 8BFH, 8BRL, 8BSY, 8BUM, 8DY, 8FW, 8FP, 8HP, 8JU, 8MZ, 8QS, 8RQ, 8SP, 8TB, 8UJ, 8WE, 8WO, 8XE, 8YN, 9DXM, Canadian 3BG.

CW: 1AB, 1AEU, 1AFV, 1AGI, 1AIP, 1AJM, (1AKB fone and ICW), (1ALY), 1AR, 1ARM, (1ARY), 1AVI, 1AVR, 1AWB, 1AXI, 1AYL, 1AYQ, 1AZ, (1AZX), 1BB, (1BCF), 1BCG, 1BDC, (1BDS), (1BEA), 1BEC, 1BEP, (1BES), 1BFZ, 1BKA, (1KK), 1KQ, 1MY, (1BQE), 1BVA, 1BVH, 1BVQ, 1BWJ, 1BYX, 1CAE, 1CF, 1CGO, 1CJH, 1CK, 1CLN, (1ES), 1EZ, 1FB, 1FF, (1IT), 1IV, 1QG, (1QN), 1QP, 1RZ, (1TS), 1UQ, 1XD, 1XM, 1YK, 1ZE, (2AAB), 2AAX, 2ABA, 2ABR, 2ACZ, 2AGB, 2AGI, 2AGW, 2AHK, (2AJF), 2AJW, 2ANJ, (2ANZ), (2AQU), 2VU, 2AWF, 2AWK, (2AWL), 2AWU, 2AXF, 2AYZ, 2BA, 2BAK, (2BB fone), 2BBB, 2BDU, (2BEA), 2BEB, (2BEH), 2BG, (2BGH), 2BJC, 2BML, 2BRB, 2BRC, 2BSC, 2BYS, 2BZJ fone, 2CAK, 2CC, 2CS, 2EH, 2EL, 2FD, 2FP, 2FQ, 2FS, 2IH, 2KL, (2NN), 2OM, 2QR, 2RB,

2RU, 2UA, (2UD), 2UK, 2VA, 2WL, 2XB fone, (2XQ), 2ZA, 2ZL, 3AEB, 3AGL, (3AHK), 3AJB, 3ANJ, 3ANO, 3ATB, (3BA), 3BC, 3BEC, 3BHK, 3BIY, 3CA, 3CC, 3CG, 3DH, 3EM, 3IW, 3MO, 3PB, 3QV, 3XL, 3XM, 3YO, 3ZV, (3ZO), XF1, 4BY, 4CO, 4GL, 4GX, 8ACF, (8ADG), 8ADR, 8AIL, 8AIO, 8AMK, 8AMM, 8AOG, 8AQI, (8AQV), (8AWP), 8AYZ, 8BEF, 8BFX, 8BJ, (8BK), 8BNY, 8BO, 8BOX, 8BUM, 8BZC, 8DW, 8HF, 8HJ, 8IL, (8IQ), (8JL), 8JQ, 8KY, 8LF, 8UC, 8UK, 8VJ, 8WW, 8ZY, 9DWJ, 9JQ, 9NX, 9PG, 9XAH, 9ZJ.

2AGH, Caldwell, N. J.

CW: 1ADB, 1AFV, 1AJP, 1AJM, 1AKA, 1AKB, 1ANQ, 1ARY, 1AWB, 1AZW, 1BCF, 1BCG, 1BDI, 1BEA, 1BEP, 1BIS, 1BKA, 1BKQ, 1BKZ, 1BMY, 1BOQ, 1BQE, 1BQT, 1BSD, 1BUA, 1BWJ, 1CAK, 1CF, 1DH, 1FF, 1PT, 1QN, 1QP, 1QR, 1QW, 1RU, 1RZ, 1TS, 1UN, 1UQ, 1WS, 1XM, 1ZE, 2AAB, 2AAX, 2ABA, 2ACQ, 2ACI, 2ABD, 2ADL, 2AEQ, 2AGB, 2AJA, 2AJW, 2AKO, 2ALR, 2AME, 2AMF, 2AMO, 2ANZ, 2AOS, 2AOG, 2APJ, 2AQU, 2ARZ, 2ASH, 2AUU, 2AVU, 2AWE, 2AWF, 2AWK, 2AWL, 2AYV, 2AYZ, 2AXF, 2BAK, 2BB, 2BDM, 2BEA, 2BEB, 2BEH, 2BGA, 2BGH, 2BGK, 2BH, 2BML, 2BMR, 2BNZ, 2BLO, 2BPD, 2BQT, 2BRE, 2BRB, 2BSC, 2BTW, 2BUM, 2BUA, 2BXG, 2BXK, 2BZY, 2CBT, 2CBW, 2CAF, 2CDK, 2CC, 2CCL, 2CS, 2EX, 2EH, 2FD, 2FP, 2EL, 2HI, 2IA, 2KL, 2KP, 2KU, 2NN, 2OM, 2QR, 2RB, 2RM, 2RU, 2TJ, 2TP, 2UD, 2VA, 2VH, 2VL, 2WB, 2WD, 2WP, 2XQ, 3AAE, 3AAN, 3ADT, 3AEV, 3AHK, 3BAG, 3BEC, 3BIY, 3BQ, 3BUW, 3BZ, 3CA, 3DH, 3FS, 3HG, 3LR, 3MO, 3NH, 3QV, 3RF, 3SQ, 3TJ, 3XO, 3ZO, 3ZY, 4BQ, 4BY, 4CO, 4EL, 4GL, 4GX, 4XD, 4ZE, 8ABO, 8AC, 8ACF, 8ADG, 8ADR, 8ADY, 8AGZ, 8AHR, 8AIL, 8AIO, 8AIX, 8ALB, 8ALD, 8ALY, 8AMM, 8AMQ, 8ANP, 8AOG, 8APT, 8AQF, 8AQZ, 8AQU, 8AUJ, 8AWF, 8AWP, 8AWX, 8AWY, 8AXU, 8BAD, 8BFH, 8BFX, 8BIX, 8BLT, 8BMW, 8BNJ, 8BNY, 8BO, 8BOX, 8BOZ, 8BK, 8BU, 8BUM, 8BVR, 8BXA, 8BA, 8BAV, 8CDR, 8CG, 8CI, 8DR, 8HJ, 8IB, 8IL, 8IQ, 8IV, 8JQ, 8JS, 8KM, 8KS, 8KH, 8LU, 8LF, 8LX, 8OW, 8QB, 8QY, 8TT, 8UJ, 8UK, 8VJ, 8WR, 8WY, 8XK, 8XM, 8XV, 8ZAE, 8ZV, 9AAS, 9AAV, 9AAY, 9AIH, 9AJA, 9AJH, 9AMB, 9ARK, 9BAP, 9BBG, 9BED, 9BHE, 9DBQ, 9DWJ, 9GL, 9IO, 9LQ, 9WC, 9XAH, 9ZB, 9ZY, Canadian 3BP, 9AW.

Spark: 1ABB, 1AO, 1AEV, 1ARY, 1AW, 1ADC, 1APO, 1ASF, 1BGF, 1BJW, 1BFZ, 1CHJ, 1COK, 1DY, 1SN, 1YD, 3AIC, 3AQR, 3CG, 3CK, 3CV, 3FQ, 3HB, 3HJ, 3LD, 3OU, 3XM, 3ZM, 3ZV, 4AU, 4CX, 4EA, 5DA, 8AAV, 8ACF, 8AFB, 8AFD, 9AFG, 8AGB, 8AHH, 8AIH, 8AJT, 8AKQ, 8AMZ, 8ANO, 8AOT, 8APB, 8ARD, 8AUE, 8AVT, 8AXO, 8AYN, 8AYS, 8BAH, 8BEP, 8BGF, 8BRL, 8BSY, 8BVA, 8BK, 8CAY, 8CF, 8EF, 8HG, 8EW, 8LH, 8KP, 8KY, 8MZ, 8SH, 8SP, 8XE, 8YN, 8YAA, 8ZAC, 9AAP, 9AAW, 9ACB, 9AGR, 9AIR, 9ASJ, 9AJU, 9AYH, 9AZA, 9AZE, 9AMT, 9AWX, 9DHZ, 9DWP, 9HM, 9HR, 9MC, 9ME, 9LF, 9OX, 9TL, 9UU, 9YM, 9ZJ, Canadian 3BP, 3GE, 3JL, 3LI, 9AK.

2BEB, Englewood, N. J.

CW: 1AFV, 1AJM, 1ANQ, 1ARG, 1ARY, 1AWB, 1BCG, 1BDI, 1BQE, 1CAC, 1CAK, 1CFJ, 1DF, 1UN, 1ZE, 2BG (Canadian), 2AAE, 2AHK, 3AJB, 3BEC, 3BIY, 3BUW, 3BZ, 3CA, 3CG, 3FG, 3FS, 3HG, 3LR, 3MO, 3MZ, 3NH, 3XY, 3YQ, 3ZO, 3ZY, 4BY, 4EL, 4GL, 4ID, 5UU, 8ADG, 8AGZ, 8AIL, 8AKW, 8ALV, 8AMM, 8AMQ, 8AOG, 8APT, 8AQJ, 8AQV, 8AQZ, 8ARO, 8AWP, 8BFX, 8BK, 8BLT, 8BNY, 8BOX, 8BRC, 8BU, 8BUM, 8BXA, 8BCZ, 8CBR, 8DR, 8IB, 8IV, 8JA, 8JQ, 8OW, 8PS, 8QM, 8SH, 8UK, 8VJ, 8XK, 8XV, 8ZG, 8ZN, 8ZV, 8ZZ, 9AJA, 9ARK, 9LQ, 9NX, 9XAH.

2AWF, Albany, N. Y.

Spark: 1AB, 1AEV, 1AO, (1ARY), 1AW, 1AWU, 1AYU, 1BIR, 1BOQ, 1CK, 1HO, 2AJE, 2AST, 2DA, 2EL, 2JU, 2OM, (2OO), 2TS, 3AGT, 3AHK, 3AIS, 3AQR, 3ARM, 3BFS, 3CC, 3DH, 3FB, 3FR, 3HG, 3HJ, 3IW, 3OU, 3TA, 3TH, 3US, 3XM, (3ZA), 3ZO, 3ZV, 4BQ, 4CX, 4EA, 4EY, 4XC, 5DA, 5HK, 5XA, 5XU, 8ACF, 8AFB, 8AHH, 8AHU, 8AJT, 8AKQ, 8AMZ, 8ANV, 8AOT, 8APB, 8AVD, 8AYS, 8BEP, 8BFH, 8BGJ, 8BRL, 8BUK, 8BUN, 8BVA, 8CG, 8DZ, 8EF, 8EW, 8FW, 8HR, 8IV, 8JQ, 8KY, 8OI, 8PQ, 8QC, 8SP, 8TZ, (8XE), 8YAA, 8YN, 8YV, 8ZP, 8ZZ, 9AAP, 9AAW, 9ACL, 9AIR, 9AK, 9AMQ, 9AQM, 9AZA, 9AZE, 9BES, 9DWP, 9DXM, 9HR, 9KF, 9LF, 9QH, 9TL, 9UU, 9VL, 9YB, 9YC, 9ZJ, 9ZN, Can. 3BP, 3FO, 3GE, 3JL.

CW: 1ANQ, 1ARY, (1AVR), (1AZW), 1BCG, 1BDI, (1BEA), (1BOQ), 1BQE, (1BUA), (1ES), 1XM, 1YD, (1ZE), (2AAB), 2AAX, 2AKO, 2BB, 2BFZ, 2BML, (2BRC), 2BSC, 2BUM, 2CDA, (2EH), 2FP, 2OM, 2QR, 2VH, 2WP, 2ZV, 3AAE, 3AAN, 3AFB, 3AHK, 3BC, 3BHL, 3BIY, (3BZ), (3CC), 3KM, (3LR), (3MO), 3XY, 3ZO, 3ZZ, 4BY, 4EL, 4ID, 4YA, 5UU, 8ABO, 8AC, 8ADG, 8AIO, 8AKP, 8ALB, (8AQV), (8AQZ), 8ARW, 8AUO, 8BFX, 8BQT, 8BRC, (8BXA), (8BXH), 8EB, 8IQ, (8JS), 8KX, 8SP, 8WY, 8XV, (8ZAE), 8ZZ, 9AAS, 9AAW, 9AAY, 9AIH, 9AJH, 9AKR, 9EK, 9II, 9RT, 9XI, 9XM, 9ZJ, 9ZY, DF1, KDKA, NSF, NZO, WDY, WJZ, WL2, Can. 3BP.

2OM, Ridgewood, N. J.—Nov.-Dec.

Spark: 1ACK, (1ADC), (1ADL), (1AEV), (1AHF), 1AIT, (1AKG), (1AMD), (1APO), 1ARY, (1ASF), 1ASW, 1ASZ, (1AW), 1AWM, 1AWO, (1AZK), (1BDC), 1BDI, (1BDT), (1BDV), (1BIR), 1BIS, 1BJN, 1BLE, 1BMR, (1BQ), 1BQA, 1BQL, 1BRQ, (1BVB), 1BWZ, (1BYG), 1CAK, 1CEO, 1CHJ, 1CK, (1CM), (1CO), 1COK, (1DY), (1DZ), (1FU), (1GM), 1HK, (1IA), 1MA, (1OE), (1OJ), (1RV), (1SN), 1UA, 1XB, 1YB, 1YD, 1ZE, (2PV), (2XQ), (2AWF), (3BP), (3EI), (3FQ), (3GE), (3JL), (3LI), (3QJ), Canadians, (8AC), 8ACE, 8AFB, (8AHF), (8AHK), 8AIC, 8AIS, 8AJD, 8ALI, (8ALN), 8AOZ, (8ARM), (8ARN), 8ATZ, 8AUN, 8AUW, 8BFU, 8BGT, 8BJ, (8CG), 8CK, (8CN), 8PM, 8FB, 8GX, (8HG), (8HJ), (8IW), 8KM, (8LP), (8LY), 8NB, 8NH, (8OU), 8QF, (8RW), 8TH, 8TJ, 8TT, 8UC, 8US, 8VW, 8XF, (8XM), 8YO, (8ZA), (8ZF), 8ZO, 4AL, 4AS, 4BQ, (4BX), (4CX), (4DH), (4DQ), (4EA), (4EY), 4FD, 4GN, (4XC), 5DA, 5EA, 5ER, 5FJ, (5FV), 5HK, 5JD, 5XF, 5XU, 5ZL, 7XD, 7ZU, (8AAE), 8AAG, 8AAV, 8ACF, (8ADE), 8AFB, (8AFD), (8AFG), 8AFS, (8AGB), 8AGF, 8AGK, 8AGT, 8AHE, 8AHF, 8AHH, 8AHS, 8AIB, (8AIG), 8AIZ, (8AJO), (8AJT), 8AJV, (8AJW), 8AKQ, (8ALT), (8AMB), 8AMK, (8AMZ), (8ANO), (8AOI), (8AOT), 8AOU, 8APB, (8AQV), 8AQZ, (8ARD), (8ARG), (8ARS), 8ATU, 8AUE, 8AUR, 8AVI, 8AVO, 8AVT, 8AWR, (8AXN), 8AYN, (8AYS), 8BAH, 8BAI, 8BBY, (8BCO), 8BDB, 8BDL, (8BDY), 8BEN, 8BEP, (8BFH), (9FV), 5HA, 8PB, (8BRL), 8BSY, 8BUA, (8BUN), (8BVA), (8BXC), (8CAY), 8CF, 8CG, 5CI, (8CP), 8CX, 8DE, 8DP, 8DZ, (8EA), (8EB), 8EF, 8EV, (8EW), 8FI, (8FT), 8GW, 8HG, 8HY, 8HU, (8IN), 8JJ, (8JP), 8JQ, (8JU), 8KE, 8KK, (8LH), 8LQ, (8MJ), (8MZ), 8NO, 8OI, 8OJ, 8PM, 8PQ, (8PT), 8QC, 8RB, (8RQ), (8RU), (8SP), (8TJ), 8TK, 8TT, 8TY, 8UC, 8UD, (8UP), 8VI, 8VQ, 8UR, 8VW, 8WA, (8WE), (8WO), 8WZ, (8XE), 8XU, 9YAA, 8YM, 8YN, 8YU, (8ZAC), 8ZG, 8ZO, (8ZN), 8ZR, 8ZY, (9AAW), 9ACB, (9ACY), 9ACZ, 9AEK, 9AEY, 9AF, 9AFF, 9AFK, (9AGH), 9AGR, 9AIP, (9AIR), 9AIU, 9AKR, 9AMA, 9AMK, 9AOE, 9AOJ, 9APK, 9AQE, 9AQM, 9AQV, 9ARG, 9ARZ, 9AS, (9ASJ), 9ASK, 9ASU, (9AU), 9AWX, 9AWZ, 9AXU, 9AZA, (9AZE), 9BDE, (9CP), 9DBW, 9DEH, (9DLX), 9DMJ, 9DOI, 9DPH, 9DQY, (9DWP), 9DXM, 9DYU, 9DZI, 9ET, 9GO, 9GX, 9HM, 9HR, 9II, 9JN, (9ME), 9MC, (9OX), 9PD, (9PS), (9RC), (9TL), (9UH), (9UU), 9VG, 9VL, 9VZ, (9WT), 9WU, 9YH, 9ZJ, 9ZN, 9ZY.

CW: 1AEV, (1AFV), 1AJP, (1ALY), 1ARY, (1AVI), 1AVR, 1AWB, (1AZW), (1BCG), (1BDI), 1BEA, (1BKQ), 1BMY, 1BSD, (1BWJ), 1CDR, (1ES), (1PE), (1PT), (1QP), 1UN, (1XM), 1ZE, (2XQ), (Can. 3BP), 3AAN, 3ABI, 3AHK, (3BEC), (3BHL), 3CA, (3CG), (3DH), (3EM), 3GR, 3HG, (3HJ), (3IW), (3MO), (3RF), 3ZO, (4BY), 4FF, 4GL, 4GX, 4ID, 5XK CW & voice, 6WV, (8ADR), (8AGZ), 8AIO, 8ALB, 8AML, (8AMM), 8AQV, 8AWP, (8AXC), 8BCI, 8BEF, (8BFX), 8BK, 8BNJ, 8BNY, 8BO, 8BOX, (8BPL), (8BRL), (8BUM), 8BVR, (8BWK), 8DE, 8DR, (8HJ), (8IB), 8IQ, 8IV, 8JL, (8JQ), 8LJ, (8LX), (8PT), 8SE, 8UJ, 8UO, 8UU, 8VJ, 8VO, 8WY, 8XK, 8XM, 8ZAE, 8ZD, 9AAY, 9AMB, (XF1), (X4L), (NZO).

2AWS, Freeport, L. I.

Spark: 1ABB, 1ACO, 1ADC, 1AEV, 1AHF, 1AJO,

1AMD, 1AMQ, 1AO, 1APO, 1ARY, 1AW, 1AZK, 1BDT, 1BGH, 1BJN, 1BJY, 1BKO, 1BKQ, 1BOE, 1BRQ, 1BRZ, 1BWY, 1BVB, 1CHJ, 1CK, 1CM, 1DY, 1FV, 1HK, 1HO, 1IA, 1MA, 1OJ, 1QP, 1RV, 1VQ, 1YD, 3AC, 3ACN, 3ACQ, 3ADJ, 3AHK, 3AGR, 3AGT, 3AIC, 3AIS, 3ALN, 3AQZ, 3AQR, 3ARM, 3AS, 3ASK, 3AUW, 3BFU, 3BG, 3BGT, 3BJ, 3CC, 3CG, (3DT), 3DM, (3FB), 3FP, 3GV, 3HJ, 3HW, 3HX, 3IW, 3OV, 3PV, 3QF, 3RW, 3NC, 3UQ, 3US, 3VW, 3XM, 3YV, 3ZY, 4AN, 4BC, 4BX, 4CX, 4EA, 4EY, 4GN, 5DA, 5IW, 5XA, 5XK, 8ACF, 8ADR, 8AFA, 8AFB, 8AFD, 8AFG, 8AFO, 8AHH, 8AHS, 8AHU, 8AIZ, 8AJK, 8AJT, 8AMZ, 8ANV, 8APB, 8AUE, 8AVG, 8AOT, 8AWT, 8AXN, 8AXO, 8AXY, 8AYH, 8AZG, 8BAD, 8BCO, 8BFH, 8BFV, 8BKO, 8BOF, 8BQ, 8BRD, 8BRL, 8BSF, 8BSY, 8BUN, 8BVA, 8BYZ, 8CAY, 8CG, 8DF, 8DZ, 8EF, 8EW, 8EZ, 8FJ, 8HM, 8IA, 8JA, 8JJ, 8JU, 8KY, 8LH, 8ML, 8NO, 8NZ, 8OE, 8UI, 8OW, 8PO, 8RB, 8RG, 8RQ, 8SP, 8TK, 8TT, 8UJ, 8VL, 8WD, 8XE, 8YAA, 8YN, 8ZAC, 8ZV, 8ZW, 9AAW, 9AGR, 9AIR, 9ALN, 9AKH, 9ARB, 9AZE, 9ASJ, 9CA, 9CP, 9DKV, 9DWP, 9DXH, 9DXM, 9DYE, 9DYN, 9GX, 9LF, 9ME, 9MC, 9TL, 9UH, 9UN, 9SK, 9VL.

CW: 1AFV, 1AJP, 1AJU, 1ANQ, 1ARY, 1AWB, 1AXI, 1AYL, 1BCA, 1BCG, 1BEA, 1BGF, 1BII, 1BQE, 1CAK, 1CDR, 1DH, 1FB, 1QP, 1QN, 1RU, 1UN, 1XM, 1ZE, 3AAN, 3ADT, 3AHK, 3AP, 3BA, 3BEC, 3BHA, 3BHL, 3BIY, 3BZ, 3CA, 3CE, 3DH, 3EM, 3FR, 3HS, 3HX, 3KP, 3MO, 3RF, 3XL, 3ZO, 4BY, 4BQ, 4EL, 4GL, 4GX, 4II, 4ZE, 5UU, 8ADG, 8AGZ, 8AHU, 8AIO, 8AKJ, 8ALB, 8AMM, 8AMS, 8AOO, 8AQB, 8AQZ, 8ANO, 8AWP, 8BFX, 8BGY, 8BK, 8BNJ, 8BO, 8BOX, 8BRL, 8BTP, 8BU, 8BUM, 8BWR, 8BXA, 8CI, 8DR, 8EJ, 8HJ, 8IR, 8IV, 8IY, 8JL, 8KM, 8LX, 8TB, 8NO, 8UK, 8VO, 8VW 8XAE, 8XM, 9AJA, 9AAY, 9AJH, 9AQZ, 9DWJ, 9KR, 9RA, 9VZ, 9ZT, 9ZX, Can. 3GE, 3BP, 3EI, 2BG (CW).

3ACY, Hanover, Pa.

Spark: 1AW, 1XD, 1YD, 1ADC, 1AEV, 1APO, 1ARY, 2BK, 2DA, 2DN, 2EL, 2OM, 2PU, 2RB, 2AIM, 2AJE, 2ARB, 2ARK, 2AUK, 2AVE, 3BP Can., 3GE, 3GM, 3GX, 3KG, 3OV, 3ZO, 3ABP, 3AGT, 3AHK, 3AJD, 3AQR, 3BGH, 4AS, 4BQ, 4CX, 4EA, 4EY, 4FD, 4GG, 4GN, 5DA, 5HK, 5JD, 5XA, 5ZL, 5ZAB, 8JU, 8HP, 8KP, 8KY, 8MJ, 8OI, 8RQ, 8SP, 8VL, 8WO, 8XE, 8ZP, 8ZY, 8AAV, 8AFB, 8AFP, 8AJT, 8AOT, 8APB, 8ARD, 8AUE, 8AYN, 8BCO, 8BEP, 8BFH, 8BSY, 8BVA, 9GN, 9MC, 9UG, 9XO, 9YN, 9AAW, 9ACL, 9AGR, 9AIR, 9ARK, 9ARB, 9ASL, 9DFX, 9DHZ, 9DQY, 9DWP.

CW: 1TS, 1XM ICW, 1ZE, 1ARY, 1AYS, 1BCG, 1BQE, 1BSI, 2BQ, 2CE, 2EH, 2EL, 2FD, 2UD, 2XJ fone, 2XT fone, 2AAX, 2BEA, 2BYS, 2CDA, 3BZ, 3DH ICW, 3HG, 3RF, 3ZO, 3ZY, 3AAE, 3AAY ICW, 3AHK, 3BEC, 3BIY, 4BY, 4CO, 4FF, 4GL, 4XC, 4XD, 8BK, 8EB, 8HJ, 8KH, 8ADY, 8AHB, 8AHR, 8AWP, 8BFX, 8BNW, 8BOX, 8BUM, 9LQ, 9AAS, 9ASJ, WL-2, XF-1.

3KM, Washington, D. C.

Spark: Canadian 3BP, 3GE, 1ABB, 1AEV, 1AMD, (1ARY), 1AW, 1BCF, 1BDT, 1BGB, 1BRG, 1BYG, 1CK, 1CM, 1COK, 1HK, 1RV, 1SN, (1YD), 2AHU, 2AIM, 2AJU, 2ARB, 2ARD, 2ARK, 2ARY, 2AST, 2BJO, 2BK, 2DA, 2DI, 2DK, 2EL, 2FP, 2GK, 2OM, 2OO, 2RL, 2TS, 2WB, 3AC, 3AHF, (3AHK), 3AJD, 3ARM, 3BFU, 3FB, 3GX, 3HG, 3HJ, 3OU, 3QW, 3UC, 3XM, 3ZV, 4BQ, 4CX, 4EA, 5DA, 5ER, 5FV, 5SM, 5XA, 8ACF, 8AFB, 8AFD, 8AFG, 8AQY, 8AHU, 8AJT, 8AKQ, 8ALT, 8AMZ, 8AOT, 8APB, 8AQY, 8AUE, (8AXO), 8AYN, 8BCO 8BFF, 8BFH, 8BUN, 8BVA, 8DY, 8EF, 8FC, 8HG, 8HY, 8ID, 8JJ, (8JQ), 8MJ, 8NZ, 8RQ, 8SP, 8TK, 8TT, 8UR, 8VL, 8WE, 8WO, 8XE, 8YAA 8ZAC, 9AAW, 9AF, 9AIR, 9AIU, 9AQM, 9AZA, 9DQY, 9DWP, 9DXM, 9HR, 9LF, 9MC, 9OX, 9PS, 9TL, 9YC, 9ZJ.

