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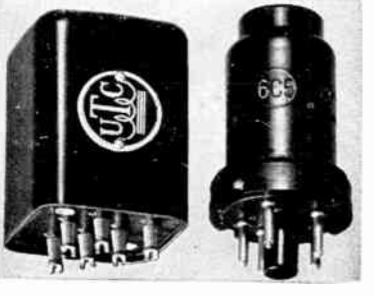

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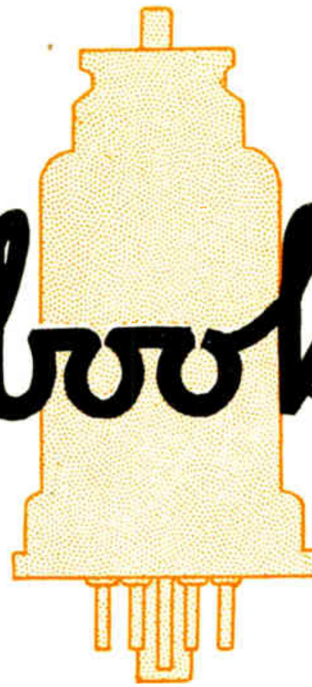
handbook



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As the spirit moves, we present in this column from time to time a bit of gossip about RADIO, its affiliated publications, and those who produce and distribute them

—"From the private life of RADIO".

RADIO is sometimes accused of being a "western" magazine, especially by the residents of a few Atlantic seaboard cities. Why this is often said in an accusing manner is beyond us Californians, both the native sons and those of us who were bred elsewhere.

We believe, and experience has borne us out, that hams will purchase a good radio magazine no matter where it is published, and will not buy a poor one even if run by the friend next door. So the matter is not of much importance.

But, just for curiosity, let's examine the matter further. In the sense that its offices are in the west it is, of course, a "western" magazine, just as its chief competitor might be considered a New England publication. And although the majority of its articles not written by its staff come from east of the Rockies, the proportion is slightly weighted in favor of "the Coast" because it's easier to "hound" a nearby person for "the dope."

But the real criterion is circulation, and in this the western states fall down badly. Of RADIO's circulation in the continental U. S. A., 78% goes east of the Rockies, 65% east of the Mississippi River.

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Among the states California just noses out New York in a neck and neck race. Quantities per thousand to the various States are: Ala., 4; Ariz., 5; Calif., 142; Colo., 6; Conn., 15; D. C., 10; Fla., 13; Ga., 7; T. H., 8; Ill., 63; Ind., 18; Ia., 11; Kan., 8; Ky., 5; La., 7; Me., 4; Md., 8; Mass., 40; Mich., 31; Minn., 14; Mo., 21; Mont., 4; Nebr., 8; N. J., 34; N. Y., 139; N. C., 6; Ohio, 52; Okla., 8; Ore., 12; Pa., 58; R. I., 5; Tenn., 7; Texas, 29; Va., 7; Wash., 19; W. Va., 4; Wis., 18. States and territories not listed take less than 4 copies out of each 1000 sold.

And why do we stay out here anyway? Well, if you ever knew any Californians you wouldn't ask that question. We advise you *not* to ask one, for with a bit of encouragement he's likely to talk your ear off.

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Those of us who travel are asked more often than any other question if the far-famed California weather is as good as it's advertised to be. Well, just between us, though it's the best in the nation which we have encountered, the tourist-traffic-stimulator organizations do exaggerate just a wee mite, or at least so it seems when over ten inches of liquid sunshine fall in one day!

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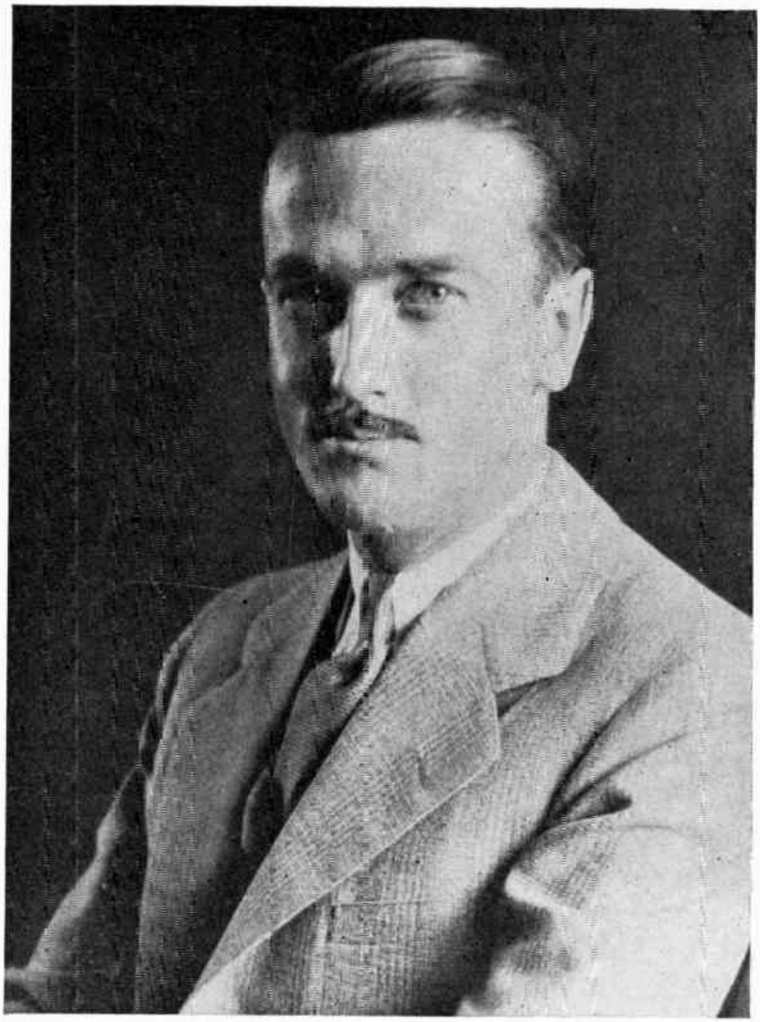


ROSS A. HULL

(1902-1938)

Amateur radio suffered a great loss on September thirteenth with the untimely passing of an eminent engineer and grand amateur, Ross A. Hull, editor of "QST."

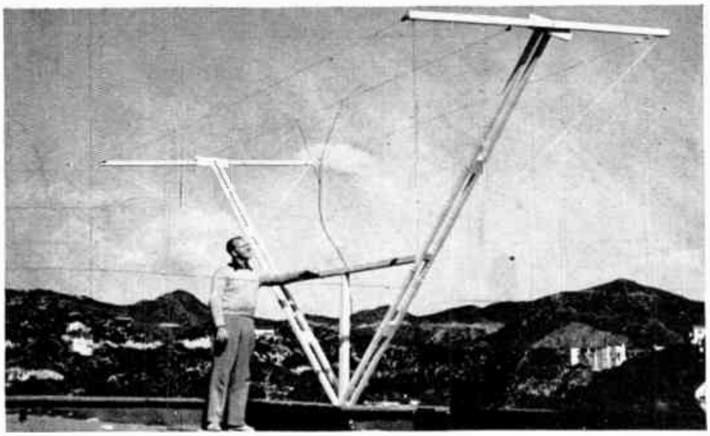


FIGURE 1.
The original wire-and-insulator three-element beam installation at W6PKK. The OM himself bracing the supporting structure.

The Three-Element Rotary

**By PETER GIOGA, W6APU, and
RAY L. DAWLEY, W6DHG***

It is an uncontested fact that most of the conversation on the higher frequency phone bands, especially on the 28-Mc. band, is on the subject of antennas. And a large proportion of this antenna conversation is concerning rotary-beam affairs. The majority of rotary beams in use at the present time are either of the two-element type suggested by Roberts[1] or of the rotary flat-top beam type suggested by Kraus.[2]

Both of these antenna types are derivations of the material given by G. H. Brown in his classic article[3] on antenna design. Sometime after the appearance of the original article J. N. A. Hawkins applied the design information of Brown to another type of rotary beam, the three-element close-spaced type. Presumably the first rotary following this design was installed at W6APU/6 in the early part of September, 1937. The phenomenal results obtained with this antenna and a 40-watt transmitter consisting of a modulated bi-push quickly aroused a considerable amount of interest among both the local 28-Mc. gang and the fellows with whom they communicated throughout the country. Shortly after this the original array and transmitter were installed at W6PKK, the station of George Cooper, from whence they have become widely known.

Through information graciously given out over the air and in person by Cooper on his particular installation, many of these antennas have been constructed and are giving excellent results at a large number of stations throughout the country. While it is, of course, impossible to list even a fraction of the stations using the array, the following installations are quite well known: W6PKK, W6PNO, W6FWN, W6OSP, W6PLD, W6NNR, W6GCX, W6OZH, K6LPW, K6OQM, W9BLL.

Theory of Operation

The design of the antenna is quite simple and it lends itself comparatively easily to the construction of simple supporting systems. It consists merely of a directly-excited dipole with a parasitically-excited director 0.15 wavelength in front of it having a capacitive reactance of about 30 ohms and with a

*Technical Editor, RADIO.
[1] "The Compact Unidirectional Array," Roberts, RADIO, Jan., 1938, p. 19.
[2] "Rotary Flat-Top Beam Antennas," Kraus, RADIO, Dec., 1937, p. 11.
[3] "Directional Antennas," Brown, I.R.E. Proceedings, Jan., 1937, p. 57.

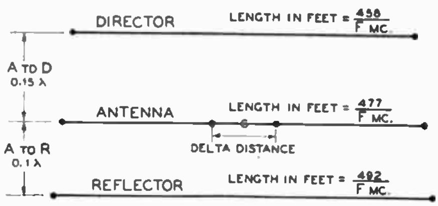


FIGURE 2

parasitically-excited reflector 0.1 wavelength behind it and having an inductive reactance of about 20 ohms. However, these optimum values of reactance are only approximate and are dependent upon the actual spacing used, which may be varied slightly provided the reactances of the elements concerned are varied to compensate. The complete procedure for tuning the array will be covered later in the article.

A top view of the elements of the array is given in figure 2 to make it perfectly clear how they are oriented in space. Then, to make the design as simple as possible for different frequencies within the 28-Mc. band, the chart of figure 1 is included. The formula given in figure 2 may be used if desired.

Design

The method of using the chart in figure 3 is as follows: First, decide upon the frequency of operation and draw a horizontal line across the chart at this point. At the point where this line crosses the line marked D, follow *downward* to the bottom abscissa where the length of the director will be found in feet and inches. Then, travel upward from this same point of intersection to the top abscissa to determine the value of the 0.15-wavelength spacing from director to antenna in feet. Now, travel out the chosen frequency line to its intersection with the A line. Travel downward from this point to the bottom abscissa to determine the antenna length. Then, travelling again out the frequency line, follow downward from the intersection of this line with the original line marked R. Reading along the bottom will be found the reflector length in feet and inches. Now, the last figure, reflector-to-antenna spacing, can be found by reading *upward* from the last intersection point to the top abscissa again where this spacing will be found in inches.

The values found by the use of the chart in figure 3 can be taken as quite accurate in most cases. If desired, the beam may be installed using the figures as given with no alterations. Many have done so and have obtained excellent results. However, if the beam is not in the clear, or if you want to be absolutely sure that it is tuned properly, the tuning

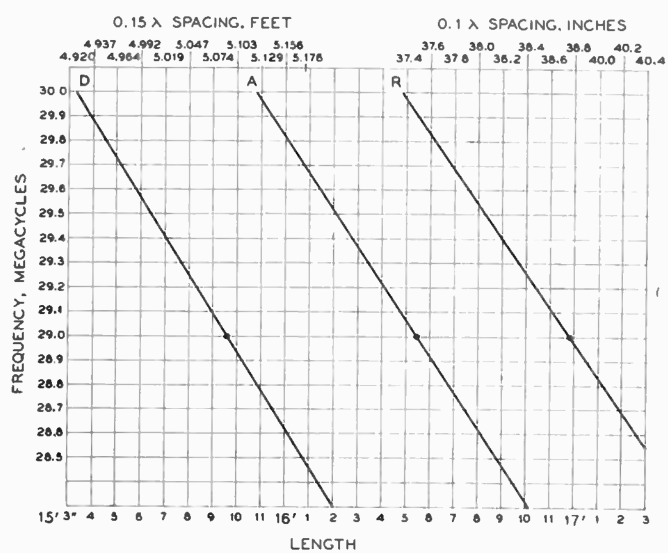


FIGURE 3

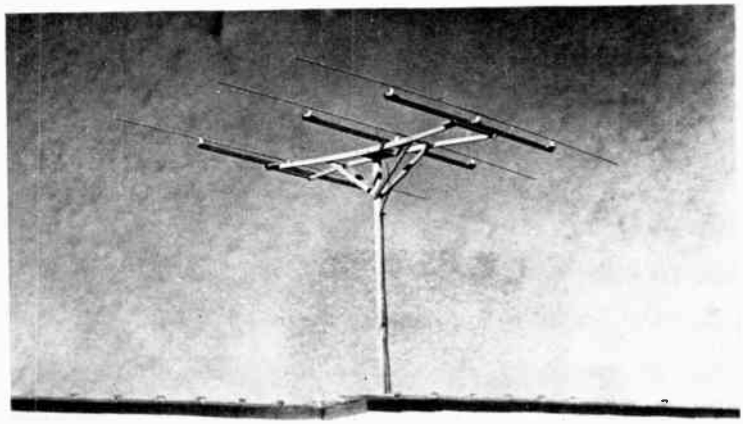


FIGURE 4
The present tubing installation at W6-PKK that replaced the one shown in figure 3.

procedure given later in the article may be employed.

Gain and Radiation Resistance

The computed (theoretical) gain of the antenna with director and reflector is only 5.8 db. However, actual comparisons made with half-wave doublets have shown indicated gains as high as four R's, or 20 db. Under certain conditions the greatly lowered vertical angle of radiation of the beam has given even larger increases in signal strength than this when compared to a half-wave-doublet reference antenna. At any rate the gain is high; certain installations have consistently given as great an increase in signal strength as a "lazy-H" array gives in its two favored directions.

Many fellows have at first been dubious about the advantages of the three-section affair over the more common antenna-director systems. The addition of the reflector *does* give an increase in the gain in the forward direction in addition to cutting down the back and side radiation *provided the elements are exactly the correct length*. In one particular installation (that of W6FWN) the addition of the reflector in back of the original two-element array gave an increase of 1¾ R's in the forward direction (somewhere in the vicinity of 8 db) and reduced the back and side radiation an additional 8 to 10 db. Of course, these large improvements are greater than would be predicted from the theory but they have been borne out in practice and have been checked in a number of cases both by a field-strength meter and an RME signal-strength meter.

The radiation resistance of the array is extremely low; therein lies the only difficulty associated with it. When everything is in proper order the center impedance of the directly-excited dipole is in the vicinity of 8 ohms. Feeding an impedance of 8 ohms satisfactorily with any of the conventional feed systems is difficult to accomplish without considerable loss. However, two or three systems that have proven quite satisfactory in practice will be discussed later.

Practical Construction

The original W6PKK/W6APU installation of the beam is illustrated in figure 1. While this is not the best type of construction, it certainly will give excellent results. As a matter of fact it is this type of installation that is in use at the majority of the stations using the beam. The array is made up of wires and is supported by the wooden truss framework shown. This arrangement is quite satisfactory when the weather is warm and dry. But in winter when occasional rains and fog are encountered, the high voltages appearing at the ends of the dipoles cause the losses to be rather high and tend to throw the array off resonance. However, the problem caused by the wetting of the insulators was solved to an extent for this particular installation by the use of comparatively long end insulators (7-inch Pyrex) and by

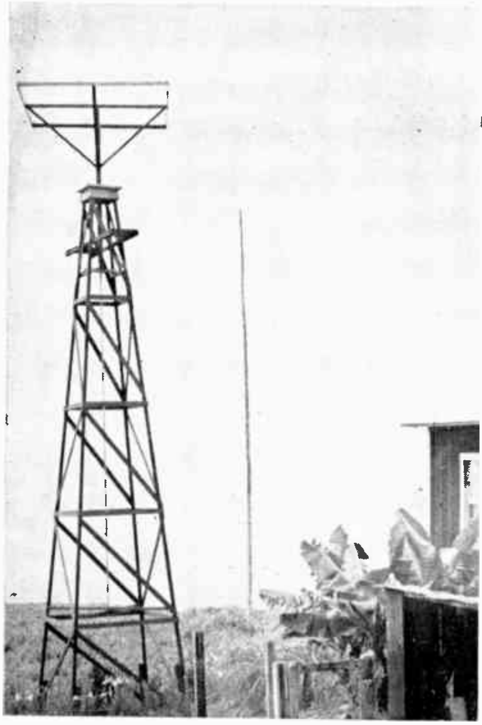


FIGURE 5.
The rotary in use at K6OQM. The three elements of the array are rather indistinct but they may just be seen mounted upon the rotary structure atop the tower.

varnishing the wooden supporting structure. The wooden structure was originally painted with white lead paint; the losses and detuning produced by wet weather were greatly reduced by the use of varnish, instead of paint.

However, both the appearance and the operation of the beams have been considerably improved by the use of self-supporting tubes of adjustable length as the radiating elements instead of the original wire-and-insulator arrangements. The present installation at W6PKK is of this sort and is illustrated in figure 4. The photo of K6OQM shows a similar arrangement, although there are large divergences in the tower designs. In figure 6 is shown another similar arrangement except that three directors, each spaced 0.15 wavelength, are used instead of one.

The W6FWN installation, shown in figure 7, illustrates a considerably different approach to the supporting-system problem, although half-drawn aluminum tubes are also used as radiators. In this case, the entire supporting arrangement is made up of iron water pipe and pipe fittings. Preliminary checks made by W6APU and W6PKK had shown, as expected, no measurable difference in operating characteristics when the centers of the three radiating elements of the array were connected together by a piece of wire. Hence, in the W6FWN installation, an additional piece of water pipe is used, with appropriate fittings, to support the three elements of the array from the vertical pipe that serves to hold the affair in the air. A 20-foot piece of 2″ x 4″ pine, with a sleeve bearing at its top and a thrust bearing about three feet above the ground, serves to keep the array oriented properly and allows it to rotate as desired. The construction of the array is indicated in the photograph.

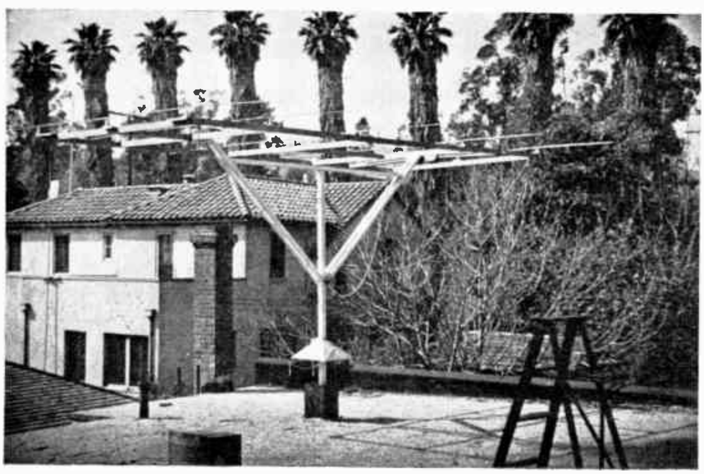


FIGURE 6
The five - element beam installation that was used for a time at W6JYP. The system used an antenna, one reflector and three directors, all close spaced.

As to the radiating elements themselves for the self-supporting type, almost any material that will support its own weight for the required distance may be used. The majority of constructors have used aluminum or dural tubing for the elements, with the end sections of the radiators a separate piece that may be slid in and out to make adjustments. However, the self-supporting tubing recently announced by Premax and General would be somewhat more easily supported. A lighter and more easily rotatable structure could be used.

Methods of Feed

As has been mentioned before, the unusually low radiation resistance of the array requires a somewhat unconventional feed system. The most commonly used and the most easily installed feed arrangement is the delta match. This is the method of feed employed in all the installations pictured. The system itself is simple enough; it is only necessary to run a transmission line of any convenient characteristic impedance from the transmitter to the directly-excited radiator and there to tap the two conductors of the line each side of the center of the dipole.

Since individual differences in the location and installation of the beam will cause variations in the radiation resistance to occur, it will be necessary to determine the exact delta distance (see figure 2) by cut and try. As a suggested distance from which to work until the standing waves are eliminated from the line, these will suffice: 70-ohm line (twisted or concentric), 13 inches each side of the center of the dipole; 470-ohm line (no. 12 spaced 2 inches), 25 inches each side of center; 550-ohm line (no. 12 spaced 4 inches) and 600-ohm line (no. 12 spaced 6 inches), 28 inches each side of center. These values are, of course, subject to variation but they are the averages of the distances used in a large number of installations. Incidentally, the lengths of each of the

[Continued on Page 92]

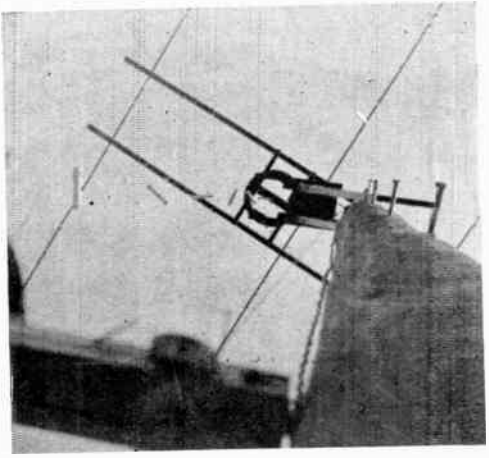


FIGURE 8.

Looking up the pole into the center of the array at W6MEP. A half-wave stub, running through the center of the rotating collar, serves to feed the center of the driven dipole. The feeders are tapped on about 16 inches from the short on the stub. The radiating elements are made up of ⅞-inch copper water pipe. The system is rotated by a reversible electric motor and a string-operated indicating device drives a dial behind the operating table which shows in what direction the beam is pointing. The whole system is supported upon a 32-foot telephone pole.

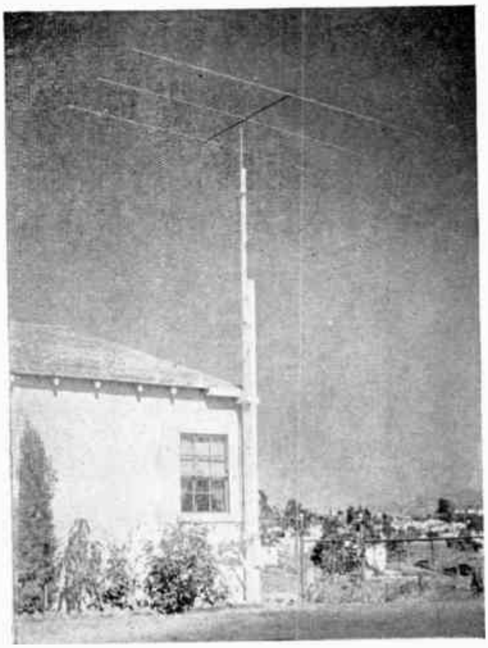


FIGURE 7.

The all-plumbing installation at W6FWN. One-tenth wave spacing is used both between the antenna and director and the antenna and reflector. The wooden supporting pole serves merely as a guy for the water pipe that holds and rotates the array. A 2-inch open-wire line, delta matched, is used to feed the system.

Taken on Canton Island. Standing from left to right: Delegate Samuel W. King; Harry Bush, K6JRN; Alfred Voight, cooperator of K6HCO; Richard B. Black; Langsdale, VR2FF; Beach, radio engineer. Kneeling: K6BAZ; Ah Kin Leong, K6ODC; Manuel Pires, K6HCO.

POUNDING BRASS

I was in a dilemma. Should I stay in Hawaii, with its movies, bright lights and pretty girls, or should I sign up with Uncle Sam for nine months on a lonely, isolated island in the Mid-Pacific? The one meant that I would have to struggle along on sixteen dollars a week, with plenty of expenses. The other meant that I would be saving up a nice bank account, for the pay was better and all expenses were paid.

I had already done one tour on an equatorial Pacific island. As a member of the Coman Oceanographic Expedition I had been stationed for four months on Howland Island, operating K6XJI-K6BAZ in 1935. It had been my first trip away from home, and living in tents amid new and difficult surroundings had not appealed to me.

Finally I decided to join. The islands were not yet equipped with their own radio transmitters, but they had their own sources of power. K6DSF was joining at the same time. It depended upon the island to which we were assigned what rigs we would need. I was assigned to Howland Island, replacing K6GNW, who had experienced the preparations and excitement in connection with the tragic Amelia Earhart flight during his nine months' stay. Herb (K6DSF) was replacing K6INF, who had spent five months on Baker Island. There was no need at that time to find a new operator for Jarvis Island, as K6ODC was staying on for another term.

These three islands, which are occupied by American colonists, are located in the "middle" of the Pacific Ocean. Jarvis is 1350 miles nearly due south of Honolulu and twenty-three miles south of the equator. It is a flat, sand-and-coral island, a mile and three-

Canton Island (Phoenix group). Shacks to left of lone cocoanut palm are the camp of the British inhabitants. To the right is the American colony.

FOR UNCLE SAM

In The Mid-Pacific

By

KENNETH LUM KING, K6BAZ

Assisted by

E. H. BRYAN, JR.*

quarters long by a mile and a quarter wide, with an elevation of about twenty feet. The beach rises steeply from a narrow fringing reef. Within this the land is depressed like a basin, the central part of which is bare, with part long ago dug up for guano, a rich fertilizer deposited by sea fowl frequenting the island. Before the arrival of the colonists there were no trees on Jarvis, only half a dozen kinds of herbs and low shrubs. The coconut palms and trees which the boys set out have not grown very well because of lack of water. It rains only about six or eight inches a year.

Baker and Howland Islands, thirty-six miles apart, lie a thousand miles west of Jarvis. They are thirteen and forty-nine miles north of the equator, respectively. They are just as barren and dreary as Jarvis, and, like Jarvis, were used between 1860 and 1880 by the American guano diggers. Baker is about a mile square. Howland, shaped like a flattened hot dog, is two miles long by half a mile wide. Both have a

** E. H. Bryan, Jr., Curator of Collections, Bernice P. Bishop Museum, Honolulu, Hawaii, has assisted in the preparation of this article by editing the author's notes and adding certain background material. He also contributed several of the photographs, which he had taken on the Equatorial Islands to be used as illustrations. Mr. Bryan has made a number of expeditions to Pacific islands for the above mentioned museum. He has written many articles about these islands and also several books, including* Hawaiian Nature Notes *and* Ancient Hawaiian Life, *which are extensively used for reference in the schools of Hawaii.*

At the village of Vaitongi or Pago Pago "watching the turtle and the shark." Note Pan American Airways transmitting station in left background.

Trading with the natives of Atafu, Union Group.

maximum elevation of about twenty feet. Howland boasts a grove of *kou* trees, but they appear to be nearly dead.

The day of our departure finally arrived, October 23, 1937. We were delighted to learn that our ship, the U. S. Coast Guard Cutter *Taney*, was making the cruise an extensive one, because of the presence on board of Dr. Ernest Gruening, head of the Division of Territories and Island Possessions of the U. S. Department of the Interior, and of Governor Joseph B. Poindexter of our own fair Hawaii. Since the route taken was south via Jarvis and north again to Baker and Howland, the last stops, K6DSF and I were able to enjoy almost the entire cruise.

Sight Kingman Reef

The afternoon of the third day we sighted Kingman Reef, a tiny speck of land at the point of a great V-shaped reef. From there a run of thirty-five miles took us to Palmyra Island, a large reef, along the edge of which are located fifty-three small islets. These are thickly covered with large trees and coconut palms, beneath which the undergrowth consists of masses of birds' nest and other ferns. These islands are anything but barren, because of the heavy rainfall which they enjoy. We gathered sprouted coconuts to plant on Jarvis.

At dawn, next day, we sighted Fanning Island. Immediately after landing I started to look for VQ1AJ, but found that he had left some two years before. Outside communication is mainly by cable, Fanning being a relay station on the cable which stretches from British Columbia to Fiji and New Zealand. Besides the cable colony there is also a copra plantation on Fanning. Four times a year a vessel comes from Honolulu with mail and supplies.

The next day we arrived at Christmas Island, a very large, flat, sand-and-coral island about thirty miles in length. On the west side is a large bay with two settlements, amusingly named London and Paris, on opposite sides about five miles apart. Here the administrator is also the radio operator, and from our chat I learned that he had intentions of doing some hamming. His radio gear was the conventional portable type, using storage batteries as a power source.

Pollywogs and Shellbacks

Between Christmas and Jarvis we crossed the equator. The crossing is always used as an excuse for a big initiation party on navy vessels. Those who have been across before and have a certificate to prove the fact, called shellbacks, greatly enjoy giving the "pollywogs" the works. I had been across before on the *Kinkajou*, but had nothing to prove the fact. The ceremony included a crawl through the water tunnel, kissing the foot of the Royal Queen and the Royal Baby, swallowing the royal pill (which was vile), having your hair clipped like the southern cross, having a

Photo taken from top of Earhart Lighthouse showing view of camp and wastes. Note three antenna poles which support the V-beam.

rotten egg shampoo, being smeared with paint, and ducked in the canvas pool. It was all good, though decidedly unclean, fun.

We stopped at Jarvis Island long enough to unload supplies, water, and replace two men. Most of the colonists are Hawaiian or part-Hawaiian boys, chosen after a rigid physical examination, these being considered the best persons to live on isolated islands. Centuries ago their Polynesian ancestors colonized islands in the Pacific, traveling in canoes made of two hulls lashed side by side, which were paddled or propelled by mat sails.

Arriving at American Samoa, I was particularly interested to meet a certain y.l. again. How we first met, I believe, is a bit unconventional these days; so perhaps you might be interested to hear about it.

Samoan Y.L.'s

At the end of a four months' stay on Howland Island in 1935 for the Coman Oceanographic Expedition, the supply vessel came for us and, much to our delight, headed for Samoa instead of home to Honolulu. Our 90-foot auxiliary schooner had not much more than found anchorage in Pago Pago harbor, about 100 feet from the wharf, when a few of the natives swam out to greet us. Observing them closely, we discovered two to be y.l.'s wearing only thin cotton dresses. One of them you could see was rather f.b. and the other, oh, about R6. In order not to seem high hat, we of the crew (as soon as we could get our trunks on) dove over the side to return their greetings. We were all having a grand time when our skipper started hollering at us. Thinking that

The wreck of the Armarath on Jarvis Island.

Standing are the colonists of Howland Island. Kneeling, left to right: K6ODC (Canton Island), K6JEG (Baker Island), and K6JRN (visitor).

we were in for it, we started to swim back to the ship; but there, standing on the rail, was the captain in his trunks, grinning at us; and a moment later he, too, dove in!

On this trip, however, our arrival was a bit more formal, with precise formations and salutes from the Samoan *Fita-fita* Guards, barefooted and clad in simple uniforms of white undershirts, *lavalavas* (like wrap-around skirts), and red bands about their hair.

To me most everything in this little island community seemed the same—the formal naval station, with its white uniformed officers and men. Just beyond its limits were the same thatch-roofed round or oval houses, the sides open except for shutters of coconut leaf plait, which could be let down when it rained or blew. There were still no restaurants, except the navy commissary, but plenty of crude beer joints.

The y.l. mentioned above was the only thing that seemed different. Perhaps she had been continuing her passion of greeting visiting ships. Somehow she did not seem the fair maiden I remembered her to be. Or had I changed? Even so, it was nice meeting her again.

I happened to meet Mr. Anderson, the radio operator for Pan American Airways, and learned that he intended

Booby birds nesting in kou thicket on Howland Island. A grove of anemic kou trees is the chief vegetation on the island.

to do some ham work before long. The only possibility of contacting American Samoa would be through a navy or P.A.A. operator who was interested enough to get on the air. On Tau and Olosenga, of the Manua group of American Samoa, sixty-seven miles east of Pago Pago, there are several small radio stations operated by men of the navy. But interest in ham radio is lacking.

Touring Tutuila

The second day at Pago Pago a dozen of us, sailors and colonists, hired a bus to tour the island of Tutuila. It was loaded with beer, guitars and ukuleles; so our arrival in native villages was made impressive by its noise. We stopped in each just long enough to exchange gifts with chiefs and people, obtaining such souvenirs as tapa or bark cloth (which the natives call *siapo*), laufala mats, kava bowls, turtle shell bracelets and rings. In some villages in return for our enthusiasm, we were invited to share kava with the chiefs. This drink is made from the pounded root of a pepper plant. It is not intoxicating, but makes one feel very sleepy.

Our visit at the village of Vaitongi was an especially interesting one. When the natives here sing on the lava rocks, a shark and a turtle appear in a little bay and swim round and round. Gathered about the chief's large *fale* (thatched house), we watched attractive native girls dance the *siva-siva*, accompanied by singing and rhythmic music provided by several young men. Now and then one of the men would join the dance, encouraged to do so by shouts from the audience. The siva-siva is a fast dance, performed either sitting or standing, with graceful but quick arm motions and leg movements, something like a modified Charleston, with a little superimposed Susy Q, and not bad at all.

At the height of the excitement, the village virgin or *taupo* was escorted in to dance for us. She was attractively dressed in brightly colored garments made of tapa and strands of fiber, with little feather leis (wreaths) about her wrists and ankles. Our inquiries about her showed that she was the chief's most eligible daughter, the official hostess of the village, but by custom "tabu." After her performance we were asked to assist with the entertainment; so some of the Hawaiian boys played and sang Hawaiian melodies.

But "all good things must come to an end sometime," and all too soon our sightseeing was over and we arrived at Howland Island. The first sight of that low bank of sand and coral, practically invisible even to the man in the crow's nest at more than ten miles, awakened all the weaker parts of me and I wished I were only a visitor for a day. All my good resolutions to "get ahead," made before leaving Honolulu, seemed "not so hot" right at that moment. This sand flat was to be my home for nine months.

Meeting K6GNW

Landing, we found K6GNW and his three companions looking like stranded victims of some shipwreck. They were tanned almost to black, hair and beards long unattended, but with broad grins and actions to fit. Why not? Weren't they bound for home in a day or so with approximately nine hundred dollars apiece?

[*Continued on Page 75*]

5- to 160-Meter

PHONE

By

FRANK C. JONES*

W6AJF

A crystal-controlled six-band amateur phone transmitter was designed around a set of the new HK54 tantalum-plate tubes. These tubes have a plate dissipation rating of 50 watts and may be used for class-B audio as well as class-C r.f. service. A pair was used for each purpose in the transmitter illustrated in the photographs.

The radio-frequency leads, especially in the final amplifier, were made very short and the tank coil connects directly across the two stators of the "cloverleaf" type of tank condenser. The latter has a maximum capacity of 46 $\mu\mu$fd. and a minimum of 11 $\mu\mu$fd. for the two sections in series. This wide ratio of capacities allows efficient operation on nearly all amateur bands. The short r.f. leads, low-C tubes and arrangement of parts in the final amplifier allow efficient operation even in the 5-meter band. The output is limited only by the available amount of grid driving power to the final amplifier.

The output in tests ran about 100 watts on 5 meters, 200 watts on 10 meters, 250 watts on 20, 40 and 75 meters and 100 watts on 160 meters. The power input must be reduced by using very loose antenna coupling on 160 meters in order to maintain proper circuit Q. The tank condenser and miscellaneous capacities amount to about 50 $\mu\mu$fd. on 160 meters, which means that the plate current should not run over 120 ma. on that band with a 1250-volt power supply. The normal plate current on other bands runs from 250 to 275 ma. in the final amplifier, except on 5 meters where from 150 to 200 ma. was obtained due to lower values of grid excitation. The d.c. grid current ran from 10 to 20 ma. in the 5-meter band, about 30 ma. on 10 meters and 40 to 50 ma. on the other bands. The plate dissipation is not exceeded on any band of operation.

The Exciter Circuit

The circuit shows a 6J5G high-mu-triode crystal oscillator similar to one section of the familiar 53 or 6A6 oscillator with cathode bias. This stage is built with its tuning condenser mounted underneath the exciter deck near the coil socket terminals. A shield partition was placed between the crystal oscillator plate coil and the following 6L6G stage in order to prevent r.f. feedback when the 6L6G is operated as a neutralized r.f. buffer stage. This 6L6G acts as a buffer amplifier, doubler or quadrupler to drive a pair of 6L6G tubes in a push-push doubler circuit. This push-push stage is connected as a doubler on all bands except 160 meters (or 80 meters when using an 80-meter crystal). The

* *Engineering Editor,* RADIO.

cathode circuit of both 6L6G tubes can be opened by a switch in order to eliminate this stage when not in use. The first 6L6G buffer stage is then link-coupled directly to the final grid coil on 160 meters.

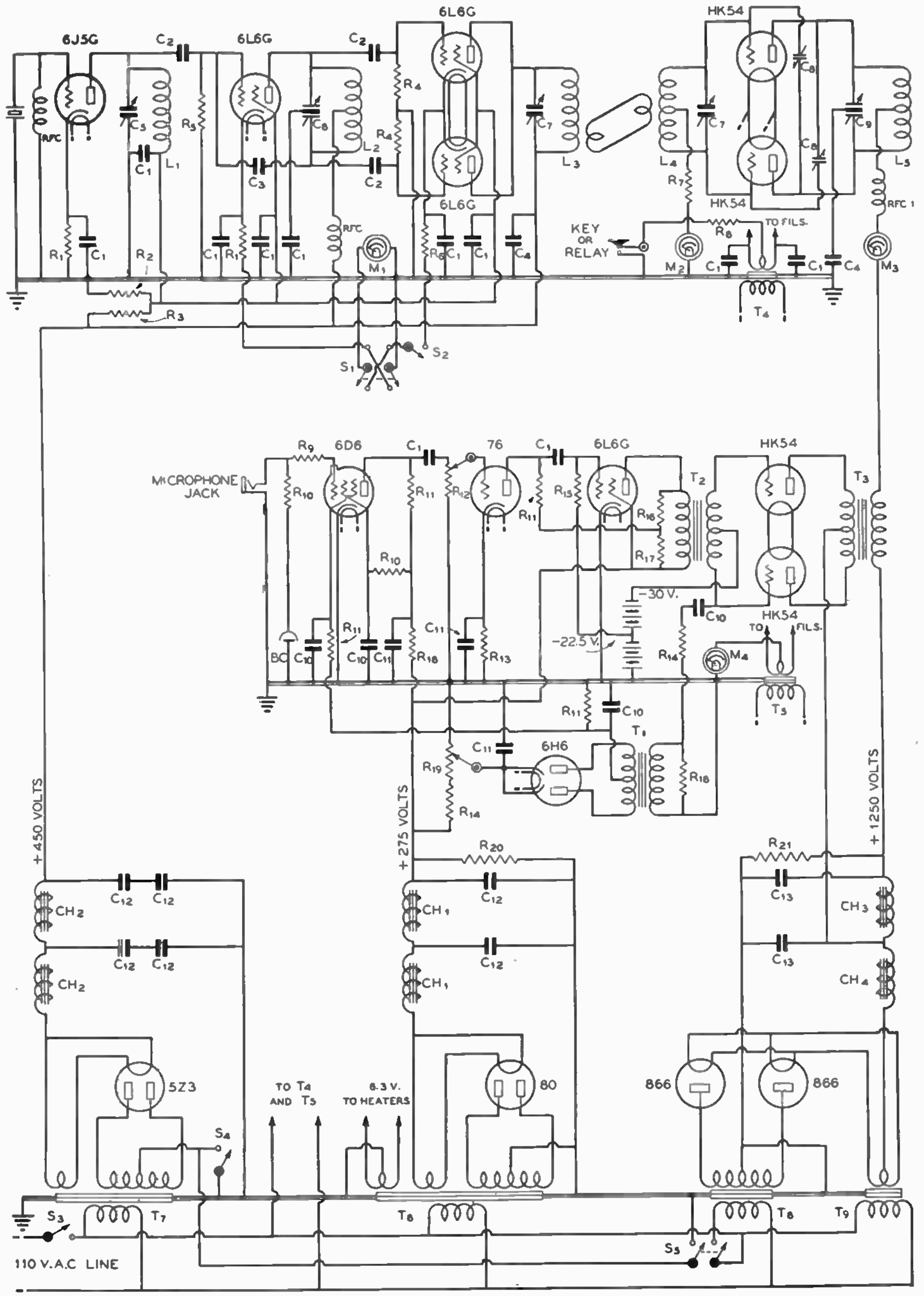
This exciter furnishes grid driving power to the final amplifier for operation in all six bands. The power supply shown in the photograph and circuit diagram furnishes a little over 400 volts at full load of nearly 175 ma. to the exciter unit. Slightly higher voltage may be used if greater output is desired. The r.f. power output from the exciter varies from about 12 watts at 5 meters up to 30 watts on the lower frequencies.

The Push-Pull HK54 Final

The final amplifier has a standard push-pull circuit. The two neutralizing condensers are an integral part of the plate tank condenser. The two variable neutralizing plates cross-connect to the HK54 grids. These plates are ¾ inch in diameter and were separated from the end stator plates by ¾ inch when the amplifier was neutralized. No readjustment was needed when changing bands. The tuned grid circuit is mounted directly below the HK54 tubes and is link-coupled by one turn of hookup wire to the exciter output coil on the deck below. The grid circuit is shielded from the plate circuit by the metal chassis.

A 200-ohm 100-watt resistor was connected in series with the final amplifier filament center tap to ground to provide self-bias for tube protection in case of r.f. grid excitation failure. This center-tap lead can be keyed by means of a suitable tube key click filter circuit such as shown in the RADIO *Handbook*. The 200-ohm resistor apparently has little effect when the amplifier is modulated, as an 8-μfd. condenser connected across it seemed to make little or no change in quality or ease of modulation. The condenser was eliminated. The 5-volt 12-ampere filament transformer was mounted on the final amplifier deck to reduce filament voltage drop in the leads to a minimum. A 2000-ohm 20-watt grid leak furnishes a good portion of the grid bias voltage and the amplifier is run at over three times cutoff bias in most of the bands.

C_1—.01-μfd. 600-volt tubular
C_2—.00005-μfd. 600-volt mica
C_3—3-30-μμfd. mica trimmer set at minimum (less screw)
C_4—.006-μfd. 1200-volt mica
C_5—50-μμfd. midget variable
C_6—100-μμfd. per section midget split stator
C_7—50-μμfd. 2000-volt variable
C_8—Neut. condensers built into C_9
C_9—88 μμfd. per section, ¼" spacing split stator
C_{10}—0.1-μfd. 400-volt tubular
C_{11}—1.0-μfd. 400-volt tubular
C_{12}—8-μfd. 450-volt elect.
C_{13}—2-μfd. 1500-volt filter
R_1—300 ohms, 10 watts
R_2—20,000 ohms, 10 watts
R_3—10,000 ohms, 50 watts
R_4—100,000 ohms, 2 watts
R_5—250,000 ohms, 2 watts
R_6—150 ohms, 10 watts
R_7—2000 ohms, 20 watts
R_8—200 ohms, 200 watts
R_9—25,000 ohms, ½ watt
R_{10}—1 megohm, ½ watt
R_{11}—250,000 ohms, 1 watt
R_{12}—500,000-ohm pot.
R_{13}—2000 ohms, 1 watt
R_{14}—100,000 ohms, 1 watt
R_{15}—500,000 ohms, ½ watt
R_{16}—50,000 ohms, 2 watts
R_{17}—5000 ohms, 1 watt
R_{18}—50,000 ohms, 1 watt
R_{19}—25,000-ohm pot.
R_{20}—20,000 ohms, 20 watts
R_{21}—100,000 ohms, 100 watts
T_1—2:1 p.p. interstage trans.
T_2—Single tube-to-class-B grids input trans.
T_3—300-watt universal class-B output
T_4, T_5—5-volt, 12-amp. filament trans.
T_6—750 c.t., 160 ma.; 6.3 v., 5 a.; 5 v., 3 a.
T_7—1200 c.t., 150 ma.; 5 v., 3 a.
T_8—3000 c.t., 500 ma.
T_9—2.5-v., 10-a. fil. trans.
M_1—0-250 d.c. milliammeter
M_2—0-100 d.c. milliammeter
M_3—0-500 d.c. milliammeter
M_4—0-500 d.c. milliammeter
S_1—Buffer - doubler meter switch
S_2—Push-push doubler on-off switch
S_3—Main a.c. line switch
S_4—Exciter tune-up switch
S_5—Main on-off switch, d.p.s.t.
BC—Bias cell
CH_1—10-hy. 160-ma. chokes
CH_2—12-hy. 200-ma. chokes
CH_3—12-hy. 500-ma. filter choke
CH_4—500-ma. swinging choke
Coils—See coil table
RFC—2.2-mh., 125-ma. r.f. chokes
RFC_1—2.5-mh., 500-ma. choke



SCHEMATIC OF THE 5-160 METER PHONE.

The Class-B Modulator

Another pair of HK54 tubes serve as class-B modulators connected to a 300-watt output transformer. On most bands 175 watts of audio power are needed to modulate the carrier fully. The output transformer was connected to transform the 5000-ohm secondary load to about 12,000 ohms plate-to-plate for the class-B tubes. When the set is operated on 160 or 5 meters, the impedance from plate to plate is increased automatically when the class-C amplifier plate load impedance increases. This increase reduces the audio output but does not adversely affect the quality. Less audio power is required for these two bands, so no change in taps on the class-B output transformer is needed.

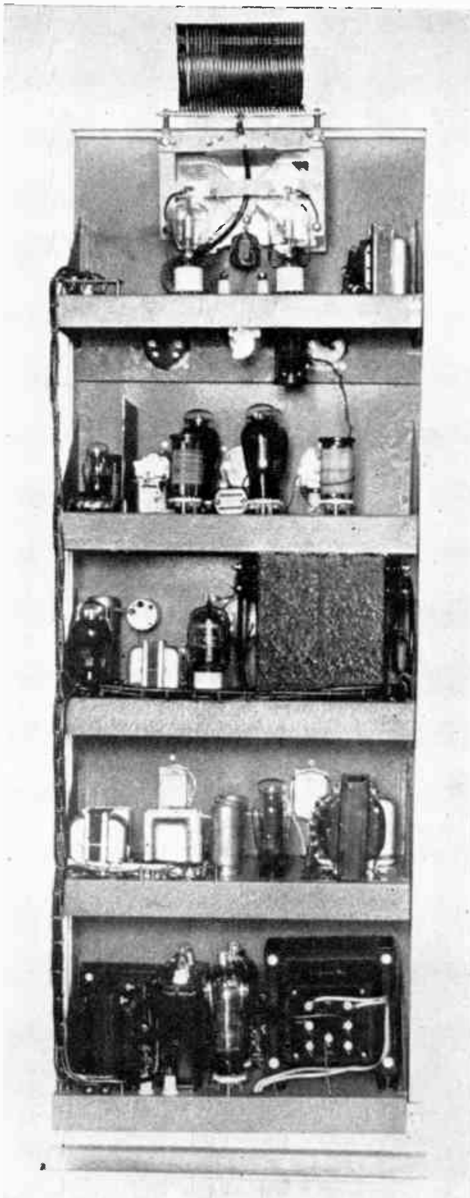
The class-B amplifier is driven by a single 6L6G tube through a standard class-B input transformer having a primary-to-one-half secondary turns ratio of about 2 to 1. The ratio is not critical since the 6L6G tube is wired as an inverse feedback amplifier which reduces its plate impedance to a value comparable to that of a low-mu triode. This arrangement makes an ideal class-B driver for medium- or low-powered amateur class-B modulators. A pair of 6L6G tubes in push-pull with inverse feedback is suitable as a driver for class-B modulators for high-powered phone transmitters. The inverse feedback reduces distortion (and gain) and lowers the plate impedance of the driver stage.

Self-Contained Speech Amplifier

A 76 triode is resistance-coupled to the 6L6G tube. A 50,000-ohm 2-watt resistor and a 5000-ohm 1-watt resistor feed back nearly 10 percent of the audio output voltage out of phase to the 6L6G grid circuit through the 76 plate resistor. A high-gain 6D6 variable-mu pentode audio amplifier is resistance-coupled to the 76 tube. The former connects to a diaphragm-type crystal microphone through a 25,000-ohm resistor to reduce r.f. feedback.

The suppressor grid of the 6D6 tube connects to an automatic audio volume control 6H6 diode.[1] A manual gain control provides an average gain setting in the 76 grid circuit and the a.v.c. system

[1] *"Peak Compression Applied to the Speech Amplifier," R. L. Dawley,* RADIO, *Nov. 1937, p. 11.*



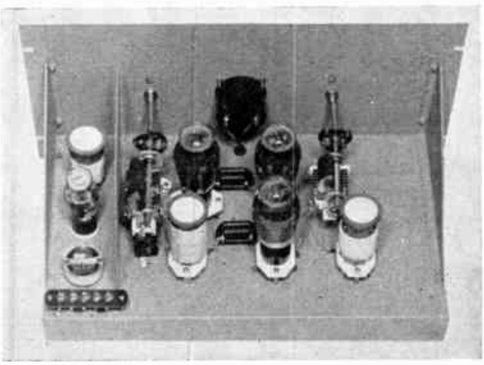
Back view of the complete transmitter with 80-meter coils in place. In top to bottom order the units are: final amplifier, exciter, modulator, low-voltage power supply, and high-voltage power supply.

prevents overmodulation on excessive voice input to the microphone. The amount of a.v.c. voltage fed back to the 6D6 suppressor grid can be adjusted from the front panel by means of a 25,-000-ohm potentiometer which controls the positive delay voltage in the delayed a.v.c. circuit. A 6H6 twin diode acts as a full-wave rectifier of a small portion of the audio voltage across the class-B grid circuit. An ordinary push-pull low-ratio interstage audio transformer is connected to the 6H6 diode plates and the rectified voltage in the center-tap lead to ground is applied to the 6D6 suppressor grid through an audio RC filter.

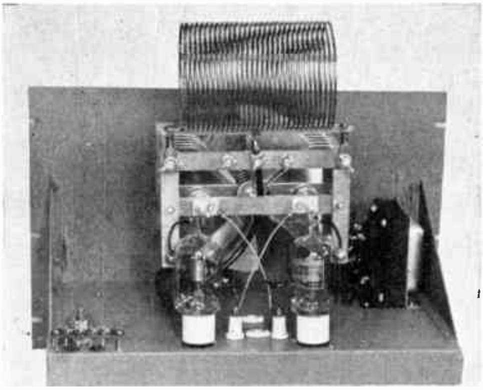
The latter prevents audio feedback but allows a relatively fast change of d.c. bias to reduce the gain of the 6D6 pentode audio amplifier. When the 6H6 cathodes are connected to ground, a.v.c. voltage is applied to the 6D6 as soon as an audio voltage appears across the HK54 grids. The d.c. positive bias on the 6H6 cathodes can be increased from zero up to about 30 or 40 volts to give any amount of a.v.c. effect. High positive values reduce the a.v.c. effect to zero so no switch is needed to cut out the a.v.c. system when it is not desired. The a.v.c. potentiometer should be set to a position which will prevent overmodulation as shown on an oscilloscope or carrier-shift indicator when the microphone is spoken into quite loudly.

Power Supplies

Three power supplies furnish plate voltages for the whole transmitter. The class-C and class-B stages are connected to a 1250-volt 500-ma. supply which has type 866 rectifiers. A heavy d.p.s.t.



THE EXCITER CHASSIS.



Rear view of the final amplifier chassis showing the filament transformer on the left and the "butterfly" combined tank and neutralizing condenser.

toggle switch turns on the high voltage and exciter plate supply at the same time for convenience in phone operation. A separate 275-volt 100-ma. supply handles the speech amplifier and class-B driver stages. Choke input was used in all of the filters.

Thirty volts of C bias for the class-B stage is supplied by a small 7½-volt and another 22½-volt battery in series. The 22½-volt tap connects to the 6L6G stage for grid bias. These batteries are mounted on the speech amplifier deck.

Relay rack construction was utilized with five 17"x10"x1½" steel chassis mounted behind standard 19-inch steel panels. The high-voltage power supply is mounted behind a 10½-inch panel. The low-voltage power supplies, speech system and exciter decks were each mounted behind 8¾-inch panels. The final amplifier required a 12½-inch panel. The layout of parts is shown in the photographs of the complete set and the final amplifier and exciter chassis.

Coils and Operation

The coil table lists the actual coils needed for six-band operation except for an extra 160-meter coil for the first 6L6G tube. This extra coil should be a duplicate of the 160-meter final grid coil. For 75- or 80-meter operation, a 150- or 160-meter crystal should be used and the first 6L6G operated as a neutralized buffer also on 150 or 160 meters. The push-push stage should be in operation

Band in Meters	6J5G Osc.	Push-Push 6L6G's	Final Grid	Final Plate	First 6L6G Plate
160	70 turns, #24 d.s.c., close-wound, 1½" dia.	No coil needed.	68 turns, #22 d.c.c., center tapped, 2¼" dia., 2¾" long.	50 turns, #14 enam., center tapped, 4¼" dia., 6" long.	68 turns, #22 d.c.c., center tapped, 2¼" dia., 2¾" long.
80	36 turns, #24 d.s.c., 1½" long, 1½" dia.	38 turns, #20 d.c.c., 1½" dia., 1½" long.	38 turns c.t., 1½" dia., 1½" long, #20 d.c.c.	30 turns, #10, c.t., 4" dia., 6" long.	Use spare "Final Grid" coils except on 160 meters.
40	17 turns, #22 d.c.c., 1½" long, 1½" dia.	16 turns, #16 Enam., 1½" dia., 1⅜" long.	20 turns, #16 Enam., 1½" long, 1½" dia., c.t.	20 turns, #10, 3" dia., 6½" long, c.t.	
20	7 turns, #20 d. c. c., 1¼" long, 1½" dia.	8 turns, #16 Enam., 1½" dia., 1" long.	10 turns, #16 Enam., 1½" dia., 1¼" long, c.t.	10 turns, #10, 3" dia., 6" long, c.t.	
10		4 turns, #16 Enam., 1½" dia., 1" long.	4 turns, #16 Enam., 1½" dia., 1" long, c.t.	6 turns, #10, 2¾" dia., 6" long, c.t.	
5		2 turns, #14, ½" dia., ¼" long.	4 turns, #14, ⅝" dia., ½" long.	4 turns, #10, 1½" dia., 6" long, c.t. with R.F.C.	

COIL DATA FOR 5- TO 160-METER TRANSMITTER.

and the doubling should be done in this stage.

For 40-meter operation, an 80-meter crystal may be used with the 80-meter final grid coil in the first 6L6G plate circuit. The first 6L6G will operate as a neutralized amplifier, and the second 6L6G stage is connected as a doubler to 40 meters.

For 20-meter operation, the first 6L6G should operate as a doubler with the 40-meter final grid coil in its plate circuit and a 20-meter coil in the second 6L6G stage. Use an 80-meter crystal.

For 10-meter operation, an 80-meter crystal stage can drive the first 6L6G stage as a quadrupler using a spare 20-meter final grid coil in the 6L6G plate tank. The second 6L6G stage operates as a doubler to 10 meters. A 40-meter or 20-meter crystal can be used if desired.

For 5-meter operation, a 40- or 20-meter crystal is needed. The first 6L6G stage acts as a quadrupler or doubler with a spare 10-meter final grid coil in its plate circuit. The second 6L6G stage acts as a doubler to 5 meters and is link-coupled by two small turns to the final 5-meter grid coil. Very careful tuning is needed on this band to obtain maximum grid drive to the final amplifier. The latter is always operated as a neutralized r.f. amplifier on all bands.

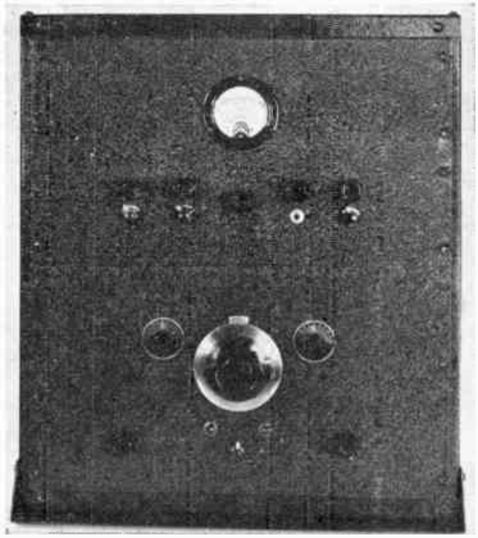
The 6L6G coil and HK54 grid coil for 5 meters were made of no. 14 wire space-wound and self-supporting. The ends of these coils (and center-tap connection on the grid coil) were fastened to small banana-type plugs. The "banana" springs were pried off, leaving the center prong which is about the same size as the prongs on the five-prong coil sockets.

The final amplifier 5-meter coil differs from the other coils in that a small Ohmite 5-meter r.f. choke was soldered to the coil center tap and connects in series with the main r.f. choke coil. Wing-nut terminals on the rear insulating strip on the tank condenser furnish good connections to the various sized tank coils. All of the other coils were wound on five-prong plug-in forms except for the oscillator which has standard four-prong coil forms.

[*Continued on Page 75*]

An Improved Receiver for 10 METERS

By
RAYMOND P. ADAMS*



Front view of the receiver.

The writer's original 10-meter phone receiver, described in considerable detail in the October, 1937, RADIO, was and still is a pretty fair design for amateur use; its rather wide acceptance and duplication bear testimony to that. However, the design had its limitations. Not only were b.f.o. and crystal filter stages omitted but no R-meter circuit was incorporated. Also, though the front end provided both r.f. and conversion gain of satisfactory order, the diode second detector drew a little too much power from the second i.f. stage. This low-resistance load on the output i.f. transformer reduced the overall gain and selectivity of the 1500-kc. intermediate channel until they were somewhat below optimum.

Several attempts have been made to improve that original super, and several both engineered and trial-and-error designed models have been constructed. During the course of this experimentation a couple of fairly good receivers have been developed. One in particular does such an effective 28-Mc. job that we believe it merits detailed description.

The design to which we refer is something of an experimental instrument and has, during the course of its somewhat haphazard evolution, suffered considerable rewiring and parts replacement. Hence, it is hardly the neatly engineered thing which we'd like to present. But if in under-chassis illustration it does not present a very pretty wiring picture, it is nevertheless that of a practical and extremely efficient job. If it is complex, it is so without being complicated, so that we may describe it not only for the circuit possibilities which it suggests but as a laboratory model for duplication in whole or major part.

* Box 146, Girard, Calif.

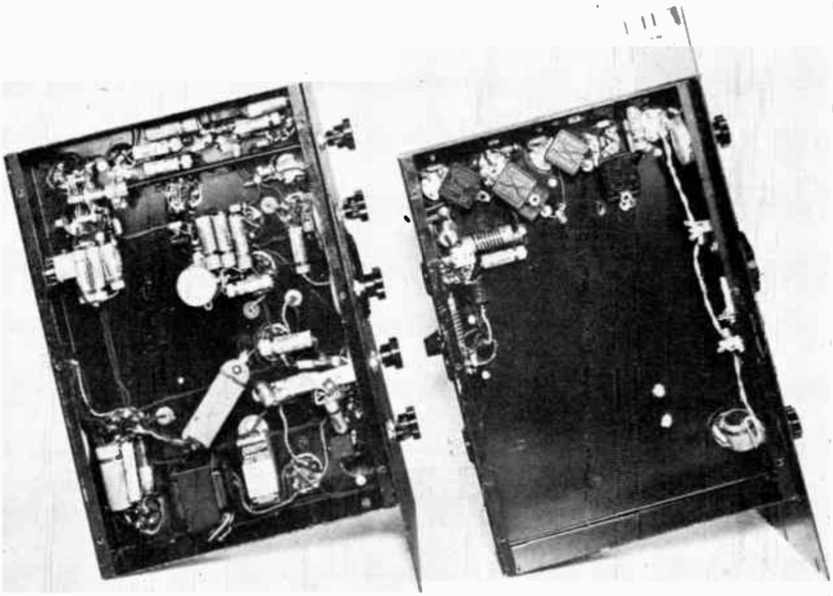
Like the original design, this one features two stages of r.f., fixed r.f. plate circuit tuning to the approximate center of the 10-meter band and a 1500-k.c. i.f. channel. Infinite-impedance detection, however, is employed and two additional i.f. stages have been added: one a first stage using a fixed gain 6J7, one a crystal filter stage. Other refinements are a separate and manually controllable a.v.c. channel, a beat oscillator stage, a forward reading R-meter circuit and the newer noise limiting layout described by Frank Jones in his story on the 1938 version of the "222" receiver (June, 1938, RADIO) and incorporated here because of its simplicity and effectiveness.

Physically, the receiver is a two-section rack-and-panel affair somewhat similar in general layout to the writer's 20-meter diversity job; r.f. components are on the lower and i.f. and a.f. sections on the upper chassis.

R.f. coils are plug-in, to facilitate both set construction and any necessary band change. A rapid tuning dial is used for h.f.o. tuning (with 180 degrees of bandspread), and r.f. tuning is simply and sensibly knob-controlled.

R. F. Circuit Details

The first r.f. stage employs a fixed gain 6J7. The second uses a manually controlled 6K7. Eventually, 1851's will replace both the "J" and the "K."



Bottom view of the two chassis, the i.f. and audio unit on the left and the r.f. and oscillator stages on the right. The adjustable antenna coupling link and the Faraday shield can be seen in the lower right corner of the r.f. deck.

As we have said, the input stage is fixed in gain; neither automatic nor manual control is provided. The second, on the other hand, features variable grid bias obtained through the conventional method of increasing or decreasing the cathode resistance value.

Screen supply for the 6J7 stage is obtained from a voltage dividing network; that for the 6K7 stage is obtained directly from the high voltage line through a suitable dropping resistor.

The Mixer Stage

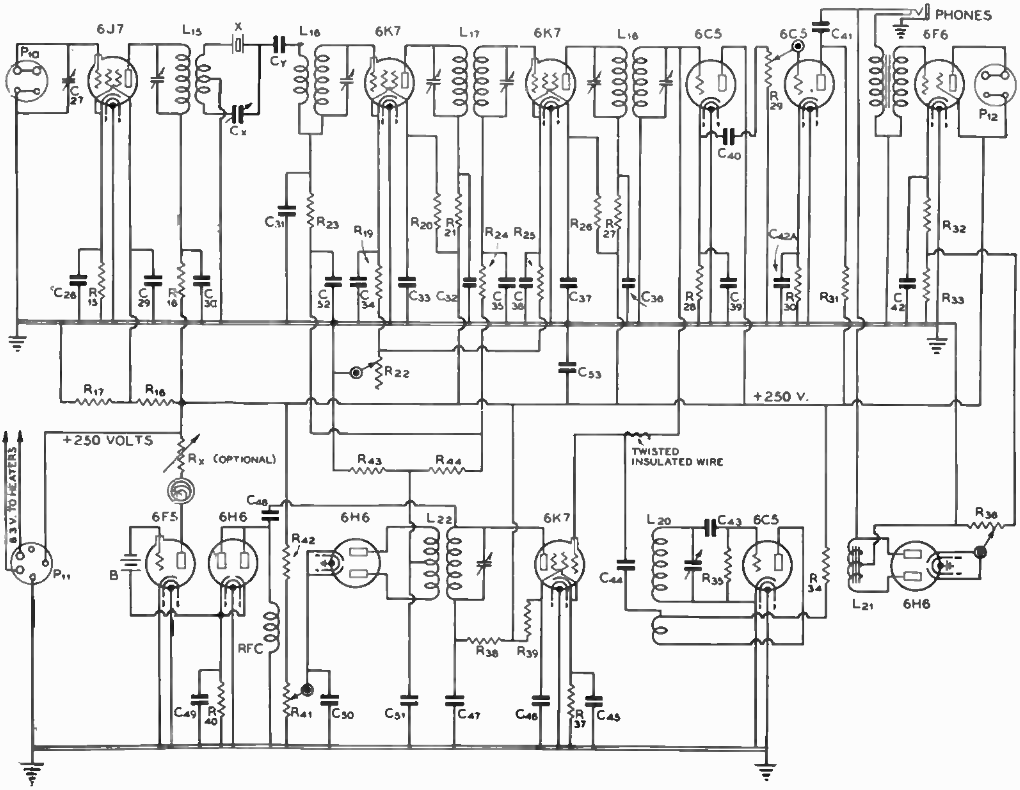
The mixer stage employs the 6J8G hexode converter—an especially fine tube for 28-Mc. service at this circuit point. Fixed signal-grid bias and screen voltage keep the conversion gain at peak under all operating conditions; no automatic control is nor will be employed here.

The H.F.O. Stage

The h.f.o. stage, of course, makes use of the triode oscillator section of the 6J8G, is conventionally wired in the recommended setup for plate circuit tuning, and, as far as its design goes, needs no particular explanation other than relating to LC constants.

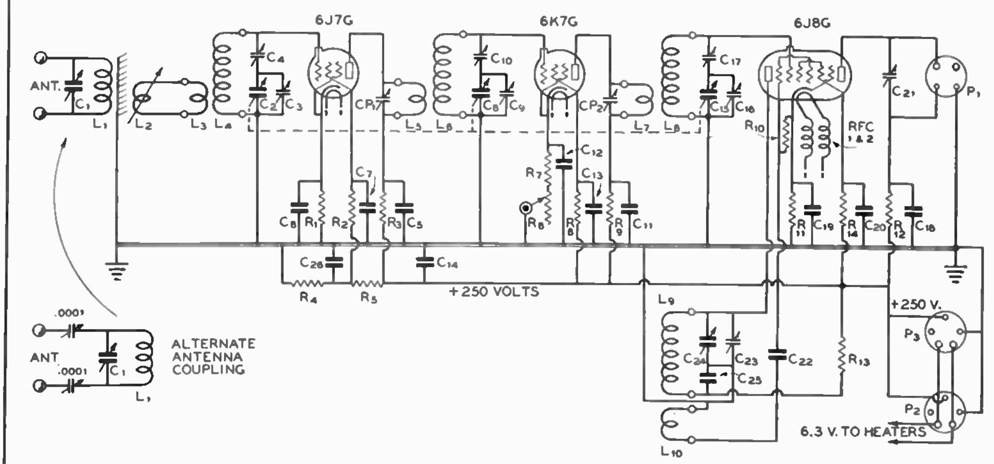
Tuned Circuit Design

All three r.f. coils are, as we have previously observed, wound on small Hammarlund CF5M isolantite forms. Grid circuits here are strictly low C, the coil secondaries having 7¼ turns as compared to 4½ turns for those used in the original 10-meter super. A very close inductance tolerance is required, of course, if accurate alignment at the high-frequency end of the band is to be had. But even though the coils are wound with great care, variations in the general circuit wiring make an exact match impossible; air trimmers (Meissner Alignaires, with a capacity range of from 1 to 12 $\mu\mu$fds.) have therefore been added. The ganged r.f.-mixer condensers have 20 $\mu\mu$fd. maximum capacity each, are left "as is" with no plates removed, and provide for full bandspread when series connected with a second set of Alignaires (whose adjustment, by the way, not only determines the amount of spread but facilitates the effecting of an accurate track across the band). The spotting trim-



I.F.-A.F. SECTION (UPPER CHASSIS) OF 10-M. RECEIVER

C_X—3-20-μμfd. variable
C_Y—.00005-μfd. mica
C_{27}—3-50-μμfd. midget trimmer
C_{28}, C_{29}—.05-μfd. 200-volt tubular
C_{30}—.05-μfd. 400-volt tubular
C_{31}—.05-μfd. 200-volt tubular
C_{32}, C_{33}, C_{34}, C_{35}, C_{36}, C_{37}, C_{38}—.05-μfd. 400-volt tubular
C_{39}—.00005-μfd. mica
C_{40}—.05-μfd. 400-volt tubular
C_{41}—.25-μfd. 400-volt tubular
C_{42}, C_{42A}—25-μfd. 25-volt electrolytics
C_{43}—.0005-μfd. mica
C_{44}, C_{45}, C_{46}, C_{47}—.05-μfd. 400-volt tubulars
C_{48}—.0001-μfd. mica
C_{49}, C_{50}—.05-μfd. 200-volt tubular
C_{51}—.00025-μfd. mica
R_{15}—1000 ohms, ½ watt
R_{16}—2000 ohms, ½ watt
R_{17}—30,000 ohms, 1 watt
R_{18}—50,000 ohms, 1 watt
R_{19}—300 ohms, ½ watt
R_{20}—100,000 ohms, ½ watt
R_{21}—2000 ohms, ½ watt
R_{22}—15,000-ohm potentiometer
R_{23}, R_{24}—250,000 ohms, ½ watt
R_{25}—300 ohms, ½ watt
R_{26}—100,000 ohms, ½ watt
R_{27}—2000 ohms, ½ watt
R_{28}—100,000 ohms, ½ watt
R_{29}—500,000-ohm potentiometer
R_{30}—2000 ohms, ½ watt
R_{31}—50,000 ohms, ½ watt
R_{32}—400 ohms, 3 watts
R_{33}—50 ohms, 3 watts
R_{34}—30,000 ohms, 1 watt
R_{35}—50,000 ohms, ½ watt
R_{36}—200-ohm w.w. potentiometer
R_{37}—400 ohms, ½ watt
R_{38}—2000 ohms, ½ watt
R_{39}—100,000 ohms, ½ watt
R_{40}—250,000 ohms, ½ watt
R_{41}—5000-ohm w. w. potentiometer
R_{42}—30,000 ohms, 1 watt
R_{43}—250,000 ohms, ½ watt
R_{44}—500,000 ohms, ½ watt
R_X—Meter-set resistor
P_{10}—4-place female receptacle
P_{11}—5-place male receptacle
P_{12}—Receptacle or binding-post assembly for connection to speaker transformer
L_{15}—Crystal-filter input, 1500 kc.
L_{16}—1500-kc. crystal output
L_{17}—1500-kc. interstage
L_{18}—1500-kc. output
L_{19}—Plate-to-grid audio trans.
L_{20}—1500-kc. b. f. o. trans.
L_{21}—Push-pull pentode-to-voice coil output transformer. Only primary is used.
L_{22}—1500-kc. single-tuned diode output transformer
RFC—10-mh. choke of high impedance at 1500 kc. or trimmer-tuned midget b.c.l. coil, shielded



R. F. SECTION (LOWER CHASSIS) OF THE 10-M. RECEIVER

C_1—140-μμfd. midget variable
C_2—20-μμfd. midget variable
C_3, C_4—1-to-12-μμfd. air trimmer
C_5, C_6, C_7—.01-μfd. mica
C_8—20-μμfd. midget variable
C_9, C_{10}—1-to-12-μμfd. air trimmer
C_{11}, C_{12}, C_{13}—.01-μfd. mica
C_{14}—0.1-μfd. 400-volt tubular
C_{15}—20-μμfd. midget variable
C_{16}, C_{17}—1-to-12-μμfd. air trimmer
C_{18}, C_{19}, C_{20}—.05-μfd. 400-volt tubular
C_{21}—3-50-μμfd. trimmer
C_{22}—.00005-μfd. mica
C_{23}—140-μμfd. midget variable
C_{24}—15-μμfd. midget variable
C_{25}—.006-μfd. mica
C_{26}—0.1-μfd. 400-volt tubular
CP_1, CP_2—3-30-μμfd. trimmers
R_1—1000 ohms, ½ watt
R_2—5000 ohms, ½ watt
R_3—2000 ohms, ½ watt
R_4—30,000 ohms, 1 watt
R_5—50,000 ohms, 1 watt
R_6—15,000-ohm rheostat
R_7—300 ohms, ½ watt
R_8—100,000 ohms, ½ watt
R_9—2000 ohms, ½ watt
R_{10}—50,000 ohms, ½ watt
R_{11}—300 ohms, ½ watt
R_{12}—2000 ohms, ½ watt
R_{13}—30,000 ohms, 1 watt
R_{14}—25,000 ohms, 1 watt
RFC_1, RFC_2—10-meter filament chokes
P_1—4-prong female receptacle
P_2—5-prong female receptacle
P_3—5-prong male receptacle (pwr supply in)
Coils—See text

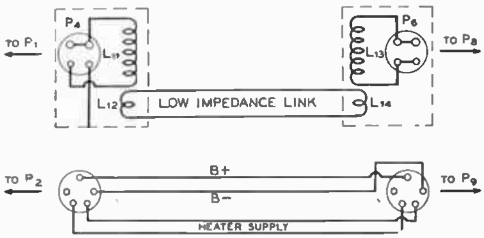
mers are wired not across the complete circuits from grids to ground but across the *tuning condensers.*

The h.f.o. circuit is really high C—, about seventy per cent of the .00014-μfd. maximum tank capacity being employed to trim it to a frequency 1500 kc. higher than a selected spot immediately above the 28-Mc. band. With this amount of initial C, and with the particular coil specified in use, it is not at all necessary to tap the 15-μμfd. maximum h.f.o. tuning condenser down on the plate inductance or to employ a series capacitor; the bandspread is just right for the full 15-μμfd. range (just right, that is, if you like 180 degrees of it).