CW: Canadian 3BP, 1AFV, 1AJP, 1ANQ, 1ARY, 1AWB, (1BCF), 1BCG, 1BEA, 1BKA, 1BKQ, 1BMJ, (1PT), 1RU, 1RZ, 1UN, 1XM, 1ZE, 2AAB, 2AAX, 2AJP, 2AJW, 2ANZ, 2AWF, 2AWL, 2AYV, 2BFZ, 2BRB, 2BRC, 2BSC 2EH, 2EL, 2FD, 2FP, 2KL, 2NN, 2NZ, 2OM, 2RU, 2TS, 2UD, 2VA, 2WL, 2XQ, 2ZL, 3AAE 3AEF, (3AHK), 3BEC, 3BIY, 3BZ, (3CG), (3DH), 3EM, (3HG), 3MO, 3XAA, 3ZN, 4BY, 4EH, 4GL, 4II, 4ZF, 5AN, 5ZA, 8ADG, 8ADO, 8AGZ, 8AHR, 8AIL, 8AIO, (8ALB), 8AMM, 8APT, 8AQF, (8AQZ), 8AWF, 8AWP, 8AWY, 8BFG, 8BK, 8BNJ, 8BNY, 8BO, 8BOX, 8BU, 8BUM, 8II, 8IQ, 8IV, 8JL, 8JS, 8LX, 8ML, 8UJ, 8VJ, 8XV, 8ZV, 9AAY, 9AJA, 9ARK, 9ASJ, 9BBF, 9ZB.

3AQW, Trenton, N. J.

Spark: 1AW, 1DY, 1OE, 1RV, 1YD, 1ABB, 1AEV,

(Continued on next page)

BOB TRUMP

(Concluded from page 47)

that a fuse blows when two hot wires are shorted. In 1913 the radio bug got its hold and in 1914 9JW was started and passed from the spark coil stage to the full 1 K.W. and the status of a star station. He was repeatedly heard on both coasts and by ships at sea off both coasts and worked old 6DM at Phoenix, Arizona, regularly, a distance of 1300 miles. Eastward his consistant range was about 600 miles and 3CV in Washington copied 9JW with fair regularity. Perhaps a lot of his range was due to a 120-ft. stick which looked many times that high in flat Kansas.

"BT" was a charter member of the Topeka Radio Club and has held all of the offices of that organization at one time or another. He was also one of the organizers of the old Central Radio Association "from the Rockies to the Ohio" and was on its famous old southwestern route.

When the lid went off in 1919, 9BT was one of the first to open up with the old spark of 9JW. The performance of 9BT was even superior to that of the old station.

A new 9BT is in operation at Ottawa now with a one-half k.w. spark and 20 watts of CW. Ill health has prevented regular watches and late hours but the old Topeka gang tell us that the same touch that made 9JW and 9BT famous is very much in evidence and has made the little bottles perform miracles.

ROBERT C. HIGGY

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southwestern route of pre-war days.

When the closing-up orders were issued and war declared, he returned to Columbus, Ohio, and served the latter part of the war as an instructor in signalling at the Ohio State University School of Military Aeronautics.

At the close of war he attended Ohio State University and operated 8IB, the old thunder factory from 6DM with almost pre-war results. Finally when the CW bug got its start, 8IB was converted into CW and has been one of the consistent twitterers from Ohio ever since.

Bob has been in Hartford since mid-December, located right here in the QST Factory, and is going to help us get QST out on time hereafter. He is one of the old A.R.R.L. enthusiastic supporters, and helped to organize the Arizona Radio Association and the Columbus Radio Club, both of which he served as president.

1ARY, 1AZK, 1BIR, 2BK, 2BY, 2CC, 2EL, 2FP, 2NB, 2QR, 2UK, 2WP, 2YA, 2ZC, 2AJE, 2ARY, 2AZY, 3AK, 3BG, 3CC, 3CM, 3CG, 3EH, 3GB, 3HX, 3NR, 3OU, 3OB, 3QW, 3RW, 3TA, 3UD, 3UF, 3UK, 3VP, 3VW, 3XC, 3XM, 3ZA, 3ZO, 3ZQ, 3ZS, 3ZV, 3ABB, 3ACM, 3AHK, 3AHQ, 3ANB, 3ARM, 3AWH, 3ANL, 4AC, 4EA, 4CX, 4GN, 5DA, 5FV, 5XA, 8BA, 8CQ, 8EF, 8EW, 8FI, 8HY, 8JQ, 8PQ, 8QC, 8RQ, 8SP, 8TJ, 8TT, 8TY, 8WO, 8XE, 8YN, 8ZN, 8ZP, 8ZR, 8ZY, 8AFA, 8AFE, 8AFD, 8AFG, 8AHH, 8AHS, 8AJT, 8APB, 8AYN, 8BCK, 8BEP, 8BFH, 8BVA, 8YAA, 8ZAC, 9DF, 9HR, 9JQ, 9AAW, 9AAY, 9ADE, 9AIR, 9DBU, 9DYU, 9DXM, Canadian 3BP.

CW: 1QG, 1QN, 1UN, 1VQ, 1XM, 1ZE, 1AFV, 1AKB, 1ANQ, 1AOL ,1ARY, 1AVA, 1AVR, 1AWB, 1AYL, 1AZW, 1BCG, 1BDI, 1BES, 1BEP, 1BDS, 1BKQ, 1BOQ, 1BWJ, 1CAK, 1CDR, 1CIT, 2BB, 2CB, 2CC, 2CS, 2DN, 2EH, 2EL, 2FP, 2KL, 2KP, 2OM, 2RM, 2RU, 2TJ, 2UD ,2UK, 2VA, 2VH, 2WP, 2XQ, 2XZ, 2ZA, 2ZL, 2ZV, 2AAB, 2AAX, 2AKO, 2AMY, 2ANZ, 2AQU, 2AWF, 2AYV, 2BAK, 2BAY, 2BEB, 2BEH, 2BFZ, 2BGH, 2BIK, 2BIS, 2BLO, 2BND, 2BRG, 2BUA, 2BVH, 2BYS, 2CBG, 2CCP, 3BC, 3BG, 3BP, 3BZ, 3CA, 3CC, 3CG, 3DP, 3DH, 3DR, 3FD, 3FS, 3FR, 3GB, 3HD, 3HG, 3HJ, 3HX, 3IH, 3IW, 3LH, 3KM, 3MO, 3NH, 3OT, 3QV, 3RF, 3RM, 3ST, 3XY, 3ZN, 3ZO, 3ZY, 3ZZ, 3AAE, 3AAN, 3ADT, 3ADX, 3AEQ, 3AEV, 3AHK, 3AJB, 3AKU, 3ALE, 3AMW, 3ANU, 3ANJ, 3APQ, 3AQF, 3BEC, 3BIY, 3BSC, 4BK, 4BQ, 4BY, 4EL, 4GL, 4II, 4ID, 4LE, 4XC, 5DA, 5ZA, 6WV, 8BK, 8CI, 8DR, 8II, 8IQ, 8IV, 8LJ, 8LU, 8LX, 8ML, 8OW, 8SP, 8UK, 8VM, 8XK, 8XV, 8ZN, 8ZV, 8ZZ, 8ABO, 8ACF, 8AFD, 8AGR, 8AGZ, 8AHR, 8AJU, 8AKJ, 8AKP, 8ALB, 8AQF, 8AQV, 8AQZ, 8AWP, 8BCI, 8BFX, 8BGX, 8BNY, 8BOX, 8BQM, 8BRC, 8BUM, 8BXA, 8ZAE, 9DW, 9II, 9LQ, 9NX, 9ZY, 9AAV, 9AJA, 9AJB, 9AMB, 9ARK, Can. 3BP.

Fone: 1OE, 1XE, 1XAD, 2QR, 2XB, 2XI, 2XJ, 2XR, 2AYZ, 3BB, 3HX, 3PB, 3YQ, 3ZO, 3AWI, 8LI, 8UJ, 8AMQ, 9ZB.

3YV, University, Va.

(1AEV), 1ARY, 1BCG, 1BRW, 1CG, 1RU, 2AHK, 2EH, 2EL, 2FP, 2OM, 2UE, 3AHK, 3AQR, (3BHL), 3DH, 3IW, 3KM, 3PU, 3QW, 3WA, 4AG, 4BQ, 4BY, 4CX, 4EA, (4FD), 4VS, 4YA, 5DA, 5FV, 8ACF, 8AFG, 8AFE, (8AFD), 8AFB, (8AFG), 8AHH, 8AJV, 8AJL, 8AJB, 8AHB, 8AL, 8APB, 8AUE, 8AWP, 8AYN, 8AYS, 8BCO, (8BYA), (8BRL), (8BUN), 8FT, 8HJ, 8HU, 8JQ, 8KE, (8NO), 8QC, 8SP, 8XE, 9ACB, 9AWX, 9AAW, 9MC, 9LF, 9OX, 9UG, 9ZJ, Canadian (3BP).

CW: 1XM, 2AAX, 2KL, 2MV, (3YO), 4GL, 8BK, 2BB fone.

4GN, Midville, Ga.

Spark: 1AEV, 1AW, 1BDT, 2AIM, 2AJE, 2BK, (2DX), 2EL, 2OM, 2PL, 2QR, 2TS, 3AHK, 3AIA, 3ARM, 3ARY, (3BG), 3BP Can., 3GE Can., 3HG, 3HJ, 3IW, 3XM, 3YV, 3ZV, (4AS), (4AU), (4BC), (4BI), (4BQ), 4BW, 4BX, (4CG), (4CX), (4DH), 4DK, (4DT), (4DZ), (4EA), 4FR, (4GH), 4HJ, 4HS, 4YA, 4YB, 5AA, 5BY, 5DA, 5EK, (5ER), 5QS, 5RO, 5SM, (5XA), 5XU, 5YL, 5ZAB, 5ZT, (5ZL), 5ZX, (8ACF), (8AFB), 8AFD, 8AFE, 8AFG, 8ANB, 8ANO, 8ANY, 8AOI, 8AUE, 8AVO, 8AXU, 8AYN, (8BEN), 8BEP, 8BFH, (8BOG), 8BRL, 8BSY, 8BVA, 8BXC, 8DZ, 8EF, 8EV, (8FT), 8JQ, 8LH, 8LS, 8NO, 8OI, (8RQ), 8HY, (8SP), 8TK, 8UC, 8VQ, 8XE, (8YAA), 8YN, 8ZAC, 8ZY, 9AAW, 9ACB, 9AEG, 9AGH, 9AIR, 9AMK, 9AMS, 9AOJ, 9AOU, (9APS), 9AQE, 9AQM, (9ASJ), 9DGX, 9DNJ, 9DPH, 9DQQ, 9DQY, 9DWP, 9DXM, 9DYU, 9FS, 9GP, (9GX), 9HR, 9JN, 9JQ, 9LF, 9ME, 9MC, (9UH), (9UU), (9VL), 9VZ, 9YM, 9ZJ.

CW: 1AFV, 1AJP, 1BCA, 1BCG, 1RU, 1UN, 1XK, 1XM, 1ZE. XF-1, 2AGB, 2ANZ, 2AWL, 2BB, 2BML, 2BRB, 2BYS, 2EH, 2EL, 2FD, 2FP, 2KL, 2NN, 2OE, 2QR, 2WP, 2XQ, WL-2, 3AAE, 3BZ, 3CA, 3DH, 3ZO, NZO, 4BT, 4BK, (4BY), 4CG, 4EB, 4EL, 4GL, 4ID, 4II, 4XC, 5KP, 5LA, 5XB, 8ALV, 8AOA, (8AXC), 8AWP, 8BFX, 8BK, 8BOG, 8BOX, 8BUM, 8DR, 8IB, 8KM, 8LX, 8VJ, 8XK, 8XU, 8ZZ, 9ARK, 9BDU, 9BNO, 9II, 9NX, 9US.

Fone: 8ZO, 9BNO, 8AXC, WDY, WJZ, KDKA.

4GE, Savannah, Ga.

Spark: 1AW, 1AEY, 2EL, 4BQ, 4AS, 5DA, 5XA, 5ZA, 5ZI, 5ZAB, 8ZY, 8HG, 8BEP, 8AFB, 8YAA, 9AR, 9GN, 9MC, 9YC, 9ZJ, 9DGX, 9DWP, 9AEK, 9AAW.

CW: 1UN, 1XM, 1BCG, 1BEP, 1AJP, 1XJ, 1QG, 2NN, 2QR, 2EH, 2XQ, 2FP, 2FD, 2AAX, 2AVU, 2AKO, 2AWL, 2AEB, 2AJW, 3MO, 3CA, 3RF, 3BEC, 4EN, 4II, 4FO, 4BQ, 4CO, 4GX, 4ZF, 5LA, 8BU, 8JL, 8IB, 8ZV, 8ZZ, 8XV, 8BOX, 8AQZ, 8BFX, 8AQV, 9II, 9NX, 9RT, 9DWJ, 9XAH, XF1, DL1, WL2, AN5, Can. 3BP.

4II, Orlando, Fla.

CW: 1AFV, 1ARY, 1AZW, 1BDI, (1QN), 2AAX, 2AAB, 2AJW, 2BYS, 2BGZ, 2BIS, (2DN), 2FQ, 2FZ, 2WP, 3BA, 3BZ, 3BIY, 3FM, 3HJ, 3IW, 3KM, 3LR, (3MO), 3SQ, 3VA, (3ZY), (4BK), (4BY), (4CD), 4CY, 4DQ, (4EL), (4GL), 4ID, (4XC), 5FV, 5KP, (5LA), 5MT, 5NZ, 5UU, 5XA, 5YA, (8AQV), 8AQF, 8AWP, 8BZJ, (8BFX), (8BOX), 8CAB, 8DR, 8GV, 8IH, (8IV), 8IQ, 8JS, 8IL, 8KI, (8LX), 8OW, 8UK, (8VJ), 8WY, 8XV, 8ZN, 8ZAE.

Univ. of North Carolina, Chapel Hill, N. C.

CW: 1DF, 1RU, 1UN, 1XM, 1ZE, 1AJP, 1ARY, 1AWB, 1BCG, 1BDI, 1BQE, 1BUA, 2BQ, 2NN, 2RB, 2TJ, 2XQ, 2XY, 2WL, 2ZL, 2AAB, 2AAX, 2ADL, 2AFG, 2AVU, 2AWK, 2AWL, 3BZ, 3CA, 3CC, 3FQ, 3FR, 3HX, 3MO, 3RF, 3RV, 3SQ, 3ZO, 3AAN, 3AWI, 4BQ, 4BY, 4CO, 4CY, 4EA, 4EL, 4JH, 4XC, 5DV, 8FB, 8HY, 8IQ, 8JS, 8MQ, 8TB, 8VY, 8WR, 8AHR, 8AKP, 8ALI, 8AQV, 8AWV, 8AWX, 8AWY, 8BEP, 8BFX, 8BKE, 8BMM, 8BMW, 8BNY, 9FQ, 9HK, 9II, 9JD, 9LQ, 9XM, 9YC, 9AAS, 9AJS, 9DDY, 9DKN.

Spark: 1AW, 1DA, 1XE, 1YD, 1AEV, 1AKE, 1ARY, 1BHO, 2BY, 2DA, 2PK, 2TS, 2AAD, 2AGB, 2AHK, 2AHU, 2ASH, 2AST, 3BP, 3DW, 3IW, 3KM, 3QJ, 3QW, 3SP, 3TT, 3XF, 3XM, 3XY, 3YM, 3ZJ, 3ZO, 3ZV, 3AAM, 3ACE, 3AHK, 3AOV, 3AQR, 3ARK, 3ARM, 3ATF, 3AUW, 3AVS, 3BFA, 3BJB, 3AXE, 4BX, 4BQ, 4CO, 4CX, 4DA, 4EA, 4XB, 5DA, 5DX, 5EK, 5EG, 5EL, 5FJ, 5JD, 5NR, 5XA, 5ZA, 5ZL, 5ZS, 5ZZ, 8AQ, 8CS, 8EF, 8EO, 8EW, 8JQ, 8NO, 8RQ, 8SP, 8SQ, 8TK, 8TL, 8TT, 8WO, 8XE, 8XS, 8YI, 8YN, 8ZA, 8ZX, 8ZY, 8AFB, 8AFD, 8AFG, 8AFQ, 8AGY, 8AIS, 8AJT, 8AMZ, 8ALT, 8AOE, 8AOI, 8ARD, 8AUE, 8AWK, 8AWY, 8AYN, 8AXQ, 8BDI, 8BEN, 8BEP, 8BGF, 8BRL, 8BUA, 8BVA, 8BWV, 8ZAA, 9AG, 9AO, 9AM, 9CS, 9DF, 9DQ, 9GN, 9GX, 9HP, 9JN, 9JQ, 9JY, 9KF, 9MC, 9ME, 9PS, 9SR, 9US, 9YA, 9YB, 9YC, 9YN, 9ZB, 9ZJ, 9AAP, 9ACL, 9AGH, 9AHR, 9AIR, 9AMK, 9AQE, 9ASJ, 9DQQ, 9DWP, 9YAC, 9ZAC.

Fone: 2BB, 2XB, 2XI, 2XR, 2ZZ, 3BZ, 3ZO, 8UV, 9XM.

5CI, Frost, Texas

CW: 1BCG, 4BQ, 4BY, 4CD, 4CO, 4EL, 4LE, 4XC, 4YA, 5AF, (5IR), (5JL), 5LA, (5ME), (5MT), 5XB, 5YI, (5ZA), 5ZAC, 5ZL, 6ALE, 6WV, 6ZZ, 8AUO, 8BEX, 8BOX, 8DV, 8IB, 8IC, 8II, 8IV, 8LX, 8UJ, 8ZG, 8ZV, 8ZZ, 9AAS, 9AAV, 9ACN, 9AIN, 9AJA, 9AJH, 9AKD, 9AMB, 9AVN, 9BAP, 9BAR, (9BBF), 9BEX, 9BHS, (9BIK), 9DVA, 9DWE, 9DWJ, 9DWO, 9DY, 9DZQ, 9FA, (9FM), 9GK, 9II, (9LQ), (9NX), 9RT, 9RY, 9UU, 9VG, 9XAE, 9XI, 9ZA, 9ZAC, 9ZAF, 9ZB, 9ZJ, 9ZT, 9ZV, XF1, NSF, WL2.

5KN, Port Arthur, Tex.

Spark: 4BQ, 4CO, 4DH, 5AO, 5BM, 5BY, 5CA, 5EW, 5FO, 5HB, 5HK, 5IF, 5IR, 5JD, 5JI, 5KC, 5KD, 5LC, 5MY, 5NC, 5NK, 5NS, 5PE, 5QA, 5QI, 5QQ, 5QS, 5SM, 5XA, 5XB, 5XI, 5XJ, 5XU, 5YI, 5YL 5ZAB, 5ZS, 5ZW, 5ZX, 5ZZ, 6AFP, 6YW, 8CF, 8EB, 9AAW, 9AHC, 9AIG, 9AIR, 9ALK, 9AMA, 9AMT, 9ANF, 9AMC, 9AVE, 9DEH, 9DLX, 9DMJ, 9DPA, 9DPH, 9DWJ, 9DZE, 9DZI, 9EL, 9GN, 9HK, 9HM, 9HI, 9HT, 9NX, 9OA, 9OX, 9PS, 9TV, 9WT, 9WU, 9YAK, 9ZAC, 9ZB, 9ZJ.

CW: 1BCG, 4BY, 4EL, 4FJ, 4GL, 4IL, 4ZF, 5JL, 5XJ, 6WV, 8AWP, 8BFX, 8BO, 8DR, 8II, 8IV, 8VJ, 8VY, 8XK, 9AJH, 9AYU, 9BED,

9BIK, 9BLO, 9BHI, 9DJF, 9DBJ, 9DWJ, 9FM, 9NV, 9TF, 9ZB, 9ZV, 9ZAF.

5LO, Miami, Oklaoma

Spark: 4BQ, 4GN, 4XC, 5AE, (5AQ), 5BA, (5BM), 5BY, 5EK, 5EW, (5FO), 5HJ, 5HK, 5HZ, 5IF, 5IR, 5IS, (5JD), 5JI, 5JR, 5KC, 5KP, 5LB, 5MK, 5MY, 5NC, 5NH, 5NS, 5OI, 5PE, 5QI, 5QS, 5RA, 5SM, 5TP, (5XA), 5XB, 5XJ, 5XT, 5YN, (5ZA), (5ZL), 5ZU, 5ZW, 5ZAB, 5ZAG, 5ZAK, 7ZJ, 8KP, 8VL, 8YN, 8ACF, 8AFD, 8ANO, 8AVH, 8BEP, 8ZAC, 9BI, 9BP, 9CA, 9CP, 9DF, 9EE, 9FS, 9GS, 9HI, 9HK, 9HR, 9HM, (9JN), 9JQ, 9JW, 9KF, 9LF, 9LW, 9MC, 9NR, 9OA, 9OI, 9OO, 9OX, 9PI, (9PS), 9QR, 9RC, 9TL, 9UG, 9VA, 9VL, 9WI, 9WT 9WU, 9YM, 9ZJ, 9ZN, 9AAP, 9ABV, 9ACB, 9ACL, 9ADR, 9AEG, 9AEK, 9AEY, 9AFX, 9AGN, 9AGR, 9AIF, 9AIG, 9AJH, 9AMA, (9AMK), 9ANF, 9ANI, 9ANO, 9OJ, 9OU, 9APN, (9AQE), 9AQM, 9ARG, (9ARZ), 9ASD, 9ATN, (9AVI), 9AWN, 9AWX, 9AYH, 9AYV, 9AYW, 9AZA, 9AZE, 9BDE, 9BDS, (9BNJ), 9BQT, (9BXM), 9DBM, 9DBS, 9DCX, 9DEU, 9DFA, 9DFL, 9DFX, (9DHB), 9DKQ, (9DMJ), 9DPH, (9DQQ), 9DSD, 9DVX, 9DWB, 9DWP, (9DXD), 9DXM, 9DYA, 9DYU, 9DZE, 9DZY, (9XAQ), 9YAC, 9YAK, AN5, MSP.

CW: 1BCG, 2FP, bux. mod., 2NB, 2XQ bux. mod., 2ZL, 3CA, 4BK, 4BL, 4BQ, 4BY, 4CD, 4CO, 4EH, 4EL, 4GL, 4XC, 4XD, 5KP, 5LA, (5MT), 5XJ, 5YI, 5ZA, 6WV fone, 6XAE fone, 6ZZ, 8CF bux. mod., 8CI bnz. mod., 8II, 8JL, 8SP, 8UJ, 8VJ, 8XK, 8XV, 8AGZ, 8AIL, 8AIO, 8ALB, 8ASV, 8AWP, 8BFX, 8BMW, 8BNJ, 8BOX, 8BOZ, 8BRL, 8BVJ, 8BXA, 8CAB, 9CR, 9FM, 9GK, 9GL, 9HW, 9II, 9IL, 9KX, 9NX, 9OH, 9PG, 9TV, 9XI, 9ZY CW & bux. mod., 9AAS, 9AAU bux. mod., 9AAY, 9AJA, 9AKR, 9AMB, 9AOG, 9AOS, (9AQR), 9AYB, 9AYS, 9BAP, 9BBF, 9BIK, 9BLO, 9BNO fone, (9BOW), 9DDY, (9DHB CW & fone), 9DJB, 9DKX, 9DOF, 9DPE, 9DTA, 9DTM, 9DUP fone, 9DVA, 9DWJ, 9DZQ, NMW, NSF CW & bux. mod.

5AA, New Orleans

1BCG, 2EL, 2FP, 2AJF, 2ZL, 2AWL, 3AL, 3BL, 3BP, 3BZ, 3MO, 3AHK, 4AE, 4AN, 4AS, 4AT, 4BQ, 4BY, 4CG, 4CN, 4CP, 4DH, 4EH, 4EI, 4EL, 4FD, 4FF, 4GL, 4GN, 4ZC, 5BM, 5BY, 5DA, 5EK, 5ER, 5FA, 5FO, 5FV, 5HK, 5HZ, 5IC, 5ID, 5IF, 5IR, 5IS, 5JD, 5JI, 5KC, 5KP, 5LO, 5LX, 5MA, 5MY, 5MT, 5NC, 5NF, 5NH, 5NK, 5NS, 5OF, 5QA, 5QQ, 5QS, 5QX, 5QY, 5XA, 5XB, 5XJ, 5XK, 5XR, 5XT, 5XU, 5YB, 5YL, 5YN, 5ZA, 5ZC, 5ZI, 5ZL, 5ZO, 5ZR, 5ZS, 5ZT, 5ZU, 5ZW, 5ZX, 5ZAA, 5ZAB, 5ZAF, 5ZAG, 5ZAM, 5ZAK, 5ZAN, 8BK, 8BO, 8BU, 8DE, 8DR, 8FI, 8FQ, 8HA, 8HJ, 8II, 8IQ, 8JM, 8JP, 8JQ, 8LX, 8OI, 8ON, 8RB, 8SP, 8TN, 8UJ, 8VJ, 8VY, 8XE, 8XK, 8XV, 8YM, 8YN, 8YR, 8ZN, 8ZR, 8ZY, 8ACF, 8ACL, 8AFB, 8AFD, 8AGK, 8AYN, 8ZG, 8AFS, 8AKS, 8ARD, 8ARG, 8AUH, 8AQF, 8AYN, 8BEN, 8BEP, 8BPL, 8BRL, 8BUM, 9DW, 9EL, 9ET, 9FS, 9FU, 9FZ, 9GN, 9GX, 9HD, 9HI, 9HM, 9HR, 9HS, 9HT, 9IY, 9JN 9JQ, 9KO, 9LF, 9LW, 9LQ, 9MC, 9ME, 9MN, 9NH, 9NQ, 9NR, 9NX, 9OR, 9OX, 9PS, 9QH, 9RY, 9TV, 9UC, 9UG, 9UH, 9UU, 9VG, 9VV, 9WI, 9WT, 9WU, 9XI, 9XJ, 9XM, 9YA, 9YB, 9YM, 9YO, 9YT, 9YAE, 9YAK, 9ZB, 9ZJ, 9ZAC, 9AAK, 9AAP, 9AAY, 9ACB, 9ACL, 9ACN, 9AEG, 9AEY, 9AFL, 9AFX, 9AIO, 9AIP, 9AIR, 9AIY, 9AJH, 9AMA, 9AMB, 9AMK, 9AMS, 9AMT, 9AMV, 9ANF, 9ANO, 9API, 9AQA, 9AQE, 9AQM, 9AQK, 9ASJ, 9ASL, 9ATI, 9ATN, 9AVN, 9AWN, 9AWX, 9AWU, 9AWZ, 9AXU, 9AYH, 9AYW, 9AZA, 9BBF, 9BCX, 9BDS, 9DAZ, 9DCX, 9DKQ, 9DHP, 9DQL, 9DQQ, 9DUG, 9DWJ, 9DWP, 9DXM, 9DYU, 9DZJ.