The coil is mounted directly on the Hammarlund HF-15 tuning condenser, and the latter is itself mounted on and inside a fourth Meissner shield can. The tank condenser, an HF-140, is also mounted inside the can, its shaft protruding at the rear.

The Antenna Circuit

So that variations in the antenna loading may be compensated for without the necessity of a manually adjustable trimmer across the first tuned circuit, and so that the noise pickup may be minimized, a special input layout is incorporated. The first r.f. coil is link coupled back to an antenna coil, which, by the way, is tuned. Between the link and the latter inductance is an electrostatic shield. The shield is placed over a hole in the chassis; the antenna coil is above



SCHEMATIC OF LINK CIRCUIT BETWEEN UPPER AND LOWER DECKS.

L_{11}, L_{13}—Midget b.c.l. coils
L_{12}, L_{14}—3 turns, ¾" dia., closely coupled to L_{11} and L_{13}
P_4, P_6—4-prong shielded male plugs
P_5—5-prong male plug
P_7—5-prong female plug

it, the coupling link below it. The coupling is variable and is controlled by a knob on the front panel.

We may employ tuned-feeder or twisted-pair transmission line input, a directly connected half-wave antenna, or anything else that convenience or circumstance or experiment dictates. In any case, we have at hand a means of antenna tuning, load compensation, and last but not least, coupling control. The electrostatic shield, of course, is a refinement well worth having.

Coupling Between Circuit Sections

In the writer's 20-meter diversity receiver, the mixer plate was directly connected to the input i.f. transformer on the upper chassis by means of a shielded lead from unit to unit. This was acceptable practice in the particular case of the receiver mentioned, whose intermediate frequency was 456 kc.; no appreciable signal loss resulted and no difficulties were experienced in trimming the input i.f. transformer's primary. However, with an i.f. of 1500 kc. it was found best to keep the mixer and first i.f. tuned circuits where they belonged, near their associated tubes, and to couple the two together by means of a low-impedance link.

In the super under discussion, therefore, we employ trimmer-tuned coils (they are simply very small broadcast band inductances with approximately ten turns removed to compensate for the effects of rather close fitting shields) at both lower chassis output and upper chassis input points. They are wired to and assembled within Amphenol shielded male plugs. Their trimmers are wired to the chassis receptacles for these plugs, and their low-impedance links are brought through the shell openings for line coupling.

This system works out very well, involves little extra cost and adds to the effective selectivity.

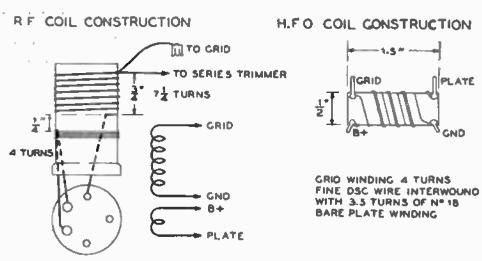
The I.F. Channel

To increase the level of weaker signals produced by the converter before they are fed to the crystal filter, an input i.f. stage is employed. This incorporates a 6J7 in a fixed-gain circuit. The filter itself is a low-impedance link affair, its crystal in the circuit at all times. Its effective selectivity is controlled simply through an adjustment of the phasing condenser. The omission of a shorting switch is quite practical in any receiver using a 1500-kc. i.f., as the circuit will pass intelligible modulation even when in perfect balance.

Following the crystal are two stages of manually and automatically controlled i.f. amplification. Plenty of overall i.f. gain is thus available. No discussion of the general setup of these stages, nor that of the succeeding infinite impedance second detector, need be given as conventional circuit design is employed.

The A.V.C. and R-Meter Circuits

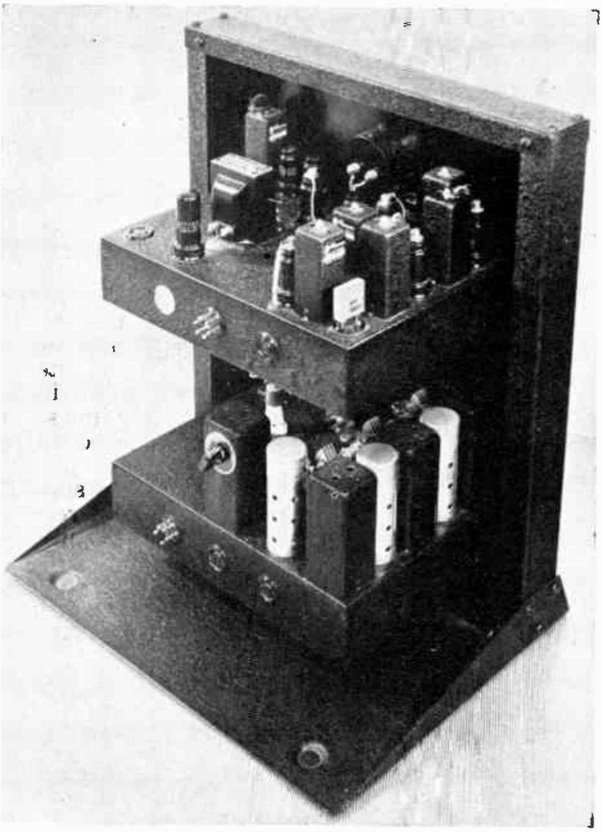
The a.v.c. and R-meter circuits are more or less optional refinements. We



shall explain them as they are given here, with the thought in mind that some amateurs may desire to simplify the receiver's design by omitting them.

A preamplifier 6K7, its signal grid tied to that of the infinite-impedance second detector, amplifies the signal at intermediate frequency and feeds it to both the diode a.v.c. rectifier and the diode v.t.v.m. rectifier.

The transformer for the a.v.c. channel is a single-tuned job with center-tapped



Rear three-quarter view of the completed receiver exclusive of power supply. The interconnecting plugs also have been removed to clarify the photograph

secondary and closely coupled windings. The coupling circuit between the amplifier and the R-circuit diode is composed of a small mica capacity and a shielded r.f. choke of extremely high impedance to frequencies in the vicinity of 1500 kc. The loading of these two diodes takes considerable power from the preamplifier. For that reason the gain of the amplifier is kept at maximum through the use of fixed bias.

Both diode circuits produce d.c. control voltages across their load components: a resistor from secondary return to ground in the case of the a.v.c., and a resistor from cathode to ground in the case of the v.t.v.m. or R-meter. The negative voltage with respect to chassis developed by the one is filtered and applied to the last two i.f. stages as automatic volume control. The positive voltage with respect to chassis developed by the other is filtered and applied to the 6F5 R-meter tube's grid.

The a.v.c. rectifier's cathode returns to a potentiometer in a voltage divider network so that the diodes may be biased by any amount up to approximately 50 volts and so that a "take off" point may be established. This squelch action assists in meeting any noise, signal or general receiving condition. No bias, on the other hand, is applied to the v.t.v.m. diodes; any signal of sufficient level to overcome its inherent bias will produce a positive d.c. voltage across the load component and apply that voltage to the meter tube's grid.

The meter tube is battery biased (4.5 volts seems to do the trick) so that the 0-5 plate milliammeter reads zero at no signal; which is to say, biased so that no plate current flows. The d.c. component of any rectified signal then lowers the resting bias, causes the tube to draw current and effects the desired forward reading needle swing. It's simply a standard v.t.v.m. layout.

[*Continued on Page 89*]

Emergency Primary Power

By LAWRENCE B. ROBBINS,* W1AFQ

Normally the amateur is not concerned with primary electrical power sources. His primary power source is maintained by the power company and he receives as much or as little of it as he needs or can afford. However, in times of emergency, a source of primary power becomes a problem of vital importance. The amateur must have some means of manufacturing his own power. He cannot rely upon the power company to supply him.

It must be emphasized that, except in a few cases, no real emergency exists until commercial sources of power have failed. As long as commercial communication companies are supplied with power, they are better qualified to carry on communication than are amateurs.

When a real emergency exists, however, the amateur equipped with a good reliable source of power can be of immeasurable service to his community. Those suitably equipped have played glorious roles in many cases of extreme emergency, while equally proficient operators have had to stand idly by because they had no power with which to operate their equipment. It is to those amateurs who have no emergency power equipment that this article is addressed. Let's explore the possibilities of various forms of emergency power sources and attempt to arrive at a few conclusions concerning the most suitable types.

The most important single requirement is that the power unit *must not deteriorate*. It may lie dormant for months, even years, perhaps forever, yet when called upon it must deliver power immediately.

Some Possibilities

Here is a partial list of emergency power units. The list is not complete, of course, but shows a goodly number of possibilities: (1) storage battery and vibrator supply; (2) wind-driven generator; (3) water wheel and generator; (4) portable gas engine and generator; (5) storage battery and dynamotor (or genemotor); (6) auto fan-belt generator; (7) hand generator; (8) B batteries (storage and dry).

* *Pleasant Lake Ave., Harwich, Mass.*

Vibrator Supplies

Storage battery and vibrator-type power supplies can be obtained very easily since they are standard equipment with all modern auto receivers. They can hardly be termed emergency power supplies, however, as they are of comparatively low output rating. They have their place, of course, and can be used in connection with small transmitters for reliable short distance relay work between automobiles and stations in the same area. Splendid work has been done with low-powered transmitters. For example:

During a New England flood a few years ago a Vermont school boy, living on a steep hillside down near the Massachusetts line, performed invaluable service with a single 201A tube, a Ford spark coil and a six-volt storage battery taken from a car. He sat at that outfit for two entire days and nights and originated or relayed fifty-four messages of cheer and hope to relatives and friends of folks dangerously marooned in that little village. But—what chance would such a makeshift outfit stand today with all the high-powered rigs and double the number of operators on the air? In these days, reliable transmission calls for an emergency power supply that will deliver a substantial amount of power.

Wind-Driven Supplies

Let's consider the wind-driven generator. Fundamentally, it isn't of much use without a wind. In too much wind the windcharger and the building upon which it functioned might be found in the next county. In a flood it might serve, provided the building stayed put and there was a wind. An earthquake might destroy the building and the wind-driven generator with it. However, such a generator is useful under some conditions. It could be used to keep a bank of storage batteries charged so that a suitable dynamotor or vibrator-type power supply could be used in emergencies, though the wind-driven generator itself is not easily transportable.

A windmill has the same frailties as the windcharger as concerns hurricanes or high winds. Yet, even in a big blow, it might outlast the elements. A good windmill will drive a fair sized generator and, with a governor or some sort of voltage regulating arrangement, the power supply might be adequate for a good bit of transmitting. Again we run up against the elements; if nature spares the windmill, all is well.

Water Wheels

How about the water wheel? It has possibilities but is subject to many disadvantages such as a frozen water head, lack of water when it is needed or an excess of water in time of flood. However, a wheel which can be depended upon can be belted to a generator. A reasonably small wheel could be used to turn over a 300- to 500-watt generator and thus supply a reasonably constant source of power for long and arduous QSO's. A water wheel has latent possibilities for emergency service, though its application is best dictated by individual needs. But a water wheel is even less transportable than a windcharger or windmill.

Gasoline Engines

Now we consider the portable gas engine and generator. We really have something here. It takes only a half- or one-horsepower engine to operate a good sized generator for many, many hours—until it runs out of ammunition. With the carburetor adjusted accordingly, a gas engine will run on gasoline, kerosene, natural gas, illuminating gas, alcohol or perhaps straight gin. Such outfits can be purchased complete, delivering either d.c. or a.c. power. The ingenious ham can assemble his own, using a washing machine or lawn mower engine and a rewound auto generator, as described in the Dec., 1937, RADIO. Mount the power supply on skids and it will be ready for any emergency. In times of emergency it is only necessary to hook on a battery and fill the tank.

Dynamotors

The storage battery and generator is really the grandfather of the auto "genemotors" or dynamotors of today. Some operate from 6-volt batteries, others from 12 volts, while others require 32 or even 110 volts (usually d.c.) to turn them over. They are all fine for low-power work. Outputs run from around ten watts from the auto-receiver type up to over a quarter kilowatt for the larger ones. There is a grand opportunity for electricians and tinkerers to rewind old automobile generators to deliver up to 1000 volts when geared or belted to a suitable motor operated from whatever battery source is available. Strictly speaking, this latter setup would be called a motor-generator since it is composed of two separate machines.

Fan-Belt Generators

One of the most suitable high-power generators is the type operating from an automobile fan belt. These usually supply alternating current at 110 volts and of sufficient current to supply any medium-power transmitter. The cost of such installations is considerable but their cost dims in the light of their capabilities. It is necessary only to fill the car with gasoline, back it up to the shack window, connect the generator leads to the transmitter and step on the starter. 110 volts of a.c. will give punch to the signal and everything is set for emergency work as long as the car holds the ground and gets its quota of fuel.

Hand Generators

The hand (or foot) generator is, of course, an old standby. It was, and still is, very satisfactory. That is—if you can get someone to turn the crank or pedal while you pound brass. Admiral Byrd and his men got themselves out of several tight spots with hand generators and Howard Hughes took one on his epochal flight; so they are not to be regarded lightly. A good one can be purchased from radio outfitters or one can be rigged up by belting a generator to a suitable flywheel operated by a set of bicycle pedals and sprockets.

B Batteries

Fortunately the B battery is still with us. For real emergency work, where mechanical apparatus must be reduced to a

[Continued on Page 88]

Rear view of the completely assembled kite showing placing of the removable cross-stick through the "buttonholes" and across the back. Notice that the box sections hang limp.

Front view of the kite showing the placing of the bridle. The pull of the support string has pulled the box sections open as in actual flight.

KITES as Antenna Supports

By B. P. HANSEN,* W9KNZ

Some time ago W9HDU and the author of this article had need for some very high, very long, five-meter antennas. Our work was purely experimental, so permanence was not a requisite. It was decided to try kites, and the results were so good that we decided to pass the information on to anyone who likes to take a little fun with his radio.

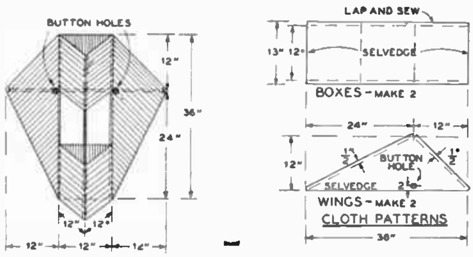
There seems to be little available data on the construction of any type of kite. The type to be described has proven its worth over many years of use by various weather observation groups. It was from this source that the information was obtained. It is a box kite with triangular boxes and with side wings. It will fly in a very light wind, will carry some load weight and is about the most efficient type of kite to be had. By a kite's efficiency is meant the ratio between the amount of string out and the height of the kite above the ground. A good kite should hold the string at very little less than a 45° angle with the ground. Another convenient feature of this design is its collapsibility; if one stick is slipped out, the whole thing rolls up into a space smaller than an ordinary umbrella.

**3800 E. Colfax, Denver, Colo.*

Construction

Construction is simple because it is only necessary to remember that all proportions are by "thirds." That is, the sticks are three feet long, the material for each box and for the wings is cut from across a piece of goods a yard wide, each box is a third as wide as it is long, and each wing is a third as wide at its apex as it is long. The cloth can all be cut so that all tacking is done along the strong selvedge. This makes for a strong kite that will hold its shape.

The sticks should be made of white pine or any similar light, stiff wood. They should be about 3/8 inch square to give adequate stiffness. This stiffness is extremely important. Four sticks are required. Saw them out of firring strip and then plane and sand them to dimensions.



Cloth pattern and constructional diagram of the assembly of the kite.

Choosing and Cutting the Cloth

Most cloth comes in bolts about a yard wide. It is usually just a little under this width, but if the cloth is ironed before cutting, it will usually work out to the necessary width. It is best to use some light, closely-woven cloth. Linen is ideal but expensive. Ordinary cheap cambric serves very well. It is best to choose a bright color; a very gaudy red will show up very well against the ground in case the kite breaks away and has to be hunted down.

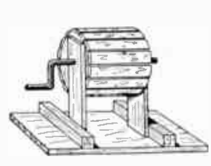
It isn't much of a job to cut the cloth but if you can persuade the XYL to do the cutting as well as the sewing, it should be worth at least a box of candy. If she does the cutting, she will probably prefer to make a pattern out of wrapping paper and then to cut around that, whereas the average man will lay the cloth out on the dining room table, draw the outlines right on the cloth and cut to the lines. It seems that the ladies' method is more accurate. Let 'em have their own way and spend the time that would otherwise be spent in kibitzing making the sticks.

Assembly

The assembly job is simple. Use 1/8-inch cut tacks to attach the cloth to the sticks. First tack the boxes in place, then attach the wings. In sewing up the wings, remember to make one the exact opposite of the other so that the seams will all be to the back. The stick on which the edges of the two boxes overlap should be the front one, with the wings attached to the other two.

Now tie a piece of strong heavy cord to the top of each of the two back sticks and thread it through the hem along the edge of each of the wings. When it comes out at the bottom of the wing, tie it to the stick, pulling it up so that it just makes the trip through the hem without puckering the wing.

The fourth stick should have notches cut in each end. To complete the setup, slip this cross-stick through the two buttonholes in the wings so that it passes behind each wing but in front of each of the two rear upright sticks. If everything has been done properly, the loops of heavy cord at the apex of each wing can now be snapped into the notches in the cross-stick, and the kite is ready to fly. Don't worry about the apparent flabby nature of the boxes—they will open out beautifully as soon as the wind strikes them. Don't try to brace them open because this will tend to make the kite unstable in the air.



Suggested method of making string reel from old magnet wire spool with slats nailed on it. This assembly is mounted in improvised bearings with a winding crank to turn it.

The bridle is a single string running from the top to the bottom of the front stick. Its length is determined in this way: Lay the kite on its back, and with the front stick laid along one of the side sticks, measure and tie the bridle so that it follows the outline of one of the wings. Then tie the flying string to the bridle about two inches above the apex of the wing. This will give about the optimum "angle of attack" for best flight. In a light wind, it may be advisable to tie it a bit higher than this, and in a heavy wind, better flight will be had if the string is lowered a bit. A few trials will show the best angle for each kite.

Line and Reel

Good silk fishline makes the best string, with linen running a close second. The string should be of as small diameter as possible but should be capable of holding twenty pounds. The weight of the string is of minor importance; it is the pressure of the wind on the string that limits the efficiency of a kite, not the weight of the string itself. It is wise to treat the string with rubber-base auto-top cement, paraffin and beeswax or some other good waterproofing material before you ever try to use it. An inch of rotten string is all that it takes to lose kite, string, antenna and a lot of good disposition.

A reel is a great comfort, especially if you use more than about 300 feet of string. It usually takes a thousand or more feet of string to do a really good job so a reel is actually almost a necessity. The sketch shows a simple one improvised out of an old ten-pound magnet-wire spool with heavy slats nailed around the edges of the sides of the spool. Space the slats a little to let the air through so that the string will dry quickly even on the reel. Make the slats of wood at least ¾ inch thick or the pressure of the string as it winds up will ultimately break them.

Antennas

Various types of antennas can be used. In an open field where there is plenty of room, a piece of no. 30 can be tied to the kite and paid out as she goes up. This can then be hooked to the rig located directly under the kite if a vertical antenna is desired—not the best arrangement but one that may have its uses. A better plan is to pass the kite string through the center of a spool of no. 30 magnet wire, then, having tied the string and wire together, pay them both out as the kite takes altitude. This scheme results in the wire being wrapped around the string so that both can be wound up on the reel together when the day's job is done. With this arrangement, control of the kite and the equipment end of the antenna is at the same spot. With such a comparatively enormous antenna, tuning adjustments will naturally be broad. Incidentally, it's an excellent plan to *keep well away from power wires* with such an antenna in the air.

One kite is enough for any reasonable antenna. Two kites on the same string will give somewhat better lift, but unless they are very well matched to each other, they will give so much trouble that all the time will have to be spent handling them, with no time out for radio. If it is desired to fly two kites on the same string, first put one up with about three hundred feet of string out. Now put up the second kite on its own string, and when it has taken about a hundred feet of string, tie it to the first string and pay them out together.

The principal objection to the use of kites for antenna supports is that it is so danged much fun flying the kites that the original idea is apt to be forgotten for a while. We took several days to get over our early enthusiasm—sending up parachutes, tangling up with the other fellow's kite, getting sunburned and what not. But when we did hang a dinky transceiver to one of them, the results were so startling that we had no trouble getting down to business. A lot of interesting things happened with a 20-meter rig hung to one of them, too. But why should we spoil your fun. Try it.

•

Strays

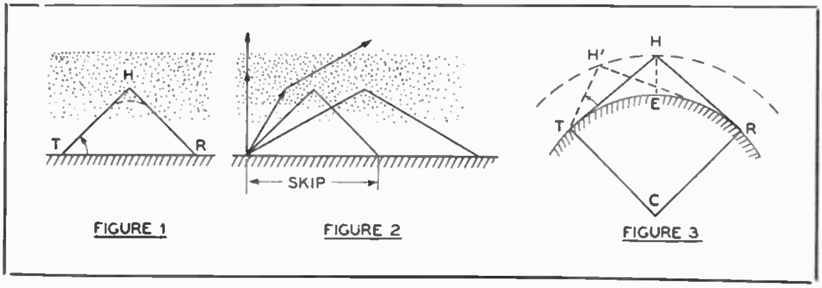
Quartz is the commonest of all solids.

•

In discussing radio teletypewriter systems, the U. S. Bureau of Air Commerce rates them with reliability equal to that of landwire teletype operation.

•

W1CTW points out that the type 80 was the first push-push doubler. The input of this tube is in push-pull, the output in parallel and the output contains the second harmonic.



FIVE-METER DX

• An Explanation

By E. H. CONKLIN*

Probably most amateurs pay no attention to the ionosphere, or to the way their signals travel from transmitter to receiver. This is a natural tendency on 14 Mc. or lower frequencies because one is apt to work anyone that is heard and not worry about the absence of signals from other points. But on ten and five meters, it becomes essential to understand what goes on, in order to make the most of conditions. Furthermore, these "marginal" bands help us to learn more about the machinery of working dx.

It doesn't require advanced mathematics to explain the nature of "skip"; drawing-board arithmetic is sufficient if you don't know trigonometry. We can take the word of others that there are two regions above the earth that are of major importance in sky-wave transmission[2]—the *E* layer at around 120 kilometers (75 miles) which is important at broadcast frequencies, and the *F* layer with its subdivisions, ranging seasonally upward from 230 kilometers (143 miles) which is important for communication on most amateur bands.

Figure 1 shows how a signal leaving the transmitter may be turned down from the sky so as to arrive at the receiver. The wave acts as if it had traveled via the heavy line, reaching the height *H*, called the *virtual* height, though actually it may have turned gradually, following the broken line in what appears to be a short cut.

Almost everyone realizes that if the layer will not reflect a signal leaving the transmitter vertically, the waves will pierce the layer at high angles above the horizon. At some lower angle they will be turned down and be received at *R*, but not closer, as shown in figure 2. In this case, the space from *T* to *R* is a silent or skip zone for the frequency being used.

To find the maximum distance that the signal can travel in one hop, it is necessary to consider the curvature of the earth, as shown in figure 3. A signal supposedly leaving the transmitter horizontally (that is, at right angles to the radius of the earth, and grazing the surface) will travel outward until the curvature of the ionosphere brings the layer in line with the wave going out, such as at *H*. At this point, the wave is turned back down and reaches the earth again at *R*. The distance *T* to *R* would give the maximum one-hop distance were it not for one other thing: *all* radiation manages to cancel itself along the earth, making it impossible to radiate much power, or to receive any appreciable signal, at *very* low angles—below, let us say, *three* degrees. Even at that angle in order to get the maximum hop, it may be necessary to use high power or an antenna capable of radiating most of its power at relatively low angles. Such antennas are (1) a properly designed

* *Associate Editor*, RADIO.

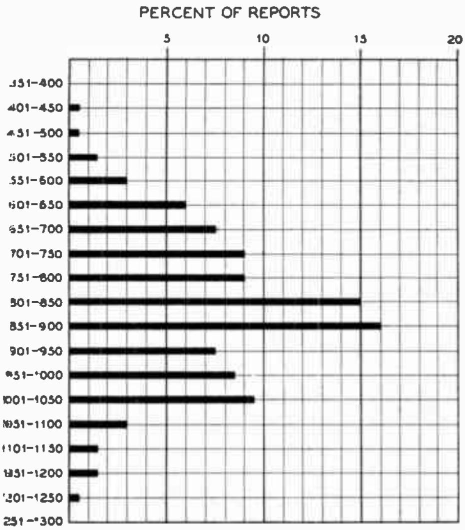


FIGURE 4.

rhombic as was in use at W5EHM, or (2) stacked antenna elements, one above another, as used at W9CLH, W8VO, W8JLQ and W6DNS, or (3) reflectors and directors as at W4EDD, W8CIR and elsewhere.

With the assumed minimum angle of radiation above the horizon, the E layer maximum distance for a single hop figures out to be around 1200 miles, while for the F layer it varies rather widely around 1800 to 2200 miles.

It is possible to determine if the ionosphere is capable of turning back a very high frequency wave, by measuring the highest frequency that will be reflected back vertically to a point near the transmitter, and then to apply some calculations or use a special chart to find out how much higher a frequency could be heard at the maximum one-hop distance. The National Bureau of Standards constantly records such reflections and advises that the highest frequencies are returned from the F region (F_2 layer) in the winter, shortly after noon at the point of reflection[3]; and from occasional sporadic E-layer reflections in summer. This sporadic condition may be the result of a change in the position of the free electrons or ions, so as to produce a sharp lower boundary to the E layer from which reflection, rather than refraction, takes place. The sporadic condition occurs at random times in the day or night. It happens a little more often in the late forenoon and during the evening than at other times during the day or night. Sometimes it is confined to a single hour and may be localized to the extent of being above only part of a single state.

So much for a general discussion of the ionosphere; let us now turn to five-meter dx reports to see if any connection can be drawn with what has happened "upstairs."

In the summer of 1937 five-meter dx was reported on about 33 days in the May through August period. By sending out hundreds of letters, some 280 cases of 56-Mc. reception were confirmed as probably being accurate. These were compared with hourly sporadic E-layer data provided by the National Bureau of Standards, and some connection was found in every correlation made. The increased probability of five-meter dx at distances of 400 to 1200 miles, whenever sporadic E-layer reflections were reported, is rather convincing. The complete study will be published shortly.

The distances of all the reports were tabulated according to the percentage of reports occurring at each distance. This appears in figure 4. It is seen that only two reports are at distances between 400 and 500 miles, with few aproaching 1200 miles. By far the majority of cases are in the middle of the 400-1200 mile range, as would be expected from consideration of the factors limiting E layer reflections. This distribution is taken as a further indication that summer 56-Mc. dx is probably the result of sporadic E-layer reflections, as proposed by the National Bureau of Standards.

Let us look at it in still another way. During the summer of 1938 W4EDD contacted stations in every district except the sixth and seventh. The longest distances from Coral Gables (near Miami) are as follows:

Kansas City	1243	miles
Farnumsville, Mass.	1235	"
Fairhaven, Mass	1222	"
W9CLH near Elgin, Ill.	1210	"
Wilmette, Ill.	1204	"
Zearing, Ill.	1200	"
Chicago, Ill.	1192	"

All distances have been calculated from the latitude and longitude, and are subject to a slight adjustment for the part of town in which the stations are located.

Of most interest in this figure is the fact that just beyond 1250 miles, especially in Massachusetts and Wisconsin, are numerous stations known to have been successful in 56-Mc. dx work this summer. None of these has reported W4EDD, though other W4's farther north have been heard. Here again one is convinced that there is some reason for the 1200-mile limit—which is entirely explainable by the sporadic E layer reflection theory.

Of course, 100- or 200-mile communication has occasionally taken place by low-atmosphere bending as explained several years ago by Ross Hull. This type of bending conceivably might take place at both ends to extend somewhat the limit of a single E layer hop.

In August *QST* it was mentioned that several reports covered distances of 1200 to 1500 miles. These distances have been rechecked. Some are just within 1200 miles rather than one or two hundred miles beyond. In other cases a careful check has uncovered the fact that the station reported has not been on the air for several years. Such bootlegging or erroneous reporting *will* slip in, but confirmation of all questionable cases will save us from obtaining faulty conclusions. (Removing these cases from Jack Pierce's chart in *QST* for September will iron out the bump at about 1200 miles).

And yet there have been cases where summer five-meter dx has taken place over distances substantially beyond 1200 miles. On a few nights in June and July W5EHM in Dallas heard some W1's (though only one W2 shows in his detailed reports) when eighth and ninth district stations were working W1's and W5's simultaneously. This obviously makes two-hop transmission possible. The distance from W5EHM to W1CSR in Boston, whom he finally raised, is 1549 miles, or just about twice the most common one-hop distance as shown in figure 4.

There were other even more astonishing things this summer. On July 24, W6DNS worked W1EYM, W8AGU, W8CIR, W8JLQ, W8NED, W5ASU, W5EHM, W7FDJ and W6OIJ, and he was called by every district but W4. W6PEX worked three W8's and one W9 that evening. W8JLQ worked five W6's. W8CIR, W8JLQ, W8VO and W9ZHB have now worked eight of the nine districts.

On that evening the usual 400- to 1200-mile hops were being reported everywhere along the path of the cross-country signals, indicating that multiple reflections were possible, and thus explaining the very long distance work.

It is important to realize that the sporadic condition must occur at three equally spaced points along the great circle path between the transmitter and the receiver for three-hop transmission. At each point the layer must be capable of reflecting the 56-Mc. signal at the proper angle. This can occur by chance with separate clouds of sporadic E, or could happen as a result of a very general condition over all of the transmission path. Either possibility is considered not highly probable, but the improbable happened on July 24 because the W6DNS-W1EYM contact was probably three hop.

Now we come to the future possibilities of the band. With little doubt summer dx will continue for a few more years, or longer, before becoming scarce around the sunspot minimum scheduled for about 1944. April and September may also bring some cases of the summer type of dx, but the ionosphere data show that relatively few hours will support E layer reflection at five meters.

Nevertheless, all is not lost. The much more predictable F_2 layer will be most favorable for high-frequency communication from October to February, and five-meter dx at distances just under 2200 miles and multiples may then be possible. For F_2 layer hop the time at the point of reflection probably will be a little after noon and all such communication will be in daylight except that it may be later afternoon or early evening at the eastern end.

In this connection five-meter dx tests are being arranged for weekends during November. The British stations already have voiced their desire to participate in the hope of running up a score in the 1938 R.S.G.B. five-meter c.w. contest.

Assuming the truth of the theory that dx is a result of sporadic E layer reflections in summer and F_2 reflections or refractions in winter, some very helpful conclusions can be drawn. In the first place, summer five-meter work almost invariably accompanies ten-meter communication at a distance of perhaps 400 miles—and both occur in about the same direction. The same is true of winter dx except that because of the longer single hops ten-meter signals might be

[Continued on Page 80]

More on

THE FLEXTAL EXCITER

By LEIGH NORTON, W6CEM

In the course of some further work with the "Flextal" conversion exciter* several "bugs" common to all conversion-type frequency controls regardless of their actual circuit arrangement have been to a large extent eliminated. With the thought of suggesting possible improvements on existing "Flextal" exciters the results of the preliminary work are offered. The remedies to be described are equally applicable to other conversion-type controls, as the cause of the trouble is identical.

The aforementioned "bugs" take the form of spurious frequencies in the output close enough to the desired frequency to pass through the tuned circuits of the associated transmitter; they are commonly known as "birdies."

The Source of the Trouble

It can be shown by a lengthy series of computations that every one of these "birdies" is the direct result of various harmonics of the low-frequency oscillator together with their beats with the conversion crystal frequency, the output frequency, the "image" frequency, (in the "Flextal," the crystal plus the low frequency), and with each other.

Actually, the number of these spurious frequencies falling close enough to the desired output frequency to pass through the tuned circuits is few, and most of these are of small magnitude due to the high order of the harmonics generating them. However, there may be one or two "birdies" for any particular output frequency that are of sufficient strength to cause concern.

The "birdie" elimination can be attacked from two angles. The first method is the obvious one—limiting the harmonic output of the low-frequency oscillator and minimizing the harmonic producing capabilities of the mixer stage.

* *The "Flextal" Exciter; Norton,* RADIO, *May, 1938, p. 51.*

In the "Flextal" harmonics generated in the mixer may be reduced by utilizing suppressor injection instead of screen injection as originally shown.

The suppressor can be biased negatively by connecting it directly to the grid of the low-frequency oscillator. It will thus be operated substantially on the negative portion of its curve. Aside from handicapping the mixer in its ability to produce harmonics, this mode of operation removes the load from the low-frequency oscillator with its attendant benefits.

Reducing Oscillator Harmonics

With the mixer taken care of in this manner the problem becomes one of reducing the harmonic output from the low-frequency oscillator. A push-pull oscillator will reduce the even harmonics but will have little effect on the odd ones. As the odd harmonics can be equally as bothersome as the even ones, the best method of attack is to try to eliminate all harmonics, odd or even, and not further to complicate the circuit by the use of a push-pull oscillator. The low-frequency oscillator in its original form had a quite high C/L ratio so no improvement can be expected by using additional capacity across the tank coil. Any changes in oscillator bias or feedback which will help in harmonic reduction will seriously affect the quality of the output; the best solution seems to be that of reducing the strength of the harmonics after they leave the oscillator itself but before they can be coupled into the mixer stage. This calls for some sort of low-pass filter between the oscillator and mixer.

A low-pass filter with a cutoff frequency of around 1000 kc. placed in the coupling lead between the two stages would be the ideal answer to the harmonic problem. However, the two- or three-section filter that would ordinarily

[*Continued on Page 95*]

Single Control BANDSPREAD

By VERNON C. STARR,* W6IKH

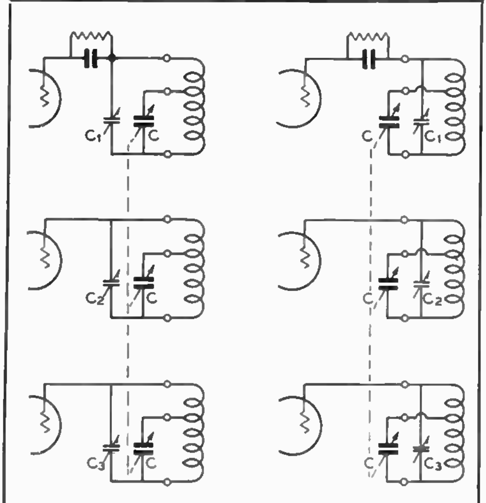


FIGURE 1 FIGURE 2

To the writer, the most important single attribute of a receiver is its stability. In modern superheterodynes stability is determined almost entirely (with the exception of purely mechanical considerations) by the ability of the high-frequency oscillator to withstand the effects of temperature and voltage variations and oscillator-tube interelectrode capacity changes. While a great deal of oscillator instability can be tolerated in a receiver used entirely for phone reception, a poor oscillator can render an otherwise excellent receiver practically useless for c.w.

When the effects of voltage and temperature variation have been eliminated (by correct electrical and mechanical design), practically complete stabilization can be brought about by the use of a high capacity in the oscillator tank.[1] The high capacity minimizes the effect of tube interelectrode capacity changes by making them a small percentage of the total capacity across the circuit. Generally, however, the use of a high capacity in the oscillator tank circuit requires compromise in receiver design. Either the r.f. and detector stages must be tuned separately from the oscillator, or, if single-dial control is desired, high capacities, with their attendant losses, must be used across the r.f. and detector tanks to enable them to track with the oscillator.

Designing the Tuning Circuits

However, by employing proper coil design, the advantages of single-dial control, r.f. sensitivity and oscillator stability may be obtained simultaneously. Briefly, the method is as follows:

Across the oscillator coil is placed a fixed high capacity. This condenser is C_1 in the diagrams; it may be as high as 100 $\mu\mu$fd. without seriously affecting the oscillator output. The r.f. and detector coils have low capacity trimmers, C_2 and C_3, placed across them. The tuning condensers, C, are ganged and tapped on the coils. Any amount of bandspread desired may be obtained by proper placement of the oscillator coil tap. The taps on the r.f. and detector coils are placed at points which allow these stages to track with the oscillator.

The Coils

The coils are first wound temporarily, close enough to receive a few signals, but not in finished form. The oscillator coils are then wound with the correct number of turns and proper location of tap to secure the desired amount of bandspread; at the same time the center of the band must be kept near the center of the dial. The band cannot be centered on the dial by varying the tank condenser as this would make accurate calibration on other bands impossible. The band must be centered by adjusting the number of turns on the coil; fine variations may be made by adjusting

[Continued on Page 86]

[1] *Stabilizing the S. S. Superheterodyne;* Perrine, RADIO, *February, 1937, p. 34.*

* *73 S. Roosevelt, Pasadena, Calif.*

MULTIPLE CRYSTAL HOLDERS

By H. CHARLES KAETEL,* W9SNK

With the increasingly crowded conditions on the higher-frequency amateur bands, more and more amateurs are resorting to some sort of an arrangement for switching from one crystal to another as QRM conditions dictate. Most frequently the inclusion of these switching arrangements has necessitated the rebuilding of the crystal stage. But this is not necessary, as this article by Mr. Kaetel will indicate; a simple method is shown whereby a group assembly of crystals with a selector switch may be plugged into the original crystal socket.

Tube-base type sockets and tube-base type plugs have come into common usage in many phases of radio to solve the connection problem simply and inexpensively. And, what is of most interest to us at the present time, the majority of manufacturers are supplying amateur crystal units in holders which are designed to plug into a simple five-prong tube socket.

First, let us assume that the exciter is now completely built and in operating condition but that we wish to incorporate some crystal-switching arrangement without greatly altering the exciter. However, we have found that there is sufficient space on the front panel to install a crystal selector switch even though there is no room behind the panel to accommodate the crystals. The solution to this problem is indicated in figure 1.

The selector switch is mounted upon the front panel so that the contact plate is adjacent to the crystal socket now in use. Without changing this socket, and with a simple rewiring job, we can easily build a plug-in crystal holder that will accommodate up to four standard crystal holders. The plug-in holder is shown in figure 1A. The base and sockets of the four-crystal holder are type RCP5 and RS5 Amphenol replacement plugs and sockets. These are assembled with tie-bolts and spacers selected from a dealer's Centralab Switchkit. The holes in the plug base and the sockets specified line up perfectly and the assembly is quite neat in appearance.

One connection from each socket goes to one common pin in the base, and the other side of each of the holders goes to a separate pin as shown in figure 1B. Under the chassis the common connection on the crystal holder socket usually goes to ground and the other leads are distributed along the switch connections.

A very suitable type of switch for this service is the type shown in figure 1C. This may be a Centralab Switchkit type K-121 index assembly together with a type-A switch section. The tie-bolts and spacers supplied with this switch will enable the constructor to place the switch section itself any distance of from ½ inch up to 2 inches back of the index plate. If shorter wiring will be obtained by placing the switch section further from the panel than this, the length of the switch can be increased up

* 2928 West Wells St., Milwaukee, Wisc.

to 8 inches with spacers and tie-bolts, together with a suitable length of flat shaft.

With 1½ inches of spacers between the sockets as shown in 1A, only the top crystal can be readily changed in its socket. Two inches of spacers will enable you to remove and insert any of the crystal holders at will but materially increases the length of the leads. The shorter spacers are to be recommended, as disassembling the device is no more difficult than opening the average crystal holder for cleaning.

In figure 2A, there is shown a horizontal type of assembly with the crystal switch self-contained in the multiple crystal holder. The parts used are the same as in the "vertical" type unit described previously. The position of the switch section below the crystal holder sockets results in very short wiring. The dial plate and the bar knob are from the switchkit and are parts no. K-115 and K-120 respectively. Figure 2B shows the wiring of the unit and figure 2C shows a top view of the unit with four crystal holders plugged into their sockets.

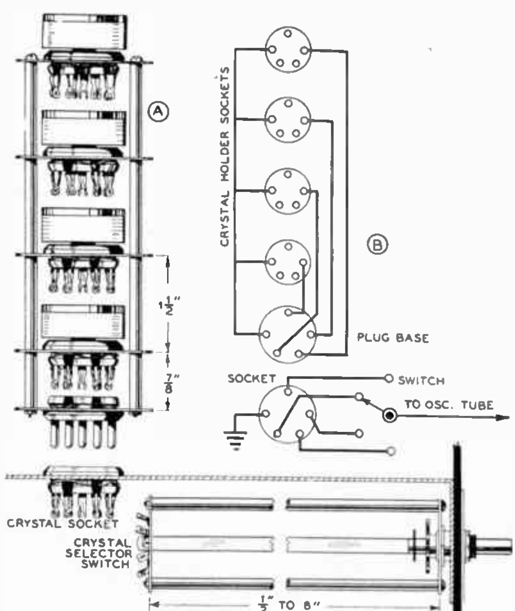


FIGURE 1

The method of stacking the crystals in the multiple holder is shown in (A), the connection arrangement in (B) and the method of mounting the selector switch in (C).

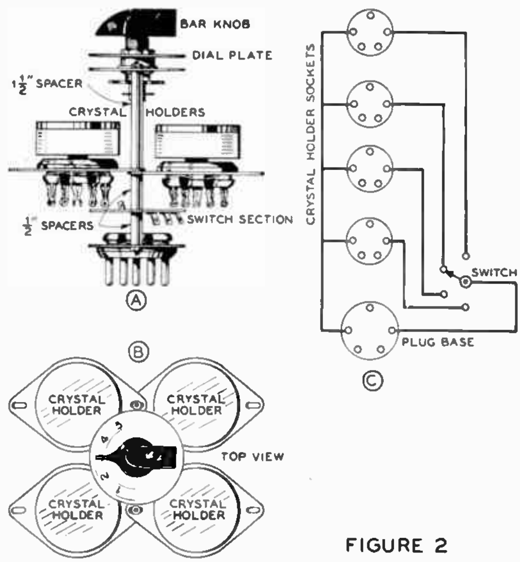


FIGURE 2

Horizontal type assembly whereby the multiple holder and the selector switch are both plugged into the original crystal socket. The arrangement is shown in (A) and (B) and the method of connection in (C).

Other arrangements of these same parts will readily suggest themselves and no attempt will be made to show more of them. With either type of assembly it will be possible to put all the crystals used for one band or one mode of operation into one unit. Then, when changing bands, the entire group of crystals may be changed as easily as one does a plug-in coil. This arrangement also minimizes the danger of operating your phone in a c.w. band or vice versa due to a little carelessness with the crystal selector switch. All phone crystals for one band and all c.w. crystals for another can be mounted in separate holders and changed when changing bands or mode of operation.

●

Besides the usual gifts of flowers and money, Western Union has made a wide variety of deliveries including a stack of wheat cakes in time for breakfast, a couple of fried eggs across the country and an after-dinner cigar.

U.H.F. BEAM OSCILLATOR

A unique u.h.f. circuit in which the antenna is used as the tuned plate circuit.

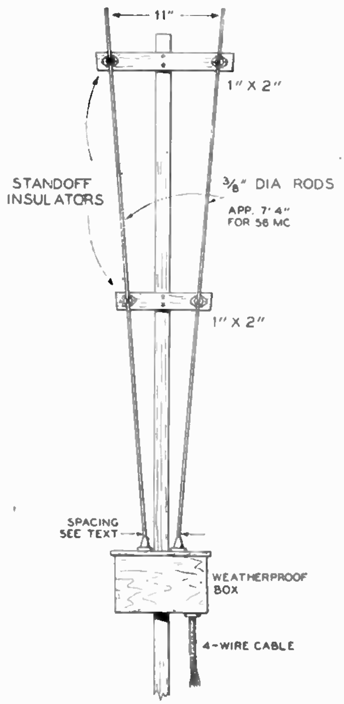


FIGURE 1

Practical layout of the transmitter box, the supporting pole, and the radiating long-line tank circuit of the u.h.f. beam oscillator.

A simplified type of oscillator or final amplifier for use on ten meters and below has been developed by Bob Smith, W3HJO. With it, he has put an R7 signal into Baltimore from Washington with 4 watts input and the antenna indoors, while with 60 watts he has raised all districts but W6 and W7, on five meters.

The circuit was discovered while experimenting with B-K oscillators below one meter, nearly ten years ago. It has been in use on 56 Mc. for over three years as an oscillator with stability comparable to local m.o.p.a. rigs, and now is being neutralized to be used as a crystal-controlled final amplifier.

The basic idea, as will be seen in figure 1, is to use the antenna as the tuned plate circuit, eliminating coils, tuning condensers and transmission lines or feeders. In the present arrangement, the antenna is similar to a single-section W8JK beam, without any center cross-over, and with a tilt between the conductors. The latter are connected to the plates of the push-pull stage through blocking condensers. The spacing of the antenna rods is 11 inches at the far end, with the near end spacing being adjusted for proper tube match. This distance is about ¾ inch for 809's and 2½ inches for the RK34.

Changing the distance between the rods affects the frequency somewhat; decreasing it causes an increase in frequency. This change is about 500 kc. for a half-inch variation in spacing.

For the low-frequency end of the five-meter band, when using ⅜-inch copper tubing, 11-inch spacing at the far end and ¾-inch at the plate end, the tubing is approximately 7 feet 4 inches long.

The RK34 setup, pictured in figures 2 and 3, is placed in a box made of ⅝-inch plywood, well varnished, located at the base of the rods at the usual antenna location. The filament transformer is placed in the box. The modulated plate supply and the 110 volts a.c. for the filament transformer are brought

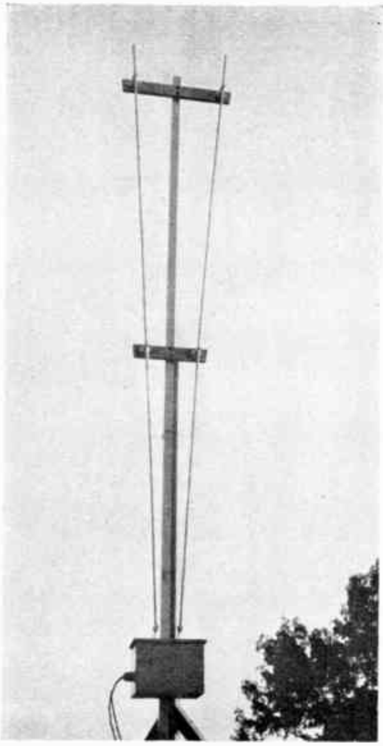


FIGURE 2

Photograph showing the installation in use at W3HJO, the diagram of which is shown in figure 1.

in through the four-lead cable. The remaining contents are the grid leak, socket, tubes, plate blocking condensers, three Bud type 925 chokes, a 10-$\mu\mu$fd. grid tuning condenser and the grid coil. The chokes appear to work best when at right angles in the form of a V. The leads to the half-wave rods are brought out in feed-through insulators and soldered directly to the rods. A mycalex or porcelain bar can be placed near the current loop at the center of the rods. By moving this bar, the initial rod spacing is changed to adjust the frequency.

Tuning is best done with a field-strength meter and a plate milliammeter. With the box cover removed, the plate ends of the rods are adjusted for proper match of the antenna impedance to the output impedance. The spacing at the outer ends is important in obtaining maximum radiation and stability; at less than 10 inches, radiation is sacrificed, while at more than 13 inches, stability is not as good. The grid coil and condenser are adjusted in the usual way to obtain sufficient excitation; this tuning has little effect on the frequency after the rod spacing is properly adjusted. By trying several frequencies, the best operating point for the actual rod length can be found. If some adjustment of this length is desired, telescoping tubing or threaded extensions can be placed at the far end of the rods.

Parallel-rod grid tuning can be used instead of the lumped coil and condenser, but if this grid circuit is better than the plate circuit, it will take over the job of controlling the frequency. We suggest doing the initial plate tuning with a coil and condenser grid circuit before substituting grid lines, in order to avoid complicating the job.

The radiation pattern for vertical rods is the expected bidirectional "figure 8" in the end-fire directions, with sharp nulls off the sides. The angle of radiation is lowered somewhat due to the end-fire arrangement. Using the rods in the

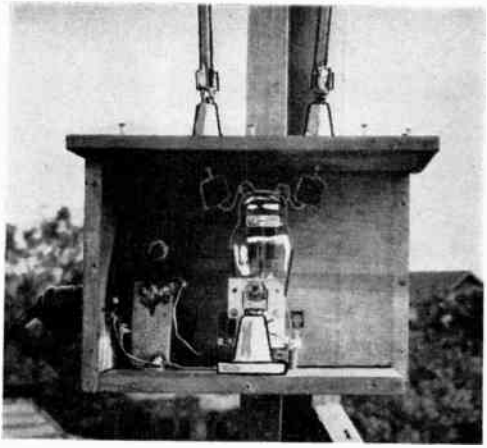


FIGURE 3

Cutaway view of the transmitter box showing the oscillator tube and its grid tank circuit.

horizontal plane produces a similar pattern but it is somewhat more broad. In either case, 180-degree rotation of the mounting pole covers the entire horizon.

[Continued on Page 81]

FOUR-WIRE LINES

• As Quarter-Wave Matching-Transformers

By

LEIGH NORTON*

W6CEM

Since the publication of Madsen's original set of curves[1] the four-wire type of line has found wide application where a low-cost, low-impedance line is desired. This type of line finds its greatest application in use as a quarter-wave matching transformer between any two points of different impedance, especially between a nonresonant feedline and an antenna current loop. When used in this way the four-wire line has the advantage of being light in weight, making it especially useful where a matching section must be supported from an antenna several half waves long.

Although Madsen's curves gave all the necessary data for the construction of this type of matching transformer, some amateurs seem hesitant to use the four-wire line without having actual dimensional figures. Therefore, with the intention of popularizing a highly useful method of feed, the tables of figures 1 and 2 have been worked out. These tables give complete design information for practically any combination of feeder impedance and antenna length. They involve nothing in the way of new information, other than a basic formula for four-wire lines which was evolved from Madsen's curves, and are merely a correlation of several well-known antenna and nonresonant line formulas. The four-wire line formula may be found in the appendix at the end of this article, along with the other basic formulas used in drawing up the tables.

Use of the Tables

The tables are used as follows: Locate the desired feedline wire size and spacing in columns 1 and 2 of the table of figure 1, and opposite this feeder in columns 4, 5, 6 or 7 will be found the required Q section impedance for antennas from one to four half waves in length. The actual antenna impedance varies somewhat depending upon the height above ground and the proximity to surrounding objects.

The figures given assume average conditions and are sufficiently close for all practical purposes. The feeder spacings given in column 2 can be obtained by using standard 2-, 4- or 6-inch spreaders. The holes originally intended to accommodate the serving wires on the 2-inch spreaders will provide the 1¼-inch spacing, while the wide slots on the sides of these same spreaders will give 1½-inch spacing. The small notches on the ends are, of course, the ones used for the 2-inch spacing. The actual values of feeder impedance given in column 3 are of no value in this table but are given

NON-RESONANT FEED LINE			REQUIRED Q SEC. IMPEDANCE FOR VARIOUS ANT LENGTHS (OHMS)			
WIRE SIZE	SPACE INCHES	IMPED. OHMS	$\lambda/2$	$2\lambda/2$	$3\lambda/2$	$4\lambda/2$
12	1.25	410	175	193	202	211
14	1.25	440	184	200	210	219
12	1.50	440	184	200	210	219
14	1.50	465	187	206	216	225
12	2.00	465	187	206	216	225
14	2.00	495	193	212	223	232
12	4.00	550	203	224	234	245
14	4.00	575	207	228	240	250
12	6.00	600	212	234	245	256
14	6.00	625	216	238	250	261
COL. 1	COL. 2	COL. 3	COL. 4	COL. 5	COL. 6	COL. 7

FIGURE 1

[1] *Multi-wire Lines and Matching Sections; Madsen,* RADIO, *April, 1937, p. 66.*

* *921 Maltman Ave., Los Angeles, Calif.*

to facilitate working out other combinations with the aid of the formulas in the appendix.

After the required Q section impedance has been found in the table of figure 1, locate this impedance in column 1 of the table of figure 2 and opposite this impedance will be found the center-to-center spacing, in inches, between *adjacent* wires in the four-wire section. Three sets of figures are given; these are for no. 12, 14 and 16 wire as indicated. The spacing is given decimally in columns 1, 4 and 7; and in fractions to the nearest sixteenth of an inch in columns 2, 5 and 8. Columns 3, 6 and 9 give the diameter of the circle upon which the wires must be placed to give the spacings of columns 1, 4 and 7, respectively. When using spreaders of the celluloid strip type, as illustrated in figures 5 and 6, these diameter figures may be used to determine the spacing between holes on each individual strip and the strips can be cemented together after the holes have been drilled.

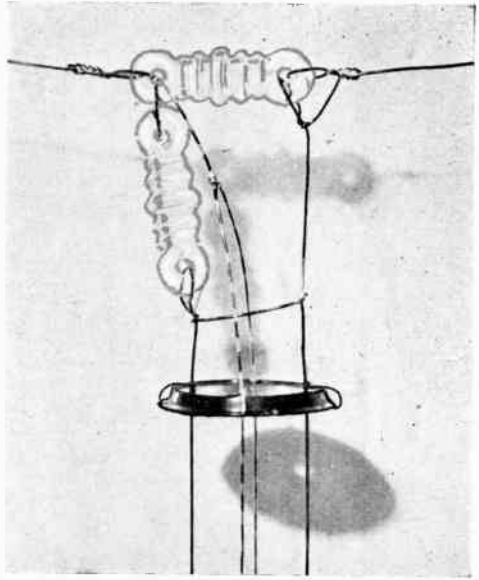


Figure 3. Method of connection of the upper end of the quarter-wave matching section to the center of the antenna. The coding of the wires indicates their polarity. Strain insulators are 3½-inch Pyrex and the circular insulator is a phenolic "glass coaster."

Supporting the Q Section

There are several simple methods of supporting the four-wire section from the antenna. Two of these are shown in figures 3 and 5. The corresponding methods of terminating the section at the feed-line end are shown in figures 4 and 6. Each of these methods has its advantages, that of figures 3 and 4 allowing somewhat greater flexibility in the plane of the antenna, while the system of figures 5 and 6 allows one pair of wires to be used for the feed line and also allows them to continue without a break on up through one side of the four-wire section to the point of connection to the antenna. This method allows an extremely lightweight section to be used, as only one insulator need be supported by the antenna. The insulator may be an ordinary 6-inch or 8-inch glass one. The insulators shown in figures 3 and 4 are 4-inch Pyrex. Undoubtedly, other methods of support will suggest themselves and could be used with equal facility. The principal requirements are that the four-wire section be well supported and that the diagonally opposite wires be con-

	Nº 12 WIRE			Nº 14 WIRE			Nº 16 WIRE		
	COL 1	COL 2	COL 3	COL 4	COL 5	COL. 6	COL 7	COL 8	COL 9
Zo OHMS	SPACING INCHES	SPACING INCHES	CIR. DIA. INCHES	SPACING INCHES	SPACING INCHES	CIR DIA INCHES	SPACING INCHES	SPACING INCHES	CIR. DIA. INCHES
175	1.415	1 7/16	2.001	1.120	1 1/8	1 585			
184	1.495	1 1/2	2.110	1 185	1 3/16	1 675			
187	1.535	1 9/16	2.175	1.215	1 1/4	1 720			
193	1.630	1 5/8	2.305	1.280	1 5/16	1 820			
200	1.720	1 3/4	2.434	1.361	1 3/8	1 935	1.065	1 1/16	1 510
202	1 820	1 13/16	2.560	1.440	1 7/16	2.100	1.128	1 1/8	1 597
203									
206	2.020	2	2.858	1.600	1 5/8	2.261	1.255	1 1/4	1 775
207									
210									
211	2.120	2 1/8	3.000	1.630	1 11/16	2.378	1.319	1 5/16	1.865
212									
216	2.301	2 5/16	3.122	1.825	1 13/16	2.581	1.430	1 7/16	2.011
219	2.420	2 7/16	3.421	1.920	1 15/16	2 719	1.503	1 1/2	2.124
223									
224	2.662	2 11/16	3.700	2.110	1 1/8	2.890	1.629	1 5/8	2.305
225									
228	2.910	2 15/16	4.110	2.310	2 5/16	3.375	1.830	1 13/16	2.585
232	3.075	3 1/16	4 350	2.435	2 7/16	3.440	1.930	1 15/16	2.730
234	3.150	3 1/8	4.450	2.497	2 1/2	3.530	1.981	2	2.810
238	3.320	3 5/16	4.690	2.625	2 5/8	3.720	2.081	2 1/16	2.945
240	3.420	3 7/16	4.835	2.721	2 11/16	3.853	2.160	2 3/16	3.050
245	3.640	3 5/8	5.150	2.881	2 7/8	4.075	2.289	2 5/16	3.240
250	4.040	4 1/16	5.710	3.204	3 3/16	4.540	2.541	2 9/16	3.595
256	4.360	4 3/8	6.160	3.460	3 7/16	4.890	2.740	2 3/4	3.875
261	4.650	4 5/8	6.580	3.683	3 11/16	5.202	2.920	2 15/16	4.125

WIRE Nº	CLEARANCE DRILL Nº
12	42
14	49
18	54

FIGURE 2

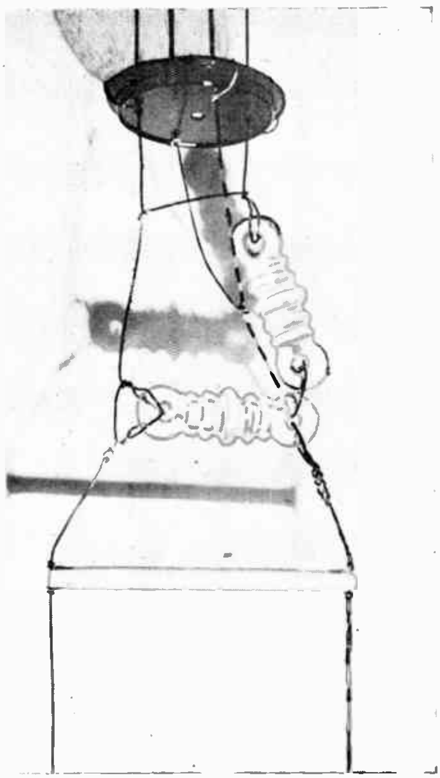


Figure 4. Bottom end of the quarter-wave line of which the upper end is shown in figure 3. The 600-ohm transmission line leaving the end of the matching section can be of any reasonable length.

nected together at each end of the section. At the same time, the oppositely polarized wires must be well separated at the terminations of the section so that normal antenna movement will not allow them to short together.

For the sake of clarity, "oppositely polarized" wires have been marked differently in the photographs, each "pair" consisting of one black and one "dotted," or black and white, wire. Thus, the feedline consists of one dotted and one black wire, each of which branches out into two similarly marked wires in the four-wire section (the similar ones being diagonally opposite). At the antenna end the identically marked wires join together leaving a pair of oppositely polarized wires to connect to the antenna. This method of joining the diagonally opposite wires is difficult to describe but should become clear with the aid of the photographs.

Where possible, the Q section should be made up of no. 14 or no. 16 wire, as no. 12 requires considerable strain to hold it in alignment. It should be found necessary to use no. 12 wire only in the case of some of the lower impedance values where the spacing becomes quite close with the smaller diameter wires.

Spreaders

Two types of spreaders for the four-wire section are shown in the photographs. Both of these have proved entirely satisfactory for powers up to 1 kw. The circular spreaders shown in figures 3 and 4 are made from what have been variously referred to as "whisky glass," "beer glass" and "iced tea glass" coasters. These are available in some unidentified phenolic material and in several colors. They may be purchased at most ten cent stores and usually sell

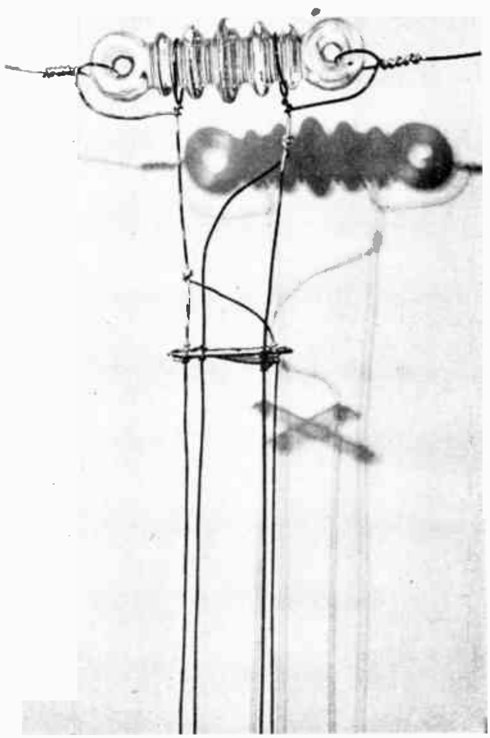


Figure 5. Upper end of the quarter-wave line using celluloid strips as spacers for the wires. This method of matching-section construction is considerably lighter than that shown in figures 3 and 4. The insulator in the center of the antenna proper is one of the 7-inch Pyrex variety.

for five cents each. A modernistic note in antenna construction may be achieved by using various bright colored coasters in the Q section; this has the disadvantage, however, of advertising to the neighbors the source of "that noise in my radio." These coasters are quite brittle, requiring care, patience and a sharp drill when holes are cut in them. The proper drill sizes are given at the bottom of the table of figure 2.

Another type of spreader that has proved satisfactory is that shown in figures 5 and 6; these are made from strips of .080-inch celluloid cemented together in the form of a cross. The celluloid may be purchased quite reasonably from most large wholesale hardware supply houses. Merchants can usually be persuaded to shear a sheet into strips ½ inch wide which can then be cut into pieces of the proper length with a pair of tin-snips or a pocket knife.

To assure reasonably constant alignment, the spreaders in the Q section should be placed approximately one foot apart; they may be placed as far as 18 inches apart, however, without serious misalignment.

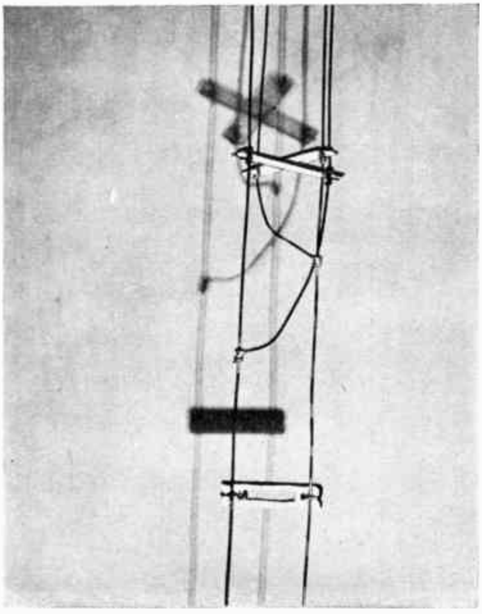


Figure 6. Bottom end of the matching section of figure 5 showing the continuous type of line construction. One of the two pairs of wires is continuous from the transmission line through the matching section to the antenna.

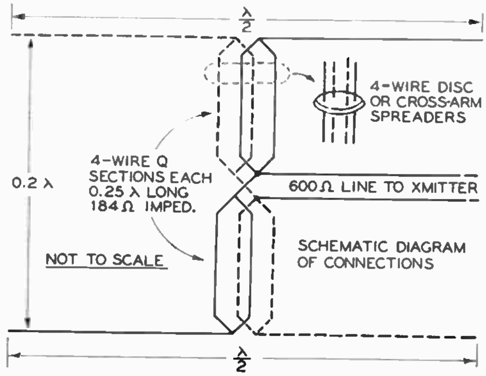


FIGURE 7.

A simple two-band directive array employing two half-wave flat tops and four-wire Q sections. The spacing for the 184-ohm sections will be found in figure 2.

Measurements

The antenna length may be determined from any of the usual formulas as found in the RADIO *Handbook*. The length of the Q section may be calculated from the formula:

$$\text{length} = \frac{234}{\text{frequency in megacycles}}$$

In measuring the length of the Q section its ends may be assumed to be at points midway between the junction points where the similarly polarized wires connect together. This length is not extremely critical, however, and a difference as great as several inches from the correct length will not seriously affect its operation.

A Directional System

Figure 7 shows a simple method of realizing a gain of approximately 4 db on the fundamental and 5 db on the second harmonic. Two half-wave antennas are spaced 0.2 wave and fed 180 degrees out of phase with two four-wire Q sections. The Q sections are paralleled at their lower termination and fed by a 600-ohm line. By using a 184-ohm four-wire line for each section, the system will be perfectly matched on the fundamental and only slightly mismatched on the second harmonic. Constructional data will be found in figure 7. The system is bidirectional, working equally well in either direction at right angles to the antenna wires.

[*Continued on Page 79*]

Shifting to

1851 R.F. TUBES

On the higher frequency bands the gain of the r.f. stage in a receiver falls off. As a result, the gain control is usually run up to get a satisfactory signal level, but this also brings up the set noise. In some receivers this hiss is audible on twenty meters, bad on ten and prohibitive on five. If the receiver is well designed, removing the grid clip from either of the i.f. tubes, or taking the first detector tube (mixer or converter) out of the socket, will cause the hiss level to drop to a very low value. If there is some conversion gain, there will also be a decline in hiss when the first detector grid clip is removed, with all the tubes operating properly, with the gain high and with no signal coming in. But when this is tried in the r.f. stage, on the highest frequency band, it is often discovered that noise in the first r.f. circuit does not come in above the first-detector noise. Herein lies the sensitivity limitation of the receiver.

If the signal input to the receiver is increased by tuning the antenna, using a good beam or adding an "outboard" r.f. stage that has good gain and signal-to-noise ratio, the receiver can be operated at a lower level and the noise is not troublesome. But something can be done for the r.f. stage to improve its gain on the higher frequencies.

In the order of desirability at high frequencies are acorn pentodes, television pentodes and then common tubes. Maximum gain should not be expected of any of these in bandswitching circuits or when using ordinary wire coils. Unless a special amplifier is built up using concentric lines as tuned circuits, not much can be done about getting high r.f.

[*Continued on Page 95*]

Conventional hookup of r.f. stage in superheterodynes using 58, 6K7 or similar tubes. The cathode resistor is usually from 100 to 300 ohms and C_1 is usually a 0.1-μfd. tubular paper condenser.