5JD, Little Rock, Ark.

2FP, (3AHK), 3BP, 3DH, (3XF), 4CG, (4DH), 4YA, 5AA, 5BM, 5DA, (5EK), (5ER), 5FO, 5FV, (5HK), 5IF, (5IR), 5IS, 5JA, 5JI, (5KP), 5LC, 5NC, (5NH), 5NK, (5NS), 5PE, (5QA), 5QI, (5QS), 5QT, 5TG, 5TP, (5UC), (5XA), (5XB), (5XJ), (5XT), (5XU), 5YK, (5YL), 5ZA, (5ZAA), (5ZAB), 5ZAD, 5ZAG, (5ZAK), 5ZAM, 5ZC, (5ZS), (5ZW), 5ZX, (8ACF), 8AEG, 8AFB, 8AIO, (8AUE), (8AYN), (8BEP), 8LX, 8RX, 8XE, (8ZF), 8ZU, (8ZY), 9AAP, 9AAS, 9AAU, (9ABV), 9ACB, 9AEG, 9AFX, 9AIQ, 9AIR, 9AJU, (9AMA), 9AMK, 9AMS, 9ANF, 9AOE, 9AOJ, 9AOM, 9AQA, (9AQE), 9AR, 9AUO, 9AWX, 9AYH, 9AYV, 9AYW, 9AZA, 9BKG, 9CP, 9DC, 9DEH, 9DFL, 9ROI, 9DPH, (9DQQ), 9DSD, 9DUG, 9DUX, 9DWP, (9DZE), (9DZI), 9DZL, 9EE, (9HI), (9HT), (9JN), (9JQ), 9KO, (9KA), 9LF, 9LQ, 9LW, 9MC, 9NR, (9PS), 9TV, 9UG, 9WI, (9WT), 9XI, 9XM, (9YAE), (9YAK), 9YB, 9YC, (9YM), 9YO, 9ZAA, (9ZAC), (9ZB), (9ZJ), 9ZN, 9ZY.

6ACY, Pasadena, Calif.

5IF, 5ZA, 5ZJ, (6AH), 6AK, 6AS, 6BW, 6CZ, 6DR, (6EX), 6FH, 6FJ, (6FK), (6GF), (6GR), (6GX), (6HC), 6JB, (6KC), 6LU, (6OC), (6OH), (6PJ), 6PR, (6QK), (6QR), 6SK, (6TU), (6TY), 6UO, (6UK), (6VX), (6WZ Spk. & CW), 6WO, 6ZB, 6ZX), 6ZZ, 6AAK, 6AAT CW, 6AAU, 6ABH, (6ABM), (6ACM), 6AEH, (6AEI), 6AEW, 6AFN, (6AGF), 6AGL, 6AKL, 6ALA, 6AMK, (6AOL), 6APH, 6APE, (6ARW), 6ASP, (6ATQ), 6ATV, 6AUD, 6AVB, 6AVC, 6AVW, 6AVZ, 6AWT, (6XAD), 6XAT, 6ZAD, 7BH (7HF), 7HK, 7IN, 7IW, 7KS, (7MF), 7MP, 9HB, 9JI, 9WI, 9WD, 9BD Can., 9AMB, 9ZAF.

6AIF, Bakersfield, Cal.

Spark: 5VQ, (5ZA), 5ZJ, (6AAH), 6AAU, (6ABW), (6ABX), 6AC, (6ACR), 6ACY, 6ADA, 6AEH, 6AEI, (6AEZ), 6AFN, 6AFY, (6AGF), (6AH), (6AHP), (6AHV), 6AHY, (6AIB), 6AIL, (6AIO), 6AJR, 6AK, 6AKL, 6AKT, 6ALA, 6ALL, (6ALP), 6ALU, 6AMK, (6AMN), (6ANG), 6ANI, 6AOA, (6AOE), 6APE, 6ARK, 6ARW, (6AS), 6ATQ, 6ATV, 6AU, 6AUD, (6AVB), (6AVV), 6AWH, 6BAK, 6BAZ, 6BCJ, 6BFE, 6BFX, 6BGL, 6BW, 6CV, 6CZ, 6DA, 6DM, (6EA), 6EB, (6EN), (6EX), (6FH), (6FK), 6GF, 6GP, 6GR, 6GT, 6GX, (6HC), (6IB), 6IK, 6IS, 6JC, 6KA, (6KC), 6KP, 6KS, 6KY, 6LC, 6LU, 6MF, 6MO, (6MH), 6NG, (6OC), (6OD), 6OH, 6OT, 6PC, 6PJ, (6PR), 6PT, (6QR), 6SC, 6SJ, 6ST, (6TF), (6TO), 6TU, 6TV, 6UO, 6VK, (6VX), (6WH), 6WO, 6WZ, 6YN, 6ZAL (ex 6KA), 6ZAM, 6ZB, 6ZE, 6ZU, (6ZX), (6ZZ), (7BA), 7BH, 7BJ, 7BK, 7CW, 7FI, 7FT, (7HF), 7IJ, 7IN, 7IW, (7JD), 7KB, 7KE, 7LY, (7MF), 7MP, 7MU, (7OT), 7TJ, 7YA, 7YG, 7ZB, 7ZO, 7ZP, 7ZT, 7ZU, 9WU, 9YAL, Canadian 9AX, Canadian 9BD.

CW: (5ZA), 6AAT, (6ABX), (6ALE), 6ARC, 6ASJ, 6ASX, (6AUL), 6AVY, 6AWT, 6AWV, 6DR, 6JD, 6JQ, 6JX, 6KM, 6OO, 6WV, 6WZ, (6XAD), 6ZA, 6ZAD, (6ZN), 7XF (CW & ICW), (9AMB), 9BEX, 9DTM, 9DVA, 9NX, 9XM, WL2, CL8, AG1, "MC" (Chiuahua, Mexico).

Irving Pinkerton, Nogales, Arizona.

CW: 4GL, 5BBB, 5JL, 5KP, 5XB, 5YI, 5ZA, 5ZAN, 6AVY, 6GD, 6JD, 6LD, 6WV fone, 6XAC fone, 6XAD, 6XAF fone, 6XG, 6XAZ, 6ZA, 6ZB, 6ZN, 6ZZ, 8XK, 8XV, 9AMB, 9ARJ, 9AYJ, 9BJH, 9BJI, 9DES, 9DTM, 9FM, 9NX, 9WD, 9ZAF.

Spark: 5AO, 5BY, 5HK, 5HM, 5IF, 5IR, 5MJ, 5RA, 5XA, 5XJ, 5XU, 5ZA, 5ZAG, 5ZJ, 5ZAK, 5ZR, 5ZZ, 6AAA, 6AAH, 6AAK, 6ACY, 6AEZ, 6AIF, 6ATG, 6EL, 6EN, 6KA, 6KC, 6LC, 6OD, 6QR, 6TV, 6GF, 6ZR, 6ZZ, 7MO, 7YA, 7ZM, 9AQE, 9NR.

6ACM, Berkeley, Calif.

Spark: 6AK, 6BM, 6DA, 6DP, 6EA, 6EB, (6EF), 6EN, 6ER, 6FD, 6FH, 6FK, (6GF), (6GR), 6GT, (6GP), 6GX, (6IS), (6IV), (6KA), 6KC, 6KM, 6KP, 6KS, 6KV, (6KY), (6LC), (6MH), 6OD, 6OH, 6OL, 6OM, (6QR), 6TF, 6TO, 6TV, 6UO, 6VV, 6VZ, 6WH, 6AAB, 6AAK, 6AAS, 6AAU, 6ABM, 6ABP, 6ABW, (6ABX), 6ACY, 6ACZ, 6ADG, 6ADL, 6AEH, 6AEI, 6AFN, 6AFY, 6AFZ, (6AGF), 6AGM, 6AGP, 6AHA, (6AHP), (6AHU), 6AHV, 6AIB, 6AIF, (6AIO), 6AJH, 6AKL, 6AKW, 6ALL, 6ALP, 6ALU, 6AMN, 6ANP, 6ARW, 6AUH, 6AVB, (6AVD), 6AVV, 6AVY, 6BAK, 6BAZ, 6BEZ, 6ZB, 6ZU, 6ZX, 6ZZ, 6ZAL, 7AH, 7BB, (7BH), 7BJ, (7BK), 7BR, 7BS, 7FI, (7HF), 7IN, (7JW), 7KB, 7KE, 7KH, 7KQ, (7MF), 7MU, 7NL, 7NW, 7OT, 7OZ, 7TJ, 7YA, (7ZJ), 7ZK, 7ZN, 7ZT, 7ZU, 9AX, 9CP, 9ED, Can. 9BD.

CW: 6DP, 6PR, 6ABG, 6ABX, 6AJH, 6ALE, 6ALU, (6AOY), 6AOZ, 6XAB, 6XAD, 7XF.

6BM, Grass Valley, Calif.

Spark: 6AAH, 6AAK, (6AAU), 6ABR, 6ABW,

6ABX, 6ADL, 6ACY, 6AEH, 6AEZ, 6AEI, 6AHP, 6AFN, 6AGP, 6AHV, 6AIB, 6AIF, 6AIX, 6AK, (6ALP), 6ALU, 6AMK, 6MN, 6AMX, 6ANI, 6ANP, 6APE, 6ARW, 6AS, 6ATF, (6AVB), 6AVV, 6AWH, 6BAZ, 6BG, (6BBB), 6BCA, 6BFX, 6DA, 6DP, 6DR, 6EB, 6EN, 6EX, (6FH), 6FT, (6GR), (6GF), 6GT, 6GX, 6GY, 6IB, 6IS, 6IV, 6JW, 6JY, 6KA, 6KC, 6KY, 6LC, (6LU), 6MH, 6MK,6MZ,6NG, 6OD, 6OC, 6OT, 6QK, 6QR, 6RN, 6TO, 6TU, 6TV, 6VM, 6VX, 6ZB, 6ZAM, 6ZAL, 6ZM, 6ZR, 6ZU, 6ZX, (7BH), 7BJ, (7BR), 7FI, 7GE, 7IN, (7IW), 7IY, 7JD, 7KE, 7LN, 7LY, 7MF, 7MU, 7TJ, 7YA, 7YG, 7ZH, 7ZJ, 7ZP, 7ZT, 7ZU, 9AX, 9BD.

CW: 4CB, 5ZA, 6AAG, 6AH, 6ALU, 6AOZ, 6AVY, 6AWV, 6JD, 6JX, 6GY, 6WZ, 6XAD, 6XS, 6ZA, 7BF, 7RN, 7XF, 9JI, CL-8 MC, MR.

Fone: 6AAT, 6AFX, 6ARJ, 6AVR, 6VM, 6XAC, 6XAJ, 6XAG, 6XC, 6XD, 6XG, 7XF, 9ZAF, AG1.

7GK, Evanston, Wyo.

Spark: 5IF, 5LA, 5LO, 5LT, 6AEQ, 6GG, 6IF, 6LA, 6SJ, 6SW, 6ZX, 7EX, 7HW, 7JD, 7LU, 7LY, 7MD, 7ZO, 7ZV, 9AEV, 9AIG, 9AMA, 9AVR, 9EE, 9LW, 9NA, 9NR, 9PE, 9PI, 9SI, 9TG, 9YAK, 9YN.

CW: 6KA, 9AIG, 9AMB, 9BBF, 9DTM.

7FT, Kuna, Idaho

Spark: 5XU, 5ZA, 6AF, 6AK, 6BQ, 6BR, 6CV, 6DP, 6EB, 6FX, 6HX, 6IK, 6IV, 6JJ, 6KM, 6LA, 6LC, 6OA, 6OT, 6SJ, 6TO, 6ZB, 6ZM, 6ZR, 6ZU, 6ZZ, 6ACR, 6AEQ, 6AEZ, 6AIF, 6AIR, 6ALH, 6AME, 6AMK, 6APE, 6AWI, 6AWS, 7BJ, 7DG, 7JD, 7JF, 7LD, 7LK, (7LN), (7LO), 7LY, 7NR, (7OT), 7PY, 7RA, 7RY, 7VO, 7YA, 7YG, 7YJ, 7YL, 7YS, 7ZB, 7ZE, 7ZL, 7ZM 7ZP, 7ZR, 7ZT, 7ZU, 7ZV, 9EE, 9OA, 9PI, 9WU, 9YA, 9ZX, 9AEY, 9AQE, 9XAQ, 9YAK.

CW: 5ZA, 6EN, 6KA, 6WV, 6ZA, 6ALE, 6XG, 6XAC, 6XAK, 7TQ (QRA), 7YA, 7ZE, 9RV, 9XR, 9AAO, 9AMB, 9XAQ, 9ZAF.

7GE, Pasco, Wash.

Spark: 6AK, 6AW, 6AX, 6CV, 6DD, 6DP, 6EA, 6EN, 6EX, 6EY, 6GB, 6GF, 6GQ, 6GR, 6GT, 6GY, 6JX, 6KA, 6KM, 6LC, 6LX, 6MH, (6QR), 6TO, 6TU, 6VX, 6VY, 6WZ, 6ZX, 6AAT, 6AAU, 6ABJ, 6ABM, 6ABX, 6AEX, (6AFN), 6AFY (6AGF), 6AIF, 6ALA, 6ALP, 6AMK, (6APE), 6ARC, 6ARD, 6ASJ, 7AU, (7BA), 7BF, 7BG, 7BH, (7BJ), (7BK), 7BR, 7BZ, 7CW, 7EE, (7FI), 7FL, (7HF), 7HI, 7IM 7IN, 7IW, 7JF, 7JJ, (7JW), 7KB, 7KE, 7KS, 7LA, (7LY), (7MF), 7MO, 7MY, 7MZ, 7NJ, (7NL), 7NW, 7NZ, 7ON, 7OO, (7TJ), 7TL, 7VO, (7VZ), 7WA, 7WM, 7ZJ, 7ZN, (7ZT), 7ZU, (9AX) Canadian, 9BD, Canadian.

CW: 4CB, 6AA, 7CE, 7XF.

7KS, Astoria, Oregon

6FK, (6GR), 6GX, 6KM, (6LU), 6MG, 6NG, 6OL, 6PG, 6QR, 6TU, 6ZK, 6ZX, 6AAU, 6ABX, 6ADC, (6AGF), 6AIX, 6AMK, 6APE, 6APH, 6ATQ, 6ATZ, 6AWH, 6AWI, 7BH (7BJ), 7BP, 7DW, 7FI, 7FT, 7HF, 7HM, 7JM, (7KE), (7MF), (7MP), 7NL, 7NN, 7UZ, 7XA, 7YA, 7ZK, 7ZT, Can. 9AX, (Can. 9BD).

8BA, Detroit, Mich.

CW: 1ARY, (1AKB), 1AZW, 1BCG, 1CAK, 1QN, 1RU, 1XM, 1ZE, 2AAX, 2ANZ, 2AUF, (2BAK), 2BFZ, 2BOW, (2BSC), 2BYS, 2CCL, 2BB, 2FD, 2FP, 2FQ, 2KP, 2WP, 2XQ, (3BIY), 3BA, 3BZ, 3EM, 3HG, 3HX, 3LR, 3RF, 3ZY, 4BQ, 4BY, 4EL, 4II, 8ADR, 8ADY, 8AGZ, 8AQV, 8AUC, 8AWK, 8AWP, 8AXC, 8BDX, (8BET), 8BFX, 8BBL, (8BXA), 8BZO, 8BUM, 8BVR, 8BK, 8CI, 8IV, 8JL, 8LF, 8NX, 8VY, 8VJ, 8XK, 8XL, 8XM, 8XV, 8ZG, (9AJA), 9AWJ, 9BBF, 9DOF, 9XAH, 9AW, 9DV, 9II 9YB.

Spark: 1AW, 1APO, 2AAM, 2AHK, 2BK, 2CM, 2DN, 2OM, 2RP, 2TS, 3AQR, 3BP-Canadian, (3CG), 3HJ, (3IW), (3VW), 3XM, 3ZO, 3ZV, 4BQ, 4DH, 4EA, 4FD, 4GN, 4YA, 5DA, 5DL, 5HK, 8AFB, 8AFD, 8AHY, 8AIZ, (8AJW), 8APB, 8AUE, (8AVT), 8AVO, (8AWP), 8BDY, 8BEN, 8BGA, (8BGT), (8BRL), 8BVA, 8ZAC, 8ZAN, 8EW, 8JQ, 8KP, 8QC, 8MJ, (8SP), 8UP, 8VL, 8WO, (8XE), 8ZP, (9ACB), 9ALS, 9AMA, 9AMK, (9AOE), 9AQE, 9AQM, 9ASJ, 9AVP, 9AWX, 9AZE, 9BDE, (9DLX), 9DPH, (9DQQ), 9DXM, 9AM, 9CP, 9HM, 9HR, 9JN, 9JQ, 9MC, (9OX), 9QH, 9RY, 9TL, (9UH), 9VA, 9WT, 9ZN.

8BHV, Belington, W. Va.

Spark: 1AW, 1BQ, 1BW, 1CC, 1XM, 1YM, 1AEV, 1AME, 1ARB, 1ARY, 1BWP, 2AU, 2BG, 2OM, 2WB, 2AEW, 2AJE, 2AIM, 2AOU, 2AST, 2BAK, 8AN, 8BG, 8CC, 8FB, 8GE, 8HJ, 8LP, 8QR, 8QW, 8SQ, 8XA, 8XT, 8ZV, 8AQR, 8ARM, 4AU, 4BQ, 4CX, 4DQ, 4GS, 4HT, 4XA, 5DA, 5PY, 5XA, 8AC, 8AS, 8AU, 8AX, 8BA, 8BC, 8BN, 8DY, 8DZ, 8EF, 8EO, 8FA, 8FT, 8HG, 8HJ, 8HL, 8HY, 8IN, 8JO, 8JU, 8KY, 8LF, 8LS, 8LX, 8MJ, 8NO, 8PJ, 8PP, 8PQ, 8PU, 8RQ, 8SG, 8SP, 8TT, 8TV, 8UR, 8VQ, 8WO 8WR, 8WZ, 8YN, 8ZL, 8ZN, 8ZY, 8ZZ, 8AAG, 8ACF, 8AER, 8AFB, 8AFD, 8AFG, 8AFZ, 8AHH, 8AIR, 8AIZ, 8AJE, 8AJT, 8AKQ, 8AMZ, 8ANB, 8ANO, 8AOO, 8APB, 8APT, 8AQV, 8ARD, 9ASS, 8ATU, 8ATW, 8AUE, 8VE, 8AYN, 8AYR, 8AYW, 8AYZ, 8YAA, 8BBA, 8BCF, 8BCI, 8BCK, 8BEE, 8BEP, 8BFS, 8BFX, 8BIY, 8BPI, 8BPU, 8BRC, 8BSY, 8BUN, 8BVA, 8BWA, 8CAA, 8CAY, 8ZAE, 9AF, 9AS, 9AQ, 9AZ, 9BA, 9CA, 9DR, 9FG, 9FU, 9GX, 9HR, 9MC, 9ME, 9QX, 9SM, 9SR, 9TF, 9TL, 9TR, 9UH, 9UU, 9UL, 9UW, 9YM, 9ZX, 9AAW, 9AAX, 9ACD, 9AEN, 9AFX, 9AGH, 9AIR, 9APT, 9ARR, 9ASP, 9AUX, 9AYS, 9AYH, 9AYW, 9AZA, 9AZE, 9BDI, 9BFO, 9BTT, 9DBU, 9DMO, 9DQQ, 9DRX, 9DSP, 9DVM, 9DWP, 9DXM, 9DYM, 9DYU, 9DYW, 9DYX, 9DZU.

CW: 1AAB, 1AME, 1ARY, 1AWL, 1BWP, 2FP, 2WB, 3CC, 3AHK, 3JQ, 3LJ, 3SP, 8AOO, 8AQV, 8AYZ, 8BBA, 8BFX, 8BIP, 8BPI, 8BRC, 8BUM, 9NX.

8BOX, Tippecanoe City, Ohio

CW: 1BDI, 1BCG, 1ARY, (2AAB), 2AAX, 2ANZ, 2AKO, (2AWL), 2AAK, 2BML, (2BAK), 2BAD, 2EH, 2FP, 2FD, 2UD, 2VA, 2WX, 2WP, 2XQ, 2ZL, (3AAE), (3AHK), 3BP, (3BIY), 3MO, 3XQ, (3XY), 3YA, 4GL, 4AI, 4BY, 4BQ, 4CO, 4CD, (4EL), 4II, 4XC, (5JL), 5XB, 5YI, 5ZA, 8AMI, 8APT, 8AIO, 8ARV, (8AKP), 8AIL, 8ADY, (8AXW), 8AQR, (8AUO), 8AQF, (8ADE), 8AQV, 8AGG, 8AOG, 8AMQ, (8AWY), (8ATU Spk.), 8ALY, 8AGZ, 8AHR, (8BK), 8BU, (8BO), 8BXH, 8BCI, (8BFX), (8BEX), (8BMW), 8BDO, 8BZO, 8BBA, 8BZC, (8BUM), 8BRL, 8BOG, (8BSQ Spk.), (8BXA), 8BOW, 8BUL, 8BZJ, (8CAB), 8CBR, 8DV, 8DX, 8FJ, 8GV, 8HD, (8IV), (8IB), 8IC, 8IQ, 8II, 8JL, 8JQ, 8LJ, (8LF), 8OH, 8LX, 8BQ, 8UJ, 8UK, (8UZ fone), 8VJ, 8VY, 8WL, 8XK, 8XV, 8XAE, 8ZU, 8ZG, (8ZZ), 8ZL, (9AJA), (9AAV), (9AUC spk.), (9AMB), (9AGH spk.), 9AVN, 9ARK, 9AKK, 9AKR, 9AKA, (9BBF), (9BIK), 9BED, (9DWJ), 9DP, (9FM), 9FE, 9GK, 9GL, (9II), (9IO), 9JL, (9LQ), 9LF, (9NX), 9KR, (9RT), 9UU, 9UR, 9VG, 9WC, (9XI), 9YAE, 9XM, (9ZN spk.), (9ZY), (9XAH), 9ZB, 9ZC, (NSF), (WL2), (WA9), (XF1).

8LX, Crafton, Penna.

Spark: 1AW, 1RV, 1BDC, 2BK, (2DN), (2EL), (2OM), (2TF), 2XQ, (2ARY), 3BF, Can. 3BP, 3CC, 8DH, 8LP, 8XM, 8ZA, (8AHK), 4ET, 4XC, 5AA, 5DA, 5JD, 5LO, 5XA (dalite), 5XU, 5ZA, 5ZL, 5ZZ, 8AS, 8AY, 8BA, 8CO, 8EA, 8EB, 8EF, 8EZ, 8FT, 8JL, 8NO, (8OI), (8PM), 8QQ, 8SP, 8TJ, 8WZ, 8XE, 8YV, 8ZAA, 8ZAC, 8AFB, 8AFD, 8AGK, (8ANO), (8AQV), 8ARD, 8AYN, 8BAZ, 8BDU, 8BEP, 8BNT, 8XAC, 9AF, 9AM, 9AU, 9AV, 9DQ, 9EE, (9FZ), 9HM, 9HT, 9IF, 9JQ, 9LO, 9LW, (9MC), 9ME, 9MH, (9OX), 9PS, 9TV, (9UH), (9UU), 9XI, 9YA, 9YH, 9YO, 9ZJ, 9ZL, (9ZN), 9ZX, (9AAW), 9AAP, 9ACB, 9AGR, 9AIW, 9AJN, 9AKD, 9ANE, 9AOU, 9AOJ, 9AOX, 9AQM, (9ASN), 9AVE, 9AWW, 9WZ, 9XU, 9AYW, 9DLX, 9DQQ, 9DZI, (9YAE), 9YAD, XF1.

CW: 1CF, 1DS, 1PE, (1PT), (1QN), 1QP, 1QR, (1TS), (1VW), 1XM, 1YM, 1ZE, 1AFV, (1AJP), 1ARY, (1AZW), (1BEG), (1BEA), (1BFZ), 1BOI, (1BWJ), (1CAK), (2AW), 2BK, (2DN), 2EH, 2FD, 2FP, (2KL), (2NN), (2OE), (2OM), (2RR), 2TH, (2VA), (2RB), (2WL), (2WP), 2XQ, 2ZV, (2AAB), (2AAX), 2ABR, (2AFP), 2AQU), 2AWO, (2AWL), 2AWV, 2BEB, 2BML, (2BRB), Can. 3BP, 3CA, 3CC, 3DH, (3EM), 3FX, (3IW), 3LR, (3MO), (3RF), 3TJ, (3ZO), (3ZY), (3ZZ), 3AAY, 3AFV, (3AHK), 3BAG, 3BEY, 3BHL, (3BIY),

8BYZ, 4BG, 4BK, (4BQ), (4BY), 4CD, (4CO), (4GL), (4II), 4XC, 5LA, 5UU, (6XAD), 8AJ, 8BK, (8CP), (8EA), (8EB), (8EW), 8GE, 8GV, (8IB), (8II), (8IV), (8JL), 8KM, 8LU, 8OH, (8OI), (8QY), (8SE), (8SP), 8SZ, (8UJ), (8UK), 8UZ, (8VJ), (8VY), (8WR fone), (8WY), 8ABO, 8AEC, (8AGZ), (8AKJ), 8AKP, (8AMK), (8AMQ), (8ANO), 8AOG, (8AOO), (8APT), (8AQF), (8AQV), (8AQZ), 8ARL, 8AWF, (8AWK), (8AWP), 8AXO, 8BEF, 8BFX, 8BMW, 8BNJ, (8BOX), 8BQM, 8BUJ, (8BUM), (8BXA), 8BZC, 9HD, (9HW), (9II), (9LE), 9NX, 9RT, 9VC, (9VD), (9VE), (9VG), 9XI, 9XM, (9ZB), (9ZV), 9ZY, 9AAP, (9AAS), (9AAW), (9AJA), (9AJH), 9ANR, 9ARK, 9ASJ, 9AVB 9AVN, 9AWW, (9BBF), (WL2), (XF1).