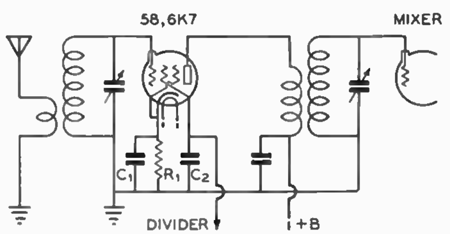


FIGURE 1

Alterations necessary to install an 1851 are quite small. Instead of the screen going to the voltage divider as is common practice, this element is supplied through a 60,000-ohm, 2-watt resistor from the plate voltage supply to the tube. The cathode resistor is changed to about 235 ohms (200 to 250), and the cathode by-pass condenser is either paralleled with or replaced by a good mica condenser of .01 to .02 μfd. capacity.

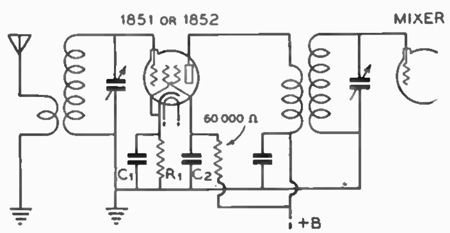
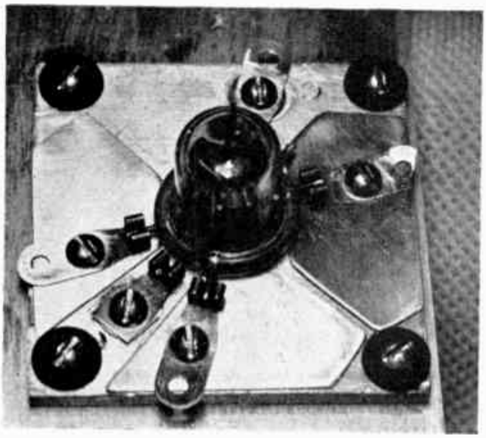


FIGURE 2



The completed socket with the tube and the capacity increasing plates in place and mounted upon the stage shield.

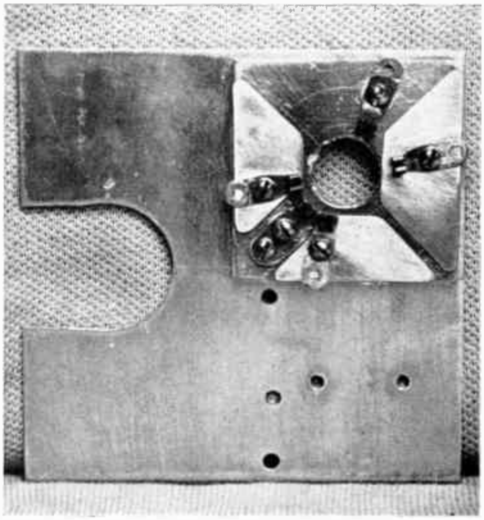
ACORN PENTODES

in R. F. Stages

When using acorn pentodes in r.f. amplifier stages in high-frequency superhet or t.r.f. receivers, good shielding and by-passing of the elements right at the socket terminals are advisable if high gain and freedom from oscillation troubles are to be assured. Arnold J. Ely, W8IPD, whose five-meter superheterodyne using acorn tubes was described in the July, 1938, issue of RADIO, has sent us some photographs of the copper tube sockets he has used to replace the bakelite ones originally used in his receiver.

The new sockets are built up from 1/8-inch sheet copper, cut into pieces 2-inches square. A hole to pass the end of the tube is first drilled in the center of the copper plate. Then, holes to pass the 4-32 brass screws (3/8-inch long) that hold the mounting clips are carefully laid out and drilled with a no. 21 drill, passing through the copper plate, the regular stage shield and a sheet of mica placed over the copper plate. Short pieces of spaghetti insulation are slipped over the screws and the clips are bolted over the mica, insulated from the copper plate and the shield but forming a condenser at the point of mounting. The nuts on the back are separated from the baffle by insulated washers. No other mounting screws are necessary. No attempt was made to insulate the cathode and suppressor clips from the copper plate.

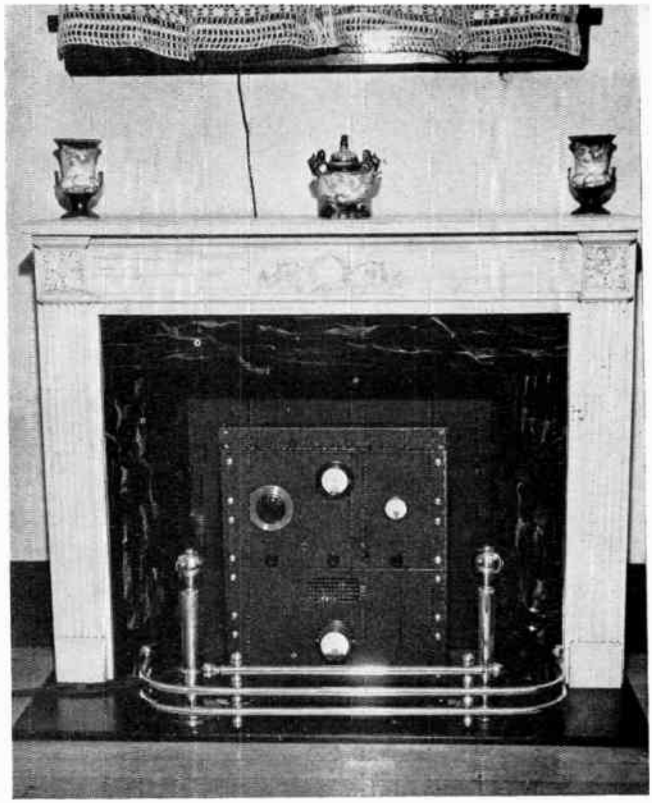
In his case, W8IPD wanted to be sure



Showing the method of assembling the socket. The cathode and suppressor clips are bolted to the copper sheet.

of enough by-passing capacity, so he put some large metal plates under the clips. Later, on calculating the by-pass capacity, he found that he had about 325 $\mu\mu$fd. per square inch by using rather thin mica sheet as the dielectric.

It was found necessary to chamfer the edges of all holes in plate and baffle, all edges of the plate, and to sand down the surfaces very well in order to prevent irregularities from puncturing the thin mica sheet. It took some time to learn that lesson, and to find out what was shorting the clips to ground.



● Add, unusual transmitter locations, that of W8BXN. The rig is a 150-watt all-band affair remotely controlled from the living room desk, and was installed in the fireplace simply because there was no suitable space elsewhere.

DEPARTMENTS

"WAZ" HONOR ROLL

C.W.

Call	Zones	Countries
ON4AU	40	148
G2ZQ	40	139
W6CXW	39	150
W6GRL	39	141
W6ADP	39	140
W6CUH	39	140
W8BTI	39	137
W8CRA	39	135
W4CBY	39	133
W2GWE	39	129
W8OSL	39	125
W6HX	39	123
W3EVT	39	122
G5BJ	39	120
W2CYS	39	117
G2LB	39	115
W6FZL	39	112
ON4FE	39	110
W6FZY	39	109
W3EVW	39	104
XE1BT	39	90
K6AKP	39	67
G6VP	39	
W3ANH	39	
W4DHZ	39	
W2BHW	38	143
W8BKP	38	138
W6KIP	38	137
W1BUX	38	130
W6DOB	38	131
W2GTZ	38	130
W1ZB	38	129
W5VV	38	125
W3EMM	38	124
W6QD	38	124
W4CYU	38	123
W5BB	38	122
W3EDP	38	121
W8LEC	38	121
W8DFH	38	119
W2AAL	38	118
W8DWV	38	118
W1CC	38	116
W3DDM	38	116
W9UQT	38	116
W3GAU	38	115
W6AM	38	115
W8HWE	38	112
W6GRX	38	111
LY1J	38	110
W6HZT	38	110
W2GT	38	108
W8OQF	38	108
W8AU	38	106
W8BOX	38	106
W9ADN	38	106
W9KG	38	106
W2GN	38	104
W9PST	38	103
W9ALV	38	102
W8LYQ	38	98
VE4RO	38	95
LU7AZ	38	94
W9VDQ	38	79
G5YH	38	
G6RB	38	
W4AJX	38	
W9TJ	38	
W7AMX	37	122
W6GAL	37	121
W2HHF	37	115
W8ZY	37	114
W6LYM	37	111
W2GVZ	37	110
W2BXA	37	105
W9PTC	37	103
G6GH	37	102
W6FKZ	37	101
W8KPB	37	100
W9AJA	37	99
W3EXB	37	98
ZL2CI	37	97
W6VB	37	97
W6JBO	37	97
ON4T	37	96
W6ITH	37	96
W8EUY	37	95
W7BYW	37	93
W5CUJ	37	93
W3AYS	37	92
VK2AE	37	90
W6GCB	37	81
W9UBB	37	77
G6NJ	37	
W2BSR	37	
W2DTB	37	
W4AH	37	
VK3EO	36	112
W2BJ	36	111
W9AFN	36	105
W6BAM	36	102
ON4EY	36	101
W1AQT	36	100
J2JJ	36	100
W8LZK	36	99
G2QT	36	98
ON4VU	36	96
ZL1HY	36	95
G2IO	36	94
G6YR	36	94
W6KWA	36	92
W9KA	36	92
W9PK	36	92
W5ENE	36	91
W9CWW	36	91
W8MTY	36	86
G2UX	36	83
W6TI	36	77
W6GCX	36	76
G6CL	36	
U1AD	36	
W2OA	36	
W8KKG	36	
W9ARL	36	
W8AQT	35	106
W6GHU	35	103
W8OXO	35	99
W8CJJ	35	98
W9RCQ	35	97
OK1AW	35	96
W9EF	35	94
ON4FQ	35	92
W6AQJ	35	92
W6MHH	35	91
W7AYO	35	91
W1GDY	35	89
W8AAT	35	87
G6QX	35	80
W2AIW	35	
W2IOP	35	
W3BBB	35	
W6NHC	35	
SU1WM	34	109
W3EPV	34	106
W6HEW	34	103
W3TR	34	100
W8BSF	34	100
W8DOD	34	96
VK2AS	34	94
W6EPZ	34	93
W8HGA	34	93
W6HJT	34	92
W1BGC	34	90
W3GHD	34	90
VE2EE	34	88
W2IYO	34	88
VK2TF	34	81
W6MJR	34	81
ON4SS	34	80
W8JSU	34	76
VK2TI	34	75
W4ELQ	34	74
W8JK	34	74
W6LHN	34	71
VK2EG	34	70
VE5MZ	34	69
VK2VN	34	63
W9QOE	34	56
K6JPD	34	
W2FAR	34	
W3EGO	34	
W8CNZ	34	
W1RY	33	92
W4IO	33	91
W8ACY	33	91
W2BMX	33	90
W4DMB	33	89
W5KC	33	88
W6CEM	33	88
W3RT	33	86
W6LEE	33	85
W8QDU	33	85
W9LQ	33	84
W2WC	33	83
W6NAE	33	83
VE4LX	33	82
LU3DH	33	81
W6LCF	33	78
W6MVQ	33	77
W2FAW	33	67
OK2HX	33	66
VK2RA	33	65
W6KQK	33	63
K6CGK	33	62
ON4TA	33	
W5AXF	33	
W6LDJ	33	
W8LDR	33	
W9LBB	33	
VK2VQ	32	99
W5ASG	32	90
W6DIO	32	90
W3KT	32	85
W6KUT	32	85
W1APU	32	83
W9RBI	32	82
W9FLH	32	80
ON4NC	32	79
W9PGS	32	78
W3CIC	32	75
W6AX	32	74
W3GAP	32	70
W6KZL	32	67
W6LPR	32	67
W9DEI	32	66
ZU1T	32	65
W6KRM	32	62
W6OAQ	32	56
W8BTK	32	
W8HYC	32	
W4MR	31	92
W6DRE	31	86
W6GNZ	31	85
W8FJN	31	85
W9LW	31	82
W2FLG	31	80
W6KEV	31	80
W2HVM	31	78
GI6TK	31	76
SM6VX	31	76
W6NNR	31	74
G5VU	31	73
W9YEG	31	69
W6POZ	31	66
VK2VA	31	62
W6OFC	31	62
W6IES	31	57
W6CLA	31	51
I1TKM	31	
VK2QL	31	
W3DCG	31	
W6HXU	31	
W9YGC	31	
VE2GA	30	84
G6WB	30	80
W4DCZ	30	80
W1APA	30	79
W3CDG	30	78
W3UVA	30	76
W1AB	30	73
W3GMS	30	72
W8MFB	30	71
W6NLZ	30	70
W4DTR	30	68
W8MPD	30	66
W9VKF	30	66
W6OEG	30	61
W9VLQ	30	58
W8PHD	30	57
W8DPY	30	53
VE5ZM	30	52
W3EMA	30	
W7AVL	30	
W8DED	30	
W8MAH	30	
W9IWE	30	

PHONE

Call	Zones	Countries
KA1ME	35	79
W6OCH	34	85
W6ITH	34	79
W3FAM	33	68
W6NNR	32	73
W6CQI	32	70
W9NLP	32	70
W6MLG	31	72
W6LLQ	31	68
F8KI	31	53
W6AM	31	
W4AH	31	
W9QI	30	75
VE1CR	30	68
W4DSY	30	
W2IXY	29	81
W3EMM	29	76
W6EJC	29	64
W9YGC	29	
W2IKV	28	77
F8VC	28	58
W9BVC	28	58
VE2EE	28	56
W6OI	28	53
W6IKQ	28	45
W8LAC	27	72
G6RW	27	68
W6FTU	27	60
W8RL	27	58
G8MX	27	56
W9ARA	27	53
W9ZTO	27	50
W6GCT	27	49
W9TIZ	27	47
W9BBU	27	45
W2HUQ	27	
W5DBD	27	
G5ZJ	26	77
W5DNV	26	60
W3LE	26	46
W7BVO	26	38
VK4JP	26	32
W6GAL	26	45
W8JK	25	47
W7AMQ	25	40
W6LYM	25	39
W6LEE	25	34
W6MXD	25	34
VK2ABG	25	
W3SI	25	
YV5AK	24	59
W1BLO	24	50
W9RBI	24	50
W6LPR	24	45
W6NLS	24	45
W2IUV	24	41
W7EKA	24	34
W6MVQ	24	32
VE5OT	24	
W2HCE	23	62
W1HKK	23	60
W6GRX	23	43
W9ORL	23	38
W7ALZ	23	27
W7ESK	23	
W8QDU	22	48
W6FKK	22	26
W6NCW	22	23
W7AO	22	
XE1BT	22	
G6DT	21	53
W6NEP	21	53
G3DO	21	47
W4TS	21	45
W1JCX	21	42
W5ASG	21	42
W6FZL	21	40
W9VYD	21	36
W6HX	21	32
W7BJS	21	25
W6MVK	21	22
W3AKX	20	32
K6KMB	20	23
W1COJ	20	
W4BMR	20	

DX AND OVERSEAS NEWS

Herb. Becker, W6QD

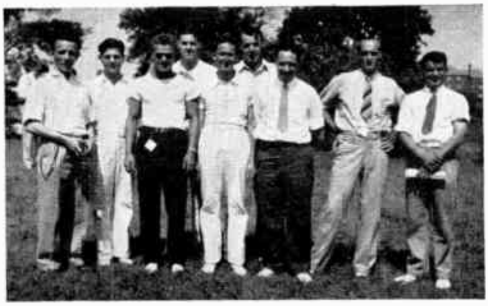
Send all contributions to Radio, attention DX Editor, 7460 Beverly Blvd., Los Angeles.

Someone once told me, in the form of advice, that to be a successful writer and to hold the interest of the readers, it would be necessary to lead off with a good snappy paragraph. If this is true I'm surely going to have to do some fancy "pitchin'" in this column . . . because I have no "snapper" for the opening. As a matter of fact if you successfully waded through last month's dx section and are coming back for more, you must have plenty of vitamin "DX" in your system.

During the past couple of weeks conditions on the 14-Mc. band hit a new low point. It was not exactly unexpected or unexplainable, because it was foretold by sunspots. The band would fold up inside of ten minutes: the only thing left to work would be "one of the local gang" across town. This enabled the phone boys to test antennas, modulation and other bits of experimenting, without fear of missing some dx. The c.w. gang would have four-way QSO's that would last hours, talking about everything, including their personal love affairs, stamp collecting, and even the "shutterbugs" came in for their latest on camera achievements. Oh yes, occasionally they would mention dx, too. Now we're going to mention dx . . . if you don't mind. First, the gossip from the c.w. men:

News for the Brasspounder

South African hams are operating under new regulations which were put into effect October 1. License classifications for amateurs in Union of South Africa are now as follows: 1st year, c.w. only, 50 watts; 1 to 2 years, c.w. and phone, 50 watts; 2 years or over, c.w. and phone, 100 watts. This was learned through W6LYM, who also has persuaded PK6XX to use c.w. now and then. PK6XX is in New Guinea (as if you



Pittsburgh Ham Outing. Left to right W8DWV, 8PT, 8OSL, 8ILL, 8BSF, 8ILL, 8JMP, 8AZG, 8CRA. All over 100 countries.

didn't know) and is usually found on 14,005 kc.

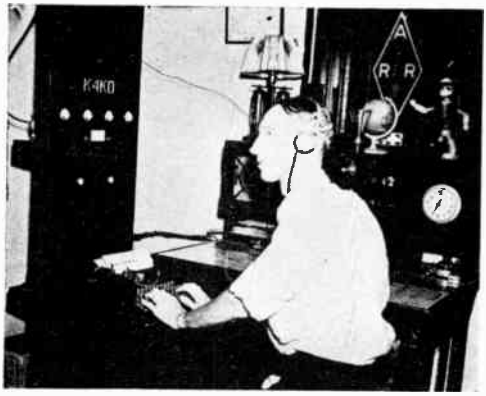
W5VV has returned from his tennis doings, and immediately grabbed two new ones, U2NE and ZD2H. Wilmer modestly says, "I was getting into pretty good shape for tennis and actually beat one crippled old man and one young girl, when I got word that I must return at once." W2GVZ has his 110th country and it was a good one, ZD4AB, 14,340 kc. W6HEW says he guesses he has worked his last dx for a while, because of his recent marriage. However, some of his last ones are ES5C, YU7AY, K4ERY, VR2FF, VR4AD, VR6AY, K6NVJ and LA3B. W3EPV joins the merry throng with 34 zones and 106 countries. W2AAL was active this summer and increased his countries from 109 to 118 . . . zones are still 38, however. Some of his new ones are VR6AY, W10XAB, YV2CU, VP9X, ZA1C, PJ3CO, ZC6NX, VQ8AI. Al says that VP9X is on c.w., 14,100 kc. and T9X. He really will QSL, too.

Speaking of VP9's, Cyril Lindley, VP9L, was a recent visitor here. Now don't all rush at once. This VP9L is *not* the fellow who was signing that call around February 22 of this year. Cyril explains that he has never been on c.w. and furthermore was not on the air until the second week in March. He said he had received about a hundred QSL cards

The "1939 Marathon"

What is it?

Details in December RADIO



K4KD in Santurce, Puerto Rico. E. W. "Ma" Mayer, operator. Transmitter uses a 35T in the final with 100 watts input.

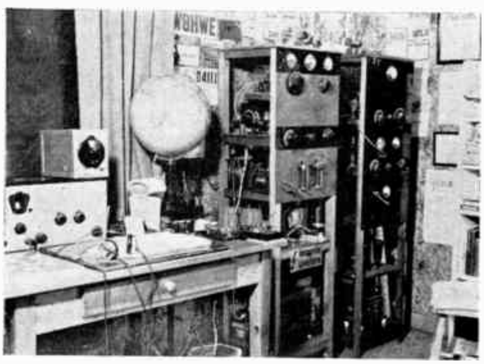
not only from W stations but from many countries throughout the world. At present in Bermuda there are four hams . . . three of them active: VP9L phone, VP9G phone, and VP9X, c.w. However, Cyril promises to use both c.w. and phone when he returns the middle of October. He will have toured the Pacific Coast to Vancouver, B. C., then across to Montreal, from there to New York and then home.

W1APU has added a couple in J5CC and G8MF. W8AQT has really been doing some good since he put up the 8JK rotary beam, and now Glenn has 35 and 106. W8BTI is heard from again after a long time and Carl has boosted his countries to 137. W8BTI, too, has just completed a new rotary beam consisting of a radiator and two close-spaced directors. VE4LX, who spent some time around Los Angeles, is back home again and on the air. No new zones, but countries now are 82. W9YEG with his 31 zones and 69 countries is making a good start and has worked UX1CP, XU8CM, ZD4AB. Fred says he has come to the conclusion that the 40-meter zepp is the best for all-around use. He and his pal W9VDY get together and pass dx back and forth. In this way when one works something the other one usually follows right behind.

G6QX is now doing a little country getting since returning from his trip to U.S.A. New ones for Bob are CE3EE, CR7AF, CN1AA, PK1MF, XU8CM, bringing his total to 35 and 80. VE5MZ, who recently was a visitor in southern California, is doing quite well in increasing his zones. Recently he added U9ML and CR7AF, which now brings him up to 34 and 69. W6KEV was very lucky to get UK8IA for his 31st zone. Ray brings up an interesting point regarding the Zone List. He points out that the 18 highest W6's in the list are located in southern California, and wonders why the northern part of the state isn't better represented. What's the matter with the gang up there anyway, Ray asks. What has happened to W6BAX, W6RH, W6BYB, W6HB, W6WB, W6CD and a flock of the others? W6KEV lives in a little town, a farming community, called Acampo. There are three hams in Acampo, W6MRB, W6MSM and W6KEV. The first two mentioned are using 100TH's in push-pull, while KEV is still using a pair of 150T's. All these fellows run about a kw. on 14 Mc. c.w.

After silence for many months, W2HVM informs us that he is ready to take off again and grab some of this dx during the winter. He has not been altogether idle, with the consequence he has found another zone and four countries . . . . K7GSC, YV1AQ, PJ3CK, and ES5C.

W8AU is heard from again, on a continuous sheet of teletypewriter paper, 30 inches long. He worked ZP2P, who gave his QTH as Box 101, San Chicato, Paraguay. Lou believes in doing things in a big way; just recently he made arrangements with a lumberjack to buy eleven poles 50 feet long. The only thing the gang has to worry about now is to find a way to haul them into town from a distance of 45 miles. Lou's pal W2BMX



LA2B Norway. One transmitter has an HF-100 in its final running at 150 watts on 7, 14 and 28 Mc. The second transmitter ends up with a 210 with 25 watts input for 3.5 and 7 Mc. His antenna is a 20-meter zepp 50 feet high especially directed for the U.S.A.

has been going to town during the summer. Being a school teacher, he had a couple of months during the summer when all he had to do was pound brass. Now Lou is crying, "Oh, for the life of a school teacher."

An interesting incident that recently happened to W6VX is recounted here. As you will see it is one of those rare coincidences.

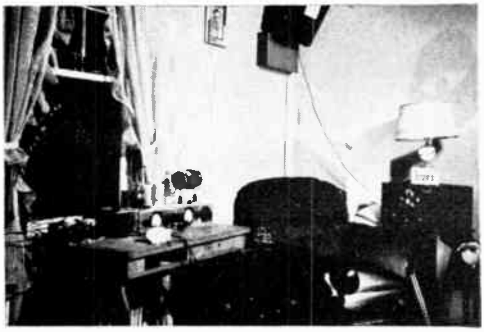
Dear Herb:

"Last night went over to the rig to sort of clean away some of the shavings that were shorting the key, due to some heavy metal drilling from a nearby drill-press. I uncovered a message that had been received from a W1 concerning sickness of a relative. The msg was bound for Alaska. I thought . . . 'Had I ever tried to send a msg anywhere, let alone Alaska, and been able to do anything about it?' Well, I let this pass and was just about ready to lay down the msg, when into my ears came a call . . . just once . . . but it was K7GLL. Then came silence. Silence, and some R6 ignition noise, and about 10,000 other signals all piled up on that frequency, 14,350. Was that my imagination? Was that a K7 calling CQ? Was that a K7 working someone, or was he just testing . . . or, was that a K7? The receiver was apparently turned on, I observed.

"I turned on the filaments, changed crystals, with my left hand I tuned the four circuits in the transmitter, and with the right I changed the 600-ohm line to the north-south antenna . . . and then started calling K7GLL with all the others. Hardly had I settled back to enjoy the ignition noise, when the unheard of happened. A signal started calling me which was fully three R's louder than the other 10,000. Furthermore, it signed K7GLL. He said, 'Ur the loudest W6 I have ever heard, o.m.,' and with a 'K' he dumped all the responsibility into my lap. WOW! Shakily, I sent, 'Hr msg concerning sickness, o.m., QSP?' K7GLL said to go ahead with the message, and how lucky I was, as this was the first time in months that K7GLL had been on so early in the evening . . . then finished by saying, 'Handle here is Beulah.'

"Well, Herb, that is how hairs turn gray, but it is a true story, and all characters named therein are not fictitious."

So long,
Dave W6VX



K7EWZ at Anchorage, Alaska.

A note from Fenton Priest, W3EMM, gives the QTH of VP4GA. Although VP4GA is not on the official list of licensed stations in Trinidad and Tobago, as printed in last month's column, Fenton has received two QSL cards from him. He still might be in Trinidad, but not licensed. Remember, the official list was supposed to be the latest of *licensed* stations. Anyway send your cards to Charles Cowden, VP4GA, Box 168, Port of Spain, Trinidad.

For the benefit of many who have asked for examples of stations in the different zones, I am listing all of the 40 zones with calls of fairly active stations.

1. K7EWZ-K7LZ-K7PQ
2. VO6D-VO6J-VE5ACS
3. W7AMX-W7BVO, W6NNR
4. W9NLP-W5VV
5. W2UK-W4SW-W1ZB-W3EMM
6. XE2N-XE2Q-XE1AG
7. TG5-TI2RC-NY2AE
8. HI5X-VP7NT-CM2AZ
9. VP3NV-VP3THE-FY8AA-YV5AK
10. OA4J-OA4AL
11. PY2AM-ZP1AC
12. CE1AO-CE4AD
13. LU7AZ-LU4CH
14. G6WY-F8VC-PAOGN
15. HA3D-I1IR-LY1J-ES5C
16. U2NE-U1AD
17. U9MF-U9ML-UK8IA
18. U9AV-U9AC-U9AL
19. UOAC-K7FST
20. SV1KE-SV1RX-YR5CF
21. VU2AN-YI2BA-U6SE
22. VU2FX-VU211-VS7RF
23. AC4YN
24. VS6AG-XU8RB-XU6MK
25. J5CC-J2KG
26. FI8AC-HS1BJ-XZ2DY
27. KA1ME-KA1ZL-KA1BC
28. PK1RI-PK6XX-PK5KG
29. VK6AF-VK6SA
30. VK4JP-VK2EO-VK3XX
31. K6CGK-K6AKP-K6GAS
32. ZL4AO-ZL2JQ-VR6AY
33. CN8MF-FA3HC-CT3AN
34. SU1WM-SU1SG
35. ZD2H-ZD4AB-EL2A
36. OQ5AA-VQ2HC-VQ2FJ
37. I7AA-VQ4CRI-CR7AK
38. ZS3F-ZS6CZ
39. FB8AB-VQ8AF
40. TF2C-W1OXAB-OY2C

W1BGC worked VO6D, OQ5AQ, TF3C and W1OXAB . . . . which boosts him up to 34 and 90. Bud Keller, W6QAP, ex-W8KZL is back to school in Tucson and probably will be banging forth from that location. Speaking of Tucson, W6CVW continues to knock 'em off with that Arizona kw. of his. W8PQQ has only been on the air a short time, but in three months he has worked 29 zones and 72 countries. Some of his best are

FO8AC, EL2A, VK9BW, K6OCL, K6OVN, YS1FM, J2JJ, J2KN, VS2AE, YV2CU, FT4AG, SV1RX, CT2BD, CT2AB, ZS5BG, PJ1BV, U9AW, U5KN, CN8MS, ES5D, CT1ZZ, 1MH, I1IR, FB8AB, K6BAZ, OZ9NH and a whole flock of other nice ones. He runs 650 watts into an HK-354C. Here's another addition to our gang . . . . W2FLG with 31 zones and 80 countries. Bill Leeder, W8MFB, has worked a great batch of stations in all parts of Europe using an 8-foot vertical antenna on 20 meters.

K6CKM on Wake Island

When you finish reading this you may start looking for K6CKM, who should be on the air at Wake. Larry says that he has been transferred there and will be on early in October. Possible frequencies are 14,324 and 7162 . . . . with the probability of another on the low frequency end of the band. All QSL cards will be answered when Larry returns to Honolulu at the end of six months. You may send your card to Larry Dickey, K6CKM c/o P.A.A. Radio Station, Wake Island. Cards from you should carry the regular postage rate to Wake, and Larry explains that due to 20 cent postal rate from Wake, he will answer them all *after* returning to Honolulu.

W5BB has worked 38 zones and has confirmations from 38. That's what I call 100%. Wonder how others stack up with that?

Tom gives a new one in the Bahamas . . . . VP7NS. He's on with 100 watts into a pair of 809's and he QSL's. QTH is M. D. Russell, P. O. Box 374, Nassau, Bahamas. Oh yes, the frequency is 14,-090. VS7MB comes through every once in a while around 14,290 kc., while VQ8AI is very consistent. W5FDR says FG8AH is on 7120 kc. with a T5 signal. W6POZ of Hermosa Beach has been going after dx for only a few months but has developed into a real dx brass-pounder. He can account for 30 zones and 65 countries; the power is around 200 watts.

A letter from Gil Williams, W1APA, tells of plans to hold a "DX Round-up" in Bridgeport, Connecticut, on November 5. He says it will be quite similar to the DX Roundups held every few months in southern California. Who knows, maybe some day with dx coming into its own, we might see "DX Round-ups" from coast to coast. Those who are planning to come to the convention in Los Angeles on November 11, 12 and 13 will be interested to know a DX Roundup will be held at that time, and will be part of the convention.

W3DK informs us that all cards for LZ1ID should be sent c/o HB9CE. LZ1ID comes through on about 14,300 and 14,420 kc. Incidentally, W3DK is the QSL bureau for that district, and says that he has over 20,000 uncalled for cards. None of them is over two years old, and he has one batch for a W3 numbering over 100 cards from 87 different countries. Barron says, too, that the cards are getting so numerous that he hasn't room for any more. Therefore, on Thanksgiving morning all uncalled for cards will be used to start the morning fire. Better get after those cards, fellows.

W4DMB has added three zones in ST2CM, VK9VG and XU8NR. This now makes 33 and 89, and W4DMB adds that his list of new countries was better than last month's but still looks bad compared with a list of the ones that got away. W8JSU says that with the epidemic of BL's and foney calls floating around, you never know whether you are working a new zone or another state. He has been debating whether to go high power or not. Charlie now has 34 and 76, and is still using a pair of T20's with 150 watts input.

W8ACY travels around New York State, and takes a portable rig with him. He apparently does quite well with it, as his 33 zones and 91 countries indicate. K7EWZ got a big kick out of working VS2AL . . . reason for same being that VS2AL told him he was using 9 watts input. However, PK1RL really hit a high spot with his 4 watts. Other good ones by K7EWZ are FI8AC, VU2AA, HS1BJ, KA3DT, VO6D, VK9VG, XU1B. In three months on the air K7EWZ has worked 18 zones. Speaking of low power, W6POZ worked VK3XB, who incidentally is a y.l. and whose rig consisted of

[Continued on Page 83]

The "1939 Marathon"

What is it?

Details in December RADIO

Calls Heard

Numeral suffix indicates "R" strength. Send Calls Heard to Calls Heard Editor, c/o RADIO, 7460 Beverly Blvd., Los Angeles, Calif.

Eric Trebilcock, (BERS-195)
Powell Creek, North Australia
(March, 1938)

(7 Mc. phone)

ZS6AM.

(14 Mc. phone)

W—1CND; 1JFG; 2AZ; 2BXA; 2CIF; 2GNQ; 2HVI; 2IUV; 2JMC; 2TP; 2UK; 3CHE; 3EMM; 3EOZ; 3EWN; 3FAY; 3GS; 4AH; 4AGB; 4AZK; 4BMR; 4BYY; 4CBY; 4DSY; 4DYP; 4DYY; 4EZL; 4FAY; 4HX; 4LU; 4QI; 5AKZ; 5ASG; 5DNV; 5EHM; 5FIY; 6AMQ; 6BIP; 6BKY; 6BUY; 6CDO; 6CQI; 6CQS; 6FJ; 6GAL; 6GRL; 6GRX; 6HOW; 6IDY; 6ISH; 6IXZ; 6IKQ; 6JYH; 6JPW: 6LFD; 6LLQ; 6LR; 6LCT; 6MHL; 6MWD; 6MZD; 6NCW; 6NNR; 6NTX; 6MVQ; 6PNX; 7TT; 8ANO; 8IRZ; 8KBJ; 8MFR; 8NJP; 8RED; 9ARA; 9ARL; 9BCV; 9AOM; 9GFQ; 9MCD; 9RBI; 9RUK; 9VXZ; 9YGC. CE1AH; CE1AO; CE1BE; F3CP; F8UE; F8VC; FB8AH; FI8AC. G—2AK; 2CG; 2NR; 2QT; 5CV; 5DR; 5ML; 5RV; 5VM; 5ZG; 6BA; 6DL; 6LL; 6VX; 6WU; 6XN; 6XR; 8KS; 8QC. GW5OD; HC1JW; HI7G; J2MI; J2NF. K—4EMG; 4SA; 5BAZ; 6CGK; 6CMC; 6BNR; 6JLB; 6KGA; 6KKC; 6KMB; 6NZQ; 6OQE. KA1AF; KA1AP; KA1BH; KA1CS; KA1HS; KA1ME; KA1MH; KA1ZL; KA2OV; LA1F; ON4DA; ON4ZA; PA0MZ; PK1KN; PK1MJ; PK1MX; PK1ZZ; PK2JN; PK2WL; PK3AA; PK3GD; PK3WI; PK4WS; SU1KG; VK4HN; VR6A; VR6AY; VS1AI; VS2AK; VS2AR; VS2AS; VU2CA; VU2CQ; XU8MC; XU8ET; XU8RB; XZ2DX; XZ2EZ; YV1AQ; YV5AK; ZE1JR; ZL2QL; ZS2AF; ZS6AJ; ZS6CT.

(7 Mc.)

W—1AML; 1BDW; 1HYP; 2CC; 2DTR; 2GUM; 2IVB; 2JDC; 2KYO; 3CAF; 3CHE; 3BML; 3BYK; 3EMM; 3EP; 3GDI; 3HJV; 4ECM; 4EIJ; 4EIT; 4OG; 4PL; 4MY; 4SW; 4TK; 5AGZ; 5BB; 5DK; 5EBF; 5EJG; 5ELE; 5FI; 5FNA; 5FNY; 5FRO; 5FQI; 5FRO; 5FVN; 5GGU; 5GJK; 5GSM; 5GWQ; 5IF; 5YJ; 6AAE; 6ABX; 6AKB; 6AM; 6AQJ; 6AYL; 6AXC; 6AZC; 6BBM; 6BNY; 6BVX; 6CUH; 6DQZ; 6EJA; 6EIL; 6GHG; 6GNS; 6GRF; 6GRL; 6GXV; 6HCI; 6HVI; 6HX; 6HXU; 6IOX; 6IRD; 6ITH; 6ITU; 6IX; 6JBO; 6JOQ; 6KBZ; 6KHU; 6KOK; 6KVU; 6KUT; 6KWX; 6LNJ; 6LRC; 6LPZ; 6MFY; 6MHH; 6MJI; 6MOI; 6MYT; 6NGC; 6NKR; 6NQS; 6NTU; 6OFZ; 6OHV; 6OKL; 6OMR; 6OMV; 6OPV; 6OWG; 6OWN; 6OXR; 6PAW; 6PBV; 6PEP; 6PCX; 6PEV; 6PHS; 6PKL; 6PKN; 6POI; 6PPR; 6PQU; 6PQW; 7AEA; 7AMX; 7AQB; 7AVL; 7AWI; 7BCV; 7BTZ; 7BXS; 7EQA; 7EQX; 7EST; 7ESN; 7EYI; 7FHB; 7BHW; 7FMK; 7FNK; 7FRS; 7FZP; 7GAS; 7GGF; 7GKY; 7GRU; 7GZP; 7JY; 7YG; 8CVU; 8DCI; 8EDD; 8FEO; 8GMZ; 8GTL; 8HGG; 8KZT; 8MJF; 8NUH; 8OXI; 8OXR; 8PBQ; 8PIJ; 8QDA; 8QCS; 8QMC; 8QVU; 8RFA; 8RGK; 8RLG; 8RMC; 8YX; 9AVJ; 9AVS; 9AJV; 9CFC; 9IO; 9JMW; 9HQZ; 9KIX; 9LTH; 9MVK; 9NAW; 9OBU; 9PLM; 9PLU; 9QAX; 9RXT; 9VIJ; 9ZEQ; 9ZRP; 9ZXR. CR7BC; CR7AU; FM8AD. G—3GX; 5LP; 5LH; 5ND; 5QG; 5TP; 6YZ; 8DR; 8KP; 8JJ; 8PQ; 8RN; 8SY. GM6RV; GW6YJ; HB9T; HK2XB; HK5JD; J2KN; J5CV. K—4DSE; 4DTH; 6BAZ; 6CGK; 6DV; 6GQF; 6ILT; 6MOJ; 6NFU; 6NJU; 6ORA; 6OWQ; 6OXT; 6PAE; 6PAH; 6PGQ; 6PIN; 6PPR; 7BZX; 7DNL; 7FBN; 7FNE; 7GKP; 7GNC; 7PQ; 7QI. KA1AX; KA1BO; KA1EE; LA1Z; LA8Z; LY1AH; LY1S; MX2B; OK2HM; ON4AU; ON4DAM; ON4DKW; ON4NW; ON4PW; ON4RA; OZ5C; PA0QQ; PA0KB; PK1OA; SM5NU; SM5OF; SM5VD; SM5YV; SM7MF; SP1KB; SU1NH; U0NB; U1DN; U1CC; U9BK; UE3EK; UE3EL; UK1BK; UK5AA; UK5CC; VE5FU; VE5HP; VE5LK; VE5TJ; VP7NT; XU1CY; 3KY; 3LK; 6TL; 8CR; 8LS; 8NA; 9KD; 9KT; 9NT. YR5BK; YR5VV; ZE1JW. ZL—1BR; 1FT; 1HQ; 1JK; 1LM; 2KS; 2US; 3GC; 4CK; 4DQ; 4CT; 4FB; 4FO. ZS—1CA; 1CC; 1CR; 2AV; 4B; 4C; 5AN; 5AQ; 5AS; 5BS; 5CR; 5CS; 5CV; 5CY; 5CU; 6AM; 6BC; 6BV; 6BX; 6CM; 6CR; 6EO; 6EQ; 6ET.

(14 Mc.)

W—1AER; 1AFR; 1ADM; 1AJO; 1AOL; 1AVJ; 1AVK; 1AQT; 1BGC; 1BGA; 1BGJ; 1BEQ; 1BNT; 1BUX; 1BXC; 1CC; 1DEO; 1DZE; 1EJT; 1FTR; 1GFS; 1HER; 1IED; 1JPE; 1KLV; 1KN; 1KPP; 1LZ; 1ME; 1RY; 1ZB; 1TS; 1TW; 2ACB; 2AHC; 2AOA; 2ARB; 2BXA; 2BYP; 2CHQ; 2CIB; 2CJX; 2CTO; 2CYX; 2DGU; 2DOZ; 2DPA; 2DTB; 2DYJ; 2FMP; 2FSK; 2GFF; 2GOF; 2GTZ; 2GUM; 2GW; 2HNA; 2HUQ; 2IFZ; 2IHQ; 2IKZ; 2IQZ; 2JF; 2JME; 2JWZ; 2KBA; 2KCC; 2KRA; 2KUD; 2MB; 2UK; 2UL; 2VY; 3AG; 3APJ; 3AYU; 3AZB; 3AZX; 3BBB; 3BHV; 3BIW; 3BM; 3BPH; 3BRZ; 3CDG; 3CHE; 3CKA; 3CWU; 3DDM; 3EMA; 3EVT; 3EYJ; 3EYY; 3EZN; 3FNK; 3FNY; 3FQP; 3GAU; 3GEH; 3GHB; 3GKN; 3GTQ; 3GVB; 3GXO; 3GXX; 3GZR; 3HIL; 3KT; 3PC; 3PV; 3QP; 3QT; 3VB; 3WN; 3WU; 4AH; 4AMM; 4ANH; 4AJX; 4ASB; 4AXY; 4BGO; 4CBY; 4CDE; 4CDQ; 4CEI; 4CYB; 4DMB; 4DSK; 4DSO; 4EHH; 4EIU; 4EIV; 4EOX; 4EQM; 4FBP; 4FEH; 4FFB; 4LN; 4MR; 4NC; 4OG; 4RA; 4TP; 5ASG; 5ASX; 5AXI; 5BB; 5BDI; 5BWQ; 5CIR; 5CSR; 5CXQ; 5DAQ; 5DM; 5DNS; 5ECE; 5ELE; 5ENE; 5EWJ; 5FFJ; 5FIX; 5FNA; 5FPE; 5GHV; 5GSJ; 5GUZ; 5JC; 5KC; 5PJ; 5SL; 5VV; 5YF; 5YJ; 6AJN; 6AKB; 6AKM; 6ALA; 6AM; 6ANN; 6AX; 6AZO; 6BAU; 6BBW; 6BVX; 6BY; 6BZN; 6CEM; 6CIS; 6CUH; 6CXW; 6CYV; 6DLN; 6DOB; 6DVT; 6EBO; 6ERM; 6EW; 6EXQ; 6EY; 6FAL; 6FDW; 6FT; 6GAL; 6GCX; 6GHU; 6GK; 6GOZ; 6GNY; 6GPB; 6GPU; 6GRL; 6HCF; 6HKA; 6HXU; 6HZW; 6IPH; 6ITY; 6IZE; 6JBO; 6JJA; 6JGQ; 6JWL; 6KIP; 6KQK; 6KQL; 6LCA; 6LCD; 6LEV; 6LDJ; 6LHN; 6LPC; 6LTE; 6LVF; 6LYM; 6MCG; 6MEL; 6MTR; 6MVH; 6NHA; 6NLJ; 6NQI; 6NTR; 7NVN; 6NZY; 6OFC; 6OHZ; 6OLL; 6OPV; 6OQD; 6ORT; 6PBI; 6PHS; 6PFD; 6PKA; 6PQV; 6QD; 6WN; 6ZAA; 7AFP; 8AAX; 7ANZ; 7AYO; 7DXZ; 7ENW; 7FH; 7FWD; 7GFX; 7GGE; 7GK; 7JB; 7WL; 8AAU; 8ACY; 8API; 8AQY; 8BOF; 8BQJ; 8BTI; 8CMH; 8CRA; 8CTR; 8CUO; 8CWX; 8CXN; 8CYT; 8DRE; 8DEN; 8DOD; 8DXN; 8ELP; 8ENA; 8ERA; 8ETQ; 8FMH; 8FMJ; 8FSS; 8HRV; 8HXJ; 8HZA; 8ICL; 8IHU; 8IMR; 8ITK; 8JAH; 8JEA; 8JMP; 8KFU; 8KFV; 8KKG; 8KO; 8KLI; 8KPB; 8LAX; 8LIR; 8LQB; 8LXA; 8LYQ; 8LZK; 8MCY; 8MEV; 8MMC; 8MRU; 8MTY; 8NAB; 8NBK; 8NJP; 8NKU; 8NSS; 8NTB; 8NV; 8OKC; 8OYW; 8PHD; 8PZZ; 8QGG; 8QBQ; 8RKR; 8RNQ; 8YX; 8ZY; 9AMM; 9ARL; 9AVS; 9BE; 9BMM; 9BQH; 9CCI; 9FER; 9FS; 9GBJ; 9GVZ; 9GWA; 9HCO; 9HQZ; 9IJW; 9JKJ; 9KA; 9KBV; 9KGU; 9KHD; 9MYX; 9PKW; 9PMU; 9QQH; 9RFA; 9RPW; 9RRT; 9RXT; 9SVT; 9TCK; 9TGB; 9TJ; 9TWV; 9UM; 9UQT; 9UZD; 9UZS; 9VFK; 9VTZ; 9WTW; 9ZPK; 9ZTL. CE1AQ; CE2BU; CM2AZ; CM2AO; CM2OP; CM5RY; CN1AA; CN8AD; CN8AR; CN8AY; CR7AC; CR7AK; CR7AU; CR7MF; CR7RB; CT1FG; CT1JU; CT1QE; CT1ZA; CT2BC; CT3AB; CT3AN; CX1CG. D—3BMP; 3BWU; 3CDK; 3GPF; 4AOO; 4ATT; 4BAF; 4BFU; 4CDM; 4DTC; 4GJO; 4KSD; 4JVB; 4QET; 4ANM; 4TKP; 4SZK; 4WXD. EI2M; EI3L; EI4L; EI5G; EI6F; EI6G; EI7F; EI8B; ES6E. F—3AD; 3CX; 3CY; 3DN; 3EB; 3KH; 3KR; 3LE; 3LI; 3MM; 3QW; 3TS; 8AM; 8BS; 8CP; 8EB; 8IZ; 8KS; 8NR; 8OK; 8PZ; 8QL; 8QM; 8RR; 8SI; 8SJ; 8SK; 8TQ; 8WB; 8YZ; 8ZF. FA8IH; FA8ZZ; FB8AB; FB8AD; FI8AC; FT4AE; FT4AL. G—2BY; 2DH; 2DN; 2FZ; 2HI; 2IK; 2IO; 2JT; 2JU; 2KH; 2KU; 2LB; 2LU; 2MA; 2MI; 2NN; 2OA; 2PN; 2QB; 2QO; 2RI; 2SO; 2TP; 2UV; 2QX; 2VO; 2WV; 2XC; 2XD; 2XN; 2YJ; 3BS; 3CB; 3CN; 5AC; 5AN; 5BD; 5BQ; 5BY; 5DR; 5DW; 5GI; 5GQ; 5HA; 5IU; 5JA; 5JF; 5JM; 5JU; 5LP; 5MY; 5ND; 5NO; 5OB; 5PJ; 5QI; 5RV; 5TO; 5TW; 5TZ; 5US; 5VB; 5VN; 5VU; 5WP; 5XC; 5XD; 5YU; 5ZT; 6BQ; 6BS; 6CJ; 6DL; 6DS; 6DX; 6GB; 6GH; 6GM; 6GN; 6HL; 6IU; 6KP; 6KS; 6KU; 6LI; 6LJ; 6LR; 6MC; 6OM; 6OY; 6PB; 6PD; 6PR; 6RJ; 6RS; 6TD; 6TI; 6TY; 6VP; 6VX; 6WB; 6WY; 6XL; 6XP; 6XQ; 6YG; 6YR; 8AP; 8AR; 8AZ; 8DQ; 8DR; 8FL; 8FZ; 8GC; 8GL; 8GO; 8HA; 8HH; 8HN; 8IF; 8IL; 8IM; 8IP; 8IW; 8IT; 8KB; 8KH; 8KS; 8NH; 8NM; 8NX; 8OB; 8OG; 8OH; 8PC; 8PI; 8PL; 8PV; 8QL; 8RD; 8RI; 8AQ; 8TC; 8TD; 8TY; 8UD; 8UG; 8UK; 8UQ; 8WV. GI5AJ; G85NJ; G85QX; G86XS. GM—2DI; 5YN; 6BM; 6HZ; 6KO; 6KH; 6MD; 6NX; 6XI; 8AT; 8FB; 8HP; 8KQ; 8MN; 8MQ; 8PM; 8SV; 8VL. GW2NG; GW2XZ; GW3AX; GW5OD; HA1P; HA2B; HA2N; HA2P; HA4H; HA5C; HA7P; HA8C; HB9AY; HB9BD; HB9CC; HB9CE; HB9J; HB9S; HC2HP; HH3L; HH5PA; HI2W; HS1BJ; HS1LT; HS1MH; HS1IT; HS1TKM; HS1ZZ. J—2CN; 2HQ; 2IU; 2JJ; 2KO; 2LK; 2LL; 2MH; 2NF; 2NG; 2OE; 2OV; 3CX; 3FI; 3FJ; 7CJ. K—4DSE; 4ESH; 4EVC; 4FWS; 4KD; 4RJ; 5AA; 5AF; 5AN; 5AU; 5AY; 6BAZ; 6BUA; 6CGK; 6COG; 6KMV; 6KPF; 6LEJ; 6LKN; 6MTE; 6LNW; 6NJU; 6NLD; 6NZC; 6OJI; 6OQV; 6OWQ; 6PCM; 6PDQ; 6PAH; 6PHD; 6PZZ; 6SO; 6TE; 7EWZ. KA—1AA; 1AF; 1AX; 1CW; 1MH; 1QL; 1SL; 1SO; 1YL; 4LH; 7EF. LA1H; LA3H; LA6L; LA7R; LU1CA; LU5AN; LY1HB; LY1S; LY1X; MX2B; OA4J; OA4R; OA4U; OE3AH; OH2OT; OH3NO; OH3NP; OH5NR; OH5OM; OH5NS. OK—1BC; 1FF; 1PZ; 1RW; 1SZ; 2BA; 2HM; 2MV; 2RM; 3VA. ON—4AA; 4AK; 4AM; 4AS; 4AU; 4AW; 4BR; 4CD; 4EJ; 4DZ; 4FE; 4FQ; 4FT; 4FX; 4HC; 4HF; 4HM; 4IF; 4JZ; 4KM; 4LX; 4MC.

POSTSCRIPTS... and Announcements

Maxim Memorial Station W1AW Inaugurated

The Maxim Memorial Radio Station, W1AW, at Newington, Connecticut, was officially dedicated on September 2 by Dr. E. C. Woodruff, W8CMP and president of the American Radio Relay League, at a ceremony witnessed by over 100 invited guests. W1AW was the call held by Hiram Percy Maxim, founder and first president of the A. R. R. L., until his death early in 1936.

Following the dedication ceremony W1AW was placed on the air and through the night messages of good wishes were received from amateurs throughout the country. These messages were relayed from station to station much in the manner of the early relay procedure used by Mr. Maxim and the comparatively few amateur stations existing at the time he formed the A. R. R. L.

Error in Resistor Formula

We are advised by L. C. Waller, W2BRO, of an error that was made in his article, "A Direction Finder for Rotary Beam Antennas," as it appeared in the October, 1938, issue of RADIO.

Near the bottom of page 17, the equation given for R_4 is, $R_4 = 1000\ E/36$. This equation should be, $R_4 = 1000\ (E-70)/36$. The current is 36 ma., and the voltage is just that part of the supply voltage which appears across R_4. The published equation takes E as the entire supply voltage which is in error.

●

Great Circle Maps from G. E.

Two azimuthal world projection maps prepared by the Radio Department of the General Electric Company at Schenectady, N. Y., are available to radio amateurs, gratis upon request. One, designated GES-1996, is centered upon Schenectady and is for use only in Northeastern United States. The other, GES-1999, is for amateurs in the Western part of the country and is centered on Oakland, California.

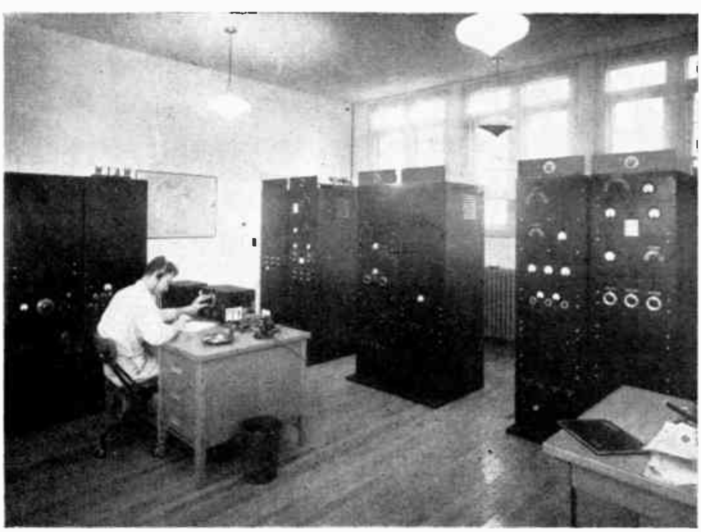
Principal cities throughout the world are indicated on the maps, and determining the paths of signals, as well as distances between points, is simplified.

●

R.C.A. Institutes Announces Television Courses

The RCA Institutes, technical radio school familiar to most radiomen for

[Continued on Page 95]



Interior view of Memorial Station W1AW, Newington, Connecticut.

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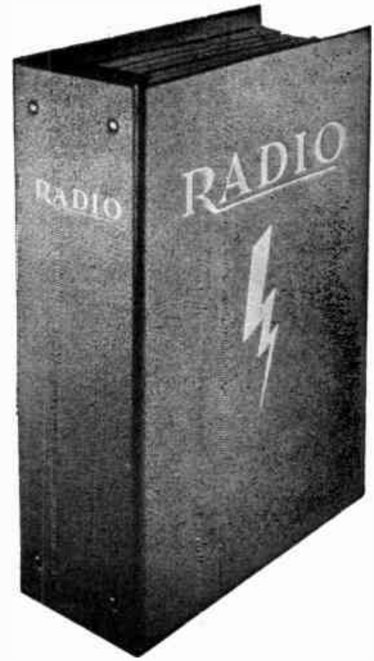

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56 MC. . . . .

By E. H. CONKLIN*

MORE 5-METER DX RECORDS

Current issue of *Break-in*, official organ of the N.Z.A.R.T.L., reports that P. A. Morrison, of Wellington, logged the American W6ENC on telephony, calling "CQ DX 56 Mc." at QSA5 R4, and copied VK2NO (experimental station of D. B. Knock, *The Bulletin's* radio editor) for an hour on c.w. at QSA5. This makes the first time that an American signal has been heard and identified on five meters across the Pacific, and the third time VK2NO has been heard across the Tasman.

—Sydney (Aust.) *Bulletin*

Don't forget the International Tests during November, outlined in October RADIO. Three of the YL's in England have written of their intention to participate, and most European countries interested in this band have been advised. VK's and ZL's are active—the latter have been poking out much better lately. A ZL was heard 270 miles, while ZL4DQ heard VK5ZU, across the Tasman.

After hearing that W1SS and W1DFY heard a "G2MY" on 56 Mc. at 3:34 to 3:51 p.m. eastern daylight time on July 10, we wrote a few letters to check up. W1SS said that the signal was on about 56.4 Mc., and said, "calling America, calling America, G2MY. . . ." The call was not accurately identified. Knowing that G2MV is active, though the call does not sound quite the same, we sent him a letter and found that he was operating at the time—8:50 British summer time—with 50 watts and a two section W8JK beam. We also find that G2MV had received reports from two W1's. Well, it isn't all confirmed yet, but we hope that something definite will come of the November tests.

While the British have been held back in their five meter dx due to the scarcity of stations at the proper distance, some good work has been done. SM5SN was heard by G6DH on May 23 and by G2HG on June 26. During a 28 Mc. contact on July 2 between G2XC and XI1ER in Milan, Italy, the latter shifted to "five" and got an R9 report. Unfortunately there wasn't any use of G2XC going to "five" himself as I1ER can't receive on that band. G2XC had heard commercial harmonics up to 50 Mc. that day.

A lot of news has been dropped from this column in recent months due to lack of space for the dx reports. For a few months we may have lots of dope as a result of the summer activity, after which comes the usual winter lull. In the meantime, let's have articles from the gang describing various well-built pieces of equipment worthy of being copied by others who will soon start preparations for the 1939 season.

Station Reports

Hundreds of letters show that over a thousand stations must have been active in the 56 Mc. dx this year. There are many tests and observations that will be of interest, but The Editor says that we can't use the whole issue for 56-Mc. news. We shall review the station reports below, continuing them in the next issue, rather than to boil them down too much. One thing we notice is that stations with better equipment are usually able to make more contacts, and on more days, not being QRM'd so much on particularly open days when overmodulated oscillators cause a lot of interference. The most successful stations use crystal control or a very good design of stabilized transmitter that is not frequency modulated, and use superheterodyne receivers with reasonably sharp i.f. amplifiers. Quite a few use vertically stacked antennas or several directors, thus holding radiation down to relatively low and useful angles. So here goes:

W6GZE in San Anselmo, California, worked W7AQJ on May 12 at about 9:20 p.m. using a Jones resistance-coupled i.f. superheterodyne and a 40-watt transmitter using 210's. The antenna was a single vertical half-wave rod, fed with a 200-ohm transmission line. He said that W6MQQ and W6OJU also heard W7AQJ; also that for a month, stations over 25 miles have had a noticeable slight fade, and signals copied in daylight are down four R's and unreadable at night.

* *Associate Editor* RADIO, *512 N. Main St., Wheaton, Ill.*

J. E. Smith, President
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DEPT. 8MK4, NATIONAL RADIO INSTITUTE,
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City .... State............14X-1

W9CMM (W9TMM?), W9ZGD, W9QCY, W9LLC, W9CLH, W9ARN, W9FP, W9TQH (W9PQH?), W9ZS (?), W9RCH, W9YSV, W9ZSS, W9BEA, W9PPB, W9TMM, W9LND, W9PQH, W9OYL.

W1EFN reports that the following were heard by W1CLI on the 5th: W8AIA, W8RVT, W8NKK, W8JLQ, W8RJM, W9CMN, W9PTB, W9CLH, W9ARN, W9YSV, W9ZSS, W9DQH (W9PQH?), W9ZGD.

W9QDA Operates at W2JCY

W9QDA was visiting in the east but didn't miss the dx because he happened in at W2JCY. On June 15 he phoned us with the information that on the 5th, W2JCY worked 35 stations including one only 310 miles away in upstate New York; he spent much time making tests. W5EHM was reported to come through that day, together with someone named "Dan," believed to be in England, using the word "over" when he finished transmitting each time. We also heard that W2JCY noticed no difference in signal strength of the dx when rotating his beam horizontally. On numerous measurements of the vertical angle, he decided that most dx signals came in at 40 degrees above the horizon, all being between 35 and 50 degrees! (Early 28-Mc. measurements using the tilting antenna method yielded similar results, but more recent measurements on winter communication on ten meters using the differential output method from two or three antennas yielded angles below 20 degrees—Ed.) Such high angles would suggest (1) a tilted layer, (2) a gradual curve in the path, or (3) a layer at a virtual height of some 350 miles. W2JCY still has an open mind on the question of how this dx takes place.

In Penfield, N. Y., W8AGU was on from 7:30 to 11:30 p.m. eastern time on the 5th. He worked W9AHZ and W9ZJB in Kansas City, W9UIZ in Ft. Leavenworth, Kansas, and W5ZS in Shreveport, La. He heard W8RSS, W8JIN, W9CLH, W9ALE, W9ARN, W9PQH, W9PLH (?), W9OLY and W8ACN. His receiver is a homemade superheterodyne with 956 r.f., 954 detector 955 oscillator, two 6K7 i.f. stages on 3 Mc., and 6H6 second detector. The transmitter, on 56,150 kc., has a pair of 35T's in the final with 250 watts input.

W3HI in Baltimore mentions a lot of W2's and W3's worked by W3HG, W3WA and himself on May 31 and June 4. On June 5, no contacts were made but W3HI heard W5ZS, W9OLY and W9AHZ—the latter on c.w.; and W3HG heard W5ETQ, W5ZS, W8RSM, W9CX, W9CLH, W9ZGD, W9LVK and W9OLY. He notes that with few exceptions, the dx stations heard were crystal controlled.

In Philadelphia, W3BZJ found the band open at 10:00 a.m. Eastern time, and contacted W9NY twenty minutes later. He had been expecting some five meter dx because of very short ten meter skip, but heard only the one station before evening. The Philadelphia gang turned out for a hamfest and missed some of the dx. W3BZJ uses 75 watts crystal controlled on 57032 and 57380 kc., being only one of seventy crystal controlled stations on the band in Philadelphia. He has compiled this record for the 5th from the reports of eighteen stations:

Stations Worked

W3BYF: W9NY, W9GGH, W9CLH, W9OVK
W3GQK: W9ZUX, W9YGS
W3FSS: W8RRH
W3FVR: W9GGH, W9CLH, W9NY
W3VX: W9CLH, W9JUE
W3MV: W8CAS, W9RCH
W3ERA: W9CLH
W3GQS: W9ZGD
W3CUD: W9ZUX, W9YMG
W3BZJ: W9NY, W9YGZ, W9ZGD
W3NU: W9LZL

Stations Heard

W5ML, W5DUA, W5ZS, W6DQH/9, W7EYN or W7EYM, W7? in Roundup, Montana, W8ARS, W8BEA, W8CAS, W8CNU, W8CLS, W8EGQ, W8JIM, W8JIN, W8LTB, W8LDD, W8LL, W8NKJ, W8NJJ, W8OCV, W8ORA, W8OTG, W8OKG, W8OIA, W8OQG, W8PQK, W8QHR, W8QDU, W8RVA, W8RKE, W8RXO, W8RVT, W8RSS, W8RMJ, W8RSM, W8RRH, W8RYT, W8RK, W8RTS, W8UUT, W8WEN, W8WYO, W8YOH, W8YOF, W8YX, W8YUT, W8YIO, W8YNT, W8YVT, W9ARN, W9ALE, W9AHZ, W9BEA, W9CLH, W9CLA, W9CX, W9DNW, W9EYH, W9FE, W9FEN, W9FEM, W9FGB, W9GGH, W9GPS, W9GLA, W9GQX, W9GNW, W9GUX, W9HPP, W9HTT, W9IVC, W9IVE, W9IBC, W9JUE, W9KGD, W9LVK, W9LZL, W9LZK, W9LYI, W9LNV, W9MXK, W9NY, W9NMF, W9OLY, W9OVK, W9PQH, W9PPB, W9PNC, W9PAW, W9QHR, W9QVB, W9QHY, W9QCY, W9RSS, W9RST, W9RCH, W9RGD, W9TAT, W9THR, W9TQH, W9UTS, W9UTF, W9UTL, W9USH, W9VO (not now assigned), W9WLX, W9YSB, W9YSV, W9YMG, W9YLD, W9YGU, W9YGS, W9YNG, W9YMD (W9YMG both times?), W9YGZ, W9ZGD, W9ZUX, W9ZSS, W9ZJD, W9ZZO, W9ZUL, W9ZJB. There are several obvious similarities in this list with calls known to be on the air.

W3EZM missed the morning dx on the 5th but was on from 7 to 11 p.m. eastern daylight time, mentioning that W9CLH was loudest and most consistent, with W9OLY last to go out with W5ZS at 11:30.

W3GIO sends in a combined report for the Baltimore stations, a number of which have come on the air with new crystal control rigs. On May 15, W4EDD was heard by several stations. On the 19th, W5EHM came through about 7 p.m. On the 27th, W3HDZ heard W9ANA and W9JUE. On June 4, W9FEN and W8RSM came through. W3GIO had a good QSO with W9ZGD on the 5th and the, following list was heard between 5:00 and 10:30 p.m. by W3HDZ, W3HFX, W3GPK, W3FZC, W3GXL, W3GHQ, W3GIO and an S.W.L., T. Sewell:

W9HMO, W8OTG, W8RKE, W9LZL, W9ZUX, W9ZGD, W9PNC, W9ALH, W9UTS, W8OED, W9CQY, W8NTY, W9BQD, W9YMG, W9FTN, W8OTG, W9ZSS, W9MXK, W9PQH, W9FEN, W9CLH, W9JUE, W9LVK, W9USH, W9AHZ, W9OLY, W5ZS, W5ETQ, W9REZ, W9PBH, W9LYI, W9NY, W9EOK, W9YGZ, W5DBB, W9YZG, W9LNV, W9HPP, W9LZK, W9QCY, W9BPD, W8QFV, W8PSD?, W9ZZY, W9FZD, W9CZJ?

W8KG was rebuilding his crystal rig and tried a modulated oscillator during much of the dx early in June, but on May 28 (or May 20th, according to another letter) he heard W5EHM, W5FI, W5AKI, and W5EEX between 7:00 and 9:30 p.m. eastern time. On June 1 at 1:30 p.m. he heard W5AJG and worked W5EHM; W8OPO worked them both. From 10:30 to 11:30 a.m. on the 5th, these were heard: W1DRE, W1EKT, W1KHO, W1DEI, W1JEX, W1DPP, W1JRB, W1KYM, W1CPM, W1JUJ, W1IZY, W1CCV, W1EHV, W2GAH, and WSFI. At 7:30 p.m. he heard these: W1LBK, W1IAK, W1KIB, W1AUN, W1DZE, W1DPP, W1IXP, W1SI, W1IKH, W2KSI, W3AJU, W4EDD (who reports not being on the air), VE3ADO. Interference was so bad that few contacts were made in this period. Three unidentified stations were heard calling W8KG. Between 7:50 and 10:30 p.m. he also heard W5ZS, W5ML, W9OLY and W9USH. On June 6 at 7:30 p.m. W5AKI came through for a short time.

In Herndon, Virginia, W3RL has been hearing quite a lot. On May 27 he heard W9ANA for nearly an hour, and heard W9JUE from 11:19 to 11:30 a.m., both using code. This reception permitted making some antenna tests. Rotation of a four element beam gave very little directional effect, which because of the usual sharpness of the beam may indicate signal arrival from a very high angle, he says. He was using a superregenerative receiver with acorn r.f. so arranged that with battery power it could be operated as a tuned r.f. receiver, which makes it sensitive for dx. On June 1 he heard W5EHM working a W8 from 12:30 to 12:41 p.m. eastern time. On June 5, W3GLV worked W5ZS and W3FKF worked W9OLY and W8OTG. W3RL heard the following between 6:44 and 10:20 p.m.: W1CJH, W1IZY, W1JUN, W1KNX, W1JIS, W9ZD, W1KUF, W1JMT, W1IXO, W8OTG, W1BEH, W1JCD, W1KCS, W9QVP, W8RKE, W9YGZ, W9LVK, W9GKO, W9LZL, W9CLH, W9YMG, W9ZGD, W9ARN, W5ZS, W9AHZ, W9OLY, W9TIW and W5ML. He noticed that the W9's seemed to be hearing mostly W1's and W2's while the W1's were hearing mostly W9's. Few dx stations seemed to call or work the third district, so he feels that he was on the southern fringe of activity.

On June 1, W8JLQ in Holland, Ohio, worked W5EHM who was heard from 1:33 to 1:50 p.m. eastern time. He says that on the 5th, the band was open three times. Between 10:20 a.m. and 12:15 p.m., he worked W2KTU, W1EYM, W1JFK, W1KH, W1IZY, W5CSU/1, W1KHO, W1KXK, W1KEX, W1JUJ and heard W3GAH, W1KAY, W1IVA and W1IKS. He mentions that a lot of signals were coming through, many with fine crystal-controlled rigs, but the overmodulated oscillators messed things up. Conditions were not as good when the band opened from 6:15 to 8:30 when contacts were made with W3DOD, W1IZY, W1HTD, W1KNH, W1KPM, W1KGE; while W1KXK, W3BYF, W2IXY, W1KOE, W2KHR, W2KMV, W2IVO and W3DNU were heard. The last opening was from 10:30 to 11:00 when W5ML and W5AJG were worked, and W5ZS was heard. W8JLQ uses a pair of 809's in the final on 56,090 kc., with 50 watts input. The antenna is the insulatorless stacked horizontal dipole arrangement described in April RADIO, but the upper dipoles were not yet connected.

Walter Peck, W1EFN, tried the June 5th dx both from his home station in the valley, where ten mile dx is good, and from Mt. Greylock, where the W8's and W9's were no louder but the more distant "local QRM" was worse. He says that at 9:30 a.m. (eastern daylight time?), W1VC heard two W5's copying "W5FOH" (who was not on the air). Nothing more until 11 a.m. to 12:30 p.m., and again from 7 to 10:30 p.m., a good five hours of dx. He said that W9ARN had the best signal, with said that W9ARN had the best signal, with W9CLH a close second. His six watt portable wasn't good enough in the QRM, but W1CLI raised W9CMN and W9DQH (W9PQH?), and was heard being called by W9ZGD; W1VC was called by a W8, according to W1FAU. Several W1's and W2's never before heard in the valley came through. The calls heard by W1EFN, as closely as he could identify them, were W8IVF, W8JIN, W8RSS, W8LDJ, W8RMJ, W8WEM (Cincinnati bootlegger?), W8RYM, W8OLH, W8QDU, W8CQK, W8EGQ, W8WEN (another?), W8COS, W8YX, W9DNW, and W9CJW.

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The Open Forum

An S. W. L. Speaks

Syracuse, N. Y.

Sirs:

About this s.w.l. business, well I am not a ham, but I am not one of these unsalaried workers for the post office and the printer.

I spend a good deal of time listening on the 20-meter phone band and have heard my share of dx, but I am not in the habit of sending out reports. I sent one once, just once, when I heard a VE5 asking for reports. A VE5 from this QTH at noon in the middle of July is pretty good, so I sent him a report, including postage, and am still waiting for his card.

There is one local ham that I hear working out quite consistently and often I am able to hear both ends; for instance, the other night it was a ZS. Now I could send him a report, but would it do him any good? It would show exactly nothing. It is practically the same way with other locations all over the country. If something exceptional is being heard, it is probably being worked there also.

One other thing: about dropping the code exam, all I can say is that if a person is so simple as not to be able to concentrate enough to get it through his head, I doubt if he would be much of an addition to amateur radio.