8BRI, Rome, N. Y.

Spark: 1ACG, 1AEV, 1APO, 1AW, 1BDT, 1BIS, 1BRW, 1CM, 1CK, 1DY, 1DZ, 1HK, 1HO, 1IA, 1MA, 1ZE, 2AER, 2AGT, 2AHK, 2AHR, 2AHU, 2AID, 2AIM, 2ARB, 2ARM, 2ASF, 2ASL, 2AWZ, 2BK, 2CG, 2DA, 2DN, 2EA, 2EL, 2JW, 2NM, 2OM, 2OQ, 2TS, 3AC, 3AHF, 3AHK, 3AIC, 3AQR, 3BFU, 3BG, 3SG, 3CN, 3DM, 3FB, 3FP, 3IW, 3PU, 3UW, 4AW, 4EA, 5DA, 8ACB, 8ACF, 8AFO 8AHU, 8AJT, 8AKA, 8AKE, 8AMZ, 8AOZ, 8APB, 8ARD, 8AXO, 8BAC, 8BCO, 8BCW, 8BFH, 8BHV, 8BMZ, 8BRL, 8BSY, 8BUH, 8BZU, 8CG, 8CH, 8DC, 8FP, 8HL, 8IX, 8KA, 8KY, 8SP, 8TK, 8TT, 8UC, 8VF, 8YAA, 9AAW, 9AGR, 9AIR, 9DWP, 9GP, 9HM, 9YM, Can. 3EI.

CW: 1AFV, 1AJP, 1BCG, 1BEA, 1BK, 1BKA, 1BQE, 1CDR, 1CJH, 1CYR, 1DA fone, 1FD, 1IN, 1RU, 1UN, 1XM, 1XK, 1YK, 2AGB, 2AJW, 2AWF, 2AWL, 2BEA, 2BML, 2BQ, 2BQT, 2BRB, 2BSC, 2BYS, 2CD, 2EH, 2FP, 2KL, 2OE, 2UD, 3BHL, 3DH, 3HI, 3TR, 4DC, 4GL, 8AHR, 8AMM, 8AWP, 8BUM, 8FO, 8OQ, 8TB, 8UJ, Can. 8UJ, Can. 9AW.

8BCK, Cleveland, O.

1AW, 1RV, 1XM, 1ADC, 1AMD, 1APO, 1APW, 1ARY, 1AWK, 1BGF, 1BVB, 2BP, 2BY, 2BQ, 2EL, 2FP 2OM, 2OO, 2TJ, 2TS, 2WB, 2YH, 2AHS, (2AIM), 2ARB, 2CHJ, 3BG, 3BP, 3CG, 3CN, 3DH, 3HG, 3IW, 3UQ, 3ADJ, 3ADT, 3AHK, 3AQR, 3ARM 3AUW, 4BQ, 4EA, 4GN, 5XA, 5ZN, 5ZAB, 8NO, (8QH), 8UP, 8VQ, 8YN, 8ACF, (8AIZ), 8AOT, 8ASC, 8AWX, 8YAA, 9CA, 9GX, 9TO, 9UU, 9WD, 9AEG, 9AIU, 9AQM, 9AQR, 9AWX, 9AZA, 9AZR, 9BDS, 9BYU, 9DWP, 9DZE, 9DZU.

9DKQ, Sioux Falls, S. D.

Spark: 2FP, 3UJ, 4CX, 5AL, 5BM, (5BY), 5DA, 5EK, 5ER, 5EW, 5FA, 5FO, 5FV, 5HK, 5IC, (5IF), 5IP, 5IR, 5IS, 5JD, 5LB, 5LU, 5NC, 5ND, 5NK (5NS), (5PE), 5PU, (5QS), 5RA, 5XU, 5YS, 5ZA, 5ZAF, 5ZAM, 5ZL, 5ZY, 5ZZ, 7LY, 7MQ, 7MP, 7ZY, (8AS), 8BI, 8BRL, 8BRM, (8BXC), 8CD, (8CP), 8CW, 8DZ, 8FI, 8HG, 8IR, 8NZ, 8OI, 8SW, 8TC 8TK, (8WO), 8XD, 8YN, 9AAW, 9ABU, 9ABV, 9AC, 9ACB, (9ACN), 9ACU, 9AEG, 9AF, 9AFC, 9AFX, 9AG, 9AGN, 9AGR, (9AIF), (9AIG), 9AIR, 9AIU, 9AIP, 9LF, (9ALU) (9AMA), 9AMC, 9AMK, (9ANF), (9ANO), 9AOG, (9AOU), 9APC, 9AQE, 9ARK, (9ARZ), 9ASJ, (9ASK), (9ASN), (9ATN), 9AU, 9AUC, 9AUO, 9AQS, 9AWU, 9AWZ, (9AXC), 9AYH, (9AYW), 9AYE, (9AZA), 9AZE, 9AZF, 9BDH, (9BFR, 9BNH, 9CP, 9CX, (9DAG), (9DAT), (9DBU), (9DDP), (9DEH), 9DJG, 9DJB, (9DJX), 9DKV, (9DLP), 9DNC, 9DPS, 9DQQ, (9DSN), (9DSD), 9DUG, 9DWP, 9DYA, (9DYU), (9DZE), 9DZK, 9EE, 9FS, 9GP, 9GX, 9HI, 9HM, 9HT, 9IF, 9JN, 9KN, 9JQ, 9KA, 9KO, 9LF, 9LW, 9LY 9ME, 9MC, 9NR, 9NQ, (9OA), (9PD), 9PI, 9PS, 9RF, 9RH, 9RP, 9RY, 9TB, 9TI, 9TL, 9UG, 9UU, 9UY, 9VL, 9WU, (9XI), 9YAE, (9YAK), 9YP, 9ZN, 9ZT.

CW: 5DA, 5LA, 5ZA, 6WV fone, 8BA, 8BE, 8BET, 8BFG, 8BNZ, 8BNJ, 8BP, 8BU, 8CI, 8DR, 8DP, 8FO, 8II, 8KS, 8UO, 8UJ, 9AET, 9AMB, 9ARK, 9BIZ, 9FM, 9LU, 9RV, 9XY, 9ZJ.

9PS, Wichita, Kansas

Spark: (2OM), 3HJ, (4DH), 5AO, (5BY), 5CA, (5EK), (5EW), 5FO, 5HB, (5HK), (5HZ), (5IF), (5IR), (5JD), (5JR), (5MY), 5NC, (5NK), (5PE), (5PU), 5PX, 5QA, (5QI), 5QS, (5SM), 5UG, (5XJ), 5XM, 5XT, (5XU), 5YL, (5ZA), (5ZL), (5ZAB), (6ZZ), 7ME, (7MP), (7ZO), (7ZU), 8CF, 8CI, (8FT), 8QC, (8RQ), (8SP), 8YN, (8YR), 8YU, (8ZN), 8AAP, 8ALO, (8ARS), 8AYN, 8AYP, 8BBC, 8BOC, 8BXA, (9AU), (9CP), (9CS), (9EL), 9FK, 9GP, (9HI), (9HM), (9HT), (9JN), 9JO, (9JQ), (9KF), (9LW), (9MC), (9NR), (9OA), (9OX), (9PD), (9PL), (9TL), (9UG), 9UU, (9VL), (9WT), (9WU), (9XM), 9XW, 9YM, (9ZB), (9ZJ), (9ZN), 9AAU, (9AAW), 9AGM, (9AIF), (9AIG), 9ALH, (9ALU), (9AMA), (9ANF), (9AOE), (9AOJ), (9AOU), (9APK), 9APN, (9AQM), (9ARG), (9ARI), (9ARZ), 9ATF, 9AVC, (9AVN), (9AWJ), (9AWX), (9AWZ), (9AXU), (9AYV), (9AYW), (9BED), (9BFR), (9BHR), (9DEH), (9DHB), 9DKO, (9DEV), (9DLX), (9DMJ), (9DNC), 9DPB, (9DPH), 9DQM, (9DQQ), (9DVM), (9DZI), 9DZQ, (9YAE), 9YAJ.

CW: 1BCG, 2ES, (2FP), 2KL, 2XQ, 4LE, 4XA, 4XB, (6WV voice), 6XAD, 7XU, 8AR, 8EB, 8IB, (8JL), 8JZ, (8UJ), (8VJ), 8VK, 8VN, (8VY), 8ZG, 8AGZ, 8APT, 8BOX, (8BUM), (9FM), 9IL 9JI, 9PE, 9XI, (9XM CW & fone), 9XW, 9YM, (9ZB), 9ZL, 9ZV, 9AAV, (9AJA), 9AJS, (9AMB), (9AOG), 9ARK, (9BBF), 9BED, 9BHS, (9DHB), 9DRK, (9DTW), (9DVA), (9DWJ).

9EA and 9GW, Duluth, Minn.

Spark: 5HK, 5TY, 5ZZ, 8AP, 8AXN, 8EF, 8HY, 8WO, 8ZP, 8ZY, 9AFX, 9AIG, 9AMA, 9AQC, 9ARZ, 9AVE, 9AYA, (9AYW), (9DHJ), 9EE, 9EI, 9HM, 9IP, 9JN, 9LW, 9MC, 9OX, (9WU), 9XI, 9YA, 9YAE, 9YAK, (9ZC).

CW: 1ARY, 1BCG, 2FD, 2WH, 2ZL, 3BZ, 3NB, 3ZY, 4BQ, 5YL, 5ZA, 7FJ, 8ACF, 8AGZ, 8AIL, 8AKP, 8AMB, 8AOG, 8AQF, 8AQV, 8BBF, 8BCF, 8BCX, 8BFX, 8BK, 8BRC, 8BRL, 8BUM, 8DR, 8II, 8IV, 8KM, 8OW, 8UJ, 8VJ, (8VY), 8XK, 8XB, 8ZG, 8ZV, 8ZY, 8ZZ, 9AAS, 9AJH, (9AJP), 9AWL, 9BAP, (9BBF), 9BI, (9DOF), 9DP, 9DWG, 9DY, 9NX, (9ZY).

9APS, Covington, Ky.

Spark: 1BP, 2BK, 2DA, 2HJ, 2JL, 2OM, 2WB, 2ARY, 3HG, 3ZA, 3AHK, 3AQR, 4AS, 4AU, 4BI, 4BQ, (4CG), 4CX, (4DH), (4DQ), (4GN), (4GU), 4YL, 5AA, 5BN, (5DA), 5ED, 5EK, (5FV), (5HK), 5IS, 5IR, (5JD), 5JM, (5NS), 5QS, 5XA, 5XM, 5XU, 5ZA, (5ZL), 5ZS, (5ZAB), 8CF, 8DP, 8DX, (8EA), (8EF), 8EW, (8IN), 8LS, 8ML, 8NZ, (8OH), (9OI), 8SP, 8XE, 8YW, (8ZF), 8AFD, 8AHH, 8AJK, (8AMZ), (8ANA), 8ANY, (8AOI), 8ASU, (8AUE), 8AVT, 8AXN, 8AYR, 8BDQ, (8BDY), 8BEP, 8BLW, 8BOJ, (8BRL), 8BVE, 8BXC, 9BP, 9CP, 9DF, 9DH, 9EG, (9FU), 9GP, 9HI, (9HR), 9HT, 9IV, (9JN), 9JT, 9KS, 9LF, 9LH, (9MC), 9ME, (9OX), 9PN, 9PS, (9QJ), 9RC, 9SY, 9UU, 9UY, 9VD, 9VL, 9WI, 9WL, (9WT), 9XE, 9XI, 9XM, 9YB, 9YS, 9ZB, 9ZF, 9ZN, 9AAW, 9AAP, 9AEG, 9AEY, 9AEX, 9AGR, 9AKA, 9AMA, 9ANW, 9ANF, 9ANO, (9AOJ), 9AOU, 9PK, 9APN, 9APV, 9AQE, (9AQJ), 9AQM, 9ARZ, (9ARG), (9ASJ), 9ASK, 9ATN, 9AVH, (9AWZ), 9AWU, 9AXU, 9AYS, 9AYW, 9AZA, 9AZE, 9BED, 9DMT, (9DNC), (9DPH), (9DQQ), 9DVM, 9DWP, (9DZE), (9DZI), 9ZAC, 9ZAE, KDKA. NZO, WDY, WJZ, (WL2), XF1.

CW: 1QN, 1XM, 1ARY, (1BCG), 2AW, 2BB, 2CC, 2DH, 2EH, 2EL, 2FP, 2FS, 2VA, 2XB, 2XF, 2ZV, (2AWL), (3DH), 3AVE, 4BQ, (4CO), (4EL), 4GL, 8DR, 8HJ, 8II, 8UJ, 8UT, 8VY, 8ZZ, 8AIO, 8BEF, 8BEX, 8BNZ, (8BVR), 9JQ, 9NX, 9AAY, 9AJA, 9AMB, 9AOM, 9BNO, 9DWJ.

R. Veverka, Omaha, Nebr.

Spark: 5BY, 5EW, 5JD, 5HK, 5IF, 5IR, 5NC, 5NK, 5PE, 5XB, 5XJ, 5XU, 5XZ, 5ZA, 5ZL, 5ZR, 5ZU, 5ZZ, 7LO, 7ZU, 8TK, 8YN, 9AU, 9BZ, 9EE, 9EL, 9FZ, 9HM, 9HI, 9JN, 9JQ, 9LF, 9LM, 9LN, 9LW, 9NJ, 9NK, 9NR, 9PS, 9RH, 9RY, 9VX, 9WI, 9XI, 9XM, 9XU, 9YB, 9ZN, 9AAN, 9AAW, 9ACB, 9ACH, 9AEG, 9AEY, 9AFF, 9AGN, 9AGR, 9AIG, 9AIF, 9ALU, 9ALW, 9AMA, 9AOU, 9AOX, 9APN, 9AQE, 9ASN, 9AUL, 9AXU, 9AYU, 9DAG, 9DKV, 9DLX, 9DMJ, 9DQU, 9DSD, 9DUG, 9DXM, 9DYU, 9DZE, 9YAE, 9YAK, 9XAQ.

CW: 1BCG, 2FP, 2XB, 5MT, 5QS, 5XJ, 5ZA, 7JL, 8BZ, 8II, 8VJ, 8VY, 8BFX, 8BUM, 8XAE, 9BL, 9FM, 9II, 9JI, 9NX, 9SV, 9XI, 9XM, 9AFD, 9AIL,

(Concluded on page 62)

Third-Fourth Convention

Say, fellows, there is going to be a REAL convention in Washington on the 17th and 18th of February—the third annual convention of the Third and Fourth Radio Districts, with every radio man and woman from all ten districts invited to be the guests of the Third and Fourth.

Pep abounds in those districts and they have many extremely live clubs with many members. That means all the strong committees needed to do a good job, and they have been going at it in a wonderful fashion. Even got out a printed "progress report" for the benefit of the numerous interlocking committees. That means efficiency, no loose ends, and things well thought out. Besides, it's an A.R.R.L. gang.

Everything will be at one place—the Hotel Raleigh, Washington, D. C., Friday and Saturday, Feb. 17 and 18, are the dates. Everything is covered by one ticket —price $5.00—which bears coupons for the different events. Here's the boiled-down program:

Friday the 17th

10:30 to 12:00 a.m.—Welcome and get-together meeting, with some novel stunts promised too.

1:30 to 5:00 p.m.—Main business and technical meeting, interspersed with stunts by clubs of the 3d and 4th.

7:30 p.m.—Contests, with valuable prizes. Radio Exhibits all of both days— yes— a radio show.

Saturday the 18th

9:00 a.m. to 12:30 p.m.—A tour to NSF, the Naval Air Station at Anacostia, and to Arlington, NAA, to see time sigs sent out on the big spark, the trip going via Washington's famous landmarks and public buildings.

2:00 to 4:00 p.m.—Technical meeting on rectifiers.

Tickets cover everything. They may be obtained from the Convention Manager, H. A. Snow, 1656 Newton St. N. W., Washington; the Publicity Manager, E. R. Bateman, 1217 W. Lafayette St., Baltimore; or the Radio Publicity Manager, H. A. Beale, Jr., Parkesburg, Pa. For any further information write to Pubilicity Manager Bateman.

Tiresome talks are verbotem. Every talk will be at a scheduled time with an alarm clock to limit it, none permitted over 30 minutes, every one will be illustrated with apparatus or slides, there will be a scheduled time for discussion of each talk, and the meeting will be jazzed up with interspersed stunts, of which there are a startling number and variety. This Convention has boldly tackled one of Amateur Radio's biggest practical problems and is going to have a technical meeting wholly devoted to Rectifiers for C.W., with talks on four distinct types, every one with demonstrations: Electrolytic type of garden variety, by S. Kruse; a new electrolytic not using aluminum, by G. L. Bidwell; Kenotrons, by somebody from Schenectady; and the new Amrad "S" tube, by Mr. H. J. Tyzzer of that company. Other technical talks will include one by Dr. J. M. Miller, of the U.S.N. Radio Research Laboratory, on antenna design and improvement. Dr. Miller built an antenna at the Bureau of Standards that had a resistance of but 2 ohms at 300 meters! He is the only man on the whole program who hasn't a time limit put on his talk— he can go as far as he likes and we all eat it. Then there will be talks on various methods of phone modulation, a demonstration of a new receiving set where tickling does not affect tuning at all, counterpoises, tube transmission, etc.

Washington is our Capitol City, one of the most beautiful in the country, and that's another reason for going. There will be a welcome committee of 130, including a goodly number of the gentler persuasion, and ladies are specifically invited. When you hit the Union Station, watch for members of this committee, who will meet every train during the two days starting at 7:30 a.m. on Friday. Watch for a big white badge with an A.R.R.L. emblem on it— that's a welcomer. They're there to meet you and every one will be able to give you instant information about hotels, rates, reservations, transportation, the program, places of interest, location of stations, etc.

The tour to NSF and NAA will take in many of Washington's most interesting sights. At NSF "LC" will be on deck to explain, and at Arlington there will be a talk by Scanlin, of the original crew of NAA. The ride to and from these places

is part of the regular ticket—no extra charge.

Listen for frequent broadcasts of convention dope by some two hundred prominent stations in every district—spark, fone, C.W., and I.C.W. The latest news will be sent out every night.

As we remarked editorially, this is a crowded issue of QST. There isn't any more room, but there is lots more we could tell—speed contests with prizes for best receiving and sending (see 3XF or 3KM), a flock of stunts by the clubs themselves that will liven up every meeting—but you've got to go to Washington anyhow, don't you? That impulse you feel stirring in you is the correct thing, OM—take a tip and make your arrangements RIGHT AWAY QUICK—CU there!

Anderson Radio Assn.
Austin Radio Club.
Birmingham Wireless Assn.
Blackstone Valley Radio Assn.
Bridgeport Radio Club.
Brockton District Radio Club.
Butte Radio Club.
Canton Radio Club.
Cass Radio Club.
Chester County Radio Assn.
Chicopee Radio Assn.
Cleveland Radio Assn.
Community Radio Club.
Coneaut Radio Club.
Crescent Radio Club.
Detroit Radio Assn.
Duluth Radio Assn.
Electric City Radio Club.
Elizabeth Radio Club.
Elmhurst Radio Club.
Eureka Radio Club.
Ft. Worth Radio Klub.
Mobile Radio Club.
Montreal Radio Assn.
New Haven Radio Assn.

Do you find the name of your club or association among those listed above? If so it means that we want some information from you as to what you are doing in radio. Come out of your shell and let us hear from you. If you are active let us all know about it. If there is no life—well, we won't hear from you.

Tell us what you do to increase interest and membership in your club. What method do you use to bring your members to all meetings? What kind of meetings do you hold and when do you hold them? How many of your members have complete stations in operation? How much relay traffic do you handle? How many stations are spark and how many CW of those who have stations? What long distance records have your members made? Why don't you send in a list of calls heard?

Those are some of the things we would like to know and no doubt they would prove of value to other clubs. This whole department is for our Affiliated Clubs and it is up to you to send in your reports. Don't wait for us to ask you for them; send them in and let the outside world known what you are doing.

Club News

At the annual banquet of the **Delaware Radio Association** which was held in Wilmington the following officers were elected for the year 1922: W. B. Osmond, pres.; H. Dunbar, vice-pres.; E. M. Symmes, secy.; F. R. Gooding, treas. E. W. Dannals and L. Manuel of the U. S. S. Ohio were the speakers of the evening and they spoke on arc and spark transmission. J. E. Delps, president of the Philadelphia Amateur Wireless Association, made an address on organization. In addition to the entire membership of the Delaware Radio Association, many prominent business men attended the meeting.

The **Springfield, (Mass.) Radio Association** is installing a 100-watt CW set for the use of its members. Demonstrations of radio fone in various organizations in and around Springfield are being given, which have resulted in a large increase in membership, the association taking in 32 new members during November.

New officers of the **Philadelphia Amateur Radio Association** were elected at a regular meeting December 5, 1921: Dr. G. M. Christine, pres.; J. Delp, jr., vice-pres.; B. Martin, secy. and treas.; J. Forsyth, cor. secy. Mr. E. C. Powell read a paper on "Data on Radio Frequency Coils for Reception." Mr. Stanley Bryce read a paper on "Long and Short Wave Receivers." After the papers were read a short time was devoted to discussion. At a meeting held on December 19th Professor Noll read a paper on "Relief from QRM" and J. E. Delp read a paper on "An Improvement Regarding the English Amplifying Circuit."

Regular meetings of the **Twin City Radio Club** (Lewiston, Me.) are held every Thursday evening at the Jordan High School. The club consists of full members and student members, a total of 28, which number is increasing steadily. 1BRQ is the headquarters station, at which a nightly watch is kept from 10 to 12.

Eighty-five amateurs attended the **First Annual Banquet of the Youngstown (Ohio) Radio Club.** After enjoying a "fine feed" the meeting was addressed by R. L. Patch, Rev. Father Manning (8ZG, we all know him very well), and Prof. H. W. Harmon of Grove City College. Messrs. Ropar and Daker put on a little skit entitled "A Message from Mars," which was the hit of the evening. Wayne Shaffer, toastmaster, was presented with a rubber con-

tact key in appreciation of his efforts with a side-swiper at 8GW.

Delegates from a radius of 200 miles attended the **First South Dakota Radio Convention** on December 28-29. It was a real howling ARRL convention and a huge success. (All ARRL Conventions have been successes; the ARRL makes them such.) Dean L. E. Akeley of the U. of S. D. addressed the meeting on a scientific subject. Boyd Phelps, Manager of the Dakota Division, was a big attraction, assisted by A. C. Anderson, president of the Twin City Radio Club, (Minneapolis and St. Paul.) Orville Wheelon was christened the Young Squirt of the convention. A committee was appointed to formulate plans for a state organization. "A Night at 9YAK," a playlet, was the hit at the banquet. Some disappointment was due to the fact that exhibitors failed to exhibit.

The new officers in the **Radio Club of Tacoma, (Wash.)** for the coming six months, as elected Nov. 22nd are: Howard Reichert, 7CE, president; Karl Weingarten, 7BG, vice-president; Winifred Dow, 7CB, secretary, (re-elected); Neville Benoit, 7BC, treasurer, and Alvin Stenso, 7LV, press agent and assistant secretary.

On Dec. 7th, the Radio Club of Tacoma took twenty of the members and their friends to surprise the newly organized club of Olympia. Cider, coffee, and cake were part of the main features, and the words, "fill 'er up again boys" still haven't left our memory, (not referring to the coffee). However, as the cider was perfectly fresh, there were no disastrous results. 7BA and the club's saxaphone quartet was another main feature, and they furnished some mighty fine "jazz." Before we knew it, everybody was on the "hop." Time slipped by unheeded and it was well toward the "wee hours" of morning before the Tacoma bunch bid farewell and started on the 35 mile drive home. But everybody was happy, and we won't soon forget the enjoyable time. If Olympia members turn out as well every meeting as they did that night, all I've got to say is that we bigger clubs will have to step to keep ahead.

Reported by 7CB.

"Static" is the official publication of the **Ridgewood Radio Club** of Ridgewood, N. J. It is not the kind of QRN that you get during the summer months, but a real interesting mimeographed outline of what is going on in New Jersey. In addition to some darn good operators in the club they have some fair poets; get this one:

"Behold here the web of the spider,
It works without switchpoint or slider,
It makes 'em all roar
When you open the door,
And they fade when you open it wider."

CALLS HEARD

(Concluded from page 59)

9AJA, 9APH, 9AMB, 9AQR, 9ARJ, 9ARM, 9ARR, 9AYS, 9AYU, 9BBF, 9BEP, 9BJI, 9DEH, 9DQM, 9DTM, 9DVA, 9DMJ, 9DWO.

9AHC, 9BAD and 9DUZ, Ellendale, N. D.

CW Canadian, 3BP, 4CB, 9AW. U.S.: 1AFV, 1BCG, 1RU, 1XM, 2AKO, 2AWF, 2AWL, 2BFZ, 2BML, 2FD, 2FP, 2KP, 2OE, 2QR, 2WP, 2XQ, 2ZL, 2ZV, 3LR, 3NB, 4EH, 4EL, 4EN, 4XC, 4YA, 5AN, 5BY, 5CI, 5JL, 5KP, 5LA, 5MT, 5NZ, 5XJ, 5XT, 5ZA, 5ZU, 6AAG, 6WV, 6XAD, 6XAE, 6ZA, 6ZT, 7EX, 7ZE, 8AAP, 8AB, 8ABO, 8ACF, 8ACP, 8ADY, 8AGZ, 8AIL, 8AIO, 8AJT, 8AMF, 8ANP, 8AOG, 8APT, 8AQF, 8AQV, 8AQZ, 8ARW, 8ASV, 8AWF, 8AWP, 8BA, 8BD, 8BDU, 8BEF, 8BET, 8BEX, 8BFX, 8BK, 8BNJ, 8BO, 8BOX, 8BOZ, 8BRL, 8BU, 8BUM, 8BXA, 8CAD, 8CF, 8CI, 8DA, 8DR, 8DU, 8DW 8DX, 8EB, 8FO, 8FU, 8FP, 8GA, 8GV, 8HA, 8IB, 8II, 8IQ, 8IV, 8JL, 8JQ, 8JS, 8KH, 8LX, 8NM, 8NQ, 8OW, 8PA, 8QY, 8TT, 8UJ, 8UK, 8UO, 8VJ, 8VK, 8VR, 8VY, 8WY, 8XK, 8XM, 8XV, 8ZAE, 8ZG, 8ZN, 8ZV, 8ZY, 8ZZ, 9AAP, 9AAO, 9AAS, 9AAU, 9AAU, 9AAV, 9ABU, 9ACB, 9AEJ, 9AEO, 9GN, 9AIO, 9AJA, 9AJH, 9AJP, 9AKB, 9AKD, 9AKR, 9AKX, 9AMA, 9AMB, 9AMF, 9AOG, 9AOS, 9AN, 9AQR, 9ARK, 9ASB, 9ASD, 9ASK, 9AT, 9ATC, 9ATH, 9AUL, 9AVM, 9AVN, 9AWB, 9AWH, 9AWJ, 9AWL, 9AWM, 9AXE, 9AYS, 9AYU, 9BAP, 9BAV, 9BBF, 9BBL, 9BED, 9BEK, 9BEX, 9BFG, 9BHD, 9BHE, 9BHS, 9BIK, 9BKB, 9BLO, 9BNO, 9OF, 9BC, 9CH, 9CR, 9DCF, 9DCY, 9DGE, 9DKX, 9DOF, 9DOU, 9DPE, 9DQM, 9DTA, 9DTM, 9DTW, 9DV, 9DVA, 9DWI, 9DWJ, 9DWN, 9DY, 9DYU, 9DZQ, 9EA, 9FM, 9FO, 9GK, 9GL, 9GO, 9HK, 9HW, 9HY, 9II, 9JD, 9KX, 9LQ, 9LY, 9NX, 9PN, 9PI, 9PG, 9QE, 9RT, 9RV, 9RZ, 9SV, 9UM, 9VG, 9WD, 9XAC, 9XI, 9XM, 9XU, 9YAC, 9ZAF, 9ZB, 9ZF, 9ZJ, 9ZT, 9ZY.

Spark: Canadian, 3BP, 4BG, 9AW, 2MO, 4DV, 5BC, 5BM, 5BY, 5EJ, 5EK, 5EL, 5ER, 5EW, 5FO, 5FV, 5HK, 5HJ, 5IP, 5IR, 5IS, 5JD, 5KK, 5LB, 5LC, 5MK, 5NC, 5NS, 5OD, 5OF, 5OH, 5OZ, 5PE, 5PG, 5PU, 5QH, 5QI, 5QS, 5RN, 5TU, 5UG, 5UJ, 5UU, 5XA, 5XB, 5XJ, 5XO, 5XS, 5XT, 5XU, 5YM, 5YN, 5ZA, 5ZAA, 5ZAB, 5ZAG, 5ZAK, 5ZC, 5ZE, 5ZK, 5ZL, 5ZS, 5ZZ, 6LC, 7DH, 1EX, 7FQ, 7GV, 7JD, 7LU, 7LY, 7MP, 7MO, 7MU, 7PI, 7ZO, 7ZS, 7ZU, 7ZV, 8AFB, 8AFD, 8ASZ, 8AYN, 8BDL, 8BEP, 8BLW, 8BRL, 8CB, 8DZ, 8FI, 8GH, 8JJ, 8JQ, 8KP, 8MG, 8MO, 8MI, 8MP, 8MZ, 8NJ, 8OI, 8PT, 8UC, 8TO, 8VJ, 8VR, 8WO, 8YL, 8YM, 8YN, 8YR, 8YU, 8ZA, 8ZF, 8ZP, 8ZN, 8ZU, 8ZY, 9AAC, 9AAP, 9AAW, 9ABV, 9ABY, 9ACB, 9ACL, 9ACM, 9ACN, 9ACY, 9ADI, 9AEG, 9AEH, 9AEY, 9AF, 9AFJ, 9AFW, 9AFX, 9AGH, 9AGN, 9AGR, 9AGU, 9AIF, 9AIG, 9AIH, 9AIJ, 9AIU, 9AJS, 9AKA, 9AKX, 9ALU, 9AMA, 9AMK, 9AMS, 9ANF, 9ANM, 9NO, 9NR, 9ANX, 9AOJ, 9AOU, 9AOW, 9APC, 9APN, 9AQ, 9AQE, 9AQM, 9ARI, 9ARK, 9ARZ, 9ASF, 9ASJ, 9ASK, 9ASL, 9ASN, 9ATN, 9AU, 9AUE, 9AUG, 9AUL, 9AUO, 9AUU, 9AUZ, 9AVC, 9AVE, 9AVK, 9AVP, 9AVR, 9AVS, 9AVZ, 9AWN, 9AWX, 9AWZ, 9AXA, 9AXR, 9AXU, 9AY, 9AYN, 9AYO, 9AYV, 9AYW, 9AZA, 9AZE, 9AZF, 9BCC, 9BDH, 9BDS, 9BFI, 9BGN, 9BGX, 9BHA, 9BJD, 9BKH, 9BP, 9CA, 9CP, 9CS, 9DAG, 9DAT, 9DAP, 9DBU, 9DBV, 9DEH, 9DF, 9DFL, 9DHZ, 9DJX, 9DKQ, 9DKS, 9DKV, 9DLK, 9DLL, 9DLX, 9DMJ, 9DNB, 9DNC, 9DNX, 9DOC, 9DOG, 9DOI, 9DPB, 9DPE, 9DPH, 9DPX, 9DQQ, 9DRJ, 9DSD, 9DSN, 9DTN, 9DTO, 9DUG, 9DUD, 9DUI, 9DUL, 9DUM, 9DVM, 9DWB, 9DWJ, 9DWL, 9DWP, 9DWX, 9WY, 9DXM, 9DY, 9DYA, 9DYG, 9DYU, 9DZF, 9DZI, 9EL, 9ET, 9FI, 9FM, 9FN, 9FO, 9FX, 9GC, 9GM, 9GN, 9GO, 9GR, 9GV, 9GX, 9HI, 9HL, 9HM, 9HR, 9HT, 9IF, 9IY, 9JN, 9JQ, 9JW, 9KF, 9KO, 9KS, 9LA, 9LF, 9LU, 9LW, 9MC, 9ME, 9MF, 9MO, 9MS, 9NO, 9NR, 9OA, 9OO, 9OX, 9PB, 9PI, 9PL, 9PN, 9PS, 9RC, 9RH, 9RP, 9RY, 9RZ, 9SY, 9TI, 9TL, 9TO, 9TV, 9UG, 9UI, 9UU, 9VL, 9WI, 9WS, 9WT, 9XAQ, 9XI, 9XM, 9XT, 9YA, 9YAC, 9YAE, 9YAK, 9YM, 9YO, 9ZAC, 9ZB, 9ZC, 9ZJ, 9ZN, 9ZU.

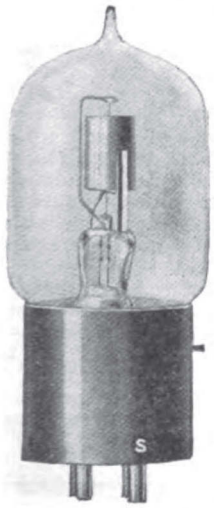
— the tubes that are used by those who know

When the best tubes obtainable are required for some test particularly severe or some enterprise unusually exacting, A-P Tubes are selected. Among the radio authorities who have chosen A-P Tubes for special work, are the U. S. Navy, Paul F. Godley, The Westinghouse Company and The Magnavox Company. That is why you want A-P Tubes in your home receiving set and in your amateur station—they have made good with those who know, proof of their efficiency. Insist that your dealer supply you with the A-P combination illustrated, or write us direct.

"Use A-P Tubes for efficiency"

—in home sets or amateur stations.

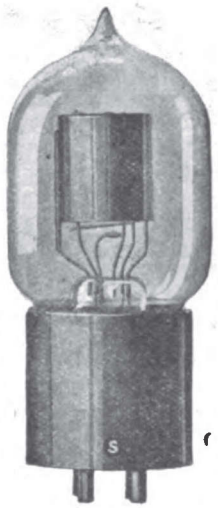
THIS A-P COMBINATION



THE A-P VT AMPLIFIER OSCILLATOR

—the Amplifier used by the U. S. Navy. "Use the tube the Navy uses." Price $6.50

It is well known to the radio art that no tube can be both an amplifier and an efficient detector of spark signals. Only a COMBINATION of tubes can give complete efficiency. Remember that, and when buying tubes insist on the A-P combination here illustrated. In this A-P combination the efficiency of neither tube is decreased by trying to make it perform the functions of the other, but each is highly specialized and fully developed to perform in its own capacity, the two operating together, thus providing a higher efficiency than can possibly be accomplished by any one tube or in any other way.



THE A-P ELECTRON RELAY

—the most sensitive detector of spark signals known to the radio art. Price $5.00

A-P Tubes are licensed by the Radio Corporation of America under DeForest Audion and Fleming patents for amateur and experimental use in Radio Communication.

Order from your dealer or direct, and for the best book on radio specify "Elements of Radio Telegraphy" by Lieut. Ellery W. Stone, U.S.N. Price $2.50

ATLANTIC-PACIFIC RADIO SUPPLIES COMPANY

NATIONAL DISTRIBUTORS FOR THE MOORHEAD LABORATORIES, INC.

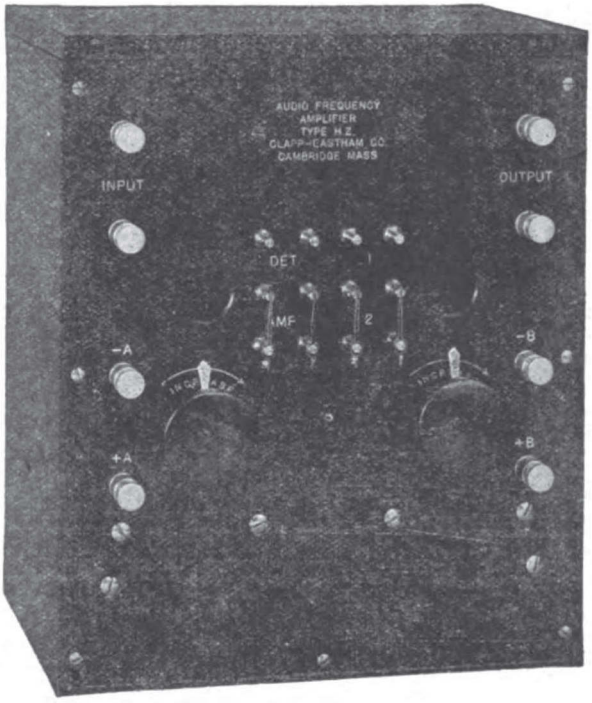
638 MISSION STREET—SAN FRANCISCO—CALIFORNIA

HENRY M. SHAW—President

Sole Western Distributors for DeForest Radio Tel. & Tel. Co., Radio Equipment; Shaw Insulator Co., Moulded Insulation; Diamond State Fibre Co., Condensite-Celoron; Redmanol Chemical Products Co., Insulating Paints and Varnishes; Pacent Electric Co., Radio Essentials; C. Brandes, Inc., Radio Head Receivers.

use A-P tubes for efficiency

CLAPP-EASTHAM SERVICE



TYPE HZ

TWO-STAGE AMPLIFIER

Now we want to tell you about the companion piece to this remarkable receiver—the new CLAPP-EASTHAM Type HZ TWO-STAGE AMPLIFIER equipped with our new "Maxiums" Amplifying Transformers. Amplifies weak signals hundreds of times—sounds almost inaudible are made to ring throughout a large room. Convenient switching arrangement permits use of Detector only, one stage of amplification, or two stages. This Amplifier exactly matches our HR set in size, finish and arrangement of binding posts, yet is equally effective with receiving sets of other types and makes. Price complete $35. Write us for full details and name of nearest dealer.

Here is the very latest thing in Amplifiers

—a Companion Piece to Our HR Receiving Set advertised in QST last month.

In last month's issue of this magazine we introduced to QST readers the new CLAPP-EASTHAM Type HR Regenerative Receiving Set—licensed under Armstrong U.S. Patent No. 1113149. We sell this set complete for only $35 yet absolutely guarantee it to give results equal or superior to any on the market regardless of price.

We promised you that this set would surprise you and your friends by its easy control and the wonderful distances at which it picks up signals, voices, music—and the great clearness and loudness with which these signals come in.

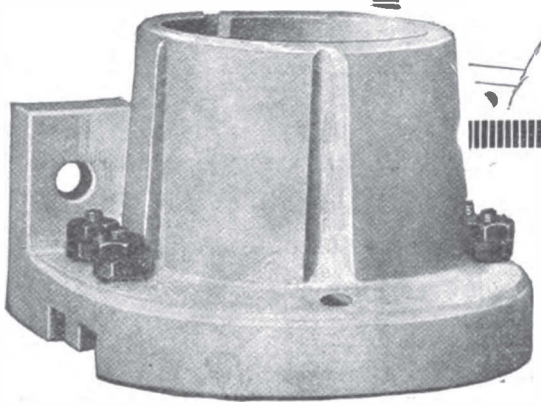
Any of the radio Dealers advertising on the following five pages of this magazine will sell you a Type HR Regenerative Receiving Set, or Type HZ Two-Stage Amplifier—$35 each. Buy from the dealer nearest your city.

CLAPP-EASTHAM COMPANY

Radio Engineers and Manufacturers

114 MAIN ST., CAMBRIDGE, MASS.

CROSLEY
V-T SOCKET



PRICE
60¢

Better—
Costs Less

Yes, it has made a wonderful hit—without doubt the biggest selling Socket on the market today. There are good reasons why. Here are some of them.

It is made for both base and panel mounting. Entirely of porcelain. The bayonet catch is now imbedded in a wall unbreakable. Being made of porcelain a soldering iron will not melt it and it can be used for power tube work without melting.

Its design eliminates possibility of short circuiting filament across high voltage B Battery.

Practically every leading jobber and dealer of radio supplies is handling the CROSLEY V-T SOCKET, because of its great popularity and demand.

We make no apologies for the price. Large production makes it possible. Every one says "The CROSLEY V-T SOCKET is "Better and Costs Less".

Buy from your Dealer. He has it or can get it for you.

To the few Jobbers and Dealers who are not handling the CROSLEY V-T SOCKET, we make the suggestion to get in line.

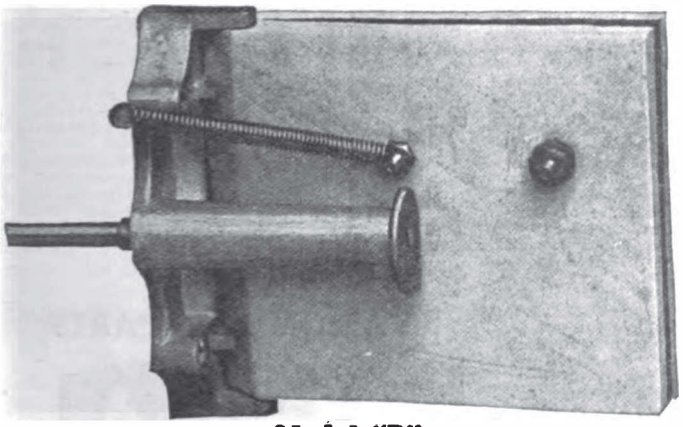
CROSLEY MANUFACTURING COMPANY

Radio Dept. Q-7, **Cincinnati, Ohio**

A New CROSLEY Variable Condenser

Model "C"

The tremendous popularity of the Model "A" CROSLEY VARIABLE CONDENSER, radical as it is, has made possible the promised new model illustrated here. Note the porcelain plates and the die cast frame. Its attractive appearance as well as its efficiency makes it an addition to any set.



Model "B"

This Model is the same as the Model "A" excepting that it has a die cast frame as shown on the illustration above of the Model "A" Condenser. The plates are of laminated wood instead of porcelain. The maximum capacity is conservatively rated at .0005 Mf. None are shipped, however, that test below .0008 Mf. The only difference between it and the Model "A" is the die cast frame. The plates are the same.

Price, unmounted	$1.75
Same with knob and dial	2.25
Same with knob and dial mounted in mahogany finished cabinet	3.00

The Model "C" is conservatively rated at .001 Mf. None are shipped, however, that test below .0012 Mf.

The CROSLEY VARIABLE CONDENSERS have many advantages over any other types of variable condensers; low resistance through the elimination of spring contacts and the use of brass and copper result in much louder signal strength. Each CROSLEY VARIABLE CONDENSER is tested to withstand one thousand volts. Try this on an air condenser if you don't want to use it any more!

The CROSLEY is a universal condenser for C.W. work and other transmission work as well as receiving. They have no body or hand capacity, making them ideal for tuning C.W.

While the new Model "C" has a higher maximum capacity, the minimum capacity remains as low as the first "A" Model Condenser. Both are efficient.

The price of the Model "C" as illustrated	$2.25
With knob and dial	2.75
Same mounted in mahogany finished cabinet, with binding posts	3.50

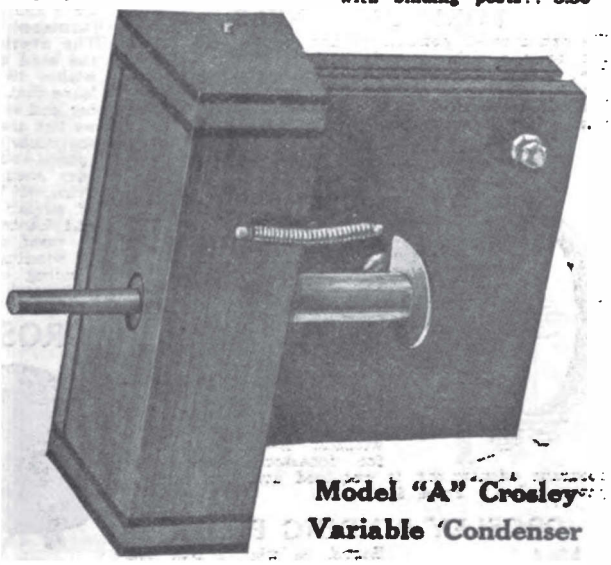
Model "A" Crosley Variable Condenser

This instrument needs no introduction to most of the readers. Thousands have been sold on our GUARANTEE of absolute satisfaction or money refunded.

This instrument on large quantity production is better than ever and is highly recommended for any one wishing a condenser with a capacity of .0005 Mf. This Condenser is illustrated herewith.

Note that the frame is made of wood which is not in any way objectionable. Some people, however, prefer the Model "B" with the die cast frame.

The price of the Model "A" as illustrated, without knob and dial	$1.25
Same with knob and dial	1.75
Same with knob and dial, mounted in mahogany finished cabinet	2.50



Model "A" Crosley Variable Condenser

Many Jobbers and Dealers are handling the CROSLEY VARIABLE CONDENSER. If yours does not, send order direct, send us his name and address and we will ship prepaid.

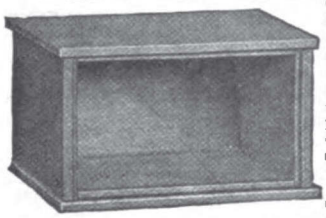
CROSLEY MANUFACTURING COMPANY

RADIO DEPT. Q-7 **CINCINNATI, OHIO**

--More CROSLEY RADIO APPARATUS

"Better--Costs Less"

Crosley Cabinets



The tendency in the radio field today is to put apparatus in cabinets not only for appearance's sake, but as a protection from dust, dirt, atmospheric conditions etc. Realizing the demand for attractive stock cabinets of various sizes, we are building them in quantities in our large wood working plant. These cabinets are all uniform in style. The panels are rabbated in to the front. As the outside dimensions and inside dimensions are either larger or smaller than the panel itself, we show panel size and also inside dimensions. Prices quoted do not include the panels.

Wood used is either gum or mahogany in dark antique or red mahogany finish or in quartered oak in natural or antique finished. Specify type of wood and finish in ordering. Lids or tops are hinged. Sizes and prices are:

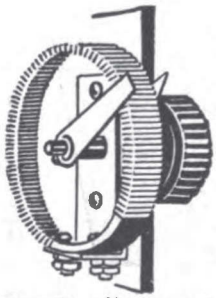
For Panel Size	CABINETS Inside Dimensions High	Wide	Deep	Mahogany or Quartered Gum	Oak
6x7	5½"	6½"	7"	$2.50	$3.85
6x10½	5½"	10"	7"	2.75	4.40
6x14	5½"	13½"	7"	3.30	5.55
6x21	5½"	20½"	7"	3.90	7.30
9x14	8½"	13½"	10"	3.70	6.80
12x14	11½"	13½"	10"	4.40	6.80
12x21	11½"	20½"	10"	5.25	10.60

Cash must accompany order. No C.O.D.'s. We pay transporation charges.

FORMICA PANELS

We can furnish genuine formica panels ¼" thick, cut to the following dimensions: 6x7; 6x10½; 7x9; 6x14; 7x12; 6x21; 7x18; 9x14; 12x14; 14x18; 18x21. Price of panels—2½c per square inch. For odd sizes order the next largest size: we will trim. We pay postage.

CROSLEY RHEOSTATS

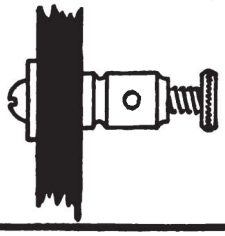


Complete with knob, pointers, etc. as shown in illustration. Our unique construction permits mounting on panel of any thickness up to and including ⅜": non-corrosive resistance wire.

Model "A"—overall diameter 1⅜". Resistance 7 ohms, one ampere without heating. Suitable for detector or amplifier tubes. Price 60c each.

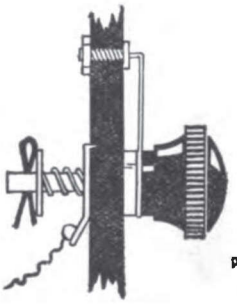
Model "B"—Resistance 4 ohms: will carry 3 amperes without heating. Suitable for detector, where very accurate adjustment is required and for 5 watt power tubes. Price $1.25.

CROSLEY BINDING POSTS



Barrel ⅜"x½". Not too small nor too large, just the right size.

Nickel plated. Complete with base screw and washer as illustrated. Price, 8c each or 90c per dozen.

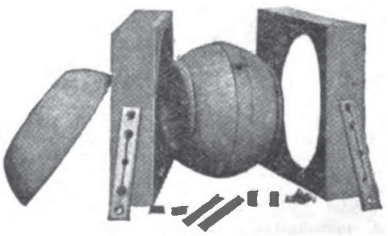


CROSLEY TAP SWITCHES

Note unique construction assuring constant tension. Composition knob, nickel-plated switch arm and bushing. Note stationary washer with soldering lug, making possible buss wire connection. Price 10c each. Better—Costs Less.

SWITCH TAPS for above, brass nickel-plated, complete with brass nut, 3c each, 30c per dozen or $2.50 per hundred.

CROSLEY VARIOMETER PARTS



This set consist of two stators, one rotor, the necessary hardware shown in the illustration. Shaft for knob and dial is ¼" diameter. The wood parts are furnished either in poplar or mahogany.

The average radio man has his own ideas about the kind of wire and the number of turns that he wishes to use, depending upon its purpose, so we leave that to the purchaser. The operation of winding and setting up is very simple, but the parts that we list are difficult for the amateur to make. They are made in our own large wood working plant on special automatic machinery that make possible very accurate quantity production.

Price of Variometer parts, described above, made of poplar wood, is $1.50 (including wood parts and hardware).

If wood parts are made of mahogany $1.75.

If winding form is desired, it can be used for winding one or more variometers. Price is 30c additional.

CROSLEY VARIOCOUPLERS

CROSLEY VARIOCOUPLERS consist of formica tube, rotor and brass hardware. It is made with the same care and accuracy as the CROSLEY VARIOMETER.

Price, complete as shown in the illustration, not wound or assembled, $1.50. Stator, only, 40c.

If your dealer does not handle any of the above parts, you may order direct. We will ship prepaid.

Dealers and Distributors: Every item shown above should be in your stock. Write for proposition.

Crosley Manufacturing Company

Radio Dept. Q-7, Cincinnati, Ohio

CROSLEY RADIO UNITS

"Better--Cost Less"

HARKO RADIO RECEIVER

The most compact and complete efficient crystal receiving outfit on the market. Designed for the amateur who wishes to get started in this wonderful game. The illustration shows complete outfit ready to hook to aerial, fones and ground wire.

Will tune from 200 to 600 meters, bringing in spark, voice and music with average amateur antenna. NAM, Norfolk, Va. and ships at sea copied in Cincinnati. 20 watt Radiophone copied 25 miles with addition of the Crosley Variable Condenser in series with antenna. Radiophone copied five to ten miles without condenser.

A wonderful little instrument. Price complete with battery, interrupter for testing crystal, instructions, etc. $9.00. One thousand ohm single head set, 125 ft. antenna wire, insulators, etc. $6.00 extra. Complete outfit $15.00. If your dealer cannot furnish, we will ship direct prepaid.

HARKO SENIOR RADIO RECEIVER

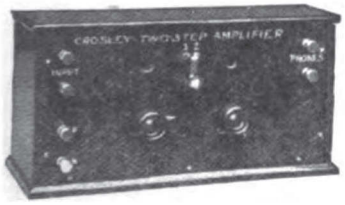
Here is a complete tuner and audion detector assembled on a formica or other high grade dielectric panel, mounted complete in mahogany finished cabinet. This instrument gives wonderful results. New Jersey phones, music and voice; KDKA, ships at sea, amateur and other signals for hundreds of miles copied in Cincinnati on detector only.

In combination with the CROSLEY TWO STEP AMPLIFIER the HARKO SENIOR brings phones in all over the house. Range, 150 to 600 meters, non-regenerative hook-up.

Satisfaction GUARANTEED or money refunded as on all CROSLEY apparatus.

Size 11½ in. long, 4⅞ in. deep and 6 in. high. Consists of condenser, tapped inductance, socket, rheostat, etc., completely wired assembled and tested, without battery, tube or phones. Price $16.00

CROSLEY TWO STEP AMPLIFIER



This instrument was designed to give the very maximum in value—to match up with the HARKO SENIOR, using the same sized cabinet. Complete with amplifying transformers, sockets, rheostats, switch, binding posts, etc., mounted on formica panel in mahogany finished cabinet.