Bob Gaughan

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Weird, Ghastly Sounds

Cleveland Heights, Ohio

Sirs:

Notwithstanding the fact that I just wrote you a letter, I find myself forced to write another. It's concerning these so-called phone stations on the low end of twenty.

Tonight, I was having an fb QSO when all of a sudden I heard the most weird, ghastly sounding noise which I thought was a diathermy machine. Imagine my surprise when I began to detect modulation on this monstrosity! Not T7, 6 or 5 but T1; it would have put a buzz saw to shame. The QRM from T9 phones is annoying enough without having to put up with somebody who puts his p.p. 45's TNT on twenty with RAC on the plate and proceeds to put a mike in the an-

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YARN *of the* MONTH

MONTHLY FREQUENCY CHECK

The scene is laid in one of our northern agricultural states, in a city of about 10,000 population, and in the very dead of winter. The time of the monthly frequency check has come around and, by reason of his being the youngest member of the staff, Bill is chosen to do the early morning trick. Also, says the boss, the trick shouldn't bother him so much because he is used to arising from a warm bed in the wee small hours to try and hook that elusive "J" for his WAC. So home and to bed, with the trusty alarm clock set for 1:30 a.m.

After what seems like about five minutes since the bed attained a comfortable state of warmth, the alarm announces in no uncertain terms that that time has arrived.

"Dang it," muses Bill, "why can't they build alarm clocks so that they will make you want to get up instead of jarring your sensibilities clear down to the bone. Now if the alarm were made so that it sounded like a nice R9 "J" answering my CQ, that'd be something."

But despite these musings the alarm continued sounding off like a 20-kw. commercial with the dot wheel running wild. "Ok, ok," grunts Bill as he arises, unceremoniously silences the alarm, and dresses in clothes more or less suited to cope with the raging snow storm which has blown up since he left the station.

After a dozen or so unsuccessful attempts to rouse the shivering Ford from its half-frozen lethargy, Bill agrees that the crate has the right idea, closes the garage doors, and sets out to walk the mile and a half to the station through the storm and the two feet of snow it has already brought.

Arriving at the station about half-hour later, blue with cold and covered with snow, Bill discovers much to his loudly-voiced chagrin, that the last operator forgot to fill the oil stove before he left. The stove, building and transmitter are all now colder than the proverbial block of ice. After filling and relighting the stove, the filaments of the transmitter are lighted and the dummy antenna is connected to the final amplifier. Soon after turning on the transmitter Bill notes that the heat put out by the combination of the rig and the dummy antenna is somewhat more than the output of the oil stove.

About 3:15, when the room is beginning to become livable, the phone rings.

"Transmitter," answers Bill.

"Hey, Bill, this is Andy and I'm snowed in. Guess you'll have to announce and run the records yourself. I don't think I'll be able to get down to the studio until along later in the morning. You don't mind, do you?"

"Oh, no, I only have about sixteen dozen other things to keep me busy. Maybe I can announce and run the records with my left hand."

"Aw, Bill, don't be like that. After all, I didn't get myself snowed in on purpose."

"No, and this frequency check business wasn't my idea either. Anyway, my jallopy wouldn't run and I had to walk to the transmitter."

"Tell you what I'll do, my fran. You know that lovely little deal of a blonde that I had at the dance last Saturday?"

"Yeah," answers Bill, his interest beginning to arise.

"Well, if you'll handle my end of the works this morning, and not say anything to the boss, I promise I'll introduce you to her."

"Ok; there's probably a catch to it but I'll be a sucker."

"That's better, and there's no catch to it either. Incidentally, there are some old emergency records and a mike in the bottom drawer of the operating desk."

"Ok, lug; so long."

"S'long, Bill; you're a pal."

Following this enlightening discourse Bill thinks, "That punk announcer

By GEORGE W. BROOKS, W1JNO

hadn't better fold up on this deal," and delves into the drawer described in search of the "old records and mike." The records are plenty old, as described, and the mike, an ancient double button, is dragged from the drawer. After baking the microphone over the oil stove and stacking the records in a semblance of order it is 3:45 and the station should be on the air.

Bill gives the turntable a spin, taps the mike a few not so gentle raps, and hits the power switch. For the next fifteen minutes he is busier than a one-operator station in a dx contest, trying to change the records, announce the station call, keep his eye on the meters in the rig and on the frequency deviation meter. This last is a little expedient thought up by the boss so that the frequency deviation meter may be recalibrated from the report of the commercial monitoring company who is to monitor the station at the same time as the government is checking it. Just one of those ideas that bosses think of when trying to get the station back into the black after grudgingly approving a large bill to attempt to keep the junkpile on the air and up to the FCC rules and regs.

At last the ordeal is over. Bill shuts down the rig, takes one look outside and decides he might as well spend the next three hours until the station goes on the air on schedule cleaning up the transmitter and the pieces of the record he dropped when the pressure became too great a few minutes before. It is while cleaning out the final amplifier compartment that the reason for the rapid warming up of the transmitter room becomes apparent. The dummy antenna is still connected to the final and the antenna is grounded. After thinking the whole situation over Bill decides to say nothing to anyone and promptly forgets it.

It isn't until four days later that a summons shows up for little William to appear before the boss and answer some questions. After a bad half-hour explaining why the station was not on the air for the frequency test, why he didn't tell him before and of listening to the nice official letter from the FCC, Bill swears never to pull a dumb one like that again and exits.

Three weeks later a letter arrives from Florida telling about reception on the night in question and asking for a verification.

What's New . . . .

IN RADIO

THE RCA 813 HIGH-POWER BEAM TETRODE

A new addition to their present family of beam tetrode transmitting tubes is now being manufactured by the RCA Manufacturing Co., Harrison, N. J. The tube is designed according to the principles involving the use of directed electron beams and hence has an extremely high power sensitivity.

When operating as a conventional unmodulated c.w. amplifier, it is capable of giving an output of 260 watts with a driving power of *0.5 watt*. A power gain of over *500*, and yet the tube is operating at an efficiency of over 72 per cent. This represents a really worth-while improvement in the operating characteristics of screen-grid transmitting tubes since the first ones were announced, although there is little similarity between the modern beam tetrodes and the original screen-grid tubes except that neither of them requires neutralization.

The 813 would make an excellent quarter-kilowatt amplifier for the final stage of medium-power bandswitching transmitters where it is desirable to eliminate the neutralization problem. The tube also makes a very good high-power frequency multiplier capable of giving high harmonic output with unusually high efficiency.

Another feature of the 813 is the new type of flare stem for bringing out the leads to the elements, which eliminates the bulky and inefficient press used in the majority of present transmitting tubes. This new stem has made possible reduced over-all length, short internal leads, low lead inductance and, consequently, greatly improved high-frequency performance. Actually, the tube is rated at full output on 30 Mc., 75 per cent of maximum conditions at 60 Mc. and 50 per cent of maximum conditions at 120 Mc. The new stem construction has contributed greatly to the improved u.h.f. characteristics of the tube.

The tube is rated at 50 watts output with 2000 volts on the plate as a class-B linear, and at the same output with the same voltage as a grid-modulated amplifier. It may be plate and screen modulated with 1600 volts at 150 ma. on the plate to give a rated output of 175 watts for radiotelephony. One feature of all conditions of operation, a direct result of electron-beam design, is the unusually low screen power consumption of the 813. The class-C c.w. operating conditions of the tube will be indicative of the general operating characteristics of the new beam tube.

R. F. Power Amplifier and Oscillator—Class-C Telegraphy

D.c. plate voltage (max.)	*2000 volts*
D.c. screen voltage (max.)	*400 volts*
D.c. grid voltage (max.)	*-300 volts*

D.c. plate current (max.)	*180 ma.*
D.c. grid current (max.)	*25 ma.*
Plate input (max.)	*360 watts*
Screen input (max.)	*22 watts*
Plate dissipation (max.)	*100 watts*

Typical Operation

D.c. plate voltage	*1250*	*1500*	*2000 volts*
D.c. screen voltage	*300*	*300*	*400 volts*
D.c. grid voltage	*–60*	*–70*	*–90 volts*
Peak r.f. grid voltage	*145*	*150*	*160 volts*
Beam plate voltage	*0*	*0*	*0 volts*
D.c. plate current	*180*	*180*	*180 ma.*
D.c. screen current	*23*	*20*	*15 ma.*
D.c. grid current	*7*	*6*	*3 ma.*
Screen resistor	*42,000*	*60,000*	*107,000 ohms*
Grid resistor	*8500*	*11,700*	*30,000 ohms*
Driving power (approx.)	*1*	*0.8*	*0.5 watt*
Power output	*155*	*190*	*260 watts*

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"VACUUM-TYPE" DUMMY ANTENNA RESISTOR

A new "vacuum-type" dummy antenna resistor has been developed by the Ohmite Manufacturing Company to provide a simple, accurate and convenient means of checking the output and efficiency of high-frequency radio transmitters used in amateur, aviation communication, police and broadcast services. It permits the checking of transmitter output and efficiency, stage by stage, if desired; it insures tuning for peak efficiency; and its use eliminates the creating of interference during periods of tuning-up and adjustment.

This new Ohmite model D-100 dummy antenna resistor is built like a vacuum tube, with a glass bulb; and it has a four-prong ceramic base which mounts in a standard tube socket. A unique non-inductive, non-capacitive design maintains the resistance (and impedance) constant to within a very few per cent at any frequency up to 14 megacycles (20 meters) and even beyond.

The model D-100 is rated at 100 watts; and it has a resistance of 73 ohms to match the popular concentric and twisted-pair lines. The units may easily be combined in series, parallel, and series-parallel groups for increased power capacity or other required resistances.

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NEW ANTENNA KITS

Premax Products, a division of Chisholm-Ryder Co., Inc., Niagara Falls, N. Y., has announced a line of antenna equipment based upon the use of telescoping, fluted steel tubing as the radiating elements. The steel tubing is first copper plated to insure low r.f. resistance and then lacquered to make the elements weatherproof. Two vertical radiator kits are available, one for the 14-Mc. band and one for 28 Mc. The radiators in both of these antennas are supported only by the base insulators which are of substantial design wet-process porcelain. Also, both the base insulators (the small one for the 28-Mc. vertical and the larger one for the 14-Mc. antenna) and the radiators themselves are available individually if it is desired to purchase them in this way.

Premax has also made available a kit of similar radiating elements for use in one-section flat-top beams or antenna-director beams, for use either on the 14- or 28-Mc. bands. An installation of one of the antenna-director systems for 14-Mc. operation as made by W3CHO is shown elsewhere in this issue. Also, these radiating elements are well suited for use in the three-element rotary beam as also described in this issue. They have recently announced that they also are manufacturing a complete kit of wood parts for building the supporting structures for rotary antennas. Complete information on both the masts and the rotary antennas may be obtained by writing for bulletin 50 to Premax Products, 3850 Highland Avenue, Niagara Falls, N. Y.

The Open Forum

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tenna. The high end is comparatively free from phones except where the junction of the c.w. and phone bands takes place.

Do these stations deserve to get the same credit for their achievements as the hams who fight through the QRM on the legitimate phone bands? I think not. There are getting to be fewer and fewer c.w. stations on the low end because of the phones.

Don't let them drive us off, boys! Let's drive them off. I suggest the migration of "kilowatts" of various denominations to the low end of 20 and

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5-160 Meter Phone

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Metering

One milliammeter reads cathode current to either 6L6G stage by means of a d.p.d.t. toggle switch. Other meters read final grid current, plate current and class-B cathode current. The latter reads about 50 ma. idle and swings up to 100 ma. on speech. One hundred and fifty ma. on sine-wave tone input causes full modulation, with less swing for speech for full modulation. The first 6L6G stage usually measures about 30 to 40 ma. when tuned to resonant dip. No dip occurs unless the crystal oscillator stage is functioning properly. The second 6L6G push-push doubler stage runs from 100 to 120 ma. when loaded by the final grid circuit.

Pounding Brass for Uncle Sam

[Continued from Page 22]

The camp had been greatly improved. A comfortable wooden house and sheds had replaced the tents. This meant cooler days indoors, for tents offer poor shelter beneath the fierce tropical sun. The grounds were neat and clean; the smooth air field running the length of the island and across the southern half showed that the colonists had been active. But the island, with its glaring white sand, the nearly dead, brush-like thickets of kou trees, and the myriad sea birds, all seemed just the same as two years before.

After the supplies had been safely landed, we all gathered at the spot which had been selected for the lighthouse. This was to be a cylindrical column of stone and concrete about twenty feet high, on top of which the light was to be mounted. This light was to be dedicated to the memory of Amelia Earhart and her companion Fred Noonan, who perished between New Guinea and Howland on their flight around the world. The lighthouse took two months to build, averaging six hours work a day.

Here those of us who were to remain received last minute instructions and posed for pictures with the others. That evening Dr. Gruening, his son Peter, and Richard B. Black, who has charge of these equatorial islands under the U. S. Department of the Interior, enjoyed a pleasant QSO with their wives, who were at K6MTE's shack in Honolulu.

Peter Gruening, a lad of fifteen and a future ham, was lots of fun and a grand companion throughout the cruise. Being interested in the same hobbies, we became close friends. One day I told him that eventually I hoped to have a radio shop of my own, and humorously added that suggestions for an original name for it would be welcome. Each morning he would try to have one for me; "South Sea Island Radio Trading Post" was his best.

The Station

My rig at Howland consisted of a 47 crystal oscillator, 801 buffer-doubler, and a 211 as the final amplifier, grid modulated by a 42 with a single button mike. The power system on Howland was similar to that on Jarvis. A "one lung" gasoline motor generator for battery charging, a dozen navy 4-volt storage batteries, an emergency hand generator, and a high-voltage generator rated at 750 volts 200 mils output (12 volts at 29 amps input) made up the power system. Receivers on all the islands are of the SW-3 type. For broadcast music I brought along an automobile receiver. The high voltage generator was really a problem, what with trying to get up enough juice to meet its fancy, or rather I should say, my fancy. Of course this layout was sufficient for my island schedules, which were few, but for other QSO's it was discouraging. It takes eight hours and, of much more importance, two gallons of that precious stock of gasoline to revive only six batteries; so with that haunting me, it was seldom that I entered into extensive QSO's.

We had a tractor, imported some time before to help construct the airplane runways. It was a tremendous help in hauling rocks and sand with which to build our lighthouse, but it used so much gasoline that it was necessary for me to discontinue all ham work, and as time went on the final amplifier had to be disconnected to save batteries. It was discouraging, no end, just to listen to the gang and not be able to call them.

I hated to do this, but it was necessary to conserve power so that we could be sure of our nightly broadcast programs. When night approached, after a tough day, we always had something pleasant in store for us: Hawaiian programs from home, gay melodies by dance bands in California and, later in the evening, soothing organ reveries. This helped considerably to pass the evenings pleasantly, and made up in part for the heat, and dust, and glare all day, and effectively drowned out the din of birds at night.

How I wished we had had some source of power not dependent upon gasoline, like a wind generator or one of those modern gadgets that convert the rise and fall of the tide into watts. Golly, would I go to town then, with plenty of time and a location midway between the four continents!

I spent some time experimenting trying to make two spare tractor cooling fans drive the hand generator by wind power. The wind blows steadily enough, but a hundred volts was the best I could manage. This was just enough voltage to make the crystal oscillator oscillate; while I was proud thus to have accomplished this much, it wasn't of much use. First thing next morning I started to saw a five-foot 4 x 4-inch post, and carve

it into the form of a propellor large enough to do the trick. But the job turned out to be harder than I had anticipated. What with the heat of the glaring sun beating on my back, and the amount of work required, I finally gave it up and went fishing like the others.

Finally I attached the hand generator to the charging motor generator by means of a leather belt and it worked. On 10 meters the r.f. power thus developed was hardly sufficient to send a flashlight bulb to its doom. What a thrill to get decent reports from the gang at home with this QRP outfit! At times, when conditions were extremely good, successful QSO's were to be had with some of the Pacific coast fellows. However, much of this good fortune was probably brought about by the location and the antenna, a V beam of eight waves. We were able to hold weekly phone schedules with Hawaii, through the kindness of K6LCV, K6PCF and K6MVX, without worrying about the batteries.

With this power arrangement we were killing two birds with one stone. Instead of using the batteries, we were charging them at the same time that we were sending. Without this arrangement the use of phone would not have been wise, because the continuous load of the regular generator would have drawn too much from the batteries. So much depended on our radio communication that we could not afford to let any such misfortune as battery failure occur.

The supply ship *Taney* arrived early in March, bringing some additional gasoline. It came just at the start of the dx contest. With a new supply of gas I was able to use the transmitter at its maximum power, but for some odd reason I could only contact three stations, much to my disappointment.

Fortunately my younger brother, K6KEF, thought of sending me some antenna wire; so I prepared for the phone dx contest by installing the V-beam antenna mentioned above. We were working at a great disadvantage because of lack of efficiency. But we had surprisingly good results considering the method used to get on ten meters. It was almost impossible to get anywhere on 20 meters; so I remained on 10 and contacted about forty stations. For this I did not use my battery saving device, because I felt that I deserved something better at such a time.

Doc and Dave (W4DHZ) operating W6GRL, and W6GCX and Mrs. Van were all much appreciated by the boys, who enjoyed talking with them.

DX

Before hitting the hay at night I developed the habit of contacting a limited number of stations on 20 c.w. Never in my life had I been so flattered, having so many stations so eager to make contact. I kept this up quite regularly for two months, until it became tiresome contacting the same places. So I decided to try for some real dx.

The first morning at four I was delighted to hear so much dx at one time. Stations all over Europe and Africa were coming in with an average signal of R5. Apparently they could not hear me so well, as it proved difficult to make contact. After several mornings I worked ON4OM and received R7. I still could not raise any one else for several mornings following. The total good dx amounted to about only six stations during my entire stay. Alex, W6KIP, was a real pal to all the islands, skeding us all every Sunday and handling our mainland traffic for many months.

Homeward Bound

On July 22 the good ship *Taney* returned after an absence of nearly five months, thus bringing to a close my nine months on Howland Island. This time *I* wore the broad grin.

On my way home I visited even more islands than on the way out, for this cruise of the *Taney* was made in the reverse direction. The first stop was Canton Island, K6ODC's future home, on which American colonists had been placed March 7. Here a 300-watt, commercial built transmitter, operating from a gasoline-driven 110-volt a.c. power generator, a wind-driven 6-volt battery charger and a communications type receiver were installed. A similar installation was made on Jarvis.

While this equipment was being installed by radio engineers, we ran over to Enderbury Island, forty-two miles away, to replace K6GNW by K6HCO, who returned to the Equatorial Islands after a few months' leave.

Brief visits were made at Hull, Atafu and Swains Islands, with considerable trading going on between the Tokelau natives and our passengers and crew. Three days were spent on Tutuila and American Samoa, and one day on Tau. Some of the scientific party also went ashore on Rose Atoll, uninhabited tiny eastern outpost of American Samoa.

On the trip north to Jarvis, a brief stop was made at Pukapuka, Danger Islands, where more trading was done. It had been eight months since the last ship had called at this isolated atoll, and the European residents were badly in need of foreign foods and medical supplies. Two days were spent at Jarvis while the new radio equipment was being installed. On the way back to Honolulu from here stops were made at Fanning and Palmyra, and Kingman Reef was sighted. We reached Honolulu on the evening of August 15.

It was great getting back to civilization, and to be able to use my rig without having to charge batteries and worry about the gasoline supply. But I wouldn't swap my experience for anything; even the hardships were fun, at least in retrospect.

Four-Wire Lines

[Continued from Page 52]

APPENDIX

For two-wire lines—$Z = 276 \log_{10} \frac{s}{r}$

Where s = the separation of the wires and r = the wire radius, both expressed in the same units.

For four-wire lines—$Z = 127 \log_{10} \frac{s}{r}$

Where s = the separation between adjacent wires and r = the wire radius, both expressed in the same units.

For quarter-wave matching transformers—$Z_Q = \sqrt{Z_1 \cdot Z_2}$

Where Z_1 and Z_2 are the terminating impedances at each end of the transformer.

Five-Meter DX—An Explanation

[*Continued from Page 42*]

coming in at perhaps 700 miles and permit five-meter communication. A little calculation will give more accurate figures, but due to the spotty nature of sporadic E in summer the normal connection between five and ten meters may be upset, inasmuch as the point of reflection for a 1200-mile hop is 600 miles away, while for a 400-mile hop it is only 200 miles away and the layer may not have the same characteristics over the whole difference of 400 miles. At any rate, the normal connection between skip on the two bands, and with the police frequencies in between, has been verified a hundred times or more during the last two years.

Another interesting result of an ionosphere study is its help in antenna design. Because the communication takes place via a reflection or refraction the polarization of the wave in space—that is, whether it has left a horizontal or vertical antenna—is not so important except as it affects the radiated power at the proper angle. The angle at which the signal arrives at the receiver will normally be the same as the angle at which the same ray leaves the transmitting antenna. Furthermore, knowing the distance and the layer height, it is possible to calculate the angle at which the received signal left the transmitting antenna and, of course, to decide how high an angle of radiation has any chance of being returned to earth. For maximum efficiency, practically the entire antenna radiation should be concentrated between the horizontal and the upper limiting angle.

In the case of summer dx, stations closer than 400 miles are seldom heard and relatively few have been reported between 400 and 500 miles. Using the chart designed by the National Bureau of Standards and assuming an E layer height of 120 kilometers, 400-mile work requires radiation 18 degrees above the horizon. But with most five-meter work, which according to figure 4 takes place at 800 to 900 miles, the most useful angles are around 7 degrees above the horizontal. The heavy ionization of June 5 brought the peak of the distance curve in to 650 miles, equivalent to 10½ degree radiation.

In winter it is not likely that sufficient F_2 layer density will occur during this sunspot cycle to turn 56-Mc. signals down within about 1700 miles, which indicates a maximum vertical angle of 4 degrees; in fact, 2100-mile communication would be much more likely, requiring a nearly horizontal angle at both the transmitting and receiving ends.

Radiation at low angles can be aided over a salt marsh by using a vertical antenna rather than a horizontal. Over very poor ground the horizontal may have an advantage. Ground sloping down in the direction of transmission, at least as far away as the point where the ground reflection takes place, will improve the low angle radiation. A hill of salt water would be an excellent, though impossible, location. A high antenna will have its first maximum of radiation at a low angle, but if the antenna is too high, it may have its first null at a useful angle—creating a blind angle—something which should be avoided (especially for the summer E layer work, which can involve moderately high angles on the shorter, 400-mile communication). In any event, a well-designed rhombic, the use of a number of directors, or the stacking of a number of half-wave antennas one above another will with little doubt improve the signal and will often permit dx work when the band opens only for distances close to the maximum one-hop distance. In trying to stretch this maximum, low-angle antennas at the receiving as well as at the transmitting end will probably help substantially.

●

A yl holds the last call in the book—W9ZZZ.

U.H.F. Beam Oscillator

[*Continued from Page 48*]

Other antenna systems should also work, particularly with crystal control, but self-excited oscillators will depend to some extent upon coupling back to the grid circuit for oscillation. An 8JK beam of the two-section type, with a central cross-over, may be a possibility. Also, a single half-wave center-fed antenna with quarter-wave feeder, such as the Q, should permit operation in much the same fashion, with the spacing of the Q section determining the match between the center of the half-wave antenna and the tube plates at the voltage loop at the other end of the quarter-wave line.

The r.f. chokes might be eliminated in some arrangements. One is to use a quarter-wave line, often called a "hairpin," with the open end connected to the tube plates and the closed end connected to the high voltage. Some antenna arrangements may also permit a similar connection of the high voltage, such as in figure 5, in which the half-wave rods are vertical, with a one-quarter-wave stub connected at the bottom, to which the high voltage may be connected. The tube plates can be moved along the stub to a point of match, while the frequency can be adjusted by moving the shorting bar. Some such arrangement as this may require "neutralizing" condensers adjusted to feed plate energy back to the grid, to maintain oscillation.

Those who have used the basic circuit are enthusiastic about it. Certainly it gives promise; further development work may indicate the possibility of a general improvement in our transmitters even on low frequencies.

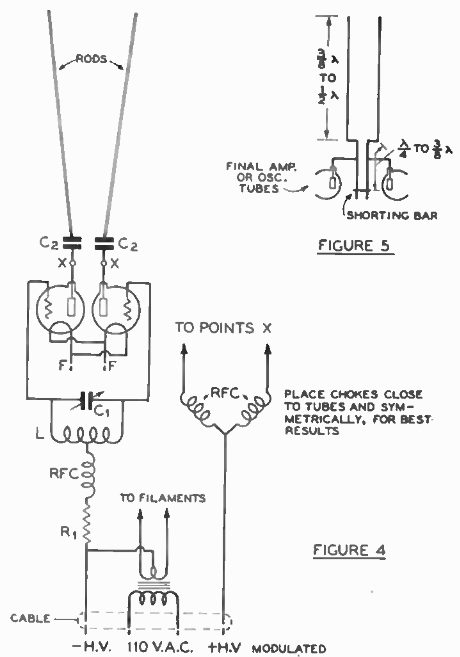


FIGURE 4.

Schematic diagram of the beam oscillator for use at 56 Mc.

C_1—10-μμfd. midget variable
C_2—.001-μfd. mica
R_1—1500 ohms, 10 watts
RFC—2½-mh., 125-ma. chokes; these chokes should be placed so as to form a 90° "V" between them

L—5 turns no 14 enam., ⅝" in dia. and tapped in center

FIGURE 5

Alternative arrangement suggested for use with parallel radiating dipoles.

DX

[Continued from page 60]

the following: 19-19-19's in p.p. Yes, the y.l. was very charming, too. Another low power one by W6POZ was VR4HR, who was using B batts on a single 201A.

The last report from OK1AW was from his portable station QRA in the mountains, where he was using a single 802 with about 25 watts input. W6GHU now has 35 and 103, his latest being VQ2FJ and VQ2GW. For those who have worked VP8AD or VP8AF . . . it is one station; in fact, on a card to W6DOB, VP8AD says he is ex-VP8AF. That will probably clear up the mystery to some fellows.

What the Phone Men Are Doing

During the past few weeks everyone has been complaining of poor conditions, and because of this, activity among the phone gang is pretty low. However, all is not lost as there have been moments when something worth while has broken through. W9QI hands in a nice one for phone and c.w. . . . VQ2PL. Address him thus: Peter Lowth, Railways Telegraph, Livingstone, Northern Rhodesia. VQ2PL is using a T20 and grid modulates it with a 53 tube. Frequency about 14,253 kc. Another worked by W9QI is VQ3HJP, who is on the same frequency . . . phone and c.w. All of this increases Larry's total to 30 and 75.

W6ITH has been getting a few new ones such as CR7AK, HP1A, VQ2HC. Reg says there will be a new KA on the air shortly, KA4LH, whose QTH is L. H. Hinckley, c/o Tuba Project, Marsman & Co., Tagcauyan, Tayabas, Philippines. W3LE reports J2KG and ZS1AX as coming through very well on 14 Mc. W3LE uses a two-section 8JK beam, and has 26 and 46. W6OCH is still at it . . . that is, picking off new ones, 4 new countries and 1 new zone. This makes Larry 34 and 85, which is very imposing to say the least. Here are his newest: GW8HI, VQ2HC, CN8NA, CR7AK.

W9NLP is at peace with the world after getting a QSL from YI2BA. Rolly has now 32 zones and 70 countries. During the National Convention he was visited by John Shirley, ZL2JQ. Johnny had a big time talking to his own station in ZL . . . on phone, of course. Since last we heard from W2IKV, he has not been the least bit idle, because he really went out and got 'em. Now it is 28 and 77.

Some of the better ones are ZB1R, CN1AF, VK4HN, VQ4KTB, PK6XX, EA9AH, OZ5BW, CT2AB, FB8AB.

W4CYU went to work on these countries early in life, because he has worked 88 of them on phone and 123 on c.w. His zones on phone are 31 and on c.w., 38. This looks like more countries than any other in the phone section. Nice going. W6OI is up to 28 and 53, the new ones being PY4CT, PY2IT, VU2CA, FA3HC, VQ2HC, CR7AK. Dave's x.y.l., Peggy, takes a whirl at the mike every once in a while, especially when he wants to grab off some of those Latin countries. Says it's a cinch then. W9RBI picked up a bit from W4DSY . . . and 'twas about YI2BA being on phone again in about a month on 14,260 kc.

VK2NS worked VQ2HC. Maybe to you this doesn't sound like so much, but during all these years that VK2NS has been on the air he has never even heard a VQ2. VQ2HC was getting a kick out of it, too. This meant a new zone and new country for VK2NS.

VK4JP, George Gray, has been knocking dx for a loop since he returned to Australia. He has only been on the air a couple of months and already he has collected 26 zones and 32 countries. Don't forget, we're still talking about phone. George puts through a terrific signal . . . and as a phone man might say . . . R9 with 6 pluses. Some of his best are ZS6CZ, CR7AK, FI8AC, CN8AV, FA8AC, I1MH. Ernie Johnstone, K6KMB, pops up with 20 zones and 23 countries. VP1BA comes through like a million on 14,125 kc. W2HCE puts more light on the subject of VQ1AB. He says he met the guy who was signing VQ1AB and this fellow said he was operating near Mexico City and used that call because it was easier to raise the boys. Well, he was frank about it, anyway. W2HCE still has a mike on his desk and with its help has managed to grab a couple of zones, which builds his total up to 23 and 62. W6IKQ worked FI8AC, VK7GL, CR7AK, ZE1JR and NY2AE, making his look like 28 and 45.

W6FTU has a nice new location and is just waiting until things open up again. Even with conditions as they have been, Doc has boosted up to 27 and 60. His playmate W6MLG, who also is a "DDS," is in hiding and won't play until FTU assures him that conditions are on the way up and dx is rolling in by the dialfull. W7EKA is putting out a good signal, and with it has hooked NY2AE and GM3DP. This gives him 24 and 34.

You probably are interested to know what the new setup is in the Pacific Islands, since K6BAZ and the rest of the others have shifted around a bit. K6BAZ is back in Honolulu and here is what the

> K6BAZ, Kenny King, gives on page 18 a swell account of his stay on Howland Island, together with a description of the other islands he visited on his return to Honolulu. In his modest manner, Kenny maintained he could not write "so that it would sound good." However, he was finally persuaded to write up the rough notes he had made while on Howland. With the assistance of Mr. Bryan, Kenny gives an idea of what life is like on any of the South Pacific Islands.

rest of them are doing:

K6DSF	Howland Island	7,190 kc.
K6NVJ	Jarvis Island	7,187 kc.
K6HCO	Enderbury Island	7,170 kc.
K6JEG	Baker Island	7,015 kc.
K6ODC	Canton Island	7,100 kc.
VR2FF	Canton Island	14,400 kc.

K6DSF on Howland will soon be on 10 meter phone, and K6ODC on Canton uses phone a bit now. The rest are on c.w.

I suppose you've heard that many of the prominent hams have become "shutterbugs" (camera fiends to you). Oh yes, W6DOB and W2VY are included.

During the month we had the pleasure of meeting W4SW, W9VKJ, and VP9L. 4SW was on a hurry up trip and did not stay long. VP9L was around for a couple of weeks and saw all of the wiles (or wilds) of Hollywood and surrounding country.

Operative No. 1492 has been active this past month and informs us that one of our local dx men has acquired an x.y.l. Or maybe we should say "ex-dx man." Anyway he is W6FZY . . . and he managed to hide it for a while, but we have a way of finding these things.

J3FJ, Osaka, Japan

We are indebted to K6CGK for obtaining the following on J3FJ, together with the photographs.

Many of the hams have wondered what has been putting out that signal especially during the last dx contest. Well, this station J3FJ belongs to Mr. Kusutaka Yuasa of Osaka. Osaka is really the "Pittsburgh" of Japan, and is the second largest city in the Empire.

The shack is located on top of a rambling two-story wooden structure. The most interesting thing about it, too, is that no nails are used in the construction of this sprawling house. Most of the houses except the ones for the foreign occupation are built in this fashion. Visitors are required to remove their shoes before entering, and are supposed to sit down on cushions placed on the floor. The floor is covered with a soft straw

[Continued on Page 86]

The Open Forum

[Continued from Page 74]

put these boys in the phone band where they can compete on an equal basis with the rest of the hams.

LLOYD W. FROHRING, W8PMJ

●

A midnight broadcast from Chicago is received in New York the next day and in Los Angeles the evening before.

Kusutaka Yuasa, operator of J3FJ.

mat. He does not need to sit with his legs crossed but must sit in true Japanese style with legs folded under him, and then sip tea slowly from a cup without handles.

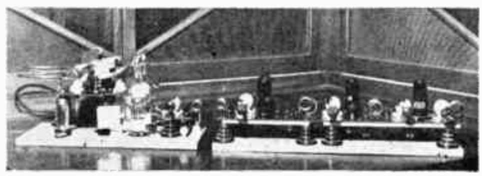
In this unique setting, a husky power growls the familiar CQ, and by opening a sliding partition one finds a very FB rig. All stations are limited to 20 watts, and it is at this point the sliding partition comes in handy. The application for a license must state power input, tube used, frequency, etc. J3FJ is using a pair of 100TH's on 5 meters. On 7, 14 and 28 Mc., he uses a pair of RS19's which are about the same as 203A tubes. For an emergency unit he has a 300-watt Pioneer generator, which must have cost plenty.

J3FJ Rig

Of interest to the 5-meter gang is that J3FJ is the only active station on 56 Mc. and sends "Tests de J3FJ 56 Mc." daily from 0200 to 0210 G.m.t. and from 0900 to 0910 G.m.t. The rig as pictured uses 6L6-6L6-6L6 p.p. into the 100TH tubes.

Three receivers are in the shack and a fourth is available powered by a vibrator for emergency use. Antennas range from a Hertz 60 meters long to a 2.5-meter vertical. W.A.C. has been made on 28, 14 and 7 Mc.

Mr. Yuasa is 24 years of age and makes a living by renting land and houses in that vicinity. He is always anxious to receive visitors.



The 5-meter rig at J3FJ, Osaka, Japan, using a pair of 100TH's in the final.

Single-Control Bandspread

[Continued from Page 44]

the spacing between turns. The taps on the r.f. and detector coils are next varied so that these stages track with the oscillator over the entire band. These coils are brought into tune by small trimmer condensers, C_2 and C_3; all the inductance possible should be used to maintain maximum sensitivity. The r.f. and detector trimmers are brought out to panel controls. They need be set but once for each band.

The above method requires considerable cut and try, especially with the oscillator coils. An alternative method which eliminates much of this difficulty is shown in figure 2. Here, the trimmer condensers are placed in the coils and adjusted separately for each band.

The Tuning Condensers

The size of the tuning condenser, C, is determined by the lowest frequency band which must be covered. The range of the oscillator tuning condenser is lowered considerably by the effect of the large tank condenser across the coil. This necessitates placing the tuning tap relatively nearer the grid end of the oscillator coil than are the taps on the r.f. and detector coils, where the trimmer capacity is much smaller.