This instrument can be used not only with the HARKO SENIOR but with any other apparatus requiring two step amplifier.

Price, complete as shown in the illustration $25.00

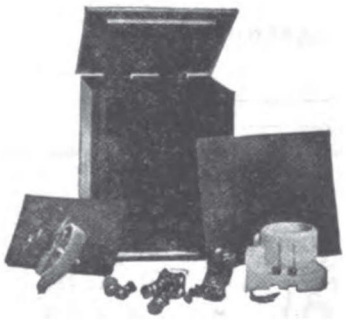
CROSLEY DETECTOR UNITS

There are furnished in two ways:

Completely wired and mounted as shown on the left, or knocked down as shown on the right. Mounted—everything ready to hook to your set. Suitable for many different hook-ups. Formica panel: mahogany finished cabinet. Matches up with the CROSLEY TWO STEP AMPLIFIER.

Price, completely assembled, as shown on the left $7.50

Price of all parts, including formica or other panel of high grade dielectric composition, not drilled as shown on the right 6.00



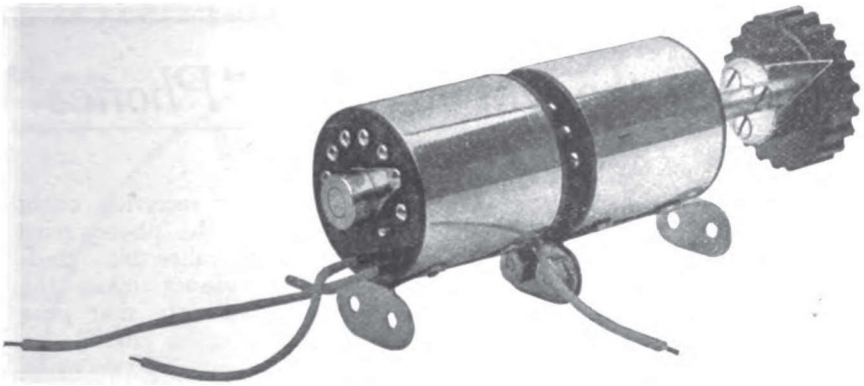
Size of the cabinet is 5⅞ in. long, 4⅞ in. deep and 6 in. high.

If your dealer cannot furnish any of the above units, we will ship direct prepaid, at the price. Dealers: Do not overlook the sales possibilities of the above units. Write for proposition.

CROSLEY MANUFACTURING COMPANY

Radio Dept. Q-7, Cincinnati, Ohio

Radio Frequency Amplifier



Pat. Appld. For

There is nothing that opens up a wider field on the receiving end for the amateur and experimenter, than radio frequency amplification.

After an extensive investigation of the various types of tube couplings possible for radio frequency amplification, we have developed the above units (two are shown) with a view to giving maximum efficiency and greatest ease of control, at a reasonable price.

Tuning each stage is not necessary. Only one adjustment necessary to cover fairly wide bands of wave-lengths with several stages.

Transformers for several stages can be mounted in tandem with single control which greatly simplifies the manipulation of the set.

Remember that radio frequency amplification will increase the range, the selectivity and the satisfaction you can get from your receiver. A loop antenna will be far more effective with radio frequency amplification.

These units will cover wave-lengths from 180 to 750 meters.

TYPE 5000 RADIO FREQUENCY AMPLIFYING TRANSFORMERS, $5.50

COTO-COIL CO.

87 WILLARD AVE.,
PROVIDENCE, R. I.

THE FOLLOWING DEALERS CARRY OUR APPARATUS—CALL IN AND SEE THEM

SOMERVILLE RADIO LABORATORY
Somerville, Mass.
WHITEHALL ELECTRIC CO.
Waterbury, Conn.
R. I. ELECTRICAL EQUIPMENT CO.
Providence, R. I.
DELANCEY FELCH & CO.
Pawtucket, R. I.
CONTINENTAL RADIO AND ELECTRIC CO.
New York, N. Y.
THE SAUTER CO.,
Schenectady, N. Y.
THE CRAMER HARDWARE CO.,
North Tonawanda, N. Y.
HUGHES ELECTRIC CORP.,
Syracuse, N. Y.
STERLING HARDWARE & ELECTRIC CO.,
Jamestown, N. Y.
RUSSELL MFG. CO.,
Niagara Falls, N. Y.
RADIO SUPPLY SERVICE,
Mount Vernon, N. Y.
JATH WIRELESS CO.,
Buffalo, N. Y.
RADIO ELECTRIC CO.,
Pittsburgh, Pa.
LANCASTER ELEC. SUPPLY & CON. CO.,
Lancaster, Pa.
R. SELWAY COLLMUS,
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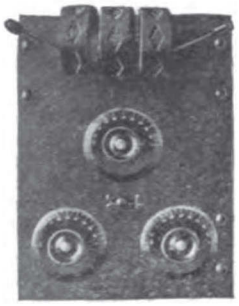
JONES ELECT. & RADIO MFG. CO.,
Baltimore, Md.
WHITE & BOYER CO.,
Washington, D. C.
CARTER ELECTRIC CO.,
Atlanta, Ga.
HERBRICK & LAWRENCE,
Nashville, Tenn.
SMITH NOVOTOY ELEC. CO.,
Charlotte, N. C.
NOLA RADIO CO.,
New Orleans, La.
JULIUS ANDRAE & SONS CO.,
Milwaukee, Wis.
INDUSTRIAL RADIO SERVICE,
Saginaw, Mich.
DETROIT ELECTRIC CO.,
Detroit, Mich.
WM. HALL ELECTRIC CO.,
Dayton, Ohio
SALZER ELECTRIC CO.,
Cleveland, Ohio.
WIRELESS MFG. CO.,
Canton, Ohio.
MARSHALL-GERKEN CO.,
Toledo, Ohio.
PRECISION EQUIPMENT CO.,
Cincinnati, Ohio
RADIOLECTRIC SHOP CO.,
Cleveland, Ohio.
SCIENTIFIC ENGINEERING CO.,
Cincinnati, Ohio
DODGE'S RADIO INSTITUTE,
Valparaiso, Ind.
TELEPHONE MAINTENANCE CO.,
Chicago, Ill.
WESTERN RADIO CO.,
Kansas City, Mo.
WESTERN RADIO ELECTRIC CO.,
Los Angeles, Cal.
ALTADENA RADIO LABORATORY,
Altadena, Cal.
SCIENTIFIC EXPERIMENTER, LTD.,
Montreal, Canada.

Type "Q" Receiver



AN IDEAL RECEIVING SET FOR LONG AND SHORT WAVE AND RADIO TELEPHONE RECEPTION

This set is the most flexible receiving set on the market. With the use of the various sizes of Honeycomb Coils everything in the range of radio telegraph and telephone reception from 200 to 25,000 meters is brought into your home. Consists of a three coil mounting, and three Variable Condensers of proper capacity. Tuning extremely sharp. Remler dials.

Price without Detector.....$35.00

Duck's New Radio Catalog No. 16

Send 12c today for copy of the greatest radio catalog ever put between the pages of two covers.

275 Pages--A Catalog DeLuxe

Never in the history of radio was such a catalog printed. The radio data and diagrams embracing upwards of fifty pages, gives the experimenter more valuable and up-to-date information than will be found in many text books selling for $2.00, and $1.00 could be spent for a dozen different radio catalogs before you could gather together the comprehensive listing of worth while radio goods found in this great catalog.

A brief summary of the radio goods listed in this catalog:

The entire radio catalog of the Radio Corporation, with a wealth of scientific and technical data on C.W. transmitting sets, and all the diagrams for the assembling of these sets; the complete Remler catalog, which embraces 25 pages, the Westinghouse, Firth, Murdock, Federal, DeForest, Clapp-Eastham, Brandes, Connecticut Company, Thordarson, Turney, Magnavox Company catalogs, the best products of Adams-Morgan, Signal and countless other manufacturers, including our own complete line of radio apparatus, and many individual items and parts used in radio work today.

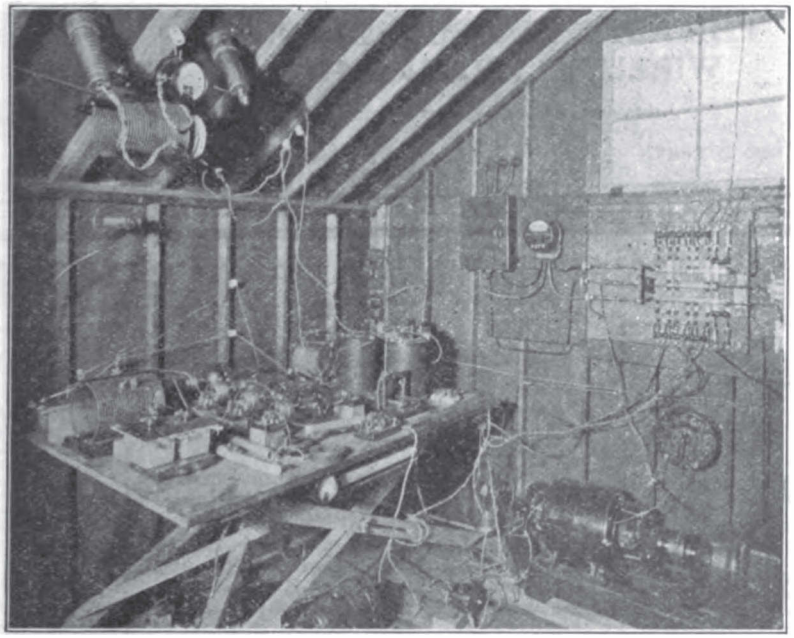
Send only 12c for copy of this wonderful catalog. You will need no other when you have Duck's, and you cannot find in all others combined what you will find in Duck's Wonder Catalog.

The William B. Duck Company

243-245 Superior Street **Toledo, Ohio**

Dubilier Condensers Helped to Make Radio History

"No circuit is stronger than its weakest link." When 1BCG sent its now historical message across the Atlantic, a perfect co-relation of parts and apparatus was necessary. Everything from the commutator on the generator to the lead-in insulator in the roof had to function "just so". During the preliminary tests, the operators of 1BCG were constantly confronted with condenser trouble. One after another, the condensers would break down. It is always best to use the right thing in the right place, so two Dubilier Mica Condensers were placed in the circuit and the weakest link was immediately repaired. From that moment on, the condensers were forgotten because they could be trusted—they were reliable.



Are your condensers the weakest link in your circuit? There is a Dubilier Condenser to meet your every need. Dubilier Condensers are different because their construction is patented and they are manufactured by a controlled process. Send for literature describing them today.

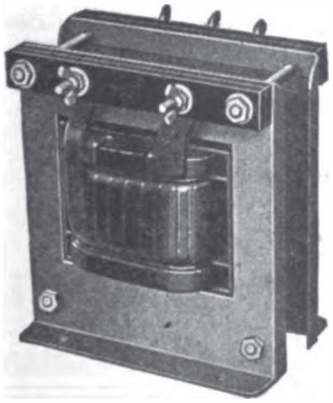
The next time you visit your radio dealer, ask to see Pacent Radio Essentials. We sell apparatus plus service.

Pacent Electric Company, Inc.

150 Nassau Street, New York City

Member Radio Section Associated Manufacturers of Electrical Supplies.

SHELL TYPE
Transformers
FOR C.W.



The Superiority of Shell Type Transformers Is Recognized

FOR FILAMENT HEATING

Capacity Watts	Sec. Volts	Price Unmounted	Mounted
80	8.5	$6.00	$7.00
150	12	8.00	10.00
300	12	12.50	15.00

FOR PLATE SUPPLY

Capacity Watts	Secondary Each Side of Neutral	Price Unmounted	Mounted
100	350 and 550	$11.00	$13.00
450	1000 " 1500	16.00	18.00
900	1000 " 1500	27.00	30.00

WE MANUFACTURE TRANSFORMERS DESIGNED FOR ONE 5 WATT TUBE, WITH SECONDARY VOLTAGES OF 10 AND 650, BUILT SHELL TYPE, UNMOUNTED ONLY, PRICE $7.50.

Thordarson Electric Mfg. Co.

517 S. Jefferson Street. **Chicago**

RADIO APPARATUS

LARGEST STOCK SOUTH

SERVICE **PROMPT DELIVERIES** **QUALITY**

B. Batteries Radisco Small 22½ V.....	$1.50	Sockets Paragon	$1.00
B Batteries Radisco large-tapped 22½V.	2.65	Sockets Murdock	1.00
B Batteries Eveready large-tapped 22½V.	3.00	Sockets G.A.	1.50
Tubes UV200 Radiotron Detector.....	5.00	Sockets DeForest	1.20
Tubes UV201 Radiotron Amplifier.....	6.50	Rheostats Paragon	1.50
Tubes UV202 Radiotron Trans-5 watt..	8.00	Rheostats DeForest	1.65
Tubes UV203 Radiotron Trans. 50 watt	30.00	Rheostats Gen. Radio	2.50
Tubes C300 Cunningham Detector.....	5.00	Rheostats Remler-Jr.	1.00
Tubes C301 Cunningham Amplifier....	6.50	Remler Rheostat	1.50
Tubes Electron Relay Detector.....	5.00	Rheostats Parkin	.75
Tubes A & P Amplifier.....	6.50	Corwin Dial & Knob 3"	1.00
Phones Murdock 2000-ohm.....	4.50	Corwin Dial & Knob 3⅞"	1.20
Phones Murdock 3000-ohm.....	5.50	Dial and Knob Chelsea.....	1.00
Phones Brandes Superior.....	6.00	Transformers, Acme Unmounted.....	4.50
Phones Brandes Navy.....	14.00	Transformers, Acme Semi-mtd.....	5.00
Phones Baldwin Type C.....	13.75	Transformers, Acme Mounted.....	7.00
Phones Baldwin Type E.....	15.00	Transformers, Federal	7.00
Phones Baldwin Type F.....	16.25	Transformers, UV712	7.00

We have only listed a few items above, can furnish anything required for your set—we stock only high grade products.

Acme Apparatus	Federal	Brandes	Remler
Clapp-Eastham	Firth	Adams-Morgan	Signal
DeForest	Radio Dist. Co.	Chelsea	Eveready
Wm. Murdock	Radio Corp.	Magnavox	N. Baldwin Co.

ROSE RADIO SUPPLY

604 GRAVIER STREET, NEW ORLEANS, LA.

Send 10c for Catalog.

The "QSA" Line of Radio Equipment

COMBAT

A storage battery of superior construction. The only battery with non-corroding terminals. Write for particulars and incidentally get on our mailing list to receive our special monthly bargain lists. December's list will contain a special offer on the "COMBAT". Don't risk missing this offer but write immediately for our descriptive circular.

6 VOLT 80 A. H. "COMBAT"

This month only at $21.00

Our catalog of "QSA" equipment sent for 10 cents

Independent Radio Supply Co.

3716 W. Douglas Blvd. Dept. H-12

CHICAGO, ILL.

"BETTER RESULTS WITH LESS EFFORT"

OF COURSE

You want your goods shipped promptly and postpaid. Save both time and money by ordering directly from this ad.

Q1-A new Short-Wave Regenerative Set unwired, Formica panel, excellent finish, range 150 to 600 meters	$28.00
Q2—Radiotron ‡200, detector	5.00
Q3—Radiotron ‡201, amplifier	6.50
Q4—Radiotron ‡202, transmitter	8.00
Q5—Murdock Moulded V-T Socket	1.00
Q6—Crosley Porcelain V-T Socket	.60
Q7—Power Tube Rheostat, 5 ampere	1.85
Q8—Firco Amplifying Transformer	5.00
Q9—Murdock 43 plate Variable Condenser ...	4.50
Q10—Amrad Variometer (honeycomb)	6.10
Q11—Amrad Variocoupler (honeycomb)	6.90
Q12—Anti-Capacity Switch	2.50
Q13—Murdock ‡56 Phones	6.00
Q14—Baldwin Amplifying Phones	13.75
Q15—Large Burgess "B" Battery, 22½ volt..	2.25
Q16—Burgess "Baby B" Battery, 4½ volt	.40
Q17—Laminated Nickel Switch Lever	.65
Q18—Large Nickel Switch Points	.04
Q19—Large Nickel Binding Posts	.11
Q20—Cabinet 6"x14", Flemish Finish	3.30
Q21—Formica Panel for same	2.10

Our new Radio Catalog describes Radio Telephones from 10 watts to 2 K. W. $48 to $4000; Spark Transmitters; Receiving Equipment; Antenna Materials; and the best line of Parts ever offered. It will be sent free with any order of $1.00 or more from this advertisement; or mailed to any other address on receipt of 25 cents in stamps, which will be refunded on the first order for $1.00.

CRAIG AND LOUGHBOROUGH

Norwood Nat. Bank Bldg., Norwood (Cincinnati) Ohio.

Ask For These Folders

They tell all about Westinghouse Radio Receiving Sets, and about the Broadcasting Stations that provide a carefully balanced and judiciously chosen series of nightly entertainments, including news, weather, crop and stock reports, all kinds of sporting events and, on Sundays, complete church services.

Broadcasting stations are located as follows:

East Pittsburgh, Pa., Station "KDKA"	**360 meters**
Newark, N. J., Station "WJZ"	**360 meters**
Springfield, Mass., Station "WBZ"	**360 meters**
Chicago, Ill., Station "KYW"	**360 meters**

Westinghouse Electric & Manufacturing Co.

East Pittsburgh, Pa.

Westinghouse

SECOND ANNUAL AMATEUR RADIO

Convention-Exhibition

A Real Radio Convention and a Real Exhibition of Radio Equipment

Pennsylvania Hotel—New York

MARCH 7-8-9-10-11, 1922

Another year has rolled around and the time for the Second District Convention and Radio Show, the big event of radio, is almost here. Everybody remembers, (for everybody was there), the smashing big success of last year. Well this year is going to add another big success to the history of radio. There isn't any doubt about it, for everybody who was there last year will be on hand again to meet everybody else, and will bring with them all the new converts to the cause created by radiophone broadcasting.

This Simon-pure radio show will be the most interesting and instructive affair of the kind ever held. The general arrangements are practically the same as last year.

The glass-enclosed roof garden of the hotel will be the exhibit hall, and the adjoining Butterfly Room affords an excellent lecture hall, with adequate seating capacity. Only papers of vital interest to amateurs will be presented.

Developments in the new and rapidly broadening field of radio have come thick and fast since last year. Some of them are so amazing in character and so far beyond anything yet generally known to the average radio operator, that any attempt to describe them on this printed page would result only in a very poor and inadequate effort. Come yourself and hear about them and see these new epoch-making devices in actual operation, and you will immediately wonder at the almost unlimited applications of radio to useful purposes.

A banquet for everybody, male and female, will be held on the night of the 11th (Saturday). And it's going to be SOME banquet. This refers both to the dinner and what will be done and who will do it. All the big men of radio will be there.

That dusky-hued girl who was the sensation of last years' dinner will be there again, to demonstrate the last gasp in Hawaiian grass costumes. All male guests will be searched at the door for concealed lawn-mowers.

The Convention and Exhibition will open at 7 p.m., March 7, and will be open from 2 p. m. to 11 p. m. on the following days. A season badge will be sold at the door for 50 cents, covering the five days. One time admissions 25 cents.

The banquet charge will be $4.00. The number which can be accommodated is limited to 600. Tickets will be allotted up to this number only, in the order in which applications are received. Applications by mail should be made to John Di Blasi, 6 Warren Street, New York.

Tickets are on sale at

Continental Radio & Electric Corporation,
6 Warren Street, New York.

Manhattan Electrical Supply Company,
17 Park Place, New York.

J. H. Bunnell Company,
32 Park Place, New York.

American Electro Technical Appliance Company
235 Fulton Street, New York.

Wireless Press,
326 Broadway, New York.

This convention-exhibition is held under the auspices of the Second District Executive Radio Council. It is non-partisan, non-sectarian, non-everything —just a straight out and out Second District Amateur Radio Affair, sponsored by all the radio clubs of the Second District. This is an unparalleled opportunity for material gain, for acquiring knowledge, the making of personal acquaintances, and for general good. It will be the biggest thing ever done in the history of amateur radio.

EXECUTIVE RADIO COUNCIL--Second District

COMMITTEE

J. O. Smith, Chairman
326 Broadway, New York

R. H. McMann, Ass't. Chairman

John Di Blasi	A. C. Mills	B. B. Jackson	L. M. Cockaday
A. F. Clough	F. B. Ostman	W. A. Remy	C. E. Huffman
J. B. Ferguson	C. J. Goette	W. J. Howell	J. J. Kulick
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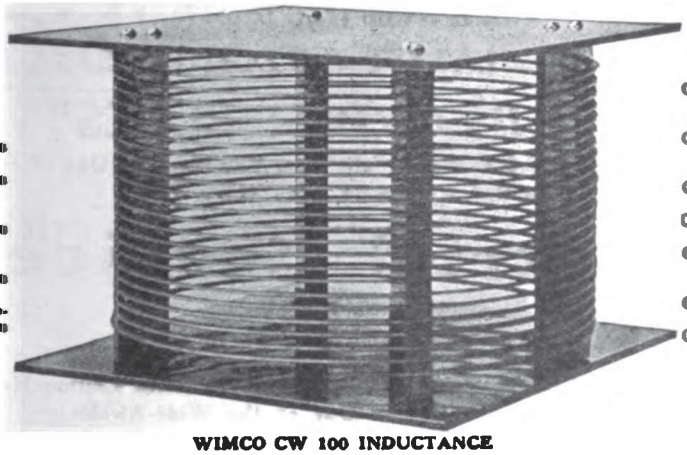
C-W C-W C-W C-W C-W C-W C-W C-W

CW Filters
CW Plate Transformers
CW Condensers
CW Filament Transformers
CW Iron Core Chokes
CW Radio Frequency Chokes



CW Power Tubes
CW Rectifier Tubes
CW Sockets
CW Rheostats
CW Microphones
CW Tone Arms
CW Modulation Transformers

WIMCO CW 100 INDUCTANCE

Get the BEST CW Inductance. Real connection clips provided, no uncertain switches which short circuit turns. Entirely insulated on Formica, high conductivity copper, very efficient. Made in 25 and 50 turn sizes, priced at $10.00 and $13.50 respectively. Also sold in parts ready to assemble.

We distribute the only complete line of panel type meters in America—Thermo-ammeters, AC and DC Voltmeters, Ammeters and Milliammeters. You can now equip your set with a complete set of meters all alike.

Big line of high voltage generators and motor-generators reasonably priced—just what you have been looking for.

SPECIAL NOTICE

Grid coils for the above CW Inductance are now supplied so that the circuit described in July QST can be employed—and take it from us it is the REAL amateur circuit. Grid coil for the CW 100 Inductance priced at $2.00. Ask for our new bulletin containing full dope on this circuit—try it on your own set, it's a winner.

Antenna Specials

Now is the time to remodel your antenna and we are especially prepared to supply your needs in solid copper, stranded copper and copper-weld aerial wire.

Ask about the New Air Gap Type

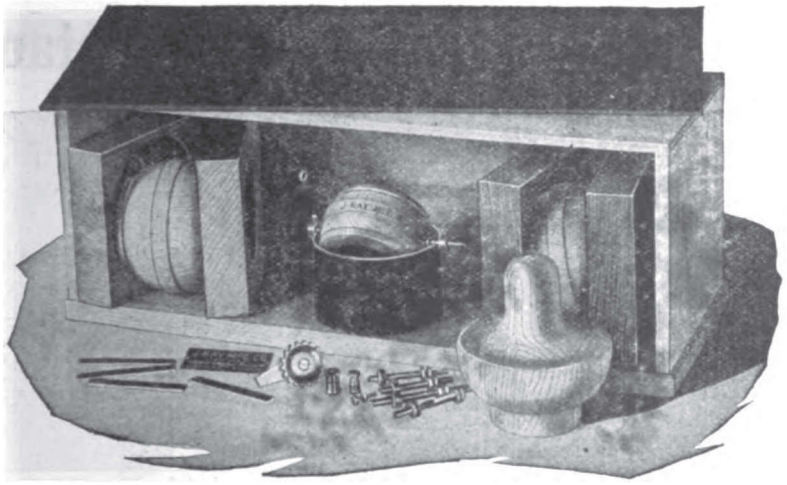
Antenna Insulators—wonderful for CW—priced right—positively superior to present forms and materials.

Send for special Antenna Material Bulletin or send 15c in stamps for catalog and complete literature.

8ZV WIRELESS MANUFACTURING CO. 8ZV

CANTON, OHIO

WIMCO apparatus is distributed in Canada by Ontario Radio Laboratory, Sault Ste. Marie, Ont.



J-RAY UNASSEMBLED RECEIVER

$15.50
As Shown

200-600 meters

$19.50
With All Windings

Save $$ on the cost of your receiving outfit by assembling your own.

This complete set of parts, assembled in an hour's time, is a most exceptional value at only $19.50 ($15.50 if you do your own winding), and is our contribution towards the lower cost of Radio. Each set is of perfect workmanship, and sold under a money back if not satisfied, basis. Set consists of the following:

1 Stained Oak Cabinet, 18″x7″x7″, removable top and back.
1 Polished Formica Panel, 18″x7″x⅛″ to fit Cabinet.
2 Variometers, 4¾″ square, mahogany wood, beautifully turned.
(Variometers are now being made "flush type" i.e., with edges grooved to accomodate bearing.)
1 Winding form for stator windings.
1 Formica Coupler primary tube 3⅝″x2½″ high.
1 Coupler secondary ball, mahogany turned.
7 Contact Points, 6 Binding Posts, 1 Switch Lever, 2 Stops.

Set complete with all holes drilled, (except panel), all necessary brass parts, screws, etc., for assambling, with directions. Panel drilled $0.50 extra. Dials $1.00 each.

Undoubtedly one of the greatest values ever offered. Place your order today and be convinced. Remember, **money returned if not satisfied in every respect**

Variometer Parts separate, wound $3.90; unwound $2.00 each.