It is possible to use standard 350-$\mu\mu$fd. ganged broadcast condensers and, through proper location of the tuning condensers, obtain full scale bandspread and accurate tracking. Broadcast type condensers, however, are not well suited to high-frequency work by reason of their mechanical construction. The best plan is to use high quality condensers (preferably double spaced) designed for high frequencies.

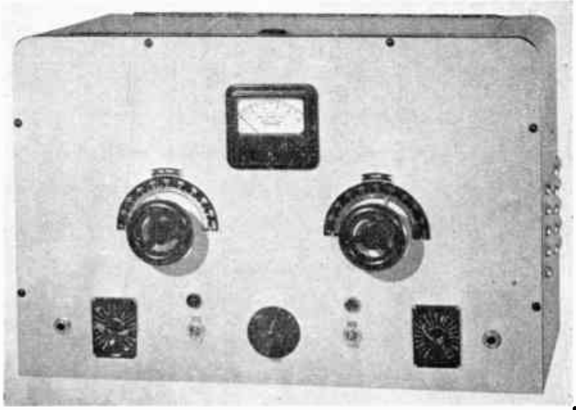
This system can be adapted for use with bandswitching by employing a switch with an extra set of contacts for

COIL SPECIFICATIONS

BAND & FORM DIA.	COIL	COIL TURNS	TUNING TAP FROM GND.	WINDING LENGTH
28 MC.	OSC.	1 1/2	1 1/4	1/4"
1 1/4"	RF-DET.	4	2 1/4	1"
14 MC.	OSC.	4 3/4	2 3/4	3/4"
1 3/8"	RF-DET.	8 1/2	2 3/4	3/4"
7 MC.	OSC.	12	6 3/4	3/4"
1 3/8"	RF-DET.	16	7	3/4"
4 MC.	OSC.	25	25	3/4"
1 3/8"	RF-DET.	40	22	1 1/4"

each stage to take care of the connections to the coil taps. It is not suited to the "all wave" type of receiver as a different set of conditions is met there. This type of tuning circuit, however, is ideal for the amateur interested in covering the amateur bands alone with a minimum amount of adjustments and maximum stability and sensitivity.

The table gives representative coil specifications for use with three-gang tuning condensers of 25 to 85 $\mu\mu$fd. capacity (350 $\mu\mu$fd. double spaced). The oscillator tank condenser should be 100



$\mu\mu$fd. and the r.f. and detector stage trimmers 50 $\mu\mu$fd. This table may be useful for preliminary work but is not necessarily correct without minor alterations to fit individual receiver designs. Only the phone band and part of the c.w. band is covered with the 4-Mc. coils.

Emergency Primary Power

[*Continued from Page 36*]

minimum, B batteries will deliver d.c. power with a minimum of trouble.

Nearly every city, town or village boasts of at least one radio service shop where a number of B batteries can be procured in case of serious emergency.

Storage B batteries are scarce these days but a bank of them, recharged occasionally, could be very useful in an emergency. Either the acid or alkaline type can be used. For emergency work, the Edison alkalines are probably the better. A fully charged bank of these placed away on the shelf will hold a charge for a surprising length of time. The writer took a 100-volt block of Edison batteries out of "lavender" one time after a seven-year rest. Forty volts still remained. A couple of hours' charge and it was once more ready for use. This speaks well for the Edison B battery. Unfortunately, however, this battery is now almost as extinct as the Dodo bird, except in some foreign countries.

In an extreme emergency two hundred "door-bell" batteries could be hooked in series to provide 300 volts of high current B supply. These batteries are rated at 30 amperes, enough to deliver lots of plate current for many hours of operating.

"Where," you ask, "can I ever find two hundred dry cells?" How about the rural telephone supply depots? They use dry batteries by the thousands and usually have a barrel or two of them on hand. Then again, five and ten-cent stores carry a large supply, as do many hardware stores and electrical supply shops. Flashlight cells give the same voltage and will make a fine supply with about the same operating life as the large B-battery blocks.

Filament Supplies

That just about covers the plate supply. Now, how about filament supply when no commercial power is available? When the emergency power supply delivers a.c. power, the filaments may be supplied through the usual transformers. If the emergency equipment delivers d.c., a separate filament supply must be used, however. The problem is relatively simple if a storage battery or two and a heavy-duty resistor or old style power rheostat can be obtained. Dry cells can also be used, though the life is comparatively short. If means can be found to turn an old auto generator, plenty of power at six to eight volts can be obtained. Even an old model-T flywheel generator will deliver as much as 9 volts when turned at normal speed if not more than a few amperes are drawn.

Microphone Power

Microphone power must be as nearly pure d.c. as possible. A few flashlight cells, or even pen light cells, will furnish voltage for a single button microphone for many hours.

The subject is not exhausted by any means—these are just a few of the possibilities for emergency radio power. Every amateur should have a list of his available emergency power sources pasted over his operating desk to help him decide on a course of action when emergencies occur. No one can predict the time of the next disaster. It may be tomorrow or ten years from then—but whenever it is, let's be prepared!

A few extra dollars and a few hours spent in buying or building an emergency power plant will certainly give the owner a feeling of security against disaster and at the same time instill in him a sense of pride in the knowledge that he can utilize his station for the benefit of others in distress. The ability and willingness of the amateur to serve others is what makes amateur radio worth while. We're fifty thousand strong; let's all be ready for emergencies with a reliable, independent source of primary power.

Improved 10-Meter Receiver

[*Continued from Page 34*]

We won't take space to discuss the noise, b.f.o., and a.f. circuits. The noise silencer follows the hookup shown with the "222" receiver in the June, 1938, RADIO. It was chosen because of its utter simplicity and effectiveness in attenuating both positive and negative noise peaks. It differs from the hookup used in that receiver only in the incorporation of a variable control for adjusting the bias on the 6H6 to any amount within practical limits. As for the a.f. and beat oscillator circuits, they are entirely conventional.

Layout

Layout is pretty well indicated in the photos and by the layout diagrams. Lower chassis components include all those employed in the r.f. portion of the receiver. The antenna coil and tuning condenser are to the right and over the electrostatic screen and the variable link coupling coil, and the shielded r.f. coils and tubes are to the left and alternate in line back toward the mixer coil at the rear. Upper chassis parts make up the balance of the items; the layout of this deck is also shown in the constructional diagram.

Construction and Wiring

1. The proper h.f.o. coil is a Meissner type 7684, one employed in their all-wave tuning assemblies for u.h.f. coverage. The writer notes, however, that though other inductances of similar manufacture are individually catalogued, this particular one is not listed; consequently, it may not be available on the open market.

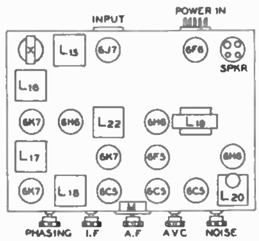
A suitable coil providing for the really high-C band spotting featured in this receiver could, of course, be constructed. An approximately ½-inch o.d. form would be required, and the coil might consist of 3½ turns of heavy (no. 14

bare) plate winding, carefully secured in place to prevent turn expansion, and 4 turns of no. 24 d.s.c. grid winding (interwound). Lugs for at least plate winding termination are suggested to insure stability.

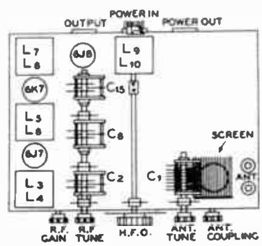
Make sure that the coil is rigidly constructed and don't worry if you have to use plenty of dope.

2. Mount the h.f.o. coil directly on the HF-15 tuning condenser and in such position that the whole assembly can be placed within the h.f.o. can. The shaft of the condenser should look toward the dial, of course. That of the tank capacity (which also should go inside the can) may well protrude in the opposite direction, toward the rear, for occasional readjustment.

3. The four r.f. coils are wound on the smaller isolantite Hammarlund forms (5 prong) and have 7¼ turns of secondary, spaced to ¾ inch, and 4½ turns of primary, closewound. About no. 24 d.s.c. wire will do, but be exceptionally careful in accurately matching the secondary inductances in each of the coils. Measure the spacing carefully.



SUGGESTED LAYOUT FOR UPPER CHASSIS



SUGGESTED LAYOUT FOR LOWER CHASSIS

4. The three r.f. tuning condensers, when ganged by insulated couplings and mounted about two inches above the chassis, will be properly placed for short lead connection to their associated components; that is, if the layout as we give it is followed and the particular coil cans specified are used. Wire Alignaire trimmers from stator lugs to rotor wiper lugs on one side and support similar trimmers on stator lugs on the other (toward the r.f. cans and tubes) side of the ganged assembly.

5. Drill the r.f. coil cans so that leads coming up and out from the inductances (two grid leads for each coil) will make short direct connection outside these cans to tube grid caps and to the series Alignaires mounted on the tuning condensers.

6. Wire in the plate circuit trimmers right at the tube sockets, below chassis.

7. At the right of the chassis, toward the front panel and below a point selected for antenna coil and condenser

assembly (the condenser shaft must be insulated from the panel), there should be an approximately two-inch hole across which may be placed the electrostatic (Faraday) screen. This screen, in our job, was made from a small square of small-mesh copper screening. The wires going one way were removed, and the parallel ones remaining were soldered together and to the chassis at one end of the square and insulated from each other and elevated slightly above chassis at the opposite end. The screen touched chassis only at the soldered point and completely covered the hole.

8. Below the hole and the Faraday screen the coupling link should be mounted. This may be a three- or four-turn winding on a one-inch form. The form is so assembled on a shaft that the coil may be turned and the coupling varied by a knob on the front panel.

9. The receptacle for the coupling link between the two chassis should be positioned on the rear drop, as near as possible to the mixer tube socket, and the specified 3-50-$\mu\mu$fd. mixer output circuit trimmer should be wired to the receptacle's terminals. Two other r.f. section chassis receptacles will be required—one for power cable connection between the two receiver units and one for cable connection to the power supply.

10. Complete the r.f. section wiring, making every effort to bring returns for each stage to one chassis point and to keep r.f. leads not only short but of such length and positioning that the inductive equalities originally secured through precision coil winding will be maintained. Then, with an output coil tunable to 1500 kc. temporarily connected into the 6J8Gs plate circuit and coupled to a broadcast receiver itself tuned to precisely 1500 kc., try out the r.f. section as a converter. Any available power pack will supply the very little filament and high voltage current required. This procedure will facilitate final adjustments, as the r.f. section, once accurately prealigned, need not again receive much attention.

11. In the r.f. alignment, first tune the h.f.o. circuit until the 28-Mc. band is properly spotted. Then, with series Alignaires at maximum and trimmer Alignaires at minimum capacity, adjust the antenna input and plate circuit capacitors for maximum noise level. Finally, trim up the r.f. to peak with the parallel set of Alignaires and to secure the desired amount of r.f. spread *and* an accurate cross-band track with the series trimmers.

12. Build the inter-chassis cable and coupling assemblies. The latter unit will consist of two Amphenol shielded male plugs, two very small broadcast coils (provided with closely coupled links having from four to six turns and installed within the plug shells) and the necessary link line. Ground both shells, of course; or rather, provide for such grounding by connecting the shells to terminals which, when the plugs are in place in their respective receptacles, will tie the shields to the chassis.

13. With the r.f. section completed and aligned, tackle the upper chassis. Follow the layout recommended if possible, keep leads short and direct and remember these suggestions: first, the crystal phasing condenser should be supported by its own lugs and frame directly at the crystal socket; second, the 6J7 first i.f. lead down through chassis to the link input receptacle must be shielded to minimize b.c.l. pickup; third, plate, screen and cathode circuits should be individually by-passed.

In adjusting this section for proper operation it is the best policy to set up the crystal in an external oscillator circuit and, beginning at the infinite-impedance detector, to align the i.f. stage by stage to precisely crystal frequency. Otherwise it may be difficult to effect accurate crystal spotting, as 1500-kc. filter units are frequently off the rated value by as much as 6 kc. in one direction or the other. The lower chassis' output-coil trimmer should be readjusted, the a.v.c. transformer peaked to i.f. frequency, the 6F5 biased for zero reading on no signal, and so on and so forth. The complexity of the layout here may suggest the application of some time in getting the various circuits going properly. But, be that as it may, once they *are* going, the result is an assembly which is a complete and unusually flexible design, well worth both the cost and the effort of construction.

Operation

All band scanning is done with the h.f.o. dial. The r.f. knob simply brings related circuits into proper track once a desired signal is received. R.f. tuning, by the way, is both broad enough to make knob tuning practicable and sharp enough to afford the receiver unusually good r.f. selectivity.

The crystal remains in circuit at all times, i.f. selectivity being effectively controlled by the phasing condenser. The bandpass, with the filter in balance, is still sufficiently wide to pass intelligible voice modulation.

The Three-Element Rotary

[*Continued from Page 17*]

sides of the delta should be approximately the same as the total distances that the wires are spread apart (twice the distances given above).

It is suggested that the values given above be used when the antenna is first installed and that the feeder wires be left at these points until the beam has been properly tuned. Then, after the beam has been adjusted, the tap-on points should be varied, first in one direction and then in the other from the values given, until standing waves on the line are eliminated or satisfactorily reduced. This is a point in favor of the open-wire line over the insulated (enclosed) type; it is much easier to tell when the adjustments are being made in the right direction with the open-wire line.

If the directly-excited dipole is broken at its center, alternative feed systems may be used. In the installations of W6MEP and W6OSP a shorted, half-wave transmission line is run from the center of the driven dipole down the supporting pole. A short distance above the shorting bar (the exact distance is determined by experiment for different transmission lines) the line that goes to the transmitter is tapped. In the two installations cited, flexible concentric transmission line is used from the bottom of the stub to the transmitter. The concentric line is quite convenient in that it may easily be twisted as the pole is rotated and it may be conveniently run around corners, under the house, etc., in its course to the transmitter. However, where its use will be equally convenient, an open-wire line is recommended for the lead from the transmitter to the beam. The losses in any appreciable length of open-wire line will be considerably lower at 28 Mc. than the same length of concentric or twisted pair.

Concentric Pipe Feed

Another method of feeding the driven dipole from the transmitter is to use the supporting pipe for the array as the outer conductor of a concentric feed line and to run another conductor on the inside of the supporting pipe as the return circuit. Under these conditions of feed the center of the driven dipole would most conveniently be broken; the center conductor of the supporting pipe would go to one side of this dipole and the outer conductor would be connected to the other side of the driven dipole. The separators between the pipe and its inner conductor could be cut from celluloid or molded from one of the thermoplastics now on the market and cemented into place on the inner conductor. To make connection to both conductors of the feed line, the outer conductor (the supporting pipe) would bear against a thrust bearing. A connection to this bearing would serve as one lead, preferably the grounded one if a grounded line is used. For the connection to the center conductor it would be best to cut the supporting pipe off just after it has passed through the thrust bearing and

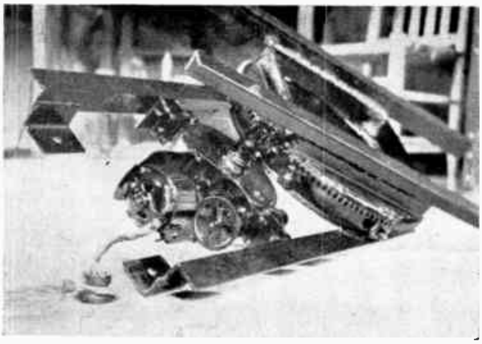


FIGURE 9.
Closeup of the rotating head in use at W6MEP. A 1/70-h.p. reversible motor, driving through a gear train, a washing-machine gear set and a model-T flywheel starter gear set, all lashed up in series, drives the beam at 4 r.p.m. The frame was made from welded pieces of 1½-inch angle iron. The feeders pass through the center of the ring gear to the driven dipole.

then to extend the inner conductor about 2 inches below it. Another bearing for the inner conductor or a metal brush arrangement would serve to make connection to it.

If 1½-inch inside diameter water pipe is used as the outer conductor and half-inch outside diameter aluminum tubing is used as the inner conductor, the characteristic impedance of the transmission line made up of them would be about 65 ohms. Hence, there would be a comparatively large standing-wave ratio on this line when feeding 8 ohms. However, if the total length of the supporting pole (the concentric line) is made electrically ¾ wave (¼ wave would be only about 7 feet on 28 Mc, too short to be of much value as a support) it will be easy and convenient to match the whole system. Since the velocity of propagation on a concentric line of this type is about 0.85 of that of air, the length of the supporting line should be made 0.85 of 25.5 (17 and 8.5) feet, or 21.7 feet long. The length from the bottom of the thrust bearing to the position where the outer conductor connects to one side of the driven dipole should be made 21.7 feet. Then, since the impedance at the antenna end is about 8 ohms and the characteristic impedance of the concentric line is 65 ohms, the impedance at the bottom of the concentric support pole will be:

$$Z_L = \sqrt{Z_S \cdot Z_R}$$
$$65 = \sqrt{Z_S \cdot 8}$$
$$Z_S = 528 \text{ ohms}$$

Consequently, if a transmission line made up of no. 12 wire spaced 4 inches (characteristic impedance, 550 ohms) is run from the bottom of the supporting pole to the transmitter, the impedances will be matched quite closely throughout the entire feed system.

This feed system has the advantages that there are no external feeder lines going up the pole to the beam itself where they will be in the way of the rotating mechanism or where they will be twisted when the system is rotated.

Cleaning the Support Pipe

In using this feed arrangement it would be advisable to clean thoroughly the inside of the water pipe that makes up the outer conductor of the line. Ordinarily, any dirt or grease that might be inside it would have no effect on its operation if it were used only as a support. However, when its inner surface is to be one side of the transmission line that feeds the beam, it is important that this surface be clean. It could be cleaned by first running a wire through the pipe and then pulling through two or three times a rag that is soaked in gasoline or cleaning solvent. Or, the pipe could be capped at one end, filled with solvent, allowed to stand for a few hours and then emptied and swabbed out with a rag or small brush. Then the pipe should be allowed to dry by allowing it to stand for a few hours in the sunlight with perhaps a stream of air being blown through it by an electric fan or a source of compressed air.

If the inside of the pipe does not appear to be clean, some of the scale or rust may be removed by drawing through it a large rag soaked in dilute hydrochloric acid, allowing the pipe to stand for a while after the rag has been drawn through and then washing it out thoroughly with a stream of water. The pipe should again be thoroughly dried. After it has been dried, it might be advisable to coat its inner surface with lacquer or shellac by drawing through a rag soaked in this material.

All these precautions may seem unnecessary but they will insure that the losses within the concentric line itself will be low. Incidentally, be *very* careful with fire, sparks, or even cigarettes when the pipe is filled with either gasoline or solvent vapor or with the hydrogen that will be generated when the inner surface is being cleaned with hydrochloric acid. Also, be careful of the HCl, although it is not particularly corrosive when dilute.

Support Line to Antenna Fittings

The upper end of the supporting pipe could be connected to a pipe fitting into which one side of the driven dipole is connected. Into the other side of the pipe fitting a piece of Micarta or similar insulating material could be screwed (after threading it on a lathe). A connection should be brought out from the inner conductor of the supporting transmission line, this connection attached to the other side of the dipole, and this side of the dipole mounted into the micarta insulating sleeve. Incidentally, micarta (bakelite impregnated fiber or canvas) would be quite satisfactory for the insulator at this point, inasmuch as the impedance is in the vicinity of 8 ohms and hence the voltage would be very low.

Tuning Up

In the majority of installations, after the antenna has been put in place it is left as is. If the figures given in the design table (figure 2) are followed very closely, the beam may be installed, a feed system decided upon and installed, and the affair left as it stands. In every case where this has been done excellent results have been obtained. However, if a good field-strength meter is available (the meter may be a receiver calibrated in decibels or R's) some distance from the installation, an attempt may be made to tune the beam more accurately.

First, let it be emphasized that any adjustment made upon any of the variables of the array will react upon all the other variables. For this reason it is advisable to leave fixed, after the original adjustments to the values given in figure 2, the driven-dipole length and the spacings between all three of the elements. Then, with the beam pointed toward the field metering device, adjust first the director for maximum forward signal. Make only very small changes in the length (an inch on each end can make a large change in operation) and make the same change each side of center. After the director has been adjusted for maximum forward gain the array should be rotated through 180 degrees and adjustments made in the reflector for minimum back-side radiation, again remembering to make only a very small change at a time. Now the array should be rotated so that it points toward the meter again and the director readjusted (if necessary) to maximum forward signal. By repeating this a number of times a point will be reached where the signal is at a maximum in front and at a minimum from the back and sides.

The Flextal Exciter

[Continued from Page 43]

be used causes a reduction in fundamental output which is all out of proportion to the decrease in harmonic output. Low-pass filters further complicate matters in that they must, to operate satisfactorily, be terminated in their characteristic impedance. This leads to further loss in fundamental output and to a great deal of oscillator and mixer circuit complication. The simpler types of low-pass filters. however, will give a marked reduction in harmonic output without seriously attenuating the fundamental frequency. All of which leads up to the fact that an ordinary 2.5-mh. "short wave" r.f. choke placed in the coupling lead between the oscillator and the mixer suppressor will offer considerable impedance to low-frequency oscillator harmonics above the fourth or fifth and at the same time cause only a very slight reduction in fundamental low-frequency output.

Another Method

One other line of attack in the elimination of "birdies" remains. This is probably the simplest of any method; it requires simply the shifting of the frequency range of the low-frequency oscillator to a place where its harmonics will fall far enough from the exciter output frequency and the conversion crystal frequency that no undesired beats can be set up. It has been found that a range of from 690 to 840 kc. in the low-frequency oscillator gives "birdie"-free output. This oscillator range calls for a 4340-kc. conversion crystal. Several manufacturers will supply crystals for such "out-of-band" frequencies on special order, or it is a simple trick to take a few thousandths of an inch off a standard 80-meter crystal.

The oscillator tank circuit for the 690- to 840-kc. range can well consist of an ordinary b.c. coil padded with a single-section b.c. condenser and tuned by a 150-$\mu\mu$fd. condenser. One-fourth to one-third of the turns on the coil must be removed to give a sufficiently high C/L ratio and provide "bandspread." As the inductance of the coil is decreased and the padding capacity across it is increased the "bandspread" will become greater.

With the low-frequency oscillator operating in the 690- to 840-kc. range it is advisable to shield the oscillator coil and, if possible, the tuning and padding condensers; this will minimize radiation on the broadcast band. The 2.5-mh. r.f. choke mentioned under the first method should be omitted, of course.

Another Change

Another circuit change which has been found helpful is the utilization of one contact on the formerly unused section of the crystal switch to apply plate voltage to the low-frequency oscillator only when the conversion crystal is being used. The mixer screen voltage should be approximately 250 volts. Excessive voltage will be indicated by the screen running hot. Other voltages (except, of course, the mixer suppressor) remain as in the original unit.

Postscripts and Announcements

[Continued from Page 62]

many years, is presenting courses in Television Engineering. These courses were inaugurated with the fall term, last month. For persons who have had no previous training in radio engineering the course requires a period of two years in the day school or five years in the evening school. Special television units of six months duration in the day school or one year in the evening school are available to applicants having adequate technical background.

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Joint Pacific and Southwestern Division A.R.R.L. Convention

A joint convention of the Pacific and Southwestern Division will be held during Armistice Day week end, November 11, 12, and 13, in Los Angeles, California. Convention headquarters will be the Elk's Temple, 6th Street at Parkview, overlooking Westlake Park. Features of the meeting will be a real banquet, a new equipment show, prominent speakers, a DX Roundup among other meetings, and a large number of prizes. A $3.00 registration fee covers all events.

[Continued on Page 97]

Buyer's Guide

Where to Buy It

PARTS REQUIRED FOR BUILDING EQUIPMENT SHOWN IN THIS ISSUE

The parts listed are the components of the models built by the author or by "Radio's" Laboratory staff. Other parts of equal merit and equivalent electrical characteristics usually may be substituted without materially affecting the performance of the unit.

ADAMS SUPERHETERODYNE

Page 29

R.f. coil forms—Hammarlund CF-M
$L_{9, 10}$—Meissner 7684
C_1—Hammarlund MC-140
$C_{2, 8, 15}$—Hammarlund MC-20 SX
$C_{3, 4, 9, 10, 16, 17}$—Meissner 22-5230
C_{23}—Hammarlund HF-140
C_{24}—Hammarlund HF-15
$CP_{1, 2}$—Hammarlund MEX
$C_{21, 27}$—Meissner 22-5256
$L_{15, 16}$—Meissner 17-8183 crystal filter transformers
L_{17}—Meissner 16-8095 interstage transformer
L_{18}—Meissner 16-8099 output transformer
L_{20}—Meissner 17-8175 b.f.o. transformer
L_{22}—Meissner 17-8177 a.v.c. transformer
L_{19}—Jefferson 467-103
$R_{6, 22}$—Yaxley H controls
R_{29}—Yaxley M control
R_{36}—Yaxley X control
R_{41}—Yaxley A5MP control
$C_{42, 42a}$—Aerovox PB-25
Mica Condensers—Aerovox 1467, 1468 and 1450
Tubular Condensers—Aerovox 284 and 484
Crystal—Bliley CF-1
R.F.C.$_{1, 2}$—Meissner 19-3656

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MULTIPLE CRYSTAL HOLDERS

Page 45

Switches—Type A
Dial Plates—Part No. K-115
Bar Knobs—Part No. K-120
All from Centralab Switchkit K-121
Bases—Amphenol RCP5
Sockets—Amphenol RS5

●

THREE-ELEMENT ROTARY

Page 13

Tubing—Premax or General Rotary Antenna Co.

●

U. H. F. BEAM OSCILLATOR

Page 47

C_1—Cardwell ZR-10-AS Trim-air
C_2—Cornell-Dubilier type 9-6D1
RFC—Hammarlund CHX
R_1—Ohmite Brown Devil
Socket—Bud type 958
Fil. trans.—U.T.C. type S-55
Standoff Insulators—Birnbach

5- TO 160-METER PHONE

Page 23

C_1, C_{10}, C_{11}—Cornell-Dubilier Dwarf Tiger
C_4—Cornell-Dubilier 9-12D6
C_5—Bud 903
C_6—Bud 911
C_7—Bud 330
C_{12}—Cornell-Dubilier EB-9080
All other fixed condensers—Cornell-Dubilier
RFC—Bud 920
RFC_1—Bud 569
Coil Forms—Bud 126
Dials—Bud 165
Ceramic Sockets—Hammarlund
Wirewound Resistors—Ohmite
Carbon Resistors—Centralab
Potentiometers—Mallory-Yaxley
Tubes—HK54—Heintz & Kaufman; all others RCA
Crystals—Bliley
Midget Standoff Insulators—Birnbach

●

SHIFTING TO 1851 R.F. TUBES

Page 53

1851 Tubes—RCA
Tubular Fixed Condensers—Solar
Mica Fixed Condensers—Cornell-Dubilier
Wirewound Resistors—Ohmite
Carbon Resistors—Centralab

Postscripts and Announcements

[Continued from Page 95]

Registrations may be sent to Federation of Radio Clubs, Box 1538, Hondo, California.

Shifting to 1851 R.F. Tubes

[Continued from Page 53]

gain in the usual commercially built receiver. Substitution of an acorn pentode, an 1851 or an 1852 (which has the grid lead out the base, otherwise the same as the 1851) will generally give sufficient improvement to be worth the trouble. Let's see what has to be done to replace a 6K7 r.f. tube which, according to RCA engineers, is capable of a stage gain of 5 only with the best of design.

56 Mc.

[Continued from Page 68]

He mentions that the band was again reported open on the 6th. On the 5th, he heard W9NY on c.w. and worked W8OIA, W8RYT, W8PNU, W8WEN, W8LL, W8RRH, W8OTG, W9WLX, W9QHR, W9LVK, W9PQH, W9OLY. He also heard W8RTS, W8RKE, W8CLS, W9EGU, W9ARN, W9GGH, W9ZUX, W9ZSS, W9MXK, W9IVC, W9ZJB, W9FEN, W9CLH, W9CLA (CLH?), W9UTF, W9ZGD, W9UTS, W5ZS and W5ML.

W8CIR, near Pittsburgh, guesses correctly that we are knee deep in daisies, reports and what have we. At 11:30 a.m. eastern daylight time on the 5th, the band opened for him for a half hour following 300-mile 28-Mc. skip to the east, and W2GAH, W1QV and W1IVA were worked. The band opened at 7:50 p.m., again following a 300-mile skip east on ten meters. Up to nine o'clock he worked W2KLZ, W9ZJB and W9AHZ in Kansas City, and W9UIZ in Ft. Leavenworth. He returned to the air at 11:10 to work W5ETQ in Oklahoma; W9REZ, W9TIW and W9QFX in Nebraska; W9WTV in Iowa; and two questionable contacts, W9AHQ and W9WWD, up to 12:30 a.m. The band would close a few minutes for W9's and let W5's come in, from 10 to 11:30. He mentions that both in the morning and evening, Akron stations 75 miles west heard east coast stations long before and after they were heard in Pittsburgh. On June 6, W9CCL in Nebraska was heard at 9:45 p.m. W8CIR needs only the seventh district now. He says, "Just a suggestion, OM. Why not a little emphasis in your columns on crystal control, increased power, beam aerials and better receivers? Many modulated oscillators don't get through because of their broad mushy signals." He is a confirmed believer in his Yagi array, 20 feet high, as compared with a dipole 80 feet high.

Among countless signals in the QRM on the evening of June 5th W2KFB identified W8YUT (Cincinnati bootlegger), W8WYO (Norwood, Ohio, probably another), W8CS, W8RSS, W8RVT, W8WEN, W8JIN, W9QCY, W9CJW, W9WLX.

Up in Cadillac, Michigan, W8RYJ couldn't raise the dx with his pair of modulated 45's but knows a fellow who worked W5EHM last year with a similar rig. He may not know that fewer receivers this year will receive a modulated oscillator unless it is well stabilized. He copied these calls on the 5th between 5:55 and 8:45 p.m. eastern time: W3DO, W3DOD, W3FBH, W3BZJ, W3VX, W3GMZ, W3AYF, W3HKM, W3HTN, W3MV, W3CUD, W2KOU, W2KNA, W2KHR, W2COK, W2JCY, W2DB, W2HWX, W1EYM, W1FZV, W1AHP, W1JMT, W1JUN, W1KJA, W1KIB, W1BRL, W1IXV, W1KIV.

Out in St. Joseph, Missouri, W9CVL sends a clipping about W9CFE who drove down a street with a transceiver in his car and worked W2MO for fifteen minutes.

Robert Lyon, in Point Pleasant, N. J., heard W9MXK at 11:20 a.m. on the 5th with his superregenerator, but he suggests that we publish more articles on u.h.f. construction, especially superheterodynes with four or five tubes. From 7:30 to 11:05 p.m. on the same night, he heard these: W8YX, W8EGQ, W8OIA, W8MJJ, W9ZC (W9ZD?), W9FP, W8OTG, W9WLX, W8MKJ, W9FEN, W9CLH, W9CX, W9PQH, W9ZSS, W9ALE, W9LNV, W9LVK, W8JIN, W9QYI, W9RCH, W9ARN, W9ZB (W9ZD in Kansas City), W9ZJD, W5ZS and W9OLY.

W2KHR was visited by W2LFM on the evening of the 5th, and went on 56 Mc. to show off the rig, which has some 300 watts on a pair of HK54's in the final. W8YX, working a W2, came right through. The W8's and W9's were all over, in and out of the band. Every CQ brought at least one call. He raised W8EGQ, W9WJW, W9ZGD, W8OTG, W9CLH, W9PQH, W8OQY, W8NKJ, W9VSX, W8NOB, W9FEN, W9YSV. He heard these: W9ARN, W9AHZ, W9RSS, (W8?), W9NY, W9YZG, W9HPP, W9LNV, W9ZFS, W9CX, W9WLX, W9LVK, W9LMP, W9YMG, W9FP, W9ZGP (W9ZGD?), W9USH, W9ZZO (ZEO?), W9WJW, W9VGH, W9LGL, W9UTS, W9QCY, W9CLH, W9FEN, W9YSV, W9VSX, W9PQH, W9ZGD, W9RH, W8EGQ, W8YUP (W8YUT?), W8OTG, W8RSS, W8OQY, W8NKJ, W8RKE, W8RVA, W8WEN, W8ICU, W8YX, W8JIN, W8NIG, W8YGC, W8GQY, W8NOB.

The Marketplace

(a) Commercial rate: 10c per word, cash with order; minimum, $1.00. Capitals: 13c per word. For consecutive advertising, 15% discount for 3d, 4th, and 5th insertions; 25% thereafter. Break in continuity restores full rate. Copy may be changed as often as desired.

(b) Non-commercial rate: 5c per word, cash with order; minimum, 50c. Available only to licensed amateurs not trading for profit; our judgment as to character of advertisement must be accepted as final.

(c) Closing date (for classified forms only): 25th of month; e.g., forms for March issue, published in February, close January 25th.

(d) No display permitted except capitals.

(e) Used, reclaimed, defective, surplus, and like material must be so described.

(f) Ads not relating to radio or radiomen are acceptable but will be grouped separately.

(g) No commissions nor further discounts allowed. No proofs, free copies, nor reprints sent.

(h) Send all Marketplace ads direct to Los Angeles accompanied by remittance in full payable to the order of Radio, Ltd.

Advertising Index

HUGHES PRINTING CO.
EAST STROUDSBURG, PA.

Tomorrow's Tube TODAY!

NEW RCA 813

gives 260 watts output with less than 1 watt Driving Power!

IT'S A FACT! This sensational new RCA Beam Power Transmitting Tube actually requires less than one watt driving power to give 260 watts output in Class "C" Telegraph service. Needing no neutralization, a pair of 813's makes a bang-up final for that quick-band-change, high-power transmitter.

The new 813, is among the finest transmitting tubes RCA has ever developed, employs a new stem structure which makes practical a compact tube—only 7½" long—having very short heavy leads and low lead inductance. Because of its design, this new high-power beam tube can be operated at full ratings up to 30 megacycles without neutralization.

Other noteworthy features of this new tube are: Heavy-duty thoriated-tungsten filament, oversized graphite plate, dome-top bulb with cushion mount supports, low screen current, and a new Giant 7-pin base having short shell and wide pin spacings.

Typical Operation (Class "C" Telegraphy)

Filament Voltage
10 volts (a. c. or d. c.)

Filament Current
5 amperes

D-C Plate Voltage
2000 volts

D-C Screen Voltage
400 volts

D-C Grid Voltage
−90 volts

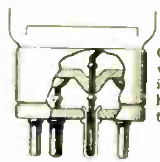
D-C Plate Current
180 milliamperes

D-C Screen Current
15 milliamperes

Driving Power
0.5 watt

Power Output
260 watts

View of moulded glass stem assembly showing individual lead seals.



Cut-away view showing short, heavy leads to terminal pins.

Price, $28.50 Amateur Net.

RCA Radio Tubes

RCA MANUFACTURING COMPANY, INC., CAMDEN, N. J.

A Service of the Radio Corporation of America