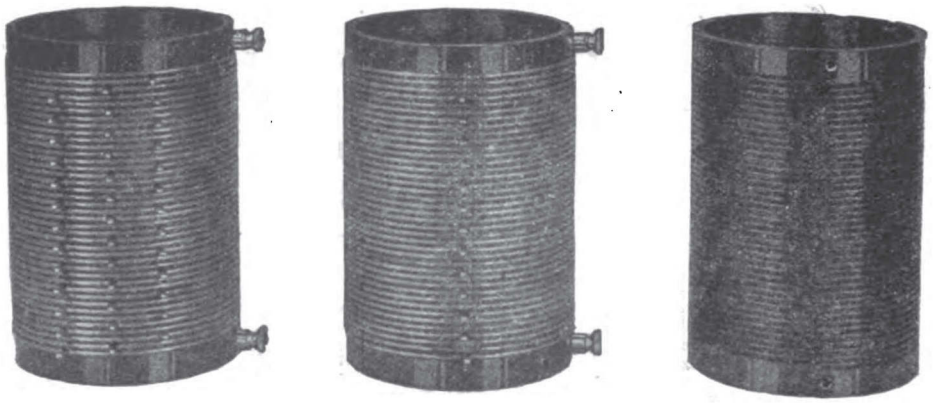
Complete Vario Set comprising grid and plate Variometers and Variocoupler, all wound and ready to assemble, $9.75. Cabinet only $6.

Unassembled receiver, as above, with detector and 1 step amplifier in slightly larger cabinet, $29.50 Includes all windings.

We are distributors for all leading makes of apparatus, try us.

J-RAY MFG. CO. 2131 DeKALB ST. ST. LOUIS, MO.

Tuska Moulded C.W. Inductances



Type 187—$4.65 Type 186—$4.15 Type 185—$3.15

This latest Tuska development consists of a moulded inductance form four inches in diameter and six inches long. The threads for the wire are also moulded in, which insures not only a perfect mechanical process but the dielectric losses are less than in the case of a machined product.

The inductance is supplied in three forms as shown. The models are wound with No. 12 soft drawn copper wire. This will carry an average load of 50 watts. The inductances are tapped every third turn or every turn in which case they are staggered in three rows.

We are proud of this latest Tuska Product and invite you to inspect it at your dealers. The latest Tuska Catalog No. 2 is out and shows several new Products. Send 5 cents in stamps.

THE C. D. TUSKA COMPANY, 10 Hoadley Place, Hartford, Conn.

RADIO FREQUENCY TRANSFORMERS

Type RF-1 for amateur range $6.00

Mr. Amateur: Hook up a radio transformer ahead of your detector and get acquainted with stations you have not heard before.

The Type RF-1 is a:—

- **Transformer of special type R.F. iron core construction (Patent Pending.)**
- **Transformer having complete shielding.**
- **Transformer covering the amateur wave-length range efficiently.**
- **Transformer giving maximum amplification per stage.**
- **Transformer designed by former Government radio engineers.**

Commercial and special range R.F. transformers supplied.

RADIO SERVICE LABORATORIES

Incorporated

Asbury Park, New Jersey

4th DISTRICT! 5th DISTRICT! RADIO MEN!

LOOK AT THESE PRICES, CAN YOU BEAT THEM?

Switch contact points, Brass, Doz.	$ .25
Switch contact points, N. P., Doz.	.30
Binding Posts, Brass, Each	.07
Binding Posts, N. P. Each	.09
Remler Switch Levers 1"	.40
Fada Rheostat	1.00
Wilcox Rheostat	.65
Magnavox	45.00
Tuska Unassembled Reg. Tuner	27.50
Formica Panels cut to order, Sq. In.	.02
Our fully guaranteed "B" battery	
22½ volt 15 cell plain	1 50
22½ volt 30 cell plain	2.50
For variable add 25 cents	
45 volt 60 cell plain	5.00
New Clapp-Eastham regenerative tuner complete with detector control	35.00

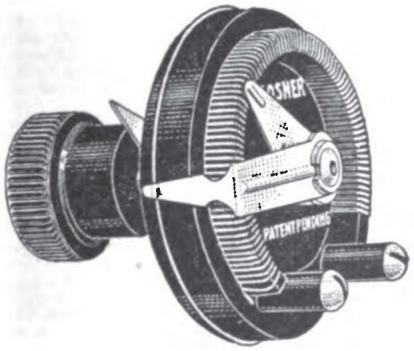
With each of these new HR sets we will give one B Battery free of charge.

We carry a complete line of the famous JEWELL Thermo-Couple instruments.

Our complete stock enables us to ship your orders same day received. Estimates furnished free on any CW or phone installation. We have a blue-print for you of a good CW hookup which you may have for the asking. We carry a full stock of the following goods. Clapp-Eastham, General Radio, Remler, Cunningham, Magnavox, DeForest, Federal, Formica, Chelsea, Murdock, Amrad, Firco, Tuska, RAC Grebe, Acme, Esco, Ace, Turney, Shramco, Pacent, Radio Corp'n, FADA, Brandes, Baldwins, Willard "A" Batteries, American Radiograms and Postalgrams.

SOUTHERN RADIO SUPPLY CO.
Box 550, St. Petersburg, Fla.

KLOSNER VERNIER RHEOSTAT



Patent Pending

FOR THE MODERN CRITICAL TUBE

The first and only Vernier rheostat made having but

One Single Knob

for both rough and fine adjustments

SIMPLE QUICK POSITIVE

Highly finished Condensite base and knob. Phosphor bronze contact springs. All metal parts polished nickel plate. Diameter 2⅛ inches.

Price Only - - $1.50

Add shipping weight one pound.
Get it at your dealer or send direct to us.
Sold on a satisfaction or money back guarantee.

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MURDOCK

radio necessities

No. 56

MURDOCK REAL RADIO RECEIVERS have delivered complete satisfaction, on a "money-back" basis for 14 years. Those years of experience have so simplified and perfected our production that there are today no receivers quite so good at so low a price.

The latest Murdock achievement, the No. 56 Receiver, is a highly sensitive instrument which retains all the rugged strength of previous types. Important features are, the improved comfortable headband, the "Murdock-Moulded" ear pieces shaped to exclude outside noise, and the riveting of all parts into one durable unit.

All models of Murdock receivers are sold with free trial offer and money-back guarantee. Use them in direct comparison to any other phones for 14 days. Make any test you wish. Then at the end of the two weeks, if the Murdock Phones are not entirely satisfactory, return them and your money will be refunded!

We strongly urge you to go to your dealer, and convince yourself of the quality of Murdock receivers, by actual examination, before you buy. **Prices $4.50 to $6.00.**

Murdock Phones are the standard bearer for a complete line of "Made-by-Murdock" radio parts and instruments. This includes the famous Murdock condensers, couplers and variometers, and the new Murdock Rheostat at $1.00.
Send for Free catalogue.

WILLIAM J. MURDOCK CO.

65 CARTER ST., CHELSEA, MASS.

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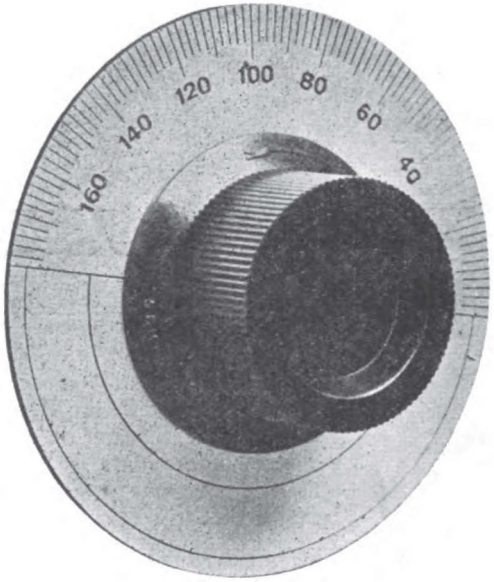
To determine the percentage of sales we make through QST ads, we make the following combination offers. These offers good to QST readers only.

1 DeForest 6 Ohm Filament Rheostat Reversible $1.65
1 DeForest Moulded Condensite VT Socket 1.25
6 15c Insulated Top Binding Posts ..... .90
1 UV200 Radiotron.. 5.00
1 2766 Eveready large B Battery 3.00
$11.80
COMBINATION PRICE $10.00 POSTPAID

2 22½V SORSINC "B" Batteries @ $4.00 ..... $8.00
1 AP Amplifier Tube 6.50
$14.50
COMBINATION PRICE $14.00 POSTPAID

Complete parts of Wimco 25 Turn CW Inductance $8.50
UV202 Radiotron 8.00
$16.50
COMBINATION PRICE $15.50

Insist on the SOMERVILLE DIAL INDICATOR



At the

NEW PRICE

$1.75

for the 4" Dia. model and

$1.60

for the new 3¼" dia. model

POSTPAID

from us. or from your dealer

New lot has dial insulated from shaft, so that dial may be grounded to act as a shield.

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Send 25c for our ENLARGED Catalog!

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SOMERVILLE
1000V CW
Condensers
75c Postpaid Post Paid

Using An Inefficient Radio Set Is A Disappointment

We won't disappoint you because we handle the things that are really worth while in Radio. Our stock includes receiving and transmitting apparatus desirable for Spark, C.W. and Phone made by:

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Magnavox	Clapp-Eastham
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Pioneer makers of Andrae Telephones. In business 60 years.

Our service is of the best and the quality of our goods unquestionable. Identified with telephone and electrical development of the Northwest since its beginning.

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119 Michigan Street,
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RADIO CITIZENS

Complete stocks carried for immediate shipment of the following apparatus:

Grebe	Murdock
DeForest	Adams-Morgan
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FREE BULLETINS PRICE LISTS

Get the new lowest prices on apparatus and supplies. Bulletins and price lists mailed FREE on your request. Send for them today.

Nash Electrical Service Co.
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Make Your Own Loud Talker!

NEW Vocaloud phonograph attachment fits tone-arm of your Victor or Columbia phonograph or metal horn. This outfit consists of a Vocaloud reproducer, altered in accordance with Firco engineering design, with special moulded cap, six feet of silk covered cord and Firco round type "Bull-Dog-Grip" Plug, complete for **$14**

FIRCO Rheostat. Mount the Firco resistor and the Firco Type 7-A switch on your panel and you have a professional type Rheostat, 100% air cooled and closely variable. Switch **90c**, Resistor **50c**. Both together **$1.30**.

HERE is the Crystal Detector exactly as used on the Kolster Decremeter. The most easily adjusted detector ever designed. Satisfaction guaranteed in direct comparison with any other type of Crystal Detector. Price **$2.50**. Silicon Crystal **25c**. Supersensitive Galena Crystal, **40c**. Both mounted in Woods' Metal.

FIRCO Jacks and Plugs. "Bull-Dog-Grip" interchangeable telephone plugs. Flat type, 34A, **$2.00**, round type 34B, **$2.50**. Firco Jacks, 99% sterling silver contacts. Nickel silver instead of phosphor bronze springs. Open circuit **70c**. Closed circuit **85c**. Double circuit **$1.00**. 3 spring automatic filament control Jack. **$1.15**. 5 spring automatic filament control Jack, **$1.40**.

Examine Firco products at all leading radio dealers

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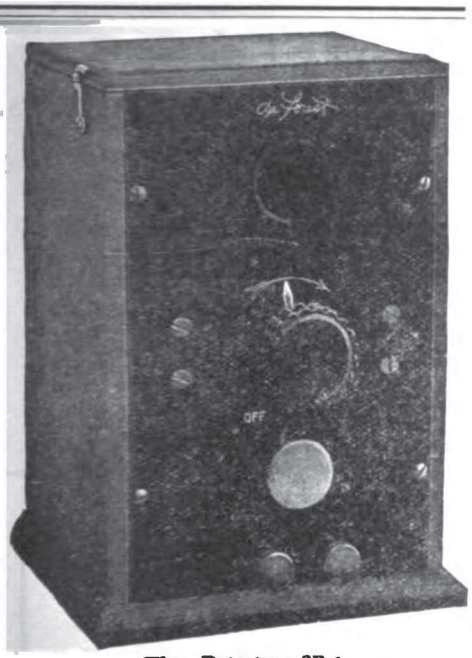
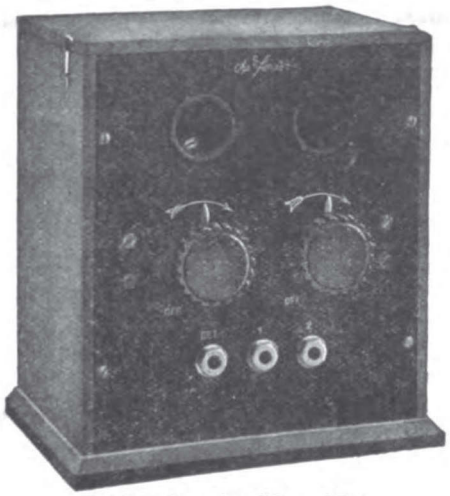
Ask your dealer to show you the new Firco-Clad transformer. Slightly larger than the Saco-Clad. Ratio 1:9. Price **$7.00**. Also the new improved Saco-Clad audio frequency transformer Ratio 1:3. Price **$6.00**



The Detector—SP-1



The Two-Step Amplifier—SP-2

A NEW DeFOREST LINE of RECEIVING INSTRUMENTS

The SP Series

Appearance and efficiency have been combined in these instruments to make equipment of which any amateur may be proud. Binding posts are mounted on bakelite insert strips set in the rear of cabinets. Jacks are of the filament control type, disconnecting filaments and amplifying transformers not in use and making unnecessary, frequent re-adjustments of rheostats.
Panels are of engraved $\frac{1}{8}$" bakelite, all visible parts are heavily nickeled, hinged tops permit ready access to interiors for insertion of tubes and for inspection. Deluxe equipment at moderate prices.

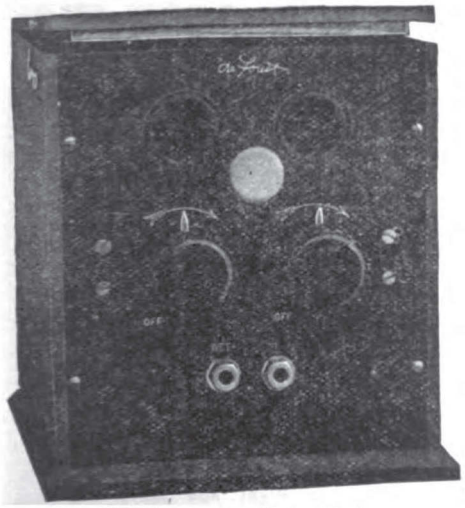
SP-1	$18.50	SP-3	$42.00
SP-2	$48.00	SP-4	$65.00

ALL PRICES F.O.B. NEW YORK

DeForest Radio Telephone and Telegraph Company

1391 Sedgwick Avenue, New York City

Western Distributors: Atlantic Pacific Radio Supplies Company, 638 Mission Street, San Francisco, Cal. Henry M. Shaw, Pres.



The Detector and 1-Step—SP-3

The Detector and 2-Step—SP-4

Duplicate the Set
Heard Across the Atlantic

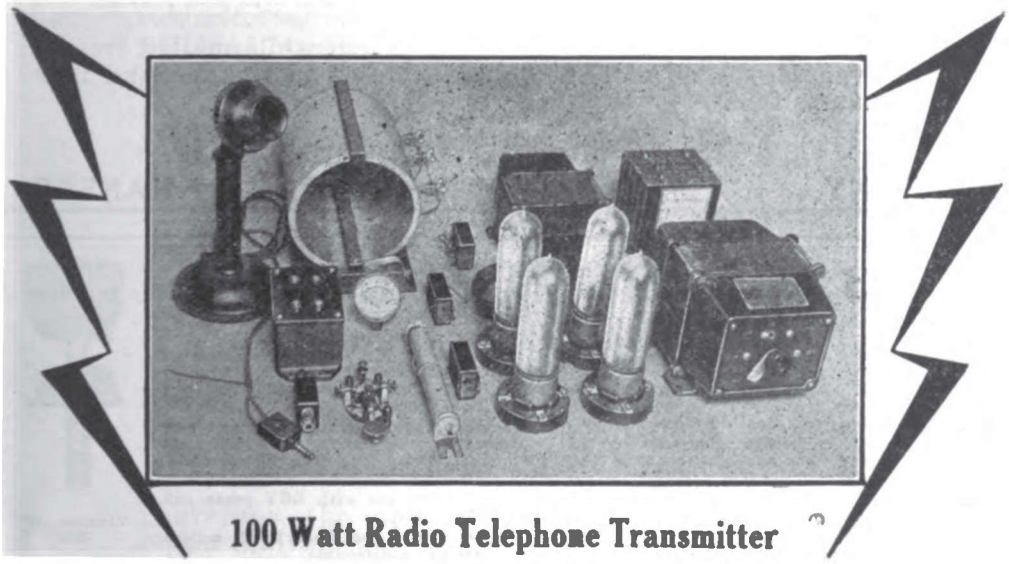
Amateur history was made on December 9, when 1BCG in Greenwich, Conn., was heard in Ardrossan, Scotland—a distance of over 3500 miles.

This amazing feat was performed with four Radiotrons UV-204—one used as a master oscillator, the other three as amplifiers.

There was nothing special about 1BCG's equipment. His circuit was similar to those described and illustrated in the RCA Catalogue for CW transmission.

You can duplicate the equipment used at 1BCG for experimental communications at a comparatively small expense.

Look over the RCA Catalogue and Instruction Book. Select the set most suitable for your needs, and then order the required parts from your nearest dealer.



100 Watt Radio Telephone Transmitter

Microphone and Stand	$15.00	Transmitter Grid Leak UP-1718	$ 1.65	Radio Frequency Choke	2.00
Jack ($1), Plug ($2), Cord ($1.50)	4.50	Transmitter Condensers UC-1015	5.40	Kenotron Rectifier Tubes UV-217 (2)	$53.00
Oscillation Transformer UL-1006	11.00	Transmitter Condensers (2) UC-1014	4.00	Filter Condensers (5) UC-1635	10.00
Magnetic Modulator UT-1367	17.00	Filter Reactor UP-1627	15.75	Power Transformer UP-1016	38.50
Antenna Ammeter UM-533	6.25	Radiotron Power Tubes UV-203 (2)	60.00	Incidentals	12.95
Sending Key UQ-809	3.00			Approximate total	$260.00

For complete circuit and details of necessary apparatus to make up this radio telephone set see Fig. 1, page 11, RCA Catalogue, which can be secured from your nearest dealer or by sending 25 cents direct to SALES DIVISION, Suite 1803

Radio Corporation of America

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RADIO APPARATUS

Distributors of Reliable Radio Apparatus to Dealers, Schools, Colleges, Radio Clubs and Experimenters All Over the World!

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SERVICE DISTRIBUTES "RADIO CORPORATION'S" PRODUCTS ALL OVER THE WORLD! TRY US AND SEE!

"PITTSCO"

NOW HAS TWO STORES! BOTH CARRY "RADIO CORPORATION'S" COMPLETE LINE. ORDER TODAY FROM THE NEAREST!

RADIO CORPORATION'S PRODUCTS

No. UV-200 Radiotron, Detector	$5.00
No. UV-201 Radiotron Amplifier	6.50
No. UV-202 Radiotron 5 watt tube	8.00
No. UV-203 Radiotron 50 watt tube	30.00
No. UV-204 Radiotron 250 watt tube	110.00
No. UT-501 End-mountings for UV-204	2.50
No. UT-502 End-mountings for UV-204 Per Pair	4.50
No. UR-542 Porcelain Socket	1.00
No. UP-552 Bakelite Socket	1.50
No. UT-541 Porcelain Socket for UV-203 and UV-217 "Kenotron" tubes	2.50
No. UV-216 20 watt "Kenotron" tube	7.50
No. UV-217 150 watt "Kenotron" tube	26.50
No. UP-1368, 325 watt C.W. Transformer	25.00
No. UP-1016, 750 watt C.W. Transformer	38.50
No. UL-1008 Oscillation Transformer	11.00
No. UT-1343 Magnetic Modulator, ¼, to 1¼ amps.	9.50
No. UT-1357 Magnetic Modulator 1¼ to 3¼ amp.	12.50
No. UT-1367 Magnetic Modulator 3¼ to 5 amps.	17.00
No. UP-1626 Filter Reactor, 160 Milli-amperes	11.50
No. UP-1627 Filter Reactor, 300 Milli-amperes	15.75
No. UP-415 Plate Circuit Reactor	5.75
No. UC-1631 Filter Cond. ½ MFD 750 Volts	1.35
No. UC-1632 Filter Cond. 1 MFD 750 Volts	1.85
No. UC-1634 Filter Cond. ½ MFD 1750 Volts	1.50
No. UC-1635 Filter Cond. 1 MFD 1750 Volts	2.00
No. UP-1719 Trans. Grid leak 5000 ohms	1.10
No. UP-1718 Trans. Grid Leak 5000 ohms for UV-203 and UV-204 Tubes	1.65
No. UM-530 Hot Wire meter, 0-2¼ Amps.	6.00
No. UM-533 Hot Wire meter, 0-5 Amps.	6.25
No. UQ-809 Sending key for C.W. Transmission	3.00
No. UP-414 Microphone Transformer	7.25
No. PR-535 Filament Rheostat for UV-200, 201 and 202 tubes	3.00
No. PT-537 Filament Rheostat for UV-203 and UV-204 tubes	10.00
No. PX-1638 Rotary Grid Chopper	7.25
Shaft Bushings for ¼" or ⅜" motor shaft	.20
No. UC-1015 Antenna Series Condenser, 7500Volts .0003 .0004, .0005 MFD 3 values	5.40
No. UC-1014 Plate and Grid Condenser, 3000 Volts .002 MFD	2.00
No. UC-1803 Special Condenser, 10,000 Volts .000025 MFD.	5.00
No. UC-1806 Special Condenser, 6000 Volts, .002 MFD	7.00
No. UV-712 Amplifying Transformer	7.00
No. PR-536 "A" Battery Potentiometer	2.00
No. UC-567, .00025 MFD Grid and Plate Condenser	1.20
No. UC-568 .0005 MFD Grid and Plate Condenser	1.35
No. UC-569 .001 MFD Grid and Plate Condenser	1.50
No. UC-570 .0025 MFD Grid and Plate Condenser	2.00
No. UP-509 to UP-527 Grid Leaks .05 to 5 megohms, each	.75
No. UX-548 Grid leak mounting	.50
Note—Radio Corporations C.W. Instruction Book giving hookups, and complete information	.25

Announcement!!!

The policy of the F. D. PITTS CO. has been and will be to render a **"Superior Service"**, a Service based on carrying in stock for immediate delivery all desirable Radio apparatus, to serve our customers promptly and intelligently and to make them feel that we are truly grateful for their patronage.

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

Mr. H. H. Tilley, a valued member of our organization will be in charge. His experience is wide and diversified, having in turn been an Amateur, Commercial Operator, Engineer, Instructor and Sales-Manager. You are cordially invited to visit our new store and experience real SERVICE.

If at any time you are interested in Radio to the extent of desiring instruction, Amateur or Commercial; Spark, Arc or Vacuum tube, let the EASTERN RADIO INSTITUTE train you—New England's, Oldest, Largest and Best equipped Radio School. For over six years I was Chief Instructing Engineer at this Institute, and I am in a position to know! Over 4000 satisfied graduates tell the story best! Our Organization with Years of phenomenal Results and Success is behind every man who enrolls.

F. D. PITTS
President and General Manager

"LET 'PITTSCO' PRODUCTS, SUPER-SERVICE, AND DELIVERY SOLVE YOUR HOLIDAY PROBLEMS"

SEND US YOUR ORDER TODAY!

Send ten cents for Catalog No. 22. Over 100 pages, over 150 illustrations, over 600 items.

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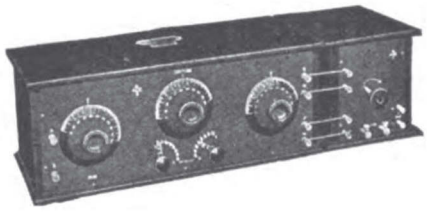

A C E **Type AVC Regenerative Receiver** **A C E**

Ideal for either voice, CW, or spark reception over maximum distances.

Price $56.00

(Licensed under Armstrong Patent 1,113,149)

"QUALITY AND EFFICIENT PERFORMANCE"

are the essential features to be considered when purchasing radio equipment.
We stock a complete line of Radio Supplies and maintain a *prompt, reliable* Mail Order Service that reaches all over the world.
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The Precision Equipment Co., Inc.

Manufacturers & Distributors of Radio Apparatus

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Cable Address ACE Cincinnati — Radio 8XB WMH

The "QSA" Line of Radio Equipment

SERVICE?—Pshaw! We could fill a page talking about it. We have, of course, the utmost confidence in our ability to live up to any promises we might make. But, since you are the judge, all we ask is an opportunity to demonstrate our ability to give you the kind of service you want. We list below, for your convenience, a representative group of radio supplies. Most of the items are just what you need to put your set in shape for real DX work. Well then, send your order in at once and give us the chance to prove ourselves. We will appreciate it.

Radiotron U.V.200 detector	$5.00
Radiotron U.V.201 Amplifier	6.50
Radiotron U.V.202 5 watt transmitter	8.00
U.V.712 Intertube Transformer	7.00
*Fada detector comp. with crystal	2.25
Acme 1K.W. Spark Transformer	28.00
Acme Amplifying Transformer	5.00
Brandes Navy Type Phones	14.00
*FADA Panel Mounting Rheostat	1.00
PR-536 "A" Battery Potentiometer	2.00
45V. B Battery special at	1.85

*These are listed at the new reduced price. Of course we handle many more items than listed here, but that is why we have a

CATALOG

Sent for 10 cents which amount will be refunded on initial purchase amounting to $1.00. Send for it TODAY.

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"BETTER RESULTS WITH LESS EFFORT"

PROMPT SHIPMENTS FROM

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Write for prices giving voltage and cycles. "Go as far as you like" with Smith Radio Apparatus.

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Victoria St., North, Sarnia, Ontario
Call 3NB

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WIRELESS, TELEPHONE GENERATORS
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FOR MOUNTING MOTOR GENERATOR SETS.
$28.50 EACH
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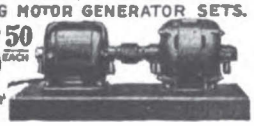
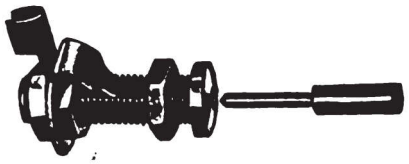


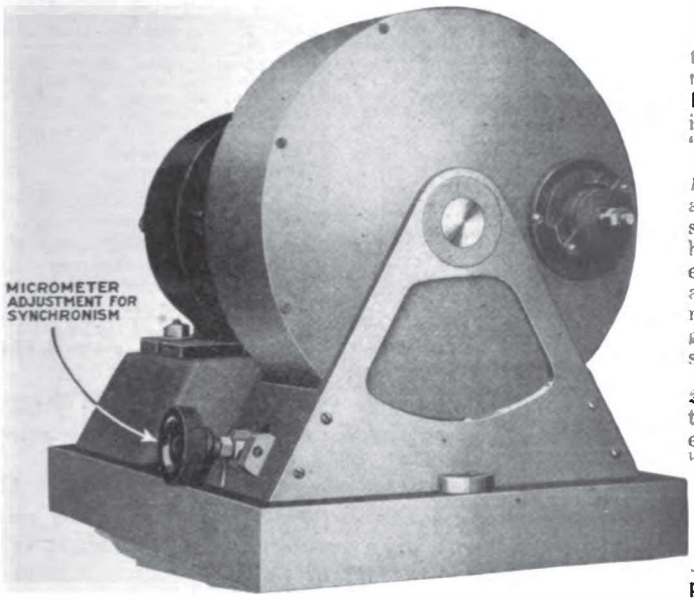
No. 122 Cord Tip Jack



Attractive proposition to dealers
Send for Bulletin No 7

A. W. BOWMAN & CO.
154 West Lake St., Chicago, Ill.
Factory, Cambridge, Mass.

AT LAST! A REAL SINK GAP!



that will put your station on the map! Here are the outstanding features of the "CINO SINK":

1st—Quick and accurate adjustment to synchronism. The housing and stationary electrodes being rotated about the motor by means of a special gear adjustment for synchronism.

2nd—Stationary electrodes may be adjusted to .001 of an inch by means of our micrometer adjustments.

3rd—Rotor turns on two ball bearings of the thrust type, one placed in the housing and the other in the cover. A feature not found in any other type of gap.

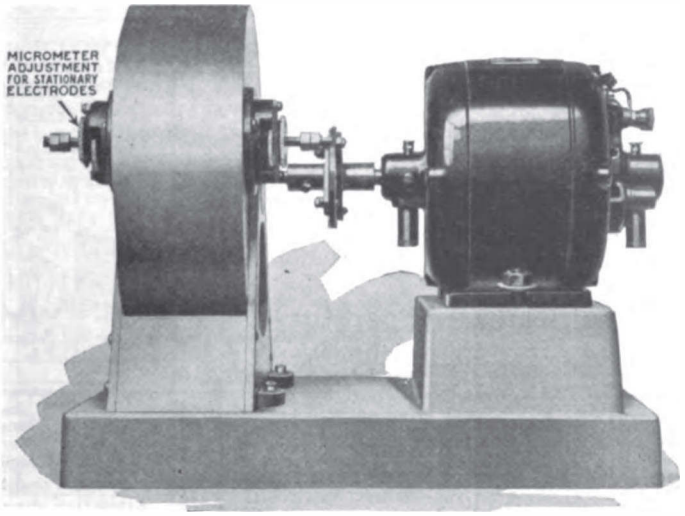
4th—Is of the "spark through" type (4" between outsides of adjusting lock-nuts).

5th—Excellent quenching because of large type rotor used (8½") and wide electrodes (1½ x ⅛") giving a quick break.

6th—The Motor is an actual ⅛ HP and will come up to speed in about two seconds.

7th—The most silent gap on the market both during operation and while running idle. A feature which does away with the necessity of shutting down while receiving.

8th—The price is within reach of all tho the costly construction and quality of materials used, by comparison make this gap worth twice the price asked.



Gap and Motor Complete as illustrated.....$65.00
Gap only..... 35.00
Motor only,..... 32.50

Orders filled in rotation. For further particulars write for Bulletin.

CINO RADIO MFG. CO.
218 West 12th St., Cincinnati, Ohio

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TO ALL RADIO—
AMERICAN and CANADIAN
AMATEUR and COMMERCIAL

Third Annual Convention

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MARYLAND	DISTRICT OF COLUMBIA
VIRGINIA	NORTH CAROLINA
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February 17-18-1922

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A Change to Make a Host of Friends

SNAPPY TECHNICAL SESSIONS

A chance to have your radio puzzles answered.

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You'll see the latest apparatus.

TOURS TO NAA AND NSF

You'll see the National Capitol.

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TICKETS NOW ARE LIMITED AS SALES WERE LARGER THAN ANTICIPATED FOR TICKET RESERVATIONS

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FOURTH DISTRICT REPRESENTATIVE
B. W. Benning, 50 Whiteford Ave., Atlantic, Ga.

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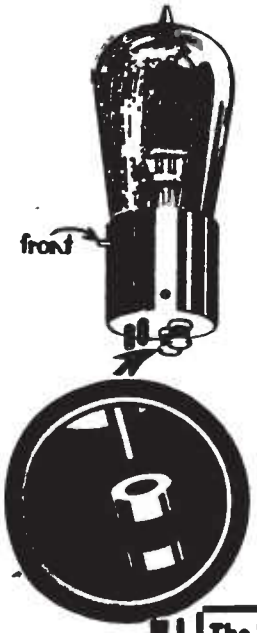
February 17 and 18, 1922



Costs but a Few Cents Saves Many Dollars

Standing as an absolutely impassable barrier between the delicate filament of your tube and high amperage from any other part of your set the

RADECO SAFETY FUSE

(pat. pending)

saves many, many times its cost by protecting bulbs positively against "burning out" from any short circuit, accidental or otherwise.

This fuse slips directly on the filament terminals of any standard bulb used in any standard socket and does not in any way affect the efficiency of your set.

Order by mail **4 for $1.00** **Buy from your dealer**

Capacity 1, 1¼, 1½, 2, 2½, 3 Amps. Size ¼ inch over all

The RADECO SAFETY FUSE is good for any delicate Radio Instrument

Special Bargain in Storage Batteries !

6 Volt--80 Ampere Hours . . .
—a special lot of brand new batteries made by a well-known manufacturer, exactly right for radio use. These batteries are not rebuilts, but new batteries.

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RADIO EQUIPMENT CO.

630 Washington Street (*4th Floor*) Boston

The Oldest Exclusive Radio Store in New England

HOOK'ER TO YER BULB—TUNERS

A full page ad. could not do justice to our line of C.W. and phone equipment shown in our new 24 page catalog. Our tuners need no advertising. 10 cents brings catalog full of phone and receiving hookups, code, and other useful information.

Tresco—Davenport, Ia.

CLASSIFIED ADVERTISEMENTS

Five cents per work per insertion, in advance. Name and address must be counted. Copy must be received by the 10th of month for suceeding month's issue.

TELEPHONE AND MUSICAL CONCERTS with a Single Bulb. Are you satisfied with your receiving set? Would you like one that will receive 6,000 miles? Would you like to build a simple one and quit experimenting? One using parts you already have and that will be the equal of any regardless of claims or price? If so, get our simple diagram of a complete short and long wave receiver, 175 to 20,000 meters, with which we read Honolulu, California, South America, German, French and English stations, and practically all the high powered foreign and domestic stations, with a single bulb. Amateurs as far west as New Mexico and numerous telephone and musical concerts come in good. Diagram and complete instructions, leaving nothing to guess about will be promptly mailed for fifty cents in coin or stamps. Virginia Novelty Co., Martinsburg, West Va.

7OZ—HAVE 1KW Quenched apparatus for sale cheap —Want motor generator or CW apparatus. Lewis, 603 East 8th, Eugene, Ore.

FOR SALE: Mignon RW-4 Undamped wave Receptor $50.00. Duck's 28" Loading Coil $5.00. Ravenswood O.T. $10.00. All A-1 condition. Write 9AIY.

SELL: Turney Spider-Web Tuner $3.50; DeForest Geared Mounting, $5.00; Chelsea 37 Plate Condenser $2.50. Donald Detwiler, 1120 Va. Ave., Washington, D. C.

GOVERNMENT GOODS CHEAP—Insulators, $0.60. 1 KW Keys, $1.25; Leyden Jars, $2.25; ½ KW Quenched Gaps, $4.50; Protective device, $4.25; .0035 French Dubilliers, $8.50; Sperry arc transmitter, $9.50; 6V. 400V. Dynamotor, $22.50; ½ KW 600 cyc. French Portable, $45; ¼ KW 500 cycle motor generator, $46; ½ KW Marconi 500 cycle Complete. Description on request. Eaton, 1915 South Twelfth, Philadelphia, Pa.

HONEY-COMB SET, consisting of honey-comb mounting, primary, secondary and grid condensers and grid leak; mounted in neat cabinet with bakelite panel, $20. James Mott Hallowell, Jr., Chestnut Hill, Mass.

HOW MANY AMPERES will a certain sized wire carry safely. Table showing this, also giving 28 "Q" signals, formulae for calculating inductance, capacity, etc., sent for 40c. Money order preferred. A. Beckwith, 614 North 32nd St., East St. Louis, Ill.

SELL: Two variometers and coupler with condenser—150 to 650 meters, $10. "Superior" phones with plug and jack attached, $5. First money order takes them C. W. Copping, 2407 Valentine Ave., N. Y. City.

FOR SALE OR EXCHANGE: 35.00 Acme .007 oil condenser, $20.00; Dubilier condenser .01 14,000 V., $15; ¼ KW coffin, $10.00; 150-375 meters Receiver (balanced French Army condenser), $15.00; Western Electric VT-1's, $7.00; Marconi Class II, $4.00; Rebuilt United Wireless antenna switch, $5.00; Army prismatic compass, $15.00; Other accessories cheap. Want Benwood gap and a good induction motor. W. L. Slaney, 6 Gibson St., Dorchester, Mass.

SALE: Grebe CR3, $45. Raymond Schlegel, 1118 N. Negley Avenue, Pittsburgh, Penna.

SPECIAL DISCOUNT 5% on all Radio Corporation, Westinghouse, Remler, Chi-rad, Acme, Baldwin, Clapp-Eastham, Murdock, Grebe, Jewell apparatus. See our ad December, page 118. This offer holds until further notice. Ask about our FREE CW offer. Hoopeston Radio Shop, Hoopeston, Ill.

8ASV—Brand new 100 W. 500V., D.C. Robbins & Myers generator. A-1 condition, $30. Am getting larger one. Write Harold C. Kauffman, 745 "A" St., Lorain, Ohio.

SELL: One KW transformer $16; Winchester 32 automatic rifle $25. F.O.B. Write for description, good condition. Geran Read, LaGrange, Indiana.

BARGAIN 2 KW Type Clapp-Eastham Transformer and condenser $30.00. B. J. Hyatt, Mt. Vernon, Ohio.

SELL: Coupler and two variometers, knocked down, $9.50. Amateur agents wanted. Also sell half kilowatt spark. 9AVO, 746 South Armstrong, Kokomo, Indiana.

SELL: ½ KW full mounted Acme Transformer, Dubilier Condenser .007, complete $30.00. 20 Amp. Boston Key $4.00. C. M. Haile, 218 Walnut St., Cincinnati, Ohio.

SORSINC TUNIT $13.50 each, postpaid. Immediate deliveries. List for stamp. Jennison, 83 Russell Street, Waltham, Mass.

QUENCHED GAP: Amrad, one ½ KW $8.50; one ¼ KW $7. Never used. Express collect. H. H. Mitchell, 808 9th St., N. W., Washington, D. C.

WILCOX ROTARY mounted on 1/12 H.P. series motor in asbestos lined box, new, $17.50; sending condenser, glass plates, paraffin immersed for 1KW, mounted, $4.00; O.T. mounted and of ribbon ½", for 1KW, $3.00; Brandes phones, $4.50; twenty amp. key, $5.25; short wave receiving transformer, $1.25; variable receiving load up to 4000 meters, compact, $1.50; doubly enclosed straight gap, noise proof, $2.00. All in finest condition. W. Weaver, 321 S. Division St., Ann Arbor, Mich.

FOUR BARGAINS in Edison Storage Batteries: 2—6 volt 150 ampere hours $24 each; 2—6 volt 225 ampere hours $29 each. Less than half cost. Fully charged. F.O.B. New York City. Also have some Edison elements for "B" batteries at 10c per set, postpaid. A. J. Hanks, 608 Montgomery St., Jersey City, N. J.

FOR SALE: 1KW Marconi "coffin" $35, type used by 9ZN. Condenser etc. George Klumph, 138 So. Grove, Oak Park, Ill.

QST—for sale at ur price—Murdock O.T. Manhattan 1½" spark coil, ¾" coil, Grebe RORA. 1JJ.

FOR SALE: 1KW Transmitting set, Packard Transformer, Dubilier Condenser, Hyrad Rotary, Thordarson OT, $75; Honeycomb Tuner $30; Audiotron Detector Cabinet including Tube $15; 3 Step Amplifier including tubes $25; Turney Spiderweb $4. John L. Herzog, 1025 Gratiot Ave., Saginaw, Mich.

REDUCED PRICES on standard makes apparatus. Large stock new and used apparatus. Some real barbains. Request bulletin. The Radio Exchange, Stroh, Ind.

FOR SALE: 1KW Coffin. Taken for $55 F.O.B. Chicago. Beverly Radio, 1703 West 103rd St., Chicago.

BARGAINS: ¼ KW Thor. $9, 30,000 V. Dubilier Condenser $20; Signal Spark Gap $13; Arlington tuner and other stuff. Elmer Baseman, 1101 W. Springfield Ave., Urbana, Ill.

SELL: My ½ KW A-1 Transmitter at a sacrifice, $30.00. Write H. J. Prebensen, Neenah, Wisconsin.

FOR SALE: 3MB Spark Transmitter, half kilowatt Packard enclosed, Murdock Condensers and rack, Robbins-Myers 8000 rpm motor, enclosed Benwood rotary, large pancake oscillation transformer, Murdock Kickback. Complete $50.00. Harold Schearer, Reading, Pa.

WANTED: Bug key. State lowest price. For Sale: one Omnigraph No. II Jr., with five dials $13.00. Wm. J. Overman, University of North Carolina, Box 284, Chapel Hill, N. C.

FOR SALE: First money takes: Paragon RA6, $30.00; Cost $65.00. Amplifier $12.00; Cost $40.00. Western Phones $10.00; Cost $20.00. Brandes Phones (Navy) $6.00, Cost $14.00. Large Xray Coil equals any coffin. Bargain $25.00; Syn-gap $20.00; 43 plate Murdocks $3.00. 110 Volt, 1½ KW D.C. Generator cheap. Many other articles all perfect, separate or lot. Lester Hammond, 20A, Valhalla, New York.

QST—Special Bargain, Grebe CR-3 $45. Noiseless Rotary Gap 14 point Benwood disc, Induction motor, enclosed in heavy wooden box. Bargain at $20. Radio 2PF, 817 East 16 St., Brooklyn, N. Y.

SELL: Regeneratice receiver, detector, phones, bulb $27.00. E. Dixon, 7906 Wentworth, Cleveland, Ohio.

SELL: 150-20,000 meter triple geared Receiver in-

cluding twelve honeycomb coils and Radiotron $65. Box 205, Williamsport, Pa.

SELL: Navy Radio Material Telefunken ½ KW 500 cycle set, meters, gaps, inductances, transformers, motor generators, etc. Henry Kienzle, 501 E 84 St., New York.

NOTHING TO SELL, BUT my call has been changed to 8HM. (C.W.) Vincent, Old 8AYW, Uniontown, Pa.

½ KW SET, consisting of Acme Transformer, Dubilier Condenser, O. T. with three inch ribbon and Super Benwood; mounted in mahogany cabinet $30. James Mott Hallowell, Jr., Chestnut Hill, Mass.

FEW NEW guaranteed 30W. trans. tubes rated 1000V. with special socket prepaid $17.50. Jack Paddon, Crawford Bay, British Columbia, Canada.

CASH TALKS: Two Amrad wavy wound variometers with dials $10.00. 1 Clapp-Eastham ½ KW $10.00 60 cycle. Elmer Scharbach, Hobart, Ind.

ATTENTION GENTLEMEN: Wesco representatives are making good. Attractive discounts on all standard radio apparatus are given to live amateurs who represent us. If interested, write at once for full particulars. Wilmington Electrical Specialty Company, Dept. S-5, 706 Adams Street, Wilmington, Delaware.

SELL: One Treseo long wave tuner, $7.00. Ed. B. Fanske, Pierce, Nebr.

FOR SALE: One KW Thordarson transformer, $25; and Thordarson Oscillation transformer, $8; Hy-rad Rotary Gap with Standard motor, $18. Description on request. Fred A. Blust, 1001 Wisconsin Ave., Sheboygan, Wisc.

$20 TAKES 1 KW Thordarson. Good condition. 9AZA, Whitewater, Wis.

BUILD YOUR OWN Synchronous Gap and save money. Synchronous motors at very low prices. Stahl Rectifier Company, 1401 W. Jackson Blvd., Chicago, Ill.

FOR SALE: 5 watt Radiotron $8. Transformer 110 volts to 350 and 10 Volt $5; 43-plate Murdock condenser $3; DeForest socket $1. All absolutely new and unused. Geo. Swayze, Danville, Pa.

RADEX "Service That Satisfies." It's worth trying. Good goods at lower prices. Quick service from large stock. Request bulletin. The Radio Exchange, Stroh, Ind.

SELL: Thordarson Oil Condenser $18 P. P. Rotary, Tubes, Storage Batteries, all new. Other equipment cheap. H. Walleze, Danville, Penna.

WANTED—One copy each QST for July 1916 and March 1920. Your own price. S. K., care QST.

BARGAINS: 1/20 H.P. 3400 R.P.M., 110 volt, A.C. induction motor, $5.00; Crystaloi Detector, $1.50; both $6.00. L. Sharp, Greenwood, Ind.

FOR SALE: 1KW United Wireless Transformer $40, 2 Condenser Jars $3 each, 2 Condenser Tubes, $2 each, rotary gap $30, receiver and detector in same cabinet $50, Acme detector $6, Acme Amplifier $9, Type C. Baldwins $9. Jameson, 1019 Rex N. E., Canton, Ohio.

SELL: Unused Spider-Web coils $4.00; Federal amplifying Transformer $5.00, etc. Robert Holman, 637 East Mahanoy St., Mahanoy City, Pa.

GUARANTEED 2 mfd Condensers. Tested to 500 Volts. Special this month $1.00 postpaid. How about that new set you are building? All standard parts and apparatus handled. We are Radio-phone specialists. Let us help you. Retlaw-Pierce Electric Co., 164 Fifth Ave., New York.

FOR SALE. One small size Magnavox, been in use only two months, price $30.00. F. U. Leitzinger, Clearfield, Pa.

FOR SALE: Good regenerative receiver with audion control embodied complete with bulb and Eveready storage A bat. $45; 1 KW type R new, $25; Cosradio O.T. 3" pri. $5; 1 KW copper-plate glass cond. with oil $10; Jewell Thermo-coupled 0-10 amps. $10. Robert Pirtle, Council Grove, Kans.

SELL: Emerson 220 volt, D.C. motor. Practically new. Fine 500 volt Generator $16. Everette Espy, Vandergrift, Pa.

FOR SALE: 1 KW Acme, $20; Benwood Gap, (rebuilt) $25; .007 Dubilier, $30; Oscillation Transformer, $5.00; Robbins-Myers Induction Motor, $18. William Chinn, 2DK, Scarsdale, N. Y.

FOR SALE, 1KW type T2 Thordarson, $25; Oil immersed condenser, 15; O. T. $4; Benwood aluminum gap, $15. Herbert Riley, 7238 Standish St., Pittsburgh, Pa.

FOR SALE: Grebe CR-3A. New. $20. Jos. Smith, 84 Swift St., New Bedford, Mass.

FOR SALE: First check, money order, or cash for $38.50 takes genuine RA-6 Paragon short wave regenerative receiver in first class condition. Designed by Paul F. Godley and built by Adams-Morgan Co., F. H. Schnell, 1045 Main St., Hartford, Conn.

THE BEST BUY you ever made. A one cent postcard. It brings our latest bulletin quoting reduced prices on standard apparatus. Chi-Rad sets $8; panels $1.75; dials $0.65 up; UV200, $4.50; UV201 $6; Large stock CW and radiophone goods. Some real bargains in used apparatus. Tell us your wants. The Radio Exchange, Stroh, Ind.

THIS IS REAL DOPE: 7-22 stranded copper aerial wire 250 feet $1.85; 500 feet $3.50; No. 14 solid copper 250 feet $1.15; 500 feet $2.00; Magnet wire 50c per lb. and up. Add postage on wire orders. Send a stamp for our new bulletins. Wilmington Electrical Specialty Company, Dept. S-6, 706 Adams Street, Wilmington, Delaware.

FOR SALE: Paragon RA10 $55. Price was incorrectly printed as $35 in the December QST. J. F. Furey, 1 Magnolia St., Hartford, Conn.

STOP! LOOK! and ACT! VT's and Accessories. With each of the listed tubes—Radiotron UV200 $5.00, and A.P. Moorhead Detector, $5.00; Radiotron UV201, $6.50 and A.P. Moorhead Amplifiers $6.50; We will supply free of charge your choice of either of these four premiums—Latest FADA Rheostat, $1.00, No. 810 Remler Bakelite smooth running rheostat $1.00, R. C. of Am. Porcelain V.T. Socket, $1.00, or Murdock V.T. Socket, improved contact type. Either of the Federal single, closed or double circuit jacks, listed respectively at $0.70, $0.85, and $1.00, will be given as premiums with each R. C. of Am. Amplifying transformer UV712, $7.00 or Federal Amplifying transformer $7.00. FADA 5 Ampere Nichrome power rheostats $1.35, or R. C. of Am. Porcelain V.T. Socket, supplied free of charge with each $8.00 UV202 5 watt Radiotron power tube for CW or Radiophone Transmission. We absolutely guarantee the foregoing apparatus. Only new and high grade equipment carried in stock. Unsatisfactory goods returned within five days replaced at once. All orders are filled within twelve hours and shipped post paid and insured, thereby saving time and money. Remember us. The Kehler Radio Laboratories, Dept. Q, Abilene, Kansas.

FOR SALE: ¼ KW mounted Acme Transformer, $9.00; O. T. $4.00; Oil Condenser $6.00 or $15.00 for all. L. Steiner, 1157 West 28 St., Erie, Penn.

RADIO STORAGE BATTERIES. 6 volt 40-60 amp., $10.00; 6 volt 60-80 amp., $12.00. All brand new and guaranteed. W. & G. Tufts, 336 Newbury St., Boston, Mass.

BKUMA YRLSBUG. Two hundred beginners tell how memorized Wireless Code in 30 minutes to two hours. Booklet 10 red stamps. Dodge, Box 210, Mamaroneck, N. Y.

EDISON B Battery elements. Make your own. Can be recharged and lasts for years. Harry Morrell, 52 Goffe St., New Haven, Conn.

SELL: CW Rectifiers, $3.75. Send for circular. South Bend Radio Co., 305 Hydraulic Ave., South Bend, Ind.

—FOR YOUR CONVENIENCE—

QST'S INDEX OF ADVERTISERS

IN THIS ISSUE

ALWAYS MENTION Q S T WHEN WRITING TO ADVERTISERS

CONTINENTAL NEWS

February, 1922

PUBLISHED OCCASIONALLY IN Q S T BY THE CONTINENTAL RADIO AND ELECTRIC CORPORATION

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U S— 500	2.20
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No. UV-200 Radiotron	$5.00
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No. UV-202 Radiotron	8.00
No. UV-203 Radiotron	30.00
No. A.P. Detector	5.00
No. A.P. Amplifier	6.50

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No. 10003 6 Volt 20-40	$14.60
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No. 10005 6 Volt 60-80	23.60
No. 10006 6 Volt 80-100	29.30

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Fada Detector and 2 Stage	$65.00
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No. 8 Federal Det. One Stage	52.00
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No. A-2 Acme Semi-Mtd.	5.00
No. A-2 Acme Unmounted	4.50
No. 226-W Federal	7.00
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No. UV-712 R.C. Mtd.	7.00

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No. 766 E R Large	$3.00
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No. 2153 Burgess Large	3.00
No. 4153 Burgess Small	2.25
No. 8191 Cyclone Large	2.40
No. 8190 Cyclone Small	1.25
No. 100 Hipco Large	3.00
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NEW ELECTRON TUBE

For Radio Detection

The interest shown by the radio world in the new CONNECTICUT Electron Tube so far exceeded our expectations that it became necessary for us to arrange for production on a much larger scale than originally planned. This has meant unavoidable delay in deliveries.

We have taken advantage of the delay, however, to make certain modifications in the operating design of the Detector assembly. The principle of the tube and its sensitiveness remain unchanged; but the new assembly will enable even the less skillful operators to obtain superior results.

The delay will therefore work to the benefit of users of the CONNECTICUT Tube. Watch for announcement of delivery dates in the next issue of QST.

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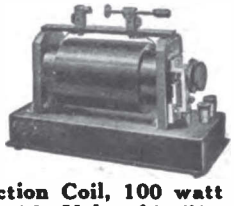
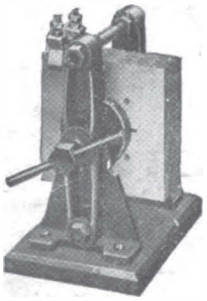
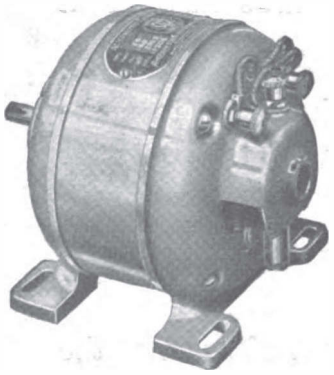


Induction Coil, 100 watt 6 or 32 Volt—$17.50



¼ KW Quenched Gap $10 Coil and Gap Combination Special Price $22.75



Synchronous Motor $25.00 1800 r.p.m. ¼ h.p. frame

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The new Amrad Variometers and Vario-Couplers, (exclusive Amrad basket-weave) the Verniers, and other popular parts for the operator who builds his own, could not be crowded into this small space. See them at your Dealer's. Or write us for descriptive literature.

The new "S" Tube—THE TUBE WITHOUT A FILAMENT—will soon be on the market as a Rectifier. The first month's production is already sold. You should IMMEDIATELY place your order with your Dealer to assure delivery.

For those desiring high class, efficient Receiving Units, at a reasonable price, nothing excels the Amrad Short Wave Tuners and Detector-Amplifiers described in Bulletin L-1. These are COMPLETE—in solid mahogany cabinets—the height of Amrad engineering.

